Lung and Pleura

Respiratory block-Anatomy-Lecture 4

Editing file
Objectives

At the end of the lecture, students should:

✓ Describe the anatomy of the pleura: subdivisions into parietal and visceral pleura, nerve supply of each of them.
✓ List the parts of parietal pleura and its recesses.
✓ Describe the surface anatomy of both pleura and lungs.
✓ Describe the anatomy of lungs: shape, relations, nerve supply & blood supply.
✓ Describe the difference between right & left lungs.
✓ Describe the formation of bronchopulmonary segments and the main characteristics of each segment in the lung.

Click here for helpful short video ;)

Color guide:
- Only in boys slides in Green
- Only in girls slides in Purple
- Important in Red
- Doctor note in Blue
- Extra information in Grey
### Pleura

Double-layered serous membrane enclosing the lung. Has two layers:

<table>
<thead>
<tr>
<th>Parietal layer</th>
<th>which lines the thoracic walls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visceral layer</td>
<td>which covers the surfaces of the lung</td>
</tr>
</tbody>
</table>

- The two layers **continue** with each other **around** the root of the lung, where it forms a loose cuff **hanging down** called the pulmonary ligament.

- The **space** between the two layers, the **pleural cavity**, contains a thin film of pleural serous fluid (5-10ml).

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### Parietal pleura

It is divided according to the region in which it lies and the surfaces it covers, into:

2. Costal pleura.
4. Diaphragmatic pleura.
Parietal pleura

1. **Cervical Pleura:**
Projects upward into the neck:
About *one inch above* the medial 1/3rd of clavicle. It lines the under surface of the *Suprarectrical* membrane.

2. **Mediastinal pleura:**
Covers the Mediastinum:
*At the Hilum,* it is reflected on to the vessels and bronchi, that enter the hilum of the lung. It is continuous with the *visceral pleura.*

3. **Costal pleura:**
lines, the back of the:
- Sternum.
- Ribs.
- Costal cartilages.
- Intercostal spaces.
- Sides of vertebral bodies.

4. **Diaphragmatic pleura:**
Covers the: thoracic (Upper) surface of the Diaphragm.
Pleural recess

<table>
<thead>
<tr>
<th>Costodiaphragmatic Recess</th>
<th>Costomediastinal Recess</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slit like space between Costal and Diaphragmatic Pleura, along the inferior border of the lung enters through it in deep inspiration.</td>
<td>Slit like space between Costal and Mediastinal Pleura, along the anterior border of the lung enters through it in deep inspiration.</td>
</tr>
</tbody>
</table>

Pleura nerve supply

- It is sensitive to (PPTT) pain, pressure, temperature, and touch.
- It is supplied as follows:
  - **Parietal**
    - Cervical and Costal pleura is segmentally supplied by the intercostal nerves.
    - Mediastinal pleura is supplied by phrenic nerves.
    - Diaphragmatic pleura is supplied over the domes by phrenic nerves, around the periphery by lower 6 intercostal nerves
  - **Visceral**
    - sensitive to stretch only and is supplied by the autonomic fibers from the pulmonary plexus.
### Surface anatomy of pleura

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Apex:</strong></td>
<td>Lies <strong>one inch</strong> above the <strong>medial 1/3</strong> of the Clavicle.</td>
</tr>
</tbody>
</table>
| **Anterior margin:**  | **Right pleura:** extends vertically from Sternoclavicular joint to xiphisternal joint (6th costal cartilage).  
                        | **Left pleura:** extends from Sternoclavicular joint to the 4th costal cartilage, then deviates laterally and extends to lateral margin of the sternum to form **cardiac notch** then turns sharply **downward** to xiphisternal joint (6th costal cartilage). |
| **Inferior margin:**  | Passes around the chest wall, on the 8th rib in **midclavicular line**, 10th rib in **mid-axillary line** and finally reaching to 12th rib adjacent to vertebral column posteriorly (T12). |
| **Posterior margin:** | Along the vertebral column from the apex (C7) to the inferior margin (T12).                     |
### Surface anatomy of lung

<table>
<thead>
<tr>
<th><strong>Apex, anterior border:</strong></th>
<th>Correspond nearly to the lines of Pleura but are <strong>slightly away</strong> from the <strong>median plane</strong>.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inferior margin:</strong></td>
<td>passes around the chest wall, on the 6th rib in <strong>midclavicular line</strong>, 8th rib in <strong>mid-axillary line</strong> and finally reaching to 10th rib adjacent to vertebral column posteriorly. -as pleura but more horizontally and finally reaching to the (T10) not (T12).</td>
</tr>
<tr>
<td><strong>Posterior margin:</strong></td>
<td>Along the vertebral column from the apex (C7) to the inferior margin (T10)</td>
</tr>
<tr>
<td><strong>Oblique fissure:</strong></td>
<td>Represented by a line extending from 3rd or 4th thoracic spine, obliquely ending at 6th costal cartilage.</td>
</tr>
<tr>
<td><strong>Transverse fissure:</strong></td>
<td>Represented by a line extending from 4th right costal cartilage to meet the oblique fissure.</td>
</tr>
</tbody>
</table>

**Note:** This slide is important, especially the numbers.
Pleural effusion

- It is an abnormal accumulation of pleural fluid about 300 ml in the Costodiaphragmatic pleural recess (normally 5-10 ml fluid)

- **Causes:**
  - Inflammation.
  - TB. (most common)
  - Congestive heart disease.
  - Malignancy.

