Respiratory Emergencies

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Objectives

- Review respiratory system physiology and pathophysiology
- Review the assessment of respiratory patients
- Review Pulmonary Edema, Pneumonia, Asthma, and COPD and the appropriate treatment of each condition
- Discuss CPAP administration

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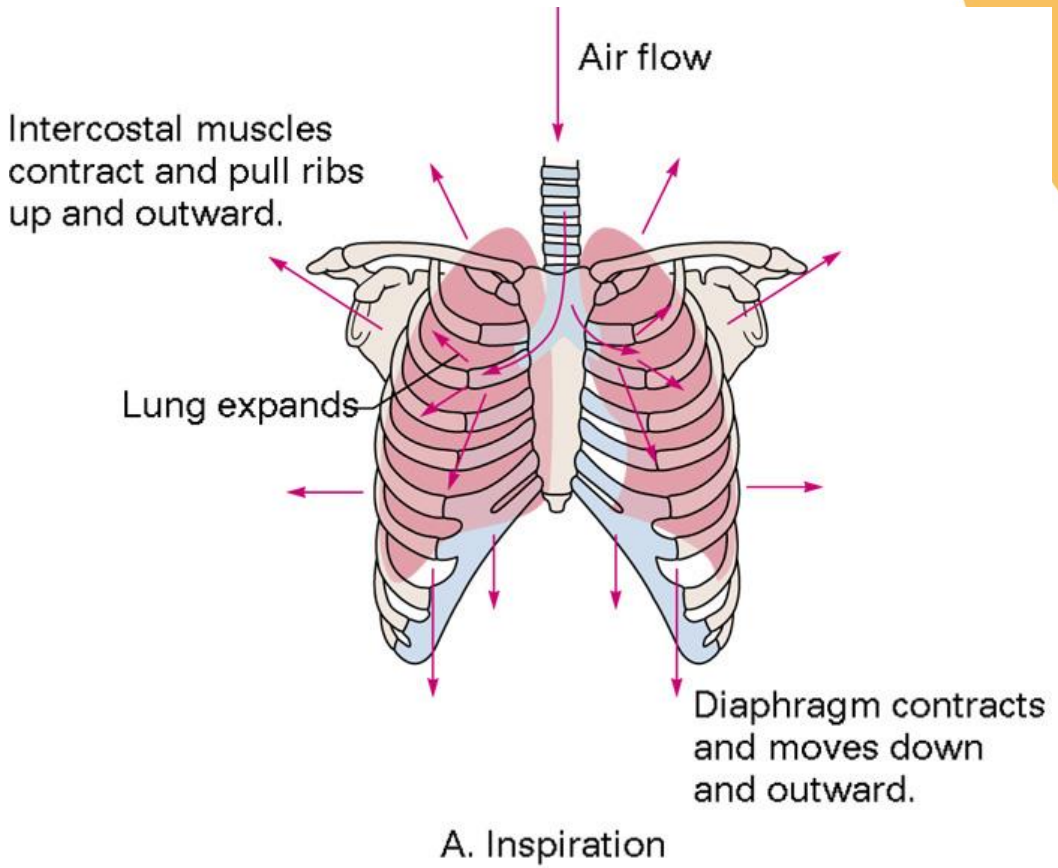
Respiratory Physiology

Ventilation

- Inspiration



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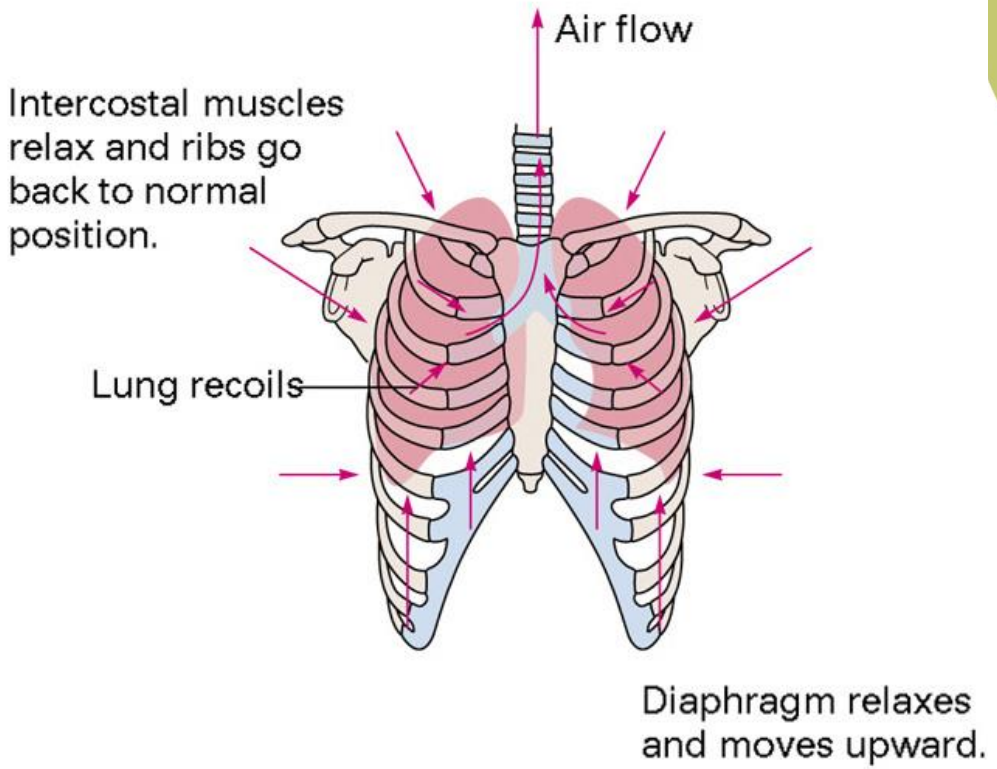
Respiratory Physiology

