

Anatomy

Lecture – 8 –

In the previous lecture we talked about the lungs, and their surface anatomy:

1-Apex: it lies 1 inch above the medial third of clavicle.

2-Anterior border: it starts from apex to the midpoint of the sternal angle and extends downward to the xiphisternal joint at the level of 6th costal cartilage.

3- Base: crosses the midclavicular line at the 6th rib, the mid axillary line at the 8th rib and posteriorly it reaches the 10th thoracic spine (T10).

4- Posterior Border: If we take 4 cm away from the posterior sagittal line we can -from the apex- mark the posterior border. The posterior border is marked from the apex, about 4 cm away from the dorsal spine until it reaches T10.

The surface anatomy of the pleura is the same as the lung's surface anatomy except that its inferior surface (base) is increased by two spaces; so it crosses the midclavicular line at the 8th rib, midaxillary line at the 10th rib, and posteriorly it reaches the 12th thoracic spine (T12).

Note: When the lung inflates, it enlarges by two spaces to fill up the pleural spaces.

The surface anatomy is clinically very important: if we want to do aspiration for fluid (in cases of pleural effusion), puss (Empyema), or blood (Hemothorax) the needle is inserted in this increased space which is below the surface anatomy of the lung and above the surface anatomy of the pleura .

The insertion of the needle:

- Midclavicular: 7th intercostal space.

- Midaxillary: 9th intercostal space.

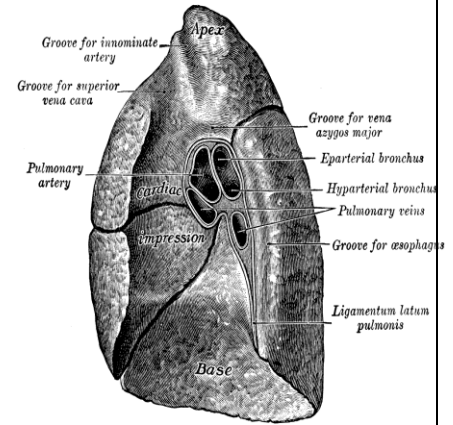
- Posteriorly: 11th intercostal space.

Right lung

- Shorter and wider than the left lung, because the liver pushes the right lung upwards.
- The right lung has three lobes (upper, middle, lower), two fissures (oblique and horizontal fissures), and two surfaces (mediastinal surface and costal surface).

This is a picture of the mediastinal surface showing:

- The three lobes and the two fissures.
- The hilum is surrounded by pleura, the two layers of the pleura (the parietal and the visceral) fuse at the hilum, this will form a sleeve around the pulmonary vessels, and these fused layers will continue downwards as the pulmonary ligament. –pulmonary ligament is found on both lungs



- In the hilum the bronchi (2 primary bronchi) are posterior, the pulmonary artery (one artery) is anterior to the bronchi, and below them are the superior and inferior pulmonary veins (two veins).

As we are talking about the right lung; then there are two primary bronchi:

- 1- The eparterial bronchus (above the pulmonary artery).
- 2- The hyparterial bronchus (below the pulmonary artery).

The surface anatomy of the fissures:

1- The oblique fissure :

- Separates the middle lobe from the lower lobe.
- Begins posteriorly at the level of T4 (4 cm away from T4), then it crosses the 5th intercostal space laterally, and continues with the 6th rib anteriorly.

2- The horizontal fissure:

- Separates the upper lobe from the middle lobe.
- Begins from the 4th intercostal space, it crosses the 5th rib reaching the midline (starting from anterior to midaxillary line).

- ✓ When listening to the lung sounds from each lobe, it is important to place the stethoscope on the right areas, and this is done by knowing the surface anatomy of the fissures; that's why their surface anatomy is essential clinically.

The mediastinal surface of the right lung lies adjacent to (related to) a number of important structures: (related to veins and venous circulation)

- Most importantly it is related to the heart (the right atrium specifically).
- Inferior vena cava.
- Superior vena cava.
- Azygos vein – forms an arch above the hilum of the right lung.
- Esophagus – its impression starts from the apex and continues behind the hilum.
The esophagus is at the midline that's why it makes an impression on both lungs above the hilum, then it deviates to the left, passing anterior to the thoracic aorta, and then it passes through the left copula of the diaphragm one inch to the left of the midline.
- Trachea - found anterior to the esophagus and it is deviated to the right so it makes an impression only on the right lung.
- Other impressions –not very obvious- : the 1st rib on the anterior border, subclavian artery (more visible on the left lung), and brachiocephalic vein.

