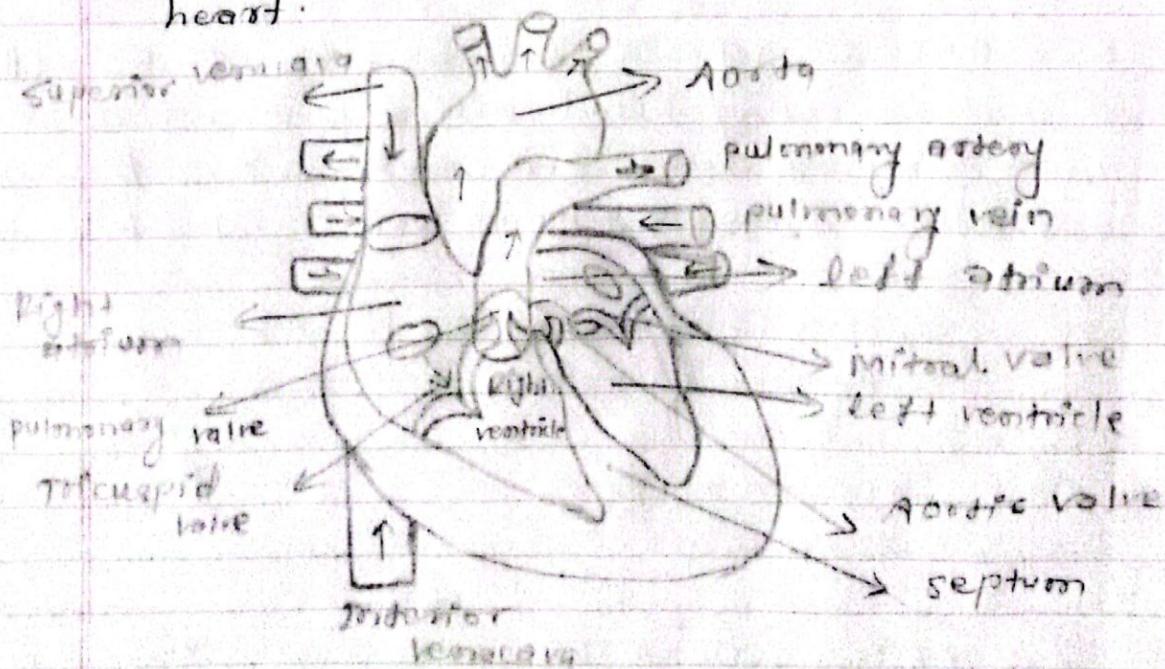


(4)

Mycocardium :- The muscular middle layer of the wall of the heart and has excitable tissue and conducting system.

- The cardiac muscle cells (cardiocytes) are short, thick and branched cells.
- The end of cardiac muscle cell connects to neighbouring cells by thick connections called intercalated discs.

Endocardium :- The endocardium is the inner most layer which is composed of a simple squamous epithelium. It provides a smooth lining for the chambers of heart and covers the valves of the heart.

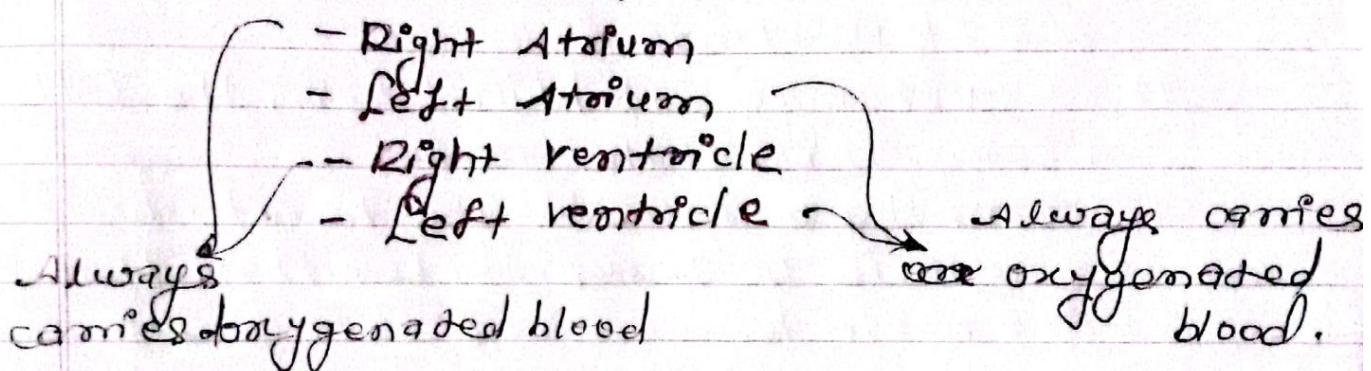


Structure of heart

Internal Structure of Heart

The heart is subdivided by septa into right and left valves, and a constriction subdivides each half of the organ into two cavities.

- The upper cavity being called the atrium, the lower the ventricle.
- The heart consists of four chambers



Right Atrium :-

- The right atrium is the upper chamber of the heart.
- Venous blood returning from the body drains into right atrium via the SVC (Superior venacava), IVC (Inferior venacava) and coronary sinuses.

