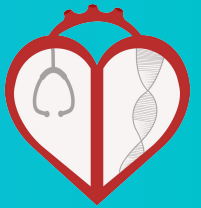




Anatomy Team  
MED 439



MED439  
KING SAUD UNIVERSITY

# Anatomy of the heart

## Cardiovascular Block - Lecture 1

### Color index:

Important

In male's slides only

In female's slides only

notes

Extra information, explanation

Don't forget to check the [Editing File](#)

## Objectives:

- Describe the shape of heart regarding : apex, base, sternocostal and diaphragmatic surfaces.
- Describe the interior of heart chambers : right atrium, right ventricle, left atrium and left ventricle.
- List the orifices of the heart :
  - Right atrioventricular(Tricuspid) orifice.
  - Pulmonary orifice.
  - Left atrioventricular(Mitral) orifice.
  - Aortic orifice.
- Describe the innervation of the heart
- Briefly describe the conduction system of the Heart

# The heart

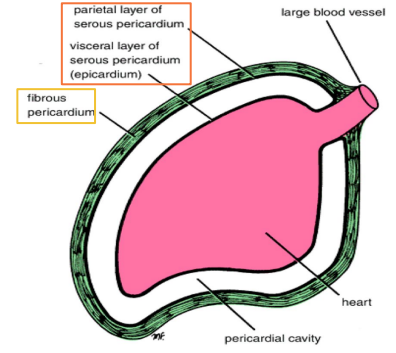


[Helpful video](#)

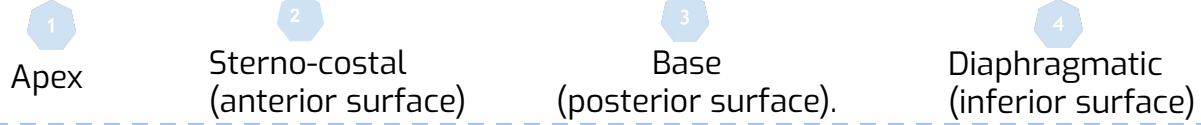


[Helpful video](#)

- It lies in the **middle mediastinum**.
- It is surrounded by a **fibroserous** sac called **pericardium** which has 2 layers :
  - 1- Outer fibrous layer (**Fibrous pericardium**).
  - 2- Inner serous sac (**Serous pericardium**).
- The Heart is somewhat **pyramidal** in shape, having:



## External features :

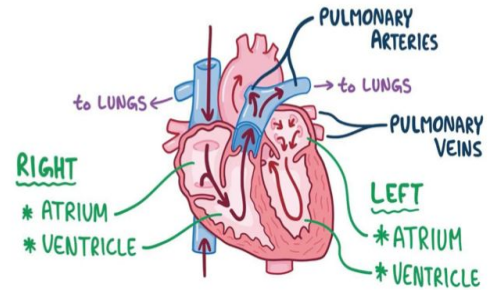


## Borders :

1. **Upper border:** Is formed by the **2 atria**. & It is concealed by ascending aorta & pulmonary trunk.
2. **Right border:** Is formed by **right atrium**
3. **Lower border:** Is formed mainly by **right ventricle** + **apical part of left ventricle**.
4. **Left border:** Is formed mainly by **left ventricle** + **auricle of left atrium**.

## Internal features (Chambers of the heart) :

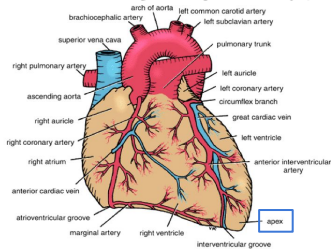
Its divided by **vertical septa** into **4** chambers **2** atria (right & left) and **2** ventricles (right & left), the right atrium lies anterior to the left atrium, and the right ventricle lies anterior to the left ventricle.



# External features of the heart:

## Apex

- Directed **downwards**, forwards and to the **left**.
- It is formed by the **left ventricle**.
- Lies at the level of left **5th** intercostal space **3.5** inch from midline (9cm).



