

INTERNATIONAL SURGICAL
ANATOMY TEACHING
SERIES



ISATS HANDOUT 2025/26

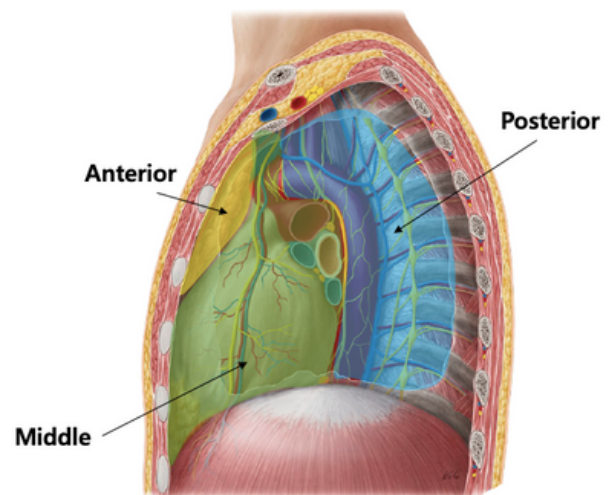
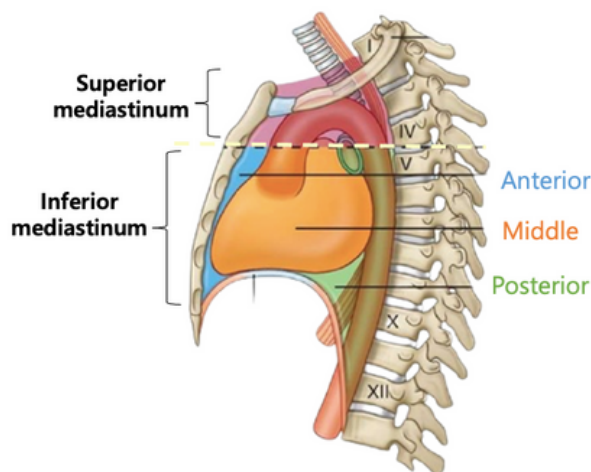
Cardiac Anatomy

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.

