

CHAPTER-12
CIRCULATION

Q1. Give the division of blood circulatory system of man.

Ans: The internal transport of blood circulatory system of man is divided into:

- (i) Cardiovascular system
- (ii) Lymphatic system

Q2. Give the division of cardiovascular system of man.

Ans: The cardiovascular system consists of:

- (i) Heart (a strong muscular organ)
- (ii) Blood vessels (arteries, capillaries, veins)
- (iii) Blood

Q3. What is heart? Describe the origin of its name.

Ans: The heart functions as a pump and is responsible for the circulation of the blood through the blood vessels. The human heart is a hollow, fibromuscular organ. The Greek name for the heart is *cardia* from which we have the adjective **cardiac**. The Latin name for the heart is *cor* from which we have adjective **coronary**. The adult heart has the shape of a cone. The blunt, rounded point of the cone is the apex and the larger flat part at the opposite end of the cone is the base.

Q4. Describe coronary circulation.

Ans: The wall of the heart has its own supply of blood vessels to meet its vital needs. The myocardium is supplied with blood by the **right** and **left coronary arteries**. From the capillaries in the myocardium, the blood enters the **cardiac veins**. The course of these vessels parallels that of the coronary arteries. These cardiac veins converge to form the **coronary sinus channel** on the posterior

surface of the heart. The coronary venous blood then enters the heart through an opening into the right atrium.

Q5. Explain the function of valves in veins and their location in veins.

Ans: Veins having diameters greater than 2mm contain valves that allow blood flow toward the heart but not in the opposite direction. Valves are present only in the lower part of the body especially in the abdomen and hind limbs. In the upper region above the heart there is no valve. As the blood pressure in the veins is comparatively low, so the flow of blood in the veins is helped by gravity, semilunar valve and muscular contraction.

Q6. What is cardiac output?

Ans: Blood flow means simply the quantity of blood that passes through a given point in the circulation in a given period. The overall blood flow in the circulation of an adult at rest is about 5000 ml/min. This is called **cardiac output**. It is the amount of blood pumped by the heart in a unit period.

Q7. Write a note on congenital heart problems.

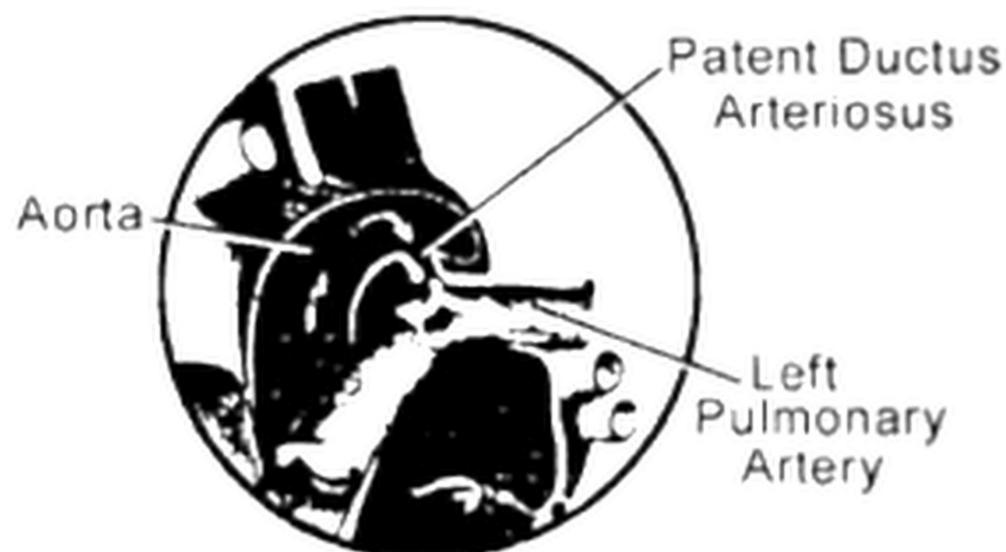
Ans: Congenital heart problems:

Heart diseases can be classified as congenital or acquired. Congenital heart problems result from abnormalities in the embryonic development and may be attributed to heredity nutritional problems (poor diet) of the pregnant mother, or viral infection.

(a) Patent ductus arteriosus:

- (i) Before birth, the two major arteries--the aorta and the pulmonary artery--are connected by a blood vessel called the ductus arteriosus. This vessel is an essential part of foetal blood circulation.

- (ii) Before a baby is born, the fetus's blood does not need to go to the lungs to get oxygenated. The ductus arteriosus is a hole that allows the blood to skip the circulation to the lungs.
- (iii) However, when the baby is born, the blood must receive oxygen in the lungs. Within minutes or up to a few days after birth, the vessel is supposed to close as part of the normal changes occurring in the baby's circulation.
- (iv) If the ductus arteriosus is still open (or patent) the blood may skip this necessary step of circulation. The open hole is called the patent ductus arteriosus.
- (v) Patent ductus arteriosus allows oxygen-rich blood from the aorta to mix with oxygen-poor blood from the pulmonary artery. This can put strain on the heart and increase blood pressure in the lung arteries.
- (vi) Treatment options for a patent ductus arteriosus include monitoring, medications and closure by cardiac catheterization or surgery.



Patent Ductus Arteriosus

(b) Blue- baby syndrome:

- (i) Blue- baby syndrome or blue baby is usually caused by a heart defect which laymen often call "a hole in the heart"
- (ii) Normally, oxygenated blood from the lungs is separated from deoxygenated blood from other tissues.

- (iii) A defect in the heart ventricle walls can allow deoxygenated blood to mix with blood from the lungs.
- (iv) The resulting blood going through the aorta has less oxygen than usual, and the baby looks blue.
- (v) An operation is usually done to fix this.

