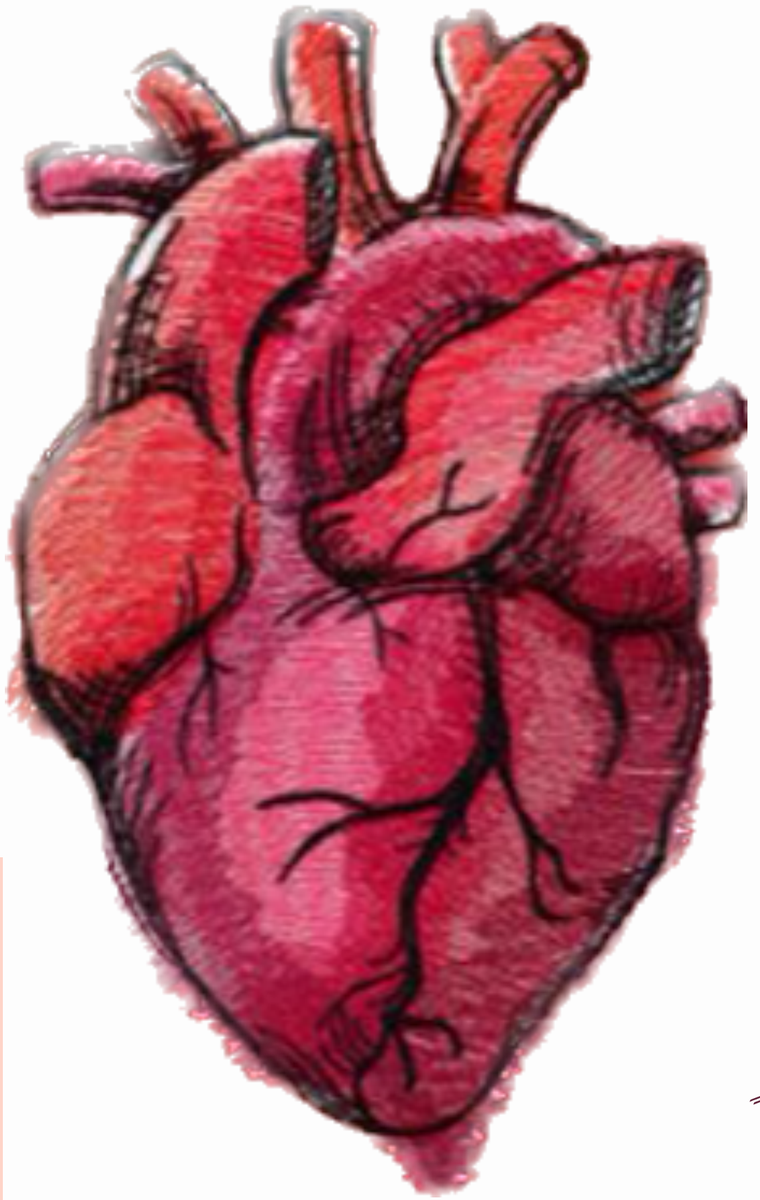


النادي الطبي

CARDIOVASCULAR SYSTEM

SUBJECT : Anatomy

LEC NO. : Lecture 1

DONE BY : Gaith & ATA

وَقُل رَّبِّ زِدْنِي عِلْمًا

SCAN ME!

CVS..

Lecture (1)

Anatomy of Pericardium & Heart

Dr. Amany Allam

Assistant professor of Anatomy & Embryology

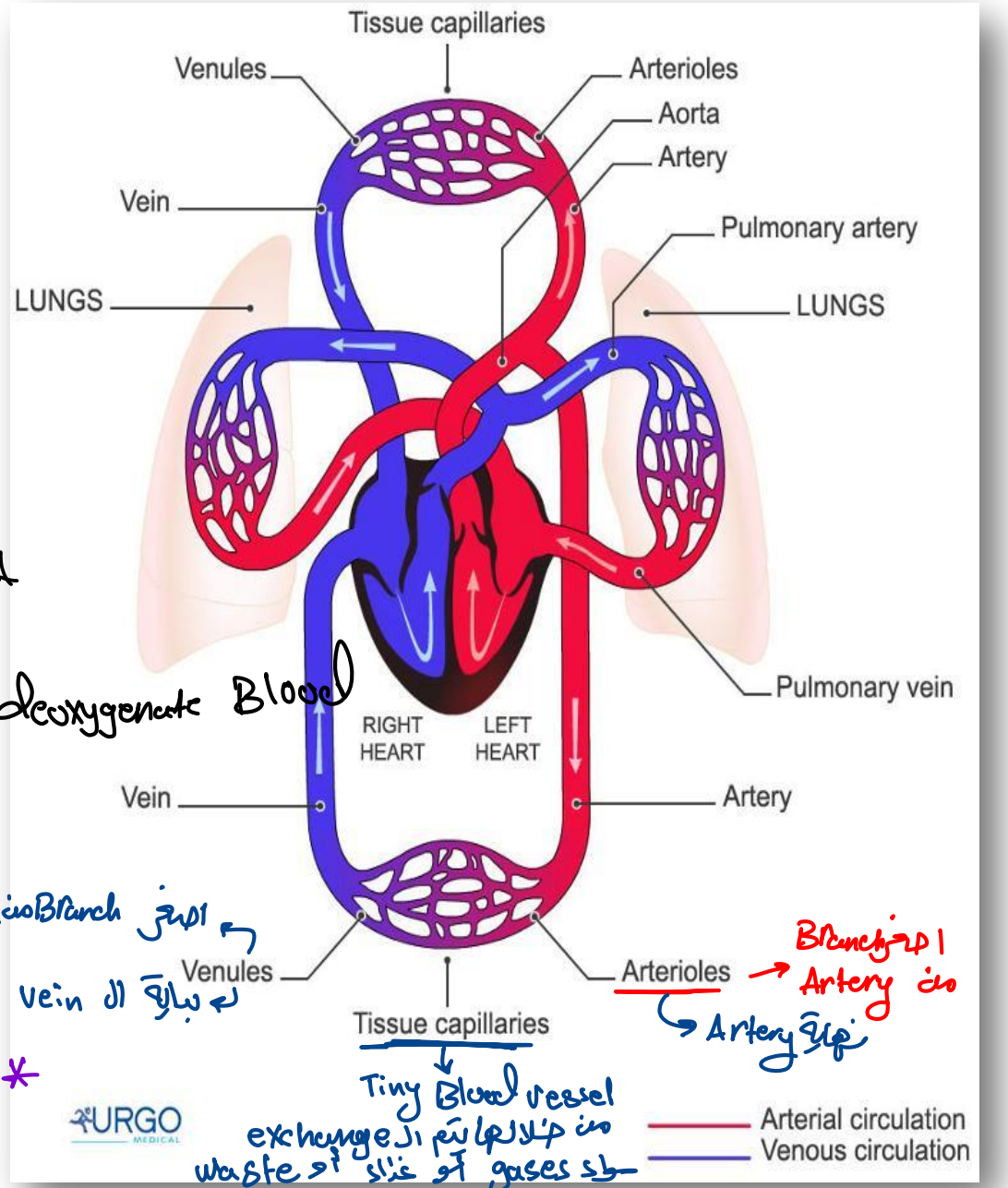
ILOs

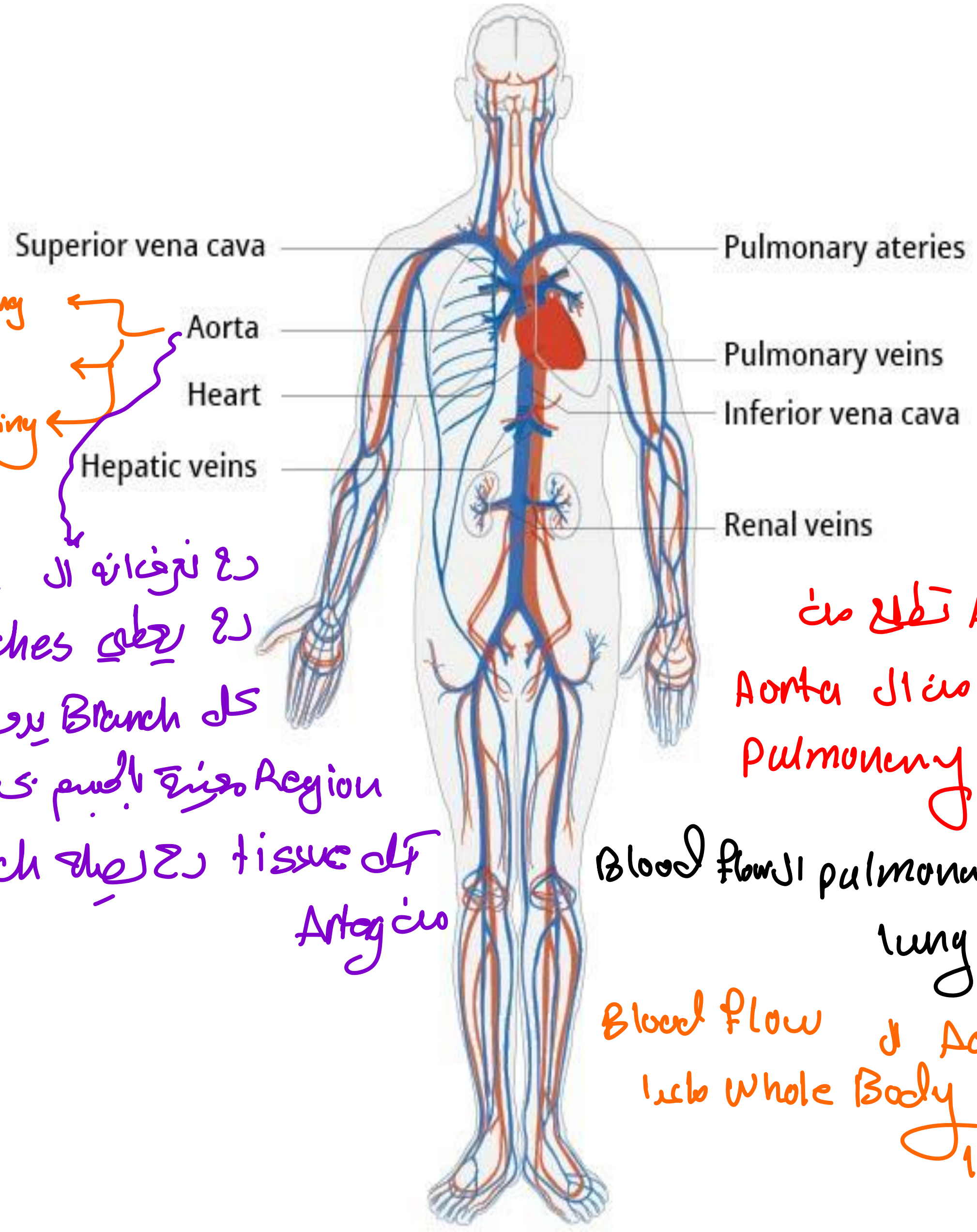
- Describe the outline and normal position of the heart.
- Describe the general organization, surface landmarks & external features of the heart. List relations of different parts of the heart.
- Define the pericardium, describe its component & its attachment to the diaphragm and the root of the great vessels.
- Discuss the pericardial space, sinuses & the pericardial fluid in normal condition.
- Describe blood supply& innervations of the pericardium.
- Describe the internal features of each chamber of the heart

Components of the cardiovascular system

- **The heart:** A muscular pump that forces blood around the body. (Hollow) → cavity.
- **A closed system of blood vessels:** These vessels include:
  - **Arteries:** Vessels that carry blood away from the heart. carry Oxygenated Blood except Pulmonary A
  - **Veins:** Vessels that bring blood back to the heart. carry deoxygenate Blood except pulmonary vein.
  - **Capillaries:** Tiny vessels that connect the arterial system to the venous system. The exchange of oxygen, nutrients, and the waste between blood and tissues also happens through the capillaries.

Direction of flow بالاتجاه Artery وال Vein ال فكر *





Ascending
Arch
Descending

رح نتعرف على ال Aorta
رح يعطي Branches
كل Branch يروح على
منطقة بالجسم بحيث Region
كل tissue رح يوصله Branch
من Artery

* Artery تطلع من
heart ال Aorta
و ال Pulmonary.

← Blood flow ال pulmonary
تاخد ال lung

← Blood flow ال Aorta
تاخد لـ Whole Body ما عدا
ال lung

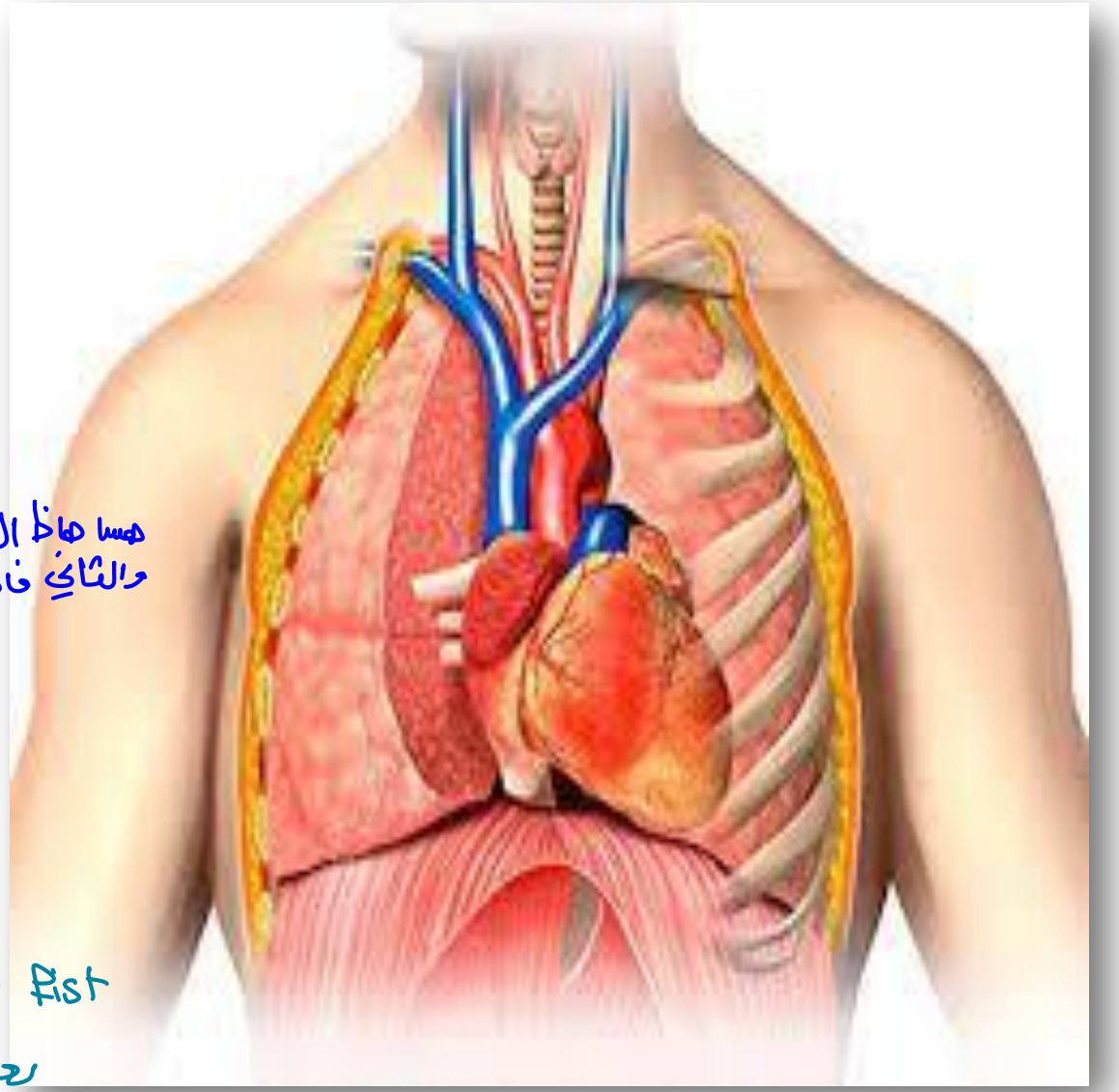
Heart

Definition:

- The heart is a hollow muscular organ, completely invested by the pericardium.