Note that the base of the heart is called the base because the heart is pyramid shaped; the base lies opposite the apex. The heart does not rest on its base; it rests on its diaphragmatic (inferior) surface

## Base (posterior surface).

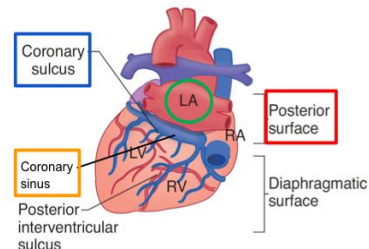
It is formed by the 2 atria, mainly **left atrium**, into which open the 4 pulmonary veins. It is directed backwards. Lies opposite middle thoracic vertebrae (5-7)

- Is separated from the vertebral column by

- Descending aorta**
- Esophagus**
- Oblique sinus of pericardium**

Bounded inferiorly by:

post part of **coronary sulcus**, which lodges the **coronary sinus**



## Sterno-costal(anterior) surface

This surface is formed mainly by the **right atrium** and **right ventricle**

Divided by **coronary** (atrio-ventricular) groove into :

**1- Atrial part:** formed mainly by **right atrium**.

**2- Ventricular part :**

the **right 2/3** is formed by **right ventricle**, while the **left 1/3** is formed by **left ventricle**.

-The **coronary groove**

- lodges the **right coronary artery**.

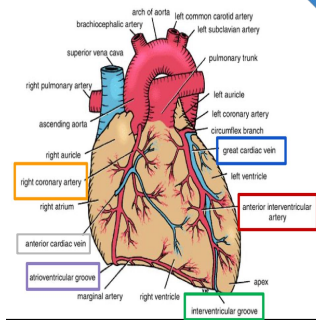
- anterior cardiac vein

-The 2 ventricles are separated by **anterior interventricular groove**, which lodges :

- Anterior interventricular artery**

(branch of left coronary).

- Great cardiac vein.**



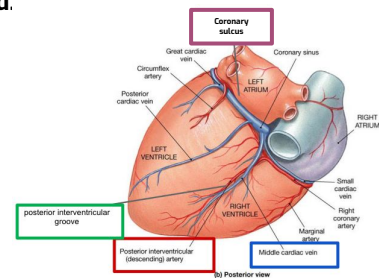
## Diaphragmatic(inferior surface)

- Formed by the 2-ventricles, mainly left ventricle (left 2/3).
- Slightly **concave** as it rests on diaphragm.
- Directed **inferiorly & backward**.

Separated from base of heart by **posterior part of coronary sulcus** (groove).

The 2-ventricles are separated by **posterior interventricular groove** which lodges:

- Posterior interventricular artery.**
- Middle cardiac vein.**



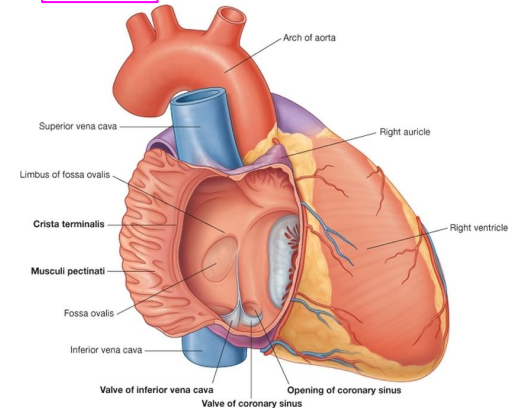
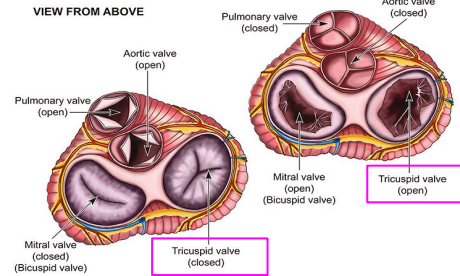
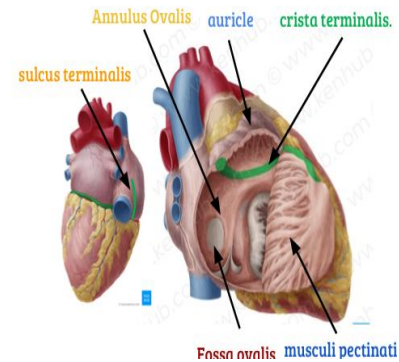
# Internal features of the heart: Right Atrium

- Consists of a main cavity and a small outpouching, the **auricle**.
 

