VENTILATION AND PERFUSION OF THE LUNG
Section 3, Part A

PULMONARY CIRCULATION

I. Characteristics of Pulmonary Circulation
   A. Areas of shunting

   Areas of Shunting in Pulmonary Circulation

   B. Distensibility - pressure vs. volume curve
      1. veins are 6 x more distensible and hold 4 x more volume than arteries
         a. capacity/mmHg inc. is 24 x greater in veins than arteries
      2. increase volume of blood in arteries and decrease same amount in veins
      3. for each 1 mmHg dec. in venous pressure there is a 24 mmHg inc. in arterial pressure

   C. Pressures in pulmonary circulation and related areas
      1. right ventricle 22/0
      2. pulmonary a. 22/8, pulse pressure = 14 (systemic = 40)
      3. transmural pulmonary capillary pressure = 6 (systemic = 24)
      4. left atrium = 4-5 (right = 0)
      5. driving pressure = 9, between pulmonary artery and left atrium
      6. left ventricle 120/0, aorta 120/80

   D. Blood flow through lungs
      1. controlled by pumping of heart and venous return
      2. pulmonary arterioles are passive to pressure changes
3. stimulation of vagus - pulmonary R decreases stimulation of sympathetic nervous system - pulmonary R increases
4. low PAO2 causes reflex pulmonary vasoconstriction - R increases
   a. blood flow through the path of least resistance
   b. blood is shunted to higher ventilated areas of the lung
5. high intra-pulmonic pressure will reduce flow
   a. R. inc. because arterioles and capillaries are compressed or collapsed

E. General
1. total area of capillary membrane = 30 m²
2. diameter of pulmonary capillary - 5 to 8 µ
3. RBC remains in the capillary 0.5 to 1 second
4. approx. 9% of the total blood volume is in the lung
   a. approx. 240 ml/m² body surface area
   b. 60 ml/m² is in contact with pulmonary capillary membrane at any given instant
5. bronchial circulation to pulmonary veins is 1-2% (shunt)
6. changes in transmural pressure can raise or lower thoracic blood volume 25 to 50%

II. Function, Pressures, and Resistance
A. Functions
1. gas exchange - O2 and CO2
2. filtration -
3. reservoir of left ventricle
4. nutrition - bronchial vessels
5. fluid exchange -
B. Pressures
1. intravascular pressure – actual blood pressure in the lumen relative to barometric pressure, aka. intraluminal pressure and absolute pressure
2. driving pressure – difference between pressure at one end of tube and the other
3. transmural pressure – difference between intravascular pressure and pressure surrounding the vessel
C. Resistance
1. systemic R = 90 mmHg/5.4L/min
   = 16 mmHg/L/min
2. pulmonary R = 9 mmHg/5.4L/min
   = 1.66 mmHg/L/min
3. effect of gravity, apex to base = 30 cm
   a. 15 cm up from pulmonary trunk and 15 cm down
   b. perfusion is not equal throughout the lung (15 cm blood = 11 mmHg pressure)
   c. pressure in pulmonary artery is 22/9
      systole 22-11 = 11 mmHg
      diastole 9-11 = no flow
   d. increasing absolute pressure will increase flow only if there is an increase in driving pressure
   e. increasing absolute pressure favors fluid filtration out of the capillary