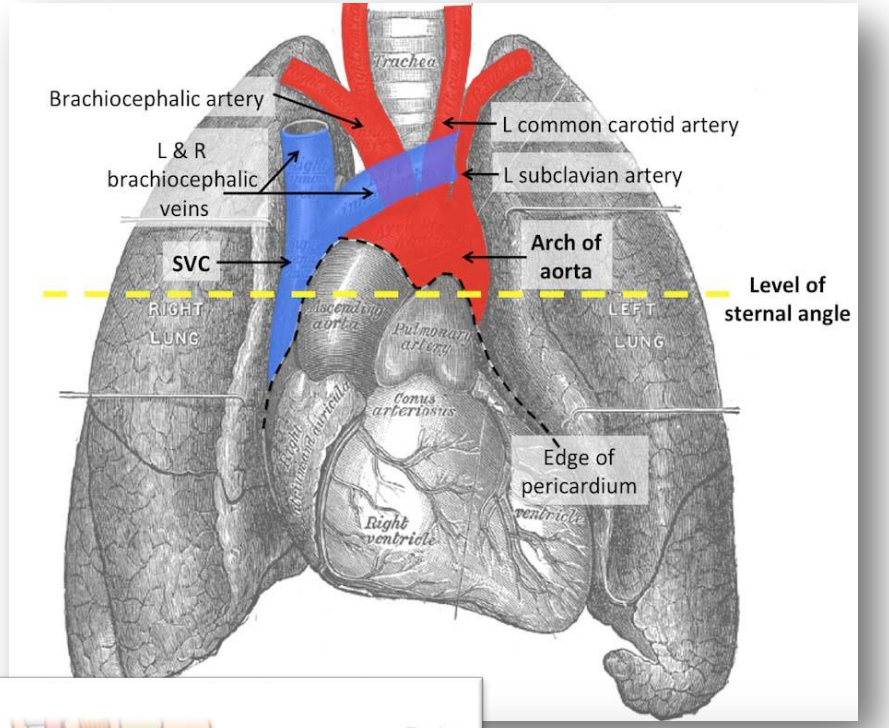
- **Size:** Size of a closed fist, an average adult heart is (12 cm) from base to apex, (8–9) cm at its broadest transverse diameter and (6 cm) at its anteroposterior diameter.

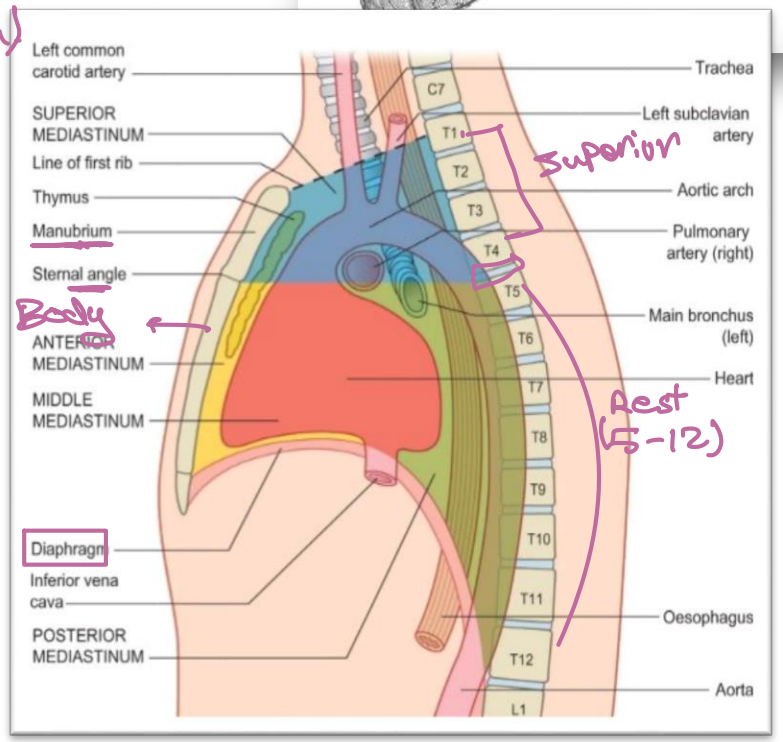
- **Weight:** average (300 g) in males &(250 g) in females.



Site of the heart:

- The position of the heart within the thoracic cavity between the two lungs. and pleura.
- It lies in the middle mediastinum. (inferior mediastenum)
- Within the mediastinum, the heart lies in its own space (pericardial cavity).





guarded by tricuspid valve, tricuspid orifice, R atrium – ventricle
Mitral valve, mitral orifice, L atrium – ventricle

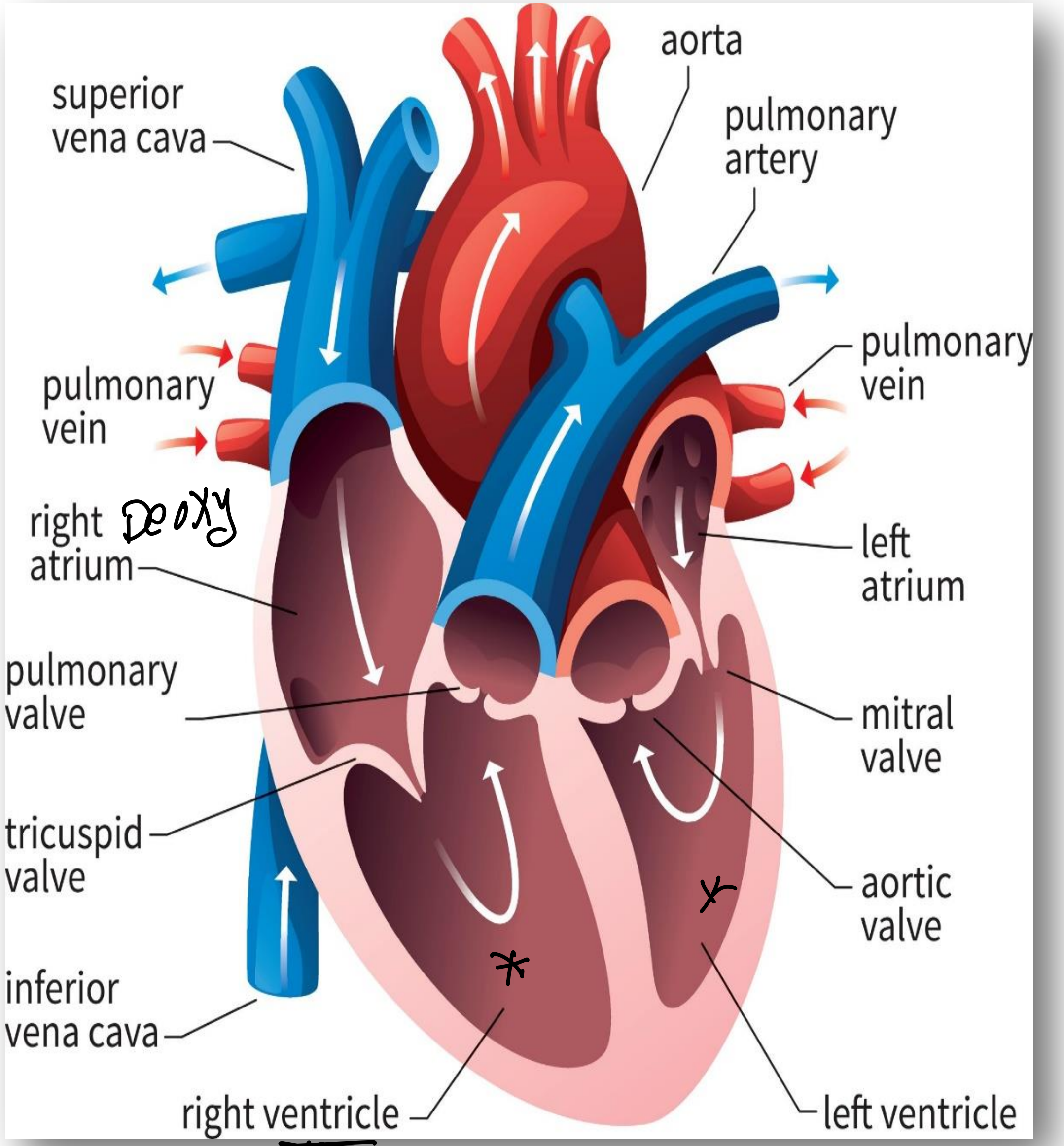
inter:- Between or among
intra:- inside or within.

The heart consists of four distinct chambers:

- Two upper chambers called "atria". Atrium (single)
- Two lower chambers called "ventricles".
- Interatrial septum& Interventricular septum.
- Valves control the flow of blood within the different chambers.
- The large arteries and veins directly connected with the heart are termed the great vessels, consisting of the inferior vena cava, superior vena cava, pulmonary arteries, pulmonary veins, and ascending aorta.

Blood follows the following path through the heart:

As shown in this figure.



Deoxygenated

هنا SVC وال IVC بجيبوا venous Drainage كل ال whole Body الا lung

Bring Deoxy Blood from upper half

Bring Deoxy Blood from superior half

و بيصبوا ال Blood بال Right Atrium (هلأ Deoxy_Blood) هاظ الدم

ع بينتقل من R.A لـ R.V من خلال Tricuspid valve (بيضخ R.V هلأ Deoxy Blood

هاظ الدم بيروح من R.V لل lung من خلال Pulmonary trunk الي تتفرع لـ pulmonary

Artery الي عبارة عن Right & left و بيروحوا على corresponding lung

بحيث رح يحصل ال gas exchange وبطلع من lung 2 pulmonary vein

معناها انا عندي 4 pulmonary vein وطبعاً الدم الي فيهم (oxygenated Blood)

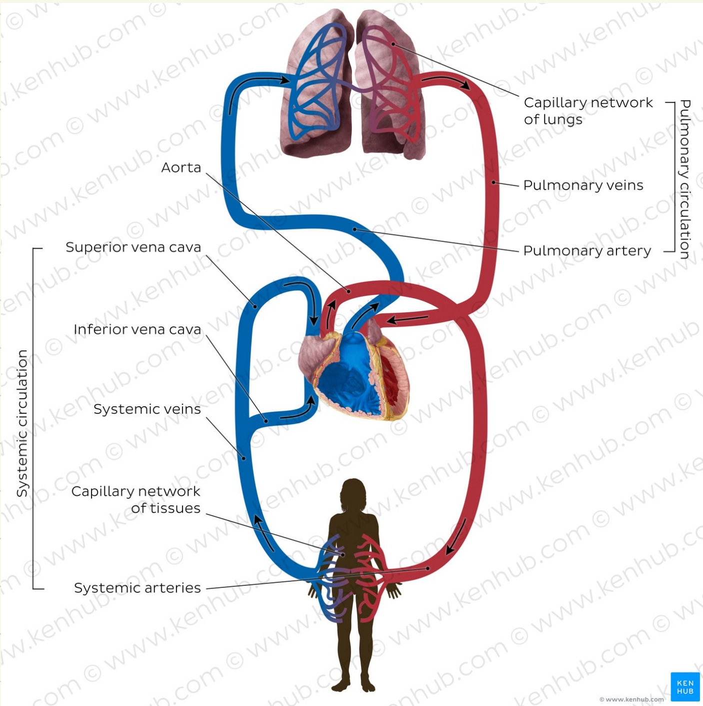
فرح يصبوا الدم بال left Atrium إذا الدم الي بال L.A (oxygenated Blood)

وبعدها رح ينتقل هاظ الدم من L.A لل L.V من خلال Mitral valve

إذاً الدم الي بال L.V بيضخوا (oxygenated Blood) وبعدها رح يروح

الدم لكل الجسم من خلال ال Aorta

Systemic Circulation

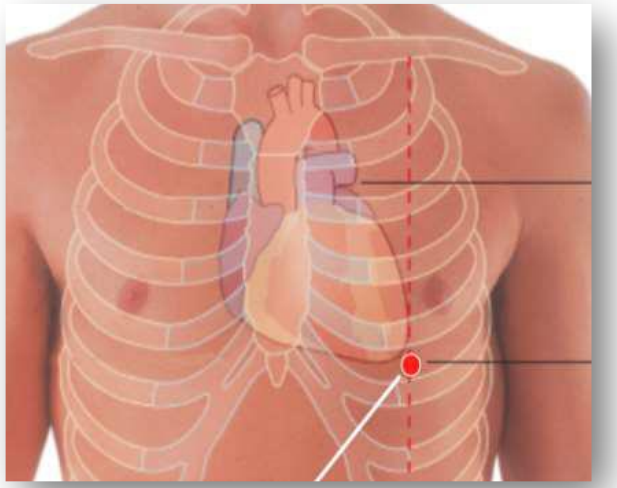


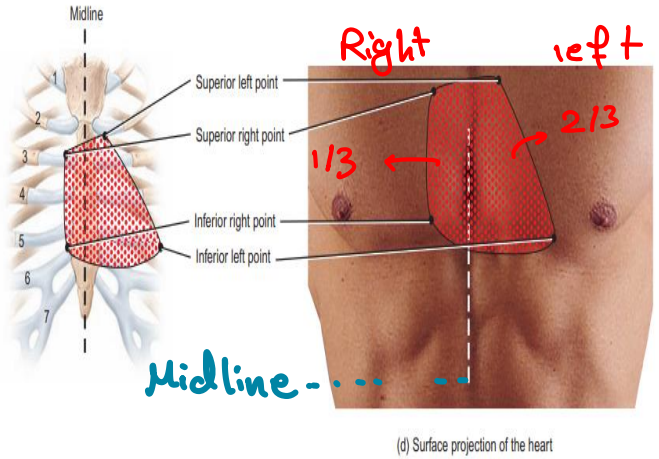
To outline the heart:

مخروطي

The heart is conical in shape, having;

- Apex & Base.
- Four surfaces (Sternocostal, Diaphragmatic, Right and Left surfaces).
- Four borders (upper, lower, right and left).





