* Cardiovascular system *

⇒ The blood vessels :-

- Cardiovascular system has three types of blood vessels.
- Arteries and arterioles — carry blood away from the heart.
- Capillaries - Where nutrients and gas exchange occurs.
- Veins and venules :- carry blood towards heart.

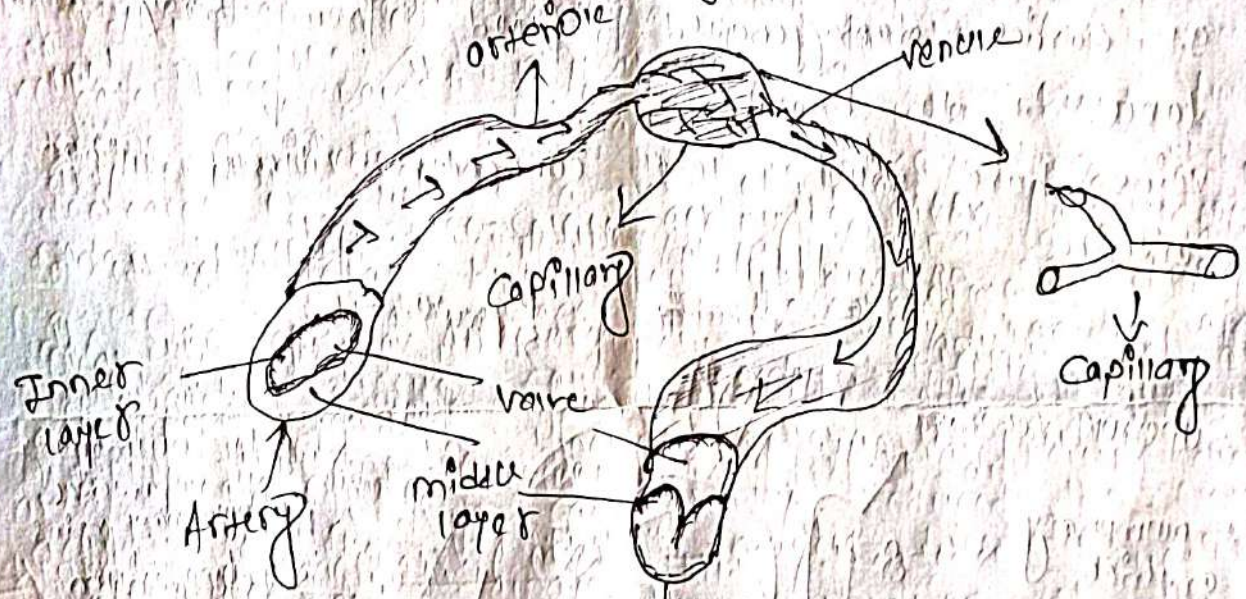


Fig :- Illustration of Artery, capillary and vein

→ The Arteries :-

- Arteries and arterioles take oxygenated blood away from the heart.
- The largest artery is Aorta.
- The middle layer of Artery wall consists of smooth muscle that can constrict to regulate blood flow and blood pressure.
- Arterioles can constrict or dilate, changing blood pressure.

⇨ The capillaries :-

- Capillaries have walls, allow exchange of gases and nutrients with tissue fluid.
- Capillary beds are present in all region of body but not all capillary beds are open at the same time.

⇨ The veins :-

- Venules drain blood from capillaries, then join to form veins that take blood to the heart.
- It carries deoxygenated blood from body and takes it to heart.
- veins have much less connective tissue than arteries

