Chapter 28

Assisting with Respiration and Oxygen Delivery

Lesson 28.1
Overview of Respiratory System Function

Theory

1) Explain how the respiratory system functions.
2) Name three causes of hypoxia.
3) Outline procedures to follow in the event of respiratory or cardiac arrest.

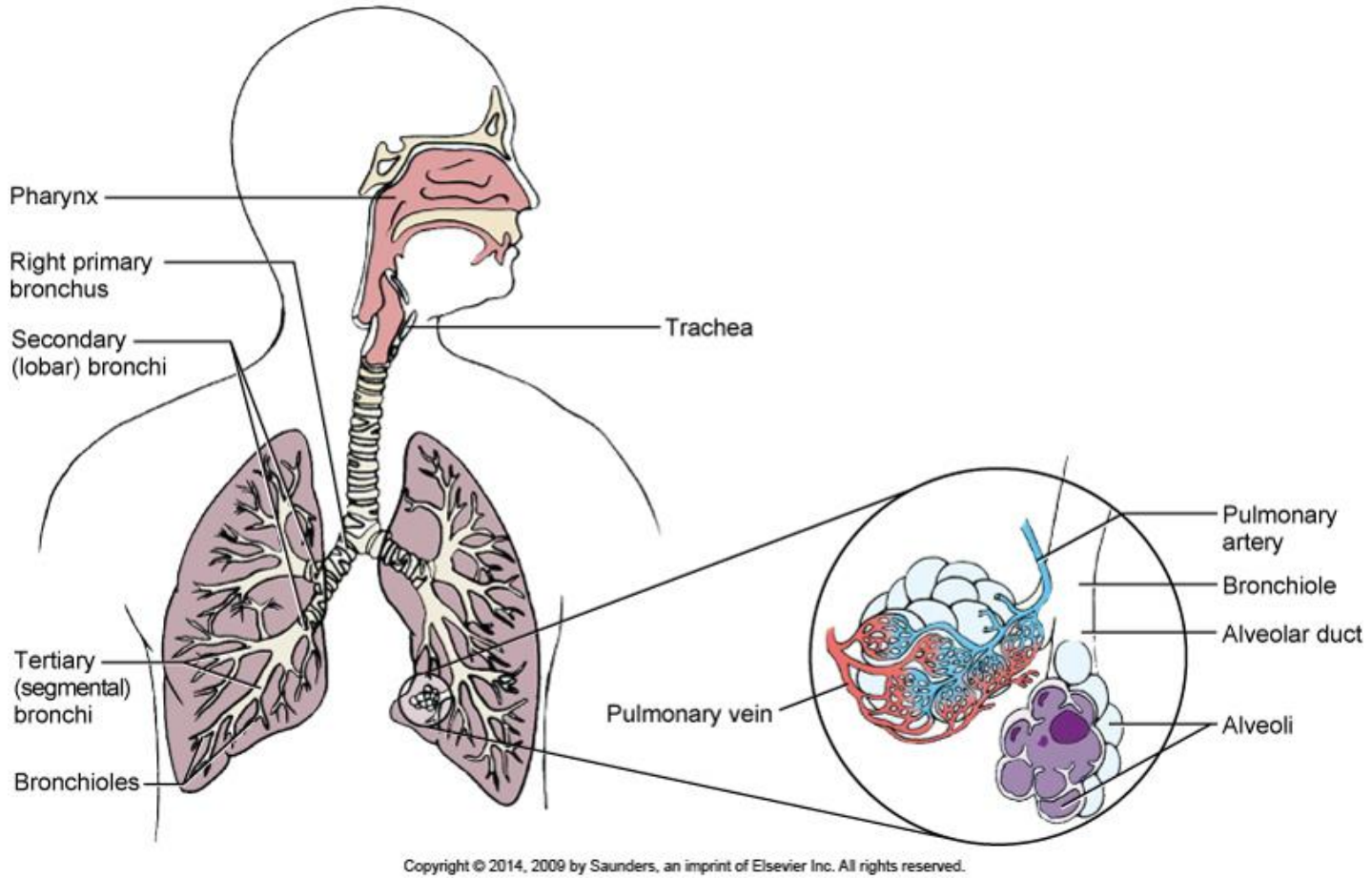
Clinical Practice

1) Prepare to assist patients in clearing the airway via coughing, postural drainage, suctioning, abdominal thrusts (Heimlich maneuver), and inhalation therapy.

