

# 430 Radiology team

## Lecture 5

### **Radiological investigation of Chest and CVS diseases (Respiratory diseases)**

#### Hanan Alrabiah

Ghadeer AlWuhayd

Hanan AlSalman

Maha AlKubidan

Khawla AlOthman

#### Resources:

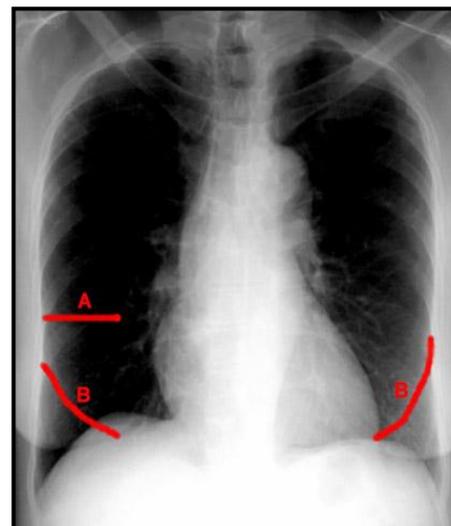
- Lecture by Dr.
- 429 Radiology team work.

## Introduction

### Normal Anatomy of the lung:

- It is important to know the location of lung fissures on the normal chest X-ray, (to locate the abnormality in which lobe).
- They Transverse fissure.
- B: two oblique fissures.
- If there is a shift in any of these fissures, it indicates abnormal lungs.

A. Transvers fissure locate just below the hilum of the lung (7<sup>th</sup> Rib).



## Abnormal Lungs

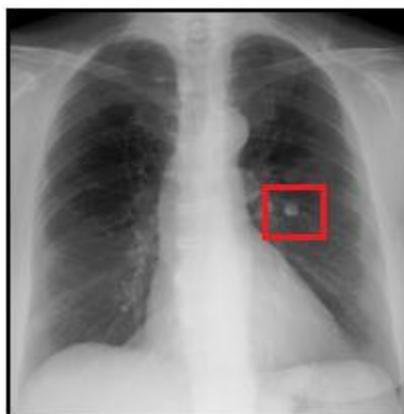
### Mass Vs Diffuse Infiltration:



- The basic diagnostic instance is to detect an abnormality.
- In both of the cases above (A, B), there is an abnormal opacity (in the left lung parahilar lesion).
- In each of the cases, there is an abnormal opacity in the **left upper lobe (above the transverse fissure)**.
- The case A has opacity with **poorly defined margins**. This is **airspace disease** such as pneumonia.
- In the case B, the opacity would best be described as a **mass** because it is presented with **well-defined margins**.

### Solitary Nodule in the Lung:

- A solitary nodule in the lung can be totally innocuous or potentially a fatal lung cancer. After detection the initial step in analysis is to compare the film with prior films if available. A nodule that is unchanged for two years is almost certainly benign. Be sure to evaluate for the presence of multiple nodules as this finding would change the differential entirely.
- If the nodule is indeterminate after considering old films and calcification, subsequent steps in the work-up include ordering a CT and a tissue biopsy.



## Pleural Based Lesion

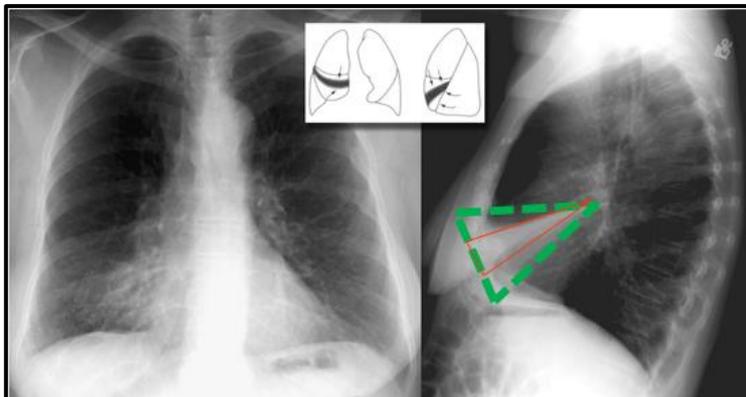
### Atelectasis:

- **Definition:** Loss of volume of lobe, segment or sub segment of the lung.
- **Example:** lung collapse.
- **Most Common Cause:**
  - Bronchial obstruction.
  - Pneumothorax.
  - Pleural effusion.

Green lines → normal fissures.

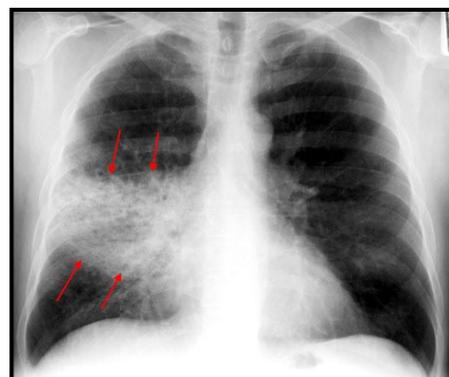
Red lines → actual fissures as appeared in the x-ray.

There is a shift of the fissures toward each other → loss of volume.