منحرف الشكل

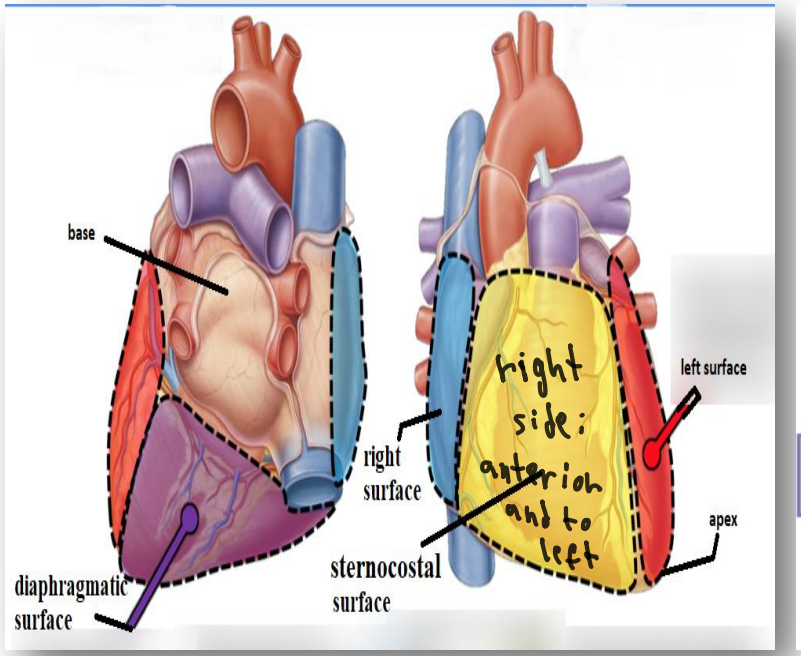
It has an oblique position;

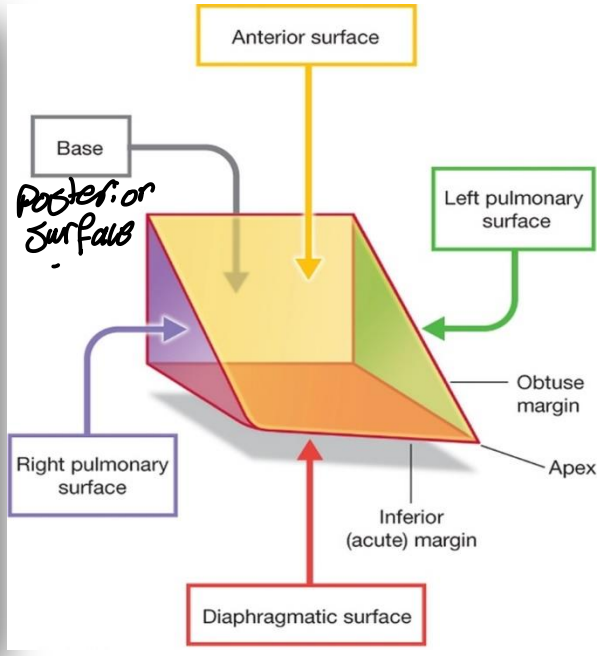
Its long axis directed downwards, forwards & to left. So

1- 1/3 of heart lies on right side & 2/3 on left side of the median plane.

2-Right side heart lies anterior to left side heart.

لانه القلب منحرف نحو الشمال فراح يكون جهة اليمين :
برضوا رايحة لامام الجسم منحرفة لجهة الشمال





. Topographic Surface Anatomy *

Apex of the heart

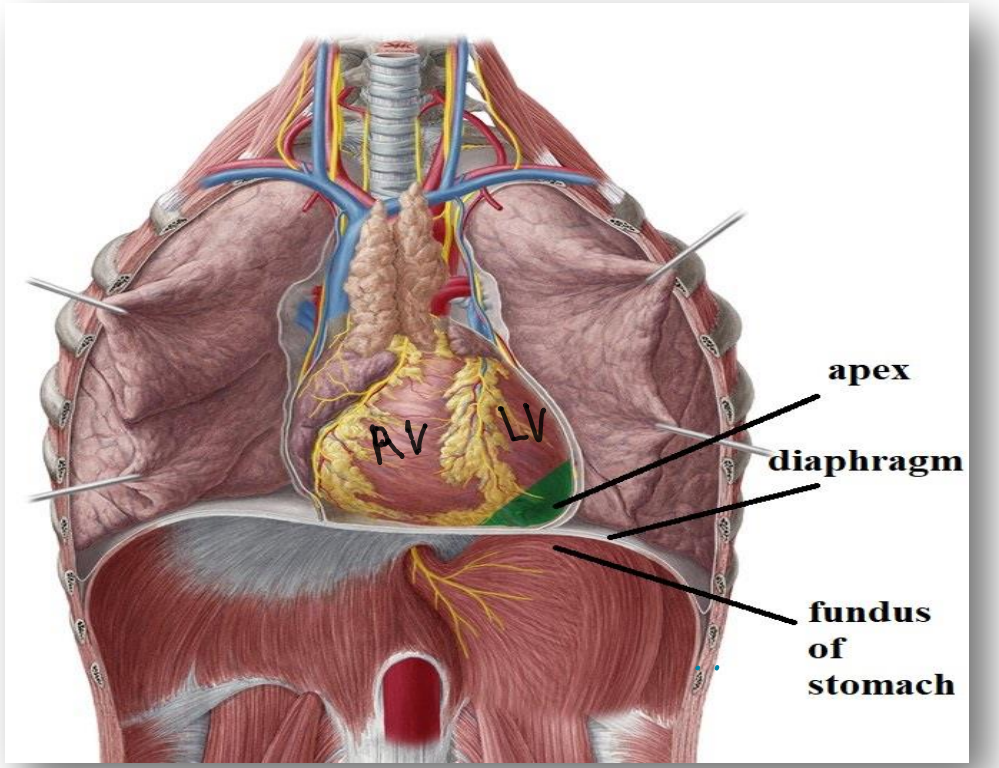
Formed by: Lt. ventricle.

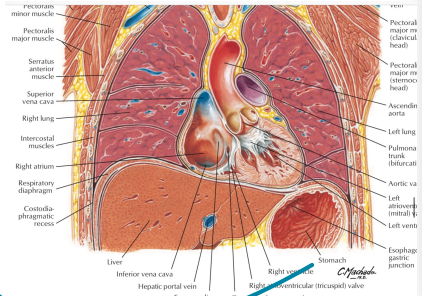
Directed:

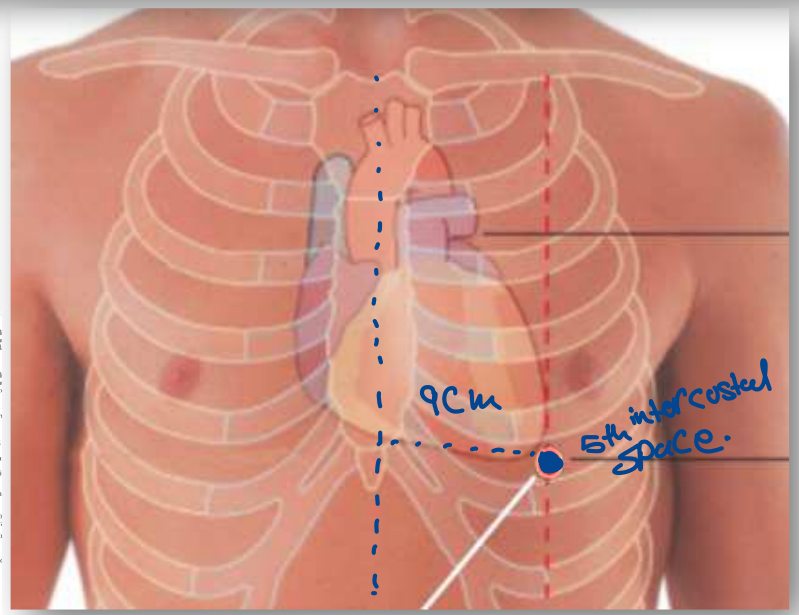
- Downward, forward & to Lt. *
- **It lies** opposite left 5th intercostal space, 3.5 inches (9cm) to the left from median plane. ↳ transverse line. ↳ vertical line.

Relation:

- Left lung & pleura.
- The pericardium and diaphragm separate the apex of heart from the fundus of the stomach.







Base (Posterior Surface):

Formed by:

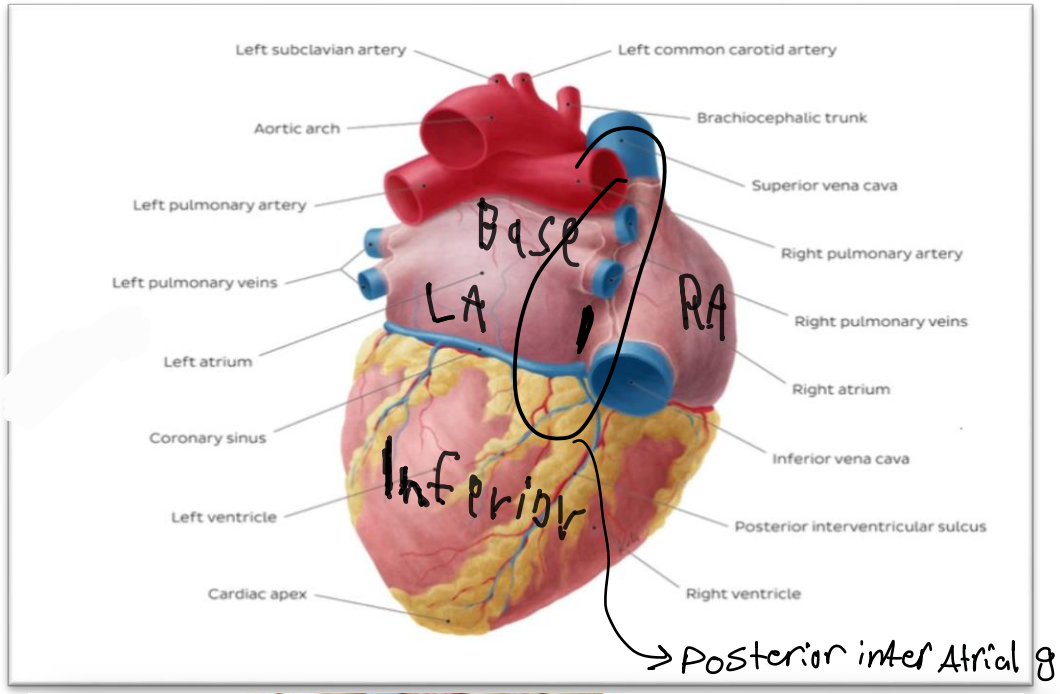
- Left atrium (mainly), part of right atrium & posterior inter atrial groove.

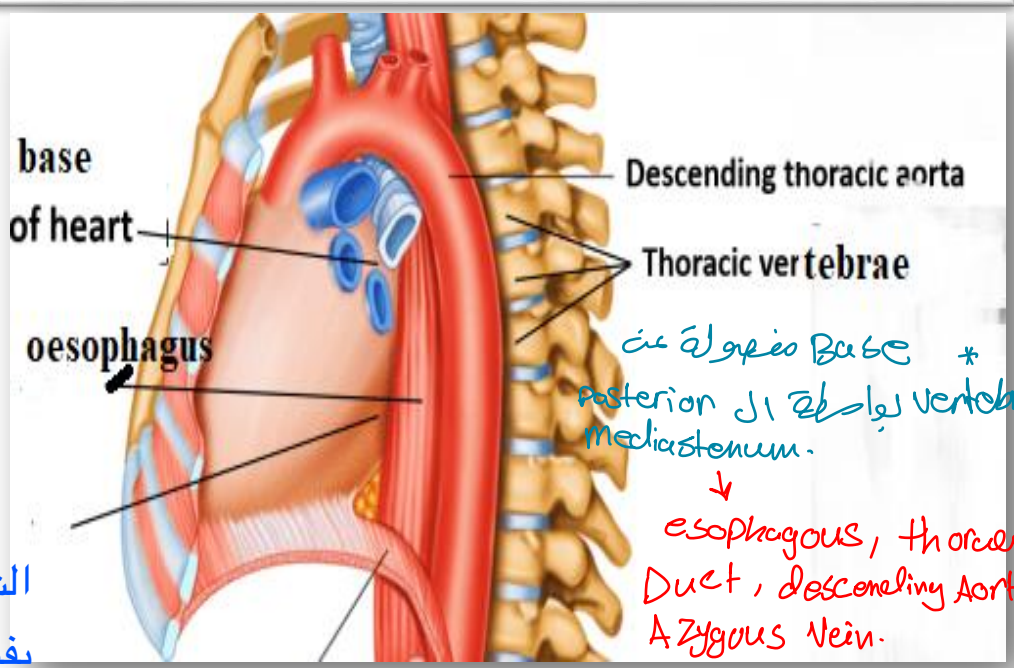
Direction:

- It is directed, upward backwards and slightly to the right.
- It lies opposite the middle 4 thoracic vertebrae (5, 6, 7 and 8).

Relations:

- It is quadrilateral in shape, **bounded inferiorly** by the coronary (atrio-ventricular) groove.
- It is separated from the vertebral column by the descending aorta, oesophagus, Azygos vein& oblique sinus of the pericardium,





الشق الي يفصل بين الatrial وال ventricle والذي
يفصل بين الbase وال inferior surface

Chambers هو ال surface العهيد المكون من كل
تشارك فيه

Anterior (sternocostal) surface: Directed Forward.