Ventilation

- Expiration



B. Expiration

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Pathophysiology

Disruption in Ventilation

- Upper & Lower Respiratory Tracts
  - Obstruction due to trauma or infectious processes
- Chest Wall & Diaphragm
  - Trauma
    - Pneumothorax
    - Hemothorax
    - Flail chest
  - Neuromuscular disease

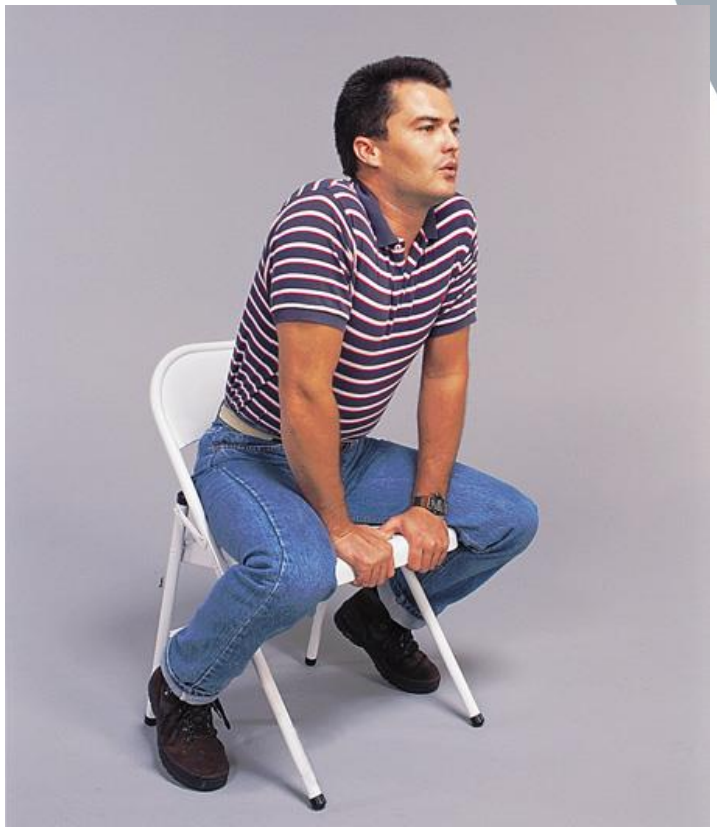
Pathophysiology

- Disruption in Diffusion
  - Hypoxia
  - Damaged Alveoli
- Disruption in Perfusion
  - Alteration in Blood Flow
  - Changes in Hemoglobin
  - Pulmonary Shunting

Assessment of the Respiratory System

Initial Assessment

- General Impression
  - Position
  - Color
  - Mental status
  - Ability to speak
  - Respiratory effort



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Assessment of the Respiratory System

- Airway
  - Proper ventilation cannot take place without an adequate airway.
- Breathing
  - Signs of life-threatening problems
    - Alterations in mental status
    - Severe central cyanosis, pallor, or diaphoresis
    - Absent or abnormal breath sounds
    - Speaking limited to 1–2 words
    - Tachycardia
    - Use of accessory muscles or presence of retractions

Focused History & Physical Exam

History

- SAMPLE History
- OPQRST History
  - Paroxysmal nocturnal dyspnea and orthopnea
  - Coughing and hemoptysis
  - Associated chest pain
  - Smoking history or exposure to secondary smoke
- Similar Past Episodes

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Focused History & Physical Exam

Physical Examination

- Inspection
  - Look for asymmetry, increased diameter, or paradoxical motion.
- Palpation
  - Feel for subcutaneous emphysema or tracheal deviation.
- Percussion
- Auscultation

Focused History & Physical Exam

- Auscultation
  - Abnormal Breath Sounds
    - Snoring
    - Stridor
    - Wheezing
    - Rhonchi
    - Rales/Crackles
    - Pleural Friction Rub

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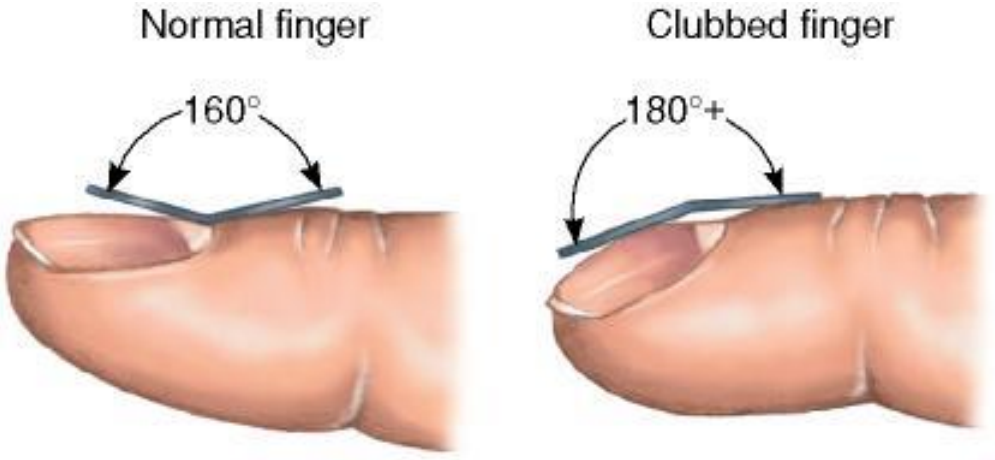
Focused History & Physical Exam

- Extremities
  - Look for peripheral cyanosis.
  - Look for swelling and redness, indicative of a venous clot.
  - Look for finger clubbing, which indicates chronic hypoxia.



