

## Lung & Pleura

### The Topics :

- The Trachea.
- The Bronchi.
- The Brochopulmonary Segments.
- The Lungs.
- The Hilum.
- The Pleura.
- The Surface Anatomy Of The Lung & Pleura.
- The Root & Hilum.

- first of all , the lung and pleura are clinically the most organs affected by diseases regarding the respiratory system !! so we have to focus on them.

### A# The Trachea.

- It's a continuation of the larynx. Its length is about (4.5 -5) inches and its diameter is the diameter of your index. In children or infants it's very narrow and equals the diameter of a pencil, so it's difficult to do tracheotomy (tracheostomy) to a child or an infant.

- It begins from the lower border of C6 cervical vertebra, and ends at the level of the sternal angle (also called : angle of lewis) , where it bifurcates to the Left and Right main bronchus.  
the sternal angle : it's located the level between T4 and T5 thoracic vertebrae .

- It contains: C-shaped hyaline cartilages. They are (16-20) cartilages. However, it's absent posteriorly and replaced by the **Trachealis** muscle (smooth muscle).

Imagine if it was cartilaginous posteriorly, it will press on the esophagus and block the bolus movement downward through the esophagus.

## >> The Relations of the trachea:

- (the Dr. said : it's an important topic in theory exam. we always asks about it)  
so All relations are important.

### → Anterior relations:

- 1) remnants of the thymus gland:
  - it's located behind the sternum.
- 2) the origin of Brachiocephalic artery.
- 3) Manubrium sterni:
  - the 1<sup>st</sup> part of the sternum.

### → Left side relations:

- 1) Arch of Aorta & descending Aorta.
- 2) Lt. subclavian , Lt. common carotid arteries.
- 3) Lt. Phrenic , Lt. Vagus nerves.
  - Lt. Phrenic: goes **Ant.** to the hilum of the lung.
  - Lt. Vagus: goes **post.** to the hilum of the lung.
- 4) Lt. main bronchus

### → Right side relations:

- 1) Brachiocephalic artery:
  - originates from the Aortic arch and goes to the right side.
- 2) Rt. subclavian, Rt. common carotid arteries.
- 3) Rt. Phrenic , Rt. Vagus nerves:
  - Rt. Phrenic: goes **Ant.** to the hilum of the lung.
  - Rt. Vagus: goes **post.** to the hilum of the lung.
- 4) Rt. main bronchus.
- 5) Azygous arch:
  - the hemiazygous vein collects the venous drainage of the chest on the left side , and drains it in the azygous vein.
  - the azygous vein collects the venous drainage of the chest on the right side. It ends as the azygous arch in the sup. vena cava.

### → Posterior relations:

- 1) Esophagus.
- 2) **Left** recurrent laryngeal nerve:
  - begins in the chest , and ascends upward to the neck.
  - ascends between the trachea and the esophagus.

Note :

Right recurrent laryngeal nerve:

- found in the root of the neck , so it doesn't have a relation with the trachea as the left.

3) the thoracic duct:

- lies post. to the trachea and esophagus.
- begins below the diaphragm with the opening of the Abd. Aorta. It ascends upward, then deviated to the left.
- ends at the **bifurcation** of Lt. subclavian v. with the Lt. internal jugular v. (i.e. at the beginning of the Left brachiocephalic v.)

>> the carina:

- it's the region where the trachea ends and bifurcates into Right and Left main bronchus.
- it's **the most sensitive** part of the trachea. So when someone swallows a foreign body that enters the trachea and reaches the carina, this region will be irritated and the person begins to cough continuously.

Note:

In deep inspiration, the trachea descends downward, then it returns back to its normal position.

>> Tracheotomy (tracheostomy) & intubation:

- Where can we put a tube inside the trachea?

1- above the isthmus of thyroid gland.

- the isthmus of the thyroid gland :

- it lies **ant.** to the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> tracheal rings.

- Above it, there is the 1<sup>st</sup> tracheal ring and the space between the 1<sup>st</sup> and 2<sup>nd</sup> rings. So we can put the tube through this space.

2- below the isthmus of thyroid gland.

- in the space between the 5<sup>th</sup> and 6<sup>th</sup> rings.

3- suprasternal.

- **Usually** when someone has a problem in the larynx, and the doctor wants to put a permanent tube inside his trachea, they put the tube **above the isthmus** between 1<sup>st</sup> and 2<sup>nd</sup> rings.

- By this tube, we can make suction for any mucous or materials that may cause a slight block in the trachea, especially the accumulation of fluids.

## **B# The Bronchi.**

- the Rt. bronchus:  
wider, more vertical with the trachea and shorter (about 1 inch).

- the Lt. bronchus:  
narrower , more horizontal and longer (2 inches and may reach 3 inches).

These differences are clinically important, why?