### Consolidation:

- **Definition:** Loss of air in lobe, segment or sub segment of the lung.
- **Example:** pneumonia (lobe).
- **Most common causes:**
  - Pneumonia.
  - Infarction.
  - Contusion.
  - Immunological Disorders.



There is ↑ in density **without** loss of volume → consolidation

### Difference between consolidation and atelectasis:

| Atelectasis  | Consolidation (pneumonia)   |
|--|---|
| <ul style="list-style-type: none"> <li>- Volume loss</li> <li>- Associated with ipsilateral shift.</li> <li>- Linear, wedge-shaped.</li> <li>- Apex at hilum.</li> </ul> | <ul style="list-style-type: none"> <li>- Normal or ↑ volume</li> <li>- No shift or contralateral (if presented)</li> <li>- Consolidation, air space process.</li> <li>- Not centered at the hilum.</li> </ul> |

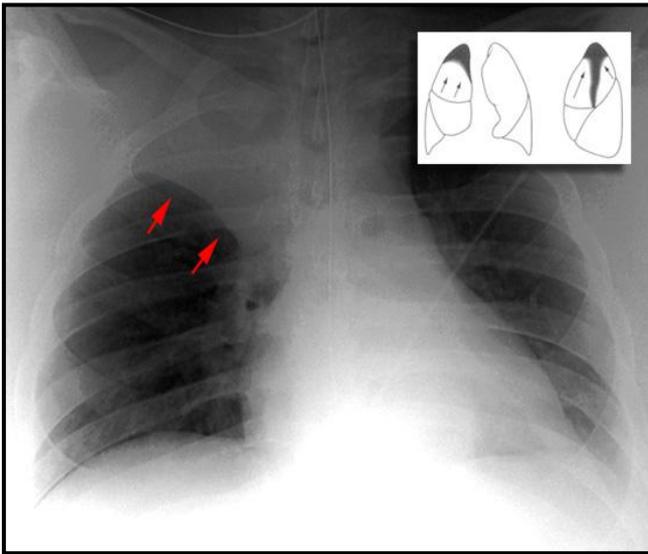
Air bronchograms can occur in both.

### Examples 1:

- PA view shows ↑ in density in the **right upper lobe**. (above the transvers fissure).
- Lateral view: there is **no shifting of the fissures** → **no volume loss** → **consolidation** (pneumonia).



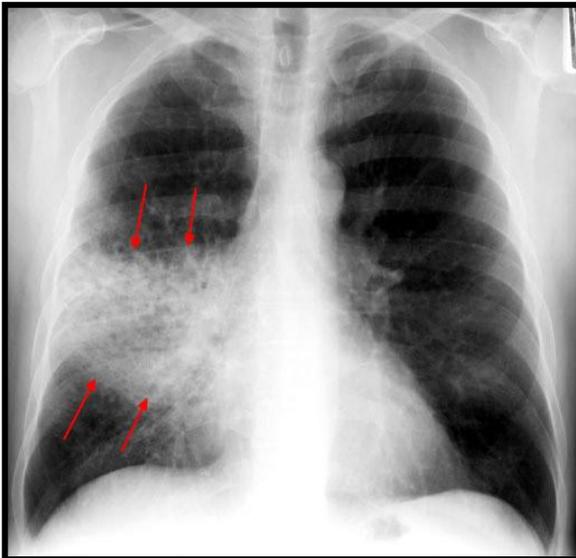
### Examples 2:



There is  $\uparrow$  in opacity in the **Right upper lobe** + the **transverse fissure is moved upward** (red arrows) + trachea is slightly moved to the other side  $\rightarrow$  Atelectasis of the **Right upper lobe**.

Because of a reduction in the upper lobe of the right lung, Transvers fissure has moved upward (toward the collapsed part)

### Examples 3:

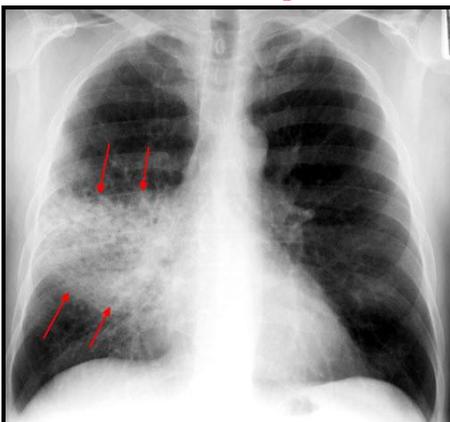


There is  $\uparrow$  in opacity in the **right Middle lobe** + there is **no shift** of the transverse and oblique fissure (red arrows)  $\rightarrow$  **consolidation** (pneumonia).

