Human Circulatory System - III

Course on Human Physiology: Body Fluids & Circulation

Tue, 21
Thurs - 23
fri - 24
Sat - 25

3:30 pm

Dr Amit Gupta • Lesson 9 • Sept 21, 2021

Ischemic heart diseases

If the lumen of any of the coronary artery gets narrowed due to obstruction or cholestrol deposition, the cardiac tissues enter a condition of more demand and less supply whenever the person performs exhertion. Under such hypoxic conditions a pain might arise in heart muscles, this condition is called **Angina Pectoris.** This condition is reversible when the demand supply ratio is restabilised. (i.e. when the person stops exhertion and rests). A coronary artery by pass grafting (CABG) may be required to provide additional channel of blood suppply in such cases.

In coronary artery By pass grafting a part of internal mammary artery or a segment of patients own saphenous vein is used as the By pass channel.

Myocardial Infarction (M.I.) - This is cellular death of cardiac tissue due to anoxia.

When the blood supply to the heart completely stops due to complete blockage of a coronary artery, under reduced oxygen condition the heart tries to restablish the blood supply by working even harder, thus aggravating the situation even further. Due to this reason the cardiac tissue starts dying by necrosis and myocardial infarction sets in, this is an irreversible condition. It is also called as HEART ATTACK in common language.

A blockage of left anterior descending artery (LAD) can be most fatal for the heart, (widows artery)

Ischaemic Heart Disease

Coronary Artery Disease

Deposition of Cholesterol inside Lumen of CA. → Lumen of C.A. Narrows → ↓ Blood flow to the walls of Heart [Ischaemic Heart] → Exhertion → Hypoxia → Angina Pectoris [Chest pain]

Pain stops ← Rest ← Angina Pectoris [Chest pain]

Angina Pectoris [Chest pain] → MI

High Blood Cholesterol → Deposition of Cholesterol inside Lumen of CA.