- When someone inhales or swallows a foreign body that enters the trachea , it will always go the Rt. bronchus ; it's more vertical and wider.

So when a doctor uses the bronchoscope, he always insert it in the Rt. Bronchus to find out the foreign body, because it will **commonly** be there.

- A little bit histology.  
the bronchi differ from the trachea in that :  
the hyaline cartilage forms pieces instead of c-shaped.

## **>>The Bronchial tree.**

- There are:  
1ry bronchi: Rt. and Lt. main bronchi.  
2ry bronchi: Lobar bronchi.  
3ry bronchi: Segmental bronchi.

### **→ 1ry bronchi.**

- the Rt. main bronchus divides **at the hilum** of the **Rt. lung** into:  
eparterial bronchus: above the pulmonary artery.  
hyarterial bronchus: below the pulmonary artery.

- the Lt. main bronchus remains as one unit.

### **→ 2ry bronchi.**

Divides the lungs into lobes:

\* The Rt. lung is composed of 3 lobes ; upper , middle , and lower.  
Accordingly, it has 2 fissures: horizontal and oblique fissures.

- Three 2ry bronchi in the Rt. lung; each one for a lobe.

\* The Lt. lung is composed of 2 lobes; upper and lower.

So it has only 1 fissure: an oblique fissure.

- The Lingula :

--The heart pushes the Lt. lung and forms the lingua and the cardiac notch.

-- Only on the left lung not the right one.

- One 2ry bronchus reaches the lower lobe & the lingula.

- One 2ry bronchus reaches the upper lobe.

→ **3ry bronchi:**

- supply the bronchopulmonary segments.

Before birth:

- in the Rt. lung; 10 segments. In the Lt. lung; 8 segments.

After birth:

there are 10 segments in each lung.

- Each segment has its own bronchus, lymphatics, pulmonary vessels and nerve supply.

- These segments are very important surgically. Why?

In the past, the surgeons used to remove or eradicate an entire lobe in surgery (called: Lobectomy). Nowadays, there is no need to remove the entire lobe. It's enough to remove a specific bronchopulmonary segment if it has a disease.

Each segment is surrounded by a separate connective tissue and pulmonary veins. Also, it has its own bronchi, pulmonary vessels, lymphatics and nerve supply. So it's easy to remove any segment alone.

>> **The Bronchiole:**

- Differs from the bronchi in that:

- it has No cartilage.

- No goblet cells.

- No glands.

- The smooth muscles **increase** in it.

Note:

in Asthma attack, there is a contraction in the smooth muscles of the bronchioles.

After bronchioles, we have: respiratory bronchiole → alveolar duct → alveolar sac → alveoli.  
Those are important in Gas exchange.

## C# The Bronchopulmonary Segments.

- It's important both surgically & functionally.
- located inside the lungs lobes.
- supplied by segmented bronchus.
- It has pulmonary vessels.
- It's pyramidal in shape; has an apex and a base.
- The apex: in which a bronchus, pulmonary artery, lymphatic vessels and nerve supply (symp. & parasymp.) enter the segment through it.
  
- The connective tissue forms the boundaries and found in both sides of the pyramid.
  
- The **landmark** for the surgeon is the **pulmonary vein** which is found in the connective tissue. So he looks for the pulmonary vein in each side of the pyramid and determines the segment that he wants to remove.

### → Rt. lung 10 segments :

#### - Upper lobe:

Apical, posterior, Ant.

#### - Middle lobe:

Medial, Lateral, Basal

#### - Basal lobe:

Apical (apico basal), Ant., Med, Lat., Post.

#### Note:

- before birth :

we have 8 segments in the lt. lung. How?

In the upper lobe, "apico posterior" segment (apical + post.).

In the basal lobe, "antero medial" segment (ant. + medial).

## → **Lt. lung 10 segments:**

### - **Upper lobe:**

Apical, posterior, Ant., **sup. Lingual, inf. lingual**

### - **Basal lobe:**

Apical (apico basal), Ant., Med, Lat., Post.

**Again**, these segments are clinically important. Why?

If a child inhaled or swallowed a foreign body, it will go through the Rt. main bronchus as we mentioned before, then it will reach the lung and goes inside one of the segments. We have to know exactly this specific segment.

We have two cases:

- if the child stays in the standing position after swallowing the foreign body, we will find this foreign body in the **Basal lobe**; inside its **post. segment**.

The reason: the basal lobe is the most dependant part.

- If the child is in a laying down position. E.g. when he was in the dental clinic, he swallowed his tooth accidentally while the doctor was treating him. The tooth will go through the Rt. main bronchus and continues until reaching the **Basal lobe**. But in this case, we will find it in the **Apico basal segment**.

## >> **The Clinical importance of bronchopulmonary segments.**

### 1- **Infections.**

When a segment is affected by an infection, it won't allow it to spread since it has connective tissue barriers around it.

