

MEDIASTINUM

- * It is the median space of the chest cavity extending from its inlet to its outlet, and is bounded on each side by pleura and lung.
- * For the purpose of description, it is divided into :

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1) Superior mediastinum :

It is the area above a line extending from the sternal angle to the lower border of 4th thoracic vertebra. It extends from the manubrium sterni (anteriorly) to the vertebral column (posteriorly).

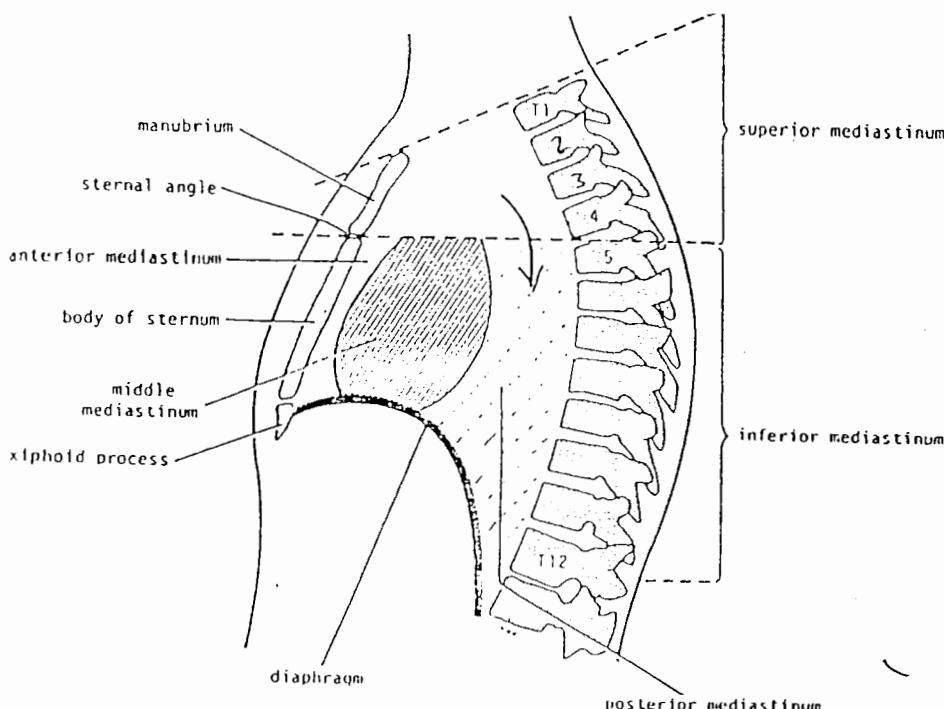
of bustam

2) The part below the superior mediastinum (inferior mediastinum) is divided into 3 parts :

a — **Anterior mediastinum** : anterior to the heart.

b — **Middle mediastinum** : occupied by the heart and pericardium.

c — **Posterior mediastinum** : posterior to the heart.



Superior mediastinum

Anterior → Manubrium Sterni

Posterior → T₁ - T₄ Vertebrae

Sup. → thoracic inlet
inf. → imaginary plane
Passing from Sternal angle
anteriorly to the lower border
of the body of 4th thoracic
Vertebra posteriorly

Contents Arch of Aorta
and related structures

Inferior mediastinum

Anteriorly → Body of Sternum

Posteriorly → lower 8 thoracic Vertebrae (T₅ - T₁₂)

Superiorly → imaginary plane

Inferiorly → thoracic outlet (largely closed by diaphragm)

Divisions → (1) Ant. mediastinum

Contents → Fat + Lymph nodes

(2) Middle med.

- a. Pericardium and its contents
- b. 2 phrenic nerves

(3) Post. med.

- a. oesophagus
- b. descending aorta
- c. others

Serous Pericardium \Rightarrow It is a serous sac that has been invaginated in fetal life by the developing heart, so it becomes folded

in 2 layers

1. Visceral layer (epicardium) adjacent to the heart

2. Fibrous pericardium

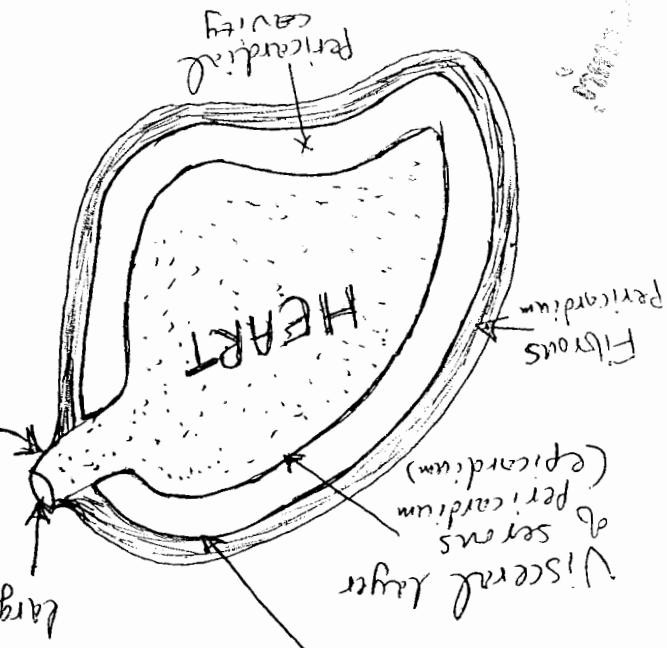
3. Anteriorly connected to the body

4. Posteriorly related to descending aorta and inferior sternal pericardial ligaments

5. On each side related to esophagus

Pericardio- \rightarrow medastinal pleura \rightarrow parietal peritoneum \rightarrow Phrenic muscle \rightarrow surface of lungs

- * The two layers (visceral) are continuous with each other at the pericardial cavity and potential space between the visceral and parietal layers the fibrous pericardium (superficial) is supplied by the phrenic nerves
- * The two layers (visceral) are continuous with each other at the pericardial cavity and potential space between the visceral and parietal layers the fibrous pericardium (superficial) is supplied by the autonomic nerves
- * Two layers (visceral) are continuous with each other at the pericardial cavity and potential space between the visceral and parietal layers the fibrous pericardium (superficial) is supplied by the autonomic nerves



* 2 sacs of pericardium

outer single-layered fibrous

inner double-layered serous

sac which encloses the heart and middle mediastinum

roots of the great vessels. It is situated in the middle

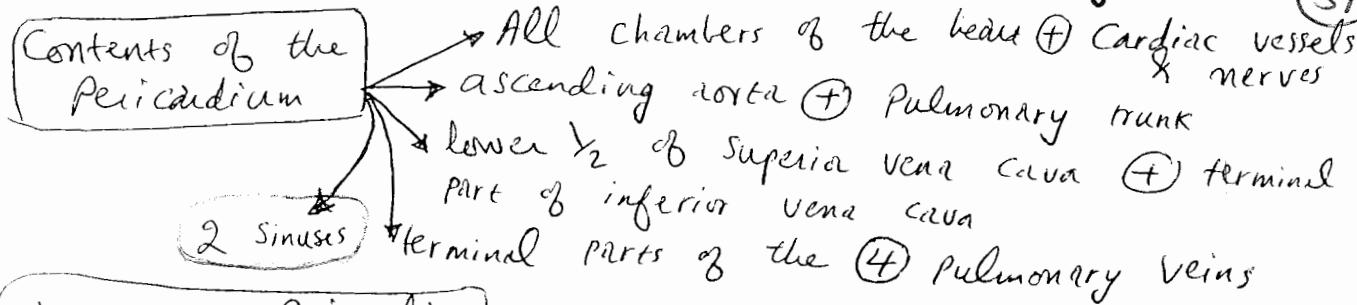
fibrosous

roots

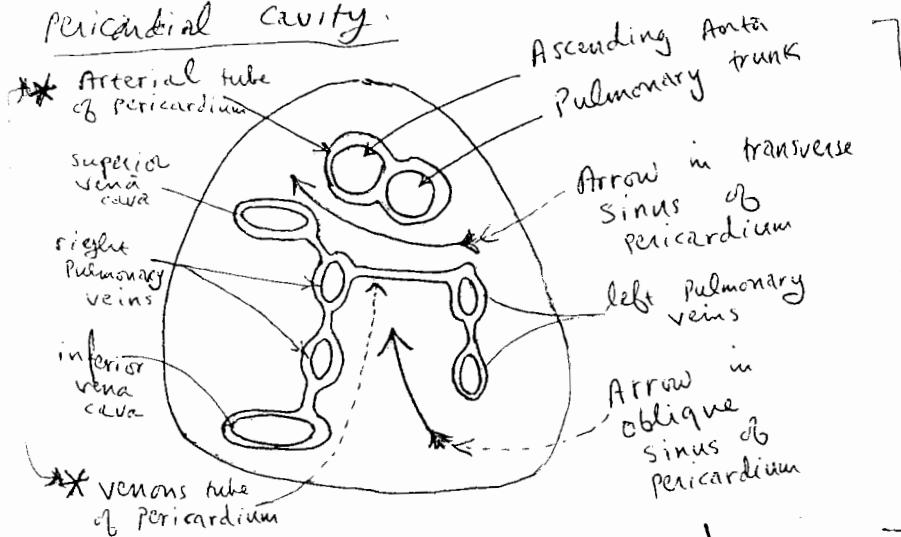
of the great vessels

PERICARDIUM

-30-



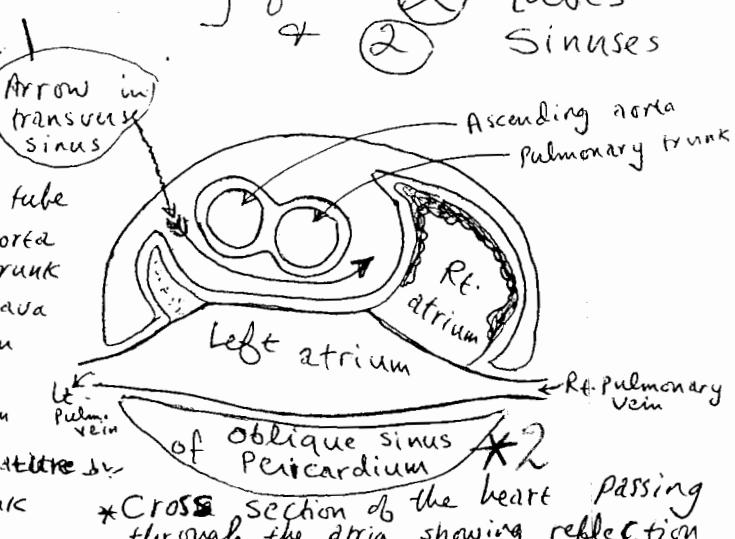
Sinuses of Pericardium → The visceral pericardium (epicardium) at the roots of the great vessels is arranged in the form of two tubes. The ARTERIAL TUBE encloses the ascending aorta and Pulmonary trunk i.e. arterial end of the heart tube. and the VENOUS TUBE encloses 2 Vena cavae & 4 Pulmonary veins i.e. venous end of the heart tube. The Passage between the two tubes is known as the transverse sinus of pericardium. The arrangement of the venous tube encloses a recess → the oblique sinus of pericardium which opens downwards into the general pericardial cavity.



The Pericardial cavity seen after removal of the heart → Note the great vessels piercing the pericardium and the reflection of the pericardium forms 2 tubes + 2 sinuses

* The transverse Sinus

- a horizontal gap between the arterial & venous ends of the heart tube
- bounded anteriorly by ascending aorta, pulmonary trunk
- posteriorly by sup. vena cava, left atrium
- develops from breaking down of dorsal mesocardium
- through this sinus a temporary ligature is passed to occlude pulmonary trunk & ascending aorta during cardiac operations



* Cross section of the heart passing through the atria showing reflection of pericardium to form two sinuses.

The oblique sinus of pericardium

- a narrow gap behind the heart (like the lesser sac behind the Stomach)
- bounded
 - anteriorly by → left atrium
 - posteriorly by → Parietal pericardium (outside lies the oesophagus and descending aorta).

N.B. 1. Stand on the right side of the cadaver → Put your left index finger in the transverse sinus of pericardium and the right index finger in the oblique sinus → the (LEFT ATRIUM) lies between the two fingers

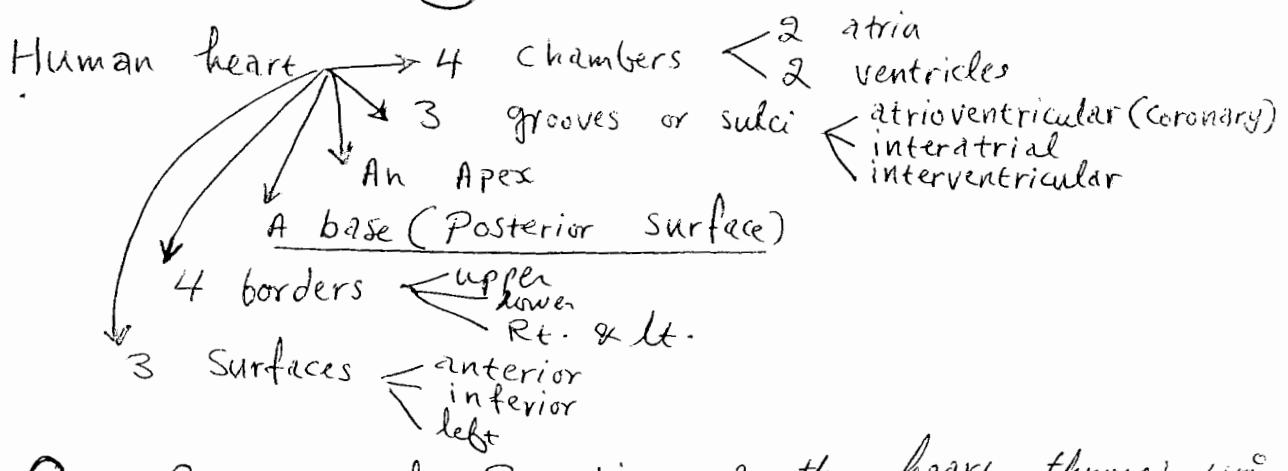
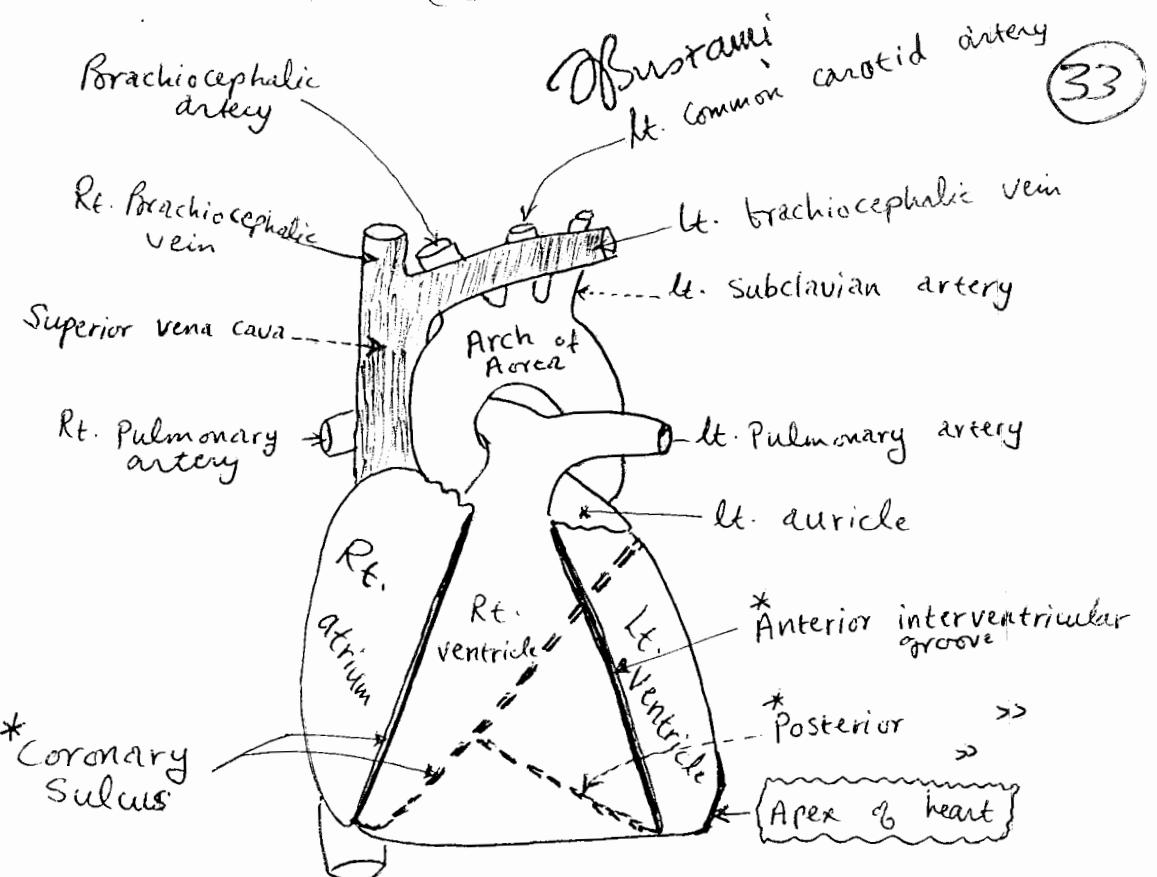
2. The sinuses lie INSIDE the pericardium → they DO NOT communicate with the pleural sacs.