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Focused History & Physical Exam

- Vital Signs
  - Heart Rate
    - Tachycardia
  - Blood Pressure
  - Respiratory Rate
    - Observe for trends

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Focused History & Physical Exam

- Assume that an elevated respiratory rate in a patient with dyspnea is caused by hypoxia.
- A persistently slow rate indicates impending respiratory arrest.

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Focused History & Physical Exam

Diagnostic Testing

- Pulse Oximetry
  - Inaccurate Readings

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Focused History & Physical Exam

- Capnometry
  - Continuous waveform monitoring
  - Colorimetric devices

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Management of Respiratory Disorders

Basic Principles

- Maintain the airway.
  - Protect the cervical spine if trauma is suspected.
- Any patient with respiratory distress should receive oxygen.
- Any patient suspected of being hypoxic should receive oxygen.
- Oxygen should never be withheld from a patient suspected of suffering from hypoxia.

Pulmonary Edema

A pathophysiologic condition, not a disease

- Fluid in and around alveoli
- Interferes with gas exchange
- Increases work of breathing

Two Types

- Cardiogenic (high pressure)
- Non-Cardiogenic (high permeability)

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Pulmonary Edema

High Pressure (cardiogenic)

- AMI
- Chronic HTN
- Myocarditis

High Permeability (non-cardiogenic)

- Poor perfusion, Shock, Hypoxemia
- High Altitude, Drowning
- Inhalation of pulmonary irritants

Pulmonary Edema: Signs & Symptoms

- Dyspnea on exertion
- Paroxysmal nocturnal dyspnea
- Orthopnea
- Noisy, labored breathing
- Restlessness, anxiety
- Productive cough (frothy sputum)
- Rales, wheezing
- Tachypnea
- Tachycardia

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Management of Pulmonary Edema

EMERGENCY MEDICAL RESPONDER

- Routine Medical Care
- Allow/assist the patient to assume a position of comfort (usually upright)
- Oxygen: Per nasal cannula at 2-6 LPM or per non-rebreather at 10-15 LPM (depending on the apparent severity)
- Assisted Ventilation: Consider assisting breathing with gentle synchronous ventilations with bag-valve mask (BVM); Support ventilation with BVM if apnea or hypopnea occurs
- Airway Adjuncts: If there is loss of consciousness and loss of gag reflex, insert an oropharyngeal or nasopharyngeal airway if gag reflex still present
- If the patient is wheezing, assist with use of metered dose inhalers or give **Albuterol Sulfate** 2.5 mg in 3 ml, administer per hand held nebulizer or mask; May repeat X 2 additional doses
- Consider **Aspirin** per Chest Pain Guideline

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Management of Pulmonary Edema

2.16.2

EMT

- If the patient complains of chest pain (angina):
  - Consider **Aspirin** 324 mg (4- 81 mg baby aspirin tablets) chewed and swallowed
  - If the patient is prescribed nitroglycerine consider assisting them in taking, providing systolic blood pressure >100mmHg
  - Acquire 12-Lead EKG, if not supine mark as such
- Initiate CPAP, refer to *CPAP Procedure* [1]
- Airway Adjuncts: If there is loss of consciousness and loss of gag reflex, insert an advanced airway

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CPAP

5.4 CPAP

- **INDICATIONS** – Any patient who is complaining of shortness of breath for reasons other than pneumothorax and:
    - Is awake and oriented.
    - Are over 12 years old and is able to fit the CPAP mask.
    - Has the ability to maintain an open airway (GCS > 10).
    - Has a respiratory rate ≥ 25 breaths per minute.
    - Has a systolic blood pressure above 90 mmHg.
        - Note: CPAP decreases preload, which make the blood pressure drop
    - Using accessory muscles of respiration with SPO2 <94%
    - Signs and symptoms are consistent with asthma, COPD, pulmonary edema, CHF, or pneumonia.

- **CONTRAINDICATIONS**
    - Patient is in respiratory arrest.
    - BP < 90 mmHg
    - Heavy oral secretions or vomiting
    - Patient is suspected of having a pneumothorax.
    - Patient has a tracheotomy.
    - Major trauma

- **PRECAUTIONS** – Use care if the patient has:
    - Impaired mental status and is not able to cooperate with the procedure
    - Failed at past attempts at noninvasive ventilation
    - Active upper GI bleeding or history of recent gastric surgery
    - Complains of nausea (remove if vomiting begins)
    - Inadequate respiratory effort
    - Excessive secretions
    - Facial deformity that prevents the use of CPAP

- **ALTERNATIVE** – Intubation should be performed if:
    - Respiratory or cardiac arrest
    - Unresponsive to verbal stimuli (GCS is < 9) and loss of gag reflex
    - EMR, EMT may use a non-visualized airway
    - Paramedics may use an endotracheal tube