Semilunar valve - Aortic + pulmonary valve

- The right atrium pumps blood through the tricuspid valve into the right ventricle.

Right ventricle :-

- The right ventricle pumps blood through the pulmonary semilunar valve into the pulmonary trunk to be oxygenated to lungs.

(6)

Left atrium :-

- It is situated in the left superior of the heart.
- The chamber of the left is smaller than the right atrium but thicker.
- Blood returning from the lungs drains into left atrium via the four pulmonary veins.
- The left atrium pumps blood through the bicuspid (mitral valve) in to left ventricle.

Left ventricle :-

- It receives oxygenated blood from the left atrium and pumps it to the aorta.
- It form the apex of the heart.
- Its wall is 3 times thicker than that of the right ventricle.

Valves of heart

- The heart has four valves. All four valves of the heart have a singular purpose : allowing forward flow of blood but preventing backward flow.
- The outflow of each chamber is guarded by a heart valve.

The Atrioventricular Valves between the Atria and ventricles

- ① Tricuspid valve (right side of heart)
- ② Mitral valve (Bicuspid valve) (left side of the heart)

Semilunar valves which are located in the outflow tracts of the ventricles.

(7)

Ques
Topic

- Aortic valve (left side of heart)
- pulmonary valve (right side of heart)

Tricuspid valve :-

- It separates right atrium and right ventricle.
- It consists three flaps which are anchored in the papillary muscle by thread like cords, chordae tendineae.

Bicuspid / Mitral valve :-

- The valve between the left atrium and left ventricle
- It has two flaps which are also anchored in the papillary muscle by the chordae tendineae.
- It is also known as mitral valve.

Pulmonary Valve

- The valve guarding between the right ventricle and pulmonary artery.

Aortic valve :-

- The valve between left ventricle and aorta is called Aortic valve.

Blood supply of the heart

Arterial supply :-

The heart is supplied with arterial blood by right and left coronary arteries which arises from ascending aorta.

Venous ~~opt~~ — — : - 120

most of the venous blood is collected into a number of cardiac veins that join to form the coronary sinuses which is terminated into right atrium.

Nerve Supply :- The heart is supplied by sympathetic and parasympathetic nerves which forms a superficial cardiac plexus lies below the arch of aorta.

Function of heart

There are two types of function of heart

- ① Primary function :- It provides communication through respiratory gases, between widely separated body parts through respiratory gases, vitamins and minerals, enzymes, antibodies and buffer.

② Secondary function :- It contributes directly or indirectly to all body's metabolic functions, tissue perfusion with oxygen and nutrient, carbon balance, immunity, enzymatic reactions, pH and temperature regulation.

Cardiac Cycle

The cardiac cycle is defined as a sequence of alternating contraction and relaxation of the atria and ventricles in order to pump blood throughout the body.

It starts at the beginning

XXXX

(9)

of one heartbeat and ends at the beginning of another.

phases of cardiac cycle

The normal cardiac cycle lasts 0.8 sec. when heart rate is 75 beats/min.

- ① Atrial systole
- ② Ventricular systole
- ③ complete cardiac diastole (relaxation period)

Atrial systole :- It is also known as rapid filling phase or presystole, during atrial systole, the atria are contracting. At the same time ventricles are relaxed.

- It lasts about 0.1 sec.

- ② Ventricular systole :- As the atria go into diastole, the ventricles begin their contraction phase This phase lasts about 0.3 sec.

It has following events

~~SI~~

→ Isometric Contraction period :- It is the type of muscular contraction characterized by increase in tension without any change in length of muscle fibers.

→ Ejection period :- Due to the opening of semilunar valves and isometric contraction of ventricles, blood is ejected out of both the ventricles.

③ Relaxation period :- During the relaxation period the atria and the ventricles both are relaxed. This phase lasts about 0.4 seconds

10

Events

- ① Pre diastole
- ② Isometric relaxation period
- ③ Rapid filling phase
- ④ Slow filling phase
- ⑤ Last filling phase.

Conduction System of heart

Fig:-

(11)

Date	/	/
Page		

The cardiac muscle has the ability to generate rhythmic electrical activity which allows the heart to beat continuously.

The network of specialized cardiac muscle cells which initiate and distribute impulses throughout the heart is known as cardiac conduction system.

The conduction system consists of the following components.

- ① Sinus node (SA node)
- ② Atrioventricular node (AV node)
- ③ Atrioventricular bundle (AV bundle)
- ④ Purkinje fibres.

Sinus node

- It is small pacer of specialized ^{cell} located in the superior postero-lateral wall of right atrium immediately below and slightly lateral to the opening superior vena cava.

→ The SA node is also known as pacemaker of heart.

→ It initiates each heart beat and sets the pace for the heart as a whole.

→ Signals from the SA node spread through the atria causing atrial contraction.

→ It depolarizes spontaneously at the rate of 60-80 times / minute.