High fat Diet → High Blood Cholesterol

Heart Attack

Angiography

Angio Plasty

↓

Repair

Heart fails to function as a Pump

Heart failure

External

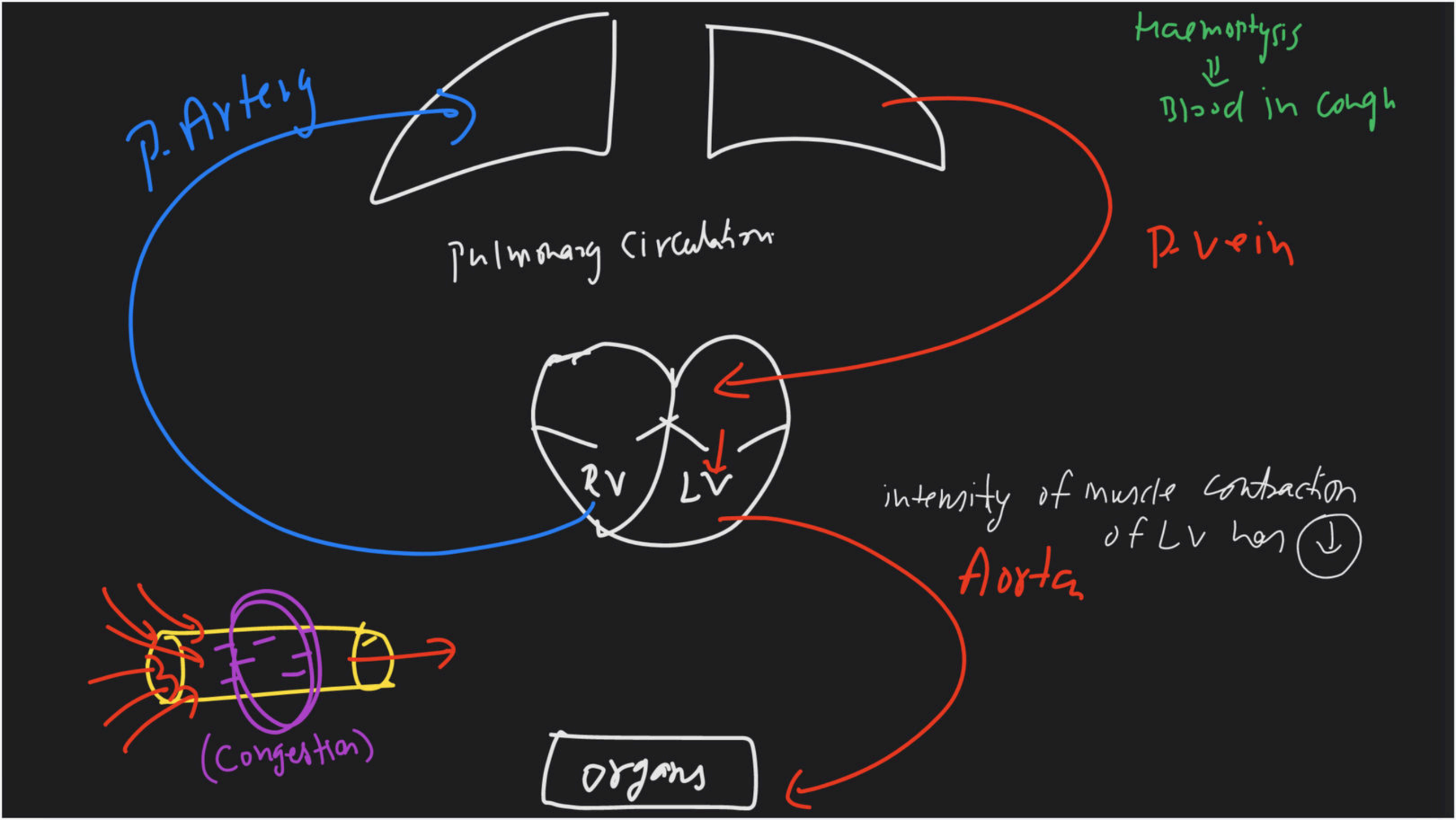
- injury

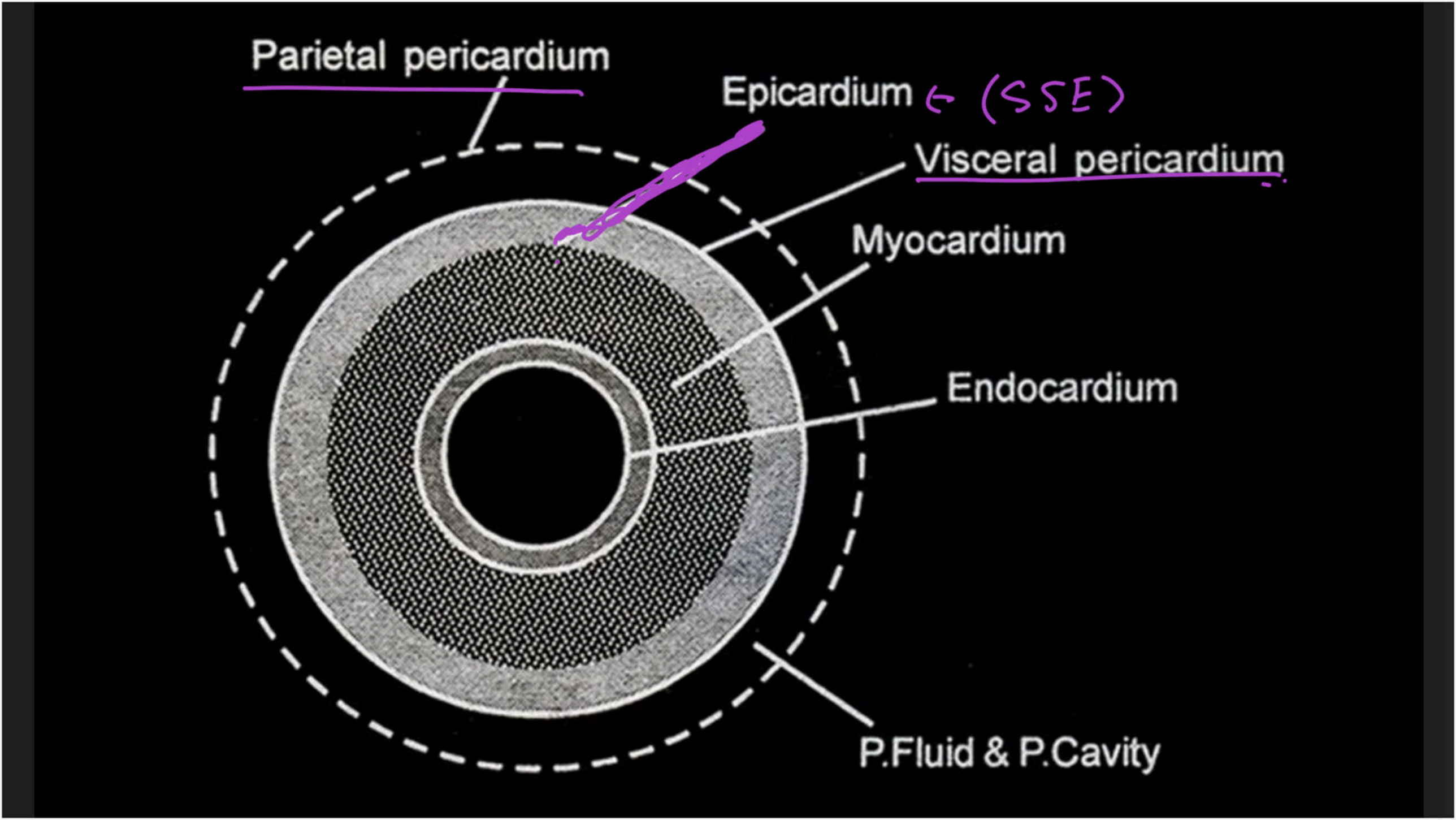
- Electric shock.
- Pericardial Effusion
  or
  Pericardial tamponade

