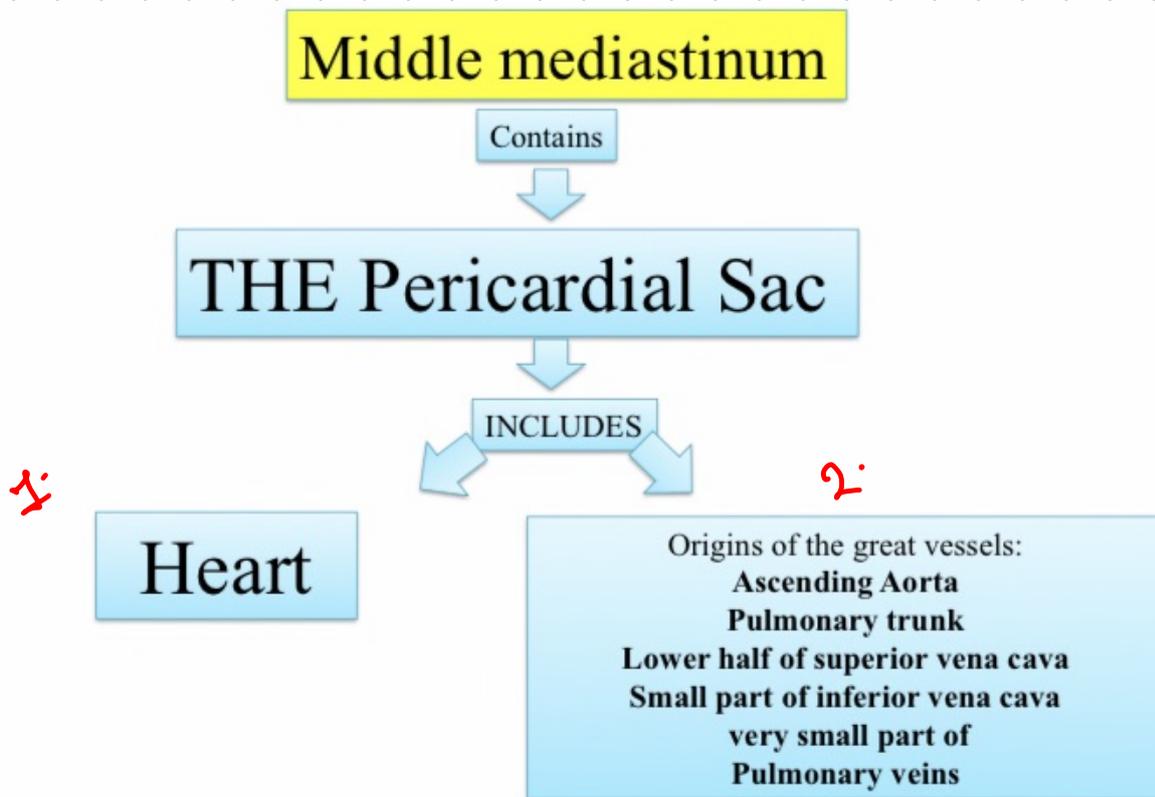


Anatomy lecture 4

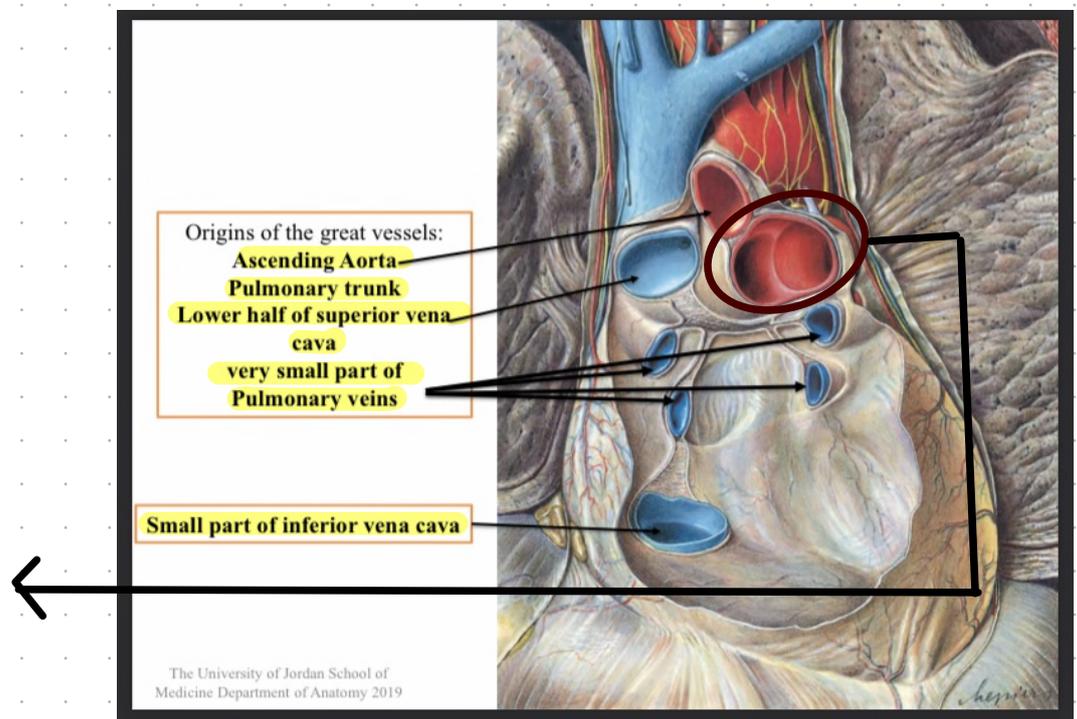
Done by : Reham badayneh

In this lecture we are going to talk about the middle mediastinum .



