CHAPTER 24

Nursing Management of the Newborn at Risk: Acquired and Congenital Newborn Conditions

KEY TERMS

alcohol-related birth defects
asphyxia
caput succedaneum
cephalhematoma
fetal alcohol spectrum disorder
fetal alcohol syndrome
gastrochisis
hyperbilirubinemia
infant of a diabetic mother
kernicterus
meconium aspiration syndrome
neonatal abstinence syndrome
neonatal sepsis
omphalocele
respiratory distress syndrome

LEARNING OBJECTIVES

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

1. Identify the most common acquired conditions affecting the newborn.
2. Describe the nursing management of a newborn experiencing respiratory distress syndrome.
3. Outline the birthing room preparation and procedures necessary to prevent meconium aspiration syndrome in the newborn at birth.
4. Differentiate risk factors for the development of necrotizing enterocolitis.
5. Explain the impact of maternal diabetes on the newborn and the care needed.
6. Describe the assessment and intervention for a newborn experiencing substance withdrawal after birth.
7. Identify assessment and nursing management for newborns sustaining trauma and birth injuries.
8. Outline the assessment, interventions, prevention, and management of hyperbilirubinemia in newborns.
9. Summarize the interventions appropriate for a newborn with neonatal sepsis.
10. Describe four gastrointestinal system congenital anomalies that can occur in a newborn.

Kelly, a 27-year-old G2P1, comes to the labor and birth area in active labor. She tells you she is overdue and relieved to finally be giving birth. Her membranes rupture on admission, revealing meconium-stained fluid. What additional nursing assessments need to be carried out now? What risk factors need to be considered in when developing Kelly's plan of care?

Wow

Courage and faith in oneself project onto others, giving them the strength to persevere.

LEARNING OBJECTIVES (continued)

11. Formulate a plan of care for a newborn with an acquired or congenital condition.
12. Discuss the importance of parental participation in care of the newborn with a congenital or acquired condition, including the nurse's role in facilitating parental involvement.

Advances in prenatal and neonatal medical and nursing care throughout the industrialized world have led to a marked increase in the number of newborns who have survived a high-risk pregnancy but experience acquired or congenital conditions. These newborns are considered at risk: that is, they are susceptible to morbidity and mortality because of the acquired or congenital disorder. Several National Health Goals address the issues of acquired and congenital conditions in newborns (Healthy People 2010 24.1).

Technological and pharmacologic advances, in conjunction with standardized policies and procedures, over the past several decades have significantly improved survival rates for at-risk newborns. However, morbidity remains an important sequela. For example, some of these newborns are at risk for continuing health problems that require long-term technological support. Other newborns remain at risk for physical and developmental problems into the school years and beyond. Providing the complex care needed to maintain the child's health and well-being will have a tremendous emotional and economic impact on the family. Nurses are challenged to provide support to mothers and their families when neonatal well-being is threatened.

Acquired disorders typically occur at or soon after birth. They may result from problems or conditions experienced by the woman during her pregnancy or at birth, such as diabetes, maternal infection, or substance abuse, or conditions associated with labor and birth, such as prolonged rupture of membranes or fetal distress. However, there may be no identifiable cause for the disorder.

Congenital disorders are disorders present at birth, usually due to some type of malformation that occurred during the antepartal period. Congenital disorders, which typically involve a problem with inheritance, include structural anomalies (commonly referred to as birth defects), chromosomal disorders, and inborn errors of metabolism. Most congenital disorders have a complex etiology, involving many interacting genes, gene products, and social and environmental factors during organogenesis. Some alterations can be prevented or compensated for with pharmacologic, nutritional, or other types of interventions, while others cannot be changed. Only through a better understanding of the complex interplay of genetic, environmental, social, and cultural factors can these devastating and life-changing outcomes be prevented (Arenson & Drake, 2007).

This chapter addresses selected acquired and congenital newborn conditions. In addition, it describes the nurse's role in assessment and management, emphasiz-

HEALTHY PEOPLE 2010

Objective	Significance
1. Reduce fetal and infant deaths Decrease the number of all infant deaths (within 1 year) from a baseline of 7.2/ 1,000 live births to 4.5/ 1,000 live births. Decrease the number of neonatal deaths (within the first 28 days of life) from a baseline of 4.8 to 2.9 deaths/ 1,000 live births. Decrease the number of post-neonatal deaths from a baseline of 2.4 to 1.2 deaths/ 1,000 live births. Reduce the number of deaths related to all birth defects from a baseline of 1.6 to 1.1 deaths/1,000 live births.	Will foster early and consistent prenatal care, including education to place infants on their backs for naps and sleeping to prevent SIDS and avoidance of exposing the newborn to cigarette smoke
2. Reduce the occurrence of developmental disabilities Reduce the number of children with mental retardation from a baseline of 131 to 124 children/10,000. Reduce the number of children with cerebral palsy from a baseline of 32.2 to 31.5 children/ 10,000. Reduce the number of children with autism spectrum disorder.	Will promote measures for close antepartal and intrapartal monitoring of women at risk, subsequently reducing the incidence of disabilities, leading to a reduction in long-term effects and costs of care
3. Reduce the occurrence of fetal alcohol syndrome	Will foster programs for at-risk groups, including adolescents, about the effects of substance abuse, especially alcohol, during pregnancy

DHHS, 2000; available online at www.healthypeople.gov

ing parental education and support. Nurses play a key role in helping the parents cope with the stress of having an ill newborn.

Acquired Disorders

NEONATAL ASPHYXIA

As the newborn makes the transition to life outside the fluid-filled intrauterine environment, dramatic changes must occur to facilitate newborn respirations. Newborns normally start to breathe with routine warming, drying, airway suctioning, and mild stimulation. Most newborns make this transition such that by 1 minute of age, they are breathing well on their own. A newborn who fails to establish adequate, sustained respiration after birth is said to have **asphyxia**. Physiologically, asphyxia can be defined as impairment in gas exchange resulting in a decrease in blood oxygen levels (hypoxemia) and an excess of carbon dioxide or hypercapnia that leads to acidosis.

Asphyxia is the most common clinical insult in the perinatal period. As many as 10% of newborns require some degree of active resuscitation to stimulate breathing (Cunningham et al., 2005). According to the World Health Organization, 4 to 9 million cases of neonatal asphyxia occur annually worldwide, accounting for approximately 20% of all newborn deaths. More than a million newborns who survive asphyxia at birth develop long-term problems such as cerebral palsy, mental retardation, and speaking, hearing, visual, and learning disabilities (Maternal and Neonatal Health [MNH], 2007).

Pathophysiology

Asphyxia occurs when oxygen delivery is insufficient to meet metabolic demands, resulting in hypoxia, hypercarbia, and metabolic acidosis. Any condition that reduces oxygen delivery to the fetus can result in asphyxia. These conditions may include maternal hypoxia, such as from cardiac or respiratory disease, anemia, or postural hypotension; maternal vascular disease that leads to placental insufficiency, such as diabetes or hypertension; cord problems such as compression or prolapse; and postterm pregnancies, which may trigger meconium release into the amniotic fluid.

Initially, the newborn uses compensatory mechanisms including tachycardia and vasoconstriction to help bring oxygen to the vital organs for a time. However, without intervention, these mechanisms fail, leading to hypotension, bradycardia, and eventually cardiopulmonary arrest.

With failure to breathe well after birth, the newborn will develop 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.

Think back to Kelly, described at the beginning of the chapter. She gives birth to a son weighing approximately 2,500 g; he appears postterm and small for gestational age. His skin is stained yellow-green and he is limp, cyanotic, and apneic at birth. The initial assessment once the newborn is under the radiant warmer indicates that resuscitation and tracheal suctioning are needed. What is the nurse's role during resuscitation? What assessments will be needed during this procedure?

Nursing Assessment

The key to successful treatment of newborn asphyxia is early identification and recognition of newborns who may be at risk. Review the perinatal history for risk factors, including:

- Trauma: injury to the central or peripheral nervous system secondary to a long or difficult labor, a precipitous birth, multiple gestation, abnormal presentation, cephalopelvic disproportion, shoulder dystocia, or extraction by forceps or vacuum
- Intrauterine asphyxia: for example, fetal hypoxia secondary to maternal hypoxia, diabetes, hypertension, anemia, cord compression, or meconium aspiration
- Sepsis: acquired bacterial or viral organisms from infected amniotic fluid, maternal infection, or direct contact while passing through the birth canal
- Malformation: congenital anomalies including facial or upper airway deformities, renal anomalies, pulmonary hypoplasia, neuromuscular disorders, esophageal atresia, or neural tube defects
- Hypovolemic shock: secondary to abruptio placentae, placenta previa, or cord rupture resulting in blood loss to the fetus
- Medication: drugs given to mother during labor that can affect the fetus by causing placental hypoperfusion and hypotension; use of hypnotics, analgesics, anesthetics, narcotics, oxytocin, and street drugs during pregnancy

At birth, assess the newborn immediately. Observe the infant's color, noting any pallor or cyanosis. Assess the work of breathing. Be alert for apnea, tachypnea, gasping respirations, grunting, nasal flaring, or retractions. Evaluate heart rate and note bradycardia. Assess the newborn's temperature, noting hypothermia. Determine the Apgar score at 1 and 5 minutes; an Apgar score below 7 at either time indicates that resuscitation is needed.

Anticipate diagnostic testing to identify etiologies for the newborn's asphyxia. For example, a chest x-ray may identify structural abnormalities that might interfere with respiration. A blood culture may identify an infectious process. A blood toxicology screen may detect any maternal drugs in the newborn (Kenner & Lott, 2007).

Nursing Management

Management of the newborn experiencing asphyxia includes immediate resuscitation. Ensure that the equipment needed for resuscitation is readily available and in working order. Essential equipment includes a wall suction apparatus, an oxygen source, a newborn ventilation bag, endotracheal tubes (2 to 3 mm), a laryngoscope, and ampules of naloxone (Narcan) with syringes and needles for administration (see Chapter 23 for a more detailed discussion of resuscitation).

Dry the newborn quickly with a warm towel and then place him or her under a radiant heater to prevent rapid heat loss through evaporation. Handling and rubbing the newborn with a dry towel may be all that is needed to stimulate the onset of breathing. If the newborn fails to respond to stimulation, then active resuscitation is needed.

The procedure for newborn resuscitation is easily remembered by the "ABCDs"—airway, breathing, circulation, and drugs (see Chapter 23, Box 23.3). Continue resuscitation 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 (Brodsky & Ouellette, 2007).

▶ *Take* NOTE!

According to the American Heart Association and American Academy of Pediatrics Emergency Care Guidelines for Neonatal Resuscitation, resuscitation efforts may be stopped if the newborn exhibits no heart beat and no respiratory effort after 10 minutes of continuous and adequate resuscitation (AHA/AAP, 2005; Zaichkin, 2006).

Provide continued observation and assessment of the newborn who has been successfully resuscitated. Monitor the newborn's vital signs and oxygen saturation levels closely for changes. Maintain a neutral thermal environment to prevent hypothermia, which would increase the newborn's metabolic and oxygen demands. Check the blood glucose level and observe for signs of hypoglycemia; if this develops, it can further stress the newborn.

The need for resuscitative measures can be extremely upsetting for the parents. Explain to them the initial resuscitation activities being performed and offer ongoing explanations about any procedures being done, equipment being used, or medications given. Provide physical and emotional support to the parents through the initial crisis and throughout the newborn's stay. When the newborn is stable, allow parents to spend time with their newborn to promote bonding (Fig. 24.1). Point out the newborn's positive attributes and give frequent updates on his or her status. Role-model techniques for holding, interacting with, and caring for the newborn to decrease the parents' anxiety.

FIGURE 24.1 A father interacting with his newborn once the newborn's condition has stabilized.

Remember Kelly, the young woman described at the beginning of the chapter? Her son is intubated and tracheal suctioning is performed. Positive-pressure ventilation is also started with a self-inflating bag and 50% oxygen. Ventilation is continued for 1 minute and then gradually discontinued. The heart rate is now 120 bpm, and spontaneous respirations are noted. When free-flow oxygen is administered, the newborn begins to cry and turn pink. What continued care is needed in the special care nursery? What explanation should be offered to Kelly regarding her son?

TRANSIENT TACHYPNEA OF THE NEWBORN

Transient tachypnea of the newborn (TTN) is a condition involving a mild degree of respiratory distress. It is described as the retention of lung fluid or transient pulmonary edema (McLenan, 2007). It usually occurs within a few hours of birth and resolves by 72 hours of age. TTN occurs in approximately 11 per 1,000 live births (Asenjo, 2007).

Pathophysiology

Most newborns make the transition from fetal to newborn life without incident. During fetal life, the lungs are filled with a serous fluid because the placenta, not the lungs, is used for nutrient and gas exchange. During and after birth, this fluid must be removed and replaced with air. Passage through the birth canal during a vaginal birth

compresses the thorax, which helps remove the majority of this fluid. Pulmonary circulation and the lymphatic drainage remove the remaining fluid shortly after birth. TTN occurs when the liquid in the lung is removed slowly or incompletely.

Nursing Assessment

Astutely observe the newborn with respiratory distress because TTN is a diagnosis of exclusion. Initially it might be difficult to distinguish this condition from respiratory distress syndrome or group B streptococcal pneumonia, since the clinical picture is similar. However, the symptoms of transient tachypnea rarely last more than 72 hours (McLenan, 2007).

History and Physical Examination

Review the perinatal history for contributing factors. TTN is commonly seen in newborns who are sedated or have been born via cesarean birth. Also check the history for evidence of a prolonged labor, fetal macrosomia, and maternal asthma and smoking. These factors are associated with a higher incidence of TTN (Rodriguez, 2006).

Closely assess the newborn for signs of TTN. Within the first few hours of birth, observe for tachypnea, expiratory grunting, retractions, labored breathing, nasal flaring, and mild cyanosis (Asenjo, 2007). Mild to moderate respiratory distress is present by 6 hours of age, with respiratory rates as high as 100 to 140 breaths per minute (Kenner & Lott, 2007). Also inspect the newborn's chest for hyperextension or a barrel shape. Auscultate breath sounds, which may be slightly diminished secondary to reduced air entry.

Laboratory and Diagnostic Testing

To aid in the diagnosis, a chest x-ray may be done. It usually reveals mild symmetric lung overaeration and prominent perihilar interstitial markings and streaking. These findings correlate with lymphatic engorgement of retained fetal fluid (Asenjo, 2007).

Nursing Management

Nursing management focuses on providing adequate oxygenation and determining whether the newborn's respiratory manifestations appear to be resolving or persisting. Provide supportive care while the retained lung fluid is reabsorbed. Administer intravenous (IV) fluids and/or gavage feedings until the respiratory rate decreases enough to allow safe oral feeding. Provide supplemental oxygen via a nasal cannula or oxygen hood to maintain adequate oxygen saturation. Maintain a neutral thermal environment with minimal stimulation to minimize oxygen demand.

Provide ongoing assessment of the newborn's respiratory status. As TTN resolves, the newborn's respiratory rate declines to 60 breaths per minute or less, the oxygen requirement decreases, and the chest x-ray shows resolution of the perihilar streaking. Provide reassurance and progress reports to the parents to help them cope with this crisis.

RESPIRATORY DISTRESS SYNDROME

Despite improved survival rates and advances in perinatal care, many high-risk newborns are at risk for respiratory problems, particularly **respiratory distress syndrome** (RDS), a breathing disorder resulting from lung immaturity and lack of alveolar surfactant. Since the link between RDS and surfactant deficiency was discovered more than 30 years ago, tremendous strides have been made in understanding the pathophysiology and treatment of this disorder. The introduction of prenatal steroids to accelerate lung maturity and the development of synthetic surfactant can be credited with the dramatic improvements in the outcome of newborns with RDS (Rodriguez, 2006).

RDS affects an estimated 25,000 infants born alive in the United States annually. The incidence declines with degree of maturity at birth. It occurs in 60% of preterm newborns of less than 28 weeks' gestation, 30% of those born at 28 to 34 weeks, and less than 5% of those born after 34 weeks (American Lung Association [ALA], 2007). Intensive respiratory care, usually with mechanical ventilation, is necessary.

Pathophysiology

Lung immaturity and surfactant deficiency contribute to the development of RDS. Surfactant is a complex mixture of phospholipids and proteins that adheres to the alveolar surface of the lungs. Surfactant forms a coating over the inner surface of the alveoli, reducing the surface tension and preventing alveolar collapse at the end of expiration. In the affected newborn, surfactant is deficient or lacking, and this deficit results in stiff lungs and alveoli that tend to collapse, leading to diffuse atelectasis. The work of breathing is increased because increased pressure similar to that required to initiate the first breath is needed to inflate the lungs with each successive breath. Hypoxemia and acidemia result, leading to vasoconstriction of the pulmonary vasculature. Right-to-left shunting occurs and alveolar capillary circulation is limited, further inhibiting surfactant production. As the disease progresses, fluid and fibrin leak from the pulmonary capillaries, causing hyaline membranes to form in the bronchioles, alveolar ducts, and alveoli. These membranes further decrease gas exchange. A vicious cycle is created, compounding the problem (Blackburn, 2007).

Nursing Assessment

Nursing assessment focuses on keen observation to identify the signs and symptoms of respiratory distress. In addition, assessment aids in differentiating RDS from other

respiratory conditions, such as TTN or group B streptococcal pneumonia.

History and Physical Examination

Review the history for risk factors associated with RDS; these include perinatal asphyxia regardless of gestational age, cesarean birth in the absence of preceding labor (related to the lack of thoracic squeezing), male gender, and maternal diabetes. It is believed that each of these conditions has an impact on surfactant production, thus resulting in RDS in the term infant (Stoll & Kliegman, 2004).

▶ *Take* NOTE!

Prolonged rupture of membranes, intrauterine growth restriction (IUGR), gestational hypertension, maternal heroin addiction, and use of prenatal corticosteroids reduce the newborn's risk for RDS because of the physiologic stress imposed on the fetus. Chronic stress experienced by the fetus in utero accelerates the production of surfactant before the 35th week of gestation and thus reduces the incidence of RDS at birth.

The newborn with RDS usually demonstrates signs at birth or within a few hours of birth. Observe the infant for expiratory grunting, nasal flaring, chest wall retractions, see-saw respirations, and generalized cyanosis. Auscultate the heart and lungs, noting tachycardia (rates above 150 to 180), fine inspiratory crackles, and tachypnea (rates above 60 breaths per minute). Use the Silverman-Anderson index assessment tool to determine the degree of respiratory distress. The index involves observation of five features, each of which is scored as 0, 1, or 2 (Fig. 24.2). The higher the score, the greater the respiratory distress. A score over 7 suggests severe respiratory distress.

Laboratory and Diagnostic Testing

The diagnosis of RDS is based on the clinical picture and x-ray findings. A chest x-ray reveals hypoaeration, underexpansion, and a "ground glass" pattern (Brodsky & Ouellette, 2007; Mattson & Smith, 2004).

Nursing Management

If untreated, RDS will worsen. However, it appears to be a self-limiting disease, with respiratory symptoms declining after 72 hours. This decline parallels the production of surfactant in the alveoli (McLenan, 2007). The newborn needs supportive care until surfactant is produced. Effective therapies for established RDS include conventional mechanical ventilation, continuous positive airway pressure (CPAP), or positive end-expiratory pressure (PEEP) to prevent volume loss during expiration, and surfactant therapy. The use of exogenous surfactant replacement therapy to stabilize the newborn's lungs until postnatal surfactant synthesis matures has become a life-saver.

Care of the newborn with RDS is primarily supportive and requires a multidisciplinary approach to obtain the best outcomes. Therapy focuses on improving oxygenation and maintaining optimal lung volumes. Expect to transfer the newborn to the neonatal intensive care unit (NICU) soon after birth. Apply the basic principles of newborn care, such as thermoregulation, cardiovascular and nutritional support, normal glucose level maintenance, and infection prevention, to achieve the therapeutic goals of reducing mortality and minimizing lung trauma.

Anticipate the administration of surfactant replacement therapy, prophylactically or as a rescue approach. With prophylactic administration, surfactant is given within minutes after birth, thus providing replacement surfactant before severe RDS develops. Rescue treatment is indicated for newborns with established RDS who require mechanical ventilation and supplemental oxygen. The earlier the surfactant is administered, the better the effect on gas exchange (Kenner & Lott, 2007).

Administer the prescribed oxygen concentration via nasal cannula. Anticipate the need for ventilator therapy, which has greatly improved in the past several years, with significant advances in conventional and high-frequency ventilation therapies (Fig. 24.3). Recent studies show no difference in outcomes for newborns who received early treatment with high-frequency oscillatory ventilation compared with those receiving conventional mechanical ventilation (Blackburn, 2007). Although mechanical ventilation has increased survival rates, it is also a contributing factor to bronchopulmonary dysplasia, pulmonary hypertension, and retinopathy of prematurity (Cunningham et al., 2005).

