Respiratory System

CHAPTER 7

Chapter Outline

Objectives
Anatomy and Physiology
- Anatomy and Physiology Key Terms
- Upper Respiratory Tract
- Lower Respiratory Tract
- Respiration
- Connecting Body Systems–Respiratory System

Medical Word Elements
Pathology
- Chronic Obstructive Pulmonary Disease
  - Asthma
  - Chronic Bronchitis
  - Emphysema
- Influenza
- Pleural Effusions
- Tuberculosis
- Pneumonia
- Cystic Fibrosis
- Acute Respiratory Distress Syndrome
- Oncology

Diagnostic, Symptomatic, and Related Terms
Diagnostic and Therapeutic Procedures
Pharmacology
Abbreviations
Learning Activities
Medical Record Activities
- SOAP Note: Respiratory evaluation
- SOAP Note: Chronic interstitial lung disease

Objectives

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

- Locate and describe the structures of the respiratory system.
- Describe the functional relationship between the respiratory system and other body systems.
- Pronounce, spell, and build words related to the respiratory system.
- Describe pathological conditions, diagnostic and therapeutic procedures, and other terms related to the respiratory system.
- Explain pharmacology related to the treatment of respiratory disorders.
- Demonstrate your knowledge of this chapter by completing the learning and medical record activities.

Anatomy and Physiology

The respiratory system is responsible for the exchange of **oxygen** (O_2) and **carbon dioxide** (CO_2). Oxygen is essential for life. It is carried to all cells of the body in exchange for CO_2, a waste product. The cardiovascular system helps in this vital function by providing blood vessels for carrying these gases. Failure or deficiency in either system has the same effect on the body: disturbance of **homeostasis** and O_2 starvation in tissues that may cause death.

The lungs and airways bring in fresh, oxygen-enriched air and expel waste CO_2 by a process called ***breathing,*** or ***ventilation.*** Breathing helps regulate the **pH** (acidity-alkalinity) of the blood, thereby maintaining homeostasis.

Anatomy and Physiology Key Terms

This section introduces important respiratory system terms and their definitions. Word analyses for selected terms are also provided.

Term	Definition
carbon dioxide (CO_2) KĂR-bŏn dī-ŎK-sīd	Tasteless, colorless, odorless gas produced by body cells during the metabolic process ***A product of cell respiration, CO_2 is carried by the blood to the lungs and exhaled.***
cartilage KĂR-tĭ-lĭj	Tough, elastic connective tissue that is more rigid than ligaments but less dense than bone ***The tip of the nose and the outer ear are composed of cartilage.***
cilia SĬL-ē-ă	Any hairlike structure ***Cilia in the trachea move particles upward to the pharynx, where they are removed by coughing, sneezing, or swallowing. This mechanism is called the* cilia escalator.** ***Habitual smoking destroys the cilia escalator.***
diffuse dĭ-FŪZ̆	Moving or spreading out of a substance at random, rather than by chemical reaction or application of external forces
homeostasis hō-mē-ō-STĀ-sĭs *homeo-:* same, alike *-stasis:* standing still	State in which the regulatory mechanisms of the body maintain a constant internal environment ***The regulatory mechanisms of the body control temperature, acidity, and the concentration of salt, food, and waste products.***
mucous membrane MŪ-kŭs MĔM-brān *muc:* mucus *-ous:* pertaining to	Moist tissue layer lining hollow organs and cavities of the body that open to the environment; also called *mucosa*
oxygen (O_2) ŎK-sĭ-jĕn	Tasteless, odorless, colorless gas essential for human respiration ***O_2 makes up about one fifth (by volume) of the atmosphere.***
pH	Symbol that indicates the degree of acidity or alkalinity of a substance ***Increasing acidity is expressed as a number less than 7; increasing alkalinity as a number greater than 7, with 7 being neutral.***
septum SĔP-tŭm	Wall dividing two cavities, such as the nasal septum, which separates the two nostrils

Anatomy and Physiology Key Terms—cont'd

Term	Definition
serous membrane SĒR-ūs MEM-brān *ser:* serum *-ous:* pertaining to, relating to	Thin layer of tissue that covers internal body cavities, the cells of which secrete a fluid that keeps the membrane moist; also called *serosa*

Pronunciation Help

Long Sound	ā—rate	ē—rebirth	ī—isle	ō—over	ū—unite
Short Sound	ă—lone	ĕ—ever	ĭ—it	ŏ—not	ŭ—cut

Upper Respiratory Tract

The breathing process begins with inhalation. (See Figure 7–1.) Air is drawn into the (1) **nasal cavity,** a chamber lined with mucous membranes and tiny hairs called ***cilia*** (singular, ***cilium***). Here, air is filtered, heated, and moistened to prepare it for its journey to the lungs. The nasal cavity is divided into a right and left side by a vertical partition of cartilage called the ***nasal*** septum.

Olfactory neurons are receptors for the sense of smell. They are covered with a layer of mucus and located deep in the nasal cavity, embedded among the epithelial cells lining the nasal tract. Because they are located higher in the nasal passage than air normally travels during breathing, a person must sniff or inhale deeply to identify weak odors. Air passes from the nasal cavity to the throat (**pharynx**), a muscular tube that serves as a passageway for food and air. The pharynx consists of three sections: the (2) **nasopharynx,** posterior to the nose; the (3) **oropharynx,** posterior to the mouth; and the (4) **laryngopharynx,** superior to the larynx.

Within the nasopharynx is a collection of lymphoid tissue known as (5) **adenoids** (pharyngeal tonsils). The (6) **palatine tonsils,** more commonly known as ***tonsils,*** are located in the oropharynx. They protect the opening to the respiratory tract from microscopic organisms that may attempt entry by this route. The (7) **larynx** (voice box) contains the structures that make vocal sounds possible. A leaf-shaped structure on top of the larynx, the (8) **epiglottis,** seals off the air passage to the lungs during swallowing. This function ensures that food or liquids do not obstruct the flow of air to the lungs. The larynx is a short passage that joins the pharynx with the (9) **trachea** (windpipe). The trachea is composed of smooth muscle embedded with C-shaped rings of cartilage, which provide rigidity to keep the air passage open.

Lower Respiratory Tract

The trachea divides into two branches called (10) **bronchi** (singular, ***bronchus***). One branch leads to the (11) **right lung** and the other to the (12) **left lung.** The inner walls of the trachea and bronchi are composed of mucous membrane (**mucosa**) embedded with cilia. This membrane traps incoming particles, and the cilia move the entrapped material upward into the pharynx, where it is coughed out, sneezed out, or swallowed. Like the trachea, bronchi contain C-shaped rings of cartilage.

Each bronchus divides into smaller and smaller branches, eventually forming (13) **bronchioles.** At the end of the bronchioles are tiny air sacs called (14) **alveoli** (singular, ***alveolus***). An alveolus resembles a small balloon because it expands and contracts with inflow and outflow of air. The (15) **pulmonary capillaries** lie next to the thin tissue membranes of the alveoli. Carbon dioxide diffuses from the blood within the pulmonary capillaries and enters the alveolar spaces, while O_2 from the alveoli diffuses into the blood. After the exchange of gases, freshly oxygenated blood returns to the heart. It is now ready for delivery to all body tissues.

The lungs are divided into lobes: three lobes in the right lung and two lobes in the left lung. The space between the right and left lungs is called the (16) **mediastinum.** It contains the heart, aorta, esophagus, and bronchi. A serous membrane, the **pleura,** covers the lobes of the lungs and folds over to line the walls of the thoracic cavity. The membrane lying closest to the lung is the (17) **visceral pleura;** the membrane that lines the thoracic cavity is the (18) **parietal pleura.** The space between these two membranes is the (19) **pleural cavity.** It contains a small amount of lubricating fluid, which permits the visceral pleura to glide smoothly over the parietal pleura during breathing.

Ventilation depends on a pressure differential between the atmosphere and chest cavity. A large muscular partition, the (20) **diaphragm,** lies

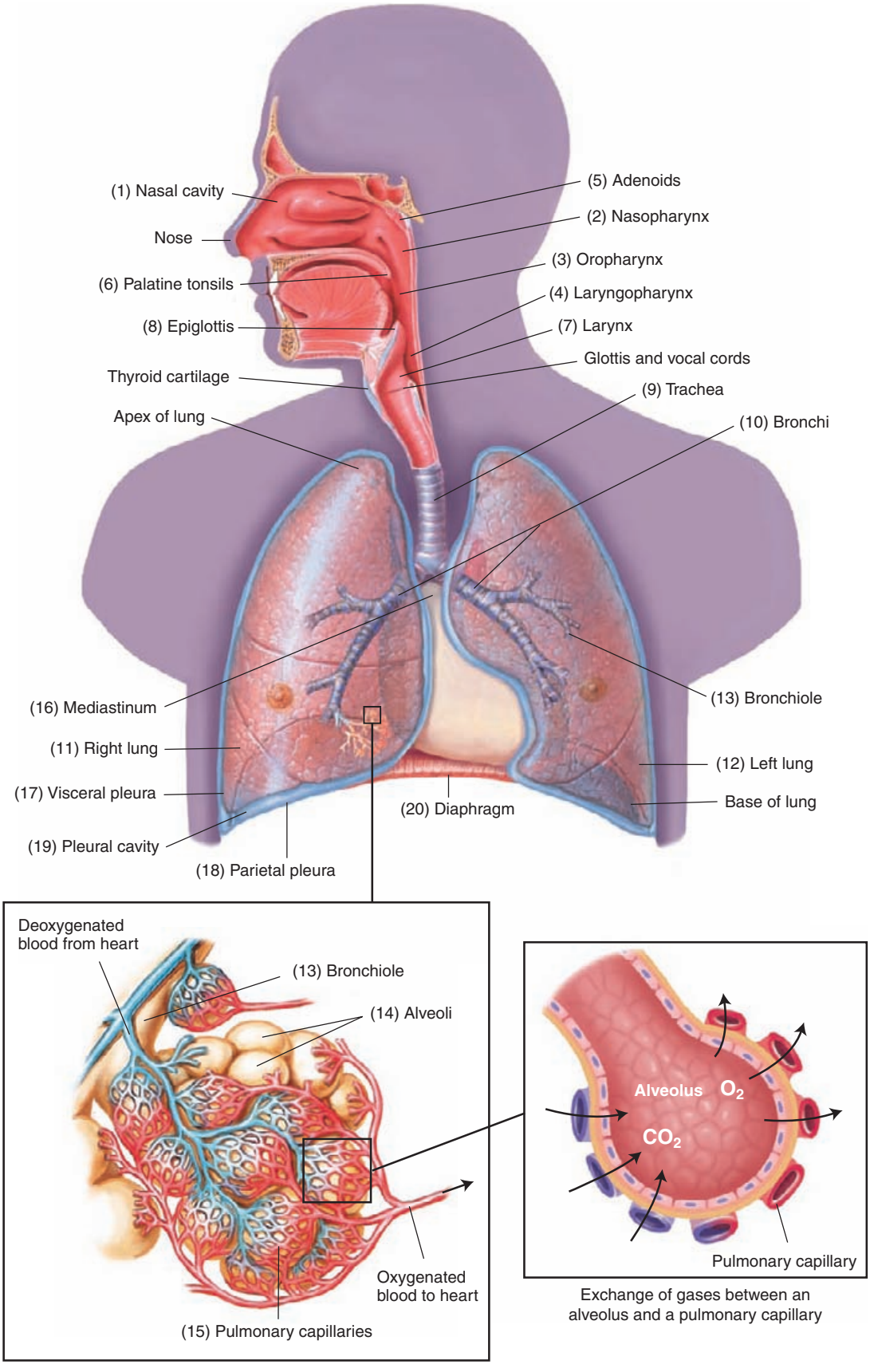


Figure 7-1. Anterior view of the upper and lower respiratory tracts.

between the chest and abdominal cavities. The diaphragm assists in changing the volume of the thoracic cavity to produce the needed pressure differential for ventilation. When the diaphragm contracts, it partially descends into the abdominal cavity, thus decreasing the pressure within the chest and drawing air into the lungs (**inspiration**). When the diaphragm relaxes, it slowly reenters the thoracic cavity, thus increasing the pressure within the chest. As the pressure increases, air leaves the lungs (**expiration**). The intercostal muscles assist the diaphragm in changing the volume of the thoracic cavity by elevating and lowering the rib cage. (See Figure 7–2.)

