BSMS MODULE: 103 HEART, LUNGS AND BLOOD

DR SESSION:

1. EXAMINATION OF THE LUNGS AND PLEURA

BSMS MODULE: 103 HEART, LUNGS AND BLOOD
THEME: ANATOMICAL STRUCTURE AND FUNCTION OF THE THORAX

DR SESSION: 1. EXAMINATION OF THE LUNGS AND PLEURA

Welcome back to Anatomy Laboratory

The anatomy team is excited to welcome you back to the anatomy laboratory for your second module. You have five dissection sessions this term and one applied anatomy and revision session in the laboratory. The format is similar to last term but with lots more of it!

LEARNING OUTCOMES

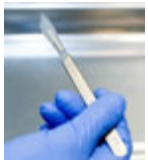
By the end of the practical session students should be able to:

1. understand the terms pleura and pleural cavities
2. name the layers and regions of the pleura
3. define the extent of the lungs
4. distinguish between the right and left lungs
5. understand the hilum and root structures of the lungs
6. identify the structures entering and leaving the medial aspect of each lung

Note: Key structures are in italics to help you when you revise.

Task 1

At the end of the last dissecting session, you will have seen the ***parietal pleura*** covering each of the lungs. Deep to this layer is the ***pleural cavity***, the potential space between the parietal pleura and the second pleural layer, the ***visceral pleura***. The two pleural layers become continuous with each other at the ***hilum*** of each lung. Examine the extent of the parietal pleura, in some cases much of the anterior part of the costal parietal pleura may have been removed with the chest wall so take a look on the internal surface of the excised chest wall to identify the parietal pleura.

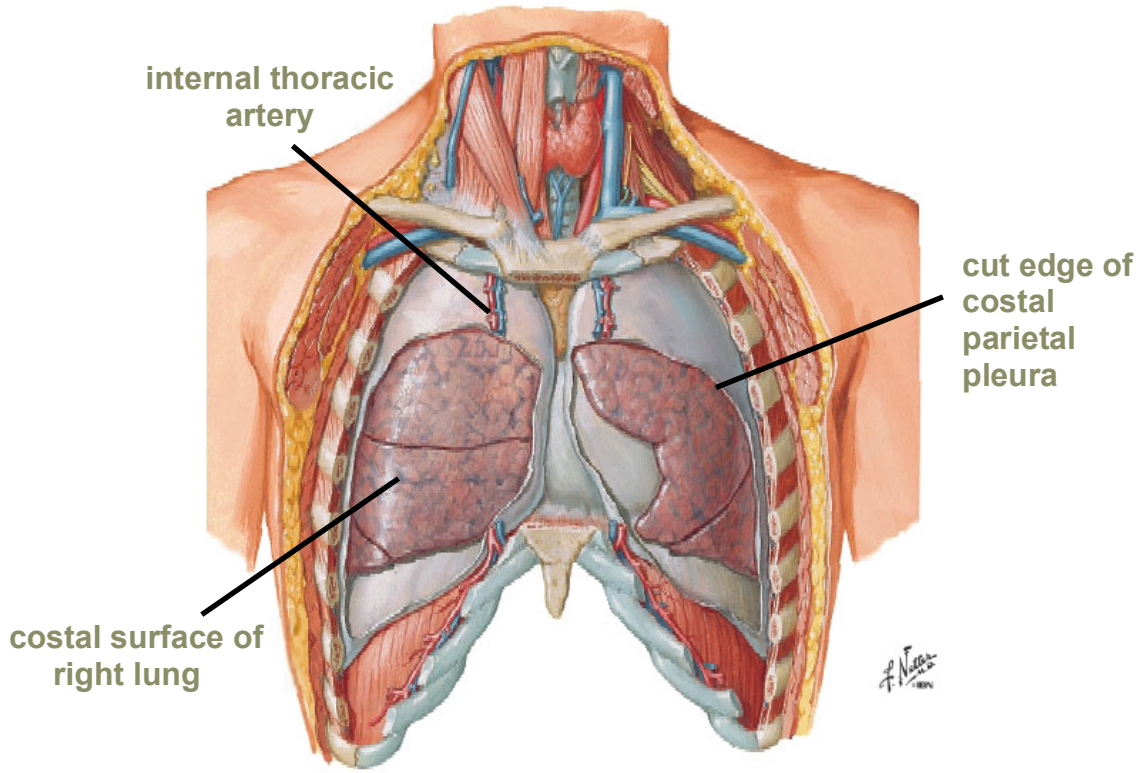


In order to view the pleural cavity and underlying structures you must remove any remaining elements of the anterior costal parietal pleura. With a scalpel, carefully cut through the thin parietal layer using the cut edge of the thoracic cage as a guide. Do not cut deeply otherwise you might damage underlying structures.

Upon removal you can now examine the extent of the pleural cavity, from the dome in the root of the neck down to the ***costodiaphragmatic recess***. The visceral pleura covers and adheres tightly to the surface of the lung and cannot therefore be easily distinguished from the underlying lung tissue. Use the diagram overleaf to help you.

Question 1

What structures make up the root of the lungs?



LUNGS AND PLEURA IN SITU

Task 2

With the parietal pleura removed you should be able to carefully pull each lung laterally from the mediastinum to find the ***hilum***. This is the site where the root structures enter and leave the lung. To remove the lungs, pass a forceps deep to the hilum and carefully divide the hilar structures close to the lung tissue, working from superior to inferior. Be very careful not to damage any underlying structures such as the aorta.

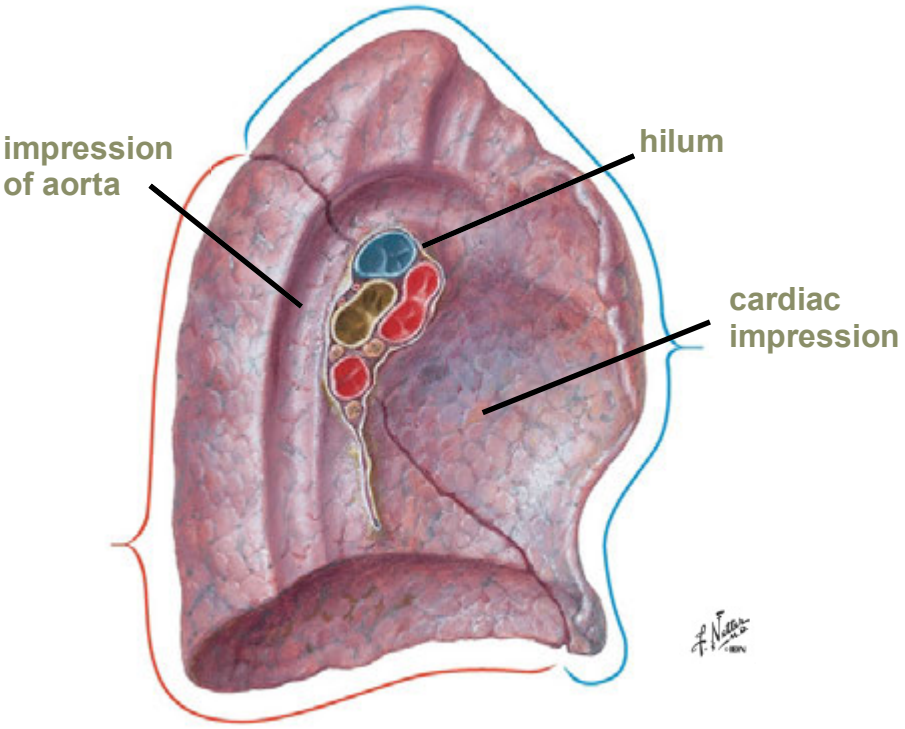
Be aware that the lungs can be adherent to the thoracic wall and that the lower lobes are easily torn (particularly on the right side) and can be left in situ. Lungs are easier to remove by lifting the base out first, followed by the apex (and the opposite when replacing). Care should be taken as the cut edge of the ribs may be sharp. As you remove the lungs note the position of the heart.