Arterial supply

The fibrous and parietal pericardia are supplied by branches from (a) internal thoracic (b) musculophrenic (c) descending thoracic aorta

Nerve supply

The fibrous and parietal Pericardia are supplied by the phrenic nerve and are Pain Sensitive. The Visceral pericardium (epicardium) is supplied by autonomic nerves of the heart and is insensitive. Cardiac pain (angina) originates in the cardiac muscle or the vessels.



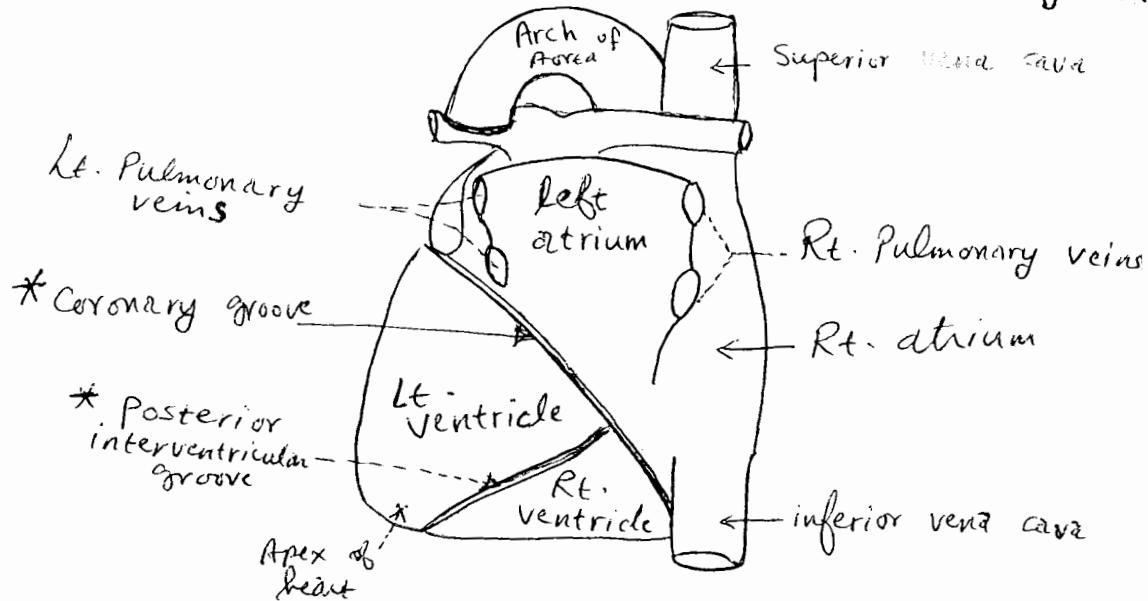
* On account of Rotation of the heart through 45° during development

- $\frac{2}{3}$ of it is shifted towards the left
- $\frac{2}{3}$ of Right atrium & Right ventricle face anteriorly
- $\frac{2}{3}$ of Left ventricle + most of Left atrium face posteriorly

Grooves or Sulci

1. Atrio-Ventricular or Coronary groove → Separate atria from ventricles
 - Obliterated anteriorly by ascending aorta & pulmonary trunk
 - Contains trunks of coronary arteries + small cardiac veins
 - + Coronary Sinus
2. Interatrial groove → anteriorly → hidden by aorta & pulmonary veins
faintly visible posteriorly
3. Anterior interventricular groove → nearer to Lt. margin of heart
 - Contains anterior interventricular branch of Rt. coronary a.
 - Great cardiac vein

Obstetrics



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Posterior View of Heart (base & diaphragmatic surface)

4. The posterior interventricular groove → Situated on diaphragmatic (inferior) surface of heart contains posterior interventricular branch of Rt. coronary artery & middle cardiac vein nearer to the Lt. margin.

(Apex of heart) → formed by the left ventricle directed downward forwards & to the left overlapped by the anterior border of the left lung
Situated in the left 5th intercostal space 3.5 inches lateral to the midsternal line → just inner to the midclavicular line.
In the living subject it is seen & palpated as apex beat

Base → forms the posterior surface of the heart → formed mainly by the left atrium & a small part of Rt. atrium
It is related to middle 4 thoracic vertebrae (T5-8) in the lying posture and descends by one vertebra (T6-9) in the standing posture.
It is separated from vertebral column by pericardium & oesophagus descending aorta

Borders → upper → slightly oblique and formed by the two atria, chiefly the left atrium
right → formed by Rt. atrium
Inferior → formed by Rt. ventricle
left → oblique, formed mainly by left ventricle & partly by Lt. auricle

Surfaces of the heart *of sustentaculum*

① Anterior (Sternocostal) surface → formed mainly by Rt. Atrium / Ventricle
partly by Lt. Ventricle / auricle

- * the left atrium is hidden from the front by the ascending aorta and pulmonary trunk
- * A part of this surface is uncovered by the left lung (within the cardiac notch) is known as the area of superficial cardiac dullness.

② Inferior (diaphragmatic) surface → Rests on central tendon of diaphragm

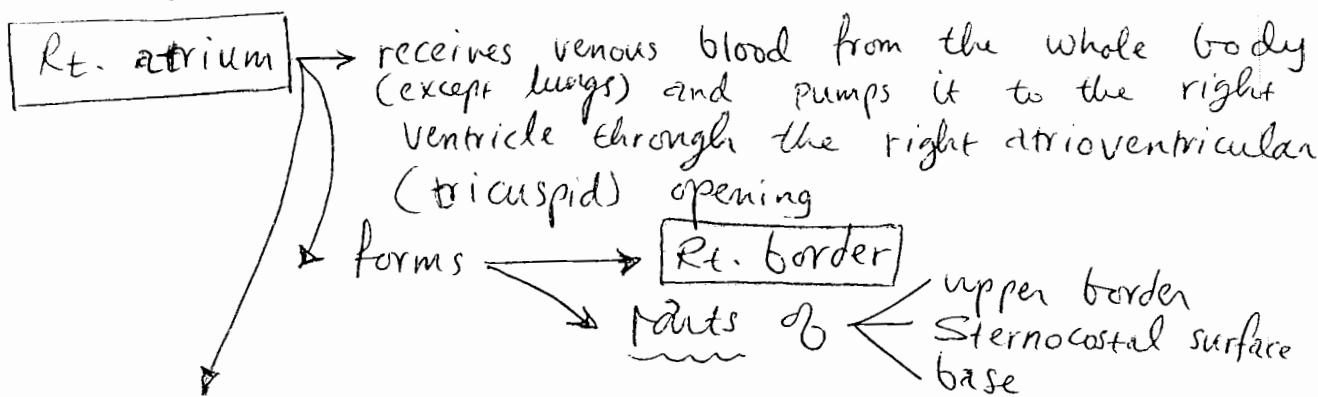
- formed in the left $\frac{2}{3}$ → by left ventricle
- in the right $\frac{1}{3}$ → = right "
- traversed by posterior interventricular groove

③ left surface - formed by left ventricle / left auricle

④ - crossed in its upper part by the coronary groove containing the left coronary artery (great cardiac vein)

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Chambers of the heart



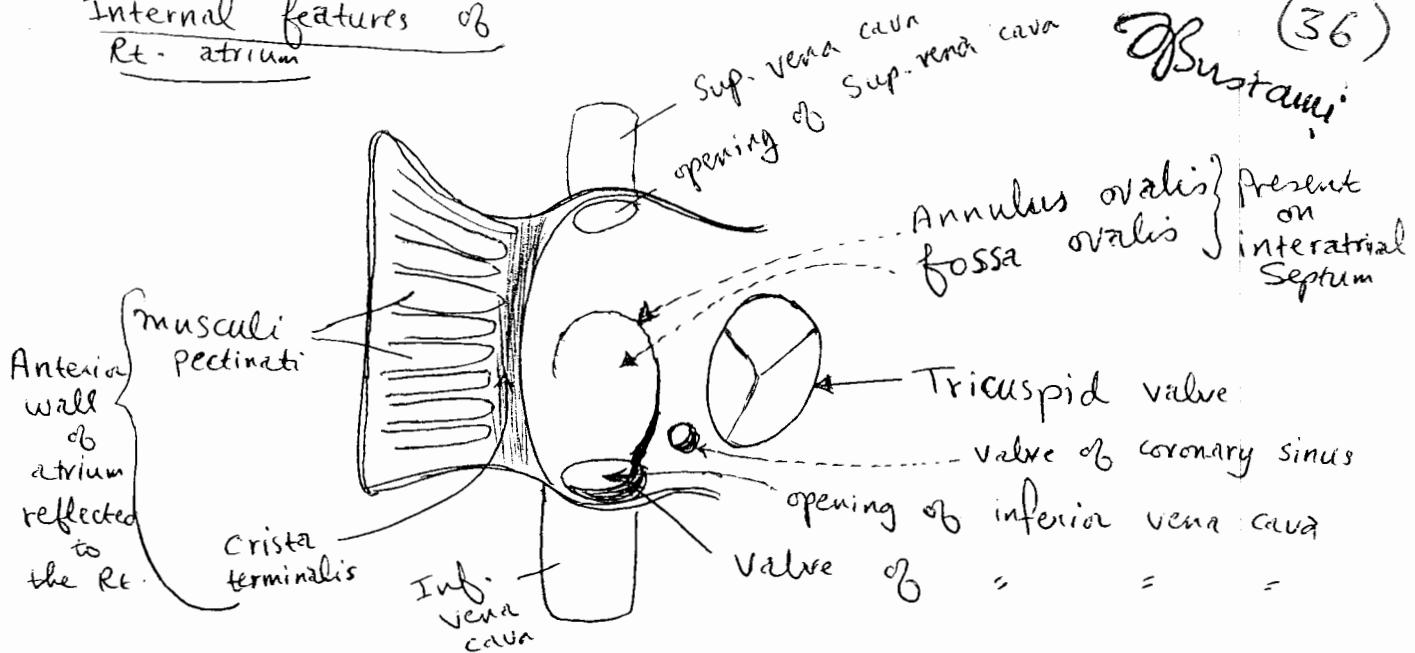
External features

- 1 - receives Superior vena cava at the upper end and inferior vena cava at the lower end
- 2 - Sulcus terminalis → a shallow groove along the right border between the superior and inferior vena cavae
not always obvious
Produced by an internal muscular ridge called Crista terminalis
Its upper part contains (SA) node which acts as the pace maker of heart

Internal features of Rt. atrium

(36)

(36)



The interior of the right atrium can be divided into the following parts

The Smooth Posterior part OR sinus venarum
The rough anterior part including the auricle OR pectinate part
The posterior wall formed largely by the interatrial septum

1) The smooth posterior part

a. developmentally it is derived from the right horn of the sinus venosus

b. It receives the superior vena cava at its upper end and the inferior vena cava at its lower end

The opening is guarded by a rudimentary valve of the inferior vena cava (during embryonic life it directs the blood to the left atrium through the foramen ovale)

Coronary sinus: opens between the inferior vena cava and the right atrioventricular opening (the opening is guarded by a valve)

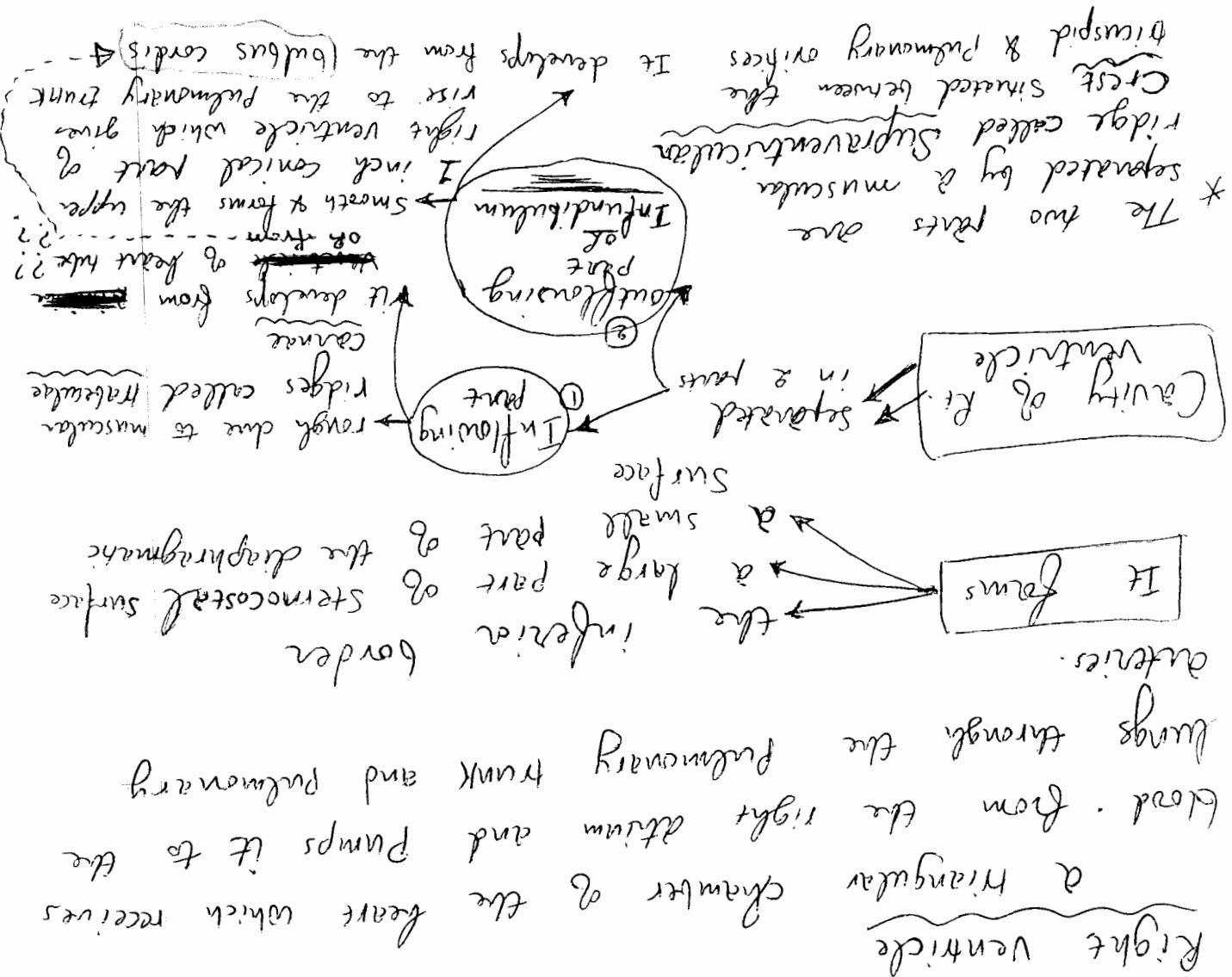
Rt. atrio-ventricular opening
guarded by the tricuspid valve

Venae cordis minimae: small pits which brings blood from the myocardium

2) The rough anterior part

a. developmentally it is derived from the primitive atrial chamber

b. It presents a series of transverse muscular ridges called musculi pectinati. They arise from the crista terminalis and run towards the A-V opening giving the appearance of the teeth of a comb.