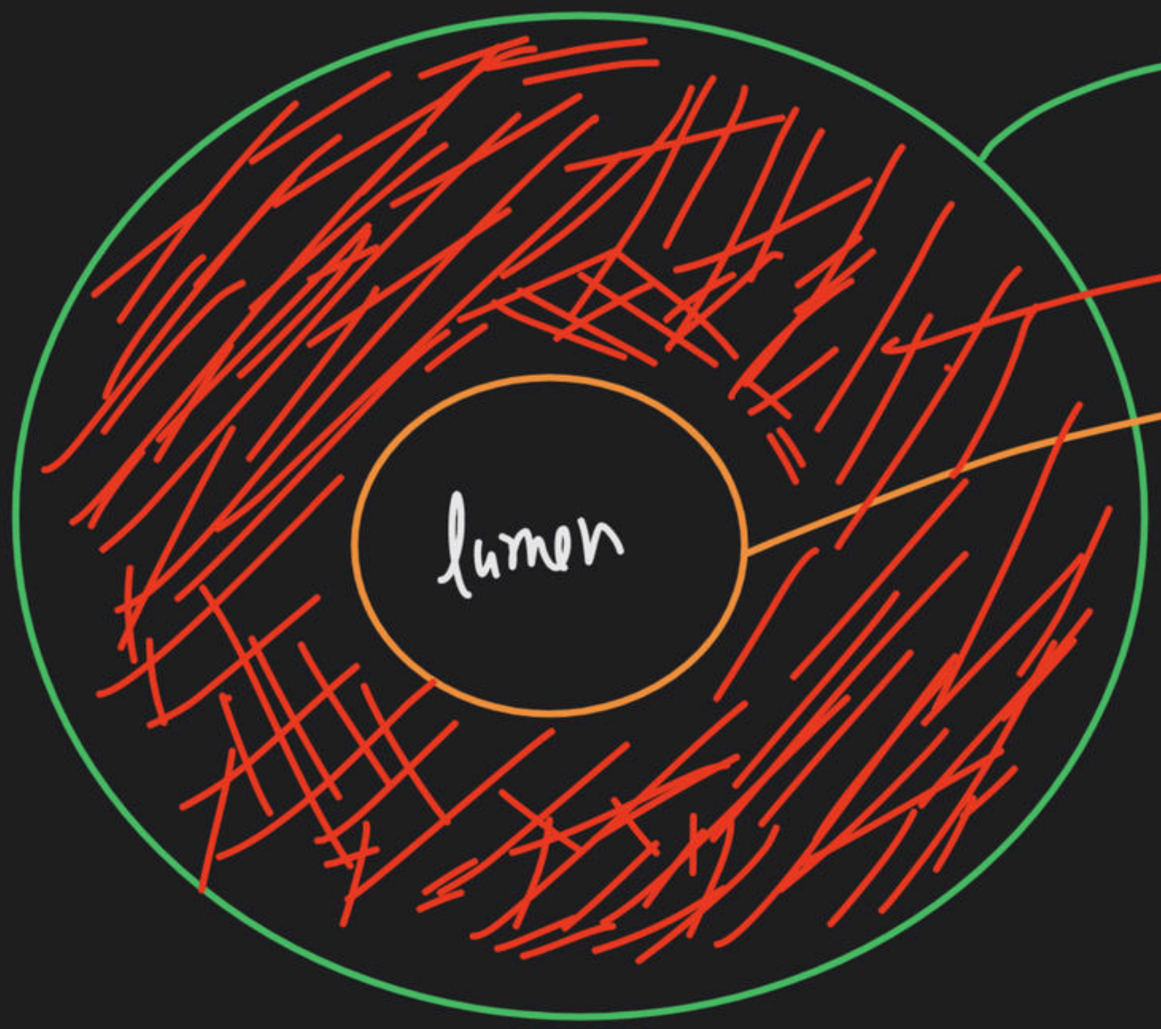
Excessive Pericardial fluid

Internal

- SA node fails
- Muscle contraction fail
- Congestive Heart failure
  (intensity of muscle contraction decreases)


P. Artery
Haemoptysis
Blood in cough
Pulmonary circulation
P. Vein
RV
LV
intensity of muscle contraction of LV ↓
Aorta
(Congestion)
organs


Parietal pericardium
Epicardium
(SSE)
Visceral pericardium
Myocardium
Endocardium
P.Fluid & P.Cavity



