UNIT EIGHT

The Newborn at Risk

CHAPTER 23

Nursing Care of the Newborn With Special Needs

KEY TERMS

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

LEARNING OBJECTIVES

Upon completion of the chapter, the learner will be able to:

1. Explain factors that assist in identifying a newborn at risk due to variations in birthweight and gestational age.
2. Select contributing factors and common complications associated with dysmature infants and their management.
3. Compare and contrast a small-for-gestational-age newborn and a large-for-gestational-age newborn; a postterm and preterm newborn.
4. Discuss associated conditions that affect the newborn with variations in birthweight and gestational age, including appropriate management.
5. Outline the nurse's role in helping parents experiencing perinatal grief or loss.
6. Integrate knowledge of the risks associated with late preterm births into nursing interventions, discharge planning, and parent education.

Anna and her husband were stunned when she went into labor at 7 months' gestation. They couldn't understand what would cause her to give birth early, but it happened. When they approached the NICU, Anna took a deep breath and looked down at her tiny baby with tubes coming from everywhere. What feelings might they be experiencing at this moment? Do you think that guilt would be one of those feelings? If so, why?

Wow

Guiding a parent's hand to touch a frail or ill newborn demonstrates courage and compassion under very difficult circumstances and is 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 birthweight or gestational age can occur, and newborns 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 (March of Dimes, 2007b, 2007c). 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. 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 birthweight or gestational age 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 and include:

- Maternal nutrition (malnutrition or overweight)
- Substandard living conditions
- Low socioeconomic status
- Maternal age of less than 20 or more than 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, 2007)

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 identifies preterm births and low birthweight as important national health goals (U.S. Department of Health and Human Services [USDHHS], 2000).

This chapter discusses the nursing management of newborns with special needs related to variations in birthweight and gestational age. It also describes selected associated conditions affecting these newborns. 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.

HEALTHY PEOPLE 2010

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% Reduce the number of live births at 32 to 36 weeks' gestation from a baseline of 9.6% to 6.4% Reduce the number of live births at less than 32 weeks' gestation from a baseline of 2% to 1.1%	• Will help to emphasize the role of preterm birth as the leading cause of newborn deaths unrelated to birth defects • Will aid in promoting an overall reduction in infant illness, disability, and death

USDHHS, 2000.

Birthweight Variations

Fetal growth is influenced by maternal nutrition, genetics, placental function, environment, and a multitude of other 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 (AGA) characterizes approximately 80% of newborns and describes a newborn with a normal height, weight, head circumference, and body mass index (BMI; Dorland, 2007). Being in the AGA group confers the lowest risk for any problems. These infants have lower morbidity and mortality than other groups.

Small-for-gestational-age (SGA) newborns typically weigh less than 2,500 g (5 lb 8 oz) at term due to less

FIGURE 23.1 A low birthweight newborn in an isolette.

growth in utero than expected. A newborn is also classified as SGA 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 (LGA) describes newborns 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 (Herranz et al., 2007).

The following terms describe other newborns 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 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.

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 newborns 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 occurring before 28 weeks) results in overall growth restriction, with all organs being small. These SGA infants never catch up in size when compared with normal children. An insult later in gestation (after 28 weeks) results in intrauterine malnutrition, but optimal postnatal nutrition generally restores normal growth potential and carries a better prognosis than earlier insults (Kenner & Lott, 2007).

Historically, IUGR has been categorized as symmetric or asymmetric. Symmetric IUGR refers to fetuses with equally poor growth rates 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. The current belief is that in most cases IUGR is a continuum from asymmetry (early stages) to symmetry (late stages) (Harper & Lam, 2007).

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 (Kristensen et al., 2007).

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 meet 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.

Nursing Assessment

Assessment of the SGA infant begins by reviewing the maternal history to identify 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 to be prepared to intervene quickly should one occur. At birth, perform a thorough physical examination, closely observing the newborn for typical characteristics, including:

- Head disproportionately large compared to rest of body
- Wasted appearance of extremities
- 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 oversized
- Thin umbilical cord

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
  - Decreased surface area, infarction
  - Decreased placental weight
  - Placenta previa
  - Placental insufficiency
- Fetal factors
  - Trisomy 13, 18, and 21
  - Turner's syndrome
  - Chronic fetal infection (cytomegalovirus [CMV], rubella, syphilis, toxoplasmosis)
  - Congenital anomalies (heart, diaphragmatic hernia, tracheoesophageal fistula)
  - Radiation exposure
  - Multiple gestation

Sources: Harper & Lam, 2007; Kenner & Lott, 2007; and Neonatal Handbook, 2007e

Also assess the SGA newborn for any congenital malformations, neurologic insults, or indications of infection. SGA newborns commonly face problems after birth because of the decrease in placental function during gestation. Table 23.1 highlights some of the common problems associated with SGA newborns and others experiencing a variation in birthweight or gestational age. Anticipate the need for and provide resuscitation as indicated by the newborn's condition.

Nursing Management

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. At birth the newborn's glucose level is 70% of the mother's serum glucose (Aylott, 2006a). Any newborn stressed at birth uses up available glucose stores with resulting hypoglycemia, a plasma glucose concentration at or below 40 mg/dL (Stanley, 2006). With the loss of the placenta at birth, the newborn now must assume control of glucose homeostasis through intermittent oral feedings. 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. Weigh the newborn daily and ensure that he or she has adequate rest periods to decrease metabolic requirements.

Observe for clinical signs of polycythemia and monitor blood results. Asymptomatic newborns with a hematocrit between 60% and 70% may simply be supported with fluids, close observation, and a repeat hematocrit level in 4 to 6 hours (Kates & Kates, 2007). If the newborn is symptomatic, partial exchange transfusion may be used, but this treatment is considered controversial.

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.

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 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. Based on these definitions, up to 10% of all births involve an LGA newborn (March of Dimes, 2007a).

Because of the newborn's large size, vaginal birth may be difficult and occasionally results in birth injury. In addition, shoulder dystocia, clavicular fractures, and facial palsies are common. The incidence of cesarean births is very high with LGA newborns to avoid arrested labor and birth trauma.

Take NOTE!

Diabetes is commonly associated with LGA newborns. However, due to poor placental perfusion, the newborn may experience IUGR and be SGA.