## Other terminology

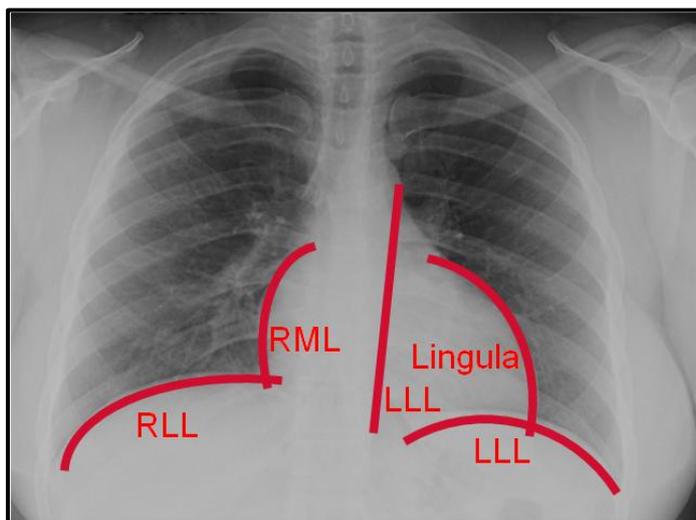
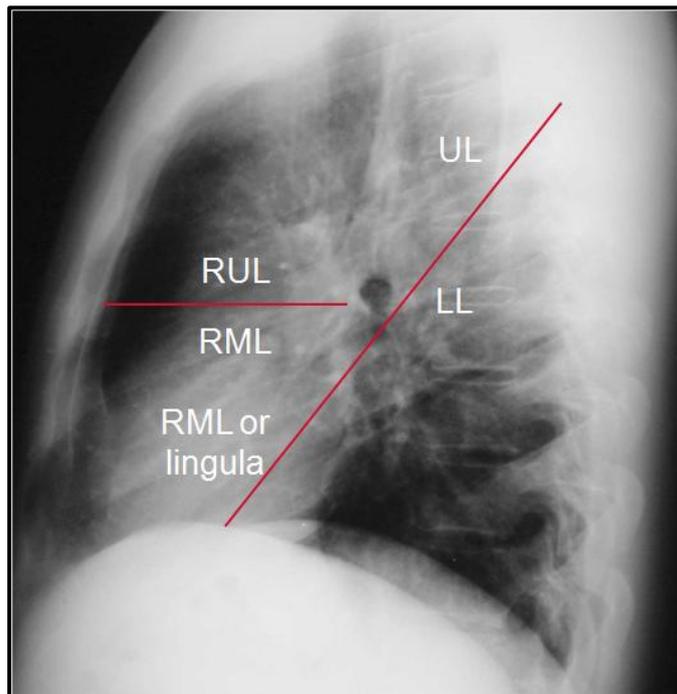
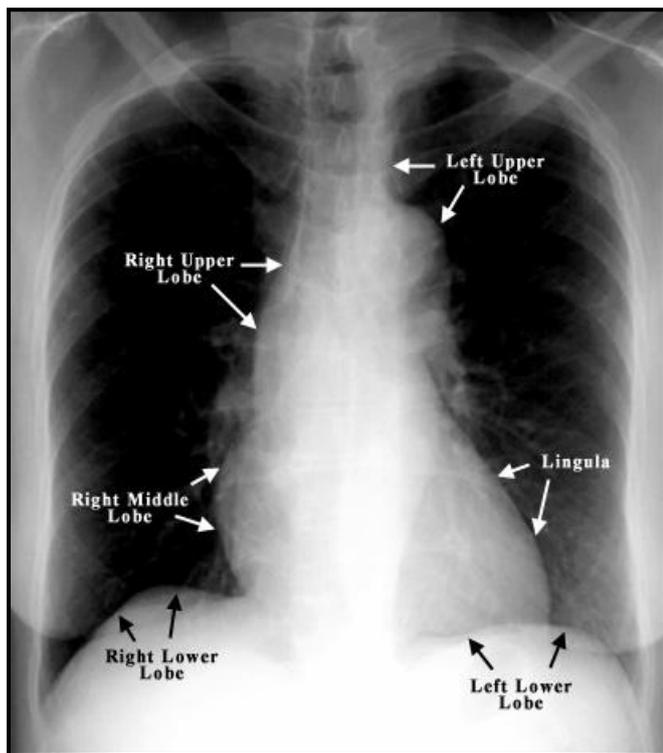
### The Silhouette Sign:

- **Definition:** the silhouette sign refers to the loss of normally seen borders between thoracic structures e.g. diaphragm or heart.
- **Indications:** **air space disease**.



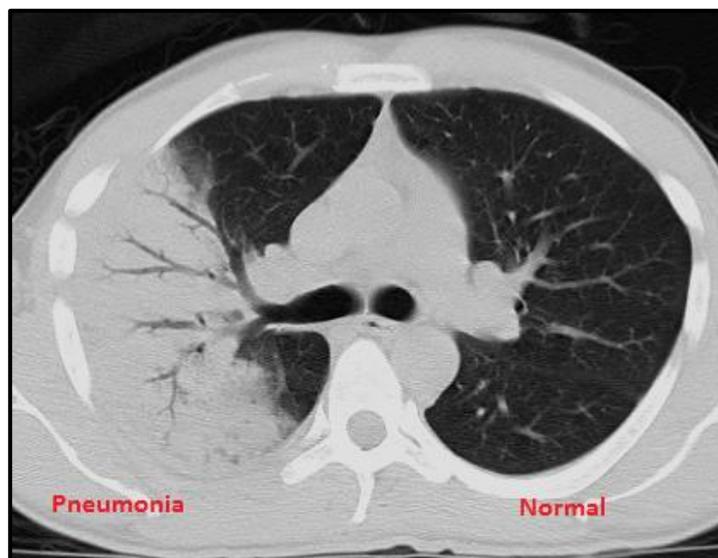
In this X-ray Silhouette sign can be seen between **the right middle lobe and right border of the heart**. (Borders cannot be differentiated).