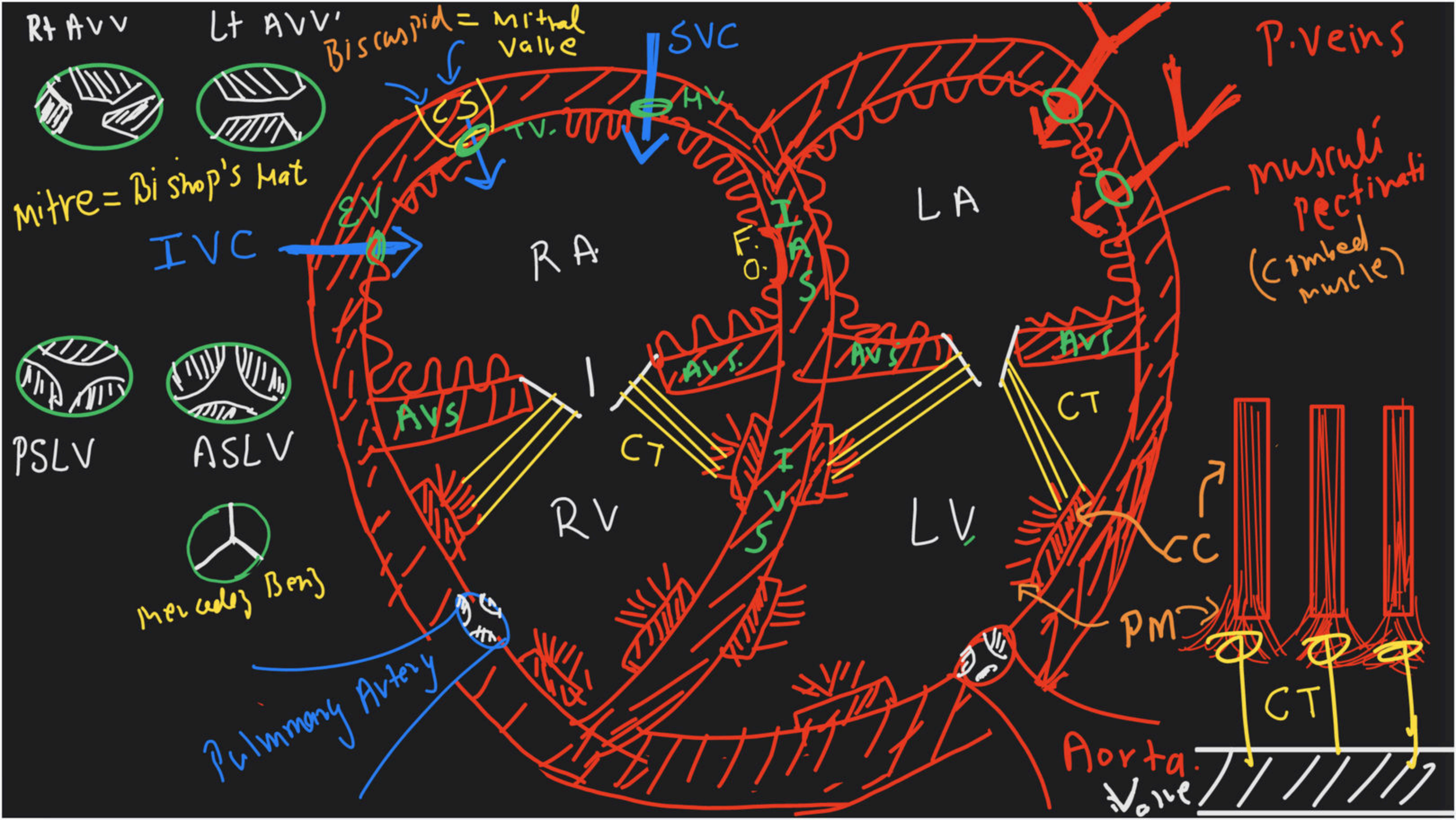
Epicardium (SSE)

myocardium [Cardiac muscles]

Endocardium (SSE)
(Endothelial)

(Striated, involuntary)

Septum = Partition


Rt AVV
Lt AVV
Biscuspid = Mitral Valve
SVC
P.Veins
Mitre = Bi shop's Hat
CS
TV.
MV
EV
IVC
RA
LA
F.O.
IAS
musculi pectinati (Crimbed muscle)
AVS
ALS.
CT
RV
LV
IVS
PSLV
ASLV
CC
PM
Mercedes Benz
Pulmonary Artery
Aorta
Valve

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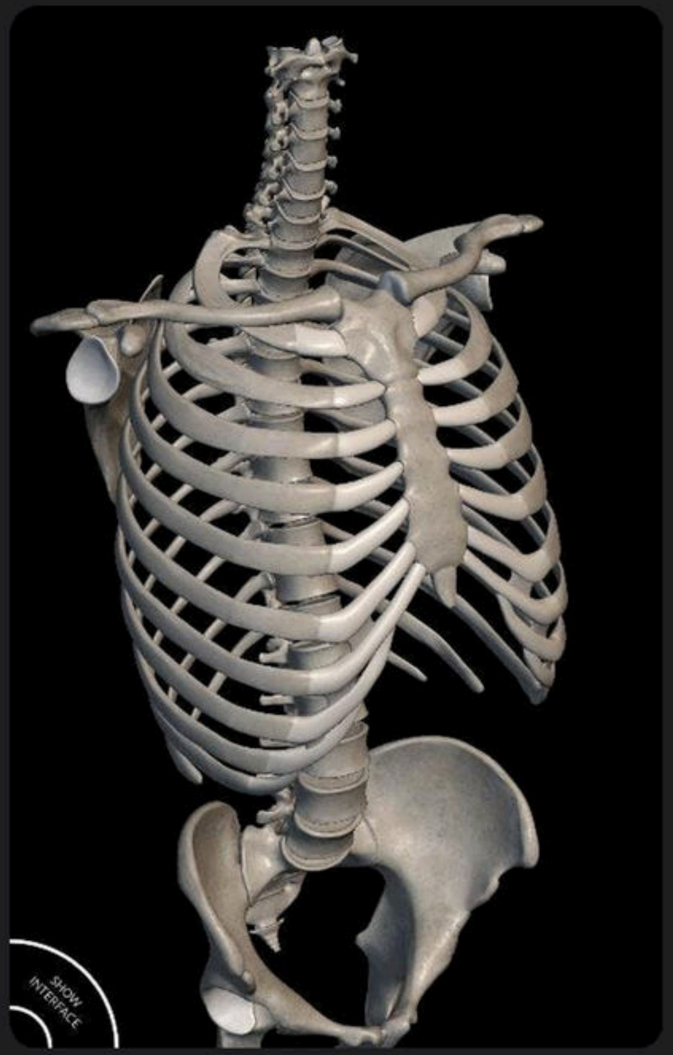
▲ 10 • Asked by Akhilesh

