

INTERNATIONAL SURGICAL
ANATOMY TEACHING
SERIES



ISATS HANDOUT 2026/27

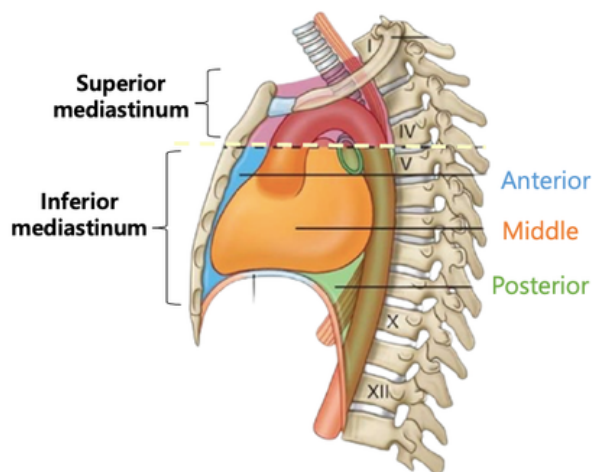
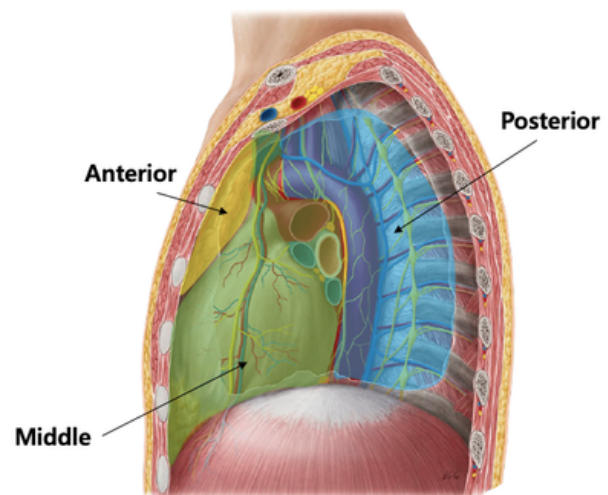
Cardiac Anatomy

CARDIAC ANATOMY

Objectives: Understand the anatomy of the mediastinum and pericardium. Understand and recall the detailed anatomy of the cardiac chambers, cardiac valves, coronary arteries and cardiac conduction system and their importance in CABG, valve repair and cardiac transplant procedures.

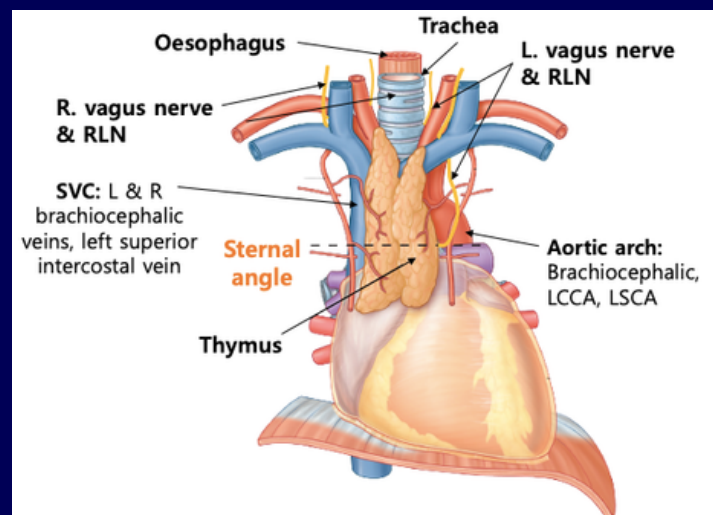
Mediastinum

- **Mediastinum** – central partition separating pleural cavities laterally.
 - **Superior mediastinum** = thoracic inlet (superior thoracic aperture) to sternal angle
 - **Inferior** = sternal angle to diaphragm
 - Anterior
 - Middle
 - Posterior mediastinum.
- **Sternal Angle of Louis (T4/T5 IV disc):**
 - 2nd costal cartilage
 - Arch of aorta
 - Trachea bifurcation into main bronchi
 - Pulmonary trunk bifurcation
 - **Other:** left recurrent laryngeal nerve, ligament arteriosum, azygous system and thoracic duct



