We watched him breathe every precious breath. He was covered with wires and tubes. The rhythmic tides of his sleeping and feeding sparsely measured his days and nights. We kept watch. He was special to us and we would say over and over, “Daddy and mommy are here and we love you.”

—Alan and Claudia, parents of a baby with RDS

LEARNING OBJECTIVES

■ Discuss how to identify infants in need of resuscitation and the appropriate method of resuscitation based on the labor record and observable physiologic indicators.

■ Based on clinical manifestations, differentiate between the various types of respiratory distress (respiratory distress syndrome, transient tachypnea of the newborn, and meconium aspiration syndrome) in the newborn and their related nursing care.

■ Discuss selected metabolic abnormalities (including cold stress and hypoglycemia), their effects on the newborn, and the nursing implications.

■ Differentiate between physiologic and pathologic jaundice based on onset, cause, possible sequelae, and specific management.

■ Explain how Rh incompatibility or ABO incompatibility can lead to the development of hyperbilirubinemia.

■ Identify nursing responsibilities in caring for the newborn receiving phototherapy.

■ Discuss selected hematologic problems such as anemia and polycythemia and the nursing implications associated with each one.

■ Describe the nursing assessments that would lead the nurse to suspect newborn sepsis.

■ Relate the consequences of selected maternally transmitted infections, such as maternal syphilis, gonorrhea, herpesvirus, and chlamydia, to the management of the infant in the neonatal period.

■ Describe the interventions to facilitate parental attachment with the at-risk newborn.

■ Identify the special initial and long-term needs of parents of at-risk infants.

CD-ROM
NCLEX-RN® Review
Skill 10-1: Performing a Capillary Puncture
Nursing in Action: Infant Receiving Phototherapy
Audio Glossary

Companion Website
NCLEX-RN® Review
Case Study: Newborn with Jaundice
Care Plan Activity: Infection in a Newborn
MediaLink Application:
   Infant Respiratory Distress Syndrome
Thinking Critically
Marked homeostatic changes happen during the transition from fetal to neonatal life. The most rapid anatomic and physiologic changes of this period occur in the cardiopulmonary system, so the newborn’s major problems are usually related to this system. These problems include asphyxia, respiratory distress, cold stress, jaundice, hemolytic disease, and anemia. Ideally, problems are anticipated and identified prenatally, and appropriate intervention measures are begun at or immediately after birth.

**CARE OF THE NEWBORN AT RISK DUE TO ASPHYXIA**

Neonatal asphyxia results in circulatory, respiratory, and biochemical changes. Circulatory patterns that accompany asphyxia indicate the newborn’s inability to make the transition to extracellular circulation—in effect, a return to fetal circulatory patterns. Failure of lung expansion and establishment of respiration rapidly produces serious biochemical changes, including hypoxia (decreased oxygen concentration available to tissues), acidosis (increased acidity of blood reflected by low pH), and hypercarbia (excess levels of carbon dioxide in the blood).

These biochemical changes cause abnormal changes in pulmonary circulation. Arterioles constrict, resulting in vascular resistance and diminished pulmonary blood flow to the organs and the lungs, and a large right-to-left shunt through the ductus arteriosus. The foramen ovale reopens as right atrial pressure exceeds left atrial pressure, and blood flows from right to left. (See Chapter 26 for a review of normal newborn cardiopulmonary adaptation.)

However, the most serious biochemical abnormality caused by hypoxia is a change from aerobic to anaerobic metabolism. This change results in the buildup of lactate and development of metabolic acidosis. Simultaneous respiratory acidosis may also occur due to a rapid increase in carbon dioxide (Pco₂) during asphyxia. In response to hypoxia and anaerobic metabolism, glycogen stores are mobilized to provide a continuous glucose source for the brain, and the amounts of free fatty acids (FFAs) and glycerol in the blood increase.

The newborn has several protective mechanisms against hypoxic insults. These include a relatively immature brain and a resting metabolic rate lower than that of adults, an ability to mobilize substances within the body for anaerobic metabolism and to use energy more efficiently, and an intact circulatory system able to redistribute lactate and hydrogen ions in tissues still being perfused. Unfortunately, the body’s stores of glycogen may be used up rapidly during an asphyxial attack. Severe, prolonged hypoxia overcomes the body’s protective mechanisms, resulting in brain damage or death of the newborn.

The newborn suffering apnea requires immediate resuscitative efforts. The need for resuscitation can be anticipated if specific risk factors are present during the pregnancy or labor and birth.

**RISK FACTORS PREDISPOSING TO ASPHYXIA**

The need for resuscitation may be anticipated if the mother demonstrates the antepartal and intrapartum risk factors described in Table 10–1 in Chapter 10 and Table 18–1 in Chapter 18. Neonatal risk factors for resuscitation are as follows (Thureen, Deacon, Hernandez et al., 2005):

- Nonreassuring fetal heart rate pattern
- Difficult birth
- Fetal scalp/capillary blood sample-acidosis

**KEY TERMS**

- Cold stress, 831
- Erythroblastosis fetalis, 836
- Hemolytic disease of the newborn, 838
- Hydrops fetalis, 836
- Hyperbilirubinemia, 835
- Hypoglycemia, 832
- Jaundice, 835
- Kernicterus, 835
- Meconium aspiration syndrome (MAS), 829
- Phototherapy, 837
- Physiologic anemia, 844
- Polycythemia, 845
- Respiratory distress syndrome (RDS), 819
- Sepsis neonatorum, 846
The Newborn at Risk: Birth-Related Stressors

- Apneic episode unresponsive to tactile stimulation
- Inadequate ventilation
- Male infant
- Prematurity
- Small for gestational age
- Multiple births
- Structural lung abnormality (congenital diaphragmatic hernia, lung hypoplasia)
- Congenital heart disease
- Sepsis with cardiovascular collapse

Risk factors are not always apparent prenatally. Particular attention must be paid to all at-risk pregnancies during the intrapartal period. Certain aspects of labor and birth challenge the oxygen supply to the fetus, and often the at-risk fetus has less tolerance for the stress of labor and birth.

**CLINICAL THERAPY**

The initial goal of medical management is to identify the fetus at risk for asphyxia, so that resuscitative efforts can begin at birth. Fetal biophysical assessment (see Chapter 16), combined with monitoring of fetal pH, fetal heart rates, and fetal oximetry if available, may help identify the presence of nonreassuring fetal status. If nonreassuring fetal status is present, appropriate measures can be taken to deliver the fetus immediately, before major damage occurs, and to treat the asphyxiated newborn.

The fetal biophysical profile enhances the ability to predict an abnormal perinatal outcome. In addition to the fetal biophysical profile, fetal scalp blood sampling may indicate asphyxic insult and the degree of fetal acidosis, when considered in relation to the stage of labor, uterine contractions, and the presence of nonreassuring fetal heart rate (FHR) patterns. The stress of labor causes an intermittent decrease in exchange of gases in the placental intervillous space, which causes the fall in pH and fetal acidosis. The acidosis is primarily metabolic.

During labor a fetal pH of 7.25 or higher is considered normal (nonacidemia). A **pH value of 7.2 or less** is considered an ominous sign of intrauterine asphyxia (acidemia). However, low fetal pH without associated hypoxia can be caused by maternal acidosis secondary to prolonged labor, dehydration, and maternal lactate production.

Assessment of the newborn’s need for resuscitation begins at the time of birth. The nurse should note the time of the first gasp, first cry, and onset of sustained respirations in order of occurrence. The Apgar score (see information in Chapter 19) may be helpful in determining the severity of the neonatal depression and may be predictive of neonatal survival (de Ungria & Steinhorn, 2003; Fananoff, Martin, & Rodriguez, 2004).

The treatment of fetal or newborn asphyxia is resuscitation. The goals of resuscitation are to provide an adequate airway with expansion of the lungs, to decrease the PCO₂, and increase the PO₂, to support adequate cardiac output, and to minimize oxygen consumption by reducing heat loss.

**RESUSCITATION MANAGEMENT**

Initial resuscitative management of the newborn is extremely important. Suctioning is always performed before resuscitation so that mucus, blood, or meconium is not aspirated into the lungs. Caregivers should keep the infant in a head-down position before the first gasp to avoid aspiration of the oropharyngeal secretions and must suction the oropharynx and nasopharynx immediately. Clearing the nasal and oral passages of obstructive fluid establishes a patent airway.

Breathing is established with the simplest form of resuscitative measures initially, with progression to more complicated methods as required. For example:

1. Simple stimulation is provided by rubbing the newborn’s back.
2. If respirations have not been initiated or are inadequate (gasping or occasional respirations), the lungs must be inflated with positive pressure. The mask is positioned securely on the face (over nose and mouth, avoiding the eyes), with the infant’s head in a “sniffing” or neutral position (Figure 31–1).

![Demonstration of resuscitation of an infant with bag and mask. Note that the mask covers the nose and mouth, and the head is in a neutral position. The resuscitating bag is placed to the side of the baby so that chest movement can be seen.](FIGURE 31–1)
Hyperextension of the infant’s neck obstructs the trachea and must be avoided. An airtight connection is made between the baby’s face and the mask (thus allowing the bag to inflate). The lungs are inflated rhythmically by squeezing the bag. Oxygen can be delivered at 100% with an anesthesia bag with manometer or modified self-inflating bag and adequate liter flow of at least 5 L/min. The self-inflating (Ambu or Hope) bag delivers only 40% oxygen unless it has been adapted with an attached oxygen reservoir (American Academy of Pediatrics [AAP] Committee on Fetus and Newborn & American College of Obstetricians and Gynecologists [ACOG] Committee on Obstetrics, 2002). It may not be possible to maintain adequate inspiratory pressure with Ambu or Hope bags. In a crisis situation, it is crucial that 100% oxygen be delivered with adequate pressure.

3. The rise and fall of the chest are observed for proper ventilation. Air entry and heart rate are checked by auscultation. Manual resuscitation is coordinated with any voluntary efforts. The rate of ventilation should be between 40 and 60 breaths per minute. Pressure should be adequate to move the chest wall. The pressure gauge (manometer) must be in place to avoid overdistention of the newborn’s lungs and other problems such as pneumothorax or abdominal distention. In newborns with normal lungs, 15 to 25 cm H2O may be adequate. If the newborn has lung disease, 20 to 40 cm H2O may be necessary. If the newborn has not taken a first breath after birth, pressures of > 30 cm H2O may be transiently required to expand collapsed alveoli. If ventilation is adequate, the chest moves with each inspiration, bilateral breath sounds are audible, and the lips and mucous membranes become pink. Distention of the stomach is controlled by inserting a nasogastric tube for decompression.

4. Endotracheal intubation may be needed. However, most newborns, except for very-low-birth-weight (VLBW) infants (< 1500 g), can be resuscitated by bag and mask ventilation. With preterm newborns, positive end expiratory pressure (PEEP) is required to help prevent alveolar collapse. If the baby is intubated and the color and heart rate fail to respond to ventilatory efforts, poor or improper placement of an endotracheal tube may be the cause. If the baby is intubated properly, pneumothorax, diaphragmatic hernia, or hypoplastic lungs (Potter’s association) may exist.

Once breathing is established, the heart rate should increase to over 100 beats per minute. If the heart rate is absent or if it remains less than 60 beats per minute after 30 seconds of adequate assisted ventilation with 100% oxygen, external cardiac massage (chest compression) is begun. Chest compressions are started immediately if there is no detectable heartbeat. The procedure for performing chest compressions is as follows:

1. The infant is positioned on a firm surface.
2. The resuscitator stands at the foot of the infant and places both thumbs over the lower third of the sternum (just below an imaginary line drawn between the nipples), with the fingers wrapped around and supporting the back (Figure 31–2A).
Alternatively, the resuscitator may use two fingers instead of thumbs (Figure 31–2B). The two-thumb method is preferred because it may provide better coronary perfusion pressure; however, it makes access to the umbilical cord for medication administration more difficult (de Ungria & Steinhorn, 2003).  

3. The sternum is depressed to sufficient depth to generate a palpable pulse or approximately one third of the anterior-posterior depth of the chest at a rate of 90 compressions per minute (AAP & ACOG, 2002). Use a 3:1 ratio of heartbeat to assisted ventilation.  

Drugs needed in the treatment of shock, cardiac arrest, and narcosis should be available in the birthing area. Oxygen is the drug most often used because of its effectiveness in ventilation.  

After 30 seconds of ventilation and cardiac compression, the newborn’s cardiopulmonary status is reassessed by palpating the umbilical cord for a pulse. If the newborn has not responded with spontaneous respirations and a heart rate above 60 beats per minute, resuscitative medications are necessary (AAP & ACOG, 2002). The most accessible route for administering medications is the umbilical vein. If bradycardia is present, epinephrine (0.1 to 0.3 mL/kg of a 1:10,000 solution or 0.01 to 0.03 mg/kg) is given through the umbilical vein catheter or the peripheral intravenous (IV) setup. When epinephrine is administered by endotracheal tube, the IV dose of epinephrine should be diluted with 1 mL of normal saline (Glomella, 2004). Sodium bicarbonate is rarely given in the birthing room and only to correct metabolic acidosis after effective ventilation is established. Dextrose is given to prevent progression of hypoglycemia. A 10% dextrose in water IV solution is usually sufficient to prevent or treat hypoglycemia in the birthing area. Naloxone hydrochloride (0.1 mg/kg), a narcotic antagonist, is used to reverse narcotic depression. See “Drug Guide: Naloxone Hydrochloride (Narcan).”  

If shock develops (low blood pressure or poor peripheral perfusion), the baby may be given a volume expander such as normal saline, or lactated Ringer’s solution in a dose of 10 mL/kg given over 5 to 10 minutes. Whole blood (O negative crossmatched against the mother), fresh frozen plasma, and packed red blood cells can also be used for volume expansion and treatment of shock. In some instances of prolonged resuscitation associated with shock and poor response to resuscitation, dopamine (5 mg/kg/min) may be necessary.

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**Drug Guide**

**Naloxone Hydrochloride (Narcan)**

**Overview of Neonatal Action**  
Naloxone hydrochloride (Narcan) is used to reverse respiratory depression due to acute narcotic toxicity. It displaces morphine-like drugs from receptor sites on the neurons; therefore, the narcotics can no longer exert their depressive effects. Naloxone reverses narcotic-induced respiratory depression, analgesia, sedation, hypotension, and pupillary constriction.  

**Route, Dosage, Frequency**  
Intravenous dose is 0.1 mg/kg (0.25 mL/kg of 0.4 mg/mL preparation or 0.1 mL/kg of 1 mg/mL concentration at birth, including premature infants. This drug is usually given through endotracheal tube (ET) or IV, although naloxone can be given intramuscularly (IM) if adequate perfusion exists. For IV push, infuse over at least 1 minute; for ET administration, dilute in 1 to 2 millimeters of (NS) normal saline.  

Reversal of drug depression occurs within 1 to 2 minutes after IV administration and within 15 minutes of IM administration. The duration of action is variable (minutes to hours) and depends on the amount of the drug present and the rate of excretion. Dose may be repeated in 3 to 5 minutes. If there is no improvement after two or three doses, discontinue naloxone administration. If initial reversal occurs, repeat dose as needed (Young & Mangum, 2005).

**Neonatal Contraindications**  
Naloxone should not be administered to infants of narcotic-addicted mothers because it may precipitate acute withdrawal syndrome (increased heart rate and blood pressure, vomiting, tremors). Respiratory depression may result from nonmorphine drugs, such as sedatives, hypnotics, anesthetics, or other nonnarcotic CNS depressants.  

**Neonatal Side Effects**  
Excessive doses may result in irritability, increased crying, and possible prolongation of partial thromboplastin time (PTT). Tachycardia may occur.  

**Nursing Considerations**  
- Monitor respirations closely—rate and depth for improved respiratory effort.  
- Assess for return of respiratory depression when naloxone effects wear off and effects of longer acting narcotics reappear.  
- Have resuscitative equipment, O₂, and ventilatory equipment available.  
- Monitor bleeding studies.  
- Note that naloxone is incompatible with alkaline solutions such as sodium bicarbonate.  
- Store at room temperature and protect from light.  
- Compatible with heparin.
NURSING MANAGEMENT

NURSING ASSESSMENT AND DIAGNOSIS

Communication between the obstetric office or clinic and the birthing area helps the birthing area nurse identify newborns who may need resuscitation. When the woman arrives in the birthing area, have the antepartal record ready. Note any contributory perinatal history factors and assess present fetal status. As labor progresses, continue ongoing monitoring of fetal heartbeat and its response to contractions, assist with fetal scalp blood sampling, and observe for the presence of meconium in the amniotic fluid to assess for fetal asphyxia. Alert the resuscitation team and the practitioner responsible for the newborn’s care of any potential high-risk laboring women.

Nursing diagnoses that may apply to the newborn with asphyxia and the newborn’s parents include the following:

- **Ineffective Breathing Pattern** related to lack of spontaneous respirations at birth secondary to intrauterine asphyxia
- **Decreased Cardiac Output** related to impaired oxygenation
- **Ineffective Family Coping: Compromised** related to baby’s lack of spontaneous respirations at birth and fear of losing their newborn

PLANNING AND IMPLEMENTATION

Hospital-Based Nursing Care

In the high-risk nursery, resuscitation may be needed at any time. Check and maintain equipment to ensure its reliability at all times. Inspect all equipment—bag and mask, oxygen and flow meter, laryngoscope, and suction machine—for damaged or nonfunctioning parts before a birth or when setting up an admission bed. Sterilize resuscitative equipment in the birthing room after each use. A systematic check of the emergency cart and equipment is a routine responsibility of each shift. It is a good idea to be prepared by assembling equipment for pH and blood gas determination.

During resuscitation it is essential to keep the newborn warm. Dry the newborn quickly with warmed towels or blankets to prevent evaporative heat loss, remove the wet blankets, and place him or her under the radiant warmer. This device provides an overhead radiant heat source (a thermostatic mechanism taped to the infant’s abdomen triggers the radiant warmer to turn on or off to maintain consistent temperature). Set the servocontrol at 36.5°C (97.7°F). Cover the newborn’s head with a hat as the head is a major source of heat loss (de Ungria & Steinhorn, 2003). An open bed is necessary for easy access to the newborn.

Training and knowledge about resuscitation are vital to personnel in the birth setting for both normal and at-risk births. Since resuscitation must be a two-person effort for high-risk newborns, call for additional support as needed. One member must have the skill to perform airway management and ventilation. Record resuscitative efforts on the newborn’s chart so that all members of the healthcare team have access to the information.

Parent Teaching

The new CPR guidelines favor family members being present during resuscitation in the birthing room and in the neonatal intensive care unit (NICU), but the procedure is particularly distressing for parents. Advise parents that a support person will be available for them if resuscitation is necessary. As soon as the infant’s condition has stabilized, a member of the interdisciplinary team needs to discuss the newborn’s condition with the parents. The parents may have many fears about the reasons for resuscitation and the condition of their baby after resuscitation.

EVALUATION

Expected outcomes of nursing care include the following:

- The newborn requiring resuscitation is promptly identified, and intervention is started early.
- The newborn’s metabolic and physiologic processes are stabilized, and recovery is proceeding without complications.
- The parents can verbalize the reason for resuscitation and what was done to resuscitate their newborn.
- The parents can verbalize their fears about the resuscitation process and potential implications for their baby’s future.

CARE OF THE NEWBORN WITH RESPIRATORY DISTRESS

Respiratory distress is an inappropriate respiratory adaptation to extraterine life. It is one of the most severe conditions that may affect the newborn. The nurse caring for a baby with respiratory distress needs to understand the normal pulmonary and circulatory physiology (see “Respiratory Adaptation” in Chapter 26), the pathophysiology of the disease process, clinical manifestations, and supportive and corrective therapies. Only with this knowledge can the nurse make appropriate observations about responses to therapy and development of complications. Unlike the verbalizing adult client, the newborn communicates needs only by behavior or physiologic parameters that must be interpreted by the NICU nurse. The neonatal nurse inter-
presents this behavior as clues about the baby’s condition. In this section, we discuss respiratory distress syndrome, transient tachypnea of the newborn, and meconium aspiration syndrome.

**RESPIRATORY DISTRESS SYNDROME**

Respiratory distress syndrome (RDS), also called hyaline membrane disease (HMD), is the result of a primary absence, deficiency, or alteration in the production of pulmonary surfactant. It is a complex disease that affects approximately 20,000 to 30,000 infants a year in the United States, most of whom are preterm infants. RDS is a complication in about 1% of pregnancies. The syndrome occurs more frequently in premature Caucasian infants than in infants of African descent and almost twice as often in males as in females.

Not all the factors precipitating the pathologic changes of RDS have been determined, but two main factors associated with its development include:

1. **Prematurity.** All preterm newborns—whether AGA, SGA, or LGA—and especially infants of diabetic mothers are at risk for RDS. The incidence of RDS increases with the degree of prematurity, and most deaths occur in newborns weighing less than 1500 g. The maternal and fetal factors resulting in preterm labor and birth, complications of pregnancy, cesarean birth (and its indications), and familial tendency are all associated with RDS.