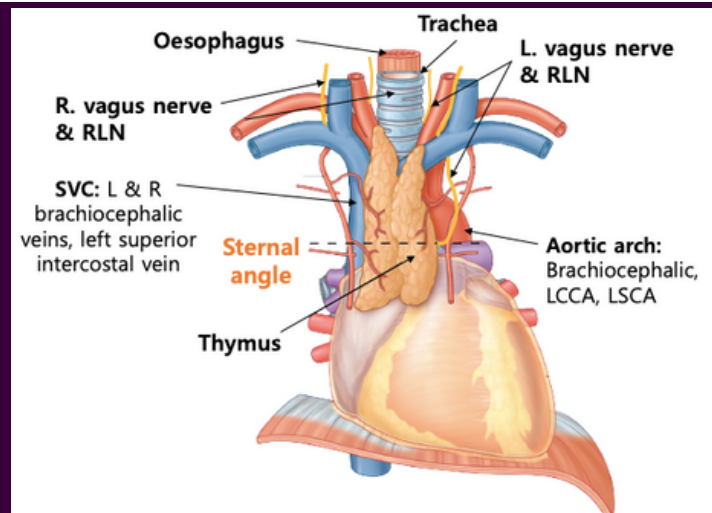
Mediastinum

- **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



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Pericardium

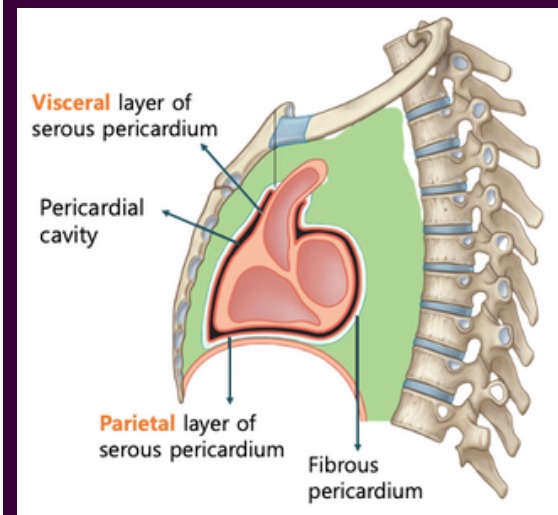
Fibrous Pericardium

- **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

Serous Pericardium

- **Visceral** – adheres to heart (epicardium)
- **Arterial supply:** internal thoracic artery + coronary arteries
- **Venous drainage:** pericardiophrenic vein + azygous venous system
- **Innervation:**
 - Parietal = somatic innervation via phrenic nerves
 - Visceral = autonomic innervation via vagus nerve and sympathetic trunk

Pericardial Layers

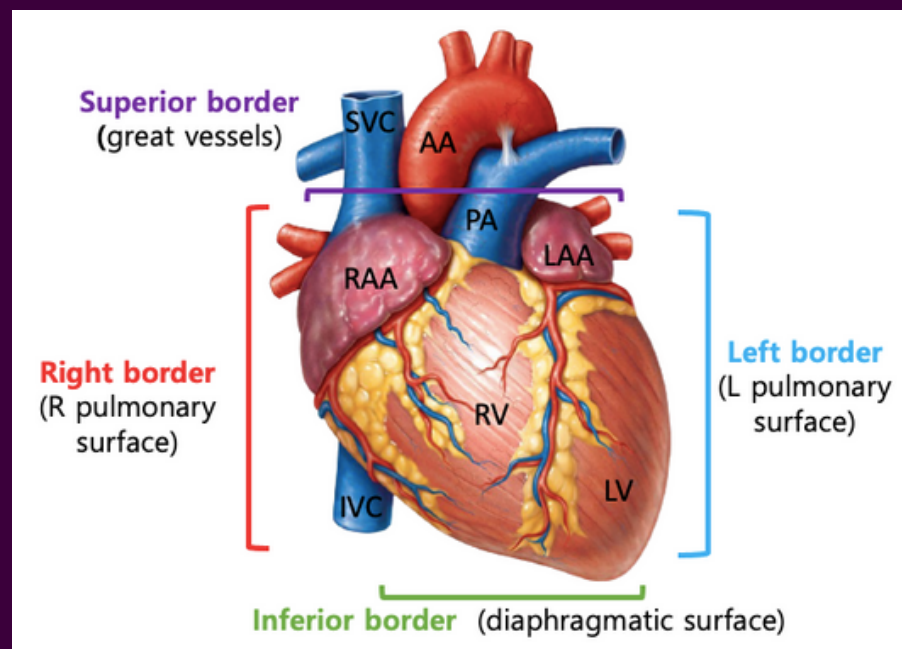


Cardiac Orientation

- 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



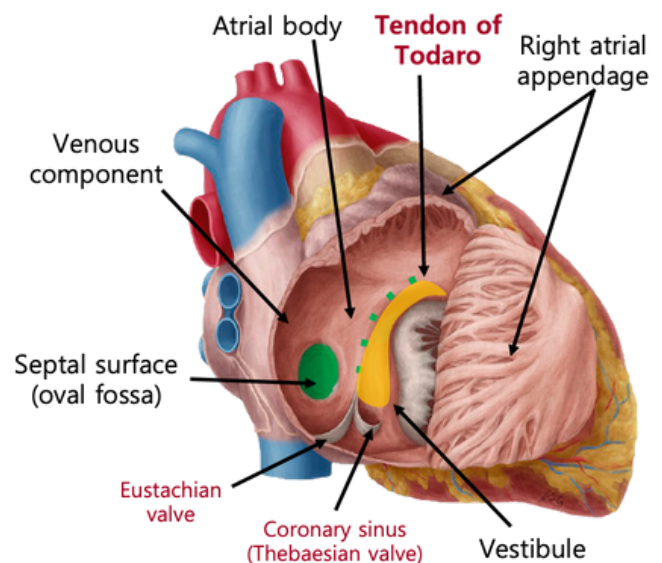
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Right Cardiac Chambers