Contents of the superior mediastinum

- Left and right vagus nerve + recurrent laryngeal nerve
- SVC – right + left brachiocephalic veins
- Aortic arch
- Thymus
- Trachea + oesophagus
- **Other contents:**
 - Phrenic nerve
 - Thoracic duct
 - Small nerves, blood vessels & lymphatics



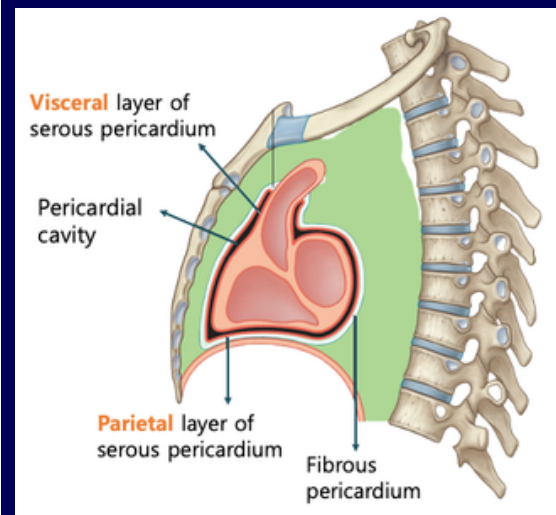
CARDIAC ANATOMY

Objectives: Understand the anatomy of the mediastinum and pericardium. Understand and recall the detailed anatomy of the cardiac chambers, cardiac valves, coronary arteries and cardiac conduction system and their importance in CABG, valve repair and cardiac transplant procedures.

Pericardium

Fibrous Pericardium	Serous Pericardium
<ul style="list-style-type: none"> • Parietal – lines inner surface of fibrous pericardium • Base fuses with central tendon of the diaphragm to form the pericardiophrenic ligament • Arterial supply: pericardiophrenic artery • Venous drainage: pericardiophrenic vein • Innervation: somatic innervation via phrenic nerves 	<ul style="list-style-type: none"> • Visceral – adheres to heart (epicardium) • Arterial supply: internal thoracic artery + coronary arteries • Venous drainage: pericardiophrenic vein + azygous venous system • Innervation: <ul style="list-style-type: none"> ◦ Parietal = somatic innervation via phrenic nerves ◦ Visceral = autonomic innervation via vagus nerve and sympathetic trunk

