CHAPTER 52

NURSING CARE DURING A PEDIATRIC EMERGENCY

KEY TERMS

asystole
barotrauma
bradycardia
cardioversion
cricoid pressure
defibrillation
hypercapnia
hyperventilation
hypocapnia
hypoventilation
intubation
periodic breathing
tachycardia
tachypnea
tracheal (endotracheal) tube

LEARNING OBJECTIVES

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

1. Identify various factors contributing to emergency situations among infants and children.
2. Discuss common treatments and medications used during pediatric emergencies.
3. Conduct a health history of a child in an emergency situation, specific to the emergency.
4. Perform a rapid cardiopulmonary assessment.
5. Discuss common laboratory and other diagnostic tests used during pediatric emergencies.
6. Integrate the principles of the American Heart Association (AHA) and Pediatric Advanced Life Support (PALS) in the comprehensive management of a pediatric emergency.

Alma Anderson, age 8 years, has been admitted to the pediatric unit. Her mother calls the nurse into the room, stating, "Alma's having trouble breathing!"

Wow *A nurse must possess the knowledge and skills to aid an acutely ill child.*

Children are uniquely vulnerable to a range of emergency situations. These situations are often life-threatening if not treated in an efficient manner. Because of their developmental level, children are at a greater risk for traumatic injury, near-drowning, and poisoning than adults. Most pediatric cardiopulmonary arrests result from respiratory failure or shock. Data suggest that children who have a cardiopulmonary arrest requiring resuscitative measures rarely fare well. For these reasons, the American Heart Association (AHA) has delineated two distinct "chains of survival," one for adults and one for children, that should be followed during a life-threatening situation.

The adult chain of survival is:

1. Early emergency medical system (EMS) activation
2. Early cardiopulmonary resuscitation (CPR)
3. Early defibrillation
4. Early access to advanced care

In contrast, the pediatric chain of survival is:

1. Prevention of cardiac arrest and injuries
2. Early CPR
3. Early access to emergency response system
4. Early advanced care

Considering the special risks that threaten children, the AHA has also developed specific guidelines for Pediatric Advanced Life Support (PALS). Courses in PALS are offered for health care professionals so that they can provide expert care for children in emergencies. This chapter emphasizes the principles of PALS in its discussion of the nurse's role in the management of pediatric emergencies.

Take NOTE!

New PALS guidelines published in 2005 define "pediatric patient" as any child up to about 16 to 18 years of age. Children in this age group should be managed using the PALS guidelines rather than those for adults (AHA, 2005f).

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Objective	Significance
Increase the number of states and the District of Columbia that have implemented guidelines for prehospital and hospital pediatric care.	• Become politically active in your local area and at the national level. • Advocate for optimal care for infants, children, and adolescents.

Common Medical Treatments

A variety of medications and other medical treatments are used in pediatric emergencies. Most of these treatments will require a physician's order when the child is in the hospital, though some emergency departments and pediatric units may have standing orders for pediatric emergencies. The most common medical treatments and medications used in pediatric emergencies are listed in Common Medical Treatments 52.1 and Drug Guide 52.1. The nurse should be familiar with these procedures and medications, how they work, and nursing implications.

Take NOTE!

Certain emergency drugs for children may be given via a **tracheal tube** *(a tube inserted into the trachea that serves to maintain the airway and facilitate artificial respiration). Use the mnemonic LEAN (lidocaine, epinephrine, atropine, and naloxone) to remember which drugs may be given via the tracheal route (AHA, 2007). In certain cases, when an emergency drug is given via a tracheal tube, the dosage must be increased. In addition, drugs given via this route should usually be diluted with 2 to 5 mL of sterile saline and followed by multiple positive-pressure ventilations to ensure that the drugs are delivered.*

Nursing Process Overview for the Child in an Emergency Situation

The nurse may encounter a pediatric emergency in a variety of settings. As a member of a trauma team at a pediatric hospital, the nurse may participate in the stabilization of a child who has suffered a near-drowning or trauma. The emergency department nurse may encounter a child who has just been injured, such as from a fall, accident, or sports. On the hospital unit, a child with asthma may suffer respiratory distress or stop breathing. Regardless of the setting or how the emergency developed, the principles for managing pediatric emergencies are the same.

Care of the child in an emergency includes all components of the nursing process: assessment, nursing diagnosis, planning, interventions, and evaluation. In an emergency, the nurse must act quickly, intervening immediately when an abnormality is determined upon assessment. When evaluating a child who presents emergently, always follow the AHA's guidelines for basic life support: evaluate airway, then breathing, then circulation. No matter what the cause of the emergency, the general approach

COMMON MEDICAL TREATMENTS 52.1 Pediatric Emergencies

Treatment	Explanation	Indication	Nursing Implications
Suctioning (oropharyngeal, nasopharyngeal, tracheal, or tracheostomy)	Removal of secretions via bulb syringe or suction catheter	Excessive airway secretions affecting airway patency	Use caution and suction only as far as recommended for age, tracheal tube size, or tracheostomy tube size or until coughing or gagging occurs.
Oxygen	Supplementation via mask, nasal cannula, hood, or tent or via tracheal/nasotracheal tube	Hypoxemia, respiratory distress, shock, trauma	Monitor response via color, work of breathing, respiratory rate, oxygen saturation levels via pulse oximetry, and level of consciousness.
Bag-valve-mask ventilation	Provision of ventilation via a bag-valve-mask device, manual ventilation	Apnea, ineffective ventilation and oxygenation with spontaneous breaths, extremely slow respiratory rate	Ensure adequate chest rise with ventilation. Do not overventilate or bag aggressively to avoid barotrauma. Maintain a seal on the child's face with the appropriate-sized mask. Ensure the oxygen supply tubing is connected to 100% oxygen.
Intubation	Insertion of a tube into the trachea to provide artificial ventilation	Apnea, airway that is not maintainable, need for prolonged assisted ventilation	Determine adequacy of breath sounds with bagging immediately upon insertion of the tracheal tube. Assess for symmetrical chest rise. Tape tube securely in place and note number marking on the tube. Connect to ventilator when available.
Needle thoracotomy	Insertion of a needle between the ribs into the pleural space to remove air	Tension pneumothorax	There should be a rush of air as the needle reaches the air space. Monitor breath sounds, work of breathing, pulse oximetry. Ensure patency of IV catheter.
IV fluid therapy	Administration of crystalloid or colloid solutions to provide hydration or improve perfusion	Altered perfusion states such as respiratory distress, shock, trauma, cardiac disturbances	Use intraosseous route if a peripheral IV cannot be obtained quickly in the young child in shock. Reassess respiratory and circulatory status frequently after each IV fluid bolus and during continuous infusion.
Blood product transfusion	Administration of whole blood, packed red blood cells, platelets, or plasma intravenously	Trauma, hemorrhage	Follow institution's transfusion protocol. Double-check blood type and product label with a second nurse.

Treatment	Explanation	Indication	Nursing Implications
			Monitor vital signs and assess child frequently to identify adverse reaction to blood transfusion. If adverse reaction is suspected, immediately discontinue transfusion, infuse normal saline solution IV, reassess the child, and notify the physician.
Cervical stabilization	Maintenance of the cervical spine in an immobile position	Trauma, near-drowning	Use the jaw-thrust maneuver without head tilt to open the airway. Maintain cervical stabilization until the cervical spine x-rays are cleared by the physician or radiologist.
Defibrillation and synchronized cardioversion	Provision of electrical current to alter the heart's electrical rhythm	Defibrillation: ventricular fibrillation and pulseless ventricular tachycardia Synchronized cardioversion: supraventricular tachycardia and ventricular tachycardia with a pulse	In the pulseless client, always ensure CPR is ongoing while the defibrillator is being readied. Ensure adequate oxygenation. Provide lidocaine or epinephrine if indicated before defibrillation. Sedate the child if time allows.

to managing the child is universal, with minimal specific variations. Once the child's cardiopulmonary status is stabilized or the child is resuscitated, assessment and management will vary depending on the cause of the emergency.

Assessment

Nursing assessment of the child who presents emergently includes health history, physical examination, and laboratory and diagnostic testing. However, the initial history may be focused and very brief if the child is critically ill; the nurse may need to proceed immediately to rapid cardiopulmonary assessment. Once a child is stabilized, a more comprehensive history is obtained. Laboratory tests, while often important, should never take priority over cardiopulmonary and hemodynamic stabilization.

Remember Alma, the 8-year-old with breathing trouble? What additional health history and physical examination assessment information should the nurse obtain?

Health History

Obtain the health history rapidly while simultaneously evaluating the child and providing life-saving interventions. A brief history is needed initially, followed by a more thorough history after the child is stabilized. The parents or caregiver will provide information about the child's chief complaint. Record the information using the caregiver's own words. For example, the caregiver might say, "He's been having trouble breathing" if the child is presenting in respiratory distress. If the child was injured in a bicycle accident, the caregiver might say, "She was riding her bike down the hill and lost control." This brief statement provides guidance for obtaining more in-depth information about the emergency.

Ask about any significant past history that may affect the care of the child. For example, children who are medically fragile, who were born prematurely, or who have a significant genetically linked disease (e.g., sickle cell anemia) may require special consideration when planning and implementing care.

Physical Examination

In an emergency, the nurse must perform a rapid cardiopulmonary assessment and intervene immediately if alterations are noted. The remainder of the physical examination then follows.

Rapid Cardiopulmonary Assessment

As the brief history is being obtained, begin to evaluate the ABCs of the rapid cardiopulmonary assessment: A, airway; B, breathing; and C, circulation. Since pediatric

DRUG GUIDE 52.1 Common Medications Used in Pediatric Emergencies

Medication	Action/Indication	Nursing Implications
Adenosine (antiarrhythmic)	Slows conduction through AV node, restoring normal sinus rhythm Supraventricular tachycardia (SVT)	• Administer IV at a dose ranging from 0.05 to 0.1 mg/kg. • Administer very rapidly (1 to 2 seconds) followed by a rapid, generous saline flush. • Repeat every 1 to 2 minutes, increasing by 0.05 to 0.1 mg/kg with each dose (maximum dose 0.3 mg/kg). • Monitor for shortness of breath, dyspnea, worsening of asthma.
Atropine (anticholinergic)	Increases cardiac output, dries secretions, inhibits serotonin and histamine Sinus bradycardia, asystole, pulseless electrical activity	• Administer via IV, IO, or ET route at a dose of 0.02 mg/kg (maximum dose 0.5 mg child, 1 mg adolescent). • Repeat every 5 minutes PRN. • Give undiluted over 30 seconds for IV or IO route. • Dilute with 3 to 5 mL normal saline for ET route; follow with five positive-pressure ventilations. • Do not mix with sodium bicarbonate (incompatible).
Dobutamine (synthetic catecholamine)	Beta-adrenergic agent primarily affecting beta-1 receptors; increases myocardial contractility and heart rate Ongoing short-term management of shock (hypovolemic and cardiogenic)	• Administer via IV or IO route at 2 to 20 mcg/kg/minute via a continuous infusion. Monitor for development of ventricular arrhythmias. • Expect to titrate infusion rate based on cardiac output and BP. • Administer via central line if possible due to risk of extravasation. • Monitor child closely, preferably in an ICU setting.
Dopamine (inotropic)	Increases cardiac output, BP, and renal perfusion (beta-adrenergic agonist) Bradycardia, hypotension, and poor cardiac output	• Administer via IV or IO route at a dose of 2 to 20 mcg/kg/minute via continuous infusion. • Ensure that child has received adequate fluid resuscitation prior to administration. • Due to risk of extravasation, give via central line if possible. • Monitor child closely, preferably in an ICU setting. • Assess for ventricular arrhythmias.
Epinephrine (adrenergic)	Stimulates alpha- and beta-adrenergic receptors, increasing heart rate and systemic vascular resistance Bradycardia, anaphylaxis	• Administer via IV or IO route at a dose of 0.01 mg/kg (0.1 mL/kg of 1:10,000 solution) or via ET route at 0.1 mg/kg (0.1 mL/kg of 1:1,000 solution). • During CPR, repeat every 3 to 5 minutes. • Monitor for ventricular arrhythmias. • High doses may cause tachycardia in newborns. • Due to risk of extravasation and subsequent tissue necrosis, give through a central line if possible. • May also be used as a bronchodilator IV or via inhalation (racemic epinephrine)

Medication	Action/Indication	Nursing Implications
Glucose	Increases blood glucose level Hypoglycemia	• Administer via IV or IO route at a dose of 1 to 2 mL/kg (D50%); maximum dose 2 to 4 mL/kg. • When administering via a peripheral IV line, dilute 1:1 with sterile water to make D25%. Monitor IV site for infiltration and tissue extravasation. • Monitor blood glucose levels closely.
Lidocaine (anti-dysrhythmic)	Decreases automaticity of conduction tissues of the heart Ventricular arrhythmias	• Administer via IV or IO route at a dose of 1 mg/kg; administer via ET route at dose 2 times IV dose diluted with 3 to 5 mL normal saline, followed by positive-pressure ventilation. Maximum dose 5 mg/kg or 100 mg/dose. • Monitor ECG continuously. • Contraindicated in complete heart block • With larger-than-normal doses, monitor for hypotension or seizures.
Naloxone (Narcan)	Antagonizes action of narcotic agents Reversal of respiratory depression related to narcotic effects	• Administer via IV, IO, SC, or ET route at a dose of 0.01 to 0.1 mg/kg in children <5 years old or <20 kg or at a dose of 2 mg in children >5 years old or >20 kg. Onset of action is within 2 to 5 minutes. • May repeat dose as necessary; narcotic effects outlast therapeutic effects of naloxone.

arrests are usually related primarily to airway and breathing, and usually only secondarily to the heart, focus the assessment and interventions using the ABCs of resuscitation. Always perform the assessment and interventions in that order. In most circumstances, if a child's airway is properly managed and breathing is assisted, the child may not experience a full arrest requiring chest compressions.

Take NOTE!

Assessment and management of the airway of a pre-arresting or arresting child is ALWAYS the first intervention in a pediatric emergency. Intervene if there is an airway problem before moving on to assessment of breathing. If an intervention for breathing is required, start it before proceeding to assessment of circulation.

A: Airway Evaluation and Management

First evaluate the airway. Assess its patency. If cervical spine injury is not suspected, position the airway in a manner that promotes good air flow. If secretions are obstructing the airway, suction the airway to remove them. If the child is unconscious or has just been injured, open the airway using the head tilt–chin lift maneuver. Place the fingertips on the bony prominence of the child's chin and lift the chin to open the airway. Simultaneously, place one hand on the forehead and tilt the child's head back (Fig. 52.1). If the airway is not maintainable, reposition the airway for appropriate airflow. Place the child immediately on oxygen at 100% and apply a pulse oximeter to monitor oxygen saturation levels.

Take NOTE!

If cervical spine injury is a possibility, do not use the head tilt–chin lift maneuver; use only the jaw-thrust technique for opening the airway (see trauma section for explanation and illustration).

B: Breathing Evaluation and Management

After establishing an open airway, look for signs of respiration. Turn your head and place your ear over the child's mouth to "look, listen, and feel" for spontaneous respirations. Look to see if the child's chest is rising, listen for air escaping, and note if you feel any air coming out of the child's nose or mouth. If the child is breathing, evaluate the quality of the respirations: Is ventilation effective, or is the child simply gasping ineffectively for air? Count the

Figure 52.1 Head tilt–chin lift maneuver in a child.

respiratory rate. Observe the child's color. Note depth of respiration, chest rise, adequacy of air flow in all lung fields, and presence of adventitious sounds. Evaluate for increased work of breathing and the use of accessory muscles.

When signs of respiratory distress are noted, immediately place the child on oxygen at 100% and apply a pulse oximeter to monitor oxygen saturation levels. If the child is breathing shallowly and has poor respiratory effort, attempt to reposition the airway to promote better airflow. For the child receiving 100% oxygen who does not improve with repositioning, begin assisted ventilation with a bag-valve-mask (BVM) device. A need for ongoing BVM ventilation may require airway **intubation** (process by which a breathing tube, such as a tracheal tube, is inserted into a child's airway to assist with breathing).

> ▶ **Take NOTE!**
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> *Attempts to insert a tracheal tube should last no longer that 20 to 30 seconds each. After each attempt, the child should receive multiple ventilations by the BVM method using 100% oxygen.*

C: Circulation Evaluation and Management

The next step is to evaluate C, circulation. During this phase, evaluate the heart rate, pulses, perfusion, skin color and temperature, blood pressure, cardiac rhythm, and level of consciousness. Determine the heart rate via direct auscultation or palpation of central pulses. Radial and brachial pulses are more difficult to palpate, especially in infants and young children. If perfusion is poor, such as with shock or cardiac arrest, the child may have a weak pulse or no pulse. In the young infant, check the brachial artery for a pulse. In the child and adolescent, evaluate the carotid pulse. If there is a pulse, note its quality: Is it barely palpable or weak? Is it strong or bounding? Compare the strength and quality of central and peripheral pulses. Assess capillary refill time.