- Localizing disease from the silhouette sign:

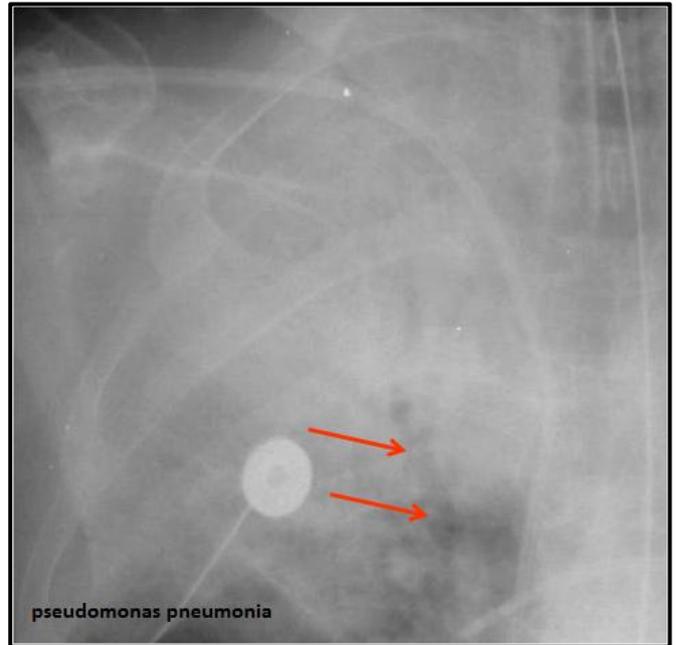
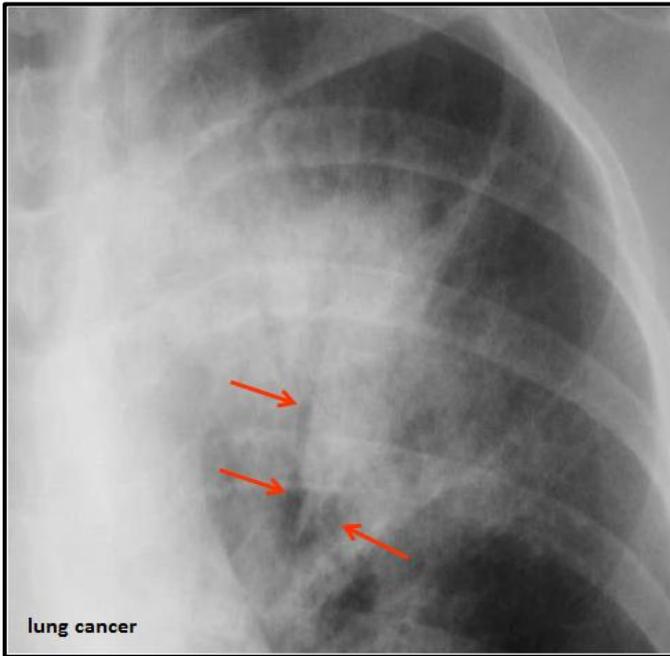


**Air bronchogram sign:**

- On a normal CT, we can visualize the air filled trachea, mainstem bronchi and initial portions of the lobar bronchi. Further branchings should only be seen with the injection of contrast during a bronchogram. (Appears white bronchial tree with a black background).
- When air can be **visualized in the more peripheral intrapulmonary bronchi**, this is known as the ‘**airbronchogram sign**’. This abnormality is usually caused by an **infiltrate/consolidation** that surrounds the bronchi (black bronchial tree with a white background inflammatory tissue “ sign of consolidation”



- **Examples:**



## Diseases

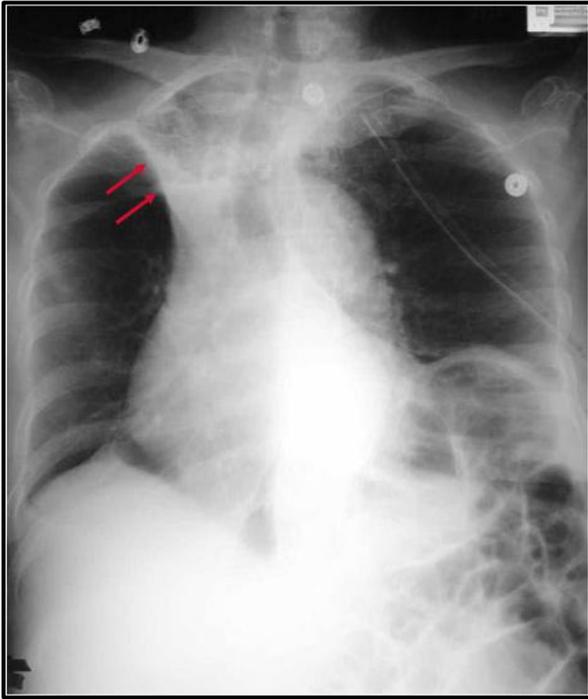
### Air Space Disease:

- **Definition:** a lung disease in which the Alveolar spaces are filled with something (rather than air).
  - **Radiologist's report:**
    - “consolidation”
    - “air space opacity”
    - “fluffy density”
    - “infiltrate”
- Other terminology for pneumonia
- **Nonspecific signs:**
    - Atelectasis, pneumonia, bleeding, edema, tumor.

