Cardiovascular system consists of Heart and Vascular system. It is well organised blood transport system of body. Heart is the central pumping organ. Blood vessels that constituting vascular system are arteries, arterioles, capillaries, venules and veins.

1. **HEART**

* **1.1 Anatomical position of the heart**
* Located in the mediastinum left lateral to midsagittal plain of thorax
* **Anterolateral**: sternum and Between 2nd and 6th ribs
* **Posteriorly**: Between T5-T8 (T= Thoracic vertebrae)
* Apex beat of heart Located at the 5th intercostal space (=left ventricle)
* **Superiorly**: the superior mediastinum
* **Inferiorly:** rested on diaphragm

**1.2 histology o the heart**

**1-Pericardium** – loose fitting sac surrounding the heart lined by:

**Parietal layer:** lines the inside of the pericardium

**Visceral layer:** adheres to outside of the heart

Pericardial space: between parietal and visceral layer filled with 10-15mL of pericardial fluid to decreases friction.

**2-Wall**

I//Epicardium – an outer layer. Epicardium = visceral pericardium plus the loos connective tissue

2//Myocardium – thick, branched contractile layer of cardiac muscle cells allow heart to function as a single unit

3//Endocaridium – interior of cardiac wall composed of Endothelial tissue

**1.3. heart chambers**

Heart has four chambers. Two of them are upper chambers called atria. Lower two chambers are called ventricles. The two atria are separated by interatrial septum. The two ventricles are separated by interventricular septum.

Atria are filling chambers (or receiving chambers) and ventricles are pumping chambers. Compared to artia, ventricles are thicker and the wall of left ventricle is three times thicker than that of right ventricle since left ventricle pumps oxygenated blood to all parts of body. Right ventricle pumps deoxygenated blood to lungs only.

**1.4 Valves of Heart**

Opening between right artium and right ventricle is guarded by tricuspid valve. It prevents back entry of blood into right atrium from right ventricle at the beginning of ventricular systole. Pulmonary artery is guarded by tricuspid semilunar valve which prevents back flow into right ventricle at the begining of ventricular diastole.

Opening between left atrium and left ventricle is guarded by bicuspid or mitral valve. It prevents back entry of blood into left atrium at the beginning of ventricular systole . Aorta has tricuspid semilunar valve which prevents back flow of blood into left ventricle at the begining of ventricular diastole.

**Chordae tendinae and papillary muscles:Papillary muscles arise from ventricular walls. Chordae tendinae attach apical end of valves and papillary muscles. They prevent over distension of valves during diastole.**

**1.5 Blood Vessels attached to Heart**

Blood vessels attached to heart are

1. Superior and inferior venacavae - carrying deoxygenated blood from parts of body to right atrium.

2. Pulmonary artery carrying venous blood to lungs from right ventricle.

3. Pulmonary veins carrying oxygenated blood from lungs to the left atrium of heart.

4. Aorta carrying oxygenated blood to all parts of body from left ventricle of heart.

**Ductus arteriosus** : Ductus arteriosus is a connection between arch of aorta and pulmonary trunk. In foetal life, it bypasses pulmonary circulation. After birth, it closes, becomes obsolete and atrophies.

**Foramen ovale :** It is the opening in interatrial septum in foetal life. It avoids blood entry into lungs in foetal life. After birth, it closes and forms **septum ovale.**

**1.6 Cardiac centres**

1. Cardio inhibitory centre is dorsal motor nucleus of vagus in medulla.

2. Cardio accelerator centre is situated in lateral horn cells of upper thoracic segments of spinal cord.

**1.7 Conducting System of Heart (pulse formation and conduction system)**

System of conducting impulses of cardiac contraction formed by modified cardiac muscle fibres. It consist of

1. **SA node** : It is present at the opening of superior venacava into right atrium. It is called pacemaker of heart. It is made of modified cardiac muscle fibres.
2. **AV node:** It is present in the right atrium at the posterior part of inter atrial septum.
3. **Bunle of His :** Main trunk of bundle of His is continuous with AV node. It passes through interventricular septum.
4. **Right and left branches of bundle of His :**  Bundle of His divides into right and left branches.
5. **Purkinje fibres : T**hey arise from bundle brnaches. They Extend into the walls of the ventricles
6. **Anatomy of Vascular System**

Blood vessels constitute vascular system. There are two types of blood vessels mainly arteries and veins. Arteries subdivide into arterioles. Arterioles end in capillaries. Capillaries are single layered thin vessels. Capillaries unite to form venules. Venules unite to form veins. Arteries are the vessels carrying oxygenated blood to tissues (except pulmonary arteries). Veins are the vessels carrying dexoygenated blood (except pulmonary veins).

**2.1 Arteries of the Body**

**Aorta,** arising from left ventricle of heart is the main artery of body.It consists of three parts which are:

**1. Ascending aorta, giving off two branches**

i. Right coronary artery ii) Left coronary artery.

Coronary arteries supply blood to heart.