> ▶ **Take NOTE!**
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> *ALWAYS evaluate the presence of a heart rate by auscultation of the heart or by palpation of central pulses. NEVER use the cardiac monitor to determine if the child has a heart rate. The presence of a cardiac rhythm is not a reliable way to evaluate the ability to perfuse the body. In certain circumstances a rhythm continues but there is no pulse (pulseless electrical activity). If the child has no heart rate (pulse) despite adequate respiratory interventions, begin cardiac compressions.*

Evaluate the child's perfusion by noting skin temperature and color. Is the skin pink? Is it warm to the touch? The child's skin may be cool to the touch and may appear pale, mottled, or cyanotic. As the child's condition worsens with developing shock and cardiovascular compromise, note a line of demarcation of skin temperature. In this situation, the distal extremities will feel cooler than the proximal regions of the body. Measure the blood pressure (BP) and place the child on a cardiac monitor to evaluate the cardiac rhythm. Note the child's sensorium or level of consciousness; if circulation is poor, the child will demonstrate an altered level of consciousness as perfusion to the brain becomes diminished.

> ▶ **Take NOTE!**
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> *According to PALS, calculate minimum acceptable systolic BP by using this formula: 70 + (2 times the age in years). For example, a 4-year-old should have a minimal systolic BP of 78: $70 + (2 \times 4) = 78$.*

If the circulation or perfusion is compromised, then fluid resuscitation is necessary. Establish large-bore intravenous (IV) access immediately and administer isotonic fluid rapidly. Provide 20 mL/kg of normal saline (NS) or lactated Ringer's (LR) as an IV bolus (if the infant is less than 1 month old, administer 10 mL/kg). If peripheral IV access cannot be obtained in the child with altered perfusion within three attempts or 90 seconds, assist with insertion of an intraosseous needle for fluid administration (refer to shock section for further information about intraosseous access). Central venous lines or cutdown access may also be used, but these measures take longer to accomplish.

Additional Physical Examination Components

In addition to assessing and stabilizing the child's airway, breathing, and circulation, perform a thorough physical examination and assess pain.

Neurologic Evaluation

Quickly evaluate the sensorium in an older child. Ask the child to state his or her name. Ask what happened to the child. Does the child know what day it is? Is the child aware of where he or she is?

If the child is an infant, evaluate his or her interest in the environment and response to parents. An infant who is not interested in the environment or seems unable to recognize his or her parents is a cause for concern. In contrast, an infant who enjoys sucking on a finger and making eye contact with the nurse during the assessment is reassuring.

Evaluate the child's head. In the infant or young toddler, palpate the anterior fontanel to determine if it is normal (soft and flat), depressed, or full. A sunken fontanel is associated with volume depletion from dehydration or blood loss. If the fontanel is full, note if it is bulging or tense, which may indicate increased intracranial pressure. Next assess the eyes. Are they open or closed? If closed, do they open spontaneously, to voice, to pain? Does the child focus on and follow your movements? Evaluate the pupils for equality and reactivity. Sluggish pupillary reaction may occur with increased intracranial pressure.

> **Take NOTE!**
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> *A nonreactive pupil is an ominous sign indicating a need for immediate relief of increased intracranial pressure.*

Evaluate the child's face. Does the child smile or cry? Does the child react to playfulness with a laugh? Does the young infant cry vigorously? Are facial movements equal? In a child, a normal or near-normal neurologic examination can be a reassuring sign. Conversely, obtunded or muted responses to environmental stimuli are a cause for concern.

Next evaluate for spontaneous movement of the extremities. Young infants cannot walk, so assess their ability to move their arms and legs and grossly evaluate the tone of their extremities. Does the infant vigorously and equally move the arms and legs? Is the muscle tone normal, or does the infant appear floppy or flaccid? When evaluating the older child, note whether he or she is ambulatory alone, ambulatory with assistance, or unable to walk. Note whether the child has use of the upper extremities. In the case of trauma, the child may arrive immobilized on a backboard. In this scenario, evaluate the child's motor responsiveness and sensation in each extremity, comparing findings bilaterally while the child is in the supine position. Ask the child if he or she feels you touching each extremity. Ask the child to squeeze your fingers and to wiggle the toes. This will provide information about cerebral integrity and perfusion, cerebellar health, and spinal cord integrity.

The Pediatric Glasgow Coma Scale may also be used to evaluate the neurologic status in children. Chapter 37 provides a more in-depth discussion of this scale.

Skin and Extremity Evaluation

Remove the child's clothing and thoroughly examine the skin for bruising, lesions, or rashes. If the child has a rash, note the size, shape, color, configuration, and location. Apply pressure to the rash with the fingertips to see whether it blanches. Inspect the trunk, abdomen, and extremities for abrasions or deformities.

> **Take NOTE!**
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> *Rashes that do not blanch may be classified as petechiae or purpura. This type of rash may be associated with certain serious conditions, such as meningococcemia. Report this finding to the physician or nurse practitioner immediately.*

Pain Assessment

In emergencies, children may experience pain as a direct result of the injury or disease, and life-saving interventions such as resuscitation, insertion of IV lines, and administration of medications may cause further pain. The child's pain may also be exaggerated by light, noise, movement of the stretcher or bed, and the sensations of cold or heat. Nurses play a key role in minimizing the child's pain, and this may decrease the child's future distress (Johnston et al., 2005; Probst et al., 2005). If the child is awake and verbal, use an age-appropriate pain assessment scale to determine the child's pain level. If the child is sedated or unconscious, assess pain with a standardized scale that relies on physiologic measurements as well as behavioral parameters. Refer to Chapter 35 for additional information on pain assessment in children.

Laboratory and Diagnostic Testing

A number of laboratory and diagnostic tests may be ordered in a pediatric emergency. Laboratory tests can help to distinguish the cause of the emergency or additional problems that need to be treated. Standard laboratory tests obtained in most emergency departments include:

- Arterial blood gases (ABG), obtained initially and then serially to assess for changes
- Electrolytes and glucose levels
- Complete blood count (CBC)
- Blood cultures
- Urinalysis

If an ingestion is suspected, then a toxicology panel will be obtained. In suspected sepsis, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and urine and spinal fluid cultures may also be obtained. The pediatric trauma victim may have additional laboratory tests performed, including amylase, liver enzymes, and blood type and cross-match.

Diagnostic tests may include radiologic tests, computed tomography (CT) scanning, and magnetic resonance imaging (MRI). One advantage of radiologic diagnostic testing is that the tests are relatively noninvasive. A disadvantage of CT and MRI scans is that before they can be performed, the patient must be stabilized. Common Laboratory and Diagnostic Tests 52.1 discusses the tests most commonly used in pediatric emergencies.

After completing an assessment of Alma, the nurse noted the following: a patent airway, anxious but able to speak in short sentences, and skin temperature cool on the extremities. Based on these assessment findings, what would your top three nursing diagnoses be for Alma? Describe appropriate nursing interventions.

Nursing Diagnoses and Related Interventions

After completing a thorough assessment and initial stabilization of the child, the nurse might identify several nursing diagnoses, including:

- Airway clearance, ineffective
- Breathing pattern, ineffective
- Gas exchange, impaired
- Fluid volume, deficient
- Cardiac output, decreased
- Tissue perfusion (cardiopulmonary, peripheral cerebral, or renal), ineffective
- Knowledge, deficient
- Fear
- Family processes, interrupted

Specific nursing goals, interventions, and evaluation for the child in an emergency are based on the nursing diagnoses. Additional information about nursing management will be included later in the chapter as it relates to specific disorders.

Providing Cardiopulmonary Resuscitation

Always evaluate and manage the airway first, unless this is an out-of-hospital, witnessed, sudden collapse of a child. Call for help and assign someone to obtain the automatic external defibrillator (AED). Open the airway and assess for adequate breathing. If the child is not breathing, begin rescue breathing. Check for a pulse. In the child, the carotid or femoral pulses are easiest to assess. In the past, it was recommended that the brachial pulse be checked in the infant, but this is often difficult, so an alternative is to check the femoral pulse. Carefully assess for signs of a pulse, but do not spend more than 10 seconds checking the pulse. If there is not a pulse or if the heart rate is less than 60 beats per minute, begin chest compressions.

Take NOTE!

When an arrest occurs out of the hospital and is a witnessed, sudden collapse, initial management is slightly different than that for other arrests. In these sudden, witnessed events, phone first, get the AED, and return to start CPR.

Table 52.1 presents the AHA's most recent recommendations for ratios of breaths and compressions. These recommendations stress the importance of properly performed chest compressions. Therefore, several changes have been made to the guidelines:

- Rescuers must provide compressions of adequate rate and depth.
- Chest recoil should be allowed.
- Minimal interruption of chest compressions should be the goal.
- For infant CPR, two-person infant CPR can be performed by encircling the chest with two thumbs and simultaneously using the hands to provide a thoracic squeeze.
- For two-person CPR, no pauses should occur for ventilation, with the compressing health care provider giving continuous compressions.

Providing Defibrillation or Synchronized Cardioversion

In some cases, the child has an abnormal life-threatening cardiac rhythm or an arrhythmia that does not respond to pharmacologic therapy or leads to hemodynamic instability. In these cases, electrical therapy, in the form of defibrillation or synchronized cardioversion, may be needed.

Defibrillation is the use of electrical energy to depolarize the cells of the myocardium to terminate an abnormal life-threatening cardiac rhythm, such as ventricular fibrillation. Defibrillation is used in conjunction with oxygen, CPR, and medications. The effects of defibrillation are

COMMON LABORATORY AND DIAGNOSTIC TESTS 52.1 Pediatric Emergencies

Test	Explanation	Indications	Nursing Implications
Chest x-ray	Radiograph used to evaluate heart and lung structures	To identify: • Infections (e.g., pneumonia) • Foreign body • Injury • Endotracheal tube placement • Central line placement • Pneumothorax Re-evaluation of lungs after chest tube placement	• X-rays can be obtained quickly during resuscitation; usually available in emergency department. • Assist the child to lie still if necessary.
Computed tomography (CT)	Use of high radiation (equivalent to about 100 to 150 chest x-rays) with computer processing targeting specific body areas	Rapid evaluation of tissues and skeletal areas Superior test for the evaluation of internal bleeding	• Expect the child to be transported out of the area for the study. • Accompany the child to provide continued observation and management, especially if child's condition is unstable.
Magnetic resonance imaging (MRI)	Incorporation of responses of hydrogen protons to a dynamic magnetic field	Superior test for the evaluation of the spinal cord and the cerebrospinal fluid spaces; less useful in emergency situations	• Administer sedation as ordered. • Assist child in remaining still; MRI requires child to remain still for a longer period than for a CT. • Assist the conscious child to deal with fear related to loud banging noise of the machine.
Arterial blood gases (ABG)	Evaluation of blood pH and arterial blood levels of oxygen and carbon dioxide	Evaluation of quality of respiration and evaluation of acid–base balance	• Anticipate serial ABGs to assess for status changes. • Never delay resuscitation efforts pending blood gas results.
Serum electrolytes	Evaluation of electrolyte levels, such as sodium, potassium, and chloride, in the blood	Useful for determining baseline and if dehydration is hypertonic or isotonic	• Hemolysis of specimen may lead to falsely elevated potassium levels.
Glucose	Evaluation of glucose level in the blood	Valuable for determining need for supplementation, as in the case of hypoglycemia	• Use Accucheck or other rapid glucose test at the bedside or obtain serum blood specimen. • Elevated glucose levels can be associated with stress or with use of corticosteroids.
Toxicology panel (blood and/or urine)	Determination of most commonly abused mood-altering medications, as well as commonly ingested drugs	Drug abuse, overdose, or poisoning	• Standard toxicology panel varies with the agency. • Follow agency protocol; may require special handling or labeling of specimen. • Use a blood specimen that is best for determining overdose or poisoning.

(continued)

COMMON LABORATORY AND DIAGNOSTIC TESTS 52.1 Pediatric Emergencies (continued)

Test	Explanation	Indications	Nursing Implications
Complete blood count (CBC)	Evaluation of hemoglobin and hematocrit, white blood cell count, and platelet count	Any condition in which anemia, infection, or thrombocytopenia is suspected Trauma if blood loss is suspected	• Be aware of normal values and how they vary with age and gender. • Hemoglobin and hematocrit may be elevated secondary to hemoconcentration in the case of hypovolemia.
Blood type and cross-match	Determination of ABO blood typing as well as presence of antigens Cross-match is performed on RBC-containing products to avoid transfusion reaction.	Trauma victim or any person with suspected blood loss as preparation for transfusion	• Handle specimen gently to avoid hemolysis. • Ensure that specimen request and label are appropriately signed and dated. • Apply “type and cross” or “blood band” to child at time of specimen collection if required by agency. • Most type and cross-match specimens expire after 48 to 72 hours.
Urinalysis	Evaluation of color, pH, specific gravity, and odor of urine Assessment for protein, glucose, ketones, blood, leukocyte esterase, RBCs, WBCs, bacteria, crystals, and casts	Clients with fever, dysuria, flank pain, urgency, or hematuria or those who have experienced trauma to provide information about the urinary tract	• Many drugs can affect urine color; notify the laboratory if the child is taking one. • Notify the laboratory and document on the laboratory form if the client is menstruating. • Refrigerate the specimen if it is not processed promptly. • Specimen may be obtained by catheterization, clean-catch voiding sample, or a U-bag.

enhanced in an oxygen-rich environment coupled with good artificial circulation (CPR). **Cardioversion**, another means of applying electrical current to the heart, is used when the child has supraventricular tachycardia (SVT) or ventricular tachycardia with a pulse. Cardioversion may also be enhanced with medications. Cardioversion is delivered synchronized—that is, the electrical current is applied on the R wave of the electrocardiogram (ECG).

The basic defibrillator is equipped with adult- and pediatric-sized paddles. A switch turns the machine on and controls are used to select the amount of energy (joules). Typically, the initial energy amount is 2 joules/kg; it can be

TABLE 52.1 Ratios of Breaths to Compressions

Age	One-Person CPR	Two-Person CPR
Infant	• 30 compressions to 2 breaths • Hand placement: two fingers, placed one fingerbreadth below the nipple line	• 15 compressions to 2 breaths • Hand placement: two thumbs encircling the chest at the nipple line
Child	• 30 compressions to 2 breaths • Hand placement: heel of hand or two hands (adult position in larger child), pressing on the sternum at the nipple line	• 15 compressions to 2 breaths • Hand placement: heel of one hand or two hands (adult position in larger child), pressing on the sternum at the nipple line

American Heart Association. (2005e). Part 11: Pediatric basic life support. *Circulation, 112,* 156–166.

increased up to 4 joules/kg for defibrillation. Energy for cardioversion is delivered at 0.5 to 1 joule/kg.

When the defibrillator is being used in an acute care setting, the leader of the code team will take charge of defibrillator use. He or she is responsible for ensuring that only the patient receives the energy from the defibrillator. The code team leader will count to 4 before delivering a shock to the patient to ensure that all personnel and other equipment are clear of the bed to avoid accidental shock.

Using Automated External Defibrillation

In cases of sudden, witnessed, out-of-hospital collapse, an arrhythmia is often the cause. Therefore, the AHA has revised its recommendations about the use of an AED. An AED is an alternative to manually defibrillating a patient. The AED device consists of electrodes that are applied to the chest. These electrodes are used to monitor the heart rhythm and deliver the electrical current. AED devices are readily available in a variety of locations, such as airports, sports facilities, and businesses. Traditionally, the AED was designed for use in adults, but newer AEDs with smaller pads and the ability to alter energy delivery are now more readily available. Therefore, the AHA has recommended that an AED be used for children who are older than age 1 year who have no pulse and have suffered a sudden, witnessed collapse.

The AED is designed to be used by persons in the prehospital setting. Once the AED is turned on, the machine uses auditory commands to guide laypersons and health care professionals alike through the correct placement of the electrodes and the administration of energy. The AED periodically evaluates the victim's cardiac rhythm and instructs the user about checking the pulse, continuing CPR, and delivering shocks. Nurses who care for children should be able to operate an AED and be prepared to use it in nontraditional settings.

Determining Medication Doses and Equipment Sizes

Many pediatric acute care facilities prepare code reference sheets when a child is admitted. This sheet uses the child's actual weight to determine medication doses and equipment sizes. The reference sheet is kept on a clipboard at the child's bedside or taped on the wall at the head of the bed. An additional copy is placed in the child's chart.

