

Chronic Lung Disease: COPD, Emphysema, PAH

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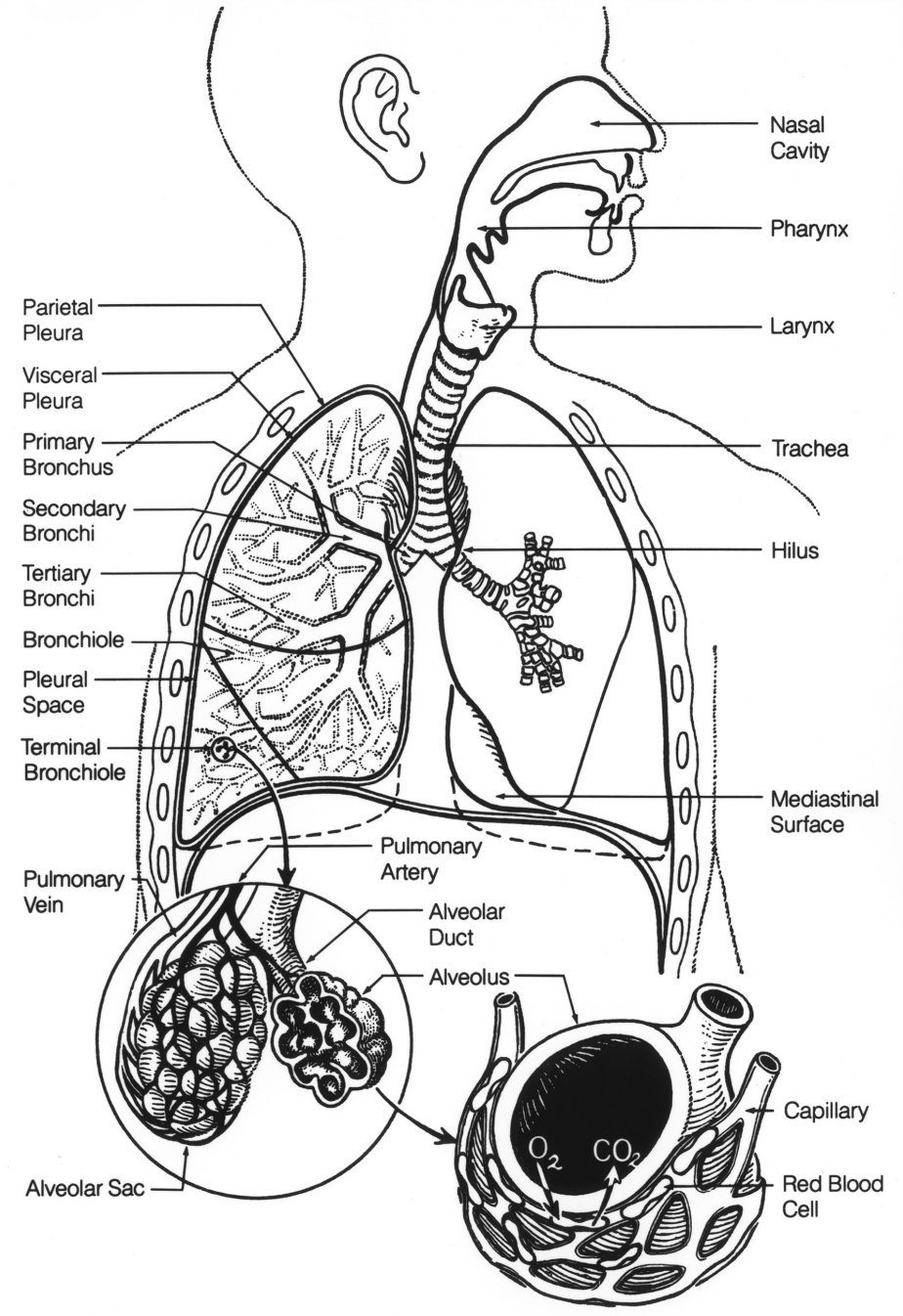
Disclosures

No financial disclosures

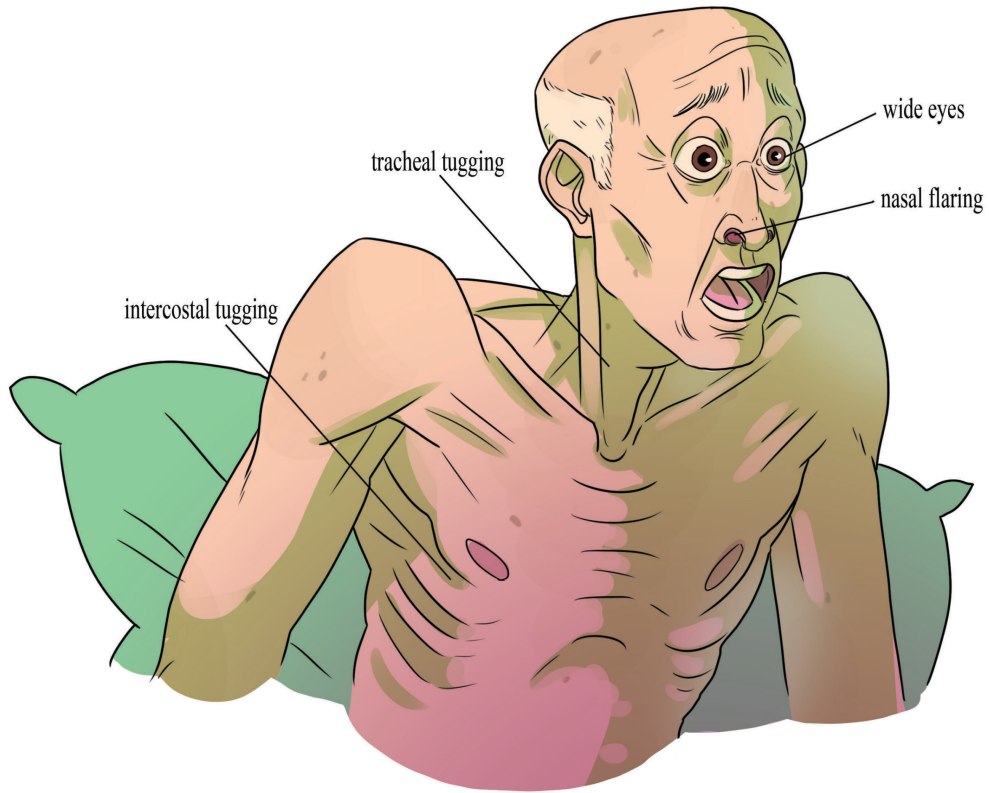


Outline

- Lung Anatomy/Physiology Review
- Pathophysiology of COPD
 - Emphysema
 - Chronic Bronchitis
- Prehospital Treatment approach to COPD
- Pathophysiology of Pulmonary Arterial Hypertension (PAH)
- Prehospital Treatment approach to PAH
- Summary/Takehome