In addition, support the newborn with RDS using the following interventions:

- Continuously monitor the infant's cardiopulmonary status via invasive or noninvasive means (e.g., arterial lines or auscultation, respectively).
- Monitor oxygen saturation levels continuously; assess pulse oximeter values to determine oxygen saturation levels.
- Closely monitor vital signs, acid–base status, and arterial blood gases.
- Administer broad-spectrum antibiotics if blood cultures are positive.
- Administer sodium bicarbonate or acetate as ordered to correct metabolic acidosis.
- Provide fluids and vasopressor agents as needed to prevent or treat hypotension.
- Test blood glucose levels and administer dextrose as ordered for prevention or treatment of hypoglycemia.
- Cluster caretaking activities to avoid overtaxing and compromising the newborn.
- Place the newborn in the prone position to optimize respiratory status and reduce stress.

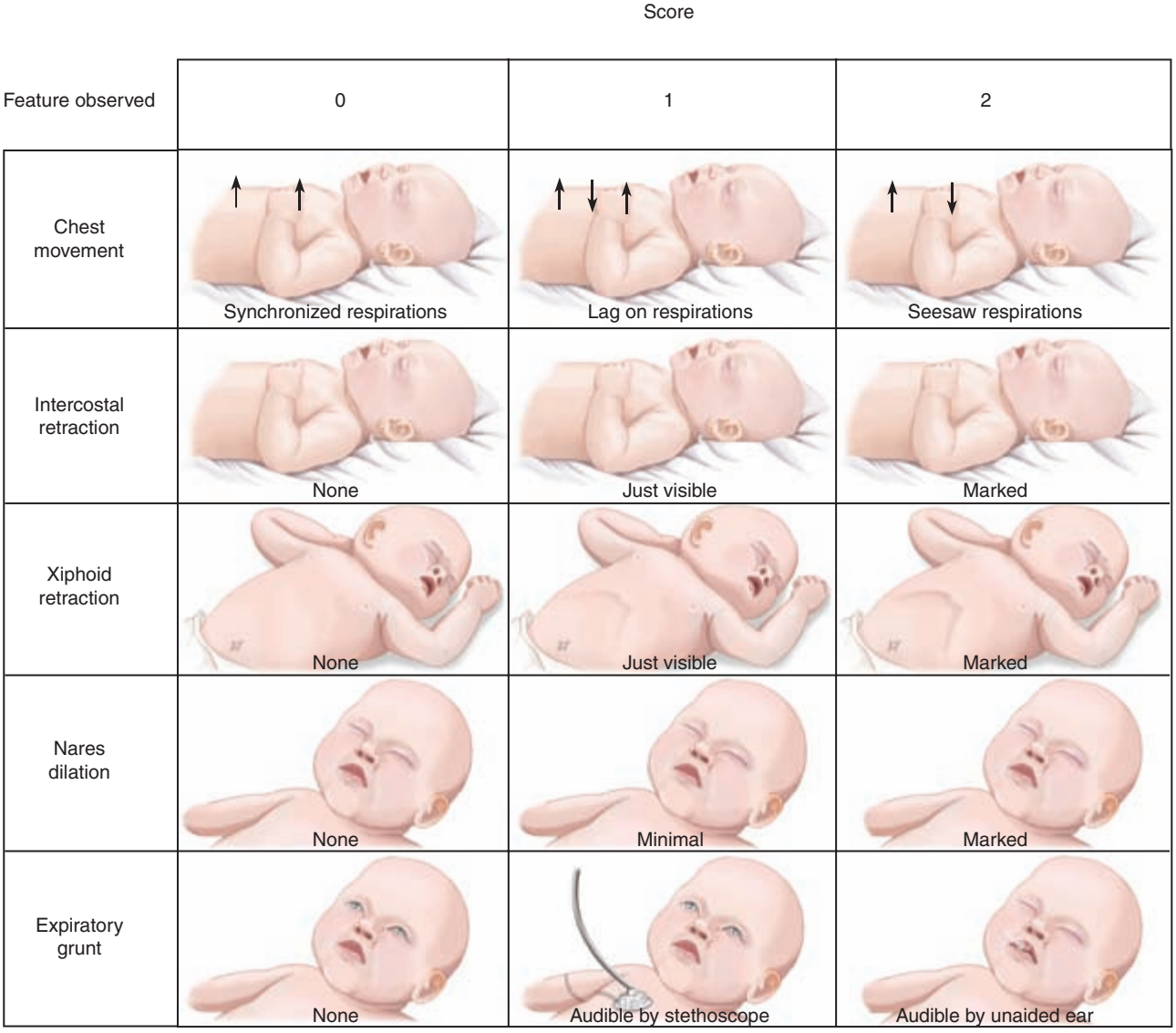


FIGURE 24.2 Assessing the degree of respiratory distress. (Used with permission from Silverman, W. A., & Anderson, D. H. [1956]. A controlled clinical trial of effects of water mist on obstructive respiratory signs, death rate, and necroscopy findings among premature infants. *Pediatrics, 17*[4], 1–9.)

FIGURE 24.3 A newborn with RDS receiving mechanical ventilation.

- Perform gentle suctioning to remove secretions and maintain a patent airway.
- Assess level of consciousness to identify intraventricular hemorrhage.
- Provide sufficient calories via gavage and IV feedings.
- Maintain adequate hydration and assess for signs of fluid overload.
- Provide information to the parents about treatment modalities; give thorough but simple explanations about the rationales for interventions.
- Encourage the parents to participate in care (Blackburn, 2007).

Provide ongoing assessment and be alert for complications. These may include air leak syndrome, bronchopulmonary dysplasia (chronic lung disease), patent ductus

arteriosus, congestive heart failure, intraventricular hemorrhage, retinopathy of prematurity, necrotizing enterocolitis, complications resulting from intravenous catheter use (infection, thrombus formation), and developmental delay or disability (Stoll & Kliegman, 2004).

MECONIUM ASPIRATION SYNDROME

Meconium is a viscous green substance composed primarily of water and other gastrointestinal secretions that can be noted in the fetal gastrointestinal tract as early as 10 to 16 weeks' gestation (Clark & Clark, 2007). It is expelled as the newborn's first stool after birth. **Meconium aspiration syndrome** occurs when the newborn inhales particulate meconium mixed with amniotic fluid into the lungs while still in utero or on taking the first breath after birth. It is a common cause of newborn respiratory distress and can lead to severe illness. Meconium staining of the amniotic fluid, with the possibility of aspiration, occurs in approximately 20% of pregnancies at term (Cunningham et al., 2005). Aspiration induces airway obstruction, surfactant dysfunction, hypoxia, and chemical pneumonitis with inflammation of pulmonary tissues. In severe cases, it progresses to persistent pulmonary hypertension and death (Cunningham et al., 2005). About 3% to 5% of infants with meconium aspiration syndrome die (Wiswell, Tin, & Ohler, 2007).

Pathophysiology

Meconium may be passed in utero secondary to hypoxic stress. Hypoxia induces the fetus to gasp or attempt to breathe. The fetus may bear down and pass meconium into the amniotic fluid or he or she may experience a vagal reflex that causes relaxation of the anal sphincter, allowing meconium to be passed into the amniotic fluid. The fetus then sucks or swallows this amniotic fluid in utero, or the infant may aspirate meconium with the first breath after birth as air rushes into the lungs.

Although the etiology is not well understood, the effects of meconium can be harmful to the fetus. Meconium alters the amniotic fluid by reducing antibacterial activity and subsequently increasing the risk of perinatal bacterial infection. Additionally, meconium is very irritating because it contains enzymes from the fetal pancreas.

When aspirated into the lungs, meconium blocks the bronchioles, causing an inflammatory reaction as well as a decrease in surfactant production. Gas exchange is impaired and atelectasis occurs. A ball–valve effect occurs when air is inspired into the alveoli but cannot be fully expired secondary to reduced airway diameter. Significant respiratory distress is followed by persistent pulmonary hypertension, right-to-left shunting of blood, and patent ductus arteriosus. Conventional mechanical ventilation, extracorporeal membrane oxygenation (ECMO), nitric oxide, high-frequency ventilation, or liquid ventilation may be necessary.

Nursing Assessment

Review prenatal and birth records to identify newborns who may be at high risk for meconium aspiration. Predisposing factors for meconium aspiration syndrome include postterm pregnancy; breech, forceps, or vacuum extraction births; prolonged or difficult labor associated with fetal distress in a term or postterm newborn; maternal hypertension or diabetes; oligohydramnios; IUGR; prolapsed cord; or acute or chronic placental insufficiency (Kenner & Lott, 2007).

Assess the amniotic fluid for meconium staining when the maternal membranes rupture. Green-stained amniotic fluid suggests the presence of meconium in the amniotic fluid and should be reported immediately. After birth, note any yellowish-green staining of the umbilical cord and nails and skin. This staining indicates that meconium has been present for some time.

Consider Kelly, the 27-year-old woman who gave birth to a son who required resuscitation. What findings would lead the nurse to suspect that her son aspirated meconium? What risk factors in Kelly's history would support the diagnosis of meconium aspiration syndrome?

Take NOTE!

Recent evidence suggests that newborns with meconium staining do not routinely require intrapartum suctioning (before the birth of the shoulders). Tracheal suctioning is warranted if the newborn does not exhibit a strong respiratory effort, good muscle tone, and a heart rate greater than 100 beats per minute (AHA/AAP, 2005).

Observe the newborn for a barrel-shaped chest with an increased anterior-posterior (AP) chest diameter (similar to that found in a patient with chronic obstructive pulmonary disease), prolonged tachypnea, progression from mild to severe respiratory distress, intercostal retractions, end-expiratory grunting, and cyanosis (Clark & Clark, 2007). Auscultate the lungs, noting coarse crackles and rhonchi.

Chest x-rays show patchy, fluffy infiltrates unevenly distributed throughout the lungs and marked hyperaeration mixed with areas of atelectasis. Arterial blood gas analysis will indicate metabolic acidosis with a low blood pH, decreased PaO_2, and increased $PaCO_2$ (Wiswell,

Tin, & Ohler, 2007). Direct visualization of the vocal cords for meconium staining using a laryngoscope can confirm the presence of meconium below the larynx.

Nursing Management

Nursing management focuses on ensuring adequate tissue perfusion and minimizing oxygen demand and energy expenditure. Caring for the newborn with meconium aspiration begins in the birthing unit when the birth attendant identifies meconium-stained amniotic fluid with membrane rupture during labor. Upon delivery of the newborn's head, before the newborn takes the first breath, the nasal cavity and then the posterior pharynx are gently suctioned to decrease the potential for aspiration. If the newborn is significantly depressed at birth, secondary clearing of the lower airways by direct tracheal suctioning may be necessary. Repeated suctioning and stimulation are limited to prevent overstimulation and further depression (Clark & Clark, 2007). Usually the newborn is transferred to the NICU for close monitoring.

Maintain a neutral thermal environment, including placing the newborn under a radiant warmer or in a warmed isolette, to prevent hypothermia. In addition, minimize handling to reduce energy expenditure and oxygen consumption that could lead to further hypoxemia and acidosis.

Administer oxygen therapy as ordered via nasal cannula or with positive-pressure ventilation. Monitor oxygen saturation levels via pulse oximetry to evaluate the newborn's response to treatment and to detect changes. Increased pulmonary pressures associated with meconium aspiration may cause blood to be shunted away from the lungs. The newborn may exhibit uneven pulmonary ventilation, with hyperinflation in some areas and atelectasis in others. This leads to poor perfusion and subsequent hypoxemia, which in turn may increase pulmonary vasoconstriction, resulting in a worsening of hypoxemia and acidosis.

Expect to administer hyperoxygenation to dilate the pulmonary vasculature and close the ductus arteriosus or nitric oxide inhalation to decrease pulmonary vascular resistance, or to use high-frequency oscillatory ventilation to increase the chance of air trapping (Clark & Clark, 2007). In addition, administer vasopressors and pulmonary vasodilators as prescribed and administer surfactant as ordered to counteract inactivation by meconium. Monitor arterial blood gas results for changes and assist with measures to correct acid–base imbalances to facilitate perfusion of tissues and prevent pulmonary hypertension (Cunningham et al., 2005). If these measures are ineffective, be prepared to assist with the use of ECMO, a modified type of heart–lung machine.

In addition, perform the following interventions:

- Cluster newborn care to minimize oxygen demand.
- Administer broad-spectrum antibiotics to treat bacterial pneumonia.
- Administer sedation to reduce oxygen consumption and energy expenditure.
- Continuously monitor the newborn's condition.
- Reassure and support the parents throughout the experience (McLenan, 2007).

PERSISTENT PULMONARY HYPERTENSION OF THE NEWBORN

Persistent pulmonary hypertension of the newborn, previously referred to as persistent fetal circulation, is a cardiopulmonary disorder characterized by marked pulmonary hypertension that causes right-to-left extrapulmonary shunting of blood and hypoxemia. Persistent pulmonary hypertension can occur idiopathically or as a complication of perinatal asphyxia, meconium aspiration syndrome, pneumonia, congenital heart defects, metabolic disorders such as hypoglycemia, hypothermia, hypovolemia, hyperviscosity, acute hypoxia with delayed resuscitation, sepsis, and RDS. It occurs in 2 to 6 newborns per 1,000 live births of term, near-term, or postterm infants (Steinhorn, 2007).

Pathophysiology

Normally, pulmonary artery pressure decreases when the newborn takes the first breath. However, interference with this ability to breathe allows pulmonary pressures to remain increased. Hypoxemia and acidosis also occur, leading to vasoconstriction of the pulmonary artery. These events cause an elevation in pulmonary vascular resistance. Normally, the decrease in pulmonary artery pressure and pulmonary vascular resistance with breathing leads to the closure of the ductus arteriosus and foramen ovale. However, with persistent pulmonary hypertension, pulmonary vascular resistance is elevated to the point that venous blood is diverted to some degree through fetal structures, such as the ductus arteriosus or foramen ovale, causing them to remain open, leading to a right-to-left shunting of blood into the systemic circulation. This diversion of blood bypasses the lungs, resulting in systemic arterial hypoxemia.

Nursing Assessment

Assess the newborn's status closely. A newborn with persistent pulmonary hypertension demonstrates tachypnea within 12 hours after birth. Observe for marked cyanosis, grunting, and retractions. Auscultate the heart, noting a systolic ejection murmur, and measure blood pressure for hypotension resulting from both heart failure and persistent hypoxemia (Kenner & Lott, 2007). Measure oxygen saturation via pulse oximetry and report low values. Prepare the newborn for an echocardiogram, which will reveal right-to-left shunting of blood that confirms the diagnosis.

Nursing Management

When caring for the newborn with persistent pulmonary hypertension, pay meticulous attention to detail, with continuous monitoring of the newborn's oxygenation and perfusion status and blood pressure. The goals of therapy include improving alveolar oxygenation, inducing metabolic alkalosis by administering sodium bicarbonate, correcting hypovolemia and hypotension with the administration of volume replacement and vasopressors, and anticipating use of ECMO when support has failed to maintain acceptable oxygenation (Steinhorn, 2007).

Provide immediate resuscitation after birth and administer oxygen therapy as ordered. Early and effective resuscitation and correction of acidosis and hypoxia are helpful in preventing persistent pulmonary hypertension. Monitor arterial blood gases frequently to evaluate the effectiveness of oxygen therapy. Provide respiratory support, which frequently necessitates the use of mechanical ventilation. Administer prescribed medications, monitor cardiopulmonary status, cluster care to reduce stimulation, and provide support and education to the parents.

▶ *Take* NOTE!

Almost any procedure, such as suctioning, weighing, changing diapers, or positioning, can precipitate severe hypoxemia due to the instability of the pulmonary vasculature. Therefore, minimize the newborn's exposure to stimulation as much as possible.

PERIVENTRICULAR–INTRAVENTRICULAR HEMORRHAGE

Periventricular–intraventricular hemorrhage is defined as bleeding that usually originates in the subependymal germinal matrix region of the brain, with extension into the ventricular system (Brodsky & Ouellette, 2007). It is a common problem in preterm infants, especially in those born before 32 weeks. A significant number of these newborns will incur brain injury, leading to complications that may include hydrocephalus, seizure disorders, periventricular leukomalacia (an ischemic injury resulting from inadequate perfusion of the white matter adjacent to the ventricles), cerebral palsy, learning disabilities, vision or hearing deficits, and mental retardation. Identifying preventive strategies to reduce the incidence of these brain insults is a national public health priority (McLenan, 2007).

The incidence of ventricular hemorrhage depends on the gestational age at birth. Up to 50% of newborns weighing 1,500 g or less or born at 30 weeks' gestation or less will have evidence of hemorrhage. Only about 4% of term newborns show evidence of ventricular hemorrhage. Very-low-birthweight infants have the earliest onset of hemorrhage and the highest mortality rate (Brodsky & Ouellette, 2007).

Pathophysiology

The preterm newborn is at greatest risk for periventricular–intraventricular hemorrhage because cerebral vascular development is immature, making it more vulnerable to injury. The earlier the newborn is, the greater the likelihood for brain damage. While all areas of the brain can be injured, the periventricular area is the most vulnerable.

Each ventricular area contains a rich network of capillaries that are very thin and fragile and can rupture easily. The causes of rupture vary and include fluctuations in systemic and cerebral blood flow, increases in cerebral blood flow from hypertension, IV infusions, seizure activity, increases in cerebral venous pressure due to vaginal delivery, hypoxia, and respiratory distress. With a preterm birth, the fetus is suddenly transported from a well-controlled uterine environment into a highly stimulating one. This tremendous physiologic stress and shock may contribute to the rupture of periventricular capillaries and subsequent hemorrhage. Most hemorrhages occur in the first 72 hours after birth (Cunningham et al., 2005).

Periventricular–intraventricular hemorrhage is classified according to a grading system of I to V (least severe to most severe) (Blackburn, 2007). The prognosis is guarded, depending on the grade and severity of the hemorrhage. Generally, newborns with mild hemorrhage (grades I and II) have a much better developmental outcome than those with severe hemorrhage (grades III and IV).

Nursing Assessment

The signs of periventricular–intraventricular hemorrhage vary significantly; no clinical signs may be evident. Closely monitor newborns who are at an increased risk, such as those who are preterm or of low birthweight. Also assess for risk factors such as acidosis, asphyxia, unstable blood pressure, meningitis, seizures, acute blood loss, hypovolemia, respiratory distress with mechanical ventilation, intubation, apnea, hypoxia, suctioning, use of hyperosmolar solutions, rapid volume expansion, and activities that involve handling.

Evaluate the newborn for an unexplained drop in hematocrit, pallor, and poor perfusion as evidenced by respiratory distress and oxygen desaturation. Note seizures, lethargy or other changes in level of consciousness, weak suck, high-pitched cry, or hypotonia. Palpate the anterior fontanel for tenseness. Assess vital signs, noting bradycardia and hypotension. Evaluate laboratory data for changes indicating metabolic acidosis or glucose instability (Annibale & Hill, 2007). Frequently a bleed can progress rapidly

and result in shock and death. Prepare the newborn for cranial ultrasonography, the diagnostic tool of choice to detect hemorrhage.

Nursing Management

Prevention of preterm birth is essential in preventing periventricular–intraventricular hemorrhage. Promote community awareness of factors that may contribute to periventricular–intraventricular hemorrhage, such as a lack of prenatal care, maternal infection, alcohol consumption, and smoking (Kenner & Lott, 2007). Identify risk factors that can lead to hemorrhage, and focus care on interventions to decrease the risk of hemorrhage. For example, institute measures to prevent perinatal asphyxia and birth trauma and provide developmental care in the NICU. If a preterm birth is expected, having the mother deliver at a tertiary care facility with a NICU would be most appropriate.

Care of the newborn with periventricular-intraventricular hemorrhage is primarily supportive. Correct anemia, acidosis, and hypotension with fluids and medications. Administer fluids slowly to prevent fluctuations in blood pressure. Avoid rapid volume expansion to minimize changes in cerebral blood flow. Keep the newborn in a flexed, contained position with the head elevated to prevent or minimize fluctuations in intracranial pressure. Continuously monitor the newborn for signs of hemorrhage, such as changes in the level of consciousness, bulging fontanel, seizures, apnea, and reduced activity level. Also, measure head circumference daily.

Minimize handling of the newborn by clustering nursing care, and limit stimulation in the newborn's environment to reduce stress. Also reduce the newborn's exposure to noxious stimuli to avoid a fluctuation in blood pressure and energy expenditure. Provide adequate oxygenation to promote tissue perfusion but controlled ventilation to decrease the risk of pneumothorax.