Ambulatory care providers often use the Broselow tape to estimate the child's weight based on the child's length (Fig. 52.2). The tape is color-coded and emergency equipment for a child of that size is stored in corresponding color-coded packages or in color-coded drawers on the pediatric emergency cart (DeBoer et al., 2005). Medication doses and equipment sizes are also located on the tape. The most accurate calculation for code medications

EVIDENCE-BASED PRACTICE 52.1
The Role of Automated External Defibrillators (AEDs) in Cardiac Resuscitation of Children

Background

Primary cardiac arrest resulting from arrhythmia or commotio cordis is rare in children and adolescents but often has a very poor outcome. Also, sudden death during sporting events has occurred in children and adolescents. Traditionally, manual defibrillation has been the only form of defibrillation used in children. With the newer technology available in AEDs, the question arose as to whether they could be used effectively to treat arrhythmia in children.

Study

Cecchin et al. (2001) performed a study of over 600 children to determine the specificity and sensitivity of automated external defibrillation in children.

Findings

The researchers found that AEDs can be sensitive and specific for detecting and treating arrhythmia by defibrillation in children over 1 year of age. Salib et al. (2005) report a positive and healthy outcome after an AED was used at the scene on a 13-year-old who suffered a baseball blow to the chest resulting in commotio cordis. As a result of these and many other studies, in 2005 the American Heart Association recommended changes in the pediatric basic life support guidelines to include the use of AEDs in sudden witnessed collapse in children.

Nursing Implications

For nurses working in hospitals, ensure that witnessed collapse in children includes assessing for the need for defibrillation. Outside the hospital, nurses should advocate for AEDs to be placed in all high school gymnasiums and at all parks and ball fields.

Cecchin, F., Jorgenson, D. B., Berul, C. I., et al. (2001). Is arrhythmia detection by automatic external defibrillator accurate for children? Sensitivity and specificity of an automatic external defibrillator algorithm in 696 pediatric arrhythmias. *Circulation, 103,* 2438–2483; Salib, E. A., Cyran, S. E., Cilley, R. E., Maron, B. J., & Thomas, N. J. (2005). Efficacy of bystander cardiopulmonary resuscitation and out-of-hospital automated external defibrillation as life-saving therapy in commotio cordis. *Journal of Pediatrics, 147,* 863–869.

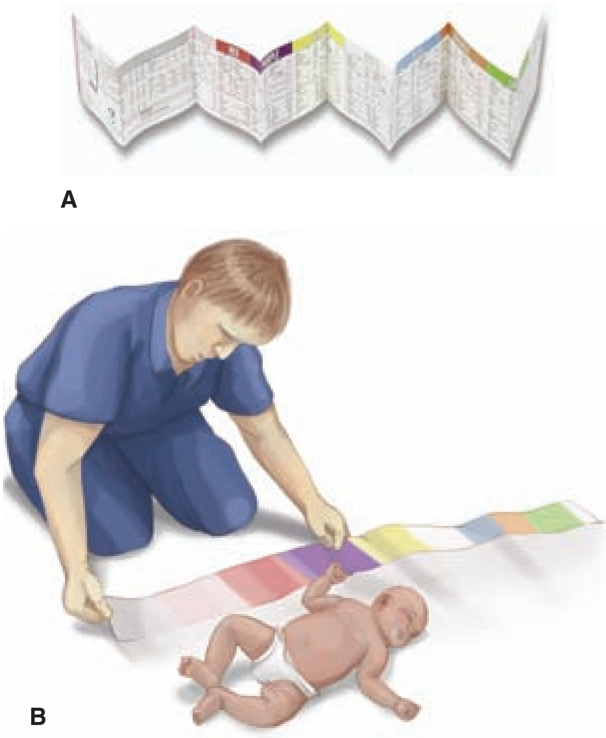

Figure 52.2 (**A**) Broselow tape. (**B**) Measure the child's length with the Broselow tape to determine medication doses and tracheal tube size.

is based on the child's weight, but in numerous research studies, use of the Broselow tape for estimating the weight has been shown to be successful except in the case of very obese children (Hashikawa et al., 2007).

Managing Pain

Depending on the child's status and pain level, individualize pain management interventions. For the alert child, nonpharmacologic measures may be used in addition to medications. Provide atraumatic care for procedures and use aggressive pharmacologic treatments to manage pain as the child's condition allows. Refer to Chapter 35 for additional information on pain management strategies.

Ensuring Stabilization

After a child has been resuscitated, the nurse plays a key role in stabilization and transport. Thoroughly document the interventions that were performed as well as the ongoing assessment of the child's response to the interventions. Provide continued monitoring of the child while awaiting transport. Copy and assemble any pertinent documentation, such as the resuscitation record, nurse's notes, and laboratory test results, that will be given to the receiving institution. Ensure that all lines are taped securely and that vascular access sites are dressed and labeled with the date and time of insertion. As soon as possible, bring the child's family in to visit with the child. Provide explanations about the IV lines, monitoring equipment, and other medical equipment and devices. Encourage the family to talk to and touch the child.

Providing Support and Education to the Child and Family

The experience of respiratory distress, oxygen deprivation, and an emergency situation is a frightening one for persons of all ages. The life-saving interventions that take place during an emergency can be especially intimidating and upsetting to children. Infants and young children cannot understand explanations about these interventions, and older children and adolescents may feel frightened and angry about the loss of control. The caregivers may feel fear, anger, guilt, and sadness. They may be concerned about the very real possibility that their child might die.

Resuscitation of a child is often a perplexing and frightening event for laypersons to observe. Therefore, traditionally family members have been excluded during the resuscitation of children. Recently, however, there has been a trend to allow family members to be present during pediatric resuscitation. Current evidence-based practice guidelines recommend individual evaluation of each family to determine whether allowing their presence during the resuscitation will be beneficial (Nibert & Ondrejka, 2005).

Considering the highly technical nature of resuscitation, the rapidity with which interventions occur, and the fear associated with a life-threatening event, nurses can play a crucial role in providing understandable explanations to families, coupled with empathic support. During the acute phase, the nurse should give brief explanations as life-saving interventions are being provided. Examples of these types of explanations include:

- When applying the pulse oximeter sensor: "I need to put this little light on Johnny to check his oxygen level; it won't hurt."
- When connecting the child to the cardiac monitor: "We're going to put these sticky patches on Johnny and connect them so we can monitor his heart rate on this screen."
- When preparing for intubation and ventilation: "Johnny can't breathe on his own right now, so we're going to give him some extra help with this tube. This tube will go through his breathing passage and this machine will help him to breathe."

The nurse plays a key role in providing empathy and support. Do not provide false reassurance and say, for example, "He's going to be alright." The outcome is never certain. Rather, communicate empathically. For example, say, "This must be very difficult for you. We're doing everything we can to help Johnny." Provide honest answers in a reassuring manner. Respect each family's diversity and observe their strengths and weaknesses. Be nonjudgmental in all interactions with families, even when the child's emergency situation may have resulted from family neglect.

Parents often feel helpless when their child is in a high-tech environment. Suddenly overwhelmed with the equipment and monitoring devices, they no longer are the persons who are the most skilled in caring for their child. Integrate the child's parents into the health care team. Suggest ways the parents can make the hospital experience more normal for their child. For example, simply allowing a father to read a story to his daughter or encouraging a mother to hold her child's hand is therapeutic both for the child and the parents. Be aware of this dramatic change and how it affects the parents. Always ensure that they feel like they are a welcome part of their child's care.

Providing the child with familiar comfort objects helps to decrease stress. Once the intubated child is alert and stabilized, assist him or her with communication. Some children can lift one finger for yes and two fingers for no. If the child is old enough to write, provide paper and pencil. Play is essential to the work of the child, and even if he or she is immobile, play is still possible. Puppets at the bedside and books help give the child a more normal experience in a scary situation that is far from the norm. Teenagers may enjoy listening to music through headphones. Even children who are comatose should be talked to and allowed to listen to familiar music.

Even if the outcomes are serious, the nurse can provide critical support to children and families. Whether hugging a crying mother or playing "peek-a-boo" with an intubated child, the nurse will be the one who can make a difference during a frightening experience.

Nursing Management of Children in Emergencies

Nurses must be adept at identifying the beginning stages of an emergency so they can quickly and appropriately intervene to prevent deterioration to cardiopulmonary arrest. Assessment and management of the most common types of emergencies in children are discussed below. The topics covered include respiratory arrest, shock, cardiac arrhythmias and arrest, near-drowning, traumatic injury, and poisoning.

RESPIRATORY ARREST

Respiratory emergencies may lead to respiratory failure and eventual cardiopulmonary arrest in children. Infants and young children are at greater risk for respiratory emergencies than adolescents and adults because they have smaller airways and underdeveloped immune systems, resulting in a diminished ability to combat serious respiratory illnesses. Young children often lack coordination, making them susceptible to choking on foods and small objects, which may also lead to cardiopulmonary arrest. In addition, sudden infant death syndrome (SIDS) is a leading cause of cardiopulmonary arrest in young infants and thus is one of the leading causes of post-neonatal mortality in the United States. For these reasons, nurses must be skilled at recognizing the signs of pediatric respiratory distress so they can prevent progression to cardiopulmonary arrest. Table 52.2 lists some of the more common causes of pediatric respiratory arrest.

TABLE 52.2 **Causes of Respiratory Arrest in Children**

Condition	Cause
Upper airway	Burns Croup Epiglottitis Foreign body aspiration Reflux Strangulation or near-strangulation Tracheomalacia Vascular ring
Lower airway	Asthma Bronchiolitis Burns Foreign body aspiration Pertussis infection Pneumonia Pneumothorax Reflux
Nonrespiratory origins	Septic shock HIV
Neurologic	CNS infection Guillain-Barré syndrome Poliomyelitis Seizures Sleep apnea Spinal cord trauma Sudden infant death
Chronic illness	Complications of severe prematurity Cystic fibrosis Bone marrow transplant Neutropenia
Metabolic/endocrine disorders	Diabetic ketoacidosis Mitochondrial disorders
Cardiac conditions	Arrhythmia Congenital cardiac problems Acquired cardiac problems
Traumatic/unintentional/intentional injury	Asphyxia Child abuse/"shaken baby syndrome" Drowning Electrocution Gunshot wound Toxic ingestion Vehicular-related trauma

Adapted from Balwin, G. (2001). *Handbook of pediatric emergencies.* Philadelphia: Lippincott Williams & Wilkins; Behrman, R. E., Kliegman, R. M., & Jenson, H. B. (2004). *Nelson's textbook of pediatrics* (17th ed.). Philadelphia: Saunders.

Nursing Assessment

If the child has severe respiratory compromise, obtain a brief history while simultaneously providing respiratory interventions. To obtain the history, use the following questions as a guide:

- When did the symptoms begin and when do they occur?
- Did the symptoms have a sudden onset (as with a foreign body aspiration)?
- How have the symptoms progressed?
- Is the cough continual, intermittent, or worse at night or with exercise?
- Has there been any stridor? (Stridor is heard upon inhalation and may be associated with swelling of the trachea [as with croup] or with a foreign body in the upper airway.)
- Is there wheezing? If so, is the wheezing on inspiration or on expiration, or both?
- What makes the symptoms better and what makes them worse?
- Does drinking from a bottle induce the symptoms (as with gastroesophageal reflux–induced aspiration)?
- Is the child taking any medication for the symptoms? Does the child or do any members of the immediate family have a history of chronic respiratory disease, such as asthma?
- Are the child's immunizations up to date?
- Was the child born prematurely? If so, did the child require mechanical ventilation? For how long?
- Were there any respiratory problems during the first few days of life?
- When did the child last eat? (This question is important because a recent meal will increase the child's risk of aspiration in the event of a respiratory arrest. In addition, the presence of food in the stomach will increase the risk of aspiration during tracheal intubation.)

If the child can communicate, ask how he or she is feeling. Is he or she short of breath? Does his or her chest hurt? Observe the child while speaking. Children who are in respiratory distress may speak in short sentences with gasping between words.

Physical Examination

In an emergency, physical examination is often limited to inspection, observation, and auscultation. First, quickly survey the respiratory status. Determine if the child is breathing.

Inspection and Observation

Establish if the airway is patent, maintainable, or unable to be maintained. The child with a patent airway is breathing without signs of obstruction. The maintainable airway remains patent independently by the child or with interventions such as a towel roll under an infant's neck or the insertion of a nasal trumpet. The airway that cannot be maintained does not remain patent unless a more aggressive intervention, such as the insertion of a tracheal tube, is performed.

Look at the child's posture. Is the child sitting up, leaning forward, and drooling, as with epiglottitis? Observe the child's face: does he or she appear anxious or relaxed? Children in respiratory distress often appear anxious. Look at the nose and mouth. Are the nares patent? Is there noticeable nasal congestion or mucus coming from the nose? Note nasal flaring or mouth breathing. Observe for head bobbing. Listen for audible expiratory grunting or inspiratory stridor. Note the child's color. Does the child appear pale, mottled, dusky, or cyanotic? Children may appear mottled in response to poor oxygenation, hypothermia, or stress. Children with severe respiratory compromise may appear dusky. Look for cyanosis around the mouth or on the trunk. Cyanosis is a late and often ominous sign of respiratory distress. Central cyanosis is more likely to be associated with respiratory or cardiac compromise. In contrast, peripheral cyanosis is more likely to be associated with circulatory alteration.

Take NOTE!

Closely inspect the color of the area around the mouth. Circumoral pallor is a sign of poor oxygenation.

Evaluate the pattern and quality of respiration, noting the respiratory rate. **Tachypnea** (increased respiratory rate) is often noted in children in respiratory distress. However, seriously ill children grunt and may have normal or subnormal respiratory rates. **Hypoventilation**, a decrease in the depth and rate of respirations, is noted in very ill children or children who have central respiratory depression secondary to narcotics. If the child is a young infant (less than 2 months) or premature, periodic breathing may occur. **Periodic breathing** is regular breathing with occasional short pauses (brief periods of apnea). After the apneic pause, the infant will breathe rapidly (up to 60 breaths per minute) for a short period and then will resume a normal respiratory rate. In general, the infant who has periodic breathing looks pink and has a normal heart rate. Observe for the use of accessory muscles in the neck or retractions in the chest, determining the extent and severity of the retractions.

Auscultation

Auscultate the lungs with the diaphragm of the stethoscope. Breath sounds over the tracheal region are higher-pitched and are described as "vesicular," while breath sounds over the peripheral lung fields tend to be lower-pitched, known as "bronchial." Instruct the child to take deep breaths with the mouth open. To encourage the young child to exhale strongly, instruct him or her to "blow out" the penlight (as with a candle) or to blow on a tissue. Encourage the child not to breathe more rapidly than normal (to prevent **hyperventilation** [increased depth and rate of respirations]) and to avoid making any noises with the mouth.

> **Take NOTE!**
>
> *Significant upper respiratory congestion often interferes with assessment of the lower airways because the sound is easily transmitted throughout the chest. Differentiate between the upper and lower airway noises by listening with the stethoscope over the nose. You may be able to determine whether the noise is nasal or bronchial by using this technique.*

Auscultate the child's chest systematically. Listen in all anterior, axillary, and posterior regions, comparing the left to the right sides. Note any decreased or absent breath sounds, which may be the result of bronchial obstruction (as with mucous infection) or air trapping (as in children with asthma). Unilateral absent breath sounds are associated with foreign body aspiration and pneumothorax.

> **Take NOTE!**
>
> *Sometimes a child's respiratory status is so severely compromised that little or no air movement is noted. This commonly occurs during a severe asthma exacerbation. Minimal or no air movement requires immediate intervention.*

Note the presence and location of adventitious breath sounds such as crackles, wheezes, or rhonchi. Document the presence of a pleural friction rub (a low-pitched, grating sound), a sound resulting from inflammation of the pleura (RNCeus, 2006).

Palpation

Palpate the chest for any abnormalities. In the older, less severely ill, and cooperative child, assess for tactile fremitus. Using the palm of the hand, palpate over the lung regions in the same manner as for auscultation and percussion while the child says, "ninety-nine." Increased vibrations elicited during this maneuver are associated with consolidating conditions, such as pneumonia.

Percussion

Percuss the interspaces of the chest between the ribs in the same systematic fashion as with auscultation. Normally, percussion over an air-filled lung reveals resonant sounds. Note the presence of hyperresonance, which may indicate an acute problem such as a pneumothorax or a chronic disease such as asthma. In contrast, percussion sounds will be dull over a lobe of the lung that is consolidated with fluid, infectious organisms, and blood cells, as in the case of pneumonia.

Laboratory and Diagnostic Testing

Use continuous pulse oximetry if respiratory status is a concern. Note and report oxygen saturation levels below 95%. (See Chapter 39 for additional information about use of the pulse oximeter.)

Additional tests may reveal:

- Arterial or capillary blood gases: hypoxemia, hypercarbia, altered pH
- Chest x-ray: alterations in normal anatomy or lung expansion, or evidence of pneumonia, tumor, or foreign body
- Metal detector: evidence of metallic foreign body. Novel as it may sound, metal detectors have been found to be highly accurate (99%) in detecting the presence of ingested coins in children (Lee et al., 2005).

