RS

ANATOMY

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تدقيق: فرح سائد و ياسمين حمدان

الدكتور: د. محمد المحتسب

Pleura

Color code

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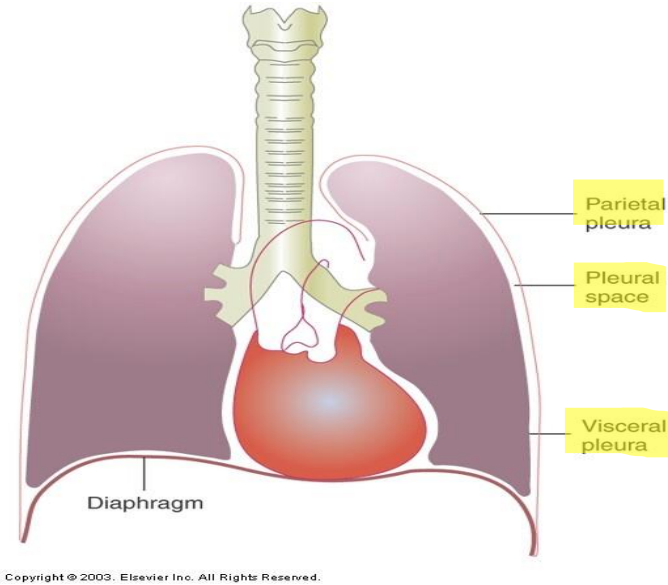
- Additional info
- Important

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 a cavity composed of 2 layers containing the lungs , visceral and parietal, the visceral adheres and covers the lung tissue internally, the parietal covers and lines the thoracic cage externally.



- 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

A potential space: is a space between two adjacent structures that are normally pressed together, to the point that it seems without any emptiness.

The evidence of the presence of this space is the potential of fluid to accumulate and collect inside this space.

- 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.

If the fluid becomes less, friction may develop and subsequent pleuritis – it is very painful, the patient feels pain between ribs and painful breathing.

pneumothorax: accumulation of **air** in the pleural sac.
pleural effusion: accumulation of **fluid** in the pleural sac.
empyema: accumulation of **pus** in the pleural sac after chronic infection.
haemothorax: accumulation of **blood** in the pleural sac.

Pleura

- The names given to the parietal pleura correspond to the parts of the wall with which they are associated

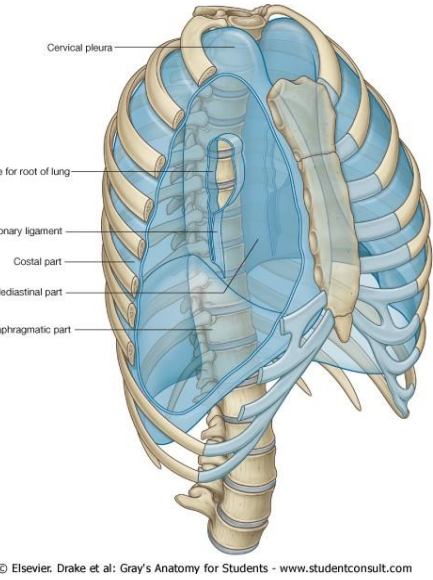
- pleura related to the ribs and intercostal spaces is termed the **costal part.**

- pleura covering the diaphragm is the **diaphragmatic part.**

  above the diaphragm and associated with the base of the lung.

- 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).