Please help me with this doubt



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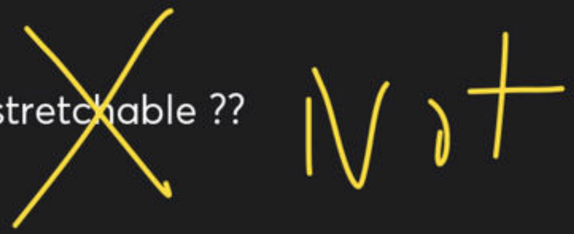
▲ 6 • Asked by Sarthak

How does CT move with valve ?? Is it stretchable ??



What happens when CT of RV are Damaged

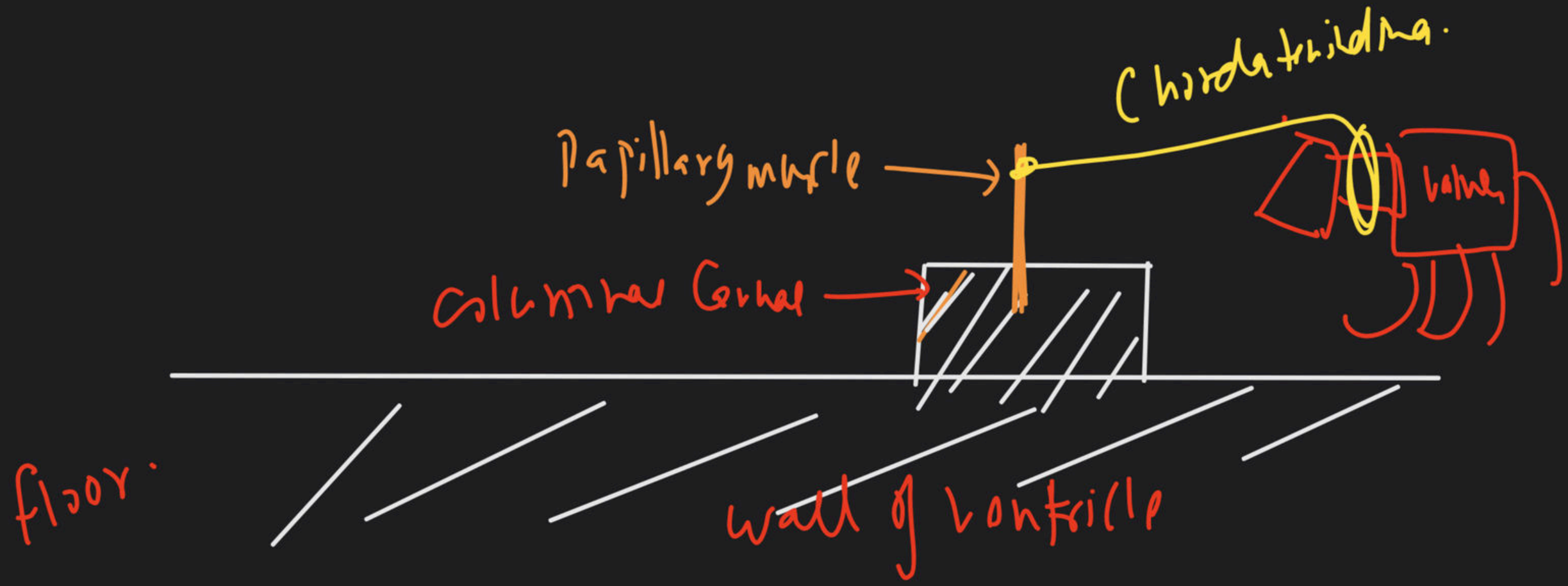
A) Blood will not Enter RV

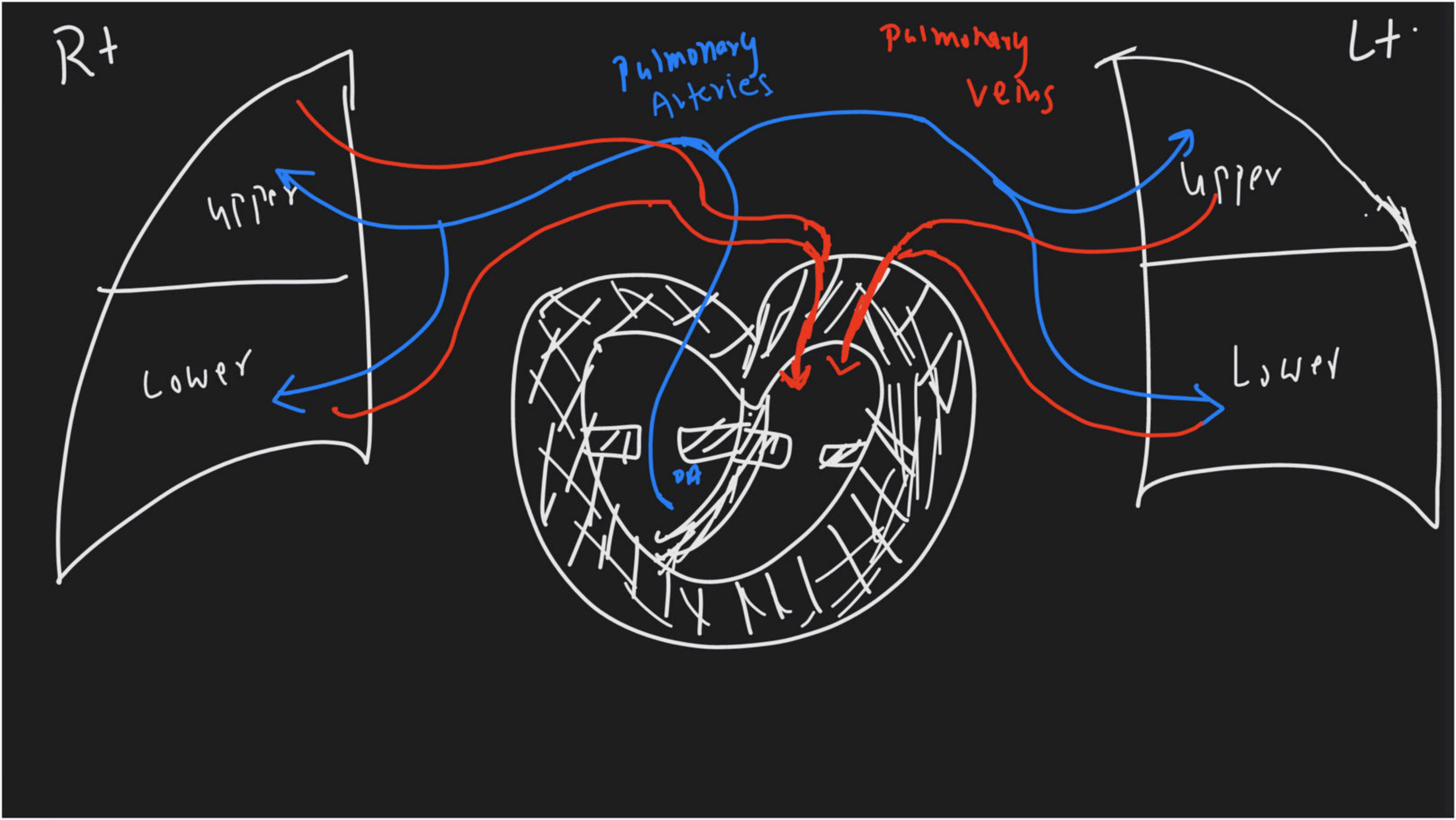
B) Blood will not Exit from RA

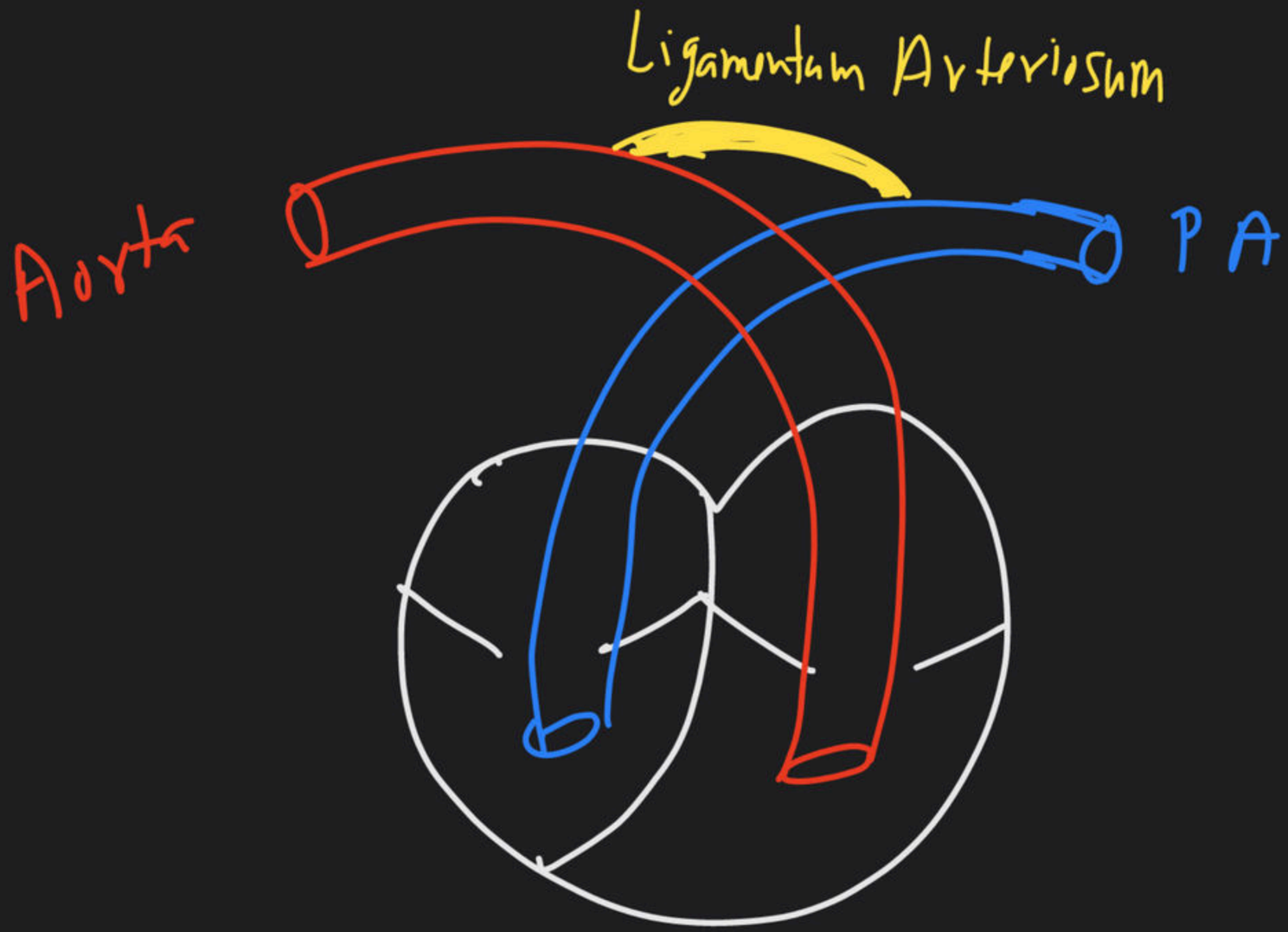
C) Blood will Backflow from RV to RA

D) Blood flow in Pulmonary Artery will decrease

PYQ


Chordae tendinea.
Papillary muscle
Valve
Columnar Carnae
floor.
wall of ventricle


Rt
Pulmonary Arteries
Pulmonary veins
Lt.
Upper
Lower
Upper
Lower
DA


Ligamentum Arteriosum
Aorta
PA

1. **Cut section of heart :**

The wall of heart is made of three layers, from outside inwards :

(i) Epicardium - outermost layer, mesodermal in origin. Made of simple squamous epithelium.

(ii) Myocardium - middle layer, thickest, mesodermal. Made of cardiac muscles which are striated but involuntary.

(iii) Endocardium - innermost layer, endodermal in origin. Made of simple squamous epithelium.

2. **Partitions of heart :**