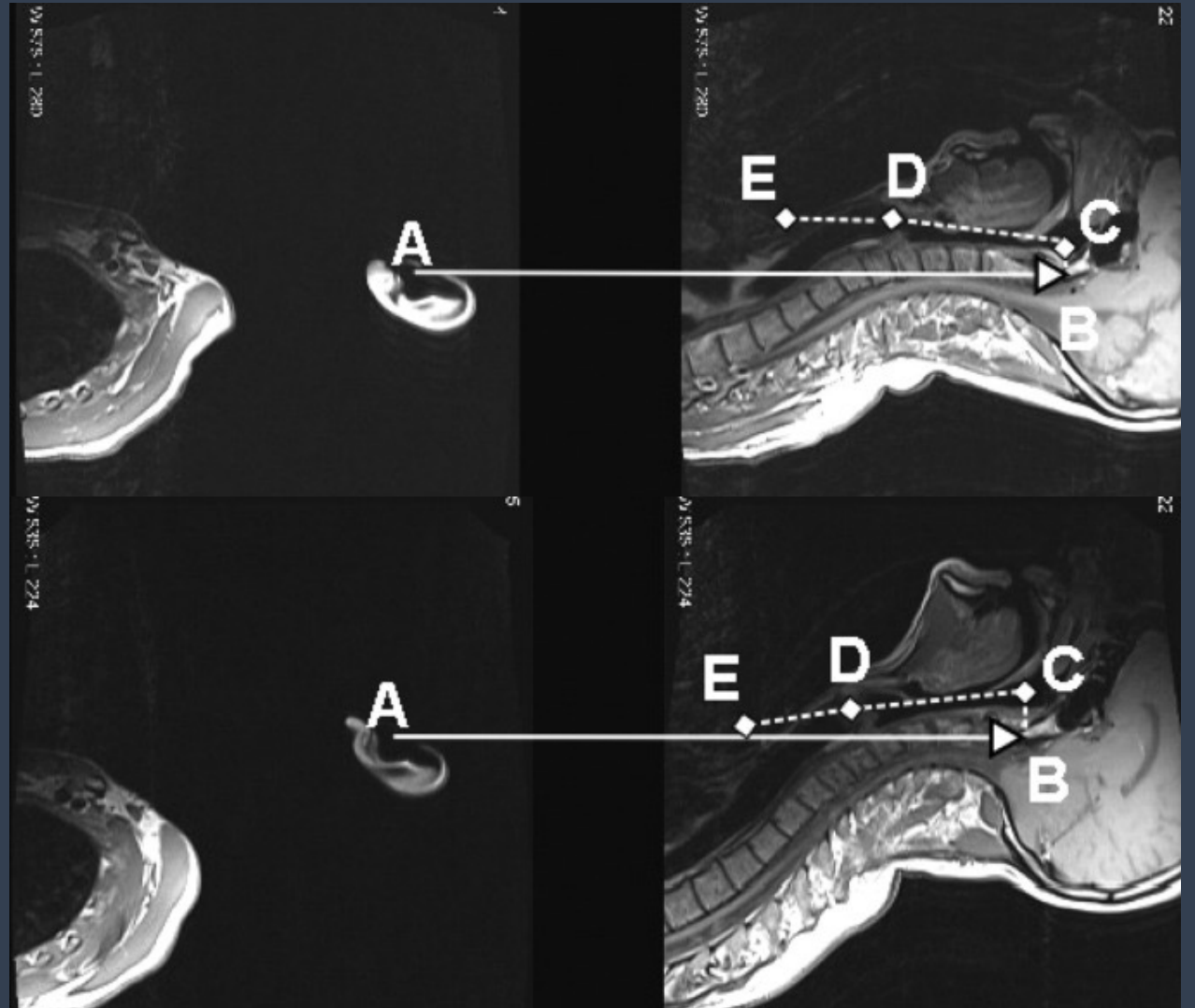


Adult Respiratory Distress

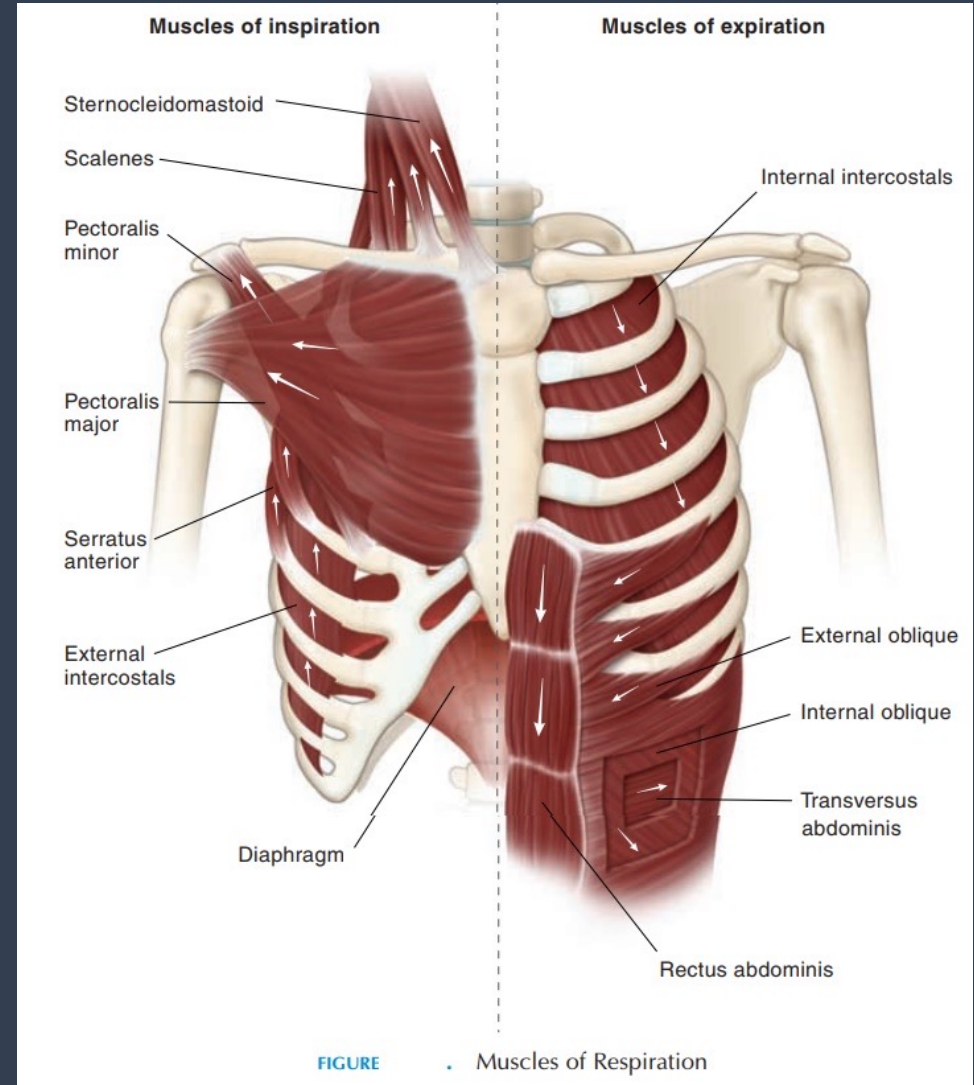


<https://opentextbc.ca/vitalsignmeasurement/chapter/respiration/>

Image credit – Paige Jones



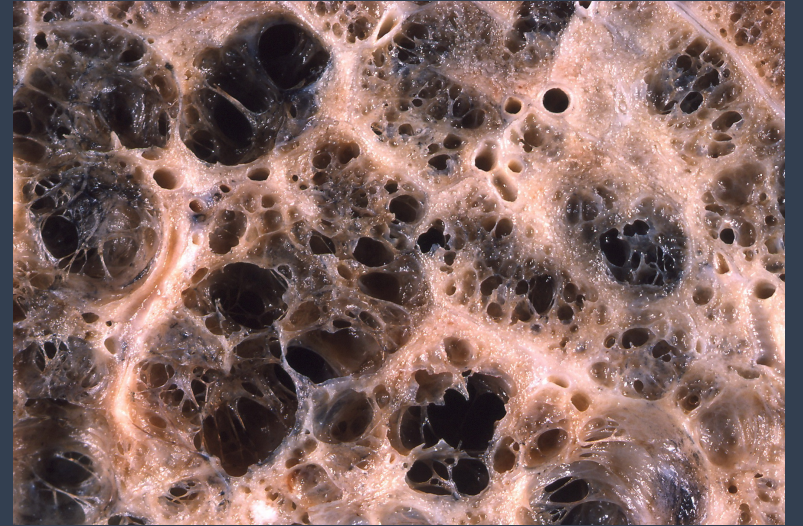
Adult Respiratory Distress





Chronic Obstructive Pulmonary Disease

- Inflammation/Scarring
- Usually effects older patients
- Periodic exacerbation
 - More persistent and insidious