Structure and Function of the Respiratory System (Slide 1 of 3)

- Nose, mouth, pharynx, and trachea compose the upper airway
- Trachea divides into right and left mainstem bronchi
- Lungs
  - Left lung has two lobes
  - Right lung has three lobes
- In each lobe of the lung, bronchi divide into bronchioles
- The bronchioles divide into alveoli

Figure 28.1: The respiratory system



Structure and Function of the Respiratory System (Slide 2 of 3)

- Alveoli are lined with mucous membranes and are the functional units of air exchange
- Diaphragm is beneath the lungs
- Contraction of the diaphragm enlarges the thoracic cavity, causing inspiration
- Relaxation of the diaphragm causes the thoracic cavity to become smaller, causing expiration

Structure and Function of the Respiratory System (Slide 3 of 3)

- Chest muscles (intercostal muscles) combine with diaphragmatic movement to aid in inspiration and expiration
- Respiratory muscles depend on nerve impulses from spinal cord nerves
- Thoracic cage allows respiratory muscles to function correctly

Functions of Respiratory Structures
(Slide 1 of 3)

- Upper airways carry air to and from the lungs
- Humidification takes place in the upper airways
- Bronchi channel air to and from the lungs
- Cilia lining mucous membranes help trap and remove foreign particles in the respiratory tract

Functions of Respiratory Structures
(Slide 2 of 3)

- Alveoli contain macrophages that phagocytize inhaled bacteria
- Mucus and cilia propel foreign substances to airway openings to be expelled
- Central nervous system controls rate and depth of respiration
- Chemoreceptors in the aorta and carotid bodies send signals to the brainstem

Functions of Respiratory Structures
(Slide 3 of 3)

- Chemoreceptors measure serum pH, serum carbon dioxide, and serum oxygen to trigger changes in rate and depth of respiration
- Oxygen diffuses across the alveolar membranes into the blood
- Carbon dioxide diffuses across the alveolar membranes out of the blood into the lungs for exhalation

Changes Occurring with Aging

- Decreased elasticity of thorax and respiratory muscles
- Decrease in total body water, drier mucous membranes
- Loss of elastic recoil during exhalation
- Thickening of alveolar membrane; less efficient gas exchange
- Less respiratory reserve

Hypoxemia

- Decreased amount of oxygen in the blood
- Results in decreased oxygen at the cellular level (called *hypoxia*)
- Also results in increased levels of carbon dioxide (called *hypercapnia*)
- Onset may be rapid and obvious or insidious and gradual

Hypoxia
(Slide 1 of 4)

- Obstruction of the airway
  - Occlusion by the tongue or mucous secretions
  - Inflammation from croup, asthma, tracheobronchitis, or laryngitis
  - Occlusion by foreign body
  - Chemical and heat burns with inflammation
  - COPD causing airway collapse
  - Near drowning: occlusion by water
- Restriction of the thoracic cage
  - Abdominal injuries
  - Chest injuries, flail chest
  - Pneumothorax
  - Extreme obesity, diseases

Hypoxia
(Slide 2 of 4)

- Decreased neuromuscular function
  - Depressed central nervous system: drugs including sedatives, anesthetic agents, and analgesics, brain trauma; CVA
  - Coma (diabetic, uremic, brain injuries)
  - Diseases (multiple sclerosis, myasthenia gravis, poliomyelitis, Guillain-Barré syndrome)

Hypoxia
(Slide 3 of 4)

- Disturbances in diffusion of gases
  - Diseases (pulmonary fibrosis, emphysema)
  - Trauma (contusion)
  - Emboli (fat embolus, pulmonary embolus)
  - Tumors, benign and malignant
  - Respiratory distress syndrome
- Environmental causes
  - High altitude