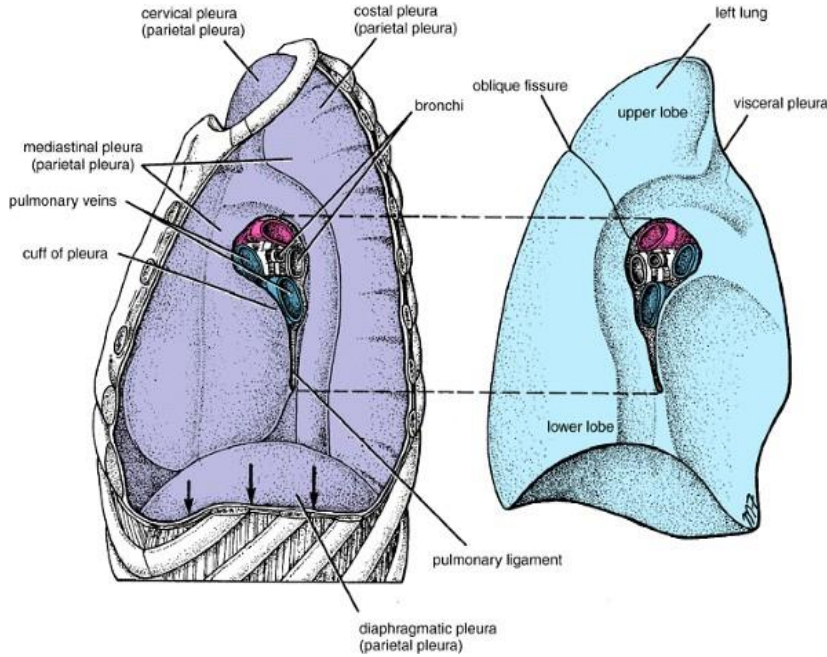
The cervical pleura is related to the apex of the lung located 1 inch above the medial 3rd of the clavicle, or 3-5 cm above the 1st rib, it has a clinical correlation, when you want to put a canula in the subclavian vein at the upper surface of the 1st rib, you should understand the anatomy of pleura clearly, you may pierce the pleura causing lung collapsing, so every time you put a canula, you should do x-ray imaging to check pleura.

Cervical pleura has 3 membranes: suprapleural membrane, parietal and visceral membranes (these membranes are important for sealing the thoracic cage and to maintain the pressure inside the cage.)

Sibson's fascia: investing deep facia of the neck, descend downward from its attachment at the superior thoracic aperture and blinding with the suprapleural membrane.

The parietal and visceral layer adhere together in the mediastinal pleura forming a sleeve around the hilum and then form what is called pulmonary ligament.

Pleura



- in the region of vertebrae TV to TVII (T5 – T7) , the mediastinal pleura reflects, forms the **root of the lung,** which is the hilum.

  *remember the pulmonary ligament formed here

- The root joins the medial surface of the lung at the **hilum**, and the mediastinal pleura becomes continuous with the visceral pleura.

The meeting between 2 different pleural membranes called **recess**.

Ex: when the costal pleura meets the diaphragmatic pleura forming an angle called costodiaphragmatic recess, or between the costal & mediastinum called costomediastinum recess.

Now let's talk about the anatomic surfaces of the pleura!

- The apex is located the same as lungs, 1 inch above the medial 3rd of the clavicle.

- The anterior border of the pleura extends from the apex to the sternoclavicular joint, then to the angle of louis, then descends downwards till the level of the 7th costal cartilage instead of the 6th costal cartilage in the lung. The cardiac notch lies at the left between the 4th and 6th costal cartilage in the pleura and lung, in cases like cardiac tamponade, the needle should be inserted in this notch.

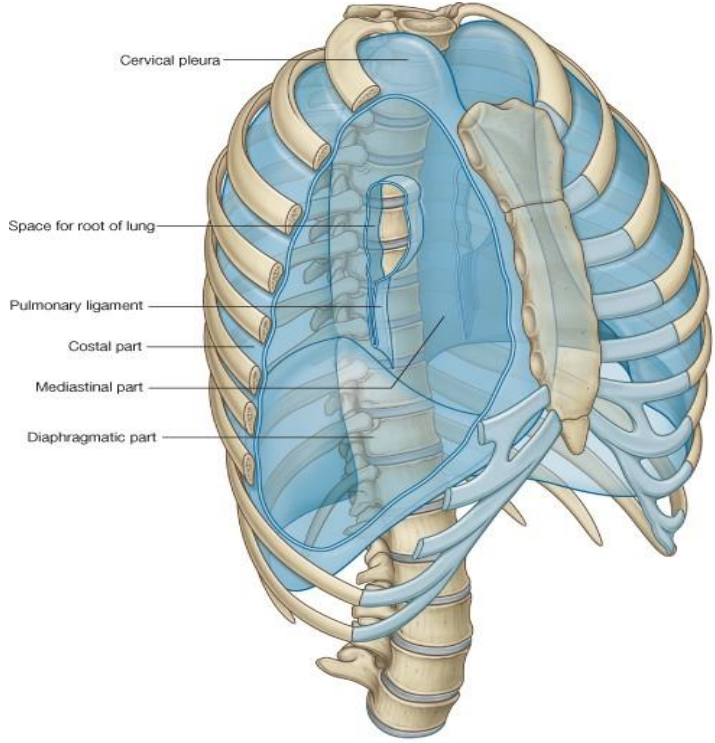
- The posterior border also follows the posterior border of the lung, but it descends two spaces below.