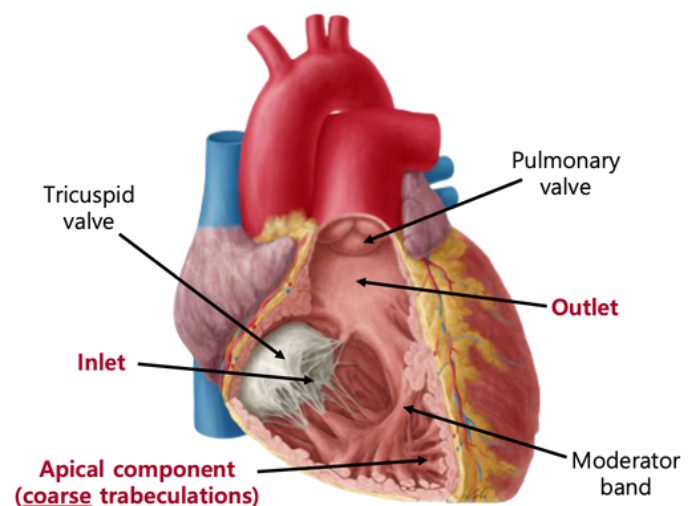
Right Atrium

- 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.

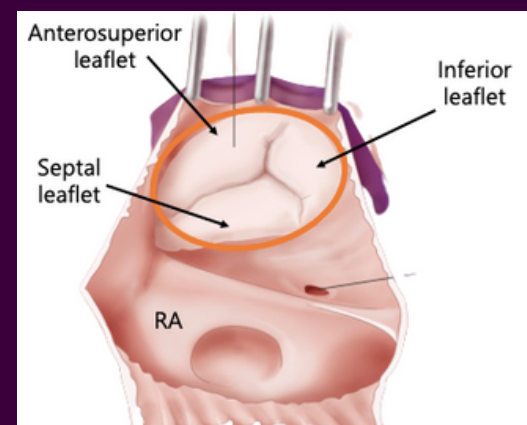


Tricuspid Valve

- 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



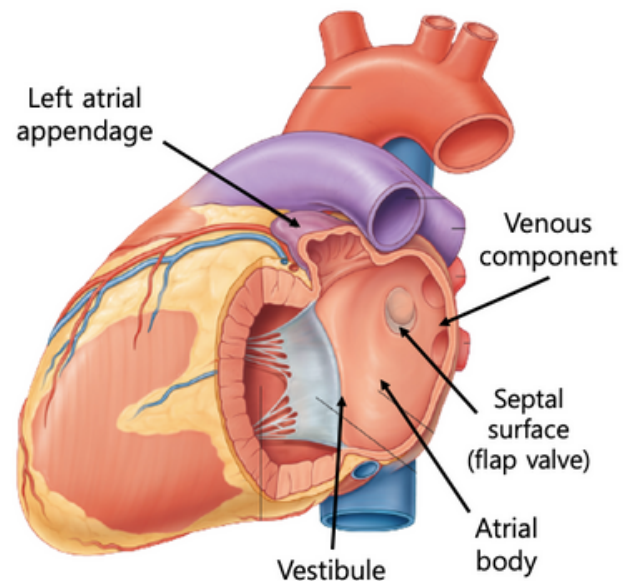
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Left Cardiac Chambers

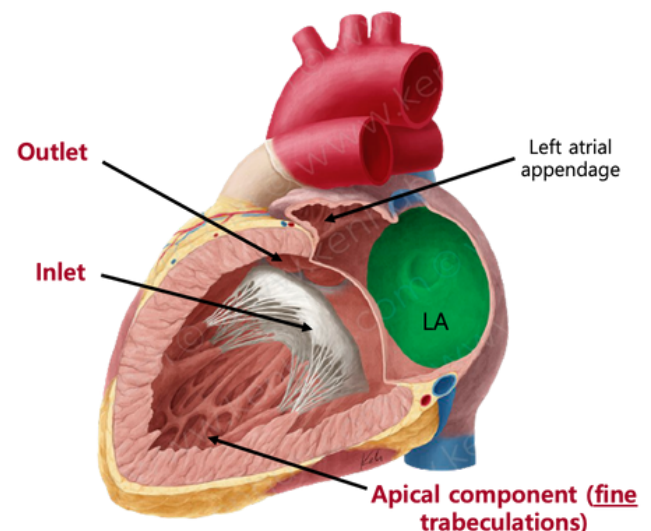
Left Atrium

- 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.

