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The Heart and its Functions

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Abstract
The cardiovascular system is a complex collection of blood vessels that carry substances between cells and blood and between blood and the environment. Its components are heart, blood vessels and blood. This article summarizes the necessary information about the physiology of the cardiovascular system. The heart is a person and satisfaction in the system central a ’ zo , due to its constant contraction (systole), it drives blood through the circulatory system and ensures its return through veins and movement in arterial blood vessels.

Key words: *Heart , systole , conduction (dromotropism) , excitability (bathmotropism) , contractility*

Embryology . In the 4th week of human embryonic development, the circulatory system and blood begin to develop into "blood islands" that appear in the mesodermal wall of the yolk sac. By this time, the embryo begins to be very large, the distribution of oxygen is carried out only by diffusion. The first blood, consisting of nucleated erythrocytes, such as reptiles, amphibians and fish, is obtained from cells called hemangioblasts located in "blood islands". At 6-8 weeks, milk is produced. Blood production, consisting of normal mammalian non-nucleated red blood cells, begins to shift to the liver. By the 6th month, erythrocytes colonize the bone marrow, and their production by the liver decreases and stops in the early neonatal period. Embryonic blood vessels are formed by three mechanisms:
coalescence (vasculogenesis).-migration of endothelial precursor cells (angioblasts) to organs.-development from existing vessels (angiogenesis). The heart arises from the mesoderm and begins to beat in the fourth week of pregnancy. During the development of the cervical and cephalic regions, the first three branchial arches of the embryo form the carotid artery system. Neuromuscular connections and innervation of smooth muscles In smooth muscles, nerve fibers do not end with motor end plates (as in skeletal muscles), that is, nerve fibers do not form a communication pathway with muscle fibers. . Instead, nerve fibers release their neurotransmitters

from each variceal into the interstitial fluid near the muscle fiber . The neurotransmitters released in this way spread to many muscles and cause the activation of all muscle fibers up to the place where they form the syncytium. The structure of smooth muscle fibers. 500 m m) For example: ● Digestive system fibers are 30-40 m m long and 5 m m in diameter; Vascular fibers are 15-20 mm long and 2-3 mm in diameter ; Uterine fibers are 300 mm long and 10 mm in diameter .

Heart physiology . The activity of the heart is based on the rhythmic contraction of the myocardium. The contraction of the heart is called systole, and its relaxation is called diastole. The heart contracts automatically. Impulses that ensure the contraction of the myocardium are generated in the conduction system of the heart. These impulses, which normally occur 60-80 times per minute in the vena cava (sinus) node, first spread to the myocardium, and then pass through the ventricular node and the bundle of Gis and the legs to the myocardium of the ventricles and cause them to contract. During the transition to the ventricles, the speed of the impulses decreases. Therefore, the contraction of the ventricles is completed earlier than that of the ventricles. The period of contraction and relaxation of the heart constitutes the cardiac cycle. This cycle consists of ventricular systole (0.1 sec), ventricular contraction (0.33-0.35 sec) and general (ventricle and ventricle relaxation phase) pause (0.4 sec). When the ventricles contract, the blood pressure in them (due to the mercury column in the right lobe, it increases from 1-2mm to 6-9mm, in the left lobe to 8-9mm). As a result, the blood goes out into the ventricle through the orifice of the ventricle.

When the ventricles contract, only 30% of the blood leaves the ventricles, and 70% flows freely during the general pause . Ventricular systole is also divided into phases. When the pressure in the ventricles increases, the ventricular valves close , but the semilunar valves do not open. In this (isometric contraction phase), all the muscle fibers of the ventricles contract and their tension increases. As a result, when the pressure in the ventricles exceeds the pressure in the aorta and pulmonary trunk, the semicircular valves open; blood rushes out of the ventricles into the veins; This is how the blood pumping phase begins. Excitability and contractility processes: Heart muscle is an excitable tissue that generates an action potential (electromechanical process) and responds to it by contraction. Electric potential in the heart muscle Resting potential of the membrane. In a normal heart muscle, the resting potential of the membrane is from -85 to -95 mV. Action potential. When stimulated, each muscle fiber generates an action potential by showing electrical activity.

Action potentials recorded from a single muscle fiber are unusually long and can be divided into 5 distinct phases: phase 0. Rapid depolarization Phase 1. Initial rapid repolarization Phase 2. Plateau Phase 3. Repolarization Phase 4. Resting potential 1. Spike potential . A typical potential is observed in most cells, as in skeletal muscle, but different in visceral muscle 2. Impulse potential added to low wave potential. In spontaneous smooth muscle, slow waves can initiate action potentials. When the slow wave potential rises to -35 mV (the approximate threshold for action potential detection in most visceral smooth muscles), an action potential is generated and propagates throughout the muscle mass. Such pulsed potentials vary rhythmically in the form of one or two impulses at the peak of the low wave and cause contraction of the spontaneously contracting muscle. 3. Action potential with a plateau. It occurs in some types of vascular smooth muscle, such as the urinary tract and uterus. As shown in Figure 2.4-6, such an action potential begins with a rapid depolarization similar to that observed in skeletal muscle, but repolarization is delayed by 100 to 1000 ms.