- From an anatomical surface perspective, a notable distinction between the pleura and the lungs lies in their lower borders. Specifically, at the mid-clavicular line, the pleura intersects with the 8th costal cartilage, at the mid-axillary line it intersects with the 10th rib, and posteriorly it extends to the 12th dorsal spine of the thoracic vertebra.

So, the pleura in the base extends by an amount of 2 more than the lung.

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.



The importance of the anatomical difference between the surface of the lung and the pleura becomes evident when fluid accumulation occurs, such as in pleural effusion or pus. A needle is inserted into the space between them.

For example, when placed in the midaxillary line, it will be inserted into the 9th intercostal space, between the 8th and 10th ribs, wouldn't affect the lung.

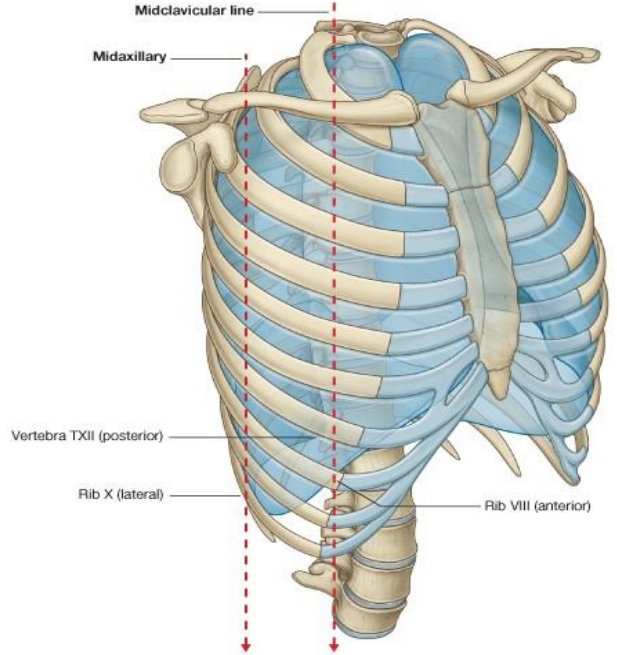
Peripheral reflections

- 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.

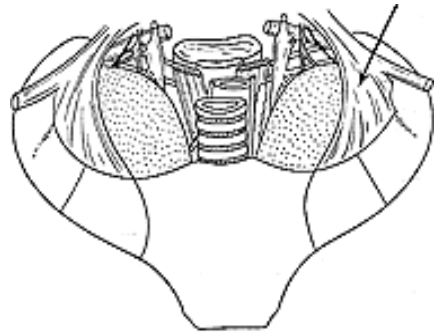
- In the midaxillary line, it extends to rib X.

- 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



Located above the apex of the lung

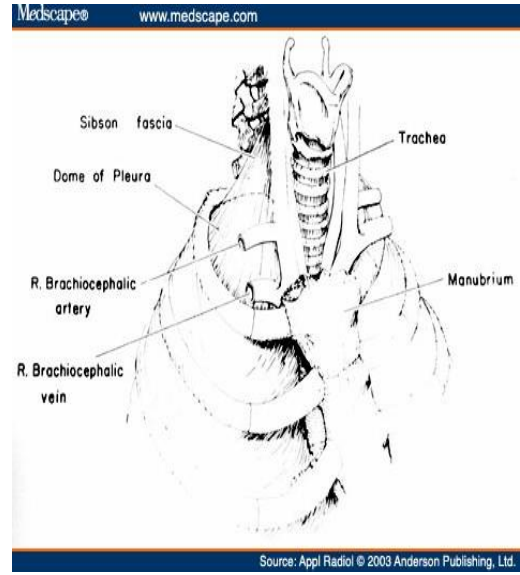
- A fibrous sheath attached to :
- Laterally: medial border of 1st rib and costal cartilage

