

CARDIOLOGY

Section I - Introduction to Cardiology

I. Basic Principles

A. Figures 2.1 and 2.2 provide a basic overview of the anatomy of the heart.

B. Coronary circulation

1. Blood from the coronary sinus drains into the right atrium → right ventricle → pulmonary arteries → pulmonary veins → left atrium → left ventricle → aortic root → coronary arteries → coronary sinus.

2. Coronary Vessels

a) The coronary arteries provide

oxygenated blood to the heart.

b) The left coronary artery (LCA) branches into the circumflex artery (LCX) and the left anterior descending artery (LAD).

c) The LCX supplies blood to the lateral and posterior walls of the left ventricle.

d) The PDA branches off of the LCX 10% of the time. These patients are considered to have a left-dominant circulation.

e) The LAD supplies blood to the anterior wall of the left ventricle and the anterior $\frac{2}{3}$ of the interventricular septum.

f) The right coronary artery (RCA)

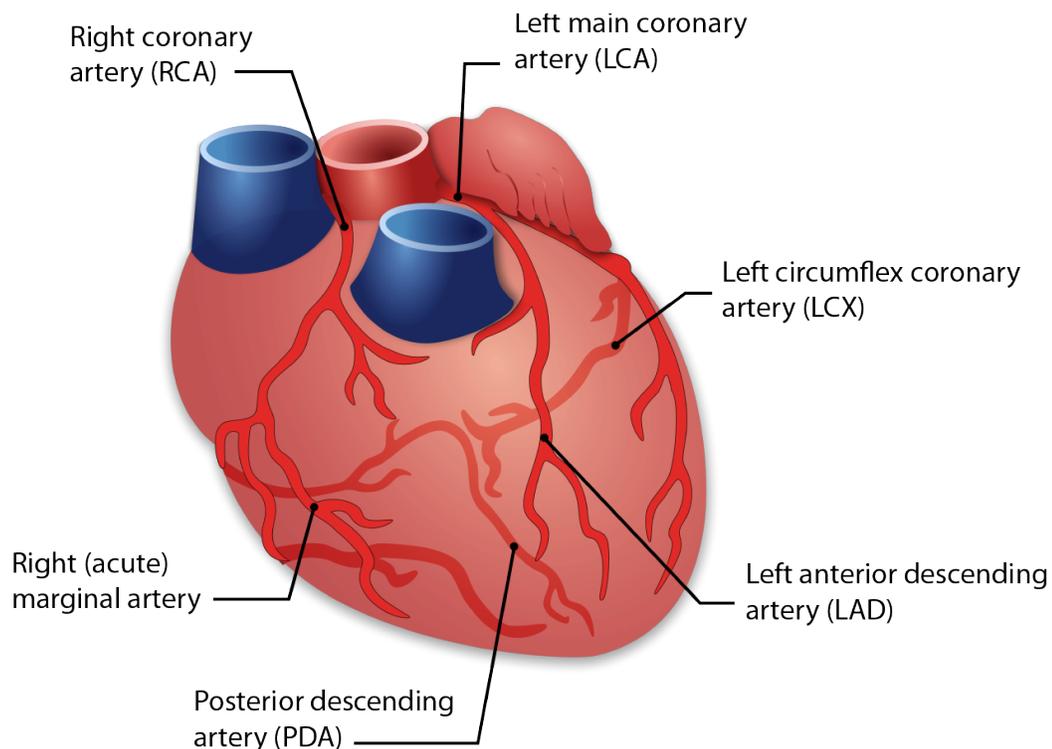
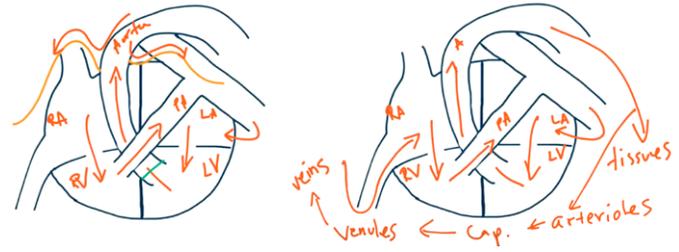


Figure 2.1 - Anterior view of the heart

branches into the right marginal artery and the posterior descending artery (PDA) 80% of the time.

- (1) The right marginal artery supplies the right ventricle.
- (2) Also supplies the papillary muscles of the right ventricle and the posterior wall of the heart.
- (3) The RCA gives rise to the PDA in patients with right-dominant circulation.

