Caring for Clients with Lower Respiratory Disorders

Learning Objectives

On completion of this chapter, you will be able to:

1. Describe infectious and inflammatory disorders of the lower respiratory airway.
2. Identify critical assessments needed for a client with an infectious disorder of the lower respiratory airway.
3. Define disorders classified as obstructive pulmonary disease.
4. Discuss strategies for preventing and managing occupational lung diseases.
5. Describe the pathophysiology of pulmonary hypertension.
6. List risk factors associated with the development of pulmonary embolism.
7. Discuss conditions that may lead to acute respiratory distress syndrome.
8. Differentiate acute and chronic respiratory failure.
10. Describe nursing assessments required for a client who experiences trauma to the chest.
11. Explain the purpose of chest tubes after thoracic surgery.

Various problems and disorders can compromise the ability of the lower respiratory tract to perform its primary functions of gas exchange and ventilation. If untreated, many of these disorders can lead to respiratory failure. Other disorders become chronic and affect the client’s quality of life.

Infectious and Inflammatory Disorders

Infectious and inflammatory disorders of the lower airway are medically more serious than those of the upper airway. Inflammation and infection in the alveoli and bronchioles impair gas exchange. In addition, clients may experience greater difficulty in maintaining a clear airway secondary to retained secretions.

Acute Bronchitis

Pathophysiology and Etiology

Inflammation of the mucous membranes that line the major bronchi and their branches characterizes acute bronchitis. If the inflammatory process involves the trachea, it is referred to as tracheobronchitis. Typically, acute bronchitis begins as an upper respiratory infection (URI);
the inflammatory process then extends to the tracheobronchial tree. The secretory cells of the mucosa produce increased mucopurulent sputum.

Viral infections most commonly give rise to acute bronchitis. Clients with viral URIs are more vulnerable to secondary bacterial infections, which then may lead to acute bronchitis. Sputum cultures identify the causative bacterial organisms, the most common of which are *Haemophilus influenzae*, *Streptococcus pneumoniae*, and *Mycoplasma pneumoniae*. Fungal infections such as *Aspergillus* may be identified as the cause of acute bronchitis. Chemical irritation from noxious fumes, gases, and air contaminants also may induce acute bronchitis. A potential complication is bronchial asthma.

### Assessment Findings

Signs and symptoms initially include fever, chills, malaise, headache, and a dry, irritating, and nonproductive cough. Later, the cough produces mucopurulent sputum, which may be blood-streaked if the airway mucosa becomes irritated with severe tracheobronchitis and coughing. Clients experience paroxysmal attacks of coughing and may report wheezing. Laryngitis and sinusitis complicate the symptoms. Moist, inspiratory crackles may be heard on chest auscultation. A sputum sample is collected for culture and sensitivity testing to rule out bacterial infection. A chest film also may be done to detect additional pathology, such as pneumonia.

### Medical Management

Acute bronchitis usually is self-limiting, lasting for several days. Suggested treatment is bed rest, antipyretics, expectorants, antitusives (drugs used to prevent coughing), and increased fluids. Humidifiers assist in keeping mucous membranes moist because dry air aggravates the cough. If secondary bacterial invasion occurs, the previously mild infection becomes more serious, and usually is accompanied by a persistent cough and thick, purulent sputum. Secondary infections usually subside as the bronchitis subsides, but they may persist for several weeks. When a secondary infection is evident, the physician orders a broad-spectrum antibiotic when sputum culture results are available.

### Pharmacologic Considerations

- The indiscriminate use of nonprescription cough medicines may cause more harm than good. Coughing is the mechanism the body uses to clear the respiratory passages of mucus; depressing the cough reflex may cause a pooling of secretions and lead to further problems. Clients with respiratory disease are advised to check with their physicians before using nonprescription antitusive preparations.

### Nursing Management

The nurse auscultates breath sounds and monitors vital signs every 4 hours, especially if the client has a fever. He or she encourages the client to cough and deep breathe every 2 hours while awake and to expectorate rather than swallow sputum. Humidification of surrounding air loosens bronchial secretions. The nurse changes the bedding and the client’s clothes if they become damp with perspiration and offers fluids frequently. The nurse, in an effort to prevent the spread of infection, teaches the client to wash hands frequently, particularly when handing secretions and soiled tissues; cover the mouth when sneezing and coughing; discard soiled tissues in a plastic bag; and avoid sharing eating utensils and personal articles with others.

### PNEUMONIA

Pneumonia is an inflammatory process affecting the bronchioles and alveoli. Although it usually is associated with an acute infection, pneumonia also can result from radiation therapy, chemical ingestion or inhalation, or aspiration of foreign bodies or gastric contents. Pneumonia, when combined with influenza, ranks as the eighth leading cause of death in the United States (American Lung Association, 2007).

### Pathophysiology and Etiology

Pneumonia is classified according to its etiology. Bacterial pneumonias are referred to as *typical pneumonias*. Atypical pneumonias (Box 21-1) are those caused by mycoplasmas, *Legionella pneumophila* (the causative agent of Legionnaire’s disease), chlamydiae, viruses, parasites, and fungi. *Mycobacterium tuberculosis* also may cause pneumonia. Viruses are the most common etiology, with influenza type A virus the usual causative organism. Bacterial pneumonias are less common but more serious. Causative bacterial organisms include *Streptococcus pneumoniae*, *Pneumocystis*.

### BOX 21-1 Atypical Pneumonias

<table>
<thead>
<tr>
<th>Organism</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Mycoplasma pneumoniae</em></td>
<td>Is the most common cause of atypical pneumonia</td>
</tr>
<tr>
<td></td>
<td>Develops gradually, with a prolonged clinical course</td>
</tr>
<tr>
<td></td>
<td>Is rarely fatal</td>
</tr>
<tr>
<td><em>Chlamydia pneumoniae</em></td>
<td>Is a common cause of pneumonia and URIs</td>
</tr>
<tr>
<td></td>
<td>Requires long-term treatment with broad-spectrum antibiotics</td>
</tr>
<tr>
<td><em>Chlamydia psittaci</em></td>
<td>Causes psittacosis, a flulike disease progressing to irregular consolidation and interstitial pneumonia</td>
</tr>
<tr>
<td></td>
<td>Is transmitted from birds and sheep</td>
</tr>
<tr>
<td><em>Legionella pneumophila</em></td>
<td>Was first described at an American Legion convention in Philadelphia, Pennsylvania</td>
</tr>
<tr>
<td></td>
<td>Is a fastidious bacterium that resides in aquatic environments</td>
</tr>
<tr>
<td></td>
<td>Outbreaks traced to air conditioners and humidifiers</td>
</tr>
<tr>
<td></td>
<td>Is rapid growing, causing inflammation and fibrin formation within the alveoli, and often complicated by empyema</td>
</tr>
<tr>
<td></td>
<td>Symptoms include fever, cough, and chest pain, with a mortality rate of 10% to 20%</td>
</tr>
</tbody>
</table>
CHAPTER 21 Caring for Clients with Lower Respiratory Disorders

White blood cells (WBCs) move into the area to destroy the pathogens, filling the interstitial spaces. If untreated, consolidation occurs as the inflammation and exudate increase. Hypoxemia results from the inability of the lungs to oxygenate blood from the heart. Bronchitis, tracheitis (inflammation of the trachea), and spots of necrosis (death of tissue) in the lung may follow.

In atypical pneumonias, the exudate infiltrates the interstitial spaces rather than the alveoli directly. The pneumonia is more scattered, as described for bronchopneumonia. As the inflammatory process continues, it increasingly interferes with gas exchange between the bloodstream and lungs. Increased carbon dioxide (CO₂) in the blood stimulates the respiratory center, causing more rapid and shallow breathing.

Without an interruption of any type of pneumonia, the client becomes increasingly ill. If the circulatory system cannot compensate for the burden of decreased gas exchange, the client is at risk for heart failure. Death from pneumonia is most common in older adults and those weakened by acute or chronic diseases or disorders (e.g., acquired immunodeficiency syndrome [AIDS], cancer, lung disease) or prolonged periods of inactivity. Complications of pneumonia include congestive heart failure (CHF), empyema (collection of pus in the pleural cavity), pleurisy (inflammation of the pleura), septicemia (infective microorganisms in the blood), atelectasis, hypotension, and shock. In addition, septicemia may lead to a secondary focus of infection, such as endocarditis (inflammation of the endocardium), pericarditis (inflammation of the pericardium), and purulent arthritis. Otitis media (infection of the middle ear), bronchitis, or sinusitis also may complicate recovery, especially from atypical pneumonia.

**Gerontologic Considerations**

- Older adults are at greater risk for pneumonia and may experience a higher acuteness due to comorbid health problems, such as heart disease and diabetes. Vaccination against pneumococcal pneumonia is recommended for clients older than 50 years with a chronic or debilitating illness, those over age 65, and residents in long-term care facilities. Current guidelines recommend a booster dose if the initial immunization was 5 or more years ago. Older adults should also be advised to receive an annual influenza immunization.

**Assessment Findings**

**Signs and Symptoms**

Symptoms vary for the different types of pneumonia. The onset of bacterial pneumonia is sudden. The client experiences fever, chills, a productive cough, and discomfort in the chest wall muscles from coughing. There also is general malaise. The sputum may be rust colored. Breathing causes pain; thus, the client tries to breathe as shallowly as possible.

Viral pneumonia differs from bacterial pneumonia in that results of blood cultures are sterile, sputum may be more copious, chills are less common, and pulse and respiratory rates are characteristically slow. The course of viral pneumonia...
secretions and positioning of the client to drain and remove

draining techniques that involve manual pounding or clapping to loosen
bed rest, chest physical therapy and postural drainage (techniques to
help to loosen secretions and replace fluids lost through fever
and electrolyte replacement sometimes is necessary sec-
during the period of treatment.

If a client is hospitalized, treatment is more vigorous,
and the nurse monitors fluid intake and output, skin turgor,
vital signs, and serum electrolytes. He or she administers antipyretics
as indicated and ordered.

Auscultation of the chest reveals wheezing, crackles,
and decreased breath sounds. The nail beds, lips, and oral mucosa
may be cyanotic. Sputum culture and sensitivity studies can
help identify the infectious microorganism and effective anti-
biotics for treatment in cases of bacterial pneumonia. A chest
film shows areas of infiltrates and consolidation. A complete
blood count discloses an elevated WBC count. Blood cultures
also may be done to detect any microorganisms in the blood.

A newer and more efficient method to diagnose pneumo-
nia is called an electronic nose or “e-nose.” The maker,
Cyrano Sciences, Inc., calls this device the Cyanose 320.
Although not yet fully approved by the U. S. Food and Drug
Administration, this hand-held device senses and evaluates
exhaled breath for various types of pneumonia and sinusitis.
Tests indicate a 70% to 90% accuracy rate, which is similar to
standard testing. The e-nose also provides diagnosis in approxi-
mately 40 minutes, whereas standard testing results are usu-
ally not available for several hours (“Sniffing out,” 2004).

Diagnostic Findings
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Medical Management
Medical management involves prompt initiation of antibi-
octherapy for bacterial pneumonia, hydration to thin
secretions, supplemental oxygen to alleviate hypoxemia,
bed rest, chest physical therapy and postural drainage (tech-
niques that involve manual pounding or clapping to loosen
secretions and positioning of the client to drain and remove

secretions from specific areas of the lungs), bronchodilat-
ators, analgesics, antipyretics, and cough expectorants or
suppressants, depending on the nature of the client’s cough.
If a client is hospitalized, treatment is more vigorous,
depending on the potential or actual complications. Fluid
and electrolyte replacement sometimes is necessary sec-
dary to fever, dehydration, and inadequate nutrition. If
the client experiences severe respiratory difficulty and
and thick, copious secretions, he or she may require intubation
along with mechanical ventilation.

Nursing Management
The nurse auscultates lung sounds and monitors the client
for signs of respiratory difficulty. He or she checks oxy-
genation status with pulse oximetry and monitors arterial blood
gases (ABGs). Assessments of cough and sputum produc-
tion also are necessary.

The nurse places the client in the semi-Fowler’s position to
aid breathing and increase the amount of air taken with each
breath. Increased fluid intake is important to encourage because
it helps to loosen secretions and replace fluids lost through fever
and increased respiratory rate. The nurse monitors fluid intake
and output, skin turgor, vital signs, and serum electrolytes. He
or she administers antipyretics as indicated and ordered.

Identifying clients at risk for pneumonia provides a
means to practice preventive nursing care. Box 21-2 identifies
strategies to implement for clients who are at risk for pneumo-
nia. In addition, nurses encourage at-risk and elderly clients to
receive vaccination against pneumococcal and influenza
infections. Because the nursing care of clients with infectious
lung disorders is similar regardless of the etiology, refer to
“Nursing Process: Tuberculosis” for additional interventions.

TABLE 21-1 Categories of Pneumonia

<table>
<thead>
<tr>
<th>TYPE</th>
<th>ORGANISM RESPONSIBLE</th>
<th>COMMON CLINICAL MANIFESTATIONS</th>
<th>USUAL TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Community-Acquired Pneumonia (CAP)</strong></td>
<td>Streptococcus pneumoniae</td>
<td>Abrupt or insidious onset; one or more lobes involved; flu-like symptoms; lobar infiltrates seen on x-ray; pleu-ritic and/or chest pain; often begins with a URI</td>
<td>Penicillins or alternative antibiot-ics such as cefotaxime, cephalo-spoin, erythromycin, or others</td>
</tr>
<tr>
<td>Streptococcal pneumonia (pneumococcal)</td>
<td>Haemophilus influenzae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haemophilus influenzae</td>
<td>Legionella pneumophila</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legionnaire’s disease</td>
<td>Mycoplasma pneumoniae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mycoplasma pneumoniae</td>
<td>Influenza virus types A, B, adenovirus, parainfluenza, cytomegalovirus, coronavirus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viral pneumonia</td>
<td>Chlamydia pneumoniae</td>
<td></td>
<td></td>
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<tr>
<td>Chlamydia pneumonia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hospital-Acquired Pneumonia (HAP)</strong></td>
<td>Pseudomonas aeruginosa</td>
<td>Diffuse consolidation on chest x-ray; fever; chills; productive cough; bacteremia; cyanosis; hypoxemia; clients have toxic appearance; can get lung abscesses</td>
<td>Antibiotics; antipseudomonal agents such as piperacillin; rifampin or gentamycin; third-generation cephalosporins</td>
</tr>
<tr>
<td>Staphylococcal pneumonia</td>
<td>Staphylococcus aureus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Klebsiella pneumonia</td>
<td>Klebsiella pneumoniae</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pneumonia in Immunocompromised Host</strong></td>
<td>Pneumocystis carinii pneumonia (PCP)</td>
<td>Pulmonary infiltrates on chest x-ray; cough; dyspnea; hemoptysis; fever; night sweats; weight loss</td>
<td>Trimethoprim/sulfamethoxazole (TMP-SMZ); amphotericin B; rifampin; streptomycin</td>
</tr>
<tr>
<td>Pneumocystis carinii</td>
<td>Pneumocystis carinii</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fungal pneumonia</td>
<td>Aspergillus fumigatus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mycobacterium tuberculosis</td>
<td>Mycobacterium tuberculosis</td>
<td></td>
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</tr>
</tbody>
</table>

PLEURISY

Pleurisy or pleuritis refers to acute inflammation of the parietal and visceral pleurae. During the acute phase, the pleurae are inflamed, thick, and swollen, and an exudate forms from fibrin and lymph. Eventually the pleurae become rigid. During inspiration, the inflamed pleurae rub together, causing severe, sharp pain.