- Medially : blend with fascia investing the structure that pass from thorax to neck(Sibson fascia)

- Apex : to the tip of the transverse process of the 7th cervical vertebra

- Action : protect the cervical pleura and lung.
- Also resist changes in the intrathoracic pressure during respiratory movements

Mechanism of respiration:
Inspiration: Stimulation(contraction) of the diaphragm downward → intrathoracic pressure will become less than atmospheric pressure → filling the lung with air (active)
Expiration: Relaxation of the diaphragm moving upward → intrathoracic pressure will increase→ air will be expelled out of the lung(passive)



Function of this attachment: sealing of the apex of thoracic cage. Thoracic cage must be completely sealed (like the buildings) to maintain intrathoracic pressure

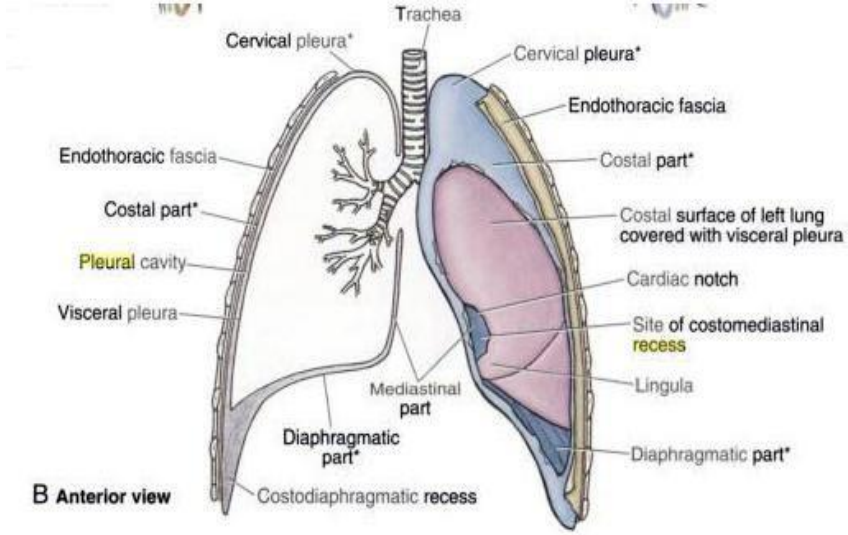
Visceral pleura

- 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

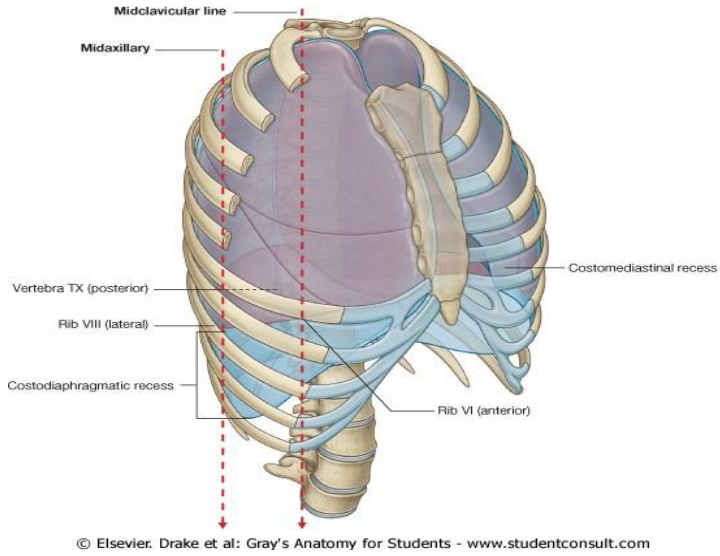
- The lungs do not completely fill the anterior or posterior inferior regions of the pleural cavities
- This results in recesses in which two layers of parietal pleura become opposed.
- Expansion of the lungs into these spaces usually occurs only during forced inspiration
- the recesses also provide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



As we said the recess is formed due to meeting between 2 different pleural membranes
During inflation of the lungs the lungs move downward only filling the Costodiaphragmatic recess.