Respiration

Respiration is the overall process by which O_2 is taken from air and carried to body cells for their use, while CO_2 and water, the waste products generated by these cells, are returned to the environment. Respiration includes four separate processes:

- **pulmonary ventilation,** more commonly called ***breathing***, which is a largely involuntary action that moves air into (**inspiration**) and out of (**expiration**) the lungs in response to changes in blood O_2 and CO_2 levels and nervous stimulation of the diaphragm and intercostal muscles
- **external respiration,** which is the exchange of oxygen and carbon dioxide between the alveoli and the blood in the pulmonary capillaries
- **transport of respiratory gases,** which occurs when blood, aided by the cardiovascular system, transports CO_2 to the lungs and O_2 to body cells
- **internal respiration,** which is the exchange of O_2 and CO_2 between body cells and the blood in systemic capillaries.

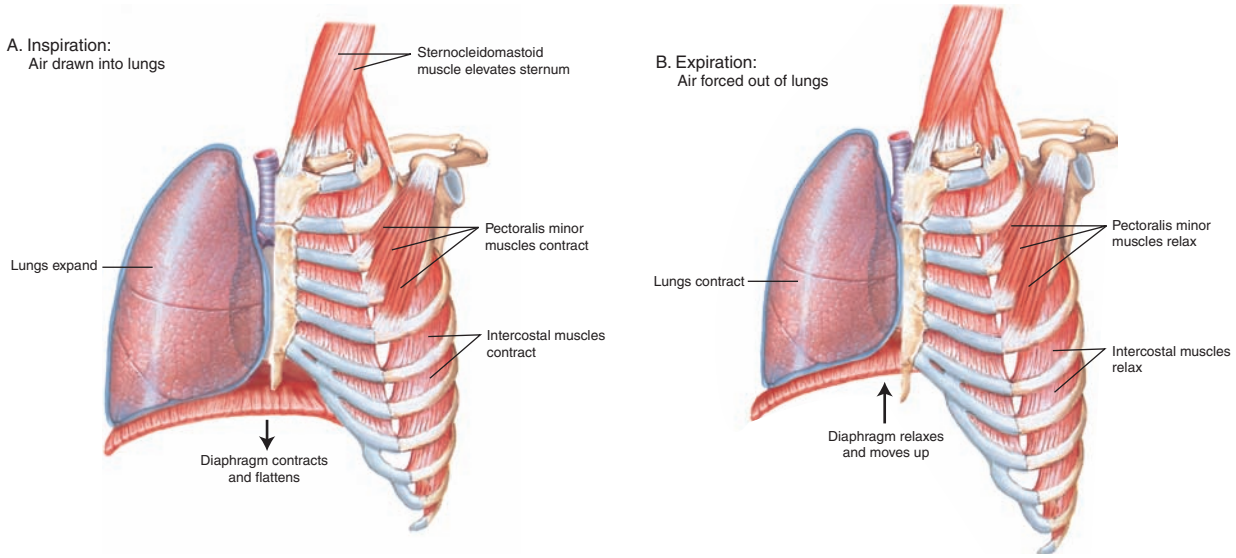


Figure 7-2. Breathing muscles.

Connecting Body Systems–Respiratory System

The main function of the respiratory system is to provide oxygen to the entire body and expel carbon dioxide from the body. Specific functional relationships between the respiratory system and other body systems are summarized below.

Blood, lymph, and immune

- Tonsils, adenoids, and other immune structures in the respiratory tract protect against pathogens that enter through respiratory passageways.

Cardiovascular

- Respiratory system provides O_2 and removes CO_2 from cardiac tissue.

Digestive

- Respiratory system provides O_2 needed for digestive functions.
- Respiratory system removes CO_2 produced by the organs of digestion.
- Respiratory and digestive system share a common anatomic structure.

(continued)

Connecting Body Systems–Respiratory System—cont'd

Endocrine

- Respiratory system helps maintain a stable pH required for proper functioning of the endocrine glands.

Female reproductive

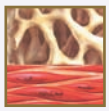
- Respiration rate increases in response to sexual activity.
- Fetal respiration occurs during pregnancy.

Genitourinary

- Respiratory system supplies O_2 and removes CO_2 to maintain proper functioning of urinary structures.
- Respiratory system helps maintain pH for gonadal hormone function.
- Respiratory system assists the urinary structures in regulating pH by removing CO_2.

Integumenary

- Respiratory system furnishes O_2 and disposes of CO_2 to maintain healthy skin.



Musculoskeletal

- Respiratory system provides O_2 for muscle contraction.
- Respiratory system eliminates CO_2 produced by muscles.
- Respiratory system provides O_2 for bone development.

Nervous

- Respiratory system provides O_2 for brain, spinal cord, and sensory organ functions.
- Respiratory system helps maintain a stable pH for neural function.

It is time to review respiratory structures by completing Learning Activity 7–1.

Medical Word Elements

This section introduces combining forms, suffixes, and prefixes related to the respiratory system. Word analyses are also provided.

Element	Meaning	Word Analysis
Combining Forms		
Upper Respiratory Tract		
nas/o	nose	**nas**/al (NĀ-zl): pertaining to the nose *-al:* pertaining to
rhin/o		**rhin/o**/plasty (RĪ-nō-plăs-tē): surgical repair of the nose *-plasty:* surgical repair ***Rhinoplasty is performed to correct birth defects or for cosmetic purposes.***
sept/o	septum	**sept/o**/plasty (SĔP-tō-plăs-tē): surgical repair of the septum *-plasty:* surgical repair ***Septoplasty is commonly performed to correct a deviated septum.***
sinus/o	sinus, cavity	**sinus/o**/tomy (sī-nŭs-ŎT-ō-mē): incision of any of the sinuses *-tomy:* incision ***Sinusotomy is performed to improve ventilation or drainage in unresponsive sinusitis.***
adenoid/o	adenoids	**adenoid**/ectomy (ăd-ĕ-noyd-ĔK-tō-mē): excision of adenoids *-ectomy:* excision, removal

Medical Word Elements—cont'd

Element	Meaning	Word Analysis
tonsill/o	tonsils	peri/**tonsill**/ar (pĕr-ĭ-TŎN-sĭ-lăr): pertaining to (the area) around the tonsils *peri-:* around *-ar:* pertaining to
pharyng/o	pharynx (throat)	**pharyng/o**/scope (făr-ĬN-gō-skōp): instrument for examining the pharynx *-scope:* instrument for examining
epiglott/o	epiglottis	**epiglott**/itis (ĕp-ĭ-glŏt-Ī-tĭs): inflammation of the epiglottis *-itis:* inflammation ***Because the epiglottis seals the passageway traveled by air to and from the lungs, inflammation can lead to severe airway obstruction and death. Epiglottitis is treated as a medical emergency.***
laryng/o	larynx (voice box)	**laryng/o**/plegia (lă-rĭn-gō-PLĒ-jē-ă): paralysis of the (vocal cords and) larynx *-plegia:* paralysis
trache/o	trachea (windpipe)	**trache/o**/plasty (TRĀ-kē-ō-plăs-tē): surgical repair of the trachea *-plasty:* surgical repair ***Tracheoplasty is performed to correct a narrow or stenotic trachea.***
Lower Respiratory Tract		
bronchi/o	bronchus (plural, bronchi)	**bronchi**/ectasis (brŏng-kē-ĔK-tă-sĭs): dilation of (one or more) bronchi *-ectasis:* dilation, expansion ***Bronchiectasis is associated with various lung conditions and is commonly accompanied by chronic infection.***
bronch/o		**bronch/o**/scope (BRŎNG-kō-skōp): instrument for examining the bronchus or bronchi *-scope:* instrument for examining ***A bronchoscope is a flexible tube that is passed through the nose or mouth and enables inspection of the lungs and collection of tissue biopsies and secretions for analysis.***
bronchiol/o	bronchiole	**bronchiol**/itis (brŏng-kē-ō-LĪ-tĭs): inflammation of the bronchioles *-itis:* inflammation
alveol/o	alveolus; air sac	**alveol**/ar (ăl-VĒ-ō-lăr): pertaining to the alveoli *-ar:* pertaining to
pleur/o	pleura	**pleur/o**/centesis (ploo-rō-sĕn-TĒ-sĭs): surgical puncture of the pleural cavity; also called *thoracocentesis* or *thoracentesis* *-centesis:* surgical puncture
pneum/o	air; lung	**pneum**/ectomy (nūm-ĔK-tō-mē): excision of (all or part of) a lung *-ectomy:* excision
pneumon/o		**pneumon**/ia (nū-MŌ-nē-ă): condition of inflammation of the lungs *-ia:* condition ***The usual causes of pneumonia are infections due to bacteria, viruses, or other pathogenic organisms.***

(continued)

Medical Word Elements—cont'd

Element	Meaning	Word Analysis
pulmon/o	lung	**pulmon/o**/logist (pŭl-mŏ-NŎL-ŏ-jĭst): specialist in the study (and treatment) of lungs (and respiratory diseases) *-logist:* specialist in the study of
Other		
anthrac/o	coal, coal dust	**anthrac**/osis (ăn-thră-KŌ-sĭs): abnormal condition of coal dust (in the lungs) *-osis:* abnormal condition; increase (used primarily with blood cells) ***Anthracosis is a chronic occupational disease found in coal miners and those associated with the coal industry.***
atel/o	incomplete; imperfect	**atel**/ectasis (ăt-ĕ-LĔK-tă-sĭs): incomplete expansion of the lung; also called *airless lung* or *collapsed lung* *-ectasis:* dilation, expansion
coni/o	dust	pneum/o/**coni**/osis (nū-mō-kō-nē-Ō-sĭs): condition of dust in the lungs *pneum/o:* air; lung *-osis:* abnormal condition; increase (used primarily with blood cells) ***Pneumoconiosis is usually caused by mineral dusts of occupational or environmental origin. Forms of pneumoconiosis include silicosis, asbestosis, and anthracosis.***
cyan/o	blue	**cyan**/osis (sī-ă-NŌ-sĭs): abnormal condition of blueness *-osis:* abnormal condition; increase (used primarily with blood cells) ***Cold temperatures, heart failure, lung diseases, and smothering cause unusual blueness of the skin and mucous membranes due to the build-up of carbon dioxide in the blood.***
lob/o	lobe	**lob**/ectomy (lō-BĔK-tō-mē): excision of a lobe *-ectomy:* excision ***Lobectomies are performed when a malignancy is confined to a single lobe of any lobed organ, such as the lungs, liver, brain, and thyroid gland.***
orth/o	straight	**orth/o**/pnea (or-THŎP-nē-ă): breathing in a straight (or upright position) *-pnea:* breathing ***Various lung disorders cause a patient to experience difficulty breathing in any position other than sitting or standing erect.***
ox/i	oxygen	**ox/i**/meter (ŏk-SĬM-ĕ-tĕr): instrument used for measuring oxygen *-meter:* instrument for measuring ***An oximeter is usually attached to the tip of a finger but may also be placed on a toe or ear lobe. It provides a measurement of the oxygen saturation level of the blood.***
ox/o		hyp/**ox**/emia (hī-pŏks-Ē-mē-ă): deficiency of oxygen in blood *hyp-:* under, below, deficient *-emia:* blood condition
pector/o	chest	**pector**/algia (pĕk-tō-RĂL-jē-ă): pain in the chest; also called thoracalgia, *thoracodynia,* and *pectorodynia* *-algia:* pain
steth/o		**steth/o**/scope (STĔTH-ō-skōp): instrument used for examining the chest *-scope:* instrument for examining ***A stethoscope enables evaluation of sounds in the chest as well as the abdomen.***