- **On the outside:** at the junction between the right atrium and the right auricle is a **vertical groove**, the **sulcus terminalis**
  - **sulcus terminalis** : Extends from front of S.V.C to the front of I.V.C , which **on the inside** forms a ridge, the **crista terminalis**.
- Crista terminalis** divides right atrium into 2 parts:
  - Anterior part:** rough and trabeculated by bundles of muscle fibres (**musculi pectinati**).
  - Posterior part:** (**sinus venarum**) is smooth.
- In Posterior part The **interatrial septum** carries an oval depression called **Fossa ovalis** The margin of this depression is called **Annulus Ovalis**.  
 The fossa ovalis is the remnant of a thin fibrous sheet that covered the foramen ovale during fetal development. و تكون مفتوحة ومع الولادة تلتحم
- The blood leaves right atrium to right ventricle via **tricuspid valve**.

## Openings in right atrium:

- SVC** --- **has no valve**
- IVC** --- **guarded by a valve**
- Coronary sinus** : has a well-defined valve
- Right atrioventricular orifice:** lies anterior to IVC opening, it is surrounded by a fibrous ring which gives attachment to the tricuspid valve
- Small orifices of small veins**



# Internal features of the heart: Right Ventricle

The right ventricle communicates with :

1. **the right atrium** through **the right atrioventricular orifice**.
2. **the pulmonary trunk** through the **pulmonary orifice**.

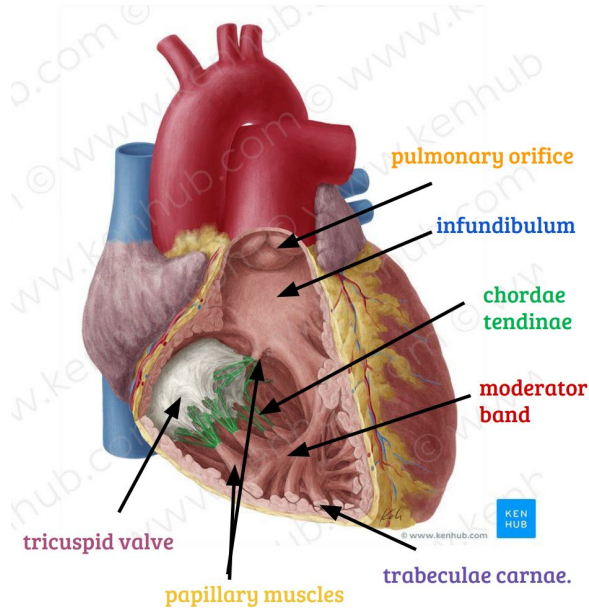
→ As the cavity approaches the **pulmonary orifice** it becomes funnel shaped, at which point it is referred to as the **infundibulum** (*conus arteriosus*) it's smooth and contains no trabeculae.

- Its wall is **thinner** than that of left ventricle
- Its wall contains projections called **trabeculae carneae**.
- Large projections arise from the walls called **papillary muscles**:
  1. Anterior papillary muscle
  2. Posterior papillary muscle
  3. Septal Papillary muscle

→ Each papillary muscle is attached to the cusps of tricuspid valve by tendinous threads called **chordae tendineae**.