Duration of the action potential. When the heart beats 75 times per minute, the action potential lasts an average of 250 ms. The process of excitation-contraction in the heart muscle. The plasma membrane of muscle fibers creates a sequence of excitation and contraction by increasing the concentration of sarcoplasmic calcium. The sequence of processes that occur during the contraction of the heart muscle skeletal It is similar to that of muscle with the following exceptions: In cardiac muscle (unlike skeletal muscle), additional calcium ions diffuse through T channels

without reducing the force of contraction, but in skeletal muscle, the change in calcium concentration strongly affects the force of contraction. The molecular mechanism of cardiac muscle contraction is similar to that of skeletal and smooth muscle, but differs in the following features: The troponin-tropomyosin complex controls the initiation and termination of muscle contraction. relaxation (diastole) occurs when the concentration of Ca+2 ions in muscle fibers decreases. The amount of Ca+2 ions in the muscle fibers decreases during diastole due to the influx of two Na+ ions instead of each Ca+2 released by the transporter system controlling the sarcolemma. The main properties of the heart muscle include: Automaticity Rhythmicity (chronotropism) Conductivity (Dromotropism) Excitability (bathmotropism) Contractility (inotropism) Excitability In the excitability of the heart muscle, we should pay special attention to its refractoriness. Refractory period. The refractory period occurs after the action potential when the heart muscle fails to respond to the stimulus . The refractoriness period in the heart muscle is long (250-300 ms in the ventricles and 150 ms in the ventricles). It is divided into 2 types 1. Absolute refractoriness (ARP) 2. Relative refractoriness (RRP) In a person, the pumping of blood into the vascular system occurs when the left side of the heart reaches 65-75 mm of mercury, and the right side reaches 5-12 mm. Within 0.10-0.12 seconds, the pressure of heart ventricles increases sharply [110-130 mm Hg in the left ventricle, 25-35 mm Hg in the right ventricle (phase of rapid blood pumping)]. The contraction of the ventricles (0.10-0.15 sec) is completed by the phase of slow blood pumping. Then the ventricles begin to relax , their pressure decreases rapidly, the pressure of the large vessels increases, and the semilunar valves close. When the pressure in the ventricles drops to 0 degrees, the reciprocating valves open and blood begins to flow from the ventricles to the ventricles. This phase is divided into fast (0.08 sec) and slow (0.07 sec) filling phase. Diastole of the ventricles ends with the stage of filling them with blood . The duration of the phases of the cardiac activity cycle is variable, depending on the frequency of the heart rhythm. Therefore, checking the phases of the heart cycle is an important way to determine the state of the heart muscle. The amount of blood pumped out of the heart every minute is called the cardiac output (MH), which is equal to the amount of blood pumped out of both ventricles. In a person at rest, the minute volume of the heart is on average 4.5-5 l, the amount of blood pumped in one contraction of the heart - the systolic volume is on average 65-70 ml. Electrocardiogram (electro., cardio... and gram) (ECG) - heart A recording of the electrical impulses generated when a muscle is working. The electrocardiogram is recorded on paper or photographic film using an electrocardiograph . Heart currents spreading throughout the body (motor currents) ECG are recorded by electrodes placed on different parts of the body (chest, arms and legs) and connected to an electrocardiograph. Advances in modern medical technology allow the patient to record an ECG even at a long distance using television or radio transmitters . Such methods provide an opportunity to monitor the heart activity of athletes, astronauts, etc. during severe physical tests. ECG means to record possible fluctuations in the heart cycle. A series of positive and negative waves (teeth) designated as P, Q, R, S, and T are recorded in each cardiac cycle as a result of successive propagation of the impulse in the atria, interventricular septum and ventricular walls, and finally repolarization of the myocardium. A depolarization moving towards the active electrode in the transducer produces a positive tooth, while a depolarization moving in the opposite direction produces a negative tooth. Therefore, the shape and polarity of the P, Q, R, S, and T waves differ in different directions due to differences in the orientation of each network relative to the heart.It is derived from the bipolar network. It is the one you often see and is studied as a reference, hence the different EKG than the one you see (standard II). don't take it as a pathology. ECG of healthy people depends on the structure of the body, age, etc. But in a normal ECG, there is always a sequence of the heart muscle you can distinguish the notches and intervals that reflect the movement . In various diseases, the size, interval and direction of ECG teeth, the duration and location of intervals (segments) change a lot. With the help of ECG, various changes in heart