- Often underlying alveolar injury
 - Decreased gas exchange in lungs
 - More persistent expansion/air trapping
 - Less functional ventilation



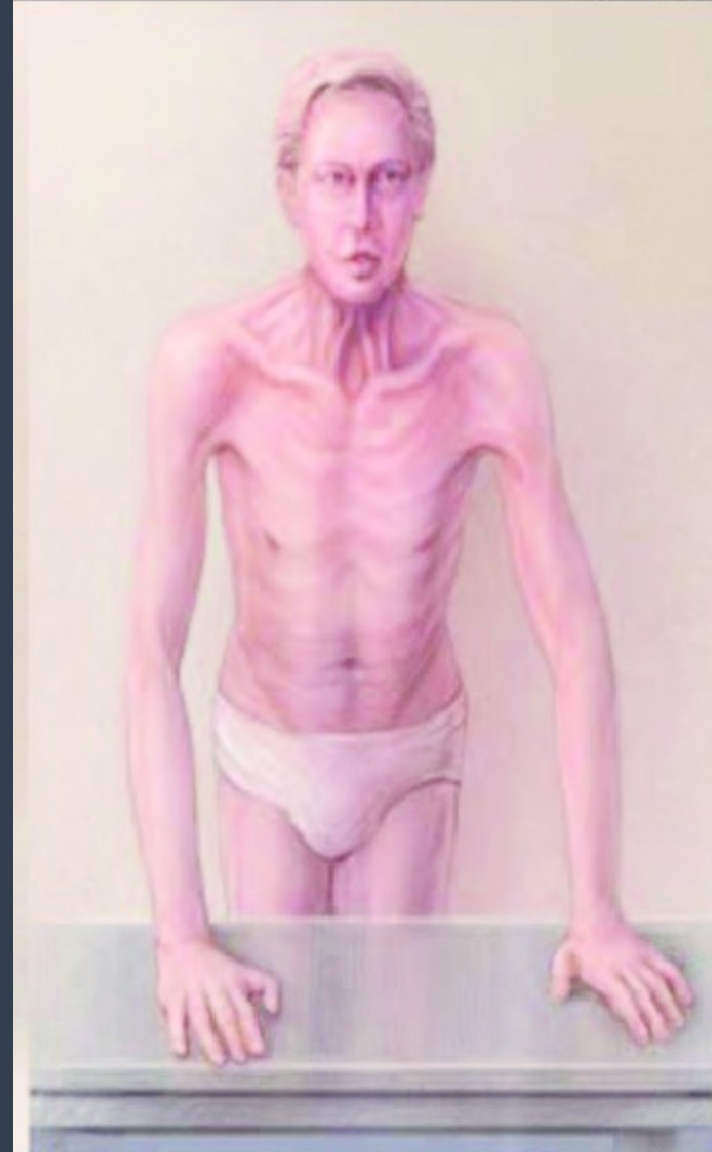
“Blue Bloater” and “Pink Puffer”

Blue Bloater = Chronic Bronchitis



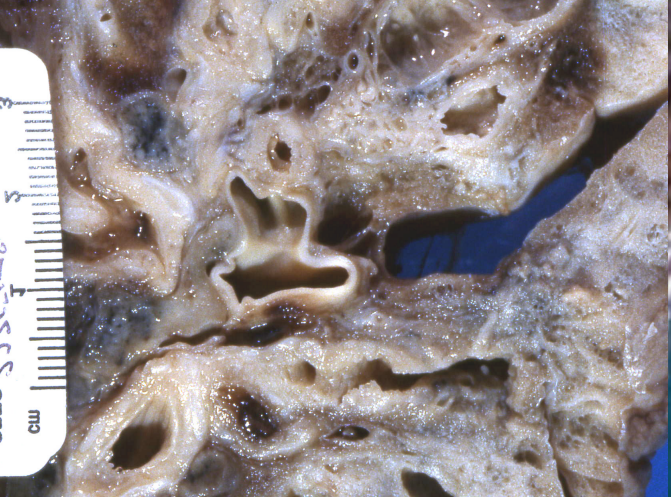
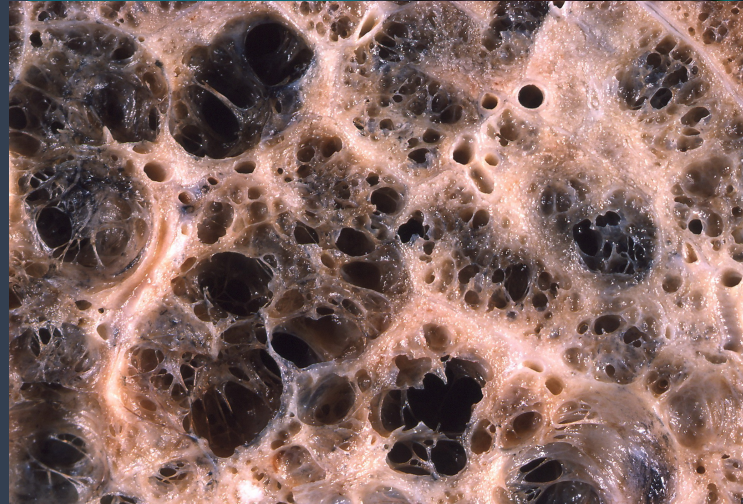
- ✓ Increased sputum
- ✓ “Cor pulmonale”
 - ✓ Crackles
 - ✓ Wheezing
- ✓ Cyanosis
- ✓ Pneumonia