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CPAP

- **PROCEDURE:**
  - Make sure patient does not have a pneumothorax!
  - EXPLAIN THE PROCEDURE TO THE PATIENT
  - Ensure adequate oxygen supply to ventilation device (100% when starting therapy and until SpO_2 is >95%)
  - Place the patient on continuous pulse oximetry and $EtCO_2$
  - Place the delivery device over the mouth and nose
  - Secure the mask with provided straps or other provided devices
  - Use 5 cm H2O of PEEP to start and titrate to effect up to 15 cm H2O.
  - Check for air leaks
  - Monitor and document the patient's respiratory response to treatment
  - Check and document vital signs every 5 minutes
    - If BP drops to < 90 mmHg, discontinue CPAP
  - Continue to coach patient to keep mask in place and readjust as needed
  - If respiratory status deteriorates, remove device and consider intermittent positive pressure ventilation with or without endotracheal intubation

- **REMOVAL PROCEDURE:**
  - CPAP therapy needs to be continuous and should not be removed unless the patient cannot tolerate the mask or experiences continued or worsening respiratory failure.
  - Intermittent positive pressure ventilation and/or intubation should be considered if the patient is removed from CPAP therapy.

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Management of Pulmonary Edema

PARAMEDIC

- IV/IO 0.9% NS @ KVO or saline lock
- Note: No NTG if patient has used Viagra or Levitra in the last 24 hours, or Cialis in the last 48 hours
- Give **Nitroglycerine** 0.4 mg (1 sublingual spray or tablet) every 3-5 minutes. No maximum dose as long as a SBP >100 is maintained
- If SBP>160 may use **Nitroglycerine** 0.8mg (2 sublingual spray or tablets) every 3-5 minutes. If SBP<160 after initial 0.8mg dose, use 0.4mg dose for subsequent doses
- Apply 1" of **Nitroglycerine Paste**, hold if SBP ≤ 100 mmHg
- If SBP < 90 mmHg withhold NTG and consider **Push Dose Epinephrine per section 5.42** to maintain SBP >100

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Endotracheal Intubation

- For those providers and agencies that are RSA credentialed, RSA may be indicated if the patient fails CPAP or the patient has contraindications to CPAP
- Non RSA intubations are restricted to patients with no gag reflex and the need for airway management.
- ***Medication Assisted Intubation (MAI) and Drug Assisted Intubation (DAI) are not included in the Mercyhealth EMS Protocols and are strictly forbidden***
  - ***Violation will result in disciplinary action, up to and including de-credentialing from the EMS system***

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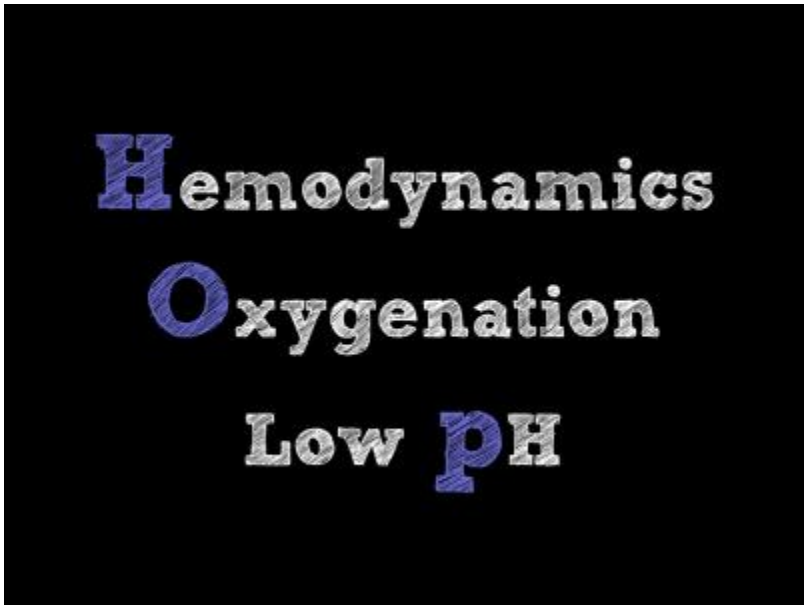
Endotracheal Intubation

Pre-intubation Optimization should occur prior to intubation attempts, with specific attention to the “HOp Killers”



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Pneumonia

- Fifth leading cause of death in US
- Inflammation of the bronchioles and alveoli
  - Products of inflammation (secretions, pus) add to respiration difficulty
  - Infection can spread through lungs
- Gas exchange is impaired
- Work of breathing increases
- May lead to
  - Atelectasis – alveolar collapse may occur
  - Sepsis
  - VQ Mismatch
  - Hypoxemia

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Pneumonia: Etiology

Viral

Bacterial

Fungi

Protozoa (pneumocystis)

Aspiration

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Presentation of Pneumonia

- Shortness of breath
- Fever, chills
- Pleuritic chest pain, tachycardia
- Deep productive cough
  - Green/brown sputum
- May have crackles, rhonchi or wheezing in affected lung fields
  - Consolidation
  - Decreased air movement in affected lung

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Management of Pneumonia

Treatment mostly based upon symptoms

- Oxygen (intubation is rarely required)
- IV access and rehydration
- B_2 agonists may be useful
- Antipyretics