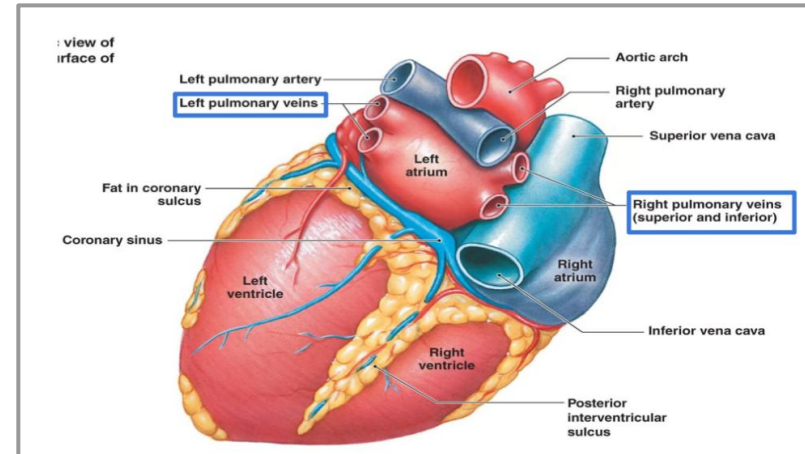
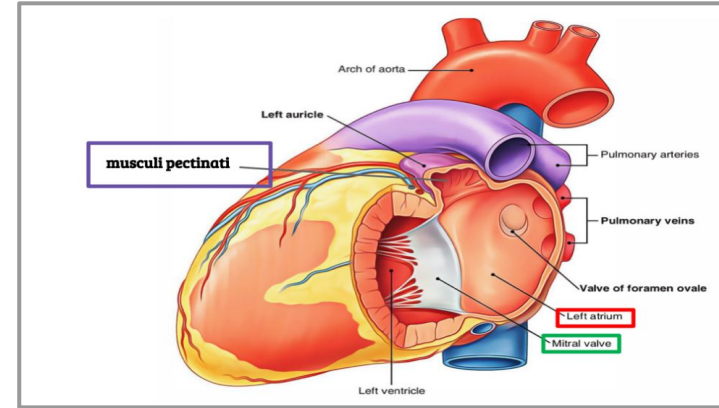
- Interventricular Septum is connected to **anterior papillary muscle** by a muscular band called **moderator band**

- Blood leaves the right ventricle to pulmonary trunk through **pulmonary orifice**.



# Internal features of the heart: Left atrium

- The left atrium communicates with the left ventricle through the left **atrioventricular orifice** and with the aorta through the aortic orifice.
- It forms the greater part of **base of heart**.
- Its wall is smooth **except** for small **musculi pectinati** in the left auricle.
- Receives **4 pulmonary veins** which have **no valves**.
- Sends blood to left ventricle through the left atrioventricular orifice which is guarded by **mitral valve (Bicuspid valve)**.



# Internal features of the heart: Left ventricle

- Its wall is **thicker** than that of right ventricle. It receives blood from left atrium through left atrioventricular orifice which is guarded by **mitral valve (bicuspid)**
  - Its wall contains **trabeculae carneae**.
  - Its wall contains **2 large papillary muscles**:
    - anterior
    - posterior
- They are attached by **chordae tendineae** to cusps of **mitral valve**.
- The blood leaves the left ventricle to the ascending aorta through the **aortic orifice**.
  - The part of left ventricle leading to ascending aorta is called **aortic vestibule**.
  - The wall of this part is **fibrous and smooth**.

