



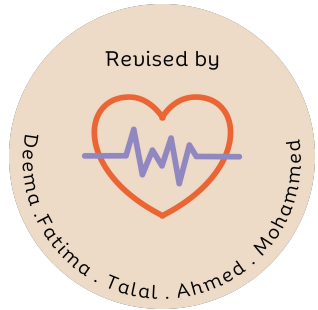
**Radiology**  
Team 438



M4  
E4  
D2



**Radiology**  
Team 442



Revised by

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# Radiology of Respiratory Diseases (2 Lectures)

## Lecture 4

### Objectives

- **Technique Objectives**
  - Learn the difference between PA vs. AP CXR
  - Learn the utility of a lateral decubitus CXR
  - Understand the terms inspiration, penetration, and rotation as they apply to determining a technically adequate film.
- **Anatomy**
  - Learn the basic anatomy of the fissures of the lungs, heart borders, bronchi, and vasculature that can be seen on a chest x-ray III.
- **Interpretation**
  - Develop a consistent and thorough technique for reading images
  - Learn how the silhouette sign can help localize pathology IV.
- **Pathology**

### Color Index:

Main text Males slides Female slides Dr's notes Important Golden note Extra

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Editing File

## Looking for Abnormality: How to Read a Chest X-ray?

- 1 Turn off stray light, optimize lighting & view images in order.
- 2 Patient Data (Name, History, Age, Sex, Old films)
- 3 Routine Technique: (AP/PA, exposure, rotation, supine or erect)
- 4 Trachea: midline or deviated, caliber and mass.
- 5 Lungs: abnormal shadowing (Capacity) or lucency (black).
- 6 Pulmonary vessels: artery/vein enlargement
- 7 Hilum: masses, lymphadenopathy
- 8 Heart: thorax >2:1? Cardiac configuration?
- 9 Mediastinal contour: width, mass
- 10 Pleura: effusion, thickening, calcification
- 11 Bones: lesions, fractures
- 12 Soft tissue: don't miss a mastectomy
- 13 ICU films: identify tubes first and look for pneumothorax.

### When you start looking for a pathology, ask yourself:

- Is it in good inspiration?
- Can you count the ribs?
- What about penetration?
- Can you see the spine processes in some extent?
- Clavicular distance from the spinous process?
- Is the trachea in midline?
- Enlarged mediastinum?
- The walls of the heart?
- Then compare the two lungs, any opacities, Lucency?
- Hemi-diaphragm, plural covering.
- Stomach bubble.

### Also remember the 5Bs

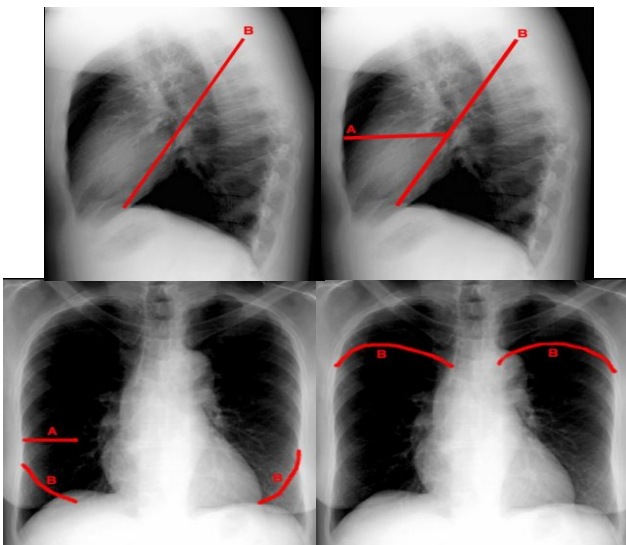
Looking to **B**ehind, **B**elow diaphragm, **B**ehind the heart, **B**ase of the neck and **B**ones.

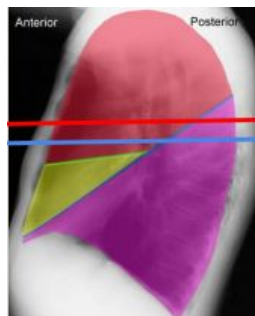
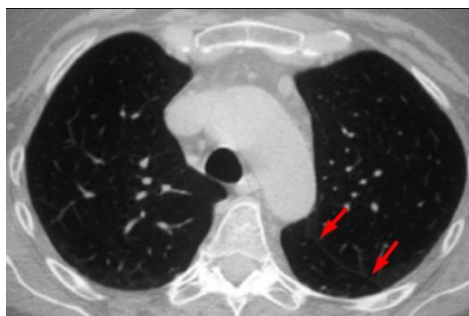
## Chest Anatomy

### » Lobes and Fissures

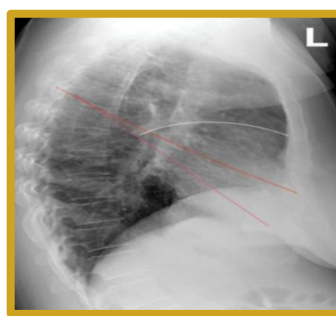
One of the landmarks for defining lobes of the lung is the interlobular septae.

- On the PA chest X-ray, the **transverse** (minor) fissure divides the right middle lobe from the right upper lobe (**marked A**).
- The **oblique** fissures are usually not well seen on a PA view (**marked B**).
- If there is fluid in the lower lobe, it usually manifests as a density in the lower lateral margin.
- Oblique fissures run from posterior to anterior aspects of the lung obliquely while the transverse is straight.



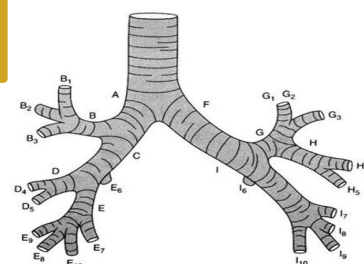


extra picture



extra picture

Pink: left Oblique fissure  
 Orange: horizontal fissure  
 Yellow: Right Oblique fissure



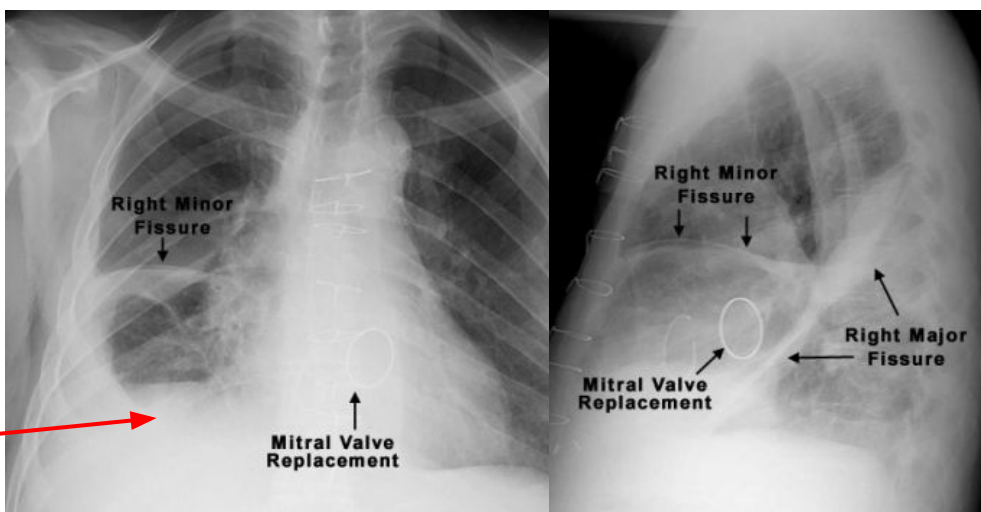
Bronchial Airway

- On a CT scan, the oblique fissure appears as a thin line from the most posterior aspect in the upper lobe and as you go down it moves toward the anterior aspect.
- Redline shows the section that the CT was taken from.

