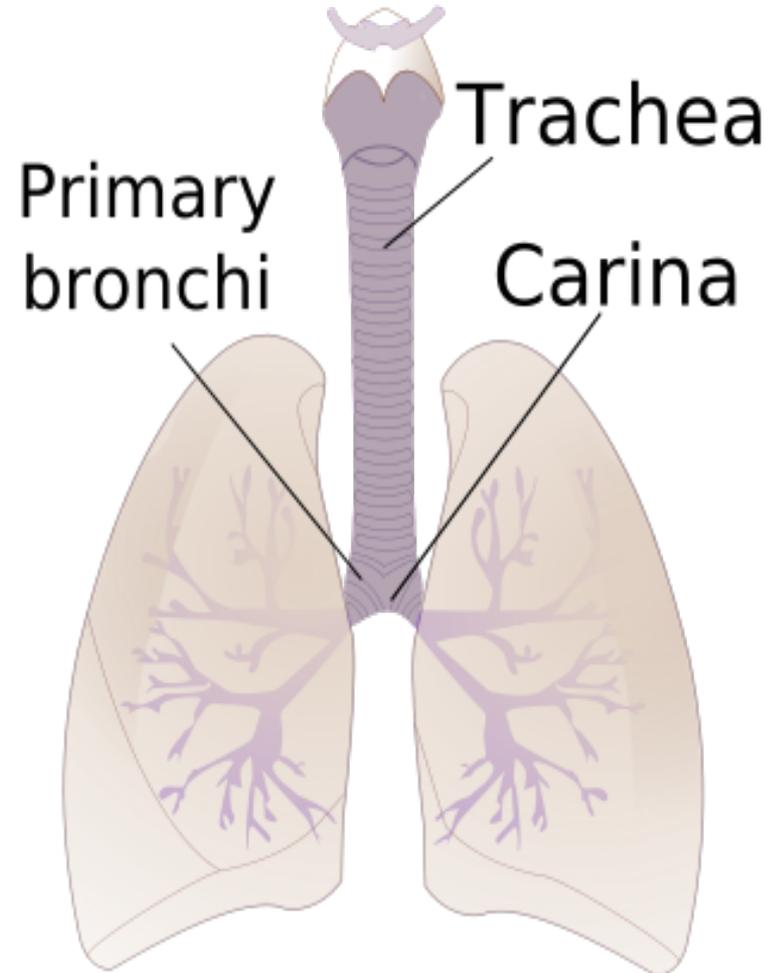


Trachea and lungs

Trachea

- The **trachea** is a flexible tube that extends from vertebral level CVI (cricoid cartilage) in the lower neck to vertebral level TIV/V
- it bifurcates into a right and a left main bronchus (carina) at the level of sternal angle
- The trachea is held open by 'C-shaped' cartilage rings (16-20) embedded in its wall-
- the open part of the 'C' facing The posterior wall of the trachea is composed mainly of smooth muscle (trachealis) and connective tissue.
- In adults the trachea is about 4½ in. (11.25 cm) long and 1 in. (2.5 cm) in diameter
- The trachea widens and lengthens slightly with each inspiration, returning to its resting size with each expiration.



Relations of Trachea

Anteriorly

- Aortic arch
- Thymus
- thyroid
- Origin of brachiocephalic artery
- Manubrium sterni

Left

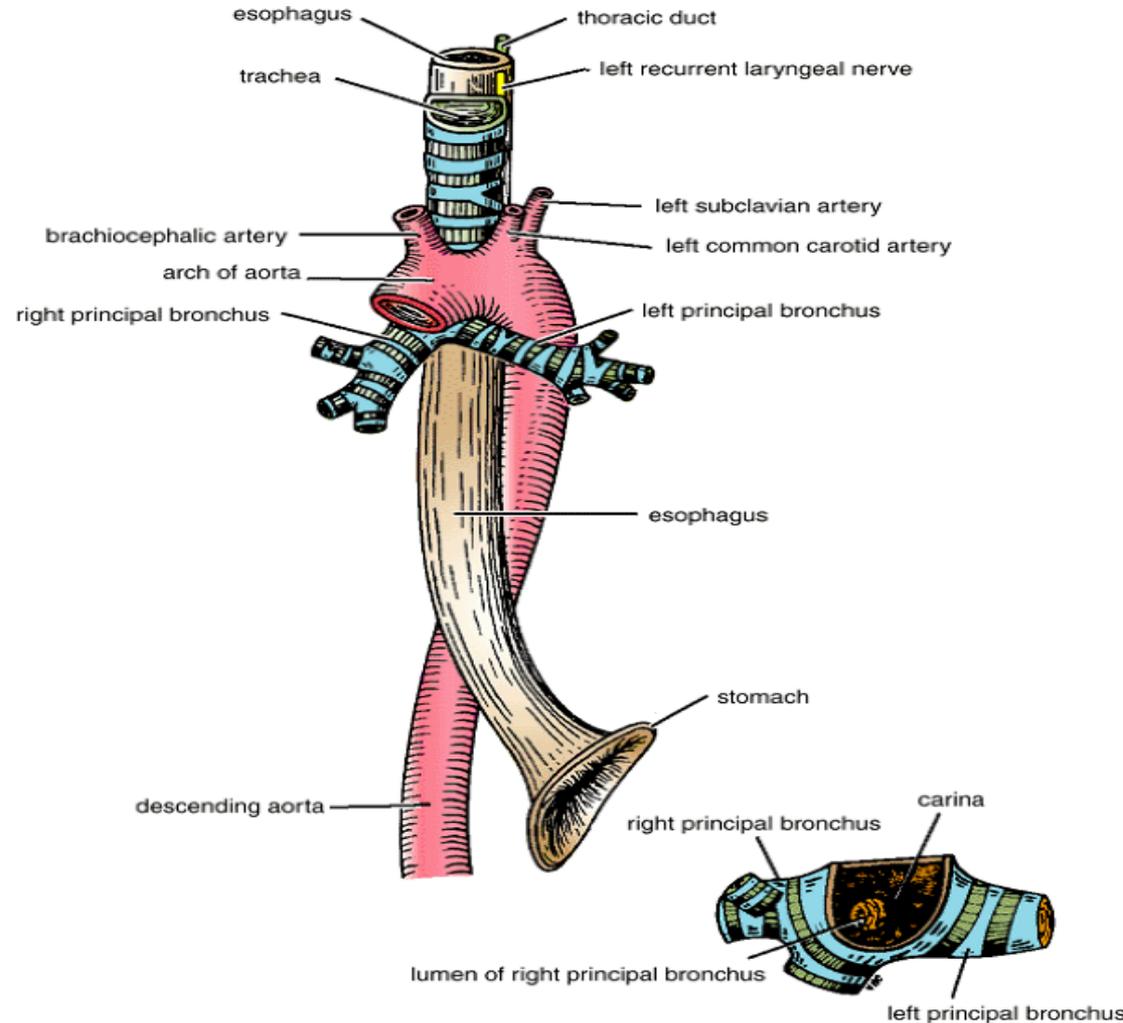
- Arch of aorta
- Lt. subclavian art.
- LT. common carotid art.
- Lt. Phrenic n.
- Lt. Vagus n.
- Lt. main bronchus

Right

- Azygous arch
- Brachiocephalic artery
- Rt. Vagus
- Rt. Phrenic
- Rt. main bronchus

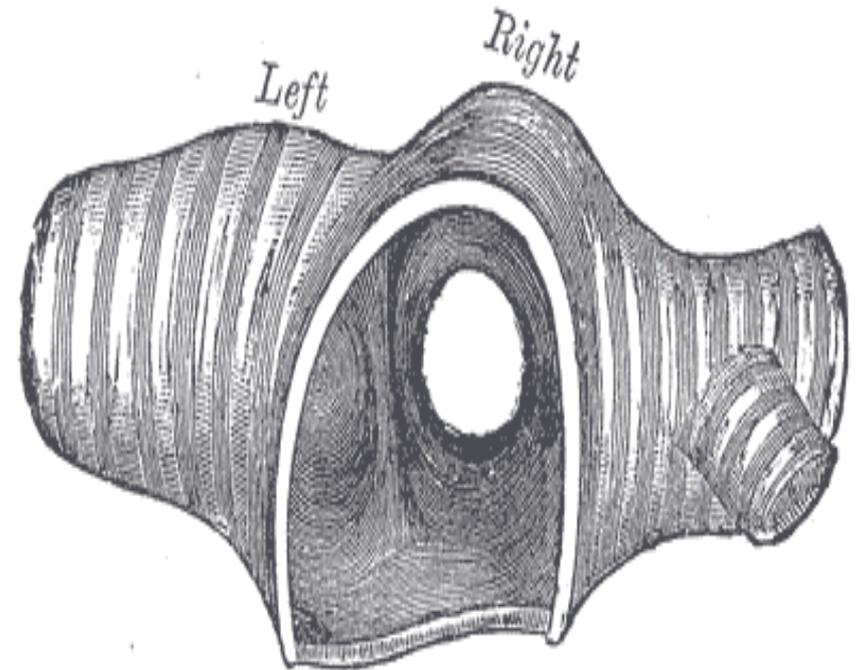
Post.

- Esophagus
- Thoracic duct
- left recurrent laryngeal nerve



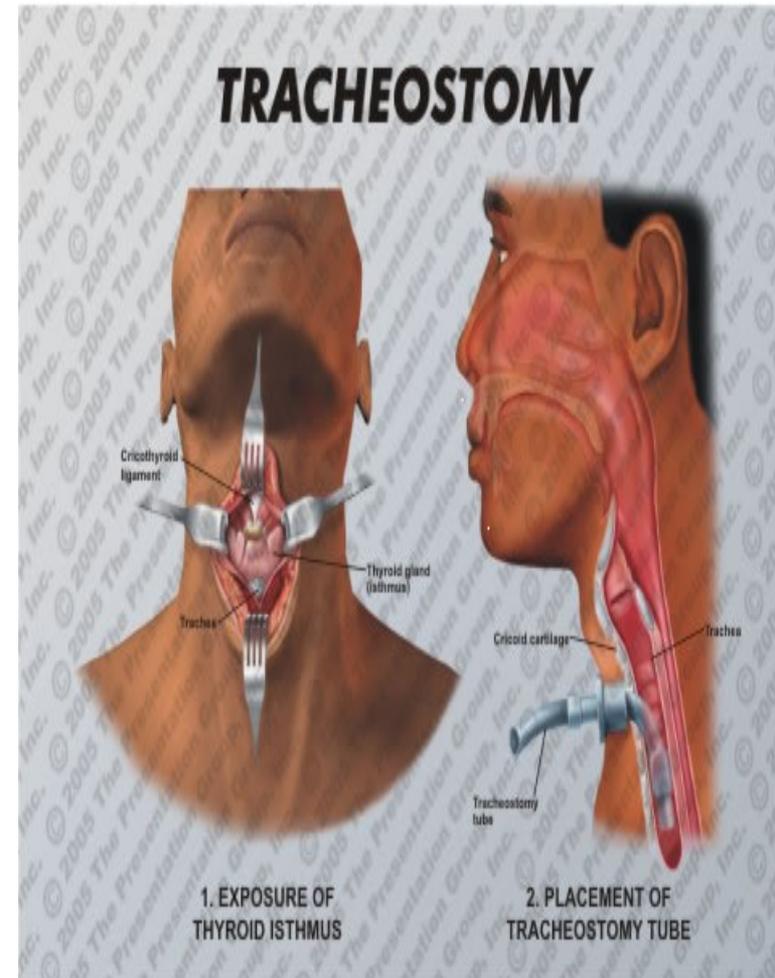
Trachea

- **carina** is a cartilaginous ridge within the [trachea](#) that runs anteroposteriorly between the two primary [bronchi](#) at the site of the tracheal bifurcation (T4-T5).
- The mucous membrane of the carina is the most sensitive area of the trachea and larynx for triggering a cough reflex.
- **In deep inspiration it descends to the level of 6th thoracic vertebra**



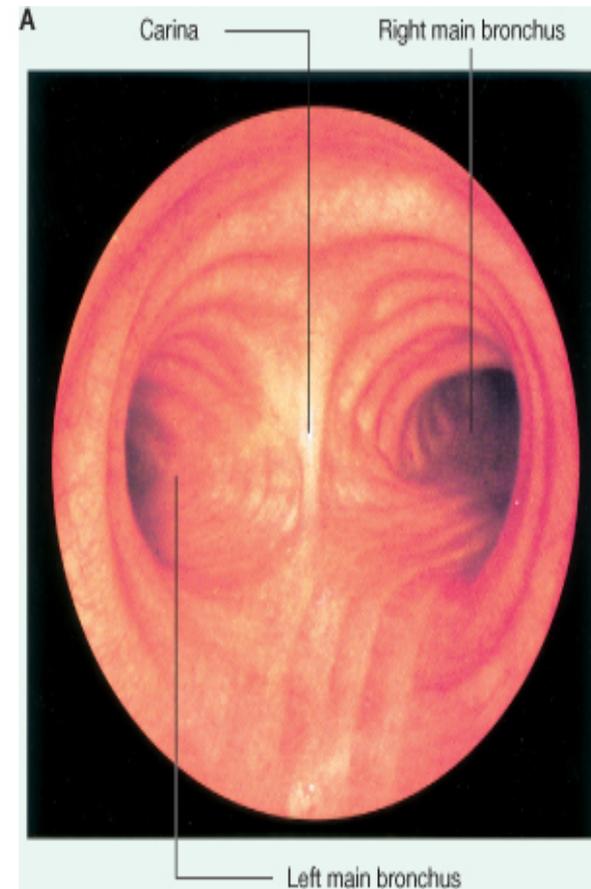
Tracheotomy and intubations

- Used to reestablish airflow past a tracheal obstruction.
- If the obstruction is superior to the larynx a tracheotomy may be performed
- A longitudinal incision below the cricoid cartilage
- The patient can the breath through a metal or plastic tube.
- in intubation the tube is inserted through the mouth or nose and push aside any flexible obstruction
- Any mucous clogging can be suctioned through the tube



Bronchi

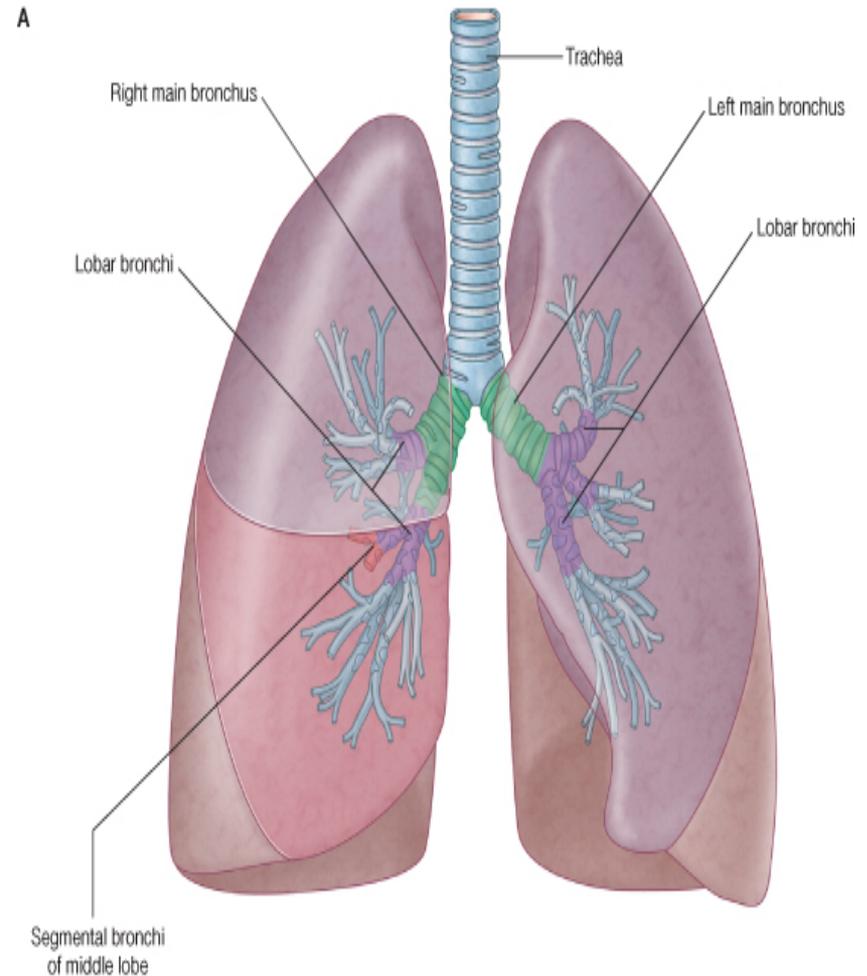
- Each main bronchus enters the root of a lung and passes through the hilum into the lung itself.
- The **right main bronchus** is wider and takes a more vertical course and is about 1 in. (2.5 cm)
- principal bronchus gives off the superior lobar bronchus. On entering the hilum, it divides into a middle and an inferior lobar bronchus.
- the **left main bronchus is narrower, longer, and more horizontal than the right and is about 2 in. (5 cm) long**
- passes to the left below the arch of the aorta and in front of the esophagus
- the principal bronchus divides into a superior and an inferior lobar bronchus.
- *Therefore, inhaled foreign bodies tend to lodge more frequently on the right side than on the left.*