Medical Word Elements—cont'd

Element	Meaning	Word Analysis
thorac/o		**thorac/o**/pathy (thō-răk-ŎP-ă-thē): disease of the chest *-pathy:* disease
phren/o	diaphragm; mind	**phren/o**/spasm (FRĔN-ō-spăzm): involuntary contraction of the diaphragm *-spasm:* involuntary contraction, twitching
spir/o	breathe	**spir/o**/meter (spī-RŎM-ĕt-ĕr): instrument for measuring breathing *-meter:* instrument for measuring ***A spirometer measures how much air the lungs can hold (vital capacity) as well as how much and how quickly air can be exhaled.***
Suffixes		
-capnia	carbon dioxide (CO_2)	hyper/**capnia** (hī-pĕr-KĂP-nē-ă): excessive CO_2 *hyper-:* excessive, above normal
-osmia	smell	an/**osmia** (ăn-ŎZ-mē-ă): without (the sense of) smell *an-:* without, not
-phonia	voice	dys/**phonia** (dĭs-FŌ-nē-ă): bad (impaired) voice quality *dys-:* bad; painful; difficult ***Dysphonia includes hoarseness, voice fatigue, or decreased projection.***
-pnea	breathing	a/**pnea** (ăp-NĒ-ă): not breathing *a-:* without, not ***Apnea is a temporary loss of breathing and includes sleep apnea, cardiac apnea, and apnea of the newborn.***
-ptysis	spitting	hem/o/**ptysis** (hē-MŎP-tī-sĭs): (coughing up or) spitting of blood *hem/o:* blood ***Bloody sputum is usually a sign of a serious condition of the lungs.***
-thorax	chest	py/o/**thorax** (pī-ō-THŌ-răks): pus in the chest (cavity); also called *empyema* *py/o:* pus ***Pyothorax is usually caused by a penetrating chest wound or spreading of infection from another part of the body.***
Prefixes		
brady-	slow	**brady**/pnea (brăd-ĭp-NĒ-ă): slow breathing *-pnea:* breathing
dys-	bad; painful; difficult	**dys**/pnea (dĭsp-NĒ-ă): difficult breathing *-pnea:* breathing ***Dyspnea includes any discomfort or significant breathlessness.***
eu-	good, normal	**eu**/pnea (ūp-NĒ-ă): normal breathing *-pnea:* breathing ***The normal range for a resting adult respiratory rate is 12 to 20 breaths/minute.***
tachy-	rapid	**tachy**/pnea (tăk-ĭp-NĒ-ă): rapid breathing *-pnea:* breathing

It is time to review word elements by completing Learning Activity 7–2. For audio pronunciations of the above-listed key terms, you can visit www.davisplus.fadavis.com/gylys/systems *to download this chapter's* Listen and Learn! *exercises or use the book's audio CD (if included).*

Pathology

Common signs and symptoms of many respiratory disorders include cough (dry or productive), chest pain, altered breathing patterns, shortness of breath (SOB), cyanosis, and fever. Many disorders of the respiratory system, including bronchitis and emphysema, begin as an acute problem but become chronic over time. Chronic respiratory diseases are usually difficult to treat. Their damaging effects are commonly irreversible.

For diagnosis, treatment, and management of respiratory disorders, the medical services of a specialist may be warranted. **Pulmonology** is the medical specialty concerned with disorders of the respiratory system. The physician who treats these disorders is called a *pulmonologist*.

Chronic Obstructive Pulmonary Disease

Chronic obstructive pulmonary disease (COPD) includes respiratory disorders that produce a chronic partial obstruction of the air passages. The patient finds it difficult to breath (**dyspnea**) especially upon exertion and usually exhibits a chronic cough. The three major disorders included in COPD are asthma, chronic bronchitis, and emphysema. (See Figure 7–3.)

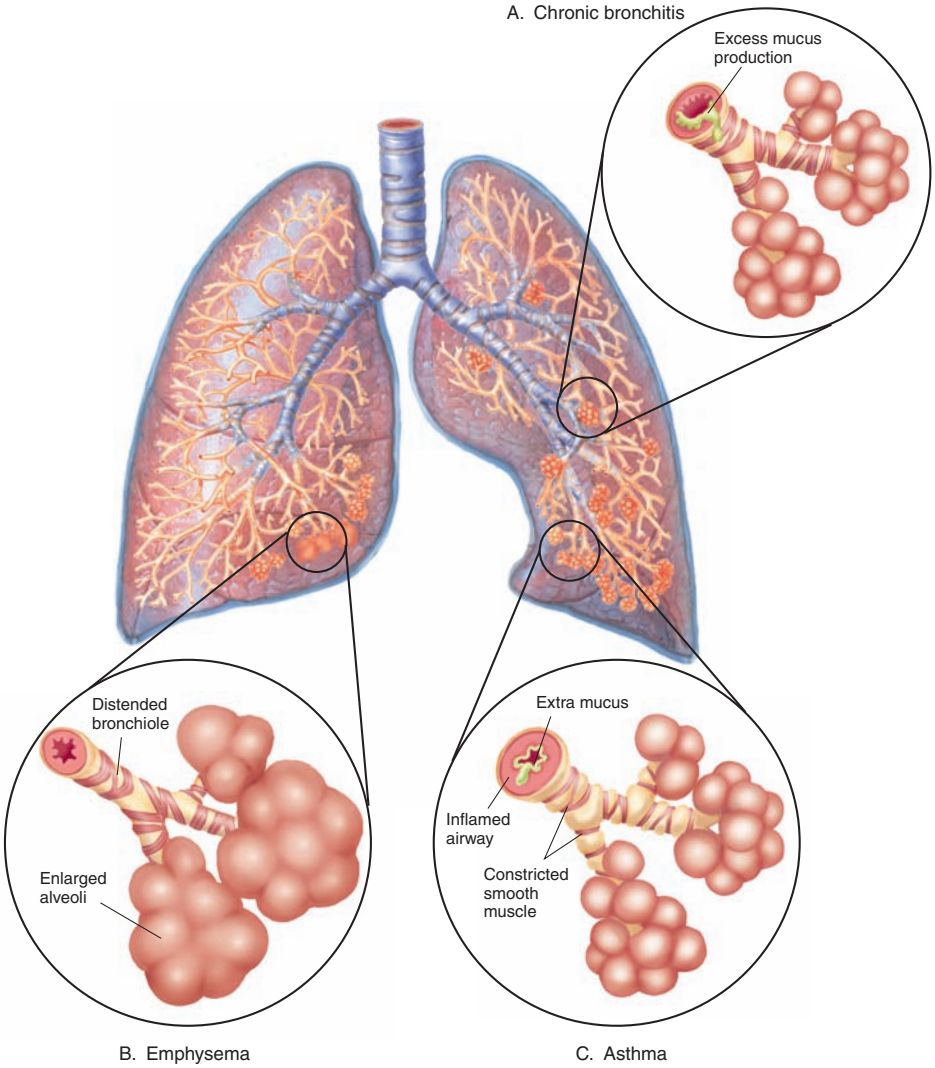


Figure 7-3. COPD. (A) Chronic bronchitis with inflamed airways and excessive mucus. (B) Emphysema with distended bronchioles and alveoli. (C) Asthma with narrowed bronchial tubes and swollen mucous membranes.

Asthma

Asthma produces spasms in the bronchial passages (**bronchospasms**) that may be sudden and violent (**paroxysmal**) and lead to dyspnea. Asthma is commonly caused by exposure to allergens or irritants. Other causes include stress, cold, and exercise. During recovery, coughing episodes produce large amounts of mucus (**productive cough**). Over time, the epithelium of the bronchial passages thickens, and breathing becomes more difficult. Treatment includes agents that loosen and break down mucus (**mucolytics**) and medications that expand the bronchi (**bronchodilators**) by relaxing their smooth muscles. If usual measures do not reverse the bronchospasms, the condition is referred to as ***status asthmaticus***.

Chronic Bronchitis

Chronic bronchitis is an inflammation of the bronchi caused mainly by smoking and air pollution. However, other agents, such as viruses and bacteria may also cause the disorder. Bronchitis is characterized by swelling of the mucosa and a heavy, productive cough, commonly accompanied by chest pain. Patients usually seek medical help when they suffer exercise intolerance, wheezing, and shortness of breath (SOB). Bronchodilators and medications that aid in the removal of mucus (**expectorants**) help to widen air passages. Steroids may be prescribed if the disease progresses or becomes chronic.

Emphysema

Emphysema is characterized by decreased elasticity of the alveoli. The alveoli expand (**dilate**) but are unable to contract to their original size. The air that remains trapped in the chest results in a characteristic "barrel-chested" appearance. This disease commonly occurs with another respiratory disorder, such as asthma, tuberculosis, or chronic bronchitis. It is also found in long-term heavy smokers. Most emphysema sufferers find it easier to breathe when sitting upright or standing erect (**orthopnea**). As the disease progresses, relief even in the orthopneic position is not possible. Treatment for emphysema is similar to that of chronic bronchitis.

Influenza

Influenza (flu) is an acute infectious respiratory viral disease. Three major viral types are responsible: type A, type B, and type C. Type A is of primary concern because it is associated with worldwide epidemics (**pandemics**) and its causative organism is highly infectious (**virulent**). Influenza type A epidemics occur about every 2 to 3 years. Type B is usually limited geographically and tends to be less severe than type A. Both viruses undergo antigenic changes; consequently, new vaccines must be developed in anticipation of outbreaks. Type C is a mild flu and is not associated with epidemics.

The onset of the flu is usually rapid. Symptoms include fever, chills, headache, generalized muscle pain (**myalgia**), and loss of appetite, but recovery occurs in about 7 to 10 days. The flu virus rarely causes death. If death occurs, it is usually the result of a secondary pneumonia caused by bacteria or viruses that invade the lungs. Children should not use aspirin for relief of symptoms caused by viruses because there appears to be a relationship between Reye syndrome and the use of aspirin by children 2 to 15 years of age.

Pleural Effusions

Any abnormal fluid in the pleural cavity, the space between the visceral and parietal pleura, is called a ***pleural effusion***. Normally, the pleural cavity contains only a small amount of lubricating fluid. However, some disorders may cause excessive fluid to collect in the pleural cavity. Two initial techniques used to diagnose pleural effusion are auscultation and percussion. **Auscultation** is the listening of sounds made by organs of the body using a stethoscope. **Percussion** is the gentle tapping the chest with the fingers and listening to the resultant sounds to determine the position, size, or consistency of the underlying structures. Chest x-ray (CXR) or magnetic resonance imaging (MRI) confirms the diagnosis.

Effusions are classified as transudates and exudates. A **transudate** is a noninflammatory fluid that resembles serum but with slightly less protein. It results from an imbalance in venous-arterial pressure or decrease of protein in blood. Both of these conditions allow serum to leak from the vascular system and collect in the pleural space. Common causes include left ventricular heart failure and liver disorders. An **exudate** is usually high in protein and often contains blood and immune cells. Common causes include tumors, infections, and inflammation. Various types of pleural effusions include serum (**hydrothorax**), pus (**empyema** or **pyothorax**), and blood (**hemothorax**). Although not considered a pleural effusion, air can enter the pleural space (**pneumothorax**), resulting in a partial or complete collapse of a lung. (See Figure 7–4.)