Left lung

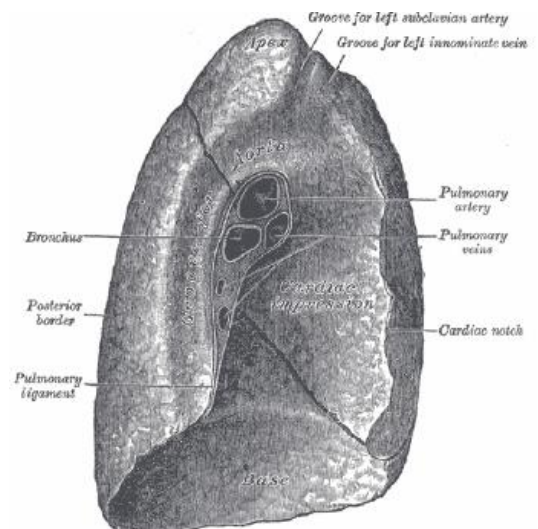
- Narrower and longer than the right lung.
- Two lobes only, separated by the oblique fissure.
- Left lung has lingula and cardiac notch.

The surface anatomy of the oblique fissure :

- Begins from the spinous process of T3(between T3 and T4 according to some books), crosses the 5th intercostal space laterally, and follows the 6th rib anteriorly.

Hilum:

- Only one primary bronchus.
- One Pulmonary artery:most superior.
- Two Pulmonary veins: one anterior and one inferior to the bronchus. (the same in both right and left lungs).
- Pulmonary ligament
- Bronchial vessels, lymphatic vessels, nerves (from the vagus and sympathetic), and lymph nodes (dark and clear especially in smokers).



The mediastinal surface of the left lung lies adjacent to (related to) a number of important structures:

- Heart – the relation is to the pericardium of the left ventricle, which occupies the space anterior to the hilum.
- Aortic arch – above the hilum, continues as the descending thoracic aorta.
- Esophagus.
- Thoracic aorta.
*** If the pointer in the lab is placed directly behind the hilum then that's the esophagus, if it's placed more posterior then that's the thoracic aorta.*
- Left subclavian artery and left common carotid artery – impression above the hilum to the anterior border.
- 1st rib – on the anterior border of both right and left lungs.
- Left brachiocephalic vein – on the anterior border above the impression of the 1st rib.

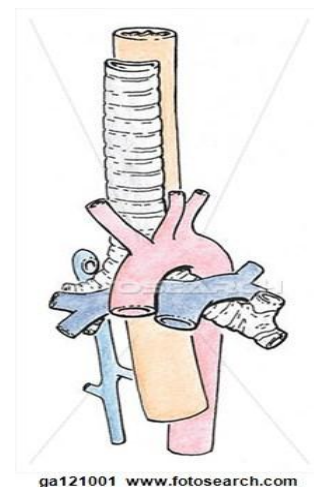
Note: The trachea doesn't have an impression on the left lung because it's deviated to the right.

Right lung	Left lung
3 lobes	2 lobes
2 fissures	1 fissure
10 segments	10 segments
Eparterial and hyperarterial bronchus.	Only one bronchus

Pulmonary arteries and Bronchial arteries:

Shown in the picture:

- *Esophagus: in the midline at first then deviates to the left.
- * Trachea (gives right and left main bronchus), the arch of the aorta is anterior to them, then the descending aorta.
- *Pulmonary trunk.



Pulmonary Trunk:

Begins from the right ventricle at the pulmonary valve so it carries deoxygenated blood, then ascends to give the right and left pulmonary arteries.

The bifurcation of pulmonary trunk: at the level of T4 (Sternal angle). The trachea bifurcates here as well.

- Right pulmonary artery:
 - Longer than the left pulmonary artery.
 - Relations: it is posterior to the ascending aorta, superior vena cava, and upper right pulmonary vein.
- Left pulmonary artery:
 - Shorter than the right pulmonary artery.
 - Relations: anterior to the descending aorta, and posterior to superior pulmonary vein.