Support for the parents to cope with the diagnosis and potential long-term sequelae is essential. The long-term neurodevelopmental outcome is determined by the severity of the bleed. Provide education and emotional support for the parents throughout the newborn's stay. Discuss expectations for short-term and long-term care needs with the parents and assist them in obtaining the necessary support from appropriate community resources.

NECROTIZING ENTEROCOLITIS

Necrotizing enterocolitis (NEC) is a serious gastrointestinal disease occurring in newborns. It is the most common and most serious acquired gastrointestinal disorder among hospitalized preterm neonates and is associated with significant acute and chronic morbidity and mortality (Stoll & Kliegman, 2007). NEC occurs in 1 to 3 cases per 1,000 live births, affecting 1% to 5% of all newborns in intensive care units (Stoll & Kliegman, 2007). Attempts to improve gastrointestinal function and reduce the risk of NEC include enteral antibiotics, judicious administration of parenteral fluids, human milk feedings, antenatal corticosteroids, enteral probiotics (*Lactobacillus acidophilus*), and slow continuous drip feedings (Neu, 2007).

Pathophysiology

The pathophysiology of NEC is not clearly understood and is thought to be multifactorial in nature. Current research points to three major pathologic mechanisms that lead to NEC: bowel ischemia, bacterial flora, and the effect of feeding (Neu, 2007).

During perinatal or postnatal stress, oxygen is shunted away from the gut to more important organs such as the heart and brain. Ischemia and intestinal wall damage occur, allowing bacteria to invade. High-solute feedings allow bacteria to flourish. Mucosal or transmucosal necrosis of part of the intestine occurs (Wood, 2007). Although any region of the bowel can be affected, the distal ileum and proximal colon are the regions most commonly involved. NEC usually occurs between 3 and 12 days of life, but it can occur weeks later in some newborns.

Nursing Assessment

NEC can be devastating, and astute assessment is crucial. Assessing the newborn for the development of NEC includes the health history and physical examination as well as laboratory and diagnostic testing.

Health History and Physical Examination

Assess the newborn's history for risk factors associated with NEC. In addition to preterm birth, prenatal and postnatal predisposing risk factors are highlighted in Box 24.1.

Also observe the newborn for common signs and symptoms, which may include:

- Abdominal distention and tenderness
- Bloody stools
- Feeding intolerance, characterized by bilious vomiting
- Signs of sepsis
- Lethargy
- Apnea
- Shock

Always keep the possibility of NEC in mind when dealing with preterm newborns, especially when enteral feedings are being administered. Note respiratory distress, cyanosis, lethargy, decreased activity level, temperature instability, feeding intolerance, diarrhea, bile-stained emesis, or grossly bloody stools. Assess blood pressure, noting hypotension. Evaluate the neonate's abdomen for distention, tenderness, and visible loops of bowel (Verklan & Walden, 2004). Measure the abdominal circumference,

BOX 24.1 Predisposing Factors for the Development of Necrotizing Enterocolitis

Prenatal Factors
- Preterm labor
- Prolonged rupture of membranes
- Preeclampsia
- Maternal sepsis
- Amnionitis
- Uterine hypoxia

Postnatal Factors
- Respiratory distress syndrome
- Patent ductus arteriosus
- Congenital heart disease
- Exchange transfusion
- Low birthweight
- Low Apgar scores
- Umbilical catheterization
- Hypothermia
- Gastrointestinal infection
- Hypoglycemia
- Asphyxia

noting an increase. Determine residual gastric volume prior to feeding; when it is elevated, be suspicious for NEC.

Laboratory and Diagnostic Testing

Common laboratory and diagnostic tests ordered for assessment of NEC include:

- Kidney, ureter, and bladder (KUB) of the abdomen x-ray: confirms the presence of pneumatosis intestinalis (air in the bowel wall) and persistently dilated loops of bowel (Verklan & Walden, 2004; Wood, 2007)
- Blood values: may demonstrate metabolic acidosis, increased white blood cells, thrombocytopenia, neutropenia, electrolyte imbalance or disseminated intravascular coagulation (DIC)

Nursing Management

Nursing management of the newborn with NEC focuses on maintaining fluid and nutritional status, providing supportive care, and teaching the family about the condition and prognosis. Therapeutic management initially consists of bowel rest and antibiotic therapy. Serial KUB x-rays are used to assess the resolution or progression of NEC. If medical treatment fails to stabilize the newborn or if free air is present on a left lateral decubitus film, surgical intervention will be necessary to resect the portion of necrotic bowel. Surgery for NEC usually requires the placement of a proximal enterostomy until the anastomosis site is ready for reconnection.

Maintaining Fluid and Nutritional Status

If NEC is suspected, immediately stop enteral feedings until a diagnosis is made. Administer IV fluids initially to restore proper fluid balance. If ordered, administer total parenteral nutrition (TPN) to keep the newborn supported nutritionally. Give prescribed IV antibiotics to prevent sepsis from the necrotic bowel (if surgery is required, antibiotics may be needed for an extended period of time). Institute gastric decompression as ordered with an orogastric tube attached to low intermittent suction. Carefully monitor intake and output. Restart enteral feedings once the disease has resolved (normal abdominal examination and KUB negative for pneumatosis) or as determined postoperatively by the surgeon.

Providing Supportive Care

Manage pain by administering analgesics as ordered. Infection control is important, with an emphasis on careful handwashing. In addition, implement these interventions in an ongoing manner:

- Check stools for evidence of blood and report any positive findings.
- Measure the abdominal girth.
- Palpate the abdomen for tenderness and rigidity.
- Auscultate for normal bowel sounds.
- Observe the abdomen for redness or shininess, which indicates peritonitis.

Teaching the Family

The diagnosis of NEC may cause significant family anxiety. Listen to the family's worries and fears. Answer their questions honestly. Inform the family that medically treated NEC is usually limited to a short period and resolves within 48 hours of stopping oral feedings. Explain that surgically treated NEC, however, can be a much lengthier process. The amount of bowel that has necrosed, as determined during the bowel resection, significantly increases the likelihood of long-term medical problems. Short bowel syndrome may result from a large resection (short bowel syndrome is discussed in Chapter 41). Reassure the family that although some infants have more involved cases of NEC, the improved parenteral nutrition formulations have improved the outcomes for these infants. Provide education about ostomy care if surgery is required (refer to page 1335 for a discussion of ostomy care). Promote interaction with their newborn.

INFANTS OF DIABETIC MOTHERS

An **infant of a diabetic mother** is one born to a woman with pregestational or gestational diabetes (see Chapter 20 for additional information). The newborn of a diabetic

woman is at high risk for numerous health-related complications, especially hypoglycemia. In light of the increasing incidence of type 2 diabetes among women of childbearing age due to obesity, it is important to educate women about the potential impact of poor glycemic control on their offspring.

Impact of Diabetes on the Newborn

For more than a century, it has been known that diabetes during pregnancy can have severe adverse effects on fetal and newborn outcomes. Infants of diabetic mothers have increased morbidity and mortality in the perinatal period. The incidence of major congenital anomalies is much greater for these newborns than for other newborns. Poor glycemic control in the first trimester, during organogenesis, is thought to be a major reason for congenital malformations. The most common types of malformations in infants of diabetic mothers involve the cardiovascular, skeletal, central nervous, gastrointestinal, and genitourinary systems. Cardiac anomalies are the most common (Kwik et al., 2007).

Infants of diabetic mothers are longer and weigh more than newborns of similar gestational age. They also have increased organ weights (organomegaly) and excessive fat deposits on the shoulders and trunk, contributing to the increased overall body weight and predisposing them to shoulder dystocia. These newborns are macrosomic (an infant whose birthweight exceeds 4,500 g). These oversized newborns frequently require cesarean births for cephalopelvic disproportion and are often hypoglycemic in the first few hours after birth.

Despite their increased size and weight, they may be remarkably frail, showing behaviors similar to those of a preterm newborn. Thus, birthweight may not be a reliable criterion of maturity. Newborns of women with diabetes but without vascular complications often tend to be large for gestational age (LGA), whereas those of women with diabetes and vascular disease are usually small for gestational age (SGA).

Pathophysiology

The large size of the infant born to a diabetic mother occurs secondary to exposure to high levels of maternal glucose crossing the placenta into the fetal circulation. Maternal hyperglycemia acts as a fuel to stimulate increased production of fetal insulin, which in turn promotes somatic growth within the fetus. The fetus responds to these high levels by producing more insulin, which acts as a growth factor in the fetus (Blackburn, 2007). How the fetus will be affected and the problems that the newborn experiences depend on the severity, duration, and control of the diabetes in the mother. Table 24.1 summarizes the common problems that may occur in infants of diabetic mothers.

Nursing Assessment

Assessment begins in the prenatal period by identifying women with diabetes and taking measures to control maternal glucose levels (see Chapter 20 for information on management of the pregnant woman with diabetes).

Physical Examination

At birth, inspect the newborn for these characteristic features:

- Full rosy cheeks with a ruddy skin color
- Short neck (some describe "no-neck" appearance)
- Buffalo hump over the nape of the neck
- Massive shoulders with a full intrascapular area
- Distended upper abdomen due to organ overgrowth
- Excessive subcutaneous fat tissue, producing fat extremities (Fig. 24.4)

Be alert for hypoglycemia, which may occur immediately after birth or within an hour. Assess blood glucose levels, which should remain above 40 mg/dL. Closely assess the newborn for signs of hypoglycemia, including listlessness, hypotonia, apathy, poor feeding, apneic episodes with a drop in oxygen saturation, cyanosis, temperature instability, pallor and sweating, tremors, irritability, and seizures.

Assess the newborn for signs of birth trauma involving the head (tense, bulging fontanels, cephalhematoma, skull fractures, and facial nerve paralysis), shoulders and extremities (posturing, paralysis), and skin (bruising). Inspect the newborn for compromised oxygenation by examining the skin for cyanosis, pallor, mottling, and sluggish capillary refill. Take the newborn's temperature frequently and provide a neutral thermal environment to prevent cold stress, which would increase the glucose utilization and contribute to the hypoglycemic state.

Laboratory and Diagnostic Testing

Determine baseline serum calcium, magnesium, and bilirubin levels and monitor them frequently for changes (Table 24.2). Hypocalcemia is typically manifested in the first 2 to 3 days of life as a result of birth injury or a prolonged delay in parathyroid hormone production. Hypomagnesemia parallels calcium levels and is suspected only when hypocalcemia does not respond to calcium replacement therapy. Red blood cell breakdown leads to increased hematocrit and polycythemia. In addition, hyperbilirubinemia may be caused by slightly decreased extracellular fluid volume, hepatic immaturity, and birth trauma forming enclosed hemorrhages. It can appear within the first 24 hours of life (pathologic) or after 24 hours of life (physiologic).

Nursing Management

The focus of care for these infants is early detection and initiation of therapy to address potential problems (Nursing

TABLE 24.1 COMMON PROBLEMS OF INFANTS OF DIABETIC MOTHERS

Condition	Description	Effects
Macrosomia	Newborn with an excessive birthweight; arbitrarily defined as a birthweight >4,000 g (8 lb 13 oz) to 4,500 g (9 lb 15 oz) or >90% for gestational age Complication in 10% of all pregnancies in the United States	Increased risk for shoulder dystocia, traumatic birth injury, birth asphyxia Risks for newborn hypoglycemia and hypomagnesemia, polycythemia, and electrolyte disturbances Increased maternal risk for surgical birth, postpartum hemorrhage and infection, and birth canal lacerations Increased risk of developing type 2 diabetes later in life for both Higher weight and accumulation of fat in childhood and a higher rate of obesity in adults
Respiratory distress syndrome (RDS)	Cortisol-induced stimulation of lecithin/sphingomyelin (phospholipids) necessary for lung maturation is antagonized due to the high insulin environment within the fetus due to mother's hyperglycemia. Less mature lung development than expected for gestational age Decrease in the phospholipid phosphatidylglycerol (PG), which stabilizes surfactant, compounding risk	Most commonly, breathing normally at birth but developing labored, grunting respiration with cough and a hoarse complaining cry within a few hours with chest retractions and varying degrees of cyanosis IDMs with vascular disease seldom develop RDS because the chronic stress of poor |intrauterine perfusion leads to increased production of steroids, which accelerates lung maturation.
Hypoglycemia	Glucose is the major source of energy for organ function. Typical characteristics: – Poor feedings – Jitteriness – Lethargy – High-pitched or weak cry – Apnea – Cyanosis and seizures Some newborns asymptomatic.	Low blood glucose levels are problematic during early post-birth period due to abrupt cessation of high-glucose maternal blood supply and the continuation of insulin production by the newborn. Limited ability to release glucagon and catecholamines, which normally stimulate glucagon breakdown and glucose release Prolonged and untreated hypoglycemia leads to serious, long-term adverse neurologic sequelae such as learning disabilities and mental retardation.
Hypocalcemia and hypomagnesemia	Hypocalcemia (drop in calcium levels) manifested by tremors, hypotonia, apnea, high-pitched cry, and seizures due to abrupt cessation of maternal transfer of calcium to fetus primarily in third trimester and experiencing birth asphyxia Associated hypomagnesemia directly related to the maternal level before birth About half of IDMs affected	Newborn is at risk for a prolonged delay in parathyroid hormone production and cardiac dysrhythmias.
Polycythemia	Venous hematocrit of >65% in the newborn Increased oxygen consumption by IDM secondary to fetal hyperglycemia and hyperinsulinemia Increased fetal erythropoiesis secondary to intrauterine hypoxia due to placental insufficiency from maternal diabetes Hypoxic stimulation of increased red blood cell (RBC) production as compensatory mechanism	Increased viscosity, resulting in poor blood flow predisposing newborn to decreased tissue oxygenation and development of microthrombi

(continued)

TABLE 24.1 COMMON PROBLEMS OF INFANTS OF DIABETIC MOTHERS (continued)

Condition	Description	Effects
Hyperbilirubinemia	Usually seen within the first few days after birth, manifested by a yellow appearance of the sclera and skin Excessive red cell hemolysis necessary to break down increased RBCs in circulation due to polycythemia Resultant elevated bilirubin levels Excessive bruising secondary to birth trauma of macrosomic infants, further adding to high bilirubin levels	If untreated, high levels of unconjugated bilirubin may lead to kernicterus (neurologic syndrome that results in irreversible damage) with long-term sequelae that include cerebral palsy, sensorineural hearing loss, and mental retardation.
Congenital anomalies	Occur in up to 10% of IDMs, accounting for 30% to 50% of perinatal deaths Incidence is greatest among SGA newborns. Overall, approximately three times the usual incidence of congenital anomalies compared to newborns from the non-diabetic general population.	Most common anomalies: – Coarctation of the aorta – Atrial and ventricular septal defects – Transposition of the great vessels – Sacral agenesis – Hip and joint malformations – Anencephaly – Spina bifida – Caudal dysplasia – Hydrocephalus

Sources: Arenson & Drake, 2007; Blackburn, 2007; Kenner & Lott, 2007; McLenan, 2007.

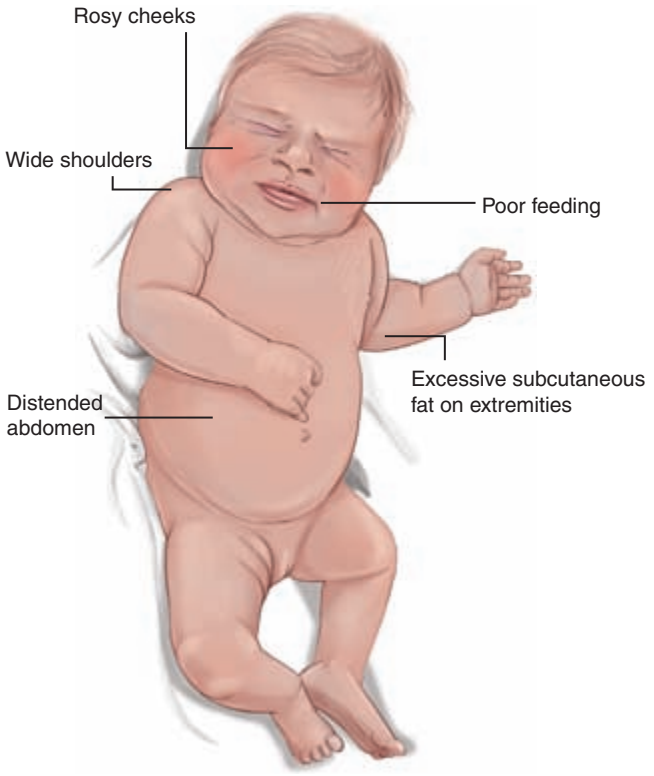


FIGURE 24.4 Characteristics of an infant of a diabetic mother.

Care Plan 24.1). Perform a head-to-toe physical assessment to identify congenital anomalies. Institute measures to correct hypoglycemia, hypocalcemia, hypomagnesemia, dehydration, and jaundice. Provide oxygenation and ventilatory support as necessary.

Preventing Hypoglycemia

Prevent hypoglycemia by providing early oral feedings with formula or breast milk at frequent intervals (every 2 to 3 hours). Feedings help to control glucose levels, reduce hematocrit, and promote bilirubin excretion. Maintain a neutral thermal environment to avoid cold stress, which may stimulate the metabolic rate, thereby increasing the demand for glucose. Provide rest periods to decrease energy demand and expenditure.

Monitor blood glucose levels via heel stick every hour for the first 4 hours of life and then every 3 to 4 hours

TABLE 24.2 CRITICAL LABORATORY VALUES FOR INFANTS OF DIABETIC MOTHERS

Hypoglycemia	<40 mg/dL
Hypocalcemia	<7 mg/dL
Hypomagnesemia	<1.5 mg/dL
Hyperbilirubinemia	>12 mg/dL (term infant)
Polycythemia	>65% (venous hematocrit)

Nursing Care Plan 24.1

Overview of an Infant of a Diabetic Mother

Jamie, a 38-year-old Hispanic woman, gave birth to a term large-for-gestational-age newborn weighing 10 lb. She had a history of gestational diabetes but had not received any prenatal care. She arrived at the hospital in active labor. Despite macrosomia, the newborn's Apgar scores were 8 and 9 at 1 and 5 minutes respectively. No resuscitative measures were needed.

One hour after birth, assessment revealed a pale, irritable newborn with sweating and several episodes of apnea. A glucose level obtained at this time via a heel stick was 35 mg/dL. Two hours later, the newborn begins exhibiting signs of respiratory distress—grunting, nasal flaring, retractions, tachypnea (respiratory rate 72 breaths/minute), and tachycardia (heart rate 176 bpm).

NURSING DIAGNOSIS: Risk for unstable glucose level related to hypoglycemia secondary to intrauterine hyperinsulin state resulting from maternal gestational diabetes as evidenced by low blood glucose level, irritability, pallor, sweating, and apnea

Outcome Identification and Evaluation

The newborn will exhibit adequate glucose control *as evidenced by maintaining blood glucose levels above 40 mg/dL and an absence of clinical signs of hypoglycemia.*

Interventions: Promoting Glucose Control

- Monitor blood glucose levels hourly for the first 4 hours and then every 3 to 4 hours or as necessary *to detect hypoglycemia, which would be <40 mg/dL.*
- Continue to observe for manifestations of hypoglycemia, such as pallor, tremors, jitteriness, lethargy, and poor feeding, *to allow for early detection and prompt intervention, thereby minimizing the risk of complications associated with hypoglycemia.*
- Monitor temperature frequently and institute measures to maintain a neutral thermal environment *to prevent cold stress, which would increase metabolic demands and further deplete glycogen stores.*
- Initiate early feedings every 2 to 3 hours or as appropriate or administer glucose supplements as ordered *to prevent hypoglycemia caused by the newborn's hyperinsulin state.* Administer IV glucose infusions as ordered *to correct hypoglycemia if glucose levels do not stabilize with feeding.*
- Cluster infant care activities and provide for rest periods *to conserve the newborn's energy and reduce use of glucose and glycogen stores.*
- Reduce environmental stimuli by dimming lights and speaking softly *to reduce energy demands and further utilization of glucose.*
- Explain all events and procedures to the mother *to help alleviate anxiety and promote understanding of the newborn's condition.*

NURSING DIAGNOSIS: Impaired gas exchange related to respiratory distress secondary to delayed lung maturity resulting from inhibition of pulmonary surfactant production due to fetal hyperinsulinemia as evidenced by grunting, nasal flaring, retractions, tachypnea, and tachycardia

Outcome Identification and Evaluation

Newborn will demonstrate signs of adequate oxygenation without respiratory distress *as evidenced by respiratory rate and vital signs within acceptable parameters, absence of nasal flaring, retractions, and grunting, and oxygen saturation and arterial blood gas levels within acceptable parameters.*

Interventions: Promoting Oxygenation

- Monitor newborn's vital signs *to establish a baseline and evaluate for changes.*
- Assess airway patency and perform gentle suctioning as ordered *to ensure patency and allow for adequate oxygen intake.*
- Position the newborn prone *to optimize respiratory status and reduce stress.*
- Assess lung sounds for changes *to allow early detection of change in status.*
- Continuously monitor oxygen saturation levels via pulse oximetry *to determine adequacy of tissue perfusion.*
- Assess arterial blood gas results *to detect changes indicating acidosis, hypoxemia, or hypercarbia, which would suggest hypoxia.* Administer medications as ordered *to correct acidosis.*
- Administer oxygen as ordered *to promote adequate tissue perfusion.*
- Assess newborn's skin to identify cyanosis, pallor, and mottling *to detect changes indicating compromised oxygenation.*
- Administer surfactant replacement therapy as ordered *to aid in stabilizing the newborn's lungs until postnatal surfactant synthesis improves.*
- Institute measures to maintain normal blood glucose levels and a neutral thermal environment, cluster care activities, and reduce excessive stimuli *to reduce oxygen demand and consumption.*

until stable. Document the results. Report unstable glucose values if oral feedings do not maintain and stabilize the newborn's blood glucose levels. If glucose levels are not stabilized, initiate IV glucose infusions as ordered and monitor that the infusions are flowing at the prescribed rate.