> **Take NOTE!**
>
> *Children with cardiac conditions resulting in cyanosis often have baseline oxygen saturations that are relatively low because of the mixing of oxygenated with deoxygenated blood.*

Nursing Management

The basic principle of pediatric emergency care and PALS is prevention of cardiopulmonary arrest. Therefore, the nurse must rapidly assess and appropriately manage children who have signs of respiratory distress. Nursing management of the child in respiratory distress involves maintaining a patent airway, providing supplemental oxygen, monitoring for changes in status, and in some cases assisting ventilation. In addition to providing these life-saving measures and monitoring the child's progress, offer support and education to the child and family.

Maintaining a Patent Airway

When a child exhibits signs of respiratory distress, make a quick decision about whether it will be safe to allow the child to stay with the parent or whether the child must be placed on the examination table or bed. For example, in the case of croup, the child will often breathe more comfortably and experience less stridor while in the comfort of the parent's lap. Many children in respiratory distress often are most comfortable sitting upright, as this position helps to decrease the work of breathing by allowing appropriate diaphragmatic movement. In contrast, a child with a decreasing level of consciousness may need to be placed in the supine position to facilitate positioning of the airway.

The infant will benefit from a small sheet or towel folded under the shoulders. This will facilitate positioning the infant's airway in the "sniff" position, as is recommended by AHA's Basic Cardiac Life Support (BCLS) guidelines (Fig. 52.3). Avoid neck flexion or hyperextension, which may completely occlude the infant's airway. In children over age 1 year, the optimal method for opening the airway is to hyperextend the neck, as recommended by AHA BCLS. If a cervical spine injury is not suspected, use the head tilt–chin lift technique to open the airway. If the child has suffered head or neck trauma and cervical spine instability is a concern, use the jaw-thrust maneuver by placing three fingers under the child's lower jaw and lifting the jaw upward and outward (Fig. 52.4). In either case, never place the hand under the neck to open the airway.

Often the nurse encounters an acutely ill child who cannot maintain an airway independently but may be able to do so with some assistance. For example, sometimes simply opening the airway and moving the tongue away from the tracheal opening is all that is required to regain airway patency. In certain conditions, a nasopharyngeal or oropharyngeal airway may be necessary for airway maintenance. Comparison Chart 52.1 provides additional information about these types of airways.

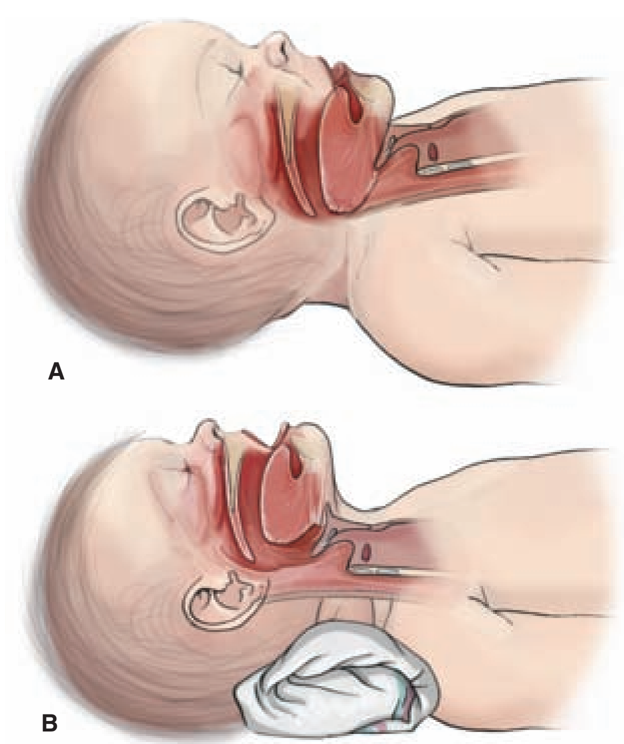

Figure 52.3 (**A**) The infant and young child's prominent occiput encourages flexion of the neck and may result in airway occlusion. (**B**) Putting a towel roll under the shoulders helps to open the infant's or young child's airway by placing it in the neutral or "sniff" position.

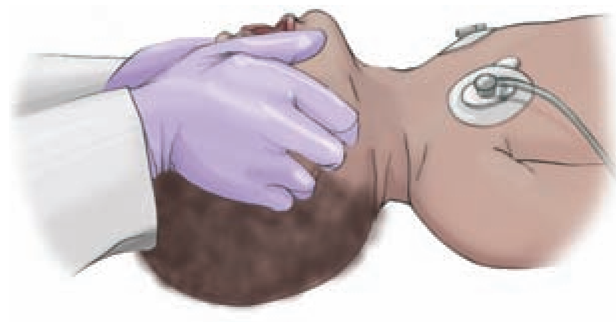

Figure 52.4 Jaw-thrust technique for opening the airway.

Assisting Ventilation

The child in respiratory distress may ventilate poorly, hypoventilate, or tire and become apneic. In this case, the child may require assistance with ventilation through BVM ventilation, tracheal intubation, or a laryngeal mask airway. Table 52.3 explains these methods.

Providing Bag-Valve-Mask Ventilation

BVM ventilation is used in the management of children who cannot ventilate or oxygenate effectively on their own. This technique is a more efficient way of ensuring ventilation than using only supplemental oxygen. In addition, resuscitating a child in this manner is superior to mouth-to-mouth resuscitation as it provides higher oxygen concentrations and protects the nurse from exposure to oral secretions. However, this technique requires proper training and practice. The proper procedure involves appropriate opening of the airway followed by providing breaths with the BVM.

Ventilation with the BVM may be performed with either one or two rescuers. First, choose an appropriate-sized bag and a corresponding face mask that fits the infant or child. Self-inflating bags are usually available in neonatal, infant, child, and adult sizes. Corresponding masks are available. Choose a face mask that properly fits the child's face and that provides a seal over the nose and mouth and excludes the eyes, thus preventing any pressure on the eyes (Fig. 52.5).

Take NOTE!

Face masks should be clear so that the nurse can see the child's lip color and identify any emesis during resuscitation. Older face masks, which were black, should no longer be used.

COMPARISON CHART 52.1 Oropharyngeal Versus Nasopharyngeal Airways

Oropharyngeal airway (used only in unconscious children)	• Consists of a simple plastic curved body that has a central air channel to allow for aeration • Is used when an unconscious child has difficulty maintaining airway patency due to upper airway obstruction, such as from the tongue • Allows for oral suction • Determine the correct size of the airway by placing it next to the child's cheek with the tip pointing down. An airway that is too large will extend past the angle of the child's mandible and can obstruct the glottic opening when inserted. • Choose the airway that best fits the child to decrease the risk of injury to the structures of the mouth.
Nasopharyngeal airway (may be used in conscious children and children who have an intact gag reflex)	• Consists of a flexible curved tube that is inserted nasally • Is used when the child has difficulty maintaining airway patency due to tongue obstruction or palate problems, when neurologic impairment causes poor pharyngeal tone, or in the child with impaired consciousness • Allows for nasopharyngeal suction • When selecting this airway, keep in mind that the diameter of the airway should not be so large that it puts too much pressure on the internal nasal tissue. There are two common methods for measuring this airway: 1) Measure the distance from the end of the child's nose to the tragus of the ear; 2) Look at the child's fifth digit, which is usually the approximate diameter of the nasopharyngeal airway. • Monitor for mucosal irritation, nasal septum swelling, and laceration of the adenoids. • Do not use this type of airway in children with a history of bleeding disorders and basilar skull fractures. • This airway's small diameter can easily become obstructed with secretions and blood.

Connect the BVM via the tubing to the oxygen source and turn on the oxygen. When resuscitating infants and children, set the flow rate at approximately 10 L/minute. For an adolescent who is adult-sized, set the flow rate at 15 L/minute or higher to compensate for the larger-volume bag. Check to make sure that the oxygen is flowing through the tubing to the bag. Self-inflating bags do not provide "free-flow" oxygen out of the face mask; manual pumping of the bag is necessary. However, the bags have a corrugated plastic tail that allows oxygen to freely flow. Therefore, check over the tail for oxygen flow through the bag.

After opening the airway appropriately (see above), place the mask over the child's face. When one rescuer is providing ventilation (commonly referred to as "bagging"), the person must provide a seal with the mask over the child's face with one hand and use the other hand to manipulate the resuscitator bag. The hand used to provide the mask seal will simultaneously maintain the airway in an open position. Generally, use the left thumb and index finger to hold the mask on the child's face. While maintaining a good seal with the mask, use upward pressure on the jaw angle while pressing downward on the mask below the child's mouth to keep the mouth open (Fig. 52.6). Take care not to put pressure on the neck with the fourth and fifth fingers.

If adequate personnel are available, a more desirable situation involves one person standing behind the child's head to maintain an open airway and to provide a seal of the mask over the face with a hand on each side (usually the thumbs and second fingers). A second rescuer stands on one side of the child and compresses the bag to ventilate the child using both hands. If the child is more difficult to ventilate, the two-rescuer method allows the ventilating nurse to provide better ventilation than with the one-rescuer method. In addition, the two-rescuer method ensures the best possible mask seal, as the rescuer holding the mask can use both hands to maintain the seal.

Regardless of the number of persons present, proper placement of the face mask is critical, and a good seal must be maintained throughout the resuscitation. In addition, during ventilation, use only the force and tidal volume necessary to cause a chest rise, no more. If a good chest rise is not observed, attempt to open the airway again. It may be necessary to adjust the position of the airway a few times to achieve a patency conducive to ventilation.

Compress the bag to deliver breaths at the amount recommended in infants and children. Initially, provide two rescue breaths and observe for a chest rise. Rescue breaths should not overinflate the lungs. Breaths should be delivered over 1 second. After the first two rescue ventilations, perform rescue breathing at a rate of one breath every 3 to 5 seconds, or about 12 to 20 breaths per minute. Delivering each breath should be a steady, one-inhalation-to-one-exhalation ratio. This means that the amount of time delivering the inspiratory ventilation is equal to the amount of time that expiration is allowed. While ventilating the infant or child, work with, not against, any spontaneous respiratory effort; in other words, if the child is breathing out, do not attempt to force air in at the same time.

If the child is unconscious and a third rescuer is available, that person can apply cricoid pressure. **Cricoid pressure** (also known as the Sellick maneuver) is the use

TABLE 52.3 Airway and Ventilation Methods

Method	Description	Comments
Anesthesia bag or flow-inflating ventilation systems	A small, collapsible bag that consists of a reservoir bag, an overflow port, and a fresh gas inflow port	• Adjustment of the oxygen flow and of the outlet control valve is necessary. • Useful in providing positive end-expiratory pressure (PEEP) or continuous positive airway pressure (CPAP) • Adequate training and significant skill are needed to properly operate this device. • Hypercapnia and barotrauma may result with improper use. • Used more commonly in the post-anesthesia care unit (PACU) and in the neonatal intensive care unit
Bag-valve-mask device or manual resuscitator	A self-inflating oxygen delivery bag that does not require an oxygen source for resuscitation and ventilation. The bag can be connected to oxygen to provide higher oxygen levels than room air. When the child exhales, the non-rebreathing valve closes, allowing exhaled, deoxygenated air to escape.	• Effective in providing oxygen to a child who is in severe respiratory distress or who has suffered a respiratory arrest • A more efficient method of respiratory resuscitation than mouth-to-mouth resuscitation; decreased rescuer exposure to communicable disease • Most medical personnel can be trained to perform resuscitation with this method. • Possibly tiring for the rescuer when used to ventilate a child for long periods of time (see discussion on bag-mask ventilation)
Laryngeal mask airway	An inflatable silicone mask and rubber connecting tube that is inserted blindly into the airway, forming a seal	• The airway is introduced into the pharynx and advanced until it meets resistance; balloon cuff is then inflated. • Easier insertion than a tracheal tube • Usually used in the unconscious child who benefits from bag-valve-mask ventilation but does not require intubation • Improvement in client comfort
Tracheal intubation	A plastic tube inserted in the trachea to establish and maintain an airway when the airway cannot be maintained effectively using other measures (e.g., nasal trumpet or bag-valve-mask ventilation)	• Skilled medical professional (physician, nurse practitioner, respiratory specialist, EMT, or physician's assistant) necessary for insertion • The nurse acts as a valuable assistant during the intubation procedure.

of gentle pressure to occlude the esophagus, preventing air from entering the stomach (Fig. 52.7). Cricoid pressure may help to prevent vomiting secondary to gastric distention. Vomiting during resuscitative efforts can complicate the situation because the child is at risk of aspirating abdominal contents.

Monitoring Effectiveness of Ventilation

During the resuscitation, continually reassess the child's response to the resuscitative efforts, noting:

- Adequacy of chest rise
- Absence or minimal presence of abdominal distention
- Improved heart rate and pulse oximetry readings
- Improved color
- Capillary refill less than 3 seconds with strengthening pulses

If the child's status deteriorates and he or she becomes pulseless, then CPR must be started. In addition, periodically and briefly stop ventilating to evaluate for spontaneous respirations.

Preventing Complications Related to Bag-Valve-Mask Ventilation

During resuscitation, health care personnel usually exhibit high energy levels, a normal physiologic response that facilitates resuscitative efforts as the rescuers act quickly. However, this heightened state can lead to overzealousness while ventilating an infant or child. Health care providers

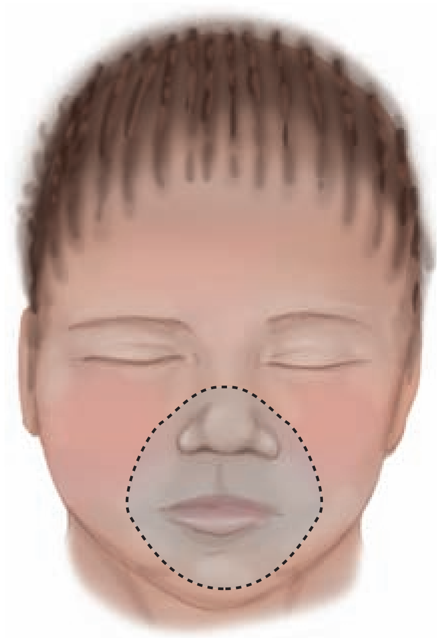

FIGURE 52.5 The mask should form a seal over the nose and mouth, across the chin and nose bridge.

may inadvertently ventilate the child too rapidly using too much tidal volume, leading to excessive ventilation volume and increased airway pressure. This poor technique can be detrimental to the child, causing:

- Reduced cardiac output (due to increased intrathoracic pressure and increased cardiac afterload)

FIGURE 52.6 Proper hand placement for maintaining airway and adequate mask seal using one-rescuer technique.

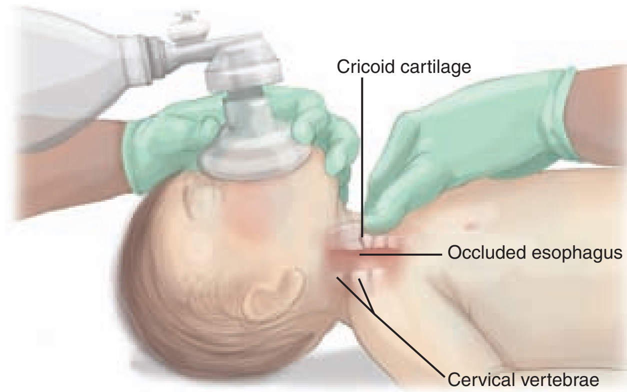

FIGURE 52.7 Applying cricoid pressure.

- Air trapping
- **Barotrauma** (trauma caused by changes in pressure)
- Air leak (thus reducing the oxygen delivered to the child)

In addition, children with head injury who receive excessive ventilation volumes and high rates may develop:

- Decreased cerebral blood flow
- Cerebral edema
- Neurologic damage (adapted from AHA, Pediatric Advanced Life Support, 2001b)

Thus, nurses must be mindful of their technique during bagging, not exceeding the recommended respiratory rate or providing too much tidal volume to the child. Ventilate the child in a controlled and uniform manner, providing just enough volume to result in a chest rise.

Assisting With Tracheal Intubation

Tracheal intubation is needed if the infant or child does not have a maintainable airway or will require artificial ventilation for a prolonged time. Intubation of infants and children is a procedure that requires great skill and therefore should be performed by only the most qualified and experienced personnel. Children are most commonly intubated orally, rather than nasally, in acute situations.

Nurses are an essential part of the intubation team, usually assisting a physician, nurse practitioner, respiratory therapist, or physician's assistant during the intubation procedure (Nursing Procedure 52.1). The nurse may set up the equipment, prepare and administer intubation medications, or assist with suctioning the oral secretions and preparing the tape to secure the tracheal tube. In a child in full arrest, the nurse might be responsible for performing ongoing chest compressions while other team members manage the child's airway.