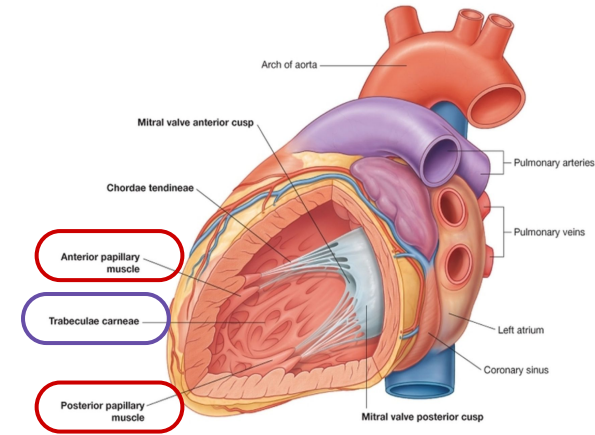
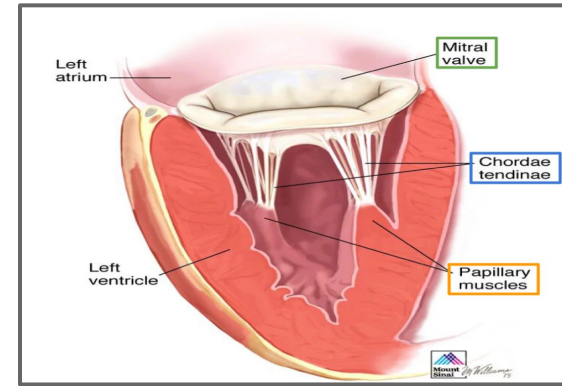


Figure.7: The left ventricle (Drake et al, 2009).

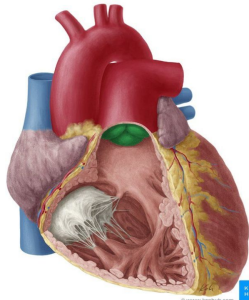




# Internal features of the heart: Semilunar orifices:

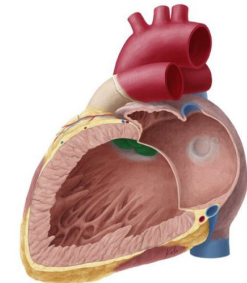
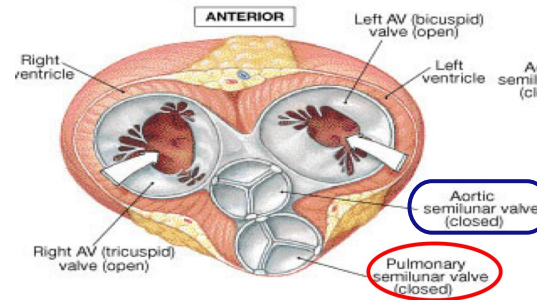
## Pulmonary Orifice

- Surrounded by a fibrous ring which gives attachment to the cusps of the **pulmonary valve**.
- The valve is formed of **3 semilunar cusps** :
  - **2 anterior**
  - **1 posterior**
- They are concave superiorly and convex inferiorly.
- No chordae tendineae or papillary muscles are attached to these cusps.



## Aortic Orifice

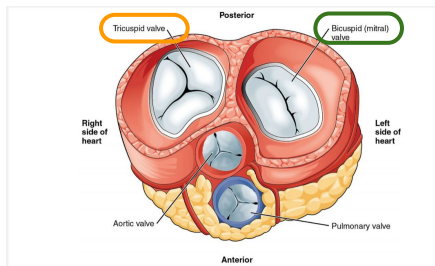
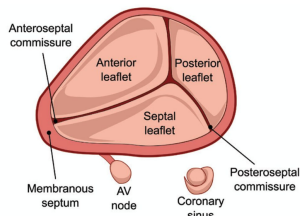
- Surrounded by a fibrous ring which gives attachment to the cusps of **aortic valve**.
- Aortic valve is formed of 3 semilunar cusps which are similar to those of pulmonary valve, but the position of the cusps differs being:
  - **1 anterior**
  - **2 posterior**



# Internal features of the heart :Atrioventricular orifices:

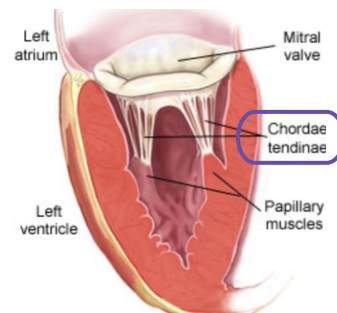
## Right AV (Tricuspid) Orifice

- One inch wide, admitting tips of 3 fingers.
- It is guarded by a fibrous ring which gives attachment to the cusps of **tricuspid valve**.
- It has **3 cusps**:
  - Anterior
  - Posterior
  - Septal(medial)
- The atrial surface of the cusps are **smooth**, while their ventricular surfaces give attachment to the **chordae tendineae**.