TABLE 23.1 COMMON PROBLEMS ASSOCIATED WITH NEWBORNS EXPERIENCING A VARIATION IN BIRTHWEIGHT OR GESTATIONAL AGE

Problem	Occurrence	Etiology/Pathophysiology	Assessment Findings	Nursing Implications
Perinatal asphyxia	SGA newborns (common)	Poor tolerance to stress of labor, frequently leading to acidosis and hypoxia Living in hypoxic environment prior to birth, leaving little to no oxygen reserves available to withstand stress of labor: —Uterine contractions increase hypoxic stress —Possible depletion of glycogen stores due to chronic hypoxic state, leading to fetal distress —Impaired uteroplacental circulation due to maternal and uterine conditions predisposing to perinatal depression Compromised newborn at birth experiencing difficulty adjusting to extrauterine environment	Fetal distress (bradycardia, decelerations) during labor Low Apgar scores (Deshpande, 2007)	Anticipate possible problem; assess for maternal risk factors. Initiate resuscitation measures immediately at birth.
	Postterm newborns	Placental deprivation or oligohydramnios, leading to cord compression and subsequent reduction in perfusion to fetus		
	Preterm newborns (common)	Surfactant deficiency Unstable chest wall Immaturity of respiratory control centers in the CNS Small respiratory passages, increasing risk for obstruction Inability to clear mucus from airways		
Difficulty with thermoregulation	SGA newborns (common)	Less muscle mass, less brown fat, less heat-preserving subcutaneous fat, and limited ability to control skin capillaries (Aylott, 2006b) Associated with depleted glycogen stores, poor subcutaneous fat stores, and disturbances in CNS thermoregulation due to hypoxia (Kenner & Lott, 2007)	Temperature <36.4° C; temperature instability; skin cool to touch; cyanosis of hands and feet Bradypnea (<25 bpm) and tachypnea (>60 breaths/min)	Maintain a neutral thermal environment to promote stabilization of newborn's temperature. Assess skin temperature and respiration characteristics. Monitor arterial blood gases and blood glucose levels.

(continued)

TABLE 23.1 COMMON PROBLEMS ASSOCIATED WITH NEWBORNS EXPERIENCING A VARIATION IN BIRTHWEIGHT OR GESTATIONAL AGE (continued)

Problem	Occurrence	Etiology/Pathophysiology	Assessment Findings	Nursing Implications
		Increased risk for acidosis and hypoglycemia secondary to metabolic stress (Neonatal Handbook, 2007j)	Tremors, irritability Wheezing, crackles, retractions Restlessness, lethargy Hypotonia Weak or high-pitched cry Seizures Poor feeding Grunting (Galligan, 2006) Acidosis	Eliminate sources of heat loss: —Dry newborn thoroughly. —Wrap in warmed blanket with stockinette cap on head. —Use radiant heat source.
	Postterm newborns	Loss of subcutaneous fat second to placental insufficiency Use of stored nutrients for nutrition due to lost ability of placenta to nourish fetus Subsequent wasting of subcutaneous fat, muscle, or both (Aylott, 2006b) Loss of natural insulation (subcutaneous fat) important in temperature regulation		
	Preterm newborns (common) Late preterm infant (common)	Immaturity of CNS (temperature-regulating center) interferes with ability to regulate body temperature Inadequate amounts of subcutaneous fat Lack of muscle tone and flexion to conserve heat Inadequate brown fat to generate heat Limited muscle mass activity, reducing ability to produce own heat Inability to shiver to generate heat		
Hypoglycemia	SGA newborns (common)	Increased metabolic rate and lack of adequate glycogen stores to meet newborn's metabolic needs	Often subtle Lethargy, tachycardia Respiratory distress Jitteriness Drowsiness Poor feeding, feeble sucking Hypothermia, temperature instability Diaphoresis Weak cry Seizures Hypotonia	Monitor blood glucose levels, initially on arrival to nursery and hourly thereafter. Maintain fluid and electrolyte balance. Watch for subtle changes. Initiate early oral feedings if possible; if not, administer IV infusion with 10% dextrose in water.
	LGA newborns (common)	Commonly associated with infants of diabetic mothers Abrupt cessation of high-glucose maternal blood supply with birth and continued insulin production by the newborn Limited ability to release glucagons and catecholamines, which normally stimulate glucagon breakdown and glucose release		

Problem	Occurrence	Etiology/Pathophysiology	Assessment Findings	Nursing Implications
	Postterm newborns	Hypoxia secondary to depleted glycogen reserves Placental insufficiency secondary to placental aging contributing to chronic fetal nutritional deficiency further depleting glycogen stores	Blood glucose levels <40 mg/dL for term newborns, <20 mg/dL for preterm newborns (Kenner & Lott, 2007)	
	Preterm newborns Late preterm infants	Immature sucking and swallowing leading to insufficient intake Perinatal hypoxia Increased energy expenditure Decreased subcutaneous and brown fat with little to no glycogen stores		
Polycythemia	SGA newborns	Chronic mild hypoxia secondary to placental insufficiency Stimulation of erythropoietin release, leading to increased RBC production	Venous hematocrit >65% Plethora (ruddy appearance) Weak sucking reflex Tachypnea Jaundice Lethargy Jitteriness Hypotonia Irritability Feeding difficulties Difficulty in arousing Seizures	Ensure adequate hydration (orally or IV). Monitor hematocrit levels (goal is ~60%). Administer partial exchange transfusion, albumin or normal saline IV to reduce RBC volume and increase fluid volume (controversial).
	LGA newborns	Secondary to fetal hypoxia, trauma with bleeding, increased erythropoietin production, or delayed cord clamping (Lessaris, 2007)		
	Postterm newborns	Intrauterine hypoxia triggers increased RBC cell production to compensate for lower oxygen levels.		
Meconium aspiration	SGA newborns	Release of meconium into amniotic fluid prior to birth Inhalation of meconium-containing amniotic fluid by the newborn, leading to aspiration	Green amniotic fluid with rupture of membranes during labor Green staining of the umbilical cord or fingernails Difficulty initiating respirations	Initiate resuscitation measures as necessary. Suction airways and support ventilation (see Chapter 24 for more information).
	Postterm newborns	Commonly associated with chronic intrauterine hypoxia Struggling by fetus making respiratory efforts and bearing down with abdominal muscles, leading to expulsion of meconium into amniotic fluid Normal sucking and swallowing by fetus leads to meconium filling airways.		

(continued)

TABLE 23.1 COMMON PROBLEMS ASSOCIATED WITH NEWBORNS EXPERIENCING A VARIATION IN BIRTHWEIGHT OR GESTATIONAL AGE (continued)

Problem	Occurrence	Etiology/Pathophysiology	Assessment Findings	Nursing Implications
Hyperbilirubinemia	LGA newborns (common)	Associated with polycythemia and RBC breakdown Inability to tolerate feedings in the first few days of life, leading to increased enterohepatic circulation of bilirubin Excessive bruising secondary to birth trauma, leading to higher-than-normal bilirubin levels	Elevated serum bilirubin levels Jaundice Tea-colored urine Clay-colored stools	Ensure adequate hydration. Institute early feedings if possible. Administer phototherapy (see Chapter 24 for more information).
	Preterm newborns Late preterm infants	Increased breakdown of RBCs and immature liver function to handle excess load		
Birth trauma	LGA newborns	Large size requiring use of operative birth procedure	Obvious deformities Bruising Edema Asymmetrical movement	Perform complete physical and neurologic assessment of the newborn. Note symmetry of structure and function. Assist parents in understanding situation (see Chapter 24 for more information).

