



CHAPTER 39

NURSING CARE OF THE CHILD WITH A RESPIRATORY DISORDER

KEY TERMS

| | | |
|-------------|----------------|---------------------|
| atelectasis | inspiration | rhinorrhea |
| atopy | laryngitis | stridor |
| clubbing | oxygenation | subglottic stenosis |
| coryza | pharyngitis | suctioning |
| cyanosis | pulmonary | tachypnea |
| expiration | pulse oximetry | tracheostomy |
| hypoxemia | rales | ventilation |
| hypoxia | retractions | wheeze |
| infiltrate | rhinitis | work of breathing |

LEARNING OBJECTIVES

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

1. Discuss how the anatomy and physiology of the respiratory system in children differs from that of adults.
2. Identify various factors associated with respiratory illness in infants and children.
3. Discuss common laboratory and other diagnostic tests useful in the diagnosis of respiratory conditions.
4. Discuss common medications and other treatments used for treatment and palliation of respiratory conditions.
5. Recognize risk factors associated with various respiratory disorders.
6. Distinguish different respiratory illnesses based on their signs and symptoms.
7. Discuss nursing interventions commonly used for respiratory illnesses.
8. Devise an individualized nursing care plan for the child with a respiratory disorder.
9. Develop client/family teaching plans for the child with a respiratory disorder.
10. Describe the psychosocial impact of chronic respiratory disorders on children.

Alexander Roberts, 4 months old, is brought to the clinic by his mother. He has a cold and has been coughing a great deal for 2 days. Today he has had difficulty taking his bottle and is breathing very quickly.

Mrs. Roberts says he seems tired.

Wow

Restoring a full breath allows a child to participate fully in life's adventures.

Respiratory disorders are the most common causes of illness and hospitalization in children. These illnesses range from mild, non-acute disorders (such as the common cold or sore throat) to serious life-threatening conditions (such as epiglottitis). Chronic disorders, such as allergic rhinitis or asthma, can affect quality of life, but frequent acute or recurrent infections also can interfere significantly with the well-being of some children.

Respiratory infections account for the majority of acute illnesses in children. The child's age and living conditions as well as the season of the year can influence the development of respiratory disorders in addition to the course of illness. For example, low-income children have a higher risk for increased severity or increased frequency of disease. Infants and younger children are more likely to deteriorate quickly from a respiratory illness. Certain viruses are more prevalent in the winter, whereas allergen-related respiratory diseases are more prevalent in the spring and fall. Children with chronic illness such as diabetes, congenital heart disease, sickle cell anemia, and cystic fibrosis and children with developmental disorders such as cerebral palsy tend to be more severely affected with respiratory disorders. Parents may have difficulty determining the severity of their child's condition and might either seek care very early in the course of the illness (when it is still very mild) or wait and present to the health care setting when the child is very ill.

Nurses must be familiar with respiratory conditions affecting children so that they can provide guidance and support to families. When children become ill, families often encounter nurses in outpatient settings first. Nurses must be able to ask questions that can help establish the severity of the child's illness and determine whether they must seek care at a health facility. Since respiratory illnesses account for the majority of pediatric admissions to general hospitals, nurses caring for children need to have expert assessment and intervention skills in this area. Detection of worsening respiratory status early in the course of deterioration allows for timely treatment and the chance to prevent a minor problem from becoming a critical illness.

Difficulty with breathing can be very frightening for both the child and parents. The child and the family need the nurse's support throughout a respiratory illness. Nurses are also in the unique position of being able to reduce the burden of respiratory illness in children by identifying these illnesses early, providing education about them, and promoting prevention efforts.

Variations in Pediatric Anatomy and Physiology

Respiratory conditions often affect both the upper and lower respiratory tract, though some affect primarily one or the other. Respiratory dysfunction in children tends to be more severe than in adults, and several differences in

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| Objective | Significance |
|---|---|
| Reduce hospitalization rates for three ambulatory-care-sensitive conditions: pediatric asthma and immunization-preventable pneumonia and influenza. | <ul style="list-style-type: none"> • Appropriately educate children with asthma and their families about the ongoing management of asthma. • Encourage pneumococcal and influenza vaccinations per recommendations. |

the infant's or child's respiratory system account for this increased severity.

Nose

Newborns are obligatory nose breathers until at least 4 weeks of age. The young infant cannot automatically open his or her mouth to breathe if the nose is obstructed. The nares must be patent for breathing to be successful while feeding. Newborns breathe through their mouths only while crying.

The upper respiratory mucus serves as a cleansing agent, yet newborns produce very little mucus, making them more susceptible to infection. However, the newborn and young infant may have very small nasal passages, so when excess mucus is present, airway obstruction is more likely.

Infants are born with maxillary and ethmoid sinuses present. The frontal sinuses (most often associated with sinus infection) and the sphenoid sinuses develop by age 6 to 8 years, so younger children are less apt to acquire sinus infections than are adults.

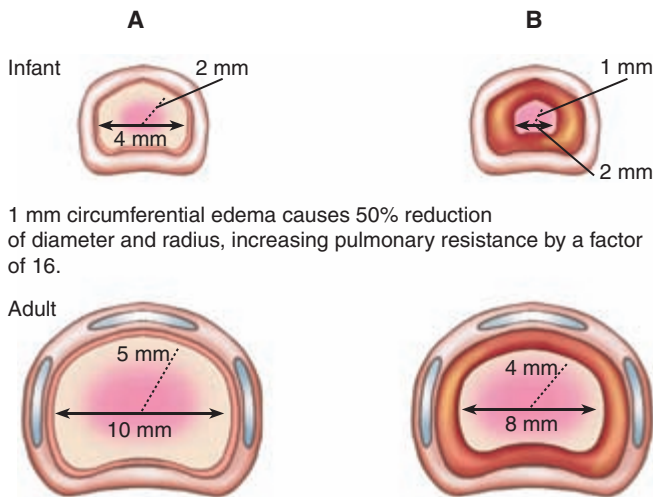
Throat

The tongue of the infant relative to the oropharynx is larger than in adults. Posterior displacement of the tongue can quickly lead to severe airway obstruction. Through early school age, children tend to have enlarged tonsillar and adenoidal tissue even in the absence of illness. This can contribute to an increased incidence of airway obstruction.

Trachea

The airway lumen is smaller in infants and children than in adults. The infant's trachea is approximately 4 mm wide compared with the adult width of 20 mm. When edema, mucus, or bronchospasm is present, the capacity for air passage is greatly diminished. A small reduction in the diameter of a child's airway can significantly increase resistance to airflow, leading to increased **work of breathing** (Fig. 39.1).

In teenagers and adults the larynx is cylindrical and fairly uniform in width. In infants and children less than 10 years old, the cricoid cartilage is underdeveloped, resulting in laryngeal narrowing. Thus, in infants and children, the larynx is funnel-shaped. When any portion of



1 mm circumferential edema causes 50% reduction of diameter and radius, increasing pulmonary resistance by a factor of 16.

Adult

1 mm circumferential edema causes 20% reduction of diameter and radius, increasing pulmonary resistance by a factor of 2.4.

FIGURE 39.1 (A) Note the smaller diameter of the child's airway under normal circumstances. (B) With 1 cm of edema present, note the exponential decrease in airway lumen diameter as compared with the adult.

the airway is narrowed, further narrowing from mucus or edema will result in an exponential increase in resistance to airflow and work of breathing. In infants and children, the larynx and glottis are located higher in the neck, increasing the chance of aspiration of foreign material into the lower airways. Congenital laryngomalacia occurs in some infants and results in the laryngeal structure being weaker than normal, yielding greater collapse on **inspiration**. Box 39.1 discusses congenital laryngomalacia.

The child's airway is highly compliant, making it quite susceptible to dynamic collapse in the presence of airway

obstruction. The muscles supporting the airway are less functional than those in the adult. Children have a large amount of soft tissue surrounding the trachea, and the mucous membranes lining the airway are less securely attached compared with adults. This increases the risk for airway edema and obstruction. Upper airway obstruction resulting from a foreign body, croup, or epiglottitis can result in tracheal collapse during inspiration.

Lower Respiratory Structures

The bifurcation of the trachea occurs at the level of the third thoracic vertebra in children, compared to the level of the sixth thoracic vertebra in adults. This anatomic difference is important when suctioning children and when endotracheal intubation is required (see Chapter 52 for further discussion). This difference in placement also contributes to risk for aspiration. The bronchi and bronchioles of infants and children are also narrower in diameter than the adult's, placing them at increased risk for lower airway obstruction (see Fig. 39.1). Lower airway obstruction during exhalation often results from bronchiolitis or asthma or is caused by foreign body aspiration into the lower airway.

Alveoli develop at approximately 24 weeks' gestation. Term infants are born with about 50 million alveoli. After birth, alveolar growth slows until 3 months of age and then progresses until the child reaches 7 or 8 years of age, at which time the alveoli reach the adult number of around 300 million. Alveoli make up most of the lung tissue and are the major sites for gas exchange. Oxygen moves from the alveolar air to the blood, while carbon dioxide moves from the blood into the alveolar air. Smaller numbers of alveoli, particularly in the premature and/or young infant, place the child at a higher risk of **hypoxemia** and carbon dioxide retention.

Chest Wall

In older children and adults the ribs and sternum support the lungs and help keep them well expanded. The movement of the diaphragm and intercostal muscles alters volume and pressure within the chest cavity, resulting in air movement into the lungs. Infants' chest walls are highly compliant (pliable) and fail to support the lungs adequately. Functional residual capacity can be greatly reduced if respiratory effort is diminished. This lack of lung support also makes the tidal volume of infants and toddlers almost completely dependent upon movement of the diaphragm. If diaphragm movement is impaired (as in states of hyperinflation such as asthma), the intercostal muscles cannot lift the chest wall and respiration is further compromised.

Metabolic Rate and Oxygen Need

Children have a significantly higher metabolic rate than adults. Their resting respiratory rates are faster and their demand for oxygen is higher. Adult oxygen consumption is 3 to 4 liters per minute, while infants consume 6 to 8 liters per minute. In any situation of respiratory distress,

BOX 39.1 Congenital Laryngomalacia

- Inspiratory stridor is present and is intensified with certain positions.
- Suprasternal retractions may be present, but the infant exhibits no other signs of respiratory distress.
- Congenital laryngomalacia is generally a benign condition that improves as the cartilage in the larynx matures. It usually disappears by age 1 year.
- The crowing noise heard with breathing can make parents very anxious. Reassure parents that the condition will improve with time.
- Parents become very familiar with the "normal" sound their infant makes and are often able to identify intensification or change in the stridor. Airway obstruction may occur earlier in infants with this condition, so intensification of stridor or symptoms of respiratory illness should be evaluated early by the primary care provider.

infants and children will develop hypoxemia more rapidly than adults. This may be attributed not only to the child's increased oxygen requirement but also to the effect that certain conditions have on the oxyhemoglobin dissociation curve.

Normal oxygen transport relies upon binding of oxygen to hemoglobin in areas of high pO_2 (pulmonary arterial beds) and release of oxygen from hemoglobin when the partial pressure of oxygen (pO_2) is low (peripheral tissues). Normally, a pO_2 of 95 mm Hg results in an oxygen saturation of 97%. A decrease in oxygen saturation results in a disproportionate (much larger) decrease in pO_2 (Fig. 39.2). Thus, a small decrease in oxygen saturation reflects a larger decrease in pO_2 . Conditions such as alkalosis, hypothermia, hypocarbia, anemia, and fetal hemoglobin cause oxygen to become more tightly bound to hemoglobin, resulting in the curve shifting to the left. Common pediatric conditions such as acidosis, hyperthermia, and hypercarbia cause hemoglobin to decrease its affinity for oxygen, further shifting the curve to the right.

Common Medical Treatments

A variety of interventions are used to treat respiratory illness in children. The treatments listed in Common Medical Treatments 39.1 and Drug Guide 39.1 usually require a physician's order when a child is hospitalized.

NURSING PROCESS OVERVIEW FOR THE CHILD WITH A RESPIRATORY DISORDER

Care of the child with a respiratory disorder includes assessment, nursing diagnosis, planning, interventions, and evaluation. There are a number of general concepts related

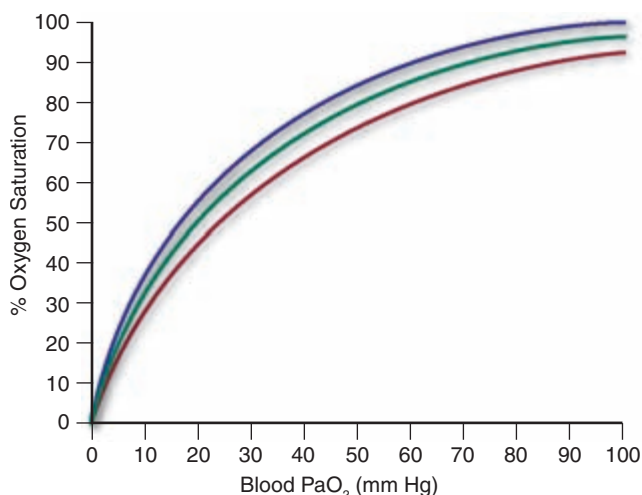


FIGURE 39.2 Normal hemoglobin dissociation curve (green), shift to the right (red), and shift to the left (black).

to the nursing process that can be applied to respiratory disorders. From a general understanding of the care involved for a child with respiratory dysfunction, the nurse can then individualize the care based on client specifics.

Assessment

Assessment of respiratory dysfunction in children includes health history, physical examination, and laboratory or diagnostic testing.

Remember Alexander, the 4-month-old with the cold, cough, fatigue, feeding difficulty, and fast breathing? What additional health history and physical examination assessment information should the nurse obtain?

Health History

The health history comprises past medical history, family history, and history of present illness (when the symptoms started and how they have progressed) as well as treatments used at home. The past medical history might be significant for recurrent colds or sore throats, **atopy** (such as asthma or atopic dermatitis), prematurity, respiratory dysfunction at birth, poor weight gain, or history of recurrent respiratory illnesses or chronic lung disease. Family history might be significant for chronic respiratory disorders such as asthma or might reveal contacts for infectious exposure. When eliciting the history of the present illness, inquire about onset and progression, fever, nasal congestion, noisy breathing, presence and description of cough, rapid respirations, increased work of breathing, ear, nose, sinus, or throat pain, ear pulling, headache, vomiting with coughing, poor feeding, and lethargy. Also inquire about exposure to second-hand smoke. Children exposed to environmental smoke have an increased incidence of respiratory illnesses such as asthma, bronchitis, and pneumonia (Sheahan & Free, 2005).

Physical Examination

Physical examination of the respiratory system includes inspection and observation, auscultation, percussion, and palpation.

Inspection and Observation

Color. Observe the child's color, noting pallor or cyanosis (circumoral or central). Pallor (pale appearance) occurs as a result of peripheral vasoconstriction in an effort to conserve oxygen for vital functions. **Cyanosis** (a bluish tinge to the skin) occurs as a result of **hypoxia**. It might first present circumorally (just around the mouth) and progress to central cyanosis. Newborns might have blue hands and feet (acrocyanosis), a normal finding. The infant might have pale hands and feet when cold or when ill, as peripheral circulation is not well developed in early



COMMON MEDICAL TREATMENTS 39.1 RESPIRATORY DISORDERS

| Treatment | Explanation | Indications | Nursing Implications |
|---|---|---|--|
| Oxygen | Supplemented via mask, nasal cannula, hood, or tent or via endotracheal or nasotracheal tube | Hypoxemia, respiratory distress | Monitor response via work of breathing and pulse oximetry. |
| High humidity | Addition of moisture to inspired air | Common cold, croup, tonsillectomy | Infant may require extra blankets with cool mist, and frequent changes of bedclothes under oxygen hood or tent as they become damp. |
| Suctioning | Removal of secretions via bulb syringe or suction catheter | Excessive airway secretions (common cold, flu, bronchiolitis, pertussis) | Should be done carefully and only as far as recommended for age or tracheostomy tube size, or until cough or gag occurs. |
| Chest physiotherapy (CPT) and postural drainage | Promotes mucus clearance by mobilizing secretions with the assistance of percussion or vibration accompanied by postural drainage | Bronchiolitis, pneumonia, cystic fibrosis, or other conditions resulting in increased mucus production. Not effective in inflammatory conditions without increased mucus. | May be performed by respiratory therapist in some institutions, by nurses in others. In either case, nurses must be familiar with the technique and able to educate families on its use. |
| Saline gargles | Relieves throat pain via salt water gargle | Pharyngitis, tonsillitis | Recommended for children old enough to understand the concept of gargling (to avoid choking) |
| Saline lavage | Normal saline introduced into the airway, followed by suctioning | Common cold, flu, bronchiolitis, any condition resulting in increased mucus production in the upper airway | Very helpful for loosening thick mucus; child may need to be in semi-upright position to avoid aspiration |
| Chest tube | Insertion of a drainage tube into the pleural cavity to facilitate removal of air or fluid and allow full lung expansion | Pneumothorax, empyema | Should tube become dislodged from container, the chest tube must be clamped immediately to avoid further air entry into the chest cavity. |
| Bronchoscopy | Introduction of a bronchoscope into the bronchial tree for diagnostic purposes. Also allows for bronchiolar lavage. | Removal of foreign body, cleansing of bronchial tree | Watch for postprocedure airway swelling, complaints of sore throat. |

infancy. It is important, then, to note if the cyanosis is central (involving the midline), as this is a true sign of hypoxia. Children with low red blood cell counts might not demonstrate cyanosis as early in the course of hypoxemia as children with normal hemoglobin levels. Therefore, absence of cyanosis or the degree of cyanosis present is not always an accurate indication of the severity of respiratory involvement.

Note the rate and depth of respiration as well as work of breathing. Often the first sign of respiratory illness in infants and children is **tachypnea**.



► **Take NOTE!**

A slow or irregular respiratory rate in an acutely ill infant or child is an ominous sign. See Chapter 52.

Nose and Oral Cavity. Inspect the nose and oral cavity. Note nasal drainage and redness or swelling in the nose. Note the color of the pharynx, presence of exudate,



DRUG GUIDE 39.1 COMMON DRUGS FOR RESPIRATORY DISORDERS

| Medication | Action/Indications | Nursing Implications |
|--|--|--|
| Expectorant (guaifenesin) | Reduces viscosity of thickened secretions by increasing respiratory tract fluid Used for the common cold, pneumonia, and other conditions requiring mobilization and subsequent expectoration of mucus | Encourage deep breathing before coughing in order to mobilize secretions. Maintain adequate fluid intake. Assess breath sounds frequently. |
| Cough suppressants (dextromethorphan, codeine, hydrocodone) | Relieves irritating, nonproductive cough by direct effect on the cough center in the medulla, which suppresses the cough reflex Used for the common cold, sinusitis, pneumonia, bronchitis | Should be used only with nonproductive coughs in the absence of wheezing |
| Antihistamines | Treatment of allergic conditions such as allergic rhinitis, asthma | May cause drowsiness or dry mouth |
| Antibiotics (oral, parenteral) | Treatment of bacterial infections of the respiratory tract such as pharyngitis, tonsillitis, sinusitis, bacterial pneumonia, cystic fibrosis, empyema, abscess, tuberculosis | Check for antibiotic allergies. Should be given as prescribed for the length of time prescribed. |
| Antibiotics (inhaled) | Treatment of bacterial infections of the respiratory tract in children with cystic fibrosis | Can be given via nebulizer |
| Beta2-adrenergic agonists (short-acting) (i.e., albuterol, levalbuterol) | Relax airway smooth muscle, resulting in bronchodilation Used for acute and chronic treatment of wheezing and bronchospasm in asthma, bronchiolitis, cystic fibrosis, chronic lung disease. Also used to prevent wheezing in exercise-induced asthma. | May be administered orally or via inhalation Can be used for acute relief of bronchospasm May cause nervousness, tachycardia, and jitteriness Inhaled agents result in fewer systemic side effects. |
| Beta2-adrenergic agonists (long-acting) (i.e., salmeterol) | Long-acting bronchodilator used in chronic asthma management and for prevention of exercise-induced asthma Long-term control in chronic asthma Prevention of exercise-induced asthma | Administered via inhalation Used only for long-term control or for exercise-induced asthma. Not for relief of bronchospasm in an acute wheezing episode. |
| Racemic epinephrine | Produces bronchodilation Indicated for croup | Assess lung sounds and work of breathing. Observe for rebound bronchospasm. |
| Anticholinergic (ipratropium) | Produces bronchodilation in asthma or chronic lung disease | In children, generally used as an adjunct to beta2-adrenergic agonists for treatment of bronchospasm |
| Antiviral agents (amantadine, rimantidine, zanamivir, oseltamivir) | Treatment and prevention of influenza A | Amantadine, rimantidine: Monitor for confusion, nervousness, and jitteriness. Zanamivir, oseltamivir: Well tolerated but expensive |
| Virazole (Ribavirin) | Treatment of severe lower respiratory tract infection with RSV, usually reserved for ventilated clients | Administer via aerosol with the small-particle aerosol generator (SPAG). Suction patients on assisted ventilation every 2 hours; monitor pulmonary pressures every 2 to 4 hours. May cause blurred vision and photosensitivity. |
| Corticosteroids (inhaled) | Exert a potent, locally acting anti-inflammatory effect to decrease the frequency and severity of asthma attacks. May also delay pulmonary damage that occurs with chronic asthma. Also used for chronic lung disease and croup syndromes. | Not for treatment of acute wheezing Rinse mouth after inhalation to decrease incidence of fungal infections, dry mouth, and hoarseness. Minimal systemic absorption makes inhaled steroids the treatment of choice for asthma maintenance program. |

| Medication | Action/Indications | Nursing Implications |
|---|---|---|
| Corticosteroids (oral, parenteral) | Suppress inflammation and normal immune response Used for acute asthma exacerbations, wheezing with chronic lung disease, and severe croup | May cause hyperglycemia May suppress reaction to allergy tests Consult physician if vaccinations are ordered during course of systemic corticosteroid therapy. Short courses of therapy are generally safe. Very effective, but long-term or chronic use can result in peptic ulceration, altered growth, and numerous other side effects. Children on long-term dosing should have growth assessed. |
| Decongestants (e.g., pseudoephedrine) | Treatment of runny or stuffy nose associated with the common cold, sinusitis, or allergic rhinitis in children over age 6 | Assess child periodically for nasal congestion. Some children react to decongestants with excessive sleepiness or increased activity. |
| Leukotriene receptor antagonists (montelukast, zafirlukast, zileuton) | Decrease inflammatory response by antagonizing the effects of leukotrienes to control asthma in children age 1 year and older Montelukast: for allergic rhinitis in children 6 months and older | Given once daily, in the evening Not for relief of bronchospasm during an acute wheezing episode, but may be continued during the episode |
| Mast-cell stabilizers (cromolyn, nedocromil) | Prevent release of histamine from sensitized mast cells, resulting in decreased frequency and intensity of allergic reactions in children with asthma or chronic lung disease. Also used as pre-exposure treatment for allergens. | Administered via inhalation For prophylactic use, not to relieve bronchospasm during an acute wheezing episode. Can be used 10 to 15 minutes prior to exposure to allergen, to decrease reaction to allergen. |
| Methylxanthines (theophylline, aminophylline) | To provide for continuous airway relaxation in moderate or severe asthma in order to achieve long-term control Also indicated for apnea of prematurity (see "Caffeine") | Administered orally or intravenously. Sustained-release oral preparation can be used to prevent nocturnal symptoms. Monitor drug levels routinely. Report signs of toxicity immediately: tachycardia, nausea, vomiting, diarrhea, stomach cramps, anorexia, confusion, headache, restlessness, flushing, increased urination, seizures, arrhythmias, insomnia. |
| Caffeine | Stimulates the respiratory center in infants with apnea of prematurity | See "Methylxanthines." |
| Pulmozyme (dornase alfa) | Enzyme that hydrolyzes the DNA in sputum, reducing sputum viscosity in children with cystic fibrosis | Administered via nebulizer Monitor for dysphonia and pharyngitis. |
| Synagis (palivizumab) | Monoclonal antibody used to prevent serious lower respiratory RSV disease in certain high-risk groups of children | Should be administered monthly during the RSV season Given intramuscularly only |

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| Objective | Significance |
|---|--|
| Reduce the proportion of children who are regularly exposed to tobacco smoke at home. | <ul style="list-style-type: none"> Educate the family about the effects that passive smoking has on children. Encourage families to join smoking cessation programs. |

tonsil size and status, and presence of lesions anywhere in the oral cavity.