Remember that the left atrium lies posterior to the right atrium

The valve of inferior vena cava.

Diameter edge is continuous with the left end of the free edge at the sides, but different inferiorly. It is also and at the sides, but different inferiorly. Its

is the prominent margin of the fossa ovalis and represents the free edge of septum secundum. It is distinct

c. the ANNULLUS OF LIMBUS fossa ovalis

septum primum

b. It presents FOSSA OVALIS \leftrightarrow a shallow saucer-shaped depression in the lower part formed by the

a. developmentally it is derived from the septum primum and septum secundum

3. The posterior septal wall of right atrium: Conotum

The cavity of the Rt. Ventricle shows two openings (orifices):

- (1) the right atrio-ventricular or tricuspid orifice guarded by the tricuspid valve
- (2) Pulmonary orifice guarded by the pulmonary valve

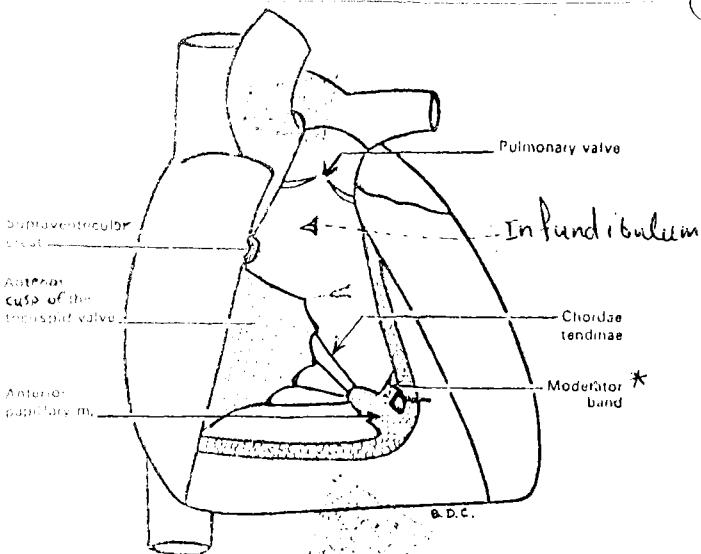


Fig. 169 Interior of the right ventricle of the heart, showing the moderator band and the supraventricular crest.

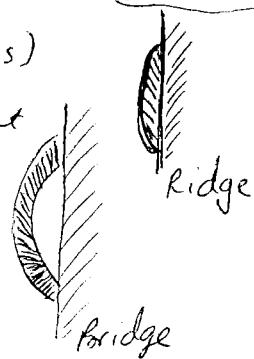
Obstacles

* The (trabeculae carneae) (muscular ridges) present in the inflowing part are of 3 types → Ridges (fixed elevations)

→ Bridges (with two ends fixed but with a free centre)
pillars (papillary muscles)

With one end attached to the ventricular wall and the other end connected to the cusps of the tricuspid valve by chordae tendinae

(papillary muscle)



* There are 3 papillary muscles in the Rt. Ventricle

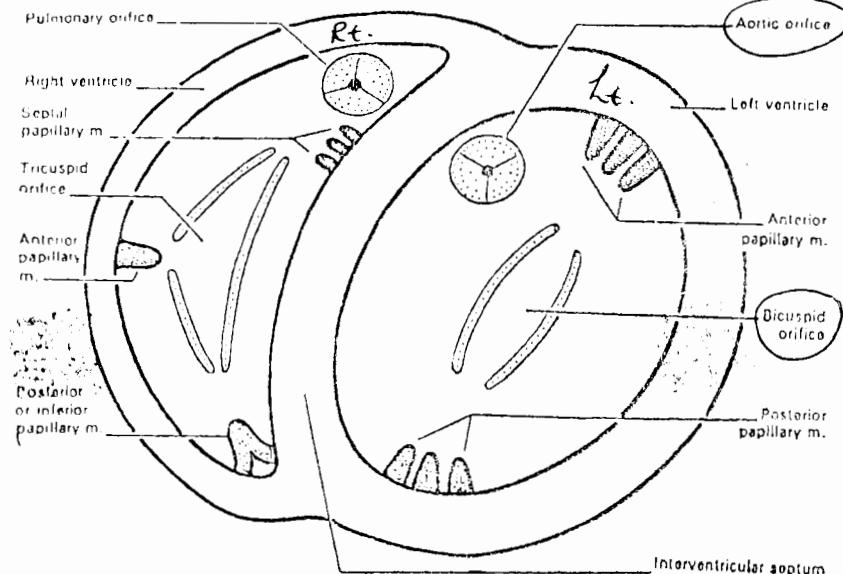
- The anterior is the largest
- The Posterior or inferior → small and irregular
- The septal → divided into a number of little nipples

EACH PAPILLARY MUSCLE IS ATTACHED BY THE CHORDAE TENDINAES TO THE CONTIGUOUS SIDES OF TWO CUSPS?
→ To ensure competency of the valve

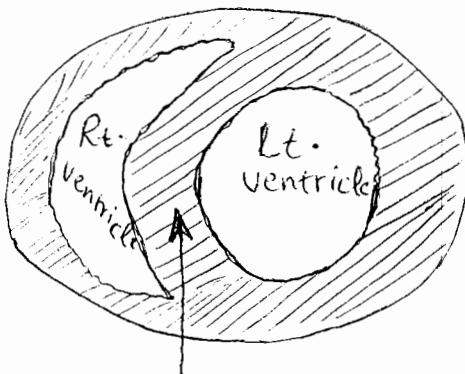
* The SEPTOMARGINAL TRABECULA (moderator band) is a muscular ridge extending from the ventricular septum to the base of the anterior papillary muscle (1) It contains Rt. branch of A-V bundle (2) It prevents overdistension of the right ventricle

* The cavity of the right ventricle ⇒ CRESCENTIC, by the forward bulge of interventricular septum

* The wall of the Rt. ventricle is thinner than that of the left ventricle, in a ratio of 1:3



Offustani
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interventricular
Septum (bulges
forward towards the
Rt. ventricle)

Fig. 168 Schematic transverse section passing through the ventricles of the heart, showing the atrioventricular orifices, papillary muscles and the pulmonary and aortic orifices.

The left ventricle: receives oxygenated blood from the left atrium and pumps it to the aorta.

It forms the apex
a part of the sternocostal surface ($\frac{1}{3}$)
left ($\frac{2}{3}$) of the diaphragmatic surface
most of the left border & left surface

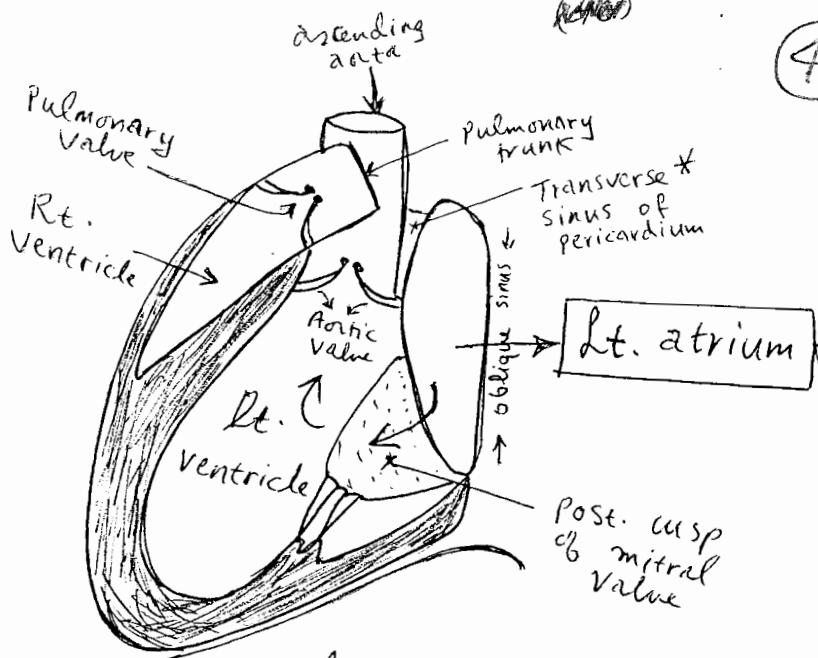
Cavity of Lt. ventricle → lower rough part with trabeculae carneae
(It develops from the primitive ventricle)
→ upper smooth part → aortic vestibule
which gives origin to the ascending aorta
(It develops from the bulbous cordis)

* The {vestibule} lies between the membranous part of the interventricular septum
the anterior (aortic) cusp of mitral valve

* The cavity of the left ventricle shows two orifices
1. The left atrioventricular (bicuspid or mitral) orifice
guarded by the bicuspid or mitral valve
2. The aortic orifice guarded by the aortic valve

* There are two papillary muscles, anterior } both are
attached to both cusps of mitral valve by chordae tendineae
Posterior }

* The walls of the left ventricle are 3 times thicker than those of the right ventricle



sagittal section of the heart showing the posterior position of the left atrium

(4) Offspring

major part of the base (left $\frac{2}{3}$)
its auricle projects anteriorly and forms part of the left border
forms part of sternocostal surface and upper border (greater part)

Receives oxygenated blood from the lungs through the (4) pulmonary veins and pumps it to the left ventricle through the left A-V (mitral) orifice

features

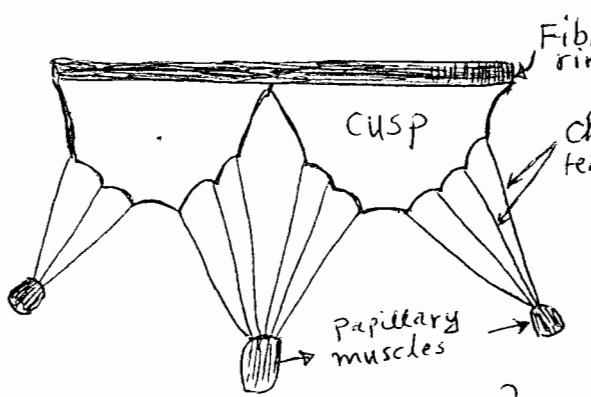
1. Its Posterior surface forms the anterior wall of the oblique sinus of pericardium
2. It intervenes between the transverse sinus of pericardium (in front) and the oblique sinus behind
3. Its anterior wall forms the interatrial septum
4. Two Pulmonary veins open on each side of the posterior wall
5. Greater part of its wall is Smooth (derived from absorption of the pulmonary veins which open into it)
6. Musculi pectinati → Present only in the auricle where they form a reticulum (this portion is derived from the primitive atrial chamber of the heart)

→ Valves of the heart ← **Oppose**

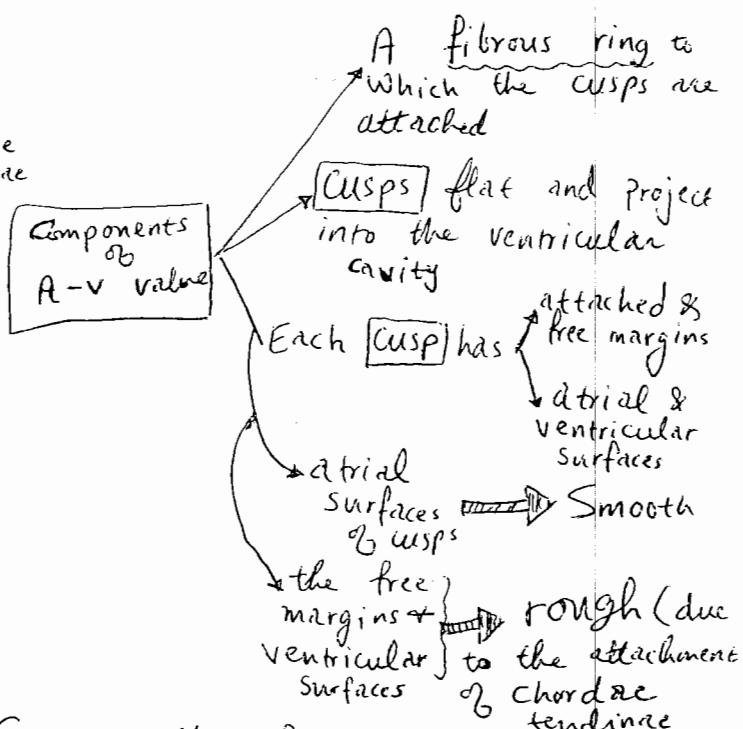
(41)

- * The valves of the blood in the opposite direction.
- * There are two pairs of valves in the heart

1. The Right atrioventricular valve is known as the tricuspid valve because it has 3 cusps
2. The left atrioventricular valve is known as the bicuspid or mitral valve because it has two cusps
3. The Semilunar valves include aortic } each one has pulmonary } 3 semilunar cusps.
4. The cusps are folds of endocardium, strengthened by the intervening layer of fibrous tissue