Pericardial Layers

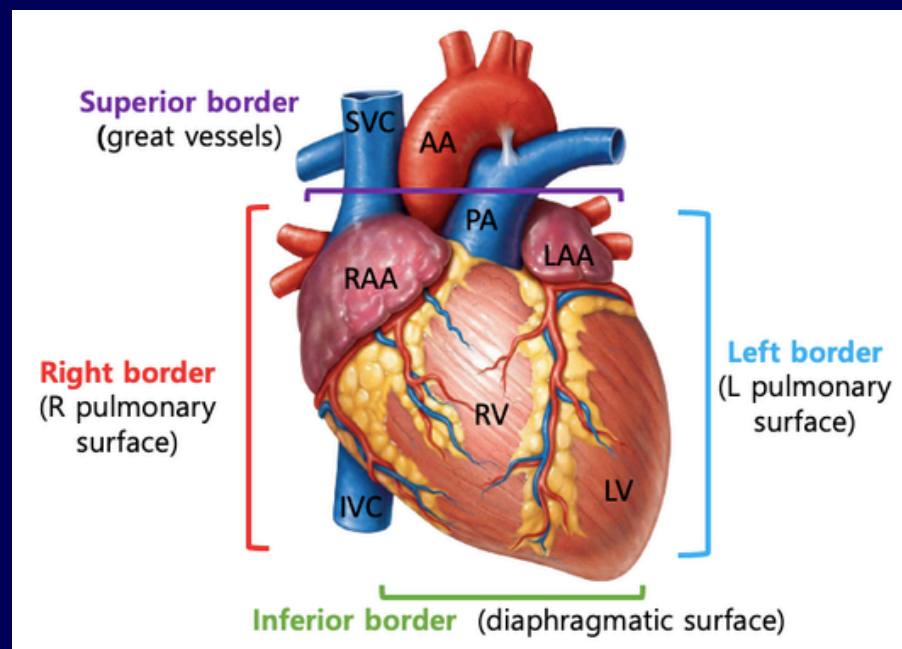


Cardiac Orientation

- Normal orientation: levocardia + leftward orientated apex
- Long-axis of heart: oblique
- Posterior surface: base (LA)
- Anterior surface: sternocostal surface (RA & RV)
- **General rule**
 - Right chambers = anterior
 - Left chambers = posterior

Diaphragmatic Openings

1. **T8** – Caval Hiatus – IVC
2. **T10** – Oeseophageal hiatus – oeseophagus
3. **T12** – Aortic hiatus – Abdominal aorta



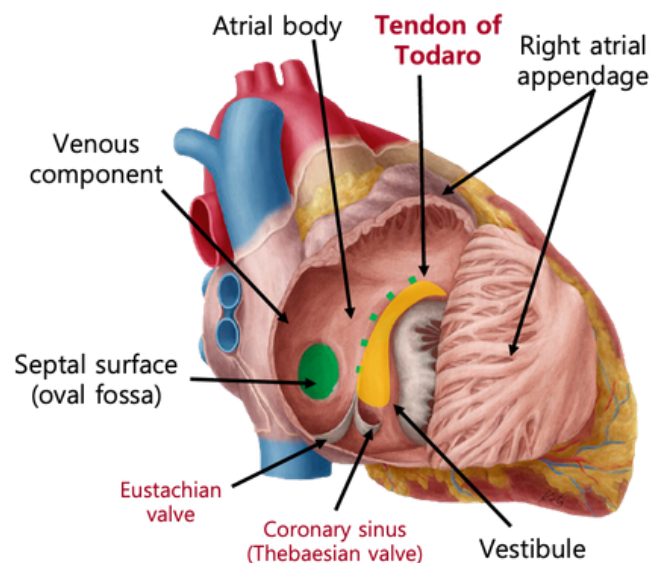
CARDIAC ANATOMY

Objectives: Understand the anatomy of the mediastinum and pericardium. Understand and recall the detailed anatomy of the cardiac chambers, cardiac valves, coronary arteries and cardiac conduction system and their importance in CABG, valve repair and cardiac transplant procedures.

Right Cardiac Chambers

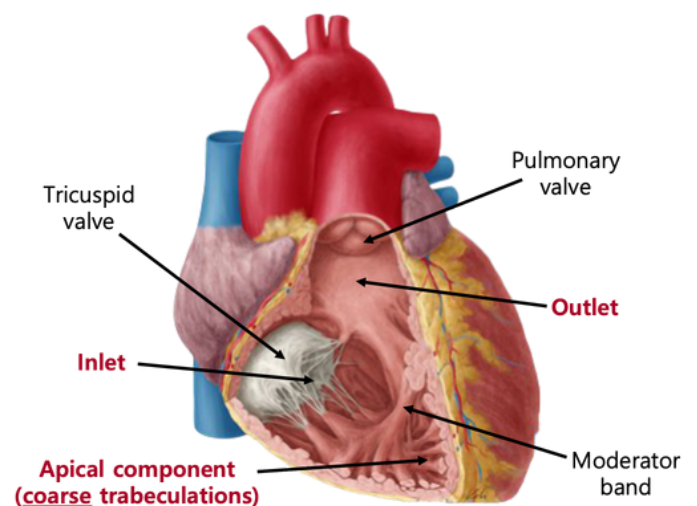
Right Atrium

- Receives systemic venous return from IVC, SVC and coronary sinus
- 5 components
 - Venous component
 - Septal surface (floor of oval fossa)
 - Atrial body
 - Tricuspid vestibule – inserts into leaflets of tricuspid valve
 - Right atrial appendage – **broad based and triangular**