Pathophysiology and Etiology

Pleurisy usually is a consequence of a primary condition, such as pneumonia or other pulmonary infections. The inflammatory process spreads from the lungs to the parietal pleura. Pleurisy also may develop with tuberculosis (TB), lung cancer, cardiac and renal diseases, systemic infections, or pulmonary embolism.

Assessment Findings

Respirations become shallow secondary to excruciating pain. Pleural fluid accumulates as the inflammatory process worsens. The pain decreases as the fluid increases because the fluid separates the pleurae. The client develops a dry cough, fatigues easily, and experiences dyspnea. A friction rub (coarse sounds heard during inspiration and early expiration) is heard during auscultation early in the disease process. As fluid accumulates, the pleural friction rub disappears. Decreased ventilation may result in atelectasis, hypoxemia, and hypercapnia.

Chest radiography shows changes in the affected area. Microscopic examination of sputum and a sputum culture may reveal pathogenic microorganisms. If a thoracentesis (removal of fluid from the chest; see Chap. 19) is performed, a pleural fluid specimen is sent to the laboratory for analysis. Occasionally the physician may perform a pleural biopsy.

Medical Management

The underlying condition dictates the treatment. Analgesic and antipyretic drugs provide relief for pain and fever. A nonsteroidal anti-inflammatory drug (NSAID) such as indomethacin (Indocin) provides analgesia and promotes more effective coughing. Severe cases may require a procaine intercostal nerve block.

Nursing Management

The client has considerable pain with inspiration; sneezing and coughing make the pain worse. The nurse instructs the client to take analgesic medications as prescribed. Heat or cold applications may provide some topical comfort. The nurse teaches the client to splint the chest wall by turning onto the affected side. The client also can splint the chest wall with his or her hands or a pillow when coughing. Providing emotional support is essential—the client is very anxious and needs reassurance.

PLEURAL EFFUSION

Pleural effusion is an abnormal collection of fluid between the visceral and parietal pleurae (Fig. 21-2). Under normal conditions, approximately 5 to 15 mL of fluid between the pleurae prevent friction during pleural surface movement. Pleural effusion may be a complication of pneumonia, lung cancer, TB, pulmonary embolism, and CHF. The amount of accumulated fluid may be so large that the lung partially collapses on the affected side. As a consequence, pressure is placed on the heart and other organs of the mediastinum.

Assessment Findings

Fever, pain, and dyspnea are the most common symptoms. Chest percussion reveals dullness over the involved area. The examiner may note diminished or absent breath sounds over the involved area when auscultating the lungs; he or she also may hear a friction rub. Chest radiography and computed tomography (CT) scan show fluid in the involved area. Thoracentesis sometimes is done to remove pleural fluid for analysis and examination for malignant cells.

Medical Management

The main goal of treatment is to eliminate the cause and relieve discomfort. Treatment includes antibiotics, analgesics,
cardiotoxic drugs to control CHF (when present), thoracentesis to remove excess pleural fluid, insertion of a chest tube to promote drainage over a longer period, and surgery for cancer when present.

**Nursing Management**

If thoracentesis is needed, the nurse prepares the client for this procedure (see Nursing Guidelines 19-3 in Chap. 19). The client usually is frightened; thus, the nurse must provide support. If a client has a chest tube, the nurse monitors the function of the drainage system and the amount and nature of the drainage (see discussion later in the chapter).

**LUNG ABSCESS**

A **lung abscess** is a localized area of pus formation in the lung parenchyma. As the abscess increases, the tissue becomes necrotic. Later, the affected area collapses and creates a cavity. The infection can then extend into one or both bronchi and the pleural cavity.

**Pathophysiology and Etiology**

A lung abscess may develop from aspiration, bacterial pneumonia, or mechanical obstruction of the bronchi, such as with a tumor. Other causes include necrosis of lung tissue after an infection and necrotic lesions resulting from inhalation of dust particles. Clients with an impaired cough reflex or altered immune function are at risk for lung abscesses.

**Assessment Findings**

Signs and symptoms include chills, fever, weight loss, chest pain, and a productive cough. Sputum may be purulent or blood streaked. Finger clubbing may occur in chronic cases. Chest auscultation reveals dull or absent breath sounds in the area of the abscess. Chest radiography and CT scan usually locate the abscess. Results of blood and sputum cultures may be positive for pathogens. Chest percussion detects an area of dullness. In some instances, thoracentesis may be done, with the aspirated fluid sent to the laboratory for culture and sensitivity tests.

**Medical and Surgical Management**

Postural drainage and antibiotics assist in controlling the infection. Occasionally, a lobectomy is performed to remove the abscess and surrounding lung tissue.

**Nursing Management**

The nurse monitors the client for possible adverse effects of antibiotics. He or she administers chest physical therapy as indicated and encourages the client to deep breathe and cough frequently. A diet high in protein and calories is pivotal. The nurse provides emotional support, while being honest with the client that the lung abscess may take a long time to resolve.

**EMPIYEMA**

Empyema is a general term used to denote pus in a body cavity. It usually refers, however, to pus or infected fluid in the pleural cavity (**thoracic empyema**). Empyema may follow chest trauma, such as a stab or gunshot wound, or a preexisting disease, such as pneumonia or TB. The pus-filled area may become walled off and enclosed by a thick membrane.

**Assessment Findings**

Fever, chest pain, dyspnea, anorexia, and malaise may accompany empyema. Chest auscultation reveals diminished or absent breath sounds over the affected area. The affected lung area is distinguished on a chest radiograph.

**Medical and Surgical Management**

Aspiration of purulent fluid by thoracentesis may be necessary to identify the microorganisms, remove pus or fluid, and select appropriate antibiotic therapy. Closed drainage may be used to empty the empyemic cavity. **Thoracotomy** (surgical opening of the thorax) is performed, and one or more large chest tubes are inserted, which are then connected to an underwater-seal drainage bottle. Open drainage, which necessitates the removal of a section of one or more ribs, may be used when pus is thick and the walls of the empyemic cavity are strong enough to keep the lung from collapsing while the chest is opened. One or more tubes may be placed in the opening to promote drainage. The wound is then covered by a large absorbent dressing, which is changed as necessary. The drainage of pus results in a drop in temperature and general symptomatic improvement.

Inadequately treated empyema may become chronic. A thick coating forms over the lung, preventing its expansion. **Decortication** (removal of the coating) and evacuation of the pleural space allow the lung to reexpand.

**Nursing Management**

Empyema takes a long time to resolve. The client requires emotional support during treatment. The nurse teaches the client to do breathing exercises as prescribed.

**INFLUENZA**

**Influenza** (flu) is an acute respiratory disease of relatively short duration. The major strains of the flu virus are A, B, and C; the strains are related yet distinct from one another. Each virus can mutate and produce variants within the given strain. The variants are called **subtypes**. Viruses that cause influenza are transmitted through the respiratory tract.

Flu chiefly occurs in epidemics, although sporadic cases appear between them. Because the viruses change, antibodies produced by those who have had one case of flu are not effective against new subtypes, and a different antibody must be produced annually or during major epidemics. Most clients recover. Fatalities usually are related to secondary bacterial complications, especially among pregnant women, elderly or debilitated clients, and those with chronic conditions, such as cardiac disease and emphysema.

During a flu epidemic, the death rate from pneumonia and cardiovascular disease rises. According to the Centers for Disease Control and Prevention, each year 5% to 20% of the population in the United States is diagnosed with influenza; more than 200,000 people are hospitalized, and approximately 36,000 people die (CDC, 2008). Complications include tracheobronchitis, bacterial pneumonia, and
cardiovascular disease. Staphylococcal pneumonia is the most serious complication.

Table 21-2 lists signs and symptoms of flu that form the basis for diagnosis. Additional diagnostic studies, such as chest radiography and sputum analysis, may be performed to rule out other diseases.

Nursing management focuses on prevention. Annual flu vaccinations are recommended for healthcare workers and people at high risk for complications or for those exposed to many different people daily. Each year a new vaccine is developed from three different virus strains that are predicted to be present in the coming flu season. The standard flu vaccine is made from inactivated influenza vaccine and is administered intramuscularly. During the 2004–2005 flu season, another form called FluMist was developed, which is a live, attenuated influenza vaccine administered intranasally. It is currently approved for healthy children aged 2 to 5 years, who do not have a history of asthma and wheezing, and for healthy persons between the ages of 5 and 49 years who are not pregnant (CDC, 2008). FluMist is not recommended for the following groups:

- People with underlying medical conditions such as diabetes or renal dysfunction
- People with known or suspected immunodeficiency diseases or those receiving immunosuppressive therapy
- People with a history of Guillain-Barré syndrome
- Children or adolescents who regularly take aspirin
- Pregnant women
- People with a hypersensitivity to eggs
- Children less than 2 years of age
- Adults 50 years of age and older

Clients admitted to the hospital with flu need to be isolated from clients who do not have it. Nurses must maintain airborne transmission precautions when caring for those clients. If a community is experiencing an epidemic, hospitals and other healthcare facilities usually develop policies regarding visitation and admissions. Box 21-3 provides information on preventing an influenza outbreak in a healthcare facility.

**PULMONARY TUBERCULOSIS**

Pulmonary tuberculosis (TB) is a bacterial infectious disease primarily caused by *M. tuberculosis*. TB essentially affects the lungs, but it may also affect the kidneys and other organs. TB continues to be a worldwide health problem. It affects one third of the world’s population and is the leading cause of death from infectious diseases and among people with human immunodeficiency virus (HIV) infection (World Health Organization [WHO], 2007). In the United States, as in much of the world, new cases of TB are slowly declining. Only in African countries is the incidence of new cases of

**BOX 21-3 Preventing Outbreaks of Influenza in Healthcare Settings**

To prevent outbreaks of influenza, healthcare settings take the following precautions in addition to Standard Precautions:

- Institute droplet precautions for air clients with suspected or confirmed influenza.
- Isolate clients with cases of suspected and confirmed influenza in private rooms, or place clients with possible pneumonia together and clients with confirmed pneumonia together.
- Administer antiviral prophylaxis according to current recommendations to all clients on an affected unit who do not appear to have influenza and for whom it is not contraindicated to receive the antiviral.
- Administer the current inactivated influenza vaccine to unvaccinated clients and healthcare personnel.
- Offer antiviral prophylaxis to unvaccinated personnel who work on the affected unit.
- Do not allow visitors with symptoms of respiratory infection to visit the hospital.
- Encourage personnel with symptoms of respiratory infection to stay at home until they are well.

TB increasing, and this correlates with the higher incidence of HIV (2005). The WHO is committed to stopping tuberculosis throughout the world. Organizations such as the Bill and Melinda Gates Foundation (2008) have donated major funding for the development, testing, licensing, and distribution of at least one new TB vaccine within 10 years.

**Gerontologic Considerations**

- The incidence of tuberculosis in older adults is twice that of the general population; tuberculosis is most prevalent in those aged 65 or older residing in long-term care facilities. The current cohort of older adults may have initially acquired tuberculosis during childhood or World War II; the disease may be reactivated by aging or treatment changes influencing immunity (Ebersole et al., 2008).

**Pathophysiology and Etiology**

Tubercle bacilli are gram positive, rod shaped, acid-fast, and aerobic. Although they can live in the dark for months as spores in particles of dried sputum, exposure to direct sunlight, heat, or ultraviolet light destroys them in a few hours. They are difficult to kill with ordinary disinfectants and are destroyed by pasteurization, a process widely used in milk and milk products to prevent the spread of TB.

TB is transmitted most commonly through the inhalation of droplets produced by coughing, sneezing, and spitting from a person with active disease. Brief contact usually does not result in infection. In contrast to the number of people who have been infected with tubercle bacilli, only a small proportion ever becomes ill. Many factors predispose a client to the development of TB, including inadequate healthcare, malnutrition, overcrowding, and poor housing.

The classification of TB is based on the client’s history, physical examination, skin test, chest x-ray, and microbiologic tests. The American Thoracic Society classifies tuberculosis in a systematic way to monitor the epidemiology and treatment. The classification is as follows (Smeltzer et al., 2008, p. 646):

- **Class 0:** no exposure; no infection
- **Class 1:** exposure; no evidence of infection
- **Class 2:** latent infection; no disease (e.g., positive PPD reaction but no clinical evidence of active TB)
- **Class 3:** disease; clinically active
- **Class 4:** disease; not clinically active
- **Class 5:** suspected disease; diagnosis pending

TB is characterized by stages of early infection (or primary TB), latency, and potential for recurrence after the primary disease (called secondary TB). The bacilli may remain dormant for many years and then reactivate, producing clinical symptoms of TB.

**Early Infection**

Tubercle bacilli, when inhaled, pass through the bronchial system and implant on the bronchioles or alveoli. Initially, the host has no resistance to this infection. Phagocytes (neutrophils and macrophages) engulf the bacilli, which continue to multiply. The bacilli also spread through the lymphatic channels to the regional lymph nodes and subsequently to the circulating blood and distant organs. Eventually, the cellular immune response limits further multiplication and dissemination of the bacilli.

**Immune Activation**

When immune activation occurs (usually a full response occurs within 2 weeks), a characteristic tissue reaction results in formation of a granuloma, referred to as the *Ghon tubercle*, from epithelial cells merging with the macrophages. Lymphocytes surround the Ghon tubercle, of which the central portion undergoes necrosis. This caseous necrosis has a cheesy appearance and may liquefy and slough into the connecting bronchus, producing a cavity. It also may enter the tracheobronchial system, promoting airborne transmission of infectious particles.

**Healing of the Primary Lesion**

Healing of the primary lesion occurs through resolution, fibrosis, and calcification. The granulation tissue of the primary lesion becomes more fibrous and creates a scar around the tubercle. This is referred to as the *Ghon complex* and is visible on radiography.

**Latent Period**

As the lesion heals, the infection enters a latent period that can persist for many years or even an entire lifetime without producing clinical symptoms. If the immune response has been inadequate, however, the affected person eventually will develop clinical disease. Clients at particular risk are those with HIV infection or diabetes and those on chemotherapy or long-term steroids. Only a small percentage of those infected with TB actually develop clinical symptoms.

**Secondary Tuberculosis**

Secondary TB usually involves reactivation of the initial infection. The person already has had an immune response, and thus the lesions that form tend to remain in the lungs. The course of this phase usually is as follows:

1. Acute local inflammation and necrosis occur.
2. Infected lung tissue becomes ulcerated.
3. Tubercles cluster together and become surrounded by inflammation.
4. Exudate fills the surrounding alveoli.
5. The client develops bronchopneumonia.
6. TB tissue becomes caseous and ulcerates into the bronchus.
7. Cavities form.
8. Ulcerations heal, with scar tissue left around cavities.
9. Pleurale thicken and retract.

The course of TB becomes a cyclical one of inflammation, bronchopneumonia, ulceration, cavitation, and scarring. The TB gradually spreads throughout the lung fields and into the rest of the respiratory structures, as well as to other organs through the lymphatic system. A client may experience periods of exacerbation, followed by remissions.

**Assessment Findings**

**Signs and Symptoms**

The onset of TB is insidious, and early symptoms vary. An infected person may be asymptomatic until the disease is
advanced. As symptoms develop, they often are vague and can be overlooked, particularly because they are systemic. Fatigue, anorexia, weight loss, and a slight, nonproductive cough are all symptoms attributable to overwork, excessive smoking, or poor eating habits. They also, however, are early symptoms of TB. Low-grade fever, particularly in the late afternoon, and night sweats are common as the disease progresses. The cough typically becomes productive of mucopurulent and blood-streaked sputum. Marked weakness, wasting, hemoptysis (expectoration of blood or bloody sputum), and dyspnea are characteristics of later stages. Chest pain may result from spread of the infection to the pleurae.