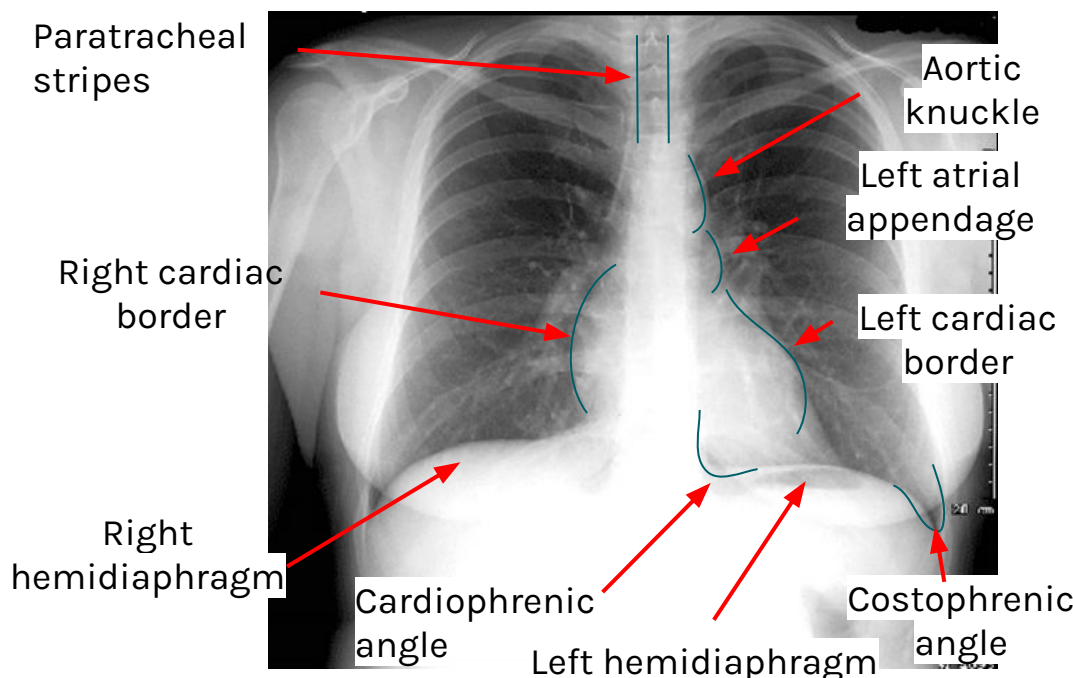
## Case: HF with pleural effusion

We have here a cardiac patient with multiple valve prosthesis (mitral & tricuspid) and cardiomegaly & pleural effusion that finds its way through the lung fissures.

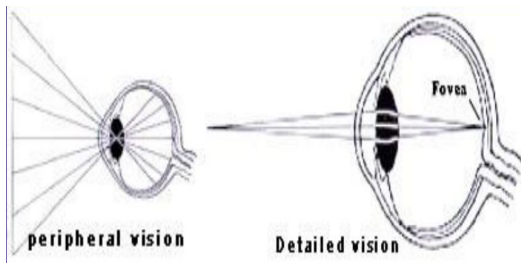
- Notice how the mediastinum is wide
- The pleural effusion extends into the right transverse fissure and to the right oblique fissure
- You can also notice that the right oblique fissure is thickened because of the fluid. (Pleural effusion)



## Mediastinum and Lungs

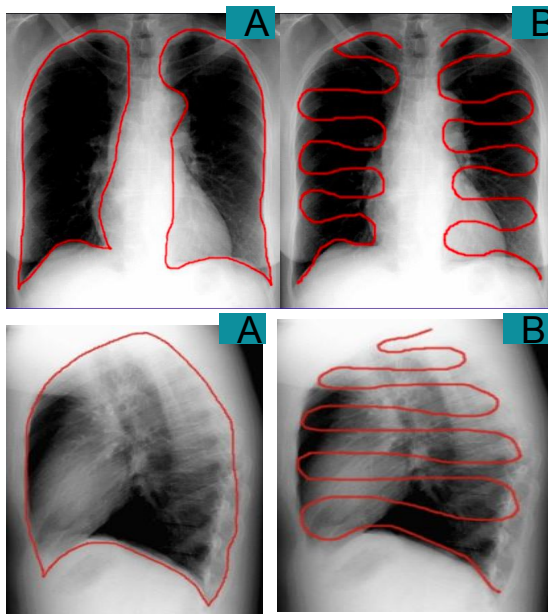
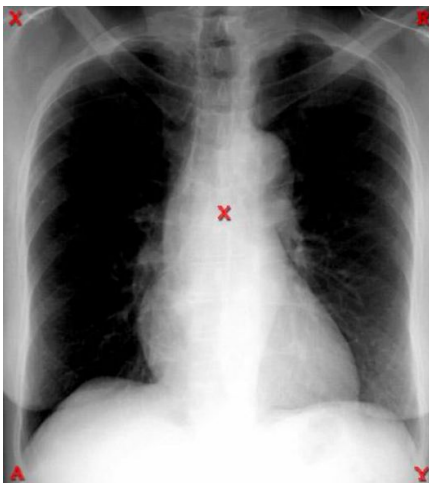


## Looking for abnormalities

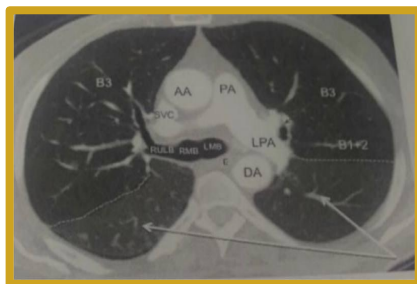


Your eye gaze should scan all portions of the film, follow lung/mediastinal interfaces and look again carefully in areas where you know that mistakes are easily made, such as over the spine on the lateral view and in the apex on the PA view.

Try to focus your gaze on the X, would you be able to read the letters in the corner?



Most important is to be **consistent** and **systematic** pleural pulmonary interface (boundaries) (A) scanning entire lung following a zig zag pattern (B).



Q-The arrow in selected cut of the ct-scan refers to:  
A: Superior aspect of lower lobe.

## CXR Signs

### Air Bronchogram Sign

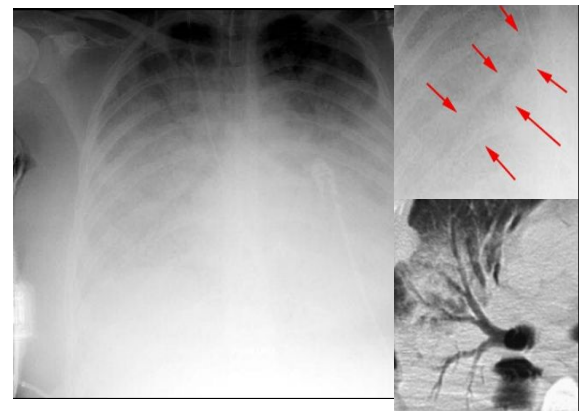
Is a tubular outline of an airway made visible by filling the adjacent structures with fluid, exudate, pus, or blood.

**Six diseases can cause an air bronchogram:**

1. Lung consolidation
2. Pulmonary edema
3. Non Obstructive atelectasis
4. Neoplasm
5. Severe interstitial disease
6. Normal expiration
7. pneumonia

**Examples**

1. Bilateral lower lobe pulmonary edema makes the bronchi visible as an air bronchogram.



## » Silhouette<sup>1</sup> Sign

- It's 2 structure with similar densities and the border between will go away.
- Loss of lung/soft tissue interface caused by a mass or fluid in the normally air-filled lung.
- Which means if there was opacity in the lung in an anatomic contact with a structured border, the opacity will obscure the border
- This sign is commonly applied in the heart, aorta, and chest wall.



<sup>1</sup>shadow

### Examples

1. **Pneumonia** in the right middle lobe will obscure the right cardiac border (image)
2. The right hemidiaphragm will be silhouetted by a right lower lobe pathology.

You can Localizing disease from the **silhouette sign**:

Ex:

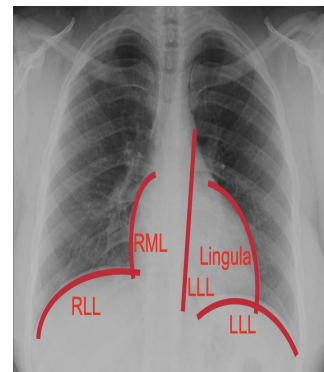
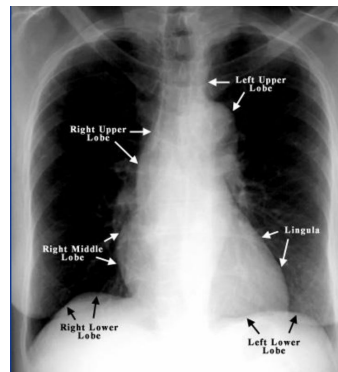
RLL → Diaphragm

RML → R heart border

RUL → Ascending Aorta

LUL → Aortic Arch

LLL → Left hemidiaphragm



## » Double Border Sign - Always read together-

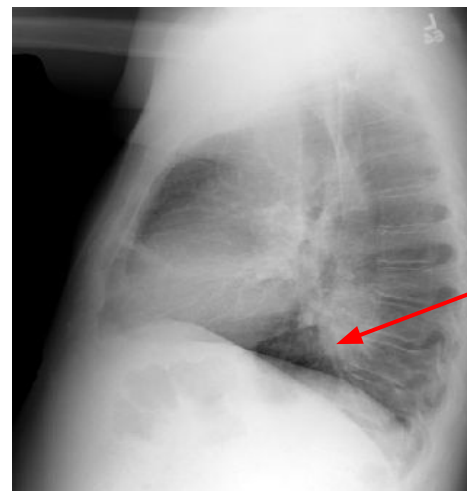
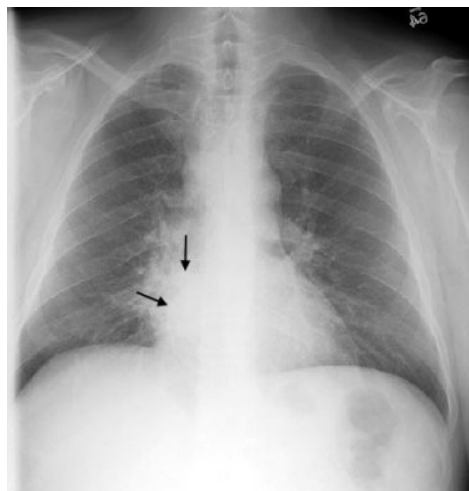
You're only allowed to have one cardiac border, once you see double border do lateral imaging.