Question 2
What impact does the heart have on the shape and size of each lung?

Task 3

Your initial task here is to distinguish the left and the right lungs by first focussing on the ***fissures*** and ***lobes*** that make up each lung. The left lung is divided into ***superior*** and ***inferior lobes*** by an ***oblique fissure***. In contrast, the right lung usually has an oblique fissure and a ***horizontal fissure***, dividing it into superior, ***middle*** and inferior lobes. The left lung may also have a thin tongue-like process, the ***lingula***, which extends from the superior lobe.

Examine the other surface features of the lungs. Start by locating the apex of the lung, which extends into the root of the neck, approximately 2-3 cm above the clavicle. Now identify the various surfaces and borders of the lung. Each lung has a ***costal***, ***mediastinal*** and ***diaphragmatic surface***, the latter surface also being known as the lung base. The ***anterior*** and ***posterior borders*** of the lung separate the costal and mediastinal surfaces whereas the inferior border is between the costal and diaphragmatic surfaces. On the mediastinal surface of each lung, identify the impressions produced by adjacent structures. On the left lung you should at least be able to identify the region normally occupied by the heart and the impression made by the ***arch of the aorta***. On the right lung try and locate the impressions made by the ***superior vena cava***, ***oesophagus***, ***azygos vein*** and the heart. On the costal surfaces of each lung, note the impressions made by the ribs.



LEFT LUNG – MEDIASTINAL SURFACE

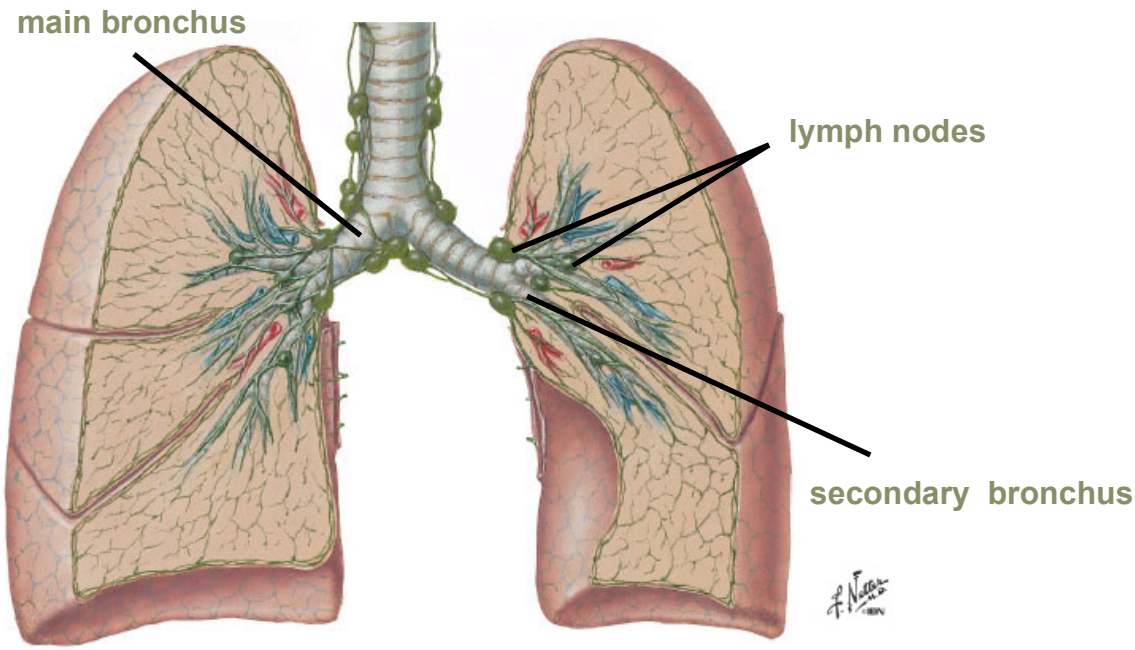
Question 3

What is the main difference between the anterior borders of the right and left lung?

Task 4

Locate the hilum of each lung, as mentioned previously, this is the site where the root structures enter and leave the lung. Identify the ***main bronchus***, the ***pulmonary artery***, the ***pulmonary veins*** and if you can some of the ***bronchial vessels***. You should also try and locate the pulmonary ligament. The main bronchi branch into secondary and tertiary bronchi, which supply each ***bronchopulmonary segment.*** You will not be required to learn the bronchopulmonary segments in detail at this stage; it is merely sufficient at this time to understand that it is possible to trace the dividing bronchioles into specific parts of the lung..

Using a scalpel or pair of forceps, carefully scrape away some of the lung tissue from around the main arteries, veins and bronchi. The initial layer of tissue that you remove will include the visceral pleura. Begin by cleaning the structures close to the hilum and if you have time proceed into the deeper aspects of the lung. During your dissection you will hopefully notice that pulmonary arteries lie mainly on the posterior surfaces of the bronchi. In addition you may come across small, blackened bodies; these are ***pulmonary lymph nodes.***



Question 4
What is the clinical significance of a bronchopulmonary segment, especially when considering surgery?

Checklist

Review all the structures you have dissected today and ensure that your demonstrator is satisfied that you have completed the check list below:

Identified and understood the location and extent of the pleural layers and pleural cavity
Identified the hilum of the lung and distinguished the structures making up the root of each lung
Identified the surface features of each lung and be able to distinguish each
Understood the components which make up a bronchopulmonary segment.

BSMS MODULE: 103 HEART, LUNGS AND BLOOD

DR SESSION:

2. SUPERIOR MEDIASTINUM

brighton and sussex medical school

BSMS MODULE: 103 HEART, LUNGS AND BLOOD
THEME: ANATOMICAL STRUCTURE AND FUNCTION OF THE THORAX

DR SESSION: 2. SUPERIOR MEDIASTINUM

LEARNING OUTCOMES

By the end of the practical session students should be able to
:

1. understand the term mediastinum and name and define its sub-regions
2. identify the brachiocephalic veins and how they contribute to the superior vena cava
3. trace the brachiocephalic veins into the neck and determine the veins that contribute to their formation
4. identify the elements of the aorta and name the branches normally arising from the arch of the aorta
5. identify the pulmonary trunk and its branches as they leave the heart
6. describe the relationship of the pulmonary trunk to the arch of the aorta

Note: Key structures are in italics to help you when you revise.

Task 1

Remove the lungs once again and put to one side. We will now examine the ***mediastinum***. The mediastinum or middle septum is the central compartment of the thorax and is divided into a number of regions and sub-regions.