- The lung is compressed and the bronchi are narrowed.
- Auscultation would reveal only faint & decreased breathing sounds over compressed or collapsed lung lobe.
- Dullness on percussion over the effusion.
The Lung

- **Located in:**
  thoracic cavity, one on each side of the mediastinum

- **Each lungs:**
  Conical in shape.
  Covered by the visceral pleura.
  Suspended free in its own pleural cavity.
  Attached to the mediastinum only by its root.

- **Each lung has:**
  1. **Apex & Base:**
     Identify the top and bottom of the lung, respectively.
  2. **Costal surface:**
     Surrounded by the ribs and intercostal spaces from front, side and back.
  3. **Medial surface:**
     Where the bronchi, blood vessels, and lymphatic vessels enter or leave the lung at the Hilum.
     It is also related to the structures forming the Mediastinum.
The Lung

<table>
<thead>
<tr>
<th>Apex</th>
<th>Projects into the <strong>root of the neck</strong> (0.5-1 inch above medial 1/3 of clavicle). It is covered by <strong>cervical pleura</strong>. It is grooved <strong>anteriorly</strong> by <strong>subclavian artery</strong>.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td><strong>Inferior</strong> or diaphragmatic surface, is <strong>concave</strong> and rests on the <strong>diaphragm</strong>.</td>
</tr>
</tbody>
</table>

**Borders**

<table>
<thead>
<tr>
<th>Anterior border</th>
<th>Is <strong>sharp</strong>, <strong>thin</strong> and overlaps the heart. <strong>Anterior border of left lung</strong> presents a <strong>cardiac notch</strong> at its lower end, has a thin projection called the <strong>lingula</strong> below the cardiac notch.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior border</td>
<td><strong>Is rounded</strong>, <strong>thick</strong> and lies beside the vertebral column.</td>
</tr>
</tbody>
</table>
Lung roots

<table>
<thead>
<tr>
<th></th>
<th>Right lung root</th>
<th>Left lung root</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronchi*</td>
<td>2 bronchi</td>
<td>One bronchus</td>
</tr>
<tr>
<td></td>
<td>Lie posterior</td>
<td>Lies posterior</td>
</tr>
<tr>
<td>Pulmonary artery</td>
<td>Superior</td>
<td></td>
</tr>
<tr>
<td>2 Pulmonary veins</td>
<td>Are inferior and anterior</td>
<td></td>
</tr>
</tbody>
</table>

Surfaces: Costal & Mediastinal

<table>
<thead>
<tr>
<th>Costal surface:</th>
<th>Medial surface:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>It is divided into 2 parts:</td>
</tr>
<tr>
<td></td>
<td>Convex</td>
</tr>
<tr>
<td></td>
<td>Anterior (mediastinal)</td>
</tr>
<tr>
<td></td>
<td>Posterior (vertebral)</td>
</tr>
</tbody>
</table>

- Covered by costal pleura which separates lung from: ribs, costal cartilages & intercostal muscles.
- Contains a hilum in the middle (it is a depression in which bronchi, vessels, & nerves forming the root of lung).
- It is related to: -Bodies of thoracic vertebrae. -Intervertebral discs -Posterior intercostal vessels -Sympathetic trunk.
Right lung

- Divided by 2 fissures (oblique & horizontal)
- 3 lobes (upper, middle and lower lobes).
- Larger & shorter than left lung

Left lung

- Divided by one oblique fissure
- 2 lobes, Upper and lower.
- There is No horizontal fissure.
- It has a cardiac notch at lower part of its anterior border.
### Mediastinal surface

#### Mediastinal surface of right lung

On the mediastinal surface of the right lung, you find these structures:
- **Vagus nerve** posterior to the root of the lung.
- **Phrenic nerve** anterior to the root of the lung.
- **Cardiac impression**: related to **right atrium**.
- **Azygos vein and its arch** (posterior and over the root of the lung).
- **Esophagus** posterior to the root.
- Below hilum and in front of pulmonary ligament: **groove for I.V.C.** "Inferior vena cava"

#### Mediastinal surface of left lung

On the mediastinal surface of the left lung, you will find these structures:
- **Vagus nerve** posterior to the root of the lung & over the root.
- **Phrenic nerve** anterior to the root of the lung.
- **Cardiac impression**: related to **left ventricle**.
- **Descending aorta** posterior to the root.
- **Arch of the aorta** over the root of the lung.
- **Groove for left common carotid** and **left subclavian arteries**.
### Blood supply of lung