### Examples

1. A problem posterior to the heart, mediastinum or lungs will show double cardiac border
  - a. The image shows a double right cardiac border which is very clear in the lateral view

In X-rays don't forget the 5 Bs:

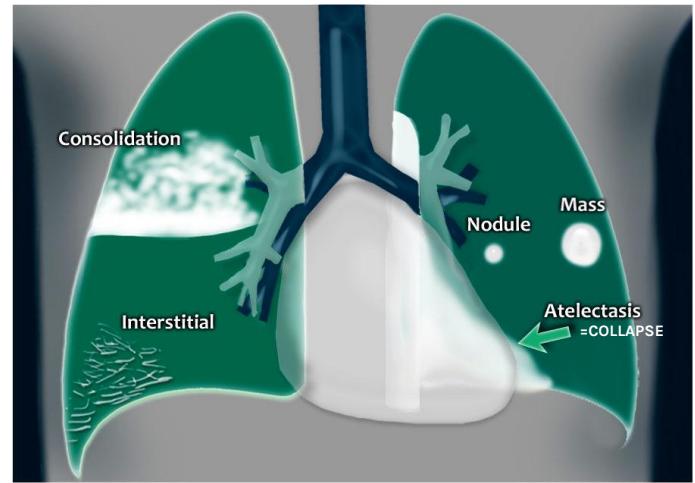
1. Base of neck
2. Below the diaphragm
3. Behind the diaphragm
4. Behind the heart
5. Bones



Site of the pathology posterior to the heart (tumor)

# Lung Diseases

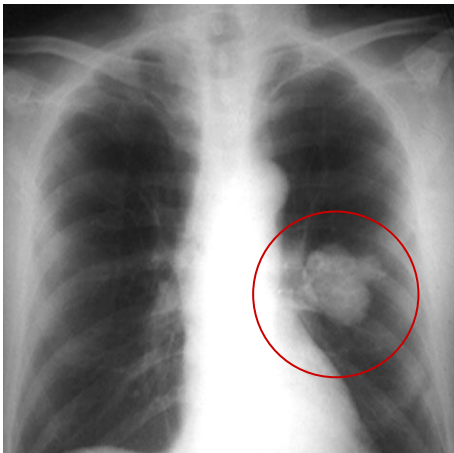
- Consolidation= pneumonia.
- Nodules= small <3cm.
- Mass= large. >3cm.
- Atelectasis= lung collapse.
- Interstitial= diffuse lung disease.
- Air space disease= consolidation
  - fills already present air space
- Mass or nodule= starts as single cell And grow to push not replace causing (mass effect).



## » Mass VS. Diffuse Infiltration

- The basic diagnostic instance is to detect an abnormality.
- In both of the cases, there is an **abnormal opacity**, left upper zone.

### Mass



- In this case, the opacity would best be described as a **mass because it has edges well-defined (clear outline)** 3D structure  
تقدر تحددھا بالرصاص
- We can see the mass in PA and lateral views which prove the 3D nature of the mass.
- In lateral view appears oval like shape “3D”.

### Diffuse Infiltration



- In this case, has an opacity that is poorly defined (**Not clear outline**). This is **airspace disease such as pneumonia (diffuse disease)**.
- Involve large space of the lung, flat and diffused.
- In lateral view there will be a change in its appearance.

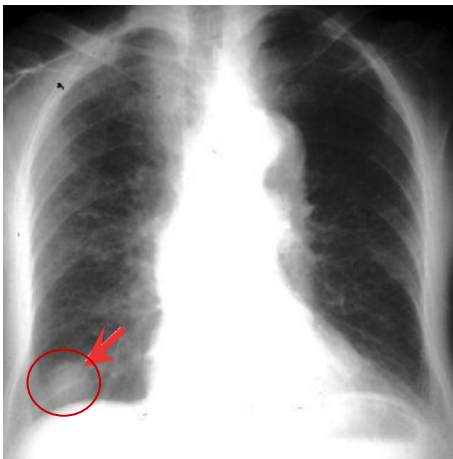
## » Solitary Nodule In The Lung

- 1 A solitary nodule in the lung can be totally innocuous "harmless" or potentially a fatal lung cancer.
- 2 After detection the initial step in analysis is to compare the film with prior films if available.
- 3 A nodule that is unchanged for two years is almost certainly benign.
- 4 Be sure to evaluate for the presence of **multiple nodules** as this finding would change the differential entirely.
- 5 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.

X-Ray can't detect nodules smaller than 1 cm so we do a CT to:

- make sure it's solitary.
- To characterise the nodule further.

### Mass



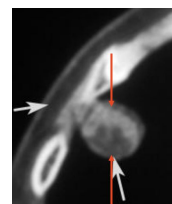
Hamartoma

Well defined mass lesion .

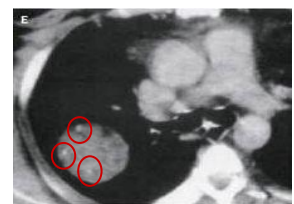
If nodule is > 3cm it's a mass.

**Mass:** Rounded structure (contains fat and soft tissue in other segments).

CT scan help to characterize the mass and if it's benign or malignant.



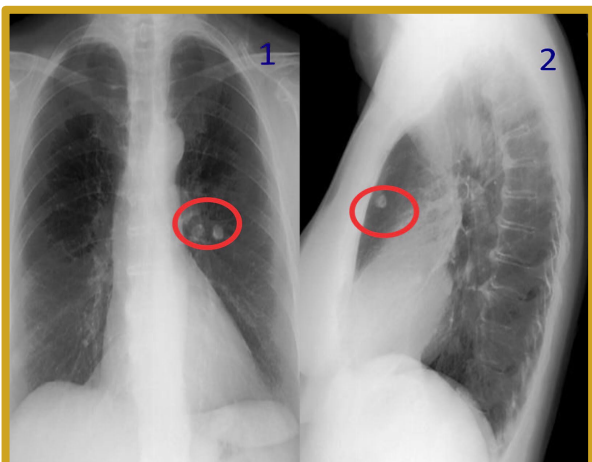
The dark area consists of Fat



Small calcifications

**Trick:** If the mass silhouette the hilum that means it's in the middle if not its in anterior or posterior. (Lateral view will further help in specifying the location).

### Solitary Nodule



If you see Pic 1 you can tell that there is a small rounded lesion. But **is it a small infiltration or a mass lesion?**

We will do lateral view (Pic 2) and we will see the lesion in 3D, we can know what is the exact location of that nodule which is anterior lung solitary nodule.

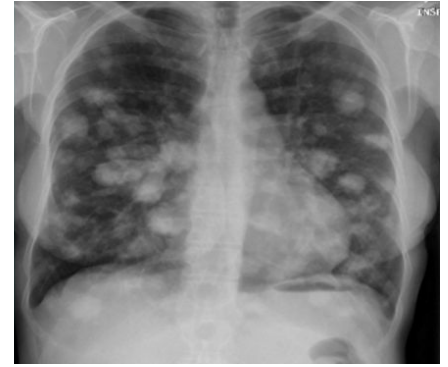
So, in order to locate if it was anterior/posterior/middle we take lateral view.

# Nodules and mass

## » MULTIPLE NODULES METASTASIS

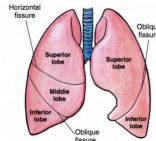
Are most often metastases from a distant primary tumor, but they must be distinguished from a number of inflammatory and infectious diseases that may cause multiple pulmonary nodules or masses.

If you see pic like this in your exam it's more likely metastasis



## Fissures

### » Fissures

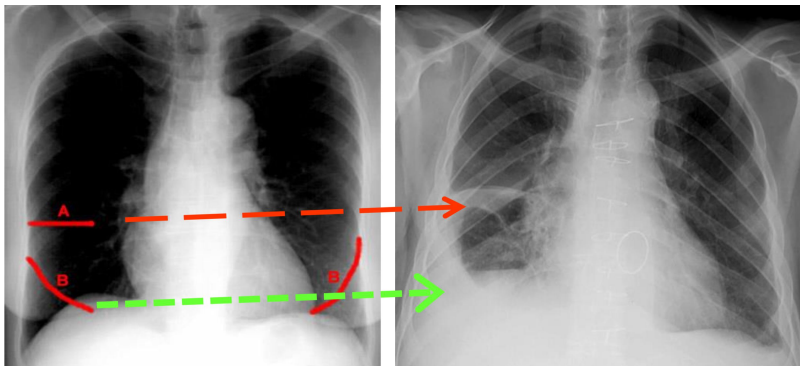


One of the most important things in lung X-Ray is the fissures: It has 2 benefits:

- 1 It shows us the lung anatomy (upper, middle, lower lobes)
- 2 The fissure are movable, if it moves up or down on x-ray it may indicates a pathology.