Right Ventricle

1. **Inlet component:** support leaflets of tricuspid valve & attachment of valvular tension apparatus
2. **Apical component:** coarse muscular trabeculations
3. **Outlet component:** smooth walled with free standing muscular sleeve or infundibulum.

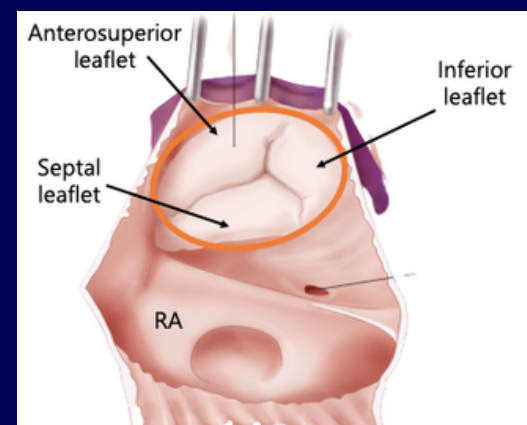


Tricuspid Valve

- Leaflets: anterosuperior, septal & inferior leaflets
- Annulus (fibrous ring)
- 3 papillary muscles – inferior, anterior (largest) and medial (muscle of Lancisi)
- Septophilic – chordal attachments to ventricular septum

Pulmonary Valve

- 3 semilunar shaped valves: anterior, left and right
- Zone of apposition – leaflets touch when valve closed



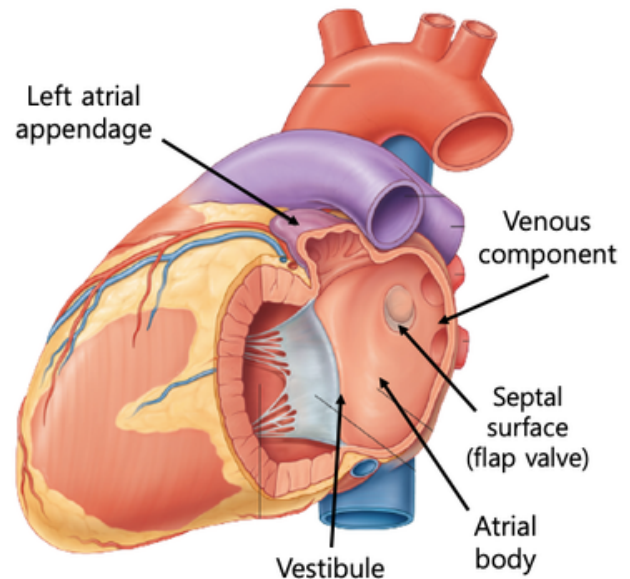
CARDIAC ANATOMY

Objectives: Understand the anatomy of the mediastinum and pericardium. Understand and recall the detailed anatomy of the cardiac chambers, cardiac valves, coronary arteries and cardiac conduction system and their importance in CABG, valve repair and cardiac transplant procedures.