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**,

It may be filled with fluid or blood or causes empyema

- 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

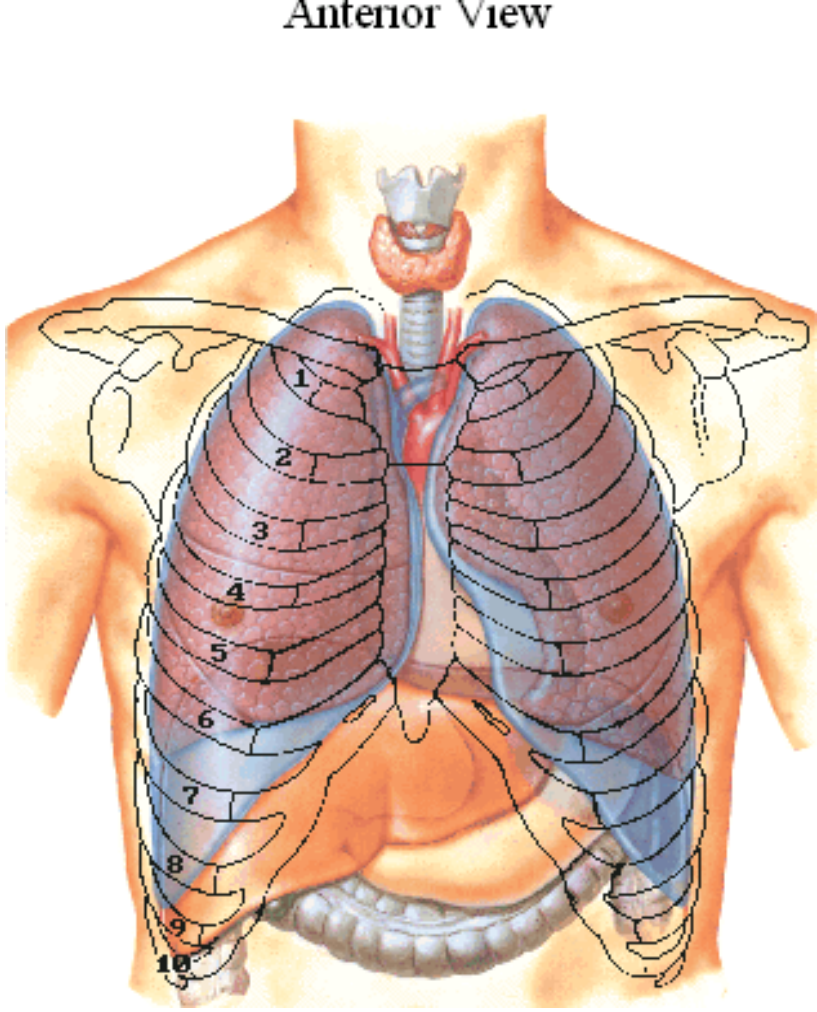
Pleural recesses

- They are deepest after forced expiration and shallowest after forced inspiration.

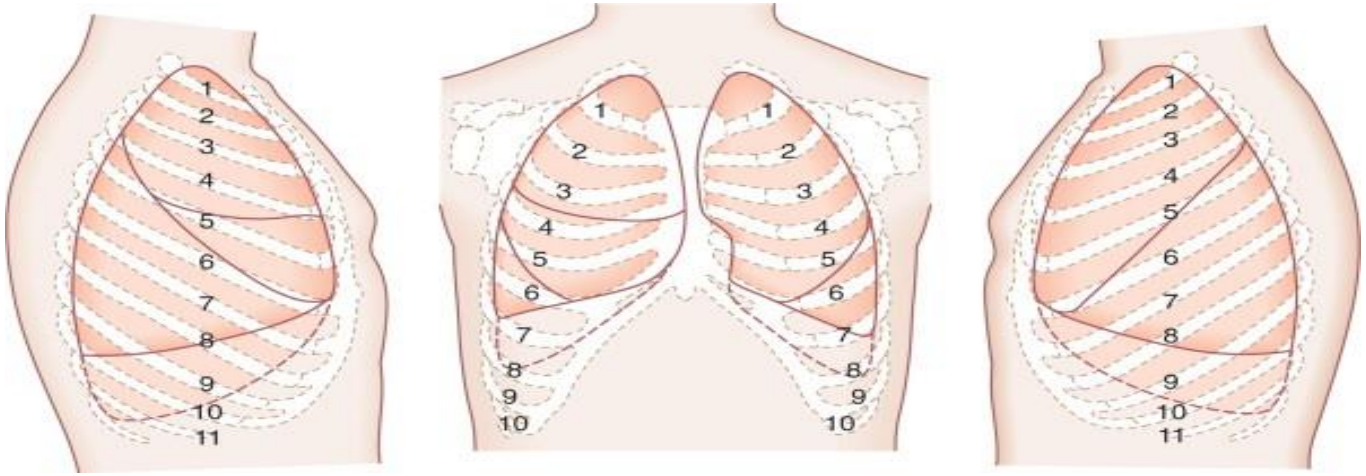
- During quiet respiration, the inferior margin of the **lung** crosses rib VI in the midclavicular line, rib VIII in the midaxillary line, and then courses somewhat horizontally to reach the vertebral column at vertebral level T10