How to differentiate between fissures and vessels?

vessels are branching, while fissures continue to the lateral side.



What is the most important sign for pleural effusion ?

meniscus sign ( C )

a crescent-shaped inclusion of air surrounded by consolidated lung tissue.

Encysted pleural effusion of transverse fissure (A) red arrow) and oblique fissures (B) green arrow), so when we see the pathology the fissure outlines becomes more clear and thick ( as they contain fluid in this case ).

## » Recognizing Air Space Disease (Alveolar Lung Disease):

Alveolar spaces are filled with...Something. (Replacement of volume → there is no volume loss in consolidation.)

Radiologist's report:

- “consolidation”
- “air space opacity”
- “fluffy density”
- “infiltrate”

Nonspecific:

Atelectasis, pneumonia ( infection so filled with pus), bleeding (Pulmonary hemorrhage in patients taking anticoagulants), edema (Heart failure), tumor, atelectasis.

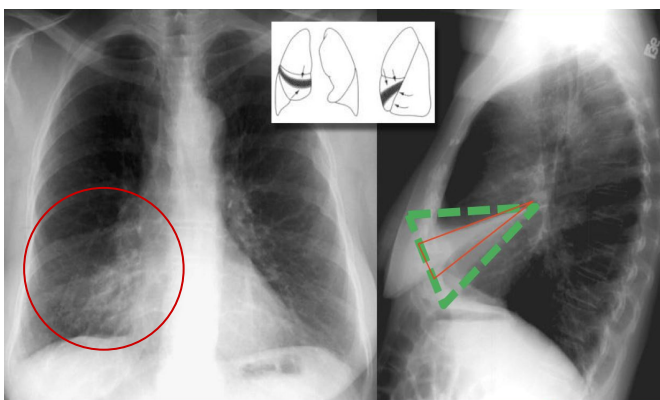


## Major differentiating factors between atelectasis and pneumonia

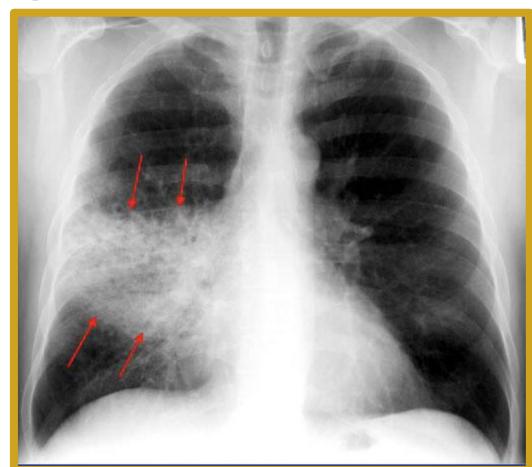
Atelectasis (Which leads to collapse)	Consolidation
Loss of volume of lobe, segment or sub segment of the lung. Because of obstruction to the bronchus.	Loss of air in lobe, segment or sub segment of the lung. The air is replaced by something else
Example: <b>collapse</b> (lung) collapse of the lung if the obstruction is in the main bronchus.	Example: <b>pneumonia</b> (lobe)
Major differentiating factors between atelectasis and pneumonia:	
<ul style="list-style-type: none"> <li>• <b>Volume loss.</b></li> <li>• <b>Associated ipsilateral shift</b> (trachea and pleura will try to fill the collapsed area).                             <ul style="list-style-type: none"> <li>• <b>Linear, Wedge-shaped.</b></li> <li>• Apex at hilum (points at hilum).</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• <b>Normal or increase volume.</b></li> <li>• No shifting, or if present then <b>contralateral.</b></li> <li>• <b>Consolidation, Air space process.</b> <ul style="list-style-type: none"> <li>• Not centered at hilum.</li> </ul> </li> </ul>
<p><b>Air bronchograms</b> (fluid inside the bronchioles) can occur in both. Sometimes consolidation and collapse happens together but it's rare, so there will be loss of volume and some replacement of air.</p>	

★ **What is the most important sign for Pneumonia: Air bronchogram**

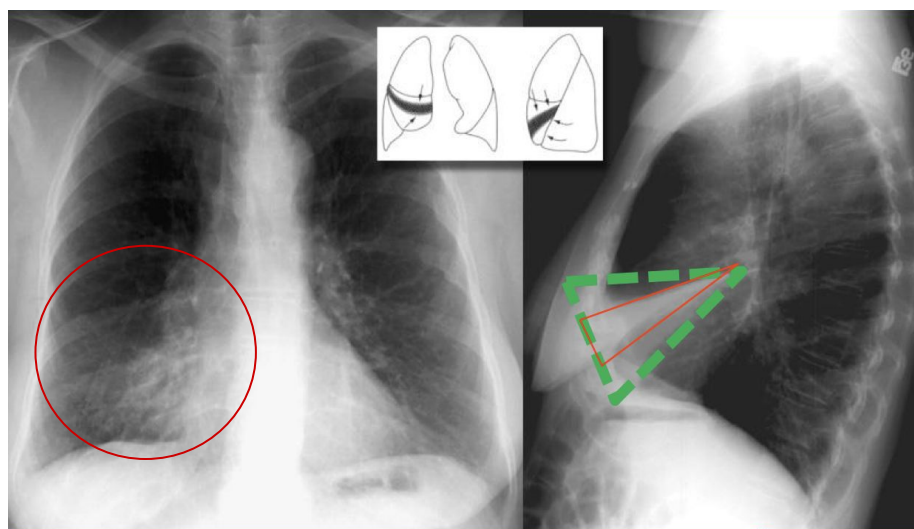
Right middle lobe collapse



Right middle lobe consolidation.



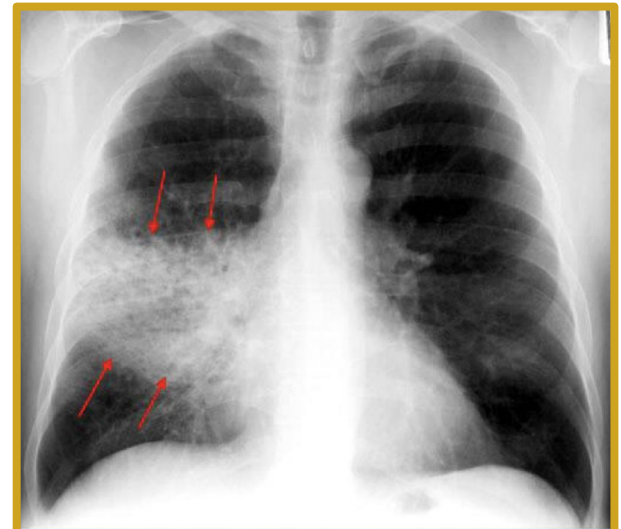
## » Atelectasis VS Pneumonia



### Right middle lobe collapse

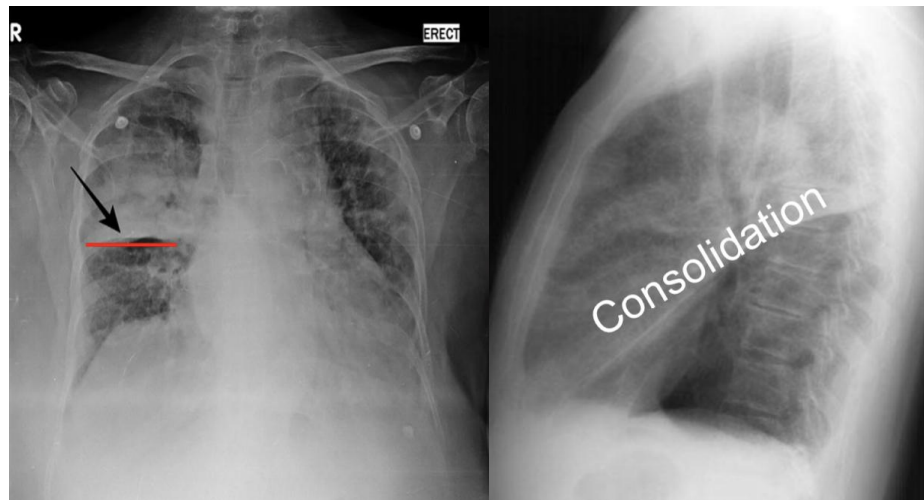
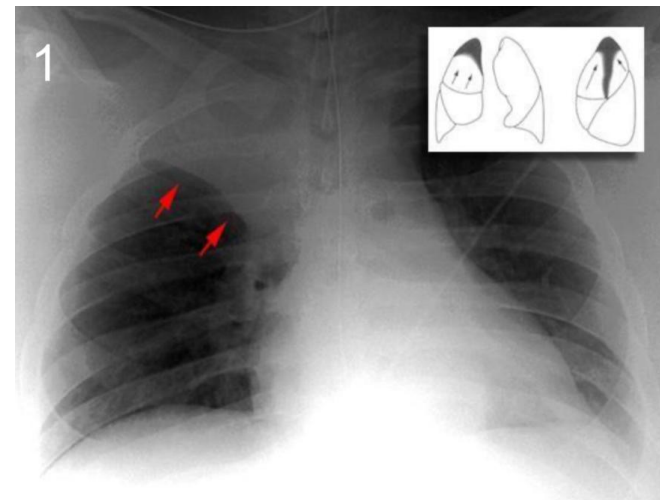
Opacity seen at the right mid zone silhouetting the right heart border.