{ Basic structure of an atrioventricular AV valve (unfolded) }

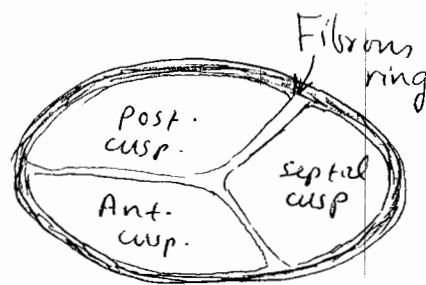
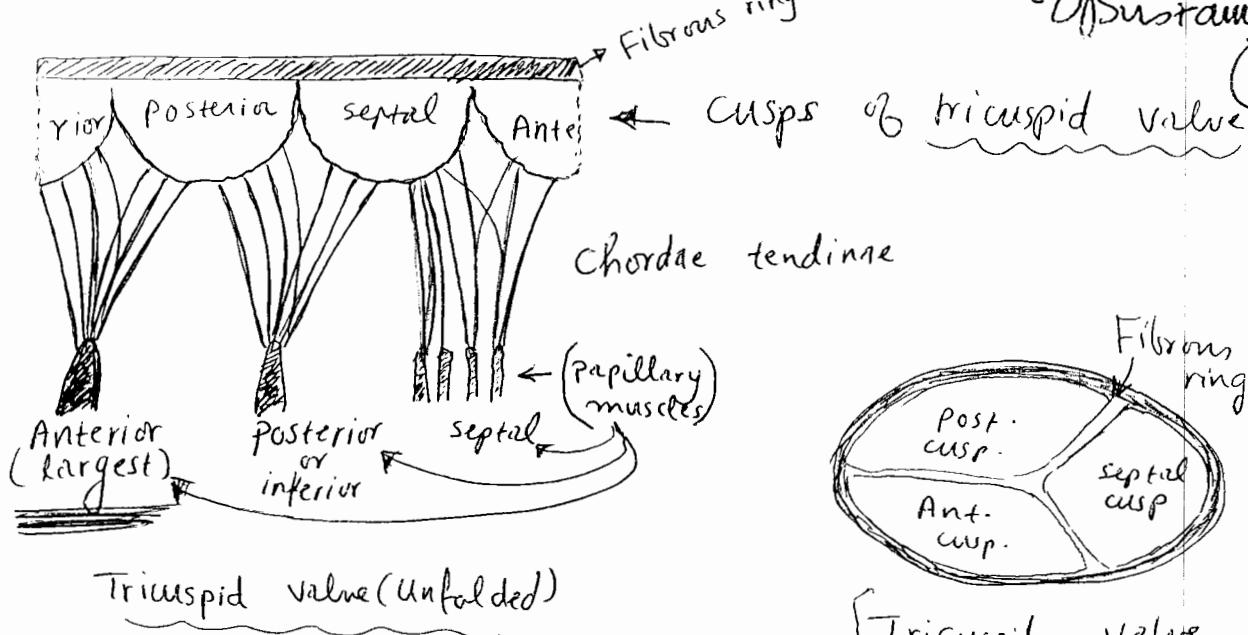


- * The Chordae tendinae → Connect the free margins and ventricular surfaces of the cusps to the apices of papillary muscles → They prevent Eversion of the free margins and limit the amount of ballooning of the cusps towards the cavity of the atrium
 - * The atrioventricular valves (A-V valves) are kept competent by ACTIVE contraction of the Papillary muscles which pull on the chordae tendinae during ventricular systole
- Remember → Each papillary muscle is connected to the adjacent halves of two cusps

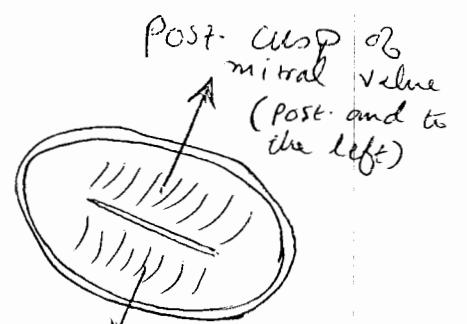
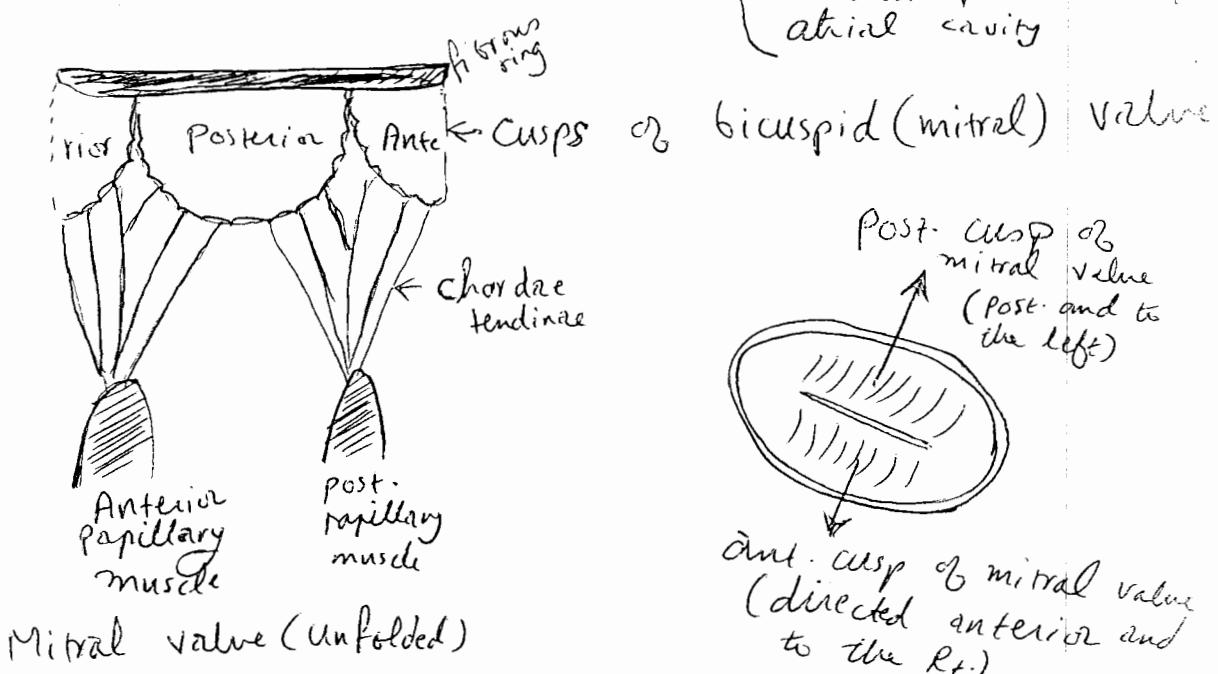
(42)

Obstetrical

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Tricuspid value
as seen from the R.
atrial cavity



Post. cusp of
mitral value
(Post. and to
the left)

ant. cusp of mitral value
(directed anterior and
to the R.)

The tricuspid value has 3 cusps and admits the tips of 3 fingers. The 3 cusps lie against the three post. septal walls of the ventricle.

The mitral (bicuspid) value has two cusps: a large anterior or aortic cusp and a small post. cusp. The anterior cusp lies between the mitral and aortic orifices (accordingly called aortic cusp or mitral). Both atrial & ventricular surfaces are smooth. Subjected to 2 streams of blood: 1st stream → from L. atrium → L. ventricle; 2nd stream → from L. ventricle → ascending aorta.

(43)

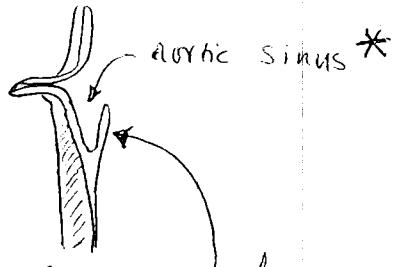
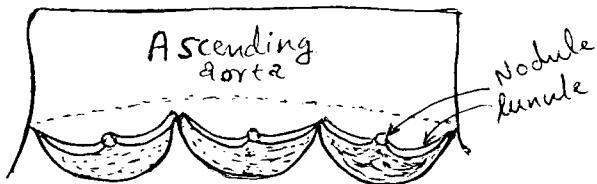
Semilunar valves

Aortic
Pulmonary

Obstruction

(43)

Their cusps are
Semilunar



- * Each valve ^(P) has 3 cusps which are attached directly to the vessel wall (fibrous ring is absent) ? one view ?
- * The free margin of each cusp contains a central fibrous nodule from each side of which a thin margin (lunule) extends up to the base

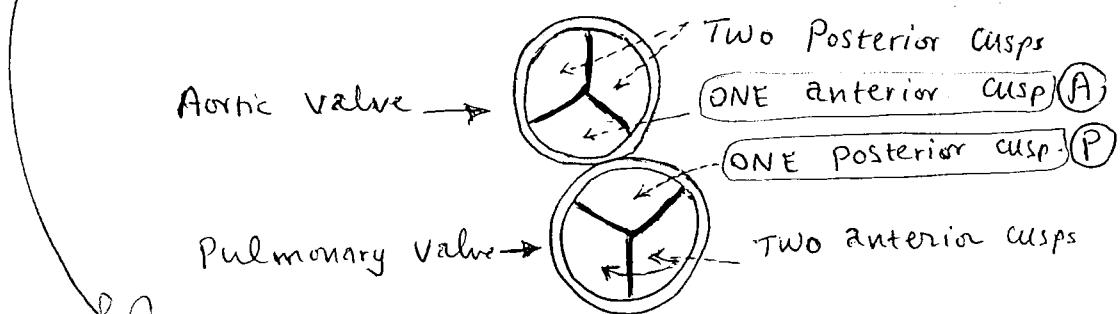
The cusps form small pockets with their mouths directed away from ventricular wall

- * Semilunar Valves → are closed during Ventricular diastole

Each cusp - filled with blood - bulges down into a globular convexity towards the ventricular cavity

- * Opposite to the cusps the vessel walls ^{of ascending aorta} ^{" pulmonary trunk} are slightly dilated to form the aortic & pulmonary sinuses.

- * CORONARY ARTERIES: arise from the ^{Anterior} ^{Posterior}
aortic sinuses



Receive blood during diastole ??? ? ? ? ?

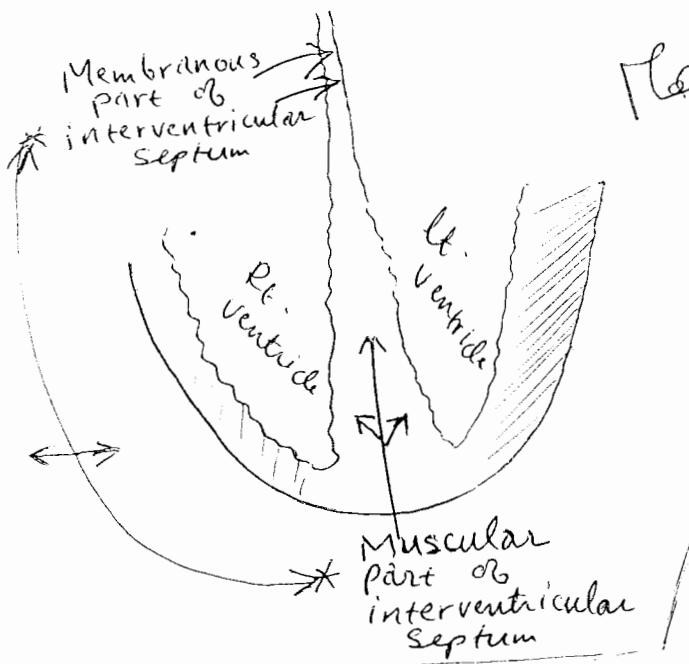
Skeleton of the heart → The fibrous rings (44)

Surrounding the atrioventricular and arterial orifices

Constitutes the fibrous skeleton of the heart.

(Function) → it provides attachment to the cardiac muscle & keeps the cardiac valves competent.

Notice → There is NO muscular continuity between the atria and ventricles across the atrioventricular fibrous ring EXCEPT for the atrioventricular (A-V) bundle (bundle of His) of the conducting tissue



PL

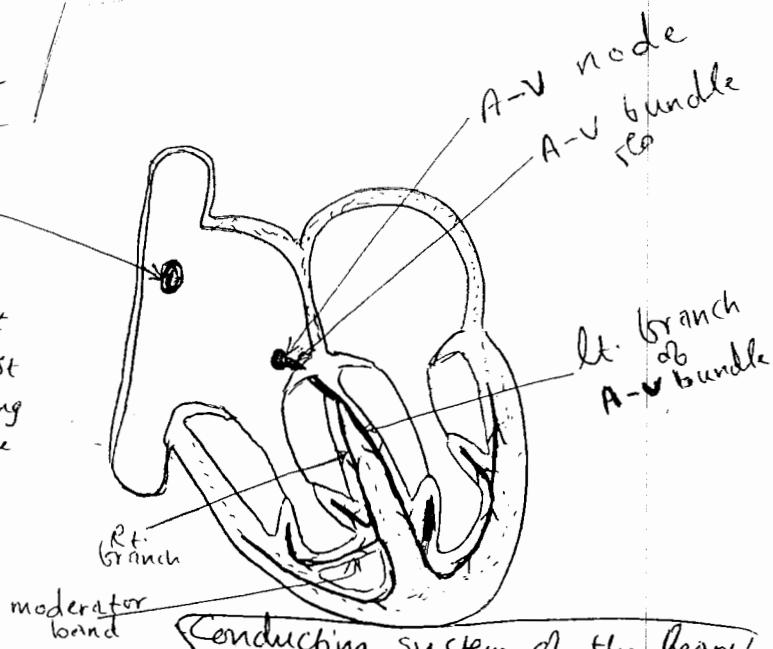
The membranous Part of interventricular septum

- Formed of fibrous tissue (~~at~~ endocardium)
- Its anterior part intervenes between the 2 ventricles
- Its posterior part intervenes between the aortic vestibule of left ventricle & right atrium i.e. it is Atrio-ventricular septum

1. Sinuatrial (SA) node
 - * is the pacemaker where the contraction of the heart is initiated
 - * situated in the upper part of Sulcus terminalis just to the right of the opening of sup. vena cava into the right atrium

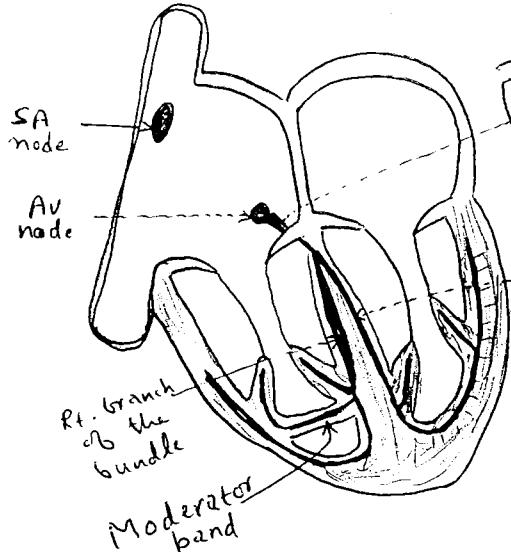
- 2 - atrioventricular (A-V) node

situated in the lower part of atrial septum just above the opening of coronary sinus



- * made up of specialized cardiac muscle fibres called Purkinje fibres

(45)



3. **A-V Bundle**

B It is the **ONH** muscular connection between the atrial and ventricular musculature

begins at the A-V node → crosses the A-V ring → descends along the postero-inferior border of the membranous part of the ventricular septum.

At the upper border of the muscular part of the septum it divides into Rt. & Lt. branches.