Nursing Assessment

Assessment of the LGA newborn begins with a review of the maternal history, which can provide clues as to whether the woman has an increased risk of giving birth to an LGA newborn. Maternal factors that increase the chance of bearing an LGA newborn include maternal diabetes mellitus or glucose intolerance, multiparity, prior history of a macrosomic infant, postdates gestation, maternal obesity, male fetus, and genetics (Jazayeri, 2007).

At birth, assess the newborn for common characteristics. 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 newborns are more difficult to arouse to a quiet alert state (Neonatal Handbook, 2007f).

Thoroughly assess the LGA newborn at birth to identify traumatic birth injuries such as fractured clavicles, brachial palsy, facial paralysis, phrenic nerve palsy, skull fractures, or hematomas. Perform a neurologic examination to identify any nerve palsies, looking for abnormalities such as immobility of the upper arm. Observe and document any injuries discovered to allow for early intervention and improved outcomes.

Obtain frequent blood glucose levels as ordered to evaluate for hypoglycemia. The clinical signs are often subtle and include lethargy, apathy, drowsiness, irritability, tachypnea, weak cry, temperature instability, jitteriness, seizures, apnea, bradycardia, cyanosis or pallor, feeble suck and poor feeding, hypotonia, and coma. Other disorders, including septicemia, severe respiratory distress, and congenital heart disease, may present with similar findings. In addition, be alert for other common problems, such as polycythemia and hyperbilirubinemia (see Table 23.1 earlier in this chapter).

Nursing Management

Assist in stabilizing the LGA newborn. Monitor blood glucose levels within 30 minutes of birth and repeat the screening every hour. Recheck levels before feedings and

also immediately in any infant suspected of having or showing clinical signs of hypoglycemia, regardless of age (Aylott, 2006a). To help prevent hypoglycemia, initiate feedings, which 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 intravenous glucose, regardless of clinical symptoms (Aylott, 2006a). Monitor and record intake and output and obtain daily weights to aid in evaluating nutritional intake.

Observe for signs 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. Polycythemia and hyperviscosity are associated with fine and gross motor delays, speech delays, and neurologic sequelae (Neonatal Handbook, 2007g). Increasing fluid volume aids in decreasing blood viscosity. Partial exchange transfusion with plasma or normal saline may be used to lower hematocrit and decrease blood viscosity, but this treatment remains controversial. Hydration, early feedings, and phototherapy are used to treat hyperbilirubinemia (see Chapter 24 for more information about hyperbilirubinemia). 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 a **preterm newborn** and one born after completion of 42 weeks is classified as a **postterm newborn**. An infant born from the first day of 38th week through 42 weeks is classified as a **term newborn**. As of 2006, a new classification has been added, the **late preterm newborn**—one who is born between 34 weeks and 36 weeks, 6 days of gestation.

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.

▸ *Take* NOTE!

Although preterm and postterm newborns may appear to be at opposite ends of the gestational age spectrum and are very different in size and appearance, both are at high risk and need special care.

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, 2007).

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.

▸ *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?

Nursing Assessment

A thorough assessment of the postterm newborn upon admission to the nursery provides a baseline from which to identify changes in clinical status. Review the maternal history for any risk factors associated with postterm birth. Also be aware of the common physical characteristics and be able to identify any deviation from the expected. Postterm newborns typically exhibit the following characteristics:

- Dry, cracked, wrinkled skin
- Long, thin extremities
- 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 (Kenner & Lott, 2007)

Assess the newborn's gestational age and complete a physical examination to identify any abnormalities. Review the medical record to determine the color of the amniotic fluid when membranes ruptured and observe for a meconium-stained umbilical cord and fingernails to assess for possible meconium aspiration. Careful suctioning at the time of birth and afterwards, if the condition dictates it, reduces the incidence of meconium aspiration. Also be alert for other typical complications associated with a postterm newborn, such as perinatal asphyxia, hypoglycemia, hypothermia, and polycythemia, and be prepared to initiate early interventions (see Table 23.1 earlier in the chapter).

Nursing Management

The birth of a postterm newborn creates a crisis for the mother and her family. In most situations, birth of a newborn requiring special care was not anticipated. Postterm newborns 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 these newborns.

The postterm newborn is at high risk for perinatal asphyxia, which is usually attributed to placental deprivation or oligohydramnios that leads to cord compression, thereby reducing perfusion to the fetus. 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 require transport to the neonatal intensive care unit (NICU) for continuous assessment, monitoring, and treatment, depending on his or her status after resuscitation.

Monitor and maintain the postterm newborn's blood glucose levels once stabilized. Intravenous dextrose 10% and/or early initiation of feedings will help stabilize the blood glucose levels to prevent central nervous system sequelae.

Also monitor the postterm newborn's skin temperature, respiration characteristics, results of blood studies, such as arterial blood gases (ABGs) and serum bilirubin levels, and neurologic status. Institute measures to prevent or reduce the risk of hypothermia by eliminating sources of heat loss: thoroughly dry the newborn at birth, wrap him or her in a warmed blanket, and place a stockinet cap on the newborn's head. Providing environmental warmth via a radiant heat source will help stabilize the newborn's temperature.

Closely assess all postterm newborns for polycythemia. Providing adequate hydration helps to 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.

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%, is born before the 37th week of gestation (March of Dimes, 2007c). Prematurity is now the leading cause of death within the first month of life and the second leading cause of all infant deaths.

The etiology of half of all preterm births is unknown (March of Dimes, 2007b, 2007c). 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 (Vargo & Trotter, 2007). Despite increasing survival rates, preterm infants continue to be at high risk for neurodevelopmental disorders such as cerebral palsy or mental retardation, intraventricular hemorrhage, congenital anomalies, neurosensory impairment, behavioral problems, and chronic lung disease (Kipiani, Tatishvili, & Sirbiladze, 2007). Making sure that all pregnant women receive quality prenatal care throughout pregnancy is a major method for preventing preterm births.

Effects of Prematurity on Body Systems

Since the preterm newborn 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 of functioning at the level needed to maintain extrauterine homeostasis (March of Dimes, 2007b, 2007c).