Pulmonary Veins:

-There are four pulmonary veins.

-Begin from the hilum of the lungs and go to the left atrium.

-They carry oxygenated blood.

Bronchial Arteries (related to the bronchi and supply the pulmonary tissue):

- There are right and left bronchial arteries:

- ❖ A singleRight bronchial artery: arises from the 3rd posterior intercostal artery, which is a branch from the descending thoracic aorta.
- ❖ TwoLeft bronchial arteries: originates from the thoracic aorta directly.

1-The superior left bronchial artery arises at vertebral level T5.

2-The inferior one is inferior to the left bronchus.

-They are present in the hilum, and they supply the lung tissue and the pleura, so they are the main blood supply to the lung tissue and alveoli.

Bronchial veins

- They drain into theazygos vein (on the right side), or the hemiazygos vein (on the left side).
- They may drain directly into the left atrium or pulmonary veins.

Innervation:

Through two plexuses of nerves: 1- The anterior pulmonary plexus. 2- The posterior pulmonary plexus.

(They are related anteriorly and posteriorly to the bifurcation of trachea).

- From the vagus nerve: parasympathetic (secreto-motor to glands).
- From the cervical sympathetic ganglia: sympathetic (vasoconstriction of the blood vessels).

Lymphatic Drainage:

*Superficial (subpleural) lymphatics.

*Deep lymphatics (from the lung tissues).

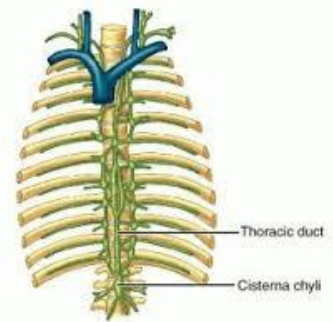
- These lymph nodes extend from within the lungs, through the hilum and root, into the posterior mediastinum.

- There are Trachiobronchial lymph nodes and Mediastinal lymph nodes and they drain eventually into the thoracic duct that drains into the venous circulation.

Notice the cisterna chyli; which is a sac of lymphatics at the opening of the abdominal aorta of the diaphragm, and the thoracic duct.

Note:

- ❖ *Thoracic duct (on the left side) ascends posteriorly to the esophagus and ends at the beginning of the brachiocephalic vein (or at the union of the internal jugular and subclavian veins).*
- ❖ *Right thoracic duct (on the right side) ascends from the upper surface of the liver, passes through the diaphragm to the right side of the chest.*



Pleura

-It surrounds the lungs.

- It consists of **two layers**:

1-Outer (parietal): lines the thoracic cage.

2-Inner (visceral): covers the tissue of the lung, and it enters the fissures.

-The space between the two layers is **a potential space** containing fluid (5-10cc) for lubrication.

-In cases of inflation these two layers become adherent to each other.

- Elongation of the lung is mostly downwards and enters a recess (recess: the acute angle produced by the parietal pleura especially at the lower part-at the base-).

Functions of the Pleura:

- ✓ Protection.
- ✓ Contains fluid for lubrication.

-Infection of the pleura (pleuritis) is painful, especially during expiration and inspiration.

-**Injury to the pleural cavity may result in:**

Entrance of: air into the pleural cavity(**pneumothorax**), blood (**hemothorax**), pus (**empyema**), or fluid (**pleural effusion**).

All need treatment by aspiration, or sometimes they put underwater-seal bottle (absorbs the air in cases of pneumothorax).

Remember that the needle is inserted in the lower part of the intercostal spaces or the upper part of the rib to stay away from the intercostal VAN.

Pleura is divided to parts:

1- Cervical pleura: at the cervical region and it forms the apex (dome of the pleura).

- At the apex, the parietal and visceral layers are adherent to the lung tissue, and superimposed on them is suprapleural membrane.

❖ **Suprapleural Membrane (Sibson's Fascia):**

- * The attachments of the membrane:
 - Laterally: inner (medial) border of the 1st rib.
 - Medially: fuses with the deep fascia of the neck.
 - Superiorly: tip of transverse process of C7.