Lateral view: we can see triangular or wedge shaped structure with the apex toward the hilum.



### Right middle lobe consolidation.

Poor defined infiltration is limited by the horizontal fissure and silhouetting the right heart border with central lucency (this could be **air bronchogram**).







**Pic 1**: chest x-ray shows **consolidation in the right upper lobe** and very clear line (red arrow) which represents the transverse fissure, these findings indicates upper lobe **atelectasis**.

**Pic 2**: diffuse area of consolidation in PA view, we don't know if there is loss of volume or not, so we will do lateral view. And the lateral view shows normal location of oblique fissure, so the area of consolidation that involves the upper and middle lobe is pneumonia (normally we don't see the oblique fissure this clear, but because of white contrasting pneumonia in the upper lobe, it will be obvious).

## » Lobar Atelectasis

- ❖ **Best sign is** → Shift of a fissure. ★
  - ❖ Rapid development and clearance. Unlike pneumonia the opacity persist for days.
  - ❖ Air bronchograms if **non-obstructive**
- Secondary signs:**

Air bronchograms means fluid inside the bronchioles, if there is obstruction in the level before the bronchioles, the fluid will not be able to reach it, so this sign will not be obvious.

- 1 Mediastinal shift 
- 2 Elevated diaphragm 
- 3 Ribs closer together 
- 4 Vague increased density 

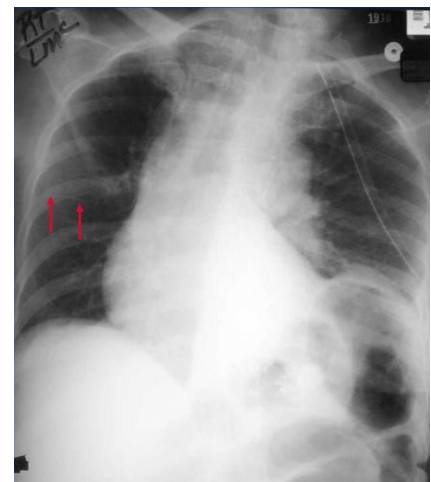
All these 4 signs because of volume loss.

## » Right Upper Lobe Atelectasis

1: A patient presented with fever, they put endotracheal tube and after that, he got dyspnea and after that a chest x ray was done. They found: **right upper lobe atelectasis.**

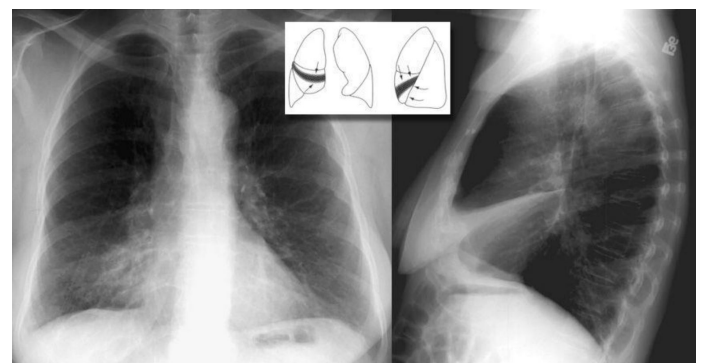


2: The patient took antibiotic and the proper treatment. They also removed the tube and they did follow up chest X-ray. They found the transverse line came back to its normal position.

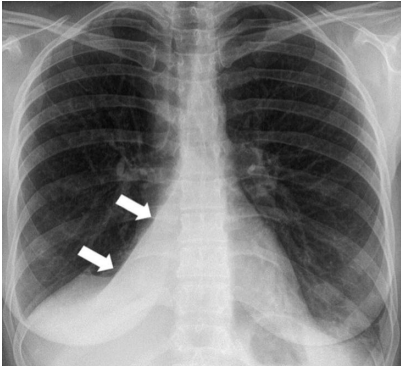


## » Right Middle Lobe Atelectasis

As far as I know there is 2 pathologies here: right middle lobe collapse and right lower lobe consolidation. In the middle area of the right lung there is opacity (consolidation), is it collapse? We did lateral view and **we can see that the transverse and oblique fissures moved from their normal position which indicates right middle lobe atelectasis.**

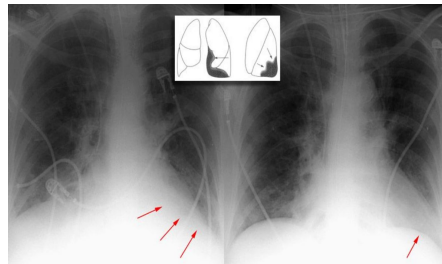
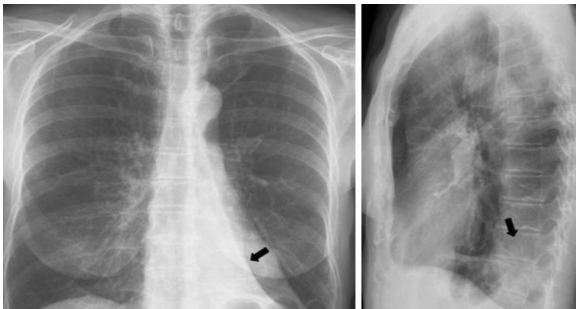


## » Right Lower Lobe Collapse

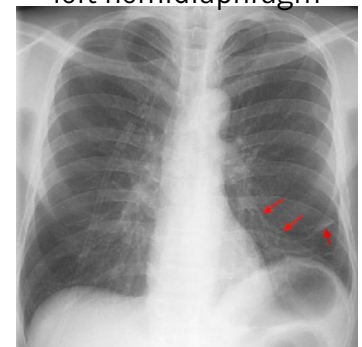


- Right side tracheal deviation.
- Triangular density demarcated by the medially displaced major fissure.
- The atelectatic RLL silhouette the right hemidiaphragm.

## » Left Lower Lobe Collapse



Note the elevation of the left hemidiaphragm

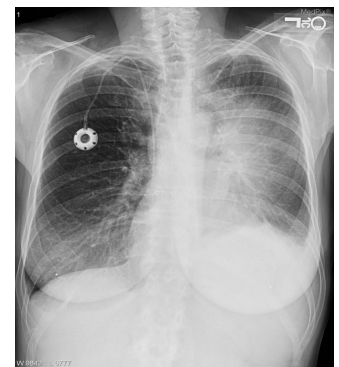
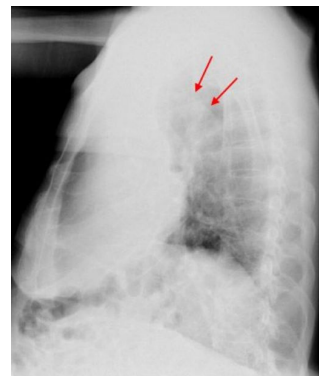
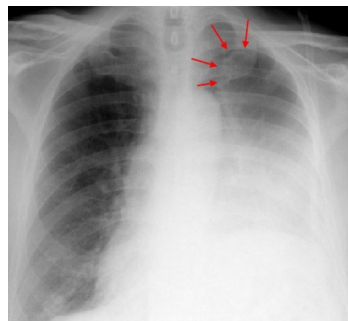
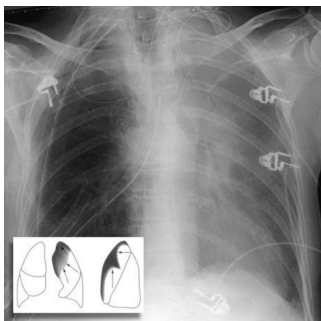


### Atelectatic left lower lobe silhouette the left hemidiaphragm:

- Well defined border, margined by fissure.
- Volume loss because the fissure shifted medially.
- Points toward the hilum.

On lateral view, positive spine sign (opacity overlying the spine).

## » Left Upper Lobe Collapse



**Tracheal deviation:** If the pathology is on the left side and the trachea deviates toward it, this means that the pathology is a volume loss, such as a collapse. However, if the trachea deviates away, it means that something is pushing it, such as hemothorax or pleural effusion.