Recall Anna, who was described at the beginning of the chapter; she gave birth to a newborn at 7 months' gestation. What problems would you anticipate that her newborn might have?

Respiratory System

The respiratory system is one of the last body systems to mature. Therefore, the preterm newborn is at great risk for respiratory complications. A few of the problems that affect the preterm newborn'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 an increased risk for 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 newborn circulation pattern. Higher oxygen levels in the circulation once air breathing begins spur this transition. 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 (Lissauer & Weindling, 2006).

Gastrointestinal System

Preterm newborns usually lack the neuromuscular coordination required 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 newborns 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 newborn at risk for nutritional deficiency and subsequent growth and development delays (Neonatal Handbook, 2007h).

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, 2007).

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, increases. In addition, preterm 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. Moreover, the preterm newborn's thin skin and fragile blood vessels provide a limited protective barrier, adding to the increased risk for infection. Thus, anticipating and preventing infections is the goal; preventing infections has a better outcome than treating them.

Central Nervous System

The preterm newborn is susceptible to injury and insult to the central nervous system (CNS), increasing the potential for long-term disability into adulthood. Like all newborns, preterm newborns 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 (Blackburn, 2007). Preventing cold stress, which would increase the newborn's metabolic and oxygen needs, is crucial. The goal is to create a neutral thermal environment in which oxygen consumption is minimal but body temperature is maintained (Kenner & Lott, 2007).

In addition, the preterm newborn is especially susceptible to hypoglycemia due to immature glucose control mechanisms, decreased glucose stores, and a reduced availability of alternative fuels such as ketone bodies.

▶ **Take** NOTE!

Glucose is needed by the brain and CNS to maintain and support numerous body system functions.

Nursing Assessment

Preterm newborns are at high risk for numerous problems and require special care. When preterm labor develops and cannot be stopped by medical interventions, plans for appropriate management of the mother and the preterm newborn are necessary, 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 newborn may be kept in the NICU for months.

A thorough assessment of the preterm newborn upon admission to the nursery provides a baseline from which to identify changes in clinical status. Be aware of the common physical characteristics and be able to identify any deviation from the expected (Fig. 23.2). Common physical characteristics of preterm infants may 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 (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 (Kenner & Lott, 2007)

Be alert for evidence that might suggest that the preterm newborn is developing a complication (see Table 23.1 earlier in the chapter).

Review the maternal history to identify risk factors for preterm birth and check antepartum and intrapartum records for maternal infections to anticipate the need for treatment. Maternal risk factors associated with preterm birth include a previous preterm delivery, low socioeconomic status, preeclampsia, hypertension, poor maternal nutrition, smoking, multiple gestation, infection, advanced maternal age, and substance abuse.

Assess the newborn's gestational age and assess for IUGR if appropriate. Inspect the newborn's skin closely, especially skin color. Assess vital signs, including temperature via skin probe to identify hypothermia or fever, and heart rate for tachycardia or bradycardia. Evaluate the newborn's respiratory effort and respiratory rate. Observe for periods of apnea lasting longer than 20 seconds. Monitor oxygen saturation levels by pulse oximetry to validate perfusion status. Note and report any signs of respiratory distress. Auscultate lung and heart sounds, being especially alert for possible murmur, which would indicate the presence of patent ductus arteriosus in a preterm newborn.

Assess neurologic status by observing the newborn's behavior. Note any restlessness, hypotonia, or weak cry or sucking effort and report unusual findings.

Monitor laboratory studies such as hemoglobin and hematocrit for signs of polycythemia. Screen for hypoglycemia upon admission and then hourly, always observing for nonspecific signs of hypoglycemia such as lethargy, poor feeding, and seizures. Evaluate serum bilirubin concentrations.

Also assess the mother and family members. Identify family strengths and coping mechanisms to establish a basis for intervention.

Nursing Management

The birth of a preterm newborn creates a crisis for the mother and family. Multiple studies have found that hospitalization for preterm newborns is often followed by negative mental health/behavioral outcomes, anxiety and depressive disorders, and developmental problems (Melnyk, Feinstein, & Fairbanks, 2006). Preterm newborns present with immaturity of all organ systems, abundant physiologic challenges, and significant morbidity and mortality (Kenner & Lott, 2007). The nurse must be vigilant for complications when managing preterm newborns (Fig. 23.3 and Nursing Care Plan 23.1).

Promoting Oxygenation

Newborns normally start to breathe without assistance and often cry after birth, being stimulated by a change in pres-

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 tone. (**D**) Breast and nipple area barely visible. (**E**) Male genitalia with minimal rugae on scrotum. (**F**) Female genitalia with prominent labia and clitoris.

sure 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 is defined as an 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

FIGURE 23.3 The physical condition of a preterm newborn demands skilled assessment and nursing care.

common clinical insult in the perinatal period that results in brain injury, which may lead to mental retardation, cerebral palsy, or seizures (Blackburn, 2007).

The preterm infant lacks surfactant. Surfactant lowers surface tension in the alveoli and stabilizes them to prevent their collapse. Even if preterm newborns can initiate respirations, they have a limited ability to retain air due to insufficient surfactant. Therefore, preterm newborns develop atelectasis quickly without alveoli stabilization. The inability to initiate and establish respirations leads to hypoxemia and ultimately 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, thus allowing fetal circulation patterns to 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 higher in preterm newborns.

Prevention and early identification of newborns at risk are key. Prenatal risk factors that can help identify the newborn who may need resuscitation at birth secondary to asphyxia include:

- 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 (placenta previa or abruptio placentae)
- Umbilical cord problems (nuchal or prolapsed)
- Difficult or traumatic birth
- Multiple births
- Congenital heart disease
- Maternal anesthesia or recent analgesia
- Preterm or postterm birth (Neonatal Handbook, 2007i)

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 underlying etiologies. For example, a chest x-ray helps to identify 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 (Lissauer & Weindling, 2007). Monitor vital signs continuously, check blood glucose levels for hypoglycemia secondary to stress, and maintain a neutral thermal environment to promote energy conservation and minimize oxygen consumption.

Resuscitating the Newborn

Any newborn can be born with asphyxia without warning. Approximately 10% of newborns require some assistance to begin breathing at birth. Anticipation, adequate preparation, accurate evaluation, and prompt initiation of support are critical for successful newborn resuscitation. Have all basic equipment immediately available and in working order. Ensure that the equipment is evaluated daily, and document its condition and any needed repairs. Box 23.2 lists the equipment needed for basic newborn resuscitation.

Determine the need for resuscitation by performing a rapid assessment using the following four questions:

- What is the gestational age of this newborn?
- Was the amniotic fluid clear of meconium or cloudy (infection present)?
- Is the newborn breathing or crying now?
- Does the newborn have good muscle tone?