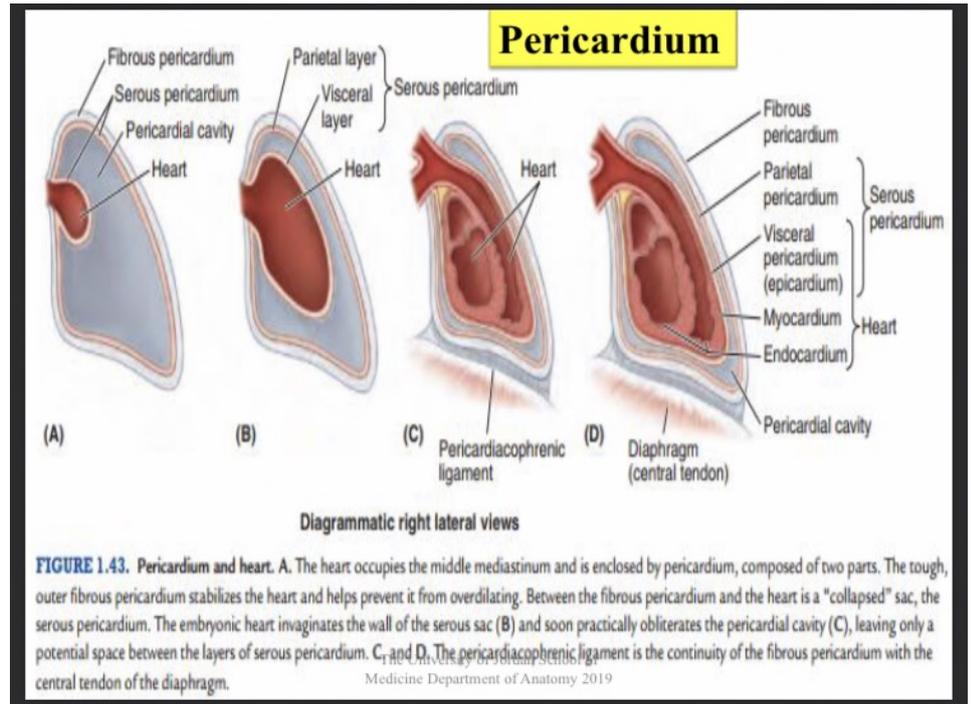
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This is the bifurcation of the pulmonary trunk , but here the pulmonary trunk has been removed



1- Pericardium

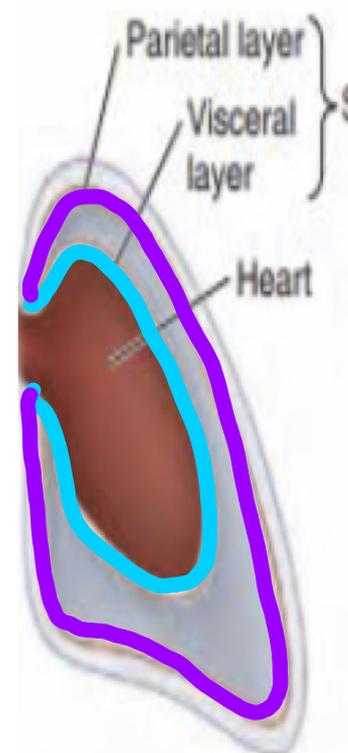
This diagram summarizes the embryogenesis of the pericardium :-



1- imagine that the heart is invaginating the pericardial sac BUT never entering the pericardial cavity (as if you are putting your finger (the heart) inside a balloon (the pericardium) without your finger reaching the air inside the balloon)

2- as the heart invaginates it takes with it **this layer** and we would call this layer **the visceral layer**

3- and what has been left here we would call it **the parietal layer**



Both the Parietal layer and the the visceral layer are called Serous pericardium (the two layers are two serous membranes)

4- As the heart gets more and more inside this balloon , the space between the visceral and parietal layer (pericardial cavity) is decreasing until these two layers reach a potential space { it is not a true space ,if there is an inflammation this space will be filled with exudate or pus and then a cardiac tamponade would develop (to be discussed later on) } , so if we dissect the pericardium we would see that it is adherent to the heart.

So , we have a visceral layer which adherent to the heart and the parietal layer and between them we have a potential pericardial cavity which contains a small amount of serous fluid secreted by these two serous membranes (lubricating fluid ; to reduce the friction between them) .

This concept (having a parietal and visceral layer) is true for many organs in our body (e.g. the intestines , the lungs , and even it is true for the BRAIN if we consider the dura matter and Pia matter are two layers of fibrous tissue to protect the brain itself)

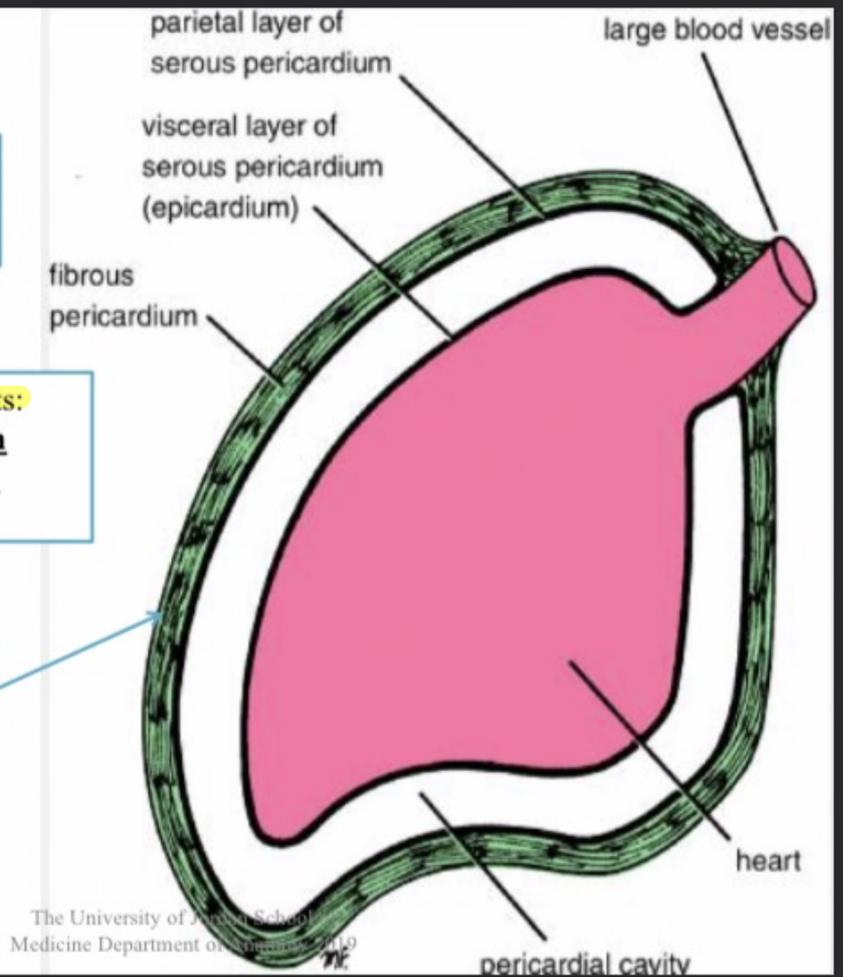
5- And because the heart is beating all the time , the friction with nearby structures has to be minimized to its lowest possible range , and this is achieved by having another sac that surrounds the Parietal layer and this sac is called **The Fibrous Pericardium (sac) { a tough fibrous tissue }**

In dissecting the pericardium we will notice that the outer layer of the pericardium (the fibrous pericardium) is rough , however the inner side (the parietal layer of the serous pericardium) is smooth , so when we open the fibrous sac we will be inside the pericardial cavity immediately (the Fibrous pericardium is completely adherent to the parietal of the serous pericardium !!)