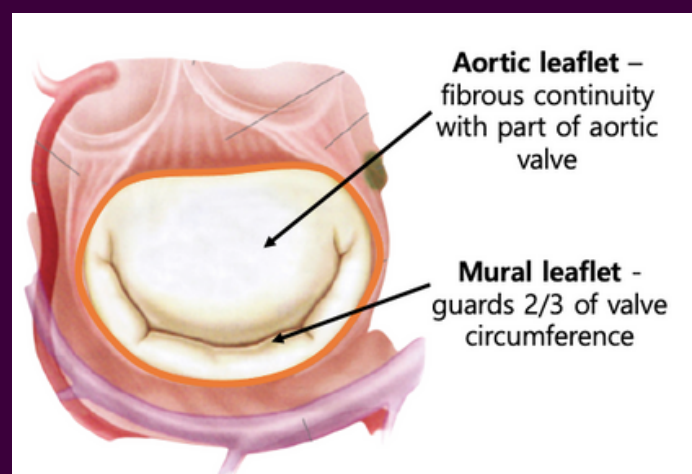


Mitral Valve

- 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.



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Conduction System

SAN node – within terminal groove

Atrioventricular Node – lies within triangle of Koch → AV septum

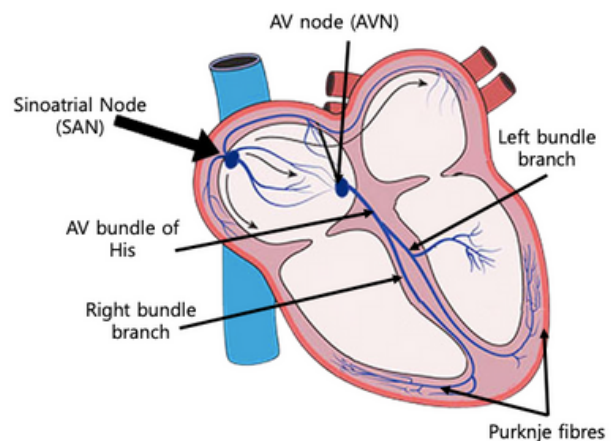
AV bundle (Bundle of His) – penetrates membranous IV septum

Left bundle branch – left side of IV septum towards apex

Right bundle branch – right side of IV septum

Purkinje fibres

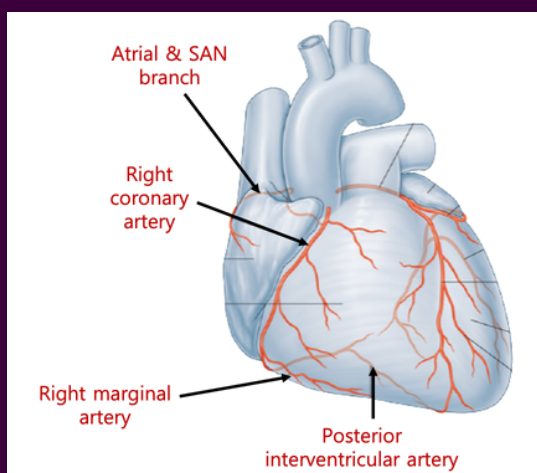
- Cardiac fibrous skeleton – dense, fibrous connective tissue (electrical insulation)



Coronary Arteries

RIGHT CORONARY ARTERY

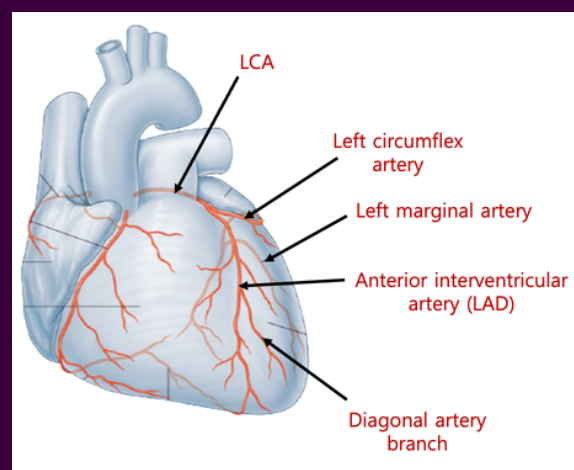
1. Atrial branch – SAN branch
2. Right marginal (acute) artery
3. AV nodal branch
4. Posterior interventricular artery