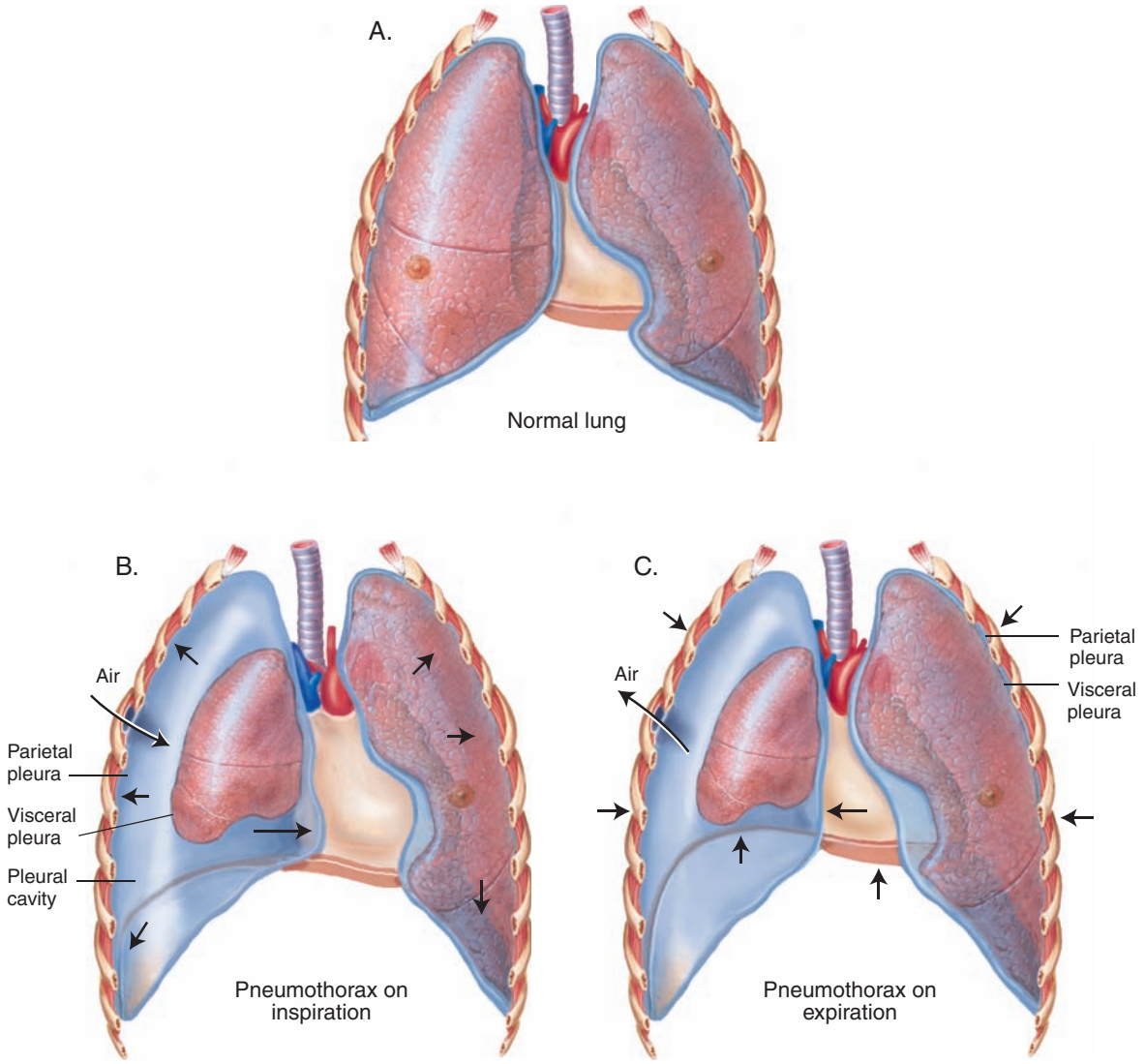


Figure 7-4. Pneumothorax. (A) Normal. (B) Open pneumothorax during inspiration. (C) Open pneumothorax during expiration.

Treatment consists of correcting the underlying cause of the effusion. Often a surgical puncture of the chest using a hollow-bore needle (**thoracocentesis, thoracentesis**) is undertaken to remove excess fluid for diagnostic or therapeutic purposes. (See Figure 7–5.) Sometimes chest tubes are inserted to drain fluid or remove air in pneumothorax.

Tuberculosis

Tuberculosis (TB) is a communicable disease caused by the bacterium *Mycobacterium tuberculosis*. TB spreads by droplets of respiratory secretions (**droplet nuclei**) from an infected individual when he/she coughs, laughs, or sneezes. The waxy coat of the TB organism keeps it alive (**viable**) and infectious for 6 to 8 months outside the body. It also makes laboratory staining of this organism more challenging. Hence TB is also known as the *acid-fast bacillus* (AFB), a reference to its more complex method of laboratory staining.

The first time the TB organism enters the body (**primary tuberculosis**), the disease develops slowly. It eventually produces typical inflammatory nodules (**granulomas**) called ***tubercles***. These granulomas usually remain dormant for years, during which time the patient is asymptomatic. When the immune system becomes impaired (**immunocompromised**) or when the patient is reexposed to the bacterium, a full-blown disease may develop.

Although primarily a lung disease, TB can infect the bones, genital tract, meninges, and peritoneum.

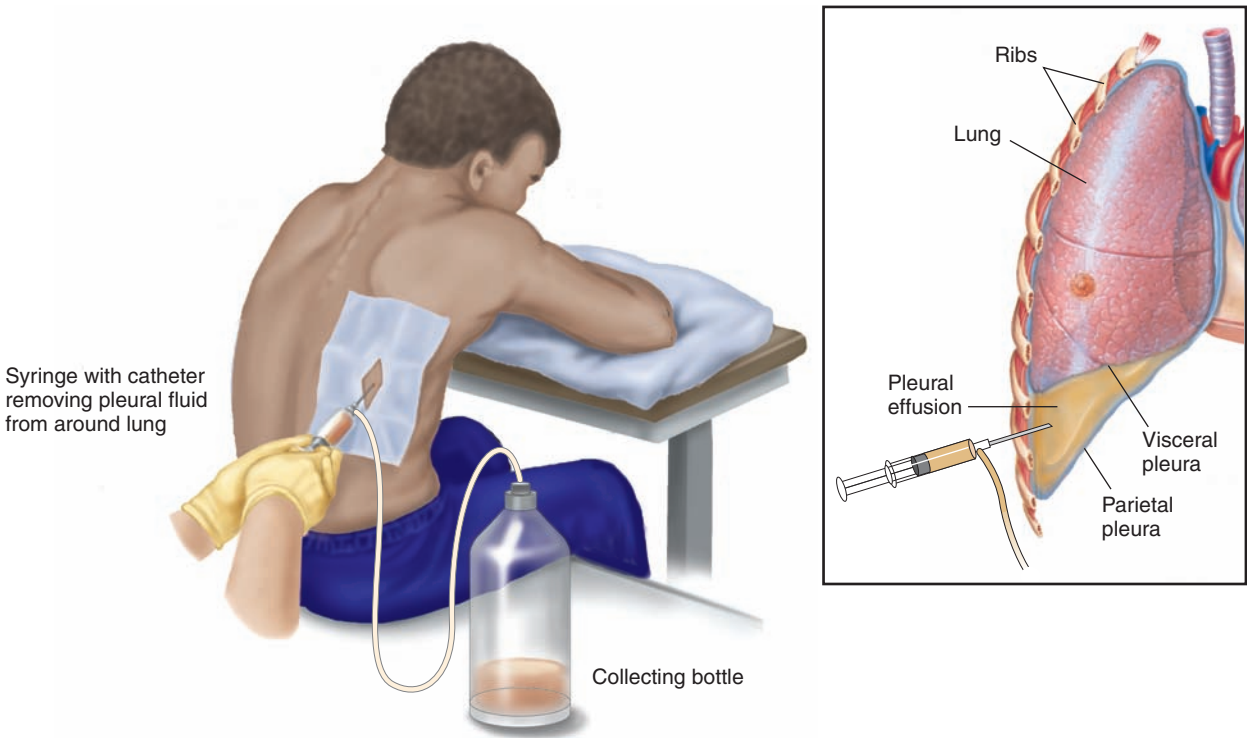


Figure 7-5. Thoracentesis.

Some TB strains that infect AIDS patients have become resistant and do not respond to standard medications. Treatment may include using several antibiotics (**combination therapy**) at the same time.

Pneumonia

Pneumonia is any inflammatory disease of the lungs that may be caused by bacteria, viruses, or fungi. Chemicals or other agents can cause the lungs to become inflamed. A type of pneumonia associated with influenza is sometimes fatal. Other potentially fatal pneumonias may result from food or liquid inhalation (**aspiration pneumonias**). Some pneumonias affect only a lobe of the lung (**lobar pneumonia**), but some are more diffuse (**bronchopneumonia**). Chest pain, mucopurulent sputum, and spitting of blood (**hemoptysis**) are common signs and symptoms of the disease. If the air in the lungs is replaced by fluid and inflammatory debris, the lung tissue looses its spongy texture and become swollen and engorged (**consolidation**). Consolidation is associated primarily with bacterial pneumonias, not viral pneumonias.

Pneumocystis carinii pneumonia (PCP) is a type of pneumonia closely associated with AIDS. Recent evidence suggests that it is caused by a fungus that resides in or on most people (**normal flora**) but causes no harm as long as the individual remains healthy. When the immune system begins to fail, this organism becomes infectious (**opportunistic**). Diagnosis relies on examination of biopsied lung tissue or bronchial washings (**lavage**).

Cystic Fibrosis

Cystic fibrosis is a hereditary disorder of the exocrine glands that causes the body to secrete extremely thick (**viscous**) mucus. This thickened mucus clogs ducts of the pancreas and digestive tract. As a result, digestion is impaired and the patient may suffer from malnutrition. It also blocks ducts of the sweat glands, causing the skin to become highly "salty." In the lungs, mucus blocks airways and impedes natural disease-fighting mechanisms, causing repeated infections. Medication in the form of mists (**aerosols**) along with postural drainage provide relief.

An important diagnostic test called the ***sweat test*** measures the amount of salt excreted in sweat. When elevated, it indicates cystic fibrosis. Although the disease is fatal, improved methods of treatment have extended life expectancy, and patient survival is approximately 30 years.

Acute Respiratory Distress Syndrome

Acute respiratory distress syndrome (ARDS) is a condition in which the lungs no longer function effectively, threatening the life of the patient. It usually occurs as a result of very serious lung conditions, such as trauma, severe pneumonia, and other major infections that affect the entire body (**systemic infections**) or blood (**sepsis**). In ARDS, the alveoli fill with fluid (**edema**) caused by inflammation, and then collapse, making oxygen exchange impossible. Mechanical ventilation is commonly required to save the life of the patient.

Hyaline membrane disease (HMD), sometimes called *infant respiratory distress syndrome (IRDS),* is a form of respiratory distress syndrome. It is most commonly seen in preterm infants or infants born to diabetic mothers. It is caused by insufficient **surfactant,** a phospholipid substance that helps keep alveoli open. With insufficient surfactant, the alveoli collapse and breathing becomes labored. Clinical signs may include blueness (**cyanosis**) of the extremities. Flaring of the nostrils (**nares**) and central cyanosis are typically present. Other signs include rapid breathing (**tachypnea**), intercostal retraction, and a characteristic grunt audible during exhalation. Radiography shows a membrane that has a ground-glass appearance (**hyaline membrane**), bilateral decrease in volume, and alveolar consolidation. Although severe cases of HMD result in death, some forms of therapy are effective.

Oncology

The most common form of lung cancer is bronchogenic carcinoma; also called *primary pulmonary cancer.* This cancer is usually associated with tobacco use. Cells of the bronchial epithelium divide repeatedly until the entire epithelium is involved. Within a short time, the epithelium begins to invade underlying tissues. As masses form, they block air passages and alveoli. Bronchogenic carcinoma spreads (**metastasizes**) rapidly to other areas of the body, including the lymph nodes, liver, bones, brain, and kidneys. Only about 10% of lung cancers are found in the early stages when the cure rate is high. Treatment of lung cancer includes surgery, radiation, and chemotherapy or a combination of these methods depending on specific cell type, how far the disease has spread, and the general health of the patient. Nevertheless, lung cancer is difficult to control and survival rates are very low.

