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Structure And Main Function Of The Cardiovascular System

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Annotation. This article is dedicated to highlighting the cardiovascular system and its main function. In addition, the article covers the internal system of the heart and its features.

Keywords: the blood vessels, circulatory system, Carbon dioxide, myocardial infarction, the endocardium, epicardium, fluid, interventricular septum.

The cardiovascular (CV) system, also called the circulatory system, maintains the distribution of blood throughout the body and is composed of the heart and the blood vessels—arteries, capillaries, and veins. The circulatory system is composed of two parts: the pulmonary circulation and the systemic circulation. The pulmonary circulation, between the heart and lungs, transports deoxygenated blood to the lungs to get oxygen, and then back to the heart. The systemic circulation carries oxygenated blood away from the heart to the tissues and cells, and then back to the heart. In this way, all the body's cells receive blood and oxygen. In addition to distributing oxygen and other nutrients, such as glucose and amino acids, the cardiovascular system also collects the waste products from the body's cells. Carbon dioxide and other waste products produced by metabolic reaction are transported by the cardiovascular system to the lungs, liver, and kidneys, where they are eliminated from the body. The heart, a muscular pump made up of cardiac muscle fibers, could be considered a muscle rather than an organ. It has four chambers, or cavities, and beats an average of 60–100 beats per minute (bpm) or about 100,000 times in one day[1]. Each time the cardiac muscle contracts, blood is ejected from the heart and pushed throughout the body within the blood vessels.

The heart is located in the mediastinum in the center of the chest cavity; however, it is not exactly centered; more of the heart is on the left side of the mediastinum than the right. At about the size of a fist and shaped like an upside-down pear, the heart lies directly behind the sternum. The tip of the heart at the lower edge is called the apex. The layers of the heart become important when studying the disease conditions affecting the heart. For instance, when the prefix endo- is added to carditis, forming endocarditis, we know that the inflammation is within the "inner layer of the heart." In discussing the muscular action of the heart, the combining form my/o, meaning muscle, is added to cardium to form the word myocardium. The diagnosis myocardial infarction (MI), or heart attack, means that the patient has an infarct or "dead tissue in the muscle of the heart[2]." The prefix peri-, meaning around, when added to the word cardium refers to the sac surrounding the heart. Therefore, pericarditis is an "inflammation of the outer sac of the heart." The wall of the heart is quite thick and is composed of three layers:

1. The endocardium is the inner layer of the heart lining the heart chambers. It is a very smooth, thin layer that serves to reduce friction as the blood passes through the heart chambers.

2. The myocardium is the thick, muscular middle layer of the heart. Contraction of this muscle layer develops the pressure required to pump blood through the blood vessels.

3. The epicardium is the outer layer of the heart. The heart is enclosed within a double-layered pleural sac, called the pericardium. The epicardium is the visceral pericardium, or inner layer of the sac. The outer layer of the sac is the parietal pericardium. Fluid between the two layers of the sac reduces friction as the heart beats.

The heart is divided into four chambers or cavities (see again Figure 5-3). There are two atria, or upper chambers, and two ventricles, or lower chambers. These chambers are divided into right and left sides by walls called the interatrial septum and the interventricular septum. The atria are the receiving chambers of the heart. Blood returning to the heart via veins first collects in the atria. The ventricles are the pumping chambers. They have a much thicker myocardium and their contraction ejects blood out of the heart and into the great arteries. our valves act as restraining gates to control the direction of blood flow[3]. They are situated at the entrances and exits to the ventricles. Properly functioning valves allow blood to flow only in a forward direction by blocking it from returning to the previous chamber. The four valves are:

1. Tricuspid valve: an atrioventricular valve (AV), meaning that it controls the opening between the right atrium and the right ventricle. Once the blood enters the right ventricle, it cannot go back up into the atrium again. The prefix tri-, meaning three, indicates that this valve has three leaflets or cusps.

2. Pulmonary valve: a semilunar valve, with the prefix semi- meaning half and the term lunar meaning moon, indicate that this valve looks like a half moon. Located between the right ventricle and the pulmonary artery, this valve prevents blood that has been ejected into the pulmonary artery from returning to the right ventricle as it relaxes.

3. Mitral valve: also called the bicuspid valve, indicating that it has two cusps. Blood flows through this atrioventricular valve to the left ventricle and cannot go back up into the left atrium.

4. Aortic valve: a semilunar valve located between the left ventricle and the aorta. Blood leaves the left ventricle through this valve and cannot return to the left ventricle.

The heart rate is regulated by the autonomic nervous system; therefore, there is no voluntary control over the beating of the heart. Special tissue within the heart is responsible for conducting an electrical impulse stimulating the different chambers to contract in the correct order. The path that the impulses travel is as follows:

1. The sinoatrial (SA, S-A) node, or pacemaker, is where the electrical impulses begin. From the sinoatrial node, a wave of electricity travels through the atria, causing them to contract, or go into systole.

2. The atrioventricular node is stimulated.

3. This node transfers the stimulation wave to the atrioventricular bundle (formerly called bundle of His).

4. The electrical signal next travels down the bundle branches within the interventricular septum.

5. The Purkinje fibers out in the ventricular myocardium are stimulated, resulting in ventricular systole[4].

In conclusion it should be noted that While humans, as well as other vertebrates, have a closed blood circulatory system (meaning that the blood never leaves the network of arteries, veins and capillaries), some invertebrate groups have an open circulatory system containing a heart but limited blood vessels. The most primitive, diploblastic animal phyla lack circulatory systems. An additional transport system, the lymphatic system, which is only found in animals with a closed blood circulation, is an open system providing an accessory route for excess interstitial fluid to be returned to the blood. The blood vascular system first appeared probably in an ancestor of the triploblasts over 600 million years ago, overcoming the time-distance constraints of diffusion, while endothelium evolved in an ancestral vertebrate some 540–510 million years ago.

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