General Anatomy of the Organs of the Circulatory System

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A B S T R A C T

The cardiovascular system functions as a pump, delivering blood to tissues and organs. Blood performs its various functions only when it is moving. The cardiovascular system includes the heart, blood vessels, and lymphatic vessels.

- The heart is the organ that drives blood to tissues and organs.
- Arteries are a group of blood vessels that dilate from the heart to other blood vessels. It is mainly oxygen-saturated blood flowing (excluding pulmonary arteries).
- Capillaries are small blood vessels that exchange oxygen, carbon dioxide, and nutrients between tissue and blood.
- Veins are a group of blood vessels formed by capillaries, which gradually become larger and larger, bringing blood to the heart.
- Lymphatic vessels - starting from the lymphatic capillaries, they are responsible for returning tissue fluid to the blood. Lymphatic capillaries join to form larger vessels, and large lymphatic vessels drain into the vein.

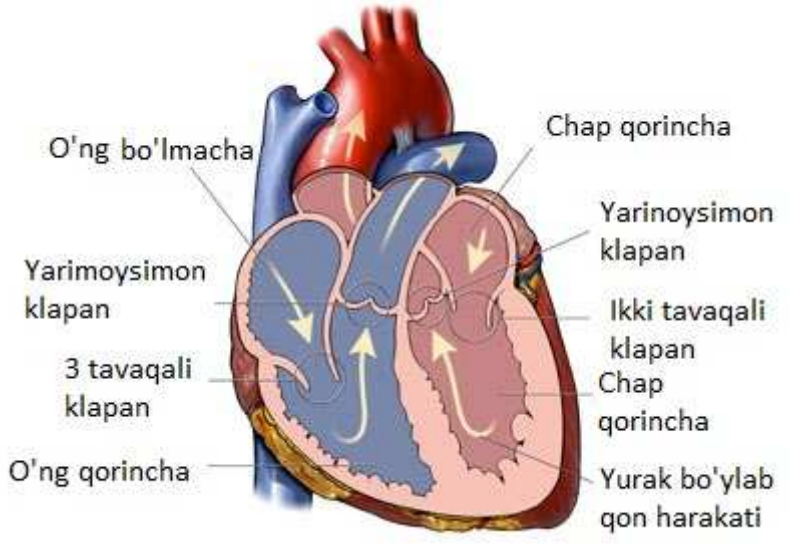
R T I C L E I N F O

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The heart (Latin: cor) is a muscular organ that carries out the rhythmic movement of blood in the small and large circulatory systems. It is located in the anterior thoracic cavity of the thorax. The larger part is on the left. On average, it is 300 g in men and 250 g in women. The heart has 4 chambers (right and left ventricles, right and left ventricles). There is a 3-valve between the left ventricle and the left ventricle, and a 2-valve between the right ventricle and the right ventricle. There are hemispherical valves between the left ventricle and the aorta, and between the right ventricle and the pulmonary arteries.