If the answers are "yes" to all questions, then routine care is initiated: provide warmth, clear the airway, dry the newborn, and assess color. If the answer to any of these questions is "no," the newborn should receive one or more of the following actions, according to this sequence:

1. Stabilization—Dry the newborn thoroughly with a warm towel; provide warmth by placing him or her under a radiant heater to prevent rapid heat loss through evaporation; position the head in a neutral position to open the airway; clear the airway with a bulb syringe or suction catheter; stimulate breathing. At times, handling and rubbing the newborn with a dry towel may be all that is needed to stimulate respirations.

Nursing Care Plan 23.1

OVERVIEW OF THE CARE OF A PRETERM NEWBORN

Alice, an 18-year-old, felt she had done everything right during her first pregnancy and certainly didn't anticipate giving birth to a preterm newborn 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/min), nasal flaring, and sternal retractions; low blood glucose level suggested by lethargy, tachycardia, jitteriness; axillary temperature of 36° C (96.8° F) despite warmed blanket; weight 2,146 g (4.73 lb); length 45 cm (17.72 inches).

NURSING DIAGNOSIS: Ineffective breathing pattern related to immature respiratory system and respiratory distress as evidenced by tachypnea, nasal flaring, and sternal retractions

Outcome Identification and Evaluation

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

Interventions: Promoting Optimal Breathing Pattern

- 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 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 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 as evidenced by extended positioning, low axillary temperature despite warmed blanket, respiratory distress, and lethargy

Outcome Identification and Evaluation

Newborn will demonstrate ability to regulate temperature as evidenced by temperature remaining in normal range (36.5° to 37.5° C) and absent signs of cold stress.

Interventions: Promoting Thermoregulation

- 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.*
- Monitor vital signs, including heart rate and respiratory rate, every hour *to identify deviations.*
- Check radiant heat source or isolette *to ensure maintenance of appropriate temperature of the environment.*
- Assess environment for sources of heat loss or gain through evaporation, conduction, convection, or radiation *to minimize risk of heat loss.*
- Avoid bathing and exposing newborn *to prevent cold stress.*
- Warm 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.*

(continued)

Nursing Care Plan 23.1 (continued)

- Encourage kangaroo care (mother or father holds preterm infant underneath clothing skin-to-skin and upright between 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.*
- Demonstrate ways to safeguard warmth and prevent heat loss.

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 as evidenced by weak sucking reflex, low birthweight, and signs and symptoms of hypoglycemia, including lethargy, tachycardia, and jitteriness

Outcome Identification and Evaluation

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

Interventions: Promoting Optimal Nutrition

- 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 signs of low blood glucose *to allow 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 weight 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 and reduce energy demands.*
- Monitor temperature *to prevent cold stress resulting in decreased blood glucose levels.*
- Offer opportunities for non-nutritive 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.*
- Decrease energy requirements, including clustering care activities and providing rest periods, *to conserve glucose and glycogen stores.*
- Inform parents about procedures and treatments, including rationale for frequent blood glucose levels, *to help reduce their anxiety.*

2. Ventilation
3. Chest compressions
4. Administration of epinephrine and/or volume expansion (AHA/AAP, 2006).

The decision to progress from one set of actions to the next and the need for further resuscitative efforts is determined by the assessment of respirations, heart rate, and color (AHA/AAP, 2006).

When performing newborn resuscitation, use the mnemonic "ABCDs" (airway, breathing, circulation, and drugs) to remember the sequence of steps (Box 23.3).

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 (AHA/AAP, 2006).

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, encourage bonding by having them stroke, touch, and when appropriate hold the newborn.

Administering Oxygen

Oxygen administration is a common therapy in newborn nurseries. Although it has been used in newborns for over 75 years, there is no universal agreement on the most ap-

BOX 23.2 Basic Equipment for Newborn Resuscitation

- 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

BOX 23.3 ABCDs of Newborn Resuscitation

- **A**irway
  - Place infant's head in "sniffing" position.
  - Suction mouth, then nose.
  - Suction trachea if meconium-stained and newborn is NOT vigorous (strong respiratory effort, good muscle tone, and heart rate > 100 bpm).
- **B**reathing
  - Use positive-pressure ventilation (PPV) for apnea, grasping, or pulse <100 bpm.
  - Ventilate at rate of 40 to 60 breaths/minute.
  - Listen for raising heart rate, audible breath sounds.
  - Look for slight chest movement with each breath.
  - Use carbon dioxide detector after intubation.
- **C**irculation
  - Start compressions if heart rate is <60 after 30 seconds of effective PPV.
  - Give 3 compressions: 1 breath every 2 seconds.
  - Compress one third of the anterior-posterior diameter of the chest.
- **D**rugs
  - Give epinephrine if heart rate is <60 after 30 seconds of compressions and ventilation.
  - *Caution:* Epinephrine dosage is different for endotracheal and IV routes!
    - Epinephrine: 1:10,000 concentration
      - 0.1 to 0.3 mL/kg IV
      - 0.3 to 1 ml/kg via endotracheal tube (AHA/AAP, 2006)

propriate range at which oxygen levels should be maintained for newborns experiencing hypoxia, nor is there a standard time frame for oxygen to be administered (Neonatal Handbook, 2007d). 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 400 to 600 children become blind because of ROP in the United States annually (Lyon & Warren, 2006).

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, 2007). However, an ophthalmology consult for follow-up after discharge is essential for preterm infants who have received extensive oxygen therapy. See Chapter 38 for a more in-depth discussion of this condition.

Respiratory distress in preterm infants is commonly caused by a deficiency of surfactant, retained fluid in the lungs (wet lung syndrome), meconium aspiration, pneumonia, hypothermia, or anemia. The principles 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 or more frequently if indicated, and document any deterioration or changes in respiratory status:

- Respiratory rate, quality of respirations, and respiratory effort
- Airway patency, including removal of secretions per facility policy
- 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

FIGURE 23.4 (**A**) A preterm newborn receiving oxygen therapy via a nasal cannula. The newborn also has an enteral feeding tube inserted for nutrition. (**B**) A preterm newborn receiving mechanical ventilation.

- 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 levels of 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% (Aylott, 2006b)
- 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 87%, prepare to give additional oxygen as ordered. Throughout care, strict asepsis, including handwashing, is vital to reduce the risk 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 newborns who are not considered stable may 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. However, the preterm newborn has an inadequate supply of brown fat because he or she left the uterus before it was adequate. The preterm newborn also 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, preterm newborns have large body surface areas compared to weight. This allows an increased transfer of heat from their bodies to the environment.