Interauricular septum – it is a partition between the left and right atria. It is shifted slightly towards left, so the Right atrium is slightly broader than left. An oval depression **(Fossa Ovalis)** is present on its Posterior part. It is remainant of **foramen ovale** present in fetal stage which closes at birth. In fetal circulation the lungs are non functional and by-passed so the blood directly reaches the It. Atrium from rt. Artium through foramen ovale.

Interventricular septum – it is separates the two ventricles. It is shifted slightly towards right. Therefore left venrticle is larger than right ventricle.

Auriculoventricular septum – it separates the two auricles from the two ventricles. It is shifted upwards towards Auricles. Therefore auricles are samaller than ventricles.

3. **Chambers**

The mammalian heart has four chambers.

(i) **Right Auricle or Atrium** - Inlet : it receives on **S.V.C.**, one **I.V.C.** and one opening of **coronary sinus** in man. (it receives two S.V.C(rt. & It.) in case of rabbit).

SVC = superior vena cava = anterior vena cava =precava ; **IVC** = inferior vena cava = posterior vena cava = post cavals.

The SVC & IVC bring impure blood from the upper and lower body parts respectively. The **Coronary sinus** receives impure blood from the rt. & It. Coronary veins and drains it in the right auricle.

Outlets : this impure blood drains through the right AV foramen into the right ventricle.

(ii) **Right ventricle** - Inlets : receives impure blood through right AV foramen from right auric
Outlets : drains the impure blood into pulmonary artery through wh
reaches lungs for oxygenation.

(iii) **Left Auricle** - Inlets : receives oxygenated blood from lungs via pulmonary vein
Outlets : this pure blood is drained into left ventricle through left AV foramen.

(iv) **Left Ventricle** - Inlets : receives pure blood through left AV foramen from left auricle
Outlets : drains pure blod into the Aorta from where it is supplied to systemic organs.

4. **Walls**

Auricles - The inner wall surface here presents a series of transverse muscular ridges called ***musculi pectinati.*** They run forwards and downwards towards AV foramen, giving appearance of the teeth of a comb (combed muscles).

Ventricles- The inner wall is rough due to presence of muscular ridges ***trabeculae carnae*** or ***columnae carnae.*** These continue as ***papillary muscles***, whose one end is attached to the ventricular wall and the other end is connected to the cusps of AV valves by ***chordae tendinae.*** These chorda tendinae are collagenous and inelastic chords one end of which is inserted in the papillary muscles and other end is connected to the flaps of AV valves. These are meant for preventing the pushing of flaps into atrium during ventricular contraction.

