DYSPNEA

1. Lung Causes:

Decreased lung area: PTX, pleural effusion, COPD, PNA, alveolar hemorrhage

Increased wall thickness: CHF, ARDS, interstitial pneumonia

***Alveolar Gas Equation: Oxygen to the alveoli..***

*PAO2=(760-47) Fio2 – PaCO2 (1.25)*

*The driving force for pushing air into the alveoli is barometric pressure. This is why it’s easier to breathe at sea level that at high altitudes. This is also why it’s harder to run when it’s humid, since you have to subtract out the partial pressure of water vapor (47). You’re getting less air into your lungs.*

*On room air (FiO2=21%) on a non humid day the first part of the equation is always 150.*

*Oxygen in the alveoli is sharing space with CO2, hence the second part of the equation.*

***Fick’s Law of Diffusion of a Gas Across a Membrane: Oxygen across the membrane to the blood..***

*Diffusion= (Pressure x Area) / Wall thickness*

*Therefore, 2 things that may decrease oxygen in the blood are decreased lung area or increased wall thickness.*

*Example:*

*ABG shows CO2=40, PaO2=60.*

*What is the amount of oxygen in the alveoli?*

*150-40 (1.25) = 100*

*What is the A-a gradient?*

*100-60=40*

*As a general rule, the A-a gradient should be < 1/3 of the patient’s age.*

*If the gradient is high, there’s enough oxygen in the alveoli but it’s not getting across; something is disrupting the diffusion of oxygen across the membrane.*

HYPOXEMIA:

1. **Check pCO2**
   1. pCO2 ELEVATED
      1. **Check Aa Gradient**
         1. NORMAL🡪Alveolar Hypoventilation
            1. narcotic overdose
            2. Neuromuscular disorder/ALS/MG
            3. OSA
            4. CVA
         2. ELEVATED🡪 VQ Mismatch
   2. pCO2 NORMAL/LOW
      1. **Does hypoxia correct with 100% O2**
         1. Yes🡪VQ Mismatch
            1. Alveolus🡪CHF, infection
            2. Bronchi🡪asthma, COPD
            3. Vasculature🡪PE, vasculitis
            4. Interstitium🡪ILD, Fibrosis
         2. No🡪Shunt
            1. ASD, PFO
            2. Massive PE
            3. ARDS

2. Cardiac Causes:

CHF, tamponade (limits preload) , MI, Arryhthmia (limits contractility)

***Cardiac Output***

*Cardiac Output = Stroke Volume x Heart Rate*

*What’s coming out times the number of strokes per minute (the heart rate)*

***Stroke Volume***

*Stroke Volume = Preload x Contractility*

3. Blood causes:

Anemia, bad blood (decrease oxygen saturation from carboxyhemoglobin)

***Delivery of Oxygen: Oxygen from blood to tissues..***

*DO2=Cardiac Output x (Hb x Sat %)*

*Delivery depends on how much the Hb is saturated and how quickly it can be delivered.*

4. Acid Base causes:

Respiratory alkalosis, metabolic acidosis

Therefore, the first 3 tests to order: CXR, EKG, ABG