Hypoxia
(Slide 4 of 4)

- Symptoms of Hypoxia
  - Restlessness, irritability, confusion
  - Difficulty in breathing (dyspnea)
  - Rapid breathing (tachypnea, stridor)
  - Abnormal lung sounds
  - Cyanosis, retractions, dysrhythmias
  - Acid-base imbalance
  - Decreased oxygen saturation

Pulse Oximetry

- Pulse oximeter
  - Used to monitor any patient at risk for hypoxia
  - Measures changes in serum oxygen continuously
  - Sensor attached to fingers, toes, ears, or skin
  - Helps track changes in oxygen therapy

Airway Obstruction and Respiratory Arrest

- Common airway obstructions
  - Choking; obstruction by the tongue, foreign bodies, or food
  - Abdominal thrusts (Heimlich maneuver) used to clear foreign objects
- Respiratory secretions
  - Complete or partial obstruction
  - Present with different disease states such as pneumonia or COPD
  - Usually can be cleared by coughing; can be facilitated by postural drainage

Clearing Respiratory Secretions: The Effective Cough

- Most effective in the sitting position
- Two deep breaths and then inhale deeply again
- Breath rapidly and forcibly exhaled as quickly as possible with the mouth open
- This moves secretions up the bronchial tree
- Repeated forceful exhalation bring secretions up to where they can be more easily coughed up

Postural Drainage

- Different positions drain different segments of the lungs
- Specific segments drained into the bronchi to facilitate coughing
- Each position assumed for 5 to 15 minutes two to four times a day as tolerated
- Percussion used: rhythmic clapping with cupped hands over the thoracic area, avoiding spine or sternum

Question 1

The most common cause of respiratory insufficiency is:

1) chronic obstructive pulmonary disease.
2) pneumothorax.
3) obstruction of the airway.
4) asthma.

Question 2

Bruce's patient is showing early signs of hypoxia. Which of the following signs is *not* an early sign of hypoxia?

1) His patient sits up to breathe
2) Restlessness
3) Mental dullness
4) Cyanosis

Lesson 28.2
Oxygen Delivery Overview

Theory

4) Describe the various methods used for oxygen delivery.
5) List safety precautions to be observed when patients are receiving oxygen therapy.

Clinical Practice

2) Regulate oxygen flow and correctly apply an oxygen delivery device.

Oxygen Administration
(Slide 1 of 5)

- Oxygen: colorless, tasteless, odorless gas present in the air
- Although essential for life, use of oxygen is not without its disadvantages
  - High concentrations cause fires to burn very rapidly
  - Very drying to the tissues of the respiratory tract
- Equipment needed for oxygen therapy
  - Oxygen source, the flowmeter, the humidifier, the tubing, and the appropriate appliance for the method ordered

Oxygen Administration

(Slide 2 of 5)

- Used to supplement oxygen in inspired air
  - Inspired air is 21% oxygen
- Can be delivered by nasal cannula, mask, tent, croupette, or catheter
- Requires humidification, flow rate prescribed by a physician
  - Common flow rates are 4-6 L/min
  - COPD patients given only 2 to 3 L/min to prevent causing respiratory arrest

Oxygen Administration
(Slide 3 of 5)

- Cannula
  - A plastic tube with short, curved prongs that extend into the nostril about ¼ to ½ inch
  - Held in place by looping it over the ears and cinching under the chin; can be easily adjusted for the patient's comfort