**Luftsichel sign** (Arrow) → due to hyperinflated left lower lobe.

**The diaphragm is elevated** (normally the left diaphragm is always at a lower position than the right diaphragm).

## » Pneumonia

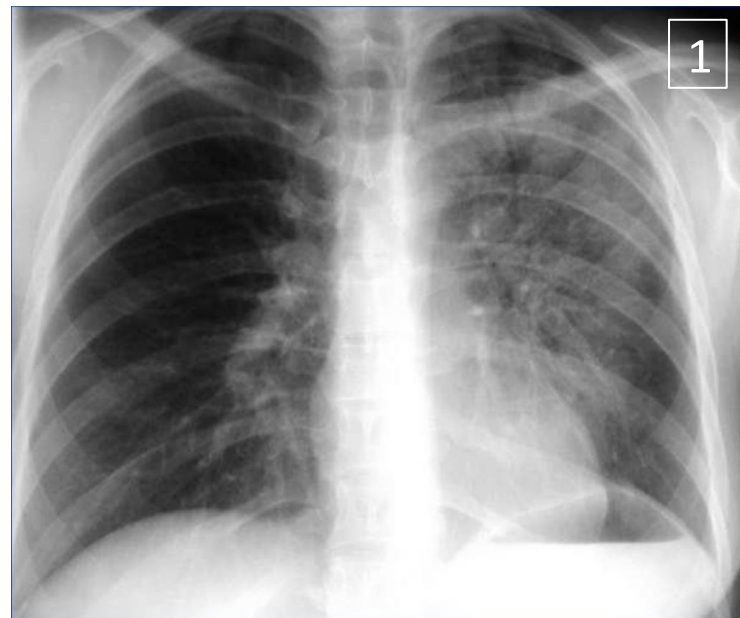
### Signs

- |  |   |                      |  |
|--|---|----------------------|--|
| <b>1</b> Air bronchogram sign<br>It's either collapse or consolidation | <b>2</b> Silhouette<br>Positive or negative | <b>3</b> Dense Hilum | <b>4</b> Spine sign<br>Dorsal spine sign (On lateral film) |
|--|---|----------------------|--|

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

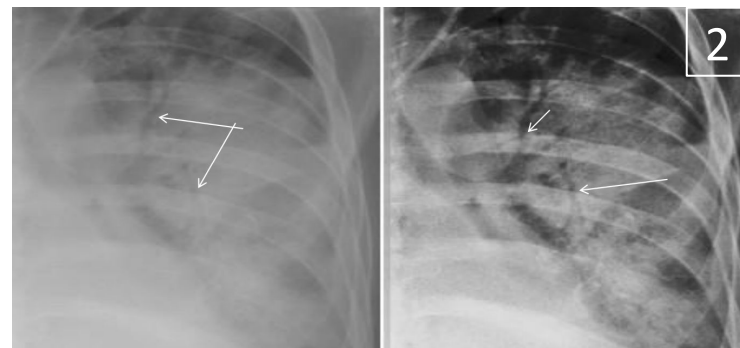
## » Air - Bronchogram it is a sign not a modality

**Pic1:** The Right lung is normal; no obvious bronchial tree, all air spaces in normal lung will have the color black on x-ray because it contains air and also bronchial tree will appear black because it contains air. In the Left lung there are very thin like lines "hair branching lines" which is bronchial tree called AIR-BRONCHOGRAM. If there is pneumonia (left lung) the lung will be white in color because the air can't go through the lung spaces and alveoli, but we may see bronchi in some cases because the bronchi are not affected.



### Pic2: Air bronchogram sign

- Air consolidation in the right upper lobe and we can see some dark grey lines on x-ray (arrows) which represent the the bronchial tree.
- AIR-BRONCHOGRAM very clear it's a sign of pneumonia.

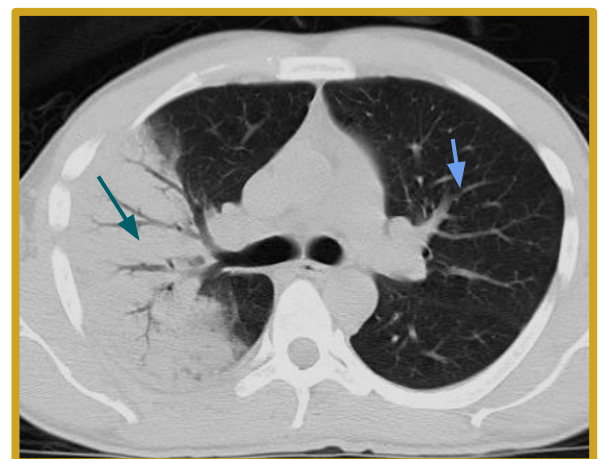


## » Air Bronchograms - CT

green: bronchi    blue: vessels

The Left side is completely healthy lung and we can't see the bronchial tree clearly because the whole lung contains air and the bronchial tree contains air so they will be all black.

The Right diseased lung we see consolidation caused by loss of air in the lung so it will be white, but the bronchial tree is still have some air so it will be back.

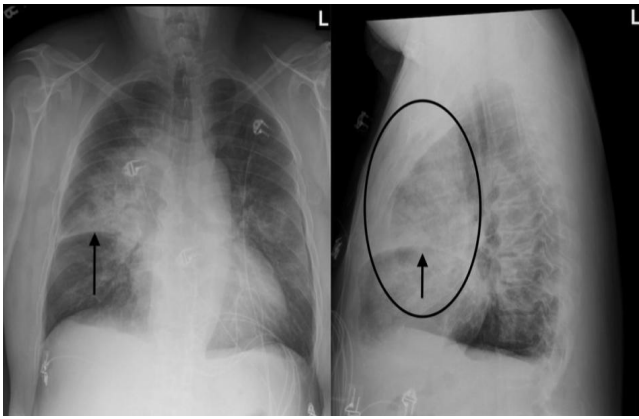


Pseudomonas pneumonia

Collapsing Pneumonia

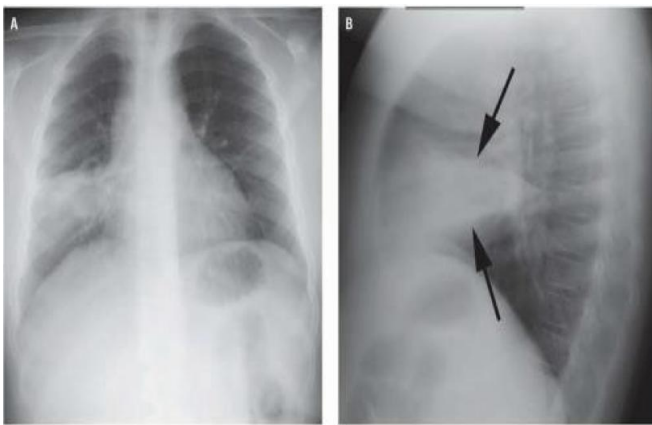
Remember this is lung window:)

## Right Upper Lobe



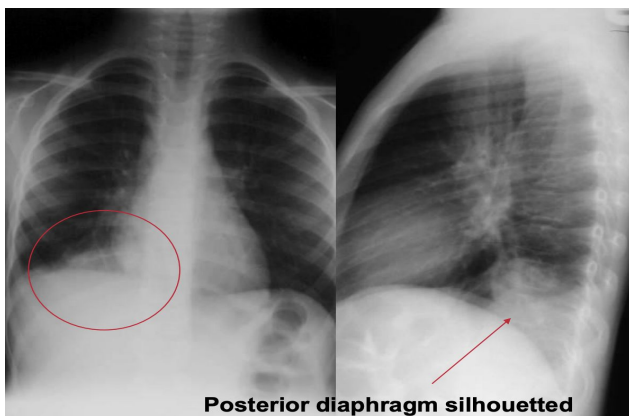
- Consolidation of the right upper lobe which is confined inferiorly by the horizontal fissure.
- Horizontal fissure is intact in pneumonia not displaced.

## Right Middle Lobe

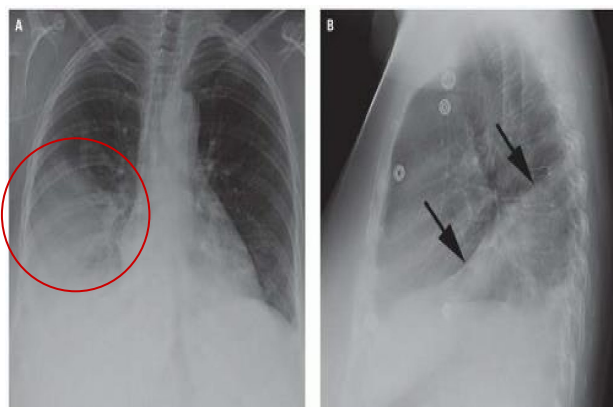


- The right middle lobe is located below the horizontal fissure which confines the area of consolidation in this image.
- The right middle lobe is also next to the right heart border which is silhouetted in this image

## Right Lower Lobe



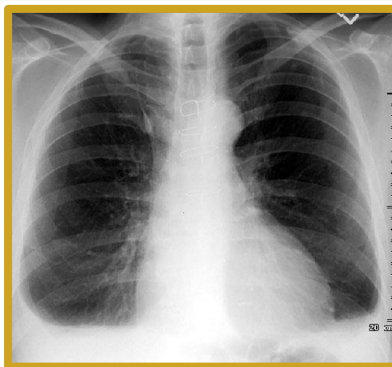
- The right lower lobe is located adjacent to the right hemidiaphragm which is not clearly visible in this image (silhouetted).
- The right heart border is still visible which indicates that the consolidation is not in the middle lobe.