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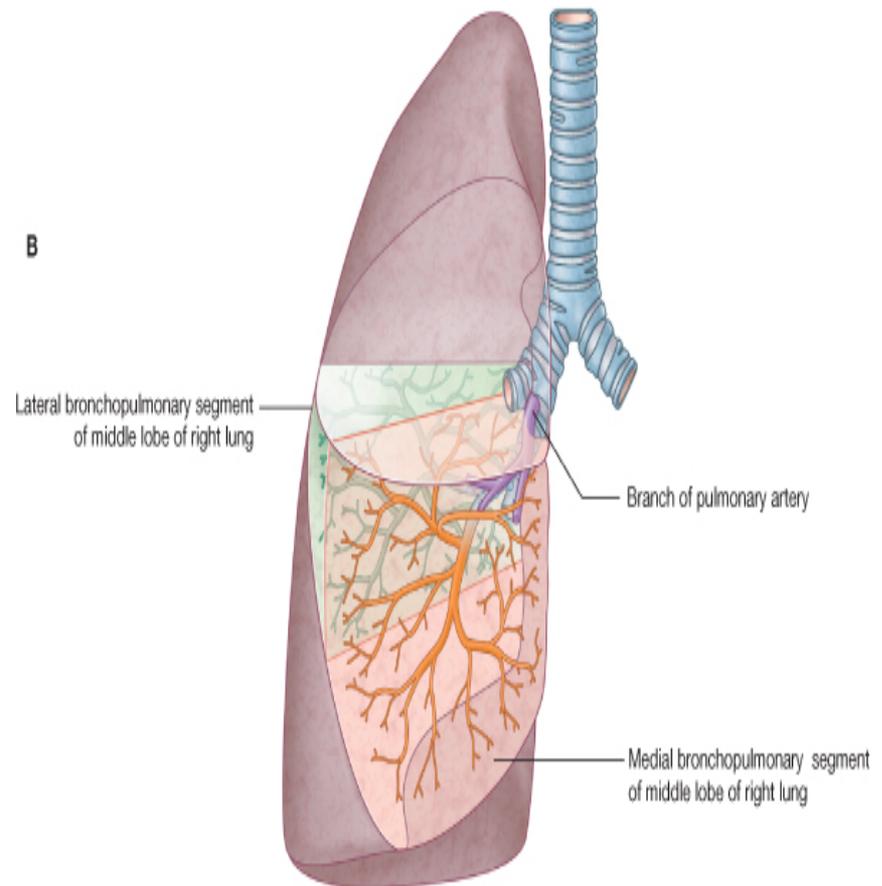
Bronchial tree

- The main bronchus divides within the lung into **lobar bronchi** (secondary bronchi),
- each of which supplies a lobe.
- On the right side, the lobar bronchus to the superior lobe originates within the root of the lung.
- The lobar bronchi further divide into **segmental bronchi** (tertiary bronchi), which supply **bronchopulmonary segments**

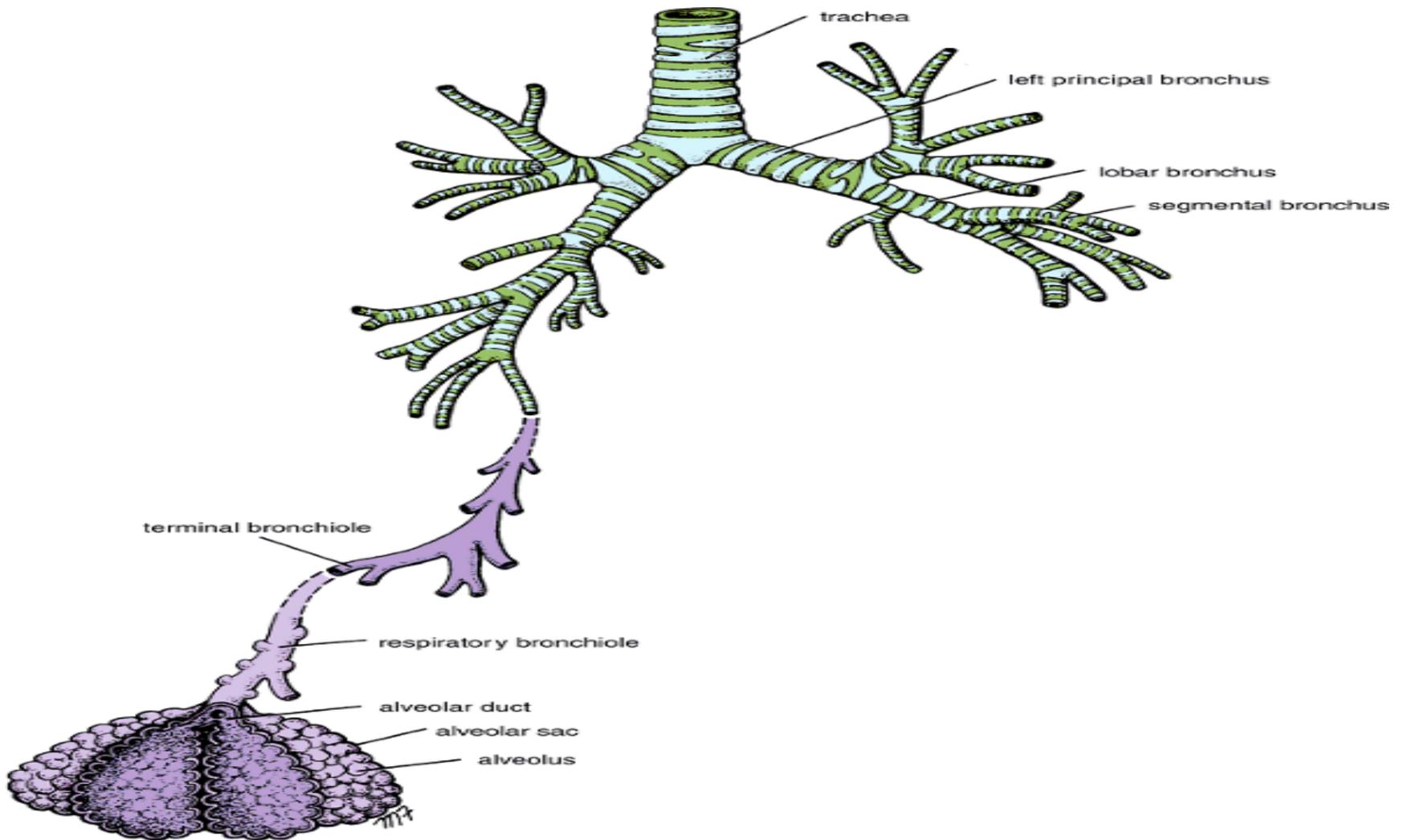


Bronchial tree

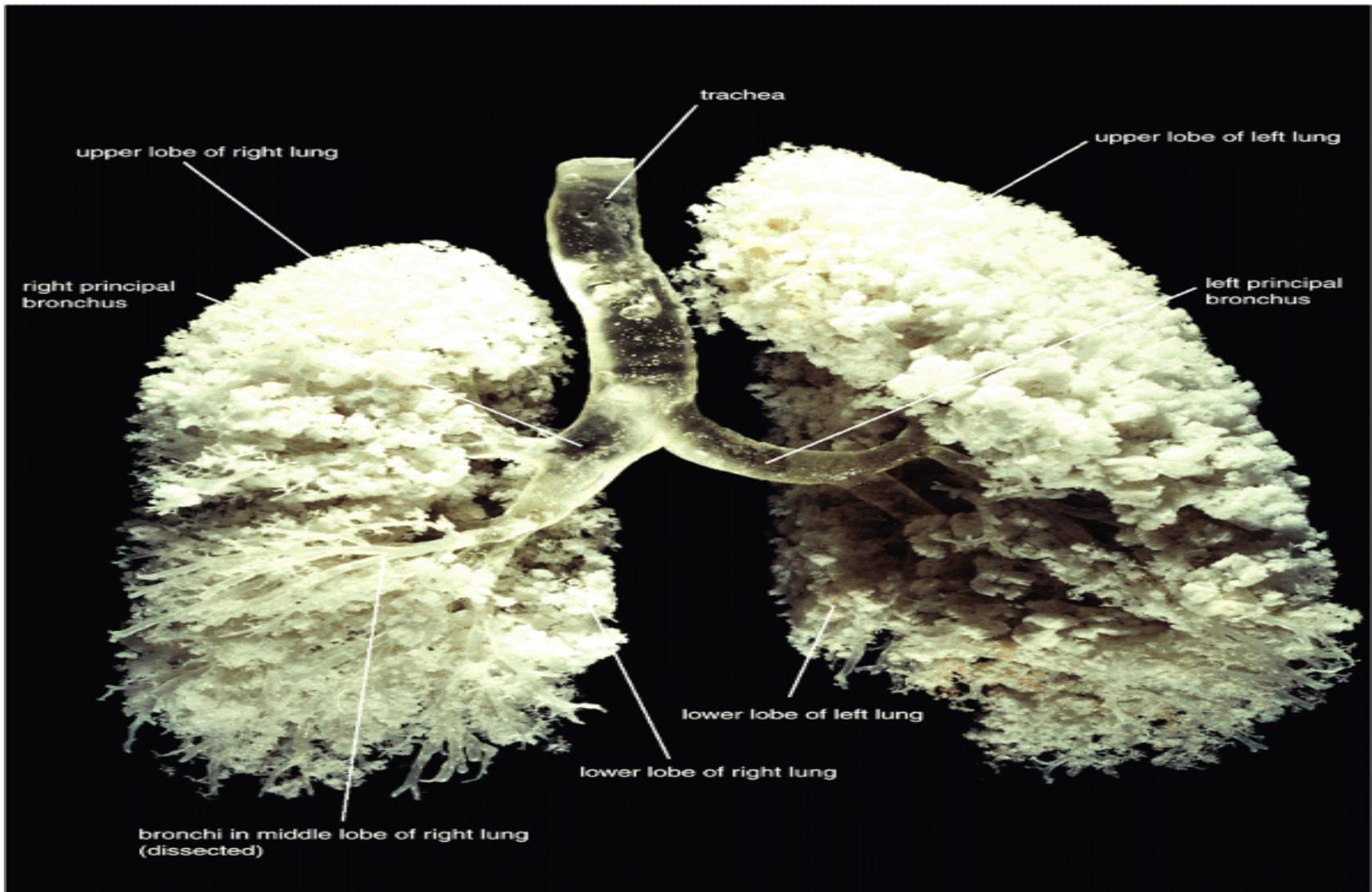
- **bronchopulmonary segment** further divide into terminal bronchioles & these into respiratory bronchioles which end in the pulmonary unit .
- Pulmonary unit consist of
alveolar ducts,atria
air sacs
pulmonary alveoli.
- The walls of the bronchi are held open by discontinuous elongated plates of cartilage, but these are not present in bronchioles.



Bronchial tree

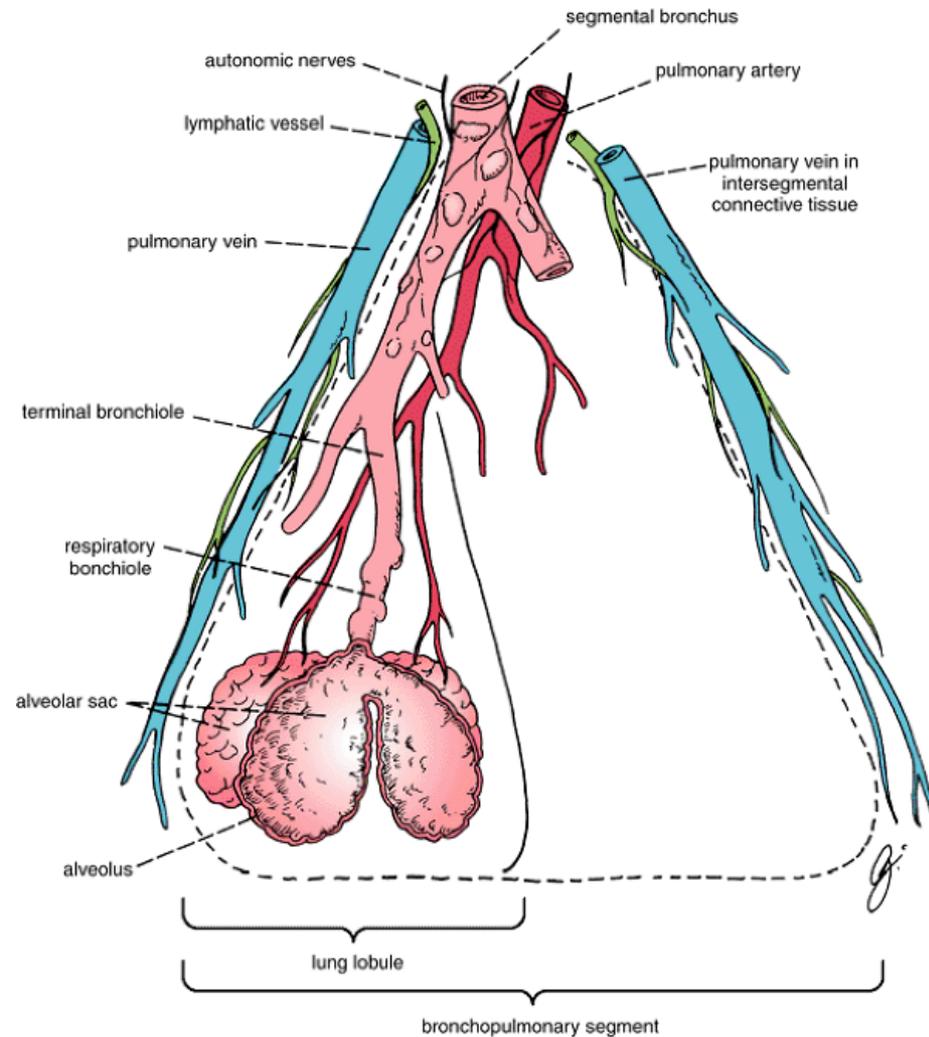


Bronchial tree



Bronchopulmonary segments

- A **bronchopulmonary segment** is the area of lung supplied by a segmental bronchus and its accompanying pulmonary artery branch
- It is a subdivision of a lung lobe.
- It is pyramid shaped, with its apex toward the lung root.
- It is surrounded by connective tissue.
- It has a segmental bronchus, a segmental artery, lymph vessels, and autonomic nerves.
- The segmental vein lies in the connective tissue between adjacent bronchopulmonary segments.
- Because it is a structural unit, a diseased segment can be removed surgically.