Pink Puffer = Emphysema



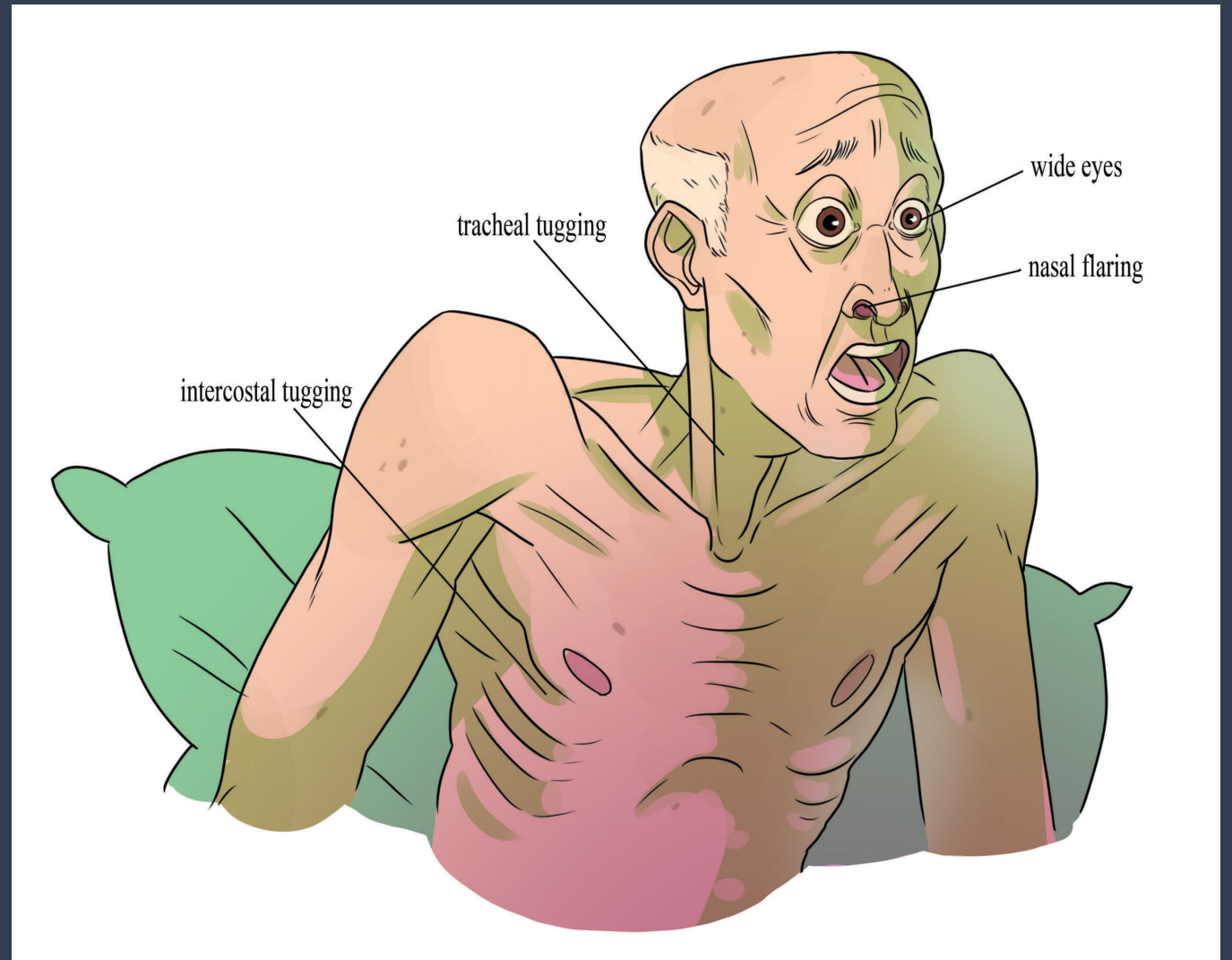
- ✓ Decreased breath sounds
- ✓ Pursed lip breathing
- ✓ Tachypnea
- ✓ Pneumothorax

COPD – Tissue Damage



COPD Exacerbation Presentation

- Wheezing
- Tachypnea/bradypnea
- Cough
- Hypoxia



Treatment - Respiratory support

- Oxygen
 - SpO₂ goal >94%
- Poor VENTILATION is the problem
 - 2nd is diaphragmatic fatigue
- If alert with respiratory drive:
 - CPAP
 - BiPAP if within scope
- Poor respiratory drive (RR <10)
 - BVM w/ PEEP valve