2. Oxygen exchange between the blood and tissues occurs at the capillaries.



C. Systemic and pulmonary circulation

1. Blood from the vena cava drains into the right atrium → right ventricle → pulmonary arteries → pulmonary veins → left atrium → left ventricle → aorta → systemic circulation (arteries, arterioles, capillaries, venules, veins) → vena cava.

Posterior surface view

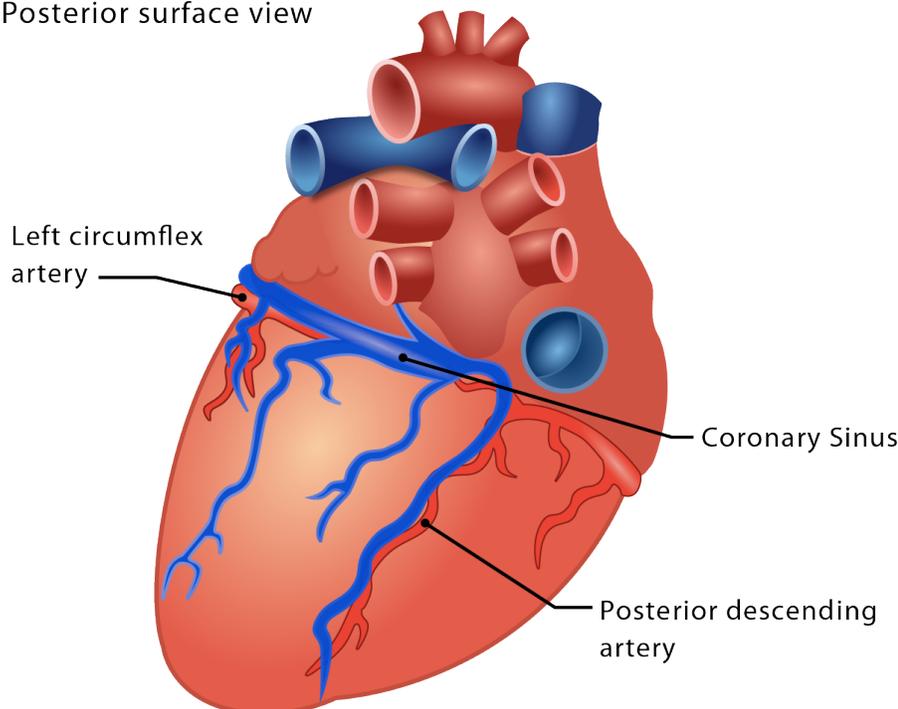


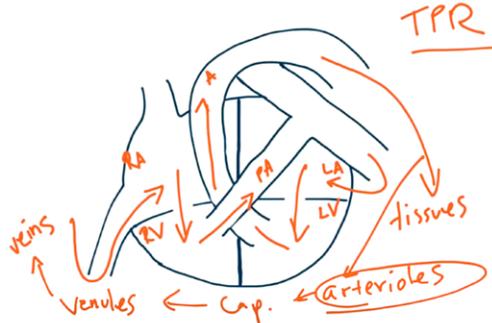
Figure 2.2 - Posterior view of the heart



REVIEW QUESTIONS

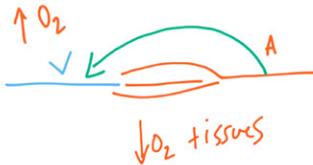
1. What part of the systemic circulation contributes the most to total peripheral resistance?

- The arterioles



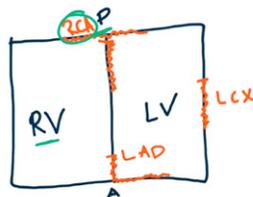
2. How would an arteriovenous (AV) shunt alter the oxygen content in the tissues?

- In an AV shunt, oxygen bypasses the capillaries and goes directly from the arteries to the veins
- Less oxygen enters the tissues \rightarrow \uparrow oxygen in the veins



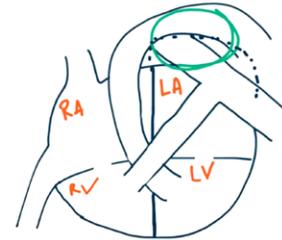
3. How would the right ventricle appear on an echocardiogram in a patient with stenosis of the right coronary artery?