Bronchopulmonary segments

Rt. Lung 10 segments

Upper lobe

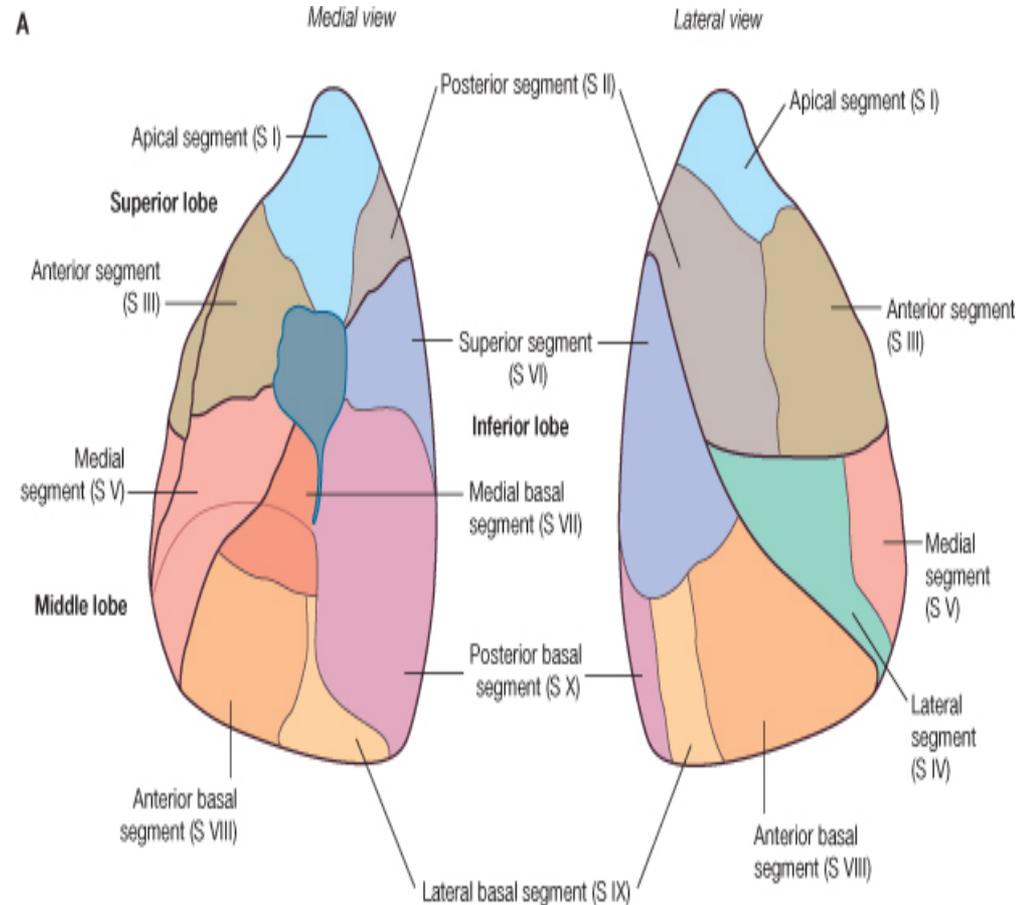
Apical
posterior
Ant

Middle lobe

Medial
Lateral

Basal lobe

Apical (apico basal)
Ant
Med
Lat
Post



Bronchopulmonary segments

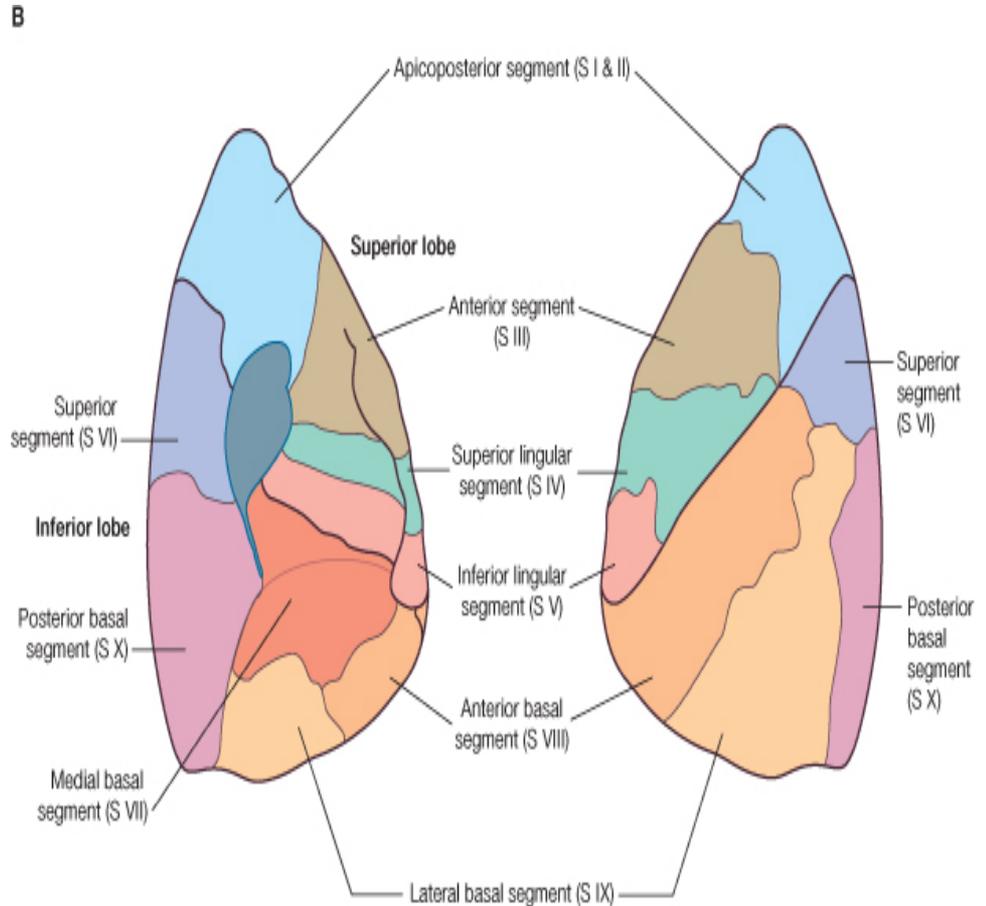
Lt. lung 10 segments

Upper lobe

- Apical
- posterior
- Ant
- sup. Lingual
- inf.lingual

Basal lobe

- Apical(apico basal)
- Ant
- Med
- Lat
- Post



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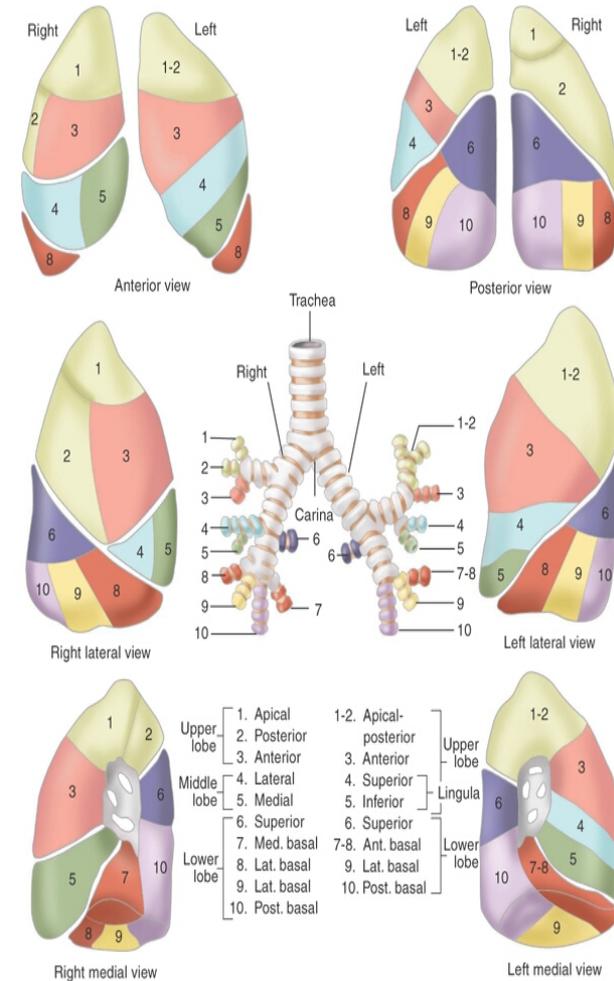
Bronchopulmonary segments

Table 7-6 ▶▶▶ Bronchopulmonary Segments*

Segment	Number	Segment	Number
Right Upper Lobe		Left Upper Lobe	
Apical	1	Upper division	
Posterior	2	Apical-posterior	1 and 2 [†]
Anterior	3	Anterior	3
Right Middle Lobe		Lower division (lingula)	
Lateral	4	Superior lingula	4
Medial	5	Inferior lingula	5
Right Lower Lobe		Left Lower Lobe	
Superior	6	Superior	6
Medial basal	7	Anterior basal	7 and 8
Anterior basal	8	Lateral basal	9
Lateral basal	9	Posterior basal	10
Posterior basal	10		

*The subdivisions of the lung and bronchial tree are fairly constant. Slight variations between right and left sides are noted by combined names and numbers.

[†]**NOTE:** Some authors feel that the left lung should be numbered so that there are eight segments, where the apical-posterior is numbered 1 and the anteromedial is numbered 6.



Bronchopulmonary segments

Before birth:

- Rt. Lung 10 segments

- Lt .lung 8 segments

 - Apicpo posterior

 - Antero medial

Clinical importance of pulmonary segments

- Infections
- No barrier
- Surgery
- Postural drainage
- Bronchoscopy

Lungs

Lungs

- organs of respiration and lie on either side of the mediastinum
- surrounded by the right and left pleural cavities

Spongy, grey, dark later on.

- 600-800gm , 90% air & 10% tissue
- The pulmonary arteries deliver deoxygenated blood to the lungs from the right ventricle of the heart.
- Oxygenated blood returns to the left atrium via the pulmonary veins.
- The right lung is normally a little larger than the left lung because the middle mediastinum, containing the heart, bulges more to the left than to the right.

Left lung is narrower

-Right lung is shorter, more vertical

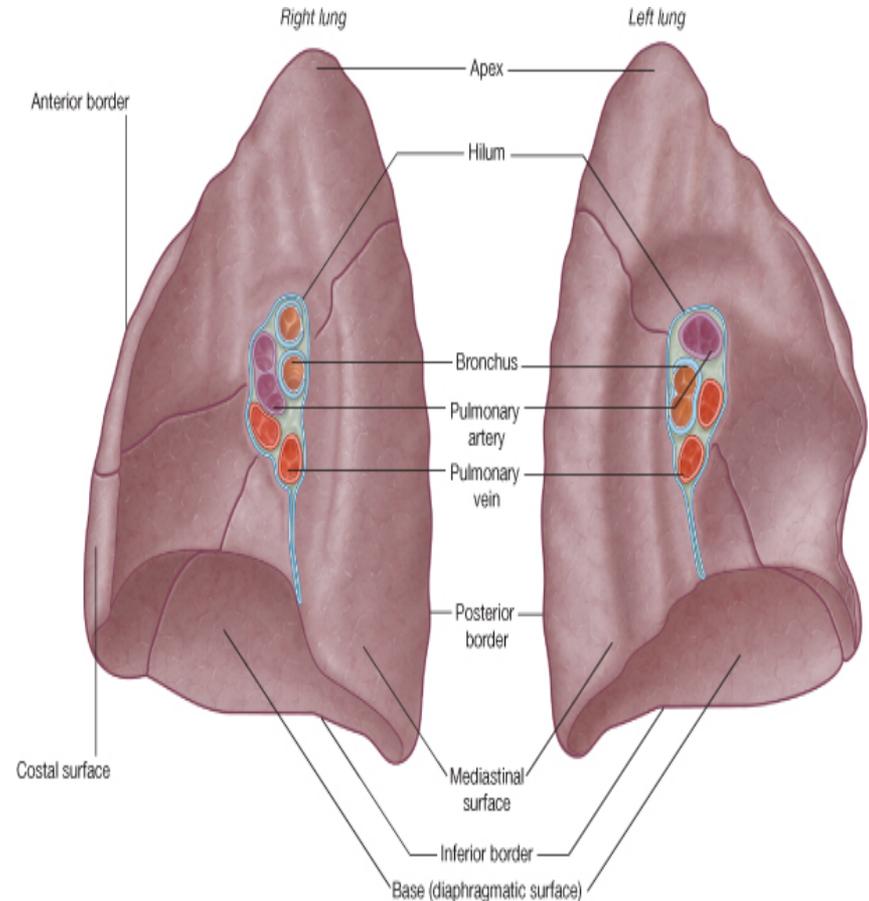


Lungs

- Each lung has a half-cone shape
- base, apex, two surfaces and three borders
- The **base** sits on the diaphragm.
- The **apex** projects above rib I and into the root of the neck.

1 inch above the medial 1/3rd of the clavicle and is covered by suprapleural membran.

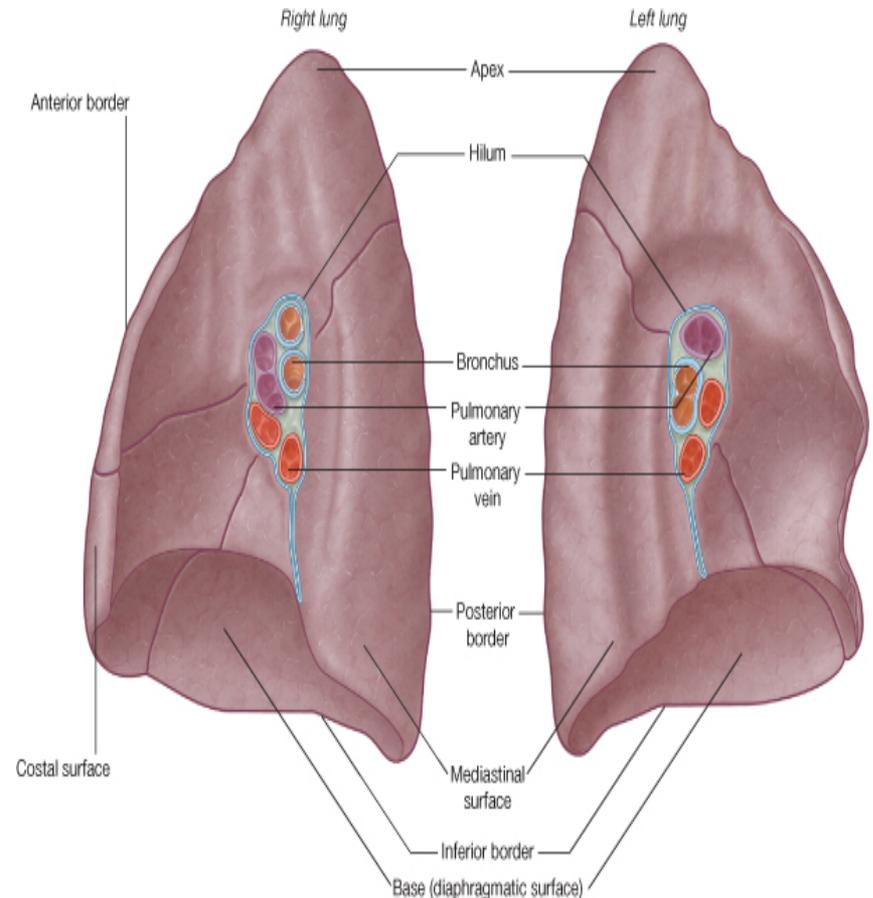
- **costal surface** lies immediately adjacent to the ribs and intercostal spaces.
- The **mediastinal surface** lies against the mediastinum anteriorly and the vertebral column posteriorly
- contains the comma-shaped hilum of the lung through which structures enter and leave.



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Lungs

- **inferior border** of the lung 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

- At end-expiration
 - 6th rib – midclavicular
 - 8th rib – midaxillary
 - 10th T.vertebra_

Posteriorly

- apex is at 1st Th vertebra

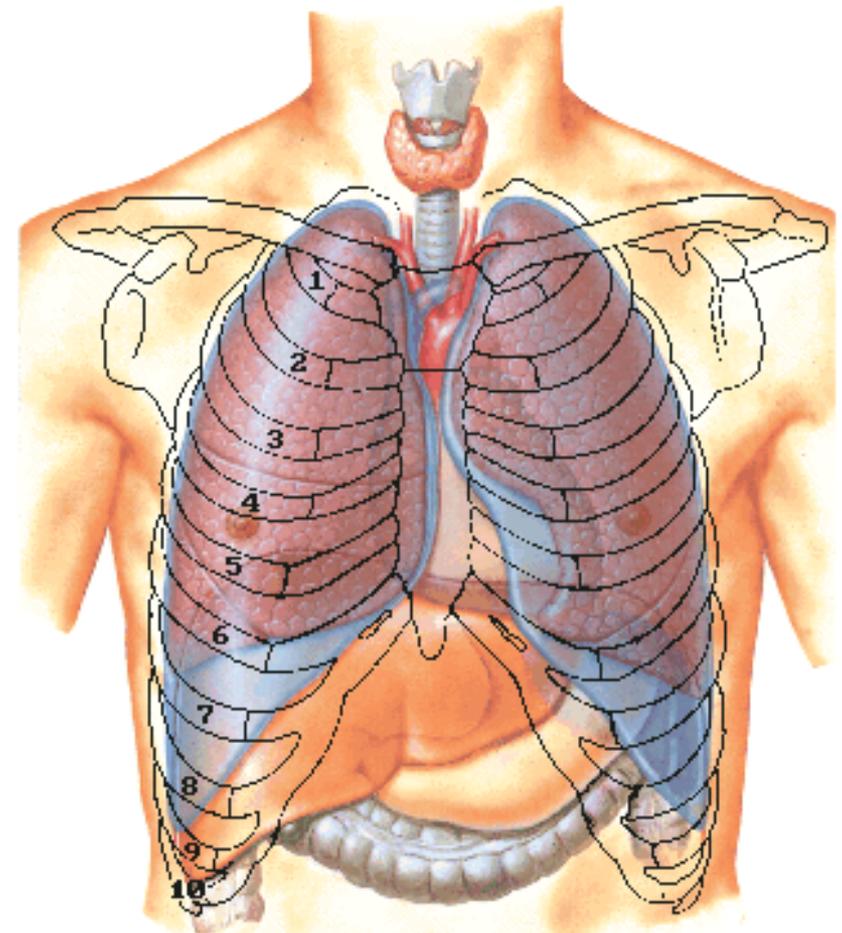
- Posterior border Extend from 7th C vert. to the 10th T vert.