Initially the mediastinum can be divided into superior and inferior regions. The ***superior mediastinum*** extends between the ***superior thoracic aperture*** and the ***transverse thoracic plane*** (passing through the sternal angle and T4-5). The ***inferior mediastinum*** extends from the transverse thoracic plane inferiorly to the diaphragm and has a number of sub-divisions: The ***anterior mediastinum*** lies anterior to the heart and pericardium, the ***middle mediastinum*** contains the heart and pericardium and the ***posterior mediastinum*** lies behind the heart and contains structures such as the oesophagus and trachea, as well as a number of nerves. Identify each region of the mediastinum in your cadaver.

Examine the anterior mediastinum. This region may still contain the remains of the ***thymus*** gland surrounded by, and invested with varying degrees of fat and connective tissue. Take just a couple of minutes to try and identify the thymus gland (if present) by separating from the surrounding tissue. If the thymus is visible then examine the extent of the gland before removing. Several small thymic blood vessels may also be visible

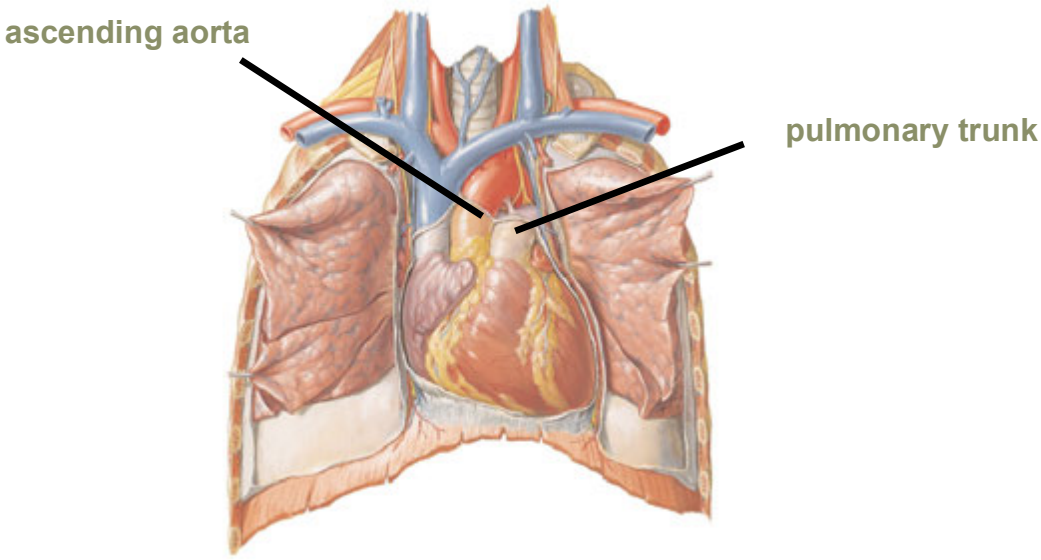
Question 1
Why is the thymus absent or very limited in most cadavers?

Task 2

To expose the superior mediastinum you will need to cut through the 1st rib (using a bone cutters) and the clavicle which should be cut (using a saw) in the in the midclavicular line. You may have already done this in a previous session. The manubrium and attached elements of the clavicle can then be excised using blunt dissection. When removing the manubrium and clavicles, be very careful not to damage the structures in the root of the neck.

The main features of the superior mediastinum are the great vessels, which include the aorta, superior vena cava, pulmonary and brachiocephalic vessels. In order to locate these vessels it will be necessary to carefully remove all surrounding fat and connective tissue (some of this will have been removed when looking for the thymus gland). In addition you should carefully cut the attachment of the fibrous pericardium from around each of the main vessels. This will allow better access to the great vessels. **Do not**, however, remove the pericardium from around the heart.

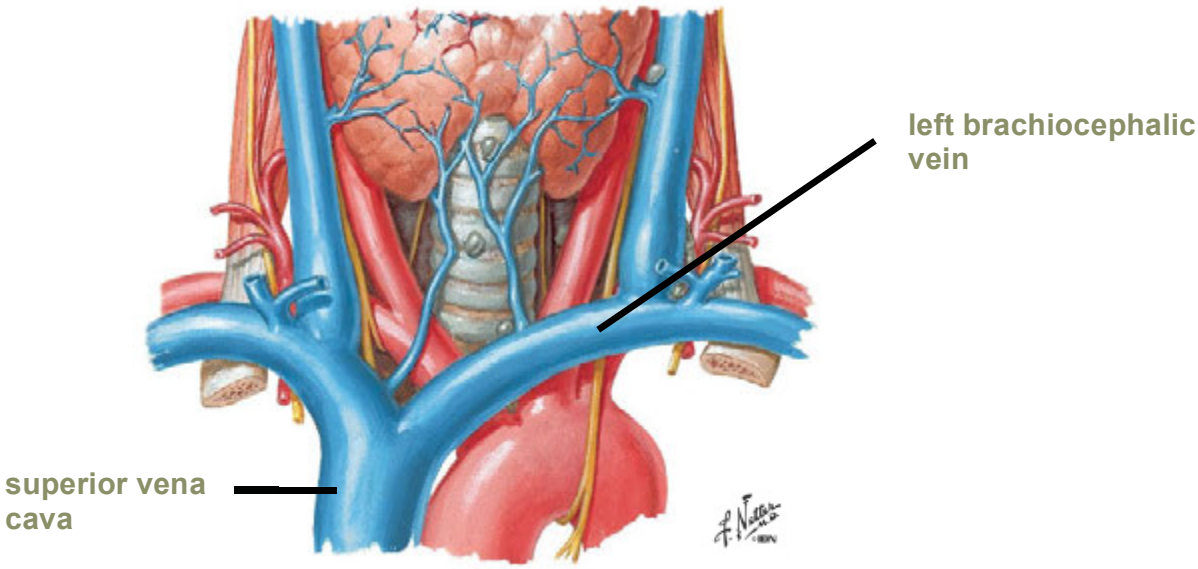
You should now be able to locate the pulmonary trunk and ascending aorta as they leave the heart.



Question 2
What are the first two arteries to branch off the ascending aorta?

Task 3

The vessels that lie most superficially are the right and left ***brachiocephalic veins*** –identify these now. Care should be taken when examining these vessels as the walls are usually quite delicate due to lack of smooth muscle and other layers. Both veins drain into the superior vena cava, which can be located on the right hand side of the ascending aorta. Identify this vessel.



A number of vessels drain into the brachiocephalic veins. Trace the veins cranially and locate some of the contributing tributaries. You should be able to identify the ***internal jugular***, ***subclavian*** and ***inferior thyroid*** veins on both sides.

Question 3
Can you locate any other vessels draining into the brachiocephalic veins?

Task 4

Carefully displace the brachiocephalic veins and expose the aortic arch, which is usually hidden from view (you may have to cut and reflect the left brachiocephalic vein, although maintain this structure if at all possible). Now go back and follow the ascending aorta superiorly as it becomes the arch of the aorta. Identify a number of branches normally arise from this region of the aorta, including the brachiocephalic, ***common carotid*** and subclavian arteries.

The pulmonary trunk and the arch of the aorta are connected by a short fibrous cord called the ***ligamentum arteriosum***. This structure can be located in the concavity of the aortic arch and links across to the adjacent pulmonary trunk. You may have to clean up this area by removing fat and connective tissue before you identify the ligamentum. Take care when doing this to avoid damage to the left ***recurrent laryngeal*** branch of the left ***vagus nerve*** during this procedure. This nerve runs across and under the aortic arch and close to the ligamentum arteriosum.