Diagnostic Findings
Diagnostic tests chiefly consist of the tuberculin skin test, chest radiography, CT scan, magnetic resonance imaging (MRI), and analysis of sputum and other body fluids. The tuberculin skin test, or Mantoux test, determines if a client has been infected with *M. tuberculosis* (Nursing Guidelines 21-1). A positive tuberculin skin test result is evidence that a TB infection has existed at some time somewhere in the body, but does not necessarily indicate active disease. The chief value of tuberculin skin tests lies in case finding. All long-term care facilities are required to test each resident on admission for TB.

Microscopic examination of sputum and other body fluids identifies the bacilli and is ordered when TB is suspected, during and after a course of drug therapy for TB, and after surgical removal of a diseased lobe of the lung. The client is instructed to cough deeply so that the specimen does not consist mainly of saliva. Most clients find that it is easier to raise sputum when they first awaken. It may be necessary to collect specimens on several consecutive days (see Nursing Guidelines 19-2 in Chap. 19).

Gastric lavage, gastric aspiration, or bronchoscopy may be used to determine the presence of the tubercle bacilli, particularly when a client has had difficulty raising a sputum specimen for examination. Tubercle bacilli may reach the stomach from the lungs when the client raises sputum but swallows rather than expectorates it. When invasion of other body areas by tubercle bacilli is suspected, specimens are obtained to confirm the diagnosis.

Medical and Surgical Management
In many cases, drugs have speeded recovery and provided a chance to arrest TB in clients with advanced lesions; however, they do not guarantee a cure. Their usefulness lies in their ability to retard the growth and multiplication of tubercle bacilli, thus giving the body a chance to overcome the disease. Two factors make drug therapy less than ideal: drug toxicity and the tendency of the tubercle bacilli to develop drug resistance. Combined therapy with two or more drugs decreases the likelihood of drug resistance, increases the tuberculostatic action of the drugs, and lessens the risk for toxic drug reactions (Drug Therapy Table 21-1).

**Pharmacologic Considerations**
- Isoniazid (INH) is used in combination with other antitubercular drugs and alone as a prophylactic to prevent the spread of TB. For example, INH may be given to household members and close associates of those recently diagnosed with TB.

Resistance of the bacilli to drugs is an important factor in the lack of response to medical treatment. Drug therapy usually is carried out while the client is at home. Regular...
visits to the physician’s office or clinic for follow-up care are necessary for assessment of response to therapy. Culture and sensitivity tests may be performed, and the adverse effects of the drugs are evaluated.

When the disease is located primarily in one section of the lung, that portion may be removed by segmental resection (removal of a lobe segment) or wedge resection (removal of a wedge of diseased tissue). If the diseased area is larger, lobectomy (removal of a lobe) may be performed. In some cases, the lung is so diseased that pneumonectomy (removal of an entire lung) is necessary (Box 21-4).

**Nursing Process for the Client with Pulmonary Tuberculosis**

**Assessment**
Assess breath sounds, breathing patterns, and overall respiratory status. Ask the client about any pain or discomfort experienced with breathing. Inspect the client’s sputum for color, viscosity, amount, and signs of blood. Clients with primary TB may have complaints related to fatigue, weakness, anorexia, weight loss, or night sweats. Clients with secondary TB may report chest pain and a cough that produces mucopurulent or blood-tinged mucus or blood. They also may report a low-grade fever.

**Diagnosis, Planning, and Interventions**
Antitubercular drug regimens extend for long periods and without interruption because healing is slow and interrupted treatment increases drug resistance. The primary focus of nursing management is encouraging the client to adhere to the prescribed medication regimen and teaching.

Instruct the client to take medications exactly as prescribed, closely observing the time interval between each dose. Clients must not skip doses or take more than the amount prescribed. Clients need to complete the entire course of drug therapy to control infection. Continuous therapy is essential because lapses in taking the prescribed drugs can result in reactivation of the infection. Advise clients to notify the physician if symptoms worsen or sudden chest pain or dyspnea develops. Clients also should drink plenty of fluids, discontinue smoking immediately, and avoid exposure to secondhand smoke. They need to eat a balanced diet with ample protein and calories to promote healing and maintain weight.

Other nursing care includes the following diagnoses, outcomes, and interventions.

**Expected Outcome:** Client will effectively clear secretions.

- Ineffective Airway Clearance related to pain with coughing, inability to cough, and abnormal respirations.

**Instruct**
The client to take medications exactly as prescribed, closely observing the time interval between each dose. Clients must not skip doses or take more than the amount prescribed. Clients need to complete the entire course of drug therapy to control infection. Continuous therapy is essential because lapses in taking the prescribed drugs can result in reactivation of the infection. Advise clients to notify the physician if symptoms worsen or sudden chest pain or dyspnea develops. Clients also should drink plenty of fluids, discontinue smoking immediately, and avoid exposure to secondhand smoke. They need to eat a balanced diet with ample protein and calories to promote healing and maintain weight.

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**BOX 21-4 Types of Lung Resections**

- **Lobectomy:** single lobe of lung removed
- **Bilobectomy:** two lobes of lung removed
- **Sleeve resection:** cancerous lobe(s) removed and a segment of the main bronchus resected
- **Pneumonectomy:** removal of entire lung
- **Segmentectomy:** segment of lung removed
- **Wedge resection:** removal of small, pie-shaped area of the segment
- **Chest wall resection with removal of cancerous lung tissue:** for cancers that have invaded the chest wall

Prioritize necessary tasks, eliminating nonessential tasks. Proper analgesic administration provide more effective pain control. Provide instructions about postural drainage. Postural drainage facilitates airway drainage and clearance.

**Expected Outcome:** The client manages pain with analgesics and use of splinting techniques when coughing. Evaluate effectiveness of pain relief measures. Such evaluation helps the nurse to determine if measures are effective or other therapies are necessary. Administer analgesics as indicated. Proper pain assessment and appropriate analgesic administration provide more effective pain control. Instruct client in splinting techniques for use during coughing. Proper splinting decreases pain and facilitates expectoration of secretions.

**Activity Intolerance** related to general weakness, respiratory difficulties, fever, and severity of illness.

**Expected Outcome:** The client manages secretions with effective coughing, increased fluid intake, and appropriate postural drainage. He or she reports adequate pain relief and can tolerate increased amounts of time out of bed and perform most ADLs. The client adheres to treatment regimen and schedules tests for liver and kidney function.

**Stop, Think, and Respond Exercise 21-1**
A client diagnosed with TB lives in a four-room apartment with his wife. What precautions must the couple follow?

**OBSTRUCTIVE PULMONARY DISEASES**

Obstructive pulmonary disease describes conditions in which airflow in the lungs is obstructed. Resistance to inspiration is decreased, whereas resistance to expiration is increased, so that the expiratory phase of respiration is prolonged (Bullock & Henze, 2000). *Chronic obstructive pulmonary disease* (COPD) is an umbrella term for chronic lung diseases that have limited airflow in and out of the lungs. Symptoms of COPD include chronic cough and expectoration, dyspnea, and shortness of breath, wheezing, and impaired expiratory airflow. Bronchiectasis, atelectasis, chronic bronchitis, and emphysema, although not categorized as COPD, involve chronic impairment of airflow. Asthma also is an obstructive disorder that is more episodic and usually more acute than COPD. Sleep apnea syndrome also can have obstructive causes (see Chap. 20). Cystic fibrosis also has obstructive characteristics and is included in this section.

**BRONCHIECTASIS**

Bronchiectasis is found in clients with COPD and is characterized by chronic infection and irreversible dilatation of the bronchi and bronchioles. Causes include bronchial obstruction by tumor or foreign body, congenital abnormalities, exposure to toxic gases, and chronic pulmonary infections. When clearance of the airway is impeded, an infection can develop in the walls of the bronchus or bronchioles. The structure of the wall tissue subsequently changes, resulting in formation of saccular dilatations, which collect purulent material. Airway clearance is further impaired, and the purulent material remains, causing more dilatation, structural damage, and more infection.
Assessment Findings
Clients with bronchiectasis experience a chronic cough with expectoration of copious amounts of purulent sputum and possible hemoptysis. The coughing worsens when the client changes position. The amount of sputum produced during one paroxysm varies with the stage of the disease, but it can be several ounces. When the sputum is collected, it settles into three distinct layers: the top layer is frothy and cloudy, the middle layer is clear saliva, and the bottom layer is heavy, thick, and purulent. Clients also experience fatigue, weight loss, anorexia, and dyspnea.

Chest radiography and bronchoscopy demonstrate the increased size of the bronchioles, possible areas of atelectasis, and changes in the pulmonary tissue. Sputum culture and sensitivity tests identify the causative microorganism and effective antibiotics to control the infection. Pulmonary function studies also may be done.

Medical Management
Treatment of bronchiectasis includes drainage of purulent material from the bronchi; antibiotics, bronchodilators, and mucolytics to improve breathing and help raise secretions; humidification to loosen secretions; and surgical removal if bronchiectasis is confined to a small area.

Nursing Management
Nursing management focuses on instructing the client in postural drainage techniques, which help the client mobilize and expectorate secretions. The positions for the client to assume depend on the site or lobe to be drained. Figure 21-3 shows positions that drain specific segments of all lobes of the lungs. The client remains in each position for 10 to 15 minutes. Chest percussion and vibration may be performed during this time. When complete, the client coughs and expectorates the secretions. This procedure may be repeated. The nurse provides oral hygiene after treatment.

ATELECTASIS
Clients with COPD are at greater risk for developing atelectasis, the collapse of alveoli (Fig. 21-4). Atelectasis may involve a small portion of the lung or an entire lobe. When alveoli collapse, they cannot perform their function of gas exchange. Atelectasis occurs secondary to aspiration of food or vomitus, a mucus plug, fluid or air in the thoracic cavity, compression on tissue by tumors, an enlarged heart, an aneurysm, or enlarged lymph nodes in the chest. Ill clients may experience atelectasis when on prolonged bed rest, when unable to breathe deeply or cough and raise secretions, or both.

Assessment Findings
The amount of involved lung tissue determines the extent of the symptoms. Small areas of atelectasis may cause few symptoms. With larger areas, cyanosis, fever, pain, dyspnea, increased pulse and respiratory rates, and increased pulmonary secretions may be seen. Although crackling may be auscultated over the affected areas, usually breath sounds are absent. A chest radiograph reveals dense shadows, indicating collapsed lung tissue. Sometimes the radiograph results are inconclusive. ABG and pulse oximetry results may be abnormal.

Medical Management
Treatment includes improving ventilation, suctioning, and deep breathing and coughing to raise secretions. Bronchodilators and humidification assist in loosening and removing secretions. Oxygen is administered for dyspnea. Removal of the cause of atelectasis helps to correct the condition.

Nursing Management
Nursing care focuses on preventing atelectasis (Box 21-5), especially when the client is at risk because of failure to aerate the lungs properly. Postoperative deep breathing and coughing can prevent atelectasis. If atelectasis occurs, the nurse encourages the client to take deep breaths and cough at frequent intervals and instructs the client in the use of an incentive spirometer (Client and Family Teaching 21-1).

CHRONIC BRONCHITIS
Chronic bronchitis is a prolonged (or extended) inflammation of the bronchi, accompanied by a chronic cough and excessive production of mucus for at least 3 months each year for 2 consecutive years. This serious health problem develops gradually and may go untreated for many years until the disease is well established.
Pathophysiology and Etiology

Chronic bronchitis is characterized by hypersecretion of mucus and recurrent or chronic respiratory tract infections. As the infection progresses, the ability of the cilia that line the airway to propel secretions upward becomes significantly altered. Secretions remain in the lungs and form plugs in the smaller bronchi. These plugs become areas for bacterial growth and chronic infection, which increases mucous secretion and eventually causes areas of focal tissue death. Airway obstruction results from the bronchial inflammation (Fig. 21-5).

Multiple factors are associated with chronic bronchitis. Its development may be insidious or follow a long history of bronchial asthma or an acute respiratory tract infection, such as influenza or pneumonia. Air pollution and smoking are significant factors.

Chronic bronchitis may develop at any age, but it appears most commonly in middle age after years of untreated, low-grade bronchitis. Diagnosis is based on evaluation of the duration of symptoms, determination of how the disease process began, and history of occupational health hazards, pulmonary disease, and smoking.

Stop, Think, and Respond Exercise 21-2

Your client with acute bronchitis smokes two packs of cigarettes per day. What would you advise this client?
Assessment Findings

Signs and Symptoms
The earliest symptom is a chronic cough productive of thick, white mucus, especially when rising in the morning and in the evening. Bronchospasm may occur during severe bouts of coughing. Acute respiratory infections are frequent during the winter months and may persist for at least several weeks. As the disease progresses, the sputum may become yellow, purulent, copious, and blood streaked after paroxysms of coughing. Expiration is prolonged secondary to obstructed air passages. Cyanosis secondary to hypoxemia may be noted, especially after severe coughing. Dyspnea begins with exertion, but progresses to occurring with minimal activity, and later occurs at rest. Right-sided heart failure results from tachycardia in response to hypoxemia, which causes edema in the extremities.

Diagnostic Findings
The progression and history of symptoms determine the diagnostic studies needed. Initially, results of the physical examination, chest radiography, and pulmonary function tests may be normal. As the disease progresses, these findings become increasingly abnormal. Chest radiography shows signs of fluid overload and consolidation in the lungs. As right-sided failure develops, the heart enlarges. Pulmonary function test results demonstrate decreased vital capacity and forced expiratory volume and increased residual volume and total lung capacity. Diagnostic studies such as bronchoscopy, microscopic examination of the sputum for malignant cells, and lung scan may be necessary to rule out cancer, bronchiectasis, TB, or other diseases in which cough is a predominant feature.

Medical Management
Treatment goals are to prevent recurrent irritation of the bronchial mucosa by infection or chemical agents, maintain the function of the bronchioles, and assist in the removal of secretions. Treatment includes smoking cessation, bronchodilators to reduce airway obstruction and bronchospasm, increased fluid intake, maintenance of a space-occupying lesion, compression, absorption, and obstruction of air flow due to multiple mechanisms: inflammation, excess mucus production, and potential smooth muscle constriction (bronchospasm).

BOX 21-5 Preventing Atelectasis
- Change client’s position frequently, especially from supine to upright position, to promote ventilation and prevent secretions from accumulating.
- Encourage early mobilization from bed to chair, followed by early ambulation.
- Encourage appropriate deep breathing and coughing to mobilize secretions and prevent them from accumulating.
- Teach/reinforce appropriate technique for incentive spirometry.
- Administer prescribed opioids and sedatives judiciously to prevent respiratory depression.
- Perform postural drainage and chest percussion, if indicated.
- Institute suctioning to remove tracheobronchial secretions, if indicated.

well-balanced diet, postural drainage to remove bronchial secretions, steroid therapy if other treatment is ineffective, change in occupation if work involves exposure to dust and chemical irritants, filtration of incoming air to reduce sputum production and cough, and antibiotic therapy.

**Nursing Management**

Nursing management focuses on educating clients in managing their disease. The nurse helps clients identify ways to eliminate environmental irritants. Such measures include smoking cessation, occupational counseling, monitoring air quality and pollution levels, and avoiding cold air and wind exposure that can cause bronchospasm.

