

Doctor.021

no. 6

RS ANATOMY



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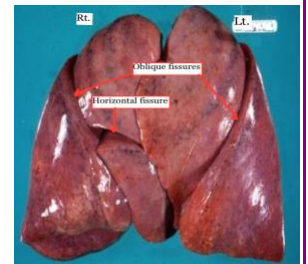


Slides the doctor didn't read are in this colour.

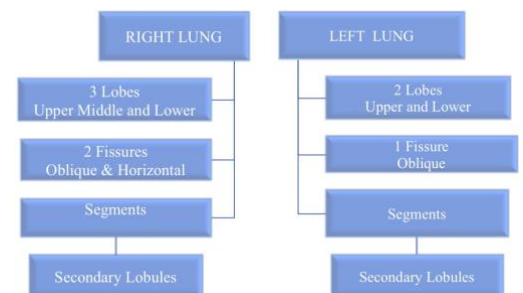
Important repeated info by the doctor is in this colour.

Lungs

- **Organs of respiration and lie on either side of the mediastinum.**
- **Each lung has a half-cone shape Spongy, grey, dark later on (smokers' lungs have black dots from nicotine) 600-800gm, 90% air & 10% tissue.**



- There are differences between the right and left lung (you can go back to them after you finish the sheet):



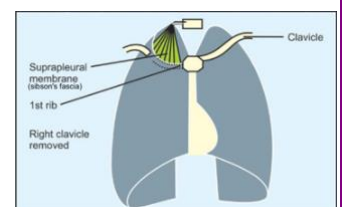
- **Right lung: broader, a little larger (because the liver and middle mediastinum, containing the heart, bulges more to the left than to the right, liner and, has 3 lobes (upper, middle and lower) separated by two fissures (horizontal and oblique), its hilum contains two bronchi (eparterial and hyparterial), and the pulmonary artery is between them.**
 - **Left lung: narrower and longer, has 2 lobes separated by a fissure (oblique), has cardiac notch and lingula, the most superior structure in its hilum is the pulmonary artery.**
- **Lungs are surrounded by the right and left pleural cavities;** pleura has two types:
 - **Visceral:** adherent to the lung tissue and can go inside the fissures, innervated by autonomic nervous system (vagus), makes the lung shiny.
 - **Parietal:** adheres to the thoracic wall, it has sensory innervation (for pain, touch and temperature) and in case of infections (e.g. pleuritis which is an infection of the **parietal** pleura), it causes severe pain in the chest with every breath (remember it has sensory innervation), and if it was pierced, the air will flow inside the lung and cause it to collapse and lose its negative pressure and this is called **pneumothorax.**

- Between the visceral and parietal pleura there is a potential space filled with serous fluid to lubricate the lungs in their inflation and deflation.

- **Lungs have base, apex, two surfaces and three borders:**

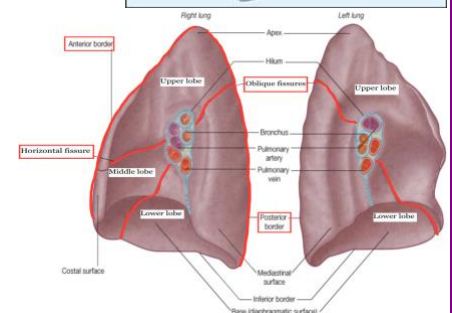
- **The base sits on the diaphragm** forming the right and left copulas and the central tendon between them (inferior to the pericardium), the edge of the base is sharp.
- **The apex** of the lung reaches the root of the neck in the posterior triangle of the neck **1 inch above the medial third of clavicle or 3-4 cm above the first rib.**

The apex of the lung can be injured during the insertion of a **cannula through the subclavian vein** (which is on the upper surface of the first rib inferior to the clavicle) doctors can pierce the apex of the lung instead and the this will cause it to collapse, so doctors should do x-ray for patients after inserting a cannula into the subclavian vein to insure that it was done right and that the lung is still inflated. At the apex is covered by **visceral and parietal pleura with no space between** them and it's also covered by **suprapleural membrane** between the first rib and the fascia of the neck (sibson's fascia) to seal the thoracic cavity and hold its pressure.