It's divided by Atrio-ventricular groove into 2 portions:

Right ال خلت ← Rotation صار في heart الشكل
(L.A-V) left side ال anterior يصبحوا (R.A-V) side
Anterior surface هو الجزء اللي خلت heart ال
R. ventricle ال mainly يكون

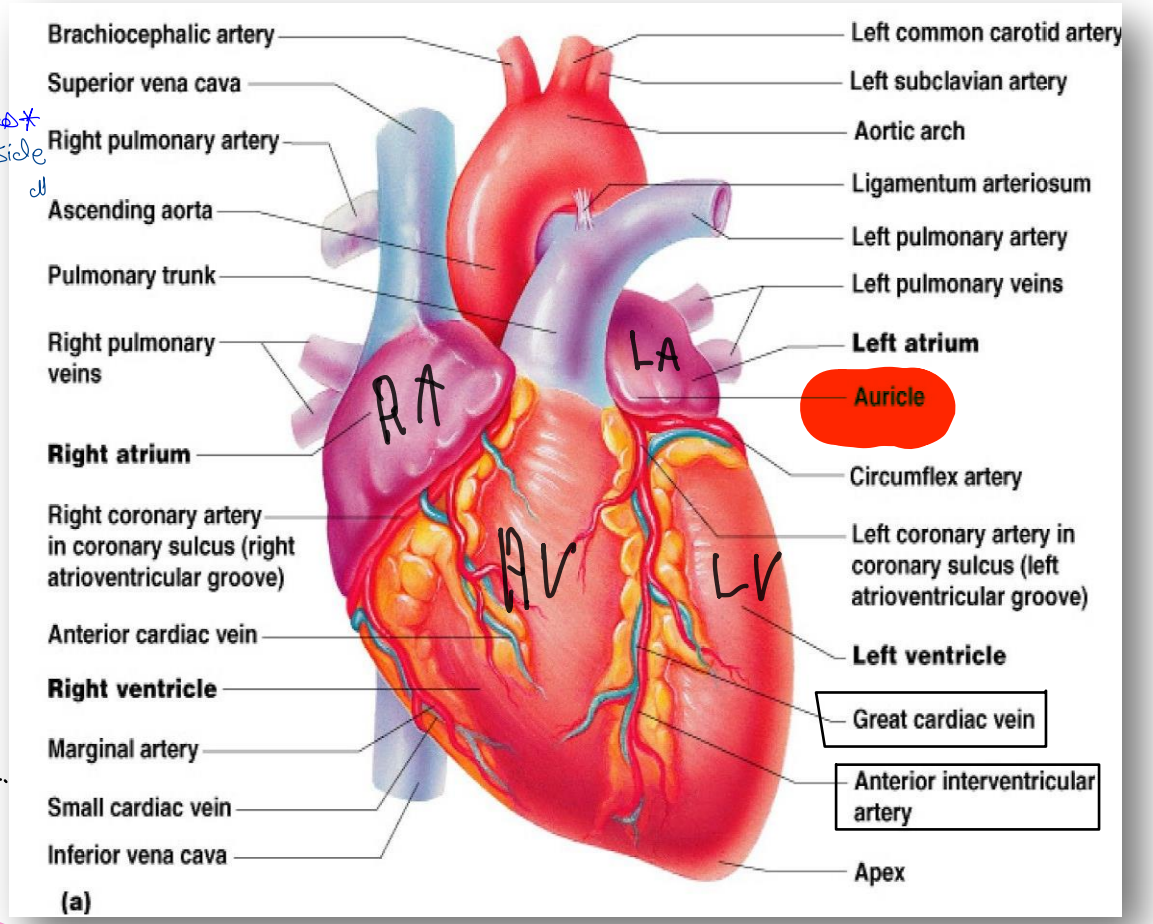
Atrial part: Formed by

- Right atrium& its auricle.
- Left auricle.

Ventricular part:

- Right 2/3 of this part formed by the right ventricle.
- Left 1/3 formed by the left ventricle.
- Anterior interventricular groove &its contents.

→ vein & Artery



!! auricle وال atrium الفرق بين ال

ال auricle هو جزء من ال atrium، يعني ال atrium تتشكل وتتمدد والإمتداد هذا عبارة عن ال auricle

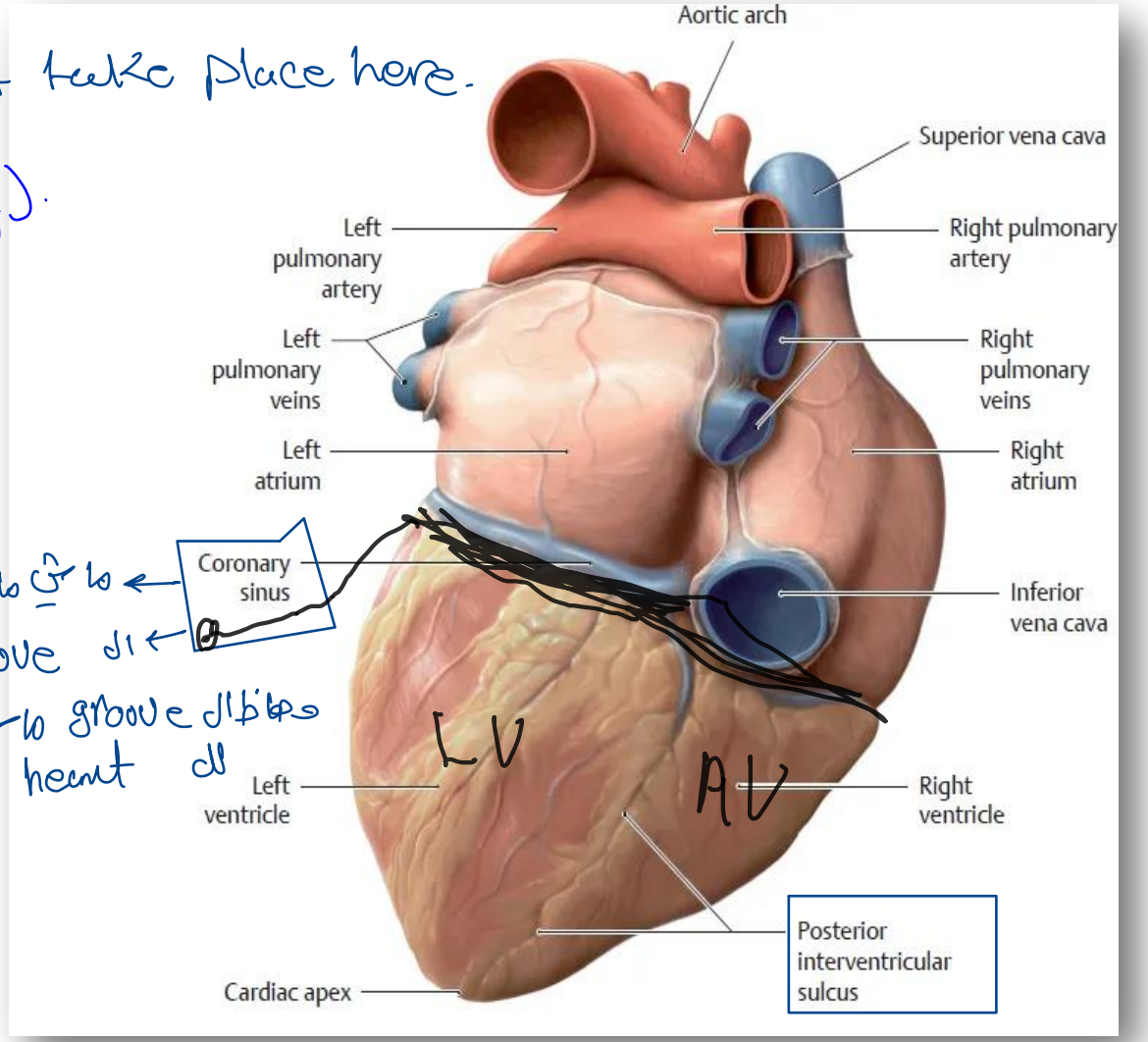
Inferior (diaphragmatic) surface

Formed by: the two ventricles, as;

- Its left 2/3 are formed by the **left ventricle.**
- Its right 1/3 is formed by the **right ventricle**.
- **Posterior interventricular groove** &its contents in between.

Relations:

- It rests on the diaphragm

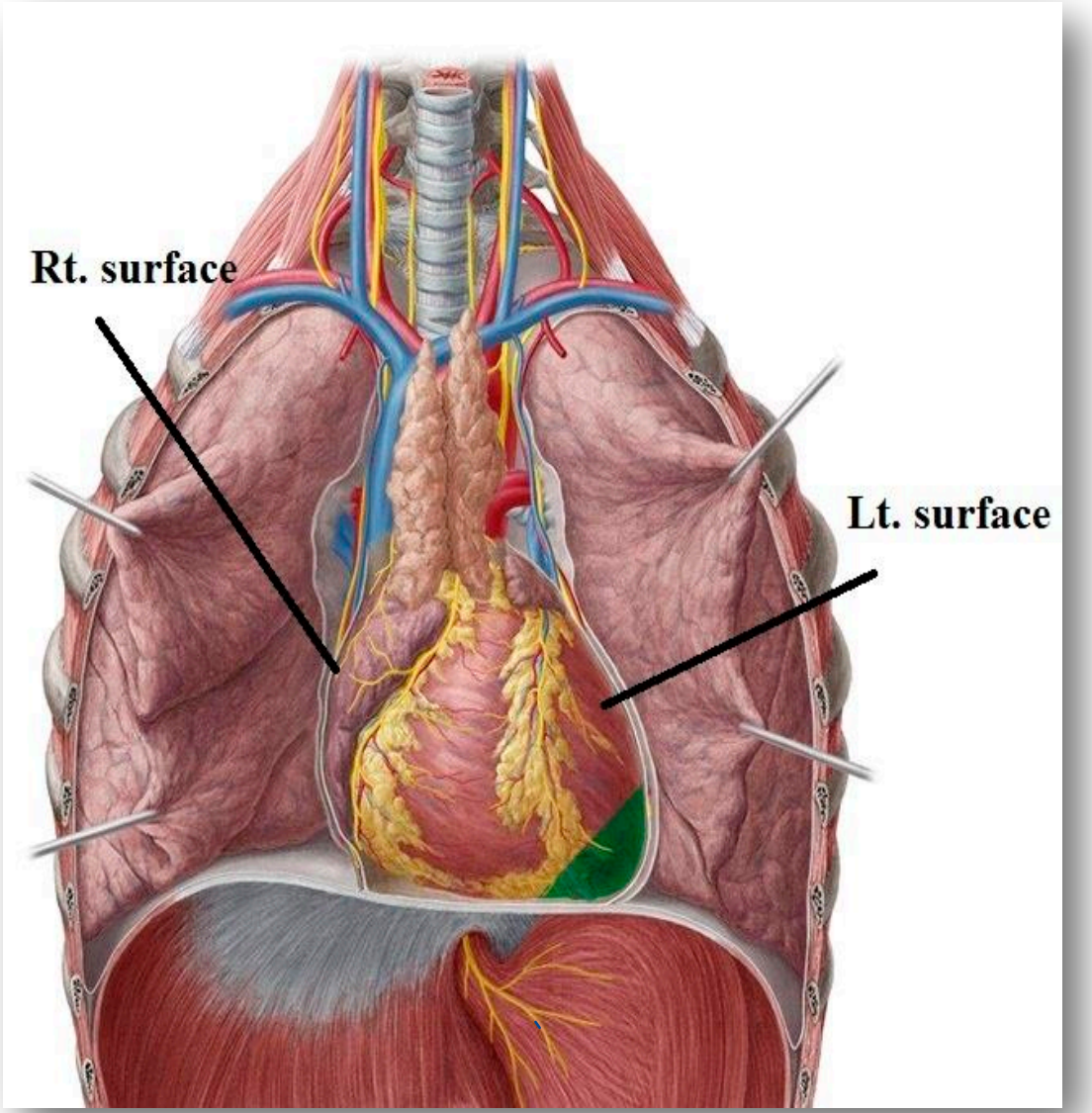


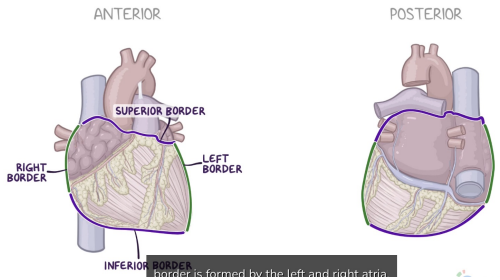
Right surface:

- Formed mainly by **right atrium**.
- Related laterally to right (lung, pleura, phrenic n.)

Left surface:

- Formed mainly by **left ventricle & left atrium**.
- Related laterally to left (lung, pleura, phrenic n.)





Borders of heart:

Upper border:

- Formed by the two atria.
- It is hidden behind the ascending aorta and pulmonary trunk.

هو نفسه الpulmanry artery

Right border:

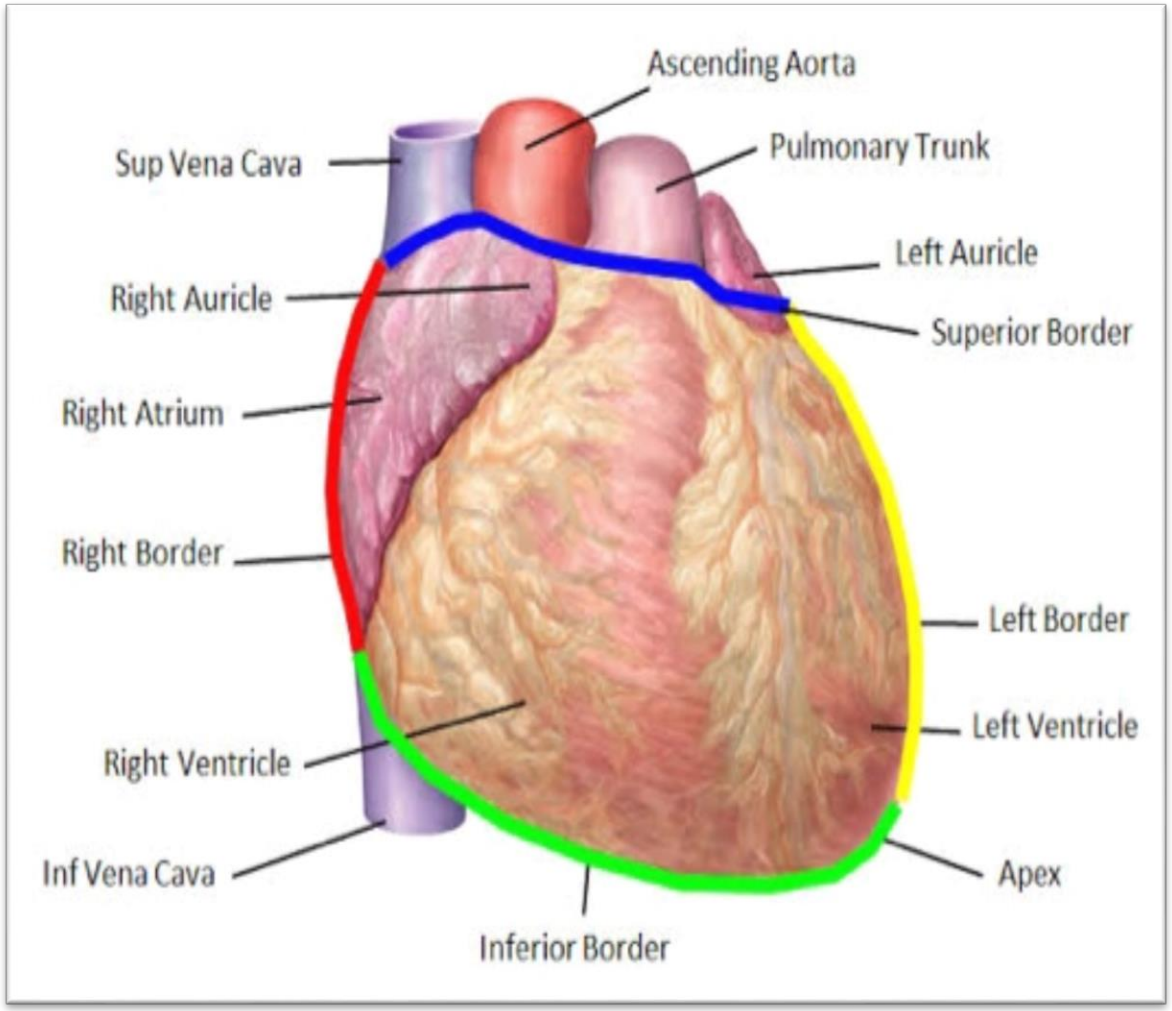
- Formed only by the right atrium. It is convex to the right.
- It extends from the opening of SVC to the opening of IVC.