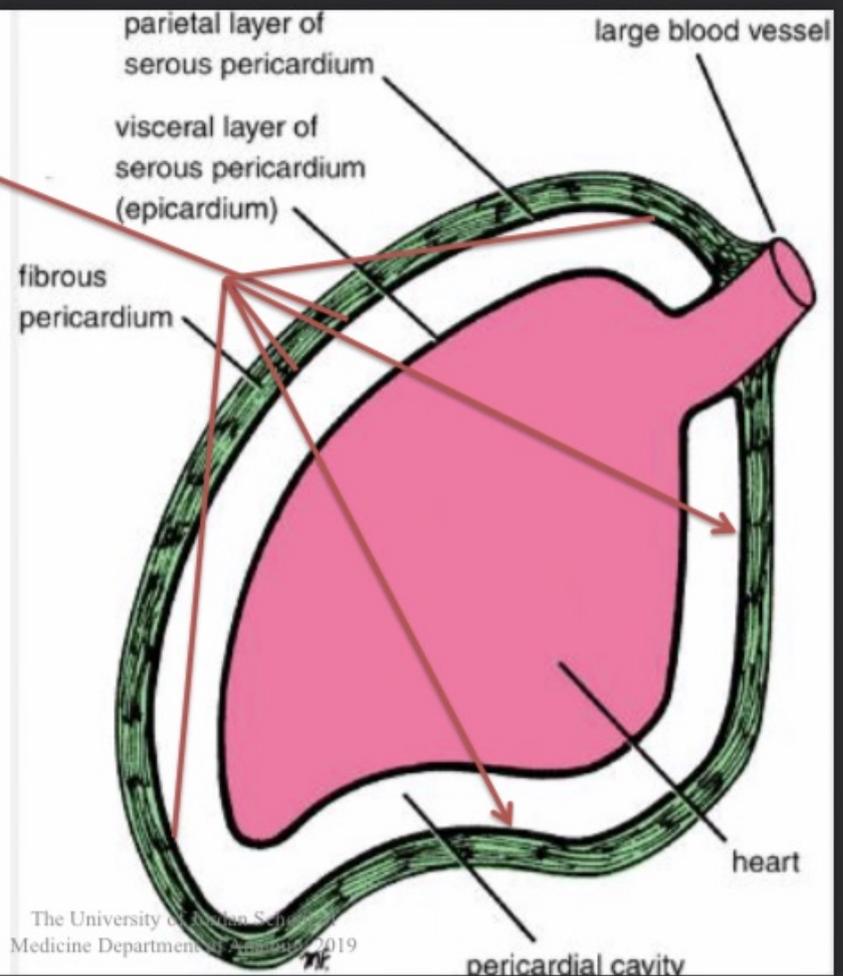
➤ is a **fibroserous sac** surrounding the heart and the roots of the great vessels.

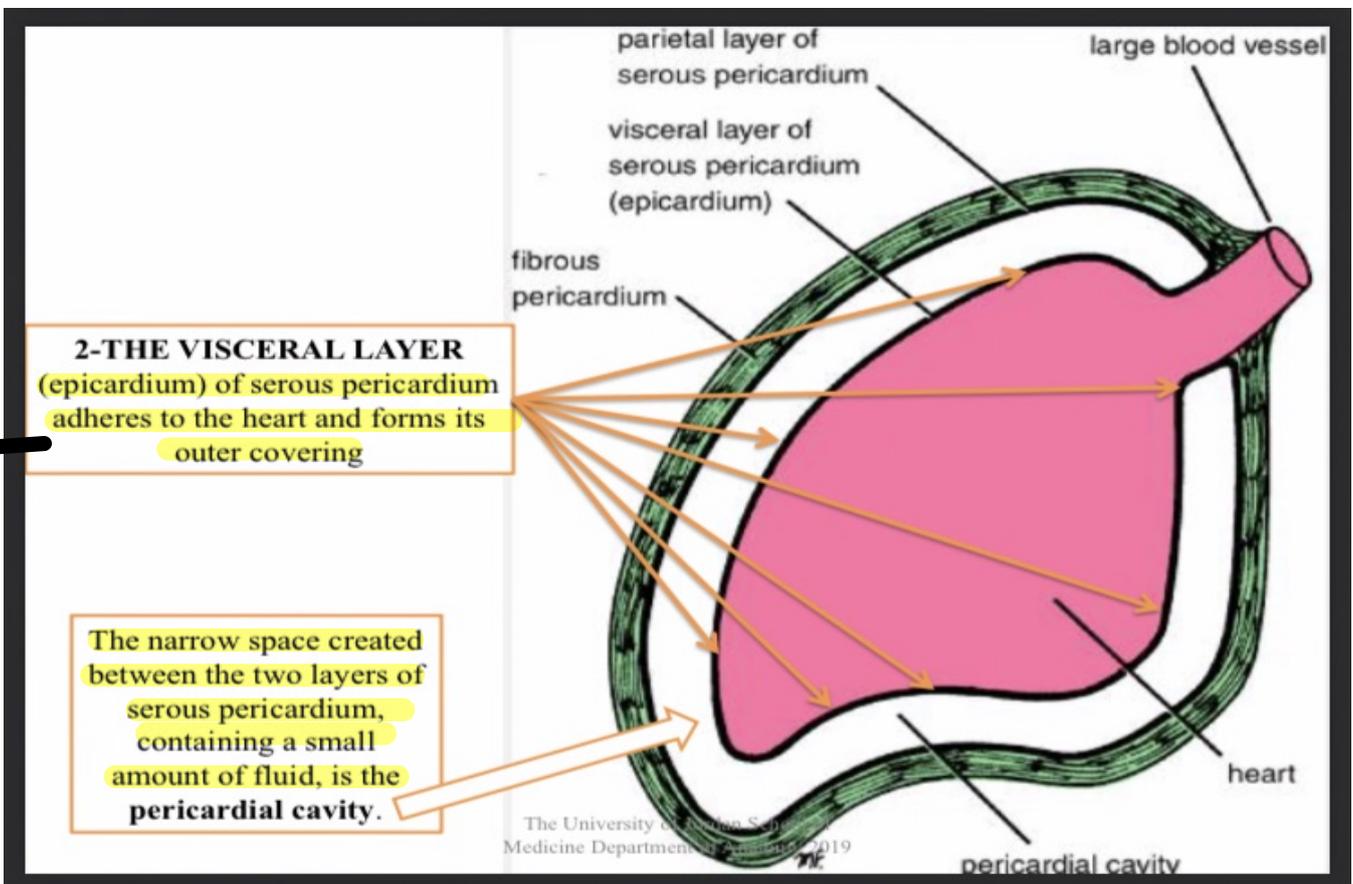
➤ It consists of two components:
1- The Fibrous Pericardium
2- The Serous Pericardium