Question 4
Why is the ligamentum arteriosum important in fetal circulation?

Checklist

Review all the structures you have dissected today and ensure that your demonstrator is satisfied that you have completed the check list below:

Identified the location and extent of the mediastinum
Distinguished the structures contained within the superior mediastinum
Traced the brachiocephalic veins and how they contribute to the superior vena cava
Traced the brachiocephalic veins into the neck and determined the veins that contribute to their formation
Identified the elements of the aorta and distinguished the branches arising from the arch of the aorta
Identified the pulmonary trunk and its branches as they leave the heart
Understood the relationship of the pulmonary trunk to the arch of the aorta

BSMS MODULE: 103 HEART, LUNGS AND BLOOD

DR SESSION:

3. EXAMINATION OF THE PERICARDIUM AND EXTERNAL FEATURES OF THE HEART.

BSMS MODULE: 103 HEART, LUNGS AND BLOOD
THEME: ANATOMICAL STRUCTURE AND FUNCTION OF THE THORAX

DR SESSION: 3. EXAMINATION OF THE PERICARDIUM AND EXTERNAL FEATURES OF THE HEART

LEARNING OUTCOMES

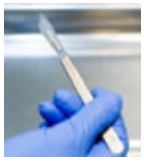
By the end of the practical session students should be able to
:

1. identify the pericardium and distinguish between serous and fibrous layers
2. name the layers of the pericardium which border the pericardial cavity
3. demonstrate the transverse sinus and explain its surgical significance
4. identify the four chambers of the heart as it lies in situ in the pericardium
5. identify and name the vessels that enter or exit the chambers of the heart
6. name and identify the coronary arteries and their main branches
7. name and identify the main cardiac veins
8. explain the functional importance of the coronary vessels and the concept of dominance

Note: Key structures are in italics to help you when you revise.

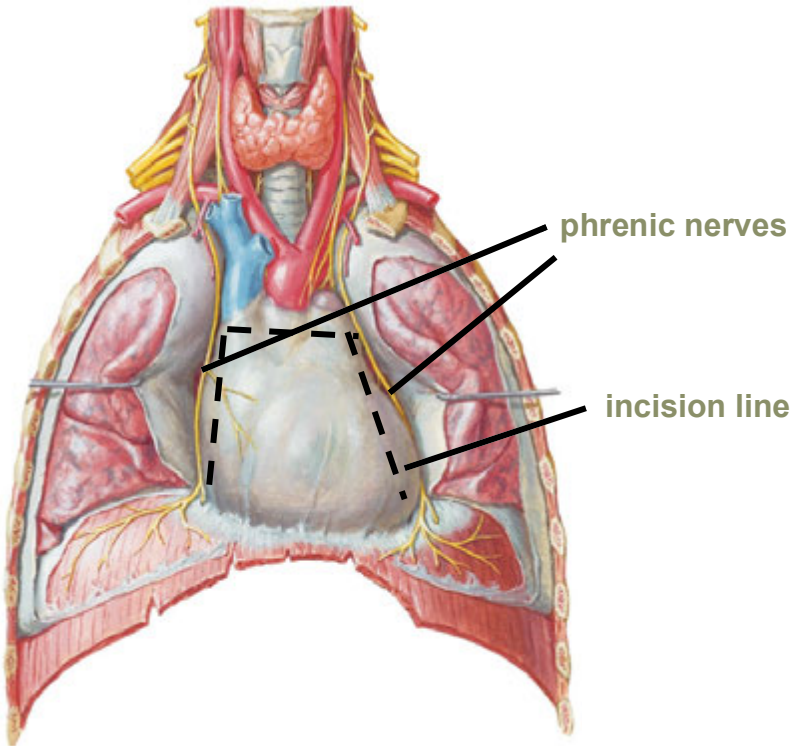
Task 1

Remove the lungs from the chest cavity and put them to one side. We will now examine the extent of the ***pericardium***. The pericardium consists of two layers; the outer ***fibrous pericardium*** and the inner ***serous pericardium***. The serous pericardium is composed of two sub-layers; the ***visceral*** and ***parietal pericardium***.

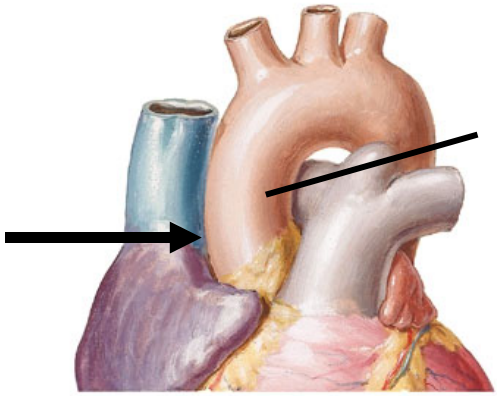


Make a vertical incision on each side of the pericardium just anterior/medial to the ***phrenic nerves*** (shown in the diagram overleaf). Examine how the pericardium at the most superior end of the flap is attached to the superior vena cava, ascending aorta and pulmonary trunk. Make a horizontal incision through the attachment sites between the pericardium and these great vessels (you will have done part of this incision in the last session) to link the two vertical incisions and if you can try and leave a small strip of pericardium on the vessels. With these three incisions you should have produced a pericardial flap. Reflect the flap inferiorly over the ***diaphragm*** to reveal the underlying ***pericardial cavity***.

You should notice that the inner surface of the fibrous pericardium is more moist and ‘slippery’ than the outer surface. This is because the ***parietal layer*** of the ***serous pericardium*** lines the fibrous pericardium. This layer is quite elastic. The rest of the serous pericardium, the ***visceral layer*** covers the outer surface of the heart and the roots of the great vessels. Examine these three different layers.



The ***transverse sinus*** of the pericardium lies between the pericardial sheath surrounding the great arteries and that enclosing the vein. This sinus formed during the development of the heart. You should try and palpate the transverse sinus. Start by placing a finger anterior to the lowest part of the superior vena cava. Push your finger behind (posterior) to the ascending aorta and the pulmonary trunk. Your finger is now in the transverse sinus (see diagram below).



Question 1
Between which layers or sub-layers of the pericardium do you think the pericardial cavity lies?

Task 2

Following on from the examination of the extent of the inner serous pericardium, using

forceps only gently start to strip this visceral (***or epicardial***) layer from the anterior surface of the heart including some of the associated fat (the fat is usually trapped deep to the visceral layer). This will allow you to examine the position of the heart chambers as well as the main ***coronary*** vessels and ***heart myocardium***. If you are able to see the surface layer of the myocardium, note the direction of the fibres and remove the fat following this direction.

The heart is rotated so that the right ventricle and atrium form the greater part of the anterior surface with the left ventricle forming a relatively small strip, which includes the apex). First identify the right atrium, which is located posterosuperior to the right ventricle and is separated from the ventricle by a deep ***coronary sulcus*** or ***atrioventricular groove***. The right ventricle can be identified starting at the sulcus and continuing anteriorly to another sulcus called the ***anterior interventricular groove***. The right ventricle therefore makes up two-thirds of the anterior ventricular surface. The remaining third is the left ventricle, which you can follow inferiorly and posteriorly. The fourth chamber, the left atrium is only just visible in part on the anterior surface. Locate the auricle of the left atrium lying superiorly to the left ventricle.