- **Two surfaces:**

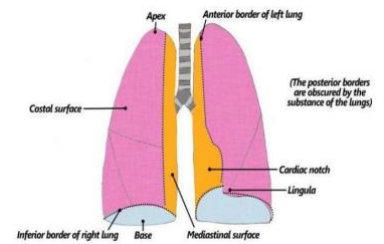
- 1. Costal** outer **surface** which lies **immediately adjacent to the ribs and intercostal spaces.**
- 2. Mediastinal** surface which lies against the **mediastinum anteriorly and the vertebral column posteriorly, it contains the comma-shaped hilum of the lung through which structures enter and leave. It is the entry point of the main bronchi (named secondary bronchi after entering the hilum) and pulmonary arteries (deoxygenated blood) from the right ventricle of the heart and where pulmonary veins (oxygenated blood) leave to the left atrium.**



- Three borders anterior, posterior and inferior border. Inferior border is sharp and separates the base from the costal surface.

The anterior and posterior borders separate the costal surface from the medial surface.

The anterior and inferior borders are sharp, the posterior border is smooth and rounded.



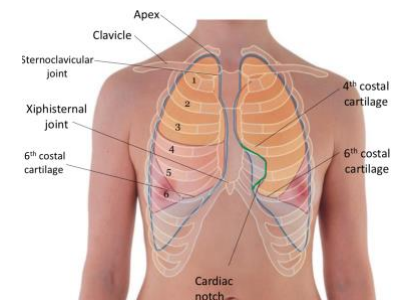
Surface anatomy of the lung

- **Apex:** 1 inch (2.5cm) above the medial third of clavicle or 3-4 cm above the 1st rib.

- **Anterior border:** (differs between the right and left lungs):

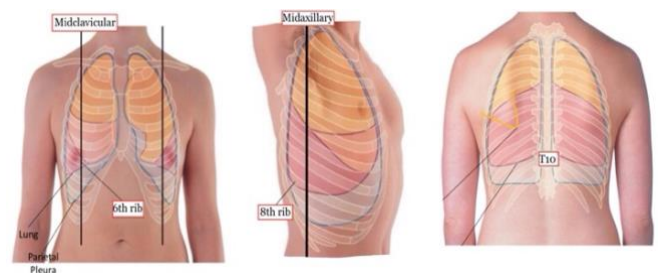
The beginning is similar between the two,

- From the apex of the lung to the sternoclavicular joint,
- then to the mid of the sternal angle,
- then on the left side, descends downwards to the 4th left intercostal cartilage then it forms the cardiac notch on the left side between the 4th and 6th intercostal cartilages (which is a semicircle ≈.5 inch or 1cm long), then ends in the xiphoid process. However, this doesn't happen at the right side and it continues as a straight line from the sternal angle to the xiphoid process.



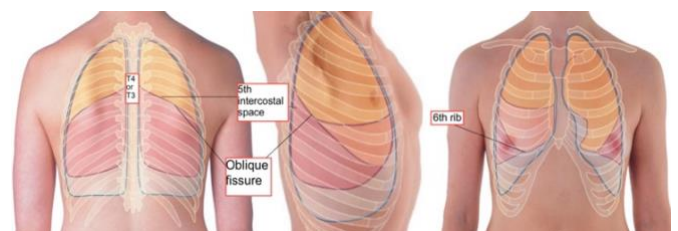
- **Base (line connecting three points):** at end-expiration.

- 6th rib at the midclavicular line.
- 8th rib at the midaxillary line.
- 10th thoracic vertebra (dorsal spine) 4cm from the midline posteriorly.



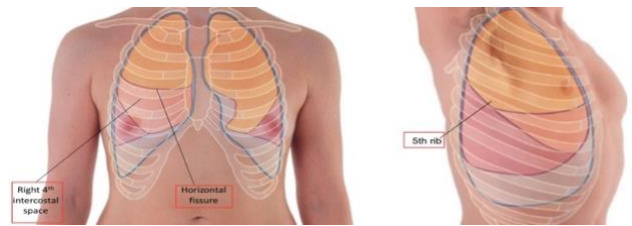
- **The oblique fissure (right and left are the same)**

- Posteriorly at the 3rd or 4th thoracic vertebra 4cm from the midline then crossing the 5th intercostal space then runs parallel with the 6th rib.



- **The horizontal fissure (right lung only).**

- Anteriorly from the 4th intercostal crossing the 5th and continues with the 6th.



- Posteriorly apex is at 1st thoracic vertebra.