### 2- **Surgery.**

### 3- **Postural drainage.**

We can specifically drain the affected segment.

### 4- **Bronchoscopy.**

- To remove the foreign bodies.

## D# The Lungs.

- Each lung has:

### 1- *The Base.*

- Lies on the cupula of diaphragm. The base of the lungs takes the shape of the dome of diaphragm, and has very sharp edges that descend downward.

### 2- *The Apex.*

- Lies at the root of the neck; 1 inch above the medial 1/3 of the clavicle.

When they put a cannula in the subclavian vein, they must be careful not to injure the apex of the lung. If they injure it, the air will enter the lung from the pleural cavity. So after you insert the cannula, you have to do an x-ray for the patient to make sure that the lung is inflated and not deflated (collapsed).

### 3- *The Costal Surface.*

- Related to the costal cartilages and ribs (the outer surface).

### 4- *The Mediastinal Surface.*

- Related to the heart (the inner or medial surface).

the mediastinum : (the space between the 2 lungs, divides into : sup. , middle and post.)  
the heart and pericardia are in the middle mediastinum.

- contains the Hilum of the lung.

### 5- *The borders.*

- the inferior border, which lies above the diaphragm.

- the anterior border.

- the post. border.



## E# The Hilum.

- Through which the bronchi, pulmonary vessels, nerve supply and lymphatics enter and leave the lungs.

### >> The Contents:

\* *the pulmonary artery:*  
blue in color (deoxy. blood)

\* *the pulmonary veins:*  
red in color (oxy. blood). They exit the hilum as 2 veins, and then becomes 4 veins. So they reach the Lt. atrium as (4) pulmonary veins.

\* *bronchi:*  
remember that the Rt. main bronchus divides into eparterial and hyperarterial unlike the Lt. main bronchus.

\* *nerve supply:*  
- parasymp. from the vagus , sympathetic.

\* *lymph nodes & lymphatic vessels:*  
these lymph nodes become black in smokers , and it resembles chickpeas (hummus beans) and found in the hilum.

Right lung is mainly related to the veins , so ant. to the hilum is related to the right atrium.

Left lung is mainly related to the arteries , so ant. to the hilum is related to the left ventricle.

## F# The Pleura.

- it's like the pericardium of the heart.

- composed of:

1) parietal layer: lining the chest wall.

2) visceral layer: adherent to the lung tissue.

-- between the two layers , there is a potential space contains visceral fluid that allows for lubrication.

Note:

- the inf. border is called : **costodiaphragmatic** border or recess of pleura . It's called recess because it makes an angle that descends downward, and when the lung is inflated, it expands in this recess. So the expansion of the lung is directed downward in the recess inside the pleura.

## G# The Surface Anatomy Of The Lung And Pleura.

### >>The surface anatomy of the lungs:

#### → the apex :

- 1 inch above the medial 1/3 of the clavicle.
- the same for the two lungs.
- covered by pleura that's called: cervical pleura.
- suprapleural membrane : forms the **ceiling** of the apex as well as the thorax , in order to form an intrathoracic pressure.

#### → the ant. border of the lungs.

##### - Right lung:

draw a line from the apex to the sternoclavicular joint. Extend this line to the midsagittal line (the midline) on the sternal angle. Extend this line until reaching the xiphisternal joint which is at the level of the 6<sup>th</sup> costal cartilage.

Remember : the 6<sup>th</sup> and 7<sup>th</sup> costal cartilages are connected to each others.

##### - Left lung:

there is a difference in surface anatomy of the ant. border between the rt. and the lt. lungs , because we have the cardiac notch in the lt. lung between the 4<sup>th</sup> and 6<sup>th</sup> costal cartilages.

According to that,

we have to draw like a semi circle or a curve deviated from the midline to the **left** side between the 4<sup>th</sup> and the 6<sup>th</sup> costal cartilages by 1/2 inch.

This is clinically important, how?

- When a fluid accumulates in the pericardium, we can insert a needle between the 4<sup>th</sup> and 6<sup>th</sup> costal cartilage (cardiac notch region) and make aspiration.

#### → the base (the lower border).

marked by 3 points:

- draw a midclavicular line crosses with the **6<sup>th</sup> rib**.
- draw a midaxillary line crosses with the **8<sup>th</sup> rib**.
- posteriorly , draw a line from the apex of the lung (posteriorly) 4c.m away from the dorsal spine and descends downward until reaching the **10<sup>th</sup> thoracic vertebra**.

## >>The surface anatomy of the pleura:

→ *the apex :*

- the same as the lung, because the cervical pleura is adherent to the lung tissue and the lung doesn't expand superiorly.

→ *the ant. border:*

- the same as the lung, but :

the midline reaches **the 7<sup>th</sup> costal cartilage** instead of the 6<sup>th</sup>.