If the main vessels entering and exiting the heart are still covered by serous pericardium, carefully remove some of this material to make visualisation easier.

The superior vena cava can be located on the right side at the lateral edge and should enter the right atrium. Next identify the ascending portion of the aorta. This vessel will probably have a much thicker diameter and should appear whiter in colour. The pulmonary trunk sits laterally to the aorta and extends superiorly and posteriorly. You may be able to follow this vessel up to its division.

Question 2

Which heart chambers do the aorta and pulmonary trunk exit from? Can you follow these connections?

Task 3

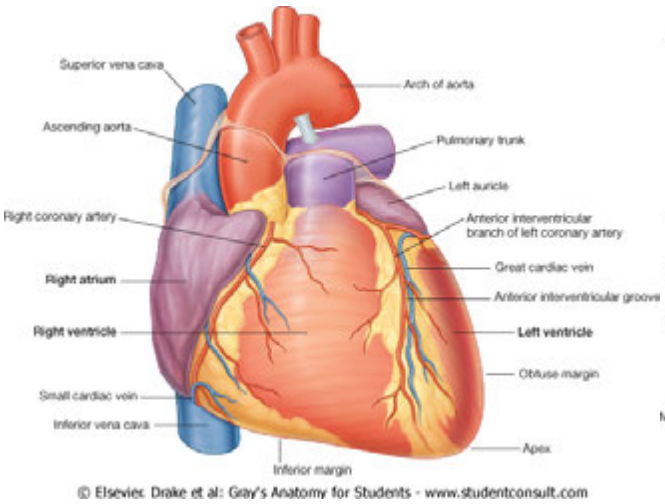
You should have already noticed the main coronary vessels lying on the surface of the heart, but it is now time to examine these in more detail. Trace each of the coronary arteries around the heart. To do so you might need to expose them by scraping away any fat.

Begin with the left coronary artery. Locate the artery as it arises from the ascending aorta. Follow it down to the ***anterior interventricular branch*** in the anterior interventricular sulcus. Trace the ***lateral (diagonal branch),*** follow the ***circumflex branch*** posteriorly and note the left marginal branch.

Now follow the ***right coronary artery***, locate it as it arises from the ascending aorta. It may be possible to see the sinoatrial nodal branch. Locate the ***right marginal*** and turning the heart to view the posterior surface locate the ***posterior interventricular branch.***

The coronary arteries are often very variable in their branching patterns. Sometimes the right artery supplies more of the myocardium and sometimes the left artery does. This is known as ***left-right dominance***.

The veins of the heart often run next to the arteries locate the ***great cardiac vein*** in the anterior interventricular sulcus and follow it to the ***coronary sinus***. Turning the heart over locate on the posterior surface the ***middle cardiac vein***.



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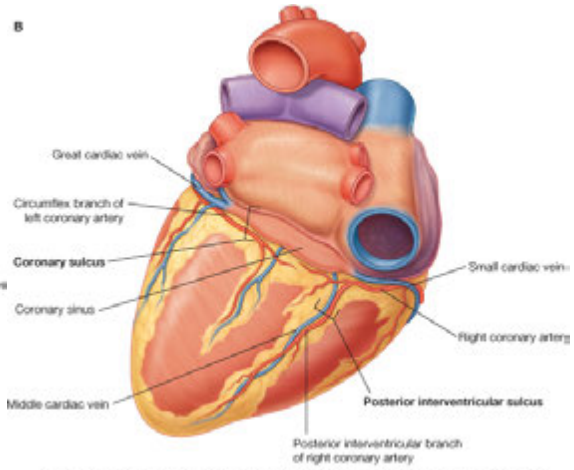

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Question 3

What is the clinical significance of left-right dominance if one of the coronary arteries is blocked?

Checklist

Review all the structures you have dissected today and ensure that your demonstrator is satisfied that you have completed the check list below:

Identified the location and extent of the pericardium
Distinguished the layers of the pericardium
Demonstrated the transverse sinus and its significance
Identified the heart chambers and the vessels entering or exiting
Named and distinguished the location and functional importance of the coronary vessels

BSMS MODULE: 103 HEART, LUNGS AND BLOOD

DR SESSION:

4. DISSECTION OF THE INTERIOR OF HEART

brighton and sussex medical school

BSMS MODULE: **103 HEART, LUNGS AND BLOOD**
THEME: **ANATOMICAL STRUCTURE AND FUNCTION OF THE THORAX**

DR SESSION: **4. DISSECTION OF THE INTERIOR OF HEART**

LEARNING OUTCOMES

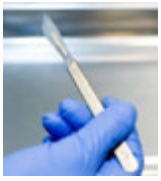
By the end of the practical session students should be able to
:

1. name and identify the posterior coronary and cardiac vessels;
2. name the vessels that enter the right atrium;
3. understand the internal features of the right atrium ;
4. state the distinguishing features of the right and left ventricles;
5. examine the elements of the tricuspid, bicuspid, pulmonary and aortic valves;
6. trace the route taken by the course of blood through the heart;
7. demonstrate the presence of the remnant of the foramen ovale and the significance of the latter in intra-uterine life.

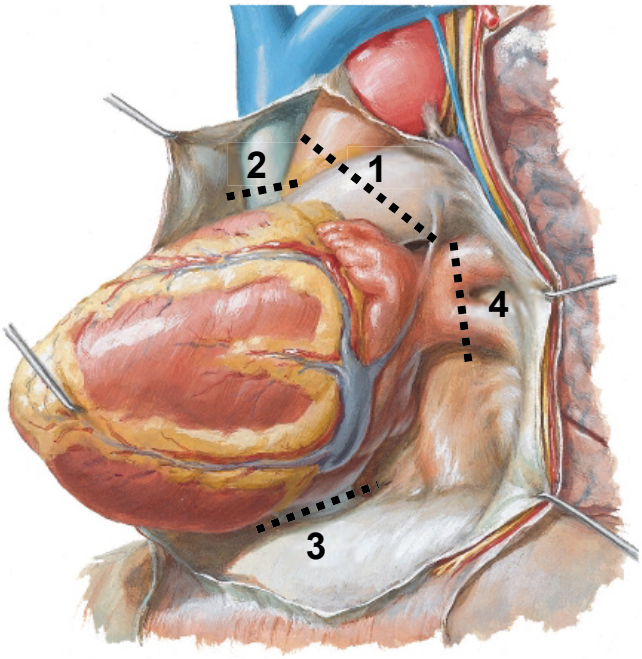
Note: Key structures are in italics to help you when you revise.

Task 1

In the last session you examined the pericardium, anatomical location of the heart chambers *in-situ* and the coronary arteries. In this dissection session you are going to remove the heart and examine the interior of the heart chambers.



To remove the heart from the pericardium, begin by passing a pair of forceps into the transverse sinus. With a sharp scalpel carefully cut through the aorta and pulmonary trunk down (Line 1 overleaf). Now place the forceps behind the superior vena cava, with a sharp scalpel carefully cut through the superior vena cava (Line 2). Make a cut through the inferior vena cava making sure the cut is flush with the surface of the diaphragm (Line 3). Next cut through the pulmonary veins, make your cut midway between the parietal pericardium and the entry of the veins into the left atrium (Line 4). Carefully cut through the rest of the pericardial attachments so that you can pull the heart forward and lift the heart out of the thoracic cavity.