HEART

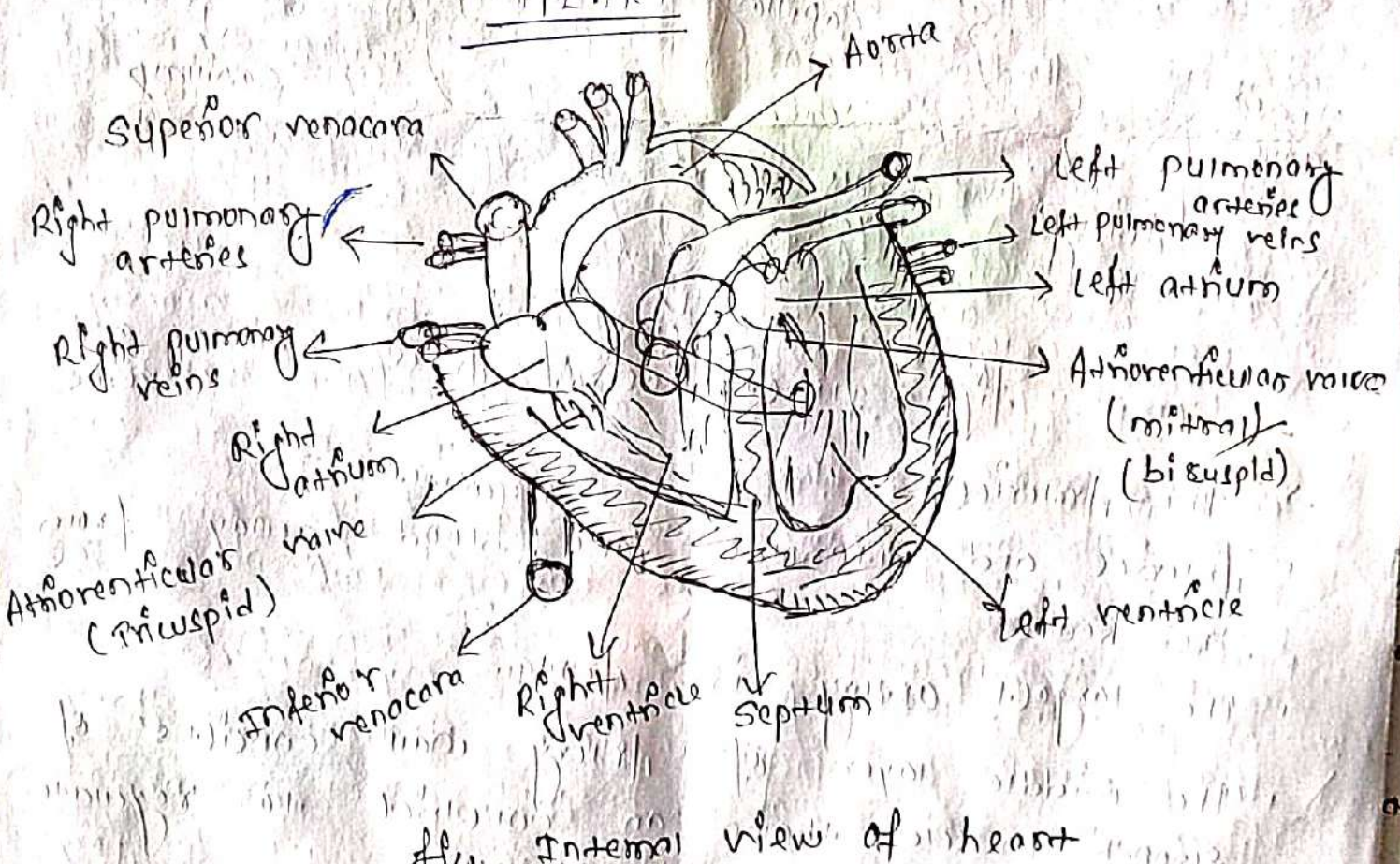


fig: Internal view of heart

Cardiovascular system is also called circulatory system of body. this system has many blood vessels [Artery and veins]

Cardio – Heart
vascular – veins / vessels

Heart is a muscular hollow organ that pump a blood. It lies between lungs, above diaphragm.
Length – 10 cm - 12 cm, 9 cm wide, 6 cm thick
weight in male – 310 gram
weight in female – 225 gram

⇒ Layers of heart :–

① Pericardium :– It is uppermost layer of heart, pericardium has two parts parietal pericardium and visceral pericardium.

② Myocardium :– myocardia is a middle layer of it is made up cardiac muscle fibres. It is responsible for pumping of heart.

③ endocardium :– Endocardium is a innermost layer of the heart.

⇒ chambers of heart :–

- Heart has 4 chambers – 2 Atrium, 2 ventricle
- Two atrium present upper side of heart (left & right)
- Two ventricle present lower part of heart (left & right)

⇒ Superior venacava :—

- It is important vein which is connected with right atrium.
- Its main function is that it carry deoxygenated blood from upper part of body. e.g. brain, eye, mouth, ear etc.

⇒ Inferior venacava :—

- It is important vein which connects to right atrium.
- Its main function is to carry impure blood from lower parts of body to right atrium.

⇒ pulmonary Artery :—

- This is a special Artery which is attached to right ventricle and it's upper end is divided into two way which is connected to lungs.
- It is one of the arteries which carries deoxygenated blood. (unique artery)

⇒ pulmonary vein :—

- This vein start from the lungs and lower end is connected to left atrium. (unique)
- It is one of the veins which carries oxgenated blood.

⇒ Aorta Artery :—

- This is largest artery of body which is connected to left atrium.
- It carry a oxygenated blood from the heart and send to all body.