- lies 4cm from the midline

Inferior border

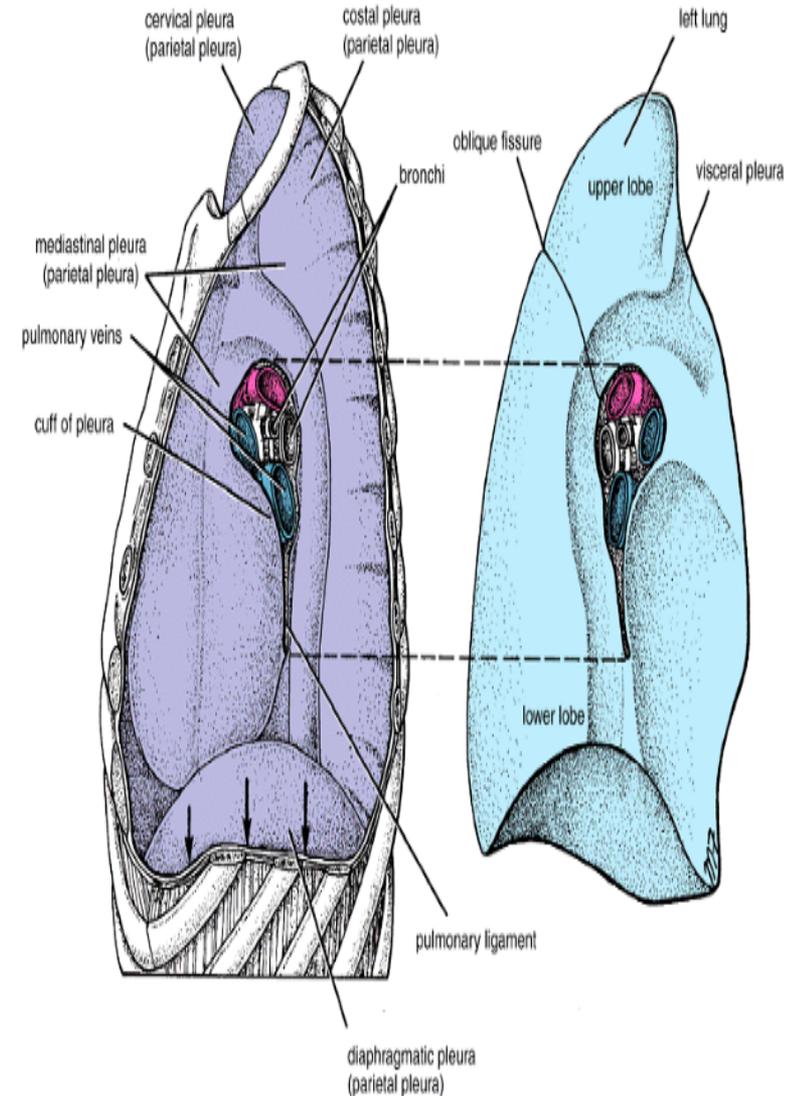
- Ascend and descend between 9th & 12th rib

Anterior View



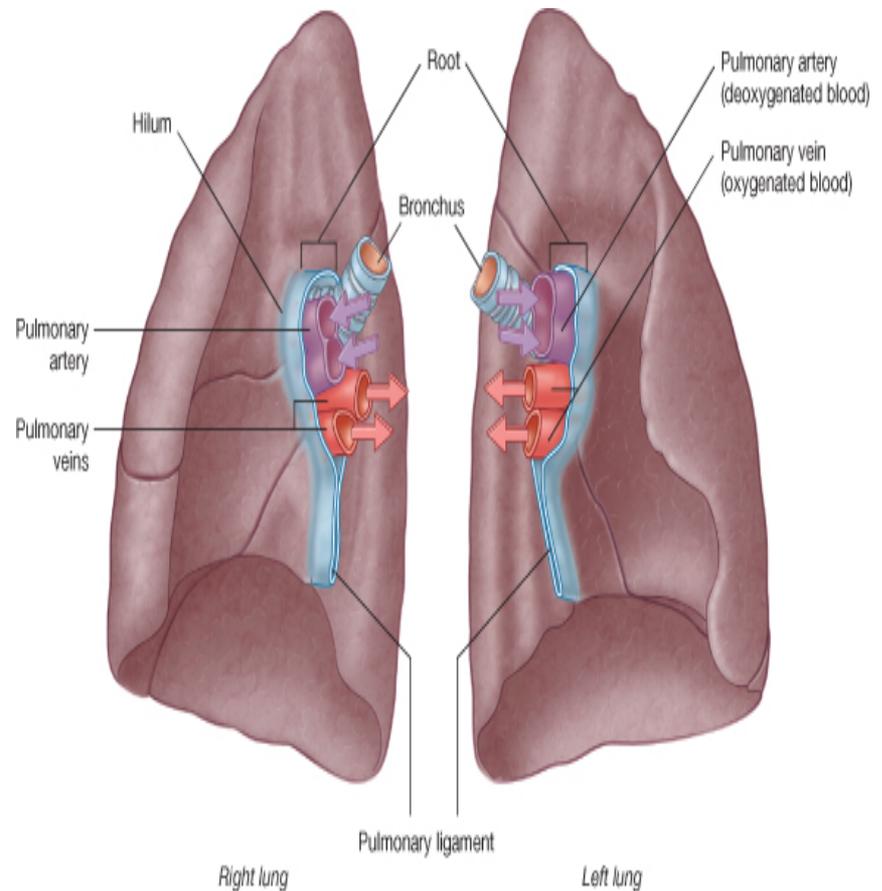
Root and hilum

- 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
- A thin blade-like fold of pleura projects inferiorly from the root of the lung. This structure is the **pulmonary ligament**
- **pulmonary ligament** 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.



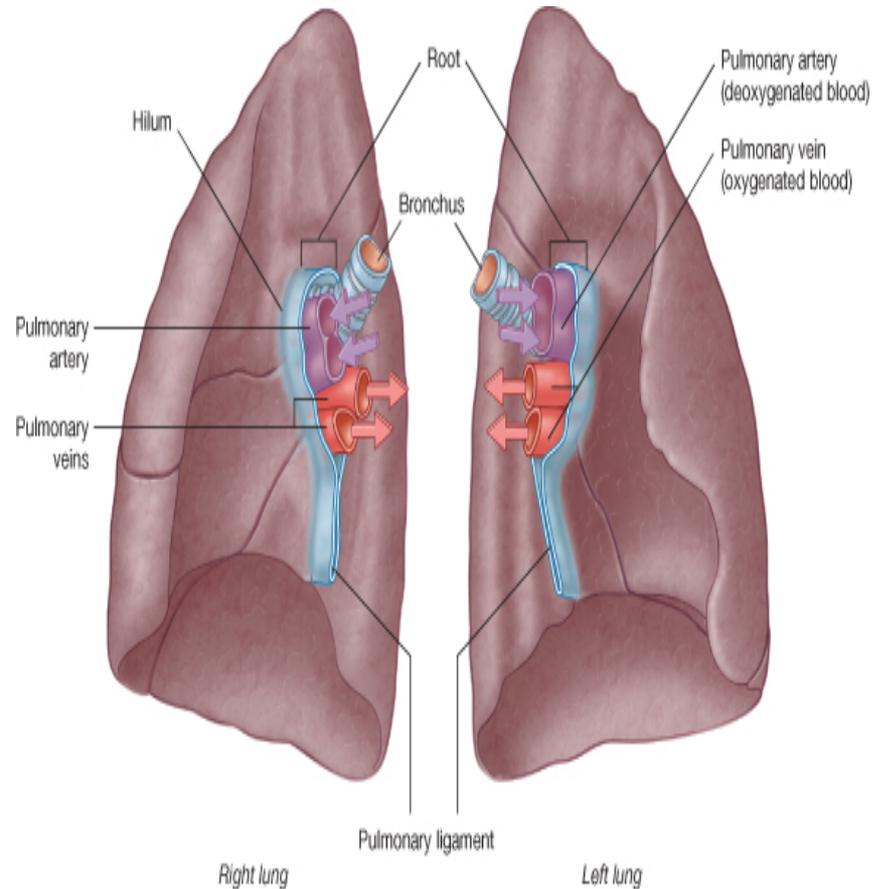
Root and hilum

- Within each root and located in the hilum are:
- **pulmonary artery;**
- **two pulmonary veins;**
- **a main bronchus;**
- **bronchial vessels;**
- **nerves;**
- **lymphatics.**



Root and hilum

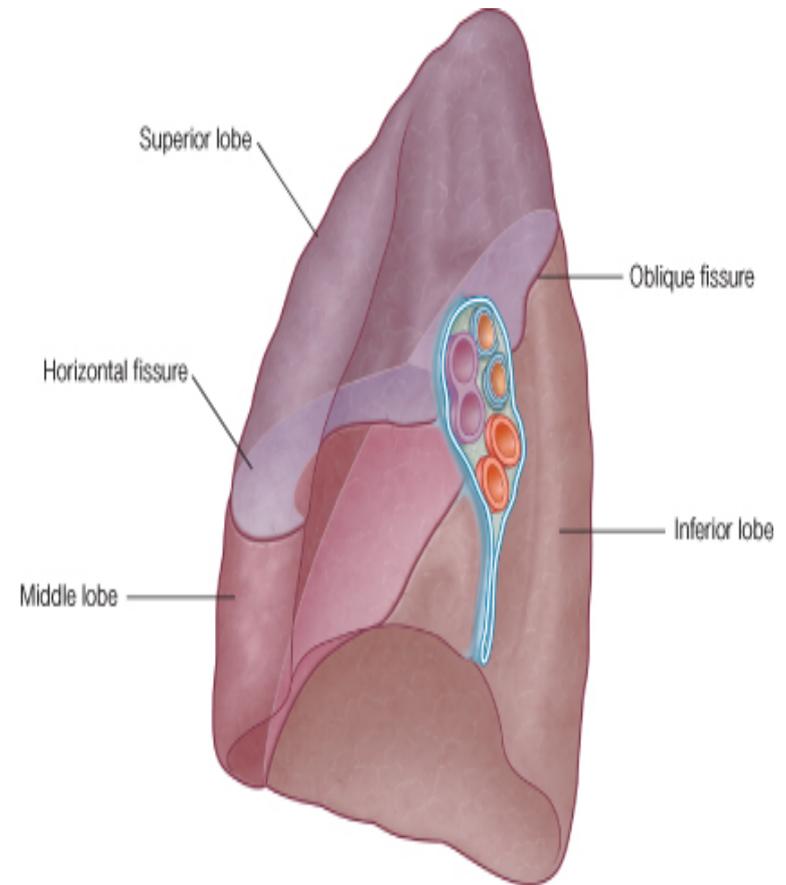
- the pulmonary artery is superior at the hilum,
- the pulmonary veins are inferior, and the bronchi are somewhat posterior in position.
- On the right side, the lobar bronchus to the superior lobe branches from the main bronchus in the root,
- on the left it branches within the lung itself, and is superior to the pulmonary artery



Right lung

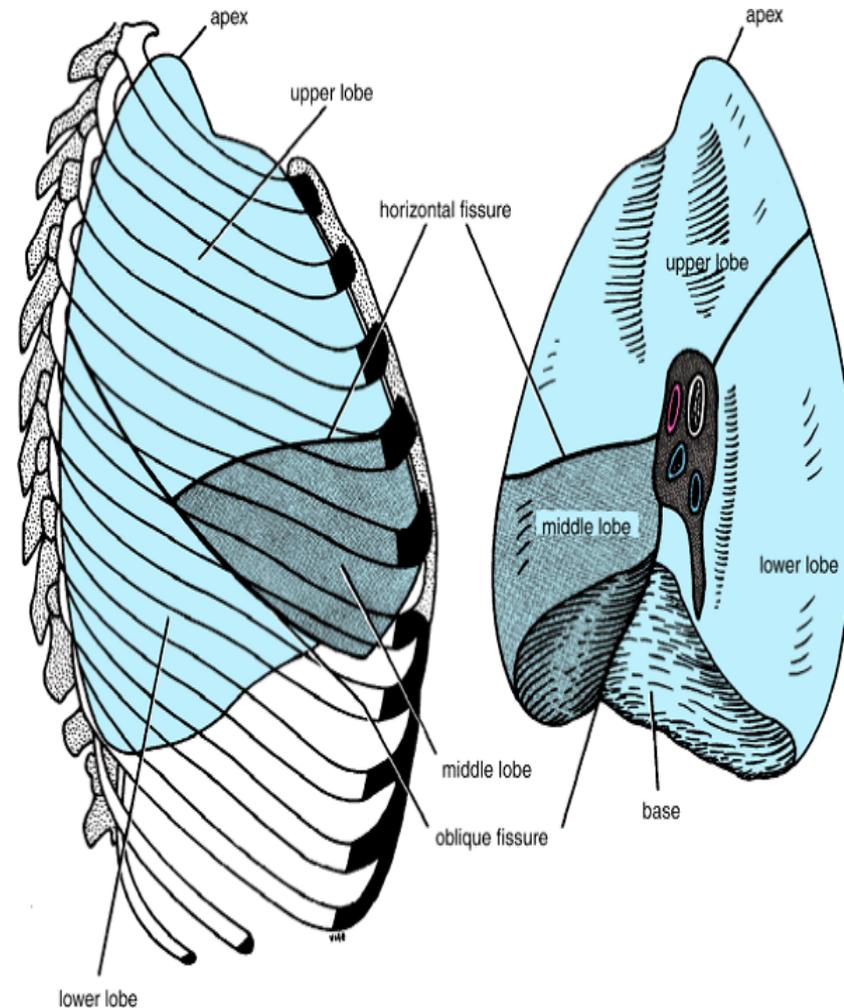
- The **right lung** has three lobes and two fissures
- Normally, the lobes are freely movable against each other because they are separated, almost to the hilum, by invaginations of visceral pleura.
- These invaginations form the **fissures**:
- the **oblique fissure** separates the **inferior lobe (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.

A



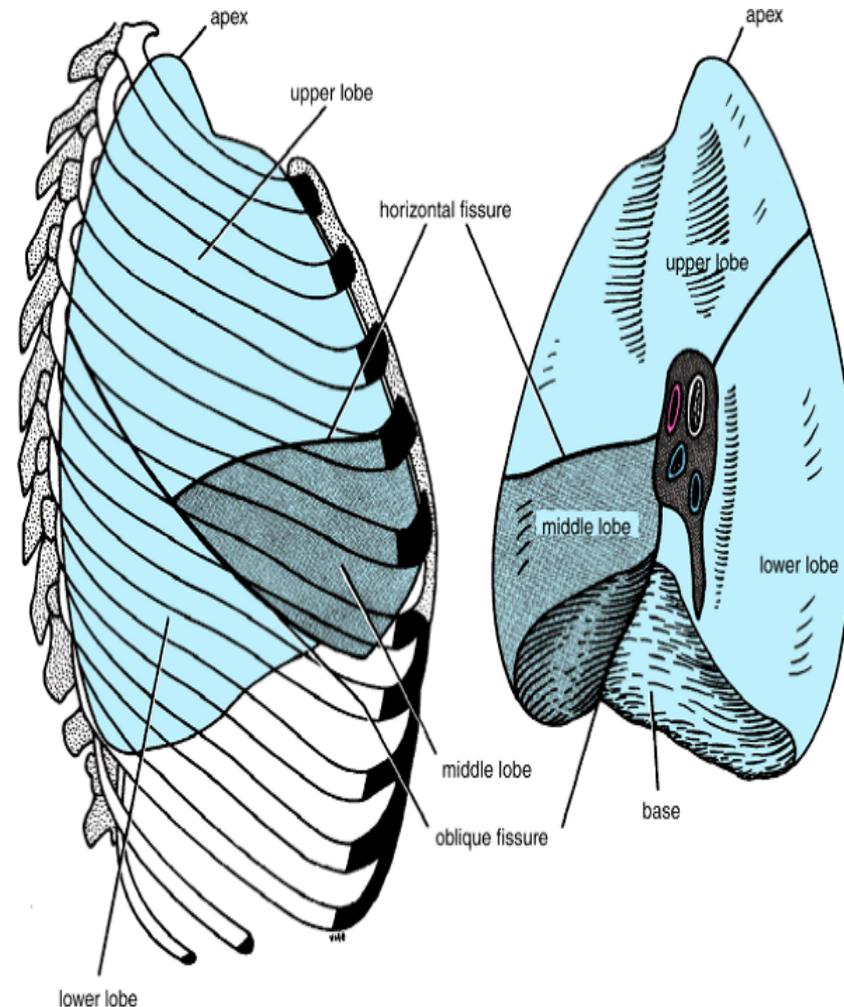
Right lung

- *The approximate position of the oblique fissure on a patient, in quiet respiration,*
- *begins roughly at the spinous process of vertebra **T4** level of the spine, crosses the **fifth** interspace laterally, and then follows the contour of **rib VI** anteriorly*



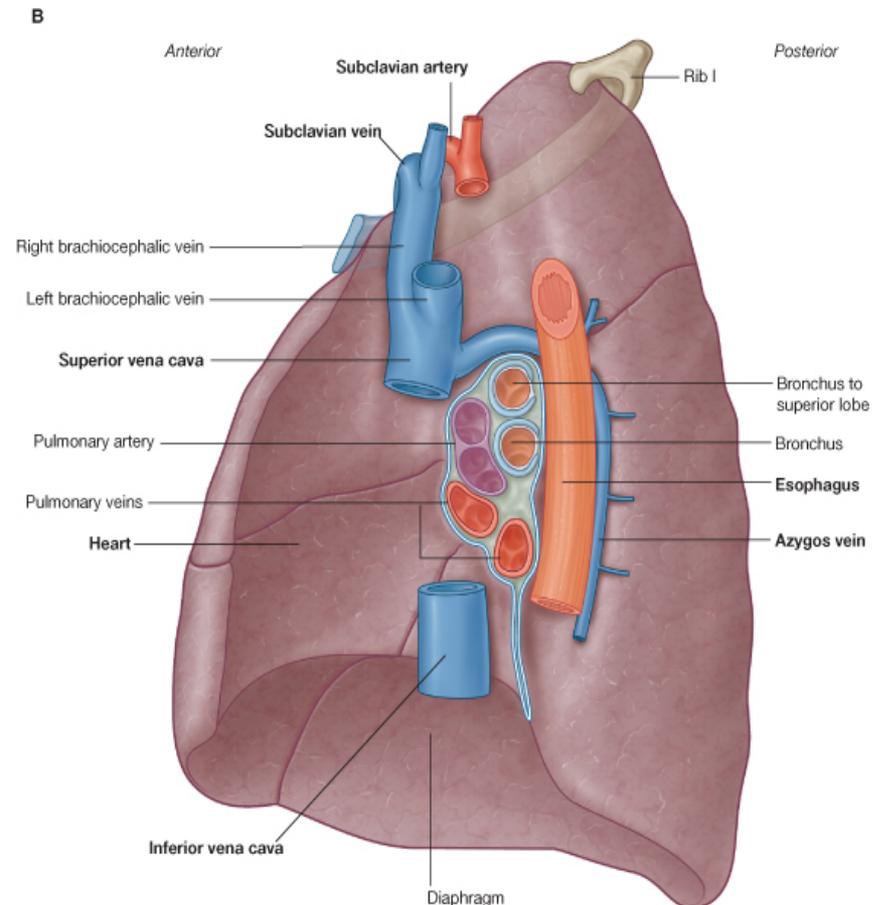
Right lung

- The horizontal fissure follows the **fourth intercostal** space from the sternum until it meets the oblique fissure as it crosses rib V.
- *The orientations of the oblique and horizontal fissures determine where clinicians should listen for lung sounds 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*