**2. Arch of aorta :**  Giving off three branches and supplying blood to head, neck and upper limb:

i) Innominate (brachiocephalic) artery - dividing into

a) Right Common carotid artery b) Right subclavian artery

ii) left common carotid artery

iii) left subclavian artery.

**Right and left common carotid arteries divide into**

a) Internal carotid artery b) External carotid artery on right and left sides.

**Branches of external Carotid artery**

i) Facial artery, supplying face

ii) Maxillary artery, supplying jaws

iii) Temporal artery supplying temporal parts in skull.

iv) Occipital artery supplying occipital parts in skull.

**Branches of Internal Carotid Artery**

i) Anterior cerebral artery supplying brain

ii) Middle cerebral artery supplying brain

iii) Opthalmic artery, supplying eyes.

**Circle of willis : Circle of willis is formed by cerebral arteries and branch of vertebral artery. Branch of vertebral artery is also called basilar artery.**

**Right and left subclavian arteries, their course and branches :**

- Subclavian artery after entering axilla continues as axillary artery. It becomes brachial artery below the axilla. It runs down the arm and divides into

(a) Radial artery (b) Ulnar artery

- Palmar arch is formed by union of these two arteries in the palm

- Palmar arch divides into digital arteries, which supply fingers.

**3. Descending aorta - divided into**

i) Thoracic aorta - supplying blood to wall of chest cavity and viscera

ii) Abdonminal aorta supplying wall of abdominal cavity and its viscera.

**Course of thoracic aorta:** Desencending aorta continues as thoracic aorta above diaphragm. It, then continues as abdominal aorta below diaphragm.

**Branches of abdominal aorta.** They are

(i) Coeliac plexus (ii) Mesenteric arteries iii) Renal arteries iv) Final branches

**Coeliac plexus divides into**

i) Hepatic artery - supplying liver

ii) Gastric artery - supplying stomach

iii) Splenic artery - supplying spleen.

**Mesenteric arteries are supplying small and large intestine SI,LI**

i) Superior mesenteric artery SI

ii) Inferior mesenteric artery LI

**Renal arteries** supply kidney.

**Final branches** are: i) Right common iliac artery ii) Left common iliac artery

These common iliac arteries divide into

1. Internal iliac artery - suplying pelvic organs.
2. External iliac artery which is:

* Continue in thigh as femoral artery.
* Continue in popliteal fossa as popliteal artery.
* It divides in leg into

a) Anterior tibial artery b) Posterior tibial artery

Plantar arch is formed by union of branches of anterior and posterior tibial arteries. Plantar arch divides into digital branches supplying the toes.

**1.8 Veins of the body**

All the veins of the body join superior and inferior venacavae and drain the collected blood into right atrium of heart.

**Superior venacava** : Superior venacava is formed by union of right and left brachiocephalic veins collecting blood from head, neck, upper extremities and some part of thorax.

**Inferior venacava** : Inferior venacava is formed by union of two common iliac veins collecting blood from lower extremities pelvis and abdomen. It extends upwards through abdomen and thorax and opens into right atrium.

Veins of the head, neck and upper limbs:

Ulnar vein collects from fingers through palmar arch. Radial veins collect blood from metacarpals. Radial and ulnar veins of fore arms unite in the arm forming brachial vein which continue as axillary vein in axilla and axillary vein continue as subclavian vein upward. Internal and external jugular veins drain head and neck. They join with subclavian veins forming brachiocephalic veins in each side. Left and right brachiocephalic veins unite forming superior vena cava.

Veins of abdomen and lower limbs: Popliteal vein is formed by union of anterior and posterior tibial veins of leg. It continues as femoral vein in the thigh. Femoral vein continues as external iliac vein. External iliac vein that drain the lower limbs join with internal iliac vein that drain the pelvic organs to form common iliac vein. Common iliac veins of both sides unite and form inferior vena cava.

In abdominal region, renal veins from kidneys, gonadal veins from testes or ovaries, suprarenal veins from suprarenal glands, hapatic vein from liver, lumbar veins from abdominal wall join inferior venacava while superior mesenteric, inferior mesenteric, splenic and gastric arteries form portal vein.

5.5 Types of Circulation

There are mainly two circulatory networks in the body. They are

1) Systemic circulation or greater circulation

2) Pulmonary circulation or lesser circulation

3) portal circulation

**Systemic circulation** blood flow from the Lt. ventricle through aorta (carrying oxygenated blood) to the body & back to the Rt. Atrium through superior and inferior vena cava (carrying unoxygenated blood).

**Pulmonary circulation:** blood flow from the Rt. Ventricle through pulmonary artery (carry unoxygenated blood) to the lungs and back to the Lt. Atrium through pulmonary veins (carrying oxygenated blood).

**Portal circulation :** It is the circulatory network through liver. Portal vein and hepatic artery bring blood to liver. Portal vein carries blood into liver from superior mesenteric, inferior mesenteric and splenic and gastric veins. Hepatic artery carries oxygenated blood from aorta to liver. Capillaries of portal vein join with capillaries of hepatic artery. Hepatic vein carries blood circulated in liver to right atrium of heart through inferior vena cava. This circulatory network of liver is called portal circulation.