- 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 (most common point for air aspiration),

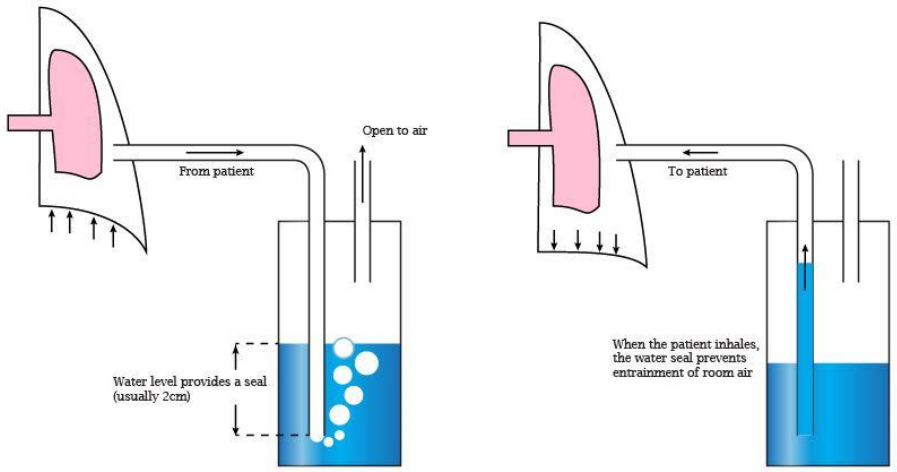
at the paravertebral line between 10 and 12

These points are important for suction(fluid or in case of pneumothorax), suction of air for example at the mid axillary line, put the needle between the two points -9th rib- ,it's rare to do it posteriorly between the 10th and 12th .

Pay attention to this info
الدكتور بحبها

For suction of air we use a bottle filled with water which is called : under water seal

Extra images for under water seal air drainage system:



Extra video about it from the good doctor:

https://youtu.be/z4PNWPelSnY?si=nmglPnvQynWj-5NF

Costodiaphragmatic recess

- 1”(1 inch) in the midclavicular line
- 2 ” in the scapular line (posteriorly)
- 3 ” in the midaxillary line

The most important one bc it is the longest and more air accumulates in it (the preferred space for aspiration as we said)

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

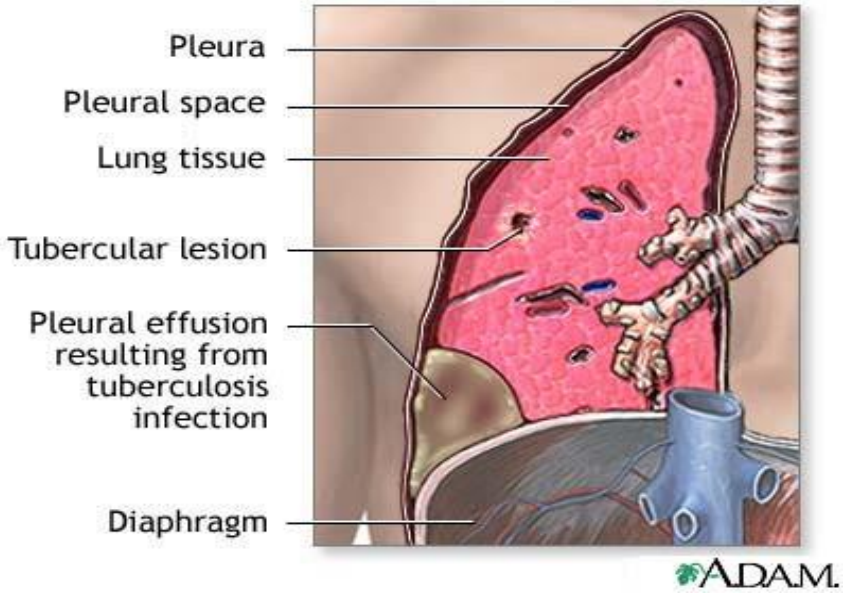
- The needle is put in the lower border of the space