2. **Surfactant deficiency disease.** Normal pulmonary adaptation requires adequate surfactant, a lipoprotein that coats the inner surfaces of the alveoli. Surfactant provides alveolar stability by decreasing the alveoli’s surface tension and tendency to collapse. Surfactant is produced by type II alveolar cells starting at about 24 weeks’ gestation. In the normal or mature newborn lung, it is continuously synthesized, oxidized during breathing, and replenished. Adequate surfactant levels lead to better lung compliance and permit breathing with less work. RDS is due to alterations in surfactant quantity, composition, function, or production.

**TEACHING HIGHLIGHTS**

**RESPIRATORY DISTRESS**

You can help parents understand their baby’s respiratory distress by having them think of the air sacs (alveoli) of the lungs as tiny balloons filled with water and no air. When the tiny balloon (alveolus) is emptied (as in expiration), water droplets can remain inside the balloon. The sides of the balloon stick together, increasing the surface tension, making the next inspiration breath very difficult.

Development of RDS indicates a failure to synthesize surfactant, which is required to maintain alveolar stability (see “Factors Opposing the First Breath” in Chapter 26). On expiration this instability increases atelectasis (lung collapse), which causes hypoxia and acidosis because of the lack of gas exchange. These conditions further inhibit surfactant production and cause pulmonary vasoconstriction. The resulting lung instability causes the biochemical problems of hypoxemia (decreased \( P_{O_2} \)), hypercarbia (increased \( P_{CO_2} \)), and acidemia (decreased pH), which further increases pulmonary vasoconstriction and hypoperfusion. The cycle of events of RDS leading to eventual respiratory failure is diagrammed in “Pathophysiology Illustrated: Respiratory Distress Syndrome (RDS).”

Because of these pathophysiologic conditions, the newborn must expend increasing amounts of energy to reopen the collapsed alveoli with every breath, so that each breath becomes as difficult as the first. The progressive expiratory atelectasis upsets the physiologic homeostasis of the pulmonary and cardiovascular systems and prevents adequate gas exchange. Breathing becomes progressively harder as lung compliance decreases, which makes it more difficult for the newborn to inflate the lungs and breathe.

The physiologic alterations of RDS produce the following complications:

1. **Hypoxia.** As a result of hypoxia, pulmonary blood vessels constrict and their resistance increases, which reduces pulmonary blood flow. The increase in pulmonary blood vessel resistance may cause a return to fetal circulation as the ductus opens and blood flow is shunted around the lungs. This shunting increases the hypoxia and further decreases pulmonary perfusion. Hypoxia also causes impairment or absence of metabolic response to cold; reversion to anaerobic metabolism, resulting in lactate accumulation (acidosis); and impaired cardiac output, which decreases perfusion to vital organs.

2. **Respiratory acidosis.** Persistently rising \( P_{CO_2} \) and decreases in pH are poor prognostic signs of pulmonary function and adequacy because increased lactate levels and decreased pH are results of alveolar hypoventilation.

3. **Metabolic acidosis.** Because the cells lack oxygen, the newborn begins an anaerobic pathway of metabolism, with an increase in lactate levels and a resulting base deficit (loss of bicarbonate). As the lactate levels increase, the pH decreases in an attempt to maintain acid-balance homeostasis.

The classic radiologic picture of RDS is diffuse bilateral reticulogranular density, with portions of the air-filled tracheobronchial tree (air bronchogram) outlined by the
CHAPTER 31

Respiratory Distress Syndrome (RDS)


B. RDS chest x-ray. Chest radiograph of respiratory distress syndrome characterized by a reticulo granular pattern with areas of microatelectasis of uniform opacity and air bronchograms. Courtesy of Carol Harrigan, RNC, MSN, NNP.
opaque (“white-out”) lungs and widespread atelectasis (Thureen et al., 2005). See “Pathophysiology Illustrated.” The progression of x-ray findings parallels the pattern of resolution, which usually occurs in 7 to 10 days, and the time of surfactant reappearance, unless surfactant replacement therapy and mechanical ventilation have been used (Blackburn, 2003). Echocardiography is a valuable tool in diagnosing vascular shunts that move blood either away from or toward the lungs.

**CLINICAL THERAPY**

Antenatally, respiratory distress due to preterm labor is treated with therapies to enhance fetal lung development (see “Care of the Woman at Risk Due to Preterm Labor” in Chapter 15). The goals of postnatal therapy are to maintain adequate oxygenation and ventilation, correct acid-base imbalance, and provide the supportive care required to maintain homeostasis.

Surfactant replacement therapy decreases the severity of RDS in low-birth-weight newborns. Surfactant replacement therapy is delivered through an endotracheal tube and may be given in either the birthing room or the nursery, as indicated by the severity of RDS. Repeat doses are often required. The most frequently reported response to treatment is rapidly improved oxygenation and decreased need for ventilatory support.

Supportive medical management consists of ventilation therapy, transcutaneous oxygen and carbon dioxide monitoring, blood gas monitoring, correction of acid-base imbalance, environmental temperature regulation, adequate nutrition, and protection from infection. Ventilation therapy is directed toward preventing hypoventilation and hypoxia. Mild cases of RDS may require only increased humidified oxygen concentrations. Moderately afflicted infants may need continuous positive airway pressure (CPAP). Babies with severe RDS require mechanical ventilatory assistance from a respirator (Figure 31–3).
High-frequency and extracorporeal membrane oxygenation (ECMO), a form of heart-lung bypass, has been tried when conventional ventilator therapy has not been successful. Both of these have specific protocols for eligibility for use and require specially trained nurses and respiratory therapists. Nitric oxide inhalation therapy may also be a useful adjunctive therapy for infants with RDS (Glomella, 2004). In some institutions, morphine or fentanyl is used for its analgesic and sedative effects. Sedation may be indicated for infants who have air leak respiratory problems. Use of pancuronium (Pavulon) for muscle relaxation in infants with RDS is controversial.

NURSING MANAGEMENT

NURSING ASSESSMENT AND DIAGNOSIS

Look for characteristics of RDS such as increasing cyanosis, tachypnea (> 60 respirations/min), grunting respirations, nasal flaring, significant retractions, and apnea. Table 31–1 reviews clinical findings associated with respiratory distress in general. The Silverman-Andersen index (Figure 31–4) may be helpful in evaluating the signs of respiratory distress in the birthing area.

Nursing diagnoses that may apply to the newborn with RDS include the following:

- **Risk for Ineffective Breathing Pattern** related to immature lung development
- **Ineffective Thermoregulation** related to increased respiratory effort
- **Altered Nutrition: Less than Body Requirements** related to increased metabolic needs in the infant
- **Risk for Fluid Volume Deficit** related to increased insensible water losses

PLANNING AND IMPLEMENTATION

Hospital-Based Nursing Care

Based on clinical parameters, the neonatal nurse implements therapeutic approaches to maintain physiologic homeostasis and provides supportive care to the newborn with RDS. (See “Nursing Care Plan: The Newborn with Respiratory Distress Syndrome.”)

Nursing interventions and criteria for instituting mechanical ventilation depend on institutional protocol. Methods of oxygen monitoring and nursing interventions are included in Table 31–2. The nursing care of infants on ventilators or with umbilical artery catheters is not discussed here. These infants have severe respiratory distress and are cared for in NICUs by nurses with advanced knowledge and training. Ventilatory assistance with high-frequency ventilators has shown positive results.

The parents of a baby with respiratory distress will need a very supportive environment.

EVALUATION

Expected outcomes of nursing care include the following:

- The newborn at risk of RDS is promptly identified and early intervention is initiated.

### TABLE 31–1 Clinical Assessments Associated with Respiratory Distress

<table>
<thead>
<tr>
<th>Clinical Picture</th>
<th>Significance</th>
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</thead>
<tbody>
<tr>
<td><strong>Skin Color</strong></td>
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<tr>
<td>Pallor or mottling</td>
<td>These represent poor peripheral circulation due to systemic hypotension and vasoconstriction and pooling of independent areas (usually in conjunction with severe hypoxia).</td>
</tr>
<tr>
<td>Cyanosis (bluish tint)</td>
<td>Depending on hemoglobin concentration, peripheral circulation, intensity and quality of viewing light, and acuity of observer’s color vision, this is frankly visible in advanced hypoxia. Central cyanosis is most easily detected by examination of mucus membranes and tongue.</td>
</tr>
<tr>
<td>Jaundice (yellow discoloration of skin and mucous membranes due to presence of unconjugated [indirect] bilirubin)</td>
<td>Metabolic alterations (acidosis, hypercarbia, asphyxia) of respiratory distress mean the newborn is predisposed to having bilirubin dissociate from albumin-binding sites and be deposited in the skin and central nervous system.</td>
</tr>
<tr>
<td>Edema (presents as slick, shiny skin)</td>
<td>This is characteristic of preterm infants because their total protein concentration is low, with a decrease in colloidal osmotic pressure and transudation of fluid. Edema of hands and feet is frequently seen within first 24 hours and resolved by fifth day in infants with severe RDS.</td>
</tr>
</tbody>
</table>
### TABLE 31–1 Clinical Assessments Associated with Respiratory Distress—continued

<table>
<thead>
<tr>
<th>Clinical Picture</th>
<th>Significance</th>
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<tbody>
<tr>
<td><strong>Respiratory System</strong></td>
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<tr>
<td>Increased respiratory rate is the most frequent and easily detectable sign of</td>
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<td>respiratory distress after birth. This compensatory mechanism attempts to</td>
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<td>increase respiratory dead space to maintain alveolar ventilation and gas</td>
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<tr>
<td>exchange in the face of an increase in mechanical resistance. As a</td>
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<tr>
<td>decompensatory mechanism, it increases workload and energy output by</td>
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<td>increasing respiratory rate, which causes increased metabolic demand for</td>
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<td>oxygen and thus increases alveolar ventilation on an already overstressed</td>
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<tr>
<td>system. Shallow, rapid respirations increase dead space ventilation, thus</td>
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<tr>
<td>decreasing alveolar ventilation.</td>
<td></td>
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<tr>
<td>Apnea (episode of nonbreathing for more than 20 seconds; periodic breathing, a</td>
<td>This poor prognostic sign indicates cardiorespiratory disease, CNS disease, metabolic alterations, intracranial hemorrhage, sepsis, or immaturity. Physiologic alterations include decreased oxygen saturation, respiratory acidosis, and bradycardia. Inspection of the thoracic cage includes shape, size, and symmetry of movement. Respiratory movements should be symmetric and diaphragmatic; asymmetry reflects pathology (pneumothorax, diaphragmatic hernia). Increased anteroposterior diameter indicates air trapping (meconium aspiration syndrome). Indicates marked increase in the work of breathing.</td>
</tr>
<tr>
<td>common “normal” occurrence in preterm infants, is defined as apnea of 5–10</td>
<td></td>
</tr>
<tr>
<td>seconds alternating with 10–15 seconds of ventilation)</td>
<td></td>
</tr>
<tr>
<td>Chest</td>
<td></td>
</tr>
<tr>
<td>Labored respirations (Silverman-Andersen index in Figure 31–4 indicates</td>
<td>These reflect the significant increase in negative intrathoracic pressure necessary to inflate stiff, noncompliant lungs. Infants try to increase lung compliance by using accessory muscles. Lung expansion markedly decreases. Seesaw respirations are seen when the chest flattens with inspiration and the abdomen bulges. Retractions increase the work of breathing and oxygen need so that assisted ventilation may be necessary due to exhaustion. This compensatory mechanism attempts to lessen the resistance of the narrow nasal passage.</td>
</tr>
<tr>
<td>severity of retractions, grunting, and nasal flaring, which are signs of labored</td>
<td></td>
</tr>
<tr>
<td>respirations)</td>
<td></td>
</tr>
<tr>
<td>Retractions (inward pulling of soft parts of the chest cage—suprasternal,</td>
<td></td>
</tr>
<tr>
<td>substernal, intercostal, subcostal—at inspiration)</td>
<td></td>
</tr>
<tr>
<td>Flaring nares (inspiratory dilation of nostrils)</td>
<td></td>
</tr>
<tr>
<td>Expiratory grunt (Valsalva maneuver in which the infant exhales against a</td>
<td>These increases transpulmonary pressure, which decreases or prevents atelectasis, thus improving oxygenation and alveolar ventilation. Intubation should not be tried unless the infant's condition is rapidly deteriorating, because it prevents this maneuver and allows the alveoli to collapse. This is a result of using abdominal and other respiratory accessory muscles during prolonged forced respirations. Decrease in breath sounds and distant quality may indicate interstitial or intrapleural air or fluid.</td>
</tr>
<tr>
<td>closed glottis, thus producing an audible moan)</td>
<td></td>
</tr>
<tr>
<td>Rhythmic body movement with labored respirations (chin tug, head bobbing,</td>
<td></td>
</tr>
<tr>
<td>retractions of anal area)</td>
<td></td>
</tr>
<tr>
<td>Auscultation of chest reveals decreased air exchange, with harsh breath sounds</td>
<td></td>
</tr>
<tr>
<td>or fine inspiratory rales; rhonchi may be present</td>
<td></td>
</tr>
<tr>
<td><strong>Cardiovascular System</strong></td>
<td></td>
</tr>
<tr>
<td>Continuous systolic murmur may be audible</td>
<td>Patent ductus arteriosus is common with hypoxia, pulmonary vasoconstriction, right-to-left shunting, and congestive heart failure.</td>
</tr>
<tr>
<td>Heart rate usually within normal limits (fixed heart rate may occur with a</td>
<td>A fixed heart rate indicates a decrease in vagal control.</td>
</tr>
<tr>
<td>rate of 110–120/minute)</td>
<td>Displacement may reflect dextrocardia, pneumothorax, or diaphragmatic hernia.</td>
</tr>
<tr>
<td>Point of maximal impulse usually located at fourth to fifth intercostal space,</td>
<td></td>
</tr>
<tr>
<td>left sternal border</td>
<td></td>
</tr>
<tr>
<td><strong>Hypothermia</strong></td>
<td>This is inadequate functioning of metabolic processes that require oxygen to produce necessary body heat.</td>
</tr>
<tr>
<td><strong>Muscle Tone</strong></td>
<td>These may indicate deterioration in the newborn's condition and possible CNS damage due to hypoxia, acidemia, or hemorrhage.</td>
</tr>
<tr>
<td>Flaccid, hypotonic, unresponsive to stimuli</td>
<td></td>
</tr>
<tr>
<td>Hypertonia and/or seizure activity</td>
<td></td>
</tr>
</tbody>
</table>
The newborn is free of respiratory distress and metabolic alterations.

The parents verbalize their concerns about their baby’s health problem and survival and understand the rationale behind the management of their newborn.

**TRANSIENT TACHYPNEA OF THE NEWBORN**

Some AGA preterm and near-term infants may develop progressive respiratory distress that can resemble classic RDS. They may have had intrauterine or intrapartal asphyxia due to maternal oversedation, maternal bleeding, prolapsed cord, breech birth, or maternal diabetes. The newborn then fails to clear the airway of lung fluid, mucus, and other debris or has an excess of fluid in the lungs due to aspiration of amniotic or tracheal fluid. Transient tachypnea occurs in 11 per 1000 live births. It is also more prevalent in cesarean birth newborns who have not had the thoracic squeeze that occurs during vaginal birth and removes some of the lung fluid (Glomella, 2004).

Usually the newborn experiences little or no difficulty at the onset of breathing. However, shortly after birth, expiratory grunting, flaring of the nares, and mild cyanosis may be noted in the newborn breathing room air. Tachypnea is usually present by 6 hours of age, with respiratory rates as high as 100 to 140 breaths per minute. Mild respiratory and metabolic acidosis may be present at 2 to 6 hours.

**Clinical Therapy**

Initial x-ray findings may be identical to those showing RDS within the first 3 hours. However, radiographs of infants with transient tachypnea usually reveal a generalized overexpansion of the lungs (hyperaeration of alveoli), which is identified principally by flattened contours of the diaphragm. Dense streaks (increased vascularity) radiate from the hilar region and represent engorgement of the lymphatic vessels, which clear alveolar fluid when air breathing begins. Within 48–72 hours the chest x-ray examination is normal (Glomella, 2004).

**NURSING PRACTICE**

In babies with RDS who are on ventilators, increased urination (determined by weighing diapers) may be an early clue that the baby’s condition is improving. As fluid moves out of the lungs and into the bloodstream, alveoli open and kidney perfusion increases, which results in increased voiding. At this point, monitor chest expansion closely. If chest expansion is increasing, ventilator settings may have to be decreased. Too high a ventilator setting may “blow the lung,” resulting in pneumothorax.

Ambient oxygen concentrations of 30% to 50%, usually under an oxygen hood, may be required to correct (continues on page 826)
### TABLE 31–2 Oxygen Monitors

<table>
<thead>
<tr>
<th>Type</th>
<th>Function and Rationale</th>
<th>Nursing Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pulse Oximetry—SPo2</strong></td>
<td>Calibrations are automatic.</td>
<td>Understand and use oxyhemoglobin dissociation curve.</td>
</tr>
<tr>
<td></td>
<td>Less dependent on perfusion than TcPO2 and TcPCO2, however, functions poorly if peripheral perfusion is decreased due to low cardiac output.</td>
<td>Monitor trends over time and correlate with arterial blood gases.</td>
</tr>
<tr>
<td></td>
<td>Much more rapid response time than TcPO2—offers real-time readings.</td>
<td>Check disposable sensor at least q8h.</td>
</tr>
<tr>
<td></td>
<td>Can be located on extremity, digit, or palm of hand, leaving chest free; not affected by skin characteristics.</td>
<td>Use disposable cuffs (reusable cuffs allow too much ambient light to enter, and readings may be inaccurate).</td>
</tr>
<tr>
<td></td>
<td>Requires understanding of oxyhemoglobin dissociation curve.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pulse oximeter reading of 87% to 95% reflects clinically safe range of saturation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Extreme sensitivity to movement; decreases if average of 7th or 14th beat is selected rather than beat to beat.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poor correlation with extreme hyperoxia.</td>
<td></td>
</tr>
<tr>
<td><strong>Transcutaneous Oxygen Monitor—TcPO2</strong></td>
<td>When transcutaneous monitors are properly calibrated and electrodes are appropriately positioned, they provide reliable, continuous, noninvasive measurements of PO2, PCO2, and oxygen saturation.</td>
<td>Use TcPO2 to monitor trends of oxygenation with routine nursing care procedures.</td>
</tr>
<tr>
<td></td>
<td>Readings vary when skin perfusion is decreased.</td>
<td>Clean electrode surface to remove electrolyte deposits; change solution and membrane once a week.</td>
</tr>
<tr>
<td></td>
<td>Reliable as trend monitor.</td>
<td>Allow machine to stabilize before drawing arterial gases; note reading when gases are drawn and use values to correlate.</td>
</tr>
<tr>
<td></td>
<td>Frequent calibration necessary to overcome mechanical drift.</td>
<td>Ensure airtight seal between skin surface and electrode; place electrodes on clean, dry skin on upper chest, abdomen, or inner aspect of thigh; avoid bony prominences.</td>
</tr>
<tr>
<td></td>
<td>Following membrane change, machine must “warm up” 1 hour prior to initial calibration; otherwise, after turning it on, it must equilibrate for 30 minutes prior to calibration.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>When placed on infant, values will be low until skin is heated; approximately 15 minutes required to stabilize.</td>
<td>Change skin site and recalibrate at least every 4 hours; inspect skin for burns; if burns occur, use lowest temperature setting and change position of electrode more frequently.</td>
</tr>
<tr>
<td></td>
<td>Second-degree burns are rare but possible if electrodes remain in place too long.</td>
<td>Adhesive disks may be cut to a smaller size, or skin prep may be used under the adhesive circle only; allow membrane to touch skin surface at center.</td>
</tr>
<tr>
<td></td>
<td>Decreased correlations noted with older infants (related to skin thickness), with infants with low cardiac output (decreased skin perfusion), and with hyperoxic infants.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The adhesive that attaches the electrode may abrade the fragile skin of the preterm infant.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>May be used for both preductal and postductal monitoring of oxygenation for observations of shunting.</td>
<td></td>
</tr>
</tbody>
</table>
## NURSING CARE PLAN