The fibrous pericardium is a tough connective tissue **outer layer**

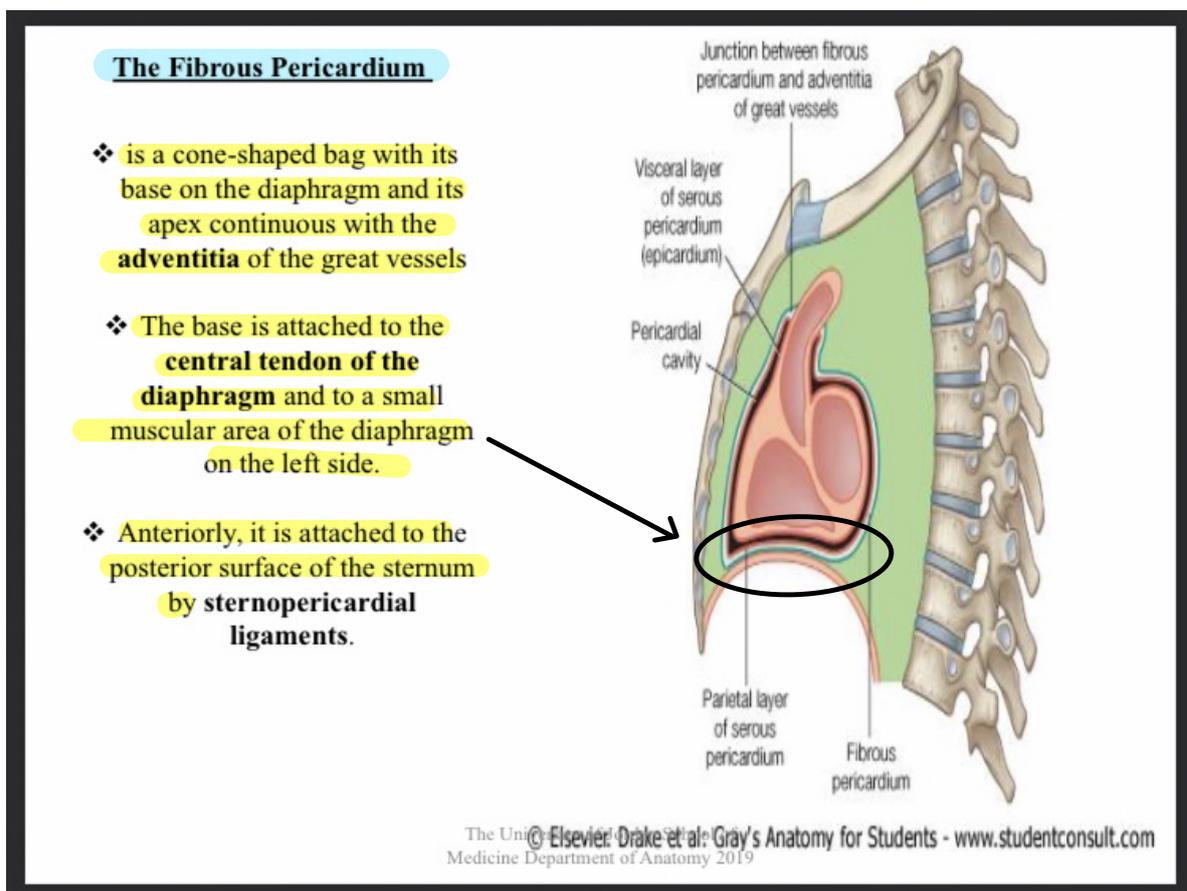


The serous pericardium is thin and consists of two parts:
1-THE PARIETAL LAYER lines the inner surface of the fibrous





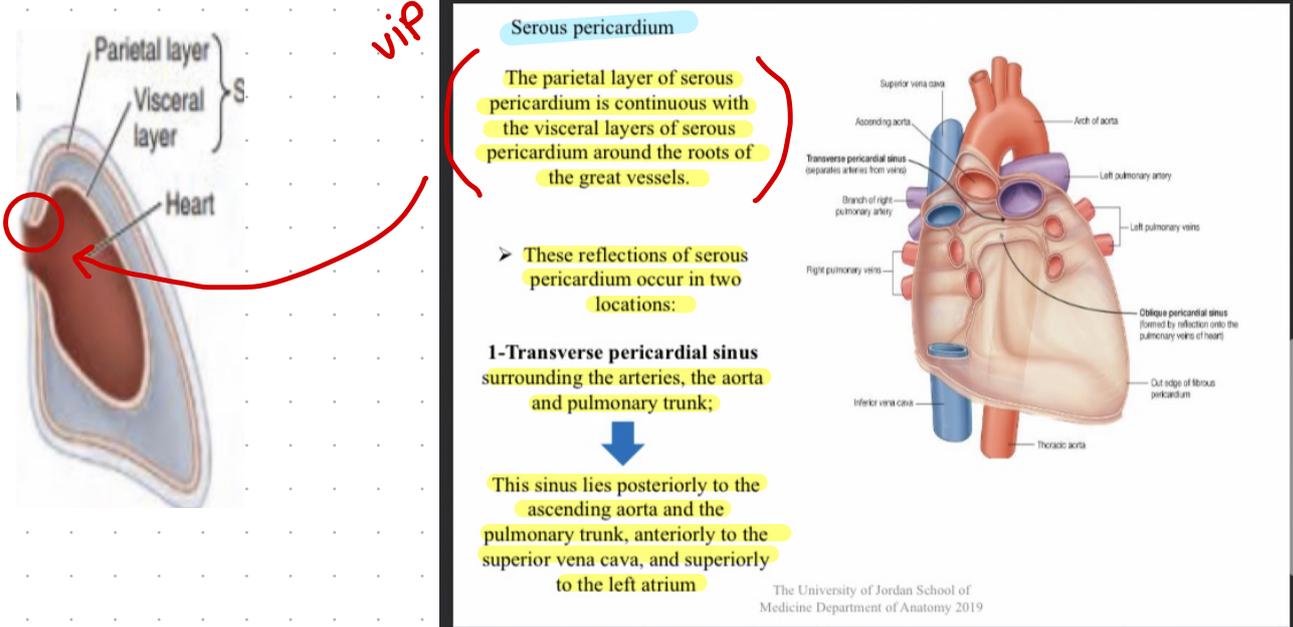
It is considered part of the heart . So we can call it the **Visceral layer of the serous pericardium Or Epicardium** (as it is a very thin layer covering the outer surface of the heart)