Setting Up Equipment

Appropriate setup and preparation of equipment is essential (Table 52.4). The tracheal tube size used depends on the child's size. To calculate tracheal tube size, divide the child's age by 4 and add 4. The resulting number will in-

Nursing Procedure 52.1

Assisting With Tracheal Intubation

1. Prepare equipment and supplies.
2. Draw up medications (for rapid sequence intubation).
3. Turn up the volume on the cardiac monitor so that members of the team can easily hear the audible QRS indication of the child's heart rate and note any bradycardia with the procedure.
4. Turn on the suction. Make sure that suction is working by placing your hand over the tubing before you attach the suction catheter.
5. Continue to ventilate the child with the BVM and 100% oxygen as the team prepares to intubate the child.
6. When there is no suspected cervical spine injury, in the child over age 2 years, place a small pillow under the child's head to facilitate opening of the airway; this step is unnecessary in children younger than age 2 due to the prominence of their occiput.
7. When assisting with the intubation, stand beside the patient's head and prepare to assist with suctioning of oral secretions, applying cricoid pressure during the insertion of the tube, providing BVM as needed, and assisting with securing the tube with tape.
8. Before the initial intubation attempt and after each subsequent attempt to intubate, provide several inhalations of 100% oxygen via the BVM ventilation method (optimally for a few minutes).
9. Administer premedication and medications for sedation.
10. Administer paralyzing medication.
11. Observe as the health care professional who is intubating the child follows the recommended procedure for intubation using the laryngoscope to visualize the vocal cords.
12. As the tracheal tube is inserted, apply gentle cricoid pressure (too much pressure can block the trachea) if appropriate.

dicate the size of the tracheal tube in millimeters. For example, if the child is 2 years old, the proper-sized tube would be 4.5 ([2/4] + 4 = 4.5). Always have one size smaller ready also, so have a 4.0 and a 4.5 tracheal tube for this child.

Administering Medications

Several medications are often given to facilitate intubation of children. Premedicating a child before passing a tracheal tube aids in the following:

- Reducing pain and anxiety (consistent with the concept of atraumatic care)
- Minimizing the effects of passing the tracheal tube down the airway (vagal stimulation leading to **bradycardia** [decrease in heart rate])
- Preventing hypoxia
- Reducing intracranial pressure
- Preventing airway trauma and aspiration of stomach contents

The use of medications during the intubation process is known as rapid sequence intubation (Table 52.5). Typically, these medications are used in controlled settings such as the emergency department or the intensive care unit. Rapid sequence intubation is done only in children who are not experiencing cardiac arrest. If the intubation is expected to be particularly difficult, paralyzing medication should not be used.

The nurse must be aware of the differences in the various medication classes, their advantages, disadvantages, and adverse effects. The nurse must also be able to distinguish between medications that produce sedation and ones that produce analgesia. Children who are paralyzed and sedated may be suffering severe pain. The pain control needs of children who are acutely ill are of paramount importance and cannot be overstated. Do not mistake a child who is immobilized as a result of sedative and paralytic medications for a child who is pain-free.

Ensuring and Maintaining Correct Tube Placement

To assess for correct placement once the tracheal tube is inserted, observe for symmetrical chest rise and auscultate over the lung fields for equal breath sounds. Inspect the tracheal tube for the presence of water vapor on the inside, indicating that the tube is in the trachea. To rule out accidental esophageal intubation, auscultate over the abdomen while the child is being ventilated: there should not be breath sounds in the abdomen. Note improvement in the oxygen saturation level via pulse oximetry.

Once tracheal tube placement is verified, mark the tube with an indelible pen at the level of the child's lip and secure it with tape. Document the number on the tracheal tube at the level of the child's mouth. Anticipate a chest x-ray to confirm correct placement of the tracheal tube.

After placement is confirmed, the tracheal tube is connected to the ventilator by respiratory personnel. The ventilator will provide continuous artificial ventilation and oxygenation. Exhaled CO_2 monitoring is recommended as it provides an indication of appropriate ventilation (Box 52.1). If an exhaled CO_2 monitor is being used, the exhaled CO_2 should be yellow.

The nurse plays a key role in ensuring that the tracheal tube remains taped securely in place by doing the following:

- Using soft wrist restraints if necessary to prevent the child from removing the tracheal tube
- Providing sedative and/or paralyzing medications
- Using caution when moving the child for x-rays, changing linens, and performing other procedures

TABLE 52.4 Equipment and Supplies for Tracheal Intubation

Laryngoscope blades	Straight blades (Miller) are usually used for infants and young children. A curved-blade laryngoscope (Macintosh) may be used for older children and adolescents. The blade has a little light bulb attached to it for visualization of the trachea. The light bulb should be bright and attached securely.
Tracheal tubes	Three sizes should be readily available: the estimated size, a size smaller, and a size larger. A stylet may be used to guide the tube through the child's vocal cords (it is then removed after the intubation procedure).
Oxygen	100% oxygen is provided using a bag-valve-mask before intubation and after unsuccessful intubation attempts.
Suction	Properly working wall or portable suction with appropriate-sized suction catheters (that fit the tracheal tube) should be prepared; the package is opened, leaving the sterile-tipped end inside the package and connecting the other end to the suction tubing. A Yankauer suction catheter (large catheter) should also be available if copious secretions are present in the mouth that interfere with the ability to visualize the airway.
Monitors	Pulse oximeter and cardiac monitor with an audible tone indicating the QRS complex should be in place. Exhaled CO_2 device is needed to detect increased CO_2 levels after the intubation.
Nasogastric tube	Placing a nasogastric (NG) tube will help to mitigate abdominal distention. Clients who are manually ventilated typically have some abdominal distention as some air passes into the stomach.
Personal protective equipment	Usually just gloves, goggles, and a mask are necessary to protect health care workers. In the case of copious bleeding, health care workers should wear gowns also.
Tape, etc.	Tape should be prepared for securing the tube. Benzoin, a sticky substance, is usually applied under the tape for enhanced security of the tape. For children who have had multiple intubations, a protective barrier (as used to protect the skin around an ostomy) may be applied under the tape to protect the skin. Gauze pads should be available to clean up excess secretions that may interfere with taping the tracheal tube.

Monitoring the Child Who Is Intubated

Provide ongoing and frequent monitoring of the intubated child to determine adequacy of oxygenation and ventilation as noted earlier. Once the child is intubated, the ventilatory support being provided should result in improvement in oxygen saturation and vital signs. If the child begins to exhibit signs of poor oxygenation, perform a quick assessment. Auscultate the lungs for equal air entry and determine the heart rate. Are the breath sounds equal? Is the heart rate normal for age? Perform a quick survey of the equipment and look for any disconnected tubes or kinks in the tubing. Determine oxygen saturation levels via pulse oximeter and evaluate the end-tidal CO_2 color (see Box 52.1). Use the PALS mnemonic "DOPE" for troubleshooting when the status of a child who is intubated deteriorates:

D = Displacement. The tracheal tube is displaced from the trachea.
O = Obstruction. The tracheal tube is obstructed (e.g., with a mucus plug).
P = Pneumothorax. Usually a pneumothorax results in a sudden change in the child's assessment. The signs of a pneumothorax include decreased breath sounds and decreased chest expansion on the side of the pneumothorax. Subcutaneous emphysema may be noted over the chest. In the case of tension pneumothorax, there may be a sudden drop in heart rate and blood pressure.
E = Equipment Failure. Relatively simple problems as previously discussed, such as a disconnected oxygen supply, can cause the child to deteriorate. Culprits such as a leak in the ventilator circuit or a loss of power are other types of equipment failure that may be responsible.

Make sure all equipment is appropriately connected and functional. When obstruction with secretions is suspected, suction the tracheal tube. If the tracheal tube is displaced from the trachea, remove the tube if it remains in the child's mouth and begin BVM ventilation. In the case of pneumothorax, prepare to assist with needle thoracotomy.

Preparing the Intubated Child for Transport

Once the child is stabilized with a secure tracheal tube in place, prepare to transport the child. The child will be moved by stretcher to an intensive care unit in the acute care facility or by air or land ambulance to another facility that specializes in the care of acutely ill children.

TABLE 52.5 Medications for Rapid Sequence Intubation

Medications	Desired Effects	Undesirable Effects
Anticholinergic: atropine	Decreases respiratory secretions and mitigates the vagal affects of intubation, thus decreasing the risk of bradycardia	Doses that are too low (<0.1 mg) can cause a paradoxical bradycardia. Young infants are more prone to the bradycardic effects of atropine, so its use is generally contraindicated in this population.
Sedatives: barbiturates—thiopental (short-acting barbiturate)	Has very rapid onset and short duration of action; reduces intracranial pressure and oxygen demand	Hypotensive effects of this drug are more severe in the dehydrated client. When given in combination with narcotics, respiratory depression is potentiated.
Sedatives: benzodiazepines—midazolam (Versed)	Has a slightly slower onset than thiopental but is associated with fewer adverse effects Also causes amnesia Can be titrated up or down (at lower doses it causes conscious sedation; at higher doses it can induce anesthesia)	When given in combination with narcotics, respiratory depression is potentiated.
Anesthetic agent: ketamine	Has a rapid onset with sedative, amnesic, and analgesic affects. Can be dissociative (child is awake but unaware). May improve BP and cause bronchodilation (helpful for children with status asthmaticus).	Ketamine can cause increased intracranial pressure and increased ocular pressure. Therefore, children who have suffered head trauma or globe injury should not receive this medication. Because of ketamine's sympathetic effects, hypertension can result from its use. Ketamine tends to cause increased secretions, often necessitating the concomitant use of atropine to counteract this adverse affect. May cause hallucinations and is therefore contraindicated in children with psychiatric problems.
Anesthetic agent: lidocaine	Can decrease intracranial pressure at higher doses Has an advantage when used in the management of hypovolemia because it is less likely to cause hypotension	Lidocaine can cause adverse cardiac effects (bradycardia, hypotension, dysrhythmias) in high doses. May be associated with CNS depression and seizures
Narcotic analgesic: fentanyl citrate (Sublimaze)	A highly concentrated opioid that causes fewer adverse effects (e.g., pruritus) than other opioids Also exerts a less hypotensive effect	Constipation and urinary retention (as is common with opioids) may occur. Increases risk for respiratory depression, increased intracranial pressure, and hypotension Chest wall rigidity is common with this drug and may cause difficulty with ventilation.

Medications	Desired Effects	Undesirable Effects
Paralyzing or neuromuscular blocking agents: rocuronium (Zemuron), succinylcholine (Anectine), vercuron (Norcuron)	Used for short-term paralysis during the intubation process. May be used for extended paralysis in ICU for clients in whom movement would be detrimental. For example, a child with epiglottitis has a very precarious airway and must remain intubated until the epiglottis decreases in size. In certain respiratory conditions, spontaneous respiratory effort would interfere with the ventilation of a client and therefore prolonged paralysis is desirable.	Succinylcholine (a depolarizing agent) has always been the gold standard for paralysis because it has a relatively rapid onset and is short-acting. However, it has a greater risk of adverse effects (bradycardia, hyperkalemia, hypertension, increased intracranial and ocular pressure) and is contraindicated in a variety of clinical conditions. The contemporary approach to paralysis involves the use of longer-acting agents, such as rocuronium and vercuron, because clients have fewer adverse effects with these medications. In addition, rocuronium and vercuron may be used for extended paralysis (not an option with succinylcholine).

Make sure that all tubes are securely taped. During transport, use portable oxygen and manually ventilate with the BVM. As the "sending" nurse, ensure that all laboratory results are obtained and provided to your "receiving" colleagues. If the child is going to another facility, complete a detailed summary of the resuscitation or provide a copy of the nurse's and/or progress notes. Complete the appropriate transfer forms as determined by the institution.

If the child is being transported by ambulance, the parents may not be able to accompany their child. In this case, find out as much as possible about the transport and assist the parents by giving directions to the receiving institution.

BOX 52.1 Exhaled CO_2 Monitoring or End-Tidal CO_2 Monitoring

- Device that connects to the child's ventilator circuit to detect CO_2 in the tubing. CO_2 should be noted in the tubing after six ventilations.
- Devices are usually color-coded. In the case of tracheal intubation, observe the color on the device change from purple to tan to yellow.
- The AHA's Pediatric Advanced Life Support (2007) suggests the following method to remember how the colors on the end-tidal CO_2 device correspond with tracheal tube placement:
  - Purple = Problem (little or no CO_2 detected)
  - Tan = Think about a problem.
  - Yellow = Yes, CO_2 is definitely detected and the tube is in the trachea.

SHOCK

Shock is defined as a "clinical state characterized by inadequate tissue perfusion resulting in delivery of oxygen and metabolic substrates that is insufficient to meet tissue metabolic demands," according to the AHA (2007). If shock is left untreated, cardiopulmonary arrest will result. Shock, which may be classified as compensated or decompensated, is due to a variety of clinical problems. Compensated shock occurs when poor perfusion exists without a decrease in BP. In decompensated shock, inadequate perfusion is accompanied by a drop in BP. Unchecked decompensated shock leads to cardiac arrest and death. The principles of PALS stress the early evaluation and management of children in compensated shock with the goal of preventing decompensated shock. Once the child in shock is hypotensive, organ perfusion is dramatically impaired and a dire clinical scenario ensues.

Pathophysiology

Shock is the result of dramatic respiratory or hemodynamic compromise. Shock is caused by impaired cardiac output or impaired systemic vascular resistance (SVR) or a combination of both. Cardiac output (CO) is equal to heart rate (HR) times ventricular stroke volume (SV) ($CO = HR \times SV$). Stroke volume is how much blood is ejected from the heart with each beat. Stroke volume is related to left ventricular filling pressure, the impedance to ventricular filling, and myocardial contractility. Left ventricular filling pressure is also known as preload, and the impedance to ventricular filling is commonly called afterload. Young children and infants have relatively small stroke volumes compared to older children and adults. Therefore, infants and young children differ from their adult counterparts in that their cardiac output depends on their heart rate, not their stroke volume. Clinically, in cases of circulatory compromise and compensated shock in infants and children, the heart rate is increased. The exception to this is a paradoxical phenomenon in neonates, who may have bradycardia rather than tachycardia.

Systemic vascular resistance or afterload is the impediment to the heart's ventricular ejection. Increased SVR will result in a decrease in blood flow unless the ventricular pressure increases. Increased vascular resistance is a common problem in shock. In children who have shock-related increased SVR, cardiac output will fall unless the ventricle can compensate by increasing pressure. In cardiac insufficiency, the child's heart will have impaired ability to compensate for the increased afterload.

Types of Shock

The most common types of shock are hypovolemic, septic, cardiogenic, and distributive. Hypovolemic shock, the most common type of shock in children, occurs when systemic perfusion decreases as a result of "inadequate intravascular volume in relation to vascular space" (AHA, 2007). Children commonly have hypovolemic shock that occurs in association with fluid losses. For example, hypovolemic shock may occur with gastroenteritis that results in vomiting and diarrhea, medications such as diuretics, and heat stroke. Other causes of hypovolemia in children include blood loss, such as from a major injury, and third spacing of fluid, such as with burns.

Septic shock is related to a systemic inflammatory response in which there may be increased cardiac output with a low SVR, known as "warm shock." More commonly in children, septic shock results in a decrease in cardiac output with an increase in SVR, known as "cold shock."

Cardiogenic shock results from an ineffective pump, the heart, with a resultant decrease in stroke volume. Children who have congenital or acquired cardiac abnormalities with a poorly functioning heart are at risk for cardiogenic shock.

Distributive shock is the result of a loss in the SVR. A relative hypovolemia occurs, most often with neurogenic injury-related shock and anaphylaxis. In relative hypovolemia, the vascular compartment expands due to systemic vasodilation. This results in a relatively larger vasculature requiring more fluid to maintain cardiac output despite no actual loss of fluid.

Lastly, toxic drug ingestions may also lead to shock.

Altered microcirculatory status is common in all types of shock. Compensatory mechanisms are activated in response to decreased blood flow. Sympathetic nervous system response results in marked contraction of larger vessel sphincters and arterioles. This compression results in dramatically impaired capillary blood flow. Blood is redirected away from less important body systems, such as the skin and the kidneys, to the vital organs (the heart and brain). During compensated shock, the body can maintain some level of blood flow to the vital organs. Peripheral vasoconstriction, the body's compensatory response to diminished blood flow, often results in the child's ability to maintain a normal or near-normal BP. As shock continues, capillary beds become obstructed by cellular debris, and platelets and white blood cells aggregate. Endothelial damage occurs as a result of capillary congestion. Poor blood flow to the capillaries results in anaerobic metabolism. Lactic acid accumulates, and this can lead to acidosis. In addition, children with septic shock sustain marked endothelial damage as a result of exposure to bacterial toxins.

The cumulative effect of capillary obstruction and dramatically impaired blood flow is tissue ischemia. As tissue ischemia progresses, the child will show signs of altered perfusion to vital organs. For example, as blood flow to the brain is diminished, the child will demonstrate an altered level of consciousness. Altered blood flow to the kidneys will result in decreased urine output or absence of urine output (oliguria). Commonly, the heart rate will increase in the early stages of shock, but as the heart becomes compromised as a result of poor perfusion, the child will become bradycardic. The child will demonstrate an increased respiratory rate in the initial phase of shock. Tachypnea is seen in septic shock as well. In fact, the child may demonstrate marked hyperventilation in an effort to "blow off" carbon dioxide in response to the acidosis that is associated with septic shock.