Atrioventricular valves :—

Atrioventricular valves occur between the atria and ventricles - The tricuspid valve on the right and the bicuspid valve on the left: both valves are reenforced by chordae tendinae attached to muscular projections with in the ventricles.

* Septum :— The septum is a wall dividing the heart into two sides i.e left and right.

⇒ Passage of Blood through the heart :—

Superior and inferior vena cava → right atrium

↓

Right ventricle ← Tricuspid valve

↓

Pulmonary semilunar valve

↓

Pulmonary trunks and arteries to the lungs → Left atrium

↓

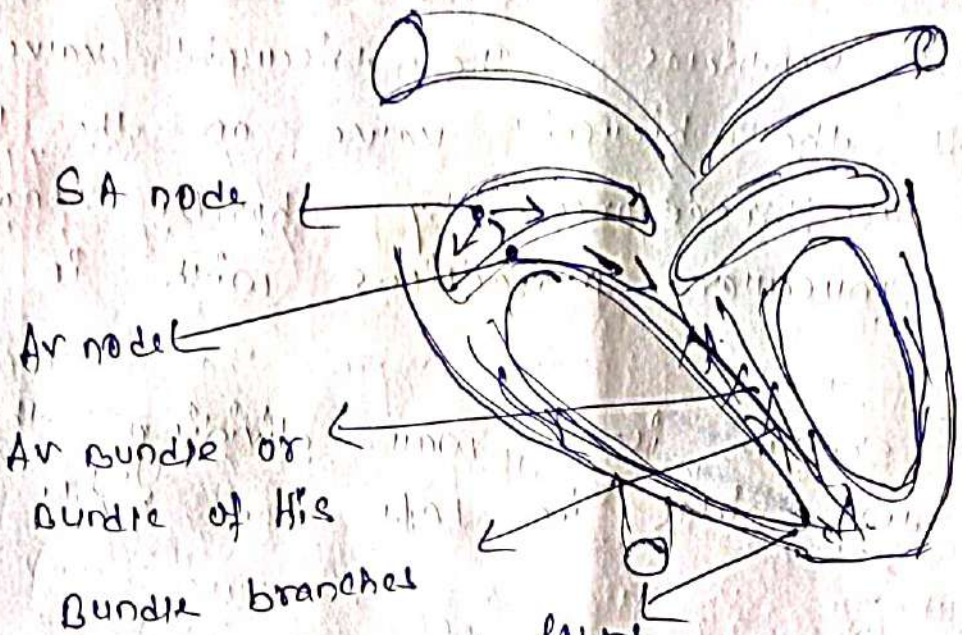
Aortic semilunar valve ← Left ventricle ← Bicuspid valve

↓

Aorta → Different part of body.

* cycle of Blood circulation *

Conducting system of heart :-



- A special system is available in the heart responsible for the rhythmic contraction and conduction of impulses in the heart.

Divided into 3 parts :-

- SA Node or Sinoatrial node :-
  - It is located in the right atrial wall just below opening of superior vena cava.
  - Cardiac excitation begins in the SA node.
  - Impulse travels throughout heart via conductionsys- pacemaker of heart
- AV node or Atrioventricular node :-
  - It is located into the septum between two atria.
  - cardiac impulses spreads from SA node to AV node.
  - Secondary pacemaker
- Bundle of His :- Impulses reaches from A.V node to Bundle of His and then divides into two parts Bundle branches & purkinje fibres.

Cardiac cycle :-

- Cardiac cycle is defined as the succession of coordinated events taking place in the heart during each beat.
- Each beats consists of two major periods called Systole and diastole.
- During systole heart contracts and pumps the blood through arteries.
- During diastole heart relaxes and blood is filled in the heart through veins.
- All these events are repeated in cyclic manner

Events of cardiac cycle :-

- Atrial events :-

When the heart beats at normal rate of 72/min duration of each cardiac cycle is about 0.8 seconds.

- Atrial systole - 0.11 (0.1) sec.
- Atrial Diastole - 0.69 (0.7) sec.

- Ventricular events :-
  - Ventricular systole - 0.27 (0.3) sec
  - Ventricular diastole - 0.53 (0.5) sec.