Left Cardiac Chambers

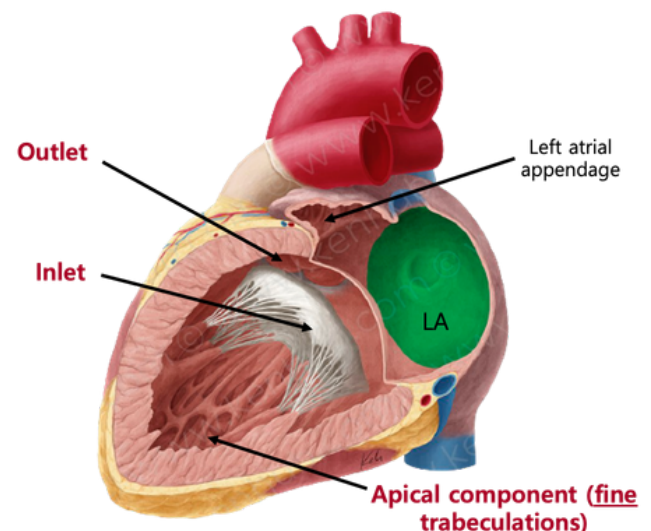
Left Atrium

- Receives oxygenated blood from pulmonary veins
- 5 components
 - Venous component
 - Septal surface (flap valve of oval fossa)
 - Atrial body (larger than right atrium)
 - Mitral vestibule – inserts into leaflets of mitral valve
 - Left atrial appendage – **narrow and tubular**



Left Ventricle

1. **Inlet component:** support leaflets of mitral valve & attachment of valvular tension apparatus
2. **Apical component:** fine criss-cross muscular trabeculations, smooth septal surface
3. **Outlet component:** supports aortic valve leaflets.

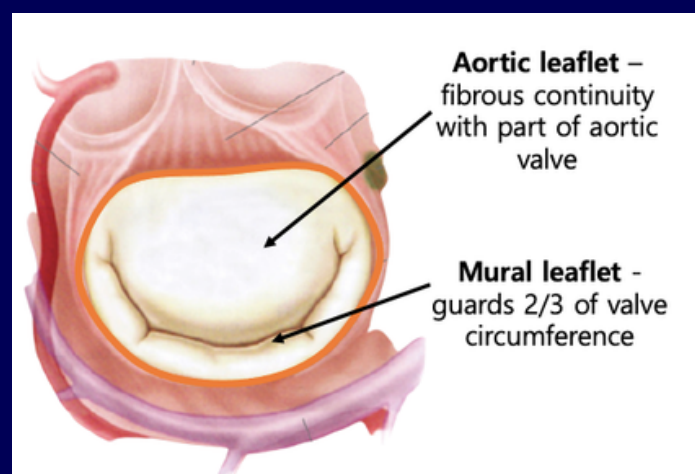


Mitral Valve

- Leaflets: mural & aortic leaflets
- Annulus (fibrous ring)
- 2 papillary muscles – inferopetal & superolateral
- Septophobic – no septal attachments

Aortic Valve

- 3 semilunar shaped valves: left coronary, right coronary, non-coronary.
- Aortic sinuses of Valsava – sinuses give rise to coronary arteries.



CARDIAC ANATOMY

Objectives: Understand the anatomy of the mediastinum and pericardium. Understand and recall the detailed anatomy of the cardiac chambers, cardiac valves, coronary arteries and cardiac conduction system and their importance in CABG, valve repair and cardiac transplant procedures.

Conduction System

SAN node – within terminal groove

Atrioventricular Node – lies within triangle of Koch → AV septum

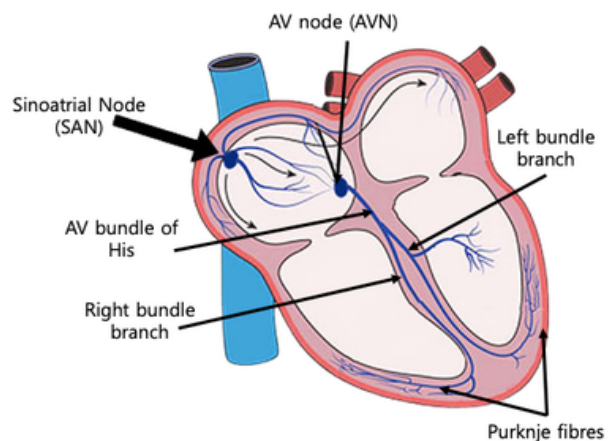
AV bundle (Bundle of His) – penetrates membranous IV septum