Posterior border extends from 7th cervical vertebrae to the 10th thoracic vertebra lies 4cm from the midline.

Inferior border ascends and descends between 9th and 12th rib.

Root and hilum

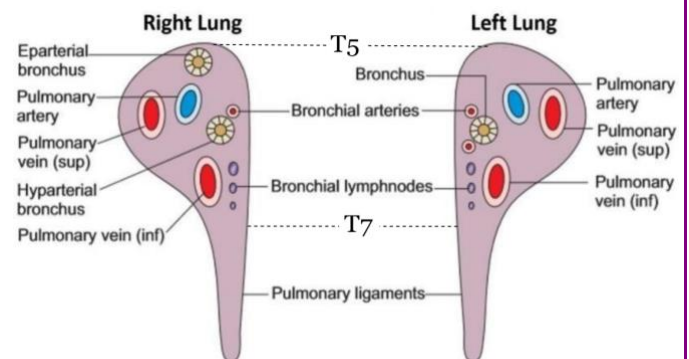
- The root of each lung is a short tubular collection of structures that together attach the lung to structures in the mediastinum.
- Covered by a sleeve of mediastinal pleura that reflects onto the surface of the lung as visceral pleura (around the hilum the parietal and visceral pleura fuse together as one layer and they form a sleeve that surrounds the hilum, and inferiorly they form pulmonary ligament). Pulmonary ligament: is the extension of the fused visceral and parietal pleura surrounding the hilum of the lung.
- **A thin blade-like fold of pleura projects inferiorly from the root of the lung. This structure is the pulmonary ligament.**
- Pulmonary ligaments stabilize the position of the inferior lobe and may also accommodate the down-and-up translocation of structures in the root during breathing.
- **The vagus nerves pass immediately posterior to the roots of the lungs, while the phrenic nerves pass immediately anterior to them.**
- **Within each root and located in the hilum are:**
 - **Pulmonary artery** (the most superior structure in the left hilum and in the right hilum it is between the eparterial and hyarterial bronchi).
 - **Two pulmonary veins** (one to the anterior part and the other for the lower part and the 4 (from the two lungs) go into the left atrium).
 - **Bronchus** (two on the right (eparterial and hyarterial) and one on the left).

- **Bronchial vessels** (form the main blood supply to the lungs and pleura).
- **Nerves** (automatic sympathetic and parasympathetic (vagus)).
- **Lymphatics** and lymph nodes.

• The pulmonary veins are inferior, and the bronchi are somewhat posterior in position.

On the right side, the lobar bronchus to the superior lobe branches from the main bronchus in the root, on the left it branches within the lung itself, and is superior to the pulmonary artery.

- The hilum is between T5 and T7 vertebrae.
- The right hilum: two bronchi (eparterial and hyperarterial bronchus), named so because they're above and below the pulmonary artery respectively.
- The left hilum: one bronchus, and the pulmonary artery is the most superior structure.



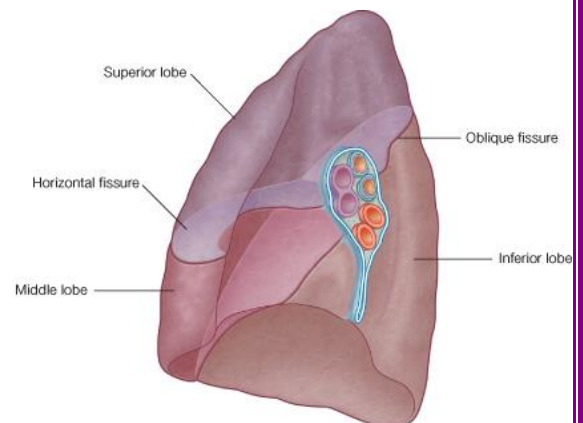
Right lung

• The right lung has three lobes and two fissures. Normally, the lobes are freely movable against each other because they are separated, almost to the hilum by invaginations of visceral pleura.

• These invaginations form the fissures: the oblique fissure separates the inferior lobe (lower lobe) from the superior lobe and the middle lobe of the right lung.

the horizontal fissure separates the superior lobe (upper lobe) from the middle lobe.

• The approximate position of the oblique fissure (the right and left are the same) in quiet respiration, begins roughly (not accurately so it can be T3 or T4) at the spinous process of vertebra T4 level of the spine 4cm



away, crosses the fifth intercostal space laterally, and then follows the contour of rib VI (6th) anteriorly.