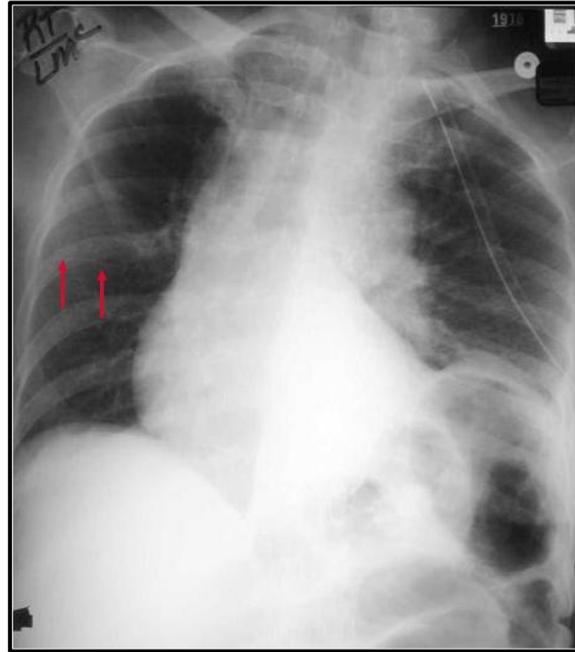
### Lobar Atelectasis (lobe collapse):

- **Signs:**
    - Best sign – **shift of a fissure**.
    - Rapid development and clearance.
    - Air bronchograms if non-obstructive.
  - **Secondary signs:**
    - Mediastinal shift.
    - Elevated diaphragm.
    - Ribs closer together.
    - Vague increased density.
- When a lobe collapses, the unobstructed lobe(s) on the side of the collapse undergoes compensatory expansion.
- The displaced (shifted) fissure is seen as a well-defined boundary to an airless lobe in an x-ray.
- The mediastinum and diaphragm may move towards the collapsed lobe.
- As lobar collapse is such an important and often difficult diagnosis to make on chest radiographs.
- CT shows lobar collapse very well, but is rarely necessary simply to diagnose a collapsed lobe.
- With collapse of the whole of one lung, the entire hemithorax is opaque and there is substantial mediastinal and tracheal shift