Left border:

- Formed by the left ventricle and the left auricle.

Lower border:

- Formed by the right ventricle (mainly) and the left ventricle.
- It separates the sternocostal surface from the diaphragmatic surface.



Surface anatomy of the heart:

Surface anatomy of the sterno-costal surface of the heart is represented by the following points;

Point B: at **Lt. 2nd c.c**. (1 cm) from the sternum.

Point A: at **Rt. 3rd c.c.** (1 cm) from the sternum.

Point D: at **Rt. 6th c.c.** (1 cm) from the sternum.

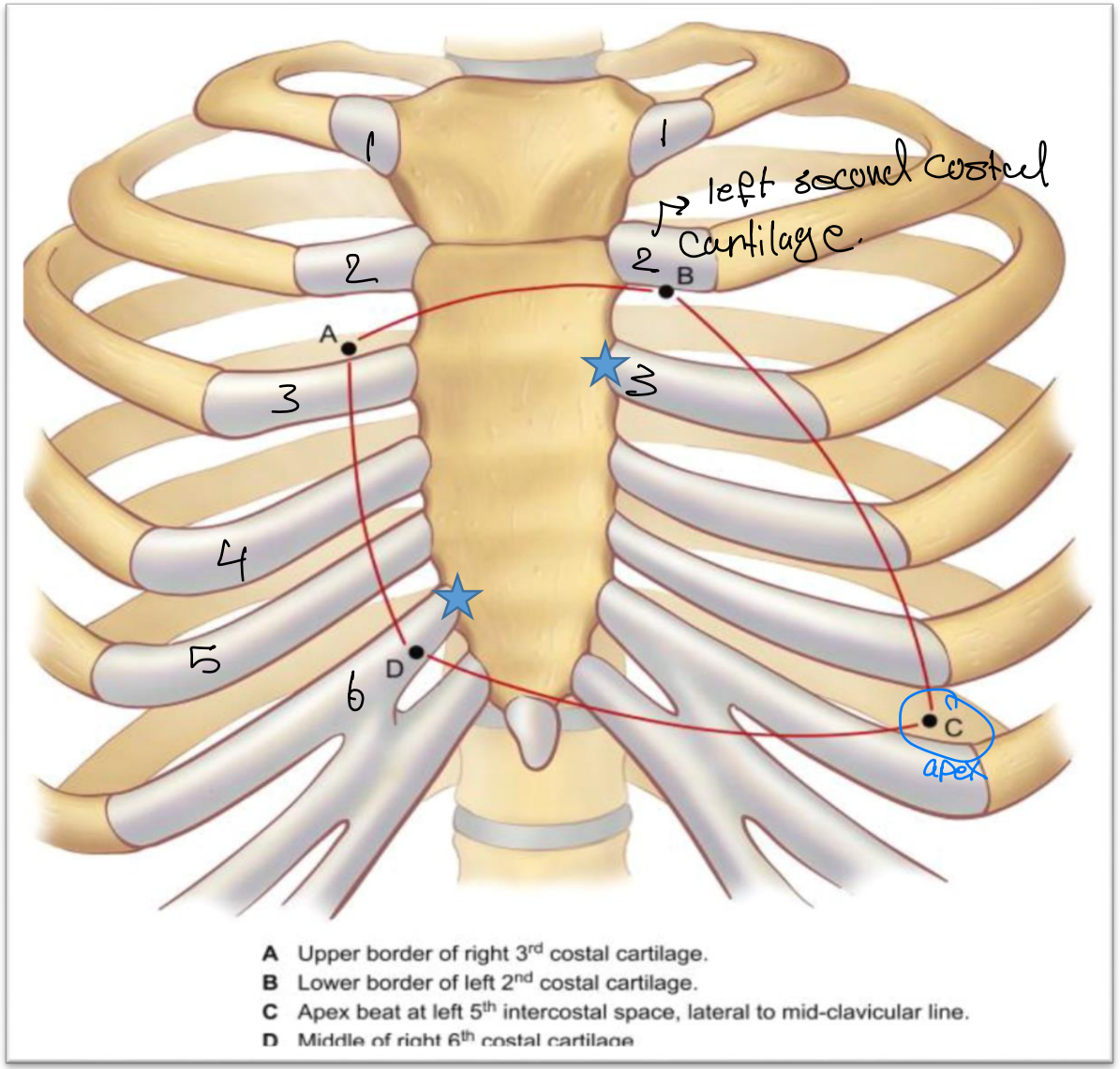
Point C (apex): at **Lt. 5th intercostal space,** (9cm) to the left from median plane.

Atrium and ventricle

Coronary groove: Oblique line from lt. 3rd to rt. 6th sternocostal junctions.

left

right



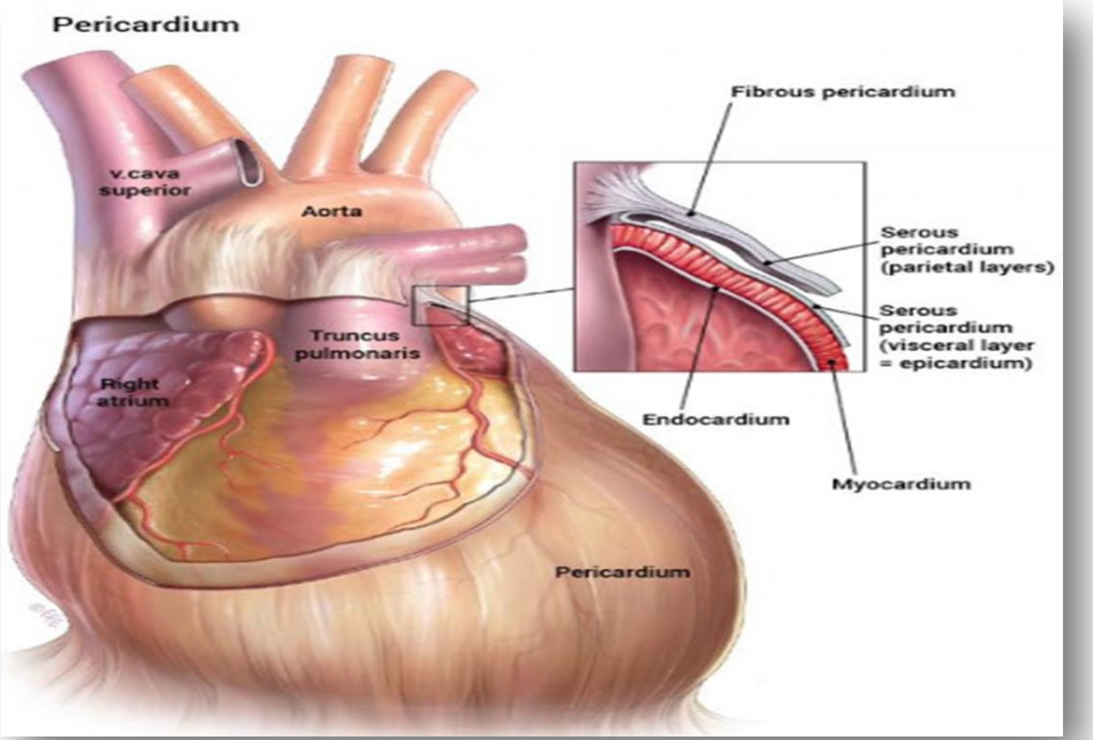
Pericardium

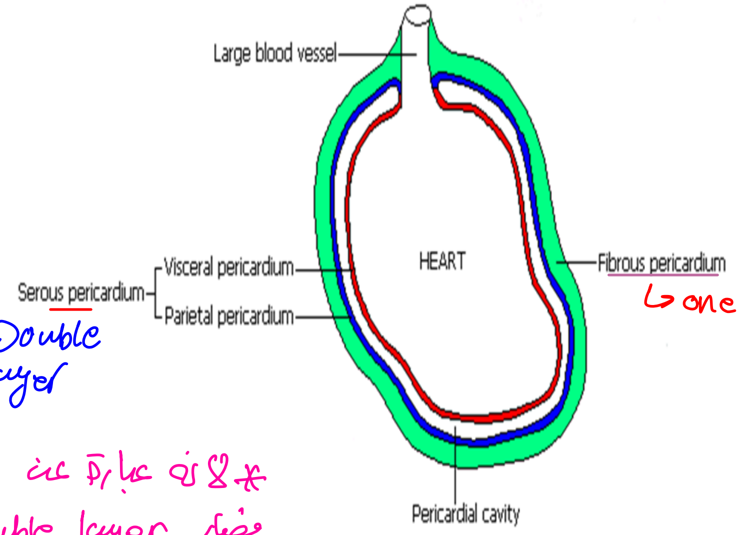
Definition: a fibro serous sac" which surrounds the heart & the proximal parts of the great vessels.

Extension: it extends from 2 to 6 costal cartilages.

Structure:

- Outer fibrous layer called " **Fibrous pericardium"**.
- Inner serous sac known as "**Serous pericardium**".





Surround the heart and root of great blood vessel

Fibrous pericardium → tough connective tissue.

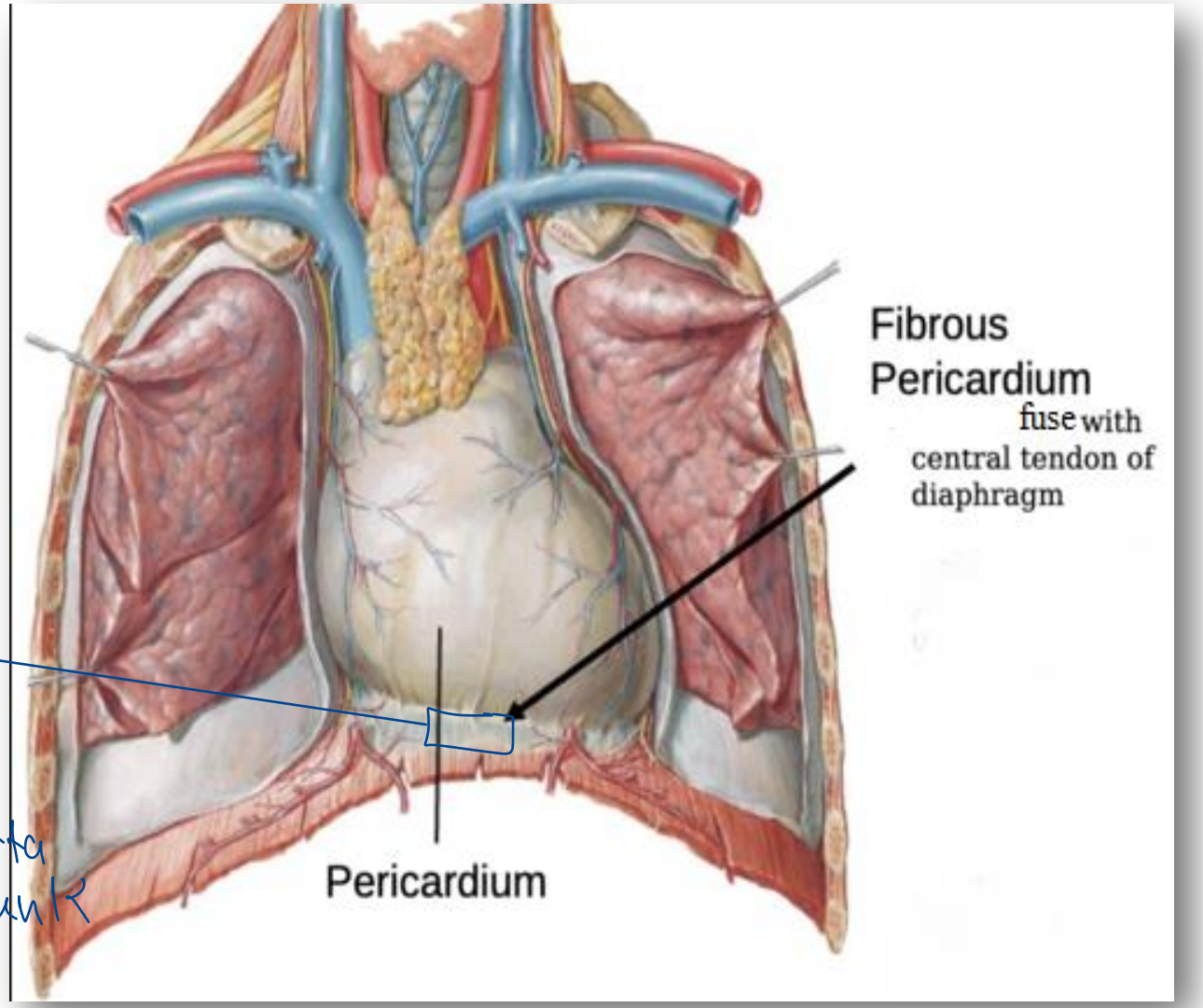
Shape: It is conical having base, apex and four surfaces (Anterior, Posterior & two laterals).

Relations & fixation:

Base: Directed downwards firmly attached to central tendon of diaphragm.

Apex: Directed upwards, and fused with the outer coats of the great vessels. ← Ascending aorta, Pulmonary trunk

↳ Adventitia



Posterior surface: (Base of heart).

- Related to the posterior mediastinum & its contents.
- Fuse with adventitia of descending thoracic aorta.

هي الطبقة الخارجية من ال descending thoracic aorta

Two lateral surfaces:

- Related to the corresponding right & left lungs & pleura & phrenic nerves.