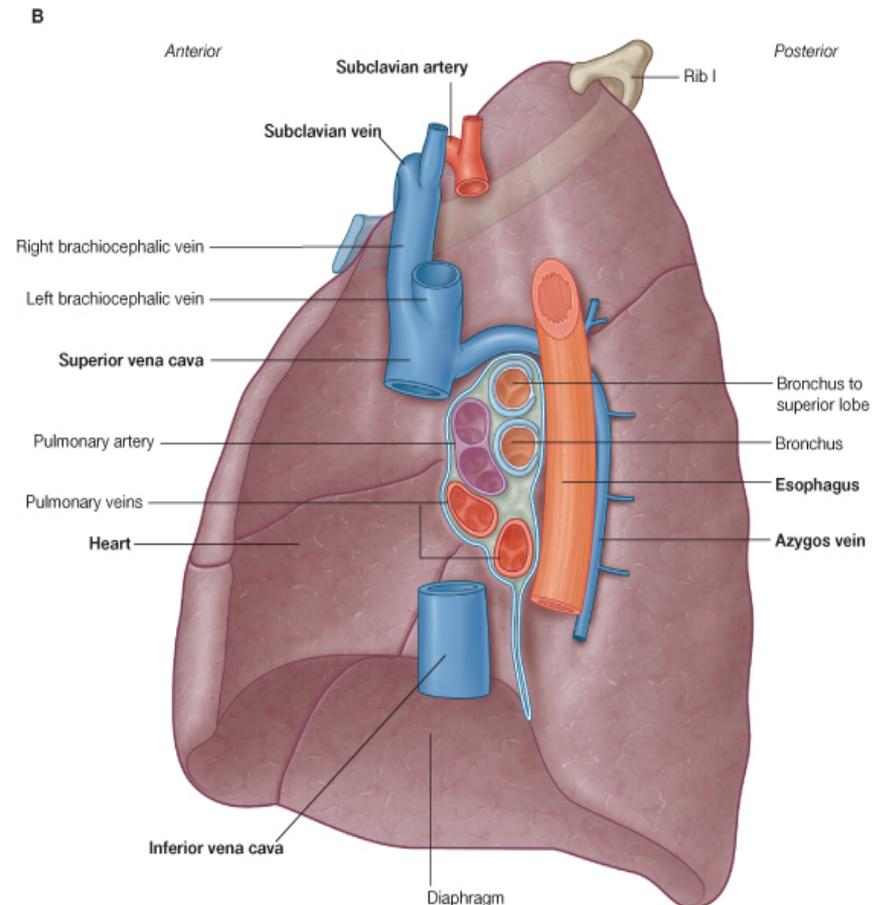
Right lung

- The medial surface of the right lung lies adjacent to a number of important structures the heart,
- **inferior vena cava,**
- **superior vena cava,**
- **azygos vein,**
- **esophagus.**



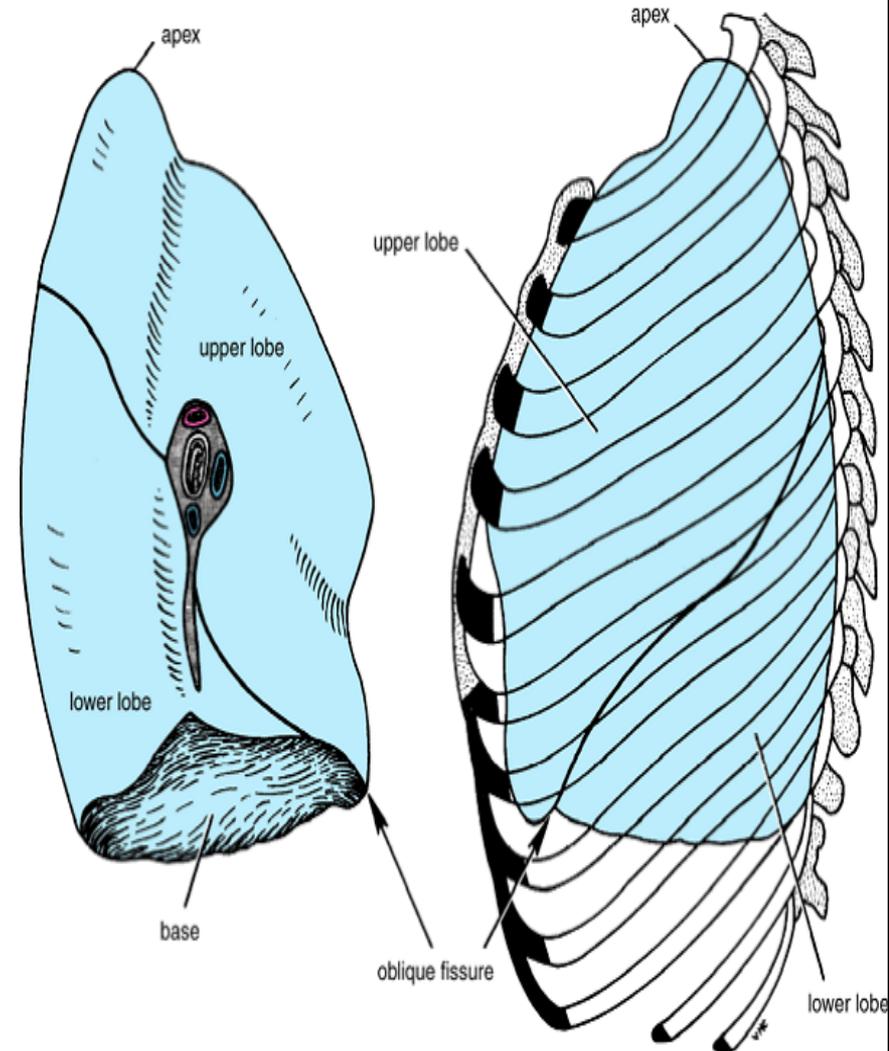
Right lung

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



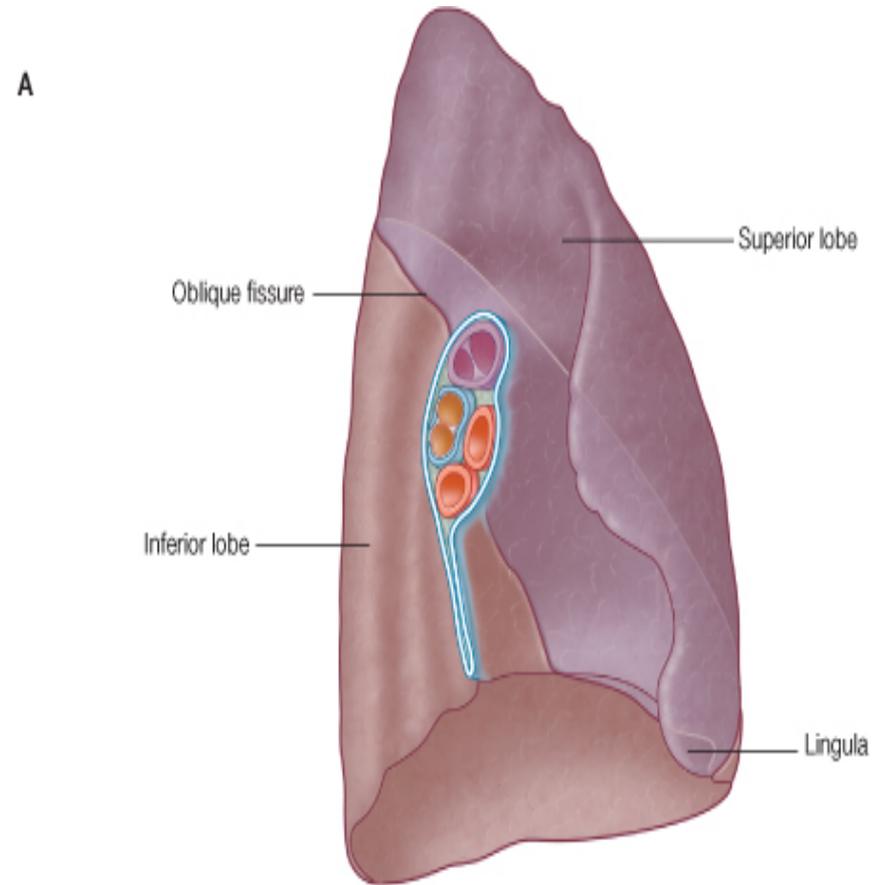
Left lung

- 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*
- *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.*



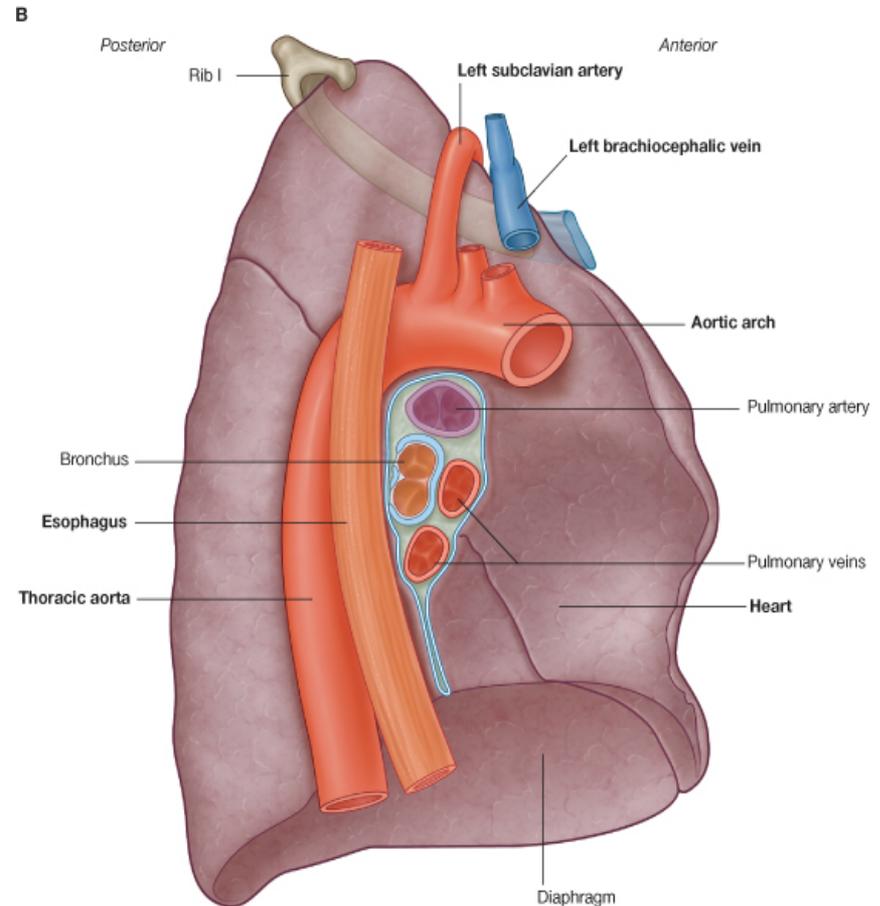
Left lung

- 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
- On the anterior surface of the lower part of the superior lobe a tongue-like extension (the **lingula of left lung**) projects over the heart bulge.



Left lung

- The medial surface of the left lung lies adjacent to a number of important structures the
- **heart,**
- **aortic arch,**
- **thoracic aorta,**
- **esophagus**