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Obstructive Airway Diseases

- Emphysema
- Chronic Bronchitis
- Asthma

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Obstructive Airway Diseases

Factors leading to Obstructive Airway Diseases

- Smoking
- Exposure to environmental agents
- Genetic predisposition

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Obstructive Airway Diseases

Exacerbation Factors

- Intrinsic
  - Stress (especially in adults)
  - URI
  - Exercise
- Extrinsic
  - Cigarette Smoke
  - Allergens
  - Drugs
  - Occupational hazards

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Obstructive Airway Diseases

General Pathophysiology

- Specific pathophysiology varies by disease
- Obstruction in bronchioles
  - Smooth muscle spasm (beta)
  - Mucous accumulation
  - Inflammation
- Obstruction, may be reversible or irreversible, and results in air trapping

COPD: Epidemiology

- Most common chronic lung disease
- 14.8 million cases in U.S.
- 4th leading cause of death
- 110,000 deaths annually

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Emphysema

Type A: COPD

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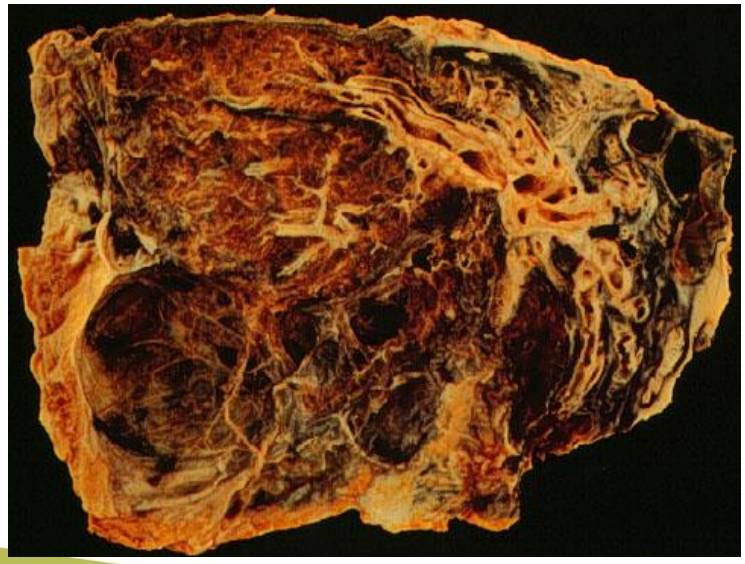
Emphysema: Definition

- Destruction of alveolar walls
- Distention of pulmonary air spaces
- Loss of elastic recoil
- Destruction of gas exchange surface



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Emphysema: Incidence

- Male > females
- Urban area > rural areas
- Age usually > 55 years old

Emphysema: Etiology

Smoking

- 90% of all cases
- Smokers 10x more likely to die of COPD than non-smokers

Environmental factors

Alpha – 1 antitrypsin deficiency

- hereditary
- 50,000 to 100,000 cases
- mostly people of northern European descent

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Emphysema: Pathophysiology

- Decreased surface area leads to decreased gas exchange with blood
- Loss of pulmonary capillaries and hypercapnia lead to:
  - increased resistance to blood flow which leads to:
    - pulmonary HTN
    - right heart failure (cor pulmonale)

Emphysema: Pathophysiology

Loss of elastic recoil leads to increased residual volume and CO_2 retention

- Air Trapping
- Hyperinflation
- Hypercapnia -> pulmonary vasoconstriction -> V/Q mismatch

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Emphysema: Signs and Symptoms

- Increasing dyspnea on exertion
- Non-productive cough
- Malaise
- Anorexia, Loss of weight
- Hypertrophied respiratory accessory muscles

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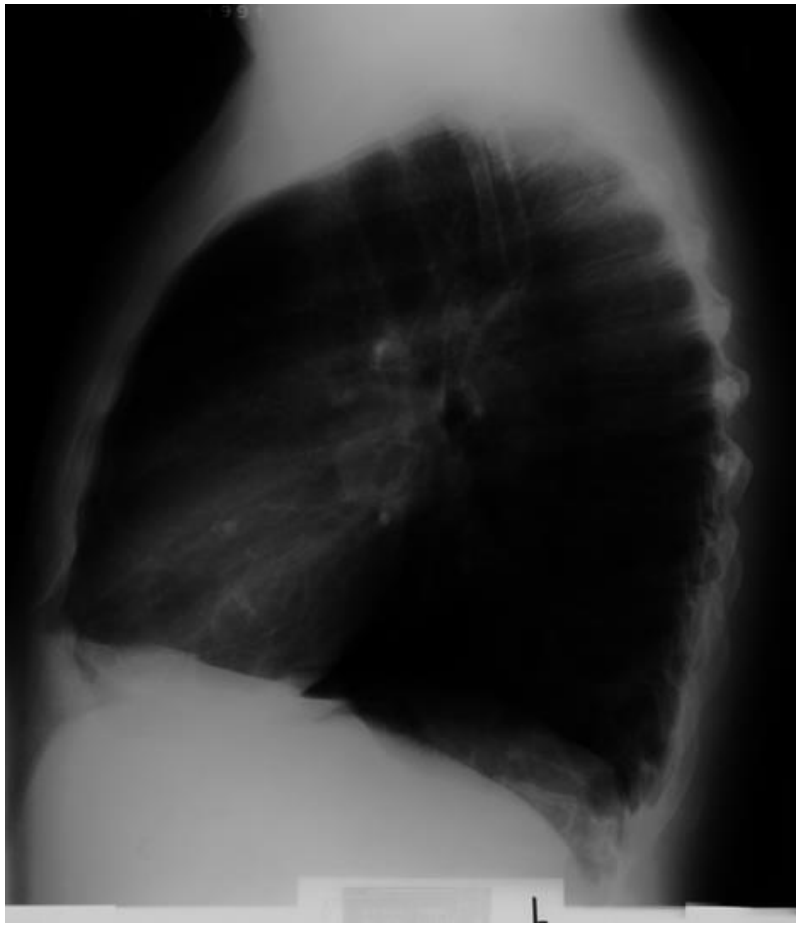
Emphysema: Signs and Symptoms