Cough and Other Airway Noises. Note the sound of the cough. (Is it wet, productive, dry and hacking, tight? When does the cough occur? Is it only or mainly at night?) If noises associated with breathing are present (grunting, stridor, or audible wheeze) these should also be noted. Grunting occurs on **expiration** and is produced by prema-

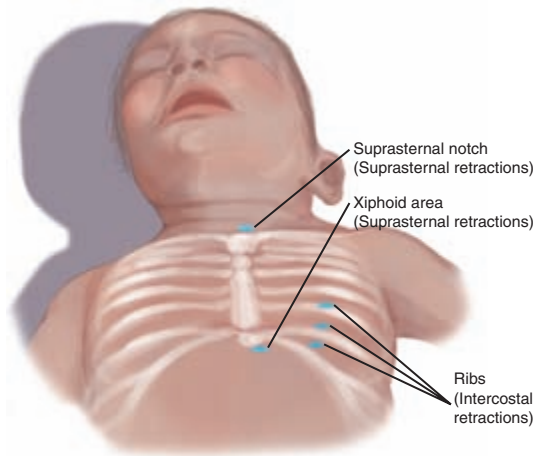


FIGURE 39.3 Location of retractions.

ture glottic closure. It is an attempt to preserve or increase functional residual capacity. Grunting might occur with alveolar collapse or loss of lung volume, such as in atelectasis, pneumonia, and pulmonary edema. **Stridor**, a high-pitched, readily audible inspiratory noise, is a sign of upper airway obstruction. Sometimes wheezes can be heard with the naked ear; these are referred to as audible wheezes.

Respiratory Effort. Assess respiratory effort for depth and quality. Is breathing labored? Infants and children with significant nasal congestion may have tachypnea, which usually resolves when the nose is cleared of mucus. Mouth breathing also may occur when a large amount of nasal congestion is present. Increased work of breathing, particularly if associated with restlessness and anxiety, usually indicates lower respiratory involvement. Assess for the presence of nasal flaring, retractions, or head bobbing. Nasal flaring can occur early in the course of respiratory illness and is an effort to inhale greater amounts of oxygen.

Retractions (the inward pulling of soft tissues with respiration) can occur in the intercostal, subcostal, substernal, supraclavicular, or suprasternal regions (Fig. 39.3). Document the severity of the retractions: mild, moderate, or severe. Also note the use of accessory neck muscles. Note the presence of paradoxical breathing (lack of simultaneous chest and abdominal rise with the inspiratory phase; Fig. 39.4). Bobbing of the head with each breath is also a sign of increased respiratory effort.



► **Take NOTE!**

Seesaw (or paradoxical) respirations are very ineffective for ventilation and oxygenation. The chest falls on inspiration and rises on expiration.

Anxiety and Restlessness. Is the child anxious or restless? Restlessness, irritability, and anxiety result from difficulty in securing adequate oxygen. These might be very early signs of respiratory distress, especially if accompanied by tachypnea. Restlessness might progress to listlessness and lethargy if the respiratory dysfunction is not corrected.

Clubbing. Inspect the fingertips for the presence of **clubbing**, an enlargement of the terminal phalanx of the finger, resulting in a change in the angle of the nail to the fingertip (Fig. 39.5). Clubbing might occur in children with a chronic respiratory illness. It is the result of increased capillary growth as the body attempts to supply more oxygen to distal body cells.

Hydration Status. Note the child's hydration status. The child with a respiratory illness is at risk for dehydration. Pain related to sore throat or mouth lesions may prevent the child from drinking properly. Nasal congestion interferes with the infant's ability to suck effectively at the breast or bottle. Tachypnea and increased work of breathing interfere with the ability to safely ingest fluids.

Assess the oral mucosa for color and moisture. Note skin turgor, presence of tears, and adequacy of urine output.

Auscultation

Assess lung sounds via auscultation. Evaluate breath sounds over the anterior and posterior chest, as well as in the axillary areas. Note the adequacy of aeration. Breath sounds should be equal bilaterally. The intensity and pitch should be equal throughout the lungs; document diminished breath sounds. In the absence of concurrent lower respiratory illness, the breath sounds should be clear throughout all lung fields. During normal respiration, the inspiratory phase is usually softer and longer than the expiratory phase. Prolonged expiration is a sign of bronchial

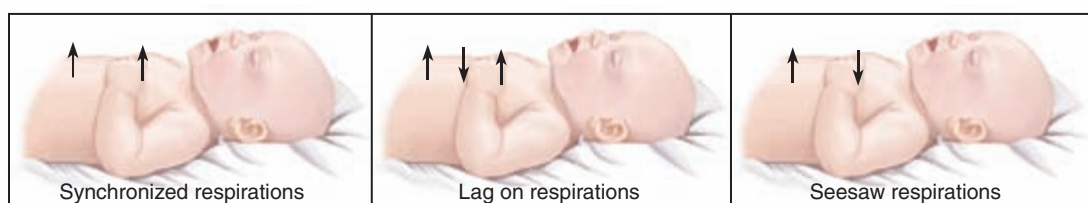


FIGURE 39.4 Seesaw respirations.



FIGURE 39.5 (A) Normal fingertip. Early clubbing (B) may progress eventually to advanced clubbing (C) as a result of chronic hypoxemia.

or bronchiolar obstruction. Bronchiolitis, asthma, pulmonary edema, and an intrathoracic foreign body can cause prolonged expiratory phases.

Infants and young children have thin chest walls. When the upper airway is congested (as in a severe cold), the noise produced in the upper airway might be transmitted throughout the lung fields. When upper airway congestion is transmitted to the lung fields, the congested-sounding noise heard over the trachea is the same type of noise heard over the lungs but is much louder and more intense. To ascertain if these sounds are truly adventitious lung sounds or if they are transmitted from the upper airway, auscultate again after the child coughs or his or her nose has been suctioned. Another way to discern the difference is to compare auscultatory findings over the trachea to the lung fields to determine if the abnormal sound is truly from within the lung or is actually a sound transmitted from the upper airway.

Note adventitious sounds heard on auscultation. Wheezing, a high-pitched sound that usually occurs on expiration, results from obstruction in the lower trachea or bronchioles. Wheezing that clears with coughing is most likely a result of secretions in the lower trachea. Wheezing resulting from obstruction of the bronchioles, as in bronchiolitis, asthma, chronic lung disease, or cystic fibrosis, does not clear with coughing. **Rales** (crackling sounds) result when the alveoli become fluid-filled, such as in pneumonia. Note the location of the adventitious sounds as well as the timing (on inspiration, expiration, or both). Tachycardia might also be present. An increase in heart rate often initially accompanies hypoxemia.

Percussion

When percussing, note sounds that are not resonant in nature. Flat or dull sounds might be percussed over partially consolidated lung tissue, as in pneumonia. Tympany might be percussed with a pneumothorax. Note the presence of hyperresonance (as might be apparent with asthma).

Palpation

Palpate the sinuses for tenderness in the older child. Assess for enlargement or tenderness of the lymph nodes of the head and neck. Document alterations in tactile fremitus detected on palpation. Increased tactile fremitus might occur in a case of pneumonia or pleural effusion. Fremitus might be decreased in the case of barrel chest,

as with cystic fibrosis. Absent fremitus might be noted with pneumothorax or atelectasis.

Compare central and peripheral pulses. Note the quality of the pulse as well as the rate. With significant respiratory distress, perfusion often becomes compromised. Poor perfusion might be reflected in weaker peripheral pulses (radial, pedal) when compared to central pulses.

Laboratory and Diagnostic Testing

Common Laboratory and Diagnostic Tests 39.1 explains the laboratory and diagnostic tests most commonly used for a child with a respiratory disorder. The tests can assist the physician in diagnosing the disorder and/or be used as guidelines in determining ongoing treatment. Laboratory or non-nursing personnel obtain some of the tests, while the nurse might obtain others. In either instance the nurse should be familiar with how the tests are obtained, what they are used for, and normal versus abnormal results. This knowledge will also be necessary when providing client and family education related to the testing.



► Take NOTE!

Ambient light may interfere with pulse oximetry readings. When the pulse oximeter probe is placed on the infant's foot or the young child's toe, covering the probe and foot with a sock may help to ensure an accurate measurement.

Nursing Diagnoses, Goals, Interventions, and Evaluation

Upon completion of a thorough assessment, the nurse might identify several nursing diagnoses, including:

- Ineffective Airway Clearance
- Ineffective Breathing Pattern
- Impaired Gas Exchange
- Risk for Infection
- Pain
- Risk for Fluid Volume Deficit
- Altered Nutrition, less than body requirements
- Activity Intolerance
- Fear
- Altered Family Processes

(text continues on page 1230)

COMMON LABORATORY AND DIAGNOSTIC TESTS 39.1 RESPIRATORY DISORDERS



| Test | Explanation | Indications | Nursing Implications |
|------------------------------|---|---|---|
| Allergy skin testing | Suggested allergen is applied to skin via scratch, pin, or prick. A wheal response indicates allergy to the substance. Carries risk of anaphylaxis. (Nursing note: Antihistamines must be discontinued before testing, as they inhibit the test.) | Allergic rhinitis, asthma | Close observation for anaphylaxis is necessary. Epinephrine and emergency equipment should be readily available. Some children react to the skin test almost immediately; others take several minutes. |
| Arterial blood gases | Invasive method (requires blood sampling) of measuring arterial pH, partial pressure of oxygen and carbon dioxide, and base excess in blood | Usually reserved for severe illness, the intubated child, or suspected carbon dioxide retention | Hold pressure for several minutes after a peripheral arterial stick to avoid bleeding. Radial arterial sticks are common and can be very painful. Note if the child is crying excessively during the blood draw, as this affects the carbon dioxide level. |
| Chest x-ray | Radiographic image of the expanded lungs: can show hyperinflation, atelectasis, pneumonia, foreign body, pleural effusion, abnormal heart or lung size | Bronchiolitis, pneumonia, tuberculosis, asthma, cystic fibrosis, bronchopulmonary dysplasia | Children may be afraid of the x-ray equipment. If a parent or familiar adult can accompany the child, often the child is less afraid. If the child is unable or unwilling to hold still for the x-ray, restraint may be necessary. Restraint should be limited to the amount of time needed for the x-ray. |
| Fluorescent antibody testing | Determines presence of respiratory syncytial virus (RSV), adenovirus, influenza, parainfluenza, or <i>Chlamydia</i> in nasopharyngeal secretions | Bronchiolitis, pneumonia | To obtain a nasopharyngeal specimen, instill 1 to 3 mL of sterile normal saline into one nostril, aspirate the contents using a small sterile bulb syringe, place the contents in sterile container, and immediately send them to the lab. |
| Fluoroscopy | Radiographic examination that uses a fluorescent screen — “real-time” imaging | Identification of masses, abscesses | Requires the child to lie still. Equipment can be frightening. Children may respond to presence of parent or familiar adult. |
| Gastric washings for AFB | Determines presence of AFB (acid-fast bacilli) in stomach (children often swallow sputum) | Tuberculosis | Nasogastric tube is inserted and saline is instilled and suctioned out of the stomach to obtain the specimen. |
| Peak expiratory flow | Measures the maximum flow of air (in L/sec) that can be forcefully exhaled in 1 second | Daily use can indicate adequacy of asthma control. | It is important to establish the child’s “personal best” by taking twice-daily readings over a 2-week period while well. The average of these is termed “personal best.” Charts based on height and age are also available to determine expected peak expiratory flow. |

| Test | Explanation | Indications | Nursing Implications |
|---|---|--|--|
| Pulmonary function tests | Measure respiratory flow and lung volumes | Asthma, cystic fibrosis, chronic lung disease | Usually performed by a respiratory therapist trained to do the full spectrum of tests. Spirometry can be obtained by the trained nurse in the outpatient setting. |
| Pulse oximetry | Noninvasive method of continuously (or intermittently) measuring oxygen saturation | Can be useful in any situation in which a child is experiencing respiratory distress | Probe must be applied correctly to finger, toe, foot, hand, or ear in order for the machine to appropriately pick up the pulse and oxygen saturation. |
| Rapid flu test | Rapid test for detection of influenza A or B | Influenza | Should be done in first 24 hours of illness so that medication administration can begin Have the child gargle with sterile normal saline and then spit into a sterile container. Send immediately to the lab. |
| Rapid strep test | Instant test for presence of strep A antibody in pharyngeal secretions | Pharyngitis, tonsillitis | Results in 5 to 10 minutes. Negative tests should be backed up with throat culture. |
| RAST (radioallergen sorbent test) | Measures minute quantities of immunoglobulin E in the blood Carries no risk of anaphylaxis but is not as sensitive as skin testing | Asthma (food allergies) | Blood test that is usually sent out to a reference laboratory |
| Sinus x-rays, computed tomography (CT), or magnetic resonance imaging (MRI) | Radiologic tests that may show sinus involvement | Sinusitis, recurrent colds | X-ray results are usually received more quickly than CT or MRI results. |
| Sputum culture | Bacterial culture of invasive organisms in the sputum | Pneumonia, cystic fibrosis, tuberculosis | Must be true sputum, not mucus from the mouth or nose. Child can deep breathe, cough, and spit, or specimen may be obtained via suctioning of the artificial airway. |
| Sweat chloride test | Collection of sweat on filter paper after stimulation of skin with pilocarpine Measures concentration of chloride in the sweat | Cystic fibrosis | May be difficult to obtain sweat in a young infant |
| Throat culture | Bacterial culture (minimum of 24 to 48 hours required) to determine presence of streptococcus A or other bacteria | Pharyngitis, tonsillitis | Can be obtained on separate swab at same time as rapid strep test to decrease trauma to the child (swab both applicators at once) Do not perform immediately after the child has had medication or something to eat or drink. |
| Tuberculin skin test | Mantoux test (intradermal injection of purified protein derivative) | Tuberculosis, chronic cough | Must be given intradermally; not a valid test if injected incorrectly |

After completing an assessment of Alexander, the nurse notes the following: lots of clear secretions in the airway, child appears pale, respiratory rate 68, retractions, nasal flaring, wheezing, and diminished breath sounds. Based on these assessment findings, what would your top three nursing diagnoses be for Alexander?

Nursing goals, interventions, and evaluation for the child with a respiratory disorder are based on the nursing diagnoses. Nursing Care Plan 39.1 can be used as a guide in planning nursing care for the child with a respiratory disorder. The nursing care plan should be individualized based on the client's symptoms and needs; refer to Chapter 35 for detailed information on pain management. Additional information will be included later in the chapter as it relates to specific disorders.

Based on your top three nursing diagnoses for Alexander, describe appropriate nursing interventions.

Oxygen Supplementation

Oxygen may be delivered to the child by a variety of methods (Fig. 39.6). Since oxygen administration is considered a drug, it requires a physician's order, except when following emergency protocols outlined in a health care facility's policies and procedures. Many health care settings develop specific guidelines for oxygen administration that are often coordinated by respiratory therapists, yet the nurse still remains responsible for ensuring that oxygen is administered properly.

Oxygen sources include wall-mounted systems as well as cylinders. The supply of oxygen available from a wall-mounted source is limitless, but use of a wall-mounted source restricts the child to the hospital room. Cylinders are portable oxygen tanks; the D-cylinder holds a little less than 400 liters of oxygen and the E-cylinder holds about 650 liters of oxygen. Cylinders turn on with a gauge attached to the top of the tank. The cylinder is useful for the child on low-flow oxygen because it allows for mobility.

The tank empties relatively quickly if the child requires a high flow of oxygen, so this is not the best oxygen source in an emergency. Respiratory therapists usually maintain the respiratory equipment that is found in the emergency room or hospital. However, in an outpatient setting the nurse may be responsible for maintaining respiratory equipment and checking the level of oxygen in the office's oxygen tanks each day.



► **Take NOTE!**

Oxygen is highly flammable, so use safety precautions. Post signs ("Oxygen in Use"); inform the family to avoid matches, lighters, and flammable or volatile materials; and use only facility-approved equipment.

The efficiency of oxygen delivery systems is affected by several variables, including the child's respiratory effort, the liter flow of oxygen delivered, and whether the equipment is being used appropriately. In general, oxygen facemasks come in infant, child, and adult sizes. Select the mask that best fits the child. In addition, ensure that the mask is sealed properly to decrease the amount of oxygen that escapes from the mask. Ensure that the liter flow is set according to the manufacturer's recommendations for use with that particular delivery method. The oxygen flow rate or concentration is usually determined by the physician's order. Whichever method of delivery is used, provide humidification during oxygen delivery to prevent drying of nasal passages and to assist with liquefying secretions. Table 39.1 provides details on oxygen delivery methods.



► **Take NOTE!**

Monitor vital signs, color, respiratory effort, pulse oximetry, and level of consciousness before, during, and after oxygen therapy to evaluate its effectiveness.

Acute Infectious Disorders

Acute infectious disorders include the common cold, sinusitis, influenza, pharyngitis, tonsillitis, laryngitis, croup syndromes, respiratory syncytial virus (RSV), pneumonia, and bronchitis.

► COMMON COLD

The common cold is also referred to as a viral upper respiratory infection (URI) or nasopharyngitis. Colds can be caused by a number of different viruses, including rhinoviruses, parainfluenza, RSV, enteroviruses, and adenoviruses (National Institute of Allergy and Infectious Diseases, 2007). Recently, human meta-pneumovirus has been identified as an important cause of the common cold (Burke, 2004). Viral particles spread through the air or from person-to-person contact. Colds occur more frequently in winter. They affect children of all ages and have a higher incidence among children who attend daycare and school-age children. It is not unusual for a child to have six to nine colds per year. Spontaneous resolution of the common cold occurs after about 7 to 10 days. Potential complications include secondary bacterial infections of the ears, throat, sinuses, or lungs.

Therapeutic management of the common cold is directed toward symptom relief. Nasal congestion may

(text continues on page 1234)

Nursing Care Plan 39.1



OVERVIEW FOR THE CHILD WITH A RESPIRATORY DISORDER

NURSING DIAGNOSIS: Ineffective airway clearance related to inflammation, increased secretions, mechanical obstruction, or pain as evidenced by presence of secretions, productive cough, tachypnea, and increased work of breathing

Outcome Identification and Evaluation

Child will maintain patent airway, *free from secretions or obstruction, easy work of breathing, respiratory rate within parameters for age.*

Interventions: Maintaining a Patent Airway

- Position with airway open (sniffing position if supine) *to allow adequate ventilation.*
- Humidify oxygen or room air and ensure adequate fluid intake (intravenous or oral) *to liquefy secretions for ease in clearance.*
- Suction with bulb syringe or via nasopharyngeal catheter as needed, particularly prior to bottle-feeding, *to promote clearance of secretions.*
- If tachypneic, maintain NPO status *to avoid aspiration.*
- In older child, encourage expectoration of sputum with coughing *to promote airway clearance.*
- Perform chest physiotherapy if ordered *to mobilize secretions.*
- Ensure emergency equipment is readily available *to avoid delay should airway become unmaintainable.*

NURSING DIAGNOSIS: Ineffective breathing pattern related to inflammatory or infectious process as evidenced by tachypnea, increased work of breathing, nasal flaring, retractions, diminished breath sounds

Outcome Identification and Evaluation

Child will exhibit adequate ventilation: *respiratory rate within parameters for age, easy work of breathing (absence of retractions, accessory muscle use, grunting), clear breath sounds with adequate aeration, oxygen saturation >94% or within prescribed parameters.*

Interventions: Promoting Effective Breathing Patterns

- Assess respiratory rate, breath sounds, and work of breathing frequently *to ensure progress with treatment and so that deterioration can be noted early.*
- Use pulse oximetry to monitor oxygen saturation in the least invasive manner *to note adequacy of oxygenation and ensure early detection of hypoxemia.*
- Position for comfort with open airway and room for lung expansion. Use pillows or padding if necessary to maintain position *to ensure optimal ventilation via maximum lung expansion.*
- Administer supplemental oxygen and/or humidity as ordered *to improve oxygenation.*
- Allow for adequate sleep and rest periods *to conserve energy.*
- Administer antibiotics as ordered: *may be indicated in the case of bacterial respiratory infection.*
- Encourage incentive spirometry and coughing with deep breathing (can be accomplished through play) *to maximize ventilation (play enhances the child's participation).*

NURSING DIAGNOSIS: Gas exchange, impaired, related to airway plugging, hyperinflation, atelectasis, as evidenced by cyanosis, decreased oxygen saturation, and alterations in arterial blood gases

Outcome Identification and Evaluation

Gas exchange will be adequate: *Pulse oximetry reading on room air is within normal parameters for age, blood gases within normal limits, absence of cyanosis.*

Interventions: Promoting Adequate Gas Exchange

- Administer oxygen as ordered *to improve oxygenation.*
- Monitor oxygen saturation via pulse oximetry *to detect alterations in oxygenation.*
- Encourage clearance of secretions via coughing, expectoration, chest physiotherapy, and suctioning *to improve gas exchange.*
- Administer bronchodilators if ordered (albuterol, levalbuterol, and racemic epinephrine) *to treat bronchospasm and improve gas exchange.*
- Provide frequent contact and support to the child and family *to decrease anxiety, which increases the child's oxygen demands.*
- Assess and monitor mental status (confusion, lethargy, restlessness, combativeness): *hypoxemia can lead to changes in mental status.*

(continued)

Nursing Care Plan 39.1 (continued)

NURSING DIAGNOSIS: Risk for infection related to presence of infectious organisms as evidenced by fever or presence of virus or bacteria on laboratory screening

Outcome Identification and Evaluation

Child will exhibit no signs of secondary infection and will not spread infection to others: *symptoms of infection decrease over time; others remain free from infection.*

Interventions: Preventing Infection

- Maintain aseptic technique, practice good handwashing, and use disposable suction catheters *to prevent introduction of further infectious agents.*
- Limit number of visitors and screen them for recent illness *to prevent further infection.*
- Administer antibiotics if prescribed *to prevent or treat bacterial infection.*
- Encourage nutritious diet according to child's preferences and ability to feed orally *to assist body's natural infection-fighting mechanisms.*
- Isolate the child as required *to prevent nosocomial spread of infection.*
- Teach child and family preventive measures such as good handwashing, covering mouth and nose when coughing or sneezing, proper disposal of used tissues *to prevent nosocomial or community spread of infection.*

NURSING DIAGNOSIS: Fluid volume deficit, risk for, related to decreased oral intake, insensible losses via fever, tachypnea, or diaphoresis

Outcome Identification and Evaluation

Fluid volume will be maintained: *Oral mucosa moist and pink, skin turgor elastic, urine output at least 1 to 2 mL/kg/hr.*

Interventions: Maintaining Adequate Fluid Volume

- Administer intravenous fluids if ordered *to maintain adequate hydration in NPO state.*
- When allowed oral intake, encourage oral fluids. Popsicles, favorite fluids, and games can be used *to promote intake.*
- Assess for signs of adequate hydration (elastic skin turgor, moist mucosa, adequate urine output).
- Monitor intake and output *to identify fluid imbalance.*
- Monitor urine specific gravity, urine and serum electrolytes, blood urea nitrogen, creatinine, and osmolality *to determine fluid status.*

NURSING DIAGNOSIS: Nutrition, altered: less than body requirements related to difficulty feeding as evidenced by poor oral intake, tiring with feeding

Outcome Identification and Evaluation

Child will maintain adequate nutritional intake: *Weight is gained or maintained. Child consumes adequate diet for age.*

Interventions: Promoting Adequate Nutritional Intake

- Weigh on same scale at same time daily *so that measurements are consistent.*
- Perform calorie counts over a 3-day period *to determine whether caloric intake is sufficient.*
- Encourage child to choose higher-calorie, protein-rich foods *to optimize growth potential.*
- Coax young children to eat better by playing games and offering favorite foods *to improve intake.*

NURSING DIAGNOSIS: Activity intolerance related to high respiratory demand as evidenced by increased work of breathing and need for frequent rest when playing

Outcome Identification and Evaluation

Child will resume normal activity level: *Activity is tolerated without difficulty breathing. Pulse oximetry readings and vital signs are within parameters for age and activity level.*

Interventions: Increasing Activity Tolerance

- Provide rest periods balanced with periods of activity, and group nursing activities and visits *to allow for sufficient rest.*
- Provide small, frequent meals *to prevent overtiring (energy is expended while eating).*
- Encourage quiet activities that do not require exertion *to prevent boredom.*
- Allow gradual increase in activity as tolerated, keeping pulse oximetry reading within normal parameters, *to minimize risk for further respiratory compromise.*

Nursing Care Plan 39.1 (continued)

NURSING DIAGNOSIS: Fear related to difficulty breathing, unfamiliar personnel, procedures, and environment (hospital), as evidenced by clinging, crying, fussing, verbalization, or lack of cooperation

Outcome Identification and Evaluation

Fear/anxiety will be reduced: *decreased episodes of crying or fussing, happy and playful at times.*

Interventions: Relieving Fear

- Establish trusting relationship with child and family *to decrease anxiety and fear.*
- Explain procedures to child at developmentally appropriate level *to decrease fear of unknown.*
- Provide favorite blanket or bear as well as comfort measures preferred by client such as rocking or music *for added security.*
- Involve parents in care *to give child reassurance and decrease fear.*

NURSING DIAGNOSIS: Family processes, altered, related to child's illness or hospitalization as evidenced by family's presence in hospital, missed work, demonstration of inadequate coping

Outcome Identification and Evaluation

Parents demonstrate adequate coping and decreased anxiety: *Parents are involved in child's care, ask appropriate questions, and are able to discuss child's care and condition calmly.*

Interventions: Promoting Adequate Family Processes

- Encourage parents to discuss their concerns related to child's illness *to identify concerns and show parents that the nurse also cares about them, not just the child.*
- Explain therapy, procedures, and child's behavior to parents *to decrease their anxiety.*
- Encourage parents to be involved in care *so they feel needed and valued.*



FIGURE 39.6 (A) Simple oxygen mask provides about 40% oxygen. (B) The nasal cannula provides an additional 4% oxygen per 1 L of oxygen flow (i.e., 1 L will deliver 25% oxygen). (C) The nonrebreather mask provides 80% to 100% oxygen.