Diagnostic, Symptomatic, and Related Terms

This section introduces diagnostic, symptomatic, and related terms and their meanings. Word analyses for selected terms are also provided.

Term	Definition
acidosis ăs-ĭ-DŌ-sĭs	Excessive acidity of body fluids ***Respiratory acidosis is commonly associated with pulmonary insufficiency and the subsequent retention of carbon dioxide***
anosmia ăn-ŎZ-mē-ă *an-:* without, not *-osmia:* smell	Absence of the sense of smell ***Anosmia usually occurs as a temporary condition resulting from an upper respiratory infection or a condition that causes intranasal swelling.***

Diagnostic, Symptomatic, and Related Terms—cont'd

Term	Definition
apnea ăp-NĒ-ă *a-:* without, not *-pnea:* breathing sleep	Temporary loss of breathing ***There are three types of apnea: obstructive (enlarged tonsils and adenoids), central (failure of the brain to transmit impulses for breathing), and mixed (combination of obstructive and central apnea).*** Sleeping disorder in which breathing stops repeatedly for more than 10 seconds, causing measurable blood deoxygenation. (See Figure 7-6.)

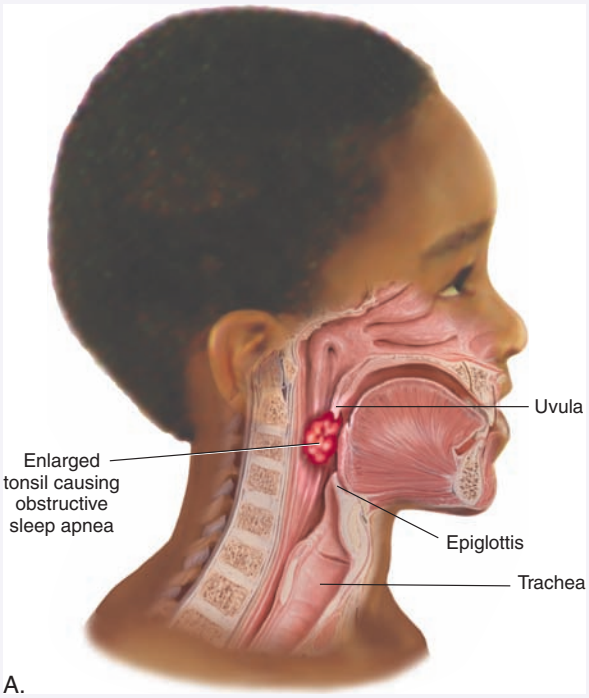


Figure 7-6. Sleep apnea. (A) Airway obstruction caused by enlarged tonsils, eventually leads to obstructive sleep apnea. (B) Continuous positive airway pressure (CPAP) machine used to treat sleep apnea.

(continued)

Diagnostic, Symptomatic, and Related Terms—cont'd

Term	Definition
asphyxia ăs-FĬK-sē-ă *a-:* without, not *-sphyxia:* pulse	Condition caused by insufficient intake of oxygen ***Some common causes of asphyxia are drowning, electric shock, lodging of a foreign body in the respiratory tract, inhalation of toxic smoke, and poisoning.***
atelectasis ăt-ĕ-LĔK-tă-sĭs *atel:* incomplete; imperfect *-ectasis:* dilation, expansion	Collapsed or airless state of the lung, which may be acute or chronic and affect all or part of a lung ***Atelectasis is a potential complication of some surgical procedures, especially those of the chest because breathing is commonly shallow after surgery to avoid pain from the surgical incision. In fetal atelectasis, the lungs fail to expand normally at birth.***
cheyne-Stokes respiration chān-stōks	Repeated breathing pattern characterized by fluctuation in the depth of respiration, first deeply, then shallow, then not at all ***Cheyne-Stokes respirations are usually caused by diseases that affect the respiratory centers of the brain (such as heart failure and brain damage).***
compliance kŏm-PLĪ-ăns	Ease with which lung tissue can be stretched ***Low compliance means lungs are less elastic; therefore, more effort is required to inflate the lungs.***
coryza kŏ-RĪ-ză	Head cold; upper respiratory infection (URI)
crackle KRĂK-ĕl	Abnormal respiratory sound heard on auscultation, caused by exudates, spasms, hyperplasia, or when air enters moisture-filled alveoli; also called *rale*
croup croop	Common childhood condition involving inflammation of the larynx, trachea, bronchial passages and, sometimes, lungs ***Signs and symptoms include a resonant, barking cough with suffocative, difficult breathing; laryngeal spasms, and, sometimes, the narrowing of the top of the air passages.***
deviated nasal septum DĒ-vē-āt-ĕd NĀ-zl SĔP-tŭm	Displacement of cartilage dividing the nostrils
epiglottitis ĕp-ĭ-glŏt-Ī-tĭs *epiglott:* epiglottis *-itis:* inflammation	Severe, life-threatening infection of the epiglottis and supraglottic structures that occurs most commonly in children between 2 and 12 years of age ***Signs and symptoms of epiglottitis include fever, dysphagia, inspiratory stridor, and severe respiratory distress. Intubation or tracheostomy may be required to open the obstructed airway.***
epistaxis ĕp-ĭ-STĂK-sĭs	Nosebleed; nasal hemorrhage
finger clubbing KLŬB-ĭng	Enlargement of the terminal phalanges of the fingers and toes, commonly associated with pulmonary disease
hypoxemia hī-pŏks-Ē-mē-ă *hyp-:* under, below, deficient *ox:* oxygen *-emia:* blood condition	Deficiency of oxygen in the blood ***Hypoxemia is usually a sign of respiratory impairment.***

Diagnostic, Symptomatic, and Related Terms—cont'd

Term	Definition
hypoxia hī-PŎKS-ē-ă *hyp-:* under, below, deficient *-oxia:* oxygen	Deficiency of oxygen in tissues ***Hypoxia is usually a sign of respiratory impairment.***
pertussis pĕr-TŬS-ĭs	Acute infectious disease characterized by a cough that has a "whoop" sound; also called *whooping* cough ***Immunization of infants as part of the diphtheria-pertussis-tetanus (DPT) vaccination is effective in the prevention of pertussis.***
pleurisy PLOO-rĭs-ē *pleur:* pleura *-isy:* state of; condition	Inflammation of the pleural membrane characterized by a stabbing pain that is intensified by coughing or deep breathing; also called *pleuritis*
pneumoconiosis nū-mō-kō-nē-Ō-sĭs *pneum/o:* air; lung *coni:* dust *-osis:* abnormal condition; increase (used primarily with blood cells)	Disease caused by inhaling dust particles, including coal dust (anthracosis), stone dust (chalicosis), iron dust (siderosis), and asbestos particles (asbestosis)
pulmonary edema PŬL-mō-nĕ-rē ĕ-DĒ-mă *pulmon:* lung *-ary:* pertaining to	Accumulation of extravascular fluid in lung tissues and alveoli, caused most commonly by heart failure ***Excessive fluid in the lungs induces coughing and dyspnea.***
pulmonary embolus PŬL-mō-nĕ-rē ĔM-bō-lŭs *pulmon:* lung *-ary:* pertaining to *embol:* plug *-us:* condition, structure	Blockage in an artery of the lungs caused by a mass of undissolved matter (such as a blood clot, tissue, air bubbles, and bacteria)
rhonchus RŎNG-kŭs	Abnormal breath sound heard on auscultation ***A rhonchus is described as a course, rattling noise that resembles snoring, commonly suggesting secretions in the larger airways.***
stridor STRĪ-dor	High-pitched, harsh, adventitious breath sound caused by a spasm or swelling of the larynx or an obstruction in the upper airway ***The presence of stridor requires immediate intervention.***
sudden infant death syndrome (SIDS)	Completely unexpected and unexplained death of an apparently normal, healthy infant, usually less than 12 months of age; also called *crib death* ***The rate of SIDS has decreased more than 30% since parents have been instructed to place babies on their backs for sleeping rather than on their stomachs.***
wheeze HWĒZ	Whistling or sighing sound heard on auscultation that results from narrowing of the lumen of the respiratory passageway ***Wheezing is a characteristic of asthma, croup, hay fever, obstructive emphysema, and other obstructive respiratory conditions.***

It is time to review pathological, diagnostic, symptomatic, and related terms by completing Learning Activity 7–3.

Diagnostic and Therapeutic Procedures

This section introduces procedures used to diagnose and treat respiratory disorders. Descriptions are provided as well as pronunciations and word analyses for selected terms.

Procedure	Descripton
Diagnostic Procedures	
Clinical	
Mantoux test măn-TŪ	Intradermal test to determine tuberculin sensitivity based on a positive reaction where the area around the test site becomes red and swollen ***A positive test suggests a past or present exposure to TB or past TB vaccination. However, the Mantoux test does not differentiate between active and inactive infection.***
oximetry ŏk-SĬM-ĕ-trē *ox/i:* oxygen *-metry:* act of measuring	Noninvasive method of monitoring the percentage of hemoglobin (Hb) saturated with oxygen; also called pulse oximetry ***In oximetry, a probe is attached to the patient's finger or ear lobe and linked to a computer that displays the percentage of hemoglobin saturated with oxygen.***
polysomnography pŏl-ē-sŏm-NŎG-ră-fē *poly-:* many, much *somn/o:* sleep *-graphy:* process of recording	Test of sleep cycles and stages using continuous recordings of brain waves (EEGs), electrical activity of muscles, eye movement (electro-oculogram), respiratory rate, blood pressure, blood oxygen saturation, heart rhythm and, sometimes, direct observation of the person during sleep using a video camera
pulmonary function tests (PFTs) PŬL-mō-nĕ-rē *pulmon:* lung *-ary:* pertaining to	Multiple tests used to evaluate the ability of the lungs to take in and expel air as well as perform gas exchange across the alveolocapillary membrane
spirometry spī-RŎM-ĕ-trē *spir/o:* breathe *-metry:* act of measuring	Measurement of ventilatory ability by assessing lung capacity and flow, including the time necessary for exhaling the total volume of inhaled air ***A spirometer produces a graphic record for placement in the patient's chart.***
Endoscopic	
bronchoscopy brŏng-KŎS-kō-pē *bronch/o:* bronchus *-scopy:* visual examination	Visual examination of the bronchi using an endoscope (flexible fiberoptic or rigid) inserted through the mouth and trachea for direct viewing of structures or for projection on a monitor (See Figure 7-7.) ***Attachments on the bronchoscope can be used to suction mucus, remove foreign bodies, collect sputum, or perform biopsy.***
laryngoscopy lăr-ĭn-GŎS-kō-pē *laryng/o:* larynx (voice box) *-scopy:* visual examination	Visual examination of the larynx to detect tumors, foreign bodies, nerve or structural injury, or other abnormalities
mediastinoscopy mē-dē-ăs-tĭ-NŎS-kō-pē *mediastin/o:* mediastinum *-scopy:* visual examination	Visual examination of the mediastinal structures including the heart, trachea, esophagus, bronchus, thymus, and lymph nodes ***The mediastinoscope is inserted through a small incision made above the sternum. The attached camera projects images on a monitor. Additional incisions may be made if nodes are removed or other diagnostic or therapeutic procedures are performed.***

