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Cardiovascular system

The heart is the key organ of the cardiovascular system – the body's transport system for blood. A muscle that contracts rhythmically and autonomously, it works in conjunction with an extensive network of blood vessels running throughout the body. Basically, the heart is a pump ensuring the continuous circulation of blood in the body.

The heart

The heart weighs around ٣٥٠g and is roughly the size of an adult's clenched fist. It is enclosed in the mediastina cavity of the thorax between the lungs, and extends downwards on the left between the second and fifth intercostal space . The heart has a middle muscular layer, the myocardium, made up of cardiac muscle cells, and an inner lining called the endocardium. The inside of the heart (heart cavity) is divided into four chambers – two atria and two ventricles – separated by cardiac valves that regulate the passage of blood. The heart is enclosed in a sac , the pericardium, which protects it and prevents it from over-expanding, anchoring it inside the thorax..

The pericardium is attached to the diaphragm and inner surface of the sternum, and is made up of:

- The fibrous pericardium, composed of a loosely fitting but dense layer of connective tissue

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- The serous pericardium or pericardium, composed of the parietal and visceral layers;

- A film of serous fluid between the fibrous and serous pericardium that allows them to glide smoothly against each other

Coronary circulation

The heart itself requires a richly oxygenated blood supply to support its activity. This is delivered via the right and left coronary arteries, which lie on the pericardium and penetrate the myocardium with deeper branches to supply this highly active layer of muscle. The right and left coronary arteries arise from vascular openings at the base of the aorta, called the coronary Ostia. The left coronary artery runs towards the left side of the heart, dividing into the left anterior descending artery and the left circumflex artery. The right coronary artery runs down the right side of the heart dividing into the marginal artery (lateral part of the right-hand side of the heart) and posterior descending artery (supplying the posterior part of the heart) (Fig ٣)

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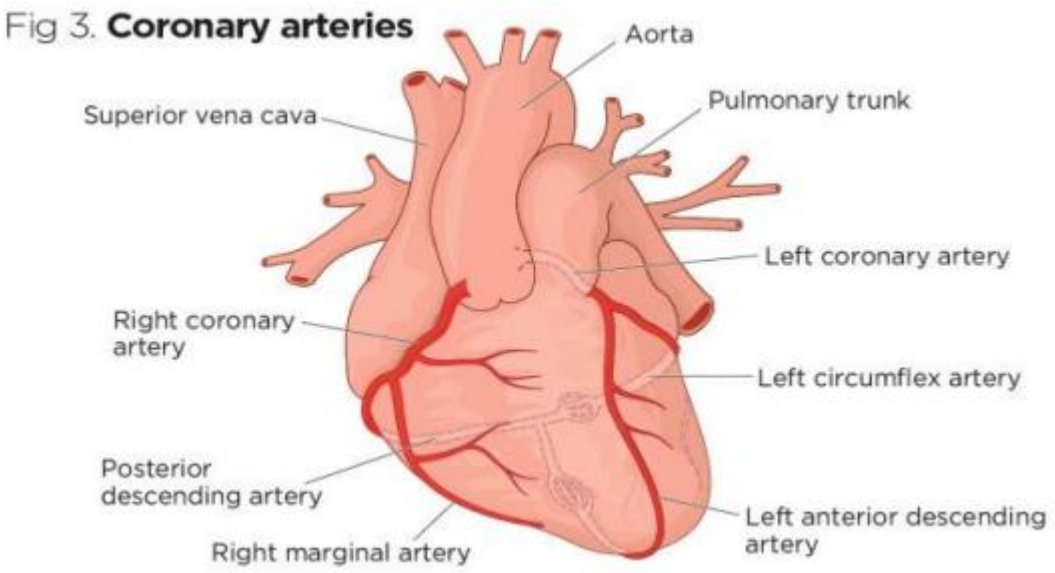

The coronary arteries provide an intermittent supply of blood to the heart, predominantly when the heart is relaxed (during diastole), as the entrance to the coronary arteries is open at that point of the cardiac cycle. Table ١: shows which regions of the heart are supplied by which coronary arteries.

The venous drainage system of the heart uses the coronary veins, which follow a course similar to that of the coronary arteries. The coronary sinus is a collection of coronary veins (small, middle, great and oblique veins, left marginal vein and left posterior ventricular vein) that drain into the RA at the posterior aspect of the \ heart. Two thirds of the cardiac venous blood is returned to the heart via the coronary sinus, while one third is returned directly into the heart (with the anterior cardiac veins opening directly into the RA and the smallest coronary veins into all four chambers).

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Cardiac cycle

The chambers of the heart contract and relax in a coordinated fashion. The contraction phase is referred to as ‘systole’ and the relaxation phase, when the heart fills up again, as ‘diastole’. The RA and LA synchronize during atrial systole and diastole, while the RV and LV synchronize during ventricular systole and diastole. One complete cycle of these events is referred to as the cardiac cycle. During the cardiac cycle, the pressure in the cardiac chambers increases or falls, affecting valve opening or closure, thereby regulating blood flow between the chambers. Pressures in the left side of the heart are around five times higher than in the right side, but the same volume of blood is pumped per cardiac beat. The cardiac cycle can be broken down into a sequence of events based on the principle that any blood flow through the chambers depends on pressure changes, as blood will always flow from a high-pressure to a low-pressure area .The process is shown in Fig ٥ and described below