Typically, a preterm newborn who is having problems with thermal regulation is cool to cold to the touch. The hands, feet, and tongue may appear cyanotic. Respirations are shallow or slow, or signs of respiratory distress are present. The newborn is lethargic and hypotonic, feeds poorly, and has a feeble cry. Blood glucose levels are probably low, leading to hypoglycemia, due to the energy expended to keep warm.

When promoting thermal regulation for the preterm newborn:

- Remember the four mechanisms for heat transfer and ways 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.
- Remember the complications of hypothermia and frequently assess the newborn for signs:
  - 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 newborns because their needs are great but their ability to take in optimal amounts of energy/calories is reduced due to their compromised health status. Individual nutritional needs are highly variable.

Depending on their gestational age, preterm newborns receive nutrition orally, enterally, or parenterally via infusion. Several different methods can be used to provide nutrition: 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 (formula or breast milk), continuous nasogastric tube feedings, or intermittent 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.

To promote nutrition and fluid balance in the preterm 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 (Kenner & Lott, 2007). Be alert for signs of dehydration, such as a decrease in urinary output, sunken fontanels, temperature elevation, lethargy, and tachypnea.
- Continually assess for enteral feeding intolerance; measure abdominal girth, auscultate bowel sounds, and measure gastric residuals before the next tube feeding.
- Encourage and support breastfeeding by facilitating maternal breast pumping.
- Encourage nuzzling at the breast in conjunction with kangaroo care if the newborn is stable.

▶ *Take* NOTE!

When assessing the fluid status of a preterm newborn, palpate the fontanels. Sunken fontanels suggest dehydration; bulging fontanels suggest overhydration.

Preventing Infection

Prevention of infection is critical when caring for preterm newborns. Infections are the most common cause of morbidity and mortality in the NICU population (Kenner & Lott, 2007). Nursing assessment and early identification of problems are imperative to improve outcomes.

Preterm newborns are at risk for infection because their early birth deprived them of maternal antibodies needed for passive protection. Preterm newborns also are susceptible to infection because of their limited ability to produce antibodies, asphyxia at birth, and thin, friable skin that is easily traumatized, providing an entry portal for microorganisms.

Early detection is crucial. The clinical manifestations 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.
- Avoid using tape on the newborn's skin to prevent tearing.
- Use equipment that can be thrown away after use.
- Adhere to standard precautions; use clean gloves to handle dirty diapers and dispose of them properly.
- Use sterile gloves when assisting with any invasive procedure; attempt to minimize the use of invasive procedures.
- Remove all jewelry on your hands prior to washing hands; wash hands upon entering the nursery and in between caring for newborns.
- Avoid coming to work when ill, and screen all visitors for contagious infections.

Preventing Complications

Preterm 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 include 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, 2007b). Several of these complications are described in Chapter 24.

Remember Anna, who was in a state of shock when she entered the NICU to see her preterm baby for the first time? How could the nurse have prepared her for this event? What information needs to be given at the isolette to reduce her anxiety and fear now?

Providing Appropriate Stimulation

Newborn stimulation involves a series of activities to encourage normal development. Research on developmental interventions shows that when preterm newborns, in particular, receive sensorimotor interventions such as rocking, skin-to-skin contact with parents, containment (swaddling and surrounded by blanket rolls), music, non-nutritive sucking, breastfeeding, massage, holding, 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 (Field et al., 2006). Conversely, overstimulation may have negative effects by reducing oxygenation and causing stress. A newborn reacts to stress by flaying 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 (Blackburn, 2007).

Appropriate developmental stimulation that would not overtax the compromised newborn might include kangaroo (skin-to-skin) holding, rocking, soft singing or music, cuddling, gentle stroking of the infant's skin, colorful mobiles, gentle massage, waterbed mattresses, and non-nutritive sucking opportunities (Fig. 23.5) or providing sucrose if tolerated.

FIGURE 23.5 A preterm newborn receiving non-nutritive sucking.

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 to 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).

Think back to Anna, the woman who gave birth to a preterm newborn at 7 months' gestation. Anna will be discharged but her newborn will be staying in the NICU for a while. What interventions would be appropriate to facilitate bonding despite their separation? What support can be provided specifically to her family?

Managing Pain

Pain is an unpleasant sensory and emotional experience felt by all humans. Newborns feel pain and require the same level of pain assessment and management as adults. Common indicators of pain in the newborn who is unable

FIGURE 23.6 A mother bonding with her preterm newborn.

to vocalize include facial expressions, body movements, and physiologic changes (Kenner & Lott, 2007). Untreated pain in newborns may result in increased morbidity and length of stay in the NICU, exaggerated responses to pain in later life, and altered psychosocial development (Koeppel, 2007). Parents commonly expect that health care providers will use appropriate measure to prevent pain in their newborns, but there are gaps in knowledge about the most effective way to accomplish this.

Assessment of pain in the newborn remains a contentious and vexing problem. 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 (AAP, 2006a, 2006b). An international consortium established principles of newborn pain prevention and management that all nurses must be familiar with and apply (Box 23.4).

Several psychometric tools are available to assess pain in the newborn. Examples include the Pain Assessment Tool (PAT), which evaluates respirations, heart rate, oxygen saturation, and blood pressure; the Premature Infant Pain Profile (PIPP), which assesses heart rate and oxygen saturation; the CRIES tool (cry, requires oxygen, increased vital signs, expression and sleeplessness); and the Neonatal Infant Pain Scale (NIPS), which evaluates respiratory patterns. Most are based on facial expressions, crying patterns, change in vital signs, and body movements (AAP, 2006a). See Chapter 35 for a more in-depth discussion of pain assessment and management.

Nurses play a key role in assessing a newborn's pain level. Assess the newborn frequently. Pain is considered the "fifth vital sign" and should be assessed as frequently as the other four vital signs. 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:

- Sudden high-pitched cry
- Facial grimace with furrowing of brow and quivering chin
- Increased muscle tone
- Oxygen desaturation

BOX 23.4 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.

Source: Kenner & Lott, 2007.

- Body posturing, such as squirming, kicking, arching
- Limb withdrawal and thrashing movements
- Increase in heart rate, blood pressure, pulse, and respirations
- Fussiness and irritability (Arenson & Drake, 2007)

The goals of pain management are to minimize the amount, duration, and severity of pain and to assist the newborn in coping. Effective pain management strategies for newborns include preventing, limiting, or avoiding noxious stimuli; using nonpharmacologic techniques to reduce pain; and administering pharmacologic agents when appropriate. Box 23.5 lists some of the more commonly used nonpharmacologic pain management techniques for the preterm newborn.