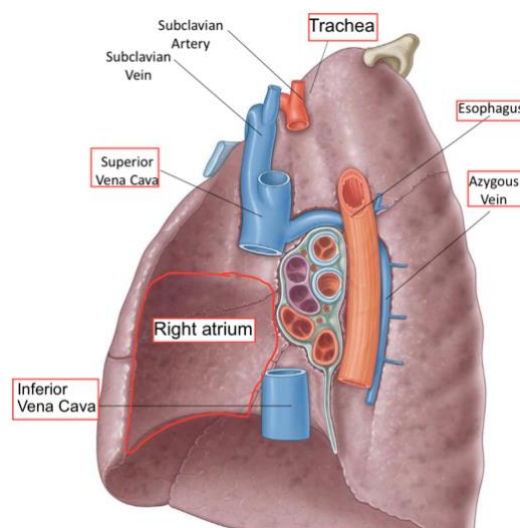
- The horizontal fissure (in the right lung only) follows the fourth intercostal space anteriorly from the sternum until it meets the oblique fissure as it crosses rib V and continues with the 6th rib.

- The orientations of the oblique and horizontal fissures determine where clinicians should listen for lung sound from each lobe. When listening to lung sounds from each of the lobes, it is important to position the stethoscope on those areas of the thoracic wall related to the underlying positions of the lobes.

- The medial surface of the right lung lies adjacent to a number of important structures, Impressions on the right lung (related to the venous blood) "بنتيجي بإمتحان العملي" يلي بالفاينل

- Heart, Pericardium covering right atrium.
- Inferior vena cava,
- Superior vena cava,
- Azygos vein and its arch
- Esophagus (at the apex then it goes behind the hilum)

Trachea (in front of the esophagus to at the apex) and it isn't present at the left side because the trachea is deviated to the right.

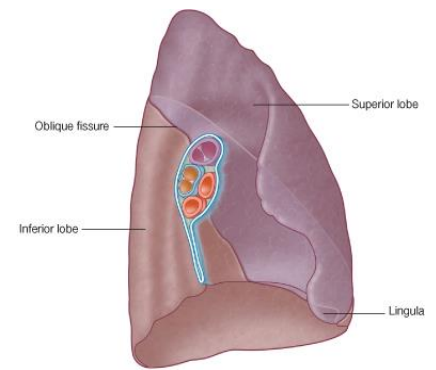


- The right subclavian artery and vein arch over and are related to the superior lobe of the right lung and they make an impression on the border of the right lung as they pass over the dome of cervical pleura and into the axilla.

Left lung

- The left lung is smaller than the right lung and has two lobes separated by an oblique fissure.

- Oblique fissure of the left lung is slightly more oblique than the corresponding fissure of the right lung. During quiet respiration, the approximate position of the left oblique fissure can be marked by line on the thoracic wall.



- **Oblique fissure begins between the spinous processes of vertebrae T3 and T4, crosses the fifth interspace laterally, and follows the contour of rib VI anteriorly.**

- As with the right lung, the orientation of the oblique fissure determines where to listen for lung sounds from each lobe.

- The most apical structure in the hilum of the left lung is the pulmonary artery.

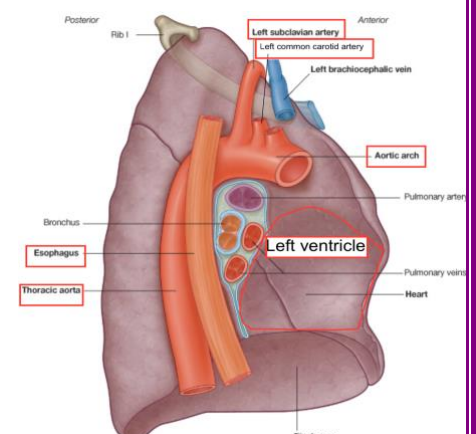
- **The inferior portion of the medial surface of the left lung, is notched because of the heart's projection into the left pleural cavity from the middle mediastinum.**

Cardiac notch is between the 4th and 6th left costal cartilages, it has a clinical importance as in cases of cardiac effusion (e.g. cardiac tamponade) a needle is placed there to drain the fluids, between the 4th and 6th costal cartilages, to avoid piercing the lung or the pleura.