<table>
<thead>
<tr>
<th>Arteries</th>
<th>Veins</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bronchial arteries</strong></td>
<td><strong>Bronchial veins</strong></td>
</tr>
<tr>
<td>(From descending aorta) It supplies oxygenated blood to bronchi, lung tissue &amp; visceral pleura.</td>
<td>drain into azygos &amp; hemiazygos veins.</td>
</tr>
<tr>
<td><strong>Pulmonary artery</strong></td>
<td>pulmonary veins</td>
</tr>
<tr>
<td>which carries non-oxygenated blood from right ventricle to the lung alveoli.</td>
<td>carry oxygenated blood from lung alveoli to the left atrium of the heart.</td>
</tr>
</tbody>
</table>

### Nerve supply of lung

#### Pulmonary plexus
at the root of lung is formed of autonomic N.S. from sympathetic & parasympathetic fibers.

#### Sympathetic Fibers
From: sympathetic trunk
Action: broncho-dilatation & vasoconstriction

#### Parasympathetic Fibers
From: Vagus nerve
Action: Broncho-constriction & vasodilatation & secretomotor to bronchial glands.
The trachea divides into **2 main bronchi**:

**Right main bronchus**
- which divides before entering the hilum, it gives: **superior lobar** (secondary) bronchus.
- **On entering hilum, it divides into middle & inferior lobar bronchi.**

**Left main bronchus**
- **On entering hilum, it divides into superior & inferior lobar bronchi.**
Bronchopulmonary segments

- They are the **anatomic**, **functional**, and **surgical** units of the lungs.

1. Each lobar (secondary) bronchus gives **segmental (tertiary)** bronchi.
2. Each segmental bronchus divides repeatedly into **bronchioles**.
3. Bronchioles divide into **terminal bronchioles**, which show delicate outpouchings “the **respiratory bronchioles**”
4. The respiratory bronchioles end by branching into **alveolar ducts**, which lead into **alveolar sacs**.
5. The alveolar sacs consist of several **alveoli**, each alveolus is **surrounded by** a network of blood capillaries for gas exchange.
Bronchopulmonary segments

The main **characteristics** of a bronchopulmonary **segment**:  

- It is a **subdivision** of a lung lobe.  
- It is **pyramidal** shaped, its **apex** toward the **lung root**.  
- It is **surrounded** by connective tissue septa.  
- It has a **segmental bronchus**, a **segmental artery**, **lymph vessels**, and **autonomic nerves**.  
- The **segmental vein** lies in the **inter-segmental C.T. septa** between the segments.  
- A diseased segment can be **removed** surgically, because it is a **structural unit**.

Note: Segmental vein can’t be removed, since it also gives the neighbor segment.
**MCQs**

**Question 1:** Which feature is found only in the left lung?
A. Oblique fissure  
B. Cardiac notch  
C. Transverse fissure  
D. Both A and C

**Question 2:** The lung is innervated by:
A. Sympathetic fibers  
B. Parasympathetic fibers  
C. Both sympathetic and parasympathetic fibers  
D. Motor fibers

**Question 3:** The pleural cavity contains a thin film of pleural serous fluid. What is the normal value of it?
A. 25-30 ml  
B. 15-20 ml  
C. 20-25 ml  
D. 5-10 ml

**Question 4:** Which one of the following is **not** a characteristic of the left lung?
A. Contains 2 lobes  
B. Has one fissure  
C. Has lingual projection  
D. Shorter than the right lung

**Question 5:** Mediastinal pleura is supplied by:
A. Phrenic nerves  
B. Intercostal nerves  
C. Autonomic fibers  
D. Both A and B

**Question 6:** The pulmonary artery carries **...** blood from **...**:
A. Oxygenated / Left ventricle  
B. Oxygenated / Left atrium  
C. Deoxygenated / Right ventricle  
D. Deoxygenated / Right atrium

**Question 7:** Visceral pleura is supplied by:
A. Autonomic fibers  
B. Thoracic nerve  
C. Intercostal nerves  
D. Phrenic nerves

**Question 8:** The phrenic nerve is found **...** to the root of the lung:
A. Superior  
B. Anterior  
C. Inferior  
D. Posterior

Boys team:
- Khalid AL-Dossari
- Naif Al-Dossari
- Faisal Alqifari
- Salman Alagla
- Ziyad Al-jofan
- Suhail Basuhail
- Ali Aldawood
- Khalid Nagshabandi
- Mohammed Al-huqbani
- Jehad Alorainy
- Khalid AlKhani
- Omar Alammar

Girls team:
- Ajeed Al Rashoud
- Taif Alotaibi
- Noura Al Turki
- Amirah Al-Zahrani
- Alhanouf Al-haluli
- Sara Al-Abdulkarem
- Rawan Al Zayed
- Renad Al Haqbani
- Nouf Al Humaidhi
- Jude Al Khalifah
- Nouf Al Hussaini
- Alwateen Al Balawi
- Rahaf Al Shabri
- Danah Al Halees
- Rema Al Mutawa
- Amirah Al Dakhilallah
- Maha Al Nahdi
- Ghaida Al Braithen

Team leaders
- Abdulrahman Shadid
- Ateen Almutairi

Best wishes