TABLE 39.1 OXYGEN DELIVERY METHODS

| Delivery Method | Description | Nursing Implications |
|--------------------------|---|--|
| Simple mask | Provides 35% to 60% oxygen with a flow rate of 6 to 10 L/minute. Oxygen delivery percentage is affected by respiratory rate, inspiratory flow, and adequacy of mask fit. | <ul style="list-style-type: none"> • Must maintain oxygen flow rate of at least 6 L/minute to maintain inspired oxygen concentration and prevent rebreathing of carbon dioxide • Mask must fit snugly to be effective but should not be so tight as to irritate the face. |
| Venturi mask | Provides 24% to 50% oxygen by using a special gauge at the base of the mask that allows mixing of room air with oxygen flow | <ul style="list-style-type: none"> • Set oxygen flow rate according to percentage of oxygen desired as indicated on the gauge/dial. • As with simple mask, must fit snugly. |
| Nasal cannula | Provides low oxygen concentration (22% to 44%) | <ul style="list-style-type: none"> • Must be used with humidification to prevent drying and irritation of airways • Can provide very small amounts of oxygen (as low as 25 cc/minute) • Maximum recommended liter flow in children is 4 L/minute. • Children can eat or talk while on oxygen. • Inspired oxygen concentration affected by mouth breathing • Requires patent nasal passages |
| Oxygen tent | Provides high-humidity environment with up to 50% oxygen concentration | <ul style="list-style-type: none"> • Oxygen level drops when tent is opened. • Must change linen frequently as it becomes damp from the humidity • Secure edges of tent with blankets or by tucking edges under mattress. • Young children may be fearful and resistant. • Mist may interfere with visualization of child inside tent. |
| Oxygen hood | Provides high concentration (up to 80% to 90%) for infants only. Allows easy access to chest and lower body. | <ul style="list-style-type: none"> • Liter flow must be set at 10 to 15 L/minute. • Good method for infant but need to remove for feeding • Can and should be humidified |
| Partial rebreathing mask | Simple facemask with an oxygen reservoir bag. Provides 50% to 60% oxygen concentration. | <ul style="list-style-type: none"> • Must set liter flow rate at 10 to 12 L/min to prevent rebreathing of carbon dioxide • The reservoir bag does not completely empty when child inspires if flow rate is set properly. |
| Nonrebreathing mask | Simple facemask with valves at the exhalation ports and an oxygen reservoir bag with a valve to prevent exhaled air from entering the reservoir. Provides 95% oxygen concentration. | <ul style="list-style-type: none"> • Must set liter flow rate at 10 to 12 L/min to prevent rebreathing of carbon dioxide • The reservoir bag does not completely empty when child inspires if flow rate is set properly. |

be relieved via humidity and use of normal saline nasal wash or spray followed by suctioning. Antihistamines are not indicated, as they dry secretions further. Over-the-counter cold preparations are available singly and in combinations. These preparations have not been proven to reduce the length or severity of the cold but may offer symptomatic relief in some children over 6 years of age.



► **Take NOTE!**

In October 2007, over-the-counter cold preparations containing decongestants intended for use in infants and young children were removed from the market. Several research studies have not shown the preparations to be effective, and they are known to have potentially serious side effects (AAP, 2007).

EVIDENCE-BASED PRACTICE 39.1

Various Body Positions and Their Effects on Hospitalized Infants and Young Children With Acute Respiratory Distress

● Study

Prone positioning has been found to improve ventilation in some adults with acute respiratory distress and in premature infants with respiratory distress syndrome, but due to the risk of sudden infant death syndrome (SIDS), infants are generally positioned supine. The authors reviewed 21 studies that evaluated the effect of positioning (supine, prone, lateral, elevated, and flat positions) on respiratory function (oxygen saturation, partial pressure of arterial oxygen, oxygenation index, thoraco-abdominal synchrony, and episodes of oxygen desaturation) in infants and young children with acute respiratory distress.

▲ Findings

The only position found to produce a statistically significant improvement in respiratory function was the

prone position. The prone position was better in terms of improving ventilation and oxygenation. The other positions did not demonstrate statistically significant differences.

■ Nursing Implications

Nurses should critically consider the result of this review. Certainly, if an alternate position is used, the infant must be closely monitored and the position changed should any level of deterioration occur. If hospitalized infants with acute respiratory distress are placed in the prone position, continuous cardiopulmonary and oxygenation saturation monitoring must be provided because of the risk of SIDS in this age group. Do not encourage families to use the prone position at home when an infant is ill with a respiratory condition.

Wells, D. A., Gillies, D., & Fitzgerald, D. A. (2007). Positioning for acute respiratory distress in hospitalised infants and children. *The Cochrane Library 2007, 4*. Indianapolis: John Wiley & Sons.

Nursing Assessment

The child may have either a stuffy or runny nose. Nasal discharge is usually thin and watery at first but may become thicker and discolored. The color of nasal discharge is not an accurate indicator of viral versus bacterial infection. The child may be hoarse and complain of a sore throat. Cough usually produces very little sputum. Fever, fatigue, watery eyes, and appetite loss may also occur. Symptoms are generally at their worst over the first few days and then decrease over the course of the illness.

Assess for risk factors such as daycare or school attendance. Inspect for edema and vasodilation of the mucosa. Diagnosis is based on clinical presentation rather than laboratory or x-ray studies. Comparison Chart 39.1 differentiates causes of nasal congestion.

Nursing Management

Nursing management of the child with a common cold consists of promoting comfort, providing family education, and preventing spread of the cold.

COMPARISON CHART 39.1 CAUSES OF NASAL CONGESTION

| Sign or Symptom | Allergic Rhinitis | Common Cold | Sinusitis |
|-------------------|--------------------------------------|---|---------------------------|
| Length of illness | Varies; may have year-round symptoms | 10 days or less | Longer than 10 to 14 days |
| Nasal discharge | Thin, watery, clear | Thick, white, yellow, or green; can be thin | Thick, yellow or green |
| Nasal congestion | Varies | Present | Present |
| Sneezing | Varies | Present | Absent |
| Cough | Varies | Present | Varies |
| Headache | Varies | Varies | Varies |
| Fever | Absent | Varies | Varies |
| Bad breath | Absent | Absent | Varies |

Promoting Comfort

Nursing care of the common cold is aimed at supportive measures. Nasal congestion may be relieved with the use of normal saline nose drops, followed by bulb syringe suctioning in infants and toddlers. Older children may use a normal saline nose spray to mobilize secretions. A cool mist humidifier also helps with nasal congestion. Generally, other over-the-counter nose sprays are not recommended for use in children, but they are sometimes prescribed for very short-term use. Promotion of adequate oral fluid intake is important to liquefy secretions.

Educate parents about the use of cold and cough medications. Although they may offer some symptomatic relief, they have not been proven to shorten the length of cold symptoms. Counsel parents to use the appropriate product depending on the symptom relief desired, rather than a combination product. Products containing acetaminophen combined with other “cold symptom” medications may mask a fever in the child who is developing a secondary bacterial infection. As with all viral infections in children, teach parents that aspirin use should be avoided because of its association with Reye syndrome.

Providing Family Education

Currently there are no medications available to treat the viruses that cause the common cold, so symptomatic treatment is all that is necessary. Antibiotics are not indicated unless the child also has a bacterial infection. Explain to parents the importance of reserving antibiotic use for appropriate illnesses. Provide education about the use of normal saline nose drops and bulb suctioning to clear the infant’s nose of secretions. Normal saline nasal wash using a bulb syringe to instill the solution is also helpful for children of all ages with nasal congestion. Though normal saline for nasal administration is available commercially, parents can also make it at home (Box 39.2). Teaching Guidelines 39.1 gives instructions on use of the bulb syringe.

Counsel parents about how to recognize complications of the common cold. These include:

- Prolonged fever
- Increased throat pain or enlarged, painful lymph nodes
- Increased or worsening cough, cough lasting longer than 10 days, chest pain, difficulty breathing

BOX 39.2 Homemade Salt Water Nose Drops

Mix 8 oz distilled water, a half-teaspoon sea salt, and a quarter-teaspoon baking soda. Keeps for 24 hours in the refrigerator, but should be allowed to come to room temperature prior to use.

- Earache, headache, tooth or sinus pain
- Unusual irritability or lethargy
- Skin rash

If complications do occur, tell parents to notify the health care provider for further instructions or reassessment.

Preventing the Common Cold

Teaching about ways to prevent the common cold is a vital nursing intervention. Explain that frequent handwashing helps to decrease the spread of viruses that cause the common cold. Teach parents and family to avoid second-hand smoke as well as crowded places, especially during the winter. Avoid close contact with individuals known to have a cold. Encourage parents and families to consume a healthy diet and get enough rest.

► Consider THIS!

Corey Davis, a 3-year-old, is brought to the clinic by her mother. She presents with a runny nose, congestion, and a nonproductive cough. Her mother says, “She’s miserable.”

What other assessment information would be helpful? Based on the history and clinical presentation, Corey is diagnosed with a common cold. What education would be helpful for this family? Include ways to improve Corey’s comfort and ways to prevent the common cold.

► SINUSITIS

Sinusitis (also called rhinosinusitis) generally refers to a bacterial infection of the paranasal sinuses. The disease may be either acute or chronic in nature, with the treatment approach varying with chronicity. Approximately 5% of upper respiratory infections are complicated with acute sinusitis. In young children the maxillary and ethmoid sinuses are the main sites of infection. After age 10 years, the frontal sinuses may be more commonly involved. Mucosal swelling, decreased ciliary movement, and thickened nasal discharge all contribute to bacterial invasion of the nose. Nasal polyps also place the child at risk for bacterial sinusitis. Complications include orbital cellulitis and intracranial infections such as subdural empyemas.

Symptoms lasting less than 30 days generally indicate acute sinusitis, whereas symptoms persisting longer than 4 to 6 weeks usually indicate chronic sinusitis. Sinusitis is managed with antibiotic treatment. The course of treatment is a minimum of 10 days. The current American Academy of Pediatrics recommendations state that antibiotics should be continued for 7 days once the child is free from symptoms to eradicate the infection (AAP, 2001).



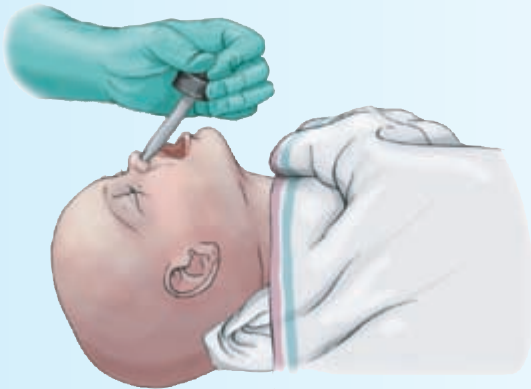
TEACHING GUIDELINES 39.1

Using the Bulb Syringe to Suction Nasal Secretions

1. Hold the infant on your lap or on the bed with head tilted slightly back.



2. If using saline, instill several drops of saline solution in one of infant's nostrils.



3. Compress the sides of the bulb syringe completely. Use only a rubber-tipped bulb syringe. Place the rubber tip in the infant's nose.



4. Release pressure on the bulb.



5. Remove the syringe and squeeze bulb over tissue or the sink to empty it of secretions.



6. Repeat on other nostril if necessary. Using a bulb syringe prior to bottle-feeding or breastfeeding may relieve congestion enough to allow the infant to suck more efficiently.
7. Clean the bulb syringe thoroughly with warm water after each use and allow to air dry.

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| Objective | Significance |
|---|---|
| Reduce the number of courses of antibiotics prescribed for the sole diagnosis of the common cold. | <ul style="list-style-type: none"> • Appropriately educate families that the cause of the common cold is a number of viruses and that antibiotics are inappropriate for the treatment of viral infections. • Encourage families to use measures such as normal saline nasal washes to decrease symptoms associated with the common cold more quickly. |

Naturally, chronic sinusitis requires a longer course of treatment than acute sinusitis. Surgical therapy may be indicated for children with chronic sinusitis, particularly if it is recurrent or if nasal polyps are present.

Nursing Assessment

The most common presentation of sinusitis is persistent signs and symptoms of a cold. Rather than improving after 7 to 10 days, nasal discharge persists. Explore the history for:

- Cough
- Fever
- In preschoolers or older children, halitosis (bad breath)
- Facial pain may or may not be present, so is not a reliable indicator of disease.
- Eyelid edema (in the case of ethmoid sinus involvement)
- Irritability
- Poor appetite

Cold symptoms that are severe and not improving over time may also indicate sinusitis (Leung & Kellner, 2004). Assess for risk factors such as a history of recurrent cold symptoms or a history of nasal polyps.

On physical examination, note eyelid swelling, extent of nasal drainage, and halitosis. Inspect the throat for postnasal drainage. Inspect the nasal mucosa for erythema. Palpate the sinuses, noting pain with mild pressure. The diagnosis may be made based on the history and clinical presentation, augmented by x-ray, computed tomography scan, or magnetic resonance imaging findings in some cases (Leung & Kellner, 2004). (Refer to Comparison Chart 39.1, which differentiates the causes of nasal congestion.)

Nursing Management

Normal saline nose drops or spray, cool mist humidifiers, and adequate oral fluid intake are recommended for children with sinusitis. Teach families the importance of continuing the full course of antibiotics to eradicate the cause

of infection. Also educate the family that using decongestants, antihistamines, and intranasal steroids as adjuncts in the treatment of sinusitis has not been shown to be beneficial. Normal saline nose spray or nasal washes may promote drainage (Leung & Kellner, 2004).

INFLUENZA

Influenza viral infection occurs primarily during the winter. “The flu” is spread through inhalation of droplets or contact with fine-particle aerosols. Infected children shed the virus for 1 to 2 days before symptoms begin and may continue increased amounts of viral shedding as compared with adults for as long as 2 weeks. Average annual infection rates in children range from 20% to 50% (Iskander et al., 2007). Influenza viruses primarily affect the upper respiratory epithelium but can cause systemic effects as well. Children with chronic heart or lung conditions, diabetes, chronic renal disease, or immune deficiency are at higher risk than other children for more severe influenza infection.

Bacterial infections of the respiratory system commonly occur as complications of influenza infection, severe pneumococcal pneumonia in particular. Otitis media occurs in 18% to 40% of all influenza cases (Iskander et al., 2007). Less common complications include Reye syndrome and acute myositis. Reye syndrome is an acute encephalopathy that has been associated with aspirin use in the influenza-infected child. Acute myositis is particular to children. A sudden onset of severe pain and tenderness in both calves causes the child to refuse to walk. Due to the potential for complications, a prolonged fever or a fever that returns during convalescence should be investigated.

Nursing Assessment

Children who attend daycare or school are at higher risk for influenza infection than those who are routinely at home. Note the presence of risk factors for severe disease, such as chronic heart or lung disease (such as asthma), diabetes, chronic renal disease, or immune deficiency or children with cancer receiving chemotherapy. School-age children and adolescents experience the illness similarly to adults. Abrupt onset of fever, facial flushing, chills, headache, myalgia, and malaise are accompanied by cough and **coryza**. About half of infected individuals have a dry or sore throat. Ocular symptoms such as photophobia, tearing, burning, and eye pain are common.

Infants and young children exhibit symptoms similar to other respiratory illnesses. Fever greater than 39.5°C is common. Infants may be mildly toxic in appearance and irritable and have a cough, coryza, and pharyngitis. Wheezing may occur, as influenza also can cause bronchiolitis. An erythematous rash may be present, and diarrhea

may also occur. The diagnosis may be confirmed by a rapid assay test.

Nursing Management

Nursing management of influenza is mainly supportive. Symptomatic treatment of cough and fever and maintenance of hydration are the focus of care. Amantadine hydrochloride (Symmetrel) and other newer antiviral drugs can reduce the symptoms associated with influenza if started within the first 24 to 48 hours of the illness.

Preventing Influenza Infection

Yearly vaccination against influenza is recommended for high-risk groups. Children 6 months or older are considered high risk if they:

- Have chronic heart or lung conditions
- Have sickle cell anemia or other hemoglobinopathy
- Are under medical care for diabetes, chronic renal disease, or immune deficiency
- Are on long-term aspirin therapy (risk of developing Reye syndrome after the flu)

Among otherwise healthy children, infants and toddlers are at highest risk for developing severe disease. All healthy children between the ages of 6 and 59 months should also be immunized. Refer to Chapter 30 for more information on immunizations.

PHARYNGITIS

Inflammation of the throat mucosa (pharynx) is referred to as **pharyngitis**. A sore throat may accompany nasal congestion and is often viral in nature. A bacterial sore throat most often occurs without nasal symptoms. Group A streptococci account for 15% to 25% of cases, with the remainder being caused by other viruses or bacteria (Martin & Green, 2006).

Suppurative complications of group A streptococcal infection include peritonsillar or retropharyngeal abscess. Peritonsillar abscess may be noted by asymmetric swelling of the tonsils, shifting of the uvula to one side, and palatal edema. Retropharyngeal abscess may progress to the point of airway obstruction, hence requiring careful evaluation and appropriate treatment. Additional complications include acute rheumatic fever (see Chapter 40) and acute glomerulonephritis (see Chapter 42).

Viral pharyngitis is usually self-limited and does not require therapy beyond symptomatic relief. Group A streptococcal pharyngitis requires antibiotic therapy. If either the rapid diagnostic test or throat culture (described below) is positive for group A streptococci, penicillin is generally prescribed. Appropriate alternative antibiotics include amoxicillin and, for those allergic to penicillin, macrolides and cephalosporins (Wong, Blumberg, & Lowe, 2006).



Take NOTE!

A “strep carrier” is a child who has a positive throat culture for streptococci when asymptomatic. Strep carriers are not at risk for complications from streptococci, as are those who are acutely infected with streptococci and are symptomatic.

Nursing Assessment

Onset of the illness is often quite abrupt. The history may include a fever, sore throat and difficulty swallowing, headache, and abdominal pain, which are quite common. Inquire about recent incidence of viral or strep throat in the family, day care center, or school.

Inspect the pharynx and tonsils, which may demonstrate varying degrees of inflammation (Fig. 39.7). Exudate may be present but is not diagnostic of bacterial infection. Note the presence of petechiae on the palate. Inspect the tongue for a strawberry appearance. Palpate for enlargement and tenderness of the anterior cervical nodes. Inspect the skin for a fine, red, sandpaper-like rash (called scarlatiniform), particularly on the trunk or abdomen, a common finding with streptococcus A infection.

The nurse may obtain a throat swab for rapid diagnostic testing and throat culture. If both tests are being obtained, the applicators may be swabbed simultaneously to decrease perceived trauma to the child. The rapid strep test is a sensitive and reliable measure, rarely resulting in



FIGURE 39.7 Note the redness of the pharynx, tonsillar exudate, and white strawberry tongue coating.

false-positive readings (Farrar-Simpson et al., 2005). If the rapid strep test is negative, the second swab may be sent for a throat culture.

Nursing Management

Nursing management of the child with pharyngitis focuses on promoting comfort and providing family education.

Promoting Comfort

Saline gargles (made with 8 oz of warm water and a half-teaspoon of table salt) are soothing for children old enough to cooperate. Analgesics such as acetaminophen and ibuprofen may ease fever and pain. Sucking on throat lozenges or hard candy may also ease pain. Cool mist humidity helps to keep the mucosa moist in the event of mouth breathing. Encourage the child to ingest Popsicles, cool liquids, and ice chips to maintain hydration.

Providing Family Education

Parents may be accustomed to “sore throats” being treated with antibiotics, but in the case of a viral cause antibiotics will not be necessary and the pharyngitis will resolve in a few days. For the child with streptococcal pharyngitis, urge parents to have the child complete the entire prescribed course of antibiotics (Parinet, 2004). After 24 hours of antibiotic therapy, instruct the parents to discard the child’s toothbrush to avoid reinfection. Children may return to daycare or school after they have been receiving antibiotics for 24 hours, as they are considered noncontagious at that point.

TONSILLITIS

Inflammation of the tonsils often occurs with pharyngitis and thus may also be viral or bacterial in nature. Viral infections require only symptomatic treatment. Treatment for bacterial tonsillitis is the same as for bacterial pharyngitis. Occasionally surgical intervention is warranted. Tonsillectomy (surgical removal of the palatine tonsils) may be indicated for the child with recurrent streptococcal tonsillitis, massive tonsillar hypertrophy, or other reasons. When hypertrophied adenoids obstruct breathing, then adenoidectomy (surgical removal of the adenoids) may be indicated.

Nursing Assessment

Note whether fever is present currently or by history. Inquire about the history of recurrent pharyngitis or tonsillitis. Note if the child’s voice sounds muffled or hoarse. Inspect the pharynx for redness and enlargement of the tonsils. As the tonsils enlarge, the child may ex-

perience difficulty breathing and swallowing. When tonsils touch at the midline (“kissing tonsils” or 4+ in size), the airway may become obstructed (see Fig. 39.7). Also, if the adenoids are enlarged, the posterior nares become obstructed. The child may breathe through the mouth and may snore. Palpate the anterior cervical nodes for enlargement and tenderness. Rapid test or culture may be positive for streptococcus A.

Nursing Management

Tonsillitis that is medically treated requires the same nursing management as pharyngitis. Nursing care for the child after tonsillectomy is described below.

Promoting Airway Clearance

Until fully awake, place the child in a side-lying or prone position to facilitate safe drainage of secretions. Once alert, he or she may prefer to sit up or have the head of the bed elevated. Suctioning, if necessary, should be done carefully to avoid trauma to the surgical site. Dried blood may be present on the teeth and the nares, with old blood present in emesis. Since the presence of blood can be very frightening to parents, alert them to this possibility.

Maintaining Fluid Volume

Hemorrhage is unusual postoperatively but may occur any time from the immediate postoperative period to as late as 10 days after surgery (Peterson & Losek, 2004). Inspect the throat for bleeding. Mucus tinged with blood may be expected, but fresh blood in the secretions indicates bleeding. Early bleeding may be identified by continuous swallowing of small amounts of blood while awake or sleeping. Other signs of hemorrhage include tachycardia, pallor, restlessness, frequent throat clearing, and emesis of bright red blood.

To avoid trauma to the surgical site, discourage the child from coughing, clearing the throat, blowing the nose, and using straws. Upon discharge, instruct the parents to immediately report any sign of bleeding to the physician. To maintain fluid volume postoperatively, encourage children to take any fluids they desire; Popsicles and ice chips are particularly soothing. Citrus juice and brown or red fluids should be avoided: the acid in citrus juice may irritate the throat, and red or brown fluids may be confused with blood if vomiting occurs.

Relieving Pain

For the first 24 hours after surgery, the throat is very sore. Adequate pain relief is essential to establish adequate oral fluid intake. An ice collar may be prescribed, as well as analgesics with or without narcotics. Counsel parents to maintain pain control upon discharge from the facility, not only for the child’s sake but also to enable the child to continue to drink fluids (Loulouides, 2006).