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

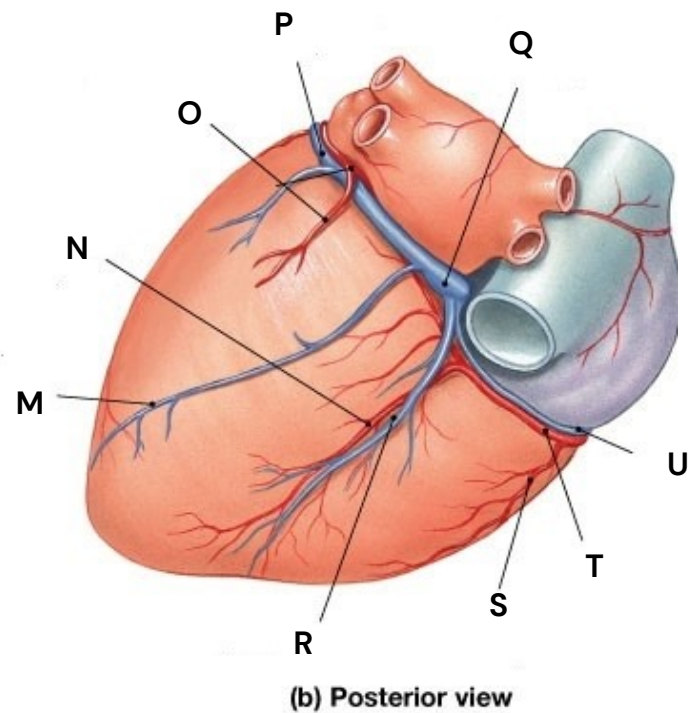
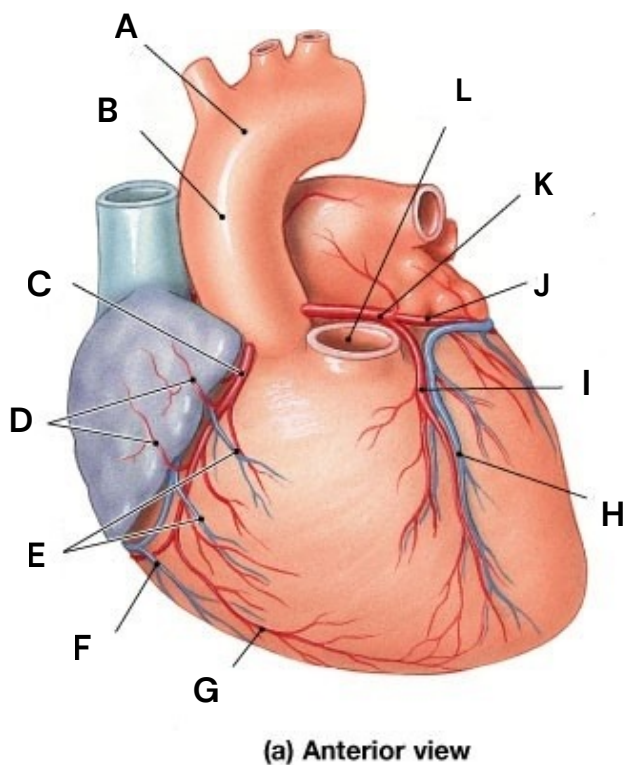


Left coronary artery = LA, LV, most of interventricular septum and AV bundles.