- The RCA supplies blood to the posterior aspect of the heart
- Stenosis of the RCA would result in decreased activity of the posterior aspect of the right ventricle



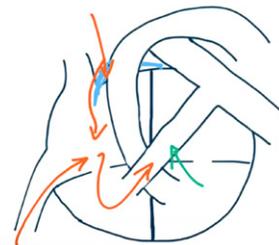
4. Dilation of what part of the heart can cause dysphagia?

- The esophagus is directly posterior to the left atrium
- Dilation of the left atrium can compress the esophagus \rightarrow dysphagia



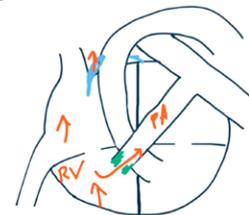
5. What vessel in the body contains the most deoxygenated blood?

- The heart is more metabolically active than the peripheral tissues
- It extracts more oxygen from RBCs than the peripheral tissues
- Therefore, the last part of the coronary circulation (the coronary sinus) contains the most deoxygenated blood



6. How would stenosis of the pulmonary artery alter the pressure in the right ventricle, right atrium, and coronary sinus?

- Stenosis of the pulm. artery \rightarrow \uparrow volume in the right ventricle and right atrium \rightarrow \uparrow pressure

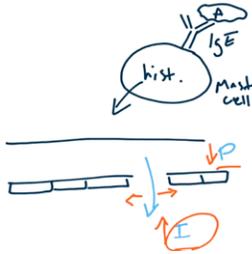


REVIEW QUESTIONS



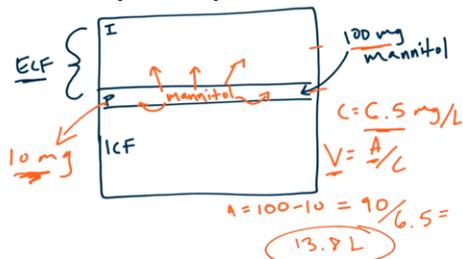
1. How would anaphylaxis alter the volume in the intracellular and extracellular compartments?

- Anaphylaxis is a severe allergic reaction → antigen binds to IgE which activates mast cell to release histamine
- Histamine dilates smooth muscle cells of arterioles → vasodilation. Also causes contraction of pericytes
- ↓ plasma volume, ↑ interstitial volume, unchanged extracellular fluid compartment volume



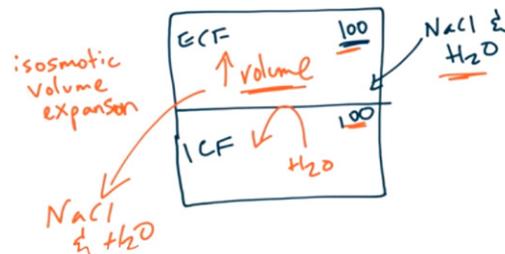
2. How would the redistribution of water be altered in the intracellular and extracellular fluid compartments in a patient who has been given an IV bolus of normal saline?

- ↑ volume of the extracellular fluid compartment, but osmolarity is unchanged → no redistribution of water (isosmotic volume expansion)



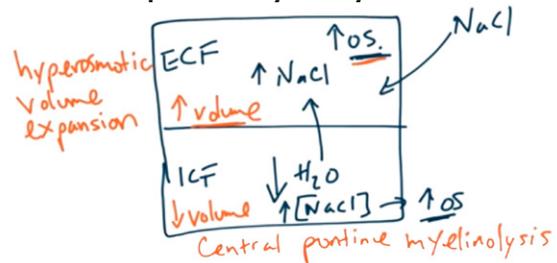
3. How would the redistribution of water be altered in the intracellular and extracellular fluid compartments in a patient who has been given an IV highly concentrated NaCl?

- ↑ NaCl in the ECF → ↑ ECF osmolarity → water moves from the ICF to the ECF until the osmolarity has equilibrated → net ↓ ICF volume and ↑ ECF volume (hyperosmotic volume expansion)



4. What neurological pathology is associated with hyperosmotic volume expansion?

- Central pontine myelinolysis



5. How would the redistribution of water be altered in the intracellular and extracellular fluid compartments in a patient who has been sweating during a long hike?

- In sweat, water loss is greater than NaCl loss → ↓ free water from ECF → ↑ ECF osmolarity → water moves from ICF to ECF → net ↓ ECF and ICF volume (hyperosmotic volume contraction)