- **On the anterior surface of the lower part of the superior lobe a tongue-like extension (the lingula **لُئْسِين** of left lung) projects over the heart bulge and above it is the cardiac notch, and it resulted from the deviation of the heart to the left in the embryo.**

- **The medial surface of the left lung lies adjacent to a number of important structures impressed on it (related to the arterial blood meaning arteries and left ventricle)**

- Heart, pericardium covering the left ventricle,
- Aortic arch, and left common carotid artery and left subclavian artery (the **brachiocephalic** trunk doesn't leave a well impression as it is more to the right)
- Descending thoracic aorta,
- **Esophagus** is in front of the descending aorta, because the opening of the aorta on the diaphragm is at the midline while the



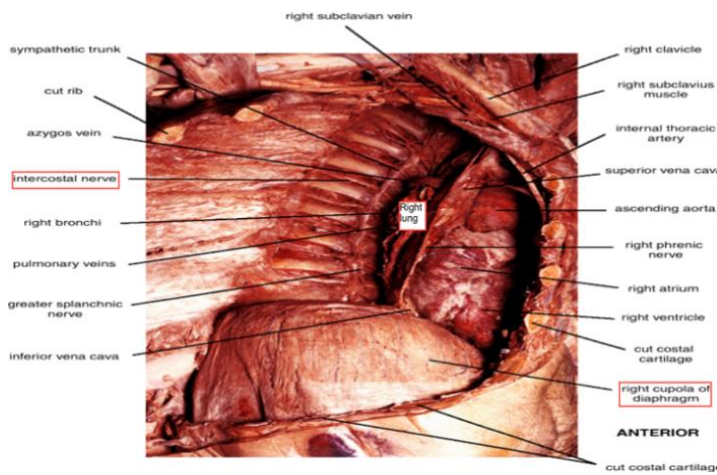
esophagus opening is at the left copula, so the esophagus crosses the aorta to go to the left at the lower part.

• **Openings of the diaphragm:**

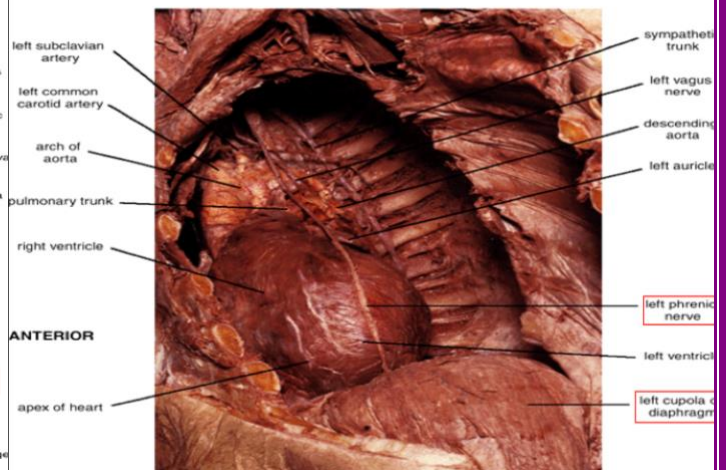
- IVC at T8.
- Esophagus with the two vagi on the left copula (1inch to the left from the midline) at T10.
- Abdominal aorta on the midline at T12.

A mnemonic that can help u “I ate 10 eggs at 12” = I 8 10 EGGs AAT 12: I 8 = IVC at T8. 10 EGGs = EsophaGus and vaGus at T10. AAT 12 = Aorta, Azygos, and Thoracic duct at T12.

Right side



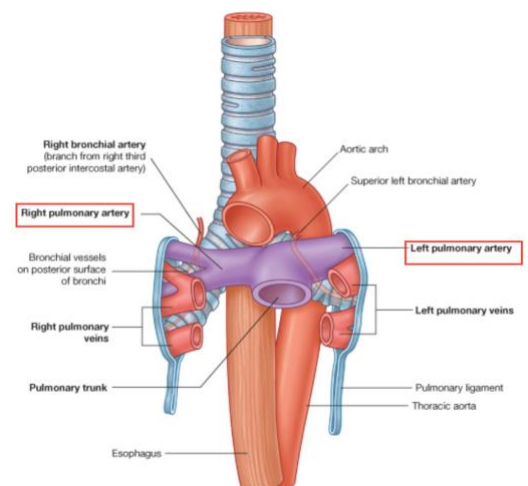
Left side



Pulmonary arteries

• The right and left pulmonary arteries originate from the pulmonary trunk and carry deoxygenated blood to the lungs from the right ventricle of the heart.