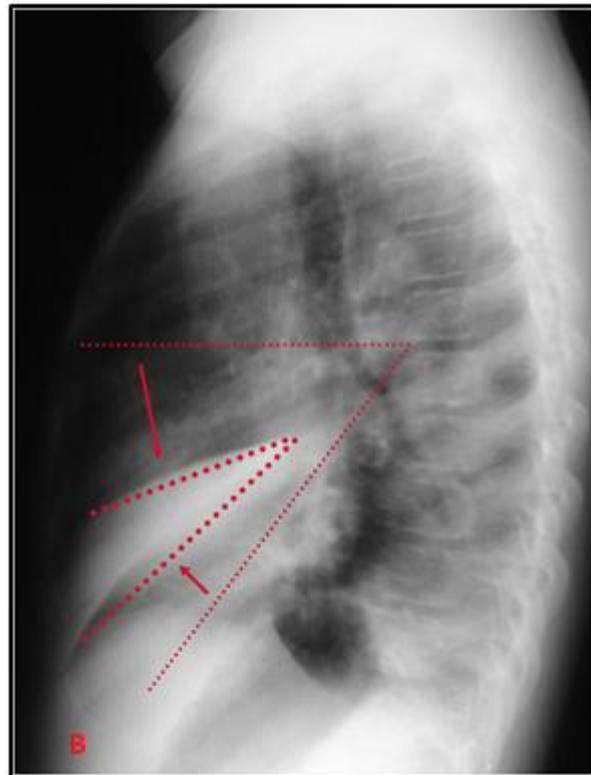
**Examples:**



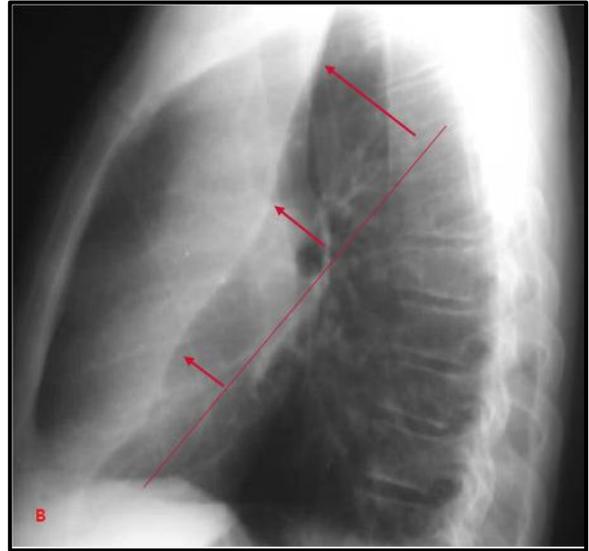
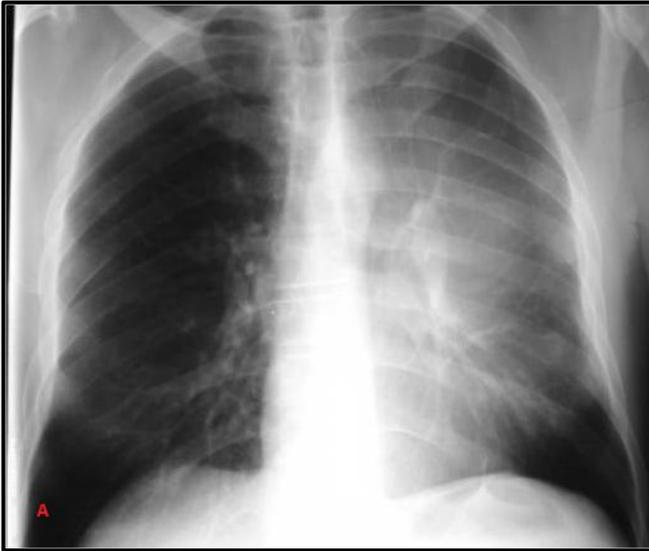
There is a shift in the transverse fissure (red arrows) caused by upper lobe collapse in the right lung. → **Right Upper Lobe Atelectasis (RUL ATx)**



After treatment → the shifting is disappeared after treatment.



- In A (PA view) → there is ↑ in density in the **middle lobe of the right lung**.
- In B (lateral view) → there is a **shifting in both transverse and oblique fissures** which indicates **loss of volume of the middle lobe** → **Right Middle Lobe Atelectasis (RML ATx)**.



- In A → abnormal left lung with no displacement of the trachea.
- In B → the oblique fissure is moved from its normal site (red line) to upward toward the collapsed side (red arrows) → **Left Upper Lobe Atelectasis (LULATx)**.

## Pneumonia Signs:

### - Signs:

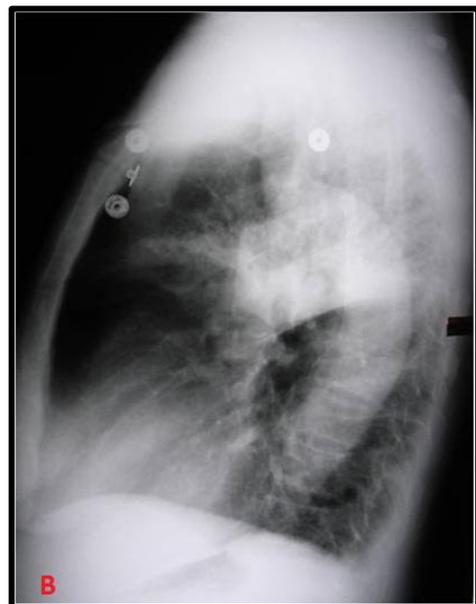
- Air bronchogram
- Silhouette - “positive” or “negative”
- Dense hilum
- “Spine” sign

- All are signs of any air space process
- Dx of pneumonia depends on appropriate clinical scenario.

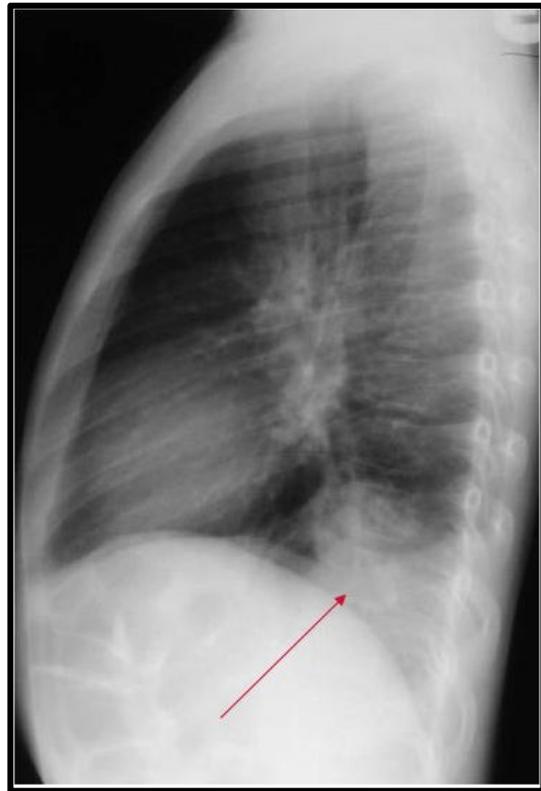
### Examples:



- In PA view → there is ↑ in density in the middle lobe of the right lung.
- In lateral view → there is no shift in the transverse or oblique fissure → **Right Middle Lobe Consolidation.**