▶ INFECTIOUS MONONUCLEOSIS

Infectious mononucleosis is a self-limited illness caused by the Epstein-Barr virus. It is characterized by fever, malaise, sore throat, and lymphadenopathy. Mononucleosis is commonly called the “kissing disease” since it is transmitted by oropharyngeal secretions. It can occur at any age but is most often diagnosed in adolescents and young adults. Some infected individuals may have concomitant streptococcal pharyngitis. Complications include splenic rupture, Guillain-Barré syndrome, and aseptic meningitis (Jensen, 2004).

Nursing Assessment

Note any history of exposure to infected individuals. Determine history of fever and onset and progression of sore throat, malaise, and other complaints. Observe for periorbital edema. Inspect the pharynx and tonsils for inflammation and patches of gray exudate. Petechiae may be present on the palate. Palpate for bilateral nontender enlargement of the posterior cervical lymph nodes. After 3 to 5 days of illness, the pharynx may become edematous and the tonsillar exudate more extensive. Lymphadenopathy may progress to include the anterior cervical nodes, which may become tender. Palpate the abdomen for splenomegaly or hepatomegaly. An erythematous maculopapular rash may appear as the illness progresses. Definitive diagnosis may be made by Monospot or Epstein-Barr virus titers.



▶ **Take NOTE!**

The Monospot is usually negative if obtained within the first 7 to 10 days of illness with infectious mononucleosis. Epstein-Barr virus titer is reliable at any point in the illness.

Nursing Management

Nursing management of mononucleosis is primarily symptomatic. The throat may be very sore, so analgesics and salt-water gargles are recommended. Bed rest should be encouraged while the child is febrile. Frequent rest periods may be necessary for several weeks after the onset of illness, as fatigue may persist as long as 6 weeks. During the acute phase, if tonsillar or pharyngeal edema threatens to obstruct the airway, then corticosteroids may be given to decrease the inflammation. In the presence of splenomegaly or hepatomegaly, strenuous activity and contact sports should be avoided. Appearance of rash or jaundice should be reported to the physician.



▶ **Take NOTE!**

Concomitant strep throat in the presence of infectious mononucleosis should be treated with an antibiotic other than ampicillin, as it may cause an allergic-type rash if used in the presence of mononucleosis.

▶ LARYNGITIS

Inflammation of the larynx is termed **laryngitis**. It may occur alone or in conjunction with other respiratory symptoms. It is characterized by a hoarse voice or loss of the voice (so soft as to make it difficult to hear). Oral fluids might offer relief, but resting the voice for 24 hours will allow the inflammation to subside. Laryngitis alone requires no further intervention.

▶ CROUP

Children between 3 months and 3 years of age are the most frequently affected with croup, though croup may affect any child. Croup is also referred to as laryngotracheobronchitis because inflammation and edema of the larynx, trachea, and bronchi occur as a result of viral infection. Parainfluenza is responsible for the majority of cases of croup. Other causes include adenovirus, influenza virus A and B, RSV, and rarely measles virus or *Mycoplasma pneumoniae* (Bjornson et al., 2004). The inflammation and edema obstruct the airway, resulting in symptoms. Mucus production also occurs, further contributing to obstruction of the airway. Narrowing of the subglottic area of the trachea results in audible inspiratory stridor. Edema of the larynx causes hoarseness. Inflammation in the larynx and trachea causes the characteristic barking cough of croup. Symptoms occur most often at night, and croup is usually self-limited, lasting only about 3 to 5 days (Leung et al., 2004).

Croup often presents suddenly at night, with resolution of symptoms in the morning. Complications of croup are rare but may include worsening respiratory distress, hypoxia, or bacterial superinfection (as in the case of bacterial tracheitis). Croup is usually managed on an outpatient basis, with only 1% to 2% of cases requiring hospitalization (Leung et al., 2004).

Corticosteroids (usually a single dose) are used to decrease inflammation, and racemic epinephrine aerosols demonstrate the alpha-adrenergic effect of mucosal

vasoconstriction, helping to decrease edema (Bjornson et al., 2004; Schooff, 2005). Children with croup may be hospitalized if they have significant stridor at rest or severe retractions after a several-hour period of observation. Comparison Chart 39.2 compares croup to epiglottitis.

Nursing Assessment

Note the age of the child; children between 3 months and 3 years of age are most likely to present with viral croup (laryngotracheobronchitis). History may reveal a cough that developed during the night (most common presentation) and that sounds like barking (or a seal). Inspect for the presence of mild URI symptoms. Temperature may be normal or elevated mildly. Listen for inspiratory stridor and observe for suprasternal retractions. Auscultate the lungs for adequacy of breath sounds. Various scales are available for scoring croup severity, though these are of limited value in the clinical assessment and treatment of croup (Leung et al., 2004). Croup is usually diagnosed based on history and clinical presentation, but a lateral neck x-ray may be obtained to rule out epiglottitis.



► **Take NOTE!**

The child with fever, a toxic appearance, and increasing respiratory distress despite appropriate croup treatment may have bacterial tracheitis (Orenstein, 2004a). Notify the physician of these findings in a child with croup.

COMPARISON CHART 39.2 CROUP VS. EPIGLOTTITIS

| | Spasmodic Croup | Epiglottitis |
|----------------------------|--------------------------------|--|
| Preceding illness | None or minimal coryza | None or mild upper respiratory infection |
| Age group usually affected | 3 months to 3 years | 1 to 8 years |
| Onset | Usually sudden, often at night | Rapid (within hours) |
| Fever | Variable | High |
| Barking cough, hoarseness | Yes | No |
| Dysphagia | No | Yes |
| Toxic appearance | No | Yes |
| Cause | Viral | <i>Haemophilus influenzae</i> type B |

TEACHING GUIDELINES 39.2

Home Care of Croup

- Keep the child quiet and discourage crying.
- Allow the child to sit up (in your arms).
- Encourage rest and fluid intake.
- If stridor occurs, take the child into a steamy bathroom for 10 minutes.
- Administer medication (corticosteroid) as directed.
- Watch the child closely. Call the physician if:
 - The child breathes faster, has retractions, or has any other difficulty breathing
 - The nostrils flare or the lips or nails have a bluish tint
 - The cough or stridor does not improve with exposure to moist air
 - Restlessness increases or the child is confused
 - The child begins to drool or cannot swallow

Adapted from Knutson & Aring, 2004.

Nursing Management

If the child's care is being managed at home, advise parents about the symptoms of respiratory distress and instruct them to seek treatment if the child's respiratory condition worsens. Teach parents to expose their child to humidified air (via a cool mist humidifier or steamy bathroom). Though never clinically proven, use of humidified air has long been recommended for alleviating coughing jags and anecdotally has been reported as helpful. Administer dexamethasone if ordered or teach parents about home administration. Explain to parents that the effects of racemic epinephrine last about 2 hours and the child must be observed closely as occasionally a child will worsen again, requiring another aerosol. Teaching Guidelines 39.2 provides information about home care of croup.

► EPIGLOTTITIS

Epiglottitis (inflammation and swelling of the epiglottis) is most often caused by *Haemophilus influenzae* type b. Extensive use of the Hib vaccine since the 1980s has resulted in a significant decrease in the incidence of epiglottitis. Epiglottitis usually occurs in children between the ages of 2 and 7 years and can be life-threatening (Leung et al., 2004). Respiratory arrest and death may occur if the airway becomes completely occluded. Additional complications include pneumothorax and pulmonary edema. Therapeutic management focuses on airway maintenance and support. Intravenous antibiotic therapy is necessary.

The child will be managed in the intensive care unit. Comparison Chart 39.2 gives information comparing croup to epiglottitis.

Nursing Assessment

Carefully assess the child with suspected epiglottitis. Note sudden onset of symptoms and high fever. The child has an overall toxic appearance. He or she may refuse to speak or may speak only with a very soft voice. The child may refuse to lie down and may assume the characteristic position, sitting forward with the neck extended. Drooling may be present. Note anxiety or a frightened appearance. Note the child's color. Cough is usually absent. A lateral neck x-ray may be performed to determine whether epiglottitis is present. This is done cautiously, so as not to induce airway obstruction with changes in position of the child's neck (Bjornson et al., 2004).

Nursing Management

Do not leave the child unattended. Keep the child and parents as calm as possible. Allow the child to assume a position of comfort. Do not place the child in a supine position, as airway occlusion may occur. Provide 100% oxygen in the least invasive manner that is acceptable to the child. Do not under any circumstance attempt to visualize the throat: reflex laryngospasm may occur, precipitating immediate airway occlusion. If the child with epiglottitis experiences complete airway occlusion, an emergency tracheostomy may be necessary. Ensure that emergency equipment is available and that personnel trained in intubation of the pediatric occluded airway and percutaneous tracheostomy are notified of the child's presence in the facility (Bjornson et al., 2004).



► **Take NOTE!**

Epiglottitis is characterized by dysphagia, drooling, anxiety, irritability, and significant respiratory distress. Prepare for the event of sudden airway occlusion.

► BRONCHIOLITIS (RSV)

Bronchiolitis is an acute inflammatory process of the bronchioles and small bronchi. Nearly always caused by a viral pathogen, RSV accounts for the majority of cases of bronchiolitis, with adenovirus, parainfluenza, and human meta-pneumovirus also being important causative agents. This discussion will focus on RSV bronchiolitis.

The peak incidence of bronchiolitis is in the winter and spring, coinciding with RSV season. RSV season in

the United States and Canada generally begins in September or October and continues through April or May. Virtually all children will contract RSV infection within the first few years of life. RSV bronchiolitis occurs most often in infants and toddlers, with a peak incidence around 6 months of age. The severity of disease is related inversely to the age of the child. The frequency and severity of RSV infection decrease with age. Repeated RSV infections occur throughout life but are usually localized to the upper respiratory tract after toddlerhood.

Therapeutic Management

Management of RSV focuses on supportive treatment. Supplemental oxygen, nasal and/or nasopharyngeal suctioning, oral or intravenous hydration, and inhaled bronchodilator therapy are used. Many infants are managed at home with close observation and adequate hydration. Hospitalization is required for children with more severe disease. The infant with tachypnea, significant retractions, poor oral intake, or lethargy can deteriorate quickly, to the point of requiring ventilatory support, and thus warrants hospital admission.

Pathophysiology

RSV is a highly contagious virus and may be contracted through direct contact with respiratory secretions or from particles on objects contaminated with the virus (Lauts, 2005). RSV invades the nasopharynx, where it replicates and then spreads down to the lower airway via aspiration of upper airway secretions. RSV infection causes necrosis of the respiratory epithelium of the small airways, peribronchiolar mononuclear infiltration, and plugging of the lumens with mucus and exudate. The small airways become variably obstructed; this allows adequate inspiratory volume but prevents full expiration. This leads to hyperinflation and atelectasis (Bennett, 2006). Serious alterations in gas exchange occur, with arterial hypoxemia and carbon dioxide retention resulting from mismatching of pulmonary ventilation and perfusion. Hypoventilation occurs secondary to markedly increased work of breathing.

Nursing Assessment

For a full description of the assessment phase of the nursing process, refer to page 1222. Assessment findings pertinent to bronchiolitis are discussed below.

Health History

Elicit a description of the present illness and chief complaint. Common signs and symptoms reported during the health history might include:

- Onset of illness with a clear runny nose (sometimes profuse)
- Pharyngitis

- Low-grade fever
- Development of cough 1 to 3 days into the illness, followed by a wheeze shortly thereafter
- Poor feeding

Explore the child's current and past medical history for risk factors such as:

- Young age (less than 2 years old), more severe disease in a child less than 6 months old
- Prematurity
- Multiple births
- Birth during April to September
- History of chronic lung disease (bronchopulmonary disease)
- Cyanotic or complicated congenital heart disease
- Immunocompromise
- Male gender
- Exposure to passive tobacco smoke
- Crowded living conditions
- Daycare attendance
- School-age siblings
- Low socioeconomic status
- Lack of breastfeeding

Physical Examination

Examination of the child with RSV involves inspection, observation, and auscultation.

Inspection and Observation

Observe the child's general appearance and color (centrally and peripherally). The infant with RSV bronchiolitis might appear air-hungry, exhibiting various degrees of cyanosis and respiratory distress, including tachypnea, retractions, accessory muscle use, grunting, and periods of apnea. Cough and audible wheeze might be heard. The infant might appear listless and uninterested in feeding, surroundings, or parents.

Auscultation

Auscultate the lungs, noting adventitious sounds and determining the quality of aeration of the lung fields. Earlier in the illness, wheezes might be heard scattered throughout the lung fields. In more serious cases, the chest might sound quiet and without wheeze. This is due to significant hyperexpansion with very poor air exchange.

Laboratory and Diagnostic Tests

Common laboratory and diagnostic studies ordered for the assessment of RSV bronchiolitis include:

- Pulse oximetry: oxygen saturation might be significantly decreased
- Chest x-ray: might reveal hyperinflation and patchy areas of atelectasis or infiltration

- Blood gases: might show carbon dioxide retention and hypoxemia
- Nasal-pharyngeal washings: positive identification of RSV can be made via enzyme-linked immunosorbent assay (ELISA) or immunofluorescent antibody (IFA) testing

Nursing Management

RSV infection is usually self-limited, and nursing diagnoses, goals, and interventions for the child with bronchiolitis are aimed at supportive care. Children with less severe disease might require only antipyretics, adequate hydration, and close observation. They can often be successfully managed at home, provided the primary caregiver is reliable and comfortable with close observation. Parents or caregivers should be educated to watch for signs of worsening and must understand the importance of seeking care quickly should the child's condition deteriorate.

Hospitalization is required for children with more severe disease, and children admitted with RSV bronchiolitis warrant close observation. In addition to the nursing diagnoses and related interventions discussed in the Nursing Care Plan for respiratory disorders, interventions common to bronchiolitis follow.



► Take NOTE!

Currently no safe and effective antiviral drug is available for definitive treatment of RSV. Aerosolized ribavirin is recommended only for the highest-risk, most severely ill patients (Lauts, 2005). Routine antibiotic use is discouraged in RSV bronchiolitis treatment because the secondary bacterial infection rate of the lower airway is very low.

Maintaining Patent Airway

Infants and young children with RSV tend to have copious secretions. Position the child with the head of the bed elevated to facilitate an open airway. These children often require frequent assessment and suctioning to maintain a patent airway (Lauts, 2005). Use a Yankauer or tonsil-tip suction catheter to suction the mouth or pharynx of older infants or children, rinsing the catheter after each suctioning. Nasal bulb suctioning may be sufficient to clear the airway in some infants, while others will require nasopharyngeal suctioning with a suction catheter. Nursing Procedure 39.1 gives further information. Adjust the pressure ranges for suctioning infants and children between 60 and 100 mm Hg, 40 and 60 mm Hg for premature infants.

Nursing Procedure 39.1

NASOPHARYNGEAL OR ARTIFICIAL AIRWAY SUCTION TECHNIQUE

1. Make sure the suction equipment works properly before starting.
2. After washing your hands, assemble the equipment needed:
 - Appropriate-size sterile suction catheter
 - Sterile gloves
 - Supplemental oxygen
 - Sterile water-based lubricant
 - Sterile normal saline if indicated
3. Don sterile gloves, keeping dominant hand sterile and nondominant hand clean.
4. Preoxygenate the infant or child if indicated.
5. Apply lubricant to the end of the suction catheter.
6. If indicated for loosening of secretions, instill sterile saline.
7. Maintaining sterile technique, insert the suction catheter into the child's nostril or airway.
 - Insert only to the point of gagging if inserting via the nostril.
 - Insert only 0.5 cm further than the length of the artificial airway.
8. Intermittently apply suction for no longer than 10 seconds, while twisting and removing the catheter.
9. Supplement with oxygen after suctioning.

Promoting Adequate Gas Exchange

Infants and children with bronchiolitis might deteriorate quickly as the disease progresses. In the child ill enough to require oxygen, the risk is even greater. Assessment should include work of breathing, respiratory rate, and oxygen saturation. The percentage of inspired oxygen (FiO₂) should be adjusted as needed to maintain oxygen saturation within the desired range. Positioning the infant with the head of the bed elevated may also improve gas exchange. Frequent assessment is necessary for the hospitalized child with bronchiolitis (Steiner, 2004).



► **Take NOTE!**

In the tachypneic infant, slowing of the respiratory rate does not necessarily indicate improvement: often, a slower respiratory rate is an indication of tiring, and carbon dioxide retention may soon be followed by apnea.

Reducing Risk for Infection

Since RSV is easily spread through contact with droplets, inpatients should be isolated according to hospital policy to decrease the risk of nosocomial spread to other clients. Clients with RSV can be safely cohorted. Attention to handwashing is necessary, as droplets might enter the eyes, nose, or mouth via the hands.

Providing Family Education

Educate parents so they can recognize signs of worsening distress. Tell parents to call the physician or nurse practitioner if the child's breathing becomes rapid or more difficult or if the child cannot eat secondary to tachypnea. Children who are less than 1 year of age or who are at higher risk (those who were born prematurely or who have chronic heart or lung conditions) might have a longer course of illness. Instruct parents that cough can persist for several days to weeks after resolution of the disease, but infants usually act well otherwise.

Preventing RSV Disease

Strict adherence to handwashing policies in daycare centers and when exposed to individuals with cold symptoms is important for all groups. Though generally benign in healthy older children, RSV can be devastating in young infants or children with pre-existing risk factors. Palivizumab (Synagis) is a monoclonal antibody that can prevent severe RSV disease in those who are most susceptible. It is given as an intramuscular injection once a month throughout the RSV season. Though quite costly, it is covered by most insurance policies and Medicaid for those who qualify. It is generally indicated for use in certain children less than 2 years of age. Qualifying factors include:

- Prematurity
- Chronic lung disease (bronchopulmonary dysplasia) requiring medication or oxygen
- Certain congenital heart diseases
- Immunocompromise (Bennett, 2006)

Additional information related to Synagis may be found at <http://www.synagis.com/>.

► PNEUMONIA

Pneumonia is an inflammation of the lung parenchyma. It can be caused by a virus, bacteria, *Mycoplasma*, or fungus. It may also result from aspiration of foreign material into the lower respiratory tract (aspiration pneumonia). Pneumonia occurs more often in winter and early spring. It is common in children but is seen most frequently in infants and young toddlers. Viruses are the most common cause of pneumonia in younger children and the least

common cause in older children (Table 39.2). Viral pneumonia is usually better tolerated in children of all ages. Children with bacterial pneumonia are more apt to present with a toxic appearance, but they generally recover rapidly if appropriate antibiotic treatment is instituted early.



► **Take NOTE!**

Community-acquired pneumonia (CAP) refers to pneumonia in a previously healthy person that is contracted outside of the hospital setting. CAP is a common cause of lower respiratory infection in North America (Ostapchuk et al., 2004).

Pneumonia is usually a self-limited disease. A child who presents with recurrent pneumonia should be evaluated for chronic lung disease such as asthma or cystic fibrosis. Potential complications of pneumonia include bacteremia, pleural effusion, empyema, lung abscess, and pneumothorax (Nield et al., 2005). Excluding bacteremia, these are often treated with thoracentesis and/or chest tubes as well as antibiotics if appropriate. Pneumatoceles (thin-walled cavities developing in the lung) might occur with certain bacterial pneumonias and usually resolve spontaneously over time.

Therapeutic management of children with less severe disease includes antipyretics, adequate hydration, and close observation. Even bacterial pneumonia can be successfully managed at home if the work of breathing is not severe and oxygen saturation is within normal limits. However, hospitalization is required for children with more severe disease. The child with tachypnea, significant retractions, poor oral intake, or lethargy might require hospital admission for the administration of supplemental oxygen, intravenous hydration, and antibiotics.

TABLE 39.2 COMMON CAUSES OF PNEUMONIA ACCORDING TO AGE

| Age Group | Most Common Causative Agents |
|---------------------|---|
| 1 to 3 months | RSV, other respiratory viruses (parainfluenza, influenza, adenovirus); <i>Streptococcus pneumoniae</i> , <i>Chlamydia trachomatis</i> |
| 4 months to 5 years | Respiratory viruses, <i>Streptococcus pneumoniae</i> , <i>Chlamydia pneumoniae</i> , <i>Mycoplasma pneumoniae</i> |
| 5 to 18 years | <i>Mycoplasma pneumoniae</i> , <i>Chlamydia pneumoniae</i> , <i>Streptococcus pneumoniae</i> |

Sources: Nield et al., 2005; Ostapchuk, 2004.



► **Take NOTE!**

Haemophilus influenzae type B has been nearly eliminated as a cause of pneumonia in the United States and other developed countries as a result of universal immunization with Hib vaccine.

Pathophysiology

Pneumonia occurs as a result of the spread of infectious organisms to the lower respiratory tract from either the upper respiratory tract or the bloodstream. In bacterial pneumonia, mucus stasis occurs as a result of vascular engorgement. Cellular debris (erythrocytes, neutrophils, and fibrin) accumulates in the alveolar space. Relative hyperexpansion with air trapping follows. Inflammation of the alveoli results in **atelectasis** (a collapsed or airless portion of the lung), so gas exchange becomes impaired. The inflammatory response further impairs gas exchange (Nield et al., 2005).

Viral pneumonia usually results in an inflammatory reaction limited to the alveolar wall. Aspiration of food, fluids, or other substances into the bronchial tree can result in aspiration pneumonia. Aspiration is the most common cause of recurrent pneumonia in children and often occurs as a result of gastroesophageal reflux disease. Secondary bacterial infection often occurs following viral or aspiration pneumonia and requires antibiotic treatment.

Nursing Assessment

For a full description of the assessment phase of the nursing process, refer to page 1222. Assessment findings pertinent to pneumonia are discussed below.

Health History

Elicit a description of the present illness and chief complaint. Note onset and progression of symptoms. Common signs and symptoms reported during the health history include:

- Antecedent viral URI
- Fever
- Cough (note type and whether productive or not)
- Increased respiratory rate
- History of lethargy, poor feeding, vomiting, or diarrhea in infants
- Chills, headache, dyspnea, chest pain, abdominal pain, and nausea or vomiting in older children

Explore the child’s past and current medical history for risk factors known to be associated with an increase in the severity of pneumonia, such as:

- Prematurity
- Malnutrition

- Passive smoke exposure
- Low socioeconomic status
- Daycare attendance
- Underlying cardiopulmonary, immune, or nervous system disease

Physical Examination

Physical examination consists of inspection, auscultation, percussion, and palpation.

Inspection

Observe the child's general appearance and color (centrally and peripherally). Cyanosis might accompany coughing spells. The child with bacterial pneumonia may appear ill. Assess work of breathing. Children with pneumonia might exhibit substernal, subcostal, or intercostal retractions. Tachypnea and nasal flaring may be present. Describe cough and quality of sputum if produced.

Auscultation

Auscultation of the lungs might reveal wheezes or rales in the younger child. Local or diffuse rales may be present in the older child. Document diminished breath sounds.

Percussion and Palpation

In the older child, percussion might yield local dullness over a consolidated area. Percussion is much less valuable in the infant or younger child. Tactile fremitus felt upon palpation may be increased with pneumonia.

Laboratory and Diagnostic Tests

Common laboratory and diagnostic studies ordered for the assessment of pneumonia include:

- Pulse oximetry: oxygen saturation might be significantly decreased or within normal range
- Chest x-ray: varies according to client age and causative agent. In infants and young children, bilateral air trapping and perihilar **infiltrates** are the most common findings. Patchy areas of consolidation might also be present. In older children, lobar consolidation is seen more frequently.
- Sputum culture: may be useful in determining causative bacteria in older children and adolescents
- White blood cell count: might be elevated in the case of bacterial pneumonia

Nursing Management

Nursing diagnoses, goals, and interventions for the child with pneumonia are primarily aimed at providing supportive care and education about the illness and its treatment. Prevention of pneumococcal infection is also important. Children with more severe disease will require hospitalization. Refer to Nursing Care Plan 39.1 for nursing diagnoses and related interventions. In ad-

dition to the interventions listed there, the following should be noted.

Providing Supportive Care

Ensure adequate hydration and assist in thinning of secretions by encouraging oral fluid intake in the child whose respiratory status is stable. In children with increased work of breathing, intravenous fluids may be necessary to maintain hydration. Allow and encourage the child to assume a position of comfort, usually with the head of the bed elevated to promote aeration of the lungs. If pain due to coughing or pneumonia itself is severe, administer analgesics as prescribed. Provide supplemental oxygen to the child with respiratory distress or hypoxia as needed.

Providing Family Education

Educate the family about the importance of adhering to the prescribed antibiotic regimen. Antibiotics may be given intravenously if the child is hospitalized, but upon discharge or if the child is managed on an outpatient basis, oral antibiotics will be used.