Left bundle branch – left side of IV septum towards apex

Right bundle branch – right side of IV septum

Purkinje fibres

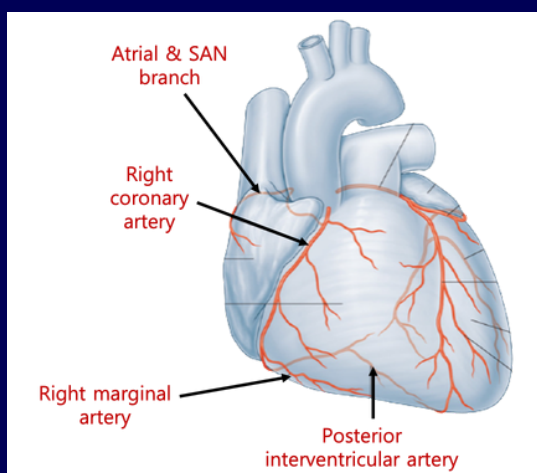
- Cardiac fibrous skeleton – dense, fibrous connective tissue (electrical insulation)



Coronary Arteries

RIGHT CORONARY ARTERY

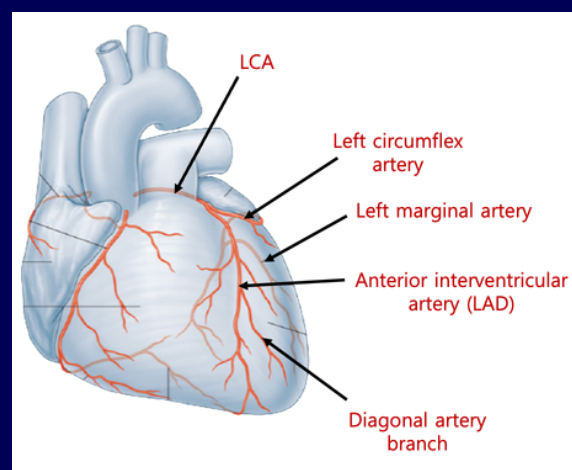
1. Atrial branch – SAN branch
2. Right marginal (acute) artery
3. AV nodal branch
4. Posterior interventricular artery



Right coronary artery = RA, RV, SAN, AVN, inter-atrial septum, portion of LA + posterior portion LV

LEFT CORONARY ARTERY

1. Left anterior descending (LAD) or anterior interventricular artery
 - Diagonal → septal perforating branches
2. Circumflex artery
 - Left marginal (obtuse) artery