Diagnostic and Therapeutic Procedures—cont'd

Procedure	Descripton

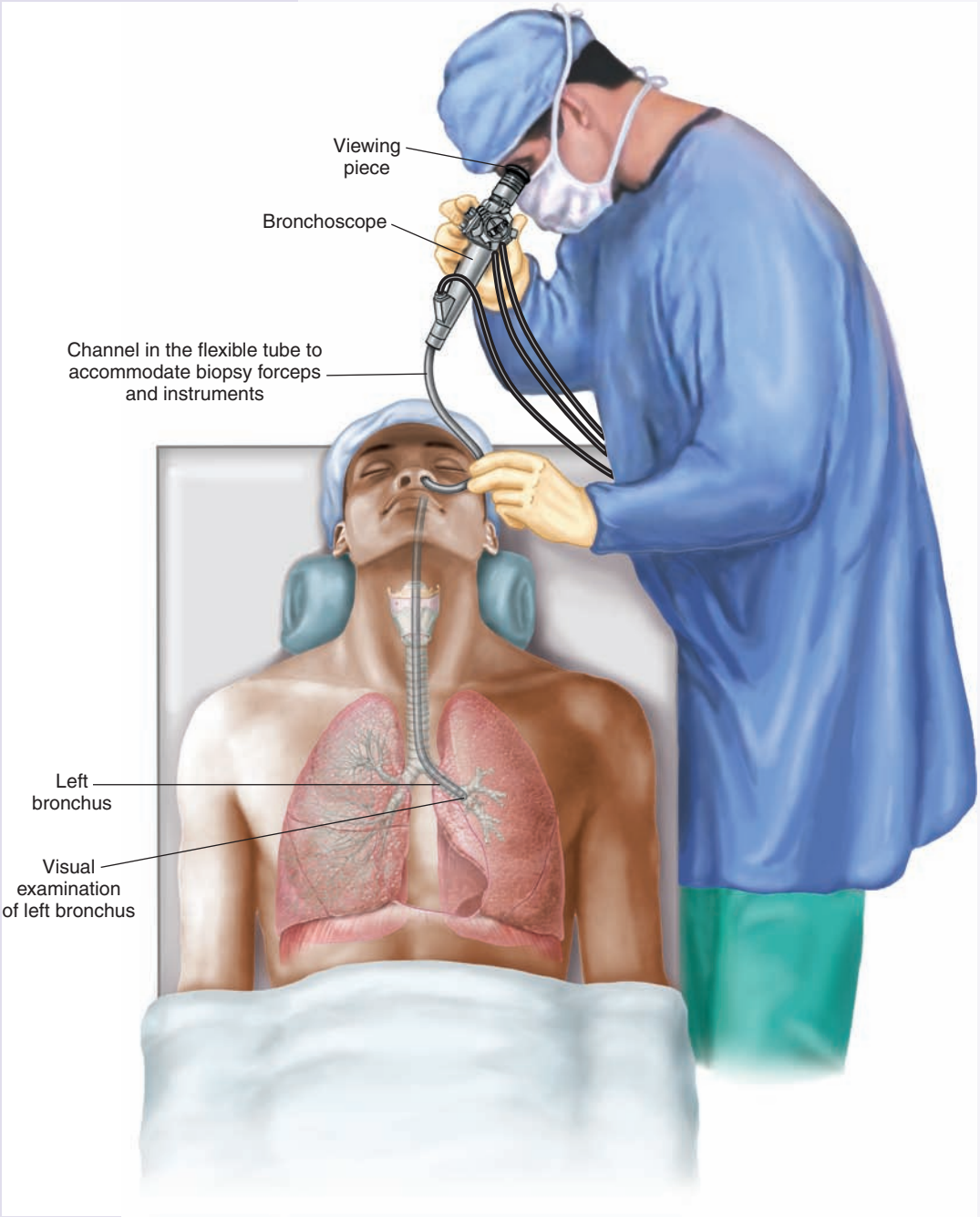


Figure 7-7. Bronchoscopy of the left bronchus.

(continued)

Diagnostic and Therapeutic Procedures—cont'd

Procedure	Descripton
Laboratory	
arterial blood gas (ABG) ăr-TĒ-rē-ăl	Test that measures partial pressure of oxygen (Po_2), carbon dioxide (Pco_2), pH (acidity or alkalinity), and bicarbonate level of an arterial blood sample ***ABG analysis evaluates pulmonary gas exchange and helps guide treatment of acid-base imbalances.***
sputum culture SPŪ-tŭm	Microbial test used to identify disease-causing organisms of the lower respiratory tract, especially those that cause pneumonias
sweat test	Measurement of the amount of salt (sodium chloride) in sweat ***A sweat test is used almost exclusively in children to confirm cystic fibrosis.***
throat culture	Test used to identify pathogens, especially group A streptococci ***Untreated streptococcal infections may lead to serious secondary complications, including kidney and heart disease.***
Radiographic	
radiography rā-dē-ŎG-ră-fē *radi/o:* radiation, x-ray; radius (lower arm bone on thumb side) *-graphy:* process of recording	Process of producing images using an x-ray passed through the body or area and captured on a film
thoracic (chest) thō-RĂS-ĭk *thorac:* chest *-ic:* pertaining to, relating to	Images of the chest taken from anteroposterior (AP) projection, posteroanterior (PA) projection, lateral projection, or a combination of these projections ***Chest radiography is used to diagnose rib fractures and lung diseases, including atelectasis, masses, pneumonia, and emphysema.***
scan	Imaging procedure that gathers information about a specific organ or structure of the body. In some cases, small amounts of injected radionuclide (tracer) are used to enhance images
lung	Nuclear scanning test primarily used to detect pulmonary emboli ***Lung scan is commonly performed to detect the presence of a blood clot that may be interfering with blood flow in or to the lung.***

Diagnostic and Therapeutic Procedures—cont'd

Procedure	Descripton
Therapeutic Procedures	
Clinical	
aerosol therapy ĀR-ō-sŏl THĔR-ă-pē	Lung treatment using various techniques to deliver medication in mist form directly to the lungs or air passageways. Techniques include nebulizers, metered-dose inhalers (MDIs), and dry powder inhalers (DPIs) *Nebulizers change liquid medications into droplets to be inhaled through a mouthpiece. (See Figure 7-8.) MDIs deliver a specific amount when activated. Children and the elderly can use a spacer to synchronize inhalation with medication release. (See Figure 7-9.) A DPI is activated by a quick inhalation by the user.*

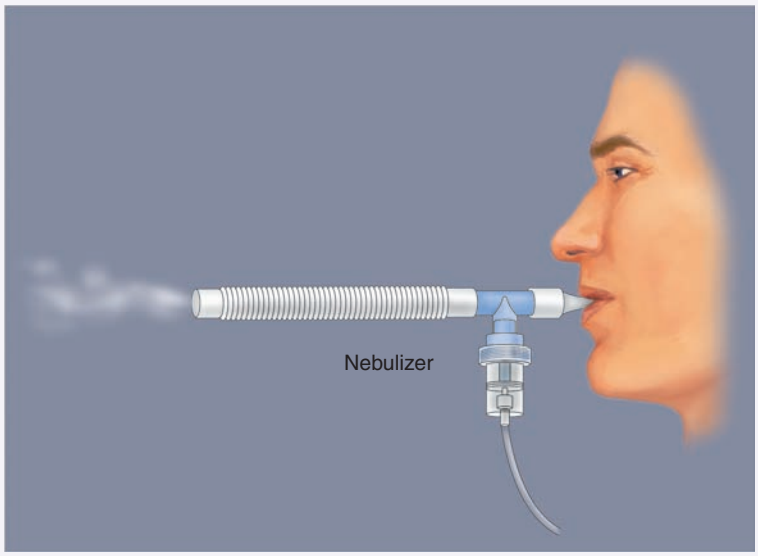


Figure 7-8. Nebulizer.

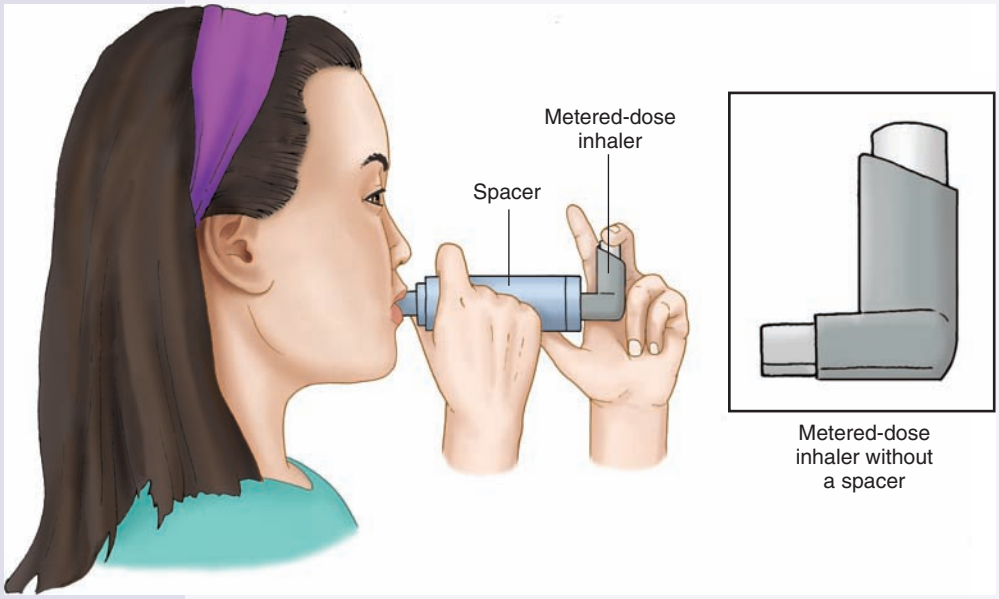


Figure 7-9. Metered-dose inhaler.

(continued)

Diagnostic and Therapeutic Procedures—cont'd

Procedure	Descripton
lavage lă-VĂZH	Irrigating or washing out of an organ, stomach, bladder, bowel, or body cavity with a stream of water or other fluid ***Lavage of the paranasal sinuses is usually performed to remove mucopurulent material in an immunosuppressed patient or one with known sinusitis that has failed medical management.***
antral ĂN-trăl	Irrigation of the antrum (maxillary sinus) in chronic or nonresponsive sinusitis
postural drainage PŎS-tū-răl	Positioning a patient so that gravity aids in the drainage of secretions from the bronchi and lobes of the lungs
Surgical	
pleurectomy ploor-ĔK-tō-mē *pleur:* pleura *-ectomy:* excision, removal	Excision of part of the pleura, usually parietal ***Pleurectomy is performed to reduce pain caused by a tumor mass or to prevent the recurrence of pleural effusion but is generally ineffective in the treatment of malignancy of the pleura.***
pneumectomy nūm-ĔK-tō-mē *pneum:* air; lung *-ectomy:* excision, removal	Excision of a lung ***The removal of a lobe of the lung is called a* lobectomy**
rhinoplasty RĪ-nō-plăs-tē *rhin/o:* nose *-plasty:* surgical repair	Reconstructive surgery of the nose to correct deformities or for cosmetic purposes
septoplasty sĕp-tō-PLĂS-tē *sept/o:* septum *-plasty:* surgical repair	Surgical repair of a deviated nasal septum usually performed when the septum is encroaching on the breathing passages or nasal structures ***Common complications of a deviated septum include interference with breathing and a predisposition to sinus infections.***
thoracentesis thō-ră-sĕn-TĒ-sĭs	Surgical puncture and drainage of the pleural cavity; also called *pleurocentesis* or *thoracocentesis* ***Thoracentesis is performed as a diagnostic procedure to determine the nature and cause of an effusion or as a therapeutic procedure to relieve the discomfort caused by the effusion.*** (See Figure 7–5.)
tracheostomy trā-kē-ŎS-tō-mē	Surgical procedure in which an opening is made in the neck and into the trachea into which a breathing tube may be inserted (See Figure 7–10.)