Teach the parents of a child with bacterial pneumonia to expect that following resolution of the acute illness, for 1 to 2 weeks the child might continue to tire easily and the infant might continue to need small, frequent feedings. Cough may also persist after the acute recovery period but should lessen over time.

If the child is diagnosed with viral pneumonia, parents might not understand that their child does not require an antibiotic. Pneumonia is often perceived by the public as a bacterial infection, so most parents will need an explanation related to treatment of viral infections. As with bacterial pneumonia, the child may experience a week or two of weakness or fatigue following resolution of the acute illness.

The young child is at risk for the development of aspiration pneumonia. Parents need to understand that the child might be at risk for injury related to his or her age and developmental stage. To prevent recurrent or further aspiration, teach the parents the safety measures in Teaching Guidelines 39.3.

Preventing Pneumococcal Infection

Children at high risk for severe pneumococcal infection should be immunized against it. This includes all children between 0 and 23 months of age, as well as children between 24 and 59 months of age who either never received the vaccine before age 2 or did not receive a booster dose between 12 and 23 months of age. Additionally, children between 24 and 59 months of age with certain conditions such as immune deficiency, sickle cell disease, asplenia, chronic cardiac conditions, chronic lung problems, cerebrospinal fluid leaks, chronic renal insufficiency, diabetes mellitus, and organ transplants, should receive the vaccine. For additional information on immunization, refer to Chapter 30.



TEACHING GUIDELINES 39.3

Preventing Aspiration

- Keep toxic substances such as lighter fluid, solvents, and hydrocarbons out of reach of young children. Toddlers and preschoolers cannot distinguish safe from unsafe fluids due to their developmental stage.
- Avoid oily nose drops and oil-based vitamins or home remedies to avoid lipid aspiration into the lungs.
- Avoid oral feedings if the infant’s respiratory rate is 60 or greater to minimize the risk of aspiration of the feeding.
- Discourage parents from “force-feeding” in the event of poor oral intake or severe illness to minimize the risk of aspiration of the feeding.
- Position infants and ill children on their right side after feeding to minimize the risk of aspirating emesis or regurgitated feeding.

BRONCHITIS

Bronchitis is an inflammation of the trachea and major bronchi. It is often associated with a URI. Bronchitis is usually viral in nature, though *Mycoplasma pneumoniae* is also an important causative agent in children over 6 years of age. Recovery usually occurs within 5 to 10 days. Therapeutic management involves mainly supportive care. Expectorant administration and adequate hydration are important. If *Mycoplasma* is the cause, antibiotics are indicated (Orenstein, 2004b).

Nursing Assessment

The illness might begin with a mild URI. Fever develops, followed by a dry, hacking cough that might become productive in older children. The cough might wake the child at night. Auscultation of the lungs might reveal coarse rales. Respirations remain unlabored. The chest x-ray might show diffuse alveolar hyperinflation and perihilar markings.

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| Objective | Significance |
|--|--|
| Reduce invasive pneumococcal infections. | <ul style="list-style-type: none"> • Provide accurate information to families about pneumococcal disease. • Encourage pneumococcal immunization per recommendations. |

Nursing Management

Nursing management is aimed at providing supportive care. Teach parents that expectorants will help loosen secretions and antipyretics will help reduce the fever, making the child more comfortable. Encourage adequate hydration. Antibiotics are prescribed only in cases believed to be bacterial in nature. Discourage the use of cough suppressants: it is important for accumulated sputum to be raised.

TUBERCULOSIS

Tuberculosis is a highly contagious disease caused by inhalation of droplets of *Mycobacterium tuberculosis* or *Mycobacterium bovis*. Children usually contract the disease from an immediate household member. Annually about 1,000 U.S. children contract active tuberculosis disease (Reznik & Ozuah, 2005). Nonwhite children and children with chronic illness or malnutrition are more susceptible to infection. After exposure to an infected individual, the incubation period is 2 to 10 weeks. The inhaled tubercle bacilli multiply in the alveoli and alveolar ducts, forming an inflammatory exudate. The bacilli are spread by the bloodstream and lymphatic system to various parts of the body. Though pulmonary tuberculosis is the most common, children may also have infection in other parts of the body, such as the gastrointestinal tract or central nervous system.

In the case of drug-sensitive tuberculosis, the American Academy of Pediatrics recommends a 6-month course of oral therapy. The first 2 months consist of isoniazid,

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| Objective | Significance |
|--|---|
| Reduce tuberculosis. Increase the proportion of all tuberculosis patients who complete curative therapy within 12 months. Increase the proportion of contacts and other high-risk persons with latent tuberculosis infection who complete a course of treatment. | <ul style="list-style-type: none"> • Assess the health history of all infants, children, and adolescents for risk factors for tuberculosis infection. • Provide tuberculosis screening as recommended. • Refer all tuberculosis infections to the local public health department. • Educate families about the importance of completing medication therapy as prescribed for active and latent tuberculosis, and the need for appropriate follow-up and retesting for tuberculosis infection. |

rifampin, and pyrazinamide given daily. This is followed by twice-weekly isoniazid and rifampin; administration must be observed directly (usually by a public health nurse). In the case of multidrug-resistant tuberculosis, ethambutol or streptomycin is given via intramuscular injection (Pickering, 2006).

Nursing Assessment

Routine screening for tuberculosis infection is not recommended for low-risk individuals, but children considered to be at high risk for contracting tuberculosis should be screened using the Mantoux test. Children considered to be at high risk are those who:

- Are infected with HIV
- Are incarcerated or institutionalized
- Have a positive recent history of latent tuberculosis infection
- Are immigrants from or have a history of travel to endemic countries
- Are exposed at home to HIV-infected or homeless persons, illicit drug users, persons recently incarcerated, migrant farm workers, or nursing home residents

Children with chronic illnesses (except HIV infection) are not more likely to become infected with tuberculosis but should receive special consideration and be screened prior to initiation of immunosuppressant therapies (Reznik & Ozuah, 2005).

The presentation of tuberculosis in children is quite varied. Children can be asymptomatic or exhibit a broad range of symptoms. Symptoms may include fever, malaise, weight loss, anorexia, pain and tightness in the chest, and rarely hemoptysis. Cough might or might not be present and usually progresses slowly over several weeks to months. As tuberculosis progresses, the respiratory rate increases and the lung on the affected side is poorly expanded. Dullness to percussion might be present, as well as diminished breath sounds and crackles. Fever persists and pallor, anemia, weakness, and weight loss are present. Diagnosis is confirmed with a positive Mantoux test, positive gastric washings for acid-fast bacillus, and/or a chest x-ray consistent with tuberculosis (Reznik & Ozuah, 2005).

Nursing Management

Hospitalization of children with tuberculosis is necessary only for the most serious cases. Nursing management is aimed at providing supportive care and encouraging adherence to the treatment regimen. Most nursing care for childhood tuberculosis is provided in outpatient clinics, schools, or a public health setting. Supportive care includes ensuring adequate nutrition and adequate rest, providing comfort measures such as fever reduction, preventing exposure to other infectious diseases, and preventing reinfection.

Providing Care for the Child With Latent Tuberculosis Infection

Children who test positive for tuberculosis but who do not have symptoms or radiographic/laboratory evidence of disease are considered to have latent infection. These children should be treated with isoniazid for 9 months to prevent progression to active disease. Follow-up and appropriate monitoring can be achieved via the child's primary care provider or local health department.

Preventing Infection

Tuberculosis infection is prevented by avoiding contact with the tubercle bacillus. Thus, hospitalized children with tuberculosis must be isolated according to hospital policy to prevent nosocomial spread of tuberculosis infection. Promotion of natural resistance through nutrition, rest, and avoidance of serious infections does not prevent infection. Pasteurization of milk has helped to decrease the transmission of *Mycobacterium bovis*. Administration of bacille Calmette-Guérin (BCG) vaccine can provide incomplete protection against tuberculosis, and it is not widely used in the United States.

Acute Noninfectious Disorders

Acute noninfectious disorders include epistaxis, foreign body aspiration, respiratory distress syndrome, acute respiratory distress syndrome, and pneumothorax.

▶ EPISTAXIS

Epistaxis (a nosebleed) occurs most frequently in children before adolescence. Bleeding of the nasal mucosa occurs most often from the anterior portion of the septum. Epistaxis may be recurrent and idiopathic (meaning there is no cause). The majority of cases are benign, but in children with bleeding disorders or other hematologic concerns, epistaxis should be further investigated and treated.



▶ **Take NOTE!**

The child with recurrent epistaxis or epistaxis that is difficult to control should be further evaluated for underlying bleeding or platelet concerns.

Nursing Assessment

Explore the child's history for initiating factors such as local inflammation, mucosal drying, or local trauma (usually nose picking). Inspect the nasal cavity for blood.

Nursing Management

The presence of blood often frightens children and their parents. The nurse and parents should remain calm. The child should sit up and lean forward (lying down may allow aspiration of the blood). Apply continuous pressure to the anterior portion of the nose by pinching it closed. Encourage the child to breathe through the mouth during this portion of the treatment. Ice or a cold cloth applied to the bridge of the nose may also be helpful. The bleeding usually stops within 10 to 15 minutes. Apply petroleum jelly or water-soluble gel to the nasal mucosa with a cotton-tipped applicator to moisten the mucosa and prevent recurrence.

▶ FOREIGN BODY ASPIRATION

Foreign body aspiration occurs when any solid or liquid substance is inhaled into the respiratory tract. It is common in infants and young children and can present in a life-threatening manner. The object may lodge in the upper or lower airway, causing varying degrees of respiratory difficulty. Small, smooth objects such as peanuts are the most frequently aspirated, but any small toy, article, or piece of food smaller than the diameter of the young child's airway can be aspirated.

Foreign body aspiration occurs most frequently in children ages 6 months to 5 years. Children this age are growing and developing rapidly. They tend to explore things with their mouths and can easily aspirate small items.

The child often coughs out foreign bodies from the upper airway. If the foreign body reaches the bronchus, then it may need to be surgically removed via bronchoscopy. Postoperative antibiotics are used if an infection is also present. Complications of foreign body aspiration include pneumonia or abscess formation, hypoxia, respiratory failure, and death (Orenstein, 2004c).

Nursing Assessment

The infant or young child might present with a history of sudden onset of cough, wheeze, or stridor. Stridor suggests that the foreign body is lodged in the upper airway. Sometimes the onset of respiratory symptoms is much more gradual. When the item has traveled down one of the bronchi, then wheezing, rhonchi, and decreased aeration can be heard on the affected side. A chest x-ray will demonstrate the foreign body only if it is radiopaque (Fig. 39.8).

Nursing Management

The most important nursing intervention related to foreign body aspiration is prevention. Anticipatory guidance



FIGURE 39.8 Foreign body is noted in the bronchus on a chest x-ray.

for families with 6-month-olds should include a discussion of aspiration avoidance. This information should be repeated at each subsequent well-child visit through age 5. Tell parents to avoid letting their child play with toys with small parts and to keep coins and other small objects out of the reach of children. Teach parents not to feed peanuts and popcorn to their child until he or she is at least 3 years old. When children progress to table food, teach parents to chop all foods so that they are small enough to pass down the trachea should the child neglect to chew them up thoroughly. Carrots, grapes, and hot dogs should be cut into small pieces. Harmful liquids should be kept out of the reach of children.



▶ **Take NOTE!**

Items smaller than 1.25 inches (3.2 cm) can be aspirated easily. A simple way for parents to estimate the safe size of a small item or toy piece is to gauge its size against a standard toilet paper roll, which is generally about 1.5 inches in diameter.

▶ RESPIRATORY DISTRESS SYNDROME

Respiratory distress syndrome (RDS) is a respiratory disorder that is specific to neonates. It results from lung immaturity and a deficiency in surfactant, so it is seen most

often in premature infants. Other infants who might experience RDS include infants of diabetic mothers, those delivered via cesarean section without preceding labor, and those experiencing perinatal asphyxia. It is believed that each of these conditions has an impact on surfactant production, thus resulting in RDS in the term infant (Stoll & Kliegman, 2004).

The administration of surfactant via an endotracheal tube shortly after delivery helps to decrease the incidence and severity of RDS. Management of RDS focuses on intensive respiratory care, usually with mechanical ventilation. Newer techniques for ventilatory support are also available (Table 39.3).

Pathophysiology

The lack of surfactant in the affected newborn's lungs results in stiff, poorly compliant lungs with poor gas exchange. Right-to-left shunting and hypoxemia result. As the disease progresses, fluid and fibrin leak from the pulmonary capillaries, causing a hyaline membrane to form in the bronchioles, alveolar ducts, and alveoli. Presence of the membrane further decreases gas exchange. Complications of RDS include air leak syndrome, bronchopulmonary dysplasia, patent ductus arteriosus and congestive heart failure, intraventricular hemorrhage, retinopathy of prematurity, necrotizing enterocolitis, complications resulting from intravenous catheter use (infection, thrombus formation), and developmental delay or disability (Stoll & Kliegman, 2004).

Nursing Assessment

The onset of RDS is usually within several hours of birth. The newborn exhibits signs of respiratory distress, including tachypnea, retractions, nasal flaring, grunting, and varying degrees of cyanosis. Auscultation reveals fine rales and diminished breath sounds. If untreated,

RDS progresses to seesaw respirations, respiratory failure, and shock.

Nursing Management

Rarely, mucus plugging can occur in the neonate placed on a ventilator after surfactant administration. Therefore, close observation and assessment for adequate lung expansion are critical. In addition to expert respiratory intervention, other crucial nursing goals include maintenance of normothermia, prevention of infection, maintenance of fluid and electrolyte balance, and promotion of adequate nutrition (parenterally or via gavage feeding). Nursing care of the infant with RDS generally occurs in the intensive care unit.

▶ ACUTE RESPIRATORY DISTRESS SYNDROME

Acute respiratory distress syndrome (ARDS) occurs following a primary insult such as sepsis, viral pneumonia, smoke inhalation, or near-drowning. Respiratory distress and hypoxemia occur acutely within 72 hours of the insult in infants and children with previously healthy lungs. The alveolar–capillary membrane becomes more permeable and pulmonary edema develops. Hyaline membrane formation over the alveolar surfaces and decreased surfactant production cause lung stiffness. Mucosal swelling and cellular debris lead to atelectasis. Gas diffusion is impaired significantly. ARDS can progress to respiratory failure and death, though some individuals recover completely or have residual lung disease.

Medical treatment is aimed at improving **oxygenation** and **ventilation**. Mechanical ventilation is used, with special attention to lung volumes and positive end-expiratory

TABLE 39.3 ALTERNATIVES TO TRADITIONAL MECHANICAL VENTILATION

| Mode | Description | Additional Information |
|--|--|--|
| High-frequency ventilators (high-frequency, oscillating, or jet) | Provide very high respiratory rates (up to 1,200 breaths per minute) and very low tidal volumes | May decrease risk of barotrauma associated with ventilator pressures |
| Nitric oxide | Causes pulmonary vasodilation, helping to increase blood flow to alveoli | Safe; no long-term developmental risks |
| Liquid ventilation | Perfluorocarbon liquid acts as a surfactant. Provides an effective medium for gas exchange and increases pulmonary function. | Virtually no reported physiologic sequelae |
| Extracorporeal membrane oxygenation (ECMO) | Blood is removed from body via catheter, warmed and oxygenated in the ECMO machine, and then returned to infant. | Labor-intensive. Risk of bleeding is great. |

pressure (PEEP). Newer treatment modalities show promise for improving outcomes of ARDS.

Nursing Assessment

Tachycardia and tachypnea occur over the first few hours of the illness. Significantly increased work of breathing with nasal flaring and retractions develops. Auscultate for breath sounds, which might range from normal to high-pitched crackles throughout the lung fields. Hypoxemia develops. Bilateral infiltrates can be seen on a chest x-ray.

Nursing Management

Nursing care of the child with ARDS is mainly supportive and occurs in the intensive care unit. Closely monitor respiratory and cardiovascular status. Comfort measures such as hygiene and positioning as well as pain and anxiety management, maintenance of nutrition, and prevention of infection are also key nursing interventions. The acute phase of worsening respiratory distress can be frightening for a child of any age, and the nurse can be instrumental in soothing the child's fears. As the disease worsens and progresses, especially when ventilatory support is required, psychological support of the family as well as education about the intensive care unit procedures will be especially important.

▶ PNEUMOTHORAX

A collection of air in the pleural space is called a pneumothorax. It can occur spontaneously in an otherwise healthy child or as a result of chronic lung disease, cardiopulmonary resuscitation, surgery, or trauma. Trapped air consumes space within the pleural cavity, and the affected

lung suffers at least partial collapse. Needle aspiration and/or placement of a chest tube is used to evacuate the air from the chest. Some small pneumothoraces resolve independently, without intervention (Kerby et al., 2007).

Nursing Assessment

Primary pneumothorax (spontaneous) occurs most often in adolescence. The infant or child with a pneumothorax might have a sudden or gradual onset of symptoms. Chest pain might be present as well as signs of respiratory distress such as tachypnea, retractions, nasal flaring, or grunting. Assess risk factors for acquiring a pneumothorax, including chest trauma or surgery, intubation and mechanical ventilation, or a history of chronic lung disease such as cystic fibrosis. Inspect the child for a pale or cyanotic appearance. Auscultate for increased heart rate (tachycardia) and absent or diminished breath sounds on the affected side. The x-ray reveals air within the thoracic cavity (Fig. 39.9).

Nursing Management

The child with a pneumothorax requires frequent respiratory assessments. Pulse oximetry might be used as an adjunct, but clinical evaluation of respiratory status is most useful. In some cases, administration of 100% oxygen hastens the reabsorption of air, but it is generally used only for a few hours. If a chest tube is connected to a dry suction or water seal apparatus, provide care of the drainage apparatus as appropriate (Fig. 39.10). A pair of hemostats should be kept at the bedside to clamp the tube should it become dislodged from the drainage container. The dressing around the chest tube is occlusive and is not routinely changed. If the tube becomes dislodged from the child's chest, apply Vaseline gauze and an occlusive dressing, immediately perform appropriate respiratory assessment, and notify the physician.

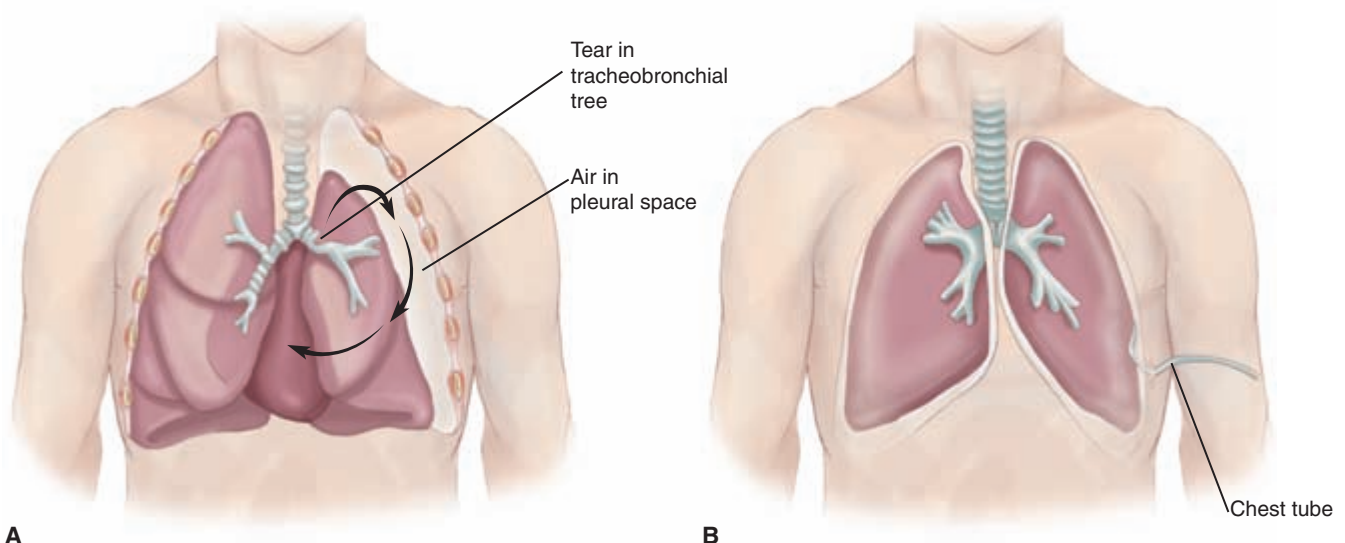


FIGURE 39.9 Pneumothorax.



FIGURE 39.10 The chest tube is connected to suction or water seal via a drainage container.

Chronic Diseases

Chronic respiratory disorders include allergic rhinitis, asthma, chronic lung disease (bronchopulmonary dysplasia), cystic fibrosis, and apnea.

▶ ALLERGIC RHINITIS

Allergic **rhinitis** is a common chronic condition in childhood, affecting up to 40% of children (Hagemann, 2005). Allergic rhinitis is associated with atopic dermatitis and asthma, with as many as 60% to 78% of asthmatic children also suffering from allergic rhinitis (Rance, 2007). Perennial allergic rhinitis occurs year-round and is associated with indoor environments. Allergens commonly implicated in perennial allergic rhinitis include dust mites, pet dander, cockroach antigens, and molds. Seasonal allergic rhinitis is caused by elevations in outdoor levels of allergens. It is typically caused by certain pollens, trees, weeds, fungi, and molds. Complications from allergic rhinitis include exacerbation of asthma symptoms, recurrent sinusitis and otitis media, and dental malocclusion.

Pathophysiology

Allergic rhinitis is an intermittent or persistent inflammatory state that is mediated by immunoglobulin E (IgE). In response to contact with an airborne allergen protein, the nasal mucosa mounts an immune response. The antigen (from the allergen) binds to a specific IgE on the surface of mast cells, releasing the chemical mediators of histamine and leukotrienes. The release of mediators results in acute tissue edema and mucus production (Banasiak & Meadows-Oliver, 2005). Late-phase mediators are released and more inflammation results. IgE binds to receptors on the surfaces of mast cells and basophils, creating the sensitization memory that causes the reaction with

subsequent allergen exposures. Allergen exposure then results in mast cell degranulation and release of histamine and other chemotactic factors. Histamine and other factors cause nasal vasodilation, watery **rhinorrhea**, and nasal congestion. Irritation of local nerve endings by histamine produces pruritus and sneezing (Hagemann, 2005). Treatment of allergic rhinitis is aimed at decreasing response to these allergic mediators as well as treating inflammation.

Nursing Assessment

For a full description of the assessment phase of the nursing process, refer to page 1222. Assessment findings pertinent to allergic rhinitis are discussed below.

Health History

Elicit a description of the present illness and chief complaint. Common signs and symptoms reported during the health history might include:

- Mild, intermittent to chronic nasal stuffiness
- Thin, runny nasal discharge
- Sneezing
- Itching of nose, eyes, palate
- Mouth breathing and snoring

Determine the seasonality of symptoms. Are they perennial (year-round) or do they occur during certain seasons only? What types of medications or other treatments have been used, and what was the child's response?

Explore the history for the presence of risk factors such as:

- Family history of atopic disease (asthma, allergic rhinitis, or atopic dermatitis)
- Known allergy to dust mites, pet dander, cockroach antigens, pollens, or molds
- Early childhood exposure to indoor allergens
- Early introduction to foods or formula in infancy
- Exposure to tobacco smoke
- Environmental air pollution
- Recurrent viral infections

Nonwhite race and higher socioeconomic status have also been noted as risk factors (Hagemann, 2005).

Physical Examination

Physical examination of the child with allergic rhinitis includes inspection, observation, and auscultation.

Inspection and Observation

Observe the child's facies for red-rimmed eyes or tearing, mild eyelid edema, "allergic shiners" (bluish or grayish cast beneath the eyes), and "allergic salute" (a transverse nasal crease between the lower and middle thirds of the nose that results from repeated nose rubbing) (Fig. 39.11).



FIGURE 39.11 Allergic shiners beneath the eyes and allergic salute across the nose.

Inspect the nasal cavity. The turbinates may be swollen and gray/blue. Clear mucoid nasal drainage may be observed. Inspect the skin for rash. Listen for nasal phonation with speech.

Auscultation

Auscultate the lungs for adequate aeration and clarity of breath sounds. In the child who also has asthma, exacerbation with wheezing often occurs with allergic rhinitis.

Laboratory and Diagnostic Tests

The initial diagnosis is often made based on the history and clinical findings. Common laboratory and diagnostic studies ordered for the assessment of allergic rhinitis may include:

- Nasal smear (positive for eosinophilia)
- Positive allergy skin test
- Positive RAST

To distinguish between the causes of nasal congestion, refer to Comparison Chart 39.1.