Preventing infection is another important aspect of care. The nurse instructs clients to avoid others with respiratory tract infections and to receive pneumonia and flu immunizations. He or she teaches the client to monitor sputum for signs of infection. The nurse also teaches the proper use of aerosolized bronchodilators and corticosteroids.

Metered-dose inhalers (MDI) are pressurized devices that contain an aerosolized powder of specific medications. When the client pushes on the pressurized canister, an exact amount of medication is delivered via inhalation. Clients need instruction regarding the use of a MDI (Client and Family Teaching 21-2). It may be difficult for clients to coordinate the equipment and the need to inhale forcibly as the medication is released. For that reason, spacers (holding chambers) are added to hold the medication, allowing the client to inhale slowly and deeply and with more control to receive the full dose of the inhaled medication. There are also other types of inhalers specific to particular medications; each requires thorough client instruction.

The nurse instructs the client in postural drainage techniques and measures to improve overall health, such as eating a well-balanced diet, getting plenty of rest, and engaging in moderate aerobic activity. For clients with lung disease, dyspnea, not heart rate, should determine the amount of aerobic activity. In other words, clients should exercise at the pace and for the length of time they can tolerate without dyspnea. Refer to nursing management of emphysema for nursing diagnoses and additional interventions.

**PULMONARY EMPHYSEMA**

**Emphysema** is a chronic disease characterized by abnormal distention of the alveoli. The alveolar walls and capillary beds also show marked destruction. This process of destruction occurs over a long period. By the time of diagnosis, damage to the lungs usually is permanent. Emphysema is a common cause of disability and the most common obstructive lung disorder.

**Pathophysiology and Etiology**

In emphysema, the alveoli lose elasticity, trapping air that the client normally would expire. On microscopic examination, the alveolar walls are broken down, forming one large sac instead of multiple, small air spaces. The capillary beds, previously located within the alveolar walls, are destroyed, and fibrous scarring replaces much of the tissue. Formation of fibrous tissue and destruction of the alveoli prevent the proper exchange of oxygen and CO₂ during respiration.

As the disease progresses, large air sacs (bullae, blebs) may be seen over the lung surface. These sacs can rupture, allowing air to enter the thorax (pneumothorax) with each respiration. In this case, emergency thoracentesis is performed to remove the air from the thoracic cavity. A chest tube may be inserted to keep additional air from entering. Recurrent episodes of pneumothorax may require surgery to correct the problem (see section on Thoracic Surgery).

**Assessment Findings**

**Signs and Symptoms**

Shortness of breath with minimal activity is called exertional dyspnea and often is the first symptom of emphysema. As the disease progresses, breathlessness occurs even at rest. A
chronic cough invariably is present and productive of mucopurulent sputum. Inspiration is difficult because of the rigid chest cage, and the chest is characteristically barrel shaped (Fig. 21-6).

The client uses the accessory muscles of respiration (muscles in the jaw and neck and intercostal muscles) to maintain normal ventilation.Expiration is prolonged, difficult, and often accompanied by wheezing. In advanced emphysema, respiratory function is markedly impaired. Clients with advanced emphysema characteristically appear drawn, anxious, and pale. They speak in short, jerky sentences. When sitting up, they often lean slightly forward and are markedly short of breath. The neck veins may distend during expiration.

In advanced emphysema, memory loss, drowsiness, confusion, and loss of judgment may result from the markedly reduced oxygen that reaches the brain and the increased CO₂ in the blood. If the disorder goes untreated, the CO₂ content in the blood may reach toxic levels, resulting in lethargy, stupor, and, eventually, coma. This condition is called carbon dioxide narcosis. Lung auscultation reveals decreased breath sounds, wheezing, and crackles. Heart sounds are diminished or muffled. Visual inspection shows a barrel-chested person breathing through pursed lips and using the accessory muscles of respiration.

**Diagnostic Findings**
Chest radiography, fluoroscopy, and CT scanning demonstrate hyperinflated lung fields. Results of pulmonary function studies show a marked decrease in overall function, including increased total lung capacity and residual volume and decreased vital capacity and forced expiratory volume. ABG analysis usually reveals hypoxemia and respiratory acidosis.

**Medical Management**
The goals of medical management include improving the client’s quality of life, slowing the disease progression, and treating the obstructed airways. Treatment includes the following measures:

- Bronchodilators to dilate airways by decreasing edema and spasms and improving gas exchange
- Aerosol therapy with nebulized aerosols for deep inhalation of bronchodilators and mucolytics in the tracheobronchial tree
- Supplemental oxygen may be prescribed
- Antibiotics
- Corticosteroids on a limited basis to assist with bronchodilation and removal of secretions
- Physical therapy to increase ventilation—deep breathing, coughing, chest percussion, vibration, and postural drainage

If the prescribed treatment regimen does not help the client, progressive loss of sleep, appetite, weight, and physical strength is likely. As the disease progresses, the client may need to curtail physical activities.

**Nursing Management**
Clients with emphysema may require supplemental oxygen. It is important to monitor oxygen levels as well as carbon dioxide (PaCO₂) levels, because some clients with emphysema tend to have chronic hypercapnia (elevated PaCO₂). For this group, when supplemental oxygen is administered, the hemoglobin is saturated with oxygen and unable to carry carbon dioxide. This results in increased hypercapnia (Smeltzer et al., 2008).

The safest method of oxygen administration is by nasal catheter or cannula, with the oxygen flow rate set at no more than 2 to 3 L/min. If the client’s color improves but his or her level of consciousness decreases, the nurse discontinues oxygen administration and notifies the physician; the client may be approaching a state of respiratory arrest.

Therapeutic breathing exercises effectively use the diaphragm (diaphragmatic breathing), thus relieving the compensatory burden on the muscles of the upper thorax. The nurse teaches the client to let the abdomen rise when taking a deep breath and to contract the abdominal muscles when exhaling. Clients can feel the correct way to do this by placing one hand on the chest and the other on the abdomen: during abdominal breathing, the chest should remain quiet and the abdomen should rise and fall with each breath.

Other exercises include blowing out candles at various distances and blowing a small object, such as a pencil or piece of chalk, along a tabletop. The nurse encourages the client to exhale more completely by taking a deep breath and then bending the body forward at the waist while exhaling as fully as possible. Pursed-lip breathing (i.e., breathing with the lips pursed or puckered on expiration) helps to control the respiratory rate and depth and slows expiration. This maneuver may decrease dyspnea and in turn reduce the anxiety that often is associated with breathing difficulties.

In addition, client education is aimed at helping clients adjust to their current level of disability and to the potential for increased disability in the future. The primary goal is to prevent or delay the progression of emphysema. Clients who are motivated will profit more from available treatments and
CHAPTER 21 Caring for Clients with Lower Respiratory Disorders

Client and Family Teaching 21-3
Following a Treatment Regimen for Emphysema

The nurse teaches the client strategies to slow the disease progression:
- Success of treatment depends on strict adherence to the treatment regimen.
- Take medication exactly as prescribed. Observe the time intervals between medications. Do not skip doses or take more than what is prescribed.
- Maintain close medical supervision.
- Contact the physician if adverse drug effects occur, drugs fail to relieve symptoms, new symptoms appear, symptoms become more severe, or signs or symptoms of respiratory infection develop.
- Drink extra fluids as indicated, unless fluids are restricted.
- Avoid respiratory irritants and people with respiratory infections.
- Eat a well-balanced diet.
- Perform breathing exercises as prescribed.
- Take frequent rests during the day. Space activities to prevent fatigue and shortness of breath.
- Avoid dry-heated areas that can aggravate symptoms.
- Humidify inspired air during the winter months.

Nutrition Notes 21-1
The Client With Emphysema

- Malnutrition among clients with emphysema is multifactorial
- Shortness of breath and difficulty breathing impair the ability to chew and swallow.
- Inadequate oxygenation of GI cells causes anorexia and gastric ulceration.
- Slowed peristalsis and digestion contribute to loss of appetite.
- Labored breathing increases calorie requirements.
- Eating is not a priority among clients who are anxious about breathing.
- To correct malnutrition, a high-protein, high-calorie diet is indicated, but an excessive calorie intake is avoided because it increases respiratory stress by increasing carbon dioxide output.
- Small, frequent feedings of nutrient-dense foods help maximize intake and lessen fatigue; concentrated liquid supplements are beneficial.
- Encourage ample fluid intake. Fluids consumed between meals instead of with meals are less likely to interfere with food intake.
- Obese clients with emphysema are encouraged to lose weight to improve breathing.

Nursing Process for the Client With Obstructive Pulmonary Disease

Assessment
Assess the client’s respiratory status, including respiratory effort, rate, and pattern. Determine whether the client has diminished breath sounds and prolonged expiration. Observe for evidence of dyspnea at rest, as well as accentuated accessory neck muscles and barrel-shaped chest. Ask the client about tolerance for activity and check the characteristics of secretions: consistency, quantity, color, or odor. Other important assessment data are the client’s ability to expectorate secretions, signs and symptoms of infection, and what the client does to relieve pulmonary symptoms.

Diagnosis, Planning, and Interventions
- **Ineffective Airway Clearance** related to bronchoconstriction, increased mucus production, and ineffective cough
- **Expected Outcome:** Client will maintain a patent airway and adequate airway clearance.
  - Auscultate breath sounds at least every 8 hours. **Findings may indicate airway obstruction secondary to mucus plug, increasing airway resistance, or fluid in larger airways.**
  - Encourage client to cough and clear secretions; suction as needed. **These measures promote airway clearance and improve ventilation.**
  - Perform postural drainage with percussion and vibration twice a day as indicated. **Postural drainage assists in mobilizing secretions for expectoration.**
  - Observe for dyspnea, restlessness, increased anxiety, or use of accessory muscles. **Such findings indicate possible airway obstruction or ineffective clearing of secretions.**
  - Increase fluid intake to 3 L/day if not contraindicated. (Right- or left-sided cardiac failure is a contraindication.) Humidify inspired air. **These measures keep secretions moist and easier to expectorate.**
  - Instruct client in early signs of infection: increased sputum production, changes in sputum color and consistency, fever, increased coughing, and increased dyspnea. **Early recognition prevents an infection from progressing to a potentially lethal process.**
  - Administer bronchodilators by nebulizer or MDI as indicated. **Bronchodilators open airways, facilitating breathing and expectoration of secretions.**
  - Teach and encourage the use of diaphragmatic and pursed-lip breathing. **These techniques improve ventilation and mobilize secretions.**
- **Impaired Gas Exchange** related to prolonged expiration, loss of lung tissue elasticity, and atelectasis
- **Expected Outcome:** Client will maintain optimal gas exchange.
  - Promote more effective breathing patterns through optimal positioning, pursed-lip breathing, and use of abdominal muscles. **High Fowler’s position promotes better lung expansion; turning side to side promotes aeration of lung lobes; pursed-lip...**
breathing and other methods open airways and provide for better exhalation.

- Administer oxygen as prescribed. Clients with COPD chronically retain CO₂ and depend on hypoxic drive as the stimulus for breathing; accurate oxygen administration is essential for preventing cessation of breathing.
- Monitor level of consciousness and mental status. Problems with mentation indicate inadequate oxygenation.
- Monitor results of ABGs and pulse oximetry. Changes in these findings indicate respiratory deterioration and provide an opportunity for early interventions.

**PC: Atelectasis**

- Expected Outcome: Nurse will manage and minimize atelectasis.
- Instruct client to do deep-breathing and coughing exercises, incentive spirometry, or both. *These techniques promote lung expansion.*
- Encourage client to use abdominal muscles when breathing. *Diaphragmatic breathing promotes lung expansion.*

**Evaluation of Expected Outcomes**

The client’s airway is free of secretions; breath sounds are clear. ABG and pulse oximetry results are within baseline values, and client remains alert and responsive. The client has no signs or symptoms of atelectasis and demonstrates the ability to do pulmonary exercises and abdominal breathing as instructed.

**ASTHMA**

Asthma is usually a reversible obstructive disease of the lower airway. Inflammation of the airway and hyper-responsiveness of the airway to internal or external stimuli characterize asthma. The incidence of asthma is increasing, particularly in children and adolescents. Asthma affects almost one fifth of the population at some time in their lives. Asthma may be fatal, but for most people it causes disruptions in school and work attendance and affects choices in careers and activities.

**Pathophysiology and Etiology**

There are two types of asthma: *allergic asthma* (extrinsic), which occurs in response to allergens, such as pollen, dust, spores, and animal dander; and *non-allergic asthma* (intrinsic), associated with factors such as upper respiratory infections, emotional upsets, and exercise. Many clients experience *mixed asthma*, which has characteristics of allergic and non-allergic asthma.

Acute asthma results from increasing airway obstruction caused by bronchospasm and bronchoconstriction, inflammation and edema of the lining of the bronchi and bronchioles, and production of thick mucus that can plug the airway (Fig. 21-7). The airways in people with asthma are hyper-reactive in response to stimuli. Allergic asthma causes the immunoglobulin E (IgE) inflammatory response (see Chap. 33). These antibodies attach to mast cells within the lungs. Reexposure to the antigen causes the antigen to attach to the antibody, releasing mast cell products such as histamine. The manifestations of asthma become evident as this occurs. Other types of asthma are hyper-responsive to the inflammatory changes.

Because alveoli cannot expel air, they hyperinflate and trap air in the lungs. The client breathes faster, blowing off excess CO₂. Although the client tries to force the air out, the narrowed airway makes it difficult. Wheezing usually is audible with expiration, resulting from air being forced out of the narrowed airway. Other pathophysiologic changes include interference with gas exchange, poor perfusion, possible atelectasis, and respiratory failure if inadequately treated.

Asthma may develop at any age. There appears to be a significant relationship between bronchiolitis (inflammation of the bronchioles) in the first year of life and development of asthma in early childhood. Asthma may be limited to occasional attacks, with the client symptom free between attacks.

**Assessment Findings**

**Signs and Symptoms**

Asthma is typified by paroxysms of shortness of breath, wheezing, and coughing and the production of thick, tenacious sputum. Duration of acute episodes varies; it may be brief (less than 1 day) or extended (lasting for several weeks).

Most clients are aware of the wheezing and report it as one of their symptoms. Every breath becomes an effort. During an acute episode, the work of breathing greatly increases, and the client may suffer from a sensation of suffocation. The client frequently assumes a classic sitting position, with the body leaning slightly forward and the arms at shoulder height. This position facilitates chest expansion and more effective excursions of the diaphragm. Because life depends on the power to breathe, fear and anxiety often accompany and also intensify the symptoms.
Marked prolongation of the expiratory phase of respiration accompanies the effort to move trapped air. Coughing commences with the onset of the attack but is ineffective in the early stage. Only as the attack begins to subside can the client expectorate large quantities of thick, stringy mucus. The skin usually is pale. During a severe attack, the nurse may observe cyanosis of the client’s lips and nail beds. Perspiration typically is profuse during an acute attack. After spontaneous or drug-induced remission of the episode, examination of the lungs commonly shows normal findings. Sometimes an acute attack intensifies and progresses to status asthmaticus (persistent state of asthma), which can be life-threatening.

**Diagnostic Findings**

Chest auscultation reveals expiratory and sometimes inspiratory wheezes and diminished breath sounds. Results of pulmonary function studies, especially of forced expiratory volume and forced vital capacity, may be abnormal, with total lung capacity and functional residual volume increased secondary to trapped air. The forced expiratory volume and forced vital capacity are decreased. During acute attacks, blood gases show hypoxemia. The partial pressure of carbon dioxide (PaCO₂) level may be elevated if the asthma becomes worse, but usually the PaCO₂ level is decreased because of the rapid respiratory rate. A normal PaCO₂ level in the latter part of an asthma attack may indicate impending respiratory failure.