CARDIAC ANATOMY

Test yourself

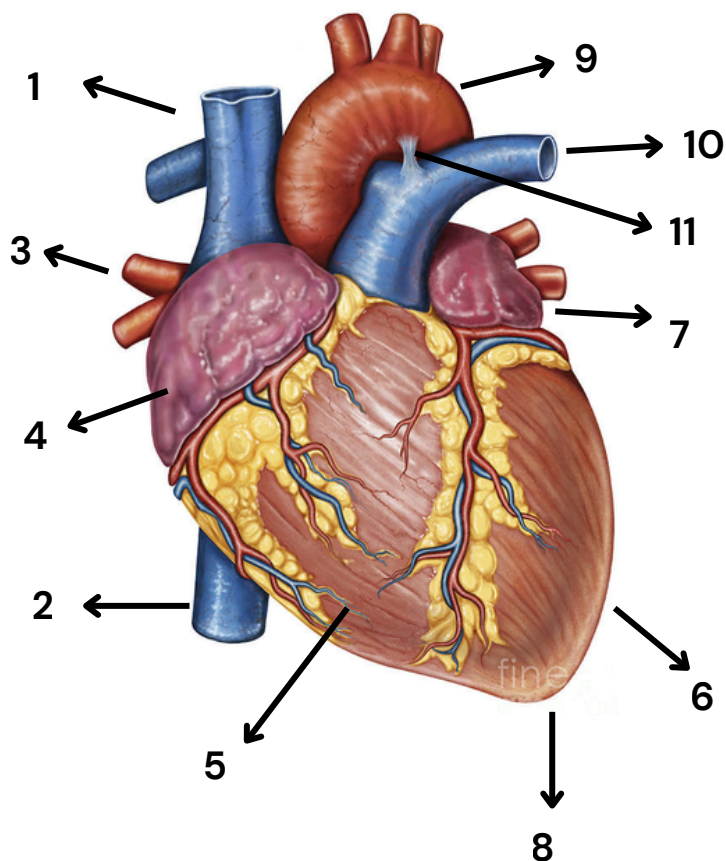
1) Name all the labelled arteries and veins of the heart...



CARDIAC ANATOMY

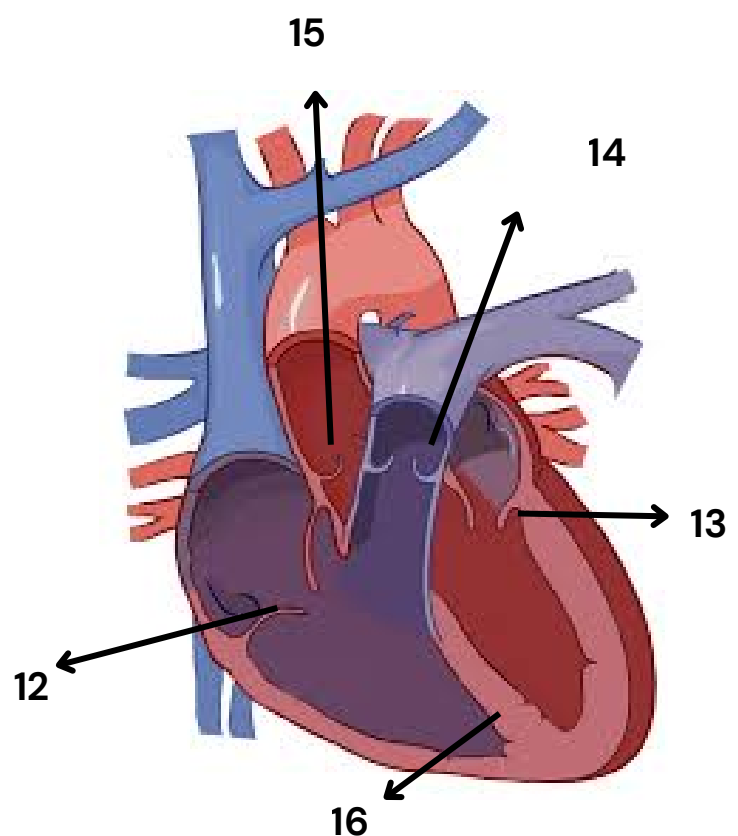
Test yourself

2) Label the structures on the external and internal surface of the heart...



- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.

- 12.
- 13.
- 14.
- 15.
- 16.