→ *the base (the lower border).*

- it increases by 2 spaces. How?

- draw a midclavicular line crosses with the **8<sup>th</sup> rib**

- draw a midaxillary line crosses with the **10<sup>th</sup> rib**

- posteriorly, draw a line from the apex of the lung (posteriorly) 4c.m away from the dorsal spine and descends downward until reaching the **12<sup>th</sup> thoracic vertebra**.

*This is important, why?*

1- When the lung is inflated, it's expanded inf. by 2 spaces and fills the pleural spaces.

2- If a patient had a pneumothorax ; air in the pleura, the air will fill the pleural cavity and consequently the lung will get collapsed.

3- If a patient had pleural effusion; excess fluid accumulation in the pleural cavity, that's may be normal or due to:

- An infection: pus accumulation in the pleural cavity. called : Empyema.

- A trauma: blood accumulation in the pleural cavity. called : Hemothorax.

*Where to put the needle to make aspiration?*

*if you draw a midclavicular line, you put the needle **1 space below** the surface anatomy of the lung in order not to injure the lung tissue.*

*so the needle will be between the lung and the pleura.*

*Usually, they put the needle in the midaxillary line in the **9<sup>th</sup> intercostals space**.*

*if you want to put the needle posteriorly, you put it in the **11<sup>th</sup> intercostals space**.*

*when you put the needle in the space, you have to put it in **the Lower border** of the space, because in the upper border there are the Intercostal VAN (vein, artery and nerve).*

*or you can say : in **the Upper border** of the Rib #9 or rib #11.*

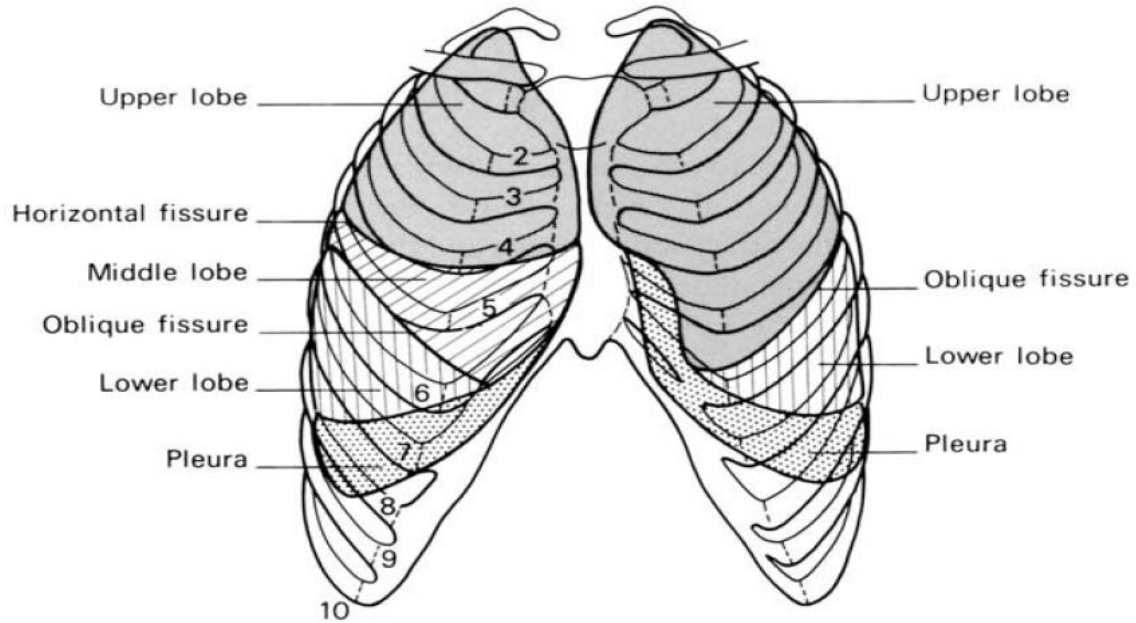


Fig. 2 The surface markings of the lungs and pleura—anterior view.

### H# The Root and Hilum.

- The pleura makes a ligament at the hilum that's called: inferior pulmonary ligament. This ligament makes a sleeve around the structures that enter or leave the hilum.

In the practical labs, we have to distinguish between the following structures:

- the bronchus which contains hyaline cartilages.
- the pulmonary artery : 1 artery , usually above the veins.
- the pulmonary vein : 2 veins , one is ant. to the bronchus , and the other is inferior.

قال الإمام ابن رجب - رحمه الله - :

ليس الخائف (أي: من الله) من بكى وعَصَرَ عينيه ؛  
وإنما الخائف مَنْ تَرَكَ ما اشتَهَى من الحرام  
إذا قَدَرَ عليه.

رسائل ابن رجب (163/1)

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