5. **Valves**

Rt. Atrium - All its inlets are guarded with valves to prevent backflow of the blood. The SVC opening is said to be guarded by **Haversion valve (absent in rabbit).** The IVC which opens below this has its opening guarded by a valve called **Eustachian valve**. The opening of coronary sinus in rt. Atrium is guarded by **Thebesian valve.**

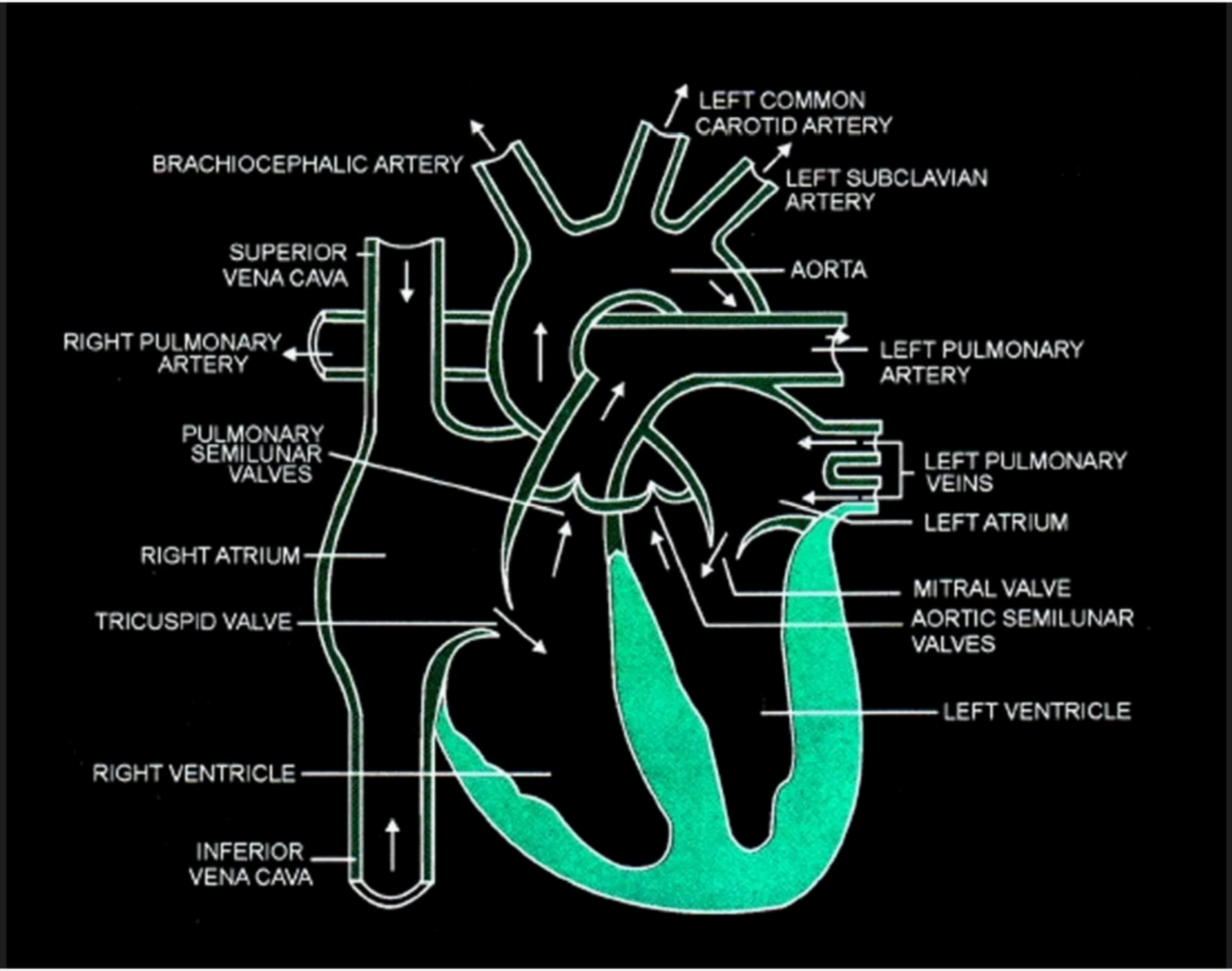
Lt. Atrium - At its inlet is pulmonary vein (four veins in man and two in rabbit), these have no guarding valve.

AV formen - The right AV foramen has a unidirectional valve called **tricuspid valve** (made of three flaps or cusps) which allows entry of Blood from Rt. Atrium to Rt ventricle and prevents its backflow. The unidirectional valve present on left AV foramen is made of two cusps only, hence called **bicuspid valve.** (also called as the **Mitral valve**).

Rt. Ventricle - Its outlet is in the pulmonary artery. It is guarded by a **pulmonary semilunar valve**

Lt. Ventricle - Its outlet is in the systemic aorta. This opening is guarded by an **aortic semilunar valve**. Both these semilunar valves are made of three cusps each and are unidirectional in nature.

From the two ventricles the pulmonary artery & systemic aorta arise out in the form of arches (called as pulmonary and systemic arches). These arches cross each other, and at the point of crossing they are attached by **ligamentum arteriosum.** Ligamentum arteriosum is the remainant of **ductus arteriosus.** Ductus arteriosus is a small channel connecting the lumen of the two arches which gets closed at the time of birth.


LEFT COMMON CAROTID ARTERY
BRACHIOCEPHALIC ARTERY
LEFT SUBCLAVIAN ARTERY
SUPERIOR VENA CAVA
AORTA
RIGHT PULMONARY ARTERY
LEFT PULMONARY ARTERY
PULMONARY SEMILUNAR VALVES
LEFT PULMONARY VEINS
LEFT ATRIUM
RIGHT ATRIUM
MITRAL VALVE
TRICUSPID VALVE
AORTIC SEMILUNAR VALVES
LEFT VENTRICLE
RIGHT VENTRICLE
INFERIOR VENA CAVA