RIGHT LUNG

3 Lobes
Upper Middle and Lower

2 Fissures
Oblique & Horizontal

Segments

Secondary Lobules

LEFT LUNG

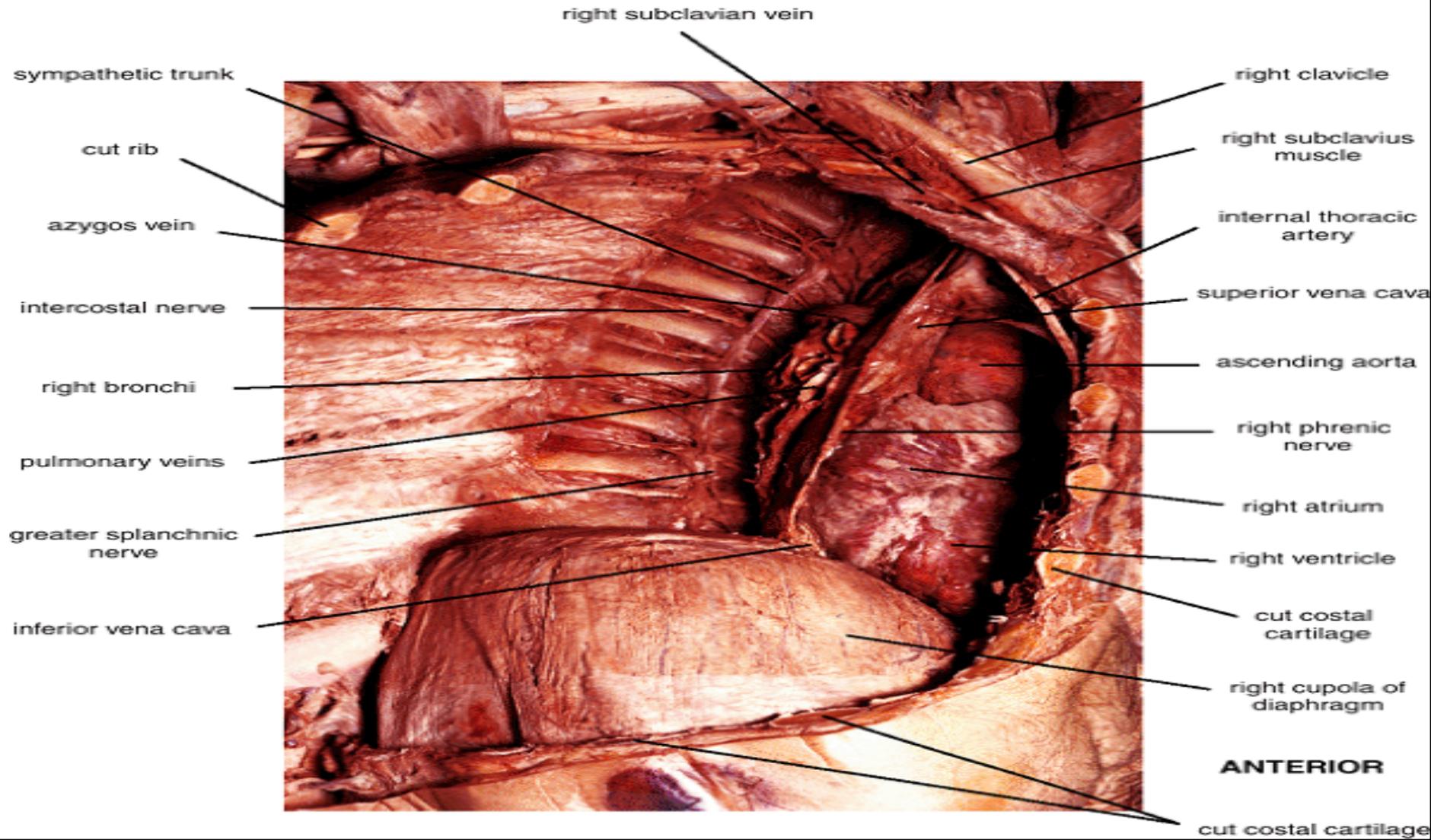
2 Lobes
Upper and Lower

1 Fissure
Oblique

Segments

Secondary Lobules

Right side

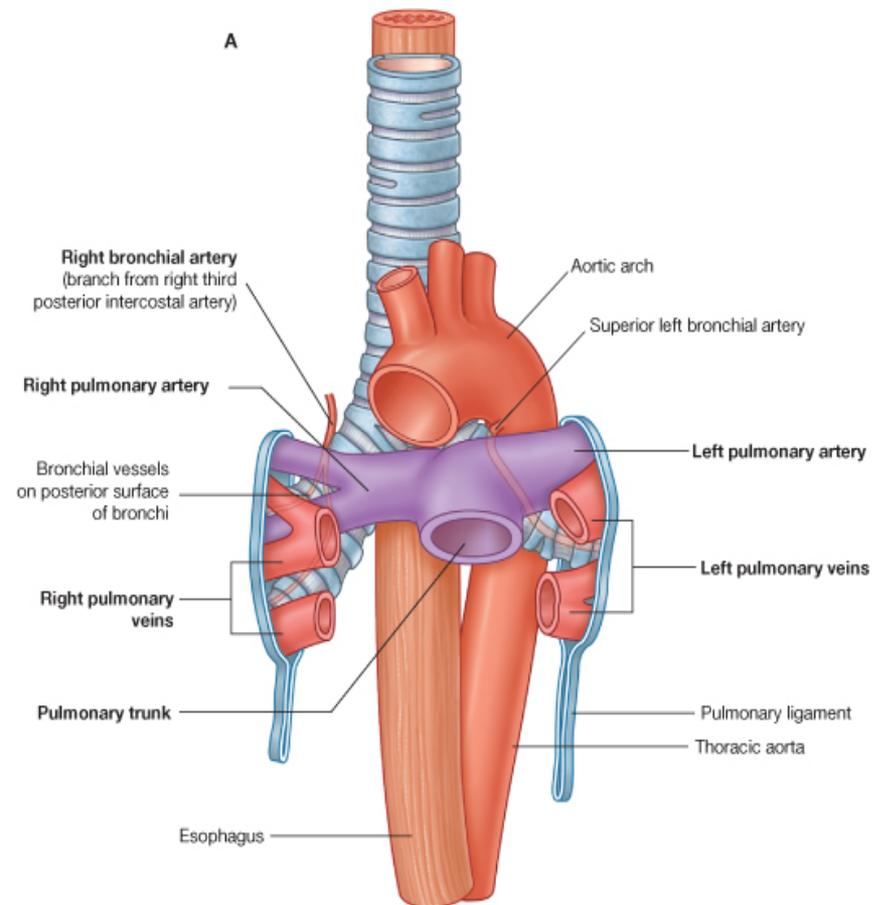


Left side



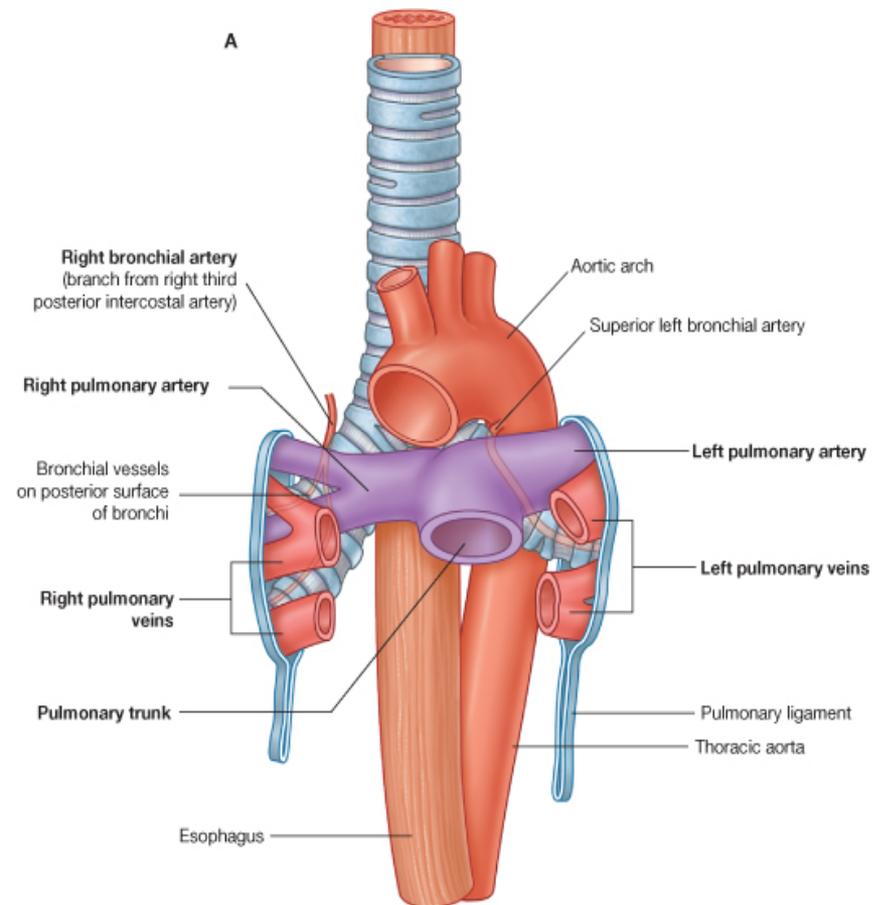
Pulmonary arteries

- 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, 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. It 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.



Pulmonary arteries

- The right pulmonary artery enters the root of the lung 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
- It passes through the root and hilum and branches within the lung.



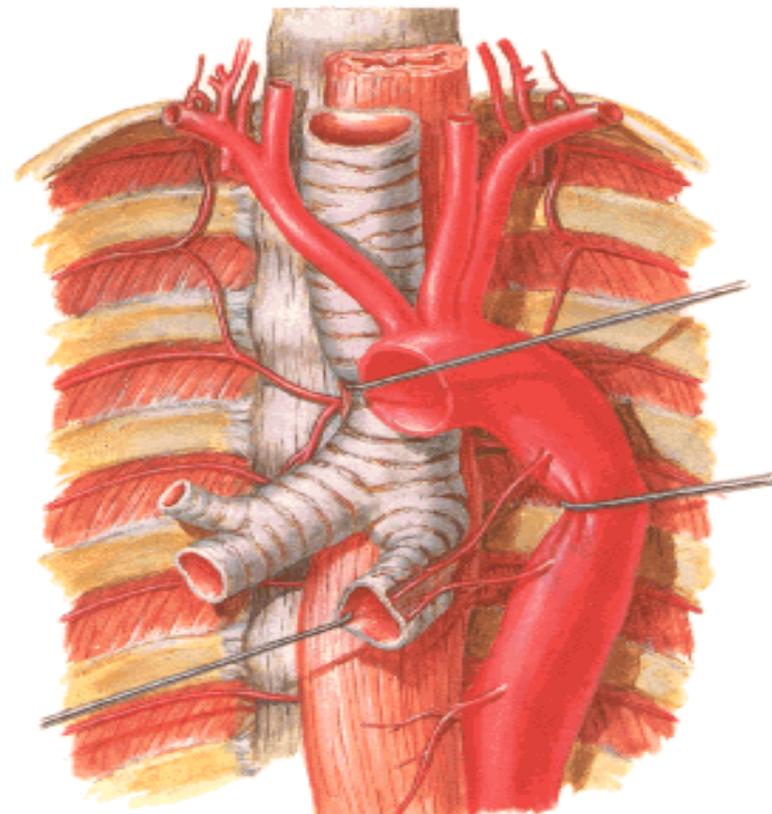
Pulmonary veins

- 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

- 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 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
- the **superior left bronchial artery** arises at vertebral level T5, and the inferior one inferior to the left bronchus.
- The bronchial arteries run on the posterior surfaces of the bronchi and ramify in the lungs to supply pulmonary tissues.

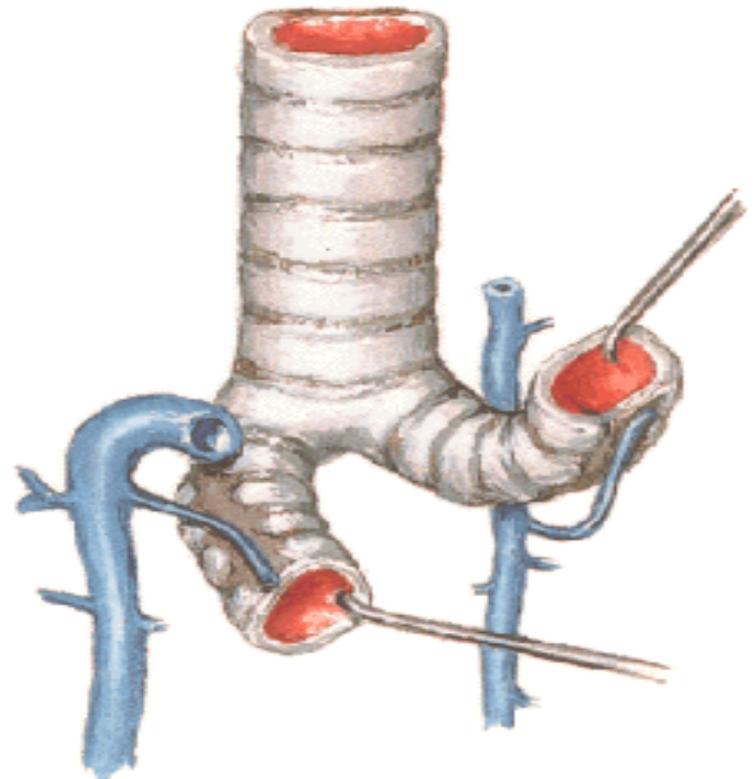
Bronchial Arteries



bronchial veins

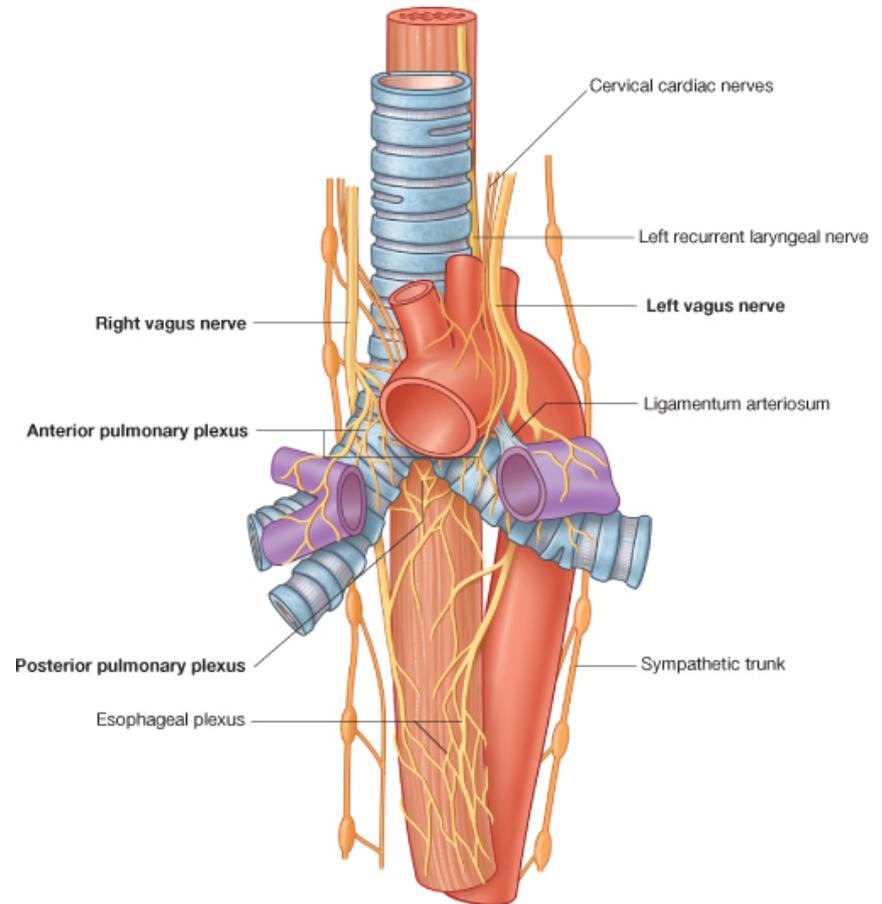
- **bronchial veins** drain into:
 - either the pulmonary veins or the left atrium;
 - into the azygos vein on the right or into the superior intercostal vein or hemiazygos vein on the left.

Bronchial Veins



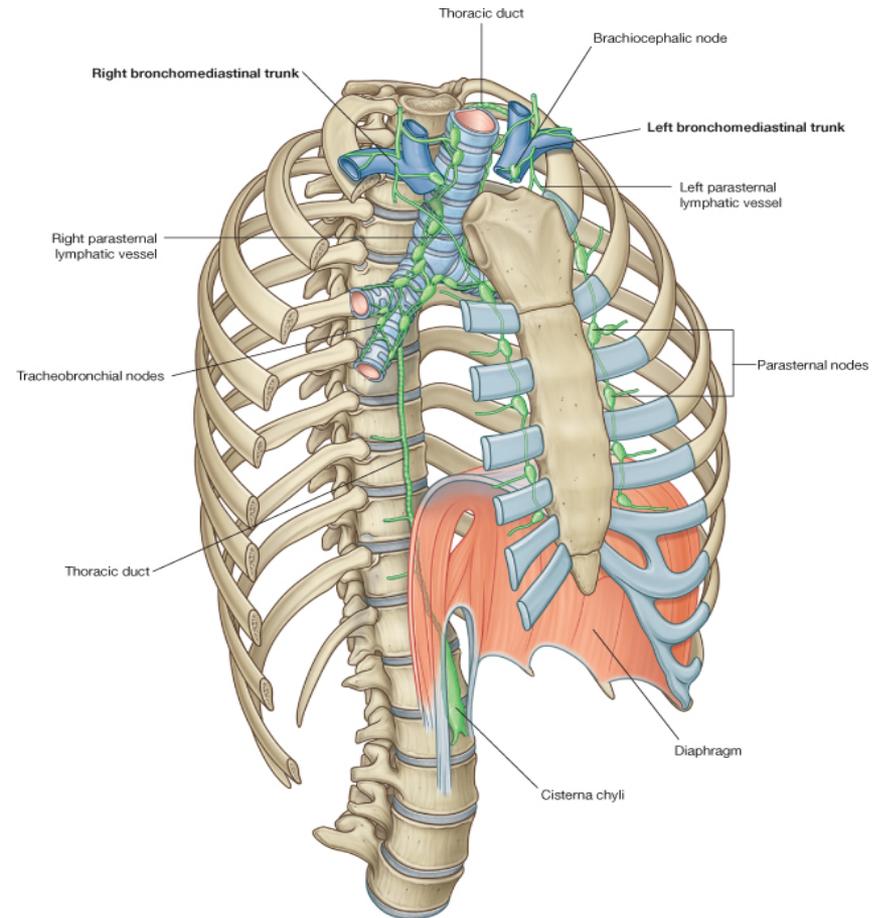
Innervation

- 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
- **Visceral efferents** from:
 - the vagus nerves constrict the bronchioles;
 - the sympathetic system dilate the bronchioles.



Lymphatic drainage

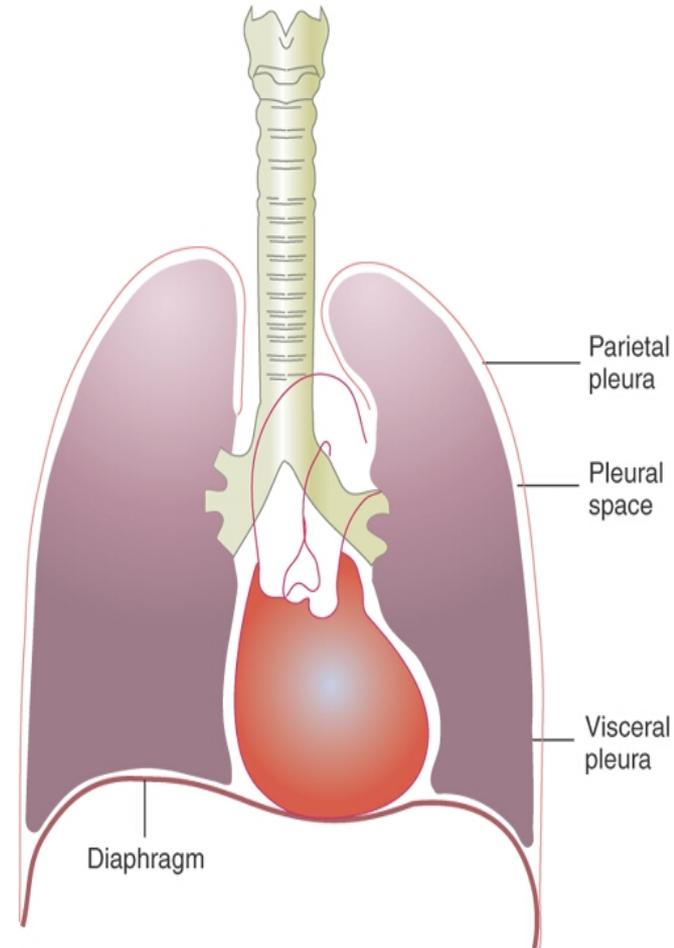
- Superficial, or subpleural, and deep lymphatics of the lung drain into lymph nodes called **tracheobronchial nodes** around the roots of lobar and main bronchi and along the sides of the trachea
- As a group, these lymph nodes extend from within the lung, through the hilum and root, and into the posterior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



Pleura

Pleura

- Each pleural cavity is lined by a single layer of flat cells, mesothelium, and an associated layer of supporting connective tissue; together, they form the pleura
- The **pleura** is divided into two major types, based on location:
 - pleura associated with the walls of a pleural cavity is **parietal pleura**;
 - **visceral pleura** which adheres to and covers the lung.
- Each pleural cavity is the potential space enclosed between the visceral and parietal pleurae. They normally contain only a very thin layer of serous fluid
- As a result, the surface of the lung, which is covered by visceral pleura, directly opposes and freely slides over the parietal pleura attached to the wall.



Pleura

- **Function:**

- 1- protection

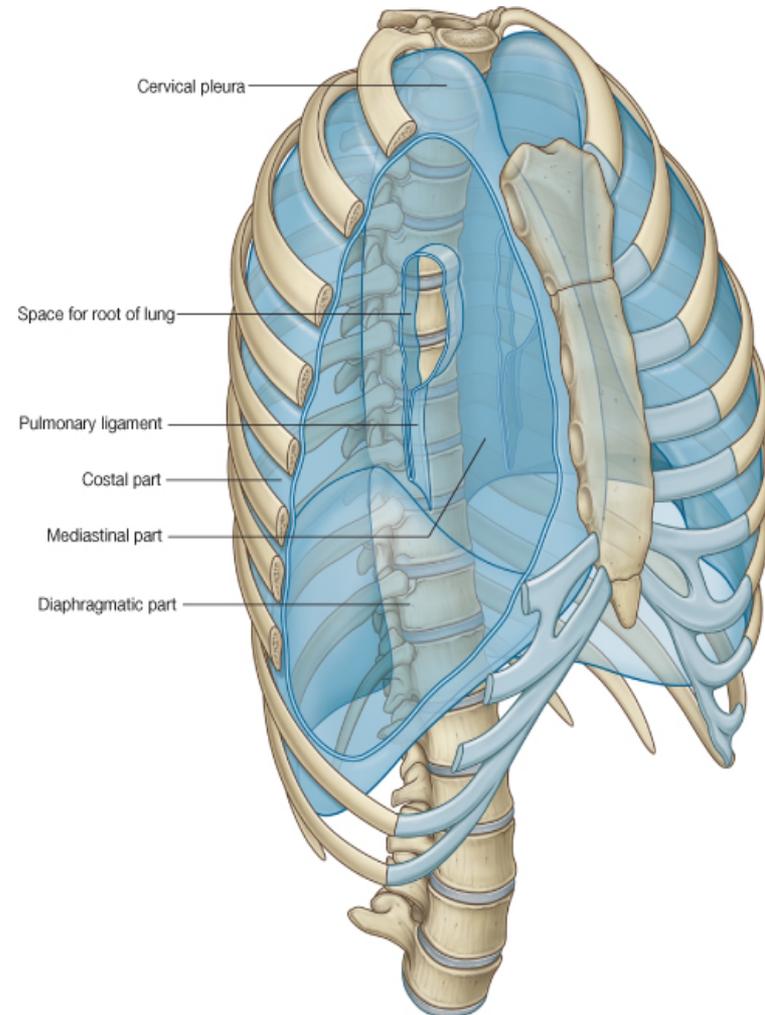
- 2- Produces fluid that allows for lubrication

- Failure to function results in difficult painful breathing

- The pleural cavity is a site for—pneumothorax, pleural effusion, Empyema & haemothorax.

