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CHAPTER 51

Respiratory Problems

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PRIORITY CONCEPTS **Gas Exchange; Perfusion**

I. Anatomy and Physiology

A. Primary functions of the respiratory system
- **1.** Provides oxygen for metabolism in the tissues
- **2.** Removes carbon dioxide, the waste product of metabolism

B. Secondary functions of the respiratory system
- **1.** Facilitates sense of smell
- **2.** Produces speech
- **3.** Maintains acid–base balance
- **4.** Maintains body water levels
- **5.** Maintains heat balance

C. Upper respiratory airway
- **1.** Nose: Humidifies, warms, and filters inspired air
- **2.** Sinuses: Air-filled cavities within the hollow bones that surround the nasal passages and provide resonance during speech
- **3.** Pharynx
  - **a.** Passageway for the respiratory and digestive tracts located behind the oral and nasal cavities
  - **b.** Divided into the nasopharynx, oropharynx, and laryngopharynx
- **4.** Larynx
  - **a.** Located just below the pharynx at the root of the tongue; commonly called the *voice box*
  - **b.** Contains two pairs of vocal cords, the false and true cords
  - **c.** The opening between the true vocal cords is the glottis. The glottis plays an important role in coughing, which is the most fundamental defense mechanism of the lungs.
- **5.** Epiglottis
  - **a.** Leaf-shaped elastic flap structure at the top of the larynx
  - **b.** Prevents food from entering the tracheobronchial tree by closing over the glottis during swallowing

D. Lower respiratory airway
- **1.** Trachea: Located in front of the esophagus; branches into the right and left mainstem bronchi at the carina
- **2.** Mainstem bronchi
  - **a.** Begin at the carina
  - **b.** The right bronchus is slightly wider, shorter, and more vertical than the left bronchus.
  - **c.** Divide into secondary or lobar bronchi that enter each of the five lobes of the lung
  - **d.** The bronchi are lined with cilia, which propel mucus up and away from the lower airway to the trachea, where it can be expectorated or swallowed.
- **3.** Bronchioles
  - **a.** Branch from the secondary bronchi and subdivide into the small terminal and respiratory bronchioles
  - **b.** Contain no cartilage and depend on the elastic recoil of the lung for patency
  - **c.** The terminal bronchioles contain no cilia and do not participate in gas exchange.
- **4.** Alveolar ducts and alveoli
  - **a.** *Acinus* (plural, *acini*) is a term used to indicate all structures distal to the terminal bronchiole.
  - **b.** Branch from the respiratory bronchioles
  - **c.** Alveolar sacs, which arise from the ducts, contain clusters of alveoli, which are the basic units of gas exchange.
  - **d.** Type 2 alveolar cells in the walls of the alveoli secrete surfactant, a phospholipid protein that reduces the surface tension in the alveoli; without surfactant, the alveoli would collapse.
- **5.** Lungs
  - **a.** Located in the pleural cavity in the thorax
  - **b.** Extend from just above the clavicles to the diaphragm, the major muscle of inspiration

speech گفتار – کلام , humidify مرطوب ساختن , inspired air هوای دمی , resonance پیچش صدا – طنین , opening دهانه , fundamental اساسی
leaf-shaped برگ مانند , flap زبانه , propel up به بالا راندن , expectorate خلط بالا آوردن , recoil به حالت اول برگشتن , contain حاوی بودن

c. The right lung, which is larger than the left, is divided into three lobes: the upper, middle, and lower lobes.
d. The left lung, which is narrower than the right lung to accommodate the heart, is divided into two lobes.
e. The respiratory structures are innervated by the phrenic nerve, the vagus nerve, and the thoracic nerves.
f. The parietal pleura lines the inside of the thoracic cavity, including the upper surface of the diaphragm.
g. The visceral pleura covers the pulmonary surfaces.
h. A thin fluid layer, which is produced by the cells lining the pleura, lubricates the visceral pleura and the parietal pleura, allowing them to glide smoothly and painlessly during respiration.
i. Blood flows throughout the lungs via the pulmonary circulation system.

6. Accessory muscles of respiration include the scalene muscles, which elevate the first two ribs; the sternocleidomastoid muscles, which raise the sternum; and the trapezius and pectoralis muscles, which fix the shoulders.
7. The respiratory process
a. The diaphragm descends into the abdominal cavity during inspiration, causing negative pressure in the lungs.
b. The negative pressure draws air from the area of greater pressure, the atmosphere, into the area of lesser pressure, the lungs.
c. In the lungs, air passes through the terminal bronchioles into the alveoli and diffuses into surrounding capillaries, then travels to the rest of the body to oxygenate the body tissues.
d. At the end of inspiration, the diaphragm and intercostal muscles relax and the lungs recoil.
e. As the lungs recoil, pressure within the lungs becomes higher than atmospheric pressure, causing the air, which now contains the cellular waste products carbon dioxide and water, to move from the alveoli in the lungs to the atmosphere.
f. Effective gas exchange depends on distribution of gas (ventilation) and blood (perfusion) in all portions of the lungs.

II. Diagnostic Tests

A. Risk factors for respiratory disorders (Box 51.1)
B. Chest x-ray film (radiograph)
1. Description: Provides information regarding the anatomical location and appearance of the lungs
2. Preprocedure
a. Remove all jewelry and other metal objects from the chest area.

BOX 51.1 Risk Factors for Respiratory Disorders

- Chest injury
- Crowded living conditions
- Environmental allergies
- Exposure to chemicals and environmental pollutants
- Family history of infectious disease
- Frequent respiratory illnesses
- Geographical residence and travel to foreign countries
- Smoking
- Surgery
- Use of chewing tobacco
- Viral syndromes

Reference: Ignatavicius, D., Workman, M., Rebar, C., & Heimgartner, N. (2021). *Concepts for interprofessional collaborative care*. (10th ed.). St. Louis: Saunders.

b. Assess the client's ability to inhale and hold their breath.
3. Postprocedure: No special care is required after the procedure unless there are abnormal findings.

⚠ Question the client regarding pregnancy or the possibility of pregnancy before performing radiography studies.

C. Sputum specimen
1. Description: Specimen obtained by expectoration or tracheal suctioning to assist in the identification of organisms or abnormal cells (see Box 70.11 in Chapter 70)
2. Sputum for culture and sensitivity should be collected before antimicrobial therapy is initiated unless the test is being performed to evaluate the effectiveness of medications already being given.
3. Preprocedure
a. Determine the specific purpose of collection, and check institutional policy for the appropriate method for collection.
b. Obtain an early morning sterile specimen by suctioning or expectoration after a respiratory treatment if a treatment is prescribed; give the client the specimen cup the night before.
c. Instruct the client to rinse the mouth with water before collection to decrease contamination of the sputum sample from particles in the oropharynx.
d. Obtain 15 mL of sputum.
e. Instruct the client to take several deep breaths and then cough deeply to obtain sputum. Remind the client that sputum comes from the lungs and that saliva is not sputum.
f. Collect the specimen before the client begins antibiotic therapy. If already started on antibiotic therapy, ensure that the laboratory can utilize an antimicrobial removal device when analyzing the specimen.

پایین رفتن descend , از طریق via , به نرمی – به روانی smoothly , سُر خوردن glide , دارای عصب شدن innervate , جا دادن accommodate
مربوط به موسسه institutional , آلوده کننده ها pollutants , جواهرآلات jewelry , توزیع distribution , تبادل exchange
خلط sputum , شستن rinse , فیزیوتراپی ریه respiratory treatment