

Cardiovascular Physiology

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The human cardiovascular system is composed of a heart which pumps blood through a closed system of blood vessels. The heart is composed mostly of cardiac muscle, or myocardium. Its primary function is to transport nutrients, water, gases, wastes, and chemical signals throughout the body. The cardiovascular system is composed of the heart, the blood vessels (or vasculature), and the cells and plasma of the blood.

1. Arteries are blood vessels that carry blood away from the heart and veins return the blood to the heart. A system of valves in the heart and veins ensures that the blood flows in one direction.

2. The heart is anatomically divided into two halves by a central wall, or septum, into left and right halves. Each half is composed of an atrium which receives blood returning to the heart and a ventricle that pumps the blood out into the blood vessels that serve the body. The atria and ventricles and exiting blood vessels are separated by closable valves. Functionally, the heart serves as a pump in series that generates pressure to propel the blood through the system.

3. The lungs are where oxygen is picked up and carbon dioxide is expelled. The pulmonary circulation goes from the right side of the heart (deoxygenated blood) and returns it to the left side of the heart, with oxygenated blood.

4. The systemic circulation consists of the vessels that go from the left side of the heart to the tissues and back to the right side of the heart.

The systemic circulation and the pulmonary circulation can be traced together:

Deoxygenated blood returning from body enters the heart in the right atrium. From the right atrium the blood passes through the tricuspid valves to enter the right ventricle. The blood is then pumped into the pulmonary arteries, passing the pulmonary valves, where it goes to the lungs. After becoming oxygenated in the lung's capillaries, the blood is carried by the pulmonary veins to the left atrium. It then passes through the bicuspid or mitral valves into the left ventricle, where it is pumped into the aorta through the aortic valves. The aorta branches into smaller and smaller arteries that finally lead to capillary beds in the tissue.

Here oxygen is exchanged for carbon dioxide and returned via veins which join into the inferior vena cava (veins coming from the lower body) and superior vena cava (from the upper body). The IVC and the SVC empty into the right atrium.

Clinical Significance

Blood pressure (BP) is an essential clinical value because it describes the status of the vasculature in acute and chronic states. If a patient has elevated blood pressure in the clinic on more than two occasions, the clinician can diagnose the patient with essential hypertension. BP can also be significant in acute settings such as in the emergency room after a patient is brought in by an ambulance due to a motor vehicle accident. At this point, it is important to assess the patient's BP because if it is low, it might indicate the patient is bleeding somewhere, and the clinician must determine the location of the bleeding as soon as possible. S1 and S2 heart sounds are normal heart sounds heard on auscultation of the heart. S1 is the sounds made due to the closure of the mitral and tricuspid valves. This is followed by systole. Then the S2 sounds are heard, which are the closure of the aortic and pulmonary valves. Diastole follows this. It is important to recognize these normal heart sounds on auscultation because abnormal heart sounds such as S3, S4, and murmurs can be signs of a pathological condition.