4. The right branch of the A-V bundle → passes down the right side of the interventricular septum → A large part enters the moderator band to reach the anterior wall of the right ventricle where it divides into Purkinje fibres

5. The left branch of the A-V bundle → descends on the left side of the interventricular septum and is distributed to the left ventricle.

N.B The Purkinje fibres

form a **Subendocardial plexus**
large pale fibres striated only at their margins
usually possess double nuclei

* Defects or damage (interference with blood supply) to the conducting system of the heart → **CARDIAC ARRHYTHMIAS**

Blood supply

The **sinu-atrial (SA) node** → in 60% of cases → supplied by a branch of right coronary artery
in 40% → from left coronary artery

A-V node + A-V bundle → supplied by the inferior interventricular artery
in 90% of cases arises from Rt. coronary a.
in 10% " " " = Lt. " "

In general → Except for a part of the left branch of A-V bundle (supplied by the left coronary artery) → the whole of the conducting system is usually supplied by the right coronary artery.

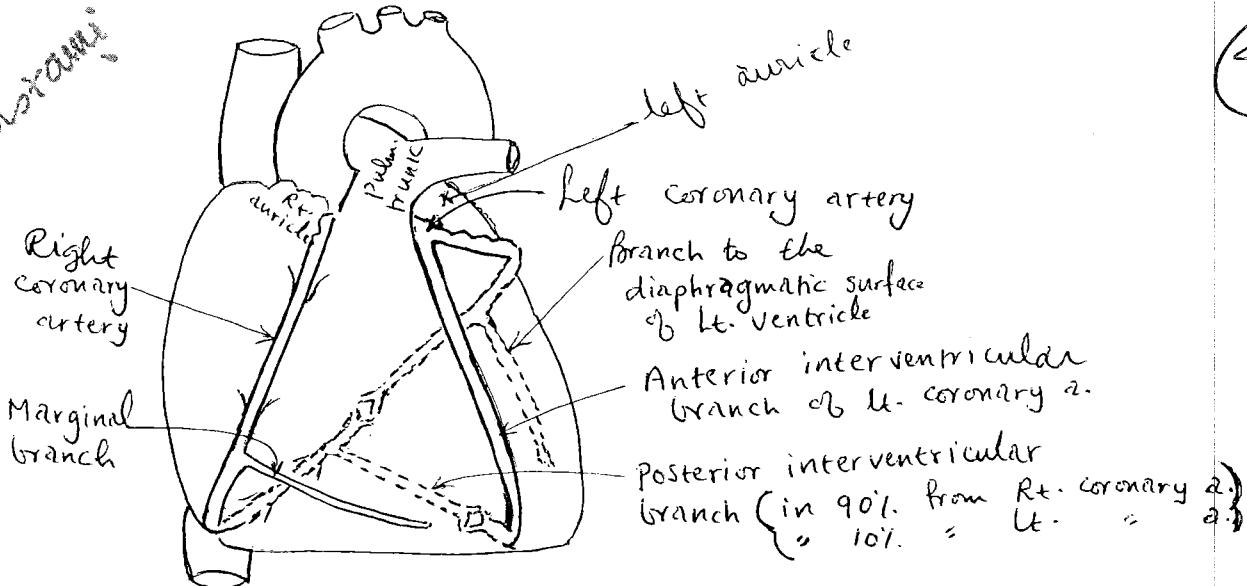
B **85**

Blood supply of the heart

(46)

Obstetrical

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Right coronary artery → Smaller than the left
origin → from the anterior aortic sinus

Course: emerges between root of pulmonary trunk and Rt. auricle
→ runs downward in the coronary groove till the inferior border
→ winds round and continues in the posterior coronary groove
where it anastomose with the left coronary artery

branches → Marginal

Posterior interventricular r.

Nodal in 60% of cases "

Rt. atrial terminal

Areas of distribution ① Rt. atrium ② Ventricles as in the diagram
③ whole of conducting system ----- (see before)

Left coronary artery

→ larger than the right

origin → from the left posterior aortic sinus

Course: emerges between the pulmonary trunk and left auricle
it gives the anterior interventricular branch

Here

runs to the left in the left posterior coronary groove where it terminates by anastomosing with the Rt. coronary a.

branches → Anterior interventricular

a branch to diaphragmatic surface of Lt. Ventricle

left atrial (Pulmonary) ④ terminal

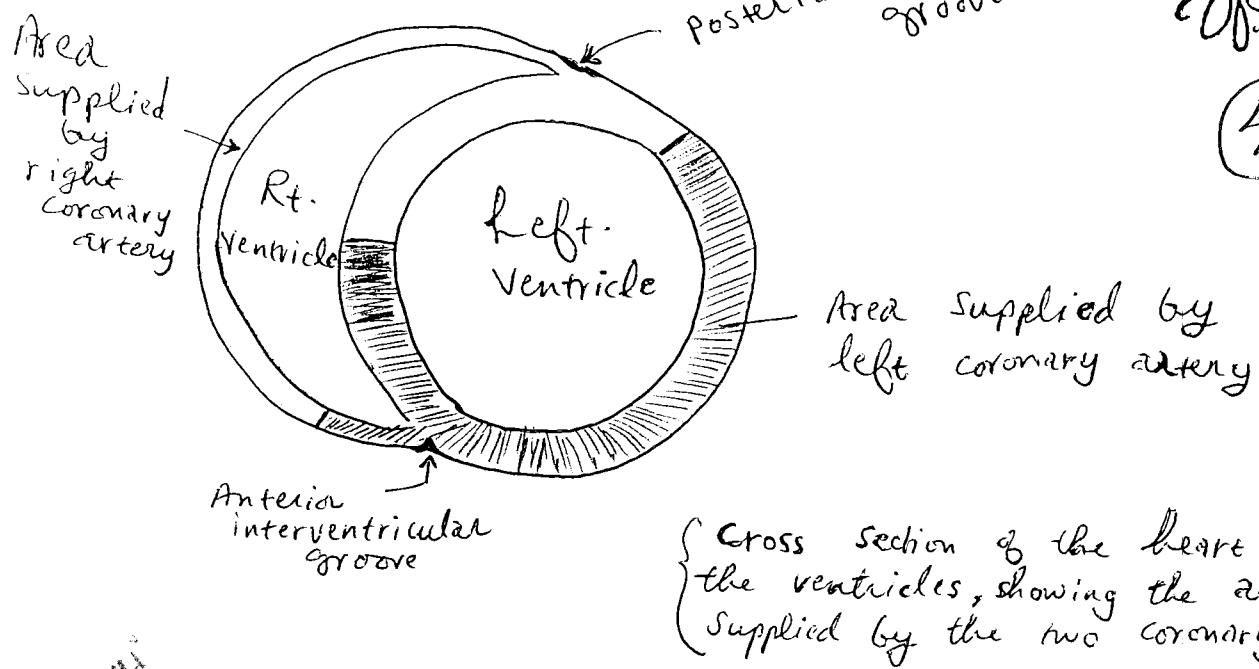
Areas of distribution ① left Atrium ② Ventricles → diagram ---
③ a part of the left branch of the AV bundle

(47.)

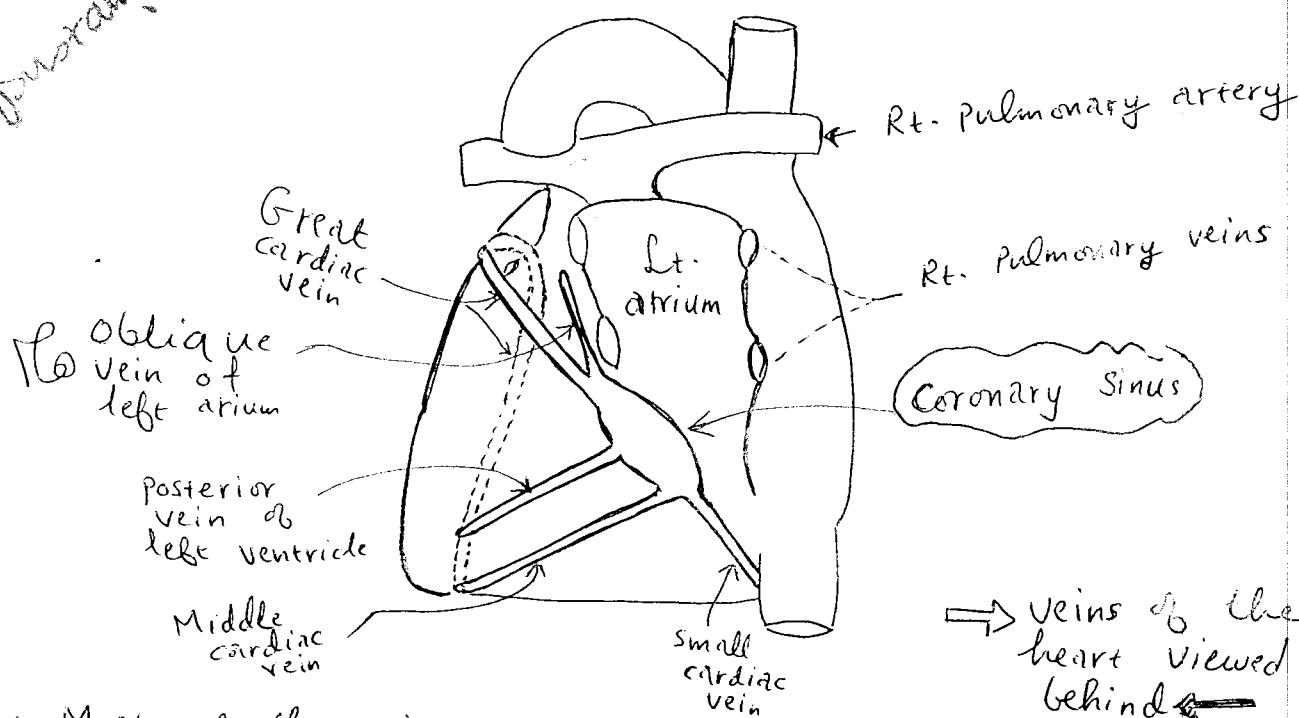
posterior interventricular groove

Obstetrical

47



Obstetrical



- * Most of the veins of the heart drain into the Coronary sinus, which opens into the right atrium.
- * Coronary sinus: the largest vein of the heart situated in the left posterior part of coronary groove.
- It is 3cm long, begins at the termination of the oblique vein of Marshall and ends by opening into the right atrium.
- develops from left horn of sinus venosus (+) part of Lt. common cardinal vein.
- ① It receives the following tributaries:-
 - ① great cardiac vein accompanies first the anterior interventricular artery and then the left coronary artery to enter the left end of the coronary sinus.
 - ② middle cardiac vein accompanies the posterior interventricular artery and joins the right end

3. Small cardiac vein: accompanies the right coronary artery in the R+ posterior coronary groove and joins the right end of the coronary sinus (48) A

4. Posterior vein of the left ventricle: runs on the diaphragmatic surface of the left ventricle and ends in the middle of the coronary sinus

5. Oblique vein of the left atrium (of Marshall) it is a small vein running on the posterior surface of the left atrium to terminate in the left end of the coronary sinus. It develops from the left common cardinal vein which sometimes may form a large left superior vena cava. So a left superior vena cava — when present — opens into the coronary sinus and NOT DIRECTLY into the R+. atrium

* The anterior cardiac veins (2-3) (4) the venae cordis minimae → open directly into the right atrium

collateral circulation

A. Cardiac anastomosis → the two coronary arteries anastomose with each other on the surface (insignificant) and in the myocardium. Intercorony anastomosis is found in less than 10% of normal hearts, in 40% of anaemic hearts, and in 100% of hearts with old coronary occlusion.

B. Extracardiac anastomosis → coronary arteries anastomose with
 (a) Vasa Vasorum of aorta and pulmonary trunk
 (b) internal thoracic arteries
 (c) bronchial arteries → through the Pericardium
 (d) Phrenic arteries

→ In spite of these collateral circulations there occurs myocardial infarction (ie death of cardiac muscle) in coronary thrombosis. All collateral circulations therefore appear to be too poor to meet the demands during emergencies.



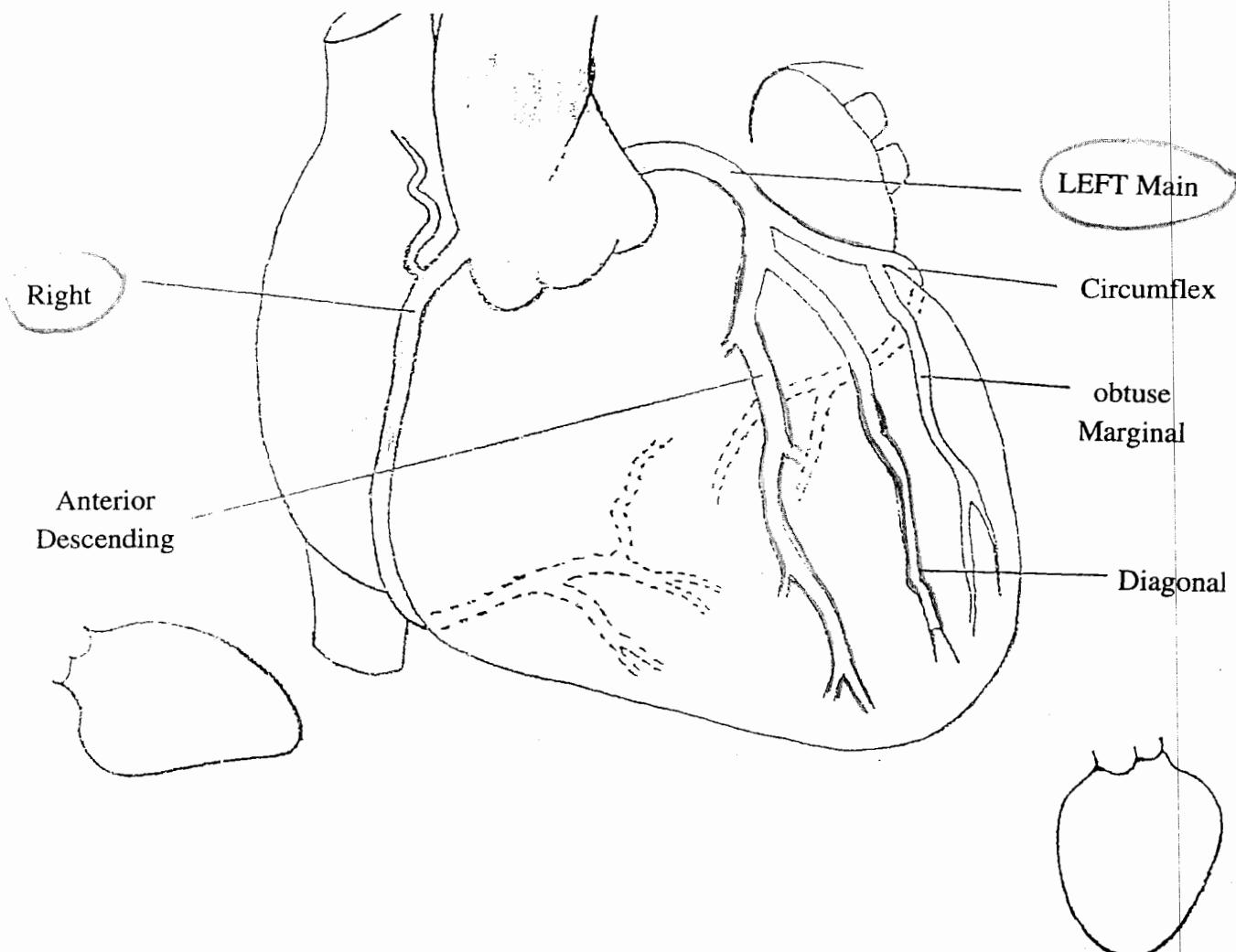
CATH #
DOCTOR

Patient Name : Age:
Patient No: Date

48/B

نمودج قسطرة شرايين القلب
CORONARY ARTERIAL DIAGRAM

Ao - p
LV p
LVED p



COMMENTS: LV:

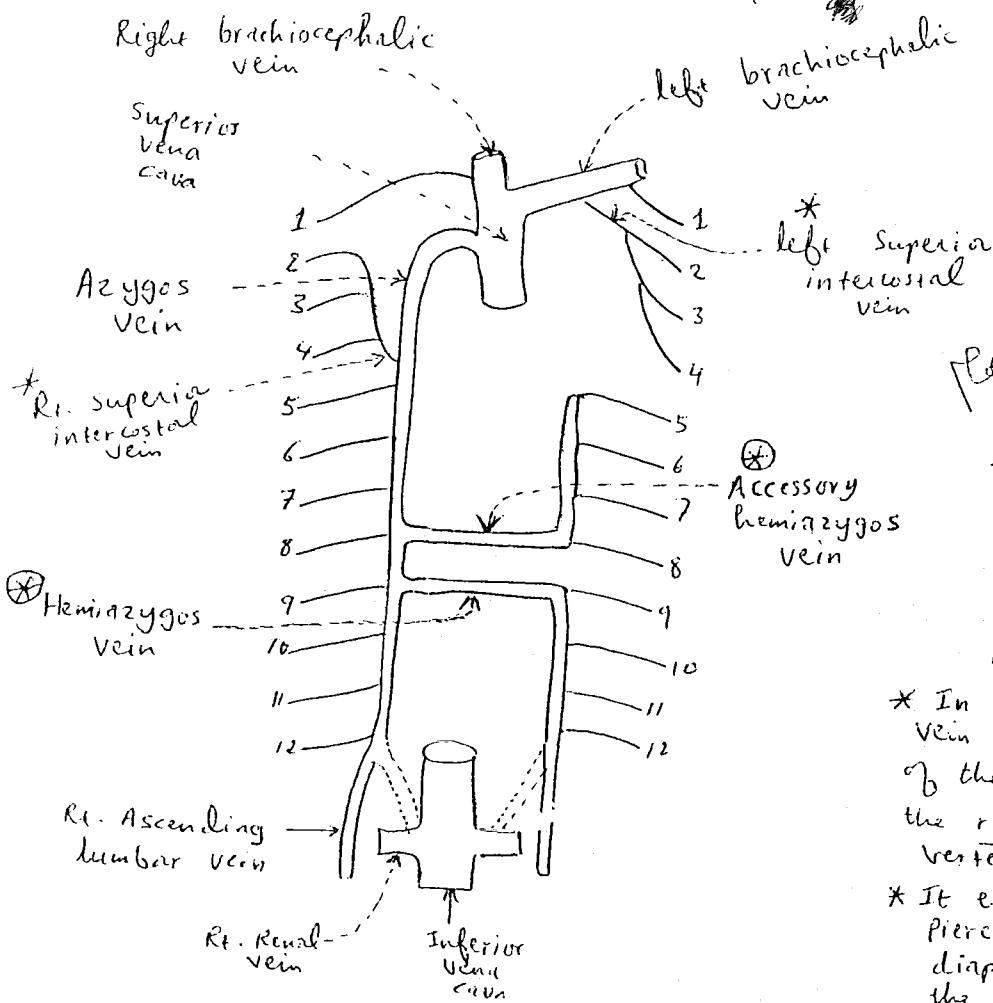
LM: LAD:

DIAG RAMUS:

CX&OM RAMUS:

RCA:

(49)

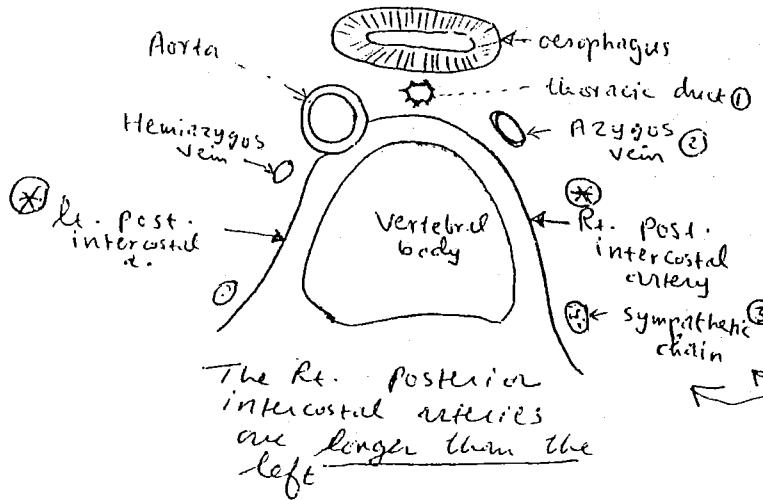


Posterior intercostal veins

Right side

- 1st : into right brachiocephalic or vertebral vein
- 2nd, 3rd, 4th : form R. Superior intercostal vein which end in azygos vein
- 5th to 11th : into azygos vein

Subcostal vein : drains into azygos vein



The R. Posterior intercostal arteries are longer than the left

Azygos vein

* drains the thoracic wall & upper lumbar region

(P.D.) * FORMS IMPORTANT CHANNEL CONNECTING THE TWO VENAE CAVAE

* on developmental ground it should originate from the posterior surface of the inferior vena cava near the renal veins → This is Known as Lumbar azygos vein

* In the absence of lumbar azygos vein it is formed by the union of the right descending lumbar with the right subcostal vein at T12 vertebra

* It enters the thorax either by piercing the R. crus of the diaphragm or by passing through the aortic opening of diaphragm

left side

1st : into left brachiocephalic vein

2nd, 3rd, 4th : form left superior intercostal vein which end in L. brachiocephalic vein

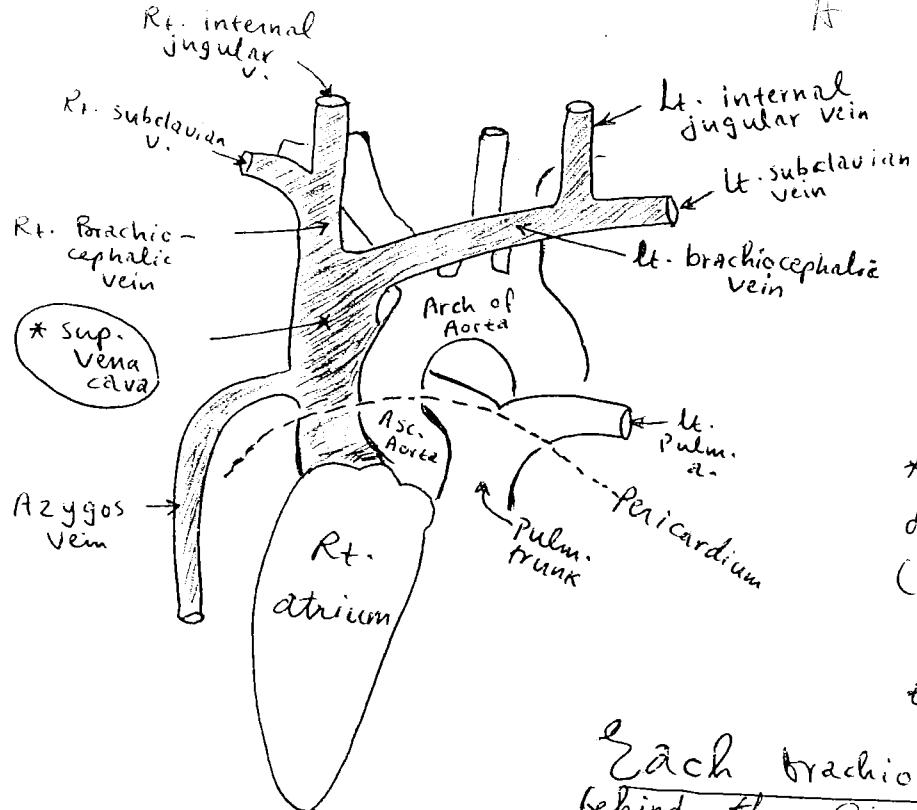
5th to 8th : into the accessory hemiazygos vein
9th to 11th : into the hemiazygos vein
Subcostal vein : drains into hemiazygos vein

Post-intercostal arteries

1st & 2nd : arise from the sup. intercostal artery which is a branch of costocervical trunk (subclavian a.)

3rd to 11th : from descending thoracic aorta

Notice : Sympathetic chain, Azygos vein, Thoracic duct, Run anterior to the R. post. intercostal arteries



Offspring
S. V. C
Sup. Vena Cava (50)
7 cm long

* A great vein which collects venous blood from the upper half of the body and drains it into the Rt. atrium.

* formed by the union of two brachiocephalic (innominate) veins behind the lower border of the first costal cartilage close to the sternum

Each brachiocephalic vein is formed behind the sternoclavicular joint by the union of the internal jugular & subclavian veins

Sup. Vena Cava → its upper 1/2 lies in the sup. mediastinum
→ its lower 1/2 lies in the middle mediastinum (inside the pericardium)

Sup. Vena Cava → begins behind the lower border of first costal cartilage
→ pierces pericardium opposite the second Rt. costal (it receives the azygous vein just before it enters the pericardium)
terminates by opening into the upper part of Rt. atrium behind the third Rt. costal cartilage

Sup. Vena Cava → Medial → Ascending aorta
→ lateral → Phrenic nerve
→ Rt. Pleura & lung

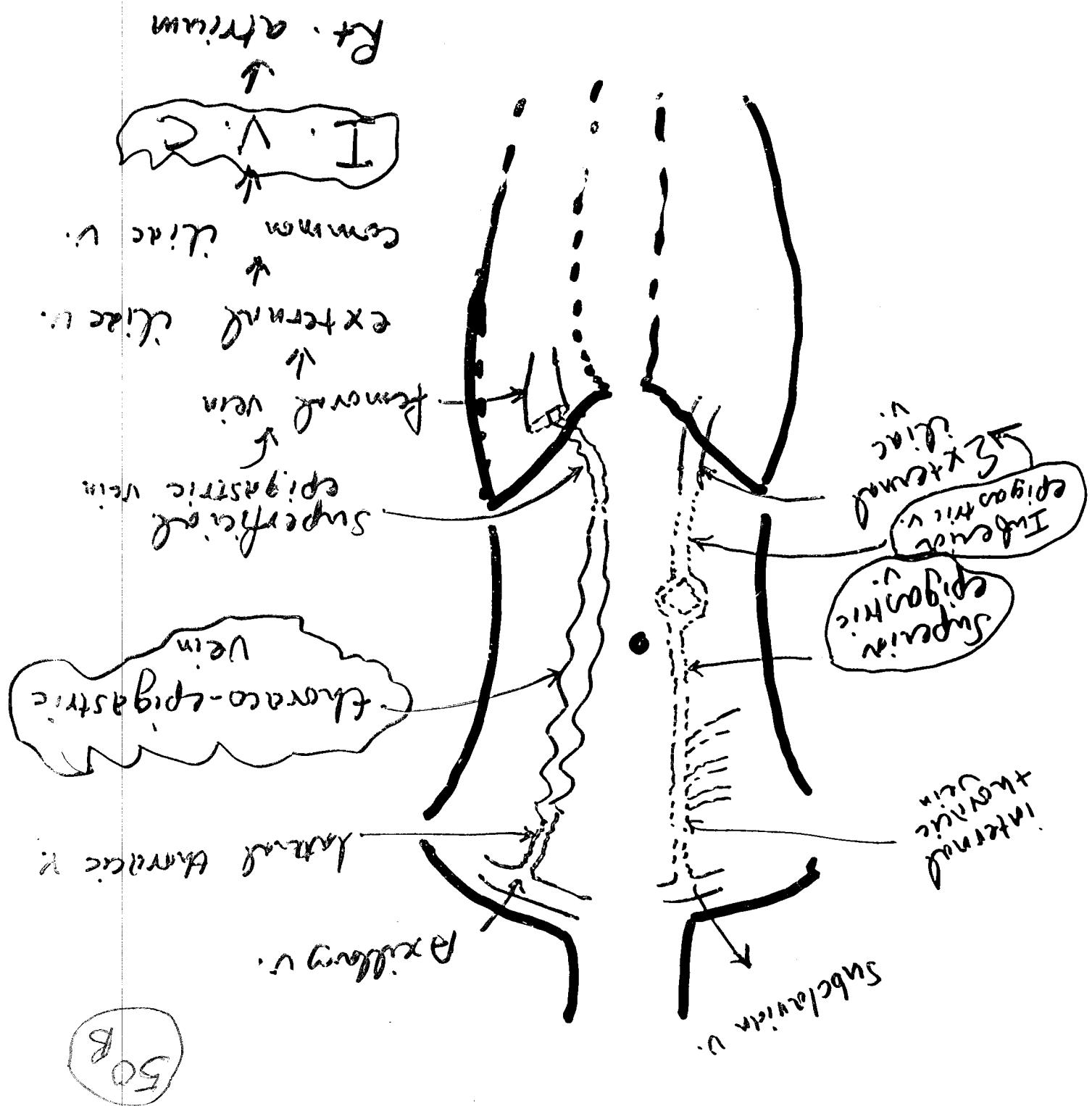
Remember → A (left) Superior Vena Cava open into the coronary sinus When present will

→ Sup. vena cava ALWAYS communicate with the inf. vena cava (directly or indirectly ... see before)

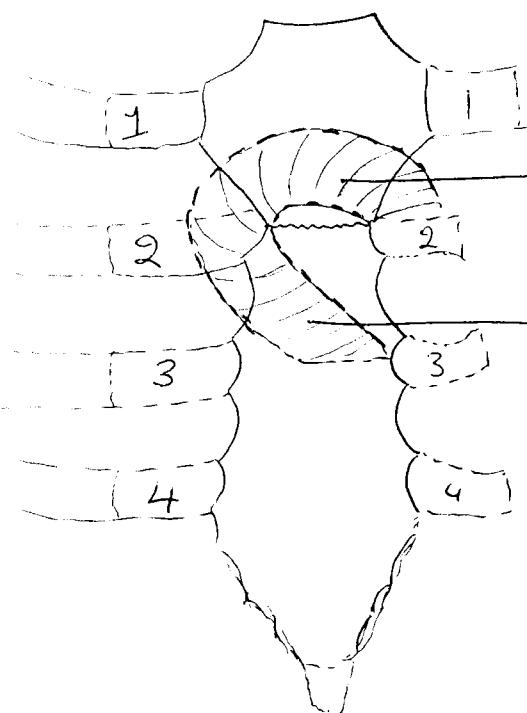
* **Obstruction** of S.V.C. above the opening of azygous vein → venous blood of the upper 1/2 of the body is returned through the azygous vein

→ Superficial veins are dilated on the chest down to costal margin

* **Obstruction** of S.V.C. below the opening of azygous vein → blood is returned through the inferior vena cava via the femoral vein and superficial veins are dilated on both chest & abdomen down to saphenous opening in the thigh.