**Medical Management**

Symptomatic treatment is given at the time of the attack. Long-term care involves measures to treat as well as to prevent further attacks. An effort must be made to determine the cause. If the history and diagnostic tests indicate allergy as a causative factor, treatment includes avoidance of the allergen, desensitization, or antihistamine therapy. Oxygen usually is not necessary during an acute attack because most clients are actively hyperventilating. Oxygen may be necessary if cyanosis occurs.

Pharmacologic management is often classified as rescue therapy and maintenance therapy. Rescue-therapy medications treat acute episodes of asthma, whereas maintenance therapy is a daily regimen designed to prevent and control symptoms. Many medications are taken through MDIs. Drug Therapy Table 21-2 lists medications used for both types of therapy.

Humidification of inspired air is valuable because dehydration of the respiratory mucous membrane may lead to asthmatic attacks. Use of steam or cool vapor humidifiers also has proved effective. Liquefaction of the secretions promotes more effective clearing of the airways and a rapid return to normal. Air conditioners may filter offending allergens as well as control temperature and humidity.

**Pharmacologic Considerations**

- Bronchodilators are used to manage acute breathing disorders, such as acute asthma attacks or reversible bronchospasm. Examples of bronchodilators include adrenergic drugs, such as epinephrine, isoproterenol (Isuprel), and terbutaline (Bricanyl), and the xanthine derivatives, such as theophylline and aminophylline. When theophylline or aminophylline is used, serum theophylline levels should be maintained in the therapeutic range of 10 to 20 micrograms (mcg)/mL. Levels over 20 mcg/mL are associated with toxicity.

**Nursing Management**

During asthma attacks, clients are extremely anxious. The nurse reassures the client that someone will remain with him or her during the acute phase. The nurse administers oxygen if indicated and puts the client in a sitting position. Rest and adequate fluid intake are important. Increased fluid intake makes secretions less tenacious and replaces the fluids lost through perspiration. Thus, the nurse keeps fluids within easy reach and encourages the client to drink them. The nurse checks the intravenous (IV) site frequently for signs of extravasation. This monitoring is especially important during an acute attack because restlessness can result in catheter dislodgment. The nurse observes for adverse drug effects, especially when the client is receiving epinephrine or other adrenergic agents, which may cause palpitations, nervousness, trembling, pallor, and insomnia.

Clients with asthma must demonstrate understanding of the following (Smeltzer et al., 2008):

- Asthma as a chronic inflammatory disease
- Role of inflammation and bronchoconstriction
- Action and purpose of medications
- How to avoid triggers for asthma attacks
- Use of metered-dose inhalers
- Use of peak-flow monitoring
- When and how to obtain medical assistance

The nurse assesses the client’s level of understanding of these topics and provides education as needed.

The nurse determines whether the client has a peak flow meter and obtains one for the client if needed. The peak flow meter measures the peak expiratory flow rate (PEFR), which is the point of highest flow during forced expiration. The nurse instructs the client in using the peak flow meter to monitor the degree of asthma control (Client and Family Teaching 21-4). The client can use the peak flow meter to assess the effectiveness of medication or breathing status. The nurse tells the client to seek care if readings fall below baseline and teaches the correct use of inhalers. He or she also helps the client to identify
## DRUG THERAPY TABLE 21-2  Drug Therapy for Asthma

<table>
<thead>
<tr>
<th>Drug Category and Examples</th>
<th>Mechanism of Action</th>
<th>Side Effects</th>
<th>Nursing Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rescue Therapy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Short-Acting Beta Agonists</strong></td>
<td>albuterol (Ventolin)</td>
<td>Dilate the smooth muscles of the bronchioles, reduce muscle spasm, and therefore increase the size of the airway</td>
<td>Restlessness, apprehension, anxiety, fear, central nervous system stimulation, nausea, dysrhythmias, sweating, flushing, paradoxical airway resistance with repeated excessive use</td>
</tr>
<tr>
<td><strong>Anticholinergics</strong></td>
<td>ipratropium bromide (Atrovent)</td>
<td>Decrease vagal tone to airways, resulting in bronchodilation</td>
<td>Nervousness, dizziness, headache, nausea, cough, palpitations, exacerbation of glaucoma, and urinary retention</td>
</tr>
<tr>
<td><strong>Maintenance Therapy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Long-Acting Beta Agonists</strong></td>
<td>formoterol (Foradil Aerolizer) salmeterol (Serevent)</td>
<td>Dilate the smooth muscles of the bronchioles, reduce muscle spasm, and therefore increase the size of the airway</td>
<td>Restlessness, apprehension, anxiety, fear, central nervous system stimulation, nausea, dysrhythmias, sweating, flushing, paradoxical airway resistance with repeated excessive use</td>
</tr>
<tr>
<td><strong>Inhaled Corticosteroids</strong></td>
<td>triamcinolone (Azmacort)</td>
<td>Decrease inflammatory response</td>
<td>Inhalants*: oral, laryngeal, and pharyngeal irritations and fungal infections. Common side effects are hoarseness, dry mouth, cough, and sore throat.</td>
</tr>
<tr>
<td><strong>Mast Cell Inhibitors</strong></td>
<td>inhaled cromolyn (Intal)</td>
<td>Prevent the release of mast cell products, promoting bronchodilation and decreasing inflammation; ineffective in acute attacks, but very therapeutic if taken regularly</td>
<td>Dizziness, nausea, throat irritation</td>
</tr>
<tr>
<td><strong>Leukotriene Modifiers</strong></td>
<td>montelukast (Singulair)</td>
<td>Mediate the inflammatory response, reduce inflammation and ease bronchoconstriction</td>
<td>Headache, nausea, diarrhea</td>
</tr>
</tbody>
</table>

*Corticosteroids administered by other routes and in higher dosages are associated with multiple adverse effects.*
Caring for Clients with Lower Respiratory Disorders

CHAPTER 21

Client and Family Teaching 21-4 Using a Peak Flow Meter

To determine peak flow, the nurse instructs the client as follows:

- Sit upright in bed or chair or stand and inhale as deeply as possible.
- Form a tight seal around the mouthpiece with lips.
- Exhale forcefully and quickly.
- Note the reading.
- Repeat these steps two more times; write the highest of the three numbers in the asthma record.
- After 2 to 3 weeks of asthma therapy, determine your best or usual individual peak flow.
- Monitor the peak flow readings according to three zones:
  - Green zone—80% to 100% of your best or usual peak flow; indicates asthma is under good control
  - Yellow zone—50% to 80% of your best or usual peak flow; indicates the asthma symptoms are getting worse
  - Red zone—less than 50% of your best or usual peak flow; indicates increasingly dangerous condition.
- Depending on the zone, take actions as instructed by healthcare providers.

Stop, Think, and Respond Exercise 21-3

Your client has asthma caused by extrinsic factors, particularly dust. How can this client reduce asthma attacks?

CYSTIC FIBROSIS

Cystic fibrosis (CF) is an inherited multisystem disorder that affects infants, children, and young adults. It obstructs the lungs, leading to major lung infections, as well as obstructing the pancreas. In the past, children with CF did not survive much beyond adolescence. Although CF remains a serious childhood disease, new treatments and therapies are enabling clients with CF to live longer and are improving their lives in terms of quality and productivity.

Pathophysiology and Etiology

CF results from a defective autosomal recessive gene. A person with CF inherits a defective copy of the CF gene from both parents. A person who is a carrier has one normal copy of the gene and one defective copy. When two carriers give birth to a child, the child has a 25% chance of having CF, a 50% chance of being a carrier, and a 25% chance of not being a carrier. The genetic mutation causes dysfunction of the exocrine glands, involving the mucus-secreting and eccrine sweat glands. Resulting major abnormalities include the following:

- Faulty transport of sodium and chloride in cells lining organs, such as the lungs and pancreas, to their outer surfaces
- Production of abnormally thick, sticky mucus in many organs, especially the lungs and pancreas
- Altered electrolyte balance in the sweat glands

The genetic defect causes inadequate synthesis of a protein (CF gene product) referred to as the CF transmembrane conductance regulator (CFTR). CFTR molecules are located in the cells lining the ducts of the exocrine glands, particularly the lungs, pancreas, intestine, and sweat ducts. Clients with CF cannot synthesize adequate CFTR to regulate the combination of water and electrolytes with exocrine secretions and mucus. Subsequently, thick, viscous secretions and protein plugs eventually block the ducts of the exocrine glands. Eventually, ducts may become fibrotic and convert into cysts (Bullock & Henze, 2000).

Assessment Findings

Signs and Symptoms

Clients usually exhibit signs and symptoms in infancy or early childhood. Some individuals, however, do not have signs of the disease until late childhood or adolescence. Clinical manifestations differ related to the degree of organ involvement and the progression of the disease. The three major reasons to suspect CF in children are respiratory involvement and the progression of the disease. The three major reasons to suspect CF in children are respiratory involvement and the progression of the disease. The three major reasons to suspect CF in children are respiratory involvement and the progression of the disease. The three major reasons to suspect CF in children are respiratory involvement and the progression of the disease. The three major reasons to suspect CF in children are respiratory involvement and the progression of the disease.

Respiratory symptoms become very common and include frequent respiratory infections, ranging from URIs with increased cough and purulent sputum to the production of thick, tenacious mucus. Finger clubbing is common. Hemoptysis also may occur as blood vessels are damaged in the lungs, secondary to frequent coughing and constant efforts to clear mucus.

Children also experience malabsorption of fats and fat-soluble vitamins, secondary to impaired pancreatic function. They have difficulty gaining weight. Risk for bowel obstruction, cholecytitis, and cirrhosis is increased.

Diagnostic Findings

The standard and most reliable diagnostic test for CF is the pilocarpine iontophoresis sweat test. Up to 20 years of age, levels higher than 60 mEq/L are diagnostic, and those between 50 and 60 mEq/L are highly suggestive for CF.

Chest radiographs demonstrate widespread consolidation, fibrotic changes, and overaerated lungs. Some clients also have areas of collapse. Pulmonary function tests assist in determining current function as well as progression of the disease.

Radiographic studies of the GI system show fibrous abnormalities. In 80% of those with CF, tests for pancreatic enzymes in duodenal contents fail to show evidence of trypsin (Bullock & Henze, 2000). Feces show steatorrhea (fat in stools).

Medical and Surgical Management

Treatment depends on the stage of the disease and the extent of organ involvement; it aims at relieving the symptoms.
Respiratory treatment includes promoting the removal of the thick sputum through postural drainage, chest physical therapy with vigorous percussion and vibration, breathing exercises, hydration to help thin secretions, bronchodiator medications, nebulized mist treatments with saline or mucolytic medications, and prompt treatment of lung infections with antibiotics. Inhaled antibiotics, such as tobramycin, are being used successfully and have the benefit of decreasing systemic absorption. For some clients, ibuprofen, an anti-inflammatory, has been instrumental in slowing the rate at which lung function decreases; other clients are benefiting from azithromycin, an antibiotic that preserves and improves lung function (Cystic Fibrosis Foundation, 2007).

When the digestive system is involved, clients take pancreatic enzyme replacements (such as Pancrease) with all meals and snacks to aid with the absorption of protein, fat, and fat-soluble vitamins. Clients also take multivitamins and fat-soluble vitamin supplements and follow a high-protein, high-calorie diet. A liberal sodium intake is recommended to replace sodium lost through sweat.

Clients with end-stage lung disease sometimes receive a lung transplant. In some cases, clients may receive a liver transplant as well. If successful, the transplants greatly extend the client’s life.

Other new treatments are in various stages of implementation and investigation. These include mucous-thinning drugs that reduce lung infections, NSAIDs, inhaled antibiotics, drugs to stimulate cells to secrete chloride and thin mucus, and gene therapy. The potential for clients with CF to live longer increases every year. Current research is focused on treating not only the symptoms but also the causes of CF (Cystic Fibrosis Foundation, 2007).

**Nursing Management**

Nursing care of clients with CF focuses on preventing complications and promoting as normal a lifestyle as possible. It is important that the client prevent respiratory infections by avoiding people with colds or flu like symptoms, particularly in the fall and winter months. Strict adherence to a vigorous pulmonary toilet (coughing) is essential for the client with CF who has significant respiratory involvement. Components include chest physical therapy (including postural drainage, percussion, and vibration) two to four times daily, deep-breathing and coughing exercises, nebulized treatments, and medications. New methods, such as high-frequency chest wall oscillation through the use of an inflatable vest, may better clear secretions from the lungs. Attached to an air-pulse generator, the vest rapidly inflates and deflates to gently compress and release the chest wall, creating coughlike forces and increasing airflow in the lungs. In a 10- to 30-minute session, the airflow moves mucus toward larger airways, where the client can clear them by coughing, huffing, or suctioning (Rueling & Adams, 2003).

Clients also need to recognize early signs and symptoms of infection, which include low-grade temperature, increased mucus production, increased cough, and change in color of secretions (white to yellow to greenish). Clients must begin antibiotics as soon as infection occurs to prevent the infection from getting worse. Preventing or minimizing infection prevents or slows lung damage. Some clients are on prophylactic antibiotic therapy to decrease the occurrence of infections. This form of treatment is not common because of the threat of developing antibiotic-resistant infections, which can be deadly for clients with CF. Clients may be taught to administer IV antibiotics at home.

For the client with CF who has significant GI involvement, the nurse must review the client’s diet. Collaboration with dietitians can ensure that the client has a diet high in calories, with appropriate amounts of carbohydrates, fats, and proteins. It is essential for the client to take his or her pancreatic enzymes (Cotazym, Creon, or Pancrease), which aid in the digestion of carbohydrates, fats, and proteins. The nurse reminds the client to take the pancreatic enzymes before or during all meals and snacks.

Young adults with CF usually are very knowledgeable about their condition. Nurses must respect their knowledge and allow them to determine their schedule for treatments and procedures. The nurse provides support for clients’ efforts in self-care. He or she refers the client as requested to other healthcare professionals, such as dietitians and respiratory and physical therapists, as needed.

**OCCUPATIONAL LUNG DISEASES**

Exposure to organic and inorganic dusts and noxious gases over a long period can cause chronic lung disorders. Pneumoconiosis refers to a fibrous inflammation or chronic inflammation of the lungs after prolonged exposure to dust or gases. It specifically refers to diseases caused by the inhalation of silica (silicosis), coal dust (black-lung disease, miners’ disease), or asbestos (asbestosis). The resulting effect is referred to as restrictive lung disease, which means that the lungs have decreased volume and inability to expand completely. Although these conditions are not malignant, they may increase the client’s risk for development of malignancies. Table 21-3 describes these specific conditions in more detail.

The primary focus is prevention, with frequent examination of those who work in areas of highly concentrated dust or gases. Laws require work areas to be safe in terms of dust control, ventilation, protective masks, hoods, industrial respirators, and other protection. Workers are encouraged to practice healthy behaviors, such as quitting smoking.

Dyspnea and cough are the most common symptoms of occupational lung diseases. Those exposed to coal dust may expectorate black-streaked sputum. The diagnosis is based on the history of exposure to dust or gases in the workplace. A chest radiograph may reveal fibrotic changes in the lungs. The results of pulmonary function studies usually are abnormal.

Treatment typically is conservative because the disease is widespread rather than localized. Surgery seldom is of value. Infections, when they occur, are treated with antibiotics. Other treatment modalities include oxygen therapy if severe dyspnea is present, improved nutrition, and adequate rest. Many people with advanced disease are permanently disabled.