Nursing Management

In addition to the nursing diagnoses and related interventions discussed in the Nursing Care Plan for disorders of the nose, mouth, and throat, interventions common to allergic rhinitis follow.

Maintaining Patent Airway

The continual nasal obstruction that occurs with allergic rhinitis can be very problematic for some children.

Performing nasal washes with normal saline may keep the nasal mucus from becoming thickened. Thickened, immobile secretions often lead to a secondary bacterial infection. The nasal wash also decongests the nose, allowing for improved nasal airflow. Anti-inflammatory (corticosteroid) nasal sprays can decrease the inflammatory response to allergens. A mast cell stabilizing nasal spray such as cromolyn sodium may decrease the intensity and frequency of allergic responses. Oral antihistamines are now available in once-daily dosing, providing convenience for the family. Some children may benefit from a combined antihistamine/nasal decongestant if nasal congestion is significant. Leukotriene modifiers such as montelukast may also be beneficial for some children (Banasiak & Meadows-Oliver, 2005).

Providing Family Education

One of the most important tools in the treatment of allergic rhinitis is learning to avoid known allergens. Teaching Guidelines 39.4 gives information on educating families about avoidance of allergens. Children may be referred to a specialist for allergen desensitization (allergy shots). Products helpful with control of allergies are available from a number of vendors, such as www.onlineallergyrelief.com.

▶ ASTHMA

Asthma is a chronic inflammatory airway disorder characterized by airway hyperresponsiveness, airway edema, and mucus production. Airway obstruction resulting from asthma might be partially or completely reversed. Severity ranges from long periods of control with infrequent acute exacerbations in some children to the presence of persistent daily symptoms in others (Kieckhefer & Ratcliffe, 2004). It is the most common chronic illness of childhood and affects about 9 million American children (Kumar et al., 2005). A small percentage of children with asthma account for a large percentage of health care use and expense (Wakefield et al., 2005a, 2005b). Asthma accounts for about 14 million lost school days per year and a significant number of lost workdays on the part of parents (Rhee et al., 2007). The incidence and severity of asthma are increasing; this might be attributed to increased urbanization, increased air pollution, and more accurate diagnosis.

Severity ranges from symptoms associated only with vigorous activity (exercise-induced bronchospasm) to daily symptoms that interfere with quality of life. Table 39.4 discusses classification of asthma severity. Though uncommon, childhood death related to asthma is also on the rise worldwide. Air pollution, allergens, family history, and viral infections might all play a role in asthma. Many



TEACHING GUIDELINES 39.4

Controlling Exposure to Allergens

Tobacco

- Avoid all exposure to tobacco smoke.
- If parents cannot quit, they must not smoke inside the home or car.

Dust Mites

- Use pillow and mattress covers.
- Wash sheets, pillowcases, and comforters once a week in 130° F water.
- Use blinds rather than curtains in bedroom.
- Remove stuffed animals from bedroom.
- Reduce indoor humidity to <50%.
- Remove carpet from bedroom.
- Clean solid-surface floors with wet mop each week.

Pet Dander

- Remove pets from home permanently.
- If unable to remove them, keep them out of bedroom and off carpet and upholstered furniture.

Cockroaches

- Keep kitchen very clean.
- Avoiding leaving food or drinks out.
- Use pesticides if necessary, but ensure that the asthmatic child is not inside the home when the pesticide is sprayed.

Indoor Molds

- Repair water leaks.
- Use dehumidifier to keep basement dry.
- Reduce indoor humidity to <50%.

Outdoor Molds, Pollen, and Air Pollution

- Avoid going outdoors when mold and pollen counts are high.
- Avoid outdoor activity when pollution levels are high.

TABLE 39.4 ASTHMA SEVERITY CLASSIFICATION IN CHILDREN NOT TAKING LONG-TERM CONTROL MEDICATIONS

| Classification | Symptoms | Lung Function | Interference with Normal Activity | Short-Acting Beta2-Agonist Use for Symptom Control |
|---------------------|---|---|-----------------------------------|---|
| Intermittent | <ul style="list-style-type: none"> • 1 or 2 times a week • Nighttime symptoms 1 or 2 times a month | FEV 80% or more of predicted | None | 1 or 2 days per week |
| Mild persistent | <ul style="list-style-type: none"> • Symptoms more than twice a week but less than once a day • Nighttime symptoms 3 or 4 times a month | FEV 80% or more of predicted, variability | Minor limitation | Greater than twice per week, but not more than once a day |
| Moderate persistent | <ul style="list-style-type: none"> • Daily symptoms • Nighttime symptoms >1 time a week, but not nightly | FEV 60% to 80% of predicted | Some limitation | Daily |
| Severe persistent | <ul style="list-style-type: none"> • Throughout the day • Nighttime symptoms often 7 times per week | FEV less than 60% of predicted | Extremely limited | Several times per day |

FEV, forced expiratory volume.

Adapted from National Asthma Education and Prevention Program. (2007). *Expert panel report 3: Guidelines for the diagnosis and management of asthma* (NIH Publication No. 07-4051). Bethesda, MD: National Institutes of Health, National Heart, Lung and Blood Institute.

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| Objective | Significance |
|---|---|
| Reduce asthma deaths, hospitalizations for asthma, and hospital emergency department visits for asthma. | <ul style="list-style-type: none"> • Provide appropriate education and triage to families of children with asthma, particularly when the child is experiencing symptoms or a decreased peak flow rate. |

children with asthma also have gastroesophageal disease, though the relationship between the two diseases is not clearly understood.

A significant long-term complication, chronic airway remodeling, may result from recurrent asthma exacerbation and inflammation. This process involves structural changes such as thickening of the sub-basement membrane, subepithelial fibrosis, airway smooth muscle hypertrophy and hyperplasia, blood vessel proliferation and dilation, and mucous gland hyperplasia and hypersecretion (NAEPP, 2007). In some individuals with poorly controlled asthma, these changes may be permanent, resulting in decreased responsiveness to therapy. Children with asthma are also more susceptible to serious bacterial and viral respiratory infections. Acute complications also include status asthmaticus and respiratory failure.

Pathophysiology

In asthma, the inflammatory process contributes to increased airway activity. Thus, control or prevention of inflammation is the core of asthma management. Asthma results from a complex variety of responses in relation to a trigger. When the process begins, mast cells, T lympho-

cytes, macrophages, and epithelial cells are involved in the release of inflammatory mediators. Eosinophils and neutrophils migrate to the airway, causing injury. Chemical mediators such as leukotrienes, bradykinin, histamine, and platelet-activating factor also contribute to the inflammatory response. The presence of leukotrienes contributes to prolonged airway constriction (Banasiak & Meadows-Oliver, 2005). Autonomic neural control of airway tone is affected, airway mucus secretion is increased, mucociliary function changes, and airway smooth muscle responsiveness increases (Kiecheter & Ratcliffe, 2004). As a result, acute bronchoconstriction, airway edema, and mucus plugging occur (Fig. 39.12).

In most children, this process is considered reversible and until recently it was not considered to have long-standing effects on lung function. Current research and scientific thought, however, recognize the concept of airway remodeling. Airway remodeling occurs as a result of chronic inflammation of the airway. Following the acute response to a trigger, continued allergen response results in a chronic phase. During this phase, the epithelial cells are denuded and the influx of inflammatory cells into the airway continues. This results in structural changes of the airway that are irreversible, and further loss of pulmonary function might occur (Kiecheter & Ratcliffe, 2004).

Therapeutic Management

Current goals of medical therapy are avoidance of asthma triggers and reduction or control of inflammatory episodes. The most recent recommendations by the National Asthma Education and Prevention Program (2007) suggest a stepwise approach to medication management as well as control of environmental factors (allergens) and comorbid conditions that affect asthma. The NAEPP guidelines stress periodic assessment of asthma control. Treatment decisions may then be made based on the indi-

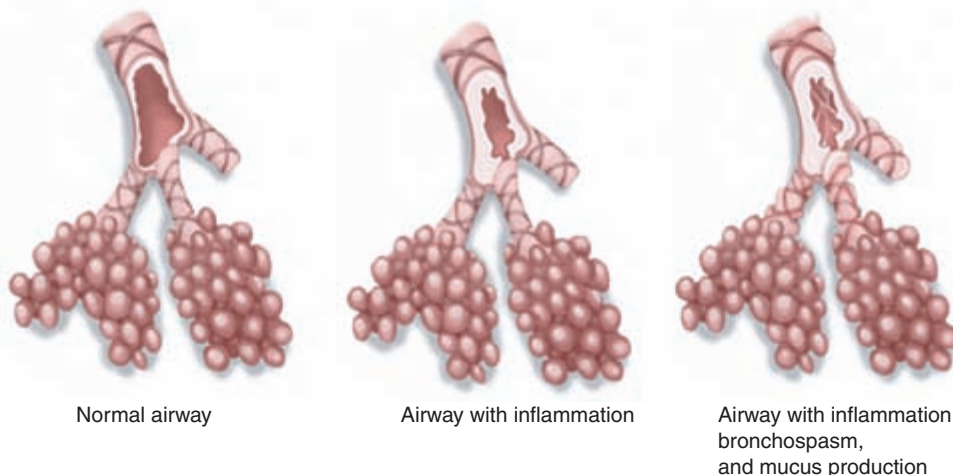


FIGURE 39.12 Note airway edema, mucus production, and bronchospasm occurring with asthma.

vidual's level of asthma control, rather than on the severity at diagnosis.

The stepwise approach to asthma treatment involves increasing medications as the child's condition worsens, then backing off treatment as he or she improves (Table 39.5). Bronchodilators may be used in the acute treatment of bronchoconstriction or in the long-acting form to prevent bronchospasm. Exercise-induced bronchospasm may occur in any child with asthma or as the only symptom in the child with mild intermittent asthma. Most children may avoid exercise-induced bronchospasm by using a longer warm-up period prior to vigorous exercise and, if necessary, inhaling a short-acting bronchodilator just prior to exercise. Long-term prevention usually involves inhaled steroids. Leukotriene modifiers may be used as an alternative but are not preferred for mild persistent asthma (NAEPP, 2007).

TABLE 39.5 STEPWISE APPROACH TO ASTHMA MANAGEMENT

All patients: patient education, environmental control, and management of comorbidities at each step. Consider referral to asthma specialist at step 3. (Step 2 and above are persistent asthma.)

Step 1 (intermittent asthma)

Preferred: short-acting beta2-agonist PRN

Step 2

Preferred: low-dose inhaled corticosteroid
Alternative: cromolyn or leukotriene modifier

Step 3

Preferred: medium-dose inhaled corticosteroid (all ages) OR low-dose inhaled corticosteroid and leukotriene modifier or long-acting beta2-agonist (children over 4 yrs)

Step 4

Preferred: medium-dose inhaled corticosteroids and long-acting beta2-agonist (can use leukotriene modifier in children under 4 yrs)

Step 5

Preferred: high-dose inhaled corticosteroids and long-acting beta2-agonist (or leukotriene modifier or theophylline)

Step 6

Preferred: high-dose inhaled corticosteroids, long-acting beta2-agonist and oral systemic corticosteroids

Adapted from National Asthma Education and Prevention Program. (2007). *Expert panel report 3: Guidelines for the diagnosis and management of asthma* (NIH Publication No. 07-4051). Bethesda, MD: National Institutes of Health, National Heart, Lung and Blood Institute. These recommendations are intended to be used as a guide in individualized asthma care.

| <i>HEALTHY PEOPLE 2010</i> | |
|---|--|
| Objective | Significance |
| Reduce activity limitations among persons with asthma. (Developmental) Reduce the number of school days or workdays missed by persons with asthma. Increase the proportion of persons with asthma who receive formal patient education, including information about community and self-help resources, as an essential part of the management of their condition. | <ul style="list-style-type: none"> • Encourage appropriate physical activity in children with asthma. • Provide extensive education to children and families about peak flow meter use and its meaning, maintenance and rescue medications, symptoms of asthma exacerbation, and a written plan for how to "step up" and "step down" asthma management. • Refer children and their families to local or Internet resources and support groups. • Refer families to formal classes on asthma education. |



► **Take NOTE!**

By the end of 2008, all metered-dose inhalers using chlorofluorocarbon (CFC) as the propellant should be off the market. Environmentally friendly formulations of hydrofluoroalkane (HFA) will be used in all metered-dose inhalers by that time (Bederka, 2006).

Nursing Assessment

For a full description of the assessment phase of the nursing process, refer to page 1222. Assessment findings pertinent to asthma are discussed below.

Health History

Elicit a description of the present illness and chief complaint. Common signs and symptoms reported during the health history might include:

- Cough, particularly at night: hacking cough that is initially nonproductive, becoming productive of frothy sputum
- Difficulty breathing: shortness of breath, chest tightness or pain, dyspnea with exercise
- Wheezing

Explore the child's current and past medical history for risk factors such as:

- History of allergic rhinitis or atopic dermatitis
- Family history of atopy (asthma, allergic rhinitis, atopic dermatitis)

- Recurrent episodes diagnosed as wheezing, bronchitis, or bronchitis
- Known allergies
- Seasonal response to environmental pollen
- Tobacco smoke exposure
- Poverty

Physical Examination

Physical examination of the child with asthma includes inspection, auscultation, and percussion.

Inspection

Observe the child's general appearance and color. During mild exacerbations, the child's color might remain pink, but as the child worsens, cyanosis might result. Work of breathing is variable. Some children present with mild retractions, while others demonstrate significant accessory muscle use and eventually head-bobbing if not effectively treated. The child may appear anxious and fearful or may be lethargic and irritable. An audible wheeze might be present. Children with persistent severe asthma may have a barrel chest and routinely demonstrate mildly increased work of breathing.

Auscultation and Percussion

A thorough assessment of lung fields is necessary. Wheezing is the hallmark of airway obstruction and might vary throughout the lung fields. Coarseness might also be present. Assess the adequacy of aeration. Breath sounds might be diminished in the bases or throughout. A quiet chest in an asthmatic child can be an ominous sign. With severe airway obstruction, air movement can be so poor that wheezes might not be heard upon auscultation. Percussion may yield hyperresonance.

Laboratory and Diagnostic Tests

Laboratory and diagnostic studies commonly ordered for the assessment of asthma include:

- Pulse oximetry: oxygen saturation may be significantly decreased or normal during a mild exacerbation
- Chest x-ray: usually reveals hyperinflation
- Blood gases: might show carbon dioxide retention and hypoxemia
- Pulmonary function tests (PFTs): can be very useful in determining the degree of disease but are not useful during an acute attack. Children as young as 5 or 6 years might be able to comply with spirometry.
- Peak expiratory flow rate (PEFR): is decreased during an exacerbation
- Allergy testing: skin test or RAST can determine allergic triggers for the asthmatic child

Nursing Management

Initial nursing management of the child with an acute exacerbation of asthma is aimed at restoring a clear airway

and effective breathing pattern as well as promoting adequate oxygenation and ventilation (gas exchange). Refer to the Nursing Care Plan. Additional considerations are reviewed below.

Educating the Child and Family

Asthma is a chronic illness and needs to be understood as such. Figure 39.13 displays the “Kids with Asthma Bill of Rights” developed by the American Lung Association. Teach families of children with asthma, and the children themselves, how to care for the disease. Symptom-free periods (often very long) are interspersed with episodes of exacerbation. Parents and children often do not understand the importance of maintenance medications for long-term control. They may view the episodes of exacerbation (sometimes requiring hospitalization or emergency room visits) as an acute illness and are simply relieved when they are over. Frequently during the periods between acute episodes, children are viewed as disease-free and long-term maintenance schedules are abandoned. The prolonged inflammatory process occurring in the absence of symptoms, primarily in children with moderate to severe asthma, can lead to airway remodeling and eventual irreversible disease.

Each child should have a management plan in place to determine when to step up or step down treatment. Figure 39.14 provides an example of a written format that may be helpful to families in the management of asthma. This written action plan should also be kept on file at the child's school, and relief medication should be available to the child at all times. Children who experience exercise-induced bronchospasm may still participate in physical education or athletics but may need to be allowed to use their medicine before the activity. Provide appropriate education to the child and family based on the child's individualized stepwise treatment plan. Stress the concept of maintenance medications for the prevention of future serious disease in addition to controlling or preventing current symptoms.

Educate families and children on the appropriate use of nebulizers, metered-dose inhalers, spacers, dry-powder inhalers, and Diskus, as well as the purposes, functions, and side effects of the medications they deliver. Require return demonstrations of equipment use to ensure that children and families can use the equipment properly (Teaching Guidelines 39.5).



► Take NOTE!

The NAEPP recommends use of a spacer or holding chamber with metered-dose inhalers to increase the bioavailability of medication in the lungs.

(text continues on page 1263)

KIDS WITH ASTHMA BILL OF RIGHTS

I _____ certify
that I have asthma, and I have the right to understand and control
my asthma to prevent an asthma attack. These are my rights:

1. I have the right to regular medical care that keeps my asthma under control.
2. I have the right to effective, affordable medicine.
3. I have the right to breathe clean air in my home, my school and my community.
4. I have the right to an asthma action plan that both my parents or guardians and my school can use to help me manage my asthma.
5. I have the right to know what causes my asthma to get worse, and how to stay away from my asthma triggers.
6. I have the right to attend an asthma-friendly school, where there's a school nurse, I can use my medicine when I need it, and all the adults know enough about asthma to help me if I get in trouble.
7. I have the right to learn as much as I can about my asthma so I can take care of myself.
8. I have the right to talk to my parents or guardians and my teachers about what I need to do to control my asthma.
9. I have the right to participate in sports and other activities, as long as my doctor says it is okay.
10. I have the right to live an active, healthy life!

Signed _____

**For more information check out
www.lungusa.org**

AMERICAN LUNG ASSOCIATION®
100 YEARS • 1904-2004
1-800-LUNG-USA
(1-800-586-4872)
www.lungusa.org

FIGURE 39.13 The Asthma Bill of Rights.



Asthma Action Plan

General Information:

Name _____
 Emergency contact _____ Phone numbers _____
 Physician/Health Care Provider _____ Phone numbers _____
 Physician Signature _____ Date _____

| Severity Classification | Triggers | Exercise |
|--|---|--|
| <input type="radio"/> Mild Intermittent <input type="radio"/> Moderate Persistent <input type="radio"/> Mild Persistent <input type="radio"/> Severe Persistent | <input type="radio"/> Colds <input type="radio"/> Smoke <input type="radio"/> Weather <input type="radio"/> Exercise <input type="radio"/> Dust <input type="radio"/> Air pollution <input type="radio"/> Animals <input type="radio"/> Food <input type="radio"/> Other _____ | 1. Pre-medication (how much and when) _____ 2. Exercise modifications _____ |

| Green Zone: Doing Well | | Peak Flow Meter Personal Best = | | | | | | | | | | | | | |
|---|---|---------------------------------|------------------|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|--|
| Symptoms <input type="checkbox"/> Breathing is good <input type="checkbox"/> No cough or wheeze <input type="checkbox"/> Can work and play <input type="checkbox"/> Sleeps all night | Control Medications | | | | | | | | | | | | | | |
| | <table border="1"> <thead> <tr> <th>Medicine</th> <th>How Much to Take</th> <th>When To Take It</th> </tr> </thead> <tbody> <tr><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>_____</td><td>_____</td><td>_____</td></tr> </tbody> </table> | Medicine | How Much to Take | When To Take It | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | | |
| Medicine | How Much to Take | When To Take It | | | | | | | | | | | | | |
| _____ | _____ | _____ | | | | | | | | | | | | | |
| _____ | _____ | _____ | | | | | | | | | | | | | |
| _____ | _____ | _____ | | | | | | | | | | | | | |
| Peak Flow Meter More than 80% of personal best or _____ | | | | | | | | | | | | | | | |

| Yellow Zone: Getting Worse | | Contact Physician if using quick relief more than 2 times per week. | | | | | | | | | | | | | |
|--|---|--|------------------|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|--|
| Symptoms <input type="checkbox"/> Some problems breathing <input type="checkbox"/> Cough, wheeze or chest tight <input type="checkbox"/> Problems working or playing <input type="checkbox"/> Wake at night | Continue control medicines and add: | | | | | | | | | | | | | | |
| | <table border="1"> <thead> <tr> <th>Medicine</th> <th>How Much to Take</th> <th>When To Take It</th> </tr> </thead> <tbody> <tr><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>_____</td><td>_____</td><td>_____</td></tr> </tbody> </table> | Medicine | How Much to Take | When To Take It | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | | |
| Medicine | How Much to Take | When To Take It | | | | | | | | | | | | | |
| _____ | _____ | _____ | | | | | | | | | | | | | |
| _____ | _____ | _____ | | | | | | | | | | | | | |
| _____ | _____ | _____ | | | | | | | | | | | | | |
| Peak Flow Meter Between 50 to 80% of personal best or _____ to _____ | IF your symptoms (and peak flow, if used) return to Green Zone after one hour of the quick relief treatment, THEN <input type="radio"/> Take quick-relief medication every 4 hours for 1 to 2 days <input type="radio"/> Change your long-term control medicines by _____ <input type="radio"/> Contact your physician for follow-up care | IF your symptoms (and peak flow, if used) DO NOT return to the GREEN ZONE after 1 hour of the quick relief treatment, THEN <input type="radio"/> Take quick-relief treatment again <input type="radio"/> Change your long-term control medicines by _____ <input type="radio"/> Call your physician/Health Care Provider within _____ hours of modifying your medication routine | | | | | | | | | | | | | |

| Red Zone: Medical Alert | | Ambulance/Emergency Phone Number: | | | | | | | | | | | | | |
|--|---|--|------------------|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|--|
| Symptoms <input type="checkbox"/> Lots of problems breathing <input type="checkbox"/> Cannot work or play <input type="checkbox"/> Getting worse instead of better <input type="checkbox"/> Medicine is not helping | Continue control medicines and add: | | | | | | | | | | | | | | |
| | <table border="1"> <thead> <tr> <th>Medicine</th> <th>How Much to Take</th> <th>When To Take It</th> </tr> </thead> <tbody> <tr><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>_____</td><td>_____</td><td>_____</td></tr> </tbody> </table> | Medicine | How Much to Take | When To Take It | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ | | |
| Medicine | How Much to Take | When To Take It | | | | | | | | | | | | | |
| _____ | _____ | _____ | | | | | | | | | | | | | |
| _____ | _____ | _____ | | | | | | | | | | | | | |
| _____ | _____ | _____ | | | | | | | | | | | | | |
| Peak Flow Meter Between 0 to 50% of personal best or _____ to _____ | Go to the hospital or call for an ambulance if <input type="radio"/> Still in the red zone after 15 minutes <input type="radio"/> If you have not been able to reach your physician/health care provider for help <input type="radio"/> _____ | Call an ambulance immediately if the following danger signs are present <input type="radio"/> Trouble walking/talking due to shortness of breath <input type="radio"/> Lips or fingernails are blue | | | | | | | | | | | | | |

FIGURE 39.14 Asthma action plan.



TEACHING GUIDELINES 39.5

Using Asthma Medication Delivery Devices

Nebulizer

1. Plug in the nebulizer and connect the air compressor tubing.



2. Add the medication to the medicine cup.



3. Attach the mask or the mouthpiece and hose to the medicine cup.



4. Place the mask on the child OR



5. Instruct the child to close the lips around the mouthpiece and breathe through the mouth.



6. After use, wash the mouthpiece and medicine cup with water and allow to air dry.



Metered-Dose Inhaler

1. Shake the inhaler and take off the cap.



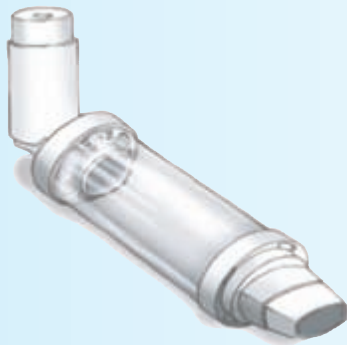
(continued)



TEACHING GUIDELINES 39.5 (continued)

Using Asthma Medication Delivery Devices

2. Attach the inhaler to the spacer or holding chamber.



3. Breathe out completely.
4. Put the spacer mouthpiece in the mouth (or place the mask over the child's nose and mouth, ensuring a good seal).



5. Compress the inhaler and inhale slowly and deeply. Hold the breath for a count of 10.



Diskus

1. Hold the Diskus in a horizontal position in one hand and push the thumb grip with the thumb of your other hand away from you until mouthpiece is exposed.