Maintaining Fluid and Electrolyte Balance

Monitor serum calcium levels for changes indicating the need for supplementation, such as with oral or IV calcium gluconate. Assess the newborn for signs of hypocalcemia, such as tremors, jitteriness, twitching, seizures, and high-pitched cry.

Also administer fluid therapy as ordered to maintain adequate hydration. Monitor serum bilirubin levels and institute phototherapy if the newborn is over 24 hours old.

Providing Parental Support

Assist the parents and family in understanding the newborn's condition and need for frequent monitoring. Offer support and information to the parents and family. They may erroneously interpret the newborn's large size as an indication that the newborn is free of problems. Encourage open communication and listen with empathy to the family's fears and concerns. Provide frequent opportunities for the parents to interact with their newborn. Make appropriate referrals to social services and community resources as necessary to help the family cope.

BIRTH TRAUMA

Injuries to the newborn from the forces of labor and birth are categorized as birth trauma. In the past, numerous injuries were associated with difficult births requiring external or internal version or mid- or high forceps deliveries. Today, however, cesarean births have contributed to the decline in birth trauma.

Significant birth trauma accounts for fewer than 2% of neonatal deaths and stillbirths in the United States (Kenner & Lott, 2007). Improved prenatal diagnosis and monitoring during labor have helped to reduce the incidence of birth injuries today.

Pathophysiology

The process of birth is a blend of compression, contractions, torques, and traction. Birth traumas are injuries sustained by the newborn during the birthing process. When fetal size, presentation, or neurologic immunity complicates this process, the forces of labor and birth may lead to tissue damage, edema, hemorrhage, or fracture in the newborn. For example, birth trauma may result from the pressure of birth, especially in a prolonged or abrupt labor, abnormal or difficult presentation, cephalopelvic disproportion, or mechanical forces, such as forceps or vacuum used during delivery. Table 24.3 summarizes the most common types of birth trauma.

Nursing Assessment

Recognition of trauma and birth injuries is imperative so that early treatment can be initiated. Review the labor and birth history for risk factors, such as a prolonged or abrupt labor, abnormal or difficult presentation, cephalopelvic disproportion, or mechanical forces, such as forceps or vacuum used during delivery. Also review the history for multiple fetus deliveries, large-for-date infants, extreme prematurity, large fetal head, or newborns with congenital anomalies.

Complete a careful physical and neurologic assessment of every newborn admitted to the nursery to establish whether injuries exist. Inspect the head for lumps, bumps, or bruises. Note if swelling or bruising crosses the suture line. Assess the eyes and face for facial paralysis, observing for asymmetry of the face with crying or appearance of the mouth being drawn to the unaffected side. Ensure that the newborn spontaneously moves all extremities. Note any absence of or decrease in deep tendon reflexes or abnormal positioning of extremities.

Assess and document symmetry of structure and function. Be prepared to assist with scheduling diagnostic studies to confirm trauma or injuries, which will be important in determining treatment modalities.

Nursing Management

Nursing management is primarily supportive and focuses on assessing for resolution of the trauma or any associated complications along with providing support and education to the parents. Provide the parents with explanations and reassurance that these injuries usually resolve with minimal or no treatment. Parents are alarmed when their newborn is unable to move an extremity or demonstrates asymmetric facial movements. Provide parents with a realistic picture of the situation to gain their understanding and trust. Be readily available to answer questions and teach them how to care for the newborn, including any modifications that might be necessary. Allow parents adequate time to understand the implications of the birth trauma or injury and what treatment modalities are needed, if any. Provide them with information about the length of time until the injury will resolve and when and if they need to seek further medical attention for the condition. Spending time with the parents and providing them with support, information, and teaching are important to allow them to make decisions and care for their newborn. Anticipate the need for community referral for ongoing follow-up and care, if necessary.

TABLE 24.3 COMMON TYPES OF BIRTH TRAUMA

Type	Description	Findings	Treatment
Fractures	Most often occur during breech births or shoulder dystocia in newborns with macrosomia Mid-clavicular fractures are the most common type of fracture, secondary to shoulder dystocia. Long bone fractures of humerus or femur, usually mid-shaft, also can occur.	Mid-clavicular fractures: The newborn presents with irritability and does not move the arm on the affected side either spontaneously or when the Moro reflex is elicited. Femoral or humeral long bone fractures: The newborn shows loss of spontaneous leg or arm motion respectively; usually swelling and pain accompany the limited movement. X-rays confirm the fracture.	Mid-clavicular fractures typically heal rapidly and uneventfully; arm motion may be limited by pinning the newborn's sleeve to the shirt. Femoral and humeral shaft fractures are treated with splinting. Healing and complete recovery are expected within 2 to 4 weeks without incident (Laroia, 2007). Explanation to the parents and reassurance are needed.
Brachial plexus injury	Primarily in large babies, babies with shoulder dystocia, or breech delivery Results from stretching, hemorrhage within a nerve, or tearing of the nerve or the roots associated with cervical cord injury Associated traumatic injuries include fracture of the clavicle or humerus or subluxations of the shoulder or cervical spine. Erb's palsy is an upper brachial plexus injury. Klumpke's palsy is an injury to the lower brachial plexus (lower brachial injuries are less common).	In Erb's palsy, the involved extremity usually presents adducted, prone, and internally rotated; shoulder movement is absent; Moro, bicep, and radial reflexes are absent, but the grasp reflex is usually present. Klumpke's palsy is manifested by weakness in the hand and wrist; grasp reflex is absent.	Erb's palsy usually involves immobilization of the upper arm across the upper abdomen/chest to protect the shoulder from excessive motion for the first week; then gentle passive range-of-motion exercises are performed daily to prevent contractures. There is usually no associated sensory loss, and this condition usually improves rapidly. Treatment for Klumpke's palsy involves placing the hand in a neutral position and using passive range-of-motion exercises. In some cases deficits may persist, requiring continuing observation.
Cranial nerve trauma	Most common is facial nerve palsy. Frequently attributed to pressure resulting from forceps May also result from pressure on the nerve in utero, related to fetal positioning such as the head lying against the shoulder	Physical findings include asymmetry of the face when crying; mouth may be drawn towards the unaffected side; wrinkles are deeper on the unaffected side. The paralyzed side may be smooth, with a swollen appearance. Eye is persistently open on the affected side.	Most infants begin to recover in the first week, but full resolution may take up to several months; parents need reassurance about this. In most cases, treatment is not necessary, only observation. If the eye is affected and unable to close, protection with patches and synthetic tears may be necessary. Parents need instruction about how to feed the newborn, since he or she cannot close the lips around the nipple without having milk seep out.

(continued)

TABLE 24.3 COMMON TYPES OF BIRTH TRAUMA (continued)

Type	Description	Findings	Treatment
Head trauma	Mild trauma can cause soft tissue injuries such as cephalhematoma and caput succedaneum; greater trauma can cause depressed skull fractures. **Cephalhematoma** (subperiosteal collection of blood secondary to the rupture of blood vessels between the skull and periosteum) occurs in 2.5% of all births and typically appears within hours after birth (Cunningham et al., 2005). **Caput succedaneum** (soft tissue swelling) is caused by edema of the head against the dilating cervix during the birth process. Subarachnoid hemorrhage (one of the most common types of intracranial trauma) may be due to hypoxia/ischemia, variations in blood pressure, and the pressure exerted on the head during labor. Bleeding is of venous origin, and underlying contusions also may occur (Laroia, 2007). Subdural hemorrhage (hematomas) occurs less often today because of improved obstetric techniques. Typically, tears of the major veins or venous sinuses overlying the cerebral hemispheres or cerebellum (most common in newborns of primaparas and large newborns, or after an instrumented birth) are the cause. Increased pressure on the blood vessels inside the skull leads to tears. Depressed skull fractures (rare) may result from the pressure of a forceps delivery; can also occur during spontaneous or cesarean births and may be associated with other head trauma causing subdural bleeding, subarachnoid hemorrhage, or brain trauma (Laroia, 2007).	In cephalhematoma, suture lines delineate its extent; usually located on one side, over the parietal bone. In caput succedaneum, swelling is not limited by suture lines: it extends across the midline and is associated with head molding. It does not usually cause complications other than a misshapen head. Swelling is maximal at birth and then rapidly decreases in size. In subarachnoid hemorrhage, some RBCs may appear in the CSF of full-term newborns. Newborns may present with apnea, seizures, lethargy, or abnormal findings on a neurologic examination (Rodriguez, 2007). Subdural hemorrhage can be asymptomatic, or the neonate can exhibit seizures, enlarging head size, decreased level of consciousness, or abnormal findings on a neurologic examination, with hypotonia, a poor Moro reflex, or extensive retinal hemorrhages. Depressed skull fractures can be observed and palpated as depressions. Confirmation by x-ray is necessary.	Cephalhematoma resolves gradually over 2 to 3 weeks without treatment (see Chapter 18). Caput succedaneum usually resolves over the first few days without treatment (see Chapter 18). Subarachnoid hemorrhage requires minimal handling to reduce stress. Subdural hematoma requires aspiration; can be life-threatening if it is in an inaccessible location and cannot be aspirated (Laroia, 2007). Depressed skull fractures typically require a neurosurgical consultation.

NEWBORNS OF SUBSTANCE-ABUSING MOTHERS

It is generally assumed that all pregnant women want to provide a healthy environment for their unborn child and know how to avoid harm. However, for women who use substances such as drugs or alcohol, this may not be the case. Substance use during pregnancy exposes the fetus to the possibility of IUGR, prematurity, neurobehavioral and neurophysiologic dysfunction, birth defects, infections, and long-term developmental sequelae (Kenner & Lott, 2007).

It is difficult to establish the true prevalence of substance use in pregnant women; many women deny taking any nonprescribed substance because of the associated social stigma and legal implications. The National Institute on Drug Abuse (NIDA) suggests that approximately 1 in 10 newborns are exposed to one or more mood-altering drugs in utero (NIDA, 2007f). Drug exposure may go unrecognized in these newborns, and they may be discharged from the newborn nursery at risk for medical and social problems, including abuse and neglect.

Tobacco, alcohol, and marijuana are the substances most commonly abused during pregnancy. Other drugs may include opioids such as morphine, codeine, methadone, meperidine, and heroin; CNS stimulants such as amphetamines and cocaine; CNS depressants such as barbiturates, diazepam (Valium), and sedative–hypnotics; and hallucinogens, such as LSD, inhalants, glue, paint thinner, nail polish remover, and nitrous oxide (NIDA, 2007f). Table 24.4 highlights commonly used substances and their effects on the fetus and newborn.

▶ *Consider THIS!*

I admit, I had led a reckless life since I was a teen. I rebelled against my mother's authority and started smoking and doing drugs just to "check out" of my painful world. It was one big blast after another with a high and then a low. I never considered the consequences of my behavior then and never thought it would hurt anyone until I learned I was about 4 months pregnant. I convinced myself that if I cut back, everything would be fine.

Now, as I stand here in the NICU watching my tiny son struggle for air and tremble all over, I am not so convinced that I didn't hurt anyone except myself. As I witness my son fight against MY nicotine and drug addiction, my heart is heavy with guilt. I wonder how I could have thought that my troubles wouldn't become another's plight sooner or later. What must I have been thinking to isolate my addiction and not

(continued)

▶ *Consider THIS! (continued)*

consider the impact that it would have on my mother and my son?

Thoughts: This woman honestly regrets what her addiction has done to her son as she stands watching him go through withdrawal. Her lifestyle choices do affect others, despite her previous denial. One problem with addiction is the difficulty in getting help after deciding to finally quit. There aren't enough rehab centers to deal with the large numbers needing their services and it can be difficult to get into one. What can be offered to pregnant women who abuse substances? How can nurses increase community awareness about the impact of this problem, especially during pregnancy?

Substance abuse during pregnancy is the subject of much controversy. The timing of drug ingestion usually determines the type and severity of damage to the fetus. Frequently, the woman uses more than one substance, which compounds the problem. Nurses must be knowledgeable about the issues of substance abuse and must be alert for opportunities to identify, prevent, manage, and educate women and families about this key public health issue.

Fetal Alcohol Syndrome

The adverse effects of alcohol consumption have been recognized for centuries, but the associated pattern of fetal anomalies was not labeled until the early 1970s. The distinctive pattern identified three specific findings: growth restriction (prenatal and postnatal), craniofacial structural anomalies, and CNS dysfunction. These distinctive findings were called **fetal alcohol syndrome**, characterized by physical and mental disorders that appear at birth and remain problematic throughout the child's life. However, there are also circumstances in which the effects of prenatal alcohol exposure are apparent, but the newborn does not meet all of the criteria. In an attempt to include those who do not meet the strict criteria, the terms "fetal alcohol effects," "alcohol-related birth defects," and "alcohol-related neurologic defects" are used to describe children with a variety of problems thought to be related to alcohol consumption during pregnancy. The Institutes of Medicine coined the term **fetal alcohol spectrum disorder** as a way of describing the broader effects of prenatal alcohol exposure. Children with fetal alcohol syndrome are at the severe end of the spectrum (Manning & Hoyne, 2007). Newborns with some but not all of the symptoms of fetal alcohol syndrome are described as having **alcohol-related birth defects**. Fetal alcohol effects may include

(text continues on page 747)

TABLE 24.4 Substances and Their Effects on the Fetus and Newborn

Substance	Description	Effects on Fetus and Newborn	Nursing Implications
Alcohol	Consumption is pervasive and widely accepted, with use, abuse, and addiction affecting all levels of society. It is a common misconception that a substance sold to the public without restriction is safe.	Fetal alcohol syndrome (one of the most common known causes of mental retardation) Fetal alcohol spectrum disorders Alcohol-related birth defects	Provide education that decreasing or eliminating alcohol consumption during pregnancy is the only way to prevent fetal alcohol syndrome and fetal alcohol effects. Assist pregnant woman in finding a treatment program if possible. Inform all women who are pregnant or planning to become pregnant about the detrimental effects of alcohol during pregnancy. Educate women using a nonjudgmental, culturally connected approach. Warn women that there is no safe time to drink or amount of alcohol they can consume.
Tobacco/nicotine	Nicotine is an addictive substance. It causes epinephrine release from adrenal cortex, leading to initial stimulation followed by depression and fatigue, causing the user to seek more nicotine. Increased numbers of women are smoking (at least 11% smoke during pregnancy; March of Dimes, 2007c). Over 2,500 chemicals are found in cigarette smoke, including nicotine, tar, carbon monoxide, and cyanide. It is unknown which are harmful, but nicotine and carbon monoxide are believed to play a role in causing adverse pregnancy outcomes.	Impaired oxygenation of mother and fetus due to nicotine crossing placenta and carbon monoxide combining with hemoglobin Increased risk for low birthweight (risk almost doubled), small for gestational age, and preterm birth Increased risk for sudden infant death syndrome (SIDS) and chronic respiratory illness (MNH, 2007)	Provide teaching to women about healthy behaviors. Provide support for smoking cessation. Individualize counseling based on factors associated with the woman's smoking and challenges faced (why woman smokes, stressors in life, and social support network). Suggest options such as group smoking cessation programs, relaxation techniques, individual counseling, hypnosis, and partner-support counseling.
Marijuana	Most widely used illicit psychoactive substance in Western world and most commonly used illicit drug in the United States (NIDA, 2007d) Derived from *Cannabis sativa* plant	Not shown to have teratogenic effects on fetus; no consistent types of malformations identified Intrauterine growth restriction (IUGR) is common due to delivery of carbon monoxide to fetus (NIDA, 2007d). Increased risk for small for gestational age	Provide teaching to women about healthy behaviors. Provide support for cessation of marijuana use.

Substance	Description	Effects on Fetus and Newborn	Nursing Implications
		Altered responses to visual stimuli, sleep-pattern abnormalities, photophobia, lack of motor control, hyperirritability, increased tremulousness, and high-pitched cry noted in infants of mothers who smoked marijuana Research related to long-term effects is continuing (NIDA, 2007d).	
Methamphetamines	Addictive stimulant; use releases high levels of dopamine, which stimulates brain cells, enhancing mood and body movement High potential for abuse and addiction; can be inhaled, injected, smoked, or taken orally Many street names, such as speed, meth, ice, and chalk Primary effects include accelerated heart and respiratory rate, elevated blood pressure, papillary dilation; secondary effects include loss of appetite. Used medically as treatment for obesity and narcolepsy in adults and hyperactivity in children	Little research on use during pregnancy because its use is less common than cocaine or narcotics Fetal effects similar to cocaine (suggesting vasoconstriction as possible underlying mechanism) Possible maternal malnutrition, leading to problems with fetal growth and development Increased risk for preterm birth and low-birthweight newborns Infants may have withdrawal symptoms, including dysphoria, agitation, jitteriness, poor weight gain, abnormal sleep patterns, poor feeding, frantic fist sucking, high-pitched cry, respiratory distress soon after birth, frequent infections, and significant lassitude (Arenson & Drake, 2007). Long-term effects are not known.	Provide teaching to women about healthy behaviors. Provide support for cessation of methamphetamine use. Monitor the woman for weight changes; emphasize the need for adequate nutritional intake to support fetal growth and development.
Cocaine	Strong CNS stimulant that interferes with reabsorption of dopamine Physical effects: vasoconstriction; pupillary dilation; increased temperature, heart rate, and blood pressure Taken orally, sublingually, intranasally, intravenously, and via inhalation Estimated that 30% to 40% of cocaine addicts are female Maternal cocaine use during pregnancy is a significant health problem (March of Dimes, 2007b). Increased potential for use of multiple drugs if mother using cocaine	Preterm birth and lower birthweight Unclear impact on later development Speculation that cocaine interferes with infant's cognitive development, leading to learning and memory difficulties later in life (Kenner & Lott, 2007) Associated congenital anomalies: GU, cardiac, and CNS defects, and prune belly syndrome Other typical newborn characteristics: smaller head circumference, piercing cry, limb defects, ambiguous genitalia, poor feeding, poor visual and auditory responses, poor sleep patterns, decreased impulse control, stiff, hyperextended positioning, irritability and hypersensitivity, inability to respond to caretaker (Blackburn, 2007)	Educate the woman about the effects of cocaine use on the fetus and newborn. Assess for use of other substances. Provide teaching to women about healthy behaviors. Provide support and guidance for cessation of cocaine and other substance use.