Nursing management of clients with occupational lung diseases is basically the same as for clients with emphysema. Many clients require a great deal of emotional support because these diseases may result in permanent disability at a relatively young age.
PULMONARY CIRCULATORY DISORDERS

PULMONARY ARTERIAL HYPERTENSION

Pulmonary arterial hypertension refers to continuous high pressure in the pulmonary arteries and results from heart disease, lung disease, or both. It does not become clinically apparent until the client is quite ill. Diagnosis is difficult without invasive testing. Clients with pulmonary arterial hypertension experience difficulty breathing and usually present as quite ill.

Pathophysiology and Etiology

Resistance to blood flow in the pulmonary circulation causes pulmonary arterial hypertension. The pressure in the pulmonary arteries increases, which in turn increases the workload of the right ventricle. Normal pulmonary arterial pressure is approximately 25/10 mm Hg. In pulmonary arterial hypertension, the pressure rises above 40/15 mm Hg and can be higher as the disease progresses.

Primary pulmonary arterial hypertension, which exists without evidence of other disease, is a rare condition. Although the cause is not apparent, there appears to be a familial tendency. “It occurs most often in women 20 to 40 years of age and is usually fatal within 5 years of diagnosis” (Smeltzer et al., 2008, p. 659). Secondary pulmonary arterial hypertension accompanies other heart and lung conditions, most commonly COPD.

Complex mechanisms cause pulmonary arterial hypertension. In primary pulmonary arterial hypertension, the inner lining of the pulmonary arteries thickens and hypertrophies, followed by increased pressure in the pulmonary arteries and vascular bed (Fig. 21-8). In secondary pulmonary arterial hypertension, alveolar destruction causes increased resistance and pressure in the pulmonary vascular bed. In both types of pulmonary arterial hypertension, the increased resistance and pressure in the pulmonary vascular bed results in pulmonary artery hypertension. Consequently, strain is placed on the right ventricle, resulting in enlargement and possible failure.

Assessment Findings

The most common symptoms of primary and secondary hypertension are dyspnea on exertion and weakness. In clients with secondary pulmonary arterial hypertension, additional symptoms are those of the underlying cardiac or respiratory disease: chest pain, fatigue, distended neck veins, orthopnea (difficulty breathing while lying flat), and peripheral edema.

An electrocardiogram (ECG) may show right ventricular hypertrophy or failure. Results of ABG analysis are abnormal. Cardiac catheterization demonstrates elevated pulmonary arterial pressures. The results of pulmonary function studies show an increased residual volume but a decreased forced expiratory volume. Echocardiography may show various abnormalities, such as left ventricular dysfunction and tricuspid valve insufficiency. A ventilation-perfusion scan or pulmonary angiography may be done to determine any defects in the pulmonary vessels, such as a pulmonary embolism.

TABLE 21-3 Occupational Lung Diseases

<table>
<thead>
<tr>
<th>OCCUPATIONAL LUNG DISEASE</th>
<th>PATHOPHYSIOLOGY AND ETIOLOGY</th>
<th>SIGNS AND SYMPTOMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal miner’s pneumoconiosis</td>
<td>Referred to as black lung disease, this condition is caused by inhalation of coal dust and other dusts. Initially, lungs clear particles by phagocytosis and transport out of the lungs. When dust inhalation becomes too great, macrophages collect in the bronchioles, leading to clogging of the airways with dusts, macrophages, and fibroblasts. This results in local emphysema and eventually massive blackened lung lesions. Coal macules eventually form, seen as black dots on radiography.</td>
<td>Chronic cough—sputum production, Dyspnea, Large amounts of sputum containing black fluid (melanoptysis), Respiratory failure</td>
</tr>
<tr>
<td>Silicosis</td>
<td>This illness results from inhalation of silica dust and is seen in workers involved with mining, quarrying, stone-cutting, and tunnel building. Silica particles inhaled into the lungs cause nodular lesions that enlarge and form dense masses over time. The results are loss of lung volume and restrictive and obstructive lung disease.</td>
<td>Shortness of breath, Hypoxemia, Obstruction of airflow, Right-sided heart failure, Edema</td>
</tr>
<tr>
<td>Asbestosis</td>
<td>This illness results from inhalation of asbestos dust. Laws restrict asbestos use, but old materials still contain asbestos. Asbestos fibers enter the alveoli and cause fibrous tissue to form around them. Pleura also have fibrous changes and plaque formation. Results are restrictive lung disease, decreased lung volume, and decreased gas exchange.</td>
<td>Dyspnea, Chest pain, Hypoxemia, Anorexia and weight loss, Respiratory failure</td>
</tr>
</tbody>
</table>
PULMONARY EMBOLISM

Medical Management
Treatment of primary pulmonary arterial hypertension includes the administration of vasodilators and anticoagulants. Primary pulmonary arterial hypertension has a poor prognosis; therefore, some affected clients are considered candidates for heart-lung transplantation. Treatment of secondary pulmonary arterial hypertension includes management of the underlying cardiac or respiratory disease. Oxygen therapy commonly is used to increase pulmonary arterial oxygenation. If right-sided heart failure is present, other treatments include medications such as digitalis to improve cardiac function, rest, and diuretics.

Nursing Management
Nursing management focuses on recognizing signs and symptoms of respiratory distress. The nurse can reduce the body’s need for oxygen by preventing fatigue, assisting with ADLs, and administering oxygen, when needed.

Assessment Findings
When a small area of the lung is involved, signs and symptoms usually are less severe and include pain, tachycardia, and dyspnea. The client also may have fever, cough, and blood-streaked sputum. Larger areas of involvement produce more pronounced signs and symptoms, such as severe dyspnea, severe pain, cyanosis, tachycardia, restlessness, and shock. Sudden death may follow a massive pulmonary infarction when a large embolism occludes a main section of the pulmonary artery.

Serum enzymes typically are markedly elevated. A chest radiograph may show an area of atelectasis. An ECG rules out a cardiac disorder such as MI, which produces some of the same symptoms. In addition, a lung scan, CT scan, or pulmonary angiography may be performed to detect the involved lung tissue. Ultrasonography and impedance plethysmography are other imaging studies that help to confirm the presence of lower extremity deep vein thrombosis (see Chap. 23).

Medical and Surgical Management
Treatment of a pulmonary embolism depends on the size of the area involved and the client’s symptoms. IV heparin may be administered to prevent extension of the thrombus and the development of additional thrombi in veins from which the embolus arose. IV injection of a thrombolytic drug (one that dissolves a thrombus) such as urokinase, streptokinase, or tissue plasminogen activator also may be used (see Chap. 25). Anticoagulants commonly are given after thrombolytic therapy. Other measures used to treat symptoms of pulmonary emboli include complete bed rest, oxygen, and analgesics.

Pulmonary embolectomy, using cardiopulmonary bypass to support circulation while the embolus is removed, may be necessary if the embolus is lodged in a main pulmonary artery. The insertion of an umbrella filter device (Greenfield filter) in the vena cava prevents recurrent episodes of pulmonary embolus. The umbrella filter is inserted by an applicator catheter inserted into the right internal jugular vein and threaded downward to an area below the renal arteries. Another surgical treatment is the placement of Teflon clips on the inferior vena cava. These clips create narrow channels in the vena cava, allowing blood to pass through on its return to the right side of the heart but keeping back large clots.

PULMONARY EMBOLISM

An embolus is any foreign substance, such as a blood clot, air, or particle of fat that travels in the venous blood flow to the lungs. The clot moves to and occludes one of the pulmonary arteries, causing infarction (necrosis or death) of lung tissue distal to the clot. Scar tissue later replaces the infarcted area.

Clots usually form in the deep veins of the lower extremities or pelvis and become the source for pulmonary emboli. Emboli also may arise from the endocardium of the right ventricle when that side of the heart is the site of a myocardial infarction (MI) or endocarditis. A fat embolus usually occurs after a fracture of a long bone, especially the femur. Other conditions that cause pulmonary emboli include recent surgery, prolonged bed rest, trauma, the postpartum state, and debilitating diseases. Three conditions, referred to as Virchow’s triad, predispose a person to clot formation: venostasis, disruption of the vessel lining, and hypercoagulability (Bullock & Henze, 2000).

Medical and Surgical Management
Treatment of a pulmonary embolism depends on the size of the area involved and the client’s symptoms. IV heparin may be administered to prevent extension of the thrombus and the development of additional thrombi in veins from which the embolus arose. IV injection of a thrombolytic drug (one that dissolves a thrombus) such as urokinase, streptokinase, or tissue plasminogen activator also may be used (see Chap. 25). Anticoagulants commonly are given after thrombolytic therapy. Other measures used to treat symptoms of pulmonary emboli include complete bed rest, oxygen, and analgesics.

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CHAPTER 21 Caring for Clients with Lower Respiratory Disorders

PULMONARY EDEMA

Pulmonary edema is accumulation of fluid in the interstitium and alveoli of the lungs. Pulmonary congestion results when the right side of the heart delivers more blood to the pulmonary circulation than the left side of the heart can handle. The fluid escapes the capillary walls and fills the airways. A client with pulmonary edema experiences dyspnea, breathlessness, and a feeling of suffocation. In addition, he or she exhibits cool, moist, and cyanotic extremities. The overall skin color is cyanotic and gray. The client has a continual cough productive of blood-tinged, frothy fluid. This condition requires emergency treatment. (See Chap. 28 for a discussion of cardiogenic pulmonary edema.)

RESPIRATORY FAILURE

Respiratory failure describes the inability to exchange sufficient amounts of oxygen and CO₂ for the body’s needs. Even when the body is at rest, basic respiratory needs cannot be met. The ABG values that define respiratory failure include a PaO₂ less than 50 mm Hg, a PaCO₂ greater than 50 mm Hg, and a pH less than 7.25.

Respiratory failure is classified as acute or chronic. Acute respiratory failure occurs suddenly in a client who previously had normal lung function. In chronic respiratory failure, the loss of lung function is progressive, usually irreversible, and associated with chronic lung disease or other disease.

Pathophysiology and Etiology

Table 21-4 describes precipitating factors that can result in respiratory failure. Acute respiratory failure is a life-threatening condition in which alveolar ventilation cannot maintain the body’s need for oxygen supply and CO₂ removal. The result is a fall in arterial oxygen (hypoxemia) and a rise in arterial CO₂ (hypercapnia), detected by ABG analysis. Ventilatory failure develops when the alveoli cannot adequately expand, when neurologic control of respirations is impaired, or when traumatic injury to the chest wall occurs.

Nursing Management

The best management of pulmonary emboli is through prevention of deep vein thrombosis (DVT) (Box 21-6). When determining the client’s potential for DVT, it is important to note the client’s ability to engage in activity such as leg exercises and ambulation. Clients on bed rest are encouraged to do active and/or passive leg exercises. Physicians may order clients to wear elastic compression stockings or use intermittent compression systems such as Venodyne. In addition, the nurse assesses the client for signs of localized calf tenderness, swelling, increased warmth, or prominence of superficial veins in one or both lower extremities, and history of DVT, all of which may indicate the presence of DVT (see Chap. 23).

Gerontologic Considerations

- Vascular changes of aging and chronic vascular diseases cause alterations in arterial and venous lumen, increasing the risk of deep vein thrombosis. The nurse should assess the older client’s history of cardiovascular disease, level of activity, hydration status, and constricting clothing such as tight-fitting hose or socks.

Pulmonary embolism almost always occurs suddenly, and death can follow within 1 hour. Obviously, early recognition of this problem is essential. The nurse starts an IV infusion as soon as possible to establish a patent vein before shock becomes profound. He or she administers vasopressors such as dopamine or dobutamine as ordered to treat hypotension. The nurse provides oxygen for dyspnea and analgesics for pain and apprehension. Close monitoring of vital signs is necessary, as is observing the client at frequent intervals for changes. The nurse institutes continuous ECG monitoring because right ventricular failure is a common problem.

Areas for the nurse to monitor include fluid intake and output, electrolyte determinations, and ABGs. The nurse assesses the client for cyanosis, cough with or without hemoptyis, diaphoresis, and respiratory difficulty. He or she monitors blood coagulation studies (e.g., partial thromboplastin time, prothrombin time) when anticoagulant or thrombolytic therapy is instituted.

The nurse assesses the client for evidence of bleeding and relief of associated symptoms. Because clients with pulmonary emboli are discharged on oral anticoagulants, they require instruction related to checking for signs of occult bleeding, taking medication exactly as prescribed, reporting missed or extra doses, and keeping all appointments for follow-up blood tests and office visits.

Stop, Think, and Respond Exercise 21-4

A 54-year-old woman recently experienced thrombophlebitis in her left calf, probably related to prolonged bed rest after a motor vehicle collision. The thrombophlebitis resolved without complications. She is no longer taking anticoagulants. She expresses concerns about having clots in the future. What should she do?

Preventing the Formation of Pulmonary Emboli

Help client practice active and passive leg exercises.
Instruct client to pump muscles (tense and relax) to improve circulation in lower extremities.
Assist client to ambulate as early as possible after a procedure.
Teach client to:
- Wear support hose/elastic hose as directed
- Avoid constrictive clothing
- Avoid sitting for long periods or with legs crossed
- Drink fluids liberally unless contraindicated
- When traveling, move lower legs and feet while sitting, change positions as able, do not cross legs, and ambulate if able

BOX 21-6 Preventing the Formation of Pulmonary Emboli

A 54-year-old woman recently experienced thrombophlebitis in her left calf, probably related to prolonged bed rest after a motor vehicle collision. The thrombophlebitis resolved without complications. She is no longer taking anticoagulants. She expresses concerns about having clots in the future. What should she do?
The most common diseases leading to chronic respiratory failure are COPD and neuromuscular disorders. The underlying disease accounts for the pathology that is seen when the respiratory system fails. Gas exchange dysfunction occurs over a long period. Symptoms of acute respiratory failure are not apparent in chronic respiratory failure because the client experiences chronic respiratory acidosis over a long period. Refer to the section on COPD for discussion of diagnostic findings, medical management, and nursing management of chronic respiratory failure.

Assessment Findings
Apprehension, restlessness, fatigue, headache, dyspnea, wheezing, cyanosis, and use of the accessory muscles of respiration are seen in clients with impending respiratory failure. If the disorder remains untreated, or if treatment fails to relieve respiratory distress, confusion, tachypnea, cyanosis, cardiac dysrhythmias and tachycardia, hypotension, CHF, respiratory acidosis, and respiratory arrest occur.

The client’s symptoms, history (e.g., surgery, known neurologic disorder), and ABG results form the basis for a diagnosis of respiratory failure. Additional tests include chest radiography and serum electrolyte determinations.

Medical Management
Treatment of respiratory failure focuses on maintaining a patent airway (in cases of upper respiratory airway obstruction) by inserting an artificial airway, such as an endotracheal or a tracheostomy tube. Additional treatments include administration of humidified oxygen by nasal cannula, Venturi mask, or rebreather masks (Fig. 21-9). Respiratory failure is managed with mechanical ventilation using intermittent positive-pressure ventilation. When possible, the underlying cause of respiratory failure is treated.

Nursing Management
Because symptoms often occur suddenly, recognition is important. The nurse must notify the physician immediately and obtain emergency resuscitative equipment.
Assessment and monitoring of respirations and vital signs are necessary at frequent intervals. The nurse must pay particular attention to respiratory rate and depth, signs of cyanosis, other signs and symptoms of respiratory distress, and the client’s response to treatment. He or she monitors ABG results and pulse oximetry findings and implements strategies to prevent respiratory complications, such as turning and ROM exercises. The nurse provides explanations to the client and initiates measures to relieve anxiety.