Nursing Assessment

Nursing assessment of the child in shock includes the health history and physical examination as well as laboratory and diagnostic testing. The nursing assessment must be performed quickly and accurately so that resuscitation can be expedited.

Health History

In shock, the health history is based on the child's presentation. Children with shock are critically ill and require emergent intervention. Therefore, the history is obtained as life-saving interventions are provided. Determine when the child first became ill and treatments that have been given thus far. Inquire about sources of volume loss, such as:

- Vomiting
- Diarrhea
- Decreased oral intake
- Blood loss

Ask when the child last urinated. Investigate for other related symptoms such as behavioral changes or lethargy. Has the child had a fever or rash, complained of headache, or been exposed to anyone with similar symptoms? Inquire about daycare attendance and whether the family has recently traveled outside of the country. Determine if the child has a history of a congenital heart defect or other heart condition or if the child has severe allergies. Ask the parent about accidental ingestion of medications or other substances and, for the older child or adolescent, about the possibility of illicit substance use.

Physical Examination

The key to successful shock management is early recognition of the signs and symptoms. Obtain vital signs, noting any alterations. Measure BP, although this is not a reliable method of evaluating for shock in children. Children tend to maintain a normal or slightly less-than-normal BP in compensated shock while sacrificing tissue perfusion until the child suffers a cardiopulmonary arrest. Therefore, other components of the circulatory evaluation will be more valuable when assessing a child.

Take NOTE!

Bradycardia is a serious sign in neonates and may occur with respiratory compromise, circulatory compromise, and/or overwhelming sepsis.

As with any emergency, evaluate the airway first. Is it patent? Then determine if the child is breathing. The child in shock will often demonstrate signs of respiratory distress, such as grunting, gasping, nasal flaring, tachypnea, and increased work of breathing. Auscultate breath sounds to determine the adequacy of air entry and airflow. If the child shows signs of respiratory distress, manage the airway and breathing problem first, as discussed earlier in the chapter.

Assess the skin color. Palpate the skin temperature and determine quality of pulses. Except in special cases, such as distributive shock, the child in shock will generally have darker and cooler extremities with delayed capillary refill. Note the line of demarcation if present. This refers to the point on the distal extremity where cool temperature begins (the proximal portion of the extremity may continue to be warm). In distributive shock, the initial assessment will reveal full and bounding pulses and warm, erythemic skin. Evaluate the pulse quality. Distal pulses will likely be weaker than central pulses.

Evaluate the child's hydration state and check skin turgor. Decreased elasticity is associated with hypovolemic states, though this is usually a late sign. Observe the child's face; in compensated shock the child may be awake but obtunded and demonstrate signs of distress. The child in decompensated shock may have his or her eyes closed and may be responsive only to voice or other stimulation. Evaluate pupillary responses. Determine urinary output, which will be decreased in the child with shock.

After having evaluated and provided initial life-saving management for airway, breathing, and circulation, evaluate the child's entire body for other disabilities. Injuries warrant vigilant evaluation for ongoing blood loss, although they may also produce internal blood loss (e.g., a femur fracture). Look for signs of malformation, swelling, redness, or pain of the extremities, which may suggest internal blood loss. Also inspect for any open wounds and active sites of bleeding. Children with abdominal injuries also may lose copious amounts of blood internally. Inspect the abdomen for redness, skin discoloration, or distention. Auscultate for bowel sounds in all four quadrants.

Laboratory and Diagnostic Testing

As the child is being resuscitated, laboratory tests and radiographs will be ordered and obtained. However, no diagnostic test should replace the priority of respiratory support, vascular access, and fluid administration. Laboratory results will guide ongoing management. Common laboratory and diagnostic tests used for children with shock include:

- Blood glucose levels: usually performed at the bedside using a glucose meter (e.g., Chem-strip or Accucheck) to obtain a rapid result
- Electrolytes: to evaluate for electrolyte abnormalities
- CBC with differential: to assess for viral or bacterial infection (septic shock) and to evaluate for anemia and platelet abnormalities
- Blood culture: to evaluate for sepsis; preliminary results will not be available for 1 to 2 days
- C-reactive protein: to evaluate for infection
- Arterial blood gases: to assess oxygen and carbon dioxide levels and to provide information about acid–base balance
- Toxicology panel (if ingestion is suspected)
- Lumbar puncture: to evaluate the cerebrospinal fluid for meningitis
- Urinalysis: to evaluate for glucose, ketones, and protein; concentration (specific gravity) is increased in dehydration states
- Urine culture: to evaluate for urinary tract or kidney infection
- Radiographs: to evaluate heart size, to evaluate the lungs for pneumonia or pulmonary edema (present with cardiogenic shock)

Nursing Management

Signs of shock in children warrant an emergent response. Always evaluate and manage the airway and breathing and check for pulses. Initiate CPR if the child is pulseless. All children who have signs and symptoms of shock should receive 100% oxygen via mask. If the child has poor respiratory effort or is apneic, administer 100% oxygen via BVM or tracheal tube (refer to the section on respiratory emergencies for more specific information about management of airway and breathing). As part of ongoing monitoring, institute cardiac and apnea monitoring and assess oxygen saturation levels via pulse oximetry.

Obtaining Vascular Access

Once the airway and breathing are addressed, nursing management of shock focuses on obtaining vascular access and restoring fluid volume. Children with signs of shock should receive generous amounts of isotonic IV fluids rapidly. However, obtaining vascular access in critically ill children can be challenging. Vascular access must be obtained using the quickest route possible in children whose condition is markedly deteriorated, such as those in decompensated shock.

Various forms of vascular access available for the management of the critically ill child include:

- Peripheral IV route: A large-bore catheter is used to give large amounts of fluid. This route may not be feasible in children with significant vascular compromise.
- Central IV route: Central lines can be inserted into the jugular vein and threaded into the superior vena cava. The femoral route is best for obtaining central venous access while CPR is in progress because the insertion procedure will not interfere with life-saving interventions involving the airway and cardiac compressions. The subclavian vein, located under the clavicle, is an alternative route for central access.
- Saphenous vein: The saphenous vein (found in the ankle) is an alternative route for venous access that is obtained using a surgical incision.
- Intraosseous access: Intraosseous access, obtained by cannulating the bone marrow, is recommended in cases of decompensated shock or cardiac arrest if IV access cannot be attained rapidly. The preferred site is the anterior tibia. Special intraosseous needles are used (generally a 15-gauge needle for older children, 18-gauge for younger children). The needle is inserted using a firm twisting motion slightly away from the growth plate. Any medications or fluids that can be administered using an IV site can be given using this route. Alternative sites include the femur, the iliac crest, the sternum, and the distal tibia.

Restoring Fluid Volume

Administer IV isotonic fluids, such as Ringer's lactate or normal saline (the isotonic fluids of choice) rapidly. Administer 20 mL/kg of the prescribed fluid as a bolus, infusing the fluid as rapidly as possible. In general a large-bore syringe, such as a 35- to 60-cc syringe attached to a three-way stopcock, is the preferred method for rapid fluid delivery in children. Infusing the fluid via gravity is too slow. The fluid bolus may be repeated up to two times (for a total of three times) if required.

Take NOTE!

Dextrose solutions are contraindicated in shock because of the risk of complications such as osmotic diuresis, hypokalemia, hyperglycemia, and worsening of ischemic brain injury.

Children in septic shock will often require larger volumes of fluid as a result of the increased capillary permeability. Children in shock due to trauma will usually receive a colloid, such as blood, when there is an inadequate response to crystalloid isotonic fluid. After each fluid bolus, reassess the child for signs of positive response to the fluid administration.

Insert an indwelling urinary catheter to allow for accurate and frequent measurement of urine output.

Indicators of improvement include:

- Improved cardiovascular status: The central and peripheral pulses are stronger. The line of demarcation of extremity coolness is diminishing and capillary refill is improved (time is decreased). BP is improved.
- Improved mental status: The child is more alert. For example, the child's eyes are open and watching personnel. If the child is younger, he or she may be pulling at the IV line.
- Improved urine output: This may not be noted initially but should be noted over the next few hours; the goal is 1 to 2 mL/kg/hour.

The process of fluid resuscitation involves giving the fluid, assessing and reassessing the child, and documenting findings. Children in shock may require as much as 100 to 200 mL/kg of resuscitative fluid during the initial hours of shock management. Most children in shock need and can tolerate this large volume of fluid. Continued reassessment will determine if the child is beginning to experience fluid overload in the form of pulmonary edema (this is rare but may occur in children with preexisting cardiac conditions or severe chronic pulmonary disease) (AHA, 2007; Prentiss et al., 2007).

Take NOTE!

Do not focus solely on the child's circulatory status; you may overlook signs and symptoms of respiratory deterioration.

Administering Medications

In some circumstances, such as septic shock or distributive shock, fluid alone does not adequately improve the child's status and adjunctive medications may be ordered. Vasoactive medications are used either alone or in combination to improve cardiac output, to increase SVR or to decrease SVR. The selection of medications is dictated by the child's cardiac and vascular status. For example, dobutamine is a medication with significant beta-adrenergic effects and thus can improve cardiac contractility. Epinephrine, which affects the heart muscle, is also a powerful vasoconstrictor. Dopamine affects the heart at lower doses but increasingly affects the vasculature with increased doses. These medications may be given as a loading dose, followed by a continuous infusion. When vasoactive drugs are administered, monitor for improvement in heart rate, BP, perfusion, and urine output.

CARDIAC ARRHYTHMIAS AND ARREST

Unlike adults, in whom cardiopulmonary arrest is most often caused by a primary cardiac event, children typically have healthy hearts and thus rarely experience primary cardiac arrest. More commonly they experience cardiopulmonary arrest from gradual deterioration of respiration and/or circulation (AHA, 2005f). In particular, children experiencing a respiratory emergency or shock may deteriorate and eventually demonstrate cardiopulmonary arrest. Thus, the standard of care for managing a child in this situation is vastly different from that for an adult.

Nurses should be skilled in evaluating and managing respiratory alterations and shock in children, as discussed in previous sections. Overwhelming evidence suggests that if primary respiratory compromise or shock is identified and treated in the critically ill child, a secondary cardiac arrest can be prevented. Rare exceptions do exist, however. For example, electrolyte abnormalities and toxic drug ingestions are primary insults to the cardiovascular system that may lead to a sudden cardiac arrest rather than a gradual progression. Other exceptions in which the child is at risk for a primary and sudden cardiac arrest include:

- History of a serious primary congenital or acquired cardiac defect
- Potentially lethal arrhythmias, such as prolonged QT syndrome
- Hyper- or hypotrophic cardiomyopathy
- Traumatic cardiac injury or a sharp blow to the chest, known as "commotio cordis" (e.g., when a high-velocity ball hits the chest)

The overwhelming majority of children rarely experience cardiac arrhythmias, so it is beyond the scope of this chapter to discuss the myriad of possible complex rhythm disturbances. Therefore, this discussion will be limited to the management of emergent cardiac conditions that are more typically found in children.

Pathophysiology

The AHA has simplified the nomenclature used to describe pediatric cardiac compromise and has established three major categories of cardiac rhythm disturbances:

"Slow": bradyarrhythmias
"Fast": tachyarrhythmias
"Absent": pulseless, cardiovascular collapse

The pathophysiology, causes, and therapeutic management of each of the categories of rhythm disturbances are discussed below.

Bradyarrhythmias

Bradycardia is a heart rate significantly slower than the normal heart rate for age. Bradycardia in children is most commonly "sinus bradycardia"—in other words, there is not a cardiac nodal abnormality associated with the slowed heart rate. In sinus bradycardia, the P waves and QRS complex remain normal on the ECG. Brief dips in heart rates can be normal, such as when the child sleeps. Children are also susceptible to brief drops in heart rate that are associated with vagal stimulation. For example, passing an orogastric tube down the esophagus of a young infant may induce a temporary bradycardic response. These normal decreases in the child's heart rate should recover with or without stimulation and are not normally associated with signs of altered perfusion.

Less commonly, children manifest bradycardia as a result of cardiac abnormalities and heart block. Infants with bradycardia related to heart block may exhibit poor feeding and tachypnea, whereas older children may demonstrate fatigue, dizziness, and syncope. Comparison Chart 52.2 compares the causes of sinus bradycardia and heart block in children.

In contrast, the child with a serious and possibly life-threatening bradyarrhythmia will have a heart rate below 60 beats per minute, with signs of altered perfusion. The most common causes of profound bradycardia in children are respiratory compromise, hypoxia, and shock. Sustained bradycardia is commonly associated with arrest. It is an ominous sign and should be taken seriously.

Tachyarrhythmias

Children normally have faster heart rates than adults, and fever, fear, and pain are common explanations for significant increases in the heart rate of a child (**tachycardia**). This normal elevation in heart rate is known as sinus tachycardia. However, once the fever is reduced, the child is comforted, or the pain is managed, the heart rate should return close to the child's baseline. Hypoxia and hypovolemia are pathological reasons for tachycardia in the child. The signs, symptoms, and management of these concerns were discussed in previous sections. If the child

COMPARISON CHART 52.2 **Causes of Sinus Bradycardia Versus Heart Block**

	Sinus Bradycardia	Heart Block
Causes	• Pathologic: medications such as digoxin, hypoxia, hypothermia, head injury • Nonpathologic: well-conditioned athlete	• Congenital: associated with cardiac anomalies • Acquired: endocarditis, rheumatic fever, Kawasaki disease

has sinus tachycardia that results from any of these causes, the focus is on the underlying cause. It is inappropriate and dangerous to treat sinus tachycardia with medications aimed at decreasing the heart rate or with a defibrillation device.

Tachyarrhythmias in children that are associated with cardiac compromise have unique characteristics that present differently from sinus tachycardia. Examples of these include supraventricular tachycardia (SVT) and ventricular tachycardia. SVT is a cardiac conduction problem in which the heart rate is extremely rapid and the rhythm is very regular, often described as "no beat-to-beat variability." Comparison Chart 52.3 explains the differences between SVT and sinus tachycardia. The most common cause of SVT is a re-entry problem in the cardiac conduction system. Commonly, SVT is the result of a genetic cardiac conduction problem such as Wolff-Parkinson-White syndrome. SVT may also be associated with medications such as caffeine and theophylline. Children often can tolerate the characteristically higher heart rate that is associated with SVT for short periods of time. However, the increased demand that is placed on the cardiovascular system usually overtaxes the child and results in signs of congestive heart failure if the SVT continues unchecked for a prolonged time.

Ventricular tachycardia is a rhythm involving an elevation of the heart rate and a wide QRS (greater than 0.08 seconds) that is the result of an abnormal, rapid firing of one or both of the ventricles. Ventricular tachycardia is a rare arrhythmia in children and usually is associated with a congenital or acquired cardiac abnormality. In addition, prolonged QT syndrome is a conduction abnormality that can result in ventricular tachycardia and sudden death in children. Less commonly, ingestion of medications and toxins, acidosis, hypocalcemia, abnormalities of potassium, and hypoxemia have been associated with the development of ventricular tachycardia in children.

COMPARISON CHART 52.3 **Distinguishing SVT From Sinus Tachycardia**

	SVT	Sinus Tachycardia
Rate (bpm)	Infants >220, children >180	Infants <220, children <180
Rhythm	Abrupt onset and termination	Beat-to-beat variability
P waves	Flattened	Present and normal
QRS	Narrow (<0.08 seconds)	Normal
History	Usually no significant history	Fever, fluid loss, hypoxia, pain, fear

Collapsed Rhythms (Pulseless Rhythms)

A collapsed rhythm, as defined by PALS, is one that produces cardiac arrest with no palpable pulse and no signs of perfusion (cardiac arrest). Typically, the most common pulseless arrest rhythms in children are asystole or pulseless electrical activity (PEA). **Asystole** occurs when there is no cardiac electrical activity, commonly referred to as "a straight line" on the ECG. The child with PEA has some appreciable rhythm on the ECG but no palpable pulses. PEA may be caused by hypoxemia, hypovolemia, hypothermia, electrolyte imbalance, tamponade, toxic ingestion, tension pneumothorax, or thromboembolism. Ventricular tachycardia may also present as pulseless. Ventricular fibrillation, once thought to be rare in children, occurs in serious cardiac conditions in which the ventricle is not pumping effectively. It may develop from ventricular tachycardia. Ventricular fibrillation is characterized by variable, high-amplitude waveforms (coarse VF) or a finer, lower-amplitude waveform with no discernible cardiac rhythm (fine VF). In either case, cardiac output is insufficient.

Nursing Assessment

Nursing assessment of the child with a cardiac emergency includes the health history and physical examination as well as laboratory and diagnostic testing. The nursing assessment must be performed quickly and accurately so that resuscitation can be instituted if needed.