Figure 2.7: Oxygen cannula in use by home care patient

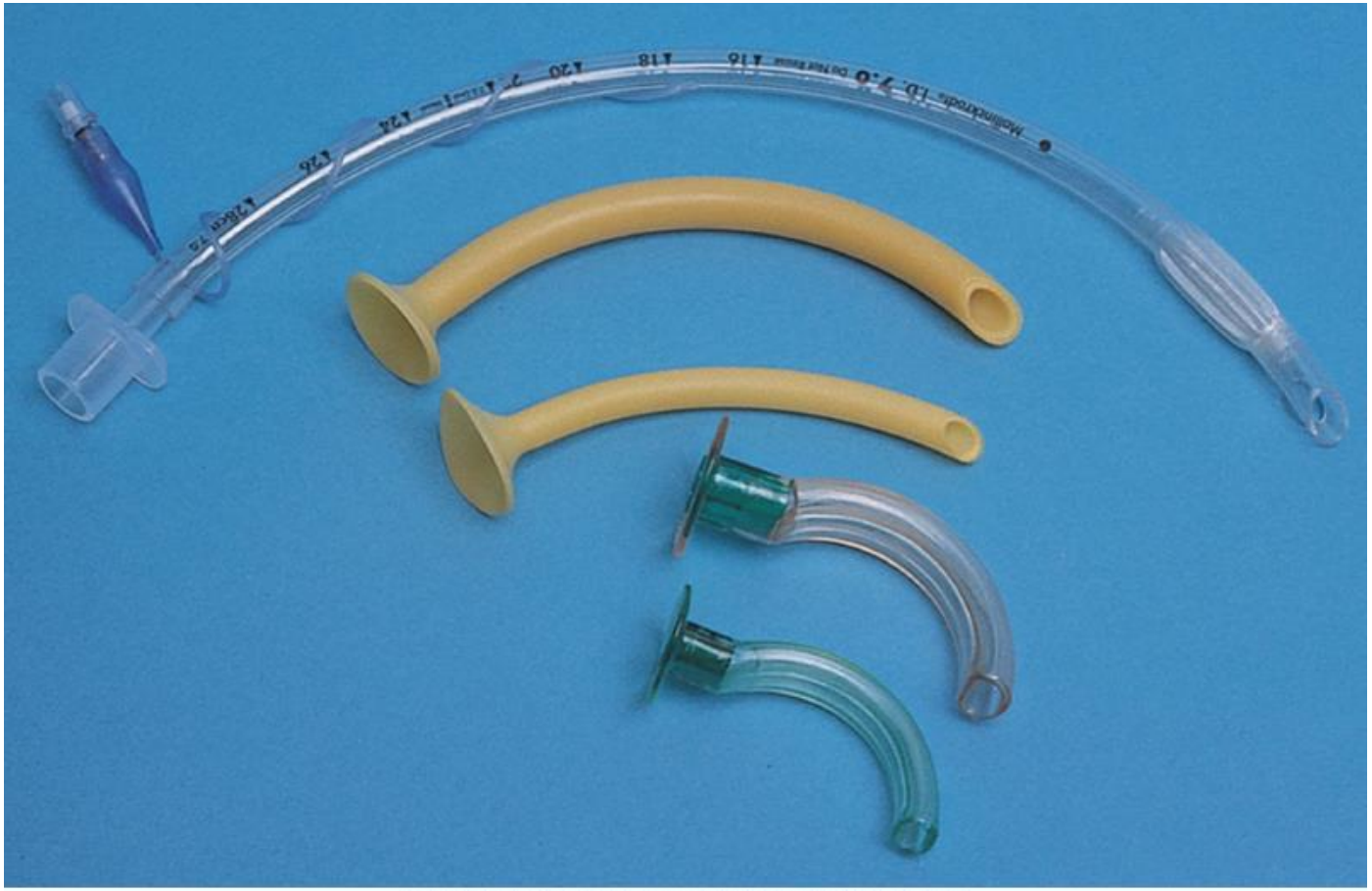
Oxygen Administration
(Slide 4 of 5)

- Masks
  - Various types available for administering oxygen in concentrations ranging from 24% to 55% at flows of 3 to 7 L/min
  - Oxygen concentrations above 60% rarely used because of the danger of oxygen toxicity

Oxygen Administration
(Slide 5 of 5)

- Artificial Airways
  - Several purposes:
    - Relieve an obstruction, protect the airway, facilitate suctioning, and provide artificial ventilation
  - Nasopharyngeal and oropharyngeal airways
    - Keep the tongue from falling back into the throat
  - Endotracheal tubes maintain an airway in those who are unconscious or unable to ventilate on their own