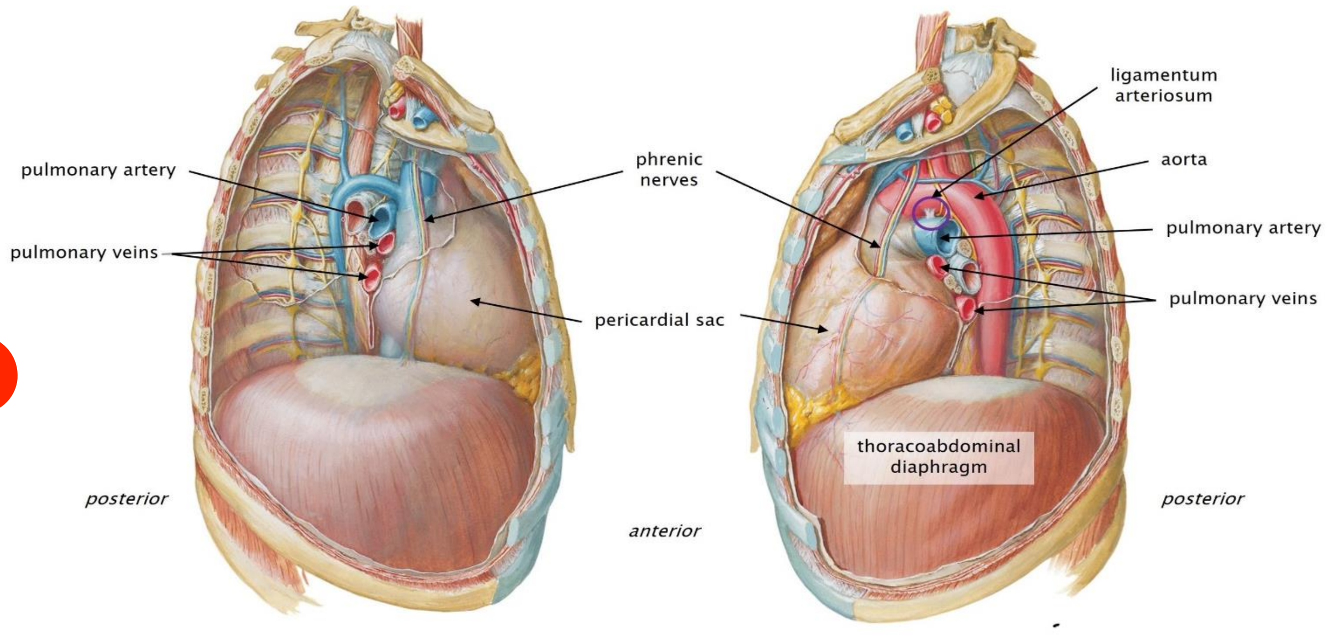
Function of Fibrous Pericardium

1) Maintain central position of heart within the chest. → ال heart نفسه ما يزحل اثبتته بـ ligament أو اشياء

ثانيا لانه organ بيضخ يعني pump فاثابتة الـ pericardium الي تحيط بال heart تحكه.

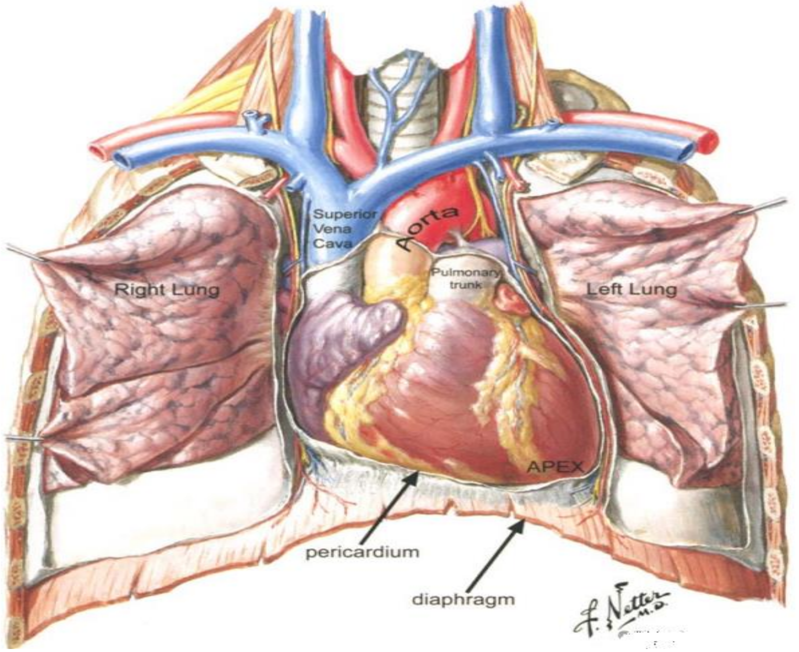
2) Prevents the over-distension of heart.

3) protection



View of thoracic cavity from right side (lung removed)

View of thoracic cavity from left side (lung removed)



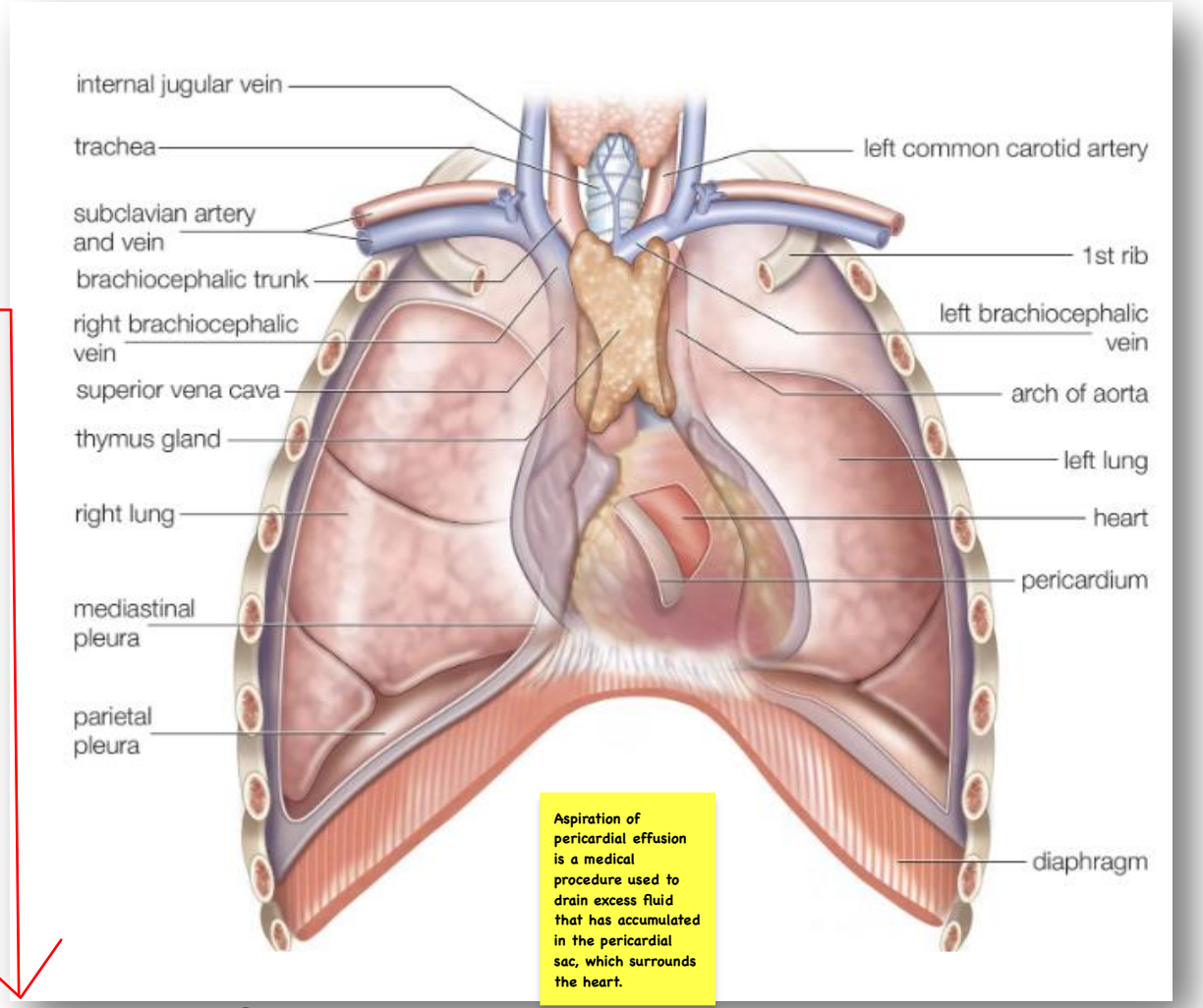
Anterior surface of the fibrous pericardium;

- It is separated from the thoracic wall (body of sternum & 3- 6 costal cartilages of both sides) by the pleural membranes and the anterior edges of the lungs.

Bare area of pericardium;

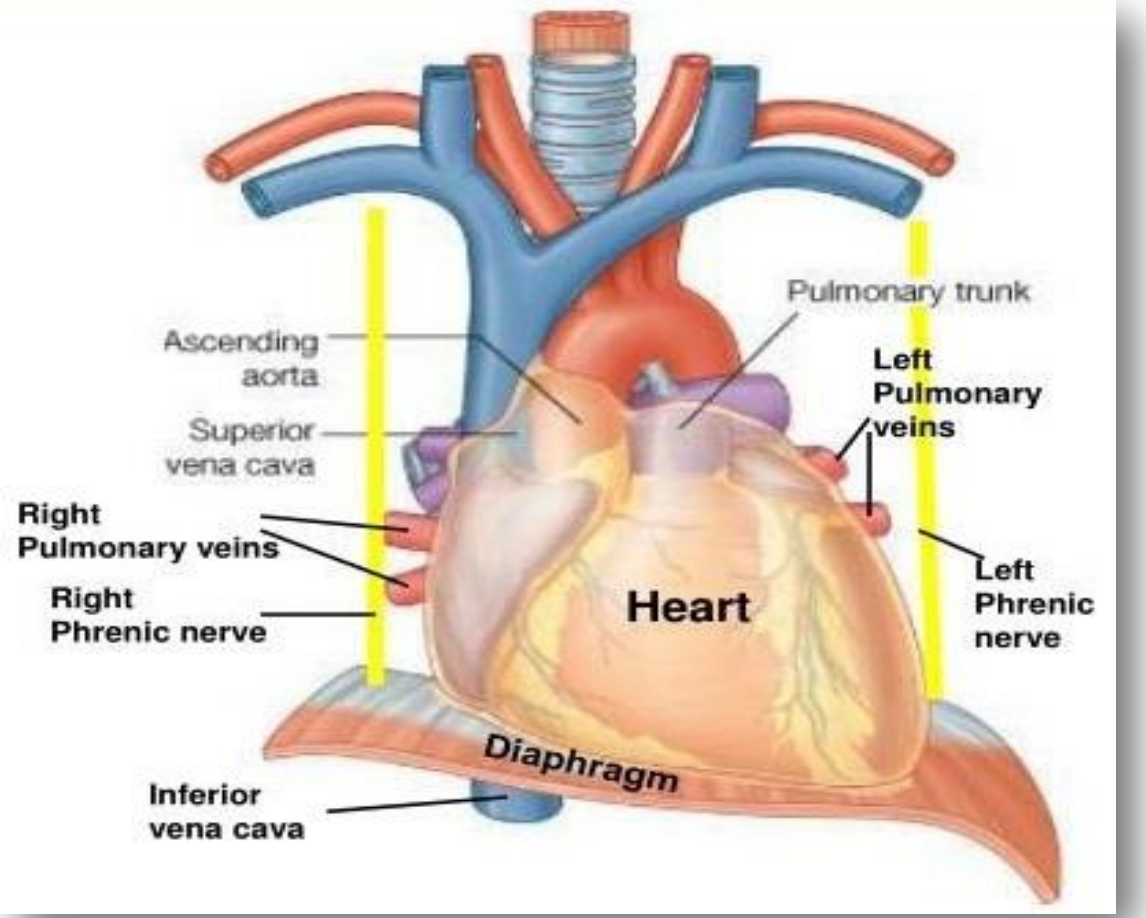
- It is an area of the anterior surface of the pericardium, at cardiac notch, behind the lower part of the left half of the body of the sternum and the sternal ends of the left 4th to 6th costal cartilages.
- At this area, the pericardium is in direct contact with the thoracic wall without lung in between.

- This surface **attached to the** body of sternum by pericardio-sternal ligaments.



Contents of the fibrous pericardium

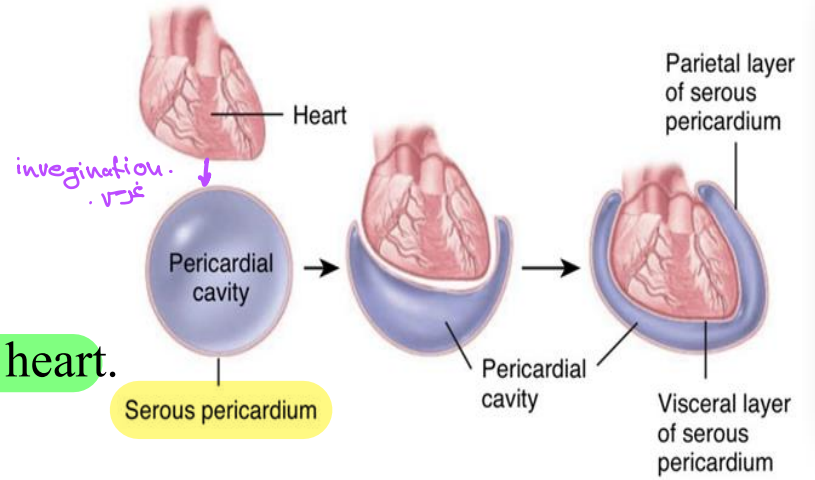
- Serous pericardium (inner to fibrous pericardium) & its sinuses
- Heart & its blood supply
- Great vessels of the heart
  - Ascending aorta
  - Pulmonary trunk
  - Lower 1/2 of SVC
  - Termination of IVC
  - Four pulmonary veins

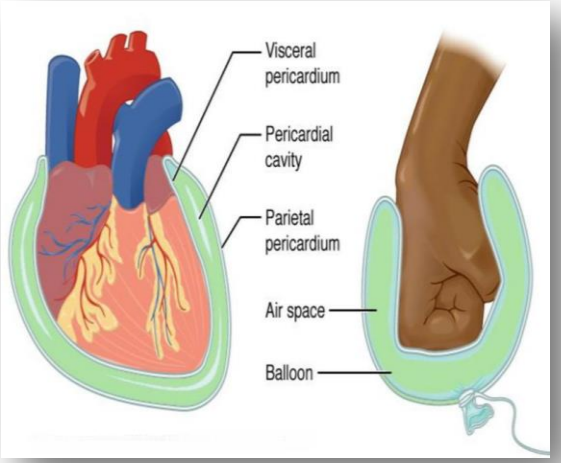


Fibrous pericardium هي اللي حاطين حولين (outer one layer).