* we give the heart a very smooth protection from the serous balloon (serous pericardium : The Parietal and Visceral layers) and the heart moves protected by the pericardial cavity between these two layers in one balloon

* Now the balloon and the heart are protected by the tough fibrous pericardium and we can connect this fibrous sac by nearby structures , so the fibrous is the one that gets fixed to nearby structures and inside it is the heart moving .

So this what makes the pericardium move without friction and also to be fixed to in this area .



Serous pericardium

The parietal layer of serous pericardium is continuous with the visceral layers of serous pericardium around the roots of the great vessels.

➤ These reflections of serous pericardium occur in two locations:

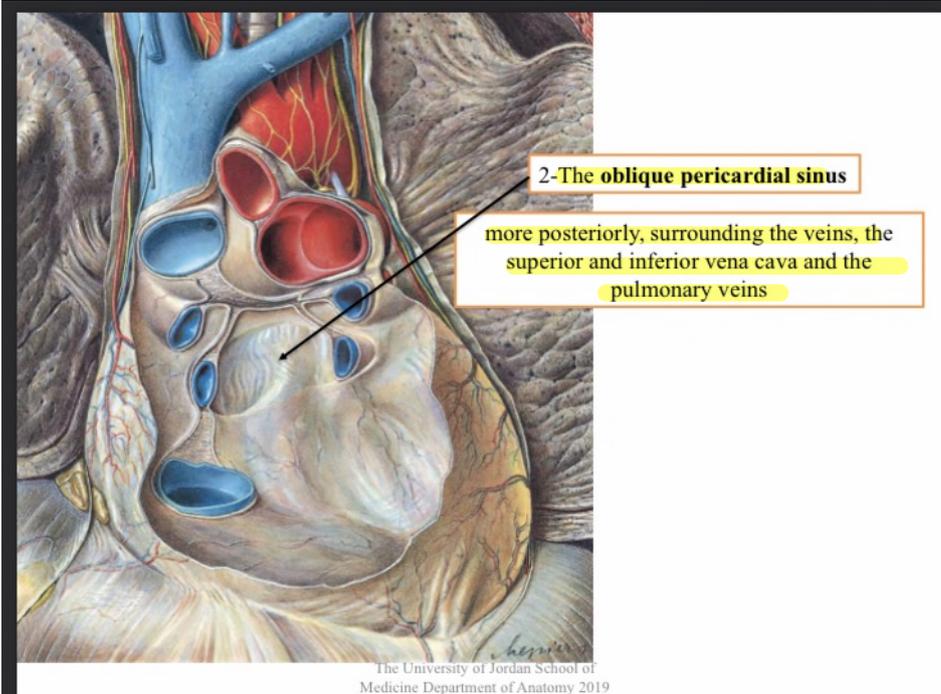
1-Transverse pericardial sinus surrounding the arteries, the aorta and pulmonary trunk;

↓

This sinus lies posteriorly to the ascending aorta and the pulmonary trunk, anteriorly to the superior vena cava, and superiorly to the left atrium

Labels in diagram: Superior vena cava, Ascending aorta, Arch of aorta, Transverse pericardial sinus (separates arteries from veins), Branch of right pulmonary artery, Right pulmonary veins, Left pulmonary artery, Left pulmonary veins, Oblique pericardial sinus (formed by reflection onto the pulmonary veins of heart), Cut edge of fibrous pericardium, Inferior vena cava, Thoracic aorta.

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2-The oblique pericardial sinus

more posteriorly, surrounding the veins, the superior and inferior vena cava and the pulmonary veins

