Overview

- Respiratory System Review
  - Anatomy
  - Physiology

- Breathing Assessment
  - Adequate Breathing
  - Breathing Difficulty
  - Focused History and Physical Examination

- Emergency Medical Care
  - Oxygen
  - Position and Transport
  - Artificial Ventilation
  - Inhalers

The Respiratory System

- The respiratory system takes oxygen from the air and makes it available for the blood to transport to every cell and rids the body of excess carbon dioxide
The Respiratory System

- The Airway
  - Upper airway
    - Extends from the mouth and nose to the trachea
  - Lower airway
    - Extends from the trachea to the alveoli

The Upper Airway

- Nose and mouth
  - Pharynx
    - Oropharynx
    - Nasopharynx
  - Epiglottis
    - Leaf-shaped structure that prevents food and liquid from entering the trachea during swallowing
The Lower Airway

- Trachea (windpipe)
- Cricoid cartilage
  - Firm cartilage ring forming the lower portion of the larynx
  - Larynx (voice box)
  - Bronchi
    - Two major branches of the trachea to the lungs; bronchus subdivides into smaller air passages ending at the alveoli
- Lungs
- Diaphragm

Respiratory Terminology

- Ventilation
  - The movement of air
- Respiration
  - The exchange of gases
Ventilation

- Inhalation (active)
  - Diaphragm and intercostal muscles contract, increasing the size of the thoracic cavity
  - Diaphragm moves slightly downward, flares lower portion of rib cage
  - Ribs move upward/outward

  *This creates a negative pressure in the chest cavity.*

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Ventilation

- Air flows into the lungs because of the negative pressure

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Ventilation

- Exhalation
  - Diaphragm and intercostal muscles relax, decreasing the size of the thoracic cavity
    - Diaphragm moves upward
    - Ribs move downward/inward
  - Air is expelled from the lungs
Respiration

- Alveolar respiration
  - Gas exchange in the lungs

- Cellular respiration
  - Gas exchange in the tissues of the body

Alveolar Respiration

- Alveolar/capillary exchange
  - Oxygen-rich air enters the alveoli during each inspiration
  - Oxygen-poor blood in the capillaries passes into the alveoli
  - Oxygen enters the capillaries as carbon dioxide enters the alveoli

Cellular Respiration

- Capillary/cellular exchange
  - Cells give up carbon dioxide to the capillaries
  - Capillaries give up oxygen to the cells
Alveolar and Cellular Respiration

Normal Breathing
- Normal respiration should be effortless

Normal Respiratory Rates
- Adult—12-20/minute
- Child—15-30/minute
- Infant—25-50/minute
Assessing Breathing
- Rate
- Rhythm
- Quality
- Breath sounds
- Chest expansion
- Effort of breathing
- Depth (tidal volume)

Effort of Breathing
- Accessory muscles
  - Additional muscles used to draw air into the chest
  - Includes the muscles of the neck, abdomen, and chest

*Use of accessory muscles is a sign of respiratory distress!*

Tidal Volume
- The amount of air exchanged in one breath
Considerations for Infants and Children

Adults versus Children Respiratory Anatomy

- Mouth and nose
  - In general, all structures are smaller and more easily obstructed than in adults

- Tongue
  - Infants’ and children’s tongues take up proportionately more space in the mouth than adults

- Trachea (windpipe)
  - Narrower tracheas that are obstructed more easily by swelling
  - Softer and more flexible in infants and children

- Cricoid cartilage
  - Less developed and less rigid

- Chest wall is softer
  - Tend to depend more heavily on the diaphragm for breathing
Focused History and Physical Examination

- **OPQRST**
  - O Onset
  - P Provocation
  - Q Quality
  - R Radiation
  - S Severity
  - T Time

- **SAMPLE**
  - S Signs and Symptoms
  - A Allergies
  - M Medications
  - P Past medical history
  - L Last Oral Intake
  - E Events leading to injury or illness

- Remember that a physical exam is required for all patients

- In the responsive patient, assess the body systems associated with the chief complaint

Emergency Medical Care
Emergency Medical Care

- Administer high-flow oxygen

Oxygen is the most important medication you can administer to a patient with respiratory distress.

Emergency Medical Care

Position and Transport
Emergency Medical Care

Patients should be transported in a position most comfortable for them.

Artificial Ventilation

- Preferred ventilation techniques
  - Mouth-to-mask
  - Two-person bag-mask
  - Flow-restricted, oxygen-powered ventilation device
  - One-person bag-mask
Inhalers

- Typical inhaler devices

Inhalers

- Most inhalers used to treat respiratory distress are drugs classified as beta-agonist inhalers
### Inhalers

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Generic Name</th>
</tr>
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<tbody>
<tr>
<td>Proventil</td>
<td>albuterol</td>
</tr>
<tr>
<td>Ventolin</td>
<td>albuterol</td>
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<tr>
<td>Bronkosol</td>
<td>isoetharine</td>
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<td>Alupent</td>
<td>metaproterenol</td>
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<td>terbutaline</td>
</tr>
<tr>
<td>Atrovent</td>
<td>ipratropium bromide</td>
</tr>
</tbody>
</table>

### Indications
- Exhibits signs and symptoms of respiratory emergency
- Has physician-prescribed, hand-held inhaler
- Specific authorization by medical direction

### Contraindications
- Inability of patient to use device
- Inhaler is not prescribed for the patient
- No permission from medical direction
- Patient has already met maximum prescribed dose prior to EMT-Basic’s arrival
Inhalers

- Assisting with an inhaler
  - Check inhaler’s expiration date
  - Determine if patient has previously taken any doses
  - Make sure that the inhaler is at room temperature
  - Shake inhaler vigorously several times
  - Remove oxygen mask
    - Nasal cannula can be left in place while the inhaler is administered

Inhalers

- Have patient place inhaler in mouth

- Have patient inhale slowly and deeply while depressing the inhaler

Inhalers

- Have the patient inhale deeply and hold his or her breath so the medication can be absorbed
Inhalers

- Allow patient to breathe a few times, then repeat the dose if it is ordered
- Record time, dose, medication name, vital signs, and any changes in the patient's condition

Inhalers

- Side effects
  - Increased heart rate
  - Tremors
  - Nervousness
  - Nausea or vomiting
Chronic Obstructive Pulmonary Disease

- COPD is a broad category that encompasses several disease processes
  - Emphysema
  - Chronic bronchitis
  - Asthma

Emphysema

- An abnormal condition of the lungs characterized by overinflation and destructive changes in the alveoli, resulting in decreased lung elasticity and impaired gas exchange

Chronic Bronchitis

- A chronic condition characterized by excessive mucous secretions and inflammatory changes in the bronchial tree
Asthma

- A lung disorder characterized by recurring episodes of breathing difficulty, wheezing due to constriction of the bronchi, coughing, and lung secretions.

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