Serous pericardium:

It is a closed serous sac, formed of two layers:



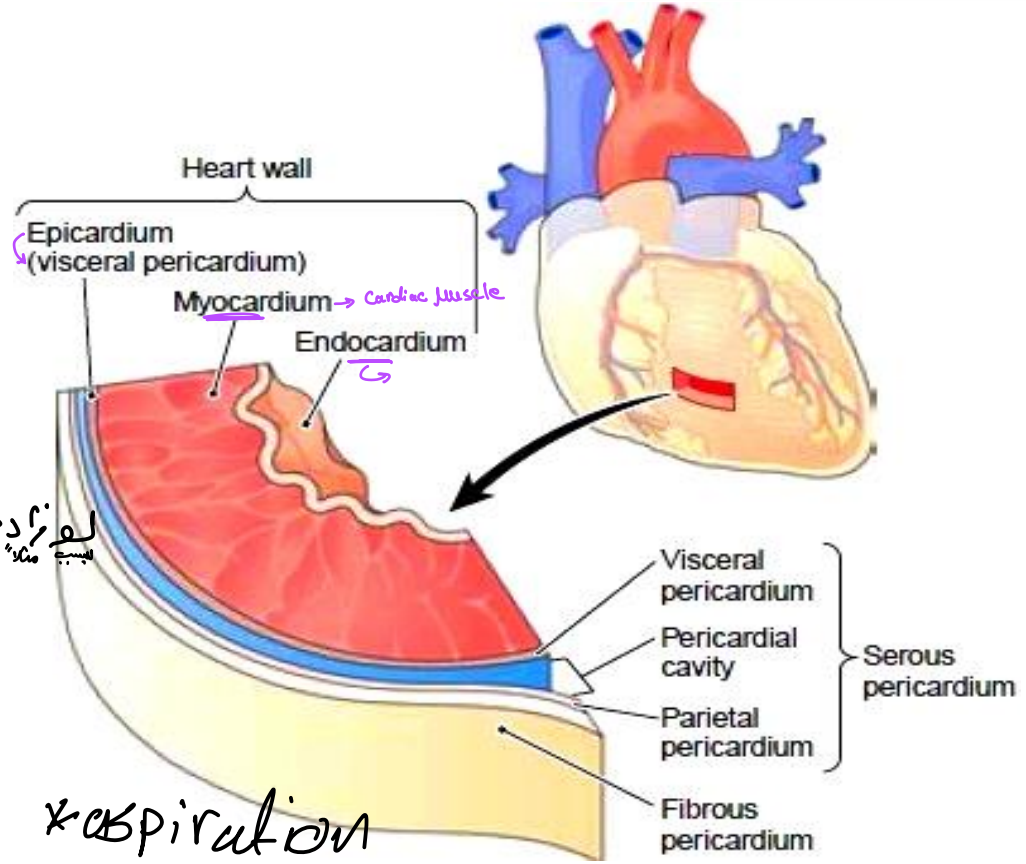


1) Visceral layer (epicardium of the heart)

- This layer is closely applied on the surface of the heart.

2) Parietal layer:

- This layer lines the inner surface of the fibrous pericardium.
- It is reflected around the roots of the great vessels to become continuous with the visceral layer of the serous pericardium.



Pericardial cavity

- It is found between the visceral and parietal layers and contains thin film of fluid.

Function of serous pericardium:

- Responsible for lubrication of heart preventing the friction during its movement.

هذه المعلومة تكررت خلال المحاضرة

Pericardiocentesis

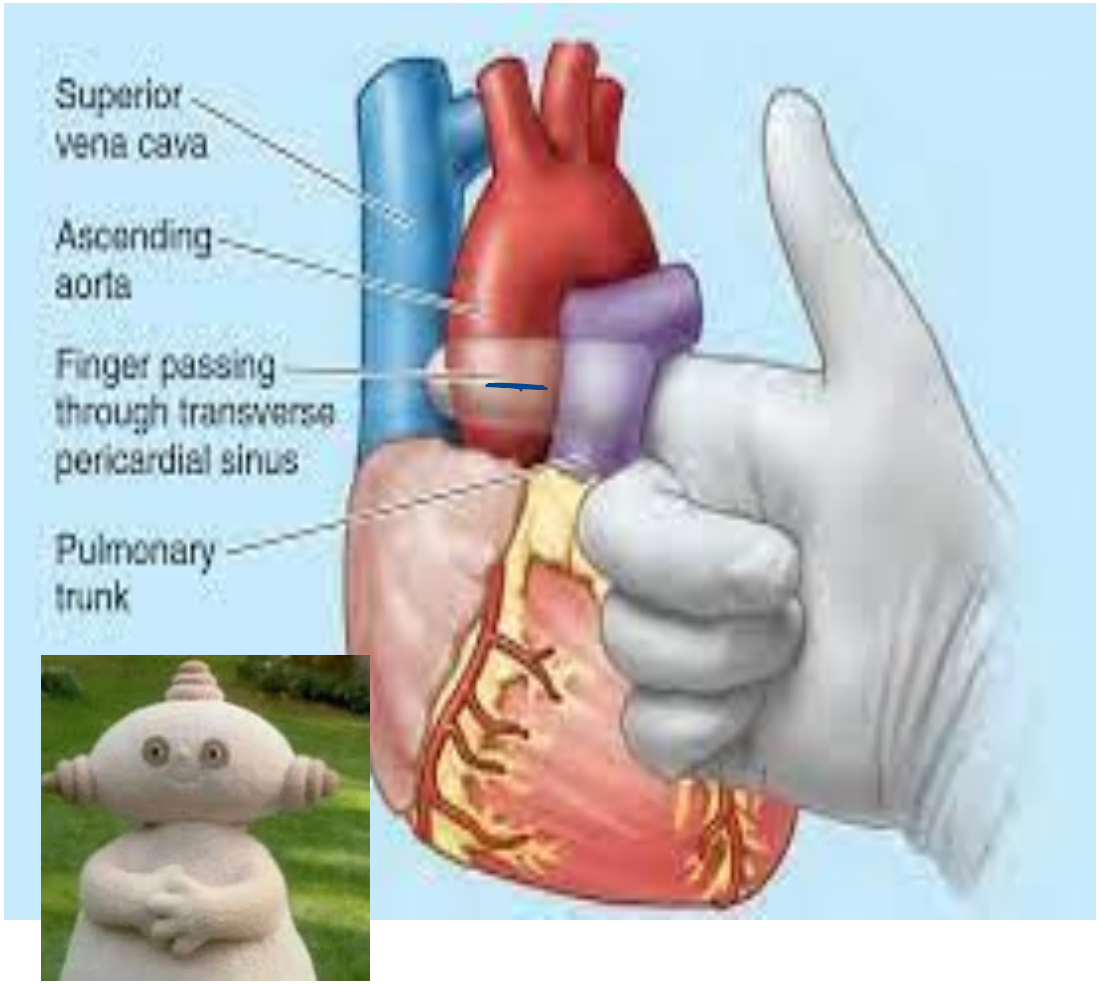
- It is a surgical puncture of the pericardial cavity for the aspiration of fluid, which is necessary to relieve the pressure of accumulated fluid on the heart in case of (pericardial effusion). A needle is inserted into the pericardial cavity through the fifth intercostal space left to the sternum, the needle doesn't penetrate the pleura and lungs, but it penetrates the pericardium

في بعض الحالات الي فيها تتجمع السوائل داخل ال pericardial cavity ، عشان نشيل السوائل المتجمعة ندخل انبوب لل pericardial cavity ونسحب السوائل في ونخفف الضغط على القلب عملية تسمى ال pericardiocentesis

Pericardial Sinuses:

1-Transverse sinus:

- It is a transverse passage lined by the serous pericardium.
- It is **situated** between the ascending aorta and pulmonary trunk in front, and the superior vena cava, and pulmonary veins behind.

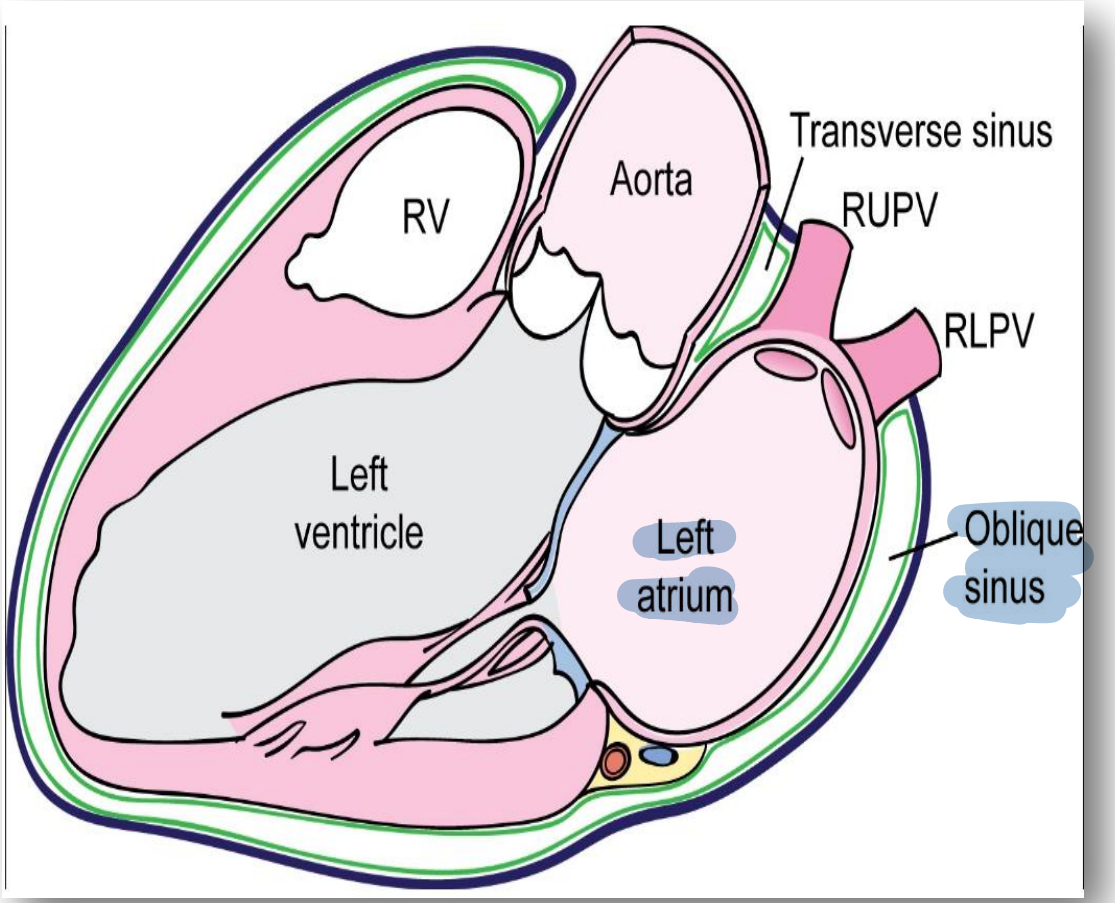


Clinical significance

During cardiac surgery, the transverse pericardial sinus allows a surgeon to isolate the pulmonary trunk and ascending aorta and apply a temporary ligature or clamp.

2- Oblique Sinus: directed oblique

- It is a recess of the serous pericardium, lies behind the left atrium of heart.
- The parietal layer of serous pericardium & fibrous pericardium separate the oblique sinus from the structures of the posterior mediastinum.



Arterial supply of pericardium:

Fibrous pericardium & parietal layer of the serous pericardium:

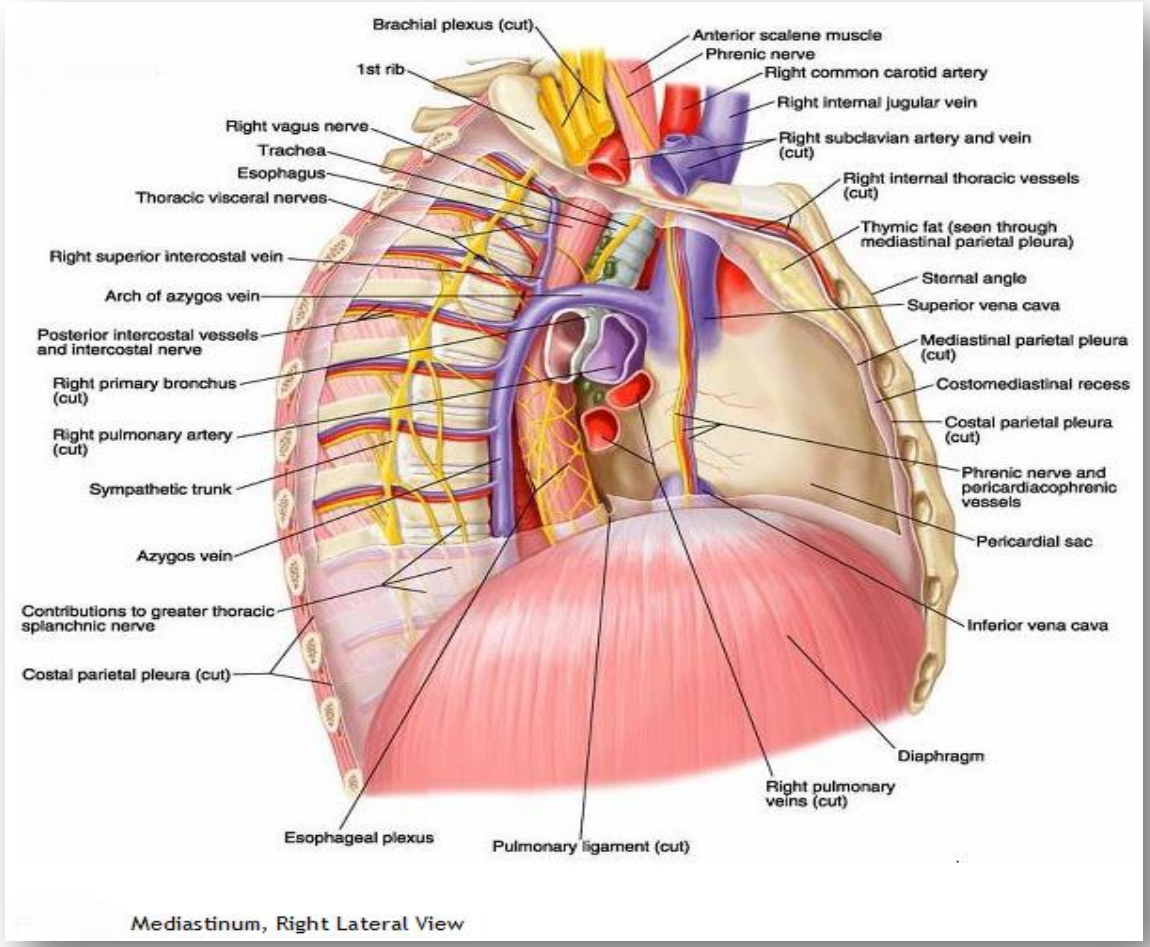
- Pericardiacophrenic artery. → internal thoracic Aorta
- Pericardial branches of descending thoracic aorta.

Visceral layer of serous pericardium: like cardiac muscle supplied by **coronary arteries.**

Nerve supply:

Fibrous & parietal layer of the serous pericardium: sensory fibers from the **phrenic nerve** (sensitive to pain). → Somatic supply.

Visceral layer of serous pericardium: supplied by **autonomic fibers** (not sensitive to pain).