Heart chambers and valves

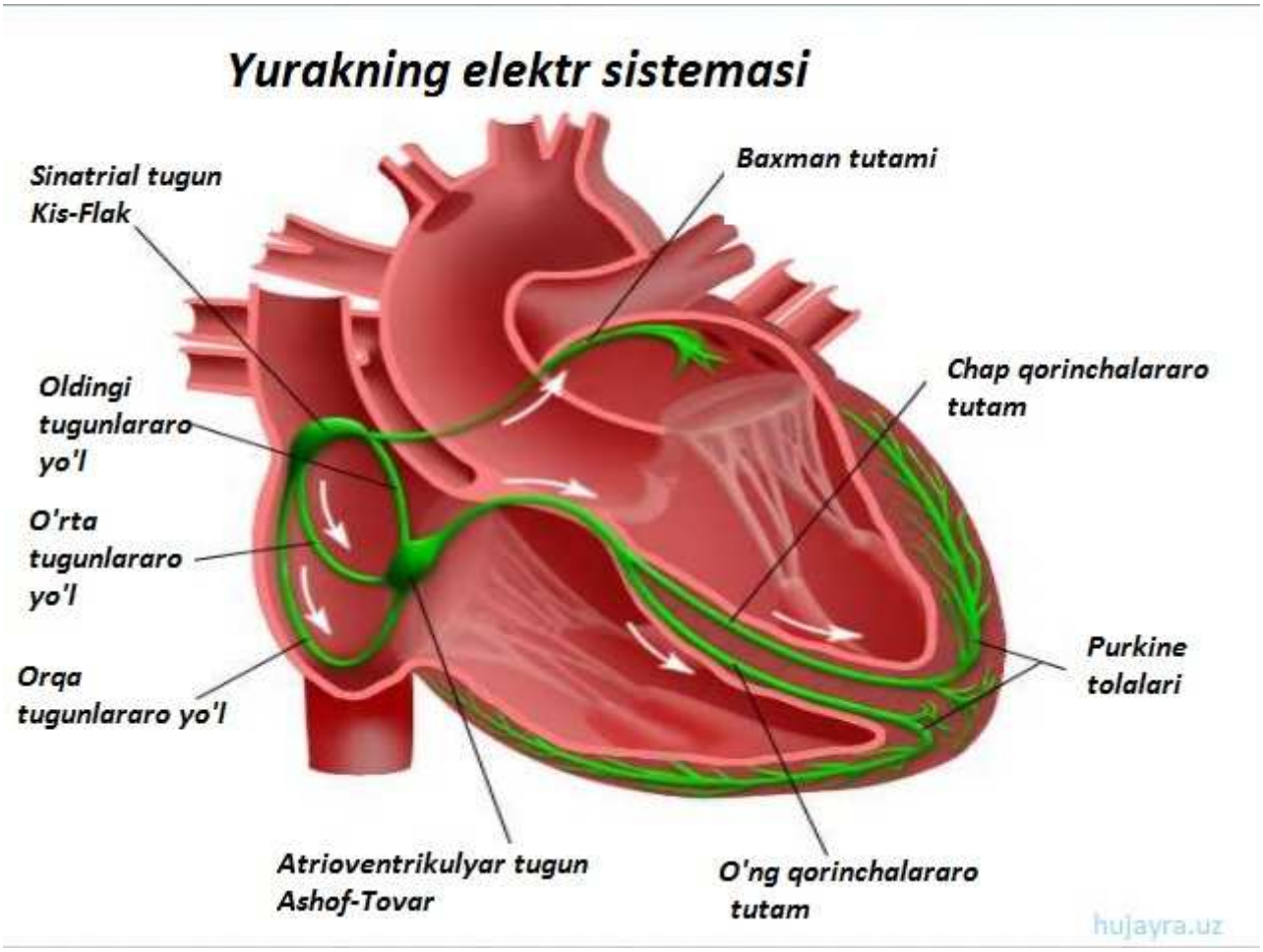
The structure of the wall. The heart wall consists of 3 layers: the inner - endocardium, middle - myocardium and outer - epicardium. The heart is also surrounded on the outside by the pericardium.

The endocardium is a relatively thin layer of the heart. It consists of the endothelium and the subendothelial layer, which is composed of connective tissue that acts as a base for it. Beneath these layers lies a muscle-elastic layer consisting of elastic fibers and smooth muscle fibers.

The thickest layer of the heart is the myocardium, made up of the heart muscle. Heart muscle cells are called cardiomyocytes. They are arranged in series to form the heart muscle fiber. In the myocardium, typical and atypical muscle fibers are distinguished. Typical muscle fibers contract, while atypical muscle fibers perform impulse conduction. Muscle fibers are connected to each other through intermediate plates. Intermediate plates perform trophic and pulse conduction functions.

The conduction system of the heart. The conduction system of the heart includes atypical muscle fibers. They generate impulses and transmit them to typical muscle fibers. The conduction system of the heart consists of the sinus node (Kis-Flak), the subventricularatrioventricular node (Ashof-Tovar) and the interventricular tuft (Gis tuft) and its fibers. The GIS tuft splits in half to form 1 pair of Purkinje fibers. You can better imagine this in the image below.