* Action: the suprapleural membrane (Sibson's Fascia) seals the thoracic cavity to maintain the IPP (intrapleural pressure), and it protects the cervical pleura.

* It is called Sibson's fascia because it is fused with the fascia of the neck.

2- Diaphragmatic pleura: below the inferior surface (above the diaphragm).

3- Costal pleura: related to costal cartilage and ribs.

****The Recess:** between the costal and diaphragmatic surfaces (forms the edges of the base).

4-Mediastinal pleura: covering mediastinum, and at the hilum the parietal and visceral pleura are fused forming the pulmonary ligament.

****Hilum:** Between T5 and T7 (root of the lung).

Peripheral Reflections of the pleura:

- Forms the recesses.

- **Superiorly:** the pleural cavity projects 3-4cm (1 inch) above the 1st costal cartilage.

- **Inferiorly:** it extends two spaces below the lung:

1. In the midclavicular it extends to the 8th rib.
2. In the midaxillary it extends to the 10th
3. Posteriorly to the 12th thoracic spine (T12).

Visceral pleura:

-Adherent to the lung.

-Continuous with the fissures.

-Continuous with the parietal pleura at the hilum.

Pleural Recesses:

▪ **Costomediastinal recess.**

▪ **Costodiaphragmatic recess (most important):**

Between costal and diaphragmatic surfaces (between the inferior margin of the lungs and the inferior margin of the pleural cavity).

1 inch in the midclavicular line (between 6th and 8th ribs).

2 inches in the scapular line posteriorly (between 10th and 12th ribs).

3 inches in the midaxillary line (between 8th rib and 10th ribs): used for to aspiration because it's the largest one.

▪ **Function of recesses:**expansion of the lungs (mostly inferiorly).

Note: Limited expansion can occur superiorly and anteriorly because there's no space.

Clinical Notes:

>**Aspiration of fluids (usually accumulate in the recesses):** by putting the needle in the 7th intercostal space of midclavicular line, or 9th intercostal space of midaxillary line (we put the needle in the lower border of the intercostal space).

>**Clinically:** cannula in the subclavian vein might cause injury to the apex of the lung, entrance of air may occur (pneumothorax). We should make sure that the lungs are inflated not collapsed by giving the patient a chest x-ray.

Pleural Effusion:

-It is the accumulation of fluids (more than 300ml) within pleural cavity.

- Causes: infections, injury, or spontaneous (without a cause).

-The lung collapses and there will be decrease in lung expansion.

-Breathing sounds (heard using a stethoscope) will decrease, especially in the lower part.

-In percussion: dullness (no resonance because there is fluid instead of air).

-There is Pain and coughing.

Nerve Supply of the Pleura:

The parietal pleura:

Sensitive to pain, touch, pressure, and temperature.

1- Costal pleura: intercostal nerves segmentally. (If we are in the 2nd intercostal space > T2, if in the 4th intercostal space > T4, etc..).

2-Mediastinal and Diaphragmatic pleura: phrenic nerve.

3- Peripheral (intercostal) pleura: lower 6 intercostal nerves.

Visceral pleura:

-Sensitive to stretch only, but insensitive to pain, touch, and temperature.

-Supplied by pulmonary plexus (sympathetic and parasympathetic).

Arterial Supply of the Pleura:

Parietal pleura:

- Anterior intercostal arteries (from the internal thoracic artery).
- Posterior intercostal arteries (from the descending aorta).
- Musculophrenic artery.

Visceral pleura:

- Bronchial arteries (they supply the lung tissue and visceral pleura).

Venous Drainage of Pleura:

- Azygous and internal thoracic (mammary) veins.

Lymphatic Drainage:

Parietal Pleura:

Mediastinal Pleura: 1- mediastinal nodes.2-Tracheobronchial nodes. 3- intercostal nodes

Diaphragmatic Pleura: 1- parasternal lymph nodes.2-Posterior mediastinal lymph nodes.

Visceral (pulmonary) Pleura:

along bronchial arteries to bronchopulmonary nodes.

All of them drain eventually to the thoracic duct.

- The End -

Thanks to Sally Al-Khateeb for her notes ☺.

Apologies for any mistake.

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