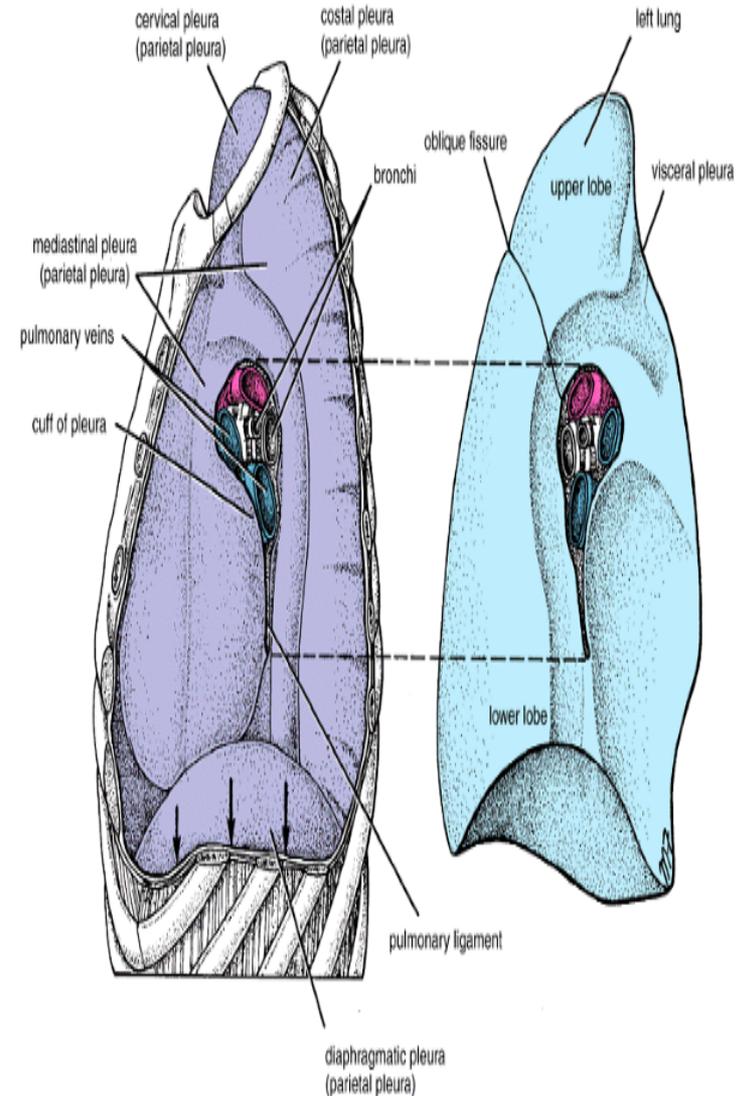
Pleura

- The names given to the parietal pleura correspond to the parts of the wall with which they are associated
- pleura related to the ribs and intercostal spaces is termed the **costal part**;
- pleura covering the diaphragm is the **diaphragmatic part**;
- pleura covering the mediastinum is the **mediastinal part**;
- the dome-shaped layer of parietal pleura lining the cervical extension is **cervical pleura (dome of pleura or pleural cupola)** and is covered by **suprapleural membrane (sibson's fascia)**.



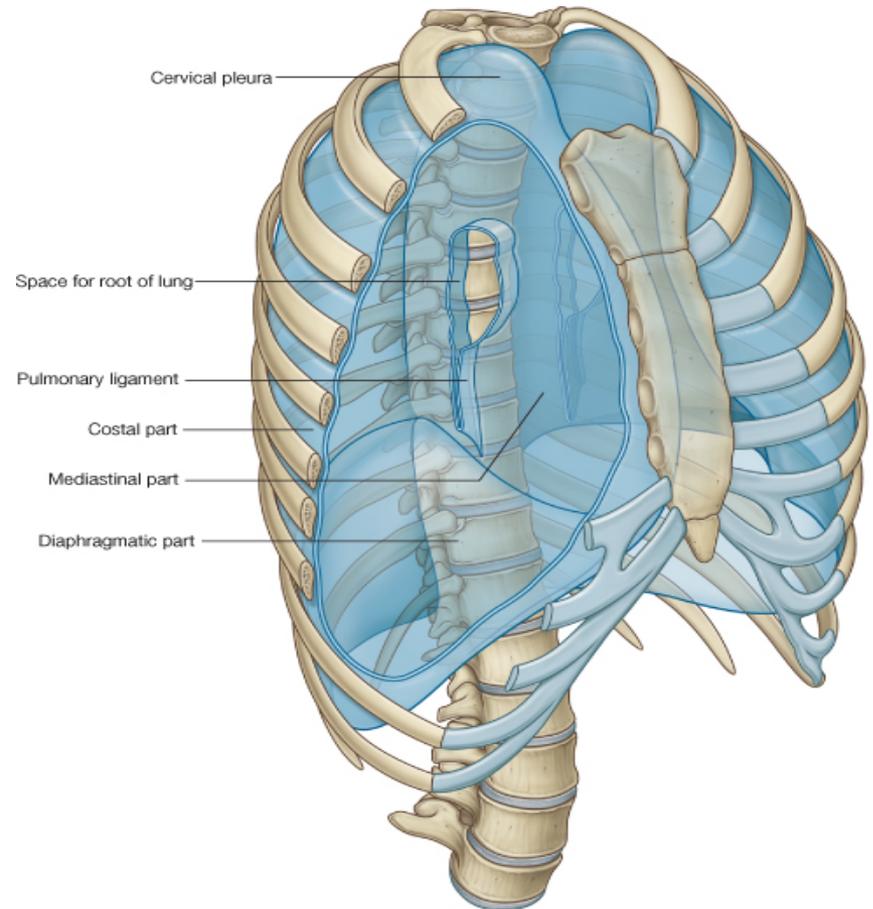
Pleura

- in the region of vertebrae TV to TVII, the mediastinal pleura reflects, forms the **root of the lung**
- The root joins the medial surface of the lung at the **hilum**, and the mediastinal pleura becomes continuous with the visceral pleura.



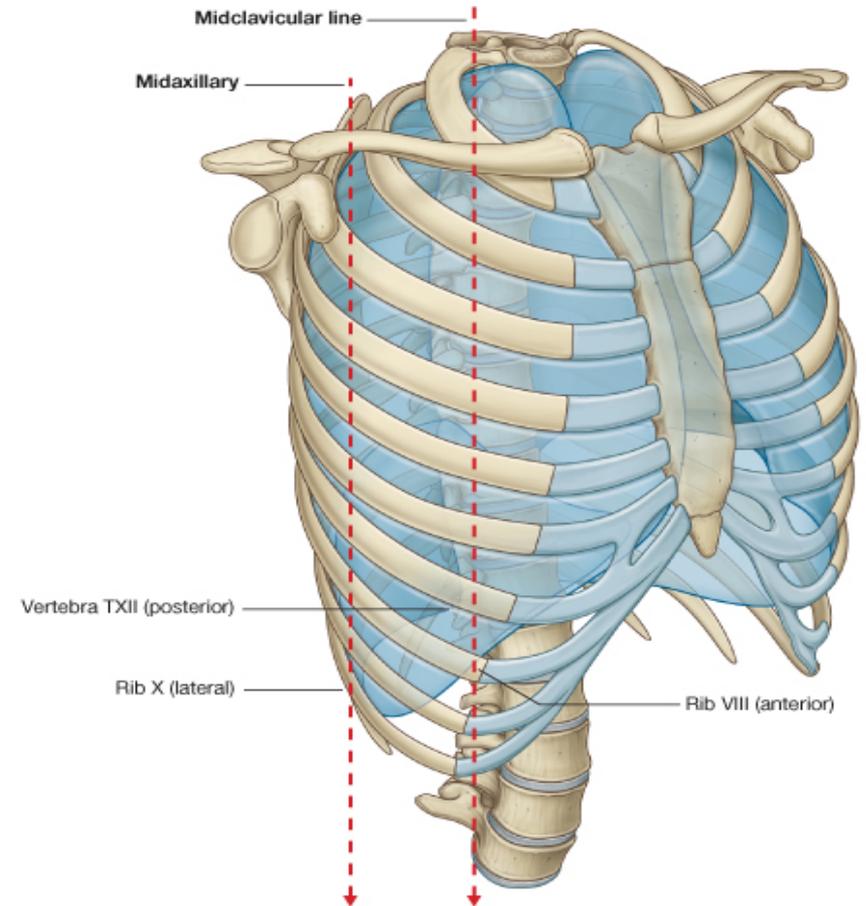
Peripheral reflections

- The peripheral reflections of parietal pleura **mark the extent of the pleural cavities**
- Superiorly, the pleural cavity can project as much as 3-4 cm above the first costal cartilage, but does not extend above the neck of rib I.
- This limitation is caused by the inferior slope of rib I to its articulation with the manubrium.
- Anteriorly, the pleural cavities approach each other posterior to the upper part of the sternum.
- posterior to the lower part of the sternum, the parietal pleura does not come as close to the midline on the left side as it does on the right because the heart bulges to the left.



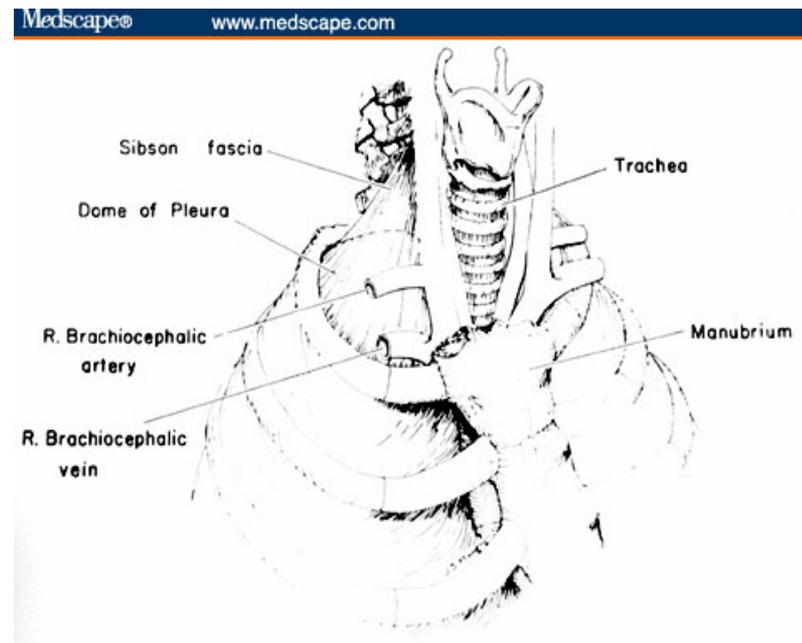
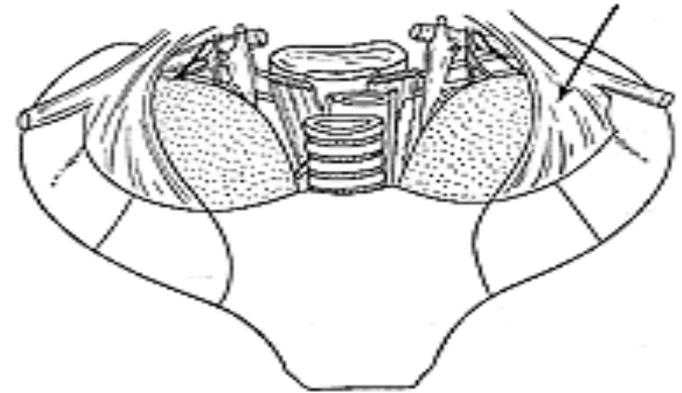
Peripheral reflections

- Inferiorly, the costal pleura reflects onto the diaphragm above the costal margin. In the midclavicular line, the pleural cavity extends inferiorly to approximately rib VIII.
- In the midaxillary line, it extends to rib X.
- From this point, the inferior margin courses somewhat horizontally, crossing ribs XI and XII to reach vertebra TXII.
- From the midclavicular line to the vertebral column, the inferior boundary of the pleura can be approximated by a line that runs between the rib VIII, rib X, and vertebra TXII.



Suprapleural membrane

- A fibrous sheath attached to :
- Laterally: medial border of 1st rib and costal cartilage
- Medially : blend with fascia investing the structure that pass from thorax to neck
- Apex : to the tip of the transverse process of the 7th cervical vertebra
- Action : protect the cervical pleura and lung a
- Also resist changes in the intrathoracic pressure during respiratory movements

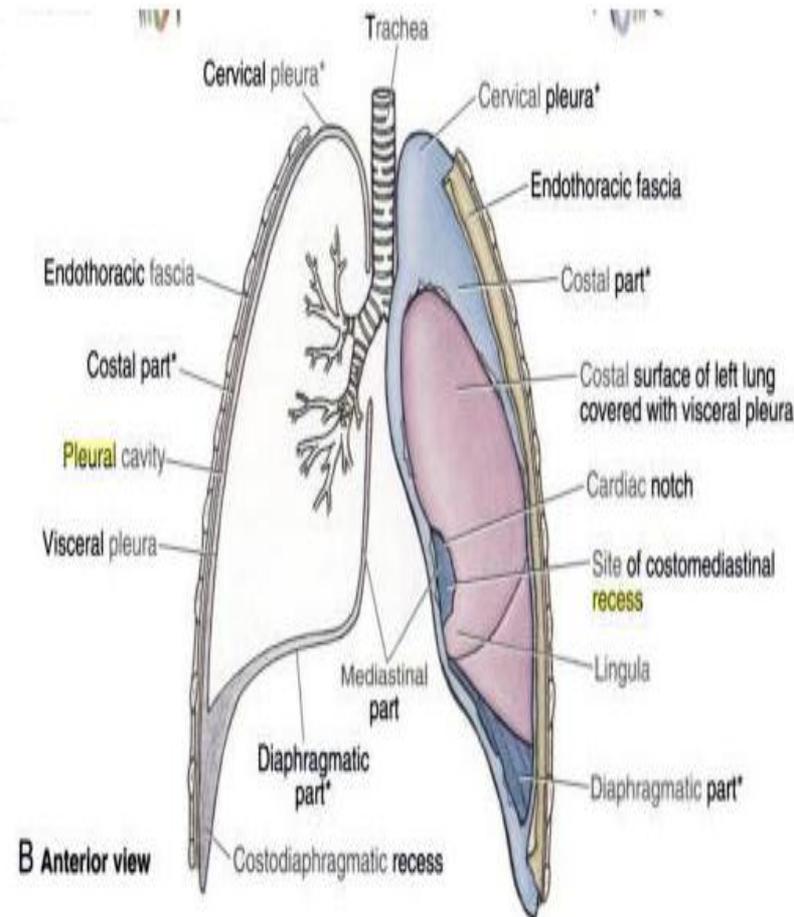


Visceral pleura

- Visceral pleura is continuous with parietal pleura at the hilum of each lung where structures enter and leave the organ
- The visceral pleura is firmly attached to the surface of the lung, including both opposed surfaces of the fissures that divide the lungs into lobes

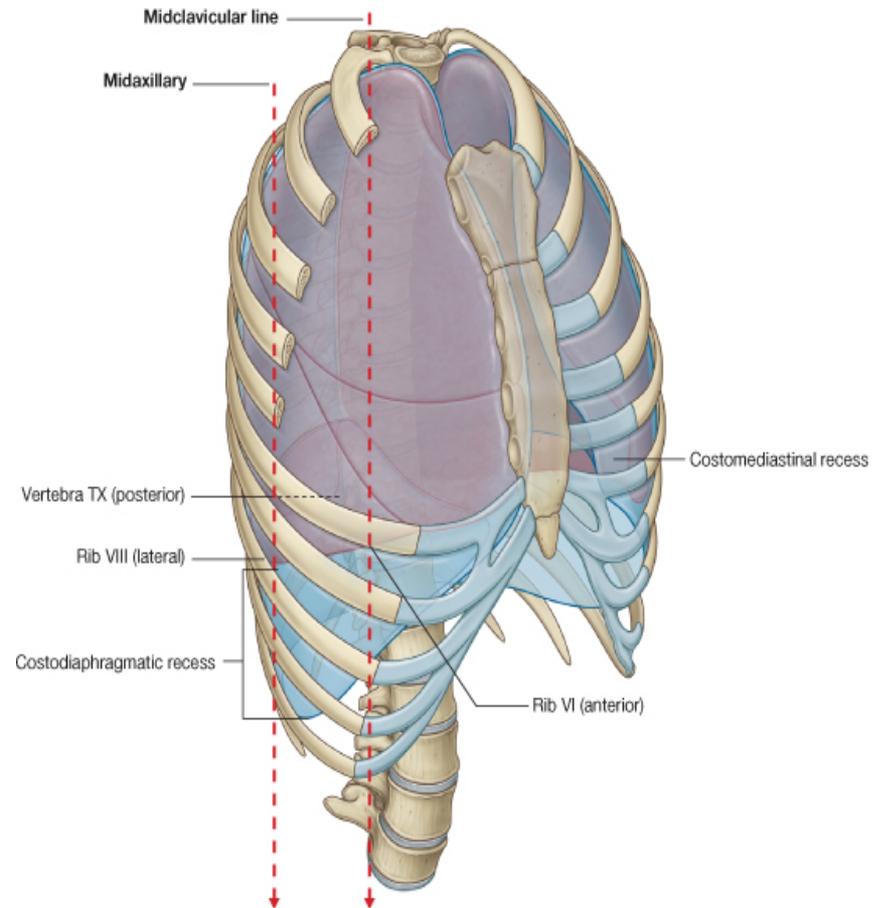
Pleural recesses

- The lungs do not completely fill the anterior or posterior inferior regions of the pleural cavities
- This results in recesses in which two layers of parietal pleura become opposed.
- Expansion of the lungs into these spaces usually occurs only during forced inspiration
- the recesses also provide potential spaces in which fluids can collect and from which fluids can be aspirated.