• The bifurcation of the pulmonary trunk occurs to the left of the midline just inferior to vertebral level T4 at the sternal angle, and anteroinferiorly to the left of the bifurcation of the trachea.



- The right pulmonary artery is longer than the left and passes horizontally across the mediastinum.
- The right pulmonary artery passes anteriorly and slightly inferiorly to the tracheal bifurcation and anteriorly to the right main bronchus, posteriorly to the ascending aorta, superior vena cava, and upper right pulmonary vein.
- The right pulmonary artery enters the root of the lung (between eparterial and hyparterial bronchi) and gives off a large branch to the superior lobe of the lung.
- The main vessel continues through the hilum of the lung, gives off a second (recurrent) branch to the superior lobe, and then divides to supply the middle and inferior lobes.
- The left pulmonary artery is shorter than the right and lies anterior to the descending aorta and posterior to the superior pulmonary vein (see the picture above).
It passes through the root and hilum (as the most superior structure) and branches within the lung.
- Pulmonary arteries (deoxygenated) don't supply the lungs, but the bronchial arteries (oxygenated) do.

Pulmonary veins

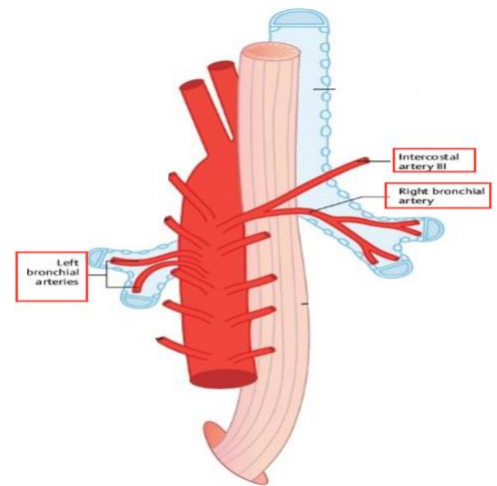
- Are 4 in number, on each side a superior pulmonary vein and an inferior pulmonary vein carry oxygenated blood from the lungs back to the heart.
- The veins begin at the hilum of the lung, pass through the root of the lung, and immediately drain into the left atrium.

Bronchial arteries and veins

- Bronchial arteries carry oxygenated blood and supply the lung tissue.
- Constitute the 'nutritive' vascular system of the pulmonary tissues (bronchial walls and glands, walls of large vessels, and visceral pleura). They interconnect within the lung with branches of the pulmonary arteries and veins. The bronchial arteries run on the posterior surfaces of the bronchi and ramify in the lungs to supply pulmonary tissues.

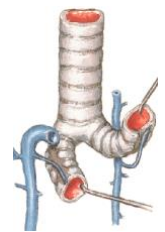
- The bronchial arteries originate from the thoracic aorta or one of its branches:

- A single right bronchial artery normally arises from the third posterior intercostal artery.
- Two left bronchial arteries arise directly from the anterior surface of the thoracic aorta.



bronchial veins

- bronchial veins drain, into either the pulmonary veins or the left atrium. Or into the azygos vein on the right (which drains into the right atrium) or into the superior intercostal vein or hemiazygos vein.

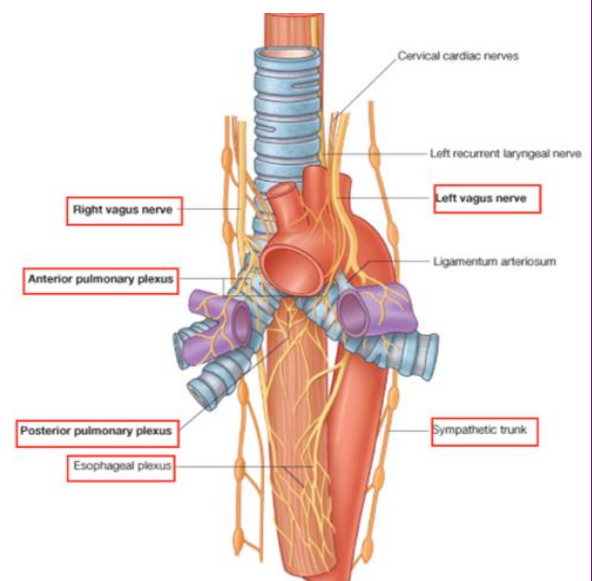


Innervation

- The visceral pleura and other structures of the lung are supplied by visceral afferents and efferents distributed through the anterior pulmonary plexus and posterior pulmonary plexus.
- These interconnected plexuses lie anteriorly and posteriorly to the tracheal bifurcation and main bronchi.

