The Pulmonary System

Chapter 4
Part I: Anatomical Function

Objectives

- Discuss the basic pulmonary structures and their functions
- Discuss the processes of ventilation and respiration
- Discuss the regulation of breathing and implications for injury or illness

Anatomical Structures

- Nasal passage
- Oral cavity
- Pharynx
- Larynx
- Trachea
- Bronchi
- Bronchioles
- Alveoli
- Capillaries
The Pulmonary System

Functions

- **Ventilation**
  - Mechanics of moving air in and out of the lungs

- **Respiration**
  - Exchanges O₂ and CO₂

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The Pulmonary System

Functions

- **Ventilation**

  ![Diagram of ventilation]

  - Inhalation or Inspiration
    - Requires active muscle contraction
    - Diaphragm
    - External intercostals
    - Accessory muscles
    - Abdominals
    - Sternocleidomastoids
    - Scalenae
    - Trapezius

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The Pulmonary System

Functions
The Pulmonary System

Functions

- Ventilation
  - Exhalation orExpiration
    - Occurs passively

- Ventilation (Inspiration)
  - Air enters through nasal passage
    - Warmed
    - Filtered
      - Mucus
      - Cilia

- Air passes through pharynx
  - Larynx
  - Trachea

The Pulmonary System

Functions
The Pulmonary System

Functions

- Ventilation (Inspiration)
- Trachea branches to form R and L bronchi

The Pulmonary System

Functions

- Ventilation (Inspiration)
- Bronchi branch into bronchioles

The Pulmonary System

Functions

- Ventilation (Inspiration)
- Bronchioles terminate into alveoli
The Pulmonary System

Functions

- Respiration
  - Alveoli surrounded by network of thin walled capillaries

- Gas exchange occurs across the thin walls of capillaries and alveoli
The Pulmonary System

Functions

- Ventilation (Expiration)
  - Air moves back through pulmonary system to be exhaled

Regulation of Breathing

- Central nervous system
  - Brain
    - Medulla is sensitive to CO₂ levels in the blood
  - Inspiratory muscles controlled by phrenic nerve (C3-C5 nerve roots) and cranial nerve XI (sternocleidomastoid)

Implications?
Questions?

The Pulmonary System

Chapter 4
Part II: Anatomical Function

Objectives
- Discuss general signs & symptoms of pulmonary pathology
- Discuss etiology & pathophysiology of acute pulmonary injury or illness
Pulmonary Pathology

- Obstructive conditions
- Restrictive conditions
- Trauma-related injury

General Signs & Symptoms of Pulmonary Pathology

- Dyspnea
- Cough
- Cyanosis
- Abnormal breathing pattern
- Thorax pain

General Assessment of Pulmonary Pathology

- History
- Observation
- Palpation
- Special Tests
  - percussion
  - auscultation
  - respiration rate & depth
  - heart rate
  - blood pressure
  - peak-flow measurement
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<th>Trauma-Related Pathology</th>
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<td>Flail chest</td>
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<tr>
<td>Pneumothorax</td>
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<tr>
<td>Hemothorax</td>
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<td>Pneumomediastinum</td>
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<tr>
<td>Mechanism</td>
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<td>water aspiration damages lung tissue</td>
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<td>asphyxiation from reflex spasm of the larynx</td>
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<td>Treatment</td>
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<td>immediate CPR</td>
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<td>activate EMS</td>
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Respiratory failure can occur 12-24 hrs. after a near-drowning incident (onset will be very rapid)
Drowning or Near-Drowning

- Complications
  - 20% of survivors have permanent complications (caused by anoxia)
    - brain damage
    - kidney damage

Flail Chest

- Free-floating segment of ribs created by multiple rib fractures (Fig. 4-7, pg. 68)
- Medical emergency
- Often causes or occurs along with pneumothorax

Pneumothorax

- Collapsed lung (Fig. 4-8, pg. 71)
  - Mechanism:
    - change in air pressure within pleural space (spontaneous)
    - trauma that damages pleural membrane (rib fracture or puncture injury to thorax)
Pneumothorax

- Collapsed lung (Fig. 4-8, pg. 71)
  - Signs & Symptoms:
    - Pleuritic chest pain
    - Dyspnea
    - Hypernea
    - Decreased or absent breath sounds
    - Crepitus (palpable air in chest cavity)
    - Hyperresonance

Pneumothorax

- Collapsed lung (Fig. 4-8, pg. 71)
  - Treatment:
    - Splinting of thorax (hugging a pillow)
    - Avoid coughing or gasping for air
    - Monitor vital signs
    - Immediate transport to ER

Tension Pneumothorax

- Collapsed lung with increasing intrathoracic pressure (Fig. 4-9, pg. 71)
  - Mechanism:
    - Opening in pleural cavity that created pneumothorax becomes sealed
    - Intrathoracic pressures increase causing the trachea & mediastinum to be displaced
Tension Pneumothorax

- Collapsed lung with increasing intrathoracic pressure (Fig. 4-9, pg. 71)
  - Signs & Symptoms:
    - same as pneumothorax

Tension Pneumothorax

- Collapsed lung with increasing intrathoracic pressure (Fig. 4-9, pg. 71)
  - Treatment:
    - same as pneumothorax
    - decompression with chest tube inserted surgically

Hemothorax

- Blood within the chest cavity
  - mechanism:
    - puncture of pleural space by rib fracture or other foreign object causing bleeding into chest cavity
<table>
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<tr>
<td><strong>Air and blood within the chest cavity</strong> (Fig. 4-10, pg. 72)</td>
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