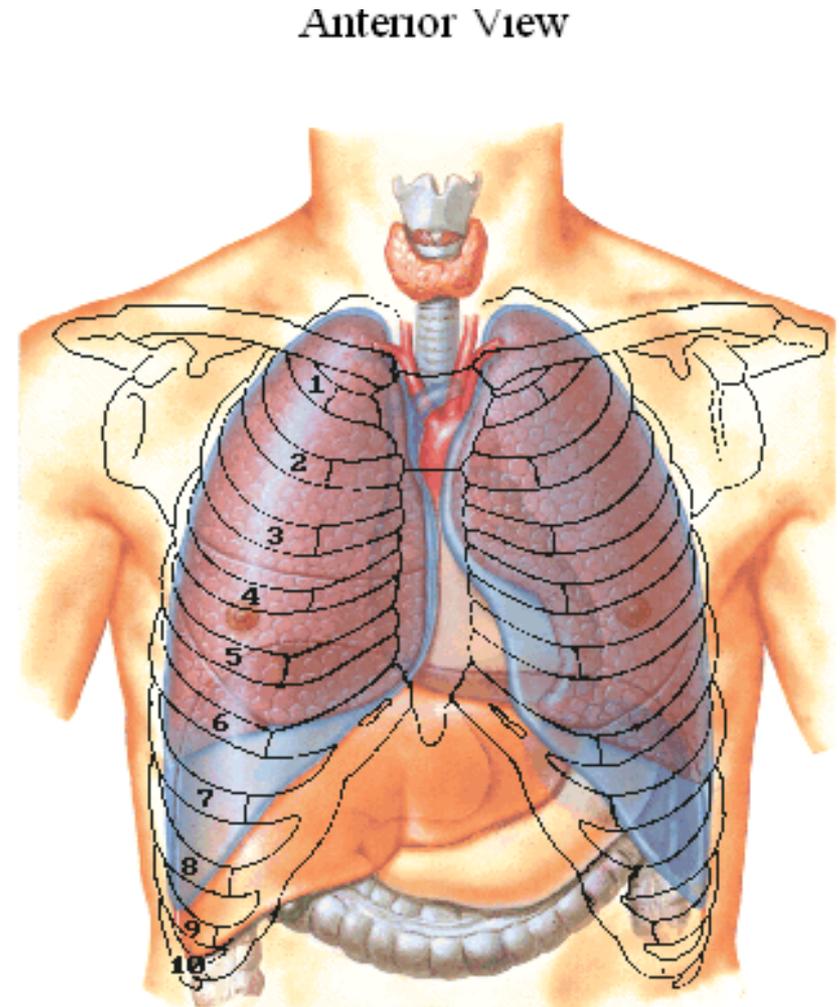
Pleural recesses

- Costomediastinal recesses occurs on each side where costal pleura is opposed to mediastinal pleura. The largest is on the left side in the region overlying the heart.
- The largest and clinically most important recesses are the **costodiaphragmatic recesses**,
- which occur in each pleural cavity between the costal pleura and diaphragmatic pleura
- The costodiaphragmatic recesses are the regions between the inferior margin of the lungs and inferior margin of the pleural cavities

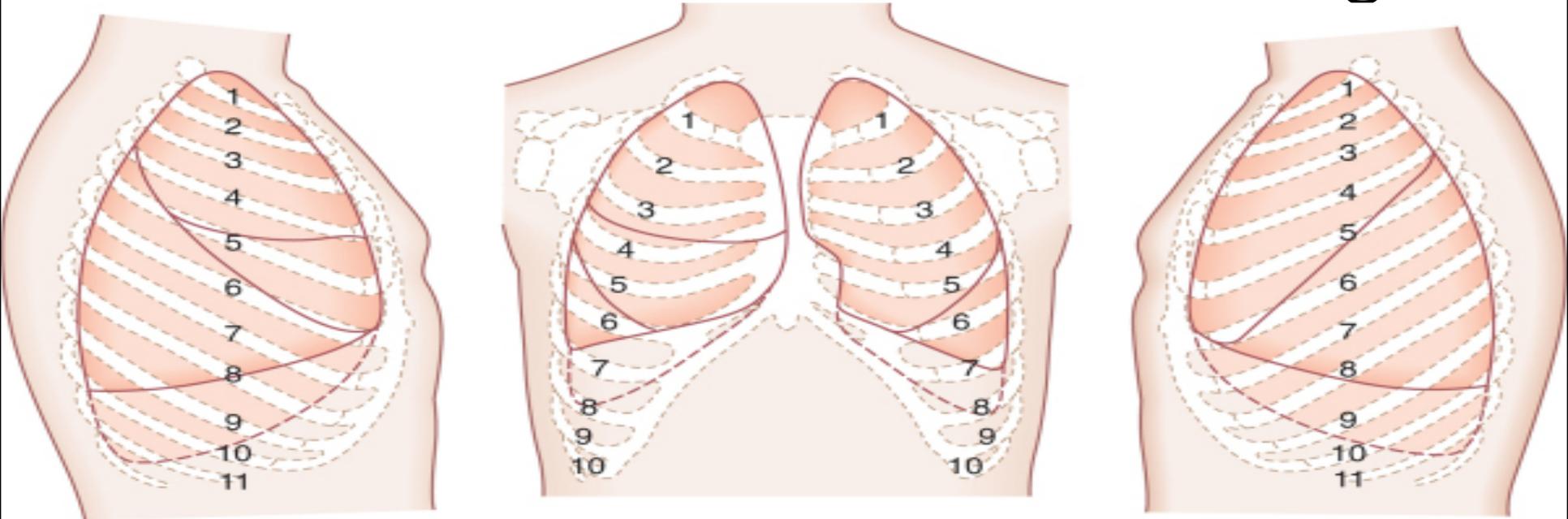


Pleural recesses

- They are deepest after forced expiration and shallowest after forced inspiration.
- During quiet respiration, the inferior margin of the **lung** crosses rib VI in the midclavicular line, rib VIII in the midaxillary line, and then courses somewhat horizontally to reach the vertebral column at vertebral level T10
- the inferior margin of the **lung** can be approximated by a line running **between rib VI, rib VIII, and vertebra T10.**
- The inferior margin of the pleural cavity at the same points is **rib VIII, rib X, and vertebra T12.** The costodiaphragmatic recess is the region between the two margins.



The relationships of the pleural reflections and the lobes of the lung



at the midclavicular line, the recess is between rib spaces 6 and 8,

- at the midaxillary line between 8 and 10
- at the paravertebral line between 10 and 12.

Costodiaphragmatic recess

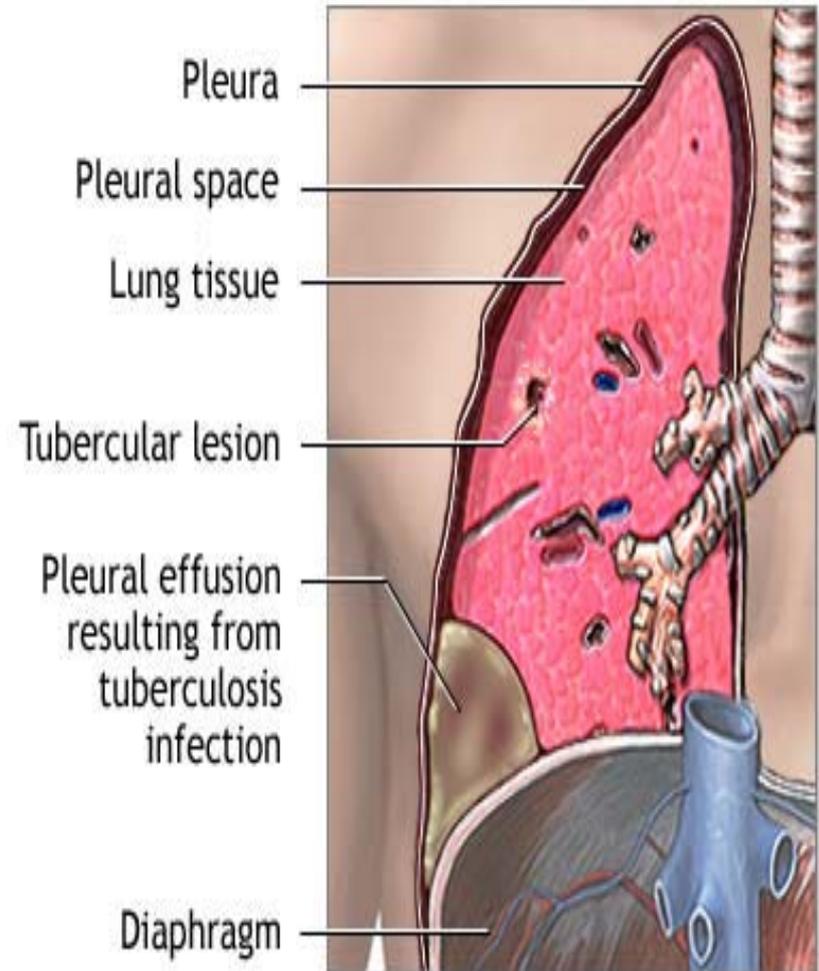
- 1" (1 inch) in the midclavicular line
- 2" in the scapular line post
- 3" in the midaxillary line

Clinical note

- Aspiration of fluid (pneumothorax) from the pleural cavity by putting a needle through the 7th intercostal space in the midclavicular line or in any other recesses
- The needle is put in the lower border of the space.

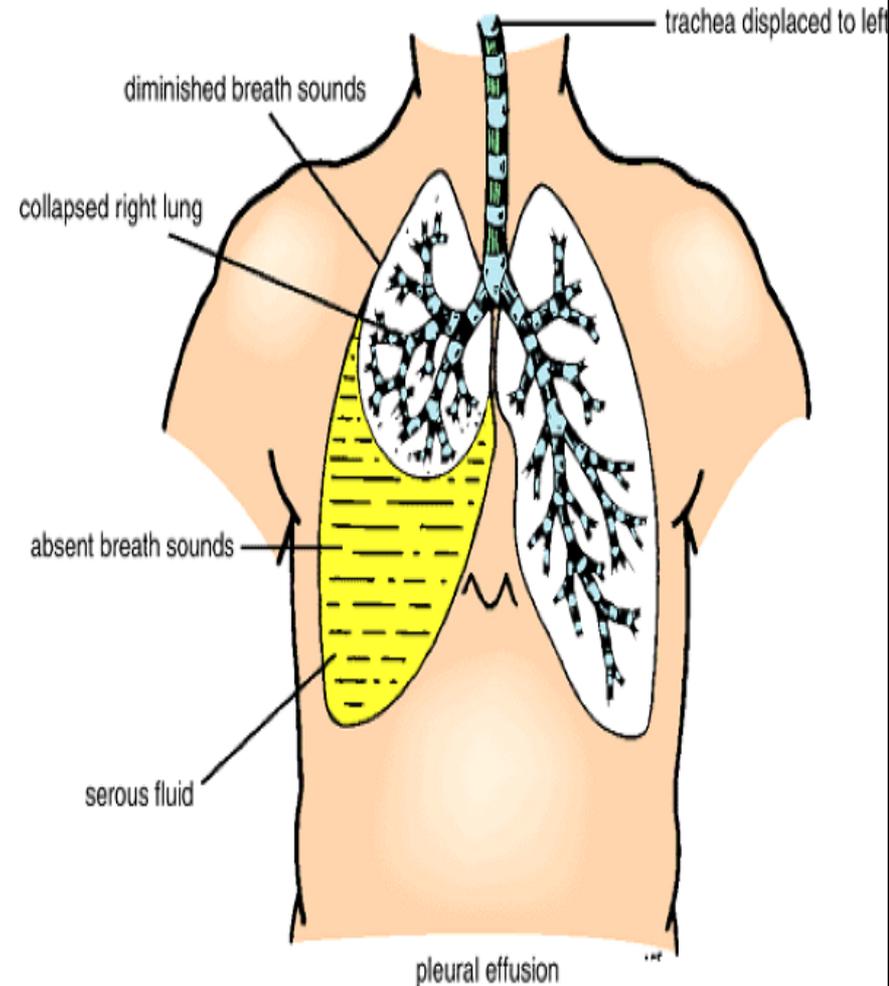
Pleural effusion

- Pleural space normally contain 5- 10 ml of clear fluid
- Absorbed normally by visceral pleura by hydrostatic and osmotic pressure
- Pleural effusion: is accumulation of excess fluid within the pleural cavity, pleural fluid increase more than 300 (ml) in costodiaphragmatic recess
- Main causes
 - 1- Infection
 - 2- Injury



Clinical Manifestations

- Decrease in lung expansion
- Decrease breath sound
- In Percussion → Dullness
- Pain
- Cough



Nerve supply of the pleura

Parietal pleura:

- It is sensitive to

pain

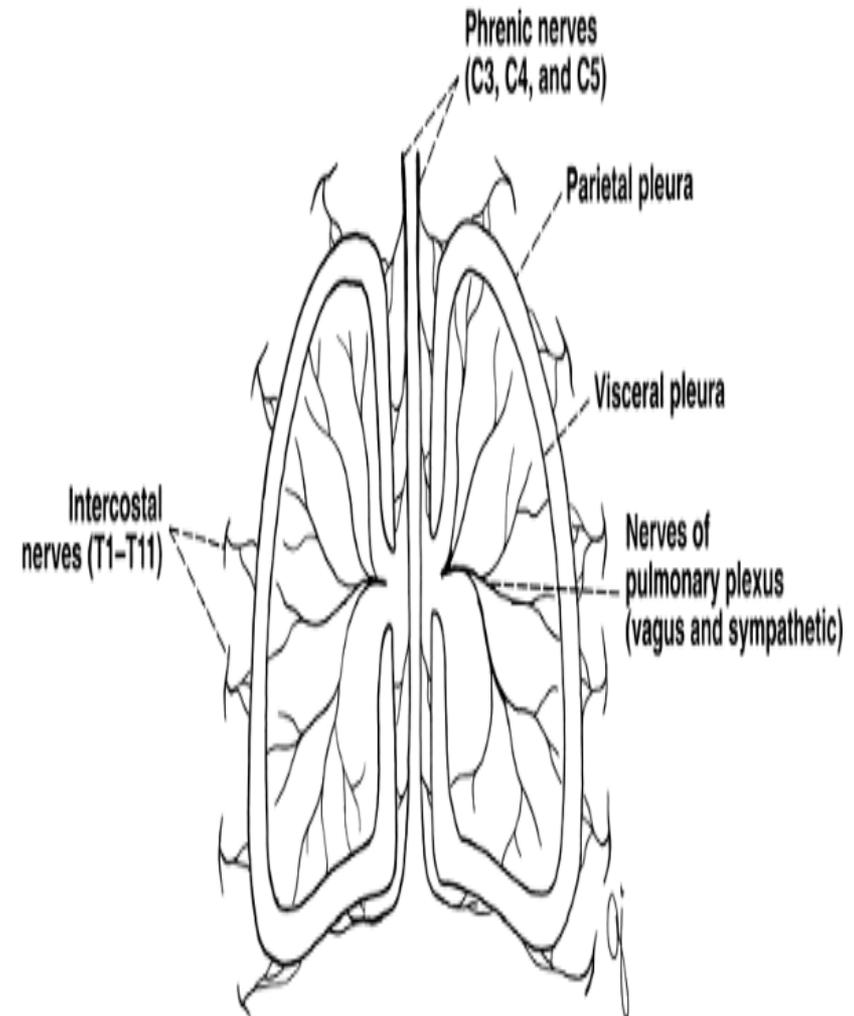
Temp

Touch & pressure

- 1- Intercostal nerves → Costal pleura (segmentally)
- 2- Phrenic nerve → Mediastinal pleura + diaphragmatic pleura
- 3- lower 6 intercostal → peripheral pleura

Visceral pleura

- Sensitive to stretch
- Insensitive to pain, temp or touch
- Supplied by pulmonary plexus & autonomic.N.S



Arterial Supply of the Pleura

- The arterial supply of the parietal pleura is from the arteries that supply the **thoracic wall**

Intercostal arteries(ant& post)

Internal thoracic

Musculophrenic arteries.

- The arterial supply of the visceral pleura is from the
-**Bronchial arteries**, which are branches of the **thoracic aorta**.

Veins drain into **azygos & internal thoracic veins**.

Lymphatic drainage of pleura

parietal pleura

Mediastinal pleura by

- 1- mediastinal nodes
- 2- Tracheobronchial nodes
- 3- Intercostal nodes

Diaphragmatic pleura

- 1- Parasternal nodes
- 2- Post.mediastinal nodes

- **Pulmonary pleura(visceral)** :along bronchial arteries → bronchopulmonary nodes

Thank you