Figure 28.9: Types of airways



Nasopharyngeal Suctioning
(Slide 1 of 2)

- Required for patients unable to clear secretions from their own airway effectively
  - Nasopharyngeal
  - Oral suction
- Can be performed with a Yankauer suction tip or with a 14 to 16 Fr. suction catheter attached to wall suction
- Suction pressure set between 80 and 120 mm Hg
- Aseptic technique used for airway suctioning

Nasopharyngeal Suctioning
(Slide 2 of 2)

- Maintain patent airway by removing accumulated secretions
- Involves upper air passages of nose, mouth, and pharynx
- Used most often for infants, gravely debilitated or unconscious patients, and those who have an ineffective cough
- Suction pressure set between 80 and 120 mm Hg

Tracheobronchial Suctioning

- Deep suctioning to remove secretions from the trachea and bronchi using sterile technique
- Most often performed on intubated patients or patients with a tracheostomy
- Patients need preoxygenation
- Sterile technique is mandatory
- Should be performed no longer than 10 seconds at a time, with oxygenation in between

Question 3

Lisa's patient has an order for nasopharyngeal suction. Which one is *not* true regarding nasopharyngeal suctioning?

1) The purpose of suctioning is to maintain a patent airway by removing accumulated secretions.
2) The amount of suction pressure should be set between 40 and 80 mm Hg.
3) It is best to use aseptic technique for all airway suctioning.
4) A catheter that has been used in the mouth is not used again for nasopharyngeal or tracheobronchial suctioning.

Question 4

Linda’s patient has a tracheostomy. Which is true regarding tracheostomy care?

1) Tracheostomy care is performed every 12 hours.
2) Ties are replaced when soiled or at least weekly.
3) A tracheostomy tube has an inflatable cuff, which must be deflated every 24 hours.
4) Tracheobronchial suctioning is a sterile procedure.

Question 5

Linda's patient cannot maintain a sufficient amount of oxygen in his body. Linda must administer oxygen to her patient. Oxygen should be administered by:

1) mask, cannula, tent, or catheter only.
2) anyone; a physician's order is not necessary.
3) nebulizer.
4) humidified apparatus to prevent drying to the mucosa.

Lesson 28.3
Care of the Patient Receiving Tracheostomy or Chest Tube and Drainage System

Theory

5) List safety precautions to be observed when patients are receiving oxygen therapy. (Continued)

Clinical Practice

3) Prepare to provide care for the tracheostomy patient.

4) Prepare to care for the patient who has a chest tube and drainage system.

Tracheostomy

- A surgical opening into the trachea to facilitate insertion of a cuffed tracheostomy tube
  - Cuff enables controlling the airway and preventing aspiration
- Maintains a patent airway; facilitates suctioning and mechanical ventilation
- May be temporary or permanent

Chest Drainage Tubes

- Used to remove air from patient with a pneumothorax or hemothorax or after chest surgery
- Connected to a drainage device that allows air or drainage to escape and not enter the cavity
- May require suction to operate or may use gravity drainage
- Tubes are removed and an occlusive dressing is applied when the air is removed from the plural space

Figure 28.12: Disposable chest drainage unit

Nursing Role in Airway Support

- Always maintain a patent airway
- Patients should be turned and encouraged to cough and deep-breathe every 2 hours when in bed
- Splint surgical patients with a pillow to help them deep-breathe and cough
- For unconscious patients, use an oral or nasal airway to keep the tongue from obstructing the airway, and suction as necessary
- Encourage use of an incentive spirometer

Figure 28.16: Teaching the patient to splint incision while coughing

Figure 28.18: Teaching use of incentive spirometer

Nursing Diagnosis/Problem Identification

- Alteration in airway clearance related to muscle weakness and impaired cough; decreased level of consciousness; or thick secretions
- Altered gas exchange related to retained respiratory secretions
- Potential for infection related to alteration in airway (tracheostomy)
- Insuffeciient knowledge related to use of oxygen equipment, tracheostomy, ventilator, or incentive spirometer
- Potential for injury related to improper safety precautions when using oxygen