

CARDIOVASCULAR SYSTEM (ANATOMY AND PHYSIOLOGY)

-by Newton Rain

LOCATION OF HEART

- Located in the **mediastinum, between the lungs.**
- Slightly tilted to the left, behind the sternum.
- Rests on the diaphragm.

COVERINGS OF THE HEART

Pericardium: Double-walled sac

1. Fibrous pericardium (outer): Protects & anchors heart
2. Serous pericardium (inner):
 - Parietal layer
 - Visceral layer (epicardium)

Pericardial cavity: Between layers, filled with fluid (reduces friction)

 **MCQ Point:**

✓ Pericardial fluid: prevents friction during heartbeats, and works as shock absorber.

● LAYERS OF HEART WALL

1. **Epicardium**: Outer, same as visceral pericardium
2. **Myocardium**: Middle muscular layer (**thickest**)
3. **Endocardium**: Inner smooth lining of chambers

✓ MCQ Point:

✓ **Myocardium*** is the **thickest** layer*

● EXTERNAL ANATOMY

- 4 chambers: 2 atria (upper), 2 ventricles (lower)
- Auricles: Ear-like extensions of atria
- Sulci (grooves):

Coronary sulcus: separates atria & ventricles

Interventricular sulcus: separates right & left ventricles

● INTERNAL ANATOMY

✓ Chambers:

Right atrium: Receives blood from body via SVC (Superior Vena Cava), IVC (Inferior Vena Cava), coronary sinus

Right ventricle: Pumps blood to lungs via pulmonary artery

Left atrium: Receives blood from lungs via pulmonary veins

Left ventricle: Pumps blood to body via aorta

✓ **MCQ Points:**

✓ **Left ventricle = Thickest chamber** (Because it has to pump blood to whole body and so it needs to contract with more force and hence it is thickest)

✓ **Right atrium receives 3 vessels:** SVC, IVC, coronary sinus

✓ **Valves:**

- **Atrioventricular (AV) valves:**

1. **Tricuspid** (Right AV) [t**RI**- **RI**ght]

2. **Bicuspid / Mitral** (Left AV)

- **Semilunar valves:**

1. **Pulmonary valve** (Right ventricle → pulmonary artery)

2. **Aortic valve** (Left ventricle → aorta)

✓ MCQ Point:

✓ **M**itral valve = Left AV valve = **B**icuspid * **(Mi-Bi)**

🌀 CARDIAC IMPULSE CONDUCTION SYSTEM

CONDUCTION PATHWAY OF CARDIAC IMPULSE:

SA Node (Sinoatrial node) — known as Primary pacemaker



AV Node (Atrioventricular node) — known as **Pace Setter**



Bundle of His



Right & Left Bundle Branches



Purkinje Fibers — spread impulse in ventricles

##**MNEMONICS**: [**SA-Ave His Purks**] =

SA NODE → **AV** NODE → bundle of **HIS** → **PURK**inje fibres

✓ MCQ Points:

✓ SA node = natural pacemaker

✓ Impulse delay occurs at AV node

✓ AV node is called **reserve pacemaker** because if SA node fails to work then AV node works as primary pacemaker*

● NERVE SUPPLY OF HEART

Controlled by Autonomic Nervous System (ANS)

- Sympathetic nerves → Increase heart rate & force
- Parasympathetic (Vagus nerve) → Decrease heart rate

✓ MCQ Point:

✓ Vagus nerve (CN X) slows heart

● HEART RATE

Normal: 72 bpm

Tachycardia: >100 bpm

Bradycardia: <60 bpm

##MNEMONICS: [Dy—De] = bra**DY**cardia—**De**crease heart rate

✓ MCQ Point:

✓ Normal heart rate = **72 bpm**

🌀 BLOOD PRESSURE

Force exerted by blood on artery walls

Measured in mm Hg:

- **Systolic: ~120 mm Hg**
- **Diastolic: ~80 mm Hg**

Hypertension: BP > 140/90 mm Hg

Hypotension: BP < 90/60 mm Hg

- BP is measured from **brachial artery of hand**
- Measured using **sphygmomanometer** and **stethoscope**

✓ MCQ Points:

✓ Normal BP = **120/80 mm Hg**

✓ Hypertension = **>140/90 mm Hg**

- ✓ Hypotension = <90/60 mm Hg
- ✓ Brachial artery used to measure BP
- ✓ Sphygmomanometer + Stethoscope used

HEART SOUNDS

- **S1 (Lub):** Closure of AV valves — beginning of ventricular systole
- **S2 (Dub):** Closure of semilunar valves — beginning of diastole
- S3: Occurs during rapid ventricular filling (may be normal in children)
- S4: Atrial contraction against stiff ventricle (usually abnormal)

Murmur: Abnormal sound due to valve defects

- ✓ MCQ Point:
- ✓ S1 = AV valve closure, S2 = semilunar valve closure
- ✓ S3 and S4 abnormal in adults
- ✓ Murmur = abnormal heart sound

ECG (ELECTROCARDIOGRAM)

ECG: Graphical recording of electrical activity of the heart

Components: **P** wave, **QRS** complex, **T** wave

 MCQ Point:

 ECG = Electrocardiogram

CARDIAC CYCLE

Complete heartbeat: One contraction & one relaxation

Duration: 0.8 sec

- Atrial systole: 0.1 sec
- Atrial diastole: 0.7 sec
- Ventricular systole: 0.3 sec
- Ventricular diastole: 0.5 sec

 MCQ Point:

 Duration of cardiac cycle = 0.8 sec

DIFFERENCES BETWEEN ARTERIES AND VEINS

Features

Arteries

Veins

Wall thickness-> **Thick** Thin

Lumen size-> Narrow **Wide**

Pressure -> High. Low

Direction of blood flow:

- **In arteries:** Away from heart
- **In veins:** Toward heart

✓ MCQ Point:

✓ **Valves are present in Veins, absent in arteries**
(except pulmonary artery)

##MNEMONICS—V for Veins and Valves

ARTERIAL SYSTEM

Aortic arch gives:

- **Brachiocephalic artery** → right subclavian + right common carotid
- **Left common carotid artery** → head and brain
- **Left subclavian artery** → upper limb

Thoracic aorta → bronchial, esophageal, mediastinal branches

Abdominal aorta:

Celiac trunk → liver, stomach, spleen

Superior mesenteric → small intestine, pancreas

Renal arteries → kidneys

Inferior mesenteric → large intestine

Common iliac arteries → pelvic organs & lower limbs

 **MCQ Point:**

 Abdominal aorta gives renal arteries to kidneys

VENOUS SYSTEM

SVC (Superior Vena Cava): From head, neck, upper limbs

IVC (Inferior Vena Cava): From abdomen, pelvis, lower limbs

Jugular veins: Drain head and brain

Subclavian veins: Drain upper limbs

Hepatic vein: From liver

Renal vein: From kidneys

✓ MCQ Point:

✓ SVC drains blood from upper body, IVC from lower body

● LYMPHATIC SYSTEM

Network of vessels returning interstitial fluid to blood

Lymph = clear fluid containing WBCs

Functions:

- Drains excess fluid
- Absorbs fats from intestines
- Immune defense

✓ Lymph Organs:

Lymph nodes, Spleen, Thymus, Tonsils

✓ MCQ Point:

✓ Spleen = largest lymphatic organ

● PORTAL SYSTEM

Definition: A vein that starts and ends in capillaries

Hepatic portal system: GI tract → liver → IVC

Others: Hypophyseal portal system (hypothalamus → pituitary)

 **MCQ Point:**

 Hepatic portal vein carries nutrient-rich blood from GI tract to liver

DOUBLE CIRCULATION

Pulmonary circulation: Heart → lungs → heart

Systemic circulation: Heart → body → heart

 **MCQ Point:**

 Double circulation = pulmonary + systemic circulation