At the upper border of the rib or the lower border of intercostal space→ to avoid the injury of VAN (vein, artery, nerve)

Pleural effusion

- Pleural space normally contain 5- 10 ml of clear fluid
- Absorbed normally by visceral pleura by hydrostatic and osmotic pressure

if more than 300ml → auscultation sound is lower than normal bc of fluid accumulation



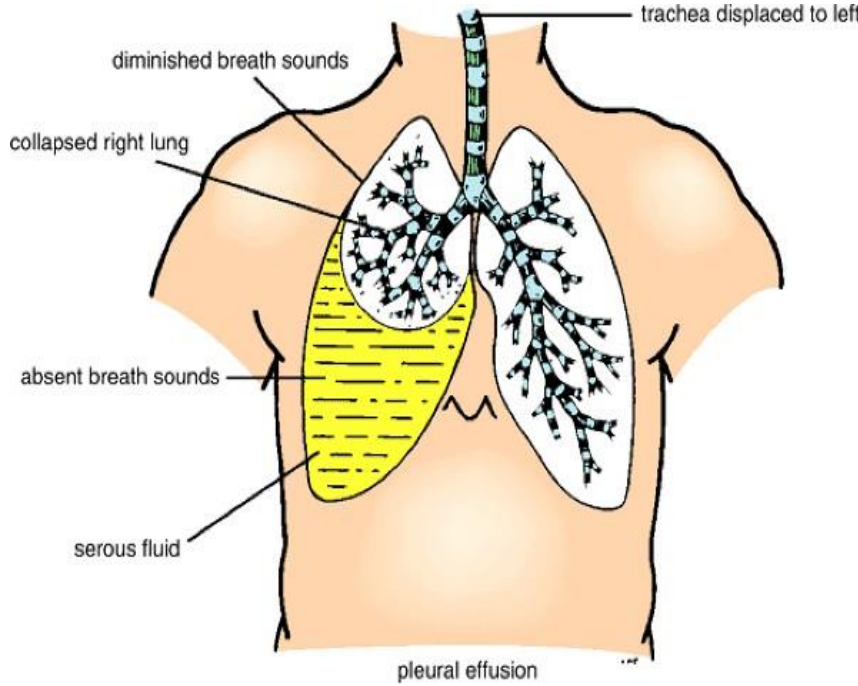
- Pleural effusion: is accumulation of excess fluid within the pleural cavity, pleural fluid increase more than 300 (ml) in costodiaphragmatic recess

- Main causes
  1. Infection
  2. Injury

Clinical Manifestations

- Decrease in lung expansion

The fluid impedes the expansion of the lungs

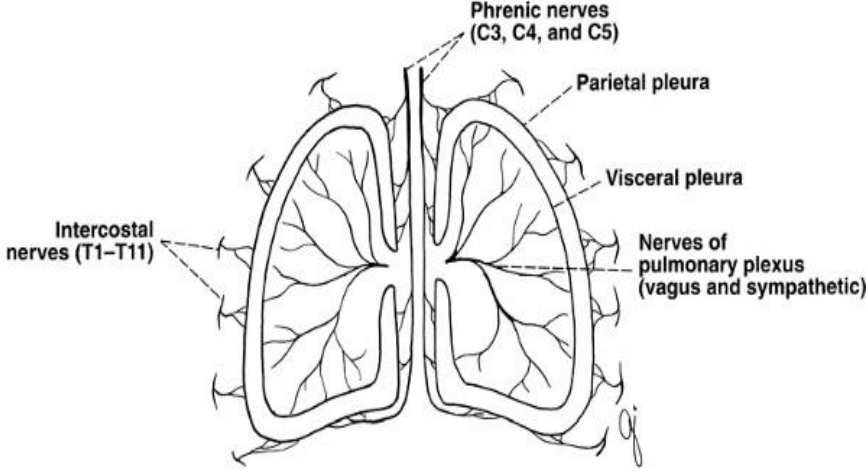


- Decrease breath sound
- In Percussion(palpitation) → Dullness

If you place your fingers in the intercostal spaces and there is fluid present, the resulting sound can be described as dullness