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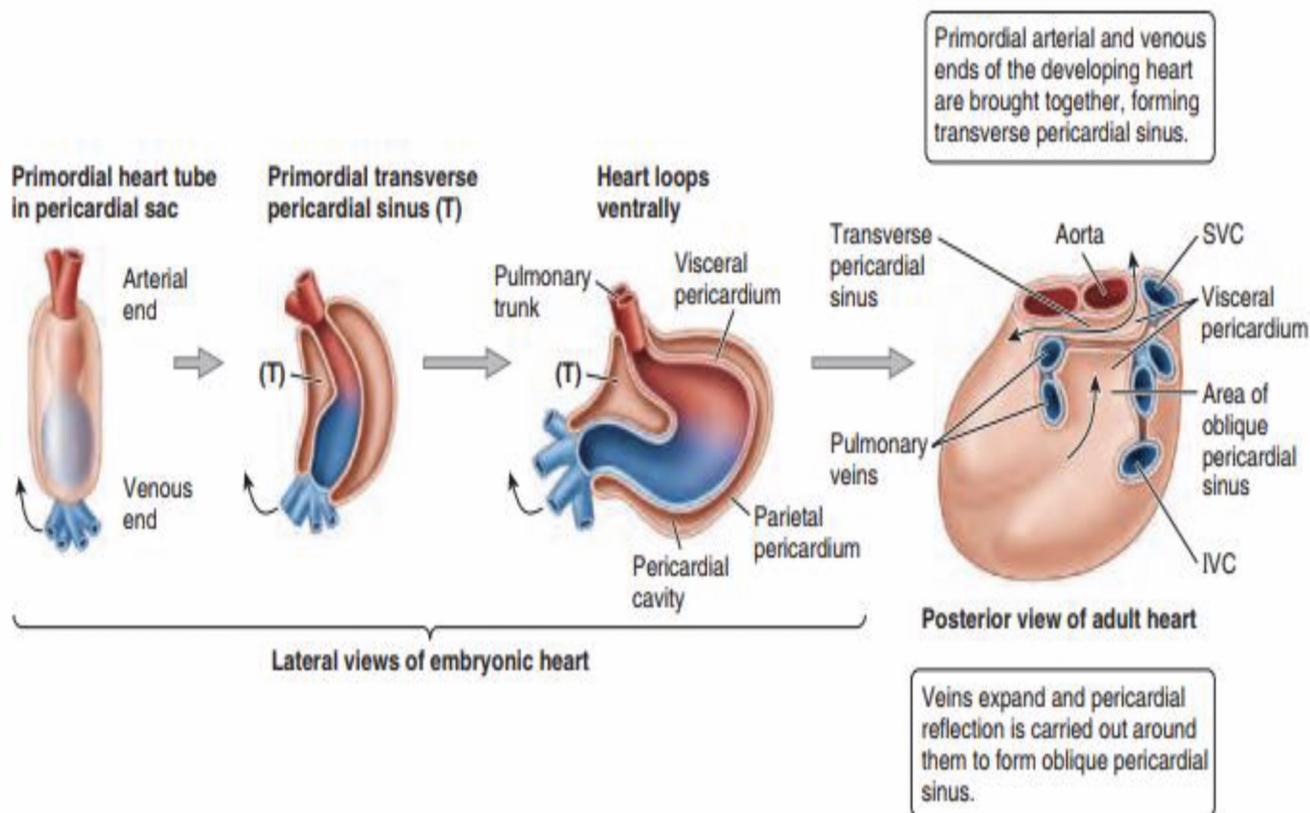
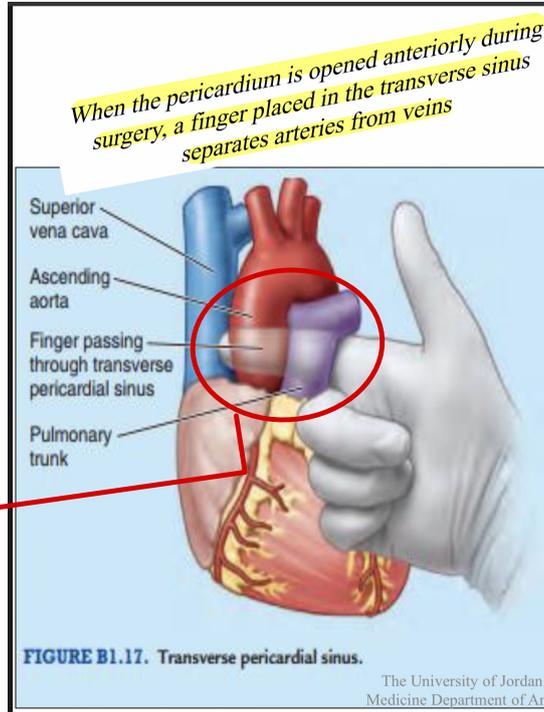


FIGURE 1.45. Development of heart and pericardium. The longitudinal embryonic heart tube invaginates the double-layered pericardial sac (somewhat like placing a wiener in a hot dog bun). The primordial heart tube then “loops” ventrally, bringing the primordial arterial and venous ends of the heart together and creating the primordial transverse pericardial sinus (T) between them. With growth of the embryo, the veins expand and spread apart, inferiorly and laterally. The pericardium reflected around them forms the boundaries of the oblique pericardial sinus. IVC, inferior vena cava; SVC, superior vena cava.

We will talk about them later on in the embryology of the heart , but simple :-

The heart in the embryogenesis was a tube (not pyramidal in shape as we are familiar with) with two ends (arterial end superiorly and it is fixed to the aorta and the venous end inferiorly) , as the heart gets larger and larger in size the lower part would be free to move and fold , as a result , part of the balloon which covers the heart (Serous sac) gets trapped between the arterial and venous end forming the Transverse sinus and another sinus The Oblique sinus .

So , anterior to the surgeon's finger (his finger in the Transverse sinus) is the Arterial end and behind his finger is the Venous end



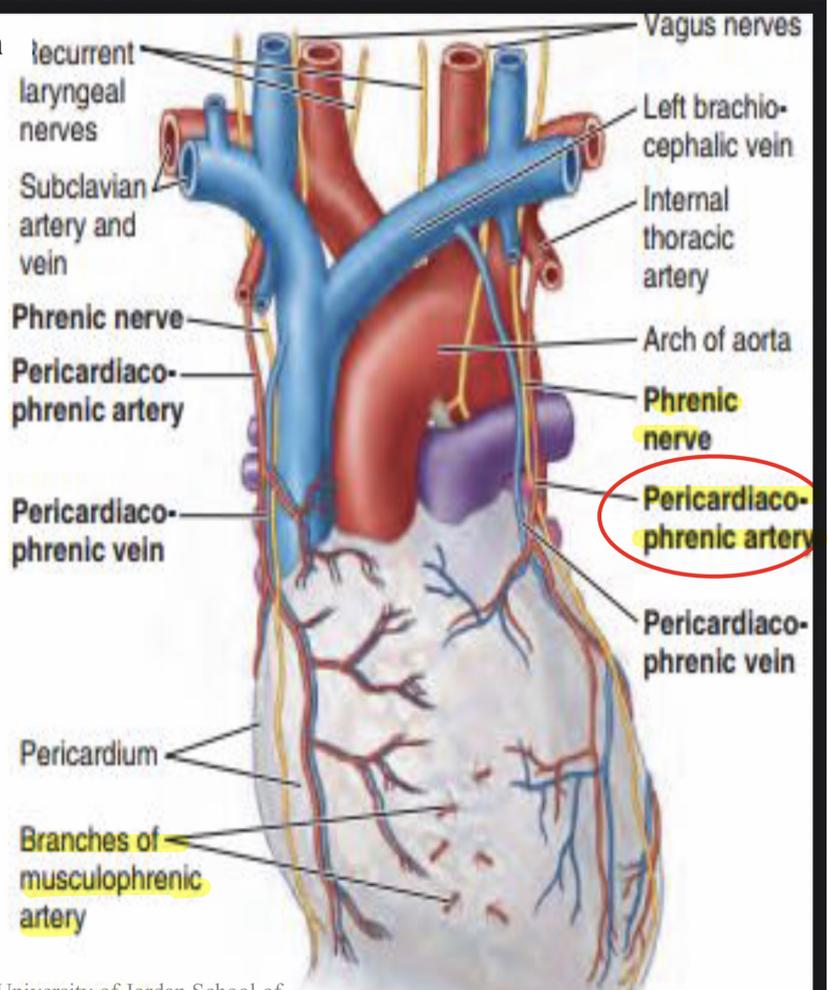
The transverse pericardial sinus is especially important to cardiac surgeons. After the pericardial sac is opened anteriorly, a finger can be passed through the transverse pericardial sinus posterior to the ascending aorta and pulmonary trunk. By passing a surgical clamp or a ligature around these large vessels, inserting the tubes of a coronary bypass machine, and then tightening the ligature, surgeons can stop or divert the circulation of blood in these arteries while performing cardiac surgery, such as coronary artery bypass grafting.

