HEART AND CIRCULATION

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Abstract

The cardiovascular system, comprising the heart and blood vessels, serves as the primary transport network of the human body. It ensures continuous delivery of oxygen, nutrients, hormones, and immune components to tissues while removing carbon dioxide and metabolic waste. This review article provides a comprehensive overview of cardiac anatomy (chambers, valves, layers), the two major circulatory loops (pulmonary and systemic), the cardiac cycle, conduction system, and coronary circulation. Key physiological mechanisms and clinical correlations are emphasized. The content is designed to support medical students mastering English medical terminology while deepening their understanding of cardiovascular structure and function.

Keywords: heart, cardiovascular system, cardiac anatomy, blood circulation, pulmonary circulation, systemic circulation, cardiac cycle, conduction system, myocardium, coronary arteries, heart valves.

Introduction

The cardiovascular system is essential for maintaining homeostasis. The heart functions as a muscular pump that propels approximately 5–6 liters of blood per minute at rest, performing over 100,000 beats daily and potentially 2.5–3 billion beats over a lifetime. Any disruption in this system can lead to life-threatening conditions such as myocardial infarction, heart failure, hypertension, and arrhythmias.

This article aims to present the anatomy and physiology of the heart and circulation in clear, professional English, facilitating better comprehension of international medical literature and clinical discussions.

Anatomy of the Heart

Location and General Structure The heart is located in the mediastinum of the thoracic cavity, slightly deviated to the left. It has a conical shape, with dimensions of approximately 12 cm in length, 8–9 cm in width, and a weight of 250–350 grams in adults. The apex (apex cordis) is directed downward and leftward, palpable at the 5th left intercostal space in the midclavicular line (point of maximal impulse – PMI).

To understand heart disease and its effects on your body, it may help to learn more about your heart. This booklet explains the structure of the heart and blood vessels and how they work.

Words in bold are explained in a word list at the end of the resource.

Objectives: This information may help you:

Identify the size and location of your heart.

Identify the three layers of the heart.

Identify the four chambers of your heart.

Explain the purpose of the valves.

Describe the three main kinds of blood vessels.

Explain the role of coronary (heart) arteries in the functioning of your heart.

Discuss the difference between the systolic and diastolic blood pressure.

Trace the basic route of your heart's electrical conduction system on the diagram provided.

LOCATION AND SIZE OF THE HEART

Your heart is located under your rib cage beneath and to the left of your breastbone (sternum) (figure 1). About the size of your fist, the heart is a hollow, muscular organ that weighs less than a pound.

Hardworking and powerful, the heart pumps blood to all parts of the body — to every cell, muscle, bone, and organ.

LAYERS OF THE HEART

The heart lies inside a protective sac of fibrous tissue called the pericardium (figure 2). The heart itself has three layers of tissue: the epicardium, the myocardium, and the endocardium.

The epicardium is a thin, shiny membrane covering the surface of the heart. Under the epicardium is a thick layer of muscle called the myocardium. The inside of the heart is covered with another smooth, shiny membrane called the endocardium. It covers the inside of the chambers of the heart, the heart valves, and the muscles attached to the valves (figure 3).

THE CHAMBERS OF THE HEART

The heart is divided into four chambers (figure 4). The top two chambers are called the right and left atria (plural for atrium). The two lower chambers, the ventricles, are larger, thick-walled chambers that pump the blood to all parts of the body.

The septum is a muscular wall that divides the right atrium from the left atrium and the right ventricle from the left ventricle. The septum prevents blood from passing from one side of the heart to the other. The right atrium and right ventricle together are referred to as the "right heart." The left atrium and left ventricle together are called the "left heart."

VALVES OF THE HEART

Four valves keep blood flowing in the proper direction through the heart, to the lungs, and to the body. The valves are flexible flaps of tissue surrounded by semirigid rings (figure 4).

On the right side of the heart, the tricuspid valve allows blood to flow from the right atrium down into the right ventricle and prevents blood from flowing in the opposite direction.

From the right ventricle, the blood is pumped through the pulmonary valve to the lungs, where it picks up oxygen and gets rid of carbon dioxide and other waste products.

From the lungs, the oxygen-rich blood flows through the pulmonary veins to the left atrium. From the left atrium the blood flows through the mitral valve into the left ventricle

From the left ventricle, the blood is pumped through the aortic valve to all parts of the

body.

