بسم الله الرحمن الرحيم

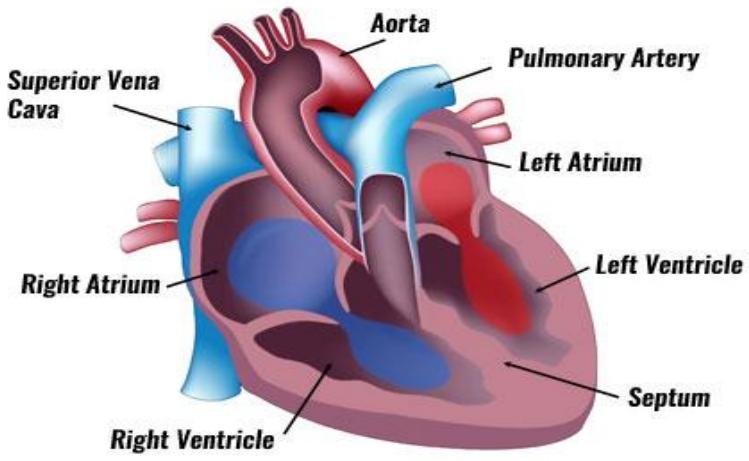
Human Physiology 2nd stage / كلية آشور الجامعة – قسم تقنيات المختبرات الطبية

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The heart:

The heart is a muscular organ in most animals, which pumps blood through the blood vessels of the circulatory system. Blood provides the body with oxygen and nutrients, as well as assisting in the removal of metabolic wastes. In humans, the heart is located between the lungs, in the middle compartment of the chest. In humans, other mammals, and birds, the heart is made up of 4 chambers, 2 atria and 2 ventricles.

De-oxygenated blood returns to the right side of the heart via the venous circulation. It is pumped into the right ventricle and then to the lungs where carbon dioxide is released and oxygen is absorbed. The oxygenated blood then travels back to the left atria, then into the left ventricle from where it is pumped into the aorta and arterial circulation.



Cardiac Physiology:

Cardiac output can be calculated as heart rate multiplied by stroke volume, this equation explains the relationship between the amount of blood pumped by the heart and heart rate. The system functions to maintain a stable cardiac output. For example, if your stroke volume increases, your heart rate drops in order to maintain a constant cardiac output. The cardiovascular system is capable of regulating heart rate and stroke volume in order to maintain cardiac output. These variables normally fluctuate throughout the day as your body recognizes and responds to changes.

Conductive system:

The conducting system of the heart consists of cardiac muscle cells and conducting fibers (not nervous tissue) that are specialized for initiating impulses and conducting them rapidly through the heart. They initiate the normal cardiac cycle and coordinate the contractions of cardiac chambers. Both atria contract together, as do the ventricles, but atrial contraction occurs first. The conducting system provides the heart its automatic rhythmic beat. For to pump the heart efficiently.

The heart is a beating muscle that continually pumps blood to the rest of the body. What we commonly call a heartbeat is actually the rhythmic contraction of the heart's four chambers.

Each heartbeat is stimulated by electrical signals that travel through a specific nerve pathway in the heart. These signals can be tracked and recorded by an electrocardiogram, or EKG. The heart's electrical signal begins at the sino-atrial node, or SA node, which is located in the top right atrium. The signal then travels to both the right and left atria, causing them to contract and push blood into the lower chambers, or ventricles. The electrical signal continues into the ventricles via the atrioventricular node (AV node). The signal continues down the bundle and into the left and right bundle branches, located within the ventricles. When the signal reaches bundle branches, it causes the ventricles to contract and pump blood to the lungs and body, completing the heartbeat. The conduction system keeps the heart beating at a normal rate of 60 to 100 beats per minute.

Cardiac output:

The **cardiac output (CO)** is simply the amount of blood pumped by the heart per minute. therefore, the cardiac output is the product of the **heart rate** (HR), which is the number of beats per minute, (normally, 70 beats/min). And the **stroke volume** (SV), is the amount of blood ejected per beat of the heart. **CO = HR X SV**

The cardiac output is usually expressed in liters/minute. For some one weighing about 70 kg, the cardiac output at rest is about 5 liters/minute. In this case, if the heart rate is 70

beats/min, the stroke volume would be a little more than 70 ml/beat.

Controls cardiac output:

Although cardiac output is measured as the flow of blood from the left ventricle into the aorta, the system that controls cardiac output includes many other components besides the heart itself. The strength of contraction of the heart responds to changes in atrial pressure, with small changes in atrial pressure eliciting large changes in strength of contraction.

The function of the cardiovascular system is strongly affected by the operation of the renal sodium excretion–body fluid volume that maintains arterial blood pressure at a controlled value over long periods.

Factors affect cardiac output:

Cardiac output (CO) can be defined in words, units of measurement or equations. In short it is the volume of blood being pumped from the left ventricle of the heart in one minute, also expressed as liters per minute (L/min). In the average adult at rest the cardiac output will typically measure between 4.5 and 5.5 L/min. Several factors can affect cardiac output indirectly by affecting the heart rate (HR) and stroke volume (SV), the primary components of cardiac output determination often expressed by the equation CO = HR x SV.

Vascular (blood vessels):

The **blood vessels** are part of the circulatory system that transports blood throughout the body. There are three various kinds of blood vessels:

1- Arteries (**Arterioles**) are used to indicate blood high in oxygen, this include Aorta and Branches of the aorta**.** They carry the blood away from the heart.
2- **Capillarie**s, which enable the actual exchange of water and chemicals between the blood and the tissues
3- **Veins (Venules)** are carry blood from the capillaries back toward the heart.

   The blood vessels are transports blood throughout the human body. A few structures (such as cartilage and the lens of the eye) do not contain blood vessels.

Blood Pressure:

When the heart beats, it pumps blood round the body to give the energy and oxygen it needs. As the blood moves, it pushes against the sides of the blood vessels. The strength of this pushing is the blood pressure. If the blood pressure is too high, it puts extra strain on the arteries (and the heart) and this may lead to heart attacks and strokes. Ideally, we should all have a blood pressure below 120 over 80. This is the ideal blood pressure for people wishing to have good health. If the blood pressure is above 120/80mmHg, you will need to lower it. For example,

someone with a blood pressure level of 135 over 85 (135/85) is twice as likely to have a heart attack or stroke as someone with a reading of 115 over 75 (115/75).

Factors affect Blood Pressure:

Heart attacks and strokes can be caused by high blood pressure, which is a combination of the lifestyle choices and genetics. To try to prevent heart problems in the future, it's important to make healthy choices now. There are 7 factors affecting the blood pressure.

1- Genetics

If you have another health disorder like kidney disease, diabetes or gout you have a higher chance of getting heart disease.

2- Athletics

Doctors suggest doing aerobic exercises 2.5 hours a week to help prevent heart disease.

3- Nutrition

Make sure to eat fruits and vegetables that are high in magnesium and potassium for a healthy heart. These foods include carrots, green peas, oranges and peaches.

4- Alcohol

Scientists have concluded that there is a large link between drinking alcohol and high blood pressure.

5- Anxiety

Stress over a long period of time can be a big contributor to high blood pressure.

6- Smoking

Whether you smoke or someone close to you does, the effects can be devastating on your heart. Smoking causes your blood vessels to shrink which makes the heart work harder.

7- Aging

When are arteries age they get rigid and more constrained. This forces the hearts to compensate for the lack of elasticity and so they have to pump the blood harder to move it around our bodies.