Diagnostic and Therapeutic Procedures—cont'd

Procedure	Descripton

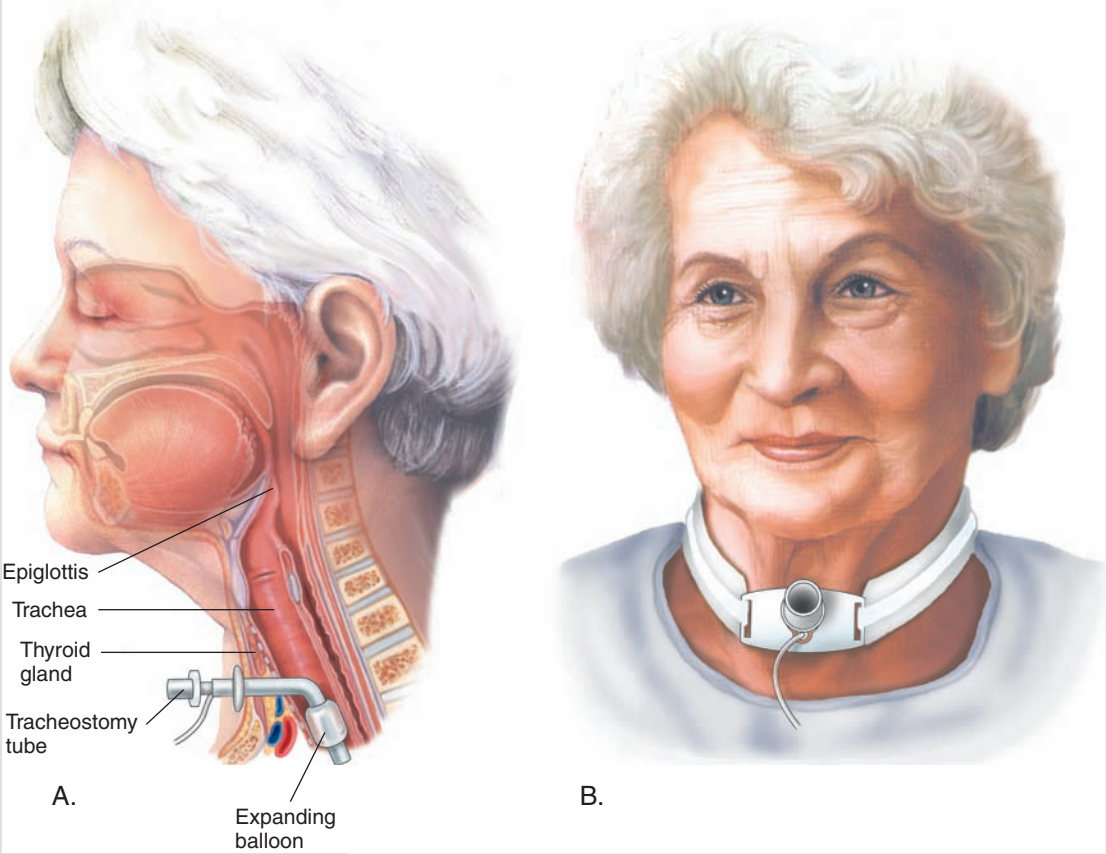


Figure 7-10. Tracheostomy. (A) Lateral view with tracheostomy tube in place. (B) Frontal view.

Pharmacology

In addition to antibiotics used to treat respiratory infections, there are several classes of drugs that treat pulmonary disorders. (See Table 7–1.) Bronchodilators are especially significant in the treatment of COPD and exercise-induced asthma. They relax smooth muscles of the bronchi, thus increasing airflow. Some bronchodilators are delivered as a fine mist directly to the airways via aerosol delivery devices, including nebulizers and metered-dose inhalers (MDIs). Another method of delivering medications directly to the lungs is dry-powder inhalers (DPIs) that dispense medications in the form of a powder. Steroidal and nonsteroidal anti-inflammatory drugs are important in the control and management of many pulmonary disorders.

Table 7-1 Drugs Used to Treat Respiratory Disorders

This table lists common drug classifications used to treat respiratory disorders, their therapeutic actions, and selected generic and trade names.

Classification	Therapeutic Action	Generic and Trade Names
antihistamines	Block histamines from binding with histamine receptor sites in tissues *Histamines cause sneezing, runny nose, itchiness, and rashes.*	**fexofenadine** fĕks-ō-FĔN-ă-dēn Allegra **loratadine** lor-ĂH-tă-dēn Claritin
antitussives	Relieve or suppress coughing by blocking the cough reflex in the medulla of the brain *Antitussives alleviate nonproductive dry coughs and should not be used with productive coughs.*	**hydrocodone** hī-drō-KŌ-dōn Hycodan **dextromethorphan** dĕk-strō-MĔTH-or-făn Vicks Formula 44
bronchodilators	Stimulate bronchial muscles to relax, thereby expanding air passages, resulting in increased air flow *Bronchodilators are used to treat chronic symptoms and prevent acute attacks in respiratory diseases, such as asthma and COPD. Pharmacological agents may be delivered by an inhaler either orally or intravenously.*	**albuterol** ăl-BŪ-tĕr-ăl Proventil, Ventolin **salmeterol** săl-mē-TĔR-ŏl Serevent
corticosteroids	Act on the immune system by blocking production of substances that trigger allergic and inflammatory actions *Corticosteroids are available as nasal sprays, in metered-dose-inhalers (inhaled steroids) and in oral forms (pills or syrups) to treat chronic lung conditions such as asthma and COPD.*	**beclomethasone dipropionate** bĕ-klō-MĔTH-ă-sōn dī-PRŌ-pĕ-ō-nāt Vanceril, Beclovent **triamcinolone** trī-ăm-SĬN-ō-lōn Azmacort
decongestants	Constrict blood vessels of nasal passages and limit blood flow, which causes swollen tissues to shrink so that air can pass more freely through the passageways *Decongestants are commonly prescribed for allergies and colds and are usually combined with antihistamines in cold remedies. They can be administered orally or topically as nasal sprays and nasal drops.*	**oxymetazoline** ŏks-ē-mĕt-ĂZ-ō-lēn Dristan **pseudoephedrine** soo-dō-ĕ-FĔD-rĭn Drixoral, Sudafed
expectorants	Liquify respiratory secretions so that they are more easily dislodged during coughing episodes *Expectorants are prescribed for productive coughs.*	**guaifenesin** gwī-FĔN-ĕ-sĭn Robitussin, Organidin

Abbreviations

This section introduces respiratory-related abbreviations and their meanings.

Abbreviation	Meaning	Abbreviation	Meaning
ABG	arterial blood gas(es)	**MRI**	magnetic resonance imaging
AFB	acid-fast bacillus (TB organism)	**NMT**	nebulized mist treatment
AP	anteroposterior	**O_2**	oxygen
ARDS	acute respiratory distress syndrome	**PA**	posteroanterior; pernicious anemia
CO_2	carbon dioxide	**PCO_2**	partial pressure of carbon dioxide
COPD	chronic obstructive pulmonary disease	**PCP**	*Pneumocystis carinii* pneumonia; primary care physician; phencyclidine (hallucinogen)
CPAP	continuous positive airway pressure	**PFT**	pulmonary function test
CPR	cardiopulmonary resuscitation	**pH**	symbol for degree of acidity or alkalinity
CT	computed tomography	**PND**	paroxysmal nocturnal dyspnea
CXR	chest x-ray, chest radiograph	**PO_2**	partial pressure of oxygen
DPI	dry power inhaler	**RD**	respiratory distress
DPT	diphtheria, pertussis, tetanus	**RDS**	respiratory distress syndrome
EEG	encephalogram, encephalography	**SaO_2**	arterial oxygen saturation
FVC	forced vital capacity	**SIDS**	sudden infant death syndrome
Hb, Hgb	hemoglobin	**SOB**	shortness of breath
HMD	hyaline membrane disease	**T&A**	tonsillectomy and adenoidectomy
Hx	history	**TB**	tuberculosis
IPPB	intermittent positive-pressure breathing	**TPR**	temperature, pulse, and respiration
IRDS	infant respiratory distress syndrome	**URI**	upper respiratory infection
MDI	metered dose inhaler	**VC**	vital capacity

It is time to review procedures, pharmacology, and abbreviations by completing Learning Activity 7–4.

LEARNING ACTIVITIES

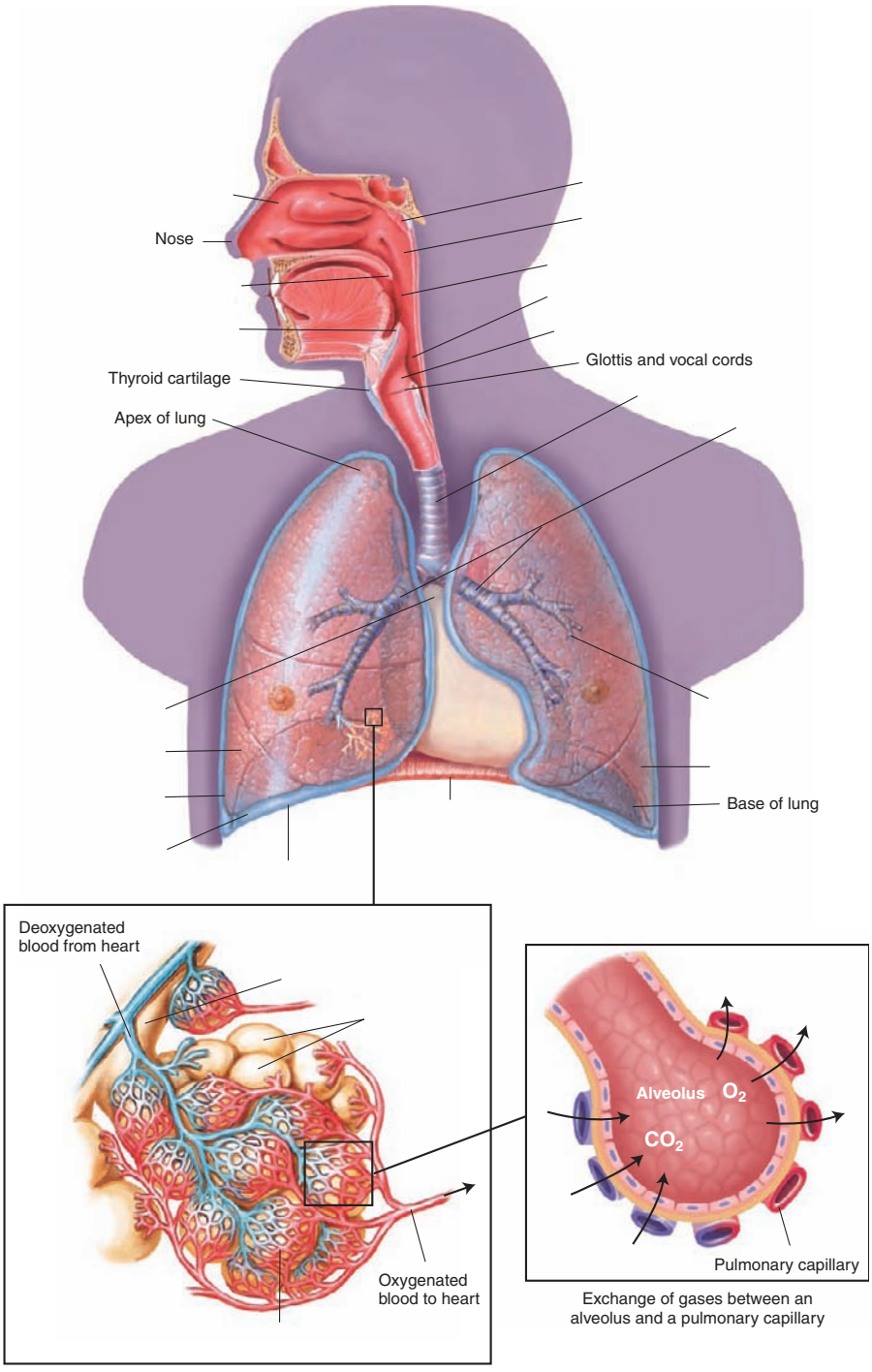
The following activities provide review of the respiratory system terms introduced in this chapter. Complete each activity and review your answers to evaluate your understanding of the chapter.

Learning Activity 7-1

Identifying Respiratory Structures

Label the following illustration using the terms listed below.

adenoids	*larynx*	*parietal pleura*
alveoli	*left lung*	*pleural cavity*
bronchi	*mediastinum*	*pulmonary capillaries*
bronchiole	*nasal cavity*	*right lung*
diaphragm	*nasopharynx*	*trachea*
epiglottis	*oropharynx*	*visceral pleura*
laryngopharynx	*palatine tonsils*	



Exchange of gases between an alveolus and a pulmonary capillary

Check your answers by referring to Figure 7–1 on page 150. Review material that you did not answer correctly.