## ⇒ Pleural Effusion

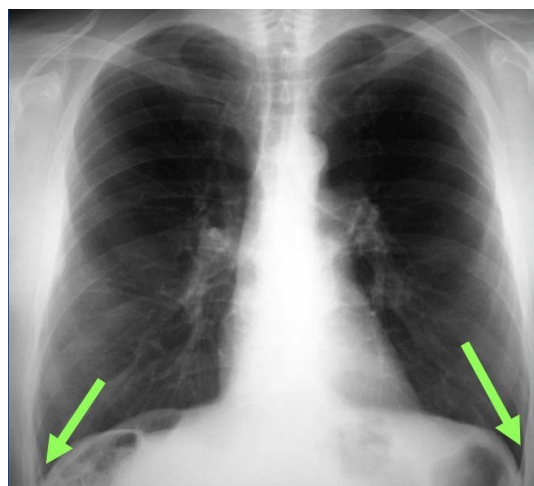
- ❖ what is pleural effusion?  
we have little **fluid** in the pleural cavity.

In normal image of chest we are suppose to see costophrenic angle peaks but once there is a fluid in the pleural cavity it causes blunted costophrenic angle. So we have bilateral costophrenic angle blunting.

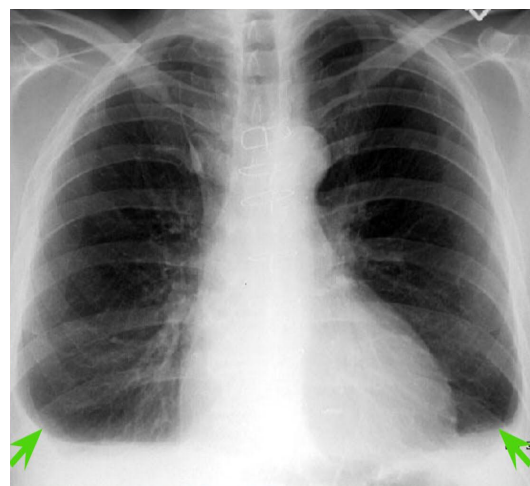


- On an upright film, an effusion will cause blunting on the lateral and if large enough, the posterior costophrenic sulci.
- Sometimes a depression of the involved diaphragm will occur.
- A large effusion can lead to a mediastinal shift away from the effusion and opacity the hemithorax.
- Approximately 200 ml of fluid are needed to detect an effusion in the frontal film vs. approximately 75 ml for the lateral.
- Larger effusions, especially if **unilateral**, are more likely to be caused by **malignancy** than smaller ones.
- Symptoms: 1- difficulties in breathing . 2- Chest pain.

## ⇒ Compare Costophrenic angles Angles



Normal costophrenic angles (sharp)



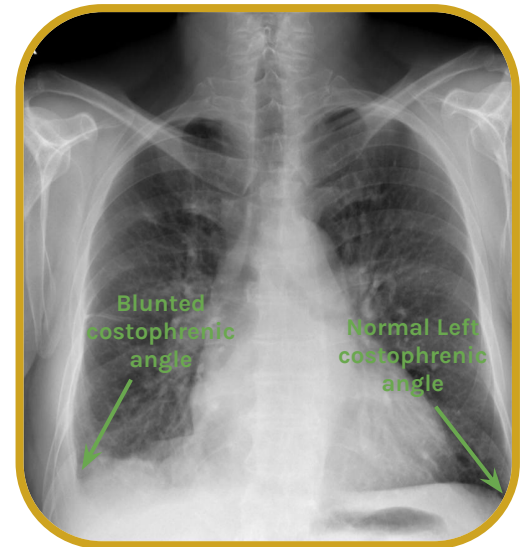
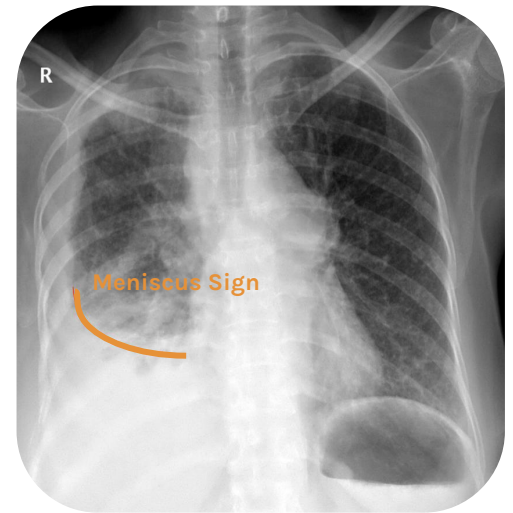
Blunted costophrenic angles

# Pleural Effusion

- Once fluid increase it goes up in curve line level (**Meniscus Sign**), it is not like a cup of water with flat line level.

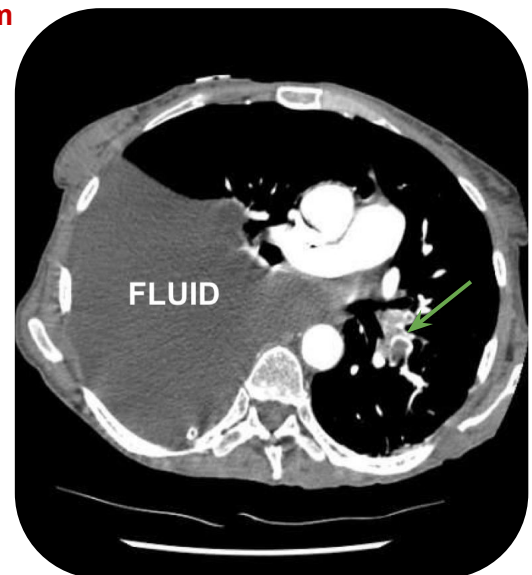
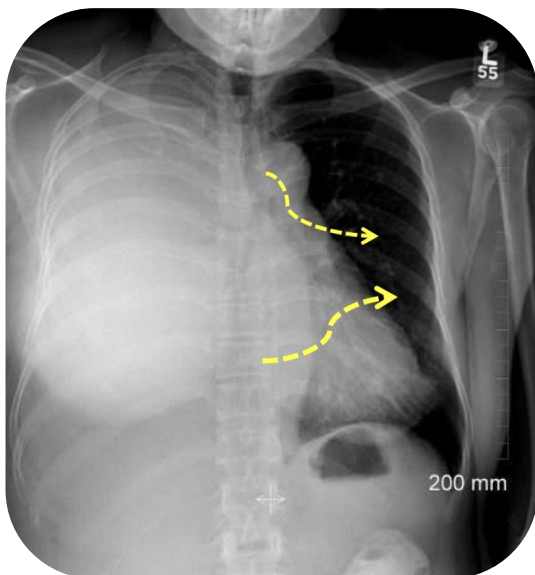
## Team 436:

- The doctor mentioned an experience in school we used to do it, we bring cup of water half empty when we see it from outside we see fluid level in flat line, but if we cover and sucked air inside it it goes up in curve line.  
→ because there is no air & no pressure so it will be curved.
- Always fluid in costophrenic angle given curve line however this is mild or moderate pleural effusion.
- If we have mild pleural effusion we will get curve like in lower figure, if we have moderate pleural effusion we will get like the upper figure.



## ⇒ Severe Pleural Effusion

Important for exam

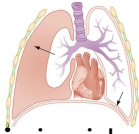


- **Unilateral pleural effusion.**
  - Think of malignancy.
  - The reason for this massive heart & mediastinal shift is the massive fluid accumulation.

- **CT-scan:**
  - Fluid density filling the right hemithorax, compressing the major vessels & the heart toward the other side.
  - Green arrow: notice that the artery is blocked with thrombus.

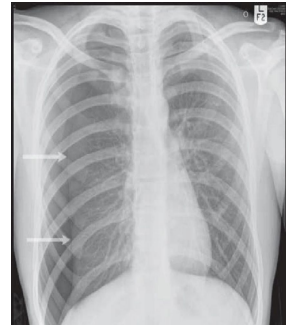


## ➤ Pneumothorax



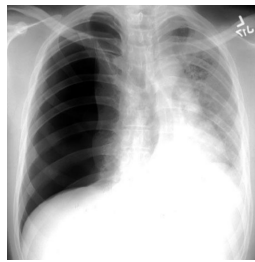
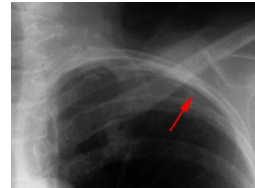
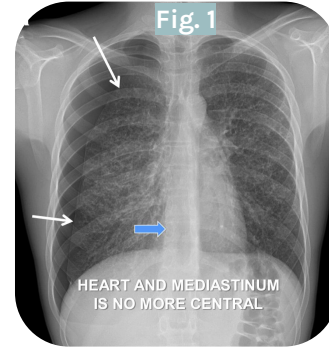
A pneumothorax is defined as **air** inside the thoracic cavity but outside the lung. Could be spontaneous or traumatic or due to lung pathology.