Science Titbits

When a stethoscope is used to listen the heart sound, distinct sounds normally are heard. The **first heart sound** is a low-pitched sound, often described as a "**lub**" sound. It is caused by vibration of the atrioventricular valves which close near the beginning of ventricular systole. The **second heart sound** is a higher pitched sound often described as "**dub**" sound. It results from closure of the aortic and pulmonary semilunar valves, near the end of systole, 'lub' is also written as 'lubb' and 'dub' as 'depp'.

Science, Technology and Society Connections

- ◆ **Rationalize the use of artificial pacemaker in patients of cardiac arrhythmias.**

A **cardiac arrhythmia** is a disturbance in electrical rhythm of heart. It may be **bradycardia** (heart beat less than 40 beats per minute) or **tachycardia** (heart beat more than 100 beats per minute). Pacemaker supplies electrical initiation to myocardial contraction. The pacemaker is put surgically under the skin where it may be programmed. It generates electrical rhythm at a set rate, so in this way arrhythmia are controlled.

Skills: Analyzing and Interpreting

◆ Justify how Vasodilation and Vasoconstriction is Reflective of Emotions?

During emotional rage such as apprehension and rage vasodilation occurs due to secretion of **epinephrine**. It is a hormone that is responsible for fear, flight and fright conditions. The sympathetic vasodilator fibres are part of a regulatory system that originates in cerebral cortex and ends at postganglionic neurons in blood vessels on skeletal muscles, activate them to release acetylcholine, and vasodilation occurs. Blood discharge through throughout channels rather than capillaries so heat loss occurs and the skin becomes hot and red. While in vasoconstriction blood, supply becomes less to skin, so heat is preserved and the skin becomes cold. Situations such as shock, hypotension and tachycardia occur by stimulation of arterial stretch receptors and production of hypertension and bradycardia (slowness of the heart) occur by increased intracranial pressure.

Teacher's Point

Teacher would guide the students to hypothesize the role and effects of diuretic drugs in regulating blood pressure.

Did you know?

Atrial septal defect is a congenital heart defect. If the interatrial septum is defective then oxygen-rich blood can flow directly from the left side of the heart to mix with the oxygen-poor blood in the right side of the heart, or vice versa. It results in cyanosis (blueness of the skin). During development of the fetus, the interatrial septum develops to separate the left and right atria.

However, a hole in the septum called the foramen ovale, allows blood from the right atrium to enter the left atrium during foetal development. The opening allows blood to bypass the nonfunctional foetal lungs while the foetus obtains oxygen from the placenta. After birth, the pressure in the right side of the heart drops as the lungs open and being working, causing the foramen ovale to close entirely.

Teacher's Point

Teacher would guide the students to list major hospitals of cardiology working in your province.

Did you know?

A new study suggests that one may have what doctors call "masked" hypertension, blood pressure that tends to be higher outside of the medical clinic environment. Masked hypertension was typically more common among males than females. Having diabetes raised the odds for the condition, and so did advancing age, the research showed. The findings were published Jan, 18, 2017 in the *American Journal of Epidemiology*.

Did you know?

Platelets are bits of cytoplasm pinched off from large cells in the bone marrow. The structure of red blood cells or **erythrocytes** suits its main function, which is to carry oxygen. Human erythrocytes are biconcave disk, thinner in the centre than at the sides. A biconcave disk has more surface area for gas exchange than a flat disk or a sphere has. Their smaller size also gives the

erythrocytes greater total surface area for gas exchange. Erythrocytes are formed in bone marrow.

There are four kinds of white blood cells or leukocytes. Leukocytes fight infection by releasing chemicals e.g. histamine. Neutrophils and monocytes are phagocytes, eating bacteria and foreign proteins. Eosinophils are phagocytic. Lymphocytes are the key in immunity. Some lymphocytes produce antibodies.

Teacher's Point

Teacher would guide the students to trace the path of lymph from lymph capillary unit it is returned to the blood.

Skills: Analyzing and Interpreting

- ◆ **Justify in what ways blood circulatory system is dependent on the lymphatic system.**

The lymphatic system represents an accessory route by which fluid flow from the interstitial spaces into the blood. And, the most important, the lymphatic system can carry proteins and large particulate matter away from the tissue spaces, neither of which can be removed by absorption directly into the blood capillary. This removal of proteins from the interstitial spaces is an essential function, without which we would die within 24 hours. Thus, blood circulatory system is dependent on lymphatic system.

- ◆ **Interpret why the swelling of the lymph nodes is a cause of concern.**

Lymphatic flow is determined by the interstitial fluid pressure and activity of lymphatic pump. Lymph node swelling is a cause of concern because lymph node swells in different diseases, e.g. in pyrexia (fever) of unknown origin enlarged lymph nodes appear. Enlargement of anterior and tonsillar nodes is usually associated with tonsillitis or pharyngitis; posterior lymphadenopathy may suggest a glandular fever syndrome or HIV infection. The causes of lymphadenopathy (swelling of lymph node) are bacterial (streptococcal, tuberculosis), viral, protozoan, fungal (histoplasmosis), leukemias etc.

Activity

1. Correlating the *lub-dub* sounds of the closing of heart valves with the monitoring of the heartbeat.
2. Identification of the phases of heartbeat on a printed ECG and comparison of the ECG of a cardiac patient with that of a healthy man.
3. Dissection of the heart of sheep and describing its internal structure.
4. Differentiation of an artery and a vein by observing prepared slides.
5. Measuring blood pressure by using sphygmomanometer.