Heart sound :-

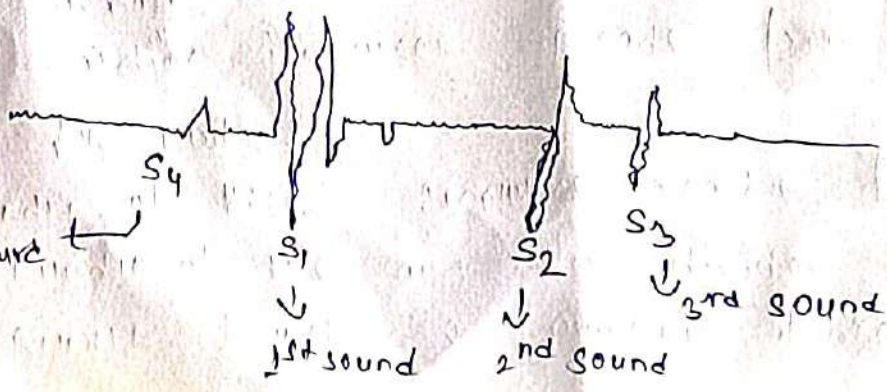
Heart sounds are the sounds produced by the heart during a cardiac cycle, specially when heart valves snap shut. 'LUB-DUB'

It can detected by stethoscope and phonocardiogram

Types of heart sound :-

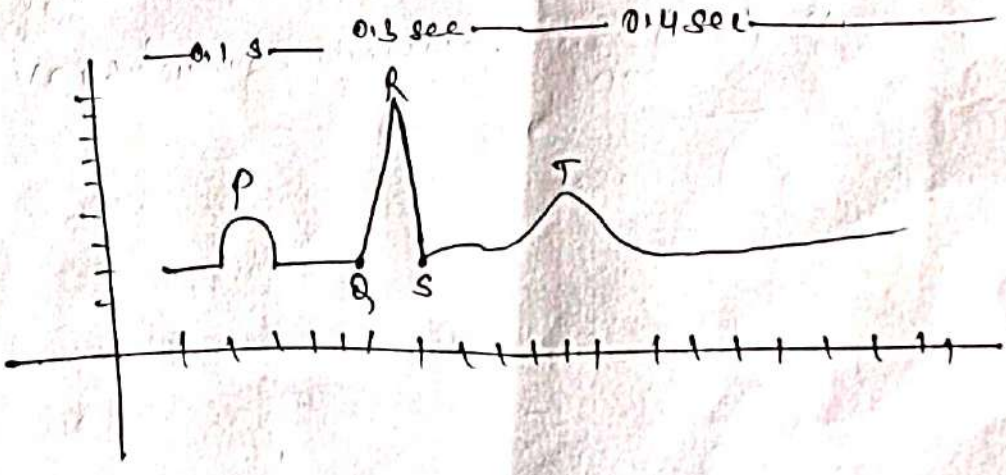
- First heart sound :-
  It is dull and prolonged as 'LUB'
  Duration :- 0.08s to 0.16 sec, average - 0.14s.
- Second heart sound :-
  It is sharp and short as 'DUB'
  Duration - 0.11s
- Third heart sound :-
  Heard occasionally and weak
  Duration - 0.04 sec
  Beings :- youth, athletes, pregnancy
- Fourth heart sound :-
  It is weak and rumbling in nature.
  cannot be heard from stethoscope but recorded on phonocardiogram.

Phonocardiogram



Electrocardiogram :—

- "conduction of action potential through electric impulse"
- An electrocardiogram is a recording of the electrical changes that occur in the myocardium during a cardiac cycle.
- Electrocardiogram shows the spread of the electrical signal generated by the SA node as it travels through the atria, the AV node and the ventricles.
- The normal ECG tracing shows five waves, which have been named P, Q, R, S and T.
- The P wave represents the impulses from the SA node sweeping over the atria (atrial depolarisation)
- The QRS complex represents the very rapid spread of impulse from the AV node through the AV bundle and the purkinje fibres, and the electrical activity of the ventricular muscle (ventricular depolarisation)
- The T wave represents the relaxation of the ventricular muscle (ventricular repolarisation).
- Normally, the heart rate falls somewhere between 60 to 90 b.p.m. A heartrate over 100 b.p.m is called tachycardia and below 60 b.p.m is bradycardia.



3) Cardiac output:- The cardiac output is the amount of blood ejected from each ventricle every minute. The amount expelled by each contraction of each ventricles is the blood volume/stroke volume.

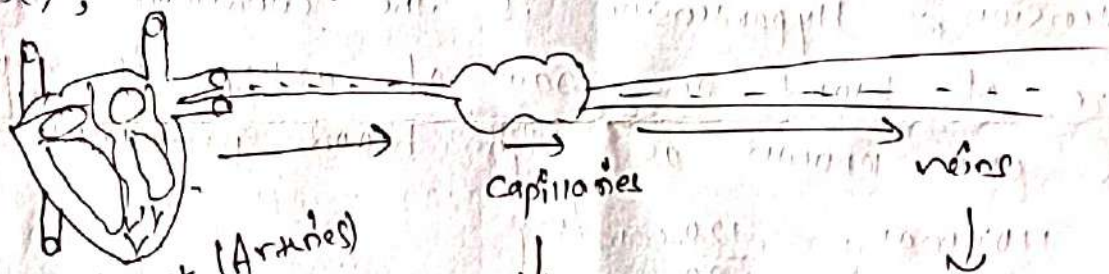
Cardiac output = stroke volume x heartrate
l/min