The epicardium is composed of connective tissue, the surface of which is covered with a layer of epithelium (mesothelium). Connective tissue contains fatty tissue, blood vessels, and nerve fibers.



The conduction system of the heart

Function: The heart muscle, like other muscles, has excitability, permeability, and contractility. However, the heart is also characterized by automation. Excitability is the occurrence of biochemical and biophysical changes in the tissue as a result of the impulse to the tissue (the emergence of action potentials). Conductivity is the distribution of the action potential generated in one cell to another. We have considered the conduction system of the heart above. The contraction manifests itself in the form of a response to the action potential generated in the heart muscle. The contraction of a member by impulses that occur without external influences is called automation.

We have often heard that the blood in the heart chambers is not used by the heart itself. However, the blood that passes into the aorta is the first to supply blood to the coronary arteries. The heart is supplied with blood through 1 pair of coronary arteries.

Blood vessels are made up of a system of tubes of large and small shapes that deliver blood to all organs and tissues and allow blood to flow only in the arteries. Blood vessels include arteries, arterioles, blood capillaries (hemocapillaries), venules, veins, and arteriolavenulus anastomoses.

The structure of the vessel wall. In addition to the capillaries, the wall of other blood vessels consists of the same layers. However, they also differ from each other in several different features. Vascular wall layers:

Internal - tunica intima;

Medium - tunica media;

Exterior - tunica externaseu adventitia.



Cross section of blood vessels

The internal structure of the vessel wall

The inner layer of the vessels consists of the endothelium, the subendothelial layer, and the elastic fibers. Endothelium is a special type of epithelial tissue that acts as a semiconductor between blood and tissue fluid. The endothelium lies in the basement membrane. The veins are located in a flat on the inner wall, the part with the core is bulging. The functions of thevascularendo theliumare different:

1. Produces antithrombotic factor by itself. It ensures that the blood does not clot inside the arteries.
2. Provides local vascular tone and blood flow.
3. They are involved in immune and inflammatory processes. They produce special substances called interleukins. Theyprovideactivationofleukocytesintheinflammatoryfocus.

The sub endothelial layer is composed of sparse fibrous unformed connective tissue that also contains a large number of stellate cells. In this layer, transversely oriented muscle cells can also be found.

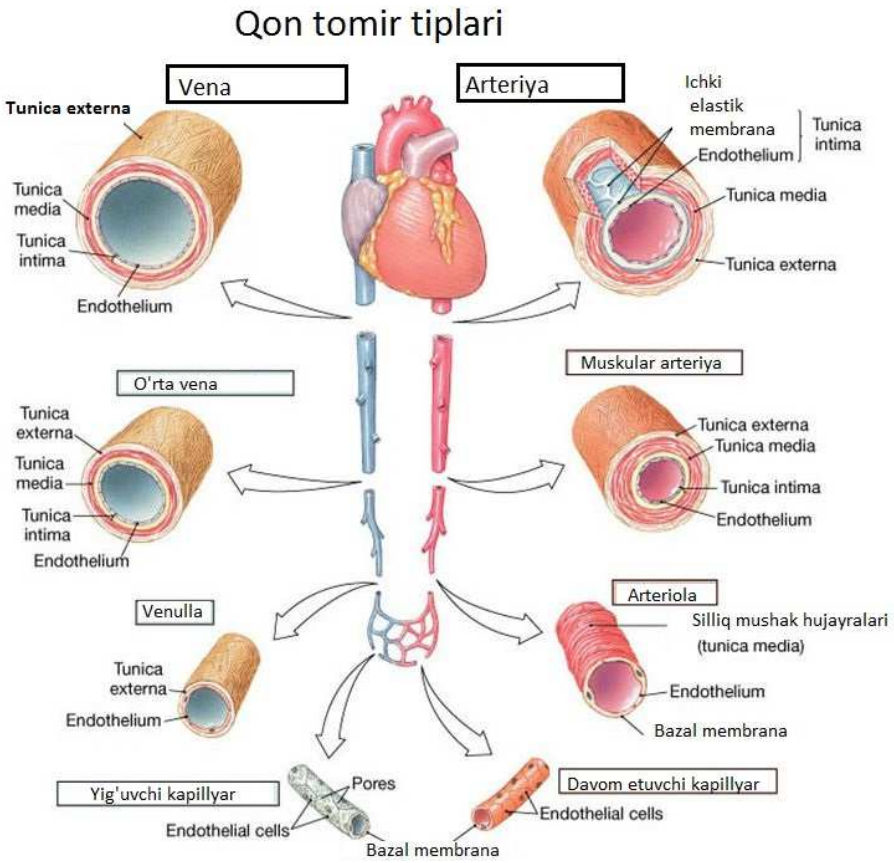
Deep below the endothelial subcutaneous layer is a layer of sparse elastic fibers, which are annular and arranged in a longitudinal order.