COPD - Decompensation



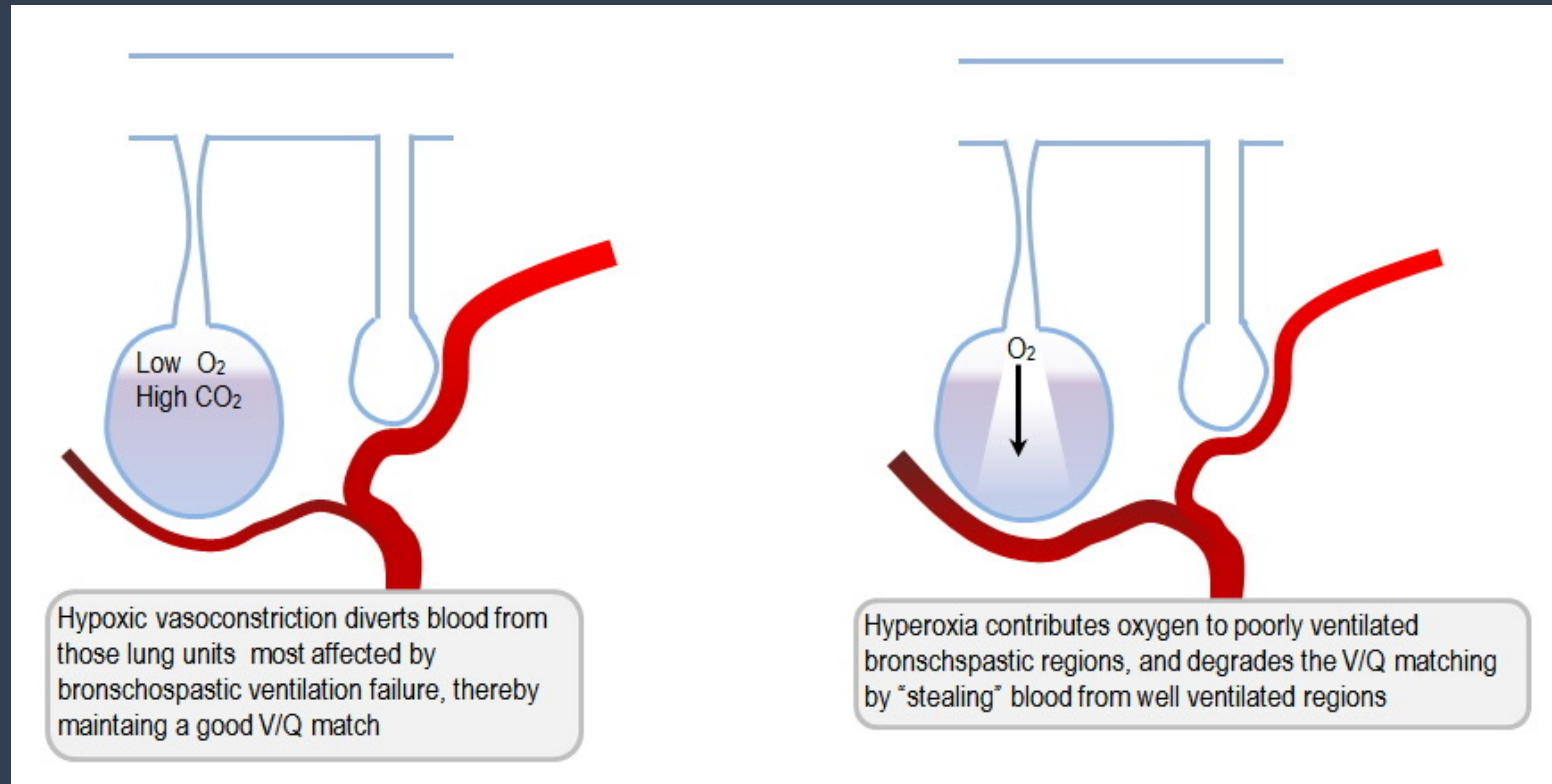
Treatment approach – Target the problem

Airway

- Suctioning (as needed)
- Adjuncts
 - NPA/OPA

Breathing

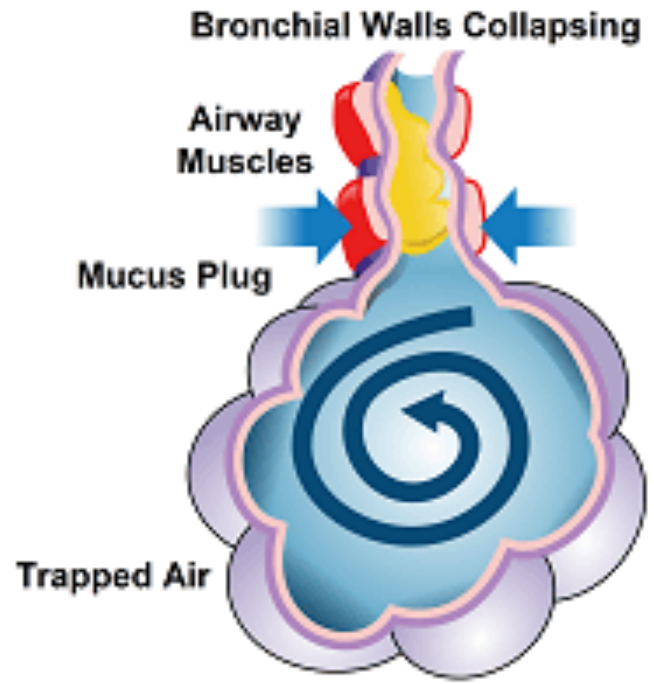
- Monitor SpO₂/EtCO₂
- Consider CPAP
- Consider BVM
- Oxygenation?
 - Target ~94% SpO₂ (normoxia)*
 - Hyperoxia can worsen respiratory status!



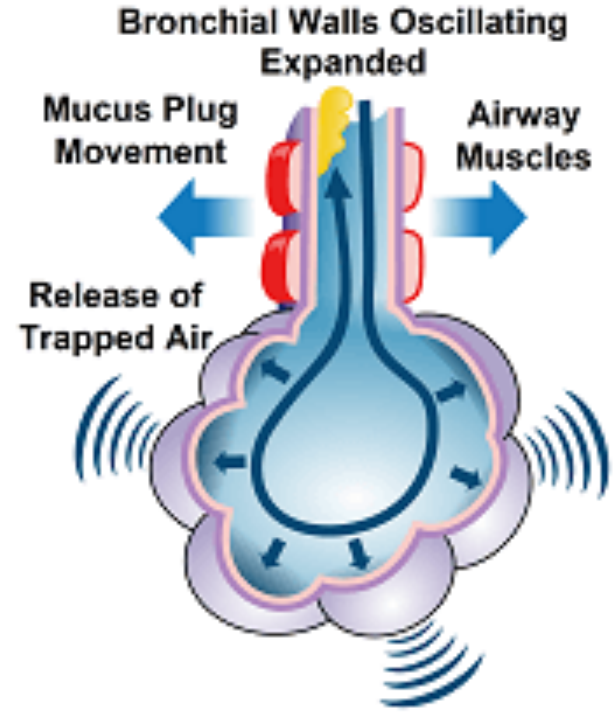
Respiratory Support - CPAP



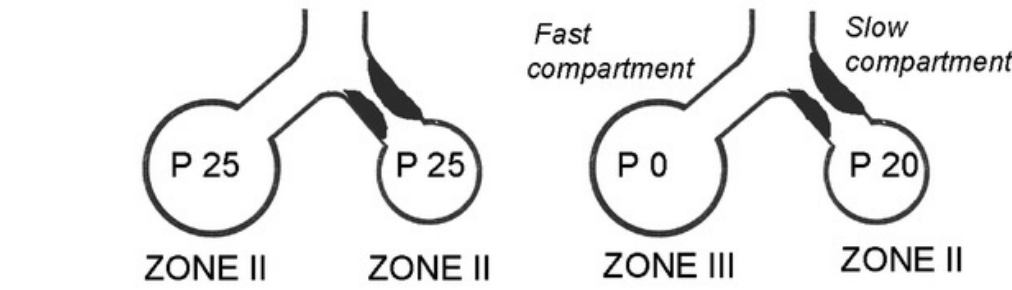
Airflow during EXHALATION



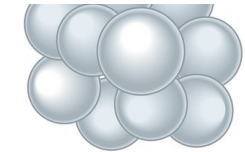
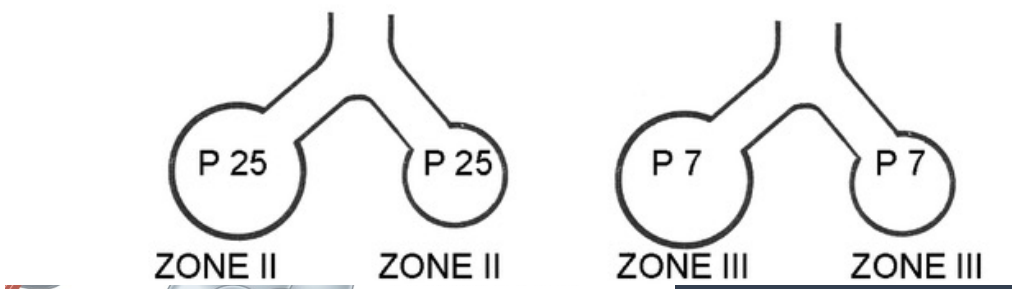
Airflow during OPEP THERAPY



ZEEP Inspiration Expiration



PEEP 7 cm H₂O



ivivcus

CPAP - Checklist



Contraindications

Can go if all
"No"

Respiratory Arrest

Hypotension

Head or facial trauma

Suspected pneumothorax or
penetrating chest trauma

Unable to protect airway
(active vomiting etc.)