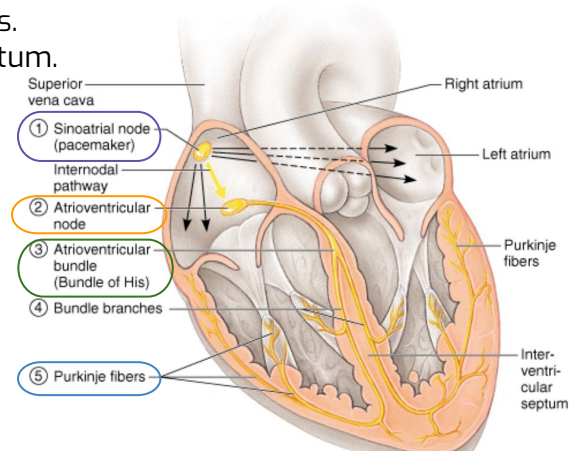
## Left AV (Mitral) Orifice

- Smaller than the right, admitting only tips of 2 fingers.
- Guarded by a **mitral valve**.
- Surrounded by a fibrous ring which gives attachment to the cusps of **mitral valve**.
- **Mitral valve is composed of 2 cusps**:
  - **Anterior**: lies anteriorly and to right.
  - **Posterior**: lies posteriorly and to left.
- The atrial surfaces of the cusps are **smooth**, while ventricular surfaces give attachment to **chordae tendineae**.



# Nerve supply and conduction system:

- The heart is supplied by **sympathetic & parasympathetic fibers** via the **cardiac plexus** situated below arch of aorta.
  - The sympathetic fibres arise from the **cervical & upper thoracic ganglia of sympathetic trunks** (accelerate heart rate)
  - The parasympathetic fibres arise from the **vagus nerves** --- slow heart rate (constriction of coronary arteries)
  - Postganglionic fibres reach heart along – **SAN, AVN & nerve plexus** around coronary arteries.
- 
- The beating of the heart is **regulated by the intrinsic conduction (nodal) system**.
  - Its function is to ensure that the chambers of the heart contract in the proper rhythm and sequence:
- 1- **The main center is the sinoatrial (SA) node**, located in the right atrium, the SA node is called the **pacemaker** of the heart, because it generates the impulse.
  - 2- **atrioventricular (AV) node**, is located at the junction of the atria and the ventricles.
  - 3- **atrioventricular (AV) bundle (bundle of His)**, is located in the interventricular septum.
  - 4- **Purkinje fibers**, are located inside the walls of the ventricles.



## Two Sinuses

1- Transverse Sinus: It is a recess of **serous** pericardium **between ascending aorta & pulmonary Trunk**, → anteriorly. and upper parts of 2 atria & S.V.C, Posteriorly.

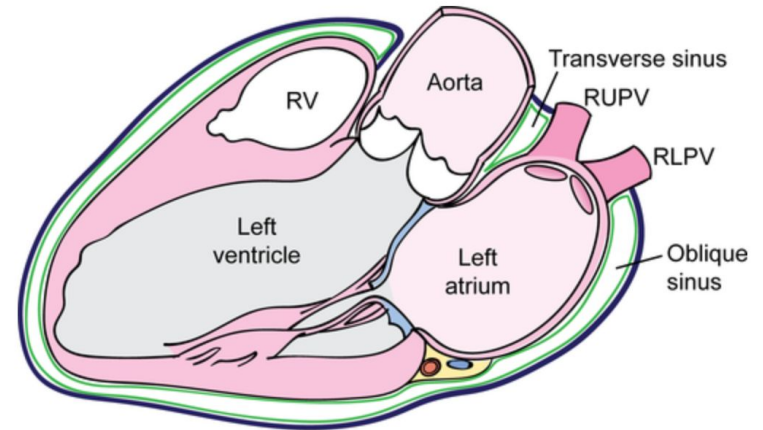
2- Oblique Sinus: It lies **posterior to the heart**. It is a recess of **serous** pericardium **behind the base of heart** (left atrium), **separate base** from **descending aorta, esophagus & vertebral column.**