51



Brusta.

51

Aorta

Ascending Arch
Descending

outside the pericardium
Posterior to the lower $\frac{1}{2}$ of manubrium
in Sterni (Superior mediastinum)

Arch of Aorta

inside the pericardium
in Middle mediastinum
Posterior to the body of sternum

begins at the aortic orifice of the left ventricle opposite the sternal end of left 3rd costal cartilage
ends at the sternal end of the right 2nd costal cartilage where it continues as the arch of aorta

Branches → Rt. & Lt coronary arteries

③ Descending aorta

begins → at the lower border of 4th thoracic vertebra (i.e. at sternal angle) to the left side of vertebral column

ends → at the lower border of 12th thoracic vertebra in the median plane

runs in the Post. mediastinum i.e. the oblique sinus of pericardium and the fibrous pericardium separate the base of the heart (left atrium) from the descending thoracic aorta

Branches → 9 posterior intercostal arteries on each side for 3-11 spaces

subcostal artery on each side

2 left bronchial arteries

oesophageal branches to middle $\frac{1}{3}$ of oesophagus

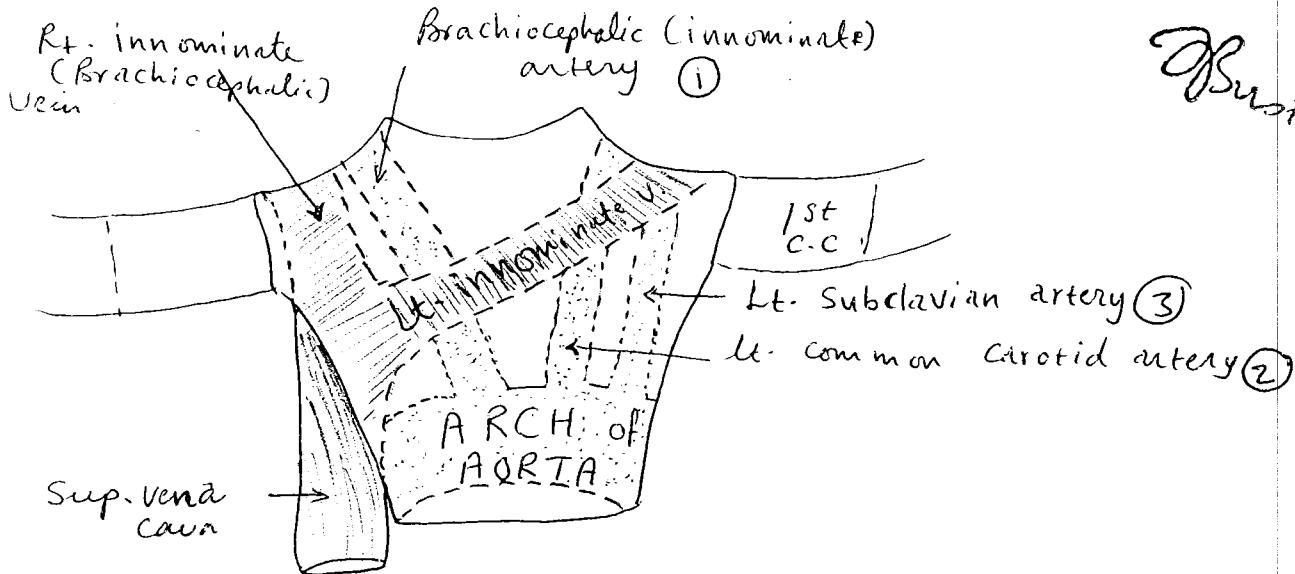
pericardial branches

mediastinal → to lymph nodes in Post. mediastinum

superior phrenic arteries

Arch of Aorta

(56)



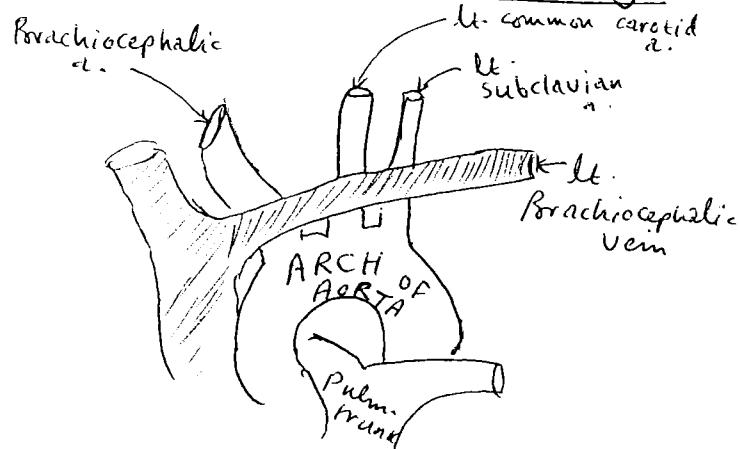
52

Bursa

Arch of Aorta

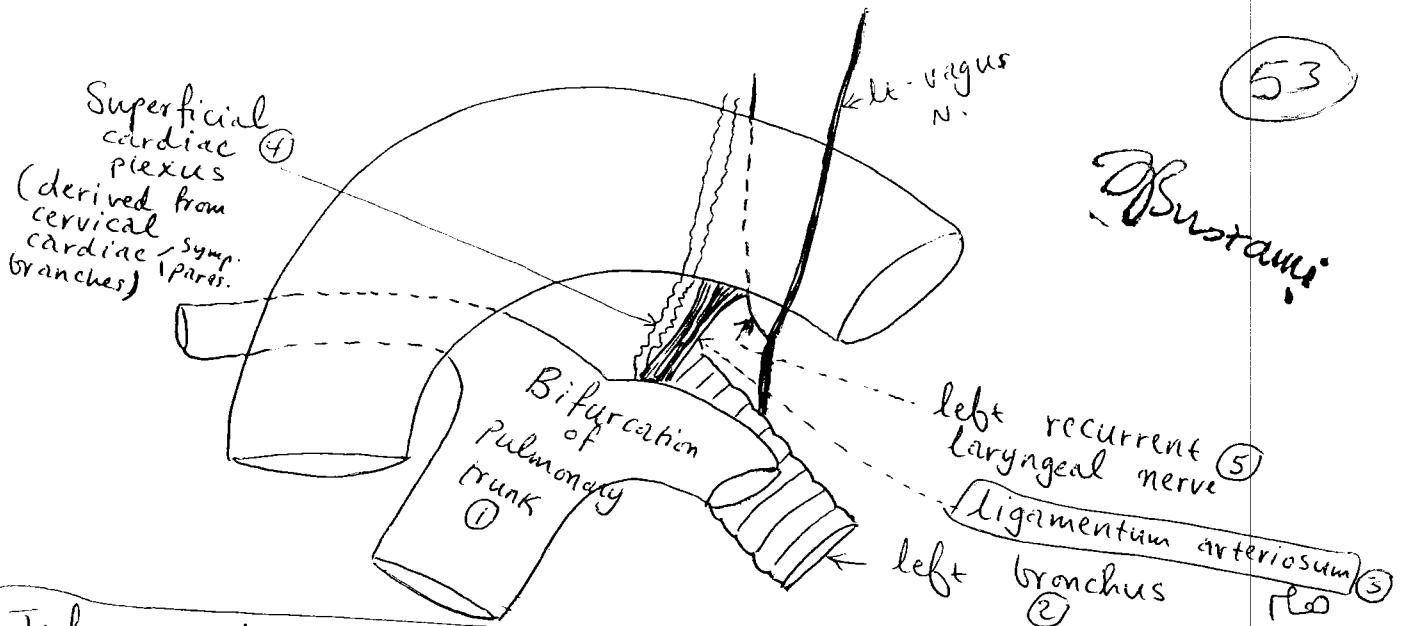
- Continuation of the ascending aorta
- Situated in Superior mediastinum
Posterior to lower $\frac{1}{2}$ of the manubrium sterni
- begins behind the upper border of 2nd
Rt. sternochondral joint (ie sternal angle)
- Runs upwards, backwards and to the left
ACROSS THE LEFT SIDE OF THE
BIFURCATION OF TRACHEA
- Then Passes downward behind the left bronchus
ends on the left side of the body of 4th
thoracic vertebra (ie level of sternal angle)

Thus the beginning and the end of the aortic arch
are at the same level, although it begins anteriorly
and ends posteriorly



Superior relations

- * 3 branches of the arch of aorta
 - Brachiocephalic a.
 - Lt. common carotid a.
 - Lt. subclavian a.
- * left brachiocephalic (innominate) vein → in front of the lower part of the 3 branches
- * Remnates of thymus gland



Inferior relations of the arch of aorta

1. Bifurcation of the pulmonary trunk
2. left bronchus
3. ligamentum arteriosum

Remember → the ligamentum arteriosum extends between the left of the arch of aorta and lower surface BRANCH (left subclavian a.)

superficial cardiac plexus
anterior to it ④
left recurrent laryngeal nerve
posterior to it ⑤



→ Transverse section of thorax passing through T4 showing superficial and deep relations of arch of aorta

Anterior & to the left (Superficial) relations

1. left phrenic nerve
2. left vagus nerve
3. left superior intercostal vein (deep to phrenic but superficial to vagus)
4. 2 cardiac nerves (symp. to superficial cardiac plexus, parasymp. to vagus)
5. Left pleura & lung

Posterior & to the right (Deep) relations

1. Trachea (with deep cardiac plexus)
2. oesophagus
3. left recurrent laryngeal nerve (in the groove between trachea & oesophagus)
4. thoracic duct (on the left side of oesophagus)
5. vertebral column

PULMONARY TRUNK

COURSE : (The left Pleura & lung separates it from its Intercostal space)

- * It arises from the right ventricle at the pulmonary orifice opposite the sternal end of 3rd left costal cartilage.
- * It is at 1st in front of the ascending aorta, enclosed together within a single sheath of serous pericardium (both develop from the **truncus arteriosus**).
- * It then passes upwards to gain the left side of the ascending aorta and ends below the arch of aorta (opposite the 2nd left costal cartilage) by dividing into right and left pulmonary arteries.
- * The point of division is to the left of the median plane (bifurcation of trachea is to the right of the median plane).
- * It runs in the 2nd left space close to the sternal margin.

BRANCHES : (only 2 terminal branches)

1. RIGHT PULMONARY ARTERY :

- * It is longer than the left one.
- * It passes to the right in the roof of the transverse sinus of pericardium to join the root of the right lung.
- * **Relations :**
 - a) **Anterior relations :**
 - * Ascending aorta.
 - * S.V.C.
 - b) **Posterior relations :**
 - * Oesophagus.
 - * Right bronchus.

2. LEFT PULMONARY ARTERY :

- * It is shorter and passes to the left to join the root of left lung.
- * It is joined to lower surface of the arch of aorta by the ligamentum arteriosum (fibrosed ductus arteriosus of the foetus).
- * **Posterior relations :**

Descending aorta
left bronchus

55

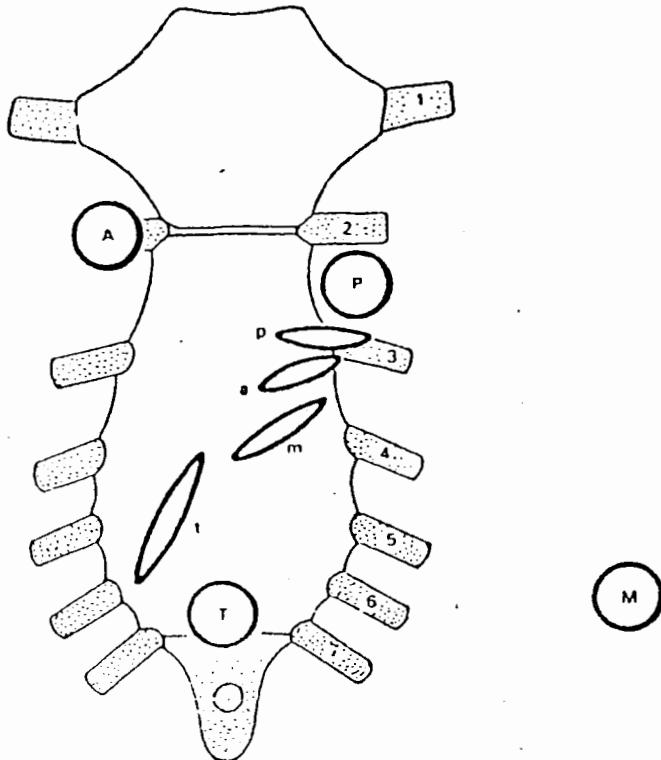


Fig. 173 Surface marking of the cardiac valves; p = pulmonary, a = aortic, m = mitral, and t = tricuspid. The position of the auscultatory areas is shown by circles and they are named by block letters.

Table 18. Surface marking of the cardiac valves, and the sites of the auscultatory areas

Valve	Diameter of orifice	Surface marking	Auscultatory area
1. Pulmonary	2.5 cm	A horizontal line, 2.5 cm long; behind the upper border of 3rd left costal cartilage and adjoining part of the sternum.	Second left interspace near the sternum.
2. Aortic	2.5 cm	A slightly oblique line, 2.5 cm long; behind the left 1/2 of the sternum at the level of the lower border of the 3rd costal cartilage.	Second right costal cartilage near the sternum,
3. Mitral	3 cm	An oblique line, 3 cm long; behind the left 1/2 of the sternum opposite the 4th costal cartilage.	Cardiac apex.
4. Tricuspid	4 cm	Most oblique of all valves, being nearly vertical, 4 cm long; behind the right 1/2 of the sternum opposite to the 4th and 5th spaces.	Lower end of the sternum.

(56)

SURFACE MARKING OF THE HEART

The *upper border* is marked by a straight line joining (i) a point at the lower border of the 2nd left costal cartilage about $1/2$ inch (1.3 cm) from the sternal margin to (ii) a point at the upper border of the 3rd right costal cartilage $1/2$ inch (1.3 cm) from the sternal margin.