Severe Gastric distention

Indications

- ✓ Persistent Hypoxia despite NRB
- ✓ Ventilatory failure
- ✓ Respiratory Drive

CPAP – Considerations



Remove if:

- 1) Patient vomits
- 2) Respiratory arrest
- 3) Cardiac arrest

Beards and Seals



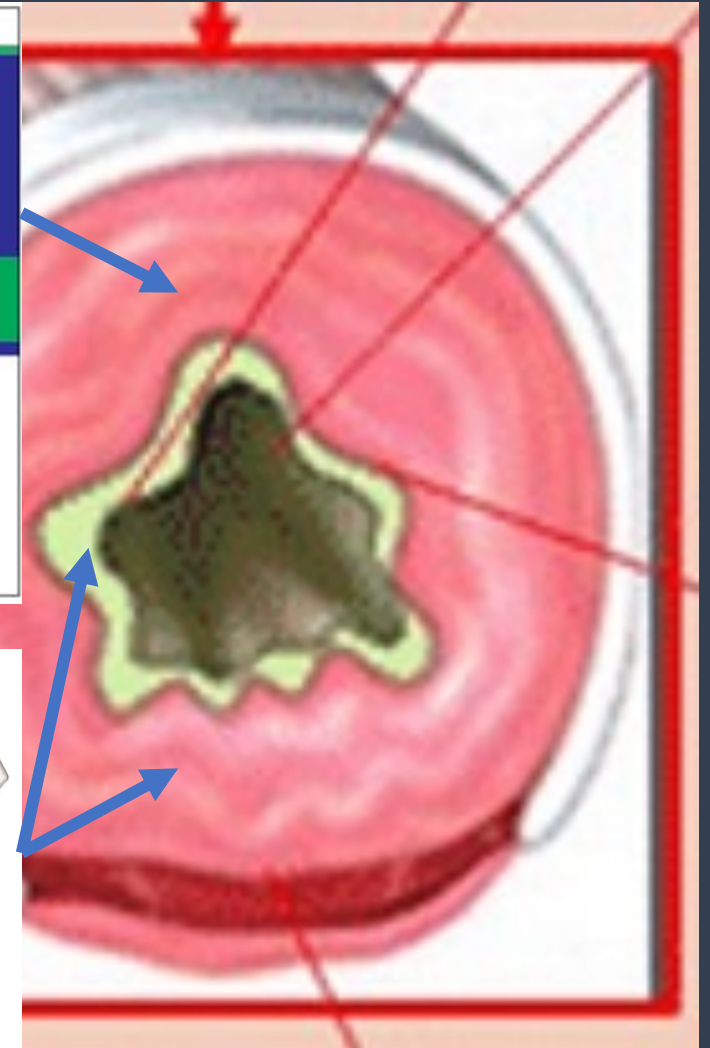
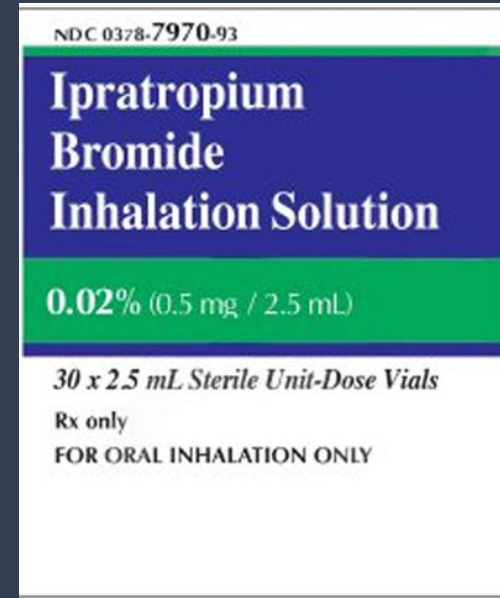
Treatment approach – Pharmacology

Ipratropium = Anticholinergic

- Primarily muscarinic type receptors
- Smooth muscle relaxation

Albuterol = Beta-agonist

- Smooth muscle relaxation in airways
- Mild increase in HR

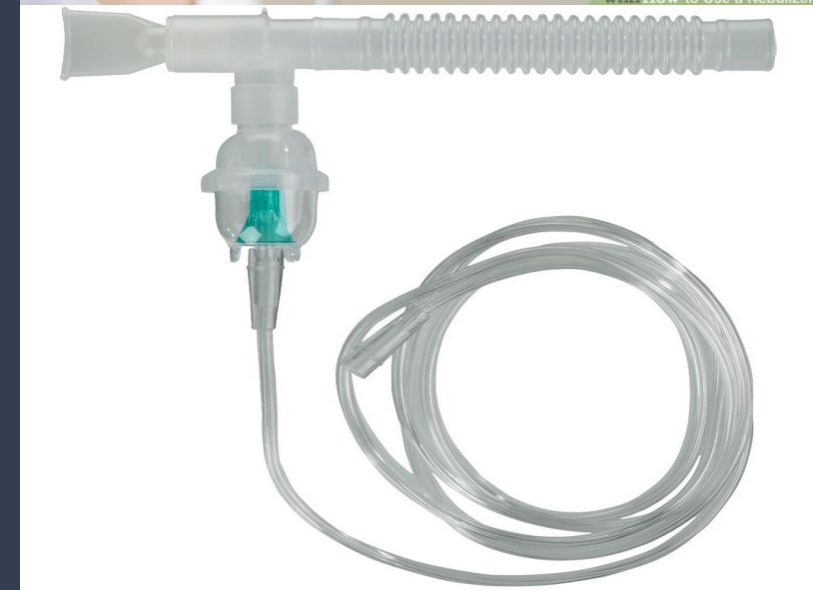
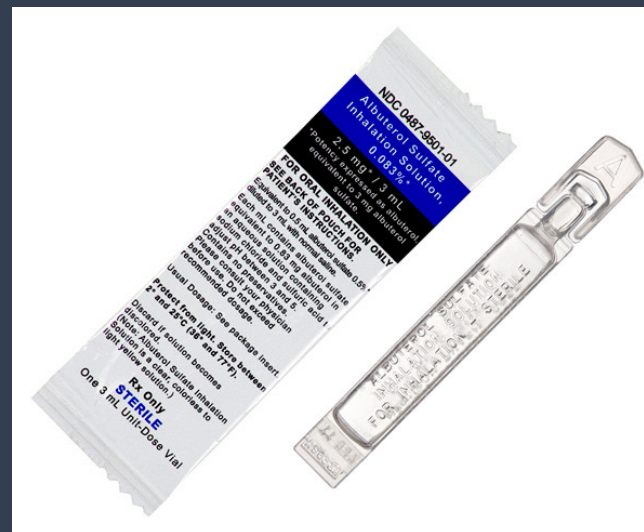
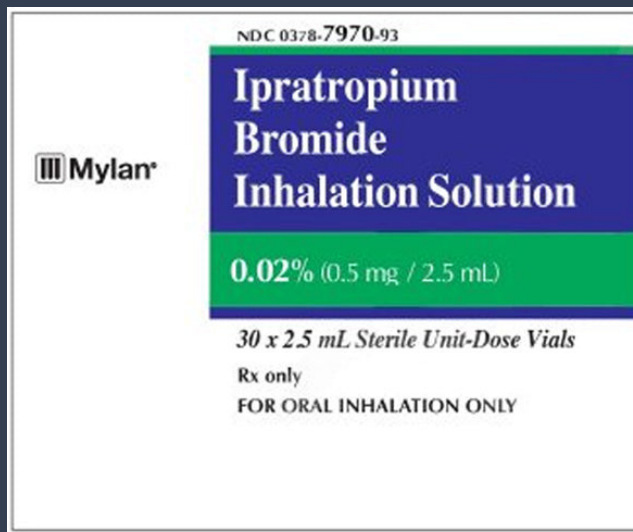