2. Push the lever until it clicks (the dose is now loaded).



3. Breathe out fully.
4. Place your mouth securely around the mouthpiece and breathe in fully and quickly through your mouth.
5. Remove the Diskus, hold the breath for 10 seconds, and then breathe out.





TEACHING GUIDELINES 39.5 (continued)

Using Asthma Medication Delivery Devices

Turbuhaler

1. Hold the Turbuhaler upright. Load the dose by twisting the brown grip fully to the right.



2. Then twist it to the left until you hear it click.



3. Breathe out fully.
4. Holding the Turbuhaler horizontally, place the mouth firmly around the mouthpiece and inhale deeply and forcefully.



5. Remove the Turbuhaler from the mouth and then breathe out.

In children who have more severe asthma, the NAEPP recommends the use of the peak expiratory flow rate (PEFR) to determine daily control. PEFR measurements obtained via a home peak flow meter can be very helpful as long as the meter is used appropriately; Teaching Guidelines 39.6 gives instructions on peak flow meter

use. The child's "personal best" is determined collaboratively with the health care practitioner during a symptom-free period. PEFR is measured daily at home using the peak flow meter. The asthma management plan then gives specific instructions based on the PEFR measurement (Table 39.6).

TEACHING GUIDELINES 39.6

Using a Peak Flow Meter

- Slide the arrow down to "zero."
- Stand up straight.
- Take a deep breath and close the lips tightly around the mouthpiece.
- Blow out hard and fast.
- Note the number the arrow moves to.
- Repeat three times and record the highest reading.
- Keep a record of daily readings, being sure to measure peak flow at the same time each day.

► **Take NOTE!**

Young children with asthma receiving inhaled medications via a nebulizer should use a snugly fitting mask to ensure accurate deposition of medication to the lungs. "Blow-by" via nebulizer should be discouraged, as medication delivery is variable and unreliable.

Avoidance of allergens is another key component of asthma management. Avoiding known triggers helps to prevent exacerbations as well as long-term inflammatory changes. This can be a difficult task for most families, particularly if the affected child suffers from several allergies.

TABLE 39.6 ASSESSMENT OF PEAK EXPIRATORY FLOW RATE (PEFR)

| Zone* | PEFR | Symptoms | Action |
|---------------------|--------------------------|------------------|---|
| Green: Good control | >80% personal best | None | Take usual medications. |
| Yellow: Caution | 50% to 80% personal best | Possibly present | Take short-acting inhaled beta2-agonist right away. Talk to your health care provider. |
| Red: Medical alert | <50% personal best | Usually present | Take short-acting inhaled beta2-agonist right away. Go to office or emergency department. |

*The National Asthma Education and Prevention Program recommended the “traffic light” approach for educating individuals on PEFrs and management plans.

Teaching Guidelines 39.4 outlines strategies for allergen avoidance.

Research has found a lag in parent/child education in relation to asthma management (Horner, 2004). Asthma education is not limited to the hospital or clinic setting. Nurses can become involved in community asthma education: community-centered education in schools, churches, and daycare centers or through peer educators has been shown to be effective. Education should include pathophysiology, asthma triggers, and prevention and treatment strategies. With such a large number of children affected with this chronic disease, community education has the potential to make a broad impact.

School nurses must also become experts in asthma management as well as being committed to ongoing education of the child and family. Resources for schools include:

- Open Airways for Schools: an educational program presented by the American Lung Association or its local chapter, focusing on increasing asthma awareness and compliance with asthma action plans and decreasing asthma emergencies. Contact the local lung association or call 1-800-LUNG-USA.
- Asthma and Allergies at School: a kit available from AANMA at www.breatherville.org/schoolhouse or 1-800-878-4403.
- Healthy School Environments Assessment Tool: <http://www.epa.gov/schools/>



► **Take NOTE!**

Exposure to cigarette smoke increases the need for medications in children with asthma as well as the frequency of asthma exacerbations. Both indoor air quality and environmental pollution contribute to asthma in children.

Promoting the Child's Self-Esteem

Fear of an exacerbation and feeling “different” from other children can harm a child’s self-esteem. In qualitative research studies, children have made such statements as “my body shuts down” and “I feel like I’m going to die” (Yoos et al., 2005). The fatigue and fear associated with chronic asthma may reduce the child’s confidence and sense of control over his or her body and life. In addition to coping with a chronic illness, the asthmatic child often also has to cope with school-related issues. Moodiness, acting out, and withdrawal correlate with increases in school absence, which can contribute to poor school performance. To live in fear of an exacerbation or to be unable to participate in activities affects the child’s self-esteem.

Through education and support, the child can gain a sense of control. Children need to learn to master their disease. Accurate evaluation of asthma symptoms and improvement of self-esteem may help the child to experience less panic with an acute episode. Improved self-esteem might also help the child cope with the disease in general and with being different from his or her peers. The school-age child has the cognitive ability to begin taking responsibility for asthma management, with continued involvement on the part of the parents. Transferring control of asthma care to the child is an important developmental process that will increase the child’s feeling of control over the illness (Buford, 2004).

Promoting Family Coping

Parent denial is an issue in many families. The family, through education and encouragement, can become the experts on the child’s illness as well as advocates for the child’s well-being. The resilient child is better able to cope with the challenges facing him or her, including asthma. Cohesiveness and warmth in the family environment can improve a child’s resiliency as well as contribute to family hardiness. Parents need to be allowed to ask questions and voice their concerns. A nurse who understands the family’s issues and concerns is better able to plan for support and education. Provide culturally sensitive education

and interventions that focus on increasing the family's commitment to and control of asthma management. As the child and parents become confident in their ability to recognize asthma symptoms and cope with asthma and its periodic episodes, the family's ability to cope will improve (Svavarsdottir & Rayens, 2005).

▶ CHRONIC LUNG DISEASE

Chronic lung disease (formerly termed bronchopulmonary dysplasia) is often diagnosed in infants who have experienced RDS and continue to require oxygen at 28 days of age. It is a chronic respiratory condition seen most commonly in premature infants. It results from a variety of factors, including pulmonary immaturity, acute lung injury, barotrauma, inflammatory mediators, and volutrauma. Epithelial stretching, macrophage and polymorphonuclear cell invasion, and airway edema affect the growth and development of lung structures. Cilia loss and airway lining denudation reduce the normal cleansing abilities of the lung. The number of normal alveoli is reduced by one third to one half. Lower birthweights, white race, and male gender pose increased risk for development of chronic lung disease. Complications include pulmonary artery hypertension, cor pulmonale, congestive heart failure, and severe bacterial or viral pneumonia. (Harvey, 2004; Stoll & Kliegman, 2004).

Anti-inflammatory inhaled medications are used for maintenance, and short-acting bronchodilators are used as needed for wheezing episodes. Supplemental long-term oxygen therapy may be required in some infants.

Nursing Assessment

Tachypnea and increased work of breathing are characteristic of chronic lung disease. After discharge from the NICU, these symptoms can continue. Exertion such as activity or oral feeding can cause dyspnea to worsen. Failure to thrive might also be evident. Auscultation might reveal breath sounds that are diminished in the bases. These infants have reactive airway episodes, so wheezing might be present during times of exacerbation. If fluid overload develops, rales may be heard.

Nursing Management

If the infant is oxygen-dependent, provide education to the parents about oxygen tanks, nasal cannula use, pulse oximetry use, and nebulizer treatments. Often these children require increased-calorie formulas to grow adequately. Fluid restrictions and/or diuretics are necessary in some infants. Follow-up echocardiograms might be used to determine resolution of pulmonary artery hypertension prior to weaning from oxygen. Encourage developmentally appropriate activities. It might be difficult for

the oxygen-dependent infant or toddler to reach gross motor milestones or explore the environment because the length of the oxygen tubing limits him or her.

Parental support is also a key nursing intervention. After a long and trying period of ups and downs with their newborn in the intensive care unit, parents find themselves exhausted caring for their medically fragile infant at home.

▶ CYSTIC FIBROSIS

Cystic fibrosis is an autosomal recessive disorder that occurs about once in every 3,300 live white births and about once in every 16,000 live black births (Boat, 2004). A deletion occurring on the long arm of chromosome 7 at the cystic fibrosis transmembrane regulator (CFTR) is the responsible gene mutation. DNA testing can be used prenatally and in newborns to identify the presence of the mutation. The American College of Obstetrics and Gynecology currently recommends screening for cystic fibrosis to any person seeking preconception or prenatal care. At present, 11 states include testing for cystic fibrosis as part of newborn screening (Gross et al., 2004).

Cystic fibrosis is the most common debilitating disease of childhood among those of European descent. Medical advances in recent years have greatly increased the length and quality of life for affected children: about 50% now live past the age of 30 years (Boat, 2004), and many live a high-quality life into their 40s (Carpenter & Narsavage, 2004). Complications include hemoptysis, pneumothorax, bacterial colonization, cor pulmonale, volvulus, intussusception, intestinal obstruction, rectal prolapse, gastroesophageal reflux disease, diabetes, portal hypertension, liver failure, gallstones, and decreased fertility.

Therapeutic Management

Therapeutic management of cystic fibrosis is aimed toward minimizing pulmonary complications, maximizing lung function, preventing infection, and facilitating growth. All children with cystic fibrosis who have pulmonary involvement require chest physiotherapy with postural drainage several times daily to mobilize secretions from the lungs. Physical exercise is encouraged. Recombinant human DNase (Pulmozyme) is given daily using a nebulizer to decrease sputum viscosity and help clear secretions. Inhaled bronchodilators and anti-inflammatory agents are prescribed for some children. Aerosolized antibiotics are often prescribed and may be given at home as well as in the hospital. Choice of antibiotic is determined by sputum culture and sensitivity results. Pancreatic enzymes and supplemental fat-soluble vitamins are prescribed to promote adequate digestion and absorption of nutrients and optimize nutritional status. Increased-calorie, high-protein diets are recommended, and sometimes supplemental high-calorie

formula, either orally or via feeding tube, is needed. Some children require total parenteral nutrition to maintain or gain weight (McMullen, 2004). Lung transplantation has been successful in some children with cystic fibrosis.

Pathophysiology

In cystic fibrosis, the CFTR mutation causes alterations in epithelial ion transport on mucosal surfaces, resulting in generalized dysfunction of the exocrine glands. The epithelial cells fail to conduct chloride, and water transport abnormalities occur. This results in thickened, tenacious secretions in the sweat glands, gastrointestinal tract, pancreas, respiratory tract, and other exocrine tissues. The increased viscosity of these secretions makes them difficult to clear. The sweat glands produce a larger amount of chloride, leading to a salty taste of the skin and alterations in electrolyte balance and dehydration. The pancreas, in-

trahepatic bile ducts, intestinal glands, gallbladder, and submaxillary glands become obstructed by viscous mucus and eosinophilic material. Pancreatic enzyme activity is lost and malabsorption of fats, proteins, and carbohydrates occurs, resulting in poor growth and large, malodorous stools. Excess mucus is produced by the tracheobronchial glands. Abnormally thick mucus plugs the small airways, and then bronchiolitis and further plugging of the airways occur. Secondary bacterial infection with *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Burkholderia cepacia* often occurs. This contributes to obstruction and inflammation, leading to chronic infection, tissue damage, and respiratory failure. Nasal polyps and recurrent sinusitis are common. Boys have tenacious seminal fluid and experience blocking of the vas deferens, often making them infertile. In girls, thick cervical secretions might limit penetration of sperm (Boat, 2004; Simpson & Ivey, 2005). Table 39.7 gives further details of the pathophysiology

TABLE 39.7 PATHOPHYSIOLOGY OF CYSTIC FIBROSIS AND RESULTANT RESPIRATORY AND GASTROINTESTINAL CLINICAL MANIFESTATIONS

| Defect in the CFTR Gene Affects: | Pathophysiology | Clinical Manifestations |
|----------------------------------|--|---|
| Respiratory tract | <ul style="list-style-type: none"> • Infection leads to neutrophilic inflammation. • Cleavage of complement receptors and immunoglobulin G leads to opsonophagocytosis failure. • Chemoattractant interleukin-8 and elastin degradase contribute to inflammatory response. • Thick, tenacious sputum that is chronically colonized with bacteria results. • Air trapping related to airway obstruction • Pulmonary parenchyma is eventually destroyed. | <ul style="list-style-type: none"> • Airway obstruction • Difficulty clearing secretions • Respiratory distress and impaired gas exchange • Chronic cough • Barrel-shaped chest • Decreased pulmonary function • Clubbing • Recurrent pneumonia • Hemoptysis • Pneumothorax • Chronic sinusitis • Nasal polyps • Cor pulmonale (right-sided heart failure) |
| Gastrointestinal tract | <ul style="list-style-type: none"> • Decreased chloride and water secretion into the intestine (causing dehydration of the intestinal material) and into the bile ducts (causing increased bile viscosity) • Reduced pancreatic bicarbonate secretion • Hypersecretion of gastric acid • Insufficiency of pancreatic enzymes necessary for digestion and absorption • Pancreas secretes thick mucus. | <ul style="list-style-type: none"> • Meconium ileus • Retention of fecal matter in distal intestine, resulting in vomiting, abdominal distention and cramping, anorexia, right lower quadrant pain • Sludging of intestinal contents may lead to fecal impaction, rectal prolapse, bowel obstruction, intussusception. • Obstructive cirrhosis with esophageal varices, and splenomegaly • Gallstones • Gastroesophageal reflux disease (compounded by postural drainage with chest physiotherapy) • Inadequate protein absorption • Altered absorption of iron and vitamins A, D, E, and K • Failure to thrive • Hyperglycemia and development of diabetes later in life |

and resulting respiratory and gastrointestinal clinical manifestations of cystic fibrosis.

Nursing Assessment

For a full description of the assessment phase of the nursing process, refer to page 1222. Assessment findings pertinent to cystic fibrosis are discussed below.

Health History

Elicit a description of the present illness and chief complaint. Common signs and symptoms reported during the health history in the undiagnosed child might include:

- A salty taste to the child's skin (resulting from excess chloride loss via perspiration)
- Meconium ileus or late, difficult passage of meconium stool in the newborn period
- Abdominal pain or difficulty passing stool (infants or toddlers might present with intestinal obstruction or intussusception at the time of diagnosis)
- Bulky, greasy stools
- Poor weight gain and growth despite good appetite
- Chronic or recurrent cough and/or upper or lower respiratory infections

Children known to have cystic fibrosis are often admitted to the hospital for pulmonary exacerbations or other complications of the disease. The health history should include questions related to:

- Respiratory status: has cough, sputum production, or work of breathing increased?
- Appetite and weight gain
- Activity tolerance
- Increased need for pulmonary or pancreatic medications
- Presence of fever
- Presence of bone pain
- Any other changes in physical state or medication regimen

Physical Examination

The physical examination includes inspection, auscultation, percussion, and palpation.

Inspection

Observe the child's general appearance and color. Check the nasal passages for polyps. Note respiratory rate, work of breathing, use of accessory muscles, position of comfort, frequency and severity of cough, and quality and quantity of sputum produced. The child with cystic fibrosis often has a barrel chest (anterior–posterior diameter approximates transverse diameter) (Fig. 39.15). Clubbing of the nail beds might also be present. Note whether rectal prolapse is present. Does the child appear small or thin for his or her age? The child might have a protuberant abdomen and thin extremities, with decreased amounts of subcutaneous fat. Observe for the presence of edema (sign of

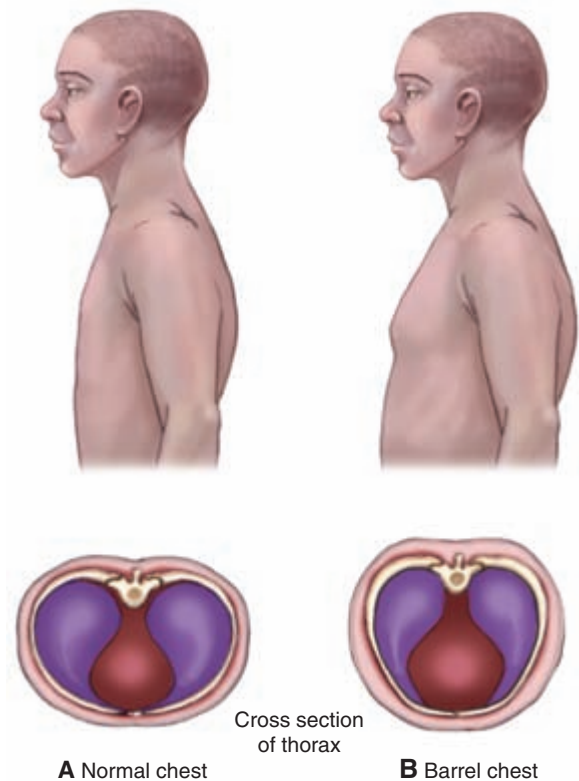


FIGURE 39.15 (A) Normal chest shape—transverse diameter is greater than anterior–posterior diameter. (B) Barrel chest—transverse diameter equals anterior–posterior diameter.

cardiac or liver failure). Note distended neck veins or the presence of a heave (signs of cor pulmonale).

Auscultation

Auscultation may reveal a variety of adventitious breath sounds. Fine or coarse crackles and scattered or localized wheezing might be present. With progressive obstructive pulmonary involvement, breath sounds might be diminished. Tachycardia might be present. Note the presence of a gallop (might occur with cor pulmonale). Note the adequacy of bowel sounds.

Percussion

Percussion over the lung fields usually yields hyperresonance due to air trapping. Diaphragmatic excursion might be decreased. Percussion of the abdomen might reveal dullness over an enlarged liver or mass related to intestinal obstruction.

Palpation

Palpation might yield a finding of asymmetric chest excursion if atelectasis is present. Tactile fremitus may be decreased over areas of atelectasis. Note if tenderness is present over the liver (might be an early sign of cor pulmonale).

Laboratory and Diagnostic Tests

Common laboratory and diagnostic studies ordered for the diagnosis and assessment of cystic fibrosis include:

- Sweat chloride test: considered suspicious if the level of chloride in collected sweat is above 50 mEq/L and diagnostic if the level is above 60 mEq/L (Fig. 39.16)
- Pulse oximetry: oxygen saturation might be decreased, particularly during a pulmonary exacerbation
- Chest x-ray: may reveal hyperinflation, bronchial wall thickening, atelectasis, or infiltration
- Pulmonary function tests: might reveal a decrease in forced vital capacity and forced expiratory volume, with increases in residual volume (Boat, 2004; McMullen, 2004)

Nursing Management

Management of cystic fibrosis focuses on minimizing pulmonary complications, promoting growth and development, and facilitating coping and adjustment by the child and family. In addition to the nursing diagnoses and related interventions discussed in the Nursing Care Plan for respiratory disorders, interventions common to cystic fibrosis follow.

Maintaining Patent Airway

Chest physiotherapy is often used as an adjunct therapy in respiratory illnesses, but for children with cystic fibrosis it is a critical intervention. Chest physiotherapy involves percussion, vibration, and postural drainage, and either it or another bronchial hygiene therapy must be performed several times a day to assist with mobilization of secretions. Nursing Procedure 39.2 gives instructions on the chest physiotherapy technique.

For older children and adolescents, the flutter-valve device, positive expiratory pressure therapy, or a high-frequency chest compression vest may also be used. The flutter valve device provides high-frequency oscillation to the airway as the child exhales into a mouthpiece that contains a steel ball. Positive expiratory pressure therapy involves exhaling through a flow resistor, which creates positive expiratory pressure. The cycles of exhalation are repeated until coughing yields expectoration of secretions.

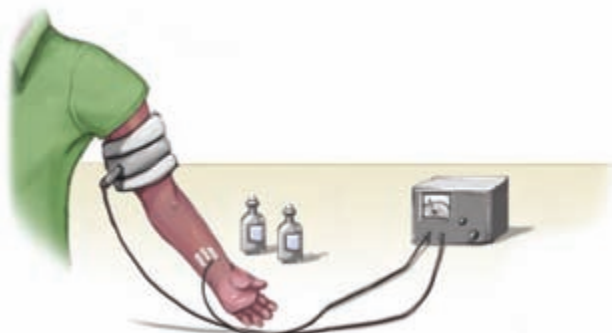


FIGURE 39.16 Sweat chloride test.

The vest airway clearance system provides high-frequency chest wall oscillation to increase airflow velocity to create repetitive cough-like shear forces and to decrease the viscosity of secretions (Chatburn, 2007). Breathing exercises are also helpful in promoting mucus clearance. Encourage physical exercise, as it helps to promote mucus secretion as well as providing cardiopulmonary conditioning. Ensure that Pulmozyme is administered, as well as inhaled bronchodilators and anti-inflammatory agents if prescribed.

Preventing Infection

Vigorous pulmonary hygiene for mobilization of secretions is critical to prevent infection. Aerosolized antibiotics can be given at home as well as in the hospital. Children with frequent or severe respiratory exacerbations might require lengthy courses of intravenous antibiotics.

Maintaining Growth

Pancreatic enzymes must be administered with all meals and snacks to promote adequate digestion and absorption of nutrients. The number of capsules required depends on the extent of pancreatic insufficiency and the amount of food being ingested. The dosage can be adjusted until an adequate growth pattern is established and the number of stools is consistent at one or two per day. Children will need additional enzyme capsules when high-fat foods are being eaten. In the infant or young child, the enzyme capsule can be opened and sprinkled on cereal or applesauce. A well-balanced, high-calorie, high-protein diet is necessary to ensure adequate growth. Some children require up to 1.5 times the recommended daily allowance of calories for children their age. A number of commercially available nutritional formulas and shakes are available for diet supplementation.

In infants, breastfeeding should be continued with enzyme administration. Some infants will require fortification of breast milk or supplementation with high-calorie formulas. Commercially available infant formulas can continue to be used for the formula-fed infant and can be mixed to provide a larger amount of calories if necessary. Supplementation with vitamins A, D, E, and K is necessary. Administer gavage feedings or total parenteral nutrition as prescribed to provide for adequate growth.

Promoting Family Coping

Cystic fibrosis is a serious chronic illness that requires daily interventions. It can be hard to maintain a schedule that requires pulmonary hygiene several times daily as well as close attention to appropriate diet and enzyme supplementation. Adjusting to the demands that the illness places on the child and family is difficult. Continual adjustments within the family must occur. Children are frequently hospitalized, and this may place an additional strain on the family and its finances. Children with cystic fibrosis may express fear or feelings of isolation, and siblings may be worried or jealous (Carpenter & Narsavage, 2004). The

Nursing Procedure 39.2

PERFORMING CHEST PHYSIOTHERAPY

1. Provide percussion via a cupped hand or an infant percussion device. Appropriate percussion yields a hollow sound, not a slapping sound.