- Pain
- Cough

Nerve supply of the pleura



Parietal pleura:

- It is sensitive to pain, temp, touch & pressure

1- Intercostal nerves → Costal pleura(segmentally)

Segmentally means the parietal pleura in the 3rd intercostal space for example is innervated by the 3rd intercostal nerve.

2-Phrenic nerve → Mediastinal pleura + diaphragmatic pleura

Motor for diaphragm and sensory for pleura (diaphragmatic and mediastinal)

3- lower 6 intercostal → peripheral pleura

Visceral pleura

- Sensitive to stretch
- Insensitive to pain, temp or touch
- Supplied by pulmonary plexus & autonomic. N.S(same as lungs)

Arterial Supply of the Pleura

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

  1-Intercostal arteries(ant& post)

  Anterior from internal mammary(internal thoracic)and posterior from descending thoracic aorta

  2- Internal thoracic

  3-Musculophrenic arteries for 6^{th} , 7^{th} and 8^{th} intercostal spaces

- 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** +subclavian

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

Ultimately, on the left side, they terminate in the thoracic duct, while on the right side, their termination is within the right lymphatic duct, ultimately ending at the beginning of brachiocephalic vein(venous angle)

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

E learning quiz

- **The nerve supply of the mediastinal pleura is one of the following:**

A) Cervical spinal nerve

B) Intercostal nerve

C) Phrenic nerve

D) Vagus narve

E) Axillary nerve

Answer: C

- **The Best Site for drainage the pleural effusion is one of the following:**

A) Fifth intercostal space med axillary line

B) Seventh intercostal space med axillary line

C) Ninth intercostal space med axillary line

D) Fifth intercostal space med clavicular

E) Tenth intercostal space posteriorly

Answer:C

Past Papers

A needle in the left ninth intercostal space at mid-axillary line wouldn't affect: A)Diaphragm B)Spleen C)Lung D)Pleura E)Peritoneum ANSWER : C	A 37 years old patient with pleural effusion. A needle should be inserted at the midaxillary line between. Which of the following two ribs to avoid puncturing the lung ? A)Ribs 6 and 8 B)Ribs 9 and 11 C)Ribs 8 and 10 D)Ribs 3 and 5 E)Ribs 1 and 3 ANSWER: C
The Best Site for drainage the pleural effusion is one of the following: A)Fifth intercostal space med axillary line B)Seventh intercostal space med axillary line C)Ninth intercostal space med axillary line D)Fifth intercostal space med clavicular E)Tenth intercostal space posteriorly ANSWER: C	The diaphragmatic pleura is supplied by which nerve A)Intercostal nerves B)Phrenic nerve C)pulmonary plexus ANSWER: B
The nerve supply of the mediastinal pleura is one of the following: A)Cervical spinal nerve B)Intercostal nerve C)Phrenic nerve D)Vagus nerve E)Axillary nerve ANSWER: C	The main blood supply of the lung a visceral pleura is A)Bronchial arteries B)Pulmonary arteries C)Internal thoracic arteries ANSWER: A

وقف الحسام بوجه الكرب منفرداً
يدعُ القرابَ ويكسر معصمَ الغمَرِ
يسَل الزمان إذا خلَّى له أحداً
فيردُّ: هل لك بعد الله من صمدِ؟

Additional sources

1. https://youtu.be/t9poAtjm-q0?si=el0nKGFTJ7dl9c9X
2. https://youtu.be/1IKpXgdEOY8?si=FOau7V6f6-2ejdHa

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V1→ V2			
V2→V3			

امسح الرمز و شاركنا بأفكارك لتحسين أدائنا !!