Treatment approach – Pharmacology

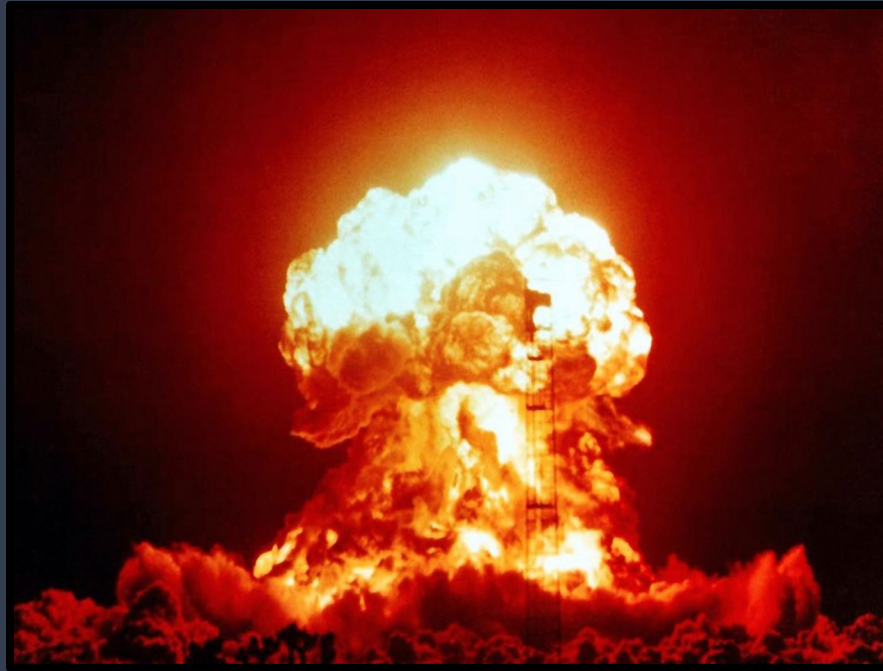
- Albuterol (All providers)
 - 5mg nebulized (can repeat)
- Ipratropium (All providers)
 - 0.5 mg nebulized
- Corticosteroids (EMT-I/AEMT)
 - Dexamethasone -> 0.6 mg/kg (max per protocol)
 - Methylprednisolone -> per protocol



wiki How to Use a Nebulizer



Epinephrine – Respiratory Failure



**Consider Use In Impending
Respiratory Arrest**

Treatment Approach – ALS

- Magnesium
- Epinephrine
 - IV/IO (infusion and push dose)
 - Nebulized?
- Mechanical Ventilation
- Intubation

Treatment Approach – ALS

- Epinephrine Infusion
 - "Mini-bolus"
 - 2-10 mcg/min IV/IO, repeat every minute to sustain MAP >65 mmHg
 - Drip
 - 2-10 mcg/min IV/IO titrated to MAP >65 mmHg in adults
- Nebulized Epinephrine?
 - No true indication unless stridor present
 - Not commonly used for COPD exacerbations

Epinephrine Mini-Bolus

- 1mL of 1mg/1mL concentration (anaphylaxis concentration)
- Inject into 100mL NS bag
- New concentration $\sim 1\text{mg}/100\text{mL} = 1000\text{mcg}/100\text{mL} = 10\text{ mcg/mL}$

- OR (Push Dose)
- Waste 9mL of code dose epi (1mg/10mL), leaving 1mL of epi (0.1mg of 100 mcg)
- Draw 9mL of normal saline into syringe
 - = 10mcg/mL

Treatment Approach – ALS

- Magnesium infusion
 - Mixed evidence for benefit in COPD
 - Use if persistent wheezing despite first line treatments
 - 2g IV/IO infused over 10 minutes
 - Use a pump if available
 - Otherwise titrate by drip rate per standard stocking on your ambulance

Mechanical Ventilation

- Assisted ventilation of apneic or minimally responsive patients in severe distress/failure
- Consider using mechanical ventilation on patients with poor respiratory effort who are awake with a CPAP mask

What is mechanical ventilation?

- Controlled POSITIVE PRESSURE ventilation
- Delivers baseline sustained pressure (PEEP) and positive inspiratory pressure (PIP) to a set pressure or volume
 - BiPAP = non-invasive mechanical ventilation with PEEP and PIP
- Can be used for respiratory distress or failure
 - The patient doesn't need to be apneic, nor do they need to be unconscious!
 - Can be attached to BVM, CPAP mask, LMA or Endotracheal tube
 - *must be able to ventilate for non-invasive ventilation

Mechanical Ventilation in COPD

- Often required for patients with severe diaphragmatic fatigue, respiratory failure
- Patients often require respiratory support to sustain ventilation and prevent CO₂ retention
- Patients will require PEEP to maintain open airways as well as positive inspiratory pressure (PIP) to assist diaphragm with ventilation

Mechanical Ventilation – Starting parameters

- Recommended tidal volume = 6-8 cc/kg
- Peep = 5 to match resistance of ventilator and circuit
 - Can add more PEEP, but will only support oxygenation
 - Not recommended to go >8
- Positive inspiratory pressure (PIP)
 - Initial settings often 10 or 12
 - Will help with VENTILATION and removal of CO₂
- Lower supportive respiratory rate (12-14)
 - Allows time for expiration (blowing off CO₂)
 - Patient may “breath over” set rate
 - However if still breathing >30/min, increase respiratory support (PIP)

Mechanical Ventilation - Monitoring

- ALWAYS apply EtCO₂ with mechanical ventilation
- In COPD a high CO₂ is expected, titrate ventilation to mentation and effort
- Hemodynamics
 - Positive pressure ventilation increases pressure in the chest and can cause decrease venous return
 - Administer IV fluids if patient does not appear to be in heart failure (Blue Bloater) or if apparently dehydrated (often the case)
- Oxygenation
 - Target oxygenation is 88-92% in COPD
 - Excess oxygenation can increase pulmonary shunting and worsen hypoxemia

Intubation – Emergent

- Gurgling secretions
- Respiratory Arrest
- Cardiac Arrest (LMA)

Pulmonary Arterial Hypertension (PAH)