- Increased Thoracic AP Diameter (Barrel Chest)
- Decreased lung sounds
- Hyperresonance

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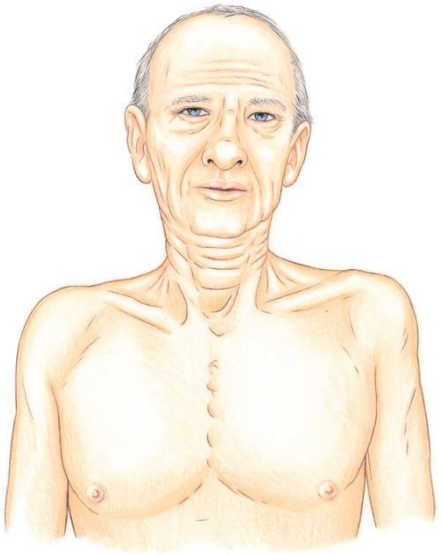
Emphysema: Signs and Symptoms



- Lip pursing on exhalation
- Clubbed fingertips
- Altered blood gases
  - Normal or decreased PaO_2
  - Elevated CO_2
- Cyanosis occurs <u>LATE</u> in course of disease

PINK PUFFER

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Chronic Bronchitis

Type B: COPD

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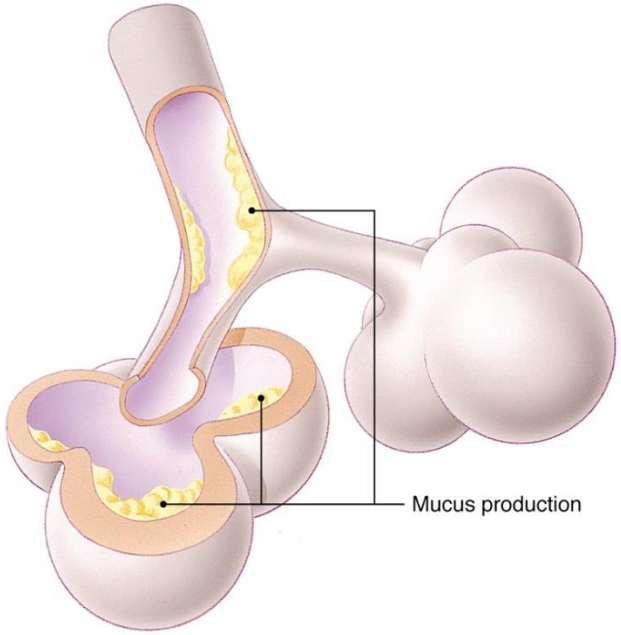
Chronic Bronchitis: Definition

Increased mucus production for ≥ 3 months for ≥ 2 consecutive years

Recurrent productive cough



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Chronic Bronchitis: Incidence

- Males > females
- Urban areas > rural areas
- Age usually > 45 years old

Chronic Bronchitis: Etiology

- Smoking
- Environmental irritants

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Chronic Bronchitis: Pathophysiology

- Mucus plugging/inflammatory edema
- Increased airflow resistance leads to alveolar hypoventilation
- Alveolar hypoventilation leads to
  - Hypercarbia
  - Hypoxemia

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Chronic Bronchitis: Pathophysiology

Hypoxemia leads to:

- increased RBC's without oxygen, which leads to cyanosis

Hypercarbia leads to:

- pulmonary vascular constriction which leads to:
  - increased right ventricular work
  - right heart failure
  - cor pulmonale

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Chronic Bronchitis: Signs and Symptoms

- Increasing dyspnea on exertion
- Frequent colds of increasing duration
- Productive cough
- Weight gain, edema (right heart failure)
- Rales, rhonchi, wheezing
- Bluish-red skin color (polycythemia)
- Headache, drowsiness (increased CO_2)

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Chronic Bronchitis: Signs and Symptoms

- Decreased intellectual ability
- Personality changes
- Abnormal blood gases
  - Hypercarbia
  - Hypoxia
- Cyanosis EARLY in course of disease

BLUE BLOATER

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COPD Assessment Findings

- Chronic condition ⇨ acute episode
- S&S of ↑ work of breathing and/or hypoxemia
  - Use of accessory muscles
  - Increased expiratory effort
  - Tachycardia, AMS, Cyanosis
  - Wheezing, Rhonchi, ↓ LS
  - Thin, red/pink appearance
- Saturation usually normal in emphysema

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Causes of Decompensation

- Respiratory infection (increased mucus production)
- Chest trauma (pain discourages coughing or deep breathing)
- Sedation (depression of respirations and coughing)
- Spontaneous pneumothorax
- Dehydration (causes mucus to dry out)