The number of analgesics available for use with preterm newborns is limited. Morphine and fentanyl, usually administered intravenously, are the most commonly used opioids for moderate to severe pain. Acetaminophen is effective for mild pain. Benzodiazepines are used as sedatives during painful procedures and can be combined with opioids for more effectiveness. Local or topical anesthetics (e.g., EMLA cream) also may be used before procedures such as venipuncture, lumbar puncture, and intravenous catheter insertion (AAP, 2006b).

Be vigilant in assessing for 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.

BOX 23.5 Nonpharmacologic Techniques to Reduce Pain in the Preterm Newborn

- Gentle handling, rocking, caressing, cuddling, and massaging
- Rest periods before and after painful procedures
- Kangaroo care (skin-to-skin contact) during procedure
- Breastfeeding, if able, to reduce pain from minor procedures
- Use of a facilitated tuck (holding arms and legs in a flexed position)
- Application of topical anesthetics prior to venipuncture or lumbar puncture
- Swaddling and positioning to establish physical boundaries
- Non-nutritive sucking (pacifier dipped in sucrose) prior to procedure
- Minimal use of tape, with gentle removal to avoid skin tears
- 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
- Distraction, such as with colored objects or mobiles (AAP, 2006a, 2006b)

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 the concept of 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 (Neonatal Handbook, 2007b).

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 (see Evidence-Based Practice 23.1). The goal is to promote a stable, well-organized newborn who can conserve energy for growth and development (Hendricks-Munoz & Prendergast, 2007).

Developmental care includes these strategies:

- Clustering care to promote rest and conserve the infant's energy
- Flexed positioning to simulate in utero positioning
- Environmental management to reduce noise and visual stimulation
- Kangaroo care to promote skin-to-skin sensation
- Placement of twins in the same isolette or open crib to reduce stress
- Activities to 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 non-nutritive sucking (calms the infant)
  - Providing objects to grasp (comforts the newborn)
- Promotion of parent–infant bonding by making parents feel welcome in the NICU
- Open, honest communication with parents and staff
- Collaboration with the parents in planning the infant's care (Davidson et al., 2007)

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

EVIDENCE-BASED PRACTICE 23.1
Promoting Development and Preventing Morbidity in Preterm Infants

● Study
Preterm newborns are at risk due to their immature body systems. This is compounded by the newborn's increased risk for complications and illnesses and his or her exposure to numerous stimuli in the NICU environment. Together, these stressors can interfere with the newborn's growth and development. Developmental care is a philosophy that includes a wide range of activities to manage the environment and individualize care. The belief is that it can reduce the effects of these stressors. Activities typically associated with developmental care include controlling external stimuli, clustering care activities, and positioning and swaddling the preterm newborn.

A study was done to examine the effects of developmental care on preterm newborns. The study evaluated relevant outcomes such as neurodevelopment, weight gain, length of hospital stay, duration of mechanical ventilation, and physiologic stress. A computerized search of all articles, controlled trials, and conference and symposia proceedings was done. Two independent experts identified the data from all relevant randomized trials that compared the elements of developmental care to routine nursery care for newborns less than 37 weeks' gestation. The researchers identified 36 controlled trials.

▲ Findings
Assessing the benefits of developmental care was difficult because most of the studies reviewed included multiple interventions and many of the trials had small sample sizes. Therefore, the authors could not determine whether any one intervention was more effective than another. Overall, they reported that developmental care had limited benefits and no major harmful effects. It had a limited benefit on decreasing moderate to severe chronic lung disease, decreasing the incidence of necrotizing colitis, and improving family outcomes. Evidence was also limited related to the long-term positive effect on behavior and movement at 5 years corrected age. However, individualized developmental care activities showed some positive effects in improving neurodevelopmental outcomes.

■ Nursing Implications
Although the study found that developmental care for preterm newborns was of limited benefit, it emphasized that this type of care had no major harmful effects. Nurses can integrate these findings into their care for preterm newborns with the understanding that they are beneficial but that the effect may be limited. Nurses can advocate for individualizing the activities involved in developmental care based on the newborn's needs. They also can play a key role in fostering research to help determine which stressors seem to be the most troublesome and which specific activities are of the greatest benefit. In addition, nurses can assist in identifying appropriate short- and long-term outcome measures.

Symington, A., & Pinelli, J. (2006). Developmental care for promoting development and preventing morbidity in preterm infants. *Cochrane Database of Systematic Reviews* 2006. Issue 2. Art. No.: CD001814. DOI: 10.1002/14651858.CD001814.pub2.

by serving 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.
- 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 (McGrath, 2006).

Promoting Parental Coping
Generally, pregnancy and the birth of a newborn are exciting times, but when the newborn has serious, perhaps life-threatening problems, the exciting experience suddenly changes to one of anxiety, fear, guilt, loss, and grief.

Parents are typically unprepared for the birth of a preterm newborn and 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 (Mok & Sui, 2006). Early interruptions in the bonding process and concern

about the newborn's survival can create extreme anxiety and interfere with attachment (Mercer & Walker, 2006).

Nursing interventions aimed at reducing parental anxiety include:

- Reviewing with them the events that have occurred since birth
- Providing simple relaxation and calming techniques (visual imagery, breathing)
- Exploring their perception of the newborn's condition and offering explanations
- Validating their anxiety and behaviors as normal reactions to stress and trauma
- Providing a physical presence and support during emotional outbursts
- Exploring the coping strategies they used successfully in the past and encouraging their use now
- Encouraging frequent visits to the NICU
- Addressing their reactions to the NICU environment and explaining all equipment used
- Identifying family and community resources available to them (Franklin, 2006)

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 typically includes 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 23.6.

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

- Assessing the physical status of the mother and the newborn
- Discussing the early signs of complications and what to do if they occur
- Reinforcing instructions for infant care and safety
- Stressing the importance of proper car seat use
- Providing instructions for medication administration
- Reinforcing instructions for equipment operation, maintenance, and troubleshooting
- Teaching infant cardiopulmonary resuscitation and emergency care

BOX 23.6 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

- Demonstrating techniques for special care procedures such as dressings, ostomy care, artificial airway maintenance, chest physiotherapy, suctioning, and infant stimulation
- Providing breastfeeding support or instruction on gavage feedings
- Assisting with defining roles in the adjustment period at home
- Assessing the parents' emotional stability and coping status
- Providing support and reassurance to the family
- Reporting abnormal findings to the health care team for intervention
- Following up with parents to assure them that they have a "lifeline"

Dealing With Perinatal Loss

Perinatal loss is a profound experience for the family. It engenders a unique kind of mourning since the infant is so much a part of the parents' identity. Instead of celebrating a new life as they expected, parents are mourning the loss of dreams and hopes and the loss of an extension of themselves. NICU nurses 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 actions help to validate the parents' sense of loss, relive the experience, and attach significance to the meaning of loss. A lock of hair, a name card, or an 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 resolving grief (Callister, 2006).