Health History

Obtain a brief health history of the child with a cardiac emergency while simultaneously assessing the child and providing life-saving interventions. Key areas to inquire about include:

- History of cardiac problems, asthma, chromosomal anomaly, delayed growth
- Symptoms such as syncope, dizziness, palpitations or racing heart, chest pain, coughing, wheezing, increased work of breathing
- Activity tolerance with play or feeding: Does the child get out of breath, turn blue, or squat during play? Can the child keep up with playmates? Does the infant tire with feedings?
- Precipitating illness, fever, unexplained joint pains, ingested medications
- Participation in a sport before the cardiac event occurred or injury to the chest
- Family history of cardiac problems, sudden death from a cardiac condition, heart attacks at a young age, chromosomal abnormalities

Determine treatment measures performed at the scene. Was CPR initiated? Was an AED used?

Physical Examination

Quickly establish the child's status. A child who is obviously in distress or is arresting must receive emergent life-saving interventions. Briefly perform the assessment while simultaneously providing life-saving interventions.

Inspection and Observation

Assess the child's airway patency and efficiency of breathing. Observe the child's color, noting circumoral pallor or duskiness or central pallor, mottling, duskiness, or cyanosis. Note any increased work of breathing, grunting, head bobbing, or apnea. Inspect the chest for barrel shape, which may be associated with chronic pulmonary or cardiac disease. Observe the pericardium for the presence of lifts or heaves. Note diaphoresis, anxious appearance, or dysmorphic features (50% of children with Down syndrome also have a congenital cardiac defect). Determine if neck vein distention is present. Inspect the fingertips for clubbing, which is indicative of chronic tissue hypoxemia.

Auscultation

Auscultate the breath sounds, noting any crackles or wheezes. Auscultate the heart rate. If the child does not have an adequate pulse, initiate CPR. If the child has a strong, perfusing pulse, complete the cardiac assessment. Auscultate with the diaphragm of the stethoscope first and then listen with the bell. Evaluate all of the auscultatory areas, listening first over the second right interspace (aortic valve) and then over the second left interspace (pulmonic valve); next move to the left lower sternal border (tricuspid area); and finally auscultate over the fifth interspace, midclavicular line (mitral area). Evaluate the rate and rhythm of the heart. Listen for any extra sounds or murmurs. Note and describe the quality, intensity, and location of any cardiac murmurs.

Take NOTE!

Murmurs are most often systolic and can be benign or associated with pathology. Murmurs that radiate to the back and are grade III or louder are more likely to be due to a cardiac defect. True diastolic murmurs are rare and almost always have a pathologic origin.

Percussion and Palpation

Percuss between the costal interspaces and note the heart's size. Palpate the heart to find the point of maximal impulse (PMI) and to evaluate for an associated thrill. A thrill feels like a fluttering under the fingers and is associated with cardiac pathology. Palpate and note the quality of the pulses. Evaluate each of the pulses bilaterally and note whether they are absent, faint, normal, or bounding. Compare the quality of pulses on each side of the body and also those of the upper and lower body. Note the skin temperature and evaluate the capillary refill.

Laboratory and Diagnostic Testing

The major diagnostic test used is the ECG. Identify the arrhythmia according to the ECG reading (Fig. 52.8).

Nursing Management

Provide oxygen at 100%. Institute cardiac monitoring and assess oxygen saturation levels via pulse oximetry. Obtain the child's preprinted code drug sheet or use the Broselow tape to obtain the child's height to estimate the tracheal tube sizes and medication dosages that are appropriate for the child. Always remember to intervene in this order: first airway, then breathing, then circulation. The remainder of this discussion will assume that the nurse has initiated interventions for airway and breathing as discussed earlier in the chapter.

Take NOTE!

Pay attention to the rhythm on the monitor, but continually monitor the child's pulse. If the child does not have a pulse or has a pulse of less than 60 bpm, perform cardiac compressions despite the monitor reading.

Managing Bradyarrhythmias

The management of sinus bradycardia is focused on remedying the underlying cause of the slow heart rate. Since hypoxia is the most common cause of sustained bradycardia, oxygenation and ventilation are necessary. The newborn is particularly susceptible to bradycardia in relation to hypoxemia. Continue to reassess the child to determine if the bradycardia improves with adequate oxygenation and ventilation. If bradycardia persists, administer epinephrine and/or atropine as ordered. Epinephrine is the drug of choice for the treatment of persistent bradycardia.

Other causes of bradycardia such as hypothermia, head injury, and toxic ingestion are managed by addressing the underlying condition. Warming the hypothermic child may restore a normal sinus rhythm. Patients with head injury may have bradycardia without any cardiac involvement, and with successful management of the head injury, the bradycardia will resolve. Antidotes to toxins may be necessary in children whose bradycardia is the result of a toxic ingestion.

Managing Tachyarrhythmias

The tachyarrhythmias include SVT (stable or unstable) and ventricular tachycardia with a pulse. Examine the ECG to determine if the child is experiencing ventricular tachycardia or SVT. Clinically, determine whether the child in SVT is showing signs that require emergent intervention or if the child is stable. In compensated SVT, the child will appear to be alert, breathing comfortably, and well perfused. The child who is demonstrating signs of

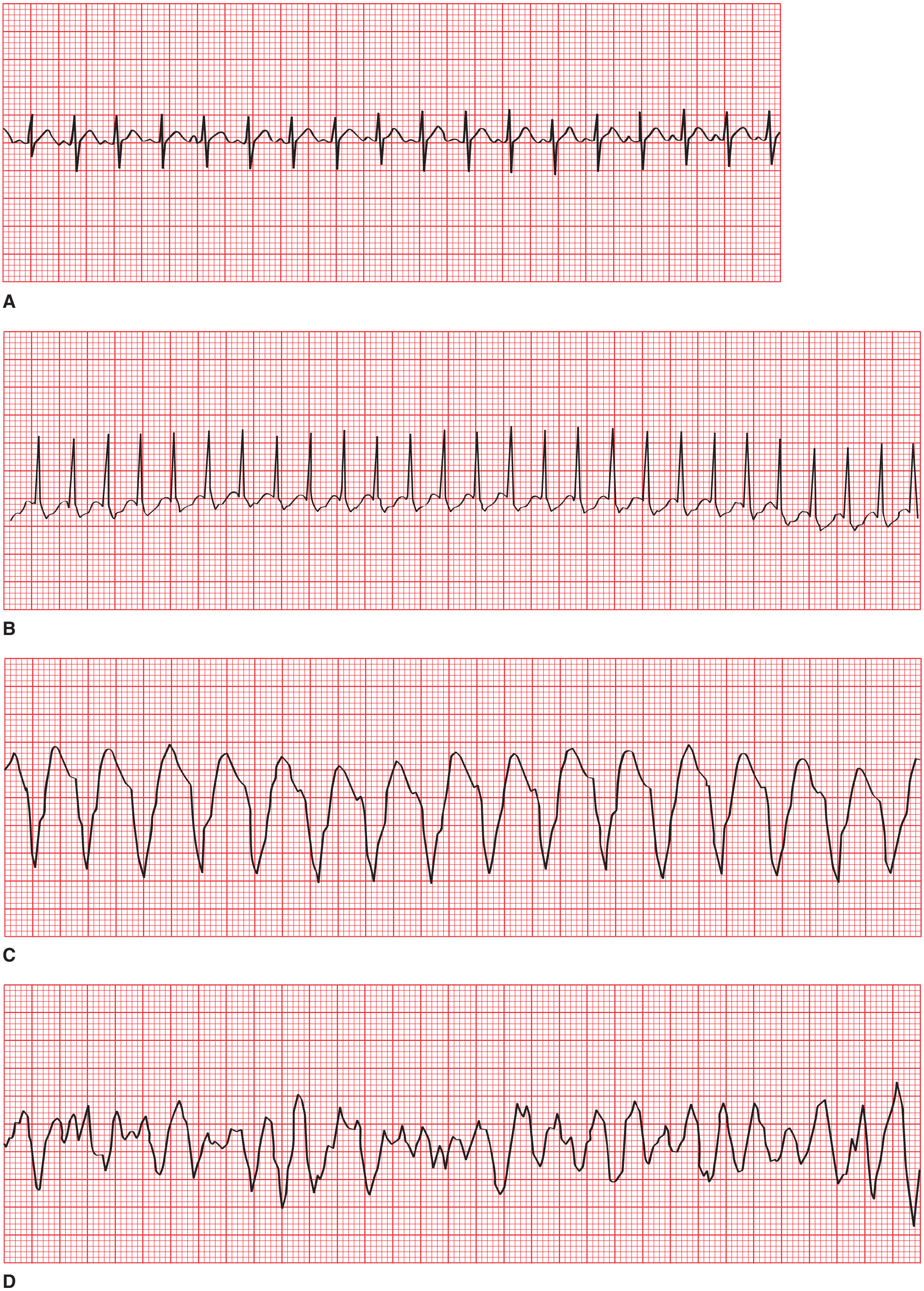

Figure 52.8 Arrhythmias. (**A**) Sinus tachycardia: normal QRS and P waves, mild beat-to-beat variability. (**B**) Supraventricular tachycardia: note rate above 220, abnormal P waves, no beat-to-beat variability. (**C**) Ventricular tachycardia: rapid and regular rhythm, wide QRS without P waves. (**D**) Coarse ventricular fibrillation: chaotic electrical activity.

TABLE 52.6 **Managing Tachyarrhythmias**

Tachyarrhythmia	Signs and Symptoms	Management
Compensated SVT	• Tachycardia, heart rate >220 • Abnormal P waves • Alert, well-perfused client • Possible complaints of headache and dizziness in older children	• Vagal maneuvers such as ice to face or blowing through a straw that is obstructed • Adenosine if vagal maneuvers fail
Uncompensated SVT	• Tachycardia, heart rate >220 • Abnormal P waves • Signs of shock: altered level of consciousness, poor perfusion, weak pulses	• Adenosine or synchronized cardioversion
Ventricular tachycardia	• Rate may range from normal to 200 bpm. • Wide QRS • No P waves • Pulse present, poor perfusion	• Synchronized cardioversion • IV amiodarone • Treatment of underlying causes

compromise, such as a change in consciousness, respiratory status, and perfusion, is considered to be in uncompensated SVT. Uncompensated SVT requires emergent intervention. The child who has ventricular tachycardia with a pulse will have poor perfusion and also requires immediate intervention. The evaluation and approaches to the tachyarrhythmias are discussed in Table 52.6.

▶ ***Take* NOTE!**

Adenosine has a rapid onset of action and an extremely short half-life. Administer it extremely rapidly with a generous amount of IV flush; otherwise, it will be ineffective.

Managing Collapsed Rhythms

As in any pediatric emergency, support the ABCs by managing the airway, providing oxygen, and giving fluids. In addition, if the child is pulseless or has a heart rate less than 60 bpm, initiate cardiac compressions. The pulseless rhythms include ventricular tachycardia, ventricular fibrillation, asystole, and PEA. ECG characteristics and management of these rhythms are summarized in Table 52.7. Also treat the underlying causes of the arrhythmia, if known.

The AHA emphasizes the importance of cardiac compressions in pulseless clients with arrhythmias. Give compressions before and immediately after defibrillation. In the past it was recommended that clients who required defibrillation be given three shocks in a row, but recent research findings have shown that the client should be de-

TABLE 52.7 **ECG Characteristics and Management of Pulseless Rhythms**

Pulseless Arrhythmia	ECG Characteristics	Management
Ventricular tachycardia	Wide QRS, no P waves	• CPR • Defibrillation • Epinephrine; also possibly amiodarone, lidocaine, or magnesium • Treat underlying causes.
Ventricular fibrillation	• Chaotic ventricular activity • No P waves, no QRS, no T waves	• CPR • Defibrillation • Epinephrine; also possibly amiodarone, lidocaine, or magnesium • Treat underlying causes.
Asystole	Flat line	• Check lead placement. • CPR if no pulse • Epinephrine
Pulseless electrical activity	Electrical activity that is not consistent with ventricular tachycardia or ventricular fibrillation	• Check lead placement. • CPR if no pulse • Treat underlying cause. • Epinephrine

fibrillated only once, followed by five cycles of CPR. For defibrillation to be most effective, cardiac compressions must be performed effectively with minimal interruptions (AHA, 2006).

Take NOTE!

Previously, multiple doses of epinephrine were given in pediatric emergency situations. Recently, however, the AHA has recommended against this practice, as multiple doses of epinephrine have not been shown to be helpful and may actually cause harm to the child.

NEAR-DROWNING

Water can be a great source of fun and exercise for children and adolescents, but drowning is the second-leading cause of preventable death in children and adolescents in the United States and worldwide (World Health Organization, 2008). In warm-weather states where swimming pools are more common, drowning is the primary cause of death in young people. Most drowning deaths are preventable, and the World Health Organization (2008) notes that "lapse in adult supervision is the single most important contributory cause for drowning."

Near-drowning is defined as a submersion injury in which the child survives. Traditionally, children experiencing cold-water submersion were expected to fare better than those drowning in warmer water. Survival and neurologic outcome depend on early and appropriate resuscitation. In recent years, with appropriate resuscitation efforts and treatment, children have demonstrated better neurologic outcomes. Currently, there are no factors to predict whether the child's long-term neurologic status will be affected after surviving a near-drowning incident (Minto & Woodward, 2005).

Typically, a child who is drowning will struggle to breathe and eventually will aspirate water. Aspiration of relatively small amounts of water leads to poor oxygenation, with retention of carbon dioxide. Alveolar surfactant is depleted during the drowning event and pulmonary edema commonly occurs. Hypoxemia results in increased capillary permeability and resultant hypovolemia. Even small amounts of aspirated water may lead to pulmonary edema within a 24- to 48-hour period after the near-drowning episode. A near-drowning survivor is also at risk for renal complications due to altered renal perfusion during the hypoxemic state.

Nursing Assessment

Nursing assessment of the near-drowning survivor is crucial and must take place quickly and accurately.

Health History

Obtain the history rapidly while providing life-saving interventions. Ask about the circumstances of the event:

- Where did the incident occur? Was the child in a lake, river, ocean, or swimming pool? Was the child submerged in a toilet, bucket, or bathtub?
- Did someone witness the child's entry into the water?
- Was the water fresh or salty? Cold or warm?
- Is it likely the water was contaminated?
- Were there any extenuating circumstances, such as a diving or automobile accident, associated with the near-drowning?
- What was the approximate length of time of the submersion? Was the child conscious or unconscious when rescued?
- What was done at the scene? Was CPR initiated? If so, when?
- If a cervical spine injury was suspected, was the cervical spine immobilized?
- Was an AED used?
- When did the child last eat (to prepare for possible intubation)?

Physical Examination

Evaluate airway patency and breathing. Auscultate all lung fields for signs of pulmonary edema, such as coarseness or crackles. Evaluate the heart rate, pulses, and perfusion. Note the cardiac rhythm on the monitor and report evidence of arrhythmias. Evaluate the child's neurologic status. Use a pen light to determine pupillary reaction. Use the pediatric coma score to further assess the neurologic status. Does the child open the eyes spontaneously, to stimuli, or not at all? Is there any spontaneous movement? Is the younger child crying? Can the older child speak? Measure the child's temperature, as hypothermia often occurs with near-drowning.

Laboratory and Diagnostic Testing

While awaiting laboratory and diagnostic testing results, continue resuscitative efforts as addressed below. Laboratory and diagnostic tests typically include the following:

- Arterial blood gases: hypoxemia, acidosis
- ECG: cardiac arrhythmias
- Chest x-ray: pulmonary edema, infiltrates
- Serum electrolytes: imbalance related to development of shock

Nursing Management

Because of the potentially devastating effects that drowning-related hypoxia has on the child's brain, airway interventions must be initiated immediately after retrieving a child from the water. Every second counts. Initial interventions in a near-drowning event are always focused on airway, breathing, and circulation; commonly, resuscitative efforts have begun before the child arrives at the acute care facility.

If a cervical spine injury is suspected (as in the case of a diving accident), provide stabilization either manually or with a cervical collar. As with any suspected neck injury, do not remove the cervical collar until injury to the cervical spine has been ruled out through an x-ray and clinical evaluation. Suction the airway to ensure airway patency. The child may have aspirated particles from a contaminated water source or emesis, a relatively common complication associated with near-drowning. A large-bore suction catheter (e.g., Yankauer) is an effective tool for clearing the upper airway. Administer supplemental oxygen at 100%. Children who have poor or absent respiratory effort most likely will require intubation. Insert a nasogastric tube to decompress the stomach and prevent aspiration of stomach contents. Initiate chest compressions if a pulse is not present.

Usually, the child exhibits some degree of hypothermia and will require warming. Generally, the core body temperature should be raised slowly, as warming a drowning victim too quickly may have deleterious effects. Remove any wet clothing, dry the child, and cover him or her with warmed blankets. Warm IV fluids and use other warming methods as prescribed.