(continued)

TABLE 24.4 SUBSTANCES AND THEIR EFFECTS ON THE FETUS AND NEWBORN (continued)

Substance	Description	Effects on Fetus and Newborn	Nursing Implications
Heroin	Illegal, highly addictive opiate derived from morphine that can be sniffed, smoked, or injected Possible consequences include HIV infection, tuberculosis, crime, violence, and family disruption. Severe physical addiction; CNS depressant producing mental dullness and drowsiness	Newborns of heroin-addicted mothers are born dependent on heroin. Increased risk for transmission of hepatitis B and C and HIV to newborns when mothers share needles Significantly increased rates of stillbirth, IUGR, preterm birth, and newborn mortality (3 to 7 times greater; NIDA, 2007b, 2007c) Small-for-gestational age newborns, meconium aspiration, high incidence of SIDS, and delayed effects from subacute withdrawal (restlessness, continual crying, agitation, sneezing, vomiting, fever, diarrhea, seizures, irritability, and poor socialization [possibly persisting for 4 to 6 months]; March of Dimes, 2007b) Intrauterine death or preterm birth is possible with abrupt cessation of heroin use.	Educate the woman about the effects of heroin use on the fetus and newborn. Assess for use of other substances. Provide teaching to women about healthy behaviors. Warn the woman not to abruptly stop heroin use. Encourage her to enroll in a methadone maintenance program.
Methadone	Synthetic opiate narcotic used primarily as maintenance therapy for heroin addiction	Improvement in many of the detrimental fetal effects associated with heroin use Withdrawal symptoms are common in newborns. Possible low birthweight due to symmetric fetal growth restriction Increased severity and longer period of withdrawal (due to methadone's longer half-life) Seizures (commonly severe) do not usually occur until 2 to 3 weeks of age, when the newborn is at home. Increased rate of SIDS (3 to 4 times higher; Goff & O'Connor, 2007)	Methadone maintenance programs are the standard of care for women with narcotic addiction. Inform the woman about the benefits and risks of methadone use vs. heroin use. Advantages include improved fetal and newborn growth, reduced risk of fetal death, and reduced risk of HIV infections. Advise the woman that she will need to return consistently to receive the prescribed methadone dose. Reinforce the need for continued prenatal care. Inform the woman that she can breastfeed her newborn while receiving methadone. Teach mother and caregivers about signs and symptoms of methadone withdrawal.

such problems as low birthweight, developmental delays, and hyperactivity. Box 24.2 summarizes the manifestations of fetal alcohol syndrome.

Worldwide, the incidence of fetal alcohol syndrome is 1 to 3 cases per 1,000 live births, and that of fetal alcohol effects is 3 to 5 per 1,000 live births (March of Dimes, 2007a). Current estimates indicate that approximately 13% of women of childbearing age are either problem drinkers or alcoholics; therefore, the number of fetuses exposed to alcohol during utero increases dramatically (March of Dimes, 2007a).

Fetal alcohol syndrome is one of the most common known causes of mental retardation, and it is the only cause that is entirely preventable. The effects last a lifetime. Children with this syndrome have varying degrees of psychological and behavioral problems and often find it difficult to hold a job and live independently (CDC, 2007b).

Decreasing or eliminating alcohol consumption during pregnancy is the only way to prevent fetal alcohol syndrome and fetal alcohol effects. Unfortunately, few treatment programs address the needs of pregnant women, so many newborns are exposed to alcohol in utero.

BOX 24.2 Clinical Picture of Fetal Alcohol Syndrome

- Microcephaly (head circumference <10th percentile)*
- Small palpebral (eyelid) fissures*
- Abnormally small eyes
- Intrauterine growth restriction
- Maxillary hypoplasia (flattened or absent)
- Epicanthal folds (folds of skin of the upper eyelid over the eye)
- Thin upper lip*
- Missing vertical groove in median portion of upper lip*
- Short upturned nose
- Short birth length and low birthweight
- Joint and limb defects
- Altered palmar crease pattern
- Prenatal or postnatal growth ≤10th percentile*
- Congenital cardiac defects (septal defects)
- Delayed fine and gross motor development
- Poor eye–hand coordination
- Clinically significant brain abnormalities*
- Mental retardation
- Narrow forehead
- Performance substantially below expected level in cognitive or developmental functioning, executive or motor functioning, and attention or hyperactivity; social or language skills*
- Inadequate sucking reflex and poor appetite

*Diagnosis of fetal alcohol syndrome requires the presence of three findings:

1. Documentation of all three facial abnormalities
2. Documentation of growth deficits (height, weight or both below 10th percentile)
3. Documentation of CNS abnormalities (structural, neurologic, or functional)

Source: National Center on Birth Defects and Developmental Disabilities (NCBDDD) (2004). Fetal alcohol syndrome: guidelines for referral and diagnosis (p. 20). Atlanta: Centers for Disease Control and Prevention (CDC), Department of Health and Human Services (DHHS)

Neonatal Abstinence Syndrome

Newborns of women who abuse tobacco, illicit substances, caffeine, and alcohol can exhibit withdrawal behavior. Withdrawal symptoms occur in 60% of all newborns exposed to drugs (Arenson & Drake, 2007). Drug dependency acquired in utero is manifested by a constellation of neurologic and physical behaviors and is known as **neonatal abstinence syndrome**. Although often treated as a single entity, neonatal abstinence syndrome is not a single pathologic condition. The manifestations of withdrawal are a function of the drug's half-life, the specific drug or combination of drugs used, dosage, route of administration, timing of drug exposure, and length of drug exposure (Kuschel, 2007). Typical newborn behaviors include CNS hypersensitivity, autonomic dysfunction, and gastrointestinal disturbances (Marcellus, 2007). Neonatal abstinence syndrome has both medical and developmental consequences for the newborn.

Nursing Assessment

Several assessment tools can be used to assess a drug-exposed newborn. Figure 24.5 shows an example. Regardless of the tool used for assessment, address these key areas:

- Maternal history to identify risk behaviors for substance abuse:
  - Previous unexplained fetal demise
  - Lack of prenatal care
  - History of missed prenatal appointments
  - Severe mood swings
  - Precipitous labor
  - Poor nutritional status
  - Abruptio placentae
  - Hypertensive episodes
  - History of drug abuse
- Laboratory test results (toxicology) to identify substances in mother and newborn
- Signs of neonatal abstinence syndrome (use the "WITHDRAWAL" acronym; see description below)
- Evidence of seizure activity and need for protective environment

The newborn's behavior often prompts the health care provider or nurse to suspect intrauterine drug exposure (Box 24.3). The newborn physical examination may also reveal low birthweight for gestational age or drug- or alcohol-related birth defects and dysfunction.

CENTRAL NERVOUS SYSTEM DISTURBANCES													
SIGNS AND SYMPTOMS	SCORE	AM							PM				
Excessive high-pitched cry	2												
Continuous high-pitched cry	3												
Sleeps <1 hour after feeding	3												
Sleeps <2 hours after feeding	2												
Sleeps <3 hours after feeding	1												
Hyperactive Moro reflex	2												
Markedly hyperactive Moro refex	3												
Mild tremors disturbed	1												
Moderate–severe tremors disturbed	2												
Mild tremors undisturbed	1												
Moderate–severe tremors undisturbed	4												
Increased muscle tone	2												
Excoloration (specify area)	1												
Myoclonic jerks	3												
Generalized convulsions	5												
METABOLIC / VASOMOTOR/RESPIRATORY DISTURBANCES													
Sweating													
Fever <101 (99–100.8°F/37.2–38.2°C)	1												
Fever >101 (38.2°C and higher)	2												
Frequent yawning (>3– 4 times/interval)	1												
Mottling	1												
Nasal stuffiness	1												
Sneezing (>3–4 times/interval)	1												
Nasal flaring	2												
Respiratory rate >60 / min	1												
Respiratory rate >60 / min, with retractions	2												
GASTROINTESTINAL DISTURBANCES													
Excessive sucking	1												
Poor feeding	2												
Regurgitation	2												
Projectile vomiting	3												
Loose stools	2												
Watery stools	3												
TOTAL SCORE													

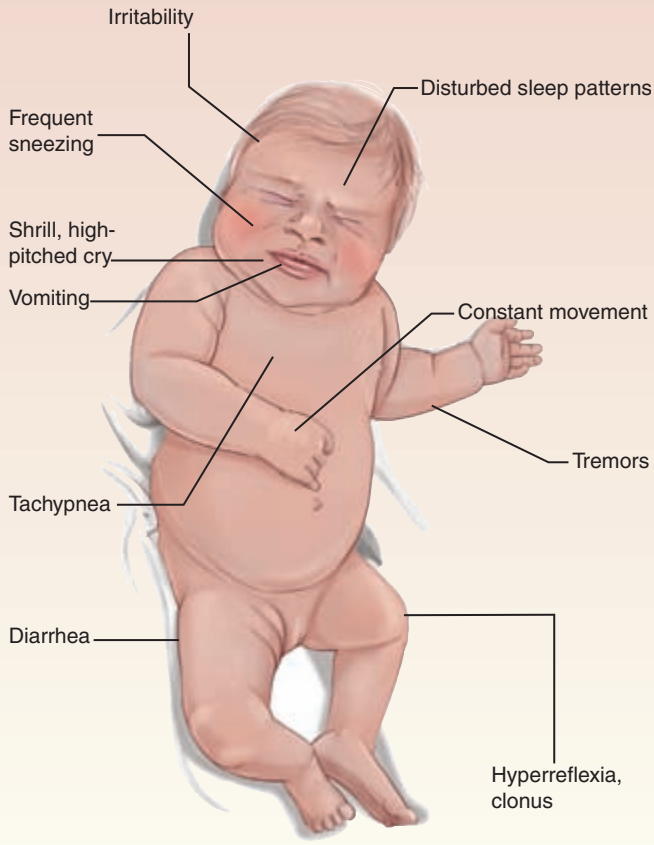
FIGURE 24.5 Neonatal abstinence scoring system (From Cloherty, J. P., & Stark, A. P. [1998]. *Manual of neonatal care* [4th ed., pp. 26–27]. Boston: Little, Brown.)

BOX 24.3 Manifestations of Neonatal Abstinence Syndrome

CNS Dysfunction
- Tremors
- Generalized seizures
- Hyperactive reflexes
- Restlessness
- Hypertonic muscle tone, constant movement
- Shrill, high-pitched cry
- Disturbed sleep patterns

Metabolic, Vasomotor, and Respiratory Disturbances
- Fever
- Frequent yawning
- Mottling of the skin
- Sweating
- Frequent sneezing
- Nasal flaring
- Tachypnea >60 bpm
- Apnea

Gastrointestinal Dysfunction
- Poor feeding
- Frantic sucking or rooting
- Loose or watery stools
- Regurgitation or projectile vomiting (Belik & Hawes, 2007; Kuschel, 2007; Marcellus, 2007)



▶ *Take* NOTE!

Cocaine-exposed newborns are typically fussy, irritable, and inconsolable at times. Cocaine-exposed infants demonstrate poor coordination of sucking and swallowing, making feeding time frustrating for the newborn and caregiver alike.

Assess the newborn for signs of neonatal abstinence syndrome. Use the acronym WITHDRAWAL to focus the assessment:

W = Wakefulness: sleep duration less than 1 to 3 hours after feeding
I = Irritability
T = Temperature variation, tachycardia, tremors
H = Hyperactivity, high-pitched persistent cry, hyperreflexia, hypertonus
D = Diarrhea, diaphoresis, disorganized suck
R = Respiratory distress, rub marks, rhinorrhea
A = Apneic attacks, autonomic dysfunction
W = Weight loss or failure to gain weight
A = Alkalosis (respiratory)
L = Lacrimation (Belik & Hawes, 2007)

Assist with obtaining diagnostic studies to identify the severity of withdrawal. Toxicology screening of the newborn's blood, urine, and meconium identifies the substances to which the newborn has been exposed.

In general, a urine screen signifies only recent newborn exposure to maternal use of drugs. It can detect marijuana use up to a month earlier, cocaine use up to 96 hours earlier, heroin use 24 to 48 hours earlier, and methadone use up to 10 days earlier (Belik & Hawes, 2007).

Nursing Management

The needs of the substance-exposed newborn are multiple, complex, and costly, both to the health care system and to society. Substance abuse takes place among people of all colors, sizes, shapes, incomes, types, and conditions. Most pregnant women are unaware of the adverse impact their substance abuse can have on the newborn.

Nurses are in a unique position to help because they interact with high-risk mothers and newborns in many settings, including the community, health care facilities, and family agencies. It is the responsibility of all nurses to identify, educate, counsel, and refer pregnant women with substance-abusing problems. For example, nurses can be instrumental in increasing the number of pregnant women who make a serious attempt to quit smoking by using the "5 A's" approach:

- Ask: Ask all women if they smoke and would like to quit.
- Advise: Encourage the use of clinically proven treatment plans.
- Assess: Provide motivation by discussing the "5 R's":
  - Relevance of quitting to the woman
  - Risk of continued smoking to the fetus
  - Rewards of quitting for both
  - Roadblocks to quitting
  - Repeat at every visit
- Assist: Help the woman to protect her fetus and newborn from the negative effects of smoking.
- Arrange: Schedule follow-up visits to reinforce the woman's commitment to quit.

Although this approach is geared to smoking cessation, nurses can adapt it to focus on cessation for any substance use. Early, supportive, ongoing nursing care is critical to the well-being of the mother and her newborn.

Caring for a substance-exposed newborn remains a major challenge to health care professionals. The major goals include providing comfort to the newborn by relieving symptoms, improving feeding and weight gain, preventing seizures, promoting mother–newborn interactions, and reducing the incidence of newborn mortality and abnormal development (Belik & Hawes, 2007).

Promoting Comfort

Keep environmental stimuli to a minimum. For example, decrease stimuli by dimming the lights in the nursery, and swaddle the newborn tightly to decrease irritability behaviors. Other techniques such as gentle rocking, using a flexed position, and offering a pacifier can help manage CNS irritability. A pacifier also helps satisfy the newborn's need for nonnutritive sucking. Use a calm, gentle approach when handling the newborn and plan activities to avoid overstimulating the newborn, allowing time for rest periods.

Meeting Nutritional Needs

When feeding the newborn, use small amounts and position the newborn upright to prevent aspiration and to facilitate rhythmic sucking and swallowing. Breastfeeding is encouraged unless the mother is still using drugs. Monitor the newborn's weight daily to evaluate the success of food intake. Assess hydration; check skin turgor and fontanels. Assess the frequency and characteristics of bowel movements and monitor the newborn's fluid and electrolyte and acid–base status.

Preventing Complications

Pharmacologic treatment is warranted if conservative measures, such as swaddling and decreased environmental stimulation, are not adequate. The AAP recommends that for newborns with confirmed drug exposure, drug therapy is indicated if the newborn has seizures, diarrhea and vomiting resulting in excessive weight loss and dehydration, poor feeding, inability to sleep, and fever unrelated to infection (AAP Committee on Substance Abuse, 2005). Common medications used in the management of newborn withdrawal include morphine, paregoric, phenobarbital, tincture of opium, methadone, clonidine, chlorpromazine, and diazepam (Marcellus, 2007). Administer the prescribed medications and document the newborn's behavioral responses.

The newborn is at risk for skin breakdown. Weight loss, diarrhea, dehydration, and irritability can contribute to this risk. Provide meticulous skin care and protect the newborn's elbows and knees against friction and abrasions.

Promoting Parent–Newborn Interaction

For a mother who abuses substances, the birth of a drug-exposed newborn is both a crisis and an opportunity. The mother may feel guilty about the newborn's condition. Many of these newborns are unresponsive and have disorganized sleeping and feeding patterns. When awake, they can be easily overstimulated and irritated. Such characteristics make parent–newborn interactions difficult and frustrating, leading to possible detachment and avoidance (Burd, 2007). In addition, the mother may be single and a victim of physical and sexual abuse and may have a limited support system. Many of these mothers may have had poor parenting themselves, lack information about characteristic infant behaviors, and have unrealistic expectations about the newborn's abilities (Goff & O'Connor, 2007). Instruct the mother or caretaker how to care for the newborn, including what to do after the newborn goes home (Teaching Guidelines 24.1).

On the other hand, the newborn may be a powerful motivator for the mother to undergo treatment and seek recovery. Refer the mother to community agencies to address addiction and the infant's developmental needs (Gilbert, 2006). The nurse can play a pivotal role in assisting her to abstain from drug use and to promote effective parenting skills.

HYPERBILIRUBINEMIA

Hyperbilirubinemia is a total serum bilirubin level above 5 mg/dL resulting from unconjugated bilirubin being deposited in the skin and mucous membranes (Blackburn, 2007). Hyperbilirubinemia is exhibited as jaundice (yellowing of the body tissues and fluids). Newborn jaundice is one of the most common reasons for hospital readmission. It occurs in 60% to 80% of term

TEACHING GUIDELINES 24.1

Caring for Your Newborn at Home

- Position your newborn with the head elevated to prevent choking.
- To aid your newborn's sucking and swallowing during feeding, position the chin downward and support it with your hand.
- Place your newborn on his or her back to sleep or nap, never on the stomach.
- Keep a bulb syringe close by to suction your newborn's mouth in case of choking.
- Cluster newborn care (bathing, feeding, dressing) to prevent overstimulation.
- If your newborn is fussy or crying, try these measures to help calm him or her:
  - Wrap your newborn snugly in a blanket and gently rock in rocking chair.
  - Take the baby for a ride in the car (using a newborn car seat).
  - Play soothing music and "dance" with the newborn.
  - Use a wind-up swing with music.
- To help your newborn get to sleep, try these measures:
  - Schedule a bath with a gentle massage prior to bedtime.
  - Change diaper and clothes to make the baby comfortable.
  - Feed the baby just prior to bedtime.
  - If the newborn cries when put in crib and all needs are met, allow him or her to cry.
  - Use a rocking chair to feed and sing a soft lullaby.
- Call your primary care provider if you observe withdrawal behaviors such as:
  - Slight tremors (shaking) of hands and legs
  - Stiff posture when held in your arms
  - Irritability and frequent fussiness
  - High-pitched cry, excessive sucking motions
  - Erratic sleep pattern
  - Frequent yawning, nasal stuffiness, sweating
  - Prolonged time needed to feed
  - Frequent vomiting after feeding

newborns in the first week of life and in virtually all preterm newborns (Rodriguez et al., 2008).

Pathophysiology

Newborn jaundice results from an imbalance in the rate of bilirubin production and bilirubin elimination. This imbalance determines the pattern and degree of newborn hyperbilirubinemia (Blackburn, 2007).

During the newborn period, a rapid transition from the intrauterine to the extrauterine pattern of bilirubin physiology occurs. Fetal unconjugated bilirubin is normally cleared by the placenta and the mother's liver in utero, so total bilirubin at birth is low. After the umbilical cord is cut, the newborn must conjugate bilirubin (convert a lipid-soluble pigment into a water-soluble pigment) in the liver on his or her own. The rate and amount of bilirubin conjugation depend on the rate of red blood cell breakdown, the bilirubin load, the maturity of the liver, and the number of albumin-binding sites (Kenner & Lott, 2007). Bilirubin production increases after birth mainly because of a shortened red blood cell lifespan (70 days in the newborn vs. 90 days in the adult) combined with an increased red blood cell mass. Therefore, the amount of bilirubin the newborn must deal with is large compared to that of an adult.

Bilirubin has two forms—unconjugated or indirect, which is fat-soluble and toxic to body tissues, and conjugated or direct, which is water-soluble and nontoxic. Elevated serum bilirubin levels are manifested as jaundice in the newborn. Typically the total serum bilirubin level rises over the first 3 to 5 days and then declines.

Physiologic Jaundice

Physiologic jaundice is the manifestation of the normal hyperbilirubinemia seen in newborns, appearing during the third to fourth days of life, due to the limitations and abnormalities of bilirubin metabolism. It occurs in 60% of term infants and up to 80% of preterm infants (Blackburn, 2007). Serum bilirubin levels reach up to 10 mg/dL and then decline rapidly over the first week after birth (Cunningham et al., 2005). Most newborns have been discharged by the time this jaundice peaks (at about 72 hours).

Physiologic jaundice may result from an increased bilirubin load because of relative polycythemia, a shortened red blood cell lifespan, immature hepatic uptake and conjugation process, and increased enterohepatic circulation (McLenan, 2007). Newborns with delayed passage of meconium are more likely to develop physiologic jaundice (Blackburn, 2007).

Physiologic jaundice differs between breastfed and bottle-fed newborns in relation to the onset of symptoms. Breastfed newborns typically have peak bilirubin levels on the fourth day of life; levels for bottle-fed newborns usually peak on the third day of life. The rate of bilirubin decline is less rapid in breastfed newborns compared to bottle-fed newborns because bottle-fed newborns tend to have more frequent bowel movements. Jaundice associated with breastfeeding presents in two distinct patterns: early-onset breastfeeding jaundice and late-onset breast milk jaundice.

Early-Onset Breastfeeding Jaundice

Early-onset breastfeeding jaundice is probably associated with ineffective breastfeeding practices because of relative

caloric deprivation in the first few days of life. Decreased volume and frequency of feedings may result in mild dehydration and the delayed passage of meconium. This delayed defecation allows enterohepatic circulation reuptake of bilirubin and an increase in the serum level of unconjugated bilirubin. To prevent this, strategies to promote early effective breastfeeding are important. The AAP guidelines recommend early and frequent breastfeeding without supplemental water or dextrose-water unless medically indicated (AAP, 2005). Early frequent feedings can provide the newborn with adequate calories and fluid volume (via colostrum) to stimulate peristalsis and passage of meconium to eliminate bilirubin.