Parent–newborn interaction is vital to the normal processes of attachment and bonding. The detachment process involved in a newborn's death is equally important for parents. 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 the newborn's status, and providing time for them to be with their dying newborn (Kavanaugh & Moro, 2006).

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 give parents a safe place to begin the healing 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), respect their feelings, and respond to them in helpful and supportive ways (Kavanaugh & Moro, 2006). Table 23.2 highlights appropriate interventions for a family experiencing a perinatal loss before and after a newborn dies.

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,

TABLE 23.2 ASSISTING PARENTS TO COPE WITH PERINATAL LOSS

Before the newborn's death	Respect variations in the family's spiritual needs and readiness. Assess cultural beliefs and practices that may bring comfort; respect culturally appropriate requests for truth telling and informed refusal. Initiate spiritual comfort by calling the hospital clergy if appropriate; offer to pray with the family if appropriate. Encourage the parents to take photographs, make memory boxes, and record their thoughts in a journal. Explore with family members how they dealt with previous losses. Discuss techniques to reduce stress, such as meditation and relaxation. Recommend that family members maintain a healthy diet and get adequate rest and exercise to preserve their health. Participate in early and repeated care conferencing to reduce family stress. Allow family to be present at both medical rounds and resuscitation; provide explanations of all procedures, treatments, and findings; answer questions honestly and as completely as possible. Provide opportunities for the family to hold the newborn if they choose to. Assess the family's support network. Provide suggestions as to how friends can be helpful to the family.
After the newborn's death	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. Encourage the father to cry and grieve with his partner. Provide opportunities for the family to hold the newborn if they desire.
At the time of the release of the newborn's body	Reassure the family that their feelings and grieving responses are normal. Encourage the parents to have a funeral or memorial service to bring closure. Suggest that the parents plant a tree or flowers to remember the infant. Address attachment issues concerning subsequent pregnancies. Provide information about local support groups. Provide anticipatory guidance regarding the grieving process. Present information about any impact on future childbearing, and refer the parents to appropriate specialists or genetic resources.

Sources: Callister, 2006; Cote-Arsenault & Donato, 2007; Kobler, Limbo, & Kavanaugh, 2007.

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 express their feelings.

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 facilitate the grieving process. Supporting and strengthening the family bond in the face of perinatal loss is essential.

LATE PRETERM NEWBORN

A late preterm newborn is an infant born between 34 weeks and 36 weeks, 6 days of gestation. In recent years, the subject of late preterm birth has received much attention, since this population of preterm newborns represents more than 70% of all preterm births in the United States and has increased by 30% in the past 20 years (National Center for Health Statistics, 2006). With the sharp rise in the number of cesarean births performed, the incidence of late preterm newborns will also rise. Perinatal nurses need to understand the risks of late preterm births and the unique needs of this population to facilitate timely assessment and intervention to improve outcomes.

Some of the challenges facing the late preterm newborn include respiratory distress (secondary to cesarean births, maternal gestational diabetes, chorioamnionitis, premature rupture of membranes, and fetal distress); thermoregulation issues related to limited ability to flex the trunk and extremities to decrease exposed surface area; hypoglycemia related to the first two challenges (respiratory distress and cold stress); jaundice and hyperbilirubinemia related to a gestational age of 36 weeks or less; and feeding challenges related to immature suck and swallowing reflexes (Askin et al., 2007). These challenges are similar to those facing the preterm newborn and require similar management. Nurses and parents must be aware of the risks associated with late preterm births to optimize care and outcomes for this group of newborns.

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, 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 the newborn may not survive. Nurses working with parents experiencing a perinatal loss can help by actively listening, 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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WEBSITES

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

1. The nurse documents that a newborn is postterm based on the understanding that he was born after:
   a. 38 weeks' gestation
   b. 40 weeks' gestation
   c. 42 weeks' gestation
   d. 44 weeks' gestation
2. SGA and LGA newborns have an excessive number of red blood cells because of:
   a. Hypoxia
   b. Hypoglycemia
   c. Hypocalcemia
   d. Hypothermia
3. Because subcutaneous and brown fat stores were used for survival in utero, the nurse would assess an SGA newborn for which of the following?
   a. Hyperbilirubinemia
   b. Hypothermia
   c. Polycythemia
   d. Hypoglycemia
4. In assessing a preterm newborn, which of the following findings would be of greatest concern?
   a. Milia over the bridge of the nose
   b. Thin transparent skin
   c. Poor muscle tone
   d. Heart murmur
5. In dealing with parents experiencing a perinatal loss, which of the following nursing interventions would be most appropriate?
   a. Sheltering the parents from the bad news
   b. Making all the decisions regarding care
   c. Encouraging them to participate in the newborn's care
   d. Leaving them by themselves to allow time to grieve
6. The nurse is providing care to several newborns with variations in gestational age and birthweight. When developing the plan of care for these newborns, the nurse focuses on energy conservation to promote growth and development. Which measures would the nurse include in the nursing plans of care? Select all that apply.
   a. Keeping the handling of the newborn to a minimum
   b. Maintaining a neutral thermal environment
   c. Decreasing environmental stimuli
   d. Initiating early oral feedings
   e. Using thermal warmers in all cribs
7. Which of the following concepts would the nurse incorporate into the plan of care when assessing pain in a newborn with special needs?
   a. Newborns experience pain primarily with surgical procedures.
   b. Preterm newborns in the NICU are at least risk for pain.
   c. Pain assessment needs to be comprehensive and frequent.
   d. A newborn's facial expression is the primary indicator of pain.

CRITICAL THINKING EXERCISES

1. After fetal distress was noted on the monitor, a postterm 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 behaviors: jitteriness, tremors, hypotonia, lethargy, and rapid respirations.
   a. What might these behaviors indicate?
   b. For what other conditions might this newborn be at high risk?
   c. What intervention is needed to address this newborn's condition?
2. 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 cardiac 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.
   a. What might have contributed to this newborn's hypothermic condition?

b. What transfer mechanism may have been a factor?

c. What intervention would be appropriate for the nurse to initiate?

3. 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.

   a. What complication might this SGA newborn be manifesting?

   b. What factors may have contributed to this complication?

   c. What would be an appropriate intervention to manage this condition?

Study Activities

1. At a community health department maternity clinic, secure permission to interview the parents of a special needs child. Ask about their feelings throughout the experience. How are they managing and coping now?

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 newborns 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 _____.