A spontaneous pneumothorax is one that occurs without an obvious inciting incident.



- **Fig. 1 Right pneumothorax:**
  - It shows increased lucency outside the lungs with no vascular marking inside. There will be loss of lung markings (blood vessels) and it will appear as extremely black structure.
  - The most important sign: **Pleural lines** of the lungs, which is a very clear outline by the free air in the pleural cavity (White arrows).
  - The lungs is compressed a little bit with middle mild shifting of the mediastinum structures to the other side (Blue arrow).

Sign and symptoms : chest pain and severe dyspnoea



- **Fig. 2 Tension pneumothorax (clinical emergency):**
  - Massive compression of the lungs.
  - More shifting of the mediastinum and the heart to the other side.
  - Left pneumothorax (no lung margin).
  - Symptoms: 1-Shortness of breath. 2-Decrease chest expansion. 3-Left hyper resonance.
  - There is a flattening of the left hemidiaphragm (the normal hump is lost)
  - There is widening of intercostal spaces (when you do examination you will hear the chest hyperresonance + decrease chest expansion).

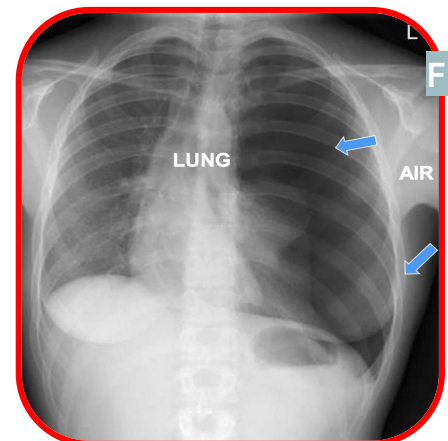
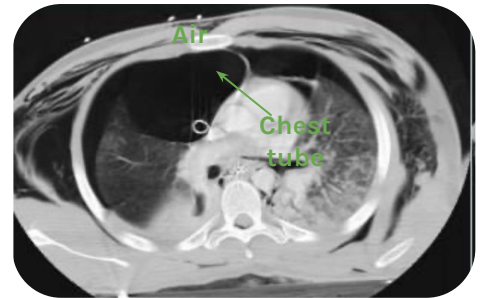


Fig. 2

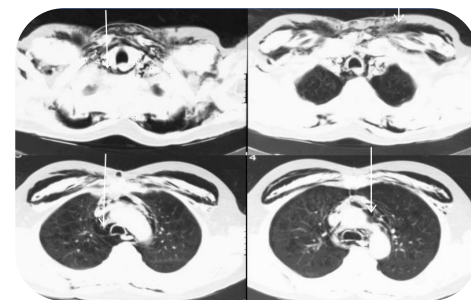
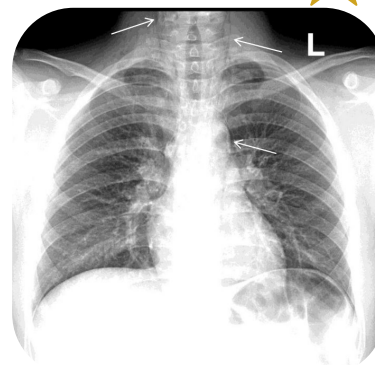
Important for exam



Tension pneumothorax

## ➤ Pneumomediastinum

- ❖ It's the abnormal presence of air or another gas in the mediastinum. Could be spontaneous or because of trauma (e.g. tracheal injury, esophageal perforation) or leakage from the lungs or windpipe.
- ❖ You can see the air extend to the neck



## »» Hydropneumothorax

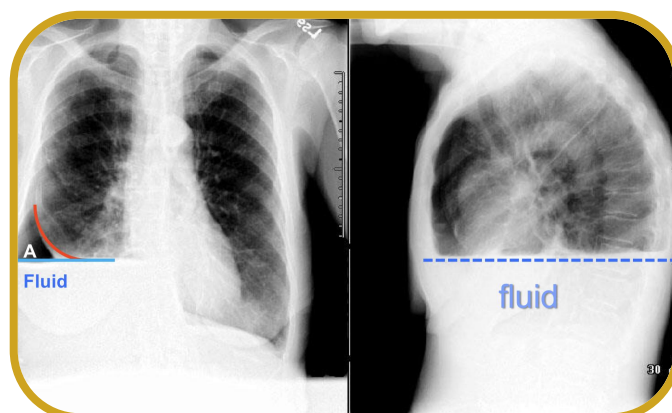
- ❖ The presence of both air and fluid within the pleural space (pleural effusion + pneumothorax).

Air fluid at the costo-phrenic angles

- When will have air fluid level appears flat as this image?

In Hydropneumothorax.

- No meniscus sign because of the air pressure (Remember the example of covered cup filled with fluid).
- We have three things in the right side: air-fluid level, above it jet black air so we have fluid, air and the lung.
- Hydropneumothorax can be a complication of TB or AIDS.



## »» Emphysema

- ❖ Emphysema is **loss of elastic recoil of the lung** with destruction of pulmonary capillary bed and alveolar septa.

- It's caused most often by cigarette smoking and can be congenital due to alpha-1 antitrypsin deficiency.

### ❖ Signs

1

Increased Lung Volume:

- Flattened Diaphragm.
- Increase in Retrosternal Airspace.
- Barrel chest.

2

Small vessels

3

Small, narrow cardiac shadow



We usually see 8-10 ribs but here we can see more than 10 ribs (11) due to **hyperinflation**.

- ❖ **Emphysema is commonly seen on CXR as:**

- Diffuse hyperinflation with flattening of diaphragms.
- Increased retrosternal space, 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.

- ❖ **Clinical signs of emphysema:**

- 1) Shortness of breath
- 2) Cyanosis

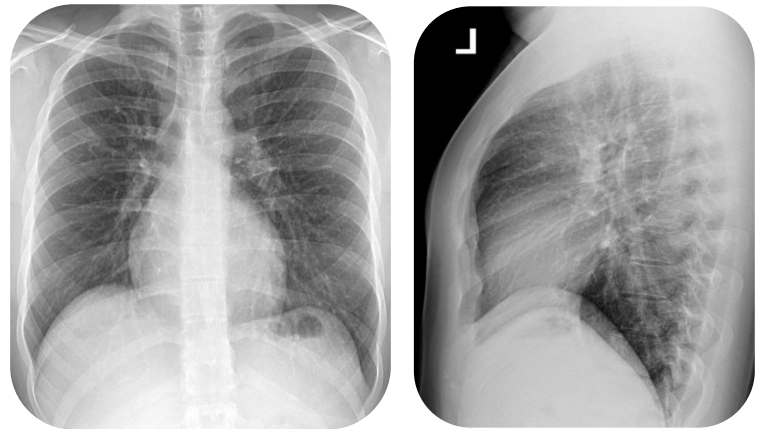
## Emphysema

### Emphysema



- Diaphragmatic cupola flattened.
- Heart decrease in size.
- Retrosternal air increased.
- Barrel chest.
- Thinning of the mediastinum.

### Normal



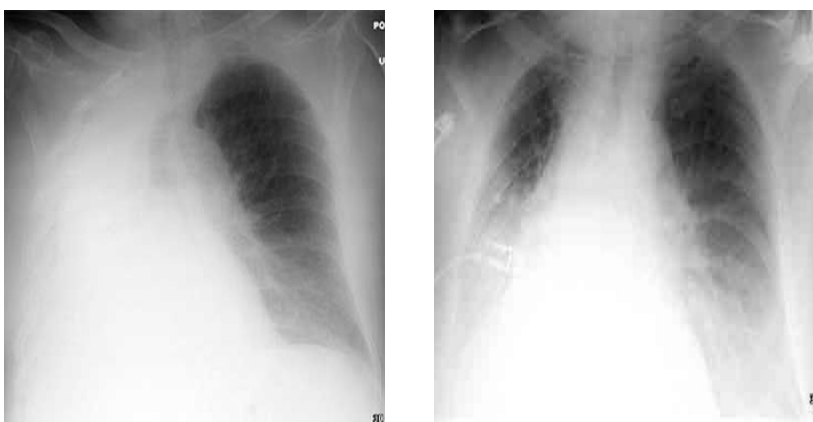
- Normal curved diaphragmatic cupola.
- Normal sized heart.

## Giant Bulla



- A **giant bulla** is a complication of emphysema.
- In areas of the lung completely damaged by the disease, air pockets can develop. These areas threaten the patient's health not only because of the underlying emphysema.
- As a bulla grows, it takes up space in the chest cavity and can encroach on the lungs.
- **complications:** pneumothorax and superinfection, and It can cause compressive atelectasis of the adjacent normal lung parenchyma