**ACUTE RESPIRATORY DISTRESS SYNDROME**

Acute respiratory distress syndrome (ARDS), previously referred to as adult respiratory distress syndrome, is a clinical condition that occurs following other clinical conditions. The less severe form of this condition is referred to as acute lung injury (ALI). ARDS and ALI are not primary diseases. When it occurs, ARDS can lead to respiratory failure and death. It is referred to as noncardiogenic pulmonary edema (pulmonary edema not caused by a cardiac disorder—occurs without left-sided heart failure). Sudden and progressive pulmonary edema, increasing bilateral infiltrates seen on chest radiography, severe hypoxemia, and progressive loss of lung compliance characterize ARDS.

**Pathophysiology and Etiology**

Factors associated with the development of ARDS include aspiration related to near drowning or vomiting; drug ingestion/overdose; hematologic disorders such as disseminated intravascular coagulation or massive transfusions; direct damage to the lungs through prolonged smoke inhalation or other corrosive substances; localized lung infection; metabolic disorders such as pancreatitis or uremia; shock; trauma such as chest contusions, multiple fractures, or head injury; any major surgery; embolism; and septicemia (Smeltzer et al., 2008). The mortality rate with ARDS is high, particularly if the underlying cause cannot be treated or is inadequately treated.

The body responds to injury by reducing blood flow to the lungs, resulting in platelet clumping. The platelets release substances such as histamine, bradykinin, and serotonin, causing localized inflammation of the alveolar membranes. Increased permeability of the alveolar capillary membrane subsequently ensues. Fluid then enters the alveoli and causes pulmonary edema. The excess fluid in the alveoli and decreased blood flow through the capillaries surrounding them cause many of the alveoli to collapse (microatelectasis). Gas exchange decreases, resulting in respiratory and metabolic acidosis. ARDS also causes decreased surfactant production, which contributes to alveolar collapse. The lungs become stiff or noncompliant. Decreased functional residual capacity, severe hypoxia, and hypocapnia result.

**Assessment Findings**

Severe respiratory distress develops within 8 to 48 hours after the onset of illness or injury. In the early stages, few definite symptoms may be seen. As the condition progresses, the following signs appear: increased respiratory rate; shallow, labored respirations; cyanosis; use of accessory muscles; respiratory distress unrelieved with oxygen administration; anxiety; restlessness; and mental confusion, agitation, and drowsiness with cerebral anoxia.

Diagnosis is made according to the following criteria: evidence of acute respiratory failure, bilateral infiltrates on chest radiography, and hypoxemia as evidenced by PaO₂ less than 50 mm Hg with supplemental oxygen of 50% to 60%. Chest radiographs reveal increased infiltrates bilaterally. There is no evidence of left-sided heart failure (see Chap. 28), such as increased size of the left ventricle.

**Medical Management**

The initial cause of ARDS must be diagnosed and treated. The client receives humidified oxygen. Insertion of an endotracheal or a tracheostomy tube ensures maintenance of a patent airway. Mechanical ventilation usually is necessary, using positive end-expiratory pressure (PEEP), which provides pressures to the airway that are higher than atmospheric pressures. Mechanical ventilators usually raise airway pressure during inspiration and let it fall to atmospheric or zero pressure during expiration (intermittent positive-pressure ventilation). When PEEP is used, positive airway pressure is maintained on inspiration, expiration, and at the end of expiration (continuous positive-pressure ventilation). The client’s pulmonary status, determined by ABG findings and pulse oximetry results, dictates the oxygen concentration and ventilator settings. Complications associated with the use of PEEP include pneumothorax and pneumomediastinum (air in the mediastinal space).

Hypotension results in systemic hypovolemia. Although the client experiences pulmonary edema, the rest of the circulatory volume is decreased. Pulmonary artery pressure monitors the client’s fluid status and assists in determining the careful administration of IV fluids. Colloids such as albumin are used to help pull fluids in from the interstitium to the capillaries. Adequate nutritional support is essential (Nutrition Notes 21-3). Usually, the first choice is enteral feedings, but total parenteral nutrition may be necessary.

**Nursing Management**

Nursing management focuses on promotion of oxygenation and ventilation and prevention of complications. Assessing
and monitoring a client’s respiratory status are essential. Potential complications include deteriorating respiratory status, infection, renal failure, and cardiac complications. The client also is anxious and requires explanations and support. In addition, if the client is on a ventilator, verbal communication is impaired. The nurse provides alternative methods for the client to communicate.

**MALIGNANT DISORDERS**

Tumors and growths affecting the respiratory system usually are malignant. Malignancies may be primary in that they arise from the lungs or mediastinum, or they can be secondary metastatic growths from other sites. Treatment of primary or secondary cancers usually does not stop progression of the disease (see Chap. 18). Disability, debilitation, and death are common outcomes from respiratory malignancies.

**LUNG CANCER**

Lung cancer is a very common cancer, particularly among cigarette smokers and those regularly exposed to second-hand smoke. It remains the number one cause of cancer-related deaths among men and women in the United States (American Cancer Society, 2007), with more Americans dying each year from lung cancer than from breast, prostate, and colorectal cancers combined. The incidence of lung cancer has markedly increased since the early 1980s, related to:

- More accurate methods of diagnosis
- The growing population of aging people
- The continued popularity of cigarette smoking
- Increased air pollution
- Increased exposure to industrial pollutants

Lung cancer is more common in men than in women. The rate of women dying from lung cancer continues to increase, however, and indeed is greater than the rate of women dying from breast cancer. Most clients are older than 40 years of age when diagnosed with lung cancer.

**Pathophysiology and Etiology**

The exact mechanism for the development of lung cancer is unknown; however, the link between irritants and lung cancer is well established. Prolonged exposure to carcinogens more than likely will produce cancerous cells. Smokers who quit reduce their risk of lung cancer to that of nonsmokers within 10 to 15 years.

Lung cancers are grouped in two overall categories: non-small cell carcinomas, which includes epidermoid or squamous cell carcinomas, large cell or undifferentiated type, and adenocarcinoma; and small cell carcinoma, also referred to as oat cell carcinoma. Many tumors begin in the bronchus and spread to the lung tissue, regional lymph nodes, and other sites, such as the brain and bone. Many tumors have more than one type of cancer cell. Table 21-5 differentiates between the major cell types of lung cancer.

The transformation of an epithelial cell in the airway initiates the growth of a lung cancer lesion. As the tumor grows, it partially obstructs the lumen of an airway or completely obstructs it, resulting in airway collapse distal to the tumor. The tumor may hemorrhage, causing hemoptysis (Bullock & Henze, 2000).

**Assessment Findings**

**Signs and Symptoms**

The cell type of the lung cancer, size and location of the tumor, and degree and location of metastasis determine the presenting signs and symptoms. A cough productive of

<table>
<thead>
<tr>
<th>CELL TYPE</th>
<th>PATHOLOGY</th>
<th>METASTASIS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-small Cell Carcinomas</strong></td>
<td></td>
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</tr>
<tr>
<td>Epidermoid or squamous cell carcinomas (located in the bronchial tubes; 25% to 35% of all lung tumors)</td>
<td>These slow-growing tumors arise from bronchi and bronchioles and spread into the bronchial lumen, causing obstruction.</td>
<td>Well-differentiated epidermoid cells typically metastasize in the thorax, whereas poorly differentiated epidermoid cells metastasize to the small bowel.</td>
</tr>
<tr>
<td>Large cell (undifferentiated) carcinomas (found near the bronchial surface; 5% to 20% of all lung tumors)</td>
<td>These arise in peripheral bronchi and do not have well-defined growth patterns. They usually are diagnosed first as a bulky tumor mass.</td>
<td>These metastasize early, usually to the CNS.</td>
</tr>
<tr>
<td>Adenocarcinoma (arise from mucus glands; 25% to 35% of all lung tumors)</td>
<td>These occur in the peripheral lung tissue and lead to patchy growth throughout the lung fields. They typically invade the pleura, leading to malignant pleural effusion.</td>
<td>Early metastasis occurs to the brain, other lung tissue, bone, liver, and adrenal glands.</td>
</tr>
<tr>
<td><strong>Small Cell Carcinoma</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oat cell (10% to 25% of lung tumors)</td>
<td>This most malignant form of lung cancer arises from the bronchi. The tumor cells hypersecrete antidiuretic hormone, leading to hyponatremia.</td>
<td>Metastasis is early through the bloodstream and lymphatics to the mediastinum, liver, bone, bone marrow, CNS, adrenal glands, pancreas, and other endocrine organs.</td>
</tr>
</tbody>
</table>

CNS, central nervous system.
mucopurulent or blood-streaked sputum is a cardinal sign of lung cancer. The cough may be slight at first and attributed to smoking or other causes. As the disease advances, the client may report fatigue, anorexia, and weight loss. Dyspnea and chest pain occur late in the disease. Hemoptysis is common.

If pleural effusion occurs from tumor spread to the out-
side portion of the lungs, the client experiences dyspnea and chest pain. Other indications of tumor spread are symptoms related to pressure on nerves and blood vessels. Symptoms include head and neck edema, pericardial effusion, hoarseness, and vocal cord paralysis.

Diagnostic Findings
Early diagnosis of cancer of the lung is difficult because symptoms often do not appear until the disease is well established. The sputum is examined for malignant cells. Chest films may or may not show a tumor. A CT or PET scan or MRI is done if results from the chest radiograph are inconclusive, or to further delineate the tumor area.

Bronchoscopy may be done to obtain bronchial washings and a tissue sample for biopsy. Fine-needle aspiration under fluoroscopy or CT guidance may be done to aspirate cells from a specific area that is not accessible by bronchoscopy. A lung scan also may locate the tumor. A bone scan detects metastasis to the bone. The results of a lymph node biopsy may be positive for malignant changes if the lung tumor has metastasized. Mediastinoscopy provides a direct view of the mediastinal area and possible visualization of tumors that extend into the mediastinal space.

Medical and Surgical Management
The client’s prognosis is poor unless the tumor is discovered in its early stages and treatment begins immediately. Because lung cancer produces few early symptoms, its mortality rate is high. Metastasis to the mediastinal and cervical lymph nodes, liver, brain, spinal cord, bone, and opposite lung is common.

Treatment depends on several factors. One major consideration is the classification and staging of the tumor. After classification of the tumor, the stage of the disease is determined. Staging refers to the extent and location of the tumor and the absence or presence and extent of metastasis (see Chap. 18). Other factors that determine treatment are the client’s age and physical condition and other diseases or disorders, such as renal disease and CHF.

Surgical removal of the tumor offers the only possibility of cure and usually is successful only in the early stages of the disease. The type of lung resection (see Box 21-4) depends on the tumor’s size and location.

Radiation therapy may help to slow the spread of the disease and provide symptomatic relief by reducing tumor size, thus easing the pressure exerted by the tumor on adjacent structures. In turn, pain, cough, dyspnea, and hemoptysis may be relieved. In a small percentage of cases, radiation may be curative, but for most, it is palliative. Complications associated with the use of radiation therapy include esophagitis, fibrosis of lung tissue, and pneumonitis.

Chemotherapy may be used alone or with radiation therapy and surgery. The principal effects of chemotherapy are to slow tumor growth and reduce tumor size and accompanying pressure on adjacent structures. Chemotherapy also is used to treat metastatic lesions. Most chemotherapeutic regimens use a combination of drugs rather than a single agent and, although not curative, often make the client more comfortable.

New treatments in various stages of development include the following (LungCancer.org, 2009):

- New chemotherapy regimens
- Monoclonal antibodies that target specific cancer proteins
- Photodynamic therapy that is a combination treatment with chemicals and light
- Lung cancer vaccines to stimulate an effective immune response

Nursing Management
Management of clients with lung cancer is essentially the same as that for any client with a malignant disease. See Chapter 18 for the nursing management of a client with cancer and Chapter 14 for perioperative care.

MEDIASTINAL TUMORS
Tumors of the mediastinum in adults often are malignant and metastatic. They are designated as anterior, middle, or posterior, according to their location on the mediastinum. The cause of these tumors is not known. Mediastinal tumors may be asymptomatic initially. When symptoms occur, they include chest pain, chest wall bulging, difficulty swallowing, dyspnea, and orthopnea. Symptoms are related to pressure of the tumor on other chest structures. Chest radiography, CT scan, MRI, mediastinoscopy, and biopsy of the lesion identify the tumor. Malignant tumors of the mediastinum almost always are inoperable but may respond to radiation therapy and chemotherapy. Benign tumors are operable.

Stop, Think, and Respond Exercise 21-5
Your 65-year-old neighbor tells you that he smoked for 25 years but quit 5 years ago. He has been experiencing a productive cough for 3 weeks. Occasionally he sees blood in the sputum. What can you advise him?

TRAUMA
All chest injuries are serious or potentially serious. A client with a chest injury must be observed for dyspnea, cyanosis, chest pain, weak and rapid pulse, and hypotension—all signs and symptoms of respiratory distress. Clients with a chest injury need to be examined by a physician as soon as possible.

FRACTURED RIBS
Fractured ribs are a common injury and may result from a hard fall or a blow to the chest. Fractured ribs usually are not considered serious, unless accompanied by other injuries.

Pathophysiology and Etiology
Automobile and household accidents are frequent causes of fractured ribs. Rib fractures are painful but not life-threatening. When a client experiences a fractured rib, other structures may be injured as well. For example, the sharp end of the broken rib may tear the lung or thoracic blood vessels. If
the injury involves fractured ribs without complications, the client usually may return home after emergency treatment.

**Flail chest** occurs when two or more adjacent ribs fracture in multiple places (two or more) and the fragments are free-floating (Fig. 21-10). This affects the stability of the chest wall and results in impairment of chest-wall movement. A paradoxical movement develops: with inspiration the chest expands, but the free-floating segments move inward instead of outward. On expiration the free-floating segments move outward, interfering with exhalation. These movements affect intrathoracic pressures, significantly decreasing the movement of air. Many pathophysiologic phenomena occur as a result: increased dead space, reduced gas exchange, decreased lung compliance, retained airway secretions, atelectasis, and hypoxemia.

**Gerontologic Considerations**

- Changes associated with aging or chronic conditions may increase older adults’ risk for falls. Falls may cause fracture of one or more ribs, increasing susceptibility to pneumonia from decreased lung expansion.

**Assessment Findings**

Symptoms consist primarily of obvious trauma and severe pain on inspiration and expiration. The client experiences shortness of breath. With flail chest, the client has hypotension and inadequate tissue perfusion secondary to decreased cardiac output. Respiratory acidosis occurs because of increased CO₂. Chest radiographs (usually from several angles) are necessary to confirm the diagnosis.

**Medical Management**

Supporting the chest with an elastic bandage or a rib belt assists in immobilizing the rib fractures. These measures, however, can lead to decreased lung expansion followed by pulmonary complications such as pneumonia and atelectasis. Therefore, the use of these devices usually is limited to multiple rib fractures. Analgesics such as codeine may be prescribed for pain. Sometimes a regional nerve block is used to relieve pain.

Management of flail chest includes supporting ventilation, clearing lung secretions, and managing pain. Other treatment depends on the severity of the flail chest. If a pulmonary contusion (crushing bruise of the lung) also exists, fluids are restricted because of the damage to the pulmonary capillary bed. Antibiotics are given to prevent infection, which is common after this type of injury. Endotracheal intubation and mechanical ventilation may be necessary if a client’s respiratory status is greatly compromised.

