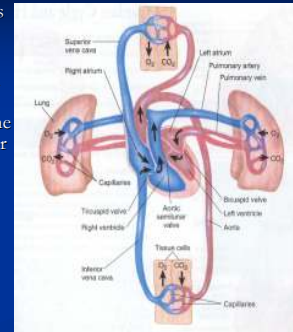


Cardiovascular (Circulatory) System (CVS)

Introduction

- The circulatory system consists of the heart, blood vessels, and lymphatics.
- It sends nutrients, oxygen, and hormones to all parts of the body and carries waste from the tissues to the kidneys and other excretory organs.
- In general, veins can be distinguished from the arteries of the same size by a thinner wall, hence in section, veins which are empty appear collapse, and their lumens are irregular.

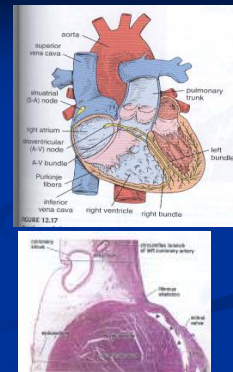


Basic Histological Consideration of the CVS

- Entire CVS is lined by **endothelium**.
- Blood circulates through the CVS and differentially distributed to various regions of the body depending on the body need.
- There are three main layers of CVS namely
 - tunica intima
 - tunica media, and
 - tunica adventitia
- In the heart, these layers are called
 - Endocardium,
 - myocardium, and
 - epicardium

Heart

- The heart is composed of three layers: the endocardium, the myocardium, and the epicardium.
- Endocardium is continuous with the intima of the blood vessels.
- The myocardium (muscular layer) corresponds to the media, and
- The epicardium to the adventitia except that its outer surface is covered with mesothelium.



1. Atria

- Endothelium is thicker in the atria, especially in the left atrium, than in the ventricles.
- Myocardium much thinner than in the ventricles.

2. Right Ventricle

- Compact part about two-thirds of entire thickness, looser part (columnar carbae) about two-thirds.

3. Left Ventricle

- Compact part two-thirds, loose part one-third of the entire thickness.
- Myocardium thickness in the left ventricle.

4. Papillary Muscle

- Small area of heart muscle surrounded by endothelial cells (endocardium).

5. Chorda Tendinea

- Composed of collagenous and elastic fibers surrounded by endocardium (endothelial cells).
- Any of the heart sections may show epicardium or endocardium.

4.Valves

- The valves of the heart are folds of endocardium.
- Atrioventricular valves consist of fibrous and elastic tissues.
- Artic and pulmonary valves are similar but have no muscle fibers.

Impulse Conducting System

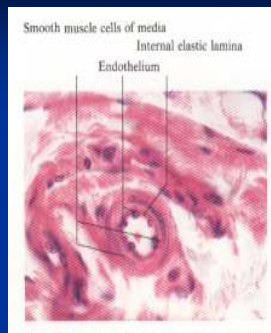
- Atrioventricular bundle of His consists of strands of fibers that are larger than cardiac muscle fibers. First described by Purkinje, hence often called Purkinje fibers. These cardiac muscle fibers are not rich in myofibrils, and in most preparation contain large empty spaces due to the unstained glycogen. These fibers are subendocardial.
- Sinoatrial and atrioventricular nodes consist of a network of fibers whose meshes are filled with connective tissue.

Capillaries

- Vary in diameter from 4.5 to 12.0 μm .
- Capillaries consist of endothelium, basement membrane, and pericytes.
- Some may contain fenestrations in the endothelium as capillaries of the kidneys and endocrine organs.
- They connect arterioles and venules.
- Walls are only one cell layer thick.
- They are separated from other tissues by a thin connective tissue layer.

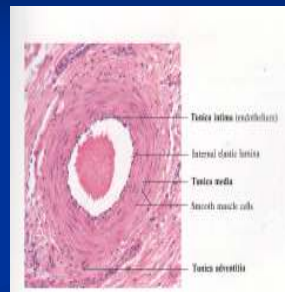
Arterioles

- Small arteries with a diameter less than 0.3 mm.
- Tunica intima consists of endothelium and the internal elastic membrane.
- Tunica media consists of smooth muscle fibers.
- Tunica adventitia (externa) is a layer of loose connective tissue with longitudinally orientated, thin, collagenous, and elastic fibers.
- They lack a definite external membrane



Muscular Arteries

- These are medium-sized arteries e.g. radial artery.
- Are responsible for the distribution of blood to all organs
- The contraction and relaxation of smooth muscle cells in the muscular arteries regulate blood pressure.
- Regulate perfusion of different parts of the body in different Physiological conditions.

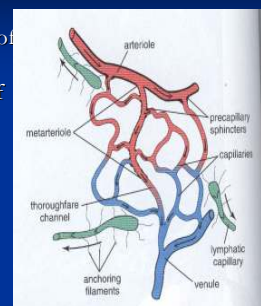


Elastic Arteries (Large-sized)

- e.g. aorta
- Tunica media consists mainly of elastic tissue.
- The role of these arteries is to smooth out the alternation in the blood pressure resulting from heart energetic energy from heart pumping the blood to the system.

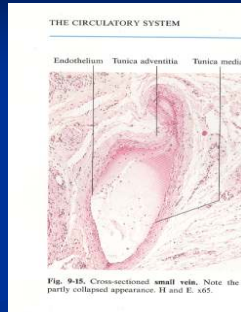
Arteriovenous Anastomoses

- In different parts of the body, many arterioles connect directly with venules instead of through capillaries, especially in limbs and exposed parts of the body. This is probably a function in temperature control.
- As an arterioles passes to a venule, the subendothelial elastic tissue disappears and the endothelium lies directly upon the musculature.



Veins and Venules

- The division between intima, media, and adventitia is less distinct and walls thinner than those in arteries.
- Less muscular and elastic and have a continuous endothelium basement membrane.
- Veins serve as blood reservoirs equipped with valves to prevent retrograde blood flow.
- Venules are very small, only slightly larger than capillaries and function in thermoregulation in the skin



Lymphatic Vessels

- Distinguished from veins of the same size with their thinner walls and more collapsed appearance and the absence of red blood cells in their lumen.
- Lymphocytes are frequently present.
- The tissue is loosely arranged as compared to that of a vein.
- Lymphatic capillaries may appear in endothelium-lined irregular spaces in the connective tissue.
- Valves occur in pairs placed in the opposite sides within the lymph vessel. They prevent the lymph from reversing in direction

Sinusoids

- In some organs such as the adrenal and bone marrow, instead of capillaries, sinusoids are interposed between the arterial and venous sides of the circulation.
- Sinusoids differ from capillaries in having larger lumen, no endothelial lining and accompanied by a dense membranous network of reticular fibrils and some phagocytic lining cells.
- In the adult mammalian body, sinusoids occur in the erectile tissue of male and female genitalia, in the parathyroids, spleen, liver, and other viscera.