Atrioventricular node (AV node)

- AV node is located in the inferior position of interarterial septum near the tricuspid valve.
- It acts as electrical gateway to the ventricles.
- The AV node does not initiate impulses but at a slower rate than the SA node.
- The AV node initiates the impulses at the rate of 40-60 times / min.
- If SA node becomes inactive, AV node will then determine the ventricular rate.

The Atrioventricular Bundle (AV bundle)

(13)

Date 1 / 1
Page 1

- It is a pathway by which electrical impulses leave the SA node.
- It is also known as bundle of His.
- It is divided into right and left bundle branches that extend through the interventricular septum.
- The electrical impulses pass along both right and left bundle branches.
- It initiates impulse at the rate of 25-40 beats/minute.

Purkinje fibres

- These are nerve like processes that arise from the bundle branches near the apex of the heart.
 - Purkinje fibres distribute the electrical excitation to the ventricular myocardium.
 - Then the ventricles contract and push the blood upward toward the pulmonary artery.
- It too initiates the rate of 25-40 beats/min

Fig:- conduction system of heart

Heart Sounds

↳ types of heart sound

- (a) first heart sound (S_1) :- It is produced by the closure of mitral and tricuspid valves at the onset of systole. It is heard by stethoscope as "Lubb".
- (b) Second Heart sound (S_2) :- It is produced by the closure of pulmonary and Aortic valve at the end of systole. It is heard by stethoscope as "dupp".
- (c) Third heart sound (S_3) :- It is produced by the rapid filling of ventricle during diastole. It is recorded by phonocardiograph.
- (d) Fourth heart sound (S_4) :- It is produced during arterial contraction by rushing of blood from arteries to ventricles. It is recorded by phonocardiograph.

Cardiac output $\text{CO}(\text{L})$:- It is the amount of blood pumped out by each ventricle (cardio) into the aorta in 1 minute.

$$\text{CO} = 4-8 \text{ L/minute.}$$

→ Depolarization :- It is orderly passing of electrical current sequentially through the heart muscle, changing it cell.

(15)

Date / /
Page

→ Repolarization : Return of the ions to their previous resting state with relaxation of ~~any~~ ^{any} skeletal muscles.

ECCG :- An electrocardiogram is recording of the electrical activities within the heart.

The ECCG is a recording of electrical impulses produced by all the heart muscle fibres during each beat.

The instrument used to record the changes is an electrocardiograph.

A normal ECCG tracing shows five waves which have been named P, Q, R, S and T.

The P wave :- It arises when the impulse from SA node sweeps over atria. It represents atrial depolarization or atrial contraction.

The "QRS complex" :- It arises when the impulse rapidly spreads from AV node through AV bundle and Purkinje fibres. It represents ventricular depolarization or ventricular contraction.

The 'T' wave :- develops during the relaxation of the ventricular muscle. It is the time of relaxation of heart. It represents ventricular - repolarization (resting stage)

Fig: waves of ECG

a

Different kinds of circulation

- pulmonary circulation
- systemic circulation
- portal circulation
- fetal circulation

pulmonary circulation

If it is otherwise called lesser circulation.

- Blood is pumped from right ventricle to lungs through pulmonary arteries

- The exchange of gases occurs between blood and alveoli of the lungs through pulmonary capillary membrane.
- The oxygenated blood returns to left atrium through pulmonary veins.
- Thus, the left side of the heart contains oxygenated or arterial blood and right side of the heart contains the venous blood.

NOTE :- In contrast to all other arteries of the body, pulmo pulmonary artery has deoxygenated blood and pulmonary vein has oxygenated blood.

Systemic circulation

It is otherwise called & greater circulation

- The blood pumped from left ventricle passes through a series of blood vessels of arterial system and reaches the tissues.
- Exchange of various substances between blood and tissues takes place in capillaries.

- After exchange of substances in the capillaries blood and tissues take the blood ~~oxygen's~~ enters the venous system.
- And return to right atrium and then the right ventricle. This completes systemic circulation.

Systemic circulation

Venous blood from upper limb, head & neck
 ↓
 Superior vena cava

Venous blood from lower part of the body
 ↓
 Inferior vena cava

Right atrium → Tricuspid valve
 ↓ Right ventricle
 ↓ → pulmonary valve
 Pulmonary trunk
 ↓ Pulmonary arteries (right & left)
 ↓ lungs

Superior and inferior vena cava → four pulmonary veins

Left atrium
 ↓ → Bicuspid valve
 Left ventricle
 ↓ Aorta
 ↓ Branches
 ↓ Capillaries

Portal circulation

The portal vein drains almost all of the blood from digestive tract and empties directly into liver.

The circulation of nutrient-rich blood between the gut and liver is called the portal circulation.

- The portal venous blood contains all the products of digestion absorbed from e.g. tract, so all useful and non-useful ~~being~~ products are processed in the liver, before being either released back in hepatic veins which joins the inferior vena cava.

When liver has broken down harmful substances, their by-products are excreted into the bile or blood. They leave the body in stool.

- The hepatic veins are three large vessels that drain venous blood from the liver into inferior vena cava.