### THE NEWBORN WITH RESPIRATORY DISTRESS SYNDROME

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Rationale</th>
<th>Expected Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NIC Intervention:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory monitoring: Collection and analysis of patient data to ensure airway patency and adequate gas exchange</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Goal:</strong> The infant will maintain an effective breathing pattern.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ Review maternal birth records noting medications given to mother prior to birth and the infant’s condition at birth such as Apgar scores and resuscitative measures.</td>
<td>■ Close monitoring detects periodic apneic spells and allows for medical intervention if necessary.</td>
<td>■ The infant will maintain an effective breathing pattern as evidenced by: respirations are 30–60 breaths/min, arterial blood gases are within a normal range, infant is free of signs of retractions or nasal flaring, and blood pH is 7.35–7.45.</td>
</tr>
<tr>
<td>■ Initiate cardiac and respiratory monitoring and calibrate these monitors every 8 hours.</td>
<td>■ Increases in respiratory rate and pulse, alteration in rhythm, and blood pressure may indicate respiratory distress.</td>
<td></td>
</tr>
<tr>
<td>■ Monitor infant’s respiratory rate and rhythm, pulse, blood pressure, and activity.</td>
<td>■ Any changes in the normal skin color may indicate a physiologic change occurring.</td>
<td></td>
</tr>
<tr>
<td>■ Assess skin color; note signs of cyanosis, duskeness, and pallor.</td>
<td>■ Opens airway by clearing mucus and allows maximum respiratory effort.</td>
<td></td>
</tr>
<tr>
<td>■ Clear infant’s airway by suctioning prn with bulb syringe.</td>
<td>■ Prevents mucosal dryness and maintains an even level of oxygen administration.</td>
<td></td>
</tr>
<tr>
<td>■ Administer warmed, humidified oxygen by oxygen hood and monitor the oxygen concentrations every 30 minutes.</td>
<td>■ Allowing oxyhood to touch infant’s face may cause apnea by stimulating the facial nerve.</td>
<td></td>
</tr>
<tr>
<td>■ Do not allow oxyhood to touch infant’s face; maintain a stable oxygen concentration by increasing and decreasing oxygen by 5%–10% increments.</td>
<td>■ Obtaining arterial blood gases is essential in managing an infant receiving oxygen. Suctioning may cause a discrepancy in ABG readings and should be avoided.</td>
<td></td>
</tr>
<tr>
<td><strong>Collaborative:</strong> Obtain arterial blood gases (ABGs) per physician orders.</td>
<td>■ Several drugs suppress respiratory function in the newborn.</td>
<td></td>
</tr>
<tr>
<td>1. Maintain constant O₂ concentration for 15–30 minutes before sample is obtained.</td>
<td>■ CPAP or PEEP can be administered by nasal prongs or by nasopharyngeal or oral intubation.</td>
<td></td>
</tr>
<tr>
<td>2. Avoid stimulating infant 15 minutes prior to obtaining sample.</td>
<td>■ Mechanical ventilation improves oxygenation and ventilation, resulting in rise in PaO₂ and decrease in PaCO₂.</td>
<td></td>
</tr>
<tr>
<td>3. Avoid suctioning infant prior to obtaining sample.</td>
<td>■ The infant will maintain an effective breathing pattern as evidenced by: respirations are 30–60 breaths/min, arterial blood gases are within a normal range, infant is free of signs of retractions or nasal flaring, and blood pH is 7.35–7.45.</td>
<td></td>
</tr>
<tr>
<td>4. Obtain sample in heparinized tuberculin syringe and maintain the temperature of the sample.</td>
<td>■ The infant will maintain an effective breathing pattern as evidenced by: respirations are 30–60 breaths/min, arterial blood gases are within a normal range, infant is free of signs of retractions or nasal flaring, and blood pH is 7.35–7.45.</td>
<td></td>
</tr>
<tr>
<td>5. Assess the patency of the IV line to prevent clot formation, then replace blood used to clear line.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Flush line with 2 mL heparinized solution before restarting flow of IV fluids.</td>
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<tr>
<td>7. Monitor transcutaneous pulse oximeter continuously or hourly and record. Rotate sensor site every 3–4 hours.</td>
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<td></td>
</tr>
<tr>
<td>■ Assess infant’s need for mechanical ventilation: apnea present, hypoxia (PaO₂ &lt; 50 mm Hg), hypercapnia (PaCO₂ &gt; 60 mm Hg), respiratory acidosis (pH &lt; 7.2).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ Administer mechanical ventilation per hospital protocol.</td>
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</tr>
</tbody>
</table>

**NOC Outcome:**

*Respiratory status: Ventilation: Movement of air in and out of the lungs*
## NURSING CARE PLAN—continued

### THE NEWBORN WITH RESPIRATORY DISTRESS SYNDROME

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Rationale</th>
<th>Expected Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2. Nursing Diagnosis: Ineffective Thermoregulation related to increased respiratory effort</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NIC Intervention:</strong></td>
<td><strong>NOC Outcome:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Temperature regulation:</strong> Attaining or maintaining body temperature within a normal range</td>
<td>Thermoregulation: Newborn: Balance among heat production, heat gain, and heat loss during the neonatal period</td>
<td></td>
</tr>
<tr>
<td><strong>Goal:</strong> The infant will exhibit no signs of hypothermia.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ Review maternal prenatal and intrapartum records. Note any medications mother received during these times.</td>
<td>■ Medications such as Demerol and magnesium sulfate used by the mother during the prenatal or intrapartum periods significantly interfere with the infant’s ability to retain heat.</td>
<td>■ The infant will not exhibit signs and symptoms of hypothermia as evidenced by temperature maintenance of 97.7–99.1°F and no signs and symptoms of respiratory distress.</td>
</tr>
<tr>
<td>■ Assess infant’s temperature frequently.</td>
<td>■ Hypothermia leads to pulmonary vasoconstriction because of the increase in oxygen consumption.</td>
<td>■ Cold air/oxygen blown in face of newborn is stimulus for consumption of oxygen and glucose and increased metabolic rate.</td>
</tr>
<tr>
<td>■ Observe for signs of increased oxygen consumption and metabolic acidosis.</td>
<td>■ Cold stress leads to increased oxygen needs; thereby, brown fat is used to maintain body temperature.</td>
<td></td>
</tr>
<tr>
<td>■ Warm all inspired gases and record temperature of delivered gases.</td>
<td>■ Hypoxia and acidosis further depresses surfactant production.</td>
<td></td>
</tr>
<tr>
<td>■ Use radiant warmers or islettes with servocontrols, incubators, and open cribs with appropriate clothing.</td>
<td>■ Maintains neutral thermal environment.</td>
<td></td>
</tr>
<tr>
<td>■ Note signs and symptoms of respiratory distress, including tachypnea, apnea, cyanosis, acrocyanosis, bradycardia, lethargy, weak cry, and hypotonia.</td>
<td>■ These signs can predispose the infant to metabolic acidosis.</td>
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<tr>
<td><strong>3. Nursing Diagnosis: Altered Nutrition: Less than Body Requirements related to increased metabolic needs in the infant</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NIC Intervention:</strong></td>
<td><strong>NOC Outcome:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Newborn monitoring:</strong> Measurement and interpretation of physiologic status of the newborn the first 24 hours</td>
<td>Nutritional status: Food and fluid intake: Amount of food and fluid taken into the body over a 24-hour period</td>
<td></td>
</tr>
<tr>
<td><strong>Goal:</strong> Infant will gain weight in a normal curve.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ Assess suck, swallow, gag, and cough reflexes.</td>
<td>■ Prevents feeding problems and assists in determining the best method of feeding for infant.</td>
<td>■ The infant will maintain steady weight gain as evidenced by &lt; 2%/day weight loss, tolerates oral feedings, and urine output is 1–3 mL/kg/hour.</td>
</tr>
<tr>
<td>■ Assess respiratory status of infant. If problems are noted, notify physician.</td>
<td>■ In the presence of respiratory distress, avoid oral fluids and initiate parenteral nutrition per physician’s orders.</td>
<td></td>
</tr>
<tr>
<td>■ Monitor IV rates per infusion pump (starting at 60 mL/kg/day) or as ordered by physician.</td>
<td>■ Allows for close monitoring of fluid intake.</td>
<td></td>
</tr>
<tr>
<td>■ Record hourly intake and output (I&amp;O) and daily weights.</td>
<td>■ IV fluids are administered to replace sensible and insensible water loss, as well as evaporative water loss secondary to infant respiratory distress. Monitoring I&amp;O will prevent circulatory system overload that can lead to pulmonary edema and cardiac problems.</td>
<td></td>
</tr>
<tr>
<td>■ Provide total parenteral nutrition (TPN) when indicated.</td>
<td>■ TPN is used as nutritional alternative if bowel sounds are not present and/or infant remains in acute distress.</td>
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<td>(continued)</td>
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</table>
### THE NEWBORN WITH RESPIRATORY DISTRESS SYNDROME

#### NURSING CARE PLAN—continued

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Rationale</th>
<th>Expected Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>■ Advance, based on tolerance, from intravenous to gastrointestinal (GI) feedings. Gavage or nipple-feedings are used, and IV is used as supplement (discontinued when oral intake is sufficient).</td>
<td>■ If IV is discontinued before oral intake is established, baby will not receive adequate calories.</td>
<td>■ The infant will be free of signs and symptoms of dehydration as evidenced by intake equaling output, urine specific gravity in normal range, and a weight gain of at least 20–30 grams/day.</td>
</tr>
<tr>
<td>■ Provide adequate caloric intake: consider amount of intake, type of formula, route of administration, and need for supplementation of intake by other routes.</td>
<td>■ Formula or breast milk stimulate GI hormones necessary for a functional absorptive GI tract.</td>
<td>■ Fluctuations in weight may indicate water imbalance or inadequate caloric intake.</td>
</tr>
<tr>
<td>■ Assess infusion site for signs and symptoms of infection, including erythema, edema, and drainage with a foul odor.</td>
<td>■ Avoid complications associated with nutrition by IV route only.</td>
<td>■ Balanced fluid intake and output suggest homeostasis.</td>
</tr>
<tr>
<td>■ Observe for weight fluctuations by obtaining daily weights.</td>
<td>■ Calories are essential to prevent catabolism of body proteins, and metabolic acidosis due to starvation or inadequate caloric intake.</td>
<td>■ Specific gravity &gt; 1.013 and nitrites present in the urine are indicative of not enough fluid intake.</td>
</tr>
<tr>
<td>■ Document cumulative balances of intake (IV fluid administration and feedings) and output (urine collection bags, weighing or counting diapers) hourly.</td>
<td>■ Appropriate intervention can be initiated when signs and symptoms of infection are detected early. Treatment may avoid infection and sepsis in the infant.</td>
<td>■ A MAP of less than 20 mm Hg may indicate hypotension.</td>
</tr>
<tr>
<td>■ Obtain urinalysis, monitor closely specific gravity and nitrites.</td>
<td>■ If signs and symptoms of infection are noted, intervention is necessary and IV site should be changed.</td>
<td>■ Detecting signs and symptoms of dehydration early in the infant is important because early intervention is vital to prevent further damage.</td>
</tr>
<tr>
<td>■ Monitor vital signs, including blood pressure, pulse, temperature, and mean arterial pressure (MAP).</td>
<td>■ Determines necessity for TPN administration.</td>
<td>■ If signs and symptoms of infection are noted, intervention is necessary and IV site should be changed.</td>
</tr>
<tr>
<td>■ Assess client for signs of dehydration (i.e., poor skin turgor, pale mucous membranes, and sunken anterior fontanelle).</td>
<td>■ Replaces low nutrient stores and treats anemia if present.</td>
<td>■ Detecting signs and symptoms of dehydration early in the infant is important because early intervention is vital to prevent further damage.</td>
</tr>
<tr>
<td>■ Assess IV site for signs of infection (erythema and edema) and infiltration.</td>
<td>Collaborative: Obtain labs for Hct, serum calcium, serum magnesium, serum potassium, blood urea nitrogen (BUN), creatinine, and uric acid levels.</td>
<td>■ If signs and symptoms of infection are noted, intervention is necessary and IV site should be changed.</td>
</tr>
<tr>
<td>■ Administer fluids, blood products, and electrolytes as ordered by physician.</td>
<td>Collage of intervention: Obtain labs for Hct, serum calcium, serum magnesium, serum potassium, blood urea nitrogen (BUN), creatinine, and uric acid levels.</td>
<td>■ If signs and symptoms of infection are noted, intervention is necessary and IV site should be changed.</td>
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<td></td>
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<tr>
<td></td>
<td>■ Determines necessity for TPN administration.</td>
<td>■ Replaces low nutrient stores and treats anemia if present.</td>
</tr>
</tbody>
</table>

#### 4. Nursing Diagnosis: Risk for Fluid Volume Deficit related to increased insensible water losses

**NIC Intervention:**

**Fluid monitoring:** Collection and analysis of patient data to regulate fluid balance

**NOC Outcome:**

**Fluid balance:** Balance of water in the intracellular and extracellular compartments of the body

**Goal:** The infant will not exhibit signs of dehydration and will display appropriate weight gain.

- Observe for weight fluctuations by obtaining daily weights.
- Document cumulative balances of intake (IV fluid administration and feedings) and output (urine collection bags, weighing or counting diapers) hourly.
- Obtain urinalysis, monitor closely specific gravity and nitrites.
- Monitor vital signs, including blood pressure, pulse, temperature, and mean arterial pressure (MAP).
- Assess client for signs of dehydration (i.e., poor skin turgor, pale mucous membranes, and sunken anterior fontanelle).
- Assess IV site for signs of infection (erythema and edema) and infiltration.

**Collaborative:** Obtain labs for Hct, serum calcium, serum magnesium, serum potassium, blood urea nitrogen (BUN), creatinine, and uric acid levels.

- Administer fluids, blood products, and electrolytes as ordered by physician.
- If IV is discontinued before oral intake is established, baby will not receive adequate calories.
- Formula or breast milk stimulate GI hormones necessary for a functional absorptive GI tract.
- Avoid complications associated with nutrition by IV route only.
- Calories are essential to prevent catabolism of body proteins, and metabolic acidosis due to starvation or inadequate caloric intake.
- Appropriate intervention can be initiated when signs and symptoms of infection are detected early. Treatment may avoid infection and sepsis in the infant.

<table>
<thead>
<tr>
<th>Rationale</th>
<th>Expected Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>■ Fluctuations in weight may indicate water imbalance or inadequate caloric intake.</td>
<td>■ The infant will be free of signs and symptoms of dehydration as evidenced by intake equaling output, urine specific gravity in normal range, and a weight gain of at least 20–30 grams/day.</td>
</tr>
<tr>
<td>■ Balanced fluid intake and output suggest homeostasis.</td>
<td>■ Fluctuations in weight may indicate water imbalance or inadequate caloric intake.</td>
</tr>
<tr>
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<tr>
<td>■ A MAP of less than 20 mm Hg may indicate hypotension.</td>
<td>■ Specific gravity &gt; 1.013 and nitrites present in the urine are indicative of not enough fluid intake.</td>
</tr>
<tr>
<td>■ Detecting signs and symptoms of dehydration early in the infant is important because early intervention is vital to prevent further damage.</td>
<td>■ A MAP of less than 20 mm Hg may indicate hypotension.</td>
</tr>
<tr>
<td>■ If signs and symptoms of infection are noted, intervention is necessary and IV site should be changed.</td>
<td>■ Detecting signs and symptoms of dehydration early in the infant is important because early intervention is vital to prevent further damage.</td>
</tr>
<tr>
<td>■ Determines necessity for TPN administration.</td>
<td>■ If signs and symptoms of infection are noted, intervention is necessary and IV site should be changed.</td>
</tr>
<tr>
<td>■ Replaces low nutrient stores and treats anemia if present.</td>
<td>■ Determines necessity for TPN administration.</td>
</tr>
</tbody>
</table>
The Newborn at Risk: Birth-Related Stressors

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the hypoxemia (Figure 31–5). Fluid and electrolyte requirements should be met with IV fluids during the acute phase of the disease. Oral feedings are contraindicated because of rapid respiratory rates. The infant should be improving by 8 to 24 hours. The clinical course of transient tachypnea lasts approximately 72 hours (Glomella, 2004).

When hypoxemia is severe and tachypnea continues, persistent pulmonary hypertension must be considered and treatment measures initiated. If pneumonia is suspected initially, antibiotics may be administered prophylactically.

**Nursing Management**

For nursing actions, see “Nursing Care Plan: The Newborn with Respiratory Distress Syndrome.”

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**CARE OF THE NEWBORN WITH MECONIUM ASPIRATION SYNDROME**

Because the body’s response to asphyxia is increased peristalsis (movement) within the bowels and relaxation of the anal sphincter, the presence of meconium in the amniotic fluid indicates that the fetus may be suffering asphyxia. However, if the fetus is in a breech position, the presence of meconium in the amniotic fluid does not necessarily indicate asphyxia.

Approximately 13% of live-born infants are born through meconium-stained amniotic fluid (MSAF). Of the newborns born through MSAF, an average of 5% develop meconium aspiration syndrome (MAS) (Gelfand, Fanaroff, & Walsh, 2004). This fluid may be aspirated into the tracheobronchial tree in utero or during the first few breaths taken by the newborn. This syndrome primarily affects term, SGA, and postterm newborns and those who have experienced a long labor.

Meconium in the lungs produces a ball-valve action (air is allowed in but not exhaled), so that alveoli overdistend and rupture, resulting in pulmonary air leaks such as pneumomediastinum or pneumothorax. The meconium also triggers a chemical pneumonitis in the lung, causing oxygen and carbon dioxide to be trapped there and the lungs to hyperinflate. Secondary bacterial pneumonia can occur.

**CLINICAL MANIFESTATIONS OF MAS**

Clinical manifestations of MAS include (1) fetal hypoxia in utero a few days or a few minutes before birth, indicated by a sudden increase in fetal activity followed by diminished activity, slowing of FHR or weak and irregular heartbeat, loss of beat-to-beat variability, and meconium staining of amniotic fluid; and (2) signs of distress at birth, such as pallor, cyanosis, apnea, slow heartbeat, and low Apgar scores (below 6) at 1 and 5 minutes. Newborns with intrauterine asphyxia, meconium-stained newborns, or newborns that have aspirated meconium are depressed at birth and require resuscitation to establish adequate respiratory effort.

After the initial resuscitation, the severity of clinical symptoms depends on the extent of aspiration. Many infants need mechanical ventilation at birth because of immediate signs of distress (generalized cyanosis, tachypnea, and severe retractions). An overdistended, barrel-shaped chest with increased anteroposterior diameter is common. Auscultation reveals diminished air movement, with prominent rales and rhonchi. Abdominal palpation may reveal a displaced liver caused by diaphragmatic depression resulting from the overexpansion of the lungs. The skin, nails, and umbilical cord usually have yellowish staining.

The chest x-ray film reveals nonuniform, coarse, patchy densities and hyperinflation (9 to 11 rib expansion)
Evidence of pulmonary air leak is frequently present. Extreme hypoxia is also caused by the cardiopulmonary shunting and resultant failure to oxygenate and can lead to persistent pulmonary hypertension of the newborn (PPHN).

**CLINICAL THERAPY**

The maternity and pediatric teams must work together to prevent MAS. The most effective form of preventive management is as follows:

1. After the head is born and while the shoulders and chest are still in the birth canal, the baby’s oropharynx and then nasopharynx are suctioned by the birth attendant with the use of a bulb syringe or DeLee attached to wall suction. (This is also done with a cesarean birth.) To decrease the possibility of HIV transmission, low-pressure wall suction is used.

2. If the infant is vigorous even if there is thick or thin meconium in the amniotic fluid, no subsequent special resuscitation is indicated (de Ungria & Steinborn, 2003).

3. If the infant has absent or depressed respirations, heart rate less than 100 beats per minute, or poor muscle tone, direct tracheal suctioning by specially trained personnel such as a neonatal nurse practitioner, an experienced NICU nurse trained in those skills, a respiratory therapist, or a nurse anesthetist is recommended. The glottis is visualized with a laryngoscope and the trachea suctioned (Gelfand et al., 2004).

If the newborn’s head is not adequately suctioned at the time the head is born but the shoulder and chest are still in the vagina, respiratory or resuscitative efforts will push meconium into the airway and into the lungs. Stimulation of the newborn should be avoided to minimize respiratory movements. Further resuscitative efforts are undertaken as indicated, following the same principles of clinical therapy used for asphyxia (discussed earlier in this chapter). Resuscitated newborns should be transferred immediately to the NICU for closer observation. An umbilical arterial line may be used for direct monitoring of arterial blood pressures; blood sampling for pH and blood gases; and infusion of intravenous fluids, blood, or medications.

Treatment usually involves delivering high levels of oxygen and high-pressure ventilation. Ventilation with low PEEP is preferred to avoid pulmonary air leaks such as pneumothorax. Unfortunately, high pressures may be needed to cause sufficient expiratory expansion of obstructed airways or to stabilize airways weakened by inflammation so that the most distal atelectatic alveoli are ventilated.

Surfactant replacement therapy is most effective when used prophylactically. It improves oxygenation and decreases the incidence of air leaks. Systemic blood pressure and pulmonary blood flow must be maintained. Dopamine or dobutamine, volume expanders, or both may be used to maintain systemic blood pressure.

Newborns over 2 kg (7 lb) with respiratory failure who are not responding to conventional ventilator therapy may need treatment with high-frequency ventilation and/or nitric oxide therapy or ECMO (Zukowsky, 2004). ECMO treatment has proved successful for newborns with meconium aspiration, pneumonia, and PPHN who are not responding to traditional treatments.

Treatment includes chest physiotherapy (chest percussion, vibration, and drainage) to remove debris. Frequently, prophylactic intravenous antibiotics are given. Bicarbonate (to correct metabolic acidosis) may be necessary for several days for severely ill newborns. Mortality in term or postterm infants is very high, because the cycle of hypoxemia and acidemia is difficult to break.