The arterial supply of the pericardium

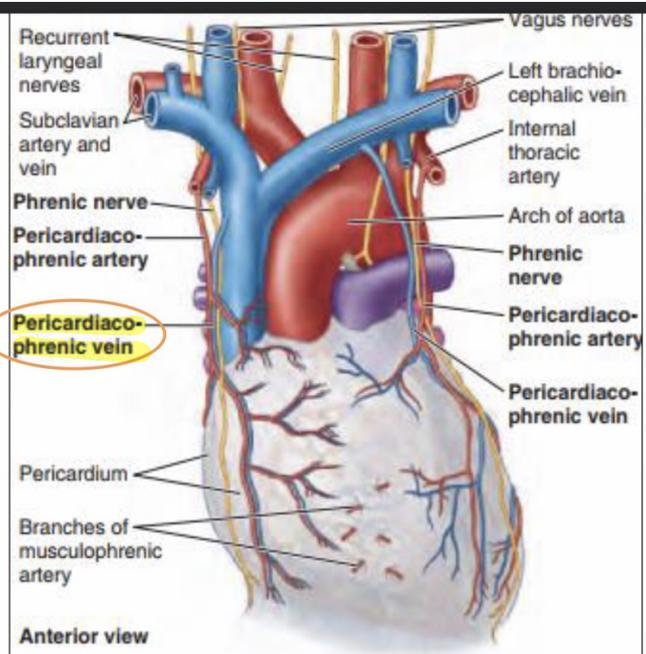
❖ is **mainly** from a slender branch of **the internal thoracic artery**, the pericardiophrenic artery, that often accompanies or at least parallels the phrenic nerve to the diaphragm.

Smaller contributions of blood come from the:

- **Musculophrenic artery**, a terminal branch of the internal thoracic artery.
- **Bronchial, esophageal, and superior phrenic arteries**, branches of the thoracic aorta.
- **Coronary arteries (visceral layer of serous pericardium only)**



The venous drainage of the pericardium is from the: • **Pericardiophrenic veins**, tributaries of the brachiocephalic (or internal thoracic) veins. Variable tributaries of the **azygos venous system**



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Whenever we are talking about nervous supply of an internal organ we have to consider facts about these organs ; do you need these organs to feel somatic pain ? Do you need these organs to be totally autonomic (muted) ? And in each system you will see different presentations of these options , example the Pericardium here has two sacs :-

1- The Parietal **pericardium** (Fibrous pericardium) ; should be similar to the somatic representation in you body .

2- The visceral Pericardium (Serous pericardium) ; which is attached to the heart , so what comes from this area is similar to the organ itself .

Now lets differentiate between the Somatic pain and the Visceral pain :-

A- Somatic pain : localized pain

Like a patient comes to you with his finger indicating the source of the pain

B- Visceral pain : it is a vague pain , the patient talks about an area of pain he will never be able to exactly define this pain

(VIP concept to evolve the right diagnosis)

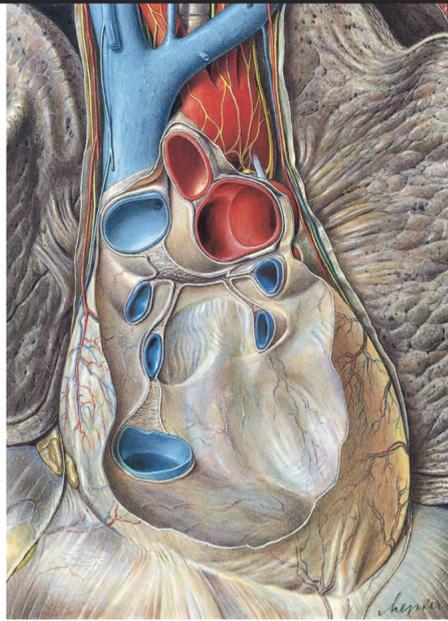
The nerve supply of the pericardium is from the:

• Phrenic nerves (C3–C5)

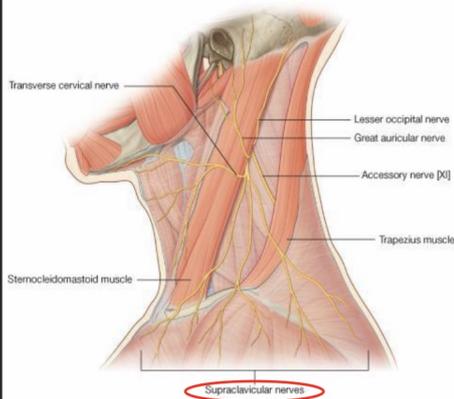
primary source of sensory fibers; pain sensations conveyed by these nerves are commonly referred to the skin (C3–C5 dermatomes)

It is important to note that the source of somatic sensation (pain) from the parietal pericardium is carried in the phrenic nerves.