Consider THIS!

Teva Dawson, a 2-year-old girl, is rushed to the emergency room by ambulance after experiencing a near-drowning in the family swimming pool. Eva was resuscitated at the scene and is now breathing spontaneously. She is lethargic and coughs occasionally.

What health history information would you obtain from the parents or caregivers? What immediate management is necessary?

What education may be necessary for this family?

POISONING

Emergency care of the pediatric poisoning victim consists of rapid nursing assessment and prompt management.

Take NOTE!

If a normally healthy child (particularly a young child) suddenly deteriorates without a known cause, suspect a toxic ingestion.

Nursing Assessment

Nursing assessment of the poisoning victim focuses on a thorough health history, followed by physical examination and laboratory and diagnostic testing.

Health History

Obtain the health history from the parents or caregiver or, in the case of an older child or teenager, from the child. Inquire about the approximate time of poisoning and the nature of the toxin. Was the toxin ingested, inhaled, or applied to the skin? In the case of pill ingestion, does the caregiver have the medication bottle? Did the child experience nausea, vomiting, anorexia, abdominal pain, or neurologic changes such as disorientation, slurred speech, or altered gait? Determine the progression of the symptoms. Did the parent or caregiver call the poison control center? Has any treatment been given? In the case of older children and teens, inquire about any history of depression or threatened suicide.

Physical Examination

Ingestion of medications or chemicals may result in a wide variety of clinical manifestations. Perform a thorough physical examination, noting alterations that may occur with particular ingestions, such as:

- Hyper- or hypotension
- Hyper- or hypothermia
- Respiratory depression or hyperventilation
- Miosis (pupillary contraction) or mydriasis (pupillary dilatation)

Pay particular attention to the child's mental status, skin moisture and color, and bowel sounds (Barry, 2005).

Laboratory and Diagnostic Testing

The suspected poison may direct the laboratory and diagnostic testing. A variety of blood tests may be performed:

- Chemistry panel: to detect hypoglycemia or metabolic acidosis and assess renal function
- ECG: to identify arrhythmias or conduction delay
- Liver function tests: to assess for liver injury
- Urine and blood toxicology screens (available for a limited number of medications; may vary per institution)
- Specific drug levels if the substance ingested is known or highly suspected

Nursing Management

Management should focus on prevention of poisoning, but when poisoning does occur, give priority to airway, breathing, and circulation, treating alterations as discussed earlier in this chapter. Monitor vital signs frequently and provide supportive care. Few specific antidotes are available for medications or other toxins. Ipecac is rarely used in the health care setting to induce vomiting and is no longer recommended for use in the home setting. Gastric lavage, administration of activated charcoal (binds with the chemical substance in the bowel), or whole bowel irrigation with polyethylene glycol electrolyte solutions may be used. Occasionally, dialysis is required to lower the level of toxin in the bloodstream. The intervention is based on the source of the ingestion. For example, activated charcoal is an effective method for preventing the absorption of many medications but is not effective in the case of an iron overdose.

If opiate or other narcotic ingestion is suspected, administer naloxone to reverse the respiratory depression or altered level of consciousness. Treatment of seizures and alterations in thermoregulation may also be needed.

Specific treatment of the poisoning will be determined when the toxin is identified and poison control is queried. Maintain ongoing assessment of the poisoned child because many toxins exhibit very late effects.

Take NOTE!

The National Poison Control number is 1-800-222-1222.

TRAUMA

The leading cause of death in persons between 3 and 33 years of age is unintentional injuries (Centers for Disease Control and Prevention [CDC], 2007d). Childhood trauma results from such events as automobile accidents, pedestrian accidents, falls, sporting injuries, and firearm use. Falls are the most common cause of pediatric injury. Children of varying ages are susceptible to various forms of injury due to their developmental level as well as their environmental exposure. Young children rely on their caregivers to promote their safety. Young children also are not developmentally equipped to be able to recognize dangerous situations.

Automobile accidents continue to cause the deaths of about five children daily, with significant numbers experiencing injury (National Highway Traffic Safety Administration, 2006). Pedestrian injuries cause 25% of traffic-related deaths in children (CDC, 2005), and annually about 280,000 children are evaluated in emergency rooms following bicycle accidents (SafeKids, 2006). Because pediatric injury is so common, nurses must become adept at assessment and intervention in the pediatric trauma victim.

Nursing Assessment

The trauma survey includes a brief health history as the child is being assessed and life-saving measures are being instituted.

Health History

Begin the health history by asking when the injury happened. If the child sustained a motor vehicle–related injury, ask how fast the vehicle was going. Determine if the child was appropriately restrained in the automobile. If the child was riding a bicycle, skateboarding, or using in-line skates, was he or she wearing a helmet, knee pads, and wrist guards? Determine what interventions were performed at the scene. Was the child immobilized on a backboard to protect the cervical spine? If the child is bleeding, ask the person who transported the child to estimate the amount of blood lost.

If the child experienced a fall, ask if the fall was witnessed and the height from which the child fell. Did the child fall onto a hard surface such as concrete? How did the child land: on the head or back, or did the child catch himself or herself with the hands? Younger children and boys are at higher risk for injuring their head. Did the child lose consciousness at the scene? What kind of behavior did the child exhibit after the fall? Since the fall, has the child complained of a headache or been vomiting?

While obtaining a detailed history about the fall, think about the child's developmental stage. For example, does it seem plausible that a toddler might fall down the stairs? In contrast, what is the likelihood that a 2-month-old would suffer a fractured femur from a fall? Keep in mind the possibility of child abuse. Critically evaluate the reported circumstances and try to determine if the history, developmental stage of the child, and the type of injury sustained match. In addition, evaluate the type of injury that the child sustained and the history given by the caregiver. For example, children who fall from significant heights often suffer skeletal fractures, but abdominal and chest injuries rarely result from falling from significant heights.

Physical Examination

Physical examination of the child with a traumatic injury should be approached with an evaluation of the ABCs (primary survey) first. Assess the patency of the airway and establish the effectiveness of breathing (as discussed earlier in the chapter). Examine the child's respiratory effort, breath sounds, and color. Next, evaluate the circulation. Note the pulse rate and quality. Observe the color, skin temperature, and perfusion. If bleeding has occurred, the child's circulation may become compromised.

After assessing and intervening for airway, breathing, and circulation, proceed to the secondary survey. Assess for disability. Rapidly assess critical neurologic function. Determine the level of consciousness, pupillary reaction, and verbal and motor responses to auditory and painful stimuli. If the patient is a young infant, palpate the anterior fontanel: a full and bulging fontanel signals increased intracranial pressure. The traumatized child's neurologic status may range from completely normal to comatose.

Take NOTE!

Unequal pupils or a fixed and dilated pupil is considered a neurosurgical emergency. Immediately report this finding.

Following the ABCs and D (disability) is E (exposure). Expose the child to observe the entire body for signs of injury, whether blunt or penetrating. Perform a systematic, thorough inspection of the child's body. Note active bleeding and extremity deformity, as well as any lacerations and abrasions. Observe for movement and any complaints of immobility or pain with movement. Inspect the abdomen for redness, skin discoloration, or distention. Auscultate for bowel sounds in all four quadrants. If the child is verbal, ask if he or she has any pain in the stomach. If the child is younger, ask, "Do you have a tummy ache?" If the child reports abdominal pain, ask the child to point to where it hurts. Note any guarding of the abdomen, which is an indication of abdominal pain. If bowel injury is a possibility, only light palpation is acceptable. Always assess the least tender areas first and palpate the more sensitive areas last.

Laboratory and Diagnostic Testing

As in other pediatric emergencies, never delay life-saving measures to wait for laboratory or diagnostic test results. In addition to routine laboratory tests, common laboratory and diagnostic tests for the pediatric trauma victim include:

- Type and cross-match: to assess the child's blood type before blood products are given
- Prothrombin time and partial thromboplastin time: to evaluate for clotting dysfunction
- Amylase and lipase: to identify pancreatic injury
- Liver function tests: to assess for liver injury
- Pregnancy test (in any female who has reached puberty)
- CT scan, ultrasound, or MRI of the head, abdomen, or extremities: to evaluate the extent of the injury

Nursing Management

Nursing management of the pediatric trauma victim focuses initially on the ABCs.

Providing Immediate Care

If head or spinal injury is suspected, open the airway using the jaw-thrust maneuver with cervical spine stabilization (see Fig. 52.4). The revised AHA guidelines for basic life support recommend that if the airway cannot be opened using the jaw-thrust maneuver, it may be opened using the head tilt–chin lift maneuver. The rationale for this change in guidelines is that the jaw thrust is often a difficult maneuver to perform. Since opening the airway is the priority, AHA has made this allowance even if the cervical spine is at risk (AHA, 2005e). In addition, new AHA recommendations advise that the head and neck of a trauma victim should be stabilized manually rather than with an immobilization device.

▸ Take NOTE!

Infants and young children require unique cervical spine management because they have prominent occiputs that result in flexion of the neck in the supine position. To maintain the optimal neutral spinal position in the young child, use a special pediatric backboard with a head indentation, or use a folded towel to elevate the child's torso.

Clear the airway of obstruction using a large-bore suction device such as a Yankauer. If the child is breathing on his or her own, give oxygen at the highest flow possible (such as with a non-rebreathing mask). If the child is not breathing on his or her own, intervene using the AHA guidelines discussed earlier in this chapter.

If a BVM device is available, connect it to the oxygen source and use the bag to ventilate the child. Observe the chest rise and be careful not to overventilate, as this results in abdominal distention. Deliver breaths at the rate recommended by the AHA, one breath every 3 seconds. Do not hyperventilate. In the not-too-distant past, head injury in children was managed using hyperventilation. This resulted in **hypocapnia** (decreased amounts of carbon dioxide in the blood). The physiologic effect of hypocapnia is the induction of vasoconstriction, which in turn results in tissue ischemia. Therefore, current management of head injury in children does not use hyperventilation. The only exception to this rule is in an acute situation, if the child is showing signs of a possible brain stem herniation, hyperventilation may be used initially and briefly.

Assess the child for a strong central pulse. If the child has no pulse, initiate CPR immediately. When perfusion is compromised, administer IV fluid resuscitation. Trauma victims are more likely to require colloids or blood products due to blood loss from the injury.

▸ Take NOTE!

Clients with head injury who have signs of shock such as poor perfusion and bradycardia should receive fluid volume resuscitation.

Key Concepts

- Young children's smaller airways and immature respiratory and immune systems place them at higher risk for respiratory distress than older children and adults. Children generally have healthy hearts and cardiovascular systems and thus rarely present with primary cardiac arrest. Younger children and adolescents are at higher risk for injury due to normal development at those ages.

- Children present with a variety of emergencies and injuries and must be evaluated and treated in an appropriate and timely fashion to achieve a positive outcome. The health history is obtained rapidly while life-saving measures are performed simultaneously.
- Assess the airway, then breathing, then circulation, providing interventions for alterations before moving on to the next assessment. Provide continuous reassessment, as children respond quickly to interventions and deteriorate quickly as well.
- Pulse oximetry and capnometry can be useful tools for evaluating respiratory status. Never delay intervention pending laboratory results if the child's clinical status warrants immediate action.
- Provide support and education to the child and family involved in an emergency. Teach families why certain procedures are being done, explaining technical medical interventions in simple terms and, for the child, at his or her developmental level.
- Small amounts of edema or secretions can contribute to significant respiratory effort in infants and young children.
- Children dehydrate more quickly than adults and experience alterations in perfusion related to hypovolemia.
- Children in respiratory distress and shock require supplemental oxygen. Intubation is necessary for the apneic child or the child whose airway is not maintainable.
- Accurate assessment of perfusion status and appropriate fluid resuscitation are critical in the prevention and treatment of shock in children.
- Life-threatening arrhythmias in children, though uncommon, often must be quickly treated with defibrillation or synchronized cardioversion in addition to CPR.
- In the case of near-drowning, maintain ongoing assessment and intervention of pulmonary status.
- Maintain airway, breathing, and circulation in the child has experienced an accidental ingestion and prepare for gastric lavage or administration of activated charcoal.
- In addition to intervening for airway, breathing, and circulation problems in the pediatric trauma victim, assess for altered neurologic status and extent of bleeding or injury.

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American Association of Poison Control Centers: www.aapcc.org

Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, Child Passenger Safety Fact Sheet: www.cdc.gov/ncipc/factsheets/childpas.htm

Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, Teen Drivers Fact Sheet: www.cdc.gov/ncipc/factsheets/teenmvh.htm

Kidspace @ the Internet Public Library: www.ipl.org/div/kidspace/poisonsafe/kjump.html

National Highway Traffic Safety Administration: http://www.nhtsa.dot.gov/

Nemours Foundation: www.kidshealth.org

Nursing CEUs and information: www.rnceus.com/index.html#_parent#_parent

Poison Prevention Week Council: www.poisonprevention.org/materials.htm

Safe Kids Worldwide: www.safekids.org

U.S. Consumers Product Safety Commission, Poison Prevention Publications: www.cpsc.gov/cpscpub/pubs/pois_prv.html

Chapter Worksheet

Multiple Choice Questions

1. An unresponsive toddler is brought to the emergency department. Assessment reveals mottled skin color, respiratory rate of 10 breaths per minute, and a brachial pulse of 52 bpm. What is the priority nursing action?
   a. Prepare the defibrillator and draw up code medications.
   b. Provide 100% oxygen with a bag-valve-mask and start chest compressions.
   c. Start chest compressions and provide 100% oxygen via non-rebreather mask.
   d. Begin an IV fluid infusion and administer epinephrine IV.

2. A 10-year-old child in respiratory distress requires intubation. Which sizes of tracheal tubes will the nurse prepare?
   a. 9.5 mm and 10.0 mm
   b. 8.5 mm and 9.0 mm
   c. 6.0 mm and 6.5 mm
   d. 6.5 mm and 7.0 mm

3. A preschooler presents to the emergency department with a history of vomiting, diarrhea, and fever over the past few days. She is receiving 100% oxygen via non-rebreather mask. Vital signs are temperature 104.5°F, pulse 144 bpm, respiratory rate 22 breaths per minute, and BP 70/50 mm Hg. She is listless and difficult to arouse and has weak peripheral pulses and prolonged capillary refill. What nursing intervention takes priority?
   a. Administering acetaminophen rectally for the high fever
   b. Administering IV antibiotics for the infection
   c. Preparing the child for tracheal intubation
   d. Giving an IV bolus of normal saline 20 mL/kg

4. Assessment of a 12-year-old who crashed his bicycle without a helmet reveals the following: temperature 99.2°F, pulse 100 bpm, respiratory rate 24 breaths per minute with easy work of breathing, and BP 102/70 mm Hg. What is the priority action by the nurse?
   a. Assess neurologic status while observing for obvious injuries.
   b. Administer IV fluid bolus of normal saline at 20 mL/kg.
   c. Remove the cervical collar if he complains that it bothers him.
   d. Listen for bowel sounds while assessing for pain.

5. An 18-month-old child is brought to the emergency department via ambulance after an accidental ingestion. What is the priority nursing action?
   a. Take the child's vital signs.
   b. Give oral syrup of ipecac.
   c. Insert a nasogastric tube.
   d. Start an IV line.

Critical Thinking Exercises

1. A school-age child presents to the emergency department for evaluation. He had been feeling faint off and on and today fainted at school. On the cardiac monitor an abnormal cardiac rhythm is noted. At present the child is stable. What questions would be most appropriate for the nurse to ask when obtaining the child's health history? What objective assessments should the nurse make?

2. Charlie is a 2-year-old who is admitted to the hospital after accidentally ingesting a medication. His mother, who brought Charlie to the hospital, is upset and crying. How does Charlie's age and stage of development affect his risk for accidental ingestion? How should the nurse respond to the mother's distress? Develop a discharge teaching plan for Charlie and his family related to poison prevention.

3. A 7-month-old is brought to the acute care facility with a chief complaint of difficulty breathing. The infant's mother says that his cold has gotten worse and he won't eat. What additional questions should the nurse ask about the infant's health history? How would the nurse appropriately manage this infant's airway?

Study Activities

1. Spend a day in the pediatric emergency department or urgent care center and document the role of the triage nurse.
2. Observe the pediatric emergency medical team at work or observe a pediatric code in the hospital. Compare and contrast the measures performed for the child with those that would be performed for an adult in a similar emergency situation.
3. Develop a teaching project related to injury prevention and present it at a local elementary, middle, or high school. Ensure that the education is geared toward the children's developmental level.
4. Interview the parents of a child who has experienced an emergency situation about how they felt during and after the emergency. Present the information to your classmates.
5. When providing care to a child in an emergency, the nurse performs the following assessments. Place them in the proper sequence.
   a. Pupillary reaction
   b. Presence of cough or sputum
   c. Heart rate and capillary refill
   d. Presence of bruises and abrasions
   e. Work of breathing