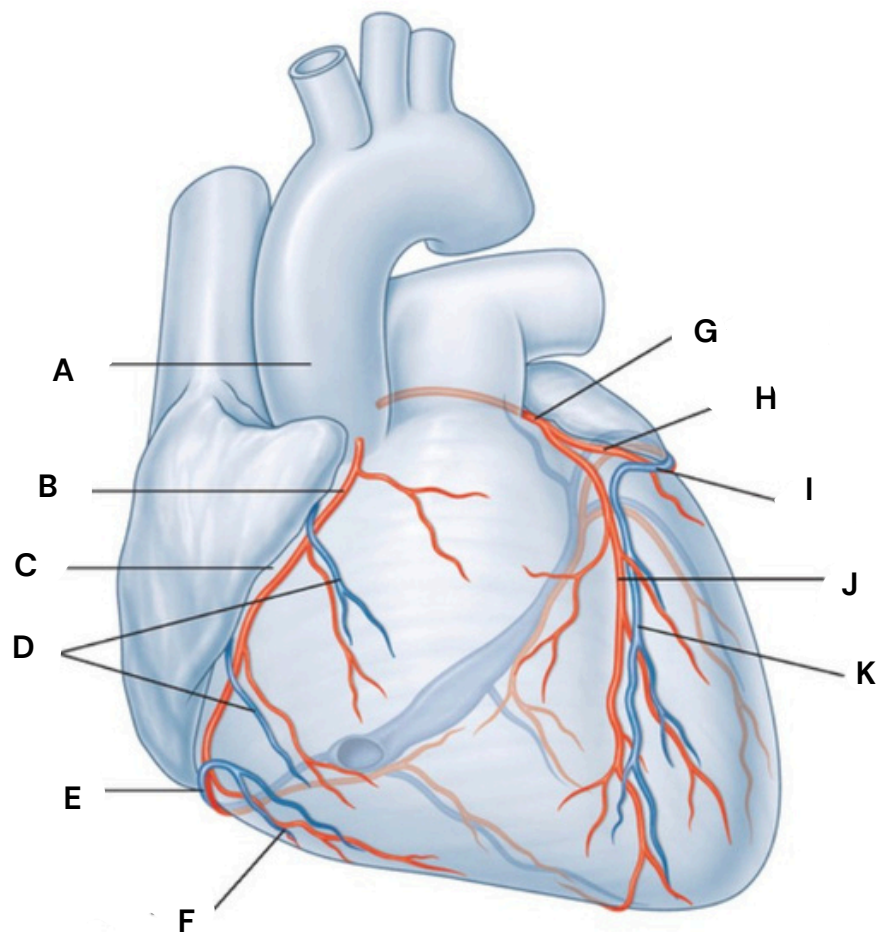
Left coronary artery = LA, LV, most of interventricular septum and AV bundles.

CARDIAC ANATOMY

Test yourself

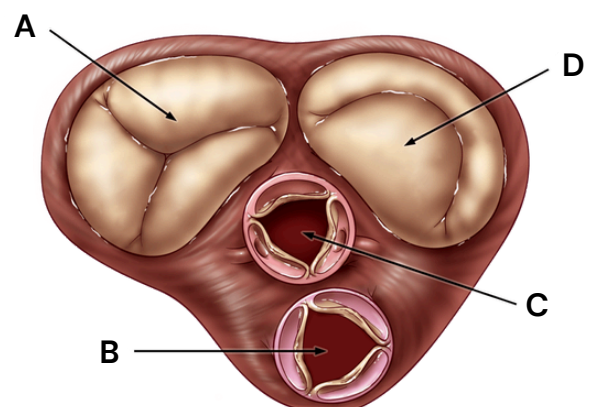
1) Name all the labelled arteries and veins of the heart...

- A)
- B)
- C)
- D)
- E)
- F)
- G)
- H)
- I)
- J)
- K)



2) Label the valves of the heart and the names of the leaflets/cusps

- A)
- B)
- C)
- D)



CARDIAC ANATOMY

Test yourself

MCQ 1

Which of the following structures is located at the T4/T5 vertebral level (sternal angle)?

- A. Inferior Vena Cava
- B. Oesophageal hiatus
- C. Bifurcation of the trachea
- D. Aortic Hiatus
- E. Diaphragm

MCQ 2

A patient develops pericardial pain following cardiac surgery. Which nerve is responsible for the somatic sensory innervation of the parietal pericardium?

- A. Vagus nerve
- B. Sympathetic trunk
- C. Recurrent laryngeal nerve
- D. Phrenic nerve
- E. Intercostal nerve

MCQ 3

A patient is undergoing mitral valve repair. How many leaflets and papillary muscles are associated with the mitral valve?

- A. 3 leaflets and 3 papillary muscles
- B. 2 leaflets and 2 papillary muscles
- C. 3 leaflets and 2 papillary muscles
- D. 2 leaflets and 3 papillary muscles
- E. 2 leaflets with septal papillary muscle attachment

MCQ 4

A 60 year old patient develops an abnormal cardiac rhythm due to dysfunction of the sinoatrial node. Which coronary artery most commonly supplies the SA node?