For this reason, 'pain' related to a pericardial problem may be referred to the supraclavicular region of the shoulder



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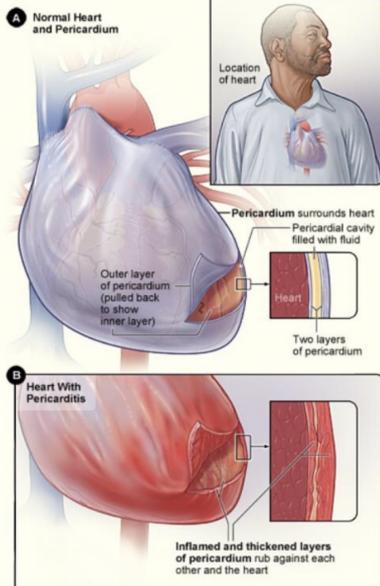


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> The supraclavicular nerve (C3 and 4) which is a branch of the cervical plexus, supplies the skin over the shoulder region

> This nerve is important clinically, because it shares the same root value with phrenic nerve and pain may be

referred along the supraclavicular nerve from the phrenic nerve (pericarditis)



Pericarditis is inflammation of the pericardium (the fibrous sac surrounding the heart). Symptoms typically include sudden onset of sharp chest pain.

The pain may also be felt in the shoulders, neck, or back.

Important

Pain from the pericardium may be exacerbated by lying back or on the left side and relieved by leaning forward

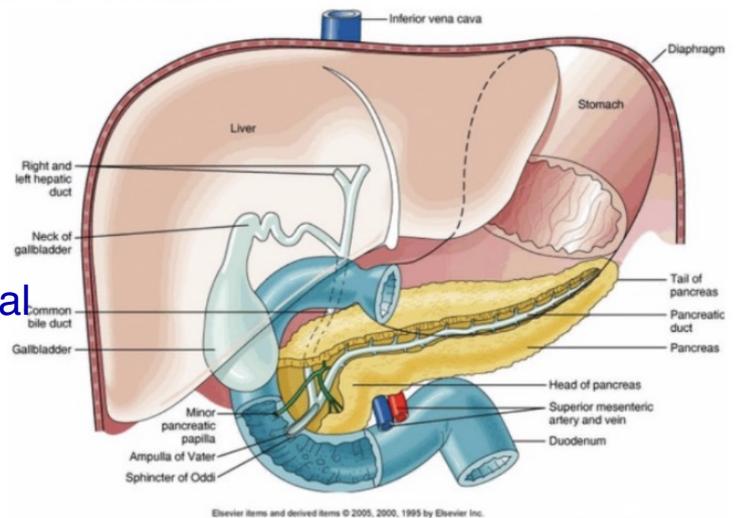
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2- another example of referred pain along the supraclavicular nerve from the phrenic nerve is Cholecystitis

Explanation :

The diaphragm has two surfaces: thoracic and abdominal.

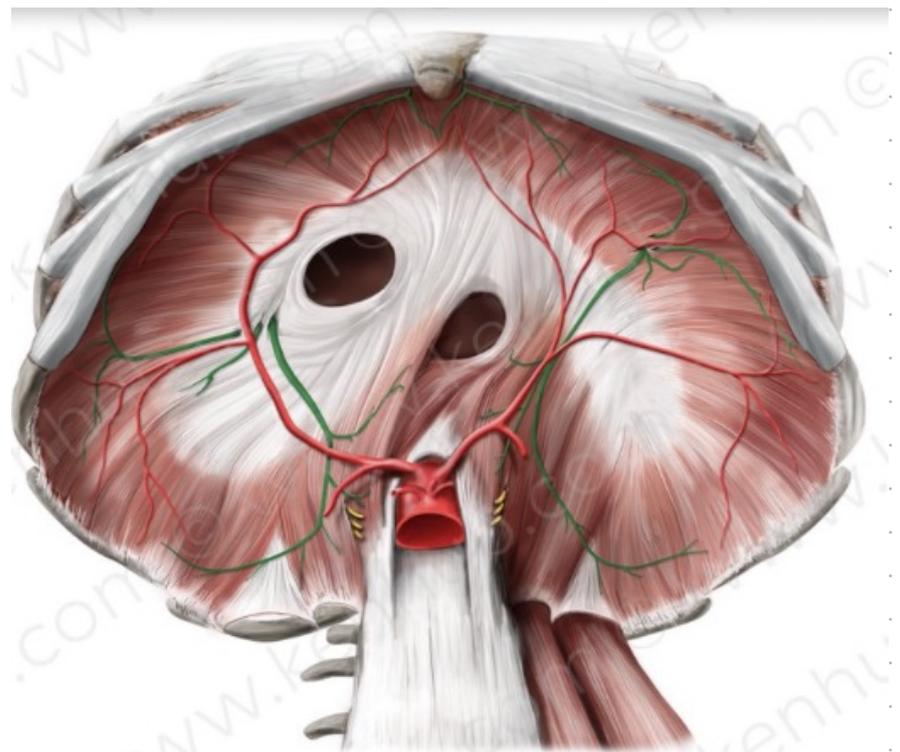
The thoracic diaphragm is in direct contact with the lungs (pleura) and pericardium, while the abdominal diaphragm is in direct contact with the liver, stomach, and spleen



The diaphragm is shaped as two domes, with the right dome positioned slightly higher than the left because of the liver and the gallbladder is touching the diaphragm

Sensory innervation (pain and proprioception) at the central tendinous part is innervated by the phrenic nerves.

Now , if we have Cholecystitis (the inflammation of the gallbladder) and this inflammation irritated the peritoneum around the the diaphragm , the pain can travel through the phrenic nerve to its origin which is the same origin of the supraclavicular nerve that supplies the skin over the shoulder region .



So , if a patient came to you with a **right shoulder pain** , think of these possibilities :-

1- True right shoulder pain , so we examine the shoulder , if it is fine we should think about another two conditions :-

2- Referred pain from the pericardium (Pericarditis)

3- Referred pain from the Gallbladder (Cholecystitis)

Hint , if a fat female patient in her 40s came with a right shoulder pain it is mainly referred pain from the gallbladder (Cholecystitis)

If a patient came to you with a **left shoulder pain** ,in addition to true shoulder pain consider Pericarditis only .

Pericardial effusion



Why the Cardiac Tamponade is dangerous ?

Because the heart is a pump needs to contract and relax , while in this case it is surrounded by fluids within a very compressed compartment both ventricles won't be able to contract .

Normally, only a **tiny amount** of fluid is present between the visceral and parietal layers of the serous pericardium.

In certain situations, this space can be filled with **excess fluid (pericardial effusion)**.

Because the fibrous pericardium is a 'relatively **fixed**' structure that cannot expand easily, a rapid accumulation of excess fluid within the pericardial sac compresses the heart

(cardiac tamponade)

resulting in **biventricular failure**.

Removing the fluid with a needle inserted into the pericardial sac can relieve the symptoms