Late-Onset Breastfeeding Jaundice

Late-onset breastfeeding jaundice occurs later in the newborn period, with the bilirubin level usually peaking in the 6th to 14th day of life. Total serum bilirubin levels may be 12 to 20 mg/dL, but the levels are not considered pathologic (Simpson, 2007). The specific cause of late-onset breast milk jaundice is not entirely understood, but it may be related to a change in the milk composition resulting in enhanced enterohepatic circulation. Additional research is needed to determine the cause. Interrupting breastfeeding is not recommended unless bilirubin levels reach dangerous levels; if this occurs, breastfeeding is stopped for only 1 or 2 days. Substituting formula during this short break usually results in a prompt decline of bilirubin levels.

Pathologic Jaundice

Pathologic jaundice is manifested within the first 24 hours of life when total bilirubin levels increase by more than 5 mg/dL/day and the total serum bilirubin level is higher than 17 mg/dL in a full-term infant (Ozen & Mukherjee, 2007). Conditions that alter the production, transport, uptake, metabolism, excretion, or reabsorption of bilirubin can cause pathologic jaundice in the newborn. A few conditions that contribute to red blood cell breakdown and thus higher bilirubin levels include polycythemia, blood incompatibilities, and systemic acidosis. These altered conditions can lead to high levels of unconjugated bilirubin, possibly reaching toxic levels and resulting in a severe condition called kernicterus.

Kernicterus (yellow nucleus) or bilirubin encephalopathy is a preventable neurologic disorder characterized by encephalopathy, motor abnormalities, hearing and vision loss, and death (Maisels & Newman, 2007). Neurotoxicity develops because unconjugated bilirubin has a high affinity for brain tissue, and bilirubin not bound to albumin is free to cross the blood–brain barrier and damage cells of the CNS.

In the acute stage, the newborn becomes lethargic, irritable, and hypotonic and sucks poorly. If the hyperbilirubinemia is not treated, the newborn becomes hypertonic, with arching and seizures. A high-pitched cry may be noted. These changes can occur rapidly, so all newborns must be assessed for jaundice and tested if indicated so that treatment can be initiated.

The most common condition associated with pathologic jaundice is hemolytic disease of the newborn secondary to incompatibility of blood groups of the mother and the newborn. The most frequent conditions are Rh factor and ABO incompatibilities.

▶ *Take* NOTE!

Significant jaundice in the newborn less than 24 hours of age should be immediately reported to the physician, as it may indicate a pathologic process.

Rh Isoimmunization

Rh incompatibility or isoimmunization develops when an Rh-negative woman who has experienced Rh isoimmunization subsequently becomes pregnant with an Rh-positive fetus. The maternal antibodies cross the placenta into the fetal circulation and begin to break down the red blood cells (Fig. 24.6). Destruction of the fetal red blood cells leads to fetal anemia and hemolytic disease of the newborn. The severity of the fetal hemolytic process depends on the level and effectiveness of anti-D antibodies and the capacity of the fetal system to remove antibody-coated cells.

Intrauterine transfusions with Rh-negative, type O blood may be life-saving if done in time. The widespread administration of Rh immune globulin (RhoGAM), combined with aggressive fetal surveillance and transfusion, has reduced the incidence of hemolytic disease of the newborn.

Immune hydrops, also called hydrops fetalis, is a severe form of hemolytic disease of the newborn that occurs when pathologic changes develop in the organs of the fetus secondary to severe anemia. Hydrops fetalis results from fetal hypoxia, anemia, congestive heart failure, and hypoproteinemia secondary to hepatic dysfunction. ABO and Rh incompatibilities can both cause hydrops fetalis, but Rh disease is the more common cause. Typically, hydrops is not observed until the hemoglobin drops below approximately 4 g/dL (hematocrit <15%) (Huang et al., 2007). Fetuses with hydrops may die in utero from profound anemia and circulatory failure. The placenta is very enlarged and edematous. One sign of severe anemia and impending death is the sinusoidal fetal heart rate pattern (Cunningham et al., 2005).

ABO Incompatibility

ABO incompatibility is an immune reaction that occurs when the mother has type O blood and the fetus has type A, B, or AB blood. Although it occurs more frequently

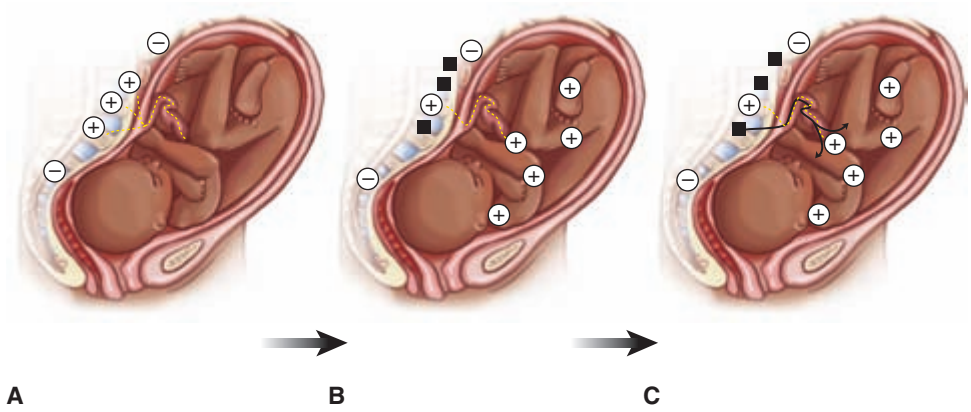


FIGURE 24.6 Rh isoimmunization. (**A**) The Rh-negative mother is exposed to Rh-positive antigens. (**B**) Maternal antibodies form. (**C**) Rh antibodies are transferred to the fetus.

than Rh incompatibilities, it causes less severe problems and rarely results in hemolytic disease severe enough to be clinically diagnosed and treated. Enlargement of the spleen and liver may be found in newborns with ABO incompatibility, but hydrops fetalis is rare (Kenner & Lott, 2007). Because the antibodies resulting in ABO incompatibility occur naturally, it is impossible to eliminate this type of incompatibility.

Women with type O blood develop anti-A or anti-B antibodies throughout their life through foods they eat and exposure to infections. Most species of anti-A and anti-B antibodies are immunoglobin M (IgM), which cannot cross the placenta and thus cannot gain access to the fetal red blood cells. Some anti-A and anti-B antibodies from the mother may cross the placenta to the fetus during the first pregnancy and can cause hemolysis of fetal blood cells.

Nursing Assessment

Nurses play an important role in early detection and identification of jaundice in the newborn. Keen observation skills are essential.

Health History and Physical Examination

Review the medical record for factors that might predispose the newborn to hyperbilirubinemia, such as:

- Polycythemia
- Significant bruising or cephalhematoma, which increases bilirubin production
- Infections such as TORCH (toxoplasmosis, hepatitis B, rubella, cytomegalovirus, herpes simplex virus)
- Use of drugs during labor and birth such as diazepam (Valium) or oxytocin (Pitocin)
- Prematurity
- Gestational age of 34 to 36 weeks
- Hemolysis due to ABO incompatibility or Rh isoimmunization
- Macrosomic infant of a diabetic mother
- Delayed cord clamping, which increases the erythrocyte volume
- Decreased albumin binding sites to transport unconjugated bilirubin to the liver because of acidosis
- Delayed meconium passage, which increases the amount of bilirubin that returns to the unconjugated state and can be absorbed by the intestinal mucosa
- Siblings who had significant jaundice
- Inadequate breastfeeding leading to dehydration, decreased caloric intake, weight loss, and delayed passage of meconium
- Ethnicity, such as Asian-American, Mediterranean, or Native American
- Male gender (Kenner & Lott, 2007)

Perform a complete physical examination. Assess the skin, mucous membranes, sclerae, and bodily fluids (tears, urine) for a yellow color. Detect jaundice by observing the infant in a well-lit room and blanching the skin with digital pressure over a bony prominence. Typically, jaundice begins on the head and gradually progresses to the abdomen and extremities. Also inspect for pallor (anemia), excessive bruising (bleeding), and dehydration (sluggish circulation), which may contribute to the development of jaundice and the risk for kernicterus.

Assess the newborn for Rh incompatibility. Be alert for clinical manifestations such as ascites, congestive heart failure, edema, pallor, jaundice, hepatosplenomegaly, hydramnios, thick placenta, and dilation of the umbilical vein (Blackburn, 2007).

The hydropic newborn appears pale, edematous, and limp at birth and typically requires resuscitation. The newborn with immune hydrops exhibits severe generalized edema, organ hypertrophy and enlargement, and effusion of fluid into body cavities.

Laboratory and Diagnostic Testing

Determine maternal and fetal blood types, checking for incompatibilities (Comparison Chart 24.1). Assess lab-

COMPARISON CHART 24.1 **Rh vs. ABO Incompatibility**

Clinical Picture	Rh Incompatibility	ABO Incompatibility
First-born	Rare	Common
Later pregnancies	More severe	No increase in severity
Jaundice	Moderate to severe	Mild
Hydrops fetalis	Frequent	Rare
Anemia	Frequently severe	Rare
Ascites	Frequent	Rare
Hepatosplenomegaly	Frequent	Common

oratory values for bilirubin (both unconjugated and conjugated). Bilirubin levels establish the diagnosis of hyperbilirubinemia. The newborn with Rh incompatibility demonstrates a rapidly rising unconjugated bilirubin level at birth or in the first 24 hours. Also expect to obtain alkaline phosphatase, liver enzymes, and prothrombin time and partial thromboplastin time, as well as:

- Direct Coombs test—to identify hemolytic disease of the newborn; positive results indicate that the newborn's red blood cells have been coated with antibodies and thus are sensitized
- Hemoglobin concentration—for evidence of anemia
- Blood type—to determine Rh status and any incompatibility of the newborn
- Total serum protein—to detect reduced binding capacity of albumin
- Reticulocyte count—to identify an elevated level indicating increased hemolysis

Assist with obtaining blood specimens. Use cord blood for hemoglobin concentration measurements; use a heel stick for direct Coombs testing and bilirubin levels. Prepare the parents and newborn for radiologic evaluation if necessary to determine abnormalities that may be causing the jaundice.

Nursing Management

Nursing management of a newborn with hyperbilirubinemia requires a comprehensive approach. As members of the health care team, nurses share in the responsibility for early detection and identification, family education, management, and follow-up of the mother and newborn. Documentation of the timing of onset of jaundice is essential to differentiate between physiologic (>24 hours) and pathologic jaundice (<24 hours). Nurses can improve care by offering their presence and support.

Reducing Bilirubin Levels

Encourage early initiation of feedings to prevent hypoglycemia and provide protein to maintain the albumin levels to transport bilirubin to the liver. Ensure newborn feedings (breast milk or formula) every 2 to 3 hours to promote prompt emptying of bilirubin from the bowel. Encourage the mother to breastfeed (8 to 12 feedings per day) to prevent inadequate intake and thus dehydration. Supplement breast milk with formula to supply protein if bilirubin levels continue to increase with breastfeeding only. Monitor serum bilirubin levels frequently to reduce the risk of severe hyperbilirubinemia.

Phototherapy

For the newborn with jaundice, regardless of its etiology, phototherapy is used to convert unconjugated bilirubin to the less toxic water-soluble form that can be excreted. Phototherapy, via special lights placed above the newborn or a fiber-optic blanket placed under the newborn and wrapped around him or her, involves blue wavelengths of light to alter unconjugated bilirubin in the skin. For the newborn receiving phototherapy, place the newborn under the lights or on the fiberoptic blanket, exposing as much skin as possible. Cover the newborn's genitals and shield the eyes to protect these areas from becoming irritated or burned when using direct lights. Assess the intensity of the light source to prevent burns and excoriation (Fig. 24.7).

FIGURE 24.7 A newborn receiving phototherapy. Here the nurse is checking the intensity of the lights with a meter.

Turn the newborn every 2 hours to maximize the area of exposure, removing the newborn from the lights only for feedings. Maintain a neutral thermal environment to decrease energy expenditure, and assess the newborn's neurologic status frequently.

Assess the newborn's temperature every 3 to 4 hours as indicated. Monitor fluid intake and output closely and assess daily weights for gains or losses. Check skin turgor for dehydration.

With feedings, remove the newborn from the lights and remove the eye shields to allow interaction with the newborn. Encourage breast or bottle feedings every 2 to 3 hours. Follow agency policy about removing the eye shields periodically to assess the eyes for discharge or corneal irritation secondary to eye shield pressure. Typically, the eyes are assessed and eye shields removed once a shift.

Monitor stool for consistency and frequency. Unconjugated bilirubin excreted in the feces will produce a greenish appearance, and typically stools are loose. Lack of frequent green stools is a cause for concern.

Provide meticulous skin care. Assess skin surfaces frequently for dryness and irritation secondary to the dehydrating effects of phototherapy and irritation from highly acidic stool to prevent excoriation and skin breakdown (Simpson, 2007). Monitor the newborn's skin turgor.

Exchange Transfusion

If the total serum bilirubin level remains elevated after intensive phototherapy, an exchange transfusion, the quickest method for lowering serum bilirubin levels, may be necessary (Springer & Annibale, 2007). In the presence of hemolytic disease, severe anemia, or a rapid rise in the total serum bilirubin level, an exchange transfusion is recommended. An exchange transfusion removes the newborn's blood and replaces it with nonhemolyzed red blood cells from a donor. During the transfusion, monitor the newborn's cardiovascular status continuously because serious complications can arise, such as acid–base imbalances, infection, hypovolemia, and fluid and electrolyte imbalances. Exchange transfusion is used only as a second-line therapy after phototherapy has failed to yield results. Intensive nursing care is needed.

Assist the physician with an exchange transfusion if necessary. Monitor the newborn's status closely for changes, especially in vital signs and heart rate and rhythm, before, during, and after the procedure.

Providing Parent Teaching and Support

Nurses can help the parents to understand the diagnostic tests and treatment modalities by offering individualized teaching. Explore with the family their understanding of jaundice and treatment modalities to reduce anxiety and gain their cooperation in monitoring the infant. Teach the parents about jaundice and its potential risk using written and verbal material. Also show the parents how to identify newborn behaviors that might indicate rising bilirubin levels. Emphasize the need to seek treatment from their pediatrician should any of the following occur:

- Lethargy, sleepiness, poor muscle tone, floppiness
- Poor sucking, lack of interest in feeding
- High-pitched cry

Teach the parents how to assess their newborn for signs of jaundice because physiologic jaundice may not occur until after the newborn is discharged. Reinforce the need for appropriate follow-up with the primary care provider within 48 to 72 hours after discharge to assess jaundice status (Keren & Bhutani, 2007).

The need for phototherapy can be anxiety-producing for the parents. Explain the rationale for the procedure and demonstrate techniques that the parents can use to interact with their newborn. Additional education about phototherapy may be necessary when home phototherapy is used (Teaching Guidelines 24.2).

NEWBORN INFECTIONS

Newborns are susceptible to infections because their immune system is immature and slow to react. The antibodies that newborns received from their mother during pregnancy and from breast milk help protect them from invading organisms. However, these need time to reach optimal levels.

Bacterial infections of the newborn affect approximately 4 out of every 1,000 live births (McLenan, 2007). Making the diagnosis of sepsis in newborns is difficult due to its nonspecific symptoms. The mortality rate from newborn sepsis may be as high as 50% if untreated. Infection is a major cause of death during the first month of life, contributing to 13% to 15% of all neonatal deaths (Anderson-Berry & Bellig, 2007).

Pathophysiology

When a pathologic organism overcomes the newborn's defenses, infection and sepsis results. **Neonatal sepsis** is the presence of bacterial, fungal, or viral microorganisms or their toxins in blood or other tissues. Infections that have an onset within the first month of life are termed newborn infections. Exposure to a pathogenic organism, whether a virus, fungus, or bacteria, occurs, and it enters the newborn's body and begins to multiply.

Newborn infections are usually grouped into three classes according to their time of onset: congenital infection, acquired in utero (intrauterine infections) by vertical transmission with onset before birth; early-onset infections, acquired by vertical transmission in the perinatal period, either shortly before or during birth; and late-onset infections, acquired by horizontal transmission in the nursery. As many as 80% to 90% of neonatal infections have

TEACHING GUIDELINES 24.2

Caring for Your Newborn Receiving Home Phototherapy

- Inspect your newborn's skin, eyes, and mucous membranes for a yellow color.
- Remember that a home health nurse will come to visit and help you set up the light system.
- Keep the lights about 12 to 30 inches above your newborn.
- Cover your newborn's eyes with patches or cotton balls and gauze to protect them.
- Keep the newborn undressed except for the diaper area; fold the diaper down below the newborn's navel in the front and as far as possible in the back to expose as much skin area as possible.
- Turn your newborn every 2 hours so that all areas of the body are exposed.
- Remove the newborn from the lights only for feeding.
- Remove the eye patches during feedings so that you can interact with your newborn.
- Record your newborn's temperature, weight, and fluid intake daily.
- Document the frequency, color, and consistency of all stools; the stools should be loose and green as the bilirubin is broken down.
- Keep the skin clean and dry to prevent irritation.
- Feed your newborn frequently, including supplemental glucose water if allowed to provide added fluid, protein, and calories.
- Rock, cuddle, or hold the newborn to promote bonding when out of the lights.
- Contact your pediatrician or home health care agency with any questions or changes, including refusing feedings, fewer than five wet diapers in one day, vomiting of complete amounts of feeding, or elevated temperature.
- Keep appointments for follow-up laboratory testing to monitor bilirubin levels.

their onset in the first 2 days of life (CDC, 2007). Comparison Chart 24.2 compares the three classes of newborn infections.

Nursing Assessment

Nursing assessment focuses on early identification of a newborn at risk for infection to allow for prompt treatment, thus reducing mortality and morbidity. Be aware of the myriad risk factors associated with newborn sepsis. Among the factors that contribute to the newborn's overall vulnerability to infection are poor skin integrity, invasive procedures, exposure to numerous caregivers, and an environment conducive to bacterial colonization (Kenner & Lott, 2007).

Few newborn infections are easy to recognize because manifestations usually are nonspecific. Early symptoms can be vague because of the newborn's inability to mount an inflammatory response. Often, the observation is that the newborn does not "look right." Assess the newborn for common nonspecific signs of infection, including:

- Hypothermia
- Pallor or duskiness
- Hypotonia
- Cyanosis
- Poor weight gain
- Irritability
- Seizures
- Jaundice
- Grunting
- Nasal flaring
- Apnea and bradycardia
- Lethargy
- Hypoglycemia
- Poor feeding (lack of interest in feeding)
- Abdominal distention (Anderson-Berry & Bellig, 2007)

Since infection can be confused with other newborn conditions, laboratory and radiographic tests are needed to confirm the presence of infection. Be prepared to coordinate the timing of the various tests and assist as necessary.

Evaluate the complete blood count with a differential to identify anemia, leukocytosis, or leukopenia. Elevated C-reactive protein levels may indicate inflammation. As ordered, obtain x-rays of the chest and abdomen, which may reveal infectious processes located there. Blood, cerebrospinal fluid, and urine cultures are indicated to identify the location and type of infection present. Positive cultures confirm that the newborn has an infection.

Nursing Management

To enhance the newborn's chance of survival, early recognition and diagnosis are key. Often the diagnosis of sepsis is based on a suspicious clinical picture. Antibiotic therapy is usually started before the laboratory results identify the infecting pathogen (see Evidence-Based Practice). Along with antibiotic therapy, circulatory, respiratory, nutritional, and developmental support is important. Antibiotic therapy is continued for 7 to 21 days if cultures are positive, or it is discontinued within 72 hours if cultures are negative. With the use of antibiotics along with early recognition and supportive care, mortality and morbidity rates have been reduced greatly.

Nurses possess the education and assessment tools to decrease the incidence of and reduce the impact of infections on women (see Chapter 20 for additional information) and their newborns. Implement measures for prevention and early recognition, including:

COMPARISON CHART 24.2 INTRAUTERINE VS. EARLY-ONSET VS. LATE-ONSET NEWBORN INFECTIONS

	Intrauterine (Congenital)	Early-Onset Infections	Late-Onset Infections
Risk factors	-Immature immune system IgM, IgA, and T lymphocytes -Decreased gastric acid, which is needed to reduce organisms	-Prolonged rupture of membranes -Urinary tract infections -Preterm labor -Prolonged or difficult labor -Maternal fever -Colonization with group B streptococci -Maternal infections	-Low birthweight -Prematurity -Meconium staining -Need for resuscitation -Birth asphyxia -Improper handwashing
Common causative organisms	-Cytomegalovirus -Rubella -Toxoplasmosis -Syphilis	-*Escherichia coli* -Group B streptococci -*Klebsiella pneumoniae* -*Listeria monocytogenes* -Other enteric gram-negative bacilli	-*Candida albicans* -Coagulase-negative staphylococci -*Staphylococcus aureus* -*E. coli* -Enterobacter -Klebsiella -Serratia -Pseudomonas -Group B streptococci
Mechanism of infection	-Organism crossing placenta into fetal circulatory system; organism residing in amniotic fluid -Ascent of organism via the vagina, ultimately infecting membranes and causing rupture and leading to respiratory and gastrointestinal tract infections	Most occur during birthing process when newborn comes into contact with infected birth canal (newborn cannot defend against host organisms). -Newborn susceptibility to infection by exogenous organisms possibly due to inadequacy of physical barriers (thin, friable skin with little subcutaneous tissue) -Lack of gastric acidity, possibly resulting in easy colonization by environmental organisms -Aspiration of microorganisms during birth with development of pneumonia	More common in newborns undergoing invasive procedures such as endotracheal intubation or catheter insertion; break in skin or mucosal protection barrier.