rhythm, ischemic heart disease, character and stages of myocardial infarction are determined. ECG is more effective than other methods in the diagnosis of heart diseases. When recording the electrocardiogram in the chest connection, the action current is taken directly in the heart area. One of the electrodes is attached to the right arm and is not removed until all chest connections are recorded. The second chest electrode is placed on the following points of the chest. On the right edge of the chest to the fourth intercostal space - the first chest connection (CR1 or V1), on the left edge of the chest on the fifth intercostal space - the second chest connection (CR2 or V2); then the chest electrode is always withdrawn along certain familiar lines in the fifth intercostal space, so that the electrode located on the left thoracic line is the third connection (CR3 or V3), left middle the fourth connection along the spine (CR4 or V4), the fifth connection along the anterior axillary line (CR5 or V5) and the sixth along the middle axillary line connection (CR6 or V6). The curve of the currents of the heart recorded with an electrocardiograph is called an electrocardiogram. A normal electrocardiogram has three up-going (B1R and T) and two down-going (Q and S) waves. The letter P reflects the electrical events that occur in the heart. QRS and T waves make up the ventricular complex. The strength and frequency of the contraction of the heart changes according to the need for oxygen and nutrients of the tissues and organs of the body. Even though the impulses that make the heart contract are generated in itself, the nervous system controls its activity. Stray nerves weaken the force of contraction of the heart and slow down its rhythm , sympathetic nerves, on the contrary, strengthen it. The heart muscles also have self-control: for example, the more blood that enters the heart, the more forcefully it contracts. How hard the heart muscle contracts is its stretch, that is, the muscle

the initial (before shortening) length of fibers. The faster a muscle fiber is stretched, the stronger it contracts. This is called the law of the heart. Circulatory response to bleeding Bleeding can be external or internal. When they grow up , they need immediate medical attention. A significant decrease in blood volume leads to a decrease in blood pressure, which is the force that moves blood in the circulatory system and provides the oxygen necessary for the survival of tissues. reduces the speed. The brainstem cardiovascular center, located at the base of the brain, detects a decrease in the activity of basoreceptors, which activates a number of homeostatic mechanisms that strive to restore normal blood pressure. increases the force of contraction, increases the volume of blood pumped in each pulse; 2) increases the number of beats per unit of time. Both processes increase blood pressure. At the same time, the medullary cardiovascular center stimulates the contraction (vasoconstriction) of some blood vessels, forcing some of their blood to flow to the rest of the circulatory system, including the heart. , increases blood pressure. Treatment of cardiovascular diseases Diseases of the cardiovascular system - diseases of the heart, arteries and veins. They are many and varied. Some of these diseases (rheumatism, myocarditis, etc.) damage the heart, some arteries (atherosclerosis) or veins (for example, thrombophlebitis), others damage the entire cardiovascular system (hypertension). Cardiovascular diseases worldwide to this day, it remains the leading cause of disability and death. According to the World Health Organization, 56% of all deaths are caused by diseases of the cardiovascular system. In European countries, cardiovascular diseases cause the death of 4.3 million (48%) people per year. According to the State Statistics Committee, 62 of the citizens who died in the Republic of Uzbekistan in January-June 2019, 1 percent of cases are caused by diseases of the circulatory system. Heart diseases and modern methods of treatment: Cardiomyopathy is a disease associated with primary damage to the myocardium - cardiovascular diseases, arterial hypertension, acquired congenital heart defects, etc. without it, there are structural and functional negative changes in the heart muscles. The real reasons for the occurrence and development of cardiomyopathy have not yet been determined. There are a number of factors that trigger the occurrence of this disease: heredity, adverse effects of the external environment, viral infections, autoimmune diseases, endocrinological diseases, exposure to allergens, alcoholism, heart pathologies, etc. In the initial stage, cardiomyopathy is

usually asymptomatic. will pass. The patient may have the following complaints: pain in the heart area , severe fatigue, general weakness, severe heaviness in the right rib cage, shortness of breath, shortness of breath and other similar symptoms. What is the treatment of cardiomyopathy? It depends on the type: hypertrophic cardiomyopathy is a thickening of the heart muscles and, as a result, a violation of the heart's blood pumping function. Medicines are prescribed by doctors, but septal myectomy surgery is recommended in cases of danger. As a result of the operation, the thickened heart muscles are reduced and normal blood circulation is restored. their elasticity decreases. As a result, the heart does not expand and the heart does not fill with enough blood during the interval between heartbeats. An electronic pacemaker that generates impulses for a slow beating heart, a defibrillator for a dangerously irregular beating heart, an auxiliary ventricular implant for a heart with impaired blood pumping can help the patient in various situations. especially in a situation where medicines cannot help, the patient can be advised as a solution to improve his condition - the doctor emphasized. A defect in the wall between the heart valves is a stable defect in the anatomical structure of the heart, deficiency and changes in normal blood interferes with the flow. It is one of the most common congenital heart defects in children older than 3 years . In this condition, there is a hole(s) in the interdispheric septum (wall) that separates the right and left atria in the heart. The presence of this hole causes pathological blood flow from the left atrium to the right and can cause heart and lung problems in the future. The modern method is the endovascular method. In this case, a long tubular catheter is inserted into the heart through the femoral vein and the defect is closed using a special coating.

If the size of the defect is large , minimally invasive surgery may be recommended. In this case, the operation can be performed through a 4-6 cm incision in the right part of the patient's chest. Aortocoronary shunting - This method is used to restore blood flow in blocked or narrowed coronary arteries. The essence of the method is that the surgeon creates a "shunt" (spare blood vessel) bypassing the blocked coronary arteries to restore blood flow.

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