2. Percuss each segment of the lung for 1 to 2 minutes.

POSITION #1
UPPER LOBES, Apical segments



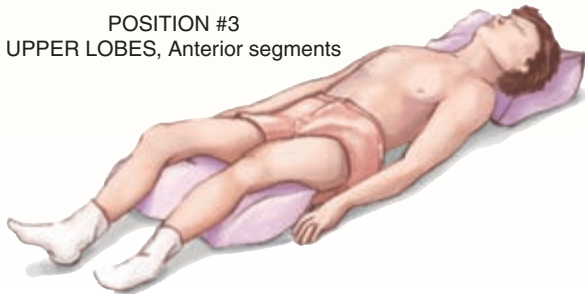
POSITION #1, for infants
UPPER LOBES, Apical segments



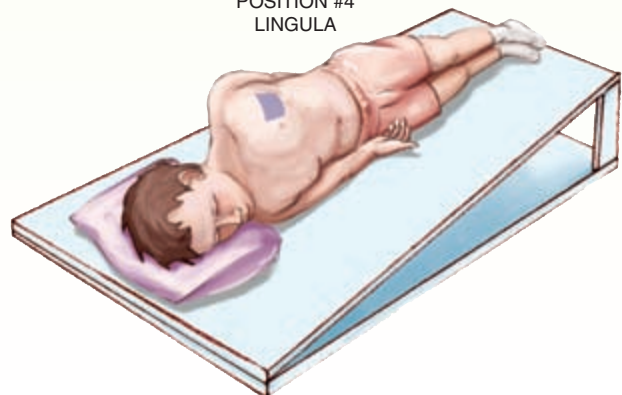
POSITION #2
UPPER LOBES, Posterior segments



POSITION #3
UPPER LOBES, Anterior segments



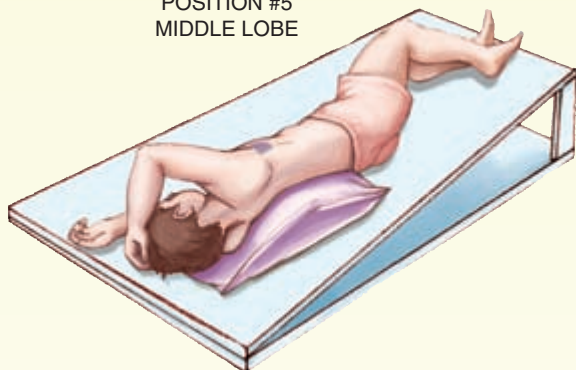
POSITION #4
LINGULA



(continued)

Nursing Procedure 39.2 (continued)

POSITION #5
MIDDLE LOBE



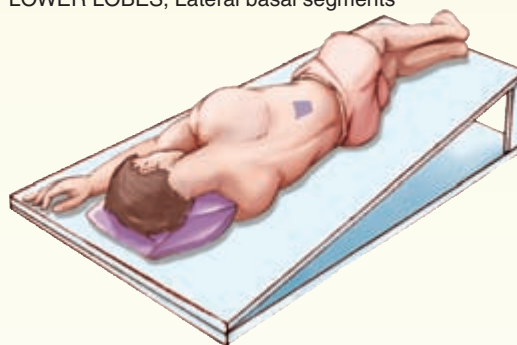
POSITION #6
LOWER LOBES, Anterior basal segments



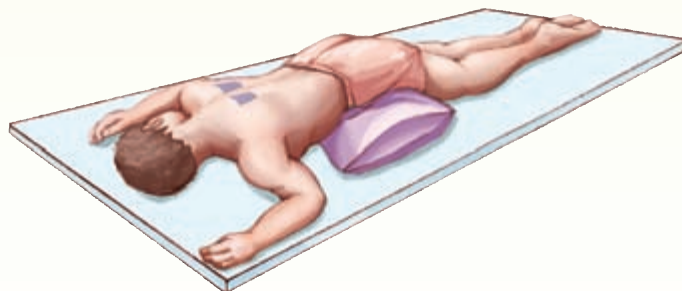
POSITION #7
LOWER LOBES, Posterior basal segments



POSITION #8 & 9
LOWER LOBES, Lateral basal segments



POSITION #10
LOWER LOBES, Superior segments



3. Place the ball of the hand on the lung segment, keeping the arm and shoulder straight. Vibrate by tensing and relaxing your arms during the child's exhalation. Vibrate each lung segment for at least five exhalations.

4. Encourage the child to deep breathe and cough.
5. Change drainage positions and repeat percussion and vibration.

family should be encouraged to lead a normal life through involvement in activities and school attendance during periods of wellness.



► **Take NOTE!**

Massage therapy performed by the parent, nurse, or licensed massage therapist may help to decrease anxiety in the child with cystic fibrosis. It may have the added benefit of improving respiratory status, but it does not replace chest physiotherapy (Huth et al., 2005).

Starting at the time of diagnosis, families often demonstrate significant stress as the severity of the diagnosis and the significance of disease chronicity become real for them. The family should be involved in the child's care from the time of diagnosis, whether in the outpatient setting or in the hospital. Ongoing education about the illness and its treatments is necessary. Once the initial shock of diagnosis has passed and the family has adjusted to initial care, the family usually learns how to manage the requirements of care. Powerlessness gives way to adaptation. As family members become more comfortable with their understanding of the illness and the required treatments, they will eventually become the experts on the child's care. It is important for the nurse to recognize and respect the family's changing needs over time.

Providing daily intense care can be tiring, and non-compliance on the part of the family or child might occur as a result of this fatigue. Overvigilance may also occur as parents attempt to control the difficult situation and protect the child. Families welcome support and encouragement. Most families eventually progress past the stages of fear, guilt, and powerlessness to a way of living that is different than what they anticipated but is something that they can manage.

Refer parents to a local support group for families of children with cystic fibrosis. The Cystic Fibrosis Foundation has chapters throughout the United States (www.cff.org). Additional resources can be found at www.cysticfibrosis.com, www.cfri.org, and www.cfw.org.

Parents of children with a terminal illness might face the death of their child at an earlier age than expected. Assisting with anticipatory grieving and making decisions related to end-of-life care are other important nursing interventions.

Preparing the Child and Family for Adulthood With Cystic Fibrosis

With current technological and medication advances, many more children with cystic fibrosis are surviving to adulthood and into their 30s and 40s. Lung transplantation is now being used in some patients with success, thus

prolonging life expectancy (barring transplant complications). Children with cystic fibrosis should have the goal of independent living as an adult, as other children do. Making the transition from a pediatric medical home to an adult medical home should be viewed as a normal part of growing up, similar to completing school or finding a first job (Kennedy et al., 2007). Pediatric clinics are focused on family-centered care that heavily involves the child's parents, but adults with cystic fibrosis need a different focus, one that views them as independent adults.

Clients with cystic fibrosis can make the transition from pediatric to adult care with thoughtful preparation and coordination. They desire and deserve a smooth transition in care that will result in appropriate ongoing medical management of cystic fibrosis in an environment that is geared toward adults rather than children.

Adults with cystic fibrosis are able to find rewarding work and pursue relationships. Most men with cystic fibrosis are capable of sexual intercourse, though unable to reproduce. Females might have difficulty conceiving, and when they do they should be cautioned about the additional respiratory strain that pregnancy causes. All children of parents with cystic fibrosis will be carriers of the gene.

► APNEA

Apnea is defined as absence of breathing for longer than 20 seconds; it might be accompanied by bradycardia. Sometimes apnea presents in the form of an acute life-threatening event (ALTE), an event in which the infant or child exhibits some combination of apnea, color change, muscle tone alteration, coughing, or gagging. Apnea may also occur acutely at any age as a result of respiratory distress. This discussion will focus on apnea that is chronic or recurrent in nature or that occurs as part of an ALTE.

Apnea in infants may be central (unrelated to any other cause) or may occur with other illnesses such as sepsis and respiratory infection. Apnea in newborns might be associated with hypothermia, hypoglycemia, infection, or hyperbilirubinemia. Apnea of prematurity occurs secondary to an immature respiratory system. Apnea should not be considered a predecessor to sudden infant death syndrome (SIDS). Current research has not proven this theory, and SIDS generally occurs in otherwise healthy young infants (AAP, Task Force on Sudden Infant Death Syndrome, 2005). Box 39.3 gives more information about SIDS and its prevention.

Therapeutic management of apnea varies depending on the cause. When apnea occurs as a result of another disorder or infection, treatment is directed toward that cause. In the event of apnea, stimulation may trigger the infant to take a breath. If breathing does not resume, rescue breathing or bag-valve-mask ventilation is necessary. Infants and children who have experienced an ALTE or who have chronic apnea may require ongoing cardiac/

BOX 39.3 Sudden Infant Death Syndrome (SIDS)

Definition

Sudden death of a previously healthy infant <1 year of age

Prevention

- Place all infants in the supine position to sleep (even side-lying is not as safe and is not recommended by the AAP).
- Provide a firm sleep surface and avoid soft bedding, excess covers, pillows, and stuffed animals in the crib.
- Avoid maternal prenatal smoking and exposure of the infant to second-hand smoke.
- Ensure the infant sleeps separately from the parents.
- Avoid overbundling or overdressing the infant.
- Encourage pacifier use during naps and at bedtime if the infant is receptive to it (AAP, 2005).

Support and Information

- SIDS Alliance: www.sidsalliance.org
- National Sudden Infant Death Resource Center: www.sidscenter.org
- Association for SIDS and Infant Mortality Program: www.asip1.org
- Sudden Infant Death Syndrome Network, Inc.: ds-network.org/

apnea monitoring. Caffeine or theophylline is sometimes administered, primarily in premature infants, to stimulate respirations.

Nursing Assessment

Question the parents about the infant's position and activities preceding the apneic episode. Did the infant experience a color change? Did the infant self-stimulate (breathe again on his or her own), or did he or she require stimulation from the caretaker? Assess risk factors for apnea, which may include prematurity, anemia, and history of metabolic disorders. Apnea may occur in association with cardiac or neurologic disturbances, respiratory infection, sepsis, child abuse, or poisoning.

In the hospitalized infant, note absence of respiration, position, color, and other associated findings, such as emesis on the bedclothes. If an infant who is apneic fails to be stimulated and does not breathe again, pulselessness will result.

Nursing Management

When an infant is noted to be apneic, gently stimulate him or her to take a breath again. If gentle stimulation is unsuccessful, then rescue breathing or bag-valve-mask ventilation must be started.

To avoid apnea in the newborn, maintain a neutral thermal environment. Avoid excessive vagal stimulation and taking rectal temperatures (the vagal response can cause bradycardia, resulting in apnea). Administer caffeine or theophylline if prescribed and teach families about the use of these medications.

Infants with recurrent apnea or ALTE may be discharged on a home apnea monitor (Fig. 39.17). Provide education on use of the monitor, guidance about when to notify the physician or monitor service about alarms, and training in infant CPR. The monitor is usually discontinued after 3 months without a significant event of apnea or bradycardia. In some ways the monitor gives parents peace of mind, but in others it can make them more nervous about the well-being of their child. Also, the alarm on home monitors is extremely loud and parents often go for months with inadequate sleep. Providing appropriate education to the parents about the nature of the child's disorder as well as action to take in the event of apnea may give the family a sense of mastery over the situation, thus decreasing their anxiety. Refer families to local support groups such as those offered by Parent to Parent and Parents Helping Parents.

Tracheostomy

A **tracheostomy** is an artificial opening in the airway; usually a plastic tracheostomy tube is in place to form a patent airway. Tracheostomies are performed to relieve airway obstruction, such as with **subglottic stenosis** (narrowing of the airway sometimes resulting from long-term intubation). They are also used for pulmonary toilet and in the child who requires chronic mechanical ventilation. The tracheostomy facilitates secretion removal, reduces work of breathing, and increases client comfort. In some cases the tracheostomy facilitates mechanical ventilation weaning. It may be permanent or temporary, depending on the indication. The tracheostomy



FIGURE 39.17 The home apnea monitor uses a soft belt with a Velcro attachment to hold two leads in the appropriate position on the chest.

tube varies in size and type depending on the child's airway size and health and the length of time the child will require the tracheostomy. Silastic tracheostomy tubes are soft and flexible; they are available with a single lumen or may have an outer and inner lumen. Both types have an obturator (the guide used during tube changes). Typically, the tubes with inner cannulas are used with older children and in children with increased mucus production. Cuffed tracheostomy tubes are generally used in older children also. The cuff is used to prevent air from leaking around the tube. The funnel-shaped airway in younger children acts a physiological cuff and prevents air leakage. Figure 39.18 shows various types of tracheostomy tubes.

Complications immediately after surgery include hemorrhage, air entry, pulmonary edema, anatomic damage, and respiratory arrest. At any point in time the tracheostomy tube may become occluded and ventilation compromised. Complications of chronic tracheostomy include infection, cellulitis, and formation of granulation tissue around the insertion site (Russell, 2005).

Nursing Assessment

When obtaining the history for a child with a tracheostomy, note the reason for the tracheostomy, as well as the size and type of tracheostomy tube. Inspect the site. The stoma should appear pink and without bleeding or drainage. The tube itself should be clean and free from secretions. The tracheostomy ties should fit securely, allowing one finger to slide beneath the ties (Fig. 39.19). Inspect the skin under the ties for rash or redness. Observe work of breathing.

When caring for the infant or child with a tracheostomy, whether in the intensive care unit, the ward, or the home, a thorough respiratory assessment is necessary. Note presence of secretions and their color, thickness, and amount. Auscultate for breath sounds, which should be clear and equal throughout all lung fields. Pulse oximetry may also be measured. When infection is suspected or secretions are discolored or have a foul odor, a sputum culture may be obtained.



FIGURE 39.18 Note smaller size and absence of inner cannula on particular brands of pediatric tracheostomy tubes.



FIGURE 39.19 Properly fitting trach ties. One fingerwidth fits between the ties and the child's neck.



► Take NOTE!

Keep small toys (risk of aspiration), plastic bibs or bedding (risk of airway occlusion), and talcum powder (risk of inhalation injury) out of reach of the child with a tracheostomy.

Nursing Management

In the immediate postoperative period the infant or child may require restraints to avoid accidental dislodgment of the tracheostomy tube. Infants and children who have had a tracheostomy for a period of time become accustomed to it and usually do not attempt to remove the tube. Since air inspired via the tracheostomy tube bypasses the upper airway, it lacks humidification, and this lack of humidity can lead to a mucus plug in the tracheostomy and hypoxia. Provide humidity to either room air or oxygen via a tracheostomy collar or ventilator, depending on the child's need (Fig. 39.20). Box 39.4 lists the equipment that should be available at the bedside of any child who has a tracheostomy.

Tracheostomies require frequent suctioning to maintain patency. The appropriate length for insertion of the suction catheter depends on the size of the tracheostomy and the child's needs. Place a sign at the head of the child's bed indicating the suction catheter size and the length (in centimeters) that it should be inserted for suctioning. Keep



FIGURE 39.20 The trach collar allows for humidification of inspired air or supplemental oxygen.

an extra tracheostomy tube of the same size and one size smaller at the bedside in the event of an emergency.

Many pediatric tracheostomy tubes do not have an inner cannula that requires periodic removal and cleaning, so periodic removal and replacement of the chronic tracheostomy tube is required. Clean the removed tracheostomy tube with half-strength hydrogen peroxide and pipe cleaners. Rinse with distilled water and allow it to dry. The tracheostomy tube can be reused many times if adequately cleaned between uses.

Perform tracheostomy care every 8 hours or per institution protocol. Change the tracheostomy tube only as needed or per institution protocol. Nursing Procedure 39.3 gives information about tracheostomy care.

If the older child or teen has a tracheostomy tube with an inner cannula, care of the inner cannula is similar to that of an adult. Involve parents in care of the tracheostomy and begin education about caring for the tracheostomy tube at home as soon as the child is stable. Refer the family to local support groups or to www.tracheostomy.com, which offers many resources for a family whose child has a tracheostomy. The child with a tracheostomy often

Nursing Procedure 39.3

TRACHEOSTOMY CARE

1. Gather the necessary equipment:
 - Cleaning solution
 - Gloves
 - Precut gauze pad
 - Cotton-tipped applicators
 - Clean tracheostomy ties
 - Scissors
 - Extra tracheostomy tube in case of accidental dislodgement
2. Position the infant/child supine with a blanket or towel roll to extend the neck.
3. Open all packaging and cut tracheostomy ties to appropriate length if necessary.
4. Cleanse around the tracheostomy site with prescribed solution (half-strength hydrogen peroxide or acetic acid, normal saline or soap and water if at home) and cotton-tipped applicators, working from just around the tracheostomy tube outward.
5. Rinse with sterile water and cotton-tipped applicator in similar fashion.
6. Place the precut sterile gauze under the tracheostomy tube.
7. With the assistant holding the tube in place, cut the ties and remove from the tube.
8. Attach the clean ties to the tube and tie or secure in place with Velcro.

qualifies for a Medicaid waiver that will provide a certain amount of home nursing care.

Always change tracheostomy ties with an assistant to avoid accidental dislodgement of the tube.

Key Concepts

- Respiratory infections account for the majority of acute illnesses in children.
- The upper and lower airways are smaller in children than adults, making them more susceptible to obstruction in the presence of mucus, debris, or edema.
- Newborns are obligatory nose breathers.
- The child's highly compliant airway is quite susceptible to dynamic collapse in the presence of airway obstruction.
- Because they have fewer alveoli, children have a higher risk for hypoxemia than adults.
- Generally, disorders of the nose and throat do not result in increased work of breathing or affect the lungs. Thus, if the lungs are involved, lower respiratory disease must be considered.

BOX 39.4 Emergency Equipment (Available at Bedside)

- Two spare tracheostomy tubes (one the same size and one a size smaller)
- Suction equipment
- Stitch cutter (new tracheostomy)
- Spare tracheostomy ties
- Lubricating jelly
- Bag-valve-mask device
- Call bell within child's/parent's reach

- Wheezing may be associated with a variety of lower respiratory disorders, such as asthma, bronchiolitis, and cystic fibrosis.
- Pulse oximetry is a useful tool for determining the extent of hypoxia. Findings should be correlated with the child's clinical presentation.
- Rapid streptococcus and rapid flu tests are very useful for the quick diagnosis of strep throat or influenza so that appropriate treatment may be instituted early in the illness.
- Supplemental oxygen is often necessary in the child who is hospitalized (particularly with lower respiratory disease). Oxygen should be humidified to prevent drying of secretions.
- Suctioning, whether with a bulb syringe or suction catheter, is very effective at maintaining airway patency, especially in the younger child or infant.
- Normal saline nasal wash is an inexpensive, simple, and safe method for decongesting the nose in the case of the common cold, allergic rhinitis, and sinusitis.
- Infants who were born prematurely, children with a chronic illness such as diabetes, congenital heart disease, sickle cell anemia, or cystic fibrosis, and children with developmental disorders such as cerebral palsy tend to be more severely affected with respiratory disorders.
- Passive cigarette smoke exposure increases the infant's and child's risk for respiratory disease.
- Continual swallowing while awake or asleep is an indication of bleeding in the postoperative tonsillectomy patient.
- Positioning to ease work of breathing and maintaining a patent airway are priorities for the child with a respiratory disorder.
- To avoid Reye syndrome, aspirin should not be given to treat fever or pain in the infant or child with a viral infection.
- Infants and children at high risk for serious RSV disease should be immunized with Synagis each RSV season. Children 6 to 23 months of age should be immunized against influenza yearly.
- Children at high risk for exposure to tuberculosis should be screened for infection.
- Promoting airway clearance and maintenance, effective breathing patterns, and adequate gas exchange is the priority focus of nursing intervention in pediatric respiratory disease.
- Children with any degree of respiratory distress require frequent assessment and early intervention to prevent progression to respiratory failure.
- Avoidance of allergens is critical in the treatment plan for the child with allergic rhinitis.
- Avoidance of allergic triggers, control of the inflammatory process, and education of the child and family are the focus of asthma management.
- Chest physiotherapy is extremely useful for mobilizing secretions in any condition resulting in an increase in mucus production and is required in children with cystic fibrosis.
- Children with chronic respiratory disorders and their families often need large amounts of education and psychosocial support: children often experience fear and isolation, while families must learn to balance care of the chronically ill child with other family life.

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WEBSITES

- Aaron's Tracheostomy Site: www.tracheostomy.com
- Allergy & Asthma Network Mothers of Asthmatics: www.aanma.org/ (offers extensive resources for families with children who have asthma)
- American Academy of Allergy, Asthma, and Immunology: www.aaaai.org
- American College of Allergy, Asthma, and Immunology: www.acaai.org/
- American Lung Association, section on children and asthma: www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=22691
- Asthma and Allergy Foundation of America: www.aafa.org
- Childhood Asthma Foundation: www.childasthma.com/
- Childhood Asthma Research and Education (CARE) Network: www.asthma-carenet.org/ (founded by the National Heart, Lung and Blood Institute)
- Consortium on Children's Asthma Camps: www.asthmacamps.org/asthmacamps/
- Cystic Fibrosis Foundation: www.cff.org
- Cystic Fibrosis Research, Inc.: www.cfri.org
- Cystic Fibrosis Worldwide: www.cfww.org
- Education about asthma, section for children, also available in Spanish: www.noattacks.org
- Information about asthma and children (supported by AstraZeneca): www.asthmaandchildren.com/
- Joint Council of Allergy, Asthma, and Immunology: www.jcaai.org
- National Guideline Clearinghouse: www.guideline.gov
- National Institute of Allergy and Infectious Disease: www.niaid.nih.gov
- Online club for kids with asthma: www.asthmabusters.org/
- Support forum for the cystic fibrosis community: www.cysticfibrosis.com

CHAPTER WORKSHEET

MULTIPLE CHOICE QUESTIONS

- A 5-month-old infant with RSV bronchiolitis is in respiratory distress. The baby has copious secretions, increased work of breathing, cyanosis, and a respiratory rate of 78. What is the most appropriate initial nursing intervention?

 - Attempt to calm the infant by placing him in his mother's lap and offering him a bottle.
 - Alert the physician to the situation and ask for an order for a stat chest x-ray.
 - Suction secretions, provide 100% oxygen via mask, and anticipate respiratory failure.
 - Bring the emergency equipment to the room and begin bag-valve-mask ventilation.
- A toddler has moderate respiratory distress, is mildly cyanotic, and has increased work of breathing, with a respiratory rate of 40. What is the priority nursing intervention?

 - Airway maintenance and 100% oxygen by mask
 - 100% oxygen and pulse oximetry monitoring
 - Airway maintenance and continued reassessment
 - 100% oxygen and provision of comfort
- The nurse is caring for a child with cystic fibrosis who receives pancreatic enzymes. Which statement by the child's mother indicates an understanding of how to administer the supplemental enzymes?

 - "I will stop the enzymes if my child is receiving antibiotics."
 - "I will decrease the dose by half if my child is having frequent, bulky stools."
 - "Between meals is the best time for me to give the enzymes."
 - "The enzymes should be given at the beginning of each meal and snack."
- Which of these factors contributes to infants' and children's increased risk for upper airway obstruction as compared with adults?

 - Underdeveloped cricoid cartilage and narrow nasal passages
 - Small tonsils and narrow nasal passages
 - Cylinder-shaped larynx and underdeveloped sinuses
 - Underdeveloped cricoid cartilage and smaller tongue
- Which is the most appropriate treatment for epistaxis?

 - With the child lying down and breathing through the mouth, apply pressure to the bridge of the nose.
 - With the child lying down and breathing through the mouth, pinch the lower third of the nose closed.
 - With the child sitting up and leaning forward, apply pressure to the bridge of the nose.
 - With the child sitting up and leaning forward, pinch the lower third of the nose closed.

CRITICAL THINKING EXERCISES

- A 10-month-old girl is admitted to the pediatric unit with a history of recurrent pneumonia and failure to thrive. Her sweat chloride test confirms the diagnosis of cystic fibrosis. She is a frail-appearing infant with thin extremities and a slightly protuberant abdomen. She is tachypneic, has retractions, and coughs frequently. Based on the limited information given here and your knowledge of cystic fibrosis, choose three of the categories below as priorities to focus on when planning her care:

 - Prevention of bronchospasm
 - Promotion of adequate nutrition
 - Education of the child and family
 - Prevention of pulmonary infection
 - Balancing fluid and electrolytes
 - Management of excess weight gain
 - Prevention of spread of infection
 - Promoting adequate sleep and rest
- A boy with asthma is admitted to the pediatric unit for the fourth time this year. The mother expresses frustration that he is getting sick so often. Besides information about onset of symptoms and events leading up to this present episode, what other types of information would you ask for while obtaining the history?
- The mother of the boy in the previous question tells you that she smokes (but never around the boy), the family has a cat that comes inside sometimes, and she always gives her son the medication prescribed. She gives salmeterol and budesonide as

soon as he starts to cough. When he is not having an episode, she gives him albuterol before his baseball games. Diphenhydramine helps his runny nose in the springtime. Based on this new information, what advice/instructions would you give the mother?

4. A 7-year-old presents with a history of recurrent nasal discharge. He sneezes every time he visits his cousins, who have pets. He lives in an older home that is carpeted. Tobacco smokers live in the home. His mother reports that he snores and is a mouth breather. She says he has symptoms nearly year-round, but they are worse in the fall and the spring. She reports that diphenhydramine is somewhat helpful with his symptoms, but she doesn't like to give it to him on school days because it makes him drowsy. Based on the history above, develop a teaching plan for this child.
5. The nurse is caring for a 4-year-old girl who returned from the recovery room after a tonsillectomy 3 hours ago. She has cried off and on over the past 2 hours and is now sleeping. What areas should the nurse assess and focus on for this patient?

STUDY ACTIVITIES

1. While caring for children in the pediatric setting, compare the signs and symptoms of a child with asthma to those of an infant with bronchiolitis. What are the most notable differences? How does the history of the two children differ?
2. A child with asthma has been prescribed Advair (fluticasone and salmeterol), albuterol, and prednisone. Develop a sample teaching plan for the child and family. Include appropriate use of the devices used to deliver the medications, as well as important information about the medications (uses and adverse effects).
3. While caring for children in the pediatric setting, compare the signs and symptoms and presentation of a child with the common cold to those of a child with either sinusitis or allergic rhinitis.
4. While caring for children in the pediatric setting, review the census of clients and identify those at risk for severe influenza and thus those who would benefit from annual influenza vaccination.
5. Compare the differences in oxygen administration between a young infant and an older child.