The middle layer of the vessels consists of ring-shaped muscle fibers and elastic and reticular fibers between them. The outer layer of blood vessels, the adventitious layer, is made up of unformed connective tissue, which contains large amounts of collagen and elastic fibers. The outer layer of the vessels merges with the connective tissue of the other organs. On the outer layer are the vascular bed (vasa vasorum) and the nerve (nerve vasorum). They provide nourishment and innervation of the vascular wall.

Arteries are divided into 3 groups according to the structure of the wall: elastic-type, muscle-elastic type and muscle-type arteries.

Comparative properties of blood vessels

Vasculartype	Diameters	Interiorcurtain	O'rtaparda	Outercurtain	Significance
Arteriesofelastictype	10 mm	Endothelium, subendothelium, elastic fiber layer	Windy elastic membranes, a small amount of muscle fiber	Rare fibrous unformed connective tissue, vascular bed and nerve	Due to its elastic properties, it can restore its shape after high blood pressure.
Muscle-typearteries	10-1 mm	Endoteliy, subendoteliy, elastikmembrana	From spiral oriented muscle fibers	Rare fibrous unformed connective tissue, vascular bed and nerve	A large number of muscle fibers supply the organs with full blood and carry the blood to the arterioles
Smallarteries	1-0.1 mm	Endothelium, connective tissue, muscle cells	3-10 layersofmusclecells	Unformed connective tissue, but no vascular bundles	Transfers blood to the arterioles
Arteriolalar	100-10 µm	Endothelium, connectivetissue	1-3 layersofmusclecells	Thinunformedconnectivetissue	Provides blood flow to the capillaries
Kapillyarlar	10-4 µm	Endotheliumonly	Faqatperitsitlar	I'q	Metabolismoccurs
venullas	10-100 µm	Endotheliumonly	Raremusclefibers	I'q	Capillaries are poured into them, separating the leukocytes from the connective tissue
Smallveins	0.1-1 mm	Endothelium, connective tissue, muscle fibers	2-3 layersofmusclefibers	Rarefibrousconnectivetissue	It receives blood from venules
Medium-sizedveins	1-10 mm	There are endothelium, connective tissue, muscle cells, valves	3-5 layersofmusclefibers	Longitudinallyorientedmusclecells	Collects blood from small veins
Largeveins	10 mm	There are endothelium, connective tissue, muscle cells, valves	5 layers of muscle cells, collagen fibers between them	Rare fibrous connective tissue, transversely oriented muscle cells	It pumps blood to the heart



There are several types depending on which member the capillaries are located. The first type is continuous capillaries, consisting of a continuously located endothelial and basal membrane. They are found in the skin, muscles and nervous system. The second is fenestrated capillaries, the wall of which consists of an endothelium and a continuous basal membrane holding small pores. Fenestrated capillaries are found in the intestinal villi, endocrine glands, and renal vesicles. The third is the sinusoidal capillaries, which hold the perforated endothelium and the annulus basal membrane. This type of capillary is found in the bone marrow, spleen, and some endocrine glands. A special type of sinusoidal capillaries is found in liver cells. They have no basal membrane tall.

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