- Increased blood pressure in pulmonary vasculature
 - Primary/Genetic – cardiac defects/shunts
 - Medications/Drugs – sympathomimetics, chemotherapy etc.
 - Left heart failure
 - Chronic lung disease (Fibrosis, COPD, restrictive lung disease etc.)
 - Chronic hypoxemia (obesity hypoventilation, obstructive sleep apnea)
 - Portal-pulmonary hypertension (~3% of all portal HTN patients)
- Consequences effecting EMS care
 - Hemodynamic compromise (hypotension, heart failure etc.)
 - Chronic pulmonary vasodilator therapy

PAH – Hemodynamic effects

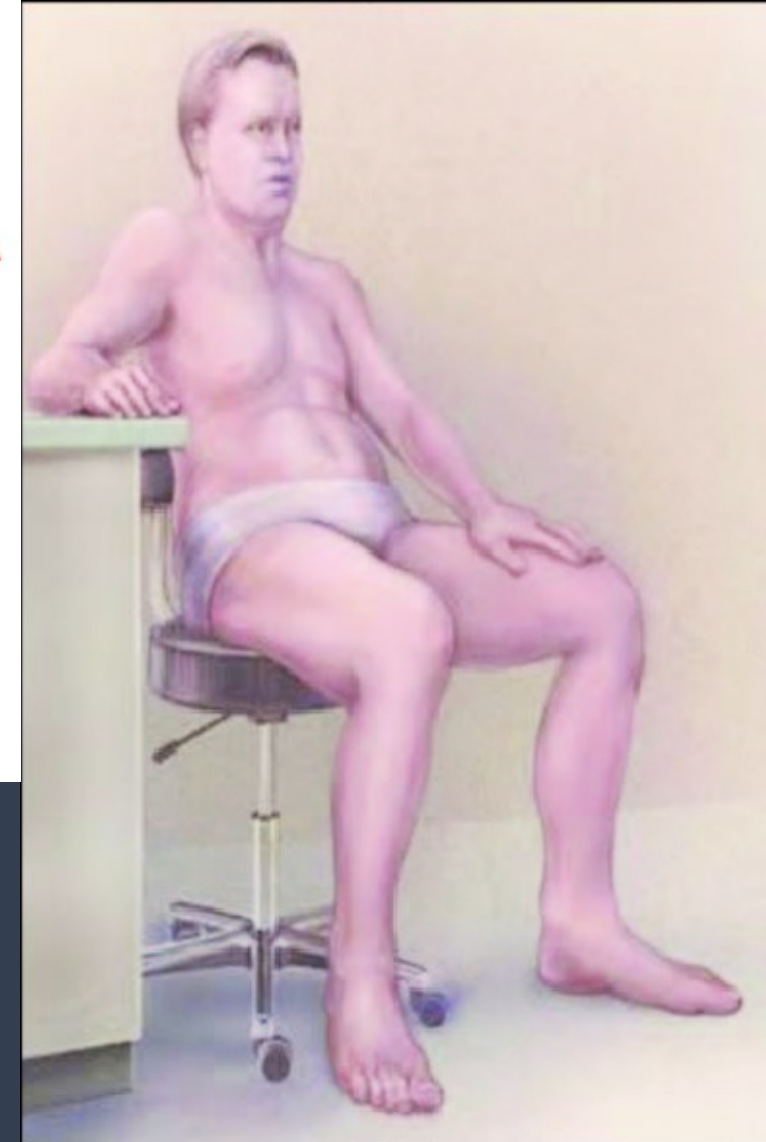
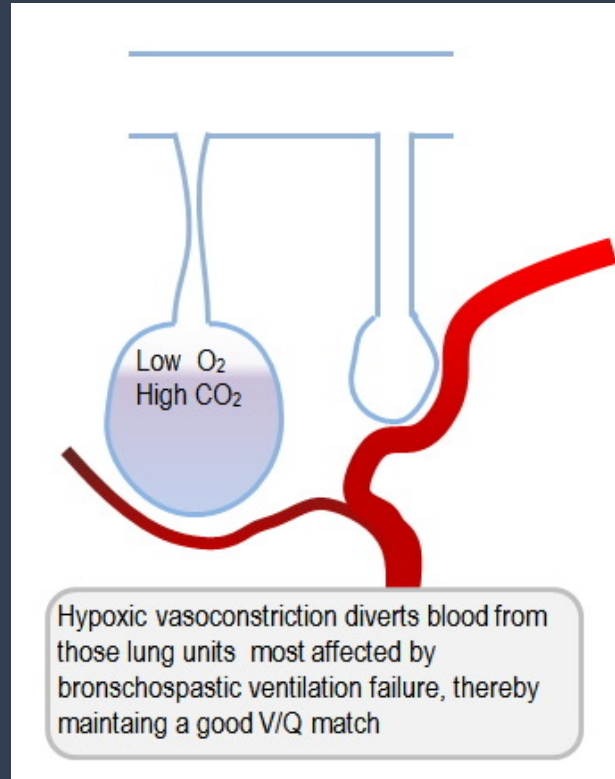
- Right-sided heart failure
 - Over-dilated RV from central congestion
- Any change in pre-load will drastically alter function
 - Overload – (Cardiogenic shock, Bradycardia, fluid retention etc.)
 - Underload – arrhythmias (A-fib etc.), vasodilatory shock (neurogenic, anaphylactic, sepsis etc.)
- What does this mean to you?
 - Very volume dependent and sensitive
 - Fluid shifts (dehydration or retention) can worsen heart function quickly
 - Prone to hypotension but SENSITIVE TO FLUID INFUSION

PAH – Presentation

- History
 - Weight gain/Peripheral edema
 - Dyspnea on exertion
 - Abdominal fullness, early satiety, RUQ pain
- Physical Exam
 - Systemic Congestion (LE Swelling, JVD, Ascites etc.)
- Shock Presentation
 - Cool, clammy extremities with poor cap refill
 - Reduced urine output
 - Delirium (agitation, anxiety common)

PAH – Chronic therapies you may run into

- Oxygen
 - Most have O₂ requirement
- Diuretics
 - Volume overload common problem
- Lung Transplant
 - i.e. immunosuppressant medications
- Pulmonary vasodilators
 - Sildenafil/Viagara
 - Systemic Prostacyclins



Systemic Prostacyclins

- Epoprostenol/Teprostinil
 - Can be administered IV or SubQ
 - Patients will often have their own pump/PCA
- Used in end-stage disease or as a bridge to transplant
 - i.e. these patients are very fragile and sick!
- Overall short half-life
 - Dysfunction of pump is an emergency!

What can we do in the field?

- Airway considerations
 - Avoid intubation!
 - Maintain SpO₂ >92%
- Breathing
 - Positive pressure ventilation (CPAP/BiPAP)
 - Keep pressures low, consult MCEP for advice
- Circulation
 - Avoid fluid boluses for target BP (norepinephrine better choice)
 - AVOID sublingual nitro administration for chest pain
 - Consider cardioversion for atrial fibrillation
 - Inotrope (lower dose epinephrine) for cardiac support
 - Epinephrine may be better first line for bradycardia with hypotension (contact MCEP)

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