The anterior plexus is much smaller than the posterior plexus. Branches of these plexuses, which ultimately originate from the sympathetic trunks and vagus nerves, are distributed along branches of the airway and vessels.

- Parietal pleura → supplied by sensory innervation.
- Visceral pleura and lung tissues → supplied by autonomic efferents (sympathetic (sympathetic chain) and parasympathetic (vagus)) through the pulmonary plexuses anterior and posterior to the trachea and continue as the esophagus plexus.



- Visceral efferents from the vagus nerves constrict the bronchioles, and the sympathetic system dilates the bronchioles.

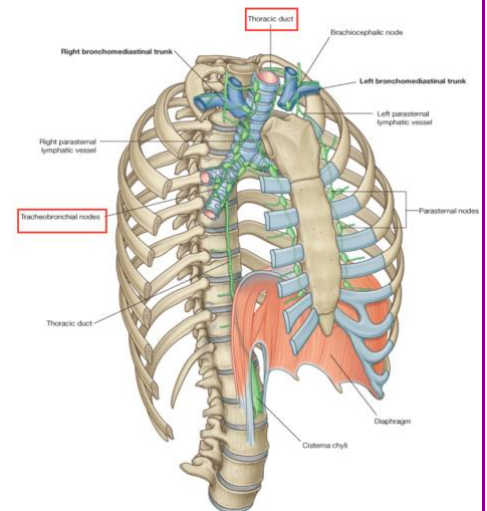
Lymphatic drainage

- The hilum contains mediastinal lymph nodes.
- Superficial, or subpleural, and deep lymphatics of the lung drain into lymph nodes called tracheobronchial nodes around the roots of lobar and main bronchi and along the sides of the trachea.
- As a group, these lymph nodes extend from within the lung, through the hilum and root, and into the posterior mediastinum.

Efferent vessels from these nodes pass superiorly along the trachea to unite with similar vessels from parasternal nodes and brachiocephalic nodes, to form the right and left bronchomediastinal trunks.

- These trunks drain directly into deep veins at the base of the neck or may drain into the right lymphatic trunk or thoracic duct on the left side which then drains into the beginning of the left brachiocephalic vein (the junction between the internal jugular vein and the subclavian vein).

- Mediastinal lymph nodes in the hilum → tracheobronchial nodes → paratracheal nodes → right lymphatic trunk or thoracic duct.



* In the last 5 minutes of this lecture the doctor mentioned some important notes about the next lecture (pleura) you can [click here](#) to watch it*

اللهم إنا نعوذ بك من كل ما يحول دون توفيق عبادك المجاهدين، اللهم ثبتنا وثبت بنا، يا رب أنت ترى ضعفنا وقلة حيلتنا فانصرنا على القوم الكافرين.

Past papers

• **Which of the following structures is least likely to be damaged during the removal of a tumor in the root of the right lung:**

- a- Phrenic nerve.
- b- Pulmonary artery.
- c- Azygous arch.
- d- Vagus nerve.
- e- Recurrent laryngeal nerve.

• **Which of the following is incorrect about the right pulmonary artery-**

- a- It originates from pulmonary trunk at sternal angle level.
- b- It is longer than the left one.
- c- It is related anteriorly to the SVC and ascending aorta.

• **What's wrong about lung carcinoma:**

the tumor will cause partial injury to left recurrent laryngeal nerve which will affect the adductors.

• **Not liable to injury when removing a tumor in the hilum:**

recurrent laryngeal nerve.

• **Wrong about pulmonary arteries:**

bronchial arteries are branches of them.

• **Not affected in the dissection of the root of the right lung:**

recurrent laryngeal nerve.

• **Wrong about the lungs:**

don't have lymph nodes.

• **No symmetry in the superficial anatomy of the lungs in:**

the anterior border below sternal angle.

ANSWERS: E, A

V2: in page 2, parietal not visceral.

V3: in page 8, brachiocephalic trunk not pulmonary.