CARDIAC ANATOMY

Test yourself

MCQ 1

Which chamber of the heart forms the apex beat felt in the 5th intercostal space, midclavicular line?

- A. Right ventricle
- B. Left ventricle
- C. Right atrium
- D. Left atrium
- E. Coronary sinus

MCQ 2

What is the most common arterial supply to the sinoatrial (SA) node?

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

MCQ 3

The coronary sinus drains directly into which cardiac chamber?

- A. Left atrium
- B. Right atrium
- C. Right ventricle
- D. Left ventricle
- E. Pulmonary artery

MCQ 4

A 58-year-old man presents with sudden tearing chest pain radiating to the back. Which of the following is the most important differential diagnosis to exclude apart from aortic dissection?

- A. Acute pericarditis
- B. Myocardial infarction
- C. Pulmonary embolism
- D. Pneumothorax
- E. Esophageal rupture

MCQ 5

A 65-year-old man presents with chest pain. His ECG shows ST elevation in leads V1–V4. Which of the following complications is most likely to develop following this type of myocardial infarction?

- A. Papillary muscle rupture
- B. Ventricular septal rupture
- C. Left ventricular free wall rupture
- D. Right ventricular infarction
- E. Atrial fibrillation

MCQ 6

Which heart valve is most commonly affected in infective endocarditis in intravenous drug users?

- 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 70-year-old man, 3 days after an anterior STEMI treated with thrombolysis, suddenly develops severe dyspnoea and chest pain.

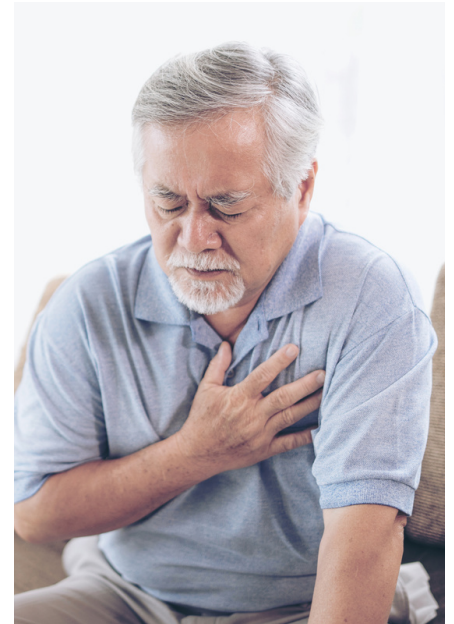
His observations are:

BP 85/55 mmHg, HR 120 bpm, O₂ sats 90% on oxygen.

On examination, he has elevated JVP, is breathless with bibasal fine inspiratory crackles, and has a new harsh pansystolic murmur at the left sternal edge with a palpable thrill.

His ECG showed sinus tachycardia and persistent anterior ST elevation.

Chest X-ray: Bilateral alveolar shadowing consistent with pulmonary oedema.



Q1. What is the most likely diagnosis?

Q2. What is the key differential diagnosis for this murmur in the post-MI setting?

Q3. Which investigation will distinguish between the two?

Q4. Which coronary artery is typically implicated in this condition?

Q5. What is the acute and the definitive management for this patient?

Answers
 MCQs: 1) B, 2) C, 3) B, 4) B, 5) B, 6) D
 Q1. The most likely diagnosis is a ventricular septal rupture (VSR) following an anterior MI. It presents with cardiogenic shock, a new harsh pansystolic murmur, and persistent ST elevation.
 Q2. The key differential is papillary muscle rupture causing acute mitral regurgitation. Both cause new murmurs and pulmonary oedema post-MI, but mitral regurgitation is loudest at the apex and radiates to the axilla.
 Q3. Echocardiography confirms the diagnosis. VSR shows a defect with left-to-right shunting, while papillary muscle rupture shows flail mitral valve leaflets and severe regurgitation.
 Q4. The left anterior descending (LAD) artery is usually involved, as it supplies the anterior septum where rupture typically occurs.
 Q5. Acute management: Oxygen, diuretics, and inotropes such as dobutamine; intra-aortic balloon pump for support if needed. Definitive management: Urgent surgical repair of the septal defect once the patient is stabilised.