**Nursing Management**

With fractured ribs, the nurse may apply the immobilization device after the physician examines the client. In such a case, the nurse instructs the client about the application and removal of the rib belt or elastic bandage. He or she stresses the importance of taking deep breaths every 1 to 2 hours, even though breathing is painful. Nurses plan and implement care of clients with more severe injuries based on respiratory needs. The nurse assesses and monitors the client for signs of respiratory distress, infection, and increased pain.

**BLAST INJURIES**

Compression of the chest by an explosion can seriously damage the lungs by rupturing the alveoli. Death often results from hemorrhage and asphyxiation. Severe respiratory distress with outward evidence of chest trauma is apparent. Subcutaneous emphysema (air in subcutaneous tissues) is a common finding because the lungs or air passages have sustained an injury. This condition resembles a superficial swelling. Crepitation (a crackling sound) is heard or felt upon palpation and may be caused by air leaking around the chest wound. Diagnosis is based on symptoms and physical examination. Additional diagnostic tests, such as chest radiography and lung scan, may be necessary to identify foreign objects or air in the chest.

Treatment includes complete bed rest and oxygen administration. Thoracentesis to remove air or fluid may be necessary. Some clients may require surgery and the insertion of chest tubes if severe injury to lung tissue has occurred or if pneumothorax is present. When a client has suffered a blast injury, the most important nursing task is immediate recognition of respiratory distress. Victims of a blast injury are closely observed for early signs of respiratory distress.
PENETRATING WOUNDS

Gunshot and stab wounds are common types of penetrating wounds to the lungs. Penetrating wounds potentially affect cardiopulmonary function and may be life-threatening.

Pathophysiology and Etiology

Penetrating wounds are classified according to the velocity of the cause. Stab wounds from weapons such as knives or switchblades usually are low velocity because they involve a small area. Gunshot wounds may be low, medium, or high velocity, depending on the caliber of the gun, the distance from which the gun was fired, and the nature of the ammunition (Smeltzer et al., 2008).

Any type of penetrating wound to the chest is serious because of the opening into the thorax. On inspiration, the thorax normally is at negative pressure. The penetrating wound creates continuous and direct communication with the outside, which is at positive pressure. Thus, air enters the thoracic cavity, causing an open pneumothorax (Fig. 21-11). If not recognized and treated promptly, death may occur. If the wound is large, a sucking noise may be heard as air enters and leaves the chest cavity. Depending on the size of the wound, it takes seconds to hours before the lung collapses as the pressure in the thorax reaches atmospheric pressure. Many chest injuries involve both pneumothorax and hemothorax, the collection of blood in the pleural cavity.

Assessment Findings

Clients exhibit various signs and symptoms, depending on the location and extent of the penetrating wound; dyspnea, pain, and bleeding are common. Clients are at risk for respiratory distress and shock. It also is important that the client be thoroughly examined to ascertain if other injuries are present, such as more penetrating wounds, particularly in the abdominal area.

Diagnosis is based on the history of injury, physical examination, and auscultation of the lungs. Radiographs show the degree of lung collapse and the amount of air or blood in the thoracic cavity. The client’s cardiopulmonary status is assessed through ABG analysis, pulse oximetry, and ECGs. CT scans or MRI may be necessary depending on the extent of the injuries.

Medical and Surgical Management

Airway management is the first concern. Once an airway is established, then other treatment begins. Thoracentesis is done to remove air and blood from the pleural space. A chest tube is inserted and attached to an underwater-seal drainage system. A thoracotomy may be required to repair the injury. Foreign bodies that entered the chest, such as a bullet or a knife, are surgically removed. Their presence in the wound may prevent or slow the entrance of air. Removal before the victim is transported to the hospital may result in continuous sucking of air into the chest, collapse of the lung, compression of the heart and opposite lung, and death. Surgical intervention may be necessary if there is bleeding from the chest tube or indications of injury to other organs or blood vessels.

Emergency treatment of pneumothorax caused by a penetrating wound includes the application of a tight pressure dressing over the injury site to prevent more air from entering the thorax. A chest tube is inserted and attached to an underwater-seal drainage system. A thoracotomy may be required to repair the injury. Foreign bodies that entered the chest, such as a bullet or a knife, are surgically removed. Their presence in the wound may prevent or slow the entrance of air. Removal before the victim is transported to the hospital may result in continuous sucking of air into the chest, collapse of the lung, compression of the heart and opposite lung, and death. Surgical intervention may be necessary if there is bleeding from the chest tube or indications of injury to other organs or blood vessels.

Nursing Management

Care of a client with a penetrating chest wound is similar to that of a client who has thoracic surgery. Refer to the nursing management of a client undergoing thoracic surgery in the next section.

THORACIC SURGERY

A thoracotomy is a surgical opening in the chest wall. It may be done to:

- Remove fluid, blood, or air from the thorax.
- Remove tumors of the lung, bronchus, or chest wall.
- Remove all or a portion of a lung (see Box 21-4).
Repair or revise structures contained in the thorax, such as open heart surgery or repair of a thoracic aneurysm.

• Repair trauma to the chest or chest wall, such as penetrating chest wounds or crushing chest injuries.

• Sample a lesion for biopsy.

• Remove foreign objects such as a bullet or metal fragments.

A thoracentesis may be done as an emergency procedure to remove blood, fluid, or air from the chest. In some instances, it is necessary to perform a thoracotomy to insert chest tubes (tube thoracotomy) to remove air or fluid from the chest during the preoperative period.

Preoperative Nursing Management
Preparing clients for thoracic surgery includes assessment of vital signs and breath sounds, particularly noting the presence or absence of breath sounds in any area of the chest. The client’s condition dictates the extent of the assessment and obtaining a history. If the surgery is an emergency, physical assessment may be limited to a general statement of the client’s condition, a list of emergency measures and treatments done, and vital signs (see Chap. 14).

Postoperative Nursing Management
The opening of the thoracic cavity requires special postoperative nursing measures. A significant issue is the interference with normal pressures in the thoracic cavity. When the chest is opened, air from the atmosphere rushes in because of the negative pressure that exists in the thoracic cavity on inspiration. The entrance of air under atmospheric pressure causes the lungs to collapse and no longer expand or contract. The anesthesiologist ventilates the client during surgery.

After thoracic surgery, draining secretions, air, and blood from the thoracic cavity is necessary to allow the lungs to expand. A catheter placed in the pleural space provides a drainage route through a closed or underwater-seal drainage system (Fig. 21-12). Sometimes two chest catheters are placed—one anteriorly and one posteriorly. The anterior catheter (usually the upper one) removes air; the posterior catheter removes fluid.

Chest tubes are securely connected to an underwater-seal system. The tube coming from the client always must be under water. A break in the system, such as from loose or disconnected fittings, allows air to enter the tubing and then the pleural space, further collapsing the lung. When chest tubes are inserted at the end of the surgical procedure, they are connected to an underwater-seal drainage system. All connections are taped carefully to minimize the possibility of air entering the closed system.

When caring for a client with chest tubes, the nurse should be aware of the following:

• Fluctuation of the fluid in the water-seal chamber is initially present with each respiration. Fluctuations cease when the lung reexpands. The time for lung reexpansion varies. Fluctuations also may cease if:
  • the chest tube is clogged.
  • the wall suction unit malfunctions.
  • a kink or dependent loop develops in the tubing.
  • Bubbling in the water-seal chamber occurs in the early postoperative period. If bubbling is excessive, the nurse checks the system for leaks. If leaks are not apparent, the nurse notifies the physician.
  • Bloody drainage is normal, but drainage should not be bright red or copious.
  • The drainage tube(s) must remain patent to allow fluids to escape from the pleural space.
  • Clogging of the catheter with clots or kinking causes drainage to stop. The lung cannot expand, and the heart and great vessels may shift (mediastinal shift) to the opposite side. The nurse must be alert to the proper functioning of the drainage system. Malfunctions need immediate correction.
  • If a break or major leak occurs in the system, the nurse clamps the chest tube immediately with hemostats kept at the bedside. He or she notifies the physician if this occurs.
**Assessment**
- Assess respirations: rate, depth, rhythm, and use of accessory muscles.
- Observe skin color, particularly for signs of cyanosis.
- Auscultate breath sounds at least every 4 hours.
- Evaluate mental status.
- Monitor heart rate and rhythm.
- Monitor results of ABGs, pulse oximetry, and other blood tests.
- Assess dressings and incisions for drainage or adherence.
- Check the chest tube drainage system.
- Assess level of pain.

**Nursing Diagnosis:** *Impaired Gas Exchange* related to decreased lung expansion, impaired lung function, and surgical procedure.

**Expected Outcome:** Client will maintain optimal gas exchange.

**Interventions**

<table>
<thead>
<tr>
<th>Rationales</th>
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</thead>
<tbody>
<tr>
<td>Such information provides baseline data and early indications of problems.</td>
</tr>
<tr>
<td>These exercises expand the alveoli, which prevents atelectasis.</td>
</tr>
<tr>
<td>Such positioning promotes lung expansion and drainage from operative side.</td>
</tr>
</tbody>
</table>

**Evaluation of Expected Outcome**

Client demonstrates improved gas exchange, as evidenced by results of ABGs and pulse oximetry and improved efforts with incentive spirometry.

**Nursing Diagnosis:** *Impaired Physical Mobility: Arm on Affected Side* related to incisional pain, edema, and decreased strength

**Expected Outcome:** Client will demonstrate effective range-of-motion (ROM) on affected side.

**Interventions**

<table>
<thead>
<tr>
<th>Rationales</th>
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</thead>
<tbody>
<tr>
<td>This assessment provides baseline data about ROM. During thoracotomy, chest muscles are incised, making ROM difficult after surgery.</td>
</tr>
<tr>
<td>These exercises increase mobility and promote renewed strength of affected arm.</td>
</tr>
<tr>
<td>Gradual use of arm promotes movement of it.</td>
</tr>
<tr>
<td>These measures promote mobility and begin to increase strength on affected side.</td>
</tr>
<tr>
<td>Removal of chest tubes decreases discomfort and assists client to move more freely.</td>
</tr>
<tr>
<td>A full exercise plan will help client gain full ROM of affected upper extremity.</td>
</tr>
</tbody>
</table>

**Evaluation of Expected Outcome**

Client demonstrates increased ROM and better ability to perform ADLs independently.

**Nursing Diagnosis:** *Deficient Fluid Volume* related to surgical procedure, drains, and pain

**Expected Outcome:** Client will maintain adequate fluid volume.

**Interventions**

<table>
<thead>
<tr>
<th>Rationales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Such monitoring provides ongoing information about client’s fluid status.</td>
</tr>
<tr>
<td>These assessments provide baseline data about fluid status.</td>
</tr>
<tr>
<td>Tachycardia can occur with hypovolemia to maintain adequate cardiac output. Pulse may be weak with hypovolemia. Hypotension occurs with hypovolemia.</td>
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</table>

(care plan continues on page 298)
Immediate postoperative care includes following the standards outlined in Chapter 14. It also is essential that the nurse check the underwater-seal drainage system, noting the amount and color of drainage and any bubbling or fluctuation. The nurse assesses dressings for drainage and firm adherence to the skin. He or she inspects the skin around the dressings for signs of subcutaneous emphysema. The nurse assesses the client’s color, neurologic status, and heart rate and rhythm; monitors respiratory rate, depth, and rhythm; and auscultates the chest for normal and abnormal breath sounds. He or she also assesses levels of pain and anxiety. Nursing Care Plan 21-1 and Client and Family Teaching 21-5 describe additional nursing management.

Pharmacologic Considerations

- When administering a narcotic to a client who has had thoracic surgery, count the respiratory rate before and 20 to 30 minutes after the client receives the medication. If the respiratory rate is below 10 breaths per minute at either time, notify the physician immediately.

Client and Family Teaching 21-5

Care After Thoracic Surgery

The nurse develops a teaching plan that includes instructions given by the physician as well as the following guidelines:

- Continue to perform arm exercises to prevent stiffness and pain.
- Eat a well-balanced diet, or follow the recommended diet.
- Take rest periods throughout the day until fatigue decreases.
- Practice breathing exercises, and take frequent deep breaths.
- Contact the physician if breathing is difficult; drainage, excessive redness, or pain develops around the incision; fever develops; or pain occurs elsewhere in the body.
- Avoid infection or irritants.
- Increase activities slowly and avoid fatigue.
- Take drugs as prescribed, and do not omit, increase, or decrease doses.
CRITICAL THINKING EXERCISES

1. A male client who underwent cholecystectomy (removal of the gallbladder) 2 days ago presses his call button. As you enter his room, he tells you that he is having trouble breathing and has chest pain. What brief questions would you ask the client before you call the physician?

2. A female client has a history of asthma. She arrives at the outpatient clinic and states that her chest feels tight and that she cannot “catch her breath.” The nurse notes that this client is having trouble speaking. Immediate care of this client includes fluids, administration of bronchodilators, and relief of anxiety. When the client is stabilized and able to be discharged, the nurse wants to assure that the client can take steps to help prevent future asthmatic attacks. What information from the client does the nurse need to better provide appropriate discharge teaching?

3. A client who has AIDS develops pleurisy. His physician instructs him to perform deep-breathing and coughing exercises every 2 hours. What can you do to ease the client’s pain and discomfort when he is performing these exercises?

4. A client who has bronchiectasis in his left lower lobe attends a pulmonary disease clinic. His physician instructs him to perform postural drainage by lying laterally on the bed, leaning from the waist, and lowering his head close to the floor. Two weeks later, the client tells you that he cannot tolerate this postural drainage position. Can you think of another way to perform postural drainage for the left lower lobe that may cause less discomfort?

NCLEX-STYLE REVIEW QUESTIONS

1. An elderly client is brought to the emergency department. Vital signs are T, 102°F; P, 88; R, 32; and BP, 160/86. Upon physical examination, the client is having difficulty breathing. Which of the following would be most appropriate for the nurse to do next?
   1. Instruct the client to take slow, deep breaths.
   2. Suction the client’s pharynx of secretions.
   3. Apply a pulse oximeter to the client’s finger.
   4. Help the client perform postural drainage.

2. A client comes to an urgent care clinic with pleurisy. The nurse is most correct in anticipating that which of the following will be the most common complaint from the client?
   1. Thick, green sputum
   2. Pain with each breath
   3. Hot flashes with chills
   4. Petechiae on the chest

3. The nurse is caring for a client with tuberculosis. A sputum sample is ordered for the next 3 consecutive days. The nurse is correct to schedule the sputum sample to be obtained at which of the following times?
   1. Upon arising in the morning
   2. Midmorning following breakfast
   3. In the evening
   4. At bedtime

4. A client with moderately controlled asthma needs to use a peak flow meter. The nurse instructing this client correctly tells the client that the peak flow meter is used to measure the:
   1. amount of forced inspiration
   2. depth of forced inhalation
   3. highest flow with forced expiration
   4. residual volume after exhalation

5. The LPN notes that the RN, in the care plan for a client who transferred from ICU 2 days post-thoracic surgery, selected “Impaired gas exchange related to decreased lung expansion, impaired lung function, and surgical procedure.” Which interventions are of primary importance for the care of this client? Select all that apply.
   1. Thirty minutes after administering pain medication, ask the client to rate his pain on a scale of 1 to 10.
   2. Assess the client’s dressings and incisions for increased drainage.
   3. Monitor client’s temperature at least every 4 hours.
   4. Remind the client to deep breathe and cough at least every 2 hours.
   5. Reposition the client so that the head is elevated 30° to 40°.