Dotted lines refer to the cuts that should be made through the great vessels

Expose, clean and demonstrate the rest of the surface of the heart, especially the posterior and inferior surfaces, ensuring you can locate the ***posterior interventricular branch*** of the right coronary artery, the ***circumflex*** and ***marginal branch*** of the left coronary artery and also the ***coronary sinus***.

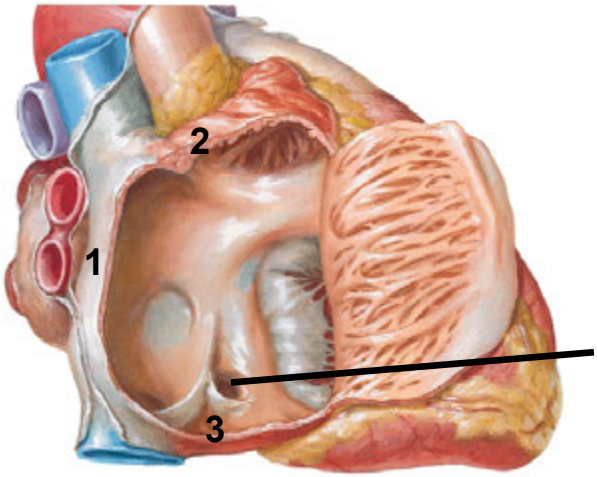
Question 1
Do you think the heart of your cadaver is larger than normal? Compare it with that of a neighbouring cadaver

Task 2

Take a look at the vessels entering the ***right atrium*** and name them. To open the right atrium, use a scalpel to cut a line running parallel to the lateral border, just to the left of the vena cava. Start the incision at the lower border of the heart and carry it upwards to the right auricle. Make a second incision along the upper border of the atrium from the superior vena cava towards the right coronary artery. The third incision should be made part way along the lower border of the atrium towards the right coronary artery.

You should now be able to open the flap and remove any large blood clots from the atrial cavity. Thoroughly wash out the atrium so that its internal features are clearly displayed.

Internally find the openings of the superior and inferior vena cavae as well as the orifice of the coronary sinus, associated valve flaps and a thickened band of tissue known as the ***crista terminalis***.



Numbers refer to the cuts that should be made

opening of coronary sinus

Take a look at the pulmonary veins entering the ***left atrium***. To open the left atrium, make an incision through the atrial wall above and parallel to the coronary sinus between the entrance of the inferior vena cava into the right atrium and the inferior left pulmonary vein into the left atrium.

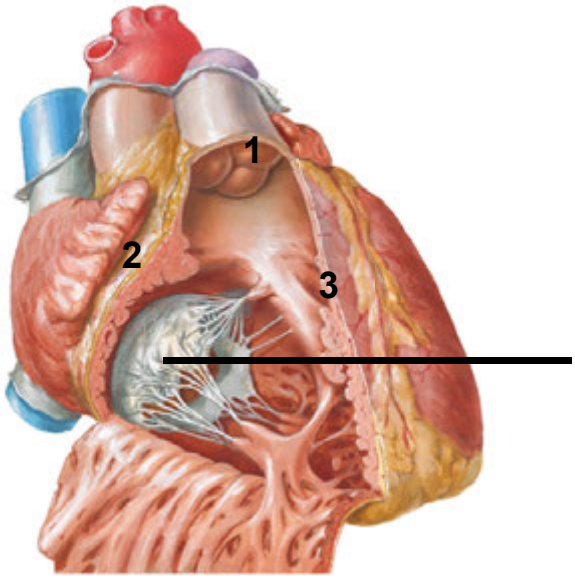
From the left-hand end of this incision, make a second cut upwards through the atrial wall (keep on the right of the openings of the left pulmonary veins. From the right-hand end of the incision, make a similar cut, keeping to the left of the right pulmonary veins. Open the resultant flap superiorly and clean out the chamber as before.

Question 2
Can you detect the remnant of the foramen ovale (*fossa ovalis*) in the interatrial wall? Remind yourself why this is important in fetal life.

Task 3

To open the right ventricle, make a transverse incision through the ventricular wall below the pulmonary trunk, between the upper ends of the anterior part of the right coronary and anterior interventricular grooves. Make sure that your incision is inferior to the level of the ***pulmonary valve***.

From the right end of this incision, make a second cut parallel with, and to the left of, the anterior part of the coronary sulcus towards the inferior surface, and from the left end, a third cut parallel with, and to the right of, the anterior interventricular groove. Carefully open the resultant flap inferiorly and clean out the chamber. There may be some resistance when opening up this chamber due to the presence of the papillary muscles. You may need to cut one or more of these.



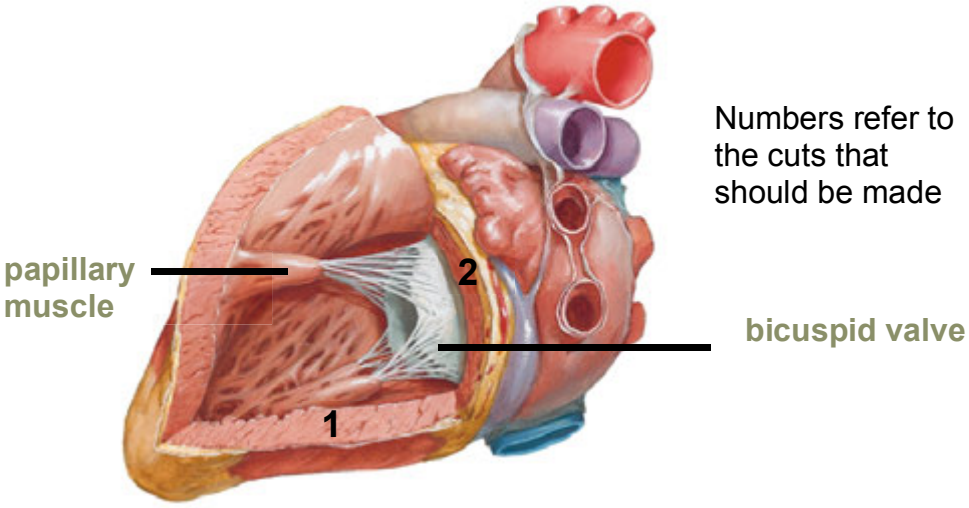
Numbers refer to the cuts that should be made

Examine the internal surface of the right ventricle and comment on the overall topography including the ***conus arteriosus***. The ***tricuspid valve*** should be clearly visible in the right ventricle. It is made up of three ***cusps***; anterior, septal and posterior. The free borders of the valve cusps are connected to ***papillary muscles*** within the ventricular walls by thin fibrous strands known as ***chordae tendineae***.

The ***pulmonary valve*** can be easily examined from a superior view. The valve consists of three ***semi-lunar cusps*** attached to the lumen of the trunk (anterior, plus left and right). To demonstrate the function of these cusps try passing a metal probe or pair of forceps from the right ventricle through the lumen of the pulmonary trunk.