DavisPlus.fadavis.com

Enhance your study and reinforcement of word elements with the power of DavisPlus. Visit www.davisplus.fadavis.com/gylys/systems *for this chapter's flash-card activity. We recommend you complete the flash-card activity before completing activity 7–2 below.*

Learning Activity 7-2

Building Medical Words

Use *rhin/o* (nose) to build words that mean:

1. discharge from the nose _____
2. inflammation of (mucous membranes of the) nose _____

Use *laryng/o* (larynx [voice box]) to build words that mean:

3. visual examination of larynx _____
4. inflammation of larynx _____
5. stricture or narrowing of the larynx _____

Use *bronch/o* or *bronchi/o* (bronchus) to build words that mean:

6. dilation or expansion of the bronchus _____
7. disease of the bronchus _____
8. spasm of the bronchus _____

Use *pneumon/o* or *pneum/o* (air; lung) to build words that mean:

9. air in the chest (pleural space) _____
10. inflammation of lungs _____

Use *pulmon/o* (lung) to build words that mean:

11. specialist in lung (diseases) _____
12. pertaining to the lung _____

Use *-pnea* (breathing) to build words that mean:

13. difficult breathing _____
14. slow breathing _____
15. rapid breathing _____
16. absence of breathing _____

Build surgical words that mean:

17. surgical repair of the nose _____
18. surgical puncture of the chest _____
19. removal of a lung _____
20. forming an opening (mouth) in the trachea _____

Check your answers in Appendix A. Review material that you did not answer correctly.

Correct Answers _____ × 5 = _____ % Score

Learning Activity 7-3

Matching Pathological, Diagnostic, Symptomatic, and Related Terms

Match the following terms with the definitions in the numbered list.

anosmia	*consolidation*	*empyema*	*pneumoconiosis*
apnea	*coryza*	*epistaxis*	*pulmonary edema*
atelectasis	*crackle*	*hypoxemia*	*stridor*
auscultation	*deviated septum*	*pertussis*	*surfactant*
compliance	*emphysema*	*pleurisy*	*tubercles*

1. _____ collapsed or airless lung
2. _____ pus in the pleural cavity
3. _____ phospholipid that allows the lungs to expand with ease
4. _____ loss of sponginess of lungs due to engorgement
5. _____ listening to the chest sounds using a stethoscope
6. _____ absence or decrease in the sense of smell
7. _____ deficiency of oxygen in the blood
8. _____ granulomas associated with tuberculosis
9. _____ temporary loss of breathing
10. _____ disease characterized by a decrease in alveolar elasticity
11. _____ ease with which lung tissue can be stretched
12. _____ nosebleed; nasal hemorrhage
13. _____ excessive fluid in the lungs that induces cough and dyspnea
14. _____ abnormal respiratory sound associated with exudates, spasms, or hyperplasia
15. _____ displacement of the cartilage dividing the nostrils
16. _____ head cold; upper respiratory infection
17. _____ condition in which dust particles are found in the lungs
18. _____ inflammation of the pleural membrane
19. _____ abnormal sound caused by spasms or swelling of larynx
20. _____ whooping cough

Check your answers in Appendix A. Review material that you did not answer correctly.

Correct Answers _____ × 5 = _____ % Score

Learning Activity 7-4

Matching Procedures, Pharmacology, and Abbreviations

Match the following terms with the definitions in the numbered list.

ABGs	*antral lavage*	*Mantoux test*	*radiography*
aerosol therapy	*decongestant*	*oximetry*	*rhinoplasty*
AFB	*expectorant*	*pneumectomy*	*septoplasty*
antihistamine	*laryngoscopy*	*polysomnography*	*sweat test*
antitussive	*lung scan*	*pulmonary function tests*	*throat culture*

1. _____ imaging procedure that uses radionuclide to evaluate blood flow in the lungs
2. _____ test of sleep cycles and stages
3. _____ producing images using an x-ray machine
4. _____ washing or irrigating sinuses
5. _____ sneezing, runny nose, itchiness, and rashes
6. _____ relieves or suppresses coughing
7. _____ used primarily in children to confirm cystic fibrosis
8. _____ noninvasive test used to monitor percentage of hemoglobin saturated with oxygen
9. _____ TB organism
10. _____ inhalation of medication directly into the respiratory system via a nebulizer
11. _____ decreases mucous membrane swelling by constricting blood vessels
12. _____ intradermal test to determine tuberculin sensitivity
13. _____ laboratory tests to assess gases and pH of arterial blood
14. _____ reduces the viscosity of sputum to facilitate productive coughing
15. _____ used to identify pathogens, especially group A streptococci
16. _____ multiple tests used to determine the ability of lungs and capillary membranes to exchange oxygen
17. _____ visual examination of the voice box to detect tumors and other abnormalities
18. _____ surgery to correct a deviated nasal septum
19. _____ excision of the entire lung
20. _____ reconstructive surgery of the nose, commonly for cosmetic purposes

Check your answers in Appendix A. Review any material that you did not answer correctly.

Correct Answers _____ × 5 = _____ % Score

MEDICAL RECORD ACTIVITIES

The two medical records included in the following activities use common clinical scenarios to show how medical terminology is used to document patient care. Complete the terminology and analysis sections for each activity to help you recognize and understand terms related to body structure.

Medical Record Activity 7-1

SOAP Note: Respiratory Evaluation

Terminology

Terms listed below come from the *SOAP Note: Respiratory Evaluation* that follows. Use a medical dictionary such as *Taber's Cyclopedic Medical Dictionary*, the appendices of this book, or other resources to define each term. Then review the pronunciations for each term and practice by reading the medical record aloud.

Term	Definition
anteriorly ăn-TĒR-ē-or-lē	
bilateral bī-LĂT-ĕr-ăl	
COPD	
exacerbation ĕks-ăs-ĕr-BĀ-shŭn	
heart failure	
Hx	
hypertension hī-pĕr-TĔN-shŭn	
interstitial ĭn-tĕr-STĬSH-ăl	
PE	
peripheral vascular disease pĕr-ĬF-ĕr-ăl VĂS-kū-lăr	
pleural PLOO-răl	
posteriorly pŏs-TĒR-ē-or-lē	
rhonchi RŎNG-kī	

Term	Definition
SOB	
wheezes HWĒZ-ĕz	

Listen and Learn Online! *will help you master the pronunciation of selected medical words from this medical record activity. Visit* www.davisplus.com/gylys/systems *to find instructions on completing the* Listen and Learn Online! *exercise for this section and to practice pronunciations.*

SOAP NOTE: RESPIRATORY EVALUATION

Emergency Department Record

Date: February 1, 20xx
Patient: Flowers, Richard

Time Registered: 1345 hours
Physician: Samara Batichara, MD

Chief Complaint: SOB

Medications: Vytorin 10/20 mg daily; Toprol-XL 50 mg daily; Azmacort 2 puffs t.i.d; Proventil 2 puffs q.6 h.

S: This 49-year-old man with Hx of COPD is admitted because of exacerbation of SOB over the past few days. Patient was a heavy smoker and states that he quit smoking for a short while but now smokes 3-4 cigarettes a day. He has a Hx of difficult breathing, hypertension, COPD, and peripheral vascular disease. He underwent triple bypass surgery in 19xx.

O: T: 98.9 F. BP: 180/90. Pulse: 80 and regular. R: 20 and shallow. PE indicates scattered bilateral wheezes and rhonchi heard anteriorly and posteriorly. When compared with a portable chest film taken 22 months earlier, the current study most likely indicates interstitial vascular congestion. Some superimposed inflammatory change cannot be excluded. There may also be some pleural reactive change.

A:
1. Acute exacerbation of chronic obstructive pulmonary disease.
2. Heart failure.
3. Hypertension.
4. Peripheral vascular disease.

P: Admit to hospital.

Samara Batichara, MD
Samara Batichara, MD

SB:icc

D: 2/1/20xx
T: 2/1/20xx

Analysis

Review the medical record *SOAP Note: Respiratory Evaluation* to answer the following questions.

1. What symptom caused the patient to seek medical help?

2. What was the patient's previous history?

3. What were the abnormal findings of the physical examination?

4. What changes were noted from the previous film?

5. What are the present assessments?

6. What new diagnosis was made that did not appear in the previous medical history?

Medical Record Activity 7-2

SOAP Note: Chronic Interstitial Lung Disease

Terminology

Terms listed below come from the *SOAP Note: Chronic Interstitial Lung Disease* that follows. Use a medical dictionary such as *Taber's Cyclopedic Medical Dictionary*, the appendices of this book, or other resources to define each term. Then review the pronunciations for each term and practice by reading the medical record aloud.

Term	Definition
ABG	
adenopathy ăd-ĕ-NŎP-ă-thē	
basilar crackles BĂS-ĭ-lăr KRĂK-ĕlz	
cardiomyopathy kăr-dē-ō-mī-ŎP-ă-thē	
chronic KRŎN-ĭk	

Term	Definition
diuresis dī-ū-RĒ-sĭs	
dyspnea dĭsp-NĒ-ă	
fibrosis fī-BRŌ-sĭs	
interstitial ĭn-tĕr-STĬSH-ăl	
kyphosis kī-FŌ-sĭs	
Lasix LĀ-sĭks	
neuropathy nū-RŎP-ă-thē	
PCO_2	
pedal edema PĔD-ĕl ē-DĒ-mă	
pH	
PO_2	
pulmonary fibrosis PŬL-mō-nĕ-rē fī-BRŌ-sĭs	
renal insufficiency RĒ-năl ĭn-sŭ-FĬSH-ĕn-sē	
rhonchi RŎNG-kī	
silicosis sĭl-ĭ-KŌ-sĭs	
thyromegaly thī-rō-MĔG-ă-lē	

Listen and Learn Online! *will help you master the pronunciation of selected medical words from this medical record activity. Visit* www.davisplus.com/gylys/systems *to find instructions on completing the* Listen and Learn Online! *exercise for this section and to practice pronunciations.*

SOAP NOTE: CHRONIC INTERSTITIAL LUNG DISEASE

09/01/20xx

O'Malley, Robert

SUBJECTIVE: Patient is an 84-year-old male with chief complaint of dyspnea with activity and pedal edema. He carries the dx cardiomyopathy, renal insufficiency, COPD, and pulmonary fibrosis. He also has peripheral neuropathy, which has improved with Elavil therapy.

OBJECTIVE: BP: 140/70. Pulse: 76. Neck is supple without thyromegaly or adenopathy. Mild kyphosis without scoliosis is present. Chest reveals basilar crackles without wheezing or rhonchi. Cardiac examination shows trace edema without clubbing or murmur. Abdomen is soft and nontender. ABGs on room air demonstrate a Po_2 of 55, Pco_2 of 45, and pH of 7.42.

ASSESSMENT: Chronic interstitial lung disease, likely a combination of pulmonary fibrosis and heart failure. We do believe he would benefit from further diuresis, which was implemented by Dr. Lu. Should there continue to be concerns about his volume status or lack of response to Lasix therapy, then he might benefit from right heart catheterization.

PLAN: Supplemental oxygen will be continued. We plan no change in his pulmonary medication at this time and will see him in return visit in 4 months. He has been told to contact us should he worsen in the interim.

Samara Batichara, MD
Samara Batichara, MD

SB:icc

Analysis

Review the medical record *SOAP Note: Chronic Interstitial Lung Disease* to answer the following questions.

1. When did the patient notice dyspnea?

2. Other than the respiratory system, what other body systems are identified in the history of present illness?

3. What were the findings regarding the neck?

4. What was the finding regarding the chest?

5. What appears to be the likely cause of the chronic interstitial lung disease?

6. What did the cardiac examination reveal?