Mediastinum, Right Lateral View

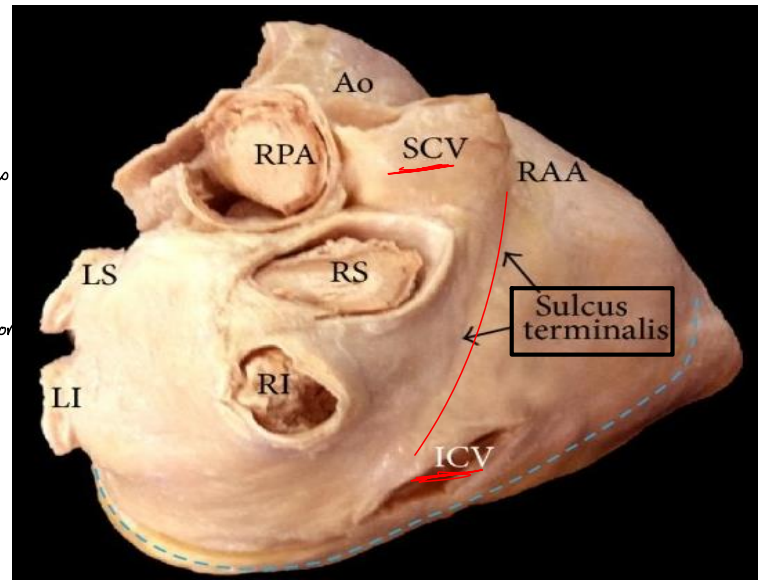
Interior of Right Atrium

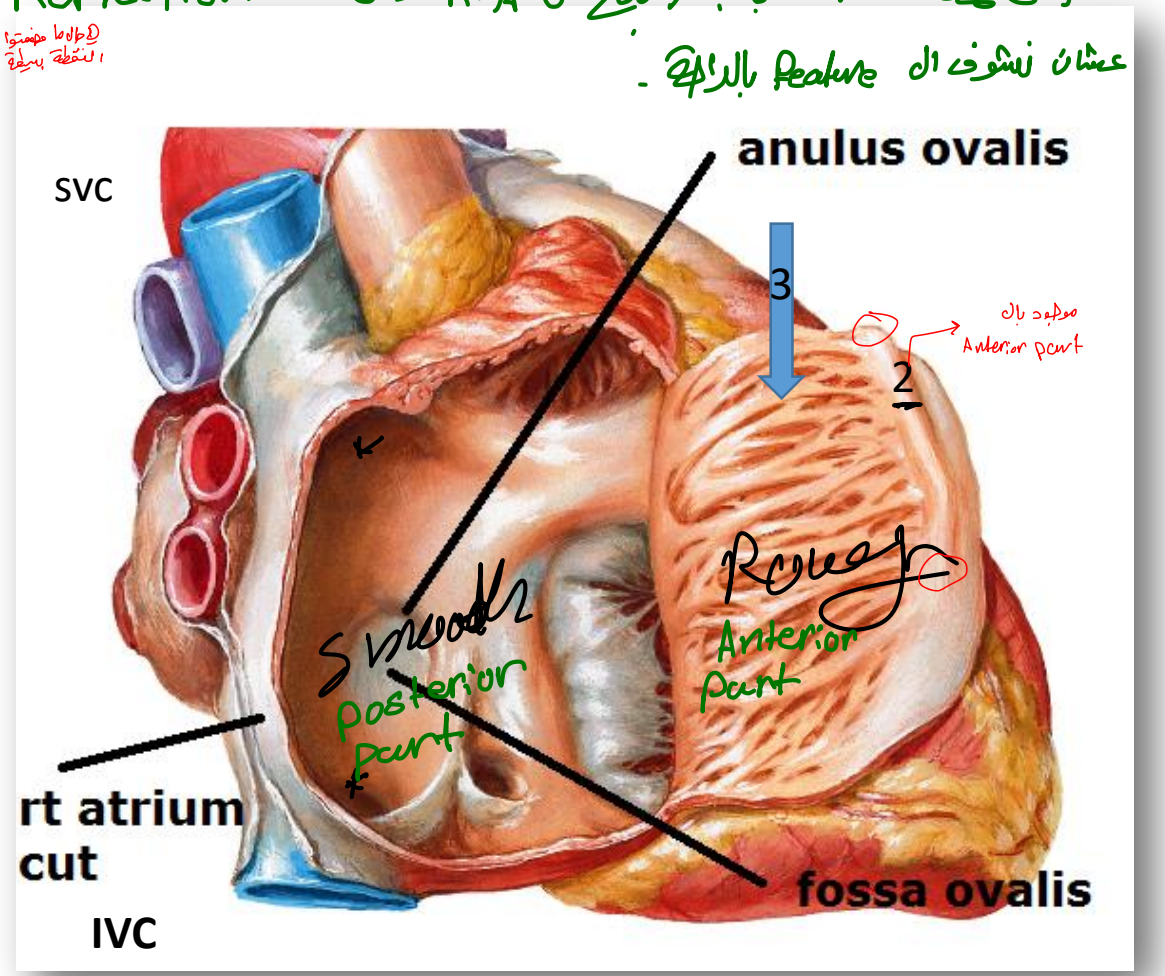
A- Rough anterior part, show:

1- Openings of anterior cardiac veins.

2- **Crista terminalis:** Vertical muscular ridge between SVC & IVC, separate anterior part from posterior part and represented externally by the sulcus terminalis.

3- **Musculi Pectinati:** Transverse muscular ridges from crista terminalis to the right auricle.





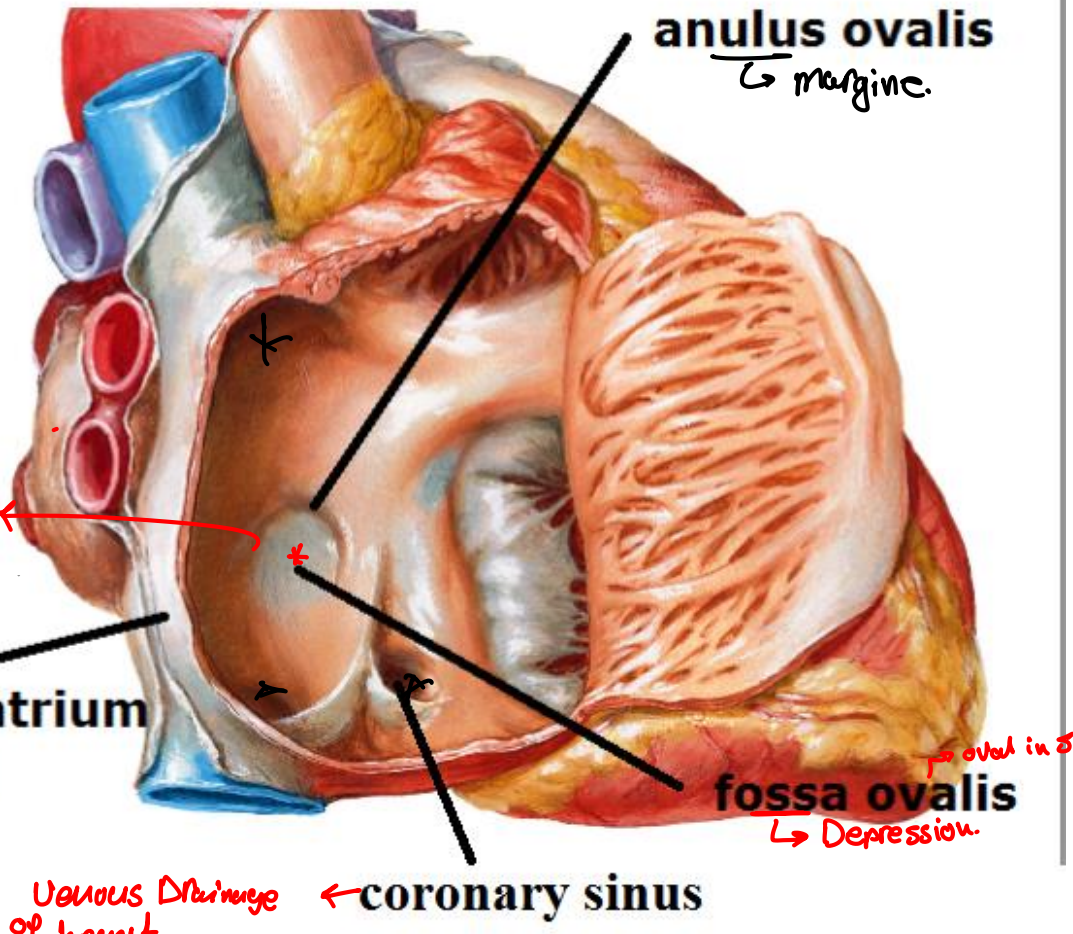
heart ← Venous Drainage ← coronary sinus

R. Atrium

B- Smooth Posterior part, shows: → No musculer Ridges

1. **Openings of:** S.V.C, I.V.C & coronary sinus. → All of these represent deoxygenated Venous Drainage
   R&Lt Atria الجاز مابين ال
2. **Interatrial septum which has:** fossa ovalis, limbus fossa ovalis.

- **Fossa ovalis:** shallow depression on interatrial septum.
- **Annulus ovalis:** Curved ridge that form upper & anterior boundaries of fossa ovalis.
  Raised margin of ال بالجهات fossa ovalis



Development خلال ال
R&Lt Atria مابين ال foramen كان في heart ال
circulation after Birth تختلف fetus ال circulation تحت انه فتحي ما نعرف
هاي ال opening بتسكر بعد الولادة
واذا خلت فاتحة الطفل رح يكون عنده
فتحة بالقلب والدكاترة بحكوا heart الطفل عنده فتحة/ثقب بال
foramen in the ال بحيث هم بعكس بقعدوا interatrial septum

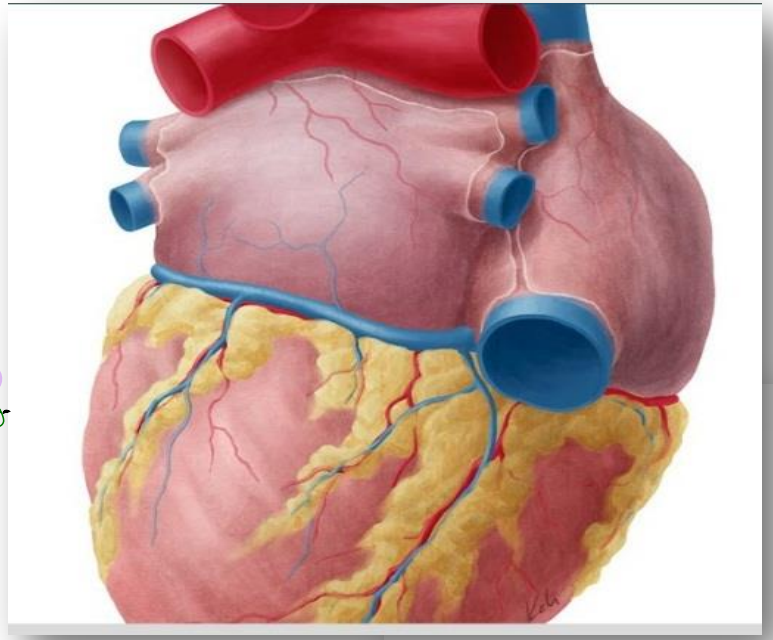
C-Tricuspid opening:

superior to R. ventricle
R.Atrium & R. Ventricle مابين تتضيق

-In lower anterior part of the right atrium.
-Guarded by tricuspid valve
-Admit three fingers.

Fibrous تكون ← fossa ovalis ال طبيعي هلقاتسكر هذي الفتحة رح تترك

Interior of Left atrium



A- Rough anterior part:

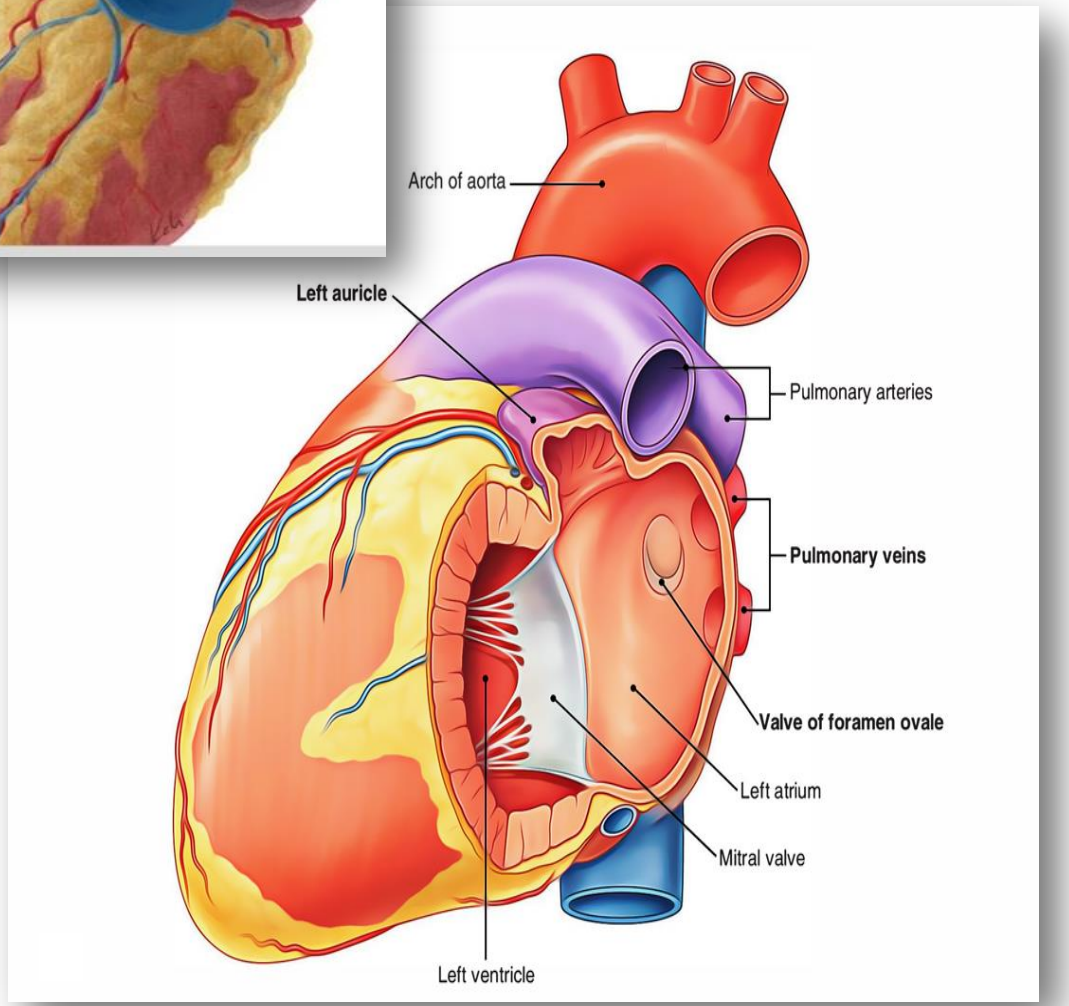
- Only its auricle that has musculi pectinate. anterior part of left Atrium is left auricle

B- Smooth posterior part shows:

- Openings of four pulmonary veins (Two at each side).

C- Mitral opening:

- Guarded by mitral valve.
- Admit two fingers.



Quiz

Which structure(s) compress(es) the posterior surface of the heart during cardiopulmonary resuscitation?

a) The body of the sternum

b) The bodies of the thoracic vertebra

c) The tracheal bifurcation

d) The inferior vena cava

PA

In a posteroanterior radiograph of the thorax, the following structures form the left margin of the heart shadow except which?

(a) Left auricle = left Atrial appendage.

(b) Pulmonary trunk

(c) Arch of aorta

(d) Left ventricle

(e) Superior vena cava