To open the left ventricle, make an incision through the ventricular wall starting from just left of the anterior interventricular branch of the left coronary artery downwards to the inferior border of the heart, running parallel with the left auricle and the coronary sinus. Continue the incision onto the diaphragmatic surface but stop just left of the posterior interventricular groove.

From this point make a second incision at right angles to the first running along the diaphragmatic surface left of the posterior interventricular groove to the apex of the heart. Open the resultant flap and clean out the chamber. There may be some resistance when opening up this chamber due to the presence of the papillary muscles. You may need to cut one or more of these.



Numbers refer to the cuts that should be made

Examine the internal surface of the left ventricle and comment on the overall topography.

The ***bicuspid valve*** should be clearly visible in the left ventricle. It is made up of two cusps; anterior and posterior. The free borders of the valve cusps are also connected to papillary muscles by chordae tendineae.

The ***aortic valve*** can be easily examined from a superior view. Like the pulmonary valve, this valve also consists of three semi-lunar cusps and these are attached to the lumen of the ascending aorta (right and left coronary cusps and posterior non-coronary cusp). To demonstrate the function of these cusps try passing a metal probe or pair of forceps from the left ventricle up through the lumen of the aorta.

Question 3
Identify the components of the bicuspid and tricuspid valves and where they attach. What is the purpose of this valve? How does it work?

Finally and importantly trace the route taken by the course of blood through the heart. Include the vessels taking blood into and out of the heart as well as the order of the chambers and where the valves are involved.

Checklist

Review all the structures you have dissected today and ensure that your demonstrator is satisfied that you have completed the check list below:

Identified the posterior coronary vessels
Identified the vessels entering and exiting the heart chambers
Identified the distinguishing features of the four heart chambers
Examined the elements of the four heart valves
Traced the route taken by the course of blood through the heart
Demonstrated the location and importance of the fossa ovalis
Explain the functional importance of the coronary vessels

BSMS MODULE: 103 HEART, LUNGS AND BLOOD

DR SESSION:

5. DISSECTION OF THE POSTERIOR MEDIASTINUM AND DIAPHRAGM

BSMS MODULE: 103 HEART, LUNGS AND BLOOD
THEME: ANATOMICAL STRUCTURE AND FUNCTION OF THE THORAX

DR SESSION: 5. DISSECTION OF THE POSTERIOR MEDIASTINUM AND DIAPHRAGM

LEARNING OUTCOMES

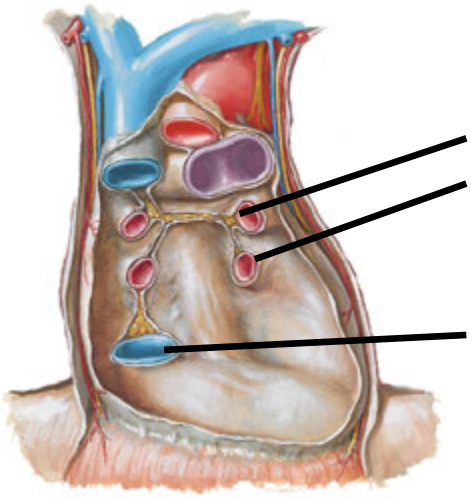
By the end of the practical session students should be able to

1. define the extent of the posterior mediastinum;
2. describe the course of the thoracic aorta in relation to the lung roots, pericardium and oesophagus and identify some of its branches;
3. identify the sympathetic trunks, sympathetic ganglia and the splanchnic nerves;
4. outline the azygos system of veins and indicate their significance when obstruction of the inferior vena cava occurs;
5. demonstrate the course of the thoracic duct and outline the importance of the duct in lymphatic drainage;
6. demonstrate the relation of the pericardium to the diaphragm;
7. review the anatomy of the diaphragm and indicate its action in breathing.

Note: Key structures are in italics to help you when you revise.

Task 1

Take a couple of minutes to re-examine the heart as it lies in situ and relate its position to the surrounding structures of the mediastinum. Remove the heart again and put to one side. Within the body examine the posterior wall of the pericardial sac. Identify the openings of the great vessels including the vena cavae and pulmonary veins



In order to expose the posterior mediastinum you should reflect the pericardial sac either inferiorly or superiorly. You will need to detach part of the pericardium at one border and gently tease away the pericardium from the underlying structures (this is best done using your fingers rather than sharp instruments). Underneath you will find fat and connective tissues surrounding the ***carina*** of the trachea and the main bronchi as well as the ***oesophagus*** and the rest of the posterior mediastinum. You should now be in a good position to define the full extent of the posterior mediastinum.

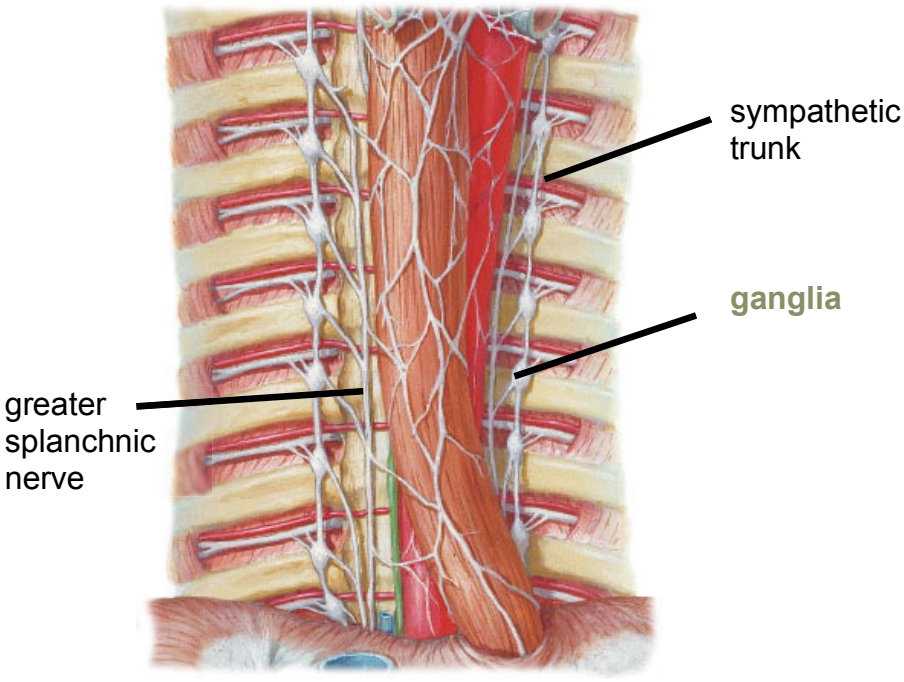
Trace the course of the ***thoracic aorta*** in relation to surrounding structures of the mediastinum. You will already have seen the ascending part of the aorta and most of the arch, so concentrate on the descending aorta. The descending aorta is continuous with the aortic arch and initially lies to the left of the fifth thoracic vertebrae. As it traverses the posterior mediastinum it inclines anteriorly and to the right, running almost into the midline in front of the twelfth thoracic vertebrae. Anteriorly the oesophagus usually crosses the aorta as it slopes from the midline to the left. Try and locate several of the branches emanating from the descending aorta. Locate the remaining branches of the vagus nerves. This is often quite difficult as they are hard to distinguish from connective tissues in the region and some cleaning may be necessary. The cardiac branches may be seen on the anterior aspect of the carina, whilst the rest of the vagus nerve runs down either side of the oesophagus where it contributes to the pulmonary and oesophageal plexuses. You will need to reflect the trachea upwards to demonstrate the more superior portion of the oesophagus.