THE DOUBLE PUMP

The heart can be thought of as a double pump. One pump, the right heart, receives blood from all parts of the body through two large veins called the superior and inferior vena cava. Blood headed for the right heart has just delivered oxygen and nutrients to the body. Because it has less oxygen, this blood is called deoxygenated (oxygen-poor) blood (shown in blue). The right heart pumps this blood to the lungs where it picks up additional oxygen.

Freshly oxygenated blood (shown in red) passes to the left heart. From the left heart, blood is pumped to the body through the aorta, the largest blood vessel in the body. The aorta divides into several branches to supply blood to various parts of the body.

The heart, then, is a double pump. It receives blood from the veins, pumps it to the lungs, receives it from the lungs, and pumps it into the body through arteries. This cycle is repeated thousands of times each day (figure 5).

No matter how strong the contraction, your heart does not pump all the blood out of both ventricles with each beat. The portion of blood that is pumped out of a filled ventricle is called the “ejection fraction.”

A normal ejection fraction is 50 to 65 percent or more. So at least half the blood in the ventricle is pumped out on each beat. The ejection fraction is a good

measure of the overall function of your heart. In a healthy person, the ejection fraction of the heart might increase by about 5 to 10 percent with exercise. It can diminish to 20 to 30 percent or lower if the ventricles are not functioning normally.

BLOOD VESSELS

Several types of blood vessels carry blood to all parts of your body. Arteries carry fresh, oxygen- rich blood away from the heart to tissues throughout the body. Veins carry blood containing waste products such as carbon dioxide back through the heart to the lungs. The lungs exchange the carbon dioxide for a fresh supply of oxygen.

Arteries branch into arterioles, which become smaller and smaller until they are big enough to allow only one cell of blood to pass through at a time. These smallest vessels are called capillaries. While passing through the capillaries the tissues get the oxygen they need and transfer carbon dioxide to the blood. The blood begins its return to the heart through tiny veins called venules. Blood flows from venules to larger and larger veins until it reaches the right atrium (figure 6).

THE CORONARY ARTERIES

The heart, like all other muscles, needs oxygen and nutrients and has its own set of arteries that supply them. These arteries, called coronary arteries, branch off the aorta just as it leaves the heart. The right coronary artery supplies the bottom and back of the heart. The left coronary artery, which has two main branches (the left circumflex and the left anterior descending), supplies the top, front, and left sides, and an area of the back of the heart (figure 7).

HEARTBEAT

The heart is a unique muscle in the body. Most muscles depend on a nerve connection to the spinal cord or brain to get the electrical stimulation to function.

But the heart muscle is different. It has its own pacemaker that sends steady electrical impulses to tell the heart to beat.

This unique pacemaker is a bundle of specialized muscle fibers called the sinoatrial or sinus (SA) node. It is located in the right atrium. The electrical impulse that signals each heartbeat starts here and travels through the atria, causing them to contract and to force blood into the ventricles.

The electrical signal then travels down connecting fibers to another bundle of specialized fibers called the atrioventricular node (AV node). The AV node is located between the atria and ventricles.

The AV node connects to a bundle of fibers that divides into two branches running along the sides of the septum into the ventricles and then divides again into numerous branches.

This network is the heart's electrical conduction system (figure 10). The electrical impulse travels through the network and stimulates the heart to beat in a coordinated manner (in synchrony).

As the electrical impulse completes one cycle, traveling from the SA node to the conducting network, it causes the heart to beat. With each heartbeat, blood circulates to all parts of the body.

Word List

Aorta — Largest artery in the body. It carries oxygen-rich blood from the heart's left ventricle to all parts of the body.

Aortic valve — Valve between the left ventricle and the aorta. It allows the blood to flow from the heart into the aorta and prevents backflow. A normal aortic valve has three leaflets.

Arteriole — Tiny artery that joins a large artery to a capillary.

Artery Blood — vessel that carries blood from the heart to various parts of the body. Arteries usually carry oxygenated (oxygen-rich) blood.

However, the pulmonary artery carries deoxygenated (oxygenpoor) blood from the heart to the lungs

Conclusion

The heart and circulatory system represent a highly integrated and efficient mechanism for sustaining life. Mastery of its anatomy and physiology, together with precise English medical terminology, is fundamental for medical education, clinical practice, and engagement with global scientific literature.

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