Sources: Blackburn (2007); Brousseau & Sharieff (2007), Kenner & Lott (2007).

- Formulating a sepsis prevention plan that includes education of all members of the health care team on identification and treatment of sepsis
- Screening all newborns daily for signs of sepsis
- Monitoring sepsis cases and outcomes to reinforce continued quality-improvement measures or to modify current practices
- Outlining and carrying out measures to prevent nosocomial infections, such as:
  - Thorough handwashing hygiene for all staff
  - Frequent oral care and inspections of mucous membranes
  - Proper positioning and turning to prevent skin breakdown
  - Use of strict aseptic technique for all wound care
  - Frequent monitoring of invasive catheter sites for signs of infection
- Identifying newborns at risk for sepsis by reviewing risk factors
- Monitoring vital sign changes and observing for subtle signs of infection
- Monitoring for signs of organ system dysfunction:
  - Cardiovascular compromise—tachycardia and hypotension

EVIDENCE-BASED PRACTICE 24.1
Treating Neonatal Sepsis With Gentamicin Given as a Once-Daily Dose or as Multiple Doses per Day

● Study
Sepsis in a newborn can be fatal, and the signs and symptoms can be vague. Antibiotic therapy is usually initiated before the infection is confirmed by cultures. Gentamicin is a common antibiotic used to treat neonatal sepsis because of its effectiveness against gram-negative pathogens. However, gentamicin, like other aminoglycosides, can have adverse effects on hearing and kidney function, leading to questions about the most effective dosing regimen. Studies have shown that once-a-day dosing is most effective in older children and adults, but these studies do not address the neonatal population.

A study involving neonates with confirmed or suspected sepsis was completed to evaluate the effectiveness and safety of two types of dosing regimens: once-a-day dosing and multiple-doses-per-day dosing. All randomized or quasi-randomized controlled trials involving a comparison of one daily dose with multiple doses per day of gentamicin to newborns less than 28 days of age were selected. Information about clinical effectiveness, pharmacokinetic effectiveness, ototoxicity, and nephrotoxicity was collected. Of the 24 studies initially selected, 11 were evaluated. Most of the studies used intravenous infusion of gentamicin as the method of administration. One study used a bolus dose of gentamicin administered over 1 minute; two other studies used intramuscular administration.

▲ Findings
Regardless of the dosing regimen, gentamicin was shown to be effective in treating the sepsis. The once-daily dosing regimen appeared to be more effective: appropriate peak and trough levels of the drug were obtained more frequently when compared to the multiple dosing regimen. The studies found no evidence of ototoxicity or nephrotoxicity with either regimen.

■ Nursing Implications
The study confirmed the effectiveness of gentamicin in the treatment of neonatal sepsis, but it did not determine whether a once-daily dose was more effective than multiple doses per day in treating sepsis. Nurses can integrate the findings of this study into their practice when caring for newborns who are at risk for or have developed sepsis. Regardless of the regimen ordered, nurses can be diligent in ensuring that peak and trough drug levels are monitored. Although the study showed no evidence of hearing and kidney adverse effects, nurses still need to monitor the newborns for this possibility.

Rao, S. C., Ahmed, M., & Hagan, R. (2006). One dose per day compared to multiple doses per day of gentamicin for treatment of suspected or proven sepsis in neonates. *Cochrane Database of Systematic Reviews* 2006. Issue 1. Art. No.: CD005091.

  - Respiratory compromise—respiratory distress and tachypnea
  - Renal compromise—oliguria or anuria
  - Systemic compromise—abnormal blood values
- Providing comprehensive sepsis treatment:
  - Circulatory support with fluids and vasopressors
  - Supplemental oxygen and mechanical ventilation
  - Obtaining culture samples as requested
  - Antibiotic administration as ordered, observing for side effects
  - Promoting newborn comfort
  - Assessing the family's educational needs and providing instructions as necessary

Perinatal infections continue to be a public health problem, with severe consequences for those affected. By promoting a better understanding of newborn infections and appropriate use of therapies, nurses can lower the mortality rates associated with severe sepsis, especially with appropriate timing of interventions. The potential for nursing interventions to identify, prevent, and minimize the risk for sepsis is significant. Primary disease prevention must be a major focus for nurses. Family education plays a key role in the prevention of perinatal infections, in addition to following accepted practices in immunization.

Congenital Conditions

Congenital conditions can arise from many etiologies, including single-gene disorders, chromosome aberrations, exposure to teratogens, and many sporadic conditions of unknown cause. Congenital conditions may be inherited or sporadic, isolated or multiple, apparent or hidden, gross or microscopic. They cause nearly half of all deaths in term newborns and cause long-term sequelae for many. The incidence varies according to the type of defect. When a serious anomaly is identified prenatally, the parents can decide whether or not to continue the pregnancy. When an anomaly is identified at or after birth, parents need to be informed promptly and given a realistic appraisal of the severity of the condition, the prognosis, and treatment options so that they can participate in all decisions pertaining to their child.

Congenital conditions can affect virtually any body system. This chapter describes those congenital conditions

that require immediate treatment or affect the newborn in the period immediately after birth. Other congenital conditions, such as congenital heart disease or CNS defects, are discussed in later chapters due to their long-term nature and ongoing effects.

ESOPHAGEAL ATRESIA AND TRACHEOESOPHAGEAL FISTULA

Esophageal atresia and tracheoesophageal fistula are gastrointestinal anomalies in which the esophagus and trachea do not separate normally during embryonic development. Esophageal atresia refers to a congenitally interrupted esophagus where the proximal and distal ends do not communicate; the upper esophageal segment ends in a blind pouch and the lower segment ends a variable distance above the diaphragm (Fig. 24.8).

Tracheoesophageal fistula is an abnormal communication between the trachea and esophagus. When associated with esophageal atresia, the fistula most commonly occurs between the distal esophageal segment and the trachea. The incidence of esophageal atresia is 1 per 3,000 to 4,000 live births (Blackburn, 2007).

Pathophysiology

Several types of esophageal atresia exist, but the most common anomaly is a fistula between the distal esopha-

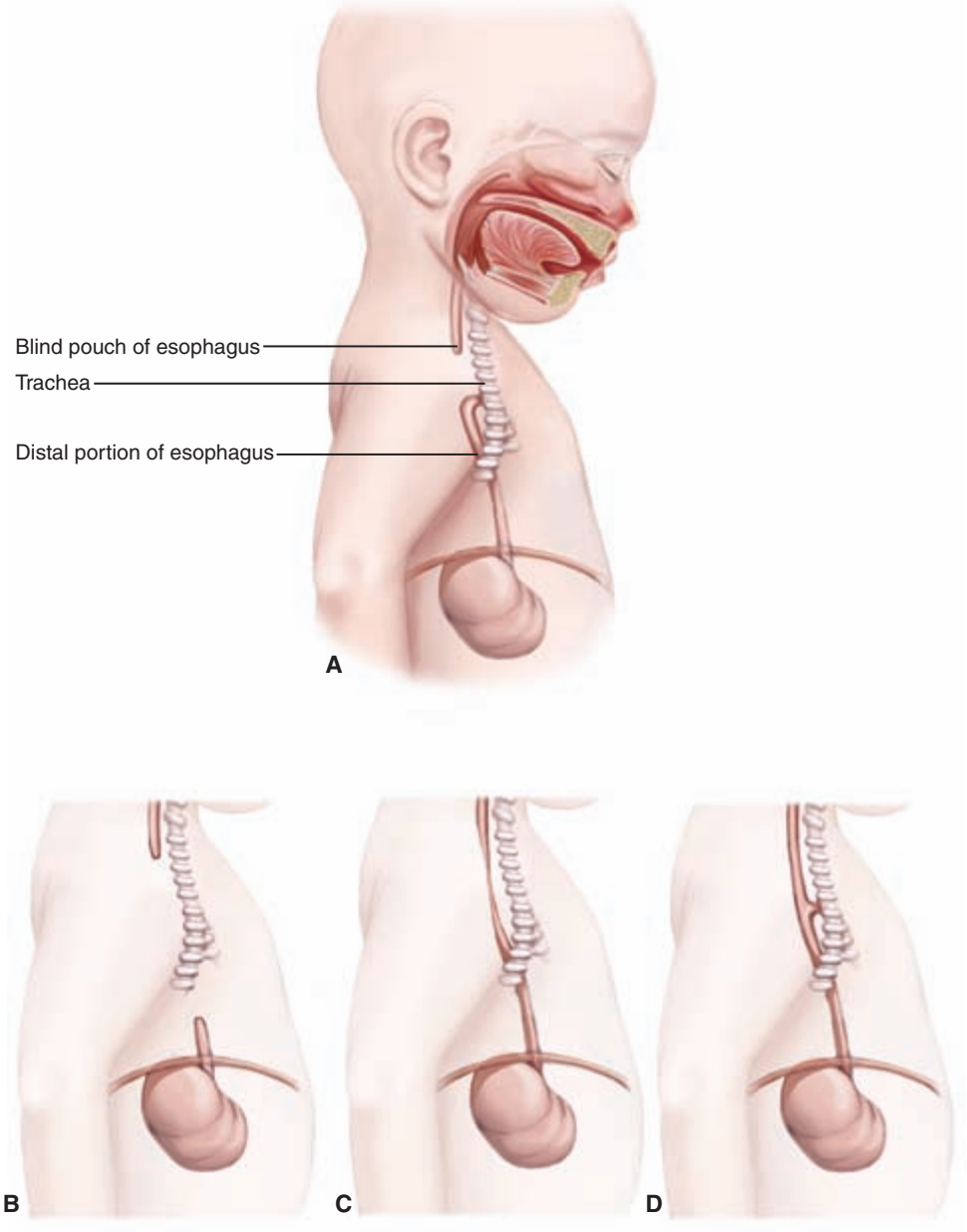


FIGURE 24.8 Esophageal atresia and tracheoesophageal fistula. (**A**) The most common type of esophageal atresia, in which the esophagus ends in a blind pouch and a fistula connects the trachea with the distal portion of the esophagus. (**B**) The upper and distal portions of the esophagus end in a blind pouch. (**C**) The esophagus is one segment, but a portion of it is narrowed. (**D**) The upper portion of the esophagus connects to the trachea via a fistula.

gus and the trachea, which occurs in 86% of newborns with an esophageal defect. Esophageal atresia and tracheoesophageal fistula are thought to be the result of incomplete separation of the lung bed from the foregut during early fetal development. A large percentage of these newborns have other congenital anomalies involving the vertebra, kidneys, heart, and musculoskeletal and gastrointestinal systems (Rodriguez, 2006); most have several anomalies.

Nursing Assessment

Review the maternal history for polyhydramnios. Often this is the first sign of esophageal atresia because the fetus cannot swallow and absorb amniotic fluid in utero, leading to accumulation. Soon after birth, the newborn may exhibit copious, frothy bubbles of mucus in the mouth and nose, accompanied by drooling. Abdominal distention develops as air builds up in the stomach. In esophageal atresia, a gastric tube cannot be inserted beyond a certain point because the esophagus ends in a blind pouch. The newborn may have rattling respirations, excessive salivation and drooling, and "the three C's" (coughing, choking, and cyanosis) if feeding is attempted. The presence of a fistula increases the risk of respiratory complications such as pneumonitis and atelectasis due to aspiration of food and secretions (Kenner & Lott, 2007).

▶ *Take* NOTE!

The "three C's" of choking, coughing, and cyanosis in conjunction with feeding are considered the classic signs of tracheoesophageal fistula and atresia.

Prepare the newborn and parents for radiographic evaluation. Diagnosis is made by x-ray: a gastric tube appears coiled in the upper esophageal pouch, and air in the gastrointestinal tract indicates the presence of a fistula (Kenner & Lott, 2007). Once a diagnosis of esophageal atresia is established, begin preparations for surgery if the newborn is stable.

Nursing Management

Nursing management focuses on preparing the newborn and parents for surgery and providing meticulous postoperative care.

Providing Preoperative Care

Preoperative nursing interventions include the following measures:

- Initiate nothing by mouth (NPO) status.
- Elevate the head of the bed 30 to 45 degrees to prevent reflux and aspiration.
- Monitor hydration status and fluid and electrolyte balance; administer and monitor parenteral IV fluid infusions.
- Assess and maintain the patency of the orogastric tube; monitor the functioning of the tube, which is attached to low continuous suction; and avoid irrigation of the tube to prevent aspiration.
- Have oxygen and suctioning equipment readily available should the newborn experience respiratory distress.
- Assist with diagnostic studies to rule out other anomalies.
- Use comfort measures to minimize crying and prevent respiratory distress; provide nonnutritive sucking.
- Inform the parents about the rationales for the aspiration prevention measures.
- Document frequent observations of the newborn's condition (Kenner & Lott, 2007).

Providing Postoperative Care

Surgery consists of closing the fistula and joining the two esophageal segments. Postoperative care involves closely observing all of the newborn's body systems to identify any complications. Expect to administer TPN and antibiotics until the esophageal anastomosis is proven intact and patent. Then begin oral feedings, usually within a week after surgery (Blackburn, 2007). Keep the parents informed of their newborn's condition and progress. Closely assess the newborn during feeding and report any difficulty with swallowing. Provide parent teaching. Demonstrate and reinforce all teaching prior to discharge.

OMPHALOCELE AND GASTROSCHISIS

Omphalocele and gastroschisis are congenital anomalies of the anterior abdominal wall. An **omphalocele** is a defect of the umbilical ring that allows evisceration of the abdominal contents into an external peritoneal sac. Defects vary in size; they may be limited to bowel loops or may include the entire gastrointestinal tract and liver (Fig. 24.9). Bowel malrotation is common, but the displaced organs are usually normal. Omphaloceles are associated with other anomalies in more than 70% of the cases. This anomaly is usually detected during routine prenatal ultrasound of the fetus or during investigation of an increased alpha-fetoprotein level (Glasser, 2006).

Gastroschisis is a herniation of the abdominal contents through an abdominal wall defect, usually to the left or right of the umbilicus (McLenan, 2007). Gastroschisis differs from omphalocele in that there is no peritoneal sac protecting the herniated organs, and thus exposure to amniotic fluid makes them thickened, edematous, and inflamed (Rodriguez, 2006). Gastroschisis is associated

FIGURE 24.9 Omphalocele in a newborn. Note the large, protruding sac.

with significant newborn mortality and morbidity rates. Despite surgical correction, feeding intolerance, failure to thrive, and prolonged hospital stays occur in nearly all newborns with this anomaly (Glasser, 2006).

Each of these diagnoses requires that a pediatric surgeon be available at delivery to determine the extent of the defect and complications.

Nursing Assessment

Review the maternal history for factors associated with high-risk pregnancies, such as maternal illness and infection, drug use, smoking, and genetic abnormalities. These factors are also associated with omphalocele and gastroschisis. They contribute to placental insufficiency and the birth of a small-for-gestational-age or preterm newborn, the populations in which both of these abdominal defects most commonly occur. The combined incidence of both congenital abdominal wall anomalies is 1 in 2,000 births (Glasser, 2006).

Omphalocele and gastroschisis are readily observed. Note the appearance of the protrusion on the abdomen and evidence of a sac. Inspect the sac closely for the presence of organs, most commonly the intestines but sometimes the liver. Also inspect the contents for any twisting of the intestines. Note the color of the organs within the sac and measure the size of the omphalocele.

Also perform a complete physical examination of the newborn. Typically these congenital conditions are associated with other congenital anomalies, such as those involving the cardiovascular, genitourinary, and central nervous systems.

Nursing Management

Nursing management of newborns with omphalocele or gastroschisis focuses on preventing hypothermia, maintaining perfusion to the eviscerated abdominal contents by minimizing fluid loss, and protecting the exposed abdominal contents from trauma and infection. These objectives can be accomplished by placing the infant in a sterile drawstring bowel bag that maintains a sterile environment for the exposed contents, allows visualization, reduces heat and moisture loss, and allows heat from radiant warmers to reach the newborn. The newborn is placed feet-first into the bag and the drawstring is secured around the torso (McLenan, 2007). Strict sterile technique is necessary to prevent contamination of the exposed abdominal contents.

An orogastric tube attached to low suction is used to prevent intestinal distention. IV therapy is administered to maintain fluid and electrolyte balance and provide a route for antibiotic therapy. Monitor the newborn's fluid status frequently. Closely observe the exposed bowel for vascular compromise, such as changes in color or a decrease in temperature, and report these immediately.

Providing Postoperative Care

Surgical repair of both defects occurs after initial stabilization and comprehensive evaluation for any other anomalies. It may have to occur in stages, depending on the defect (Box 24.4).

Postoperative care involves providing pain management, monitoring respiratory and cardiac status, monitoring intake and output, assessing for vascular compromise, maintaining the orogastric tube to suction, documenting the amount and color of drainage, and administering ordered medications and treatments (Lund, Bauer, & Berrios, 2007). Also be alert for complications, such as short bowel syndrome (see Chapter 41 for additional information).

BOX 24.4 Surgery to Repair Omphalocele and Gastroschisis

Surgical repair of gastroschisis is an emergency due to the high risk of intestinal atresia, resulting in obstruction. Primary repair of gastroschisis is usually performed without incident, unless the contents are unable to fit into the abdominal cavity. This occurs more often with a large omphalocele, requiring the surgeon to do a staged closure. This involves covering the defect with a synthetic material that is sequentially squeezed like toothpaste to reduce the defect into the abdominal cavity. After enough of the defect is in the abdominal cavity, a surgical repair is then performed (Islam, 2008). If damage to the exposed organs occurs, such as necrosis, then the necrotic sections are removed during the repair. If a significant amount of small intestine is lost, then the complication of short bowel syndrome may occur.

Promoting Parent–Newborn Interaction

The parents need continued support and progress reports on their newborn. They may be distraught at the sight of the anomaly, and they may be frightened to touch their newborn. Encourage the parents to touch the newborn and participate in care as much as possible. Because of the nature of this defect, bonding opportunities will be limited initially. However, strongly encourage frequent visiting. In addition, provide information to the parents about the defect, treatment modalities, and prognosis. After surgery, instruct the parents in care measures and provide them with home care instructions. Anticipate the need for a referral to a home health care agency and community resources for support.

IMPERFORATE ANUS

An imperforate anus is a gastrointestinal system malformation of the anorectal area that may occur in several forms. The rectum may end in a blind pouch that does not connect to the colon, or it may have fistulas (openings) between the rectum and the perineum, the vagina in girls or the urethra in boys (Fig. 24.10). The malformations occur during early fetal development and are associated with anomalies in other body systems.

Imperforate anus occurs in about 1 of every 5,000 live births (March of Dimes, 2006). The defect can be further classified as a high or low type, depending on its level. The level significantly influences the outcome in terms of fecal continence as well as management (Blackburn, 2007).

Surgical intervention is needed for both high and low types of imperforate anus. Surgery for a high type of defect involves a colostomy in the newborn period, with corrective surgery performed in stages to allow for growth. Surgery for the low type of anomaly, which frequently includes a fistula, involves closure of the fistula, creation of an anal opening, and repositioning of the rectal pouch into the anal opening. A major challenge for either type of surgical repair is finding, using, or creating adequate nerve and muscle structures around the rectum to provide for normal evacuation.

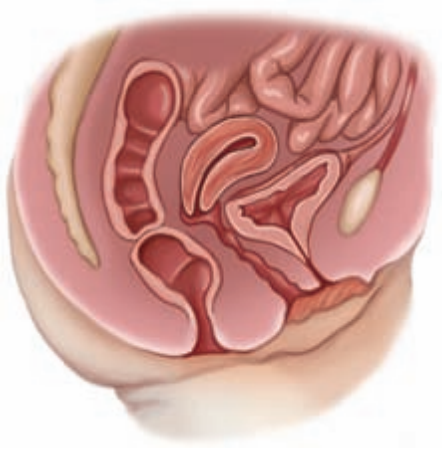


FIGURE 24.10 Imperforate anus, in which the rectum ends in a blind pouch.