Oblique sinuous



Transverse sinuous



# MCQ

**Q1:** The left atrium communicates with the left ventricle through the:

- A.** Atrioventricular orifice
- B.** Aortic orifice
- C.** Pulmonary orifice
- D.** Tricuspid orifice

**Q4:** The sympathetic fibers:

- A.** Slow heart rate
- B.** Increase blood pressure
- C.** Accelerate heart rate
- D.** A&B

**Q2:** The pulmonary orifice is formed of:

- A.** 1 anterior, 1 posterior
- B.** 2 anterior, 1 posterior
- C.** 1 anterior, 2 posterior
- D.** 1 anterior, 1 posterior, 1 septal

**Q5:** SA node located in:

- A.** Junction of the atria
- B.** Inside the walls of the ventricles
- C.** Interventricular septum
- D.** Right atrium

**Q3:** The left AV orifice has:

- A.** 3 cusps
- B.** 2 cusps
- C.** 1 cusp
- D.** 4 cusps

**Q6:** Purkinje fibers are located in:

- A.** Right atrium
- B.** Interventricular septum
- C.** Inside the walls of the ventricles
- D.** Junction of the atria & the ventricles

# MCQ

**Q7:** A 32 year old patient who weighs 187 lb comes to the doctors office. On the surface of the chest, the physician is able to locate the apex of the heart:

- A. In the level of the sternal angle
- B. In the left 4th intercostal space
- C. In the left 5th intercostal space
- D. In the right 5th intercostal space

**Q10:** The coronary groove lodges:

- A. The left coronary artery
- B. The right pulmonary artery
- C. The right coronary artery
- D. The left pulmonary artery

**Q8:** A patient came to the emergency. The angiogram exhibit that there was bleeding from the vein that accompanied by posterior interventricular artery. Which is ruptured?

- A. Great cardiac vein
- B. Middle cardiac vein
- C. Anterior cardiac vein
- D. Oblique veins of the left atrium

**Q11:** The diaphragmatic surface is separated from the base of the heart by:

- A. Anterior part of the coronary sulcus
- B. Posterior part of the coronary sulcus
- C. Middle part of the coronary sulcus
- D. Superior part of the coronary sulcus

**Q9:** Which of the following connects papillary muscles to cusps?

- A. Valves
- B. Moderator band
- C. Trabeculae carneae
- D. Chordae tendineae

**Q12:** When does the cavity of the right ventricle become funnel shaped?

- A. At the trabeculae carnae
- B. At the infundibulum
- C. At the pulmonary trunk
- D. At the chordae tendinae

# SAQ :

**1:** The right AV orifice has:

**2:** List the components of intrinsic conduction (nodal) system:

**3:** List the borders of the heart.

**4:** List the openings of the right atrium.

# SAQ Answers :

**1:** 3 cusps: anterior, posterior & septal(medial).

**2:** Sinoatrial node, atrioventricular node, Atrioventricular (AV) bundle, Purkinje fibers.

- 3:**
1. Upper border: Is formed by the 2 atria. & It is concealed by ascending aorta & pulmonary trunk.
  2. Right border: Is formed by right atrium
  3. Lower border: Is formed mainly by right ventricle + apical part of left ventricle.
  4. Left border: Is formed mainly by left ventricle + auricle of left atrium.

- 4:**
1. SVC --- has no valve
  2. IVC --- guarded by a valve
  3. Coronary sinus : has a well-defined valve
  4. Right atrioventricular orifice: lies anterior to IVC opening --- tricuspid valve
  5. Small orifices of small veins



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