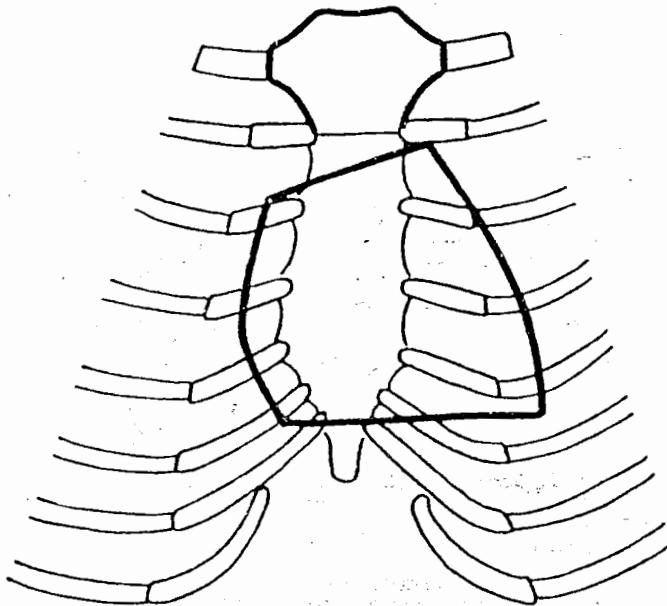
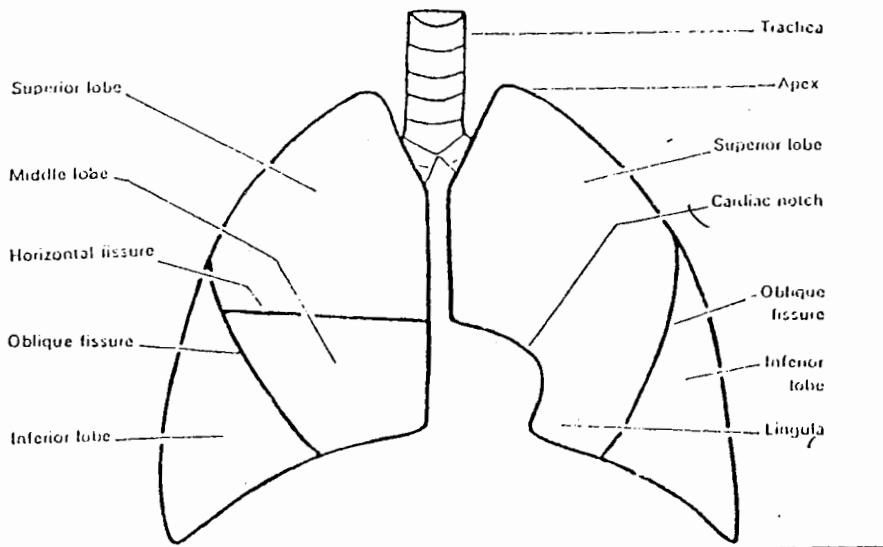


Fig. 175 Surface marking of the heart.

The *lower border* is marked by a straight line joining (i) a point at the lower border of 6th right costal cartilage 2 cm from the sternal margin to (ii) a point at the apex of the heart in the 5th intercostal space $3\frac{1}{2}$ inches (9 cm) from the midsternal line.



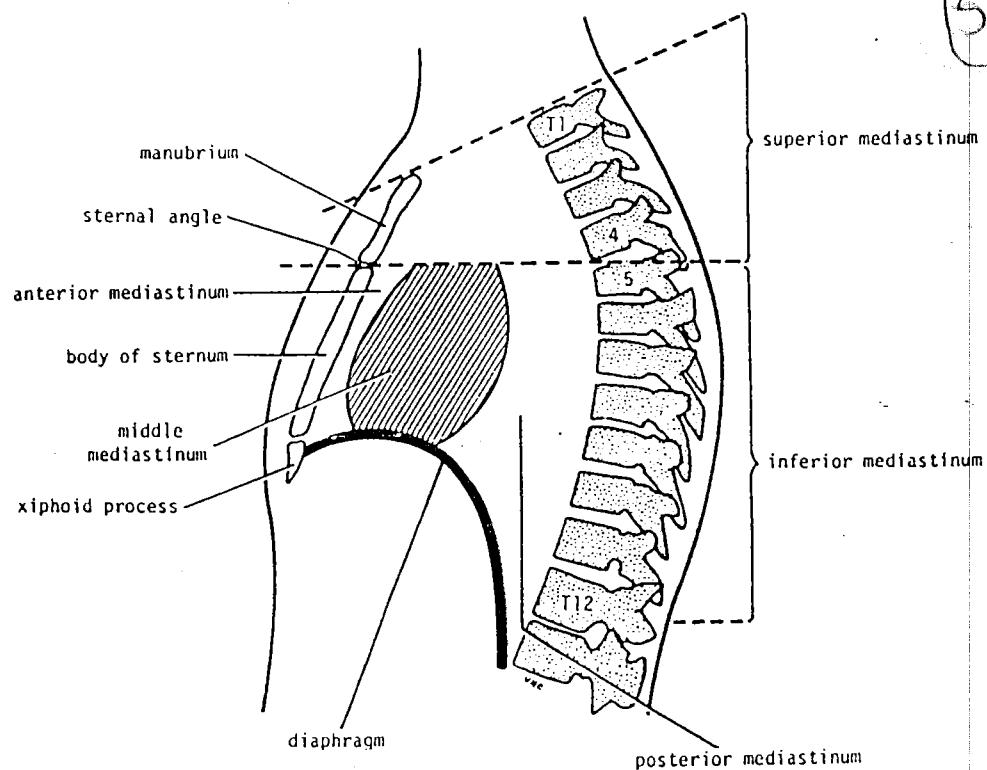
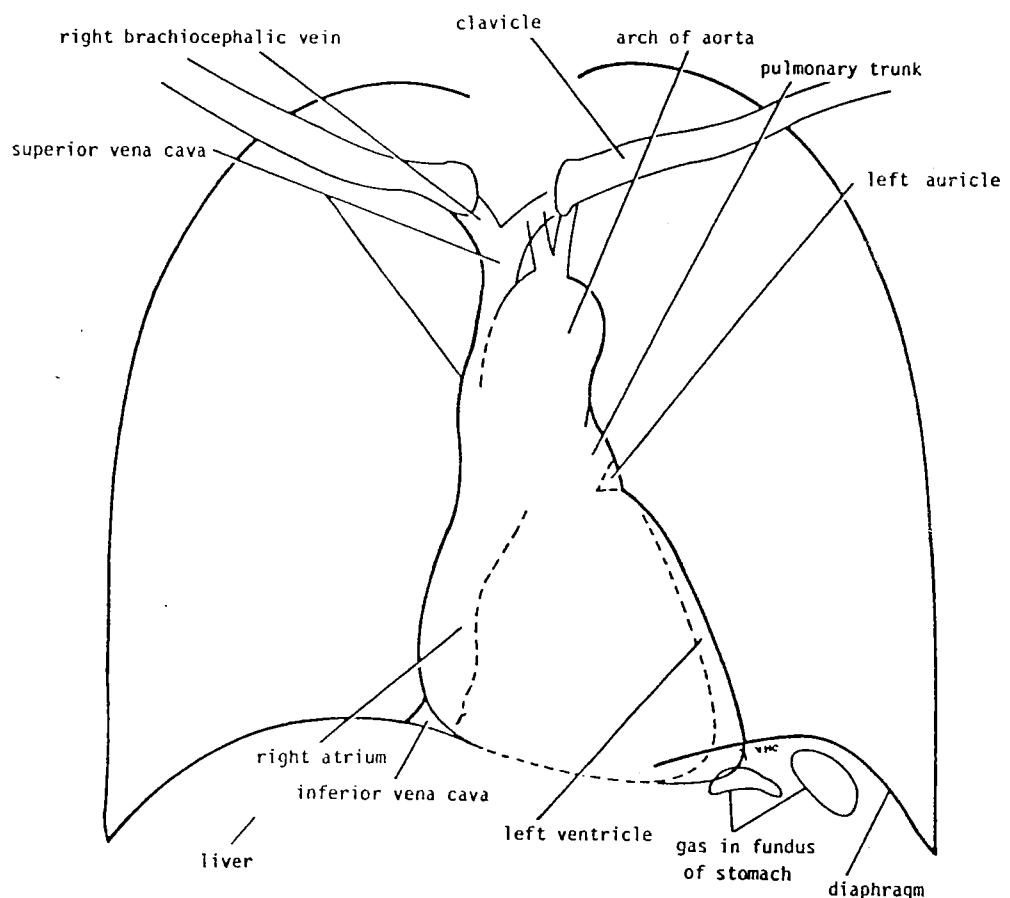


Fig. 1. Subdivisions of mediastinum.



A Portal System of veins is one which begins (58)
 & also ends in Capillaries e.g. Liver
 Kidney
 Pituitary gland

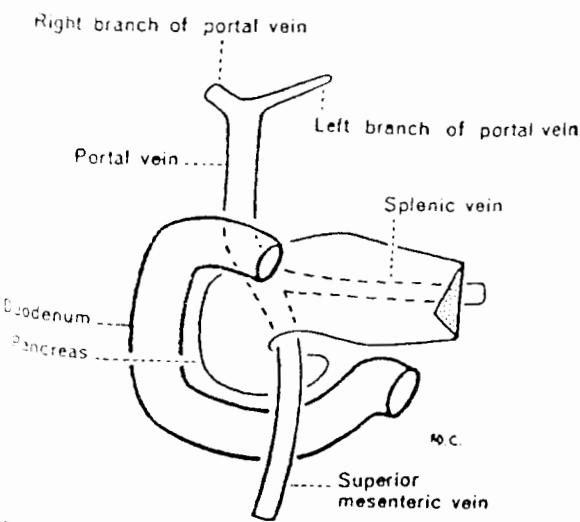


Fig. 237 Formation and course of the portal vein.

Relations

- A. Infraduodenal part (Figs. 203, 230)
 - 1. Anteriorly: neck of pancreas.
 - 2. Posteriorly: inferior vena cava.
- B. Retroduodenal part (Fig. 230)
 - 1. Anteriorly: (a) first part of duodenum; (b) common bile duct; and (c) gastro-duodenal artery.
 - 2. Posteriorly: inferior vena cava. *Upstays*
- C. Supraduodenal part, in the free margin of lesser omentum (Fig. 178)
 - 1. Anteriorly: (a) hepatic artery; and (b) bile duct.
 - 2. Posteriorly: inferior vena cava.
 - 3. Surrounded by: (a) hepatic plexus of nerves; and (b) lymph nodes and lymphatics.

PORAL CIRCULATION

- * The portal circulation carries the venous blood from the stomach, small intestine, large intestine as well as from the spleen, gall bladder and pancreas **through the portal vein to the liver**.
- * The portal blood circulates in fine capillaries inside the liver and is collected by the hepatic veins which end in the I.V.C.

N.B.: The upper part of the gut (oesophagus) as well as its lower part (anal canal and part of the rectum) are drained into the systemic circulation.

PORAL VEIN

ORIGIN AND COURSE :

- ²⁻³
- * It is only ~~4~~ inches long and is characterized by the fact that it begins as a vein (by tributaries) but ends as an artery (by giving branches). *at L₂*
 - * It begins behind the neck of pancreas [↑] by union of the splenic and superior mesenteric veins.
 - * It ascends behind the 1st part of the duodenum to enter the free margin of lesser omentum.
 - * It enters the porta hepatis where it divides into right and left branches.
 - * It is devoid of valves.

ANASTOMOSIS BETWEEN THE PORTAL AND SYSTEMIC

CIRCULATIONS : form collateral circulation in Portal obstruction

1. AT THE LOWER END OF OESOPHAGUS : between :

- a) Oesophageal tributaries of the left gastric vein (portal).
- b) Oesophageal tributaries of the azygos vein (systemic).

In portal hypertension this anastomosis enlarges to form **oesophageal varices** (dilated and tortuous veins in the submucosa of lower end of oesophagus). Its rupture leads to bleeding in the stomach (**haematemesis**). (59)

2. AT THE LOWER END OF RECTUM : between : *Obstruction*

- a) Superior rectal vein (portal).
- b) Middle and inferior rectal veins (systemic).

If this anastomosis enlarges, the veins in the submucosa of the rectum become dilated and tortuous leading to formation of **piles** (**haemorrhoids**).

3. AT THE SKIN AROUND UMBILICUS : between :

- a) Para-umbilical veins (portal).
- b) Veins of anterior abdominal wall (systemic).

Enlargement of this anastomosis leads to dilatation of the skin veins in a radial direction around the umbilicus, a condition called **caput medusae**.

4. LESS EFFECTIVE SITES OF ANASTOMOSIS :

* At the bare area of liver : between :

- a) Capillaries within the liver (portal).
- b) Phrenic tributaries on the under surface of diaphragm (systemic).

* On posterior abdominal wall : between :

- a) Lumbar veins (systemic).
- b) Colic veins (portal).

N.B. :

The portal vein is 2 inches long, formed by 2 veins (splenic and superior mesenteric), ends by 2 branches (to right and left lobes of the liver), receives 2 main tributaries (right and left gastric veins) and 2 ligaments are attached to its left branch (ligamentum teres and ligamentum venosum).

Branches of Portal Vein

1. The right branch is shorter and wider. After receiving the cystic vein, it enters the right lobe of liver.

2. The left branch is longer and narrower. It traverses the whole porta hepatis from right to the left end, and furnishes branches to the caudate and quadrate lobes. Just before entering the left lobe of liver, it receives: (a) paraumbilical veins; (b) ligamentum teres; and (c) ligamentum venosum.

The left gastric vein receives at the cardiac end of stomach a few oesophageal veins; the right gastric receives the prepyloric vein.

The para-umbilical veins are small veins that run in the falciform ligament, along the ligamentum teres, and establish anastomosis between the veins of the anterior abdominal wall around the umbilicus and the portal vein.

Bustami
60

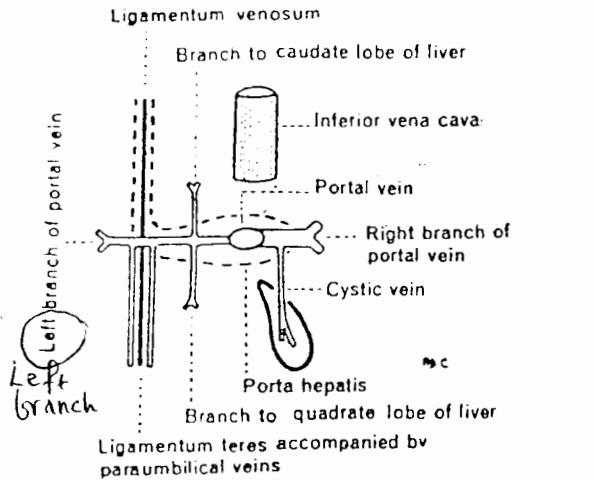


Fig. 238 Branches of the portal vein; their sub-branches and tributaries.

Intrahepatic Course

After entering the liver, each branch divides and redivides along with the hepatic artery, enclosed in the Glisson's capsule, to end ultimately in the hepatic sinusoids, where the portal venous blood mixes with the hepatic arterial blood.

Tributaries

These are: (i) the splenic (p. 180); (ii) superior mesenteric (p. 193); (iii) left gastric; (iv) right gastric; (v) superior pancreaticoduodenal; (vi) cystic; and (vii) paraumbilical veins.

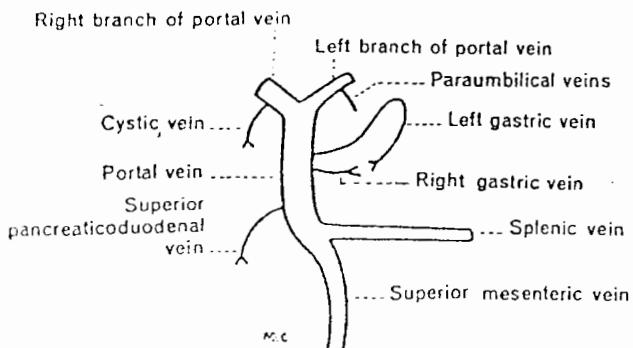


Fig. 239 Tributaries of the portal vein.

Which of these x-rays are closest to the
NORMAL size 1, 2, 3 ??



(3)



(2)



(1)

Comment on this x-ray
Chart ??