Nursing Assessment

In the newborn, observe for an appropriate anal opening. If the anal opening exists, observe for passage of meconium stool within the first 24 hours of life. Assess urine output to identify genitourinary problems. For the newborn with an imperforate anus, inspection of the perineal area would reveal absence of the usual opening. In addition, meconium generally is not passed or present within 24 hours of birth.

In the infant with suspected imperforate anus, assess for common signs of intestinal obstruction, which may occur as a result of the malformation. These include abdominal distention and bilious vomiting.

Prepare the newborn and family for radiographic studies that may be ordered to assess for complications associated with imperforate anus.

Nursing Management

Nursing management focuses on preparing the newborn and parent for surgery and providing postoperative care. Preoperatively, maintain the newborn's NPO status and provide gastric decompression. Administer IV therapy and antibiotic therapy as ordered and monitor the newborn's hydration status. Provide a full explanation of the defect, surgical options, potential complications, typical postoperative course, and long-term care needed to the parents. Make sure they are aware of the available treatment modalities. Prepare them for the possibility that the newborn may require an ostomy. Provide support to the parents and family.

Postoperative care includes ensuring adequate pain relief, maintaining NPO status and gastric decompression until normal bowel function is restored, and providing colostomy care if applicable.

BLADDER EXSTROPHY

In bladder exstrophy, the bladder protrudes onto the abdominal wall because the abdominal wall failed to close during embryonic development. Wide separation of the rectus muscles and the symphysis pubis accompanies this defect. Virtually all affected male infants have associated epispadias. The upper urinary tract is usually normal. The incidence is approximately 1 in 24,000 to 40,000 live births (Kenner & Lott, 2007). Initial bladder closure is completed within 48 hours after birth. Further surgical re-

construction is performed in several stages at about 2 to 3 years of age. (See Chapter 42 for more information.)

Key Concepts

- Asphyxia, the most common clinical insult in the perinatal period, results in brain injury and may lead to mental retardation, cerebral palsy, or seizures.
- Transient tachypnea of the newborn occurs when the liquid in the lung is removed slowly or incompletely.
- Common risk factors for respiratory distress syndrome (RDS) include young gestational age, perinatal asphyxia regardless of gestational age, cesarean birth in the absence of labor (related to the lack of thoracic squeeze), male gender, and maternal diabetes.
- Meconium aspiration has three major pulmonary effects: airway obstruction, surfactant dysfunction, and chemical pneumonitis.
- The management of persistent pulmonary hypertension of the newborn requires meticulous attention to detail, with continuous monitoring of oxygenation, blood pressure, and perfusion.
- Periventricular/intraventricular hemorrhage is bleeding that usually originates in the subependymal germinal matrix region of the brain with extension into the ventricular system.
- Necrotizing enterocolitis (NEC) is a serious gastrointestinal disease of unknown etiology in newborns that can result in necrosis of a segment of the bowel.
- Infants of diabetic mothers are at risk for malformations most frequently involving the cardiovascular, skeletal, central nervous, gastrointestinal, and genitourinary systems; cardiac anomalies are the most common.
- Factors that place the newborn at risk for birth trauma include cephalopelvic disproportion, maternal pelvic anomalies, oligohydramnios, prolonged or rapid labor, abnormal presentation, fetal prematurity, fetal macrosomia, and fetal abnormalities.
- Women who use drugs during their pregnancy expose their unborn child to the possibility of intrauterine growth restriction, prematurity, neurobehavioral and neurophysiologic dysfunction, birth defects, infections, and long-term developmental sequelae.
- Newborns of women who abuse tobacco, illicit substances, caffeine, and alcohol can exhibit withdrawal behavior.
- Physiologic jaundice is a common, normal newborn phenomenon that appears during the second or third day of life and then declines over the first week after birth. Pathologic jaundice is manifested within the first 24 hours of life when total bilirubin levels increase by more than 5 mg/dL/day and the total serum bilirubin level is higher than 17 mg/dL in a full-term infant.
- Newborn infections are usually classified according to the time of onset and grouped into three categories: congenital infection, acquired in utero by vertical transmission with onset before birth; early-onset neonatal infections, acquired by vertical transmission in the perinatal period, either shortly before or during birth; and late-onset neonatal infections, acquired by horizontal transmission in the nursery.
- Congenital conditions can arise from many etiologies including single-gene disorders, chromosome aberrations, exposure to teratogens, and many sporadic conditions of unknown cause. Congenital structural anomalies may be inherited or sporadic, isolated or multiple, apparent or hidden, and gross or microscopic.
- Esophageal atresia refers to a congenitally interrupted esophagus where the proximal and distal ends do not communicate; the upper esophageal segment ends in a blind pouch and the lower segment ends a variable distance above the diaphragm. Tracheoesophageal fistula is an abnormal communication between the trachea and esophagus.
- Omphalocele and gastroschisis are congenital anomalies of the anterior abdominal wall. An omphalocele is a defect of the umbilical ring that allows evisceration of abdominal contents into an external peritoneal sac. Gastroschisis is a herniation of abdominal contents through an abdominal wall defect, usually to the left or right of the umbilicus.

REFERENCES

American Academy of Pediatrics (AAP). (2005). AAP policy statement of breastfeeding and the use of human milk. *Pediatrics, 115*(2), 496–506.

American Academy of Pediatrics (AAP) Committee on Substance Abuse. (2005). Tobacco, alcohol, and other drugs: The role of the pediatrician in prevention, identification, and management of substance abuse. *Pediatrics, 115*(3), 816–821.

American Diabetes Association (ADA). (2007a). *Diabetic statistics for women.* Available at: http://www.diabetes.org/diabetes-statistics/women.jsp.

American Diabetes Association (ADA). (2007b). *Gestational diabetes.* Available at: http://www.diabetes.org/gestational-diabetes.jsp.

American Heart Association and American Academy of Pediatrics. (2005). *Summary of major changes in the 2005 AAP/AHA Emergency Cardiovascular Care Guidelines for Neonatal Resuscitation: translating evidence-based guidelines to the NRP.* Available at: http://www.aap.org/nrp/nrpmain.html.

American Lung Association (ALA). (2007). *Respiratory distress syndrome of the newborn fact sheet.* Lung Disease Data and Minority Lung Disease Data. Available at: http://www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=35693.

Anderson-Berry, A. L., & Bellig, L. L. (2007). Neonatal sepsis. *eMedicine.* Available at: http://www.emedicine.com/ped/topic2630.htm.

Annibale, D. J., & Hill, J. (2007). Periventricular hemorrhage-intraventricular hemorrhage. *eMedicine.* Available at: http://www.emedicine.com/ped/topic2595.htm.

Arenson, J., & Drake, P. (2007). *Maternal and newborn health.* Sudbury, MA: Jones and Bartlett Publishers.

Asenjo, M. (2007). Transient tachypnea of the newborn. *eMedicine.* Available at: http://www.emedicine.com/radio/topic710.htm.

Belik, J., & Hawes, J. (2007). Neonatal abstinence syndrome. *eMedicine.* Available at: http://emedicine.com/ped/topic2760.htm.

Blackburn, S. T. (2007). *Maternal, fetal and neonatal physiology: A clinical perspective* (3rd ed.). St. Louis: Saunders Elsevier.

Brodsky, D., & Ouellette, M. A. (2007). *Primary care of the premature infant.* Philadelphia: Elsevier Health Sciences.

Brousseau, T. J., & Sharieff, G. Q. (2007). Neonatal emergencies. *WebMD.* Available at: http://www.medscape.com/viewprogram/7232_pnt.
Burd, L. J. (2007). Interventions in FASD: We must do better. *Child: Care, Health & Development, 33*(4), 398–400.
Centers for Disease Control and Prevention (CDC). (2007a). *Surgeon General's report: Women and smoking fact sheet: tobacco use and reproductive outcomes.* Available at: http://www.cdc.gov/tobacco/sgr/sgr_forwomen/factsheet_outcomes.htm.
Centers for Disease Control and Prevention (CDC). (2007b). *Fetal alcohol syndrome: Guidelines for referral and diagnosis.* National Task Force on FAS/FAE. Atlanta: Centers for Disease Control and Prevention.
Clark, D. A., & Clark, M. B. (2007). Meconium aspiration syndrome. *eMedicine.* Available at: http://www.emedicine.com/ped/topic768.htm.
Cunningham, F. G., Leveno, K. J., Bloom, S. L., Gilstrap, L. C., Hauth, J. C., & Wenstrom, K. D. (2005). *Williams' obstetrics* (22nd ed.). New York: McGraw-Hill.
Gilbert, E. S. (2006). *Manual of high-risk pregnancy and delivery* (3rd ed.). St. Louis: Mosby.
Glasser, J. G. (2007). Omphalocele and gastroschisis. *eMedicine.* Available at: http://www.emedicine.com/ped/topic1642.htm.
Goff, M., & O'Connor, M. (2007). Perinatal care of women maintained on methadone. *Journal of Midwifery & Women's Health, 52*(3), 23–26.
Huang, H. R., Tsay, P. K., Chiang, M. C., Lien, R., & Chou, Y. H. (2007). Prognostic factors and clinical features in liveborn neonates with hydrops fetalis. *American Journal of Perinatology, 24*(1), 33–38.
Islam, S. (2008). Clinical care outcomes in abdominal wall defects. *Current Opinions in Pediatrics, 20*(3), 305–310.
Kenner, C., & Lott, J. W. (2007). *Comprehensive neonatal care: An interdisciplinary approach* (4th ed.). St. Louis: Saunders Elsevier.
Keren, R., & Bhutani, V. K. (2007). Predischarge risk assessment for severe neonatal hyperbilirubinemia. *NeoReviews, 8*(2), 68–75.
Kuschel, C. (2007). Managing drug withdrawal in the newborn infant. *Seminars in Fetal & Neonatal Medicine, 12*(2), 127–133.
Kwik, M., Seeho, S. K. M., Smith, C., McElduff, A., & Morris, J. M. (2007). Outcomes of pregnancies affected by impaired glucose tolerance. *Diabetes Research & Clinical Practice, 77*(2), 263–268.
Laroia, N. (2007). Birth trauma. *eMedicine.* Available at http://www.emedicine.com/ped/topic2836.htm.
Lund, C. H., Bauer, K., & Berrios, M. (2007). Gastroschisis. *Journal of Perinatal & Neonatal Nursing, 21*(1), 63–68.
Maisels, M. J., & Newman, T. B. (2007). Kernicterus and evidence-based medicine. *Pediatrics, 119*(5), 1038–1039.
Manning, M. A., & Hoyme, E. H. (2007). Fetal alcohol spectrum disorders: A practical clinical approach to diagnosis. *Neuroscience & Behavioral Reviews, 31*(2), 230–238.
Marcellus, L. (2007). Neonatal abstinence syndrome: Reconstructing the evidence. *Neonatal Network, 26*(1), 33–40.
March of Dimes. (2006). *Birth defects.* Available at: http://search.marchofdimes.com/cgi-bin/MsmGo.exe?grab_id=0&page_id=713&query=congenital%20defects&hiword=DEFECT%20DEFECTIVE%20DEFECTOS%20congenital%20defects%20.
March of Dimes. (2007a). *Drinking alcohol during pregnancy.* March of Dimes Fact Sheets. Available at: http://www.marchofdimes.com/professionals/681_1170.asp.
March of Dimes. (2007b). *Illicit drug use during pregnancy.* MOD Quick Reference: Fact Sheets. Available at: http://www.marchofdimes.com/professionals/14332_1169.asp.
March of Dimes. (2007c). *Smoking during pregnancy.* March of Dimes Fact Sheets. Available at: http://www.marchofdimes.com/professionals/14332_1171.asp.
Maternal & Neonatal Health (MNH). (2007). *Best practices: Detecting and treating newborn asphyxia.* MNH Program. Available at: http://www.mnh.jhpiego.org/best/detasphyxia.asp.
McLenan, D. (2007). Care of the high-risk neonate. In R. E. Rakel & E. T. Bope (Eds.), *Conn's current therapy 2007* (Section 16, pp. 1200–1210). Philadelphia: Saunders Elsevier.
Mercer, J. S., Erickson-Owens, D. A., Graves, B., & Haley, M. M. (2007). Evidence-based practices for the fetal to newborn transition. *Journal of Midwifery & Women's Health, 52*(3), 262–272.
National Center on Birth Defects and Developmental Disabilities (NCBDDD). (2004). *Fetal alcohol syndrome: Guidelines for referral and diagnosis* (p. 20). Atlanta: Centers for Disease Control and Prevention (CDC), Department of Health and Human Services (DHHS).
National Institute on Drug Abuse (NIDA). (2007a). *NIDA InfoFacts: crack and cocaine.* National Institutes of Health. Available at: http://www.drugabuse.gov/infofacts/cocaine.html.
National Institute on Drug Abuse (NIDA). (2007b). *NIDA InfoFacts: Heroin.* National Institutes of Health. Available at: http://www.nida.nih.gov/Infofacts/heroin.html.
National Institute on Drug Abuse (NIDA). (2007c). *NIDA Research Report: Heroin abuse and addiction.* NIH Publication Number 05–4165. Available at: http://www.drugabuse.gov/ResearchReports/Heroin/heroin4.html.
National Institute on Drug Abuse (NIDA). (2007d). *NIDA InfoFacts: Marijuana.* National Institutes of Health. Available at: http://www.nida.nih.gov/Infofacts/marijuana.html.
National Institute on Drug Abuse (NIDA). (2007e). *NIDA InfoFacts: Methamphetamine.* National Institutes of Health. Available at: http://www.drugabuse.gov/infofacts/methamphetamine.html.
National Institute on Drug Abuse (NIDA). (2007f). *NIDA InfoFacts: Pregnancy and drug use trends.* National Institutes of Health. Available at: http://www.drugabuse.gov/Infofacts/pregnancytrends.html.
Neu, J. (2007). Gastrointestinal development and meeting the nutritional needs of premature infants. *American Journal of Clinical Nutrition, 85*(2), 629S–634S.
Ozen, N., & Mukherjee, S. (2007). Hyperbilirubinemia, unconjugated. *eMedicine.* Available at: http://www.emedicine.com/med/topic1066.htm.
Rao, S. C., Ahmed, M., & Hagan, R. (2006). One dose per day compared to multiple doses per day of gentamicin for treatment of suspected or proven sepsis in neonates. *Cochrane Database of Systematic Reviews* 2006. Issue 1. Art. No.: CD005091.DOI: 10.1002/14651858.CD005091.pub2.
Rodriguez, R., Fanaroff, A., & Lissauer, T. (2008). *Neonatology at a glance.* Malden, MA: John Wiley.
Simpson, K. R. (2007). Kernicterus prevention. *MCN, 32*(2), 132.
Springer, S. C., & Annibale, D. J. (2007). Kernicterus. *eMedicine.* Available at: http://www.emedicine.com/ped/topic1247.htm.
Steinhorn, R. H. (2007). Pulmonary hypertension, persistent-newborn. *eMedicine.* Available at: http://www.emedicine.com/ped/topic2530.htm.
Stoll, B. J., & Kliegman, P. M. (2007). Neonatal necrotizing enterocolitis (NEC). In R. E. Behrman, R. M. Kliegman, & H. B. Jenson (Eds.), *Nelson textbook of pediatrics* (18th ed.). Philadelphia: W. B. Saunders.
U.S. Department of Health and Human Services (USDHHS). (2000). *Healthy people 2010:* Volumes 1 and 2 (conference ed.). Washington, DC: U.S. Government Printing Office.
Verklan, M. T., & Walden, M. (2004). *Core curriculum for neonatal intensive care nursing* (3rd ed.). St. Louis: Elsevier Saunders.
Wheeler, D. S., & McCaffrey, M. J. (2007). Resuscitation of the newborn. In R. E. Rakel & E. T. Bope (Eds.), *Conn's current therapy 2007* (Section 16, pp. 1193–1200). Philadelphia: Saunders Elsevier.
Wiswell, T. E., Tin, W., & Ohler, K. (2007), Evidence-based use of adjunctive therapies to ventilation. *Clinics in Perinatology, 34*(1), 191–204.
Wood, B. P. (2007). Necrotizing enterocolitis. *eMedicine.* Available at: http://www.emedicine.com/radio/topic469.htm.
Woods, D. (2007). *Neonatal resuscitation.* International Association for Maternal and Neonatal Health (IAMANEH). Available at: http://www.gfmer.ch/Medical_education_En/PGC_RH_2004/Neonatal_asphyxia.htm.
Zaichkin, J. (2006). NPR 2006: What you should know. *Neonatal Network, 25*(2), 145–151.

WEBSITES

AHRQ's Tobacco Pathfinder: www.ahrq.gov
American Diabetes Association: www.diabetes.org
Birth Defects for Children: www.birthdefects.org

Centers for Disease Control and Prevention: www.cdc.gov
Esophageal Atresia/Tracheoesophageal Fistula Family Support Connection: www.eatef.org
March of Dimes Birth Defects Foundation: www.marchofdimes.com
Narcotics Anonymous: www.na.org
National Center on Birth Defects and Developmental Disabilities: www.cdc.gov/ncbddd/fas
National Clearinghouse for Alcohol and Drug Abuse Information: www.health.org
National Institute on Alcohol Abuse and Alcoholism: www.niaaa.nih.gov
National Organization on Fetal Alcohol Syndrome: www.nofas.org
National Women's Health Information Center: www.4woman.gov
Neonatal Network: www.neonatalnetwork.com
Parental Guide for Developmentally Supportive Care: www.comeunity.com/premature/baby/supportive-care.html
Partnership for a Drug-Free America: www.drugfreeamerica.org
Physical and Developmental Environment of the High-Risk Infant: www.med.usf.edu/~tsinger
Safe Motherhood Initiative: www.safemotherhood.org
SHARE Pregnancy & Infant Loss Support, Inc.: www.nationalshareoffice.com
Substance Abuse & Mental Health Services: www.findtreatment.samhsa.gov

Chapter Worksheet

Multiple Choice Questions

1. Which finding would lead the nurse to suspect that a newborn is experiencing respiratory distress syndrome?
   a. Abdominal distention
   b. Acrocyanosis
   c. Depressed fontanels
   d. Nasal flaring
2. When assessing the substance-exposed newborn, which finding would the nurse expect?
   a. Calm facial appearance
   b. Daily weight gain
   c. Increasing irritability
   d. Feeding and sleeping well
3. A newborn with tracheoesophageal fistula is likely to present with which assessment finding?
   a. Subnormal temperature
   b. Absent Moro reflex
   c. Inability to swallow
   d. Drooling from mouth
4. The nurse would be most alert for the development of transient tachypnea in a newborn who:
   a. Was born by cesarean birth
   b. Received no sedation
   c. Has a mother with heart disease
   d. Is small for gestational age

Critical Thinking Exercises

1. As the nursery nurse, you receive a newborn from the labor and birth suite and place him under the radiant warmer. The nurse who gives you the report states that the mother couldn't remember when her membranes broke before labor and that she ran a fever during labor for the past few hours. The Apgar scores were good, but the newborn seemed lethargic. As you begin your assessment, you note that he is pale and floppy and has a subnormal temperature; heart rate is 180 bpm and respiratory rate is 70 breaths per minute.
   a. What in the mother's history should raise a red flag to the nurse?
   b. What condition is this newborn at high risk for?
   c. What interventions are appropriate for this condition?
2. Terry, a day-old baby girl, is very fretful, and calming measures don't seem to work. As the nursery nurse you notice that she is losing weight and her formula intake is poor, even though she is manifesting hungry behavior. The mother received no prenatal care and denied drug use, but her drug screen was positive for heroin.
   a. What additional information do you need to obtain from the mother?
   b. What additional laboratory work might be needed for Terry?
   c. What specific measures need to be made for her ongoing care?
3. Baby boy Sims, a term newborn, was brought to the nursery. His mother received no prenatal care, but the newborn's Apgar scores were fine. As the nurse carried out her newborn assessment, she noted an imperforate anus and palpated no testicles in the scrotal sac.
   a. What additional assessments should the nurse complete?
   b. Are anorectal agenesis and genitourinary tract anomalies common?
   c. What diagnostic tests might be ordered? What might be included in the treatment plan for this newborn?

Study Activities

1. Arrange for a tour of a regional NICU to see the nurse's role in caring for sick neonates. Ask the nurse to give a quick history of each newborn's condition. Was the nurse's role like you imagined? What was your impression of the NICU, and how would you describe it to expectant parents?
2. Select a website from the list at the end of the chapter. What kind of information is given? How helpful would it be for parents with an infant diagnosed with a specific condition?
3. A herniation of a newborn's abdominal contents present at birth describes _____.