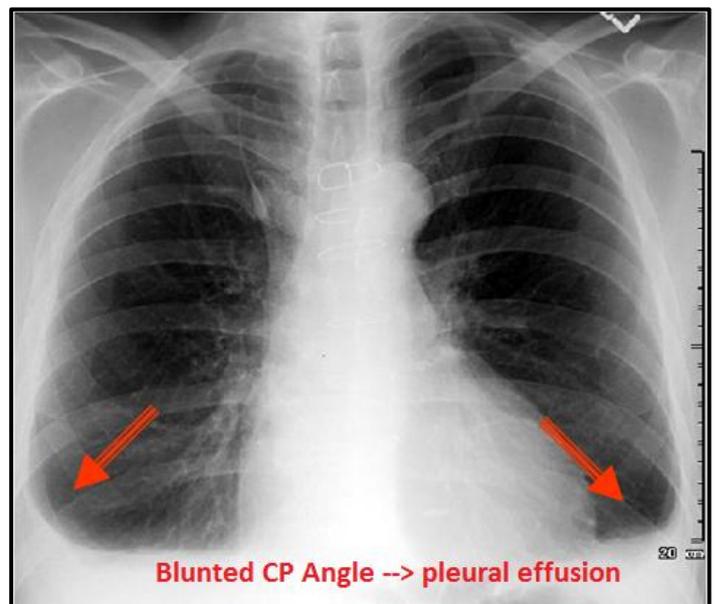
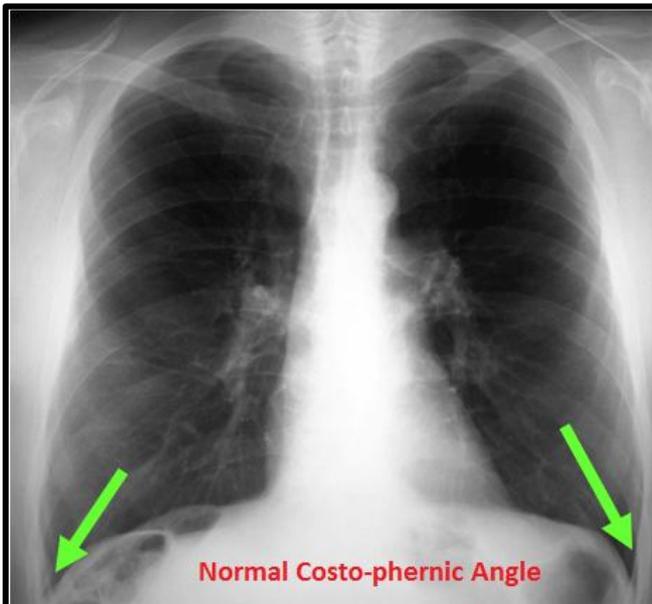
- In A → there is an ↑ density + the transverse fissure is not shifted.
- In B → no shift of the fissures.
- **Right Upper Lobe Consolidation.**



Posterior diaphragm silhouetted → Right Lower Lobe Consolidation.

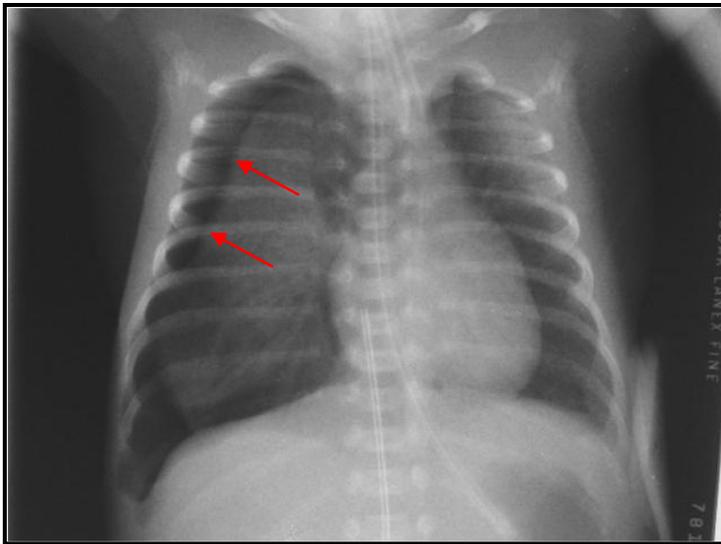
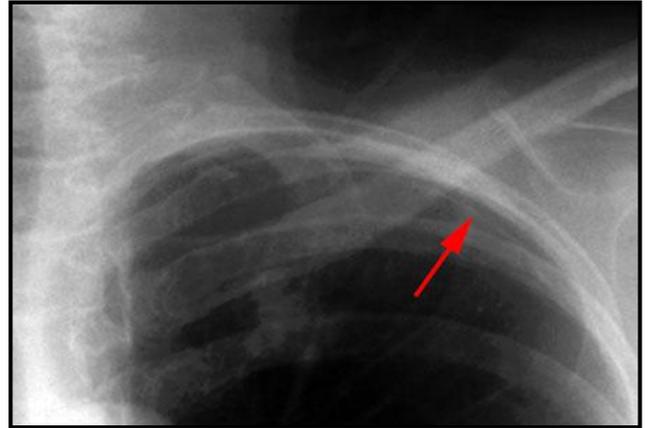
### Pleural Effusion “Hydrothorax”:

- **Definition:** Pleural effusion is excess fluid that accumulates between the two pleural layers, the fluid filled space that surrounds the lungs.
- **Sign:** Blunting of the costophrenic angle “best seen at erect position PA”