- A. Right coronary artery
- B. Circumflex artery
- C. Right marginal artery
- D. Left anterior descending artery
- E. Left marginal artery

MCQ 5

A patient develops complete heart block following an inferior myocardial infarction. Angiography shows occlusion of the artery supplying the AV nodal branch. Which vessel is most likely occluded?

- A. Left anterior descending
- B. Right coronary artery
- C. Left marginal artery
- D. Circumflex artery
- E. Posterior interventricular artery

MCQ 6

Which heart valve is most commonly affected in rheumatic fever secondary to Group A strep infection?

- A. Aortic valve
- B. Pulmonary valve
- C. Mitral valve
- D. Tricuspid valve
- E. All equally

CARDIAC ANATOMY

Test yourself

OSCE Station – Case Based Discussion

A 34-year-old woman presents with progressive exertional dyspnoea, fatigue and reduced exercise tolerance. Over the past few months, she has also noticed occasional palpitations.

She grew up in a rural area and recalls several episodes of severe sore throat associated with fever and migratory joint pains during childhood.

Observations:

BP 115/75 mmHg

HR 88 bpm, irregularly irregular

SpO₂ 96% on room air

On examination, the apex beat is tapping and non-displaced. On auscultation, there is a loud S1 followed by an opening snap and a low-pitched, rumbling mid-diastolic murmur, heard most clearly at the apex with the patient in the left lateral position.

ECG demonstrates atrial fibrillation with a controlled ventricular response.



Q1. What is the most likely diagnosis and what features in the history and examination support your diagnosis?

Q2. Which diagnostic imaging modality are essential to confirm the diagnosis and assess valve area?

Q3. What complications can develop as mitral stenosis progresses?

Q4. How is atrial fibrillation associated with mitral stenosis, and why is it clinically significant?

Q5. What is the most appropriate anticoagulation for this patient?

Answers
 Labelling: 1) A – Ascending Aorta, B – Right Coronary Artery, C – Coronary Sulcus, D – Anterior Cardiac Veins, E – Small Cardiac Vein, F – Marginal Vessels, G – Left Coronary Artery, H – Circumflex Branch of Left Coronary Artery, I – Great Cardiac Vein, J – Left Anterior Descending Artery, K – Anterior Interventricular Artery.
 2) A – Tricuspid Valve, B – Pulmonary Valve, C – Aortic Valve, D – Mitral Valve
 MCQs: 1) C, 2) D, 3) B, 4) A, 5) B, 6) D
 OSCEs: 1) Rheumatic mitral stenosis. This is suggested by progressive exertional dyspnoea, fatigue, reduced exercise tolerance, previous history of atrial fibrillation and a history suggestive of acute rheumatic fever (sore throat, fever and migratory polyarthritides). Examination findings of a tapping apex beat, loud S1, opening snap and low-pitched, rumbling mid-diastolic murmur best heard at the apex in the left lateral position further support the diagnosis. 2) Transcatheter Aortic Valve Replacement (TAVR) with Doppler colour flow mapping. 3) Complications include left atrial enlargement, atrial fibrillation, left atrial thrombus formation and systemic thromboembolism (including stroke). 4) Progressive elevation of left atrial pressure can cause pulmonary hypertension, pulmonary oedema, right ventricular failure and functional tricuspid regurgitation. 5) Atrial fibrillation is a common complication of mitral stenosis, resulting from increased left atrial pressure and enlargement. It increases the risk of left atrial thrombus formation and thromboembolic stroke due to blood stasis. Loss of atrial contraction also impairs ventricular filling, worsening dyspnoea and exercise tolerance. 6) Warfarin is recommended for patients with rheumatic mitral stenosis and atrial fibrillation. DOACs should be avoided in patients with a mitral valve area ≤ 2.0 cm² due to evidence of poorer outcomes compared with Vitamin K antagonists.