4) Stroke volume:- The stroke volume is determined by the volume of blood in the ventricles immediately before they contract i.e preload and preload is depend on the amount of blood returning to the ~~blood~~ heart through superior and inferior vanacava

5) Thrombosis:- Thrombosis is the formation of blood clot inside the blood vessels, interrupting blood supply to the tissues.

* Blood pressure *

- The pressure expected by blood on the wall of arteries is known as blood pressure.
  - Systolic blood pressure — ventricular contraction
  - Diastolic blood pressure — ventricles relaxation
- Normal B.P — 120/80 mm Hg
- pressure in blood vessels decreases as the distance from heart increases.
- It is essential to record both B.P's as it gives information regarding the status of working heart.
- B.P varies from physiological parameters like age, sex, exercise, posture, sleep during emotions etc



Speed - high
width - medium
pressure - high

Speed - medium
width - narrow
pressure - medium

Speed - low
width - wide
pressure - low

Factors affecting blood pressure :- (Risk factors)

- Age
- Race - (Black people)
- obesity
- Hormonal changes
- Use of Tobacco
- use of drinking alcohol
- low potassium level
- Genetic factor
- unwanted pills & pregnancy

Cardiovascular diseases

Cardiovascular diseases (CVDs) are a group of disorders of the heart and blood vessels. They include:

* Hypertension
* Hypotension
* Atherosclerosis
* Angina pectoris
* Myocardial infraction
* congestive heart failure
* cardiac arrhythmias etc.

⇒ Hypertension :- Hypertension is the condition in which pressure of blood on wall of artery is too high. It is also known as high blood pressure.

Normal — $\frac{120}{80}$ mmHg

Here, Systolic — ↑ 140 mmHg

Diastolic — ↑ = 90 mmHg

Also known as silent killer disease.

Symptoms :-

* Severe headache, Blurred vission, dizziness, nausea, vomiting, confusion, Irreguior heartbeat

Treatment / management :-

Two ways :-

- Life style modification :- Weight reduction, exercise, Stress mana-
- pharmacological therapy :- using long term anti-hypertension drugs like diuretics, etc

Hypotension :-

- Hypotension is a condition where pressure of blood on wall of arteries is low. It is also known as low blood pressure.

Normal — 120/80 mm Hg

Here, Systolic B.P — < 90 mm Hg

Diastolic B.P — < 60 mm Hg

Symptoms :-

* Chest pain, shortness of breath, Irregular heartbeat, headche, stiff neck, painful urination, Black tarry stools.

Treatment :-

* Some hypotension which is not chronic that can be treated easily with proper lifstyle modification.
* Some needs to be treated by using antihypotensive drugs - Noradrenaline etc.
* In lifestyle, Adding electrolytes to the diet, morning dose of caffeine can also help etc.

Arteriosclerosis :-

- Arteriosclerosis is also known as Arteriosclerosis vascular disease (ASVD).
- It is the condition in which an artery wall thickens as a result of a build-up of a fatty materials such as cholestrol.
- Accumulation of cholestrol leads to hardening of arteries and which restrict the blood flow. and cause blood clot.
- Artherosclerosis is preventable and treatable condition

⇒ Angina pectoris :-

Angina also known as angina pectoris is a medical condition characterised by chest pain usually left sided due to inadequate blood supply to the heart muscle due to obstruction (like presence of blood clot), Narrowing or contraction (vasospasm) of the supply coronary arteries.

⇒ Myocardial infarction :-

The myocardial infarction (MI), commonly known as a heart attack, occurs when blood flow decreases or stops to a part of heart by an embolus or thrombus.

Heart attack is the irreversible damage of myocardial tissue. ~~caused~~ Speedy restoration of blood flow through the blocked artery using clot-dissolving (thrombolytic) drugs can greatly reduced the extent of permanent damage but treatment must be started within few hours of infarction occuring.

⇒ Congestive heart failure :-

Congestive heart failure is chronic progressive condition effects pumping power of heart muscle and results in heart failure (Right ventricle)

⇒ Cardiac arrhythmias :- Abnormality of the cardiac rhythm is called a cardiac arrhythmia. It may cause sudden death, HF, etc.

bradycardia :- ≤ 60 b.p.m heart rate

tachycardia - > 100 b.p.m heart rate