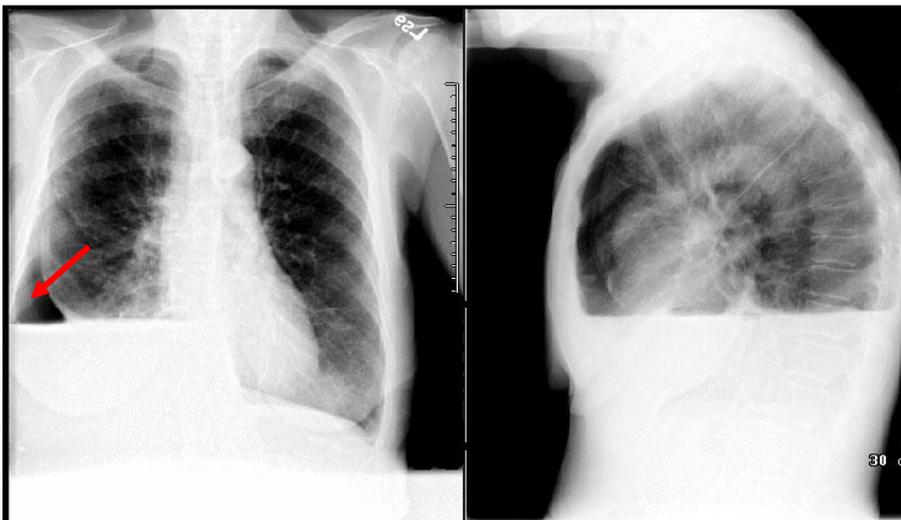
## Pneumothorax:

- **Definition:** A pneumothorax is defined as air inside the thoracic cavity but outside the lung.
- **A spontaneous pneumothorax (PTX):** is one that occurs without an obvious inciting incident.
- **Some causes of spontaneous PTX:**
  - Idiopathic.
  - Asthma.
  - COPD.
  - Pulmonary infection.
  - Neoplasm.
  - Marfanâs syndrome.
  - Smoking cocaine.
- **The diagnosis of pneumothorax:** depends on recognizing a line of pleura due to the lung edge being separated from the chest wall, mediastinum or diaphragm by air.



## Hydro-pneumo-thorax:

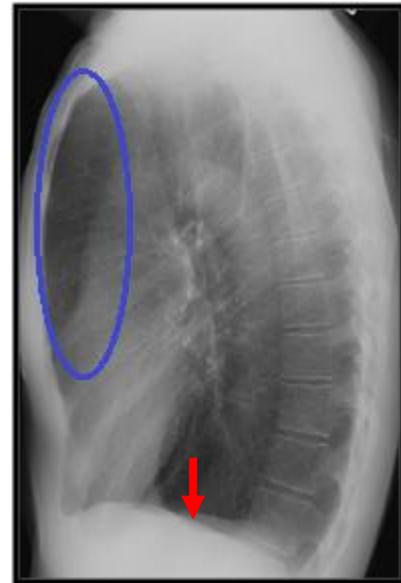
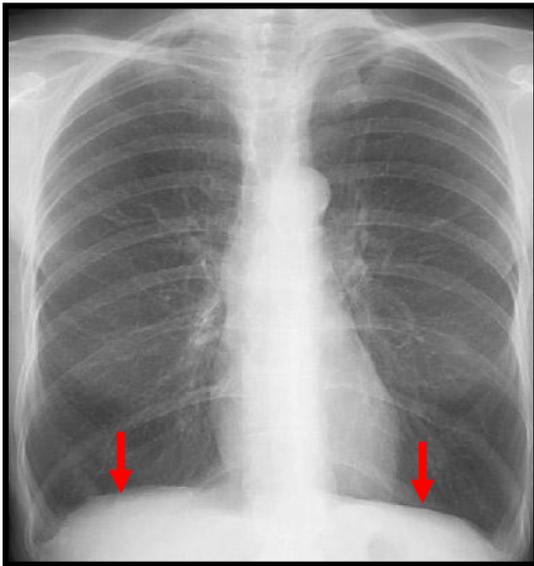
- **Definition:** presence of both air and fluid in the pleural space (between two layers of pleura).
- **Sign:** An erect chest x-ray will show the air fluid level. The horizontal fluid level is usually well defined and extends across the whole length of hemithorax.



An air (red arrow) fluid level is seen in the right lung → Hydro-pneumo-thorax

## Emphysema:

- **Definition:** Emphysema is **loss of elastic recoil** of the lung with destruction of pulmonary capillary bed and alveolar septa.
- Most common cause is cigarette smoking and less commonly by alpha-1 antitrypsin deficiency.
- **Radiological signs:**
  - on CXR commonly seen as diffuse hyperinflation with **flattening of diaphragms**, **increased retrosternal space (expanded chest)**, **bullae** (lucent, air-containing spaces that have no vessels that are not perfused).
  - Enlargement of PA/RV (secondary to chronic hypoxia) an entity also known as cor pulmonale. Hyperinflation and bullae are the best radiographic predictors of emphysema.
  - Increased lung volume. The diaphragm is pushed down and becomes low and flat.
- The patient may present with Heart Failure.



- **Flat diaphragmatic cupulae (red arrows).**
- Increase retro sternal air (**blue circle**) in the lateral view.