**NURSING MANAGEMENT**

**NURSING ASSESSMENT AND DIAGNOSIS**

During the intrapartum period, observe for signs of fetal hypoxia and meconium staining of amniotic fluid. At birth assess the newborn for signs of distress. Carefully observe for complications such as pulmonary air leaks; anoxic cerebral injury manifested by convulsions; myocardial injury evidenced by congestive heart failure or cardiomegaly; disseminated intravascular coagulation (DIC) resulting from hypoxic hepatic damage that depresses liver-dependent clotting factors; anoxic renal damage demonstrated by hematuria, oliguria, or anuria; fluid overload; sepsis secondary to bacterial pneumonia; and any signs of intestinal necrosis from ischemia, including gastrointestinal obstruction or hemorrhage.

Nursing diagnoses that may apply to the newborn with MAS and the infant’s parents include the following:

- **Impaired Gas Exchange** related to aspiration of meconium and amniotic fluid during birth
- **Altered Nutrition: Less than Body Requirements** related to respiratory distress and increased energy requirements
- **Ineffective Family Coping: Compromised** related to life-threatening illness in term newborn

**PLANNING AND IMPLEMENTATION**

**Hospital-Based Nursing Care**

Initial interventions are aimed at preventing aspiration by helping remove the meconium from the infant’s oropharynx and nasopharynx before the first extraterine breath. When significant aspiration occurs, the primary goals of
therapy are to maintain appropriate gas exchange and minimize complications. Nursing interventions after resuscitation should include maintaining adequate oxygenation and ventilation, regulating temperature, performing glucose testing by glucometer at 2 hours of age to check for hypoglycemia, observing intravenous fluids administration, calculating necessary fluids (which may be restricted in the first 48 to 72 hours due to cerebral edema), providing caloric requirements, and monitoring intravenous antibiotic therapy.

**EVALUATION**

Expected outcomes of nursing care include the following:

- The newborn at risk of MAS is promptly identified, and early intervention is initiated.
- The newborn is free of respiratory distress and metabolic alterations.
- The parents verbalize their concerns about their baby’s health problem and survival and understand the rationale behind the management of their newborn.

**CARE OF THE NEWBORN WITH COLD STRESS**

**Cold stress** is excessive heat loss that requires a newborn to use compensatory mechanisms (such as increased respiration and nonshivering thermogenesis) to maintain core body temperature. Newborns experience heat loss that results in cold stress through the mechanisms of evaporation, convection, conduction, and radiation. (See “Heat Loss” in Chapter 26 for types of thermoregulation.)

Heat loss at birth that leads to cold stress can play a significant role in the severity of RDS and the ultimate outcome for the infant. Both preterm and SGA newborns are at risk for cold stress because they have decreased adipose tissue, brown fat stores, and glycogen available for metabolism. As discussed in Chapter 26, the newborn infant’s major source of heat production in nonshivering thermogenesis (NST) is brown fat metabolism. The infant’s ability to respond to cold stress by NST is impaired in the presence of several conditions:

- Hypoxemia (PO2 less than 50 torr)
- Intracranial hemorrhage or any CNS abnormality
- Hypoglycemia (blood glucose level < 40 mg/dL)

When these conditions occur, the infant’s temperature should be monitored closely and the neutral thermal environment conscientiously maintained. The nurse must recognize these conditions and treat them as soon as possible. The metabolic consequences of cold stress can be devastating and potentially fatal to an infant. Oxygen requirements rise, glucose use increases, acids are released into the bloodstream, and surfactant production decreases. The effects are graphically depicted in Figure 31–6.

**FIGURE 31–6**

![Cold stress chain of events](image)

Cold stress chain of events. The hypothermic, or cold-stressed, newborn attempts to compensate by conserving heat and increasing heat production. These physiologic compensatory mechanisms initiate a series of metabolic events that result in hypoxemia and altered surfactant production, metabolic acidosis, hypoglycemia, and hyperbilirubinemia.
newborn in a polyethylene wrapping immediately following birth can decrease the postnatal fall in temperature that normally occurs. Both convective and evaporative heat loss can be reduced (Blackburn, 2003).

Observe the baby for signs of cold stress, including increased movement and respirations, decreased skin temperature and peripheral perfusion, development of hypoglycemia, and possibly development of metabolic acidosis.

Vasoconstriction is the initial response to cold stress. Because it initially decreases skin temperature, monitor and assess skin temperature instead of rectal temperature. A decrease in rectal temperature means that the core temperature of the infant has decreased and the infant has long-standing cold stress. By monitoring skin temperature, possible decrease will become apparent before the infant's core temperature is affected.

If skin temperature decreases, determine whether hypoglycemia is present. Hypoglycemia is a result of the metabolic effects of cold stress and is suggested by glucometer values below 45 mg/dL, tremors, irritability or lethargy, apnea, or seizure activity.

If the baby becomes hypothermic, initiate the following care plan (Blackburn, 2003):

- Keep the ambient air temperature 1°C to 1.5°C higher than the infant's temperature.
- Warm the newborn slowly because rapid temperature elevation may cause hypotension and apnea.
- Increase the air temperature in hourly increments of 1°C until the infant's temperature is stable.
- Monitor skin temperature every 15 to 30 minutes to determine if the newborn's temperature is increasing.
- Remove plastic wrap, caps, and heat shields while rewarming the infant so that cool air is not trapped along with the warm air.
- Warm intravenous fluids prior to infusion.
- Block heat loss by evaporation, radiation, convection, and conduction and maintain the newborn in a neutral thermal environment.

Assess for anaerobic metabolism and treat the resulting metabolic acidosis. Burning brown fat increases oxygen consumption, lactic acid levels, and metabolic acidosis. Hypoglycemia may be reversed by adequate glucose intake, as described in the following section.

**CARE OF THE NEWBORN WITH HYPOGLYCEMIA**

A widely used cutoff point or threshold for intervention in newborn hypoglycemia is a **plasma glucose concentration at or below 40 mg/dL** (Armentrout, 2004). **Plasma glucose values less than 20 to 25 mg/dL** should be treated with parenteral glucose, regardless of the age or gestation. Hypoglycemia is the most common metabolic disorder in IDMs, SGA infants, and preterm AGA infants. The pathophysiology of hypoglycemia differs for each classification.

AGA preterm infants have not been in utero long enough to store glycogen and fat. As a result they have decreased ability to carry out gluconeogenesis. This situation is further aggravated by the tissues' increased use of glucose (especially in the brain and heart) during stress and illness (chilling, asphyxia, sepsis, RDS).

Infants of White's classes A–C or type 1 diabetic mothers have increased stores of glycogen and fat (see “Common Complication of the IDM” in Chapter 30) and higher circulating insulin and insulin responsiveness levels than other newborns. Because the high in utero glucose loads drop at birth, the newborn experiences rapid, profound hypoglycemia (Armentrout, 2004).

The SGA infant has used up glycogen and fat stores because of intrauterine malnutrition and has a blunted hepatic enzymatic response with which to produce and use glucose. Any newborn stressed at birth (from asphyxia or hypothermia) also quickly uses up available glucose stores and becomes hypoglycemic. Epidural anesthesia may alter maternal-fetal glucose homeostasis, resulting in hypoglycemia.

**CLINICAL THERAPY**

The goal of management includes early identification of hypoglycemia through observation and screening of newborns at risk (Sperling & Menon, 2004). The newborn may be asymptomatic, or any of the following may occur:

- Lethargy, jitteriness
- Poor feeding
- Vomiting
- Pallor
- Apnea, irregular respirations, respiratory distress, cyanosis
- Hypotonia, possible loss of swallowing reflex
- Tremors, jerkiness, seizure activity
- High-pitched cry
- Exaggerated Moro reflex

Aggressive treatment is recommended after a single low blood glucose value if the infant shows any of these symptoms. In at-risk infants, routine screening should be done frequently during the first 4 hours of life and then whenever any of the noted clinical manifestations appear or at 4-hour intervals until the risk period has passed.

Differential diagnosis of a newborn with nonspecific hypoglycemic symptoms includes determining if the newborn has any of the following:
CNS disease
Sepsis
Metabolic aberrations
Polycythemia
Congenital heart disease
Drug withdrawal
Temperature instability
Hypocalcemia

Hypoglycemia may also be defined as a glucose oxidase reagent strip below 45 mg/dL, but only when corroborated with laboratory plasma glucose testing (see Skill 10–1). Common bedside methods use whole blood, an enzymatic reagent strip, and a reflectance meter or color chart. Bedside glucose oxidase strip tests can screen for hypoglycemia, but laboratory determinations must confirm the results before a diagnosis of hypoglycemia can be made. Glucose reagent strips should not be used by themselves to screen for and diagnose hypoglycemia, because their results depend on the baby’s hematocrit and there is a wide variance (5 to 15 mg/dL) between their results and laboratory plasma determinations.

Blood glucose sampling techniques can significantly affect the accuracy of the blood glucose value. Whole blood glucose concentrations are 10% to 15% lower than plasma glucose concentrations—the higher the hematocrit, the greater the difference between whole blood and plasma values. Also, venous blood glucose concentrations are approximately 15% to 19% lower than arterial blood glucose concentrations because the tissues extract some glucose before the blood enters the venous system (“Neonatal Hypoglycemia,” 2000). Newer techniques, such as using a glucose oxidase analyzer or an optical bedside glucose analyzer, are more reliable for bedside screening but must also be validated with laboratory chemical analysis.

Blood samples for the laboratory should be placed on ice and analyzed within 30 minutes of drawing to prevent the red blood cells from continuing to metabolize glucose and giving a falsely low reading.

Adequate caloric intake is important. Early formula-feeding or breastfeeding is a major preventive approach. If early feeding meets the infant’s fluid and caloric needs, the blood glucose concentration is likely to remain above the hypoglycemic level. During the first hours after birth, asymptomatic newborns may also be given oral glucose. Another plasma glucose measurement is then obtained 30 to 60 minutes after feeding.

Intravenous infusions of a dextrose solution (5% to 10%) begun immediately after birth also should prevent hypoglycemia. Plasma glucose levels are obtained when the parenteral infusion is started. However, in the very small AGA infant, infusions of 10% dextrose solution may cause hyperglycemia to develop, requiring an alteration in the glucose concentration. Infants require 6 to 8 mg/kg/min of glucose to maintain normal glucose concentrations. Therefore, an intravenous glucose solution should be calculated based on the infant’s body weight, with blood glucose tests to determine adequacy of the infusion treatment.

A rapid infusion of 25% to 50% dextrose is contraindicated because it may lead to profound rebound hypoglycemia following an initial brief increase. In more severe hypoglycemic periods, corticosteroids may be administered. It is thought that steroids enhance gluconeogenesis from noncarbohydrate protein sources (Armentrout, 2004). The untreated hypoglycemia may result in permanent, untreatable CNS damage or death.

**COMPLEMENTARY CARE**

**PAIN RELIEF IN THE NICU**

Oral administration of sucrose for pain management from procedural pain (heel sticks, venipuncture, IM injections, oral suctioning, etc.) has been introduced in the NICU. The sweetness of the sucrose, a disaccharide, elevates the infant's pain threshold through endogenous opioid release in the central nervous system. A range of 0.05 to 2 mL of 24% sucrose is administered on the anterior part of the baby's tongue via a syringe or nipple approximately 2 minutes prior to the procedure (Walden & Jorgensen, 2004). But it is important to be careful because with repeated doses of sucrose, hyperglycemia may arise in the infant. Also, repeated use of sucrose analgesia in preterm infants may impact their neurologic development and behavioral outcomes. Until further research is done, repeated doses of sucrose are not recommended (Mitchell & Waltman, 2003).
newborns diagnosed with hypoglycemia, assessment is ongoing and includes careful monitoring of glucose values. In addition, urine dipstick and urine volume tests (monitor only if above 1 to 3 mL/kg/hr) may be evaluated frequently for osmotic diuresis and glycosuria.

Nursing diagnoses that may apply to the newborn with hypoglycemia include the following:

- **Altered Nutrition: Less than Body Requirements** related to increased glucose use secondary to physiologic stress
- **Ineffective Breathing Pattern** related to tachypnea and apnea
- **Acute Pain** related to frequent heel sticks secondary to glucose monitoring

**PLANNING AND IMPLEMENTATION**

Monitor infants in at-risk groups no later than 2 hours after birth and before feedings or whenever there are abnormal signs (Armentrout, 2004). Monitor the IDM within 30 minutes of birth. Once an at-risk infant’s blood sugar level is stable, glucose testing every 2 to 4 hours (or per agency protocol), or prior to feedings, adequately monitors glucose levels. The infant’s lateral heel is the preferred site for the glucose sample, so that the posterior tibial nerve and artery and the important longitudinally oriented fat pad of the heel will not be damaged (Figures 31–7 and 31–8).

Calculate glucose requirements and maintain intravenous glucose levels for any symptomatic infant with low serum glucose levels. The method of feeding greatly influences glucose and energy requirements; thus, pay careful attention to glucose monitoring during the transition from intravenous to oral feedings. Titration of intravenous glucose may be required until the infant can take adequate amounts of formula or breast milk to maintain a normal blood sugar level. Titrate by decreasing the concentration of parenteral glucose gradually to 5%, then reducing the rate of infusion to 6 mg/kg/min, then to 4 mg/kg/min, and slowly discontinuing it over 4 to 6 hours. Enteral feedings are increased to maintain an adequate glucose and caloric intake.

Identify any discrepancies between the baby’s caloric requirements and received calories. Weigh the newborn daily at consistent times, preferably before feeding. Only then can findings of unusual losses or gains, as well as the pattern of weight gain, be considered reliable.

The therapeutic nursing measure of nonnutritive sucking during gavage feedings has been reported to increase the baby’s daily weight gain and lead to earlier bottle-feeding or breastfeeding and discharge. Nonnutritive sucking may also lower activity levels, which allows newborns to conserve their energy stores. Activity can increase energy requirements; crying alone can double the baby’s metabolic rate.

Establishing and maintaining a neutral thermal environment has a potent influence on the newborn’s metabolism. Pay careful attention to environmental conditions, physical activity, and organization of care, and integrate these factors into nursing care.
EVALUATION

Expected outcomes of nursing care include the following:

- The newborn at risk for hypoglycemia is promptly identified, and intervention is started early.
- The newborn’s glucose level is stabilized, and recovery is proceeding without sequelae.

CARE OF THE NEWBORN WITH JAUNDICE

The most common abnormal physical finding in newborns is jaundice. Jaundice is a yellowish coloration of the skin and sclera of the eyes that develops from deposits of the yellow pigment bilirubin in lipid tissues. Normally the placenta clears fetal unconjugated (indirect) bilirubin in utero, so total bilirubin at birth is usually less than 3 mg/dL unless an abnormal hemolytic process has been present. Postnatally the infant must conjugate bilirubin (convert a lipid-soluble pigment into a water-soluble pigment) in the liver.

The rate and amount of conjugation of bilirubin depend on the rate of hemolysis, the bilirubin load, the maturity of the liver, and the presence of albumin-binding sites. (See Chapter 26 for discussion of conjugation of bilirubin.) The liver of a normal, healthy term infant is usually mature enough and producing enough glucuronyl transferase that the total serum bilirubin does not reach a pathologic level.

PHYSIOLOGIC JAUNDICE

Physiologic or neonatal jaundice is a normal process that occurs during transition from intrauterine to extraterine life and appears after 24 hours of life. Some degree of jaundice occurs in about half of all healthy term newborns and in 80% of preterm newborns (Madan, MacMahon, & Stevenson, 2005). It is due to the newborn’s shortened cell life span, slower uptake by the liver, lack of intestinal bacteria, and poorly established hydration.

Lab tests reveal a predominance of unconjugated bilirubin. The average level of unconjugated bilirubin in cord blood is approximately 2 mg/dL at birth. This level rises to an average of 5 to 6 mg/dL between the third and fifth days of life. The jaundice is usually not visible after 10 days. The pattern of physiologic jaundice differs between breastfed and formula-fed newborns (for further discussion of physiologic jaundice, see “Physiologic Jaundice” in Chapter 26). Physiologic jaundice remains a common problem for the term newborn and may require treatment with phototherapy.

PATHOPHYSIOLOGY OF HYPERBILIRUBINEMIA

Serum albumin-binding sites are usually able to conjugate enough bilirubin to meet the demands of the normal newborn. However, certain conditions tend to decrease the number of sites available. Fetal or neonatal asphyxia and neonatal drugs such as indomethacin decrease the binding affinity of bilirubin to albumin, because acidosis impairs albumin’s capacity to hold bilirubin. Hypothermia and hypoglycemia release free fatty acids that dislocate bilirubin from albumin. Maternal use of sulfa drugs or salicylates interferes with conjugation or with serum albumin-binding sites by competing with bilirubin for these sites. Finally, premature infants have less albumin available for binding with bilirubin. Neurotoxicity is possible because unconjugated bilirubin has a high affinity for extravascular tissue, such as fatty tissue (subcutaneous tissue) and cerebral tissue.

Bilirubin not bound to albumin can cross the blood-brain barrier, damage cells of the CNS, and produce kernicterus or bilirubin encephalopathy (Watson, 2004). Kernicterus (meaning “yellow nucleus”) refers to deposits of indirect or unconjugated bilirubin in the basal ganglia of the brain and to the permanent neurologic sequelae of untreated hyperbilirubinemia (elevation of bilirubin level).

The classic bilirubin encephalopathy of kernicterus most commonly found with Rh and ABO blood group incompatibility is less common today due to aggressive treatment with phototherapy and exchange transfusions. But cases of kernicterus are reappearance as a result of early discharge and the increased incidence of dehydration (as a result of discharge before the mother’s milk is established). Current therapy can reduce the incidence of kernicterus encephalopathy but cannot distinguish all infants who are at risk.

CAUSES OF HYPERBILIRUBINEMIA

A primary cause of pathologic hyperbilirubinemia is hemolytic disease of the newborn secondary to Rh incompatibility. All pregnant women who are Rh negative or who have blood type O (possible ABO blood incompatibility) should be asked about outcomes of any previous pregnancies and history of blood transfusion. Prenatal amniocentesis with spectrophotometric examination may be indicated. Cord blood from newborns is evaluated for bilirubin level, which should not exceed 5 mg/dL. Newborns of Rh-negative and O blood type mothers are carefully assessed for jaundice and levels of serum bilirubin.

Alloimmune hemolytic disease, also known as erythroblastosis fetalis, occurs when an Rh-negative
mother is pregnant with an Rh-positive fetus and maternal antibodies cross the placenta. Maternal antibodies enter the fetal circulation, then attach to and destroy the fetal red blood cells (RBCs). The fetal system responds by increasing RBC production. Jaundice, anemia, and compensatory erythropoiesis result. A marked increase in immature RBCs (erythroblasts) also occurs, hence the designation erythroblastosis fetalis. Because of the use of Rh immune globulin (RhoGAM), the incidence of erythroblastosis fetalis has dropped dramatically.

**Hydrops fetalis**, the most severe form of erythroblastosis fetalis, occurs when maternal antibodies attach to the Rh site on the fetal RBCs, making them susceptible to destruction; severe anemia and multiorgan system failure result. Cardiomegaly with severe cardiac decompensation and hepatosplenomegaly occurs. Severe generalized massive edema (anasarca) and generalized fluid effusion into the pleural cavity (hydrothorax), pericardial sac, and peritoneal cavity (ascites) develop. Jaundice is not present initially because the bilirubin pigments are excreted through the placenta into the maternal circulation. The hydropic hemolytic disease process is also characterized by hyperplasia of the pancreatic islets, which predisposes the infant to neonatal hypoglycemia similar to that of IDMs. In addition the associated thrombocytopenia and hypoxic damage to the capillaries means these infants have increased bleeding tendencies. Hydrops is a frequent cause of intrauterine death among infants with Rh disease.

ABO incompatibility (the mother is blood type O and the baby is blood type A or B) may result in jaundice, although it rarely results in hemolytic disease severe enough to be clinically diagnosed and treated. Hepatosplenomegaly may be found occasionally in newborns with ABO incompatibility, but hydrops fetalis and stillbirth are rare.

Other prenatal and perinatal factors predispose the newborn to hyperbilirubinemia. During pregnancy, predisposing maternal conditions include hereditary spherocytosis, diabetes, intrauterine infections, and gram-negative bacilli infections that stimulate production of maternal alloimmune antibodies, drug ingestion (such as sulfas, salicylates, novobiocin, diazepam), and oxytocin administration.

In addition to Rh or ABO incompatibility, other conditions predispose the newborn to hyperbilirubinemia: polycythemia (central hematocrit 65% or more), pyloric stenosis, obstruction or atresia of the biliary duct or of the lower bowel, low-grade urinary tract infection, sepsis, hypothyroidism, enclosed hemorrhage (cephalhematoma, large bruises), asphyxia neonatorum, hypothermia, acidemia, and hypoglycemia. Neonatal hepatitis, atresia of the bile ducts, and gastrointestinal atresia all can alter bilirubin metabolism and excretion.

The prognosis for a newborn with hyperbilirubinemia depends on the extent of the hemolytic process and the underlying cause. Severe hemolytic disease results in fetal and early neonatal death from the effects of severe anemia—cardiac decompensation, edema, ascites, and hydrothorax. Hyperbilirubinemia may lead to kernicterus if not aggressively treated. The resulting neurologic damage may cause death, cerebral palsy, possible mental retardation, or hearing loss or, to a lesser degree, perceptual impairment, delayed speech development, hyperactivity, muscle incoordination, or learning difficulties.

### DEVELOPING CULTURAL COMPETENCE

#### ETHNIC VARIATIONS AND JAUNDICE

East Asian infants (Japanese, Chinese, and Filipino ethnic groups) have a higher occurrence of hyperbilirubinemia than Caucasian infants. Infants with Asian fathers and Caucasian mothers have a higher incidence of jaundice than if both parents are Caucasian. Other ethnic groups at risk for increased bilirubinemia are Navajo, Eskimo, and Sioux Native American newborns; Greek newborns; Sephardic-Jewish (oriental ancestry) newborns; and some Hispanic newborns.

### CLINICAL THERAPY

Neonatal hyperbilirubinemia can be considered pathologic and requires further investigation if any of the following criteria are met (American Academy of Pediatrics Subcommittee on Hyperbilirubinemia, 2004; Madan et al., 2005):

1. Clinically evident jaundice before first 24 hours of life
2. Serum bilirubin concentration rising more than 0.2 mg/dL/hour or 5 mg/dL per day
3. Total serum bilirubin (TSB) exceeding the 95th percentile on the nomogram
4. Signs of underlying illness in any infant (vomiting, lethargy, poor feeding, excessive weight loss, apnea, tachypnea, or temperature instability)
5. Clinical jaundice persisting for more than two weeks in a term newborn
6. Conjugated bilirubin concentrations greater than 2 mg/dL or more than 20% of the total serum bilirubin concentration

Initial diagnostic procedures are aimed at differentiating jaundice resulting from increased bilirubin production, impaired conjugation or excretion, or a combination of these factors. When one or more predisposing factors for jaundice are present, the maternal and neonatal blood types should be tested in the laboratory for Rh or ABO incompatibility. Early prenatal identification of the fetus at risk for Rh or ABO in-
compatibility allows prompt treatment. (See Chapter 15 for discussion of in utero management of this condition.)

Because of the shorter life span of red blood cells in the newborn, a significant bilirubin load is produced. When bilirubin breaks down, carbon monoxide (CO) is released. This production of carbon monoxide is being investigated as a marker in the study of bilirubin production. Measuring end-tidal CO (ETCO) has been shown to provide results similar to laboratory measures of bilirubin (Madan et al., 2005).

Other needed laboratory evaluations are Coombs’ test, serum bilirubin levels (direct and total), hemoglobin, reticulocyte percentage, white cell count, and positive smear for cellular morphology.

The Coombs’ test determines whether jaundice is due to Rh or ABO incompatibility. The indirect Coombs’ test measures the amount of Rh-positive antibodies in the mother’s blood. Rh-positive RBCs are added to the maternal blood sample. If the mother’s serum contains antibodies, the Rh-positive RBCs agglutinate (clump) when rabbit immune antiglobulin is added, which is a positive test result.

The direct Coombs’ test reveals antibody-coated (sensitized) Rh-positive RBCs in the newborn. Rabbit immune antiglobulin is added to the specimen of neonatal blood cells. If the neonatal RBCs agglutinate, they have been coated with maternal antibodies, a positive result.

If the hemolytic process is due to Rh sensitization, laboratory findings will reveal the following: (1) an Rh-positive newborn with a positive Coombs’ test; (2) increased erythropoiesis with many immature circulating red blood cells (nucleated blastocysts); (3) anemia, in most cases; (4) elevated levels of bilirubin in cord blood (5 mg/dL or more); and (5) a reduction in albumin-binding capacity. Maternal data may include an elevated anti-Rh titer and spectrophotometric evidence of a fetal hemolytic process.

Laboratory findings reveal an increase in immature blood cells (erythrocytes) when the hemolytic process is due to ABO incompatibility. The resulting anemia is usually not significant during the newborn period and is rare later on. The direct Coombs’ test may be negative or mildly positive, whereas the indirect Coombs’ test may be strongly positive. Infants with a positive direct Coombs’ test have increased incidence of jaundice, with bilirubin levels above 10 mg/dL. Increased numbers of spherocytes (spherical, plump, mature erythrocytes) are seen on a peripheral blood smear. Increased numbers of spherocytes are not seen on blood smears from infants with Rh disease.

**THERAPEUTIC MANAGEMENT**

Whatever the cause of hyperbilirubinemia, management of these infants is directed toward alleviating anemia, removing maternal antibodies and sensitized erythrocytes, increasing serum albumin levels, reducing serum bilirubin levels, and minimizing the consequences of hyperbilirubinemia. Early discharge of newborns from birthing centers has significantly affected the diagnosis and management of neonatal jaundice in that setting and increased the emphasis on outpatient and home care management.

Hemolytic disease may be treated with phototherapy, exchange transfusion, and drug therapy. When determining the appropriate management of hyperbilirubinemia due to hemolytic disease, the three relevant variables are the newborn’s (1) serum bilirubin level, (2) birth weight, and (3) age in hours. If a newborn has hemolysis with an unconjugated bilirubin level of 14 mg/dL, weighs less than 2500 g (birth weight), and is 24 hours old or less, an exchange transfusion may be the best management. However, if that same newborn is over 24 hours of age, which is past the time when an increase in bilirubin would be due to pathologic causes, phototherapy may be the treatment of choice to prevent the possible complication of kernicterus.

**Phototherapy** is the exposure of the newborn to high-intensity light. It may be used alone or in conjunction with exchange transfusion to reduce serum bilirubin levels. Exposure of the newborn to high-intensity light (fluorescent light bulbs or bulbs in the blue-light spectrum) decreases serum bilirubin levels in the skin by facilitating biliary excretion of unconjugated bilirubin. Phototherapy decreases serum bilirubin levels by changing bilirubin from the non-water soluble (lipophilic) form to water-soluble by-products that can then be excreted. When bilirubin absorbs light, three forms of photochemical reaction occur: photo-oxidation, photoisomerization, and structural isomerization. Photo-oxidation is a minor contributor to bilirubin elimination. Structural isomerization is the most important pathway for decreasing serum bilirubin levels. Bilirubin is converted to lumirubin which is bound to albumin and transported to the liver. It is a stable water-soluble molecule so it is excreted into the urine and bile for excretion. Photoisomerization occurs when the natural form of bilirubin is exposed to light at a certain wavelength and the bilirubin is converted to a less toxic form. The new isomer, photobilirubin, is created rapidly, but is quite unstable. Photobilirubin is bound to albumin, transported to the liver, and is incorporated into bile. If it is not quickly eliminated from the bowel it can convert back to its original form and return to the bloodstream.

Phototherapy is an intervention that is used more for the prevention of hyperbilirubinemia in order to halt bilirubin levels from climbing dangerously high. The decision to start phototherapy is based on 2 factors: gestational age and age in hours. Phototherapy is the most effective in the first 24 to 48 hours of usage; frequently the light can be discontinued during or immediately after this time frame.
CHAPTER 31

Phototherapy plays an important role in preventing a rise in bilirubin levels but does not alter the underlying cause of jaundice, and hemolysis may continue to produce anemia. Many authors have recommended initiating phototherapy “prophylactically” in the first 24 hours of life in high-risk, very-low-birth-weight or severely bruised infants.

Phototherapy can be provided through halogen spotlights, (although this is less often used due to the risk of thermal burns), conventional banks of phototherapy lights or by a fiberoptic blanket attached to a halogen light source around the trunk of the newborn or a combination of both delivery methods. The banks of bilirubin lights utilize light in the blue spectrum. This is the most effective source available, but can mask cyanosis, and causes dizziness and nausea in the staff. With the fiberoptic blanket, the light stays on at all times, and the newborn is accessible for care, feeding, and diaper changes; greater surface area is exposed and there are no thermoregulation issues. The eyes are not covered. Fluid and weight loss are not complications of this system. Furthermore, it makes the infant accessible to the parents and is less alarming to parents than standard phototherapy. A combination of a fiberoptic light source in the mattress under the baby and a standard light source above may also be used. This is termed intensive phototherapy. Intensive phototherapy should reduce the TSB by 1–2 mg/dL within 4–6 hours and should continue to decline. If this goal is not reached then an exchange transfusion should be considered. Many institutions and pediatricians use fiberoptic blankets for home care (see Figure 31–9).

Exchange Transfusion

Exchange transfusion is the withdrawal and replacement of the newborn’s blood with donor blood. It is used to treat anemia with RBCs that are susceptible to maternal antibodies, remove sensitized RBCs that would be lysed soon, remove serum bilirubin, and provide bilirubin-free albumin to increase the binding sites for bilirubin. Concerns about exchange transfusion are related to the use of blood products, which include the potential for HIV infection and hepatitis.

If the TSB is at or approaching the exchange level, send blood for immediate type and crossmatch. Blood for exchange transfusion is modified whole blood (red cells and plasma) crossmatched against the mother and compatible with the infant.

NURSING MANAGEMENT

NURSING ASSESSMENT AND DIAGNOSIS

Assessment is aimed at identifying prenatal and perinatal factors that predispose the newborn to the development of jaundice and at recognizing the jaundice as soon as it is apparent. (See “Nursing Care Plan: The Newborn with Hyperbilirubinemia.”) Clinically, ABO incompatibility presents as jaundice and occasionally as hepatosplenomegaly. Fetal hydrops or erythroblastosis is rare. Suspect hemolytic disease of the newborn if the placenta is enlarged, if the newborn is edematous with pleural and pericardial effusion plus ascites, if pallor or jaundice is noted during the first 24 to 36 hours, if hemolytic anemia is diagnosed, or if the spleen and liver are palpable. The TSB should be followed and exchanged if it surpasses the exchange level. If the TSB is at or approaching the exchange level, send blood for immediate type and crossmatch. Blood for exchange transfusion is modified whole blood (red cells and plasma) crossmatched against the mother and compatible with the infant.

FIGURE 31–9

Guidelines for phototherapy in hospitalized infants of 35 or more weeks’ gestation.


- Use total bilirubin. Do not subtract direct reacting or conjugated bilirubin.
- Risk factors = isoimmune hemolytic disease, G6PD deficiency, asphyxia, significant lethargy, temperature instability, sepsis, acidosis, or albumin < 3.0g/dL (if measured)
- For well infants 35-37 6/7 wk can adjust TSB levels for intervention around the medium risk line. It is an option to intervene at lower TSB levels for infants closer to 35 wks and at higher TSB levels for those closer to 37 6/7 wk.
- It is an option to provide conventional phototherapy in hospital or at home at TSB levels 2-3 mg/dL (35-50mmol/L) below those shown but home phototherapy should not be used in any infant with risk factors.
## NURSING CARE PLAN

### THE NEWBORN WITH HYPERBILIRUBINEMIA

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Rationale</th>
<th>Expected Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NIC Intervention:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High-risk newborn care: Identification and management of a high-risk newborn to promote healthy outcomes for baby</td>
<td>Early identification of risk factors enables the nurse to monitor babies for early signs of hyperbilirubinemia. Acidosis, hypoxia, and hypothermia increase the risk of hyperbilirubinemia at lower bilirubin levels.</td>
<td>Baby’s jaundice is identified early.</td>
</tr>
<tr>
<td><strong>Goal:</strong></td>
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<tr>
<td>Babies at risk for jaundice and early signs of jaundice will be identified.</td>
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<tr>
<td>■ Evaluate baby’s history for predisposing factors for hyperbilirubinemia.</td>
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<td></td>
</tr>
<tr>
<td>■ Observe color of amniotic fluid at time of rupture of membranes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ Assess baby for developing jaundice in daylight if possible.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Observe sclera.</td>
<td></td>
<td></td>
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<tr>
<td>2. Observe skin color and assess by blanching.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Check oral mucosa, posterior portion of hard palate, and conjunctival sacs for yellow pigmentation in dark-skinned newborns.</td>
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<tr>
<td>Report jaundice occurring within 24 hours of birth.</td>
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<td></td>
</tr>
<tr>
<td><strong>NOC Outcome:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk control:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actions to eliminate or reduce actual, personal, and modifiable health threats</td>
<td></td>
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</tr>
</tbody>
</table>

| **2. Nursing Diagnosis: Risk for Fluid Volume Deficit related to phototherapy** | | |
| **NIC Intervention:** | | |
| Fluid monitoring: Collection and analysis of patient data to regulate fluid balance | Adequate hydration increases peristalsis and excretion of bilirubin. | Baby will have good skin turgor, clear amber urine output of 1-3 mL/kg/hr, six to eight wet diapers/day, and will maintain weight. |
| **Goal:** | | |
| The infant will not exhibit signs of dehydration and will display appropriate weight gain. | | |
| ■ Offer feedings every 2 to 3 hr. Breastfeed on demand with no supplementation unless excessive weight loss or increasing TSB with adequate feeding. | | |
| ■ Provide 25% extra fluid intake. | | |
| **Assess for dehydration:** | | |
| 1. Poor skin turgor | | |
| 2. Depressed fontanelles | | |
| 3. Sunken eyes | | |
| 4. Decreased urine output | | |
| 5. Weight loss | | |
| 6. Changes in electrolytes | | |
| ■ Adequate hydration increases peristalsis and excretion of bilirubin. | | |
| ■ Replace fluid losses due to watery stools, if under phototherapy. | | |
| ■ Phototherapy treatment may cause liquid stools and increased insensible water loss, which increases risk of dehydration. | | |

(continued)
### Interventions, Rationales, and Expected Outcomes

#### 3. Nursing Diagnosis: Potential for Injury related to use of phototherapy lights

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Rationale</th>
<th>Expected Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NIC Intervention:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Newborn monitoring: Measurement and interpretation of physiologic status of the newborn the first 24 hr after birth</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NOC Outcome:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk Control: Actions to eliminate or reduce actual, personal, and modifiable health threats</td>
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</tbody>
</table>

**Goal:** Baby will not have any corneal irritation or drainage, skin breakdown, or major fluctuations in temperature.

- Cover baby’s eyes with eye patches while under phototherapy lights. Cover testes/penis in male infants.
- Make sure that eyelids are closed prior to applying eye patches.
- Remove baby from under phototherapy and remove eye patches during feedings.
- Inspect eyes each shift for conjunctivitis, drainage, and corneal abrasions due to irritation from eye patches.
- Administer thorough perianal cleansing with each stool or change of perianal protective covering.
- Provide minimal coverage--only of diaper area.
- Avoid the use of oily applications on the skin.
- Reposition baby q 2 hours.
- Observe for bronzing of skin.
- Place Plexiglas shield between baby and light. Monitor baby's skin and core temperature frequently until temperature is stable.
- Check axillary temperature with readings on servo-controlled unit on incubator. Regulate incubator temperature as needed.
- Prevents fluid overload. IV fluids may be used if baby is dehydrated or in presence of other complications. IV may be started if exchange transfusion is to be done.
- Protects retina from damage due to high-intensity light and testes from damage from heat.
- Prevents corneal abrasions.
- Provides visual stimulation and facilitates attachment behaviors.
- Prevents or facilitates prompt treatment of purulent conjunctivitis.
- Frequent stooling increases risk of skin breakdown. Prevents infection.
- Provides maximal exposure. Shielded areas become more jaundiced, so maximum exposure is essential.
- Prevents superficial burns to skin.
- Provides equal exposure of all skin areas and prevents pressure areas.
- Bronzing is related to use of phototherapy with increased direct bilirubin levels or liver damage; may last for 2 to 4 months.
- Hypothermia and hyperthermia are common complications of phototherapy. Hypothermia results from exposure to lights, subsequent radiation, and convection losses.
- Hyperthermia may result from the increased environmental heat. Additional heat from phototherapy lights frequently causes a rise in the baby's and incubator's temperatures. Fluctuations in temperature may occur in response to radiation and convection.

- Baby’s eyes are protected, skin is intact, and baby maintains a stable temperature.
### NURSING CARE PLAN—continued

#### THE NEWBORN WITH HYPERBILIRUBINEMIA

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Rationale</th>
<th>Expected Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Nursing Diagnosis: Risk for Impaired Parenting related to deficient knowledge of infant care and prolonged separation of infant and parents secondary to illness</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NIC Intervention:</strong></td>
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<td></td>
</tr>
<tr>
<td><strong>Teaching:</strong> Infant care: Instruction on nurturing and physical care needed during the first year of life</td>
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<tr>
<td><strong>NOC Outcome:</strong></td>
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<td></td>
</tr>
<tr>
<td><strong>Parenting:</strong> Provision of an environment that promotes optimum growth and development of dependent children</td>
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</tbody>
</table>

**Goal:** Parents will bond with infant and have realistic expectations about their infant. Parents are comfortable taking their infant home. They are able to demonstrate normal infant care and assessments of possible complications, and they know when to return for follow-up.

- Encourage parents to provide tactile stimulation during feeding and diaper changes.
- Encourage cuddling and eye contact during feedings.
- Offer suggestions to comfort restless infant:
  1. Nesting when beneath bili lights
  2. Talking softly and singing quietly to infant
  3. Taped music or tape recording of evening activities from home
  4. Rhythmic patting of buttocks
  5. Firm, nonstroking touch, assisting with control of extremities
  6. Pacifier for nonnutritive sucking
- Encourage family/friend support of mother/parents (i.e., meals, rest, child care for siblings, allow expressions of concerns/feelings).
- Evaluate additional psychosocial needs.
- Discuss rationale for treatment and possible side effects of phototherapy with family (stool changes, increased fluid loss, possible temp instability, slight lethargy, rash, altered sleep-wake patterns).
  Instruct family on infant’s care while undergoing phototherapy:
  1. Safety precautions—bili mask, incubator door closed and latched, covering genitalia per policy.
  2. Skin care, cord care, circumcision care as appropriate.
  3. Lab draws, rationale for intake and output.
- Encourage parent/significant other/sibling involvement in infant care as possible.
- Evaluate family’s understanding of information.
- Give explanation of equipment being used and changes in bilirubin levels. Allow parents an opportunity to ask questions; reinforce or clarify information as needed.
- Newborn has normal needs for tactile stimulation.
- Provides opportunity for parents to bond with their newborn.
- Provides comfort and decreases sensory deprivation. Presence of equipment may discourage parents from interacting with newborn.
- Decreases strain on mother/parents by assisting with other responsibilities and allows for additional time with newborn for bonding, care, etc.
- Parents may not understand what is happening or why.
- Physician preference of treatment modalities may vary. Parents may not understand why their newborn is not receiving a treatment that another with the same condition is receiving.
- The parent will demonstrate ability to perform basic infant care tasks as evidenced by exhibiting appropriate attachment behaviors (i.e., talking to and holding infant), feeding infant, and caring for infant under home bili therapy.
- Parents verbalize understanding of rationale and possible side effects from phototherapy; parents/family demonstrate safety precautions when caring for infant; parents getting meals and rest; parents verbalize support given.

(continued)
liver are enlarged. Carefully note changes in behavior and observe for evidence of bleeding. If laboratory tests indicate elevated bilirubin levels, check the newborn for jaundice about every 2 hours and record observations.

To check for jaundice in lighter-skinned babies, blanch the skin over a bony prominence (forehead, nose, sternum) by pressing firmly with the thumb. After pressure is released, if jaundice is present, the area appears yellow before normal color returns. In darker-skinned babies, check oral mucosa and the posterior portion of the hard palate and conjunctival sacs for yellow pigmentation. Because birthing units are often decorated with pink walls and surroundings, which may mask yellowish tints, and because yellow light makes differentiation of jaundice difficult, perform the assessment in daylight for the best results.

In addition to visually inspecting the newborn, use reflectance photometers that measure transcutaneous bilirubin (TcB) to screen and monitor neonatal jaundice. Analysis for end-tidal carbon monoxide is another portable screening tool. This analysis allows quick identification of those newborns with significant hemolytic disease who may be at risk for further complications of unconjugated hyperbilirubinemia (American Academy of Pediatrics Subcommittee on Hyperbilirubinemia, 2004).

If jaundice appears, record and report the time of onset and carefully observe for any increase in depth of color or changes in the newborn’s behavior. Assess the newborn’s behavior for neurologic signs associated with hyperbilirubinemia, which are rare but may include hypotonia, diminished reflexes, lethargy, or seizures.

Some hospitals have developed a mandatory screening policy of all newborns prior to discharge utilizing the TcB monitor. If the level comes back as high as earlier levels then a follow-up TSB will be performed.

Nursing diagnoses that may apply to care of a newborn with jaundice include the following:

- **Risk for Fluid Volume Deficit** related to phototherapy, increased insensible water loss, and frequent loose stools
- **Potential for Injury** related to use of phototherapy
- **Sensory-Perceptual Alterations** related to neurologic damage secondary to kernicterus
- **Risk for Altered Parenting** related to deficient knowledge of infant care and prolonged separation of infant and parents secondary to illness

**PLANNING AND IMPLEMENTATION**

**Hospital-Based Nursing Care**

Hospital-based care is described in “Nursing Care Plan: The Newborn with Hyperbilirubinemia.” If phototherapy lights are used, expose the newborn’s entire skin surface to the light. Minimal covering may be applied over the genitals and buttocks to expose maximum skin surface while still protecting the bedding from soiling. Measure phototherapy success every 12 hours or with daily serum bilirubin levels (more frequently if there is hemolysis or a higher level prior to initiation of phototherapy). Turn lights off while blood is drawn to ensure accurate serum bilirubin levels. Because it is not known if phototherapy injures the delicate eye structures, particularly the retina, apply eye patches over the newborn’s closed eyes during exposure to banks of phototherapy lights (Figure 31–10 ). Stop phototherapy and remove the eye patches at least once per shift to assess the eyes for conjunctivitis. Also remove patches to allow eye contact during feeding (social stimulation) or when parents are visiting (to promote parental attachment).
can be replaced before its effectiveness is lost. Be careful about using ointment under bilirubin lights because this combination may cause burns.

To parents, the terms jaundice, hyperbilirubinemia, exchange transfusion, and phototherapy may sound frightening and threatening. Some parents may feel guilty about their baby’s condition and think they have caused the problem. Under stress, parents may not be able to understand the physician’s first explanations. Anticipate that the parents will need explanations repeated and clarified and that they may need help voicing their questions and fears. Coach parents when they visit with the baby and encourage eye and tactile contact with the newborn. After the mother’s discharge, keep parents informed of their infant’s condition and encourage them to return to the hospital or call at any time so that they can be fully involved in the care of their infant. Advise parents that they can expect a rebound of 1 to 2 mg/dL after discontinuation of phototherapy and that a follow-up bilirubin test may be done (Watson, 2004).

While the mother is still hospitalized, phototherapy can also be carried out in the parents’ room if the only problem is hyperbilirubinemia. The parents must be willing to keep the baby in the room for 24 hours a day, be able to take emergency action (e.g., for choking) if necessary, and complete instruction checklists. Some institutions require that parents sign a consent form. Instruct the parents but also continue to monitor the infant’s temperature, activity, intake and output, and positioning of eye patches (if conventional light banks are used) at regular intervals (Table 31–3).

Nursing Care in the Community

Some studies have shown that with early discharge of newborns and their mothers comes an increase in hospital readmission and elevated risk of pathologic hyperbilirubinemia. Home phototherapy use is only recommended if

Most phototherapy units provide the desired level of irradiance when the infant is 45 to 50 cm below the lamps. Use a photometer to measure and maintain desired irradiance levels. Disadvantages of lights are that they create a difficult work environment and can distort an infant’s color. A harmless, temporary bronze discoloration of the skin may occur with phototherapy when the infant has elevated direct serum bilirubin levels or liver disease. As a side effect of phototherapy, some newborns develop a maculopapular rash.

Monitor the newborn’s temperature to prevent hyperthermia and hypothermia. The newborn needs additional fluids to compensate for the increased loss of water through the skin and loose stools. Loose stools and increased urine output result from increased bilirubin excretion. Observe the infant for signs of dehydration and perianal excoriation (see Skill 5–7).

When assessing the newborn’s skin color for jaundice and bronzing, also examine the skin for developing pressure areas. Reposition the newborn at least every 2 hours to permit the light to reach all skin surfaces, to prevent pressure areas, and to vary the stimulation to the infant. Keep track of the number of hours each lamp is used so that it

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**TABLE 31–3** Instructional Checklist for In-Room Phototherapy

| Explain and demonstrate the placement of eye patches and explain that they must be in place when the infant is under the lights. |
| Explain the clothing to be worn (diaper under lights, dress and wrap when away from the lights). |
| Explain the importance of taking the infant’s temperature regularly. |
| Explain the importance of adequate fluid intake. |
| Explain the charting flow sheet (intake, output, eyes covered). |
| Explain how to position the lights at a proper distance. |
| Explain the need to keep the infant under phototherapy except during feeding and diaper changes. |
the bilirubin level is plotted on the nomogram and found to be in the “optional phototherapy” range. Any neonate with a level in the higher range should be hospitalized for continual phototherapy and serum bilirubin levels closely monitored on a regular schedule (American Academy of Pediatrics Subcommittee on Hyperbilirubinemia, 2004).

Jaundice and its treatment can be very disturbing to parents and may generate feelings of guilt and fear. Reassurance and support are vital especially for the breastfeeding mother, who may question her ability to adequately nourish her newborn. The parents’ perception of and/or misconceptions about jaundice can affect parent-infant interactions. The nurse should explain the causes of jaundice and emphasize that it is usually a transient problem and one to which all infants must adapt after birth. It is essential that the impact of cultural beliefs be considered. Some Latina women believe that showing strong maternal emotions during pregnancy and during breastfeeding can be detrimental. “Bilis” associated with anger may be blamed by some Latina women for jaundice. Cultural beliefs lead mothers to interpret illness within their cultural framework, especially when left without clear and understood explanations. Maternal reactions can be lessened by careful explanations to the mothers about the diagnosis, prognosis, duration, management options for jaundice, and possibility of recurrence.

If the baby is to receive phototherapy at home, teach the parents to record the infant’s temperature, weight, fluid intake and output, stools, and feedings and to use the phototherapy equipment. If phototherapy lights are being used, parents must agree that the baby will be exposed to the lights for long periods of time; that they will hold the baby for only short periods for feeding, comforting, and diaper changing; and that the room temperature will be regulated to minimize heat loss. A combination of phototherapy lights and fiberoptic mattress may be used (Figure 31–11). Fiberoptic phototherapy blankets eliminate the need for eye patches, decrease heat loss because the baby is covered, and provide more chances for baby-parent interaction. The best method of home phototherapy depends on the cause of the hyperbilirubinemia and the rate of progression of the jaundice. Ongoing monitoring of bilirubin levels is essential with home phototherapy and can be carried out in the home, in the follow-up clinic, or in the clinician’s office.

**EVALUATION**

Expected outcomes of nursing care include the following:

- The newborn at risk for development of hyperbilirubinemia is identified, and care is provided to minimize the potential impact of hyperbilirubinemia.

**CARE OF THE NEWBORN WITH ANEMIA**

Neonatal anemia is often difficult to recognize by clinical evaluation alone. The hemoglobin concentration in a term newborn is 15 to 20 g/dL, slightly higher than that in premature newborns, in whom the mean hemoglobin is 14 to 18 g/dL. Infants with hemoglobin values of less than 14 g/dL (term) and 13 g/dL (preterm) are usually considered anemic. The most common causes of neonatal anemia are blood loss, hemolysis, and impaired RBC production.

Blood loss (hypovolemia) occurs in utero from placental bleeding (placenta previa or abruptio placentae). Intrapartal blood loss may be fetomaternal, fetofetal, or the result of umbilical cord bleeding. Birth trauma to abdominal organs or the cranium may produce significant blood loss, and cerebral bleeding may occur because of hypoxia.

Excessive hemolysis of RBCs is usually a result of blood group incompatibilities but may be caused by infection. The most common cause of impaired RBC production is a genetically transmitted deficiency in glucose-6-phosphate dehydrogenase (G6PD) deficiency. Anemia and jaundice are the presenting signs.

A condition known as physiologic anemia results from the normal gradual drop in hemoglobin for the first 6 to 12
weeks of life or corresponds with the decline in fetal hemoglobin. Theoretically the bone marrow stops production of RBCs in response to higher oxygen levels that result from breathing changes after birth. When the amount of hemoglobin decreases to levels of 10 to 11 g/dL at about 6 to 12 weeks of age in term newborns, the bone marrow begins production of RBCs again, and the anemia disappears.

Anemia in preterm newborns is seen earlier than in term newborns, and increased production of RBCs does not start until hemoglobin is 7 to 9 g/dL. The preterm baby’s hemoglobin reaches a low sooner (by 4 to 8 weeks after birth) than does a term newborn’s (6 to 12 weeks) because a preterm infant’s RBC survival time is shorter than that of a term newborn (Diehl-Jones & Askin, 2004). This difference is due to several factors: the preterm infant’s rapid growth rate, decreased iron stores, and an inadequate production of erythropoietin (EPO).

**CLINICAL THERAPY**

Hematologic problems can be anticipated based on the pregnancy history and clinical manifestations. The age at which anemia is first noted is also of diagnostic value. Clinically, light-skinned anemic infants are very pale when they do not have other symptoms of shock and usually have abnormally low RBC counts. In acute blood loss, symptoms of shock (such as pallor, low arterial blood pressure, and a decreasing hematocrit value) may be present.

The initial laboratory workup should include hemoglobin and hematocrit measurements, reticulocyte count, ferritin concentrations, examination of peripheral blood smear, bilirubin determinations, direct Coombs’ test of infant’s blood, and examination of maternal blood smear for fetal erythrocytes (Kleihauer-Betke test). Clinical management depends on the severity of the anemia and whether blood loss is acute or chronic. The baby should be placed on constant cardiac and respiratory monitoring. Mild or slow chronic anemia may be treated adequately with iron supplements alone or with iron-fortified formulas. Frequent determinations of hemoglobin, hematocrit, and bilirubin levels (in hemolytic disease) are essential. In severe cases of anemia, transfusions are the treatment of choice. Management of anemia due to prematurity includes recombinant human erythropoietin (rEPO) and supplemental iron. Blood transfusions (dedicated units of blood) are kept to a minimum.

**NURSING MANAGEMENT**

Assess the newborn for symptoms of anemia (pallor). If the blood loss is acute, the baby may show signs of shock (a capillary filling time greater than 3 seconds, decreased pulses, tachycardia, and low blood pressure). Continued observation identifies physiologic anemia as the preterm newborn grows. Signs of compromise include poor weight gain, tachycardia, tachypnea, and apneic episodes. Promptly report any symptoms indicating anemia or shock. Record the amount of blood drawn for all laboratory tests so that total blood removed can be assessed and replaced by transfusion when necessary. For long-term management, see “Normocytic Anemia” in Chapter 49.

**CARE OF THE NEWBORN WITH POLYCYTHEMIA**

**Polycythemia**, a condition in which blood volume and hematocrit values are increased, is more common in SGA and full-term infants with delayed cord clamping, maternal-fetal and twin-to-twin transfusions, or chronic intrauterine hypoxia than in other newborns (Diehl-Jones & Askin, 2004). An infant is considered polycythemic when the central venous hematocrit value is greater than 65% to 70% or the venous hemoglobin level is greater than 22 g/dL during the first week of life. Other conditions that present with polycythemia are chromosomal anomalies such as trisomy 21, 18, and 13; endocrine disorders such as hypoglycemia and hypocalcemia; and births at altitudes over 5000 feet.

**CLINICAL THERAPY**

The goal of therapy is to reduce the central venous hematocrit value to a range of 55% to 60% in symptomatic infants. To decrease the RBC mass, the symptomatic infant receives a partial exchange transfusion in which blood is removed from the infant and replaced milliliter for milliliter with fresh frozen plasma or 5% albumin. The infant needs supportive treatment of presenting symptoms until the condition is resolved; this usually happens spontaneously after the partial exchange transfusion.

**NURSING MANAGEMENT**

Assess for, record, and report symptoms of polycythemia. Also do an initial screening of the newborn’s hematocrit value on admission to the nursery. If a capillary hematocrit is done, warming the heel prior to obtaining the blood helps to decrease falsely high values. Peripheral venous hematocrit samples are usually obtained from the antecubital fossa.

Many infants are asymptomatic, but as symptoms develop, they are related to the increased blood volume, hyperviscosity (thickness) of the blood, and decreased deformability of RBCs, all of which result in poor perfusion of tissues. The infants have a characteristic plethoric (ruddy) appearance. The most common symptoms include:

- Tachycardia and congestive heart failure due to the increased blood volume.
- Respiratory distress with grunting, tachypnea, and cyanosis; increased oxygen need; or respiratory
hemorrhage due to pulmonary venous congestion, edema, and hypoxemia.

- Hyperbilirubinemia due to increased numbers of RBCs breaking down.
- Decrease in peripheral pulses, discoloration of extremities, alteration in activity or neurologic depression, renal vein thrombosis with decreased urine output, hematuria, or proteinuria due to thromboembolism.
- Jitteriness, decreased activity and tone, and seizures due to decreased perfusion of the brain and increased vascular resistance secondary to sluggish blood flow, which can result in neurologic or developmental problems.

Observe closely for the signs of distress or change in vital signs during the partial exchange. Assess carefully for partial exchange transfusion complications such as transfusion overload (which may result in congestive heart failure), irregular cardiac rhythm, bacterial infection, hypovolemia, and anemia. Reunite the newborn with the parents as soon as the baby’s status permits.

**CARE OF THE NEWBORN WITH INFECTION**

Newborns up to 1 month of age are particularly susceptible to an infection, referred to as *sepsis neonatorum*, caused by organisms that do not cause significant disease in older children. Once any infection occurs in the newborn, it can spread rapidly through the bloodstream, regardless of its primary site. The incidence of primary neonatal sepsis is 0.1 to 0.8 per 1000 live births (1% to 8%) (Glomella, 2004). The frequency of nosocomial infection is less in normal newborn infants and increases for infants in the NICU.

Prematurity and low birth weight are associated with nosocomial infection rates up to 15 times higher than average. The general debilitation and underlying illnesses often associated with prematurity necessitate invasive procedures such as umbilical catheterization, intubation, resuscitation, ventilator support, monitoring, parenteral alimentation (especially lipid emulsions), and prior broad-spectrum antibiotic therapy.

However, even full-term infants are susceptible, because their immunologic systems are immature. They lack the complex factors involved in effective phagocytosis and the ability to localize infection or to respond with a well-defined, recognizable inflammatory response. In addition, newborns lack the IgM immunoglobulin necessary to protect against bacteria, because it does not cross the placenta (refer to “Immunologic Adaptations” in Chapter 26 for immunologic adaptations in the newborn period ∞).

Most nosocomial infections in the NICU present as bacteremia or sepsis, urinary tract infections, meningitis, or pneumonia. Maternal antepartum infections such as rubella, toxoplasmosis, cytomegalic inclusion disease, and herpes may cause congenital infections and resulting disorders in the newborn. Intrapartum maternal infections, such as amnionitis and those resulting from premature rupture of membranes (PROM) and precipitous birth, are sources of neonatal infection (see “Care of the Woman with a Perinatal Infection” in Chapter 15 for more detailed information ∞). Passage through the birth canal and contact with the vaginal flora (β-hemolytic streptococci, herpes, *Listeria*, gonococci) expose the infant to infection (Table 31–4). When the fetus or newborn has an infection anywhere, the adjacent tissues or organs are easily penetrated. The blood-brain barrier is ineffective. Septicemia is more common in males, except for infections caused by group B β-hemolytic streptococci.

Gram-negative organisms (especially *Escherichia coli*, *Enterobacter*, *Proteus*, and *Klebsiella*) and the gram-positive organism β-hemolytic streptococcus are the most common causative agents. *Pseudomonas* is a common fomite contaminant of ventilator support and oxygen therapy equipment. Gram-positive bacteria, especially coagulase-negative staphylococci, are common pathogens in nosocomial bacteremias, pneumonias, and urinary tract infections. Other gram-positive bacteria that commonly cause infection are enterococci and *Staphylococcus aureus* (Glomella, 2004).

Protection of the newborn from infections starts prenatally and continues throughout pregnancy and birth. Prenatal prevention should include maternal screening for sexually transmitted infections and monitoring of rubella titers in women who test negative. Intrapartum sterile technique is essential. Smears from genital lesions are taken, and placental and amniotic fluid cultures are obtained if amnionitis is suspected. If genital herpes is present toward term, cesarean birth may be indicated. All newborns’ eyes should be treated with an antibiotic ophthalmic ointment to prevent damage from gonococcal infection. Prophylactic antibiotic therapy for asymptomatic women who test positive for group B streptococcus (GBS) during the intrapartum period helps prevent early-onset sepsis.

**CLINICAL THERAPY**

Cultures should be taken as soon after birth as possible for infants with a history of possible exposure to infection in utero (e.g., PROM more than 24 hours before birth or questionable maternal history of infection). They should be obtained before antibiotic therapy is begun.

1. One blood culture is obtained from different peripheral sites. They are taken from a peripheral rather than an umbilical vessel, because catheters may
### TABLE 31–4  
Maternally Transmitted Newborn Infections

<table>
<thead>
<tr>
<th>Infection</th>
<th>Nursing Assessment</th>
<th>Nursing Plan and Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group B Streptococcus</strong></td>
<td>Severe respiratory distress (grunting and cyanosis)</td>
<td>Early assessment of clinical signs necessary.</td>
</tr>
<tr>
<td>1%–2% colonized, with 1 in 10 developing disease</td>
<td>May become apneic or demonstrate symptoms of shock</td>
<td>Assist with x-ray examination—shows aspiration pneumonia or hyaline membrane disease.</td>
</tr>
<tr>
<td>Early onset—usually within hours of birth or within first week</td>
<td>Meconium-stained amniotic fluid seen at birth</td>
<td>Immediately obtain blood, gastric aspirate, external ear canal, and nasopharynx cultures.</td>
</tr>
<tr>
<td>Late onset—1 week to 3 months</td>
<td></td>
<td>Administer antibiotics, usually aqueous penicillin or ampicillin combined with gentamicin, as soon as cultures are obtained.</td>
</tr>
<tr>
<td><strong>Syphilis</strong></td>
<td></td>
<td>Early assessment and intervention are essential to survival.</td>
</tr>
<tr>
<td>Spirochetes cross placenta after 16th–18th week of gestation</td>
<td></td>
<td>Refer to evaluate for blindness, deafness, learning or behavioral problems.</td>
</tr>
<tr>
<td><strong>Gonorrhea</strong></td>
<td></td>
<td>Use isolation techniques until infants have been on antibiotics for 48 hours.</td>
</tr>
<tr>
<td>Approximately 30%–35% of newborns born vaginally to infected mothers acquire the infection</td>
<td></td>
<td>Administer penicillin.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provide emotional support for parents because of their feelings about mode of transmission and potential long-term sequelae.</td>
</tr>
<tr>
<td><strong>Herpes Type 2</strong></td>
<td></td>
<td>Carry out careful handwashing and gown and glove isolation with linen precautions.</td>
</tr>
<tr>
<td>1 in 7500 births</td>
<td></td>
<td>Administer intravenous vidarabine (Vira A) or acyclovir (Zovirax).</td>
</tr>
<tr>
<td>Usually transmitted during vaginal birth; a few cases of in utero transmission have been reported</td>
<td></td>
<td>Make a follow-up referral to evaluate potential sequelae of microcephaly, spasticity, seizures, deafness, or blindness.</td>
</tr>
<tr>
<td><strong>Oral Candidal Infection (Thrush)</strong></td>
<td></td>
<td>Encourage parental rooming-in and touching of their newborn.</td>
</tr>
<tr>
<td>Acquired during passage through birth canal</td>
<td></td>
<td>Show parents appropriate handwashing procedures and precautions to be used at home if mother's lesions are active.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Obtain throat, conjunctiva, cerebral spinal fluid (CSF), blood, urine, and lesion cultures to identify herpesvirus type 2 antibiotics in serum IgM fraction. Cultures positive in 24–48 hours.</td>
</tr>
<tr>
<td><strong>Chlamydia Trachomatis</strong></td>
<td></td>
<td>Differentiate white plaque areas from milk curds by using cotton tip applicator (if it is thrush, removal of white areas causes raw, bleeding areas).</td>
</tr>
<tr>
<td>Acquired during passage through birth canal</td>
<td></td>
<td>Maintain cleanliness of hands, linen, clothing, diapers, and feeding apparatus.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Instruct breastfeeding mothers on treating their nipples with nystatin.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Administer gentian violet (1%–2%) swabbed on oral lesions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Discuss with parents that gentian violet stains mouth and clothing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Avoid placing gentian violet on normal mucosa; it causes irritation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Carry out careful handwashing and gown and glove isolation with linen precautions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Administer intravenous vidarabine (Vira A) or acyclovir (Zovirax).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Make a follow-up referral to evaluate any loss of vision.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Administer 1% silver nitrate solution or ophthalmic antibiotic ointment (see “Drug Guide: Erythromycin [lotycin] Ophthalmic Ointment” in Chapter 28) or penicillin.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Make a follow-up referral to evaluate any loss of vision.</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Avoid placing gentian violet on normal mucosa; it causes irritation.</td>
</tr>
</tbody>
</table>
yield false-positive results due to contamination. The skin is prepared by cleaning with an unit-specific antiseptic solution and allowed to dry; the specimen is obtained with a sterile needle and syringe.

2. Spinal fluid culture is done following a spinal tap/lumbar puncture if there is concern of CNS symptoms/pathology.

3. The specimen for urine culture is best obtained by sterile catheterization or suprapubic bladder aspiration.

4. Skin cultures are taken of any lesions or drainage from lesions or reddened areas.

5. Nasopharyngeal, rectal, ear canal, conjunctival, and gastric aspirate cultures may be obtained.

Other laboratory investigations include a complete blood count, C-reactive protein (CRP), chest x-ray examination, serology, and Gram stains of cerebrospinal fluid, urine, skin exudate, and umbilicus. White blood cell (WBC) count with differential may indicate the presence or absence of sepsis. A level of 30,000–40,000 mm$^3$ WBCs may be normal in the first 24 hours of life, and a low WBC count (< 5000–7500/mm$^3$) may indicate sepsis. A low neutrophil count and a high band (immature WBCs) count indicate an infection. Stomach aspirate should be sent for culture and smear if a gonococcal infection or amnionitis is suspected. The C-reactive protein level may or may not be elevated. Serum IgM levels are elevated (normal level less than 20 mg/dL) in response to transplacental infections. If available, counterimmunoelctrophoresis tests for specific bacterial antigens are performed.

Evidence of congenital infections may be seen on skull x-ray films (cerebral calcifications such as in cytomegalovirus or toxoplasmosis), on bone x-ray films (syphilis or cytomegalovirus), and in serum-specific IgM levels (rubella). Cytomegalovirus infection is best diagnosed by urine culture.

Because neonatal infection causes high mortality, therapy begins before results of the septic workup are obtained. A combination of two broad-spectrum antibiotics, such as ampicillin and gentamicin, is given in large doses until a culture with sensitivities is obtained.

After the pathogen and its sensitivities are determined, appropriate specific antibiotic therapy is begun. Combinations of penicillin and gentamicin are increasingly being used because of kanamycin-resistant enterobacteria and penicillin-resistant staphylococcus. Rotating aminoglycosides has been suggested to prevent development of resistance. Use of cephalosporins and, in particular, cefotaxime has emerged as an alternative to aminoglycoside therapy in the treatment of neonatal infections. Duration of therapy varies from 7 to 14 days (Table 31–5). If cultures are negative and symptoms subside, antibiotics may be discontinued after 3 days. Supportive physiologic care may be required to maintain respiratory, hemodynamic, nutritional, and metabolic homeostasis.

**NURSING MANAGEMENT**

**NURSING ASSESSMENT AND DIAGNOSIS**

The nurse most often notices symptoms of infection during daily care of the newborn (Short, 2004). The infant may deteriorate rapidly in the first 12 to 24 hours after birth if β-hemolytic streptococcal infection is present, with signs and symptoms mimicking RDS. In other cases the onset of sepsis may be gradual, with more subtle signs and symptoms. The most common signs include the following:

1. Subtle behavioral changes; the infant “is not doing well” and is often lethargic or irritable (especially after the first 24 hours) and hypotonic; color changes may include pallor, duskyness, cyanosis, or a “shocky” appearance; skin is cool and clammy

2. Temperature instability, manifested by either hypothermia (recognized by a decrease in skin temperature) or, rarely in newborns, hyperthermia (elevation of skin temperature) necessitating a corresponding increase or decrease in isolette temperature to maintain a neutral thermal environment

3. Feeding intolerance, as evidenced by a decrease in total intake, abdominal distention, vomiting, poor sucking, lack of interest in feeding, and diarrhea

4. Hyperbilirubinemia

5. Tachycardia initially, followed by spells of apnea or bradycardia

Signs and symptoms may suggest CNS disease (jitteriness, tremors, seizure activity), respiratory system disease (tachypnea, labored respiration, apnea, cyanosis), hematologic disease (jaundice, petechial hemorrhages, hepatosplenomegaly), or gastrointestinal disease (diarrhea, vomiting, bile-stained aspirate, hepatomegaly). A differential diagnosis is necessary because symptoms are similar to those of other more specific conditions.

Nursing diagnoses that may apply to the infant with sepsis neonatorum and the family include the following:

- **Risk for Infection** related to newborn’s immature immunologic system
- **Fluid Volume Deficit** related to feeding intolerance
- **Ineffective Family Coping** related to present illness resulting in prolonged hospital stay for the newborn
**TABLE 31–5** Neonatal Sepsis Antibiotic Therapy

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose (mg/kg) Total Daily Dose</th>
<th>Schedule for Divided Doses</th>
<th>Route</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ampicillin</td>
<td>50–100 mg/kg</td>
<td>Every 12 hours†</td>
<td>IM or IV</td>
<td>Effective against gram-positive microorganisms, <em>Haemophilus influenzae</em>, and most <em>Escherichia coli</em> strains. Higher doses indicated for meningitis. Used with aminoglycosides for synergy.</td>
</tr>
<tr>
<td>Cefotaxime</td>
<td>50 mg/kg</td>
<td>Every 12 hours‡</td>
<td>IM or IV</td>
<td>Active against most major pathogens in infants; effective against aminoglycoside-resistant organisms; achieves CSF bactericidal activity; lack of ototoxicity and nephrotoxicity; wide therapeutic index (levels not required); resistant organisms can develop rapidly if used extensively; ineffective against <em>Pseudomonas</em>, <em>Listeria</em>.</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>2.5–3 mg/kg</td>
<td>Every 12–24 hours†</td>
<td>IM or IV</td>
<td>Effective against gram-negative rods and staphylococci; may be used instead of kanamycin against penicillin-resistant staphylococci and <em>E. coli</em> strains and <em>Pseudomonas aeruginosa</em>. May cause ototoxicity and nephrotoxicity. Need to follow serum levels. Must never be given as IV push. Must be given over at least 30–60 minutes. In presence of oliguria or anuria, dose must be decreased or discontinued. In infants less than 1000 g or 29 weeks, lower dosage 2.5–3 mg/kg/day. Monitor serum levels before administration of second dose.</td>
</tr>
<tr>
<td>Methicillin</td>
<td>25–50 mg/dose</td>
<td>Every 12 hours†</td>
<td>IM or IV</td>
<td>Effective against penicillinase-resistant staphylococci. Monitor CBC and UA. Slow IV push.</td>
</tr>
<tr>
<td>Nafcillin</td>
<td>25–50 mg/kg</td>
<td>Every 8–12 hours§</td>
<td>IM or IV</td>
<td>Effectve against penicillinase-resistant staphylococci. Caution in presence of jaundice.</td>
</tr>
<tr>
<td>Penicillin G (aqueous crystalline)</td>
<td>25,000–50,000 units/kg 50,000–125,000 units/kg/day</td>
<td>Every 12 hours†</td>
<td>IM or IV</td>
<td>Initial sepsis therapy effective against most gram-positive microorganisms except resistant staphylococci; can cause heart block in infants.</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>10–20 mg/kg</td>
<td>Every 12–24 hours†</td>
<td>IV</td>
<td>Effective for methicillin-resistant strains (<em>Staphylococcus epidermidis</em>); must be administered by slow intravenous infusion to avoid prolonged cutaneous eruption. For smaller infants, &lt; 1200 g, &lt; 29 weeks, smaller dosages and longer intervals between doses. Nephrotoxic, especially in combination with aminoglycosides. Slow IV infusion over at least 60 minutes. Peak 25–40 mcg/mL Trough 5–10 mcg/mL</td>
</tr>
</tbody>
</table>

*Up to 7 days of age.
†Greater than 7 days of age.
§Dependent on gestational age.
PLANNING AND IMPLEMENTATION

In the nursery, environmental control and prevention of acquired infection are the responsibilities of the neonatal nurse. An infected newborn can be effectively isolated in an isolette and receive close observation. Promote strict handwashing technique for all who enter the nursery, including nursing colleagues; physicians; laboratory, x-ray, and respiratory therapists; and parents. Discourage visits to the nursery area by unnecessary personnel. Be prepared to assist in the aseptic collection of specimens for laboratory investigations. Scrupulous equipment care (per agency protocol)—changing and cleaning of isolettes, removing and sterilizing wet equipment, preventing cross use of linen and equipment, cleaning sink-side equipment such as soap containers periodically, and taking special care with the open radiant warmers (access without prior handwashing is much more likely than with the closed isolette)—prevents contamination.

Provision of Antibiotic Therapy

Administer antibiotics as ordered by the nurse practitioner or physician. In addition to the five rights of drug administration, be knowledgeable about the following:

- The proper dose to be administered, based on the weight of the newborn and desired peak and trough levels
- The appropriate route of administration, because some antibiotics cannot be given intravenously
- Admixture incompatibilities, because some antibiotics are precipitated by intravenous solutions or by other antibiotics
- Side effects and toxicity

In term infants being treated for infections, neonatal home infusion of antibiotics should be considered as a viable alternative to continued hospitalization. The infusion of antibiotics at home by skilled RNs facilitates parent-infant bonding while meeting the infant’s ongoing healthcare needs.

Provision of Supportive Care

In addition to antibiotic therapy, physiologic supportive care is essential in caring for a septic infant. Responsibilities of the nurse include the following:

- Provide adequate calories; oral feedings may be discontinued due to increased mucus, abdominal distention, vomiting, and aspiration.
- Provide fluids and electrolytes to maintain homeostasis; monitor weight changes, urine output, and urine specific gravity.
- Observe for the development of hypoglycemia, hyperglycemia, acidosis, hyponatremia, and hypocalcemia.

Restricting parents’ visits to the nursery has not been shown to have any effect on the rate of infection and may be harmful for the newborn’s psychologic development. With instruction and guidance, both parents should be allowed to handle the baby and participate in daily care. Support of the parents is crucial. They need to be informed of the newborn’s prognosis as treatment continues and to be involved in care as much as possible. They also need to understand how infection is transmitted.

EVALUATION

Expected outcomes of nursing care include the following:

- The risks for development of sepsis are identified early, and immediate action is taken to minimize the development of the illness.
- Appropriate use of aseptic technique protects the newborn from further exposure to illness.
- The baby’s symptoms are relieved, and the infection is treated.
- The parents verbalize their concerns about their baby’s illness and understand the rationale behind the management of their newborn.

CARE OF THE FAMILY OF AN AT-RISK NEWBORN

The birth of a preterm or ill infant or an infant with a congenital anomaly is a serious crisis for a family. Throughout the pregnancy, the parents have felt excitement, experienced thoughts of acceptance, and pictured what their baby would look like. Both parents have wished for a perfect baby and feared an unhealthy one. Each parent and family member must accept and adjust when the fantasized fears become reality.

PARENTAL RESPONSES

Family members have acute grief reactions to the loss of the idealized baby they have envisioned. In a preterm birth, the mother is denied the last few weeks of pregnancy that seem to prepare her psychologically for the stress of birth and the
attachment process. Attachment at this time is fragile, and interruption of the process by separation can affect the future mother-child relationship. Parents express grief as shock and disbelief, denial of reality, anger toward self and others, guilt, blame, and concern for the future. Self-esteem and feelings of self-worth are jeopardized.

Feelings of guilt and failure often plague mothers of preterm newborns. They may question themselves: “Why did labor start?” or “What did I do [or not do]?” A woman may have guilt fantasies and wonder: “Was it because I had sex with my husband [a week, 3 days, a day] ago?” “Was it because I carried three loads of wash up from the basement?” or “Am I being punished for something done in the past—even in childhood?”

The period of waiting between suspicion and confirmation of abnormality or dysfunction is a very anxious one for parents because it is difficult, if not impossible, to begin attachment to the infant if the newborn's future is questionable. During the waiting period, parents need support and acknowledgment that this is an anxious time. They must be kept informed about tests and efforts to gather additional data, as well as efforts to improve their baby's outcome. It is helpful to tell both parents about the problem at the same time, with the baby present. An honest discussion of the problem and anticipatory management at the earliest possible time by health professionals help the parents (1) maintain trust in the physician and nurse, (2) appreciate the reality of the situation by dispelling fantasy and misconception, (3) begin the grieving process, and (4) mobilize internal and external support.

Although reactions and steps of attachment are altered by the birth of these infants, a healthy parent-child relationship can occur. Kaplan and Mason (1974) identified four psychologic tasks as essential for coping with the stress of an at-risk newborn and for providing a basis for the maternal-infant relationship:

1. Anticipatory grief as a psychologic preparation for possible loss of the child while still hoping for his or her survival
2. Acknowledgment of maternal failure to produce a term or perfect newborn expressed as anticipatory grief and depression and lasting until the chances of survival seem secure
3. Resumption of the process of relating to the infant, which was interrupted by the threat of nonsurvival; continuous threat of death or abnormality may impair this task, and the mother may be slow in her response of hope for the infant's survival
4. Understanding of the special needs and growth patterns of the at-risk newborn, which are temporary and yield to normal patterns

Solnit and Stark (1961) postulated that grief and mourning over the loss of the loved object—the idealized child—mark parental reactions to a child with abnormalities. Grief work, the emotional reaction to a significant loss, must occur before adequate attachment to the actual child is possible. Parental detachment precedes parental attachment. The parents must first grieve the loss of the wished-for perfect child and then must adopt the imperfect child as the new love object.

Parental responses to a child with health problems may be viewed as a five-stage process (Klaus & Kennell, 1982):

1. Shock is felt at the reality of the birth of this child. This stage may be characterized by forgetfulness, amnesia about the situation, and a feeling of desperation.
2. There is disbelief (denial) of the reality of the situation, characterized by a refusal to believe the child has a problem. This stage is exemplified by assertions that “It didn't really happen!” or “There has been a mistake; it's someone else's baby.”
3. Depression over the reality of the situation and a corresponding grief reaction follows acceptance of the situation. This stage is characterized by much crying and sadness. Anger may also emerge at this stage. A projection of blame on others or on self and feelings of “not me” are characteristic of this stage.
4. Equilibrium and acceptance are characteristic of a decrease in the emotional reactions of the parents. This stage is variable and may be prolonged by a continuing threat to the infant’s survival. Some parents feel chronic sorrow in relation to their child.
5. Reorganization of the family is necessary to deal with the child’s problems. Mutual support of the parents facilitates this process, but the crisis of the situation may precipitate alienation between the mother and father.

**DEVELOPMENTAL CONSEQUENCES**

The baby who is born prematurely, is ill, or has a malformation or disorder is at risk for emotional, intellectual, and cognitive developmental delays. The risk is directly proportional to the seriousness of the problem and the length of treatment. The necessary physical separation of family and infant and the tremendous emotional and financial burdens may adversely affect the parent-child relationship. The recent trend to involve the parents with their newborn early, repeatedly, and over protracted periods of time has done much to facilitate positive parent-child relationships.

Parents must have a clear picture of the reality of the disability and the types of developmental hurdles ahead. Unexpected behaviors and responses from the baby due to his or her problem or disorder can be upsetting and frightening.
The demands of care for the child and disputes regarding management or behavior stress family relationships. The entire multidisciplinary team may need to pool their resources and expertise to help parents of children born with problems or disorders so that both parents and children can thrive.

**NURSING MANAGEMENT**

**NURSING ASSESSMENT AND DIAGNOSIS**

A positive nurse-family relationship helps information gathering in areas of concern. A concurrent illness of the mother or other family members or other concurrent stress (lack of hospitalization insurance, loss of job, age of parents) may change the family response to the baby. Feelings of apprehension, guilt, failure, and grief expressed verbally or nonverbally are important aspects of the nursing history. These observations enable all professionals to be aware of the parental state, coping behaviors, and readiness for attachment, bonding, and caretaking. Appropriate nursing assessments during interviewing and relating to the family include the following:

1. **Level of understanding**: observations concerning the ability to assimilate the information given and to ask appropriate questions; the need for constant repetition of information
2. **Behavioral responses**: appropriateness of behavior in relation to information given; lack of response; flat affect
3. **Difficulties with communication**: deafness (reads lips only); blindness; dysphagia; understanding only of foreign language
4. **Paternal and maternal education level**: parents unable to read or write; parents with eighth-grade-level education; parents with a graduate-level degree or healthcare background

Documenting such information, gathered through continuing contact and development of a therapeutic relationship with the family, lets all professionals understand and use the nursing history to provide continuous individual care.

Visiting and caregiving patterns indicate the level or lack of parental attachment. A record of visits, caretaking procedures, affect (in relating to the newborn), and telephone calls is essential. It is important to note serial observations rather than just isolated observations that cause concern. Grant (1978) developed a conceptual framework depicting adaptive and maladaptive responses to parenting an infant with an actual or potential problem (Figure 31–12).

If a pattern of distancing behaviors evolves, intervene appropriately. Follow-up studies have found that a statistically significant number of preterm, sick, and congenitally defective infants suffer from failure to thrive, battering, or other parenting disorders. Early detection and intervention prevents these aberrations in parenting behaviors from leading to irreparable damage or death.

Nursing diagnoses that may apply to the family of a newborn at risk include the following:

- **Dysfunctional Grieving** related to loss of idealized newborn
- **Fear** related to emotional involvement with an at-risk newborn
- **Altered Parenting** related to impaired bonding secondary to feelings of inadequacy about caretaking activities

**PLANNING AND IMPLEMENTATION**

**Hospital-Based Nursing Care**

In their sensitive and vulnerable state, parents are acutely perceptive of others’ responses and reactions (particularly nonverbal) to the child. Parents can be expected to identify with the responses of others. Therefore, it is imperative that medical and nursing staff be fully aware of and come to terms with their own feelings so they are comfortable and at ease with the baby and grieving family.

Nurses may feel uncomfortable, may not know what to say to parents, or may fear confronting their own feelings as well as those of the parents. Each nurse must work out personal reactions with instructors, peers, clergy, parents, or significant others. It is helpful to have a stockpile of therapeutic questions and statements to initiate meaningful dialogue with parents. Opening statements might include the following: “You must be wondering what could have caused this,” “Are you thinking that you (or someone else) may have done something?” “How can I help?” and “Are you wondering how you are going to manage?” Avoid statements such as “It could have been worse,” “It’s God’s will,” “You have other children,” “You are still young and can have more,” and “I understand how you feel.” This child is important now.

**Support of Parents for Initial Visit to the Newborn.** Before parents see their child, prepare them for the visit. Maintain a positive, realistic attitude about the infant. An overly negative, fatalistic attitude further alienates the parents from their infant and retards attachment behaviors. Instead of beginning to bond with their child, the parents will anticipate their loss and begin the process of grieving. Once started, the grieving process is difficult to reverse.

Before preparing parents for the first view of their infant, observe the baby. All infants exhibit strengths as well
Maladaptive and adaptive parental responses during crisis period, showing unhealthy and healthy outcomes.

Used with permission from Grant, P. (1978). Psychological needs of families of high-risk infants. Family and Community Health, 11(3), 93; with permission of Aspen Publishers, Inc., © 1978. 11, 93, Fig. 1, Philadelphia: Lippincott Williams & Wilkins.

Upon entering the unit, parents may be overwhelmed by the sounds of monitors, alarms, and respirators, as well as by the unfamiliar language and “foreign” atmosphere. Preparing the parents by having the same healthcare professionals accompany them to the unit can be reassuring. The primary nurse and physician caring for the newborn need to be with the parents when they first visit their baby. Parental reactions vary, but initially there is usually an element of shock. Help them by providing chairs and time to regain composure. Slow, complete, and simple explanations—first about the infant and then about the equipment—allay fear and anxiety.

As parents attempt to deal with the initial stages of shock and grief, they may fail to grasp new information.
This 25 weeks’ gestational age infant with respiratory distress syndrome may be frightening for her parents to see for the first time due to the technology that is attached to her.

**Figure 31–13**

They may need repeated explanations to accept the reality of the situation, procedures, equipment, and the infant’s condition on subsequent visits.

Concern about the infant’s physical appearance is common yet may remain unvoiced. Parents may express such concerns as, “He looks so small and red—like a drowned rat,” “Why do her genitals look so abnormal?” and “Will that awful-looking mouth [cleft lip and palate] ever be normal?” Anticipate and address such questions. Use of pictures, such as of an infant after cleft lip repair, may be reassuring to doubting parents. Knowledge of the development of a “normal” preterm infant allows the nurse to make reassuring statements such as, “The baby’s skin may look very red and transparent with lots of visible veins, but it is normal for her maturity. As she grows, subcutaneous fat will be laid down, and these superficial veins will begin to disappear.”

The nursing staff set the tone of the NICU. Nurses foster the development of a safe, trusting environment by viewing the parents as essential caregivers, not as visitors or nuisances in the unit. Providing privacy when needed and offering easy access to staff and facilities are important in developing an open, comfortable environment. An uncrowded and welcoming atmosphere lets parents know they are welcome there. However, even in crowded physical surroundings, the nurses can convey an attitude of openness and trust.

A trusting relationship is essential for collaborative efforts in caring for the infant. Therapeutically use personal responses to relate to the parents on a one-to-one basis. Each person has different needs, different ways of adapting to crisis, and different means of support. Use techniques that feel real and spontaneous, and avoid words or actions that feel foreign. Gauge interventions so that they match the parents’ pace and needs.

**Facilitation of Attachment if Neonatal Transport Occurs.** Transport to a regional referral center that may be some distance from the parents’ community may be necessary. It is essential that the mother see and touch her infant before the infant is transported. Bring the mother to the nursery or take the infant in a warmed transport isolette to the mother’s bedside to let her see the infant before transportation to the center. When the infant reaches the referral center, a staff member should call the parents with information about the infant’s condition during transport, safe arrival at the center, and present condition.

Support of parents with explanations from the professional staff is crucial. Occasionally the mother may be unable to see the infant before transport (e.g., if she is still under general anesthesia or experiencing complications such as shock, hemorrhage, or seizures). In these cases, take a photograph of the infant to give to the mother, and provide an explanation of the infant’s condition and problems and a detailed description of the infant’s characteristics. An additional photograph is also helpful for the father to share with siblings or extended family. With the increased attention on improved fetal outcome, prenatal maternal transports, rather than neonatal transports, are occurring more frequently. This practice gives the mother of an at-risk infant the opportunity to visit and care for her infant during the early postpartal period.

**Promotion of Touching and Parental Caretaking.** Parents visiting a small or sick infant may need several visits to become comfortable and confident in their ability to touch the infant without injuring him or her. Barriers such as isolettes, incisions, monitor electrodes, and tubes may delay the mother’s development of comfort in touching the newborn. Knowledge of this normal delay in touching behavior will help the nurse understand parental behavior.

Klaus and Kennell (1982) demonstrated a significant difference in the amount of eye contact and touching behaviors of mothers of normal newborns and mothers of preterm infants. Whereas mothers of normal newborns progress within minutes to palm contact of the infant’s trunk, mothers of preterm infants are slower to progress from fingertip to palm contact and from the extremities to the trunk. The progression to palm contact with the infant’s trunk may take several visits to the nursery.

Use support, reassurance, and encouragement to help the mother develop positive feelings about her parenting abilities and her importance to her infant. Touching facilitates familiarity with the infant and thus establishes a bond.
The Newborn at Risk: Birth-Related Stressors

Mother of this 26 weeks’ gestational age, 600-g baby begins attachment through fingertip touch.  
Courtesy of Lisa Smith-Pedersen, RNC, MSN, NNP.

Encourage parents to meet their newborn’s need for stimulation. Stroking, rocking, cuddling, singing, and talking should be an integral part of the parents’ caretaking responsibilities. Promote bonding by encouraging parents to visit and become involved in their baby’s care (Figure 31–15). When visiting is impossible, the parents should feel free to phone whenever they wish to receive information about their baby. A warm, receptive attitude provides support. Facilitate parenting by personalizing a baby to the parents, by referring to the infant by name, or by relating personal behavioral characteristics. Remarks such as “Jenny loves her pacifier” help make the infant seem individual and unique.

The variety of equipment needed for life support is hardly conducive to anxiety-free caretaking by the parents. However, parents may care for even the sickest infant, if only in a small way. Promote the parents’ success by facilitating parental caretaking. Demonstration and explanation, followed by support of the parents in initial caretaking behaviors, positively reinforce this behavior. Changing their infant’s diaper, providing skin or oral care, or helping turn the infant may at first provoke anxiety, but the parents will become more comfortable and confident in caretaking and feel satisfied by the baby’s reactions and their ability “to do something.” Complimenting the parents’ competence in caretaking also increases their self-esteem, which may have been damaged by feelings of guilt and failure. Never give the parents a task that they might not be able to accomplish. Cues that the parents are ready to become involved with the child’s care include their reference to the baby by name and their questioning as to amount of feeding taken, sleeping patterns, appearance today, and the like (Loo, Espinosa, Tyler et al., 2003).

Often parents of high-risk infants have ambivalent feelings toward the nurse. As they watch the nurse competently perform caretaking tasks, they may feel both grateful for the nurse’s abilities and expertise and jealous of the nurse’s ability to care for their infant (Bruns & McCollum, 2002). These feelings may take the form of criticism of the care of the infant, manipulation of staff, or personal guilt. Instead of fostering (by silence) these inferiority feelings of parents, recognize that such feelings are needed to intervene appropriately to enhance parent-infant attachment. For example, avoid making unfavorable comparisons between the baby’s responses to parental and nursing caretaking. During a quiet time it may help to encourage the parents to talk about their hopes and fears and to facilitate their involvement in parent groups. Parents are also often anxious when their baby is transferred from the NICU to the “regular nursery.” They may feel that their infant is not being cared for as proficiently because the nurses are not at the infant’s bedside as often as they were in the NICU.

Verbalizations that improve parental self-esteem are essential and easily shared. For example, point out that, in addition to physiologic use, breast milk is important because of the emotional investment of the mother. Pumping, storing,
labeling, and delivering quantities of breast milk is a time-consuming labor of love for mothers. Positive remarks about breast milk reinforce the maternal behavior of caretaking and providing for her infant: “Breast milk is something that only you can give your baby,” “You really have brought a lot of milk today,” “Look how rich this breast milk is,” or “Even small amounts of milk are important, and look how rich it is.”

If the infant begins to gain weight while being fed breast milk, it is important to point this correlation out to the mother. Advise the parents that initial weight loss with beginning nipple-feedings is common because of the increased energy expended when the infant begins active rather than passive nutritional intake.

Encourage parents to provide care for their infant even if the baby is very sick and likely to die. Detachment is easier after attachment, because the parents are comforted by the knowledge that they did all they could for their child while he or she was alive.

Facilitation of Family Adjustment. During crisis it is difficult to maintain interpersonal relationships. Yet in a newborn intensive care area, the parents are expected to relate to many different care providers. It is important that parents have as few professionals as possible relaying information to them. A primary nurse should coordinate care and provide continuity for parents. Care providers are individuals and thus will use different terms, inflections, and attitudes. These subtle differences are monumental to parents and may confuse, confound, and produce anxiety. The transfer of the baby from NICU to a step-down unit or transport back to the home hospital provokes parental anxiety because they must now deal with new healthcare professionals. The nurse not only functions as a liaison between the parents and the various professionals interacting with the infant and parents but also offers clarification, explanation, interpretation of information, and support to the parents.

Encourage parents to deal with the crisis with help from their support system. The support system attempts to meet the emotional needs and to provide support for the family members in crisis and stress situations. Biologic kinship is not the only valid criterion for a support system; an emotional kinship is the most important factor. In our mobile society of isolated nuclear families, the support system may be a next-door neighbor, a best friend, or perhaps a schoolmate. Search out the significant others in the lives of the parents and help them understand the problems so that they can support the parents.

The impact of the crisis on the family is individual and varied. Interact with the family to find out about the family’s ability to adapt to the situation. To begin appropriate interventions, view the birth of the infant (normal newborn, preterm infant, or infant with congenital anomaly) as it is defined by the family.

It is important to encourage open communication within the family. Discourage family members from keeping secrets from one another, especially between spouses, because secrets undermine the trust of relationships. Well-meaning rationales such as “I want to protect her,” “I don’t want him to worry about it,” and so on can be destructive to open communication and to the basic element of a relationship—trust.

Open communication is especially important when the mother is hospitalized apart from the infant. The first person to visit the infant relays information regarding the infant’s care and condition to the mother and family. In this situation the mother has had minimal contact, if any, with her infant. Because of her anxiety and isolation, she may mistrust all those who provide information (the father, nurse, physician, or extended family) until she sees the infant for herself. This can put tremendous stress on the relationship between spouses. The parents (and family) should be given information together. This practice helps overcome misunderstandings and misinterpretations and promotes cooperative “working through” of problems.

Encourage the entire family—siblings as well as other relatives—to visit and obtain information about the baby. Interventions that help the family cope with the situation include providing support, confronting the crisis, and understanding the reality. Support, explanations, and the helping role must include the extended family, as well as the nuclear family, to aid the extended family in communication and to support ties with the nuclear family.

Do not overlook the needs of siblings. Siblings have been looking forward to the new baby, and they too suffer a degree of loss. Young children may react with hostility and older ones with shame at the birth of an infant with an anomaly. Both reactions may make them feel guilty. Parents, who may be preoccupied with working through their own feelings, often cannot give the other children the attention and support they need. Sometimes another child becomes the focus of family tension. Anxiety can take the form of finding fault or of over-concern. This is a form of denial; the parents cannot face the real worry—the infant at risk. After assessing the situation, the observant nurse can ensure that another family member or friend steps in to support the siblings of the affected baby.

Respect and seek to meet the desires and needs of the people involved and understand that differences can exist side by side. It is often possible to elicit the parents’ feelings about the experience by asking “How are you doing?” The emphasis is on the word you, and the interest must be sincere.

Parents from minority cultures must deal with language barriers and cultural differences that can make feelings of isolation and uncertainty more acute (Shah & Campbell, 2004). Feelings of isolation and uncertainty influence not only the parents’ emotional responses to the ill newborn, but also their ability to access and use services as well as their interaction with health professionals. Hospital
cultural interpreter programs can assist families with interactions with staff, and provide translation during family meetings and multidisciplinary family conferences.

Families with children in the NICU may become friends and support one another. To encourage the development of these friendships and to provide support, many units have established parent groups. The core of the groups consists of parents whose infants were once in the intensive care unit. Most groups make contact with families within a day or two of the infant’s admission to the unit, through either phone calls or visits to the hospital. Early one-on-one parent contacts are more effective than discussion groups in helping families work through their feelings. This personalized method gives the grieving parents a chance to express personal feelings about the pregnancy, labor, and birth and their different-than-expected infant with others who have experienced the same feelings and with whom they can identify.

**Nursing Care in the Community**

PredischARGE planning begins once the infant’s condition becomes stable and it seems likely the newborn will survive (AAP & ACOG, 2002). Discharge preparation and care conferences should involve a multidisciplinary team approach. NICU nursing staff is the fulcrum for aiding in the transition of high-risk infants from the intensive care unit to the home. Effective open communication with families during the entire discharge-planning phase of care empowers them to assume the role of primary caregiver for their children (Allen, Donohue, & Porter, 2002).

Adequate predischarge teaching helps parents transform any feelings of inadequacy they may have into feelings of self-assurance and attachment. From the beginning, teach the parents about their infant’s special needs and growth patterns. This teaching and involvement are best facilitated by a nurse who is familiar with the infant and his or her family and who has developed a comfortable and supportive relationship with them. When twins are being discharged, inform parents that cobedding of twins allows for clustering of care and facilitates the parents’ ability to spend time with both of their children (Figure 31–16).

Provide home care instructions in an optimal environment for parental learning. Learning should take place over time, to avoid bombarding the parents with instructions in the day or hour before discharge. Parents often enjoy performing minimal caretaking tasks, with gradual expansion of their role.

Many NICUs provide facilities for parents to room-in with their infants for a few days before discharge. This

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**COMPLEMENTARY CARE**

**COBEDDING OF TWINS**

As NICUs have become more and more “developmentally” friendly, complementary and alternative therapies have become an adjunct to that nurturing environment.

Cobedding of stable twins and higher order multiples replicates the closeness of the in utero environment whereby the siblings are placed together in the same incubator or crib to maintain physical contact. Clustering of care provided by the bedside nurse is a true advantage to cobedding. This in turn proves beneficial to the parents because they have interactions with fewer nurses and other members of the healthcare team. In addition the parents can care for and visit with all the infants at one time (Lutes & Altimier, 2001). Discharge teaching, therefore, is easily facilitated. Cobedding is also a strategy to maximize the synchronization of sleep-wake cycles (Hayward, 2003; Lutes & Altimier, 2001).
practice allows parents a degree of independence in the care of their infant with the security of nursing help nearby. It is particularly helpful for anxious parents, parents who have not had the opportunity to spend extended time with their infant, or parents who will be giving complex physical care at home, such as tracheostomy care.

Transitional care centers (TCCs) also allow parents to master caring for the at-risk newborn prior to discharge. The TCCs shorten the length of hospitalization and decrease readmission rates (Allen et al., 2002). Families are able to interact with the staff while gradually transitioning to the role of sole caretakers of their medically complex, high-risk infant. When discharging a medically fragile infant to home, schedule a predischarge home visit by a public health nurse or home health agency. This predischarge visit evaluates the home for any possible issues that may complicate the parents’ ability to care for their at-risk infant, especially if there are multiple monitoring-equipment needs.

The basic elements of discharge and home care instruction are as follows:

1. Teach the parents routine well-baby care, such as bathing, taking a temperature, preparing formula, and breastfeeding.
2. Help parents learn to do special procedures as needed by the newborn, such as gavage or gastrostomy feedings, tracheostomy or enterostomy care, medication administration, cardiopulmonary resuscitation (CPR), and operation of the apnea monitor. Before discharge, the parents should be as comfortable as possible with these tasks and should demonstrate independence. Written instructions are useful for parents to refer to once they are home with the infant, but they should not replace actual participation in the infant’s care.
3. Make sure that all applicable screening (metabolic, vision, hearing) tests, immunization, and respiratory syncytial virus (RSV) prophylaxis are done prior to discharge and that all records are given to the primary care provider and parents.
4. Refer parents to community health and support organizations. The Visiting Nurses’ Association, public health nurses, or social services can assist the parents in the stressful transition from hospital to home by providing predischarge home visits and then the necessary home teaching and support. Some NICUs have their own parent support groups to help bridge the gap between hospital and home care. Parents can also find support from a variety of community organizations, such as mothers-of-twins groups, trisomy 13 clubs, the March of Dimes Birth Defects Foundation, handicapped children services, and teen mother and child programs. Each community has numerous agencies capable of assisting the family in adapting emotionally, physically, and financially to the chronically ill infant. Be familiar with community resources and help the parents identify which agencies may benefit them.
5. Help parents recognize the growth and development needs of their infant. A development program begun in the hospital can be continued at home, or refer parents to an infant development program in the community.
6. Arrange medical follow-up care before discharge. A family pediatrician, a well-baby clinic, or a specialty clinic may provide follow-up care for the infant. The first appointment should be made before the infant is discharged from the hospital.
7. Evaluate the need for special equipment for infant care (such as a respirator, oxygen, apnea monitor) in the home. Any equipment or supplies should be in the home before the infant’s discharge.
8. Arrange for neonatal hospice for parents of the medically fragile infant as needed.

Further evaluation after the infant has gone home is useful in determining whether the crisis has been resolved satisfactorily. The parents are usually given the intensive care nursery’s telephone number to call for support and advice. It is a good idea for staff to follow up with each family with visits or telephone calls at intervals for several weeks to assess and evaluate the infant’s (and parents’) progress.

EVALUATION

Expected outcomes of nursing care include the following:

- The parents are able to verbalize their feelings of grief and loss.
- The parents verbalize their concerns about their baby’s health problems, care needs, and potential outcome.
- The parents participate in their infant’s care and show attachment behaviors.

CONSIDERATIONS FOR THE NURSE WHO WORKS WITH AT-RISK NEWBORNS

The birth of a baby with a problem is a traumatic event with the potential for either disruption or growth of the involved family. The staff NICU nurses may never see the long-term results of the specialized, sensitive care they give to parents and their newborns. Their only immediate evidence of effective care may be the beginning of resolution of parental grief; discharge of a recovered, thriving infant to the care of happy parents; and the beginning of reintegration of family life.
Nurses cannot provide support unless they themselves are supported. Working in an emotional environment of life-and-death situations takes its toll on staff. NICUs are among the most stressful areas in healthcare for patients, families, and nurses. Nurses bear most of the stress and largely determine the atmosphere of the NICU. The nurse's ability to cope with stress is the key to creating an emotionally healthy environment and a positive working atmosphere. The emotional needs and feelings of the staff must be recognized and dealt with so that staff can support the parents. An environment of openness to feelings and support in dealing with their human needs and emotions is essential for personnel.

As caregivers, nurses may be unaware of their need to grieve for their own losses in the NICU. Nurses must also go through the grief work that parents experience. Techniques such as group meetings, individual support, and primary care nursing may help maintain staff mental health.
Discuss selected metabolic abnormalities (including cold stress and hypoglycemia), their effects on the newborn, and the nursing implications.

Differentiate between physiologic and pathologic jaundice based on onset, cause, possible sequelae, and specific management.

Explain how Rh incompatibility or ABO incompatibility can lead to the development of hyperbilirubinemia.

Identify nursing responsibilities in caring for the newborn receiving phototherapy.

Discuss selected hematologic problems such as anemia and polycythemia and the nursing implications associated with each one.

Describe the nursing assessments that would lead the nurse to suspect newborn sepsis.

Relate the consequences of selected maternally transmitted infections, such as maternal syphilis, gonorrhea, herpesvirus, and chlamydia, to the care of the infant in the neonatal period.

**LEARNING OBJECTIVES**

Discuss selected metabolic abnormalities (including cold stress and hypoglycemia), their effects on the newborn, and the nursing implications.

Differentiate between physiologic and pathologic jaundice based on onset, cause, possible sequelae, and specific management.

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**CONCEPTS**

1. Cold stress sets up the chain of physiologic events of hypoglycemia, pulmonary vasconstriction, hyperbilirubinemia, respiratory distress, and metabolic acidosis.

2. Nursing interventions include:
   - Keep infant warmed during any transport.
   - Observe for any signs of hypoglycemia.
   - Have infant go to breast or feed early in neonatal period.
   - Assess blood glucose frequently.

1. Physiologic jaundice:
   - Occurs in 50% of all newborns.
   - Appears after 24 hours of age.
   - Not visible after 10 days of age.
   - May require phototherapy.

2. Pathologic jaundice:
   - Usually caused by ABO or Rh incompatibility.
   - Jaundice may be present within 24 hours of birth.
   - Treatment begins with phototherapy, but may progress to exchange transfusions.

3. Untreated hyperbilirubinemia (due to either type of jaundice) may result in neurotoxicity.

1. Rh incompatibility:
   - Maternal antibodies enter the fetal circulation, then attack and destroy fetal red blood cells.
   - Fetal system produces more RBCs.
   - Hyperbilirubinemia, anemia, and jaundice result.

2. ABO incompatibility:
   - Mother is type O and infant is type A or B.
   - Less severe than Rh incompatibility.

Nursing responsibilities for the newborn receiving phototherapy include:

1. Expose maximum amount of skin surface for optimal therapeutic results.
2. Apply eye patches while phototherapy is in progress.
3. Assess eyes for signs/symptoms of conjunctivitis per agency protocol.
4. Frequently monitor temperature.
5. Offer infant water and formula frequently to assist in excretion of bilirubin.
6. Keep parents informed of need for phototherapy and encourage parents to hold and care for infant while undergoing phototherapy.

1. Anemia in newborns results from prenatal blood loss, birth trauma, infection, or blood group incompatibility:
   - Nursing assessments for signs and symptoms of anemia.
   - Record all amounts of blood taken during laboratory testing.

2. Polycythemia may result from delayed cord clamping, twin-to-twin transfusion, or chronic intrauterine hypoxia:
   - Nursing assessments for signs and symptoms of polycythemia.

The most common signs of newborn sepsis include:

1. Lethargy or irritability.
2. Pallor or dusky.
3. Hypothermia.
4. Feeding intolerance.
5. Hyperbilirubinemia.
6. Tachycardia, bradycardia, or apneic spells.

1. All infants receive eye prophylaxis with ophthalmic antibiotic due to possibility of transmission of gonorrhea or chlamydia during the birth process.
2. Maternal syphilis requires that the infant be isolated from other newborns and receive antibiotics at birth.
3. Maternal herpes virus infection requires administration of IV antiviral medications in the immediate newborn period as well as multiple cultures (skin, spinal fluid) for presence of herpesvirus.
LEARNING OBJECTIVES

Describe the interventions to facilitate parental attachment with the at-risk newborn.

Identify the special initial and long-term needs of parents of at-risk infants.

CONCEPTS

1. Assess the parent’s level of understanding of the infant’s problem.
2. Prepare and facilitate the parents’ viewing of the infant.
3. Promote touching and facilitate parental participation in care of the infant.
4. Facilitate parental adjustment to the infant’s special needs.

1. Initially, the parents need to understand the infant’s problem, including expected treatments.
2. Need to understand routine well-baby care.
3. Need to understand how to perform any special procedures needed to care for the infant.
4. Need referral for normal infant screening procedures.
5. Need to understand normal growth and development of infants.
6. Need to have medical follow-up arranged.
7. Need referral for any special equipment required at home.

CRITICAL THINKING IN ACTION

View the Critical Thinking in Action video in Chapter 31 of the CD-ROM. Then, answer the questions that follow.

Rebecca Prince, age 21, G2 now P2, gives birth to a 5 pound baby at 38 weeks’ gestation by primary cesarean birth for fetal distress. The infant’s Apgars are 7 and 9 at 1 and 5 minutes. The infant is suctioned and given free flow oxygen at birth, then is admitted to the newborn nursery for transitional care and does well. You are the nurse caring for baby Prince at 36 hours old. You review the newborn’s record and note that the baby’s blood type is A+ and his mother is O-. Rebecca wants to breastfeed. You are performing a shift assessment on baby Prince when you observe the infant has a unilateral cephalhematoma and is lethargic. You blanch the skin over the sternum and observe a yellow discoloration of the skin. Lab tests reveal a serum bilirubin level of 12 mg/dL, hematocrit 55%, a mildly positive direct Coombs’ test, and a positive indirect Coombs’ test. Baby Prince is diagnosed with hyperbilirubinemia secondary to ABO incompatibility and cephalhematoma. You provide phototherapy by fiber optic blanket around the trunk of the infant and take the baby to his mother’s room.

1. How would you explain the purpose of phototherapy with the mother?
2. Describe the care the mother can give to the newborn.
3. Discuss the advantage of the fiber optic blanket phototherapy for the newborn.
4. Newborns up to 1 month of age are susceptible to organisms that do not cause significant disease in older children. Explore the circumstances that cause susceptibility to infection.
5. Describe how to distinguish between oral thrush and milk curds.

MEDIA LINK

NCLEX-RN® Review, case studies, and other interactive resources for this chapter can be found on the Companion Website at http://www.prenhall.com/london. Click on “Chapter 31” to select the activities for this chapter.

For animations, more NCLEX-RN® Review questions, and an audio glossary, access the accompanying CD-ROM in this textbook.