Question 1
Which structures are present within both superior and the posterior mediastinum?

Task 2

To fully examine the posterior mediastinum it is necessary to remove the remaining parietal pleura from both sides of the thoracic cavity. Do this by carefully making shallow longitudinal incisions through the pleura parallel to and posterior to the phrenic nerve. Reflect the pleura posterior to the nerve and back towards the intercostal spaces.

With the pleura reflected try and locate the sympathetic trunk on each of the posterior thoracic walls. These structures are firmly bound to the wall but can be *very* carefully cleaned of fat and connective tissue to be demonstrated more clearly. For a couple of the ganglia on the sympathetic trunk try and identify the connections with the corresponding intercostal nerves (this may be difficult due to the delicate nature of these features). Try and locate the splanchnic nerves (particularly the greater splanchnic), which pass inferiorly from the sympathetic trunk, through the diaphragm into the abdomen. The splanchnic nerves lie more antero-medially than the sympathetic trunk.



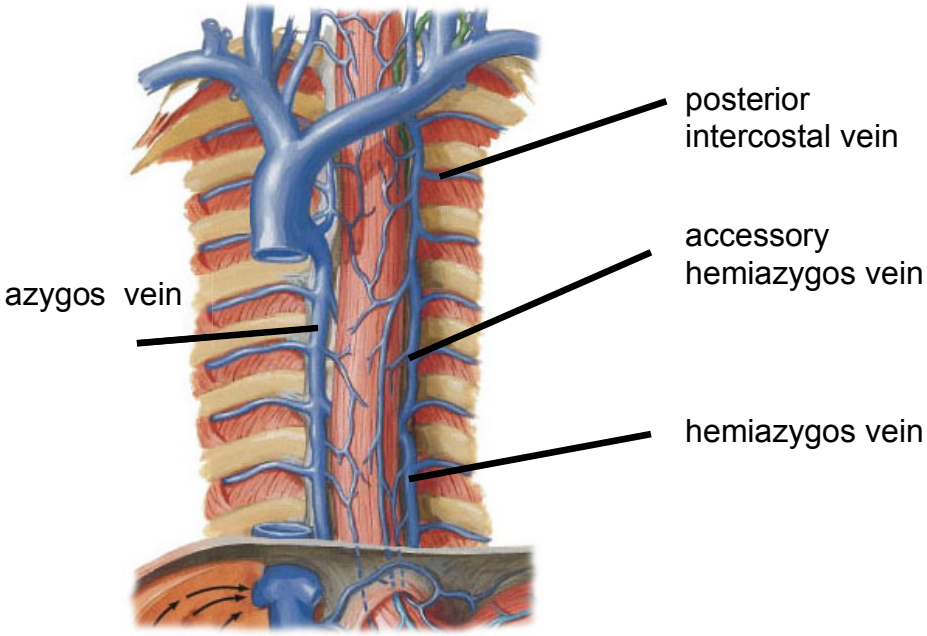
Question 2
What are splanchnic nerves?

Task 3

Start by identifying the posterior intercostal vessels on the vertebral column and in the posterior aspects of the intercostal spaces. Trace the elements of a couple of these neurovascular bundles including the intercostal veins.

On the right hand side you should be able to trace most of the intercostal veins into the azygos vein. The end of the azygos vein should have been seen entering the superior vena cava in the last session when the heart was being removed and should be visible adjacent to the right main bronchus to the right of the oesophagus. Follow several intercostal veins in the mid-thoracic region as they drain into the azygos vein.

On the left side the posterior intercostal veins have a different course. Follow a couple of these veins into the hemiazygos and accessory hemiazygos veins (if they are present). The hemiazygos and accessory hemiazygos veins drain into the azygos vein via branches crossing behind the oesophagus at about the level of T7/8. You may not be able to follow these at this stage.



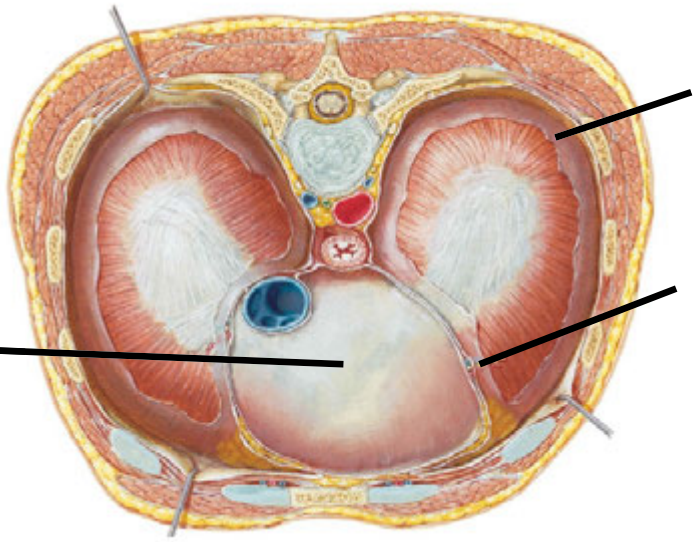
To the left of the azygos vein try and locate the thoracic duct. The duct is a delicate structure that usually lies posterior to the oesophagus and may be surrounded by considerable fat and fascia. Once identified, follow the duct both inferiorly from the diaphragm and also superiorly. You may not be able to trace the duct all the way to its termination at the venal angle as the duct can run deep within the superior mediastinum. Ask a demonstrator for help if you find this difficult.

Question 3
What other route may venous blood from the intercostal spaces take to return to the heart?

Task 4

Carefully examine the extent of the superior aspect of the diaphragm. Note that the diaphragm forms a muscular seal at the inferior margin of the thorax and is rather convex in appearance. During contraction the diaphragm flattens out and pushes the abdominal contents inferiorly.

The phrenic nerve is responsible for the contraction of the diaphragm. Follow the course of this nerve on each side adjacent to the great vessels down to the subsequent attachment with the diaphragm. They should in each case follow the lateral aspects of the mediastinum. The diaphragm is attached to the xiphoid process of the sternum, costal margin and the vertebral column. Follow the direction of the muscle fibres of the diaphragm from each of these attachments as they converge at the central tendon. The central tendon should be evident lateral to and also underneath the inferior aspect of the fibrous pericardium to which it is attached. Identify the opening of the inferior vena cava which pierces this region.



Move the diaphragm forwards, if you are able to see the aorta in the lower region of the posterior mediastinum. The aorta leaves the thorax along with the azygos vein and thoracic duct behind the median arcuate ligament at the level of the twelfth thoracic vertebrae. The oesophagus passes through the diaphragm via the oesophageal hiatus. You will revisit the diaphragm when you remove the abdominal contents in the next module.

Question 4
Why is the right side of the diaphragm (hemi-diaphragm) usually higher than the left side of the diaphragm?

Checklist

Review all the structures you have dissected today and ensure that your demonstrator is satisfied that you have completed the check list below:

Defined the extent of the posterior mediastinum
Identified the course and branches of the descending thoracic aorta
Examined the sympathetic trunk and splanchnic nerves
Identified the elements of the azygos system including its clinical significance
Traced the course of the thoracic duct
Demonstrated the structure and function and relations of the diaphragm