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COPD: Management

EMERGENCY MEDICAL RESPONDER

- Routine Medical Care
- Allow/assist the patient to assume a position of comfort (usually upright)
- Oxygen: Per nasal cannula at 2-6 LPM or per non-rebreather at 10-15 LPM (depending on the apparent severity)
- Assist with patient-prescribed **Albuterol Sulfate**: If no nebulizer available **Albuterol Sulfate** MDI with spacer 6 Puffs, may repeat X 2
- Administer Nebulizer Therapy: **Albuterol Sulfate** 2.5mg in 3 ml administer with hand held nebulizer, mask or in-line nebulizer; If no improvement, may repeat albuterol X 2 if needed
- Assisted Ventilation: Consider assisting breathing with gentle synchronous ventilations with bag-valve mask (BVM); Support ventilation with BVM if apnea or hypopnea occurs
- Airway Adjuncts: If there is loss of consciousness, insert an oropharyngeal, nasopharyngeal, or advanced airway depending on presence of gag reflex refer to *Respiratory Distress Guidelines*

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COPD: Management

EMT

- Assist with patient-prescribed medications: If no nebulizer available **Albuterol Sulfate** MDI with spacer 6 Puffs, may repeat X 2
- Administer Nebulizer Therapy: **Albuterol Sulfate** 2.5mg in 3 ml with **Ipratropium Bromide (Atrovent)** 0.5mg in 2 ml administer per hand held nebulizer, mask or in-line nebulizer; May repeat albuterol X 2 additional doses
  ** If patient is under 3 years of age, do not use Ipratropium Bromide (Atrovent), use only Albuterol via HHN
- If in severe distress[1] and still alert, consider CPAP, see *CPAP Procedure*

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COPD: Management

PARAMEDIC

- IV 0.9% NS @ KVO
- If signs of dehydration or hypovolemia are present, administer 500 ml boluses and check lung sounds
- **Methylprednisolone (SoluMedrol)** 125 mg IV/IO/IM (peds dose 2mg/kg)
- Consider **Magnesium Sulfate** 2 gm (peds 50mg/kg) IV slowly (over 10 minutes)
- Consider low dose **Ketamine** for severe CPAP anxiety 0.25mg/kg IV/IO/IM (max dose 25mg), **Fentanyl** 50-100mcg IV/IO/IN/IM, or **Versed** 2mg IV/IO/IN/IM.
- RSA using **Ketamine** unless hypertensive or strong cardiac history dictates **Versed**

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Asthma

- Asthma experienced by ~ 4 - 5 % of US population
  - Mortality rate increasing
- Lower airway hyper-responsiveness to a variety of stimuli
- Diffuse reversible airway obstruction or narrowing
- Airway inflammation

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Asthma: Incidence

- 50% onset before age 10
- 33% before age 30
- “Asthma” in older patients suggests other obstructive pulmonary diseases
- Risk Factors
  - Family history of asthma
  - Perinatal exposure to airborne allergens and irritants
  - Genetic hypersensitivity to environmental allergens

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Asthma

Diagnosis

- H&P, Spirometry
- History or presence of episodic symptoms of airflow obstruction
- airflow obstruction is at least partially reversible
- alternative diagnoses are excluded

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Asthma

Commonly misdiagnosed in children as

- Chronic bronchitis
- Recurrent croup
- Recurrent URI
- Recurrent pneumonia

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Asthma

Often triggered by:

- Cold temperature
- Respiratory Infections
- Vigorous exercise
- Emotional Stress
- Environmental allergens or irritants

Exacerbation

- Extrinsic common in children
- Intrinsic common in adults

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Asthma Pathophysiology

- Asthma triggered ⇨
  - Bronchial smooth muscle contraction
  - Increased mucus production
    - Bronchial ‘plugging’
    - Relative dehydration
- Alveolar hypoventilation ⇨
  - Ventilation Perfusion Mismatch
  - CO_2 retention
  - Air ‘Trapping’

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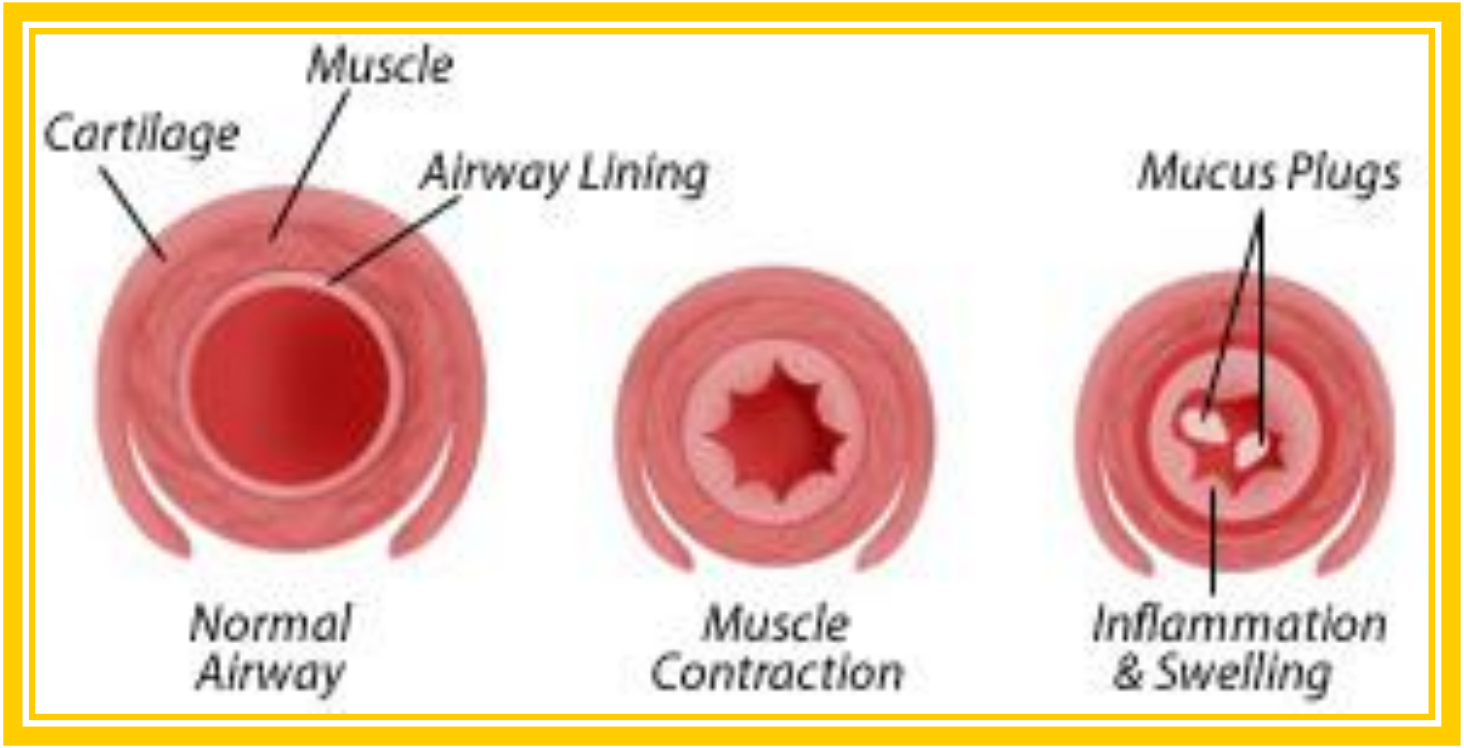
Asthma: Pathophysiology



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Asthma: Signs and Symptoms

- Onset of attacks associated with “triggers”
- Dyspnea
- Non-productive cough
- Tachypnea
- Expiratory wheezing
- Accessory muscle use
- Retractions

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Asthma: Signs and Symptoms

- Tachycardia
- Anxiety, restlessness (hypoxia) progressing to drowsiness, confusion (hypercarbia)

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Asthma: Risk Assessment

- Prior ICU admissions
- Prior intubation
- >3 ED visits in past year
- >2 hospital admissions in past year
- >1 bronchodilator canister used in past month
- Use of bronchodilators > every 4 hours
- Chronic use of steroids
- Progressive symptoms in spite of aggressive treatment

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Asthma: Management

EMERGENCY MEDICAL RESPONDER

- Routine Medical Care
- Allow/assist the patient to assume a position of comfort (usually upright)
- Oxygen: Per nasal cannula at 2-6 LPM or per non-rebreather at 10-15 LPM (depending on the apparent severity)
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Asthma: Management

EMT

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  ** If patient is under 3 years of age, do not use Ipratropium Bromide (Atrovent), use only Albuterol via HHN
- If in severe distress[1] and still alert, consider CPAP, see *CPAP Procedure*
- Status Asthmaticus(unresponsive to nebs, impending respiratory failure) **EPI-Pen(>66lbs/30kg)** IM (0.3mg) or **EPI-Pen Jr(<66lbs/30kg)** IM (0.15mg) to lateral mid-thigh for moderate or severe reactions). Hold in place for 10 seconds and massage area for 10 seconds after injection, if trained and credentialed.
- Alternative medical director approved epinephrine auto injectors may also be used.
- Drawn up epinephrine and syringe using above dosing only for departments with additional training to do so.

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Asthma: Management

PARAMEDIC

- IV 0.9% NS @ KVO
- If signs of dehydration or hypovolemia are present, administer 500 ml boluses and check lung sounds
- **Methylprednisolone (SoluMedrol)** 125 mg IV/IO/IM (peds dose 2mg/kg)
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- Consider low dose **Ketamine** for severe CPAP anxiety 0.25mg/kg IV/IO/IM (max dose 25mg), **Fentanyl** 50-100mcg IV/IO/IN/IM, or **Versed** 2mg IV/IO/IN/IM.
- RSA using **Ketamine** unless hypertensive or strong cardiac history dictates **Versed**
- For severe asthma or anaphylaxis, consider **Epinephrine** 0.5mg 1mg/1ml IM
- For imminent respiratory arrest from asthma or anaphylaxis, consider **Push Dose Epinephrine per section 5.42**

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MD-1 Medical Control

**REMINDER: ALL MEDICAL CONTROL CALLS FOR MD-1 NOW SHOULD GO THROUGH MERCYHEALTH ROCKCOM

(815) 968-0993

**Please take out your cell phone and duty phones now and update the contact information

-Calls made directly to MD-1 cell phones are no longer recorded and will no longer be answered

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Questions?

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Sources

- Caroline, Nancy. “Emergency Care in the Streets”. Eighth Edition. Jones and Bartlett, 2018.
- Mercyhealth Paramedic Program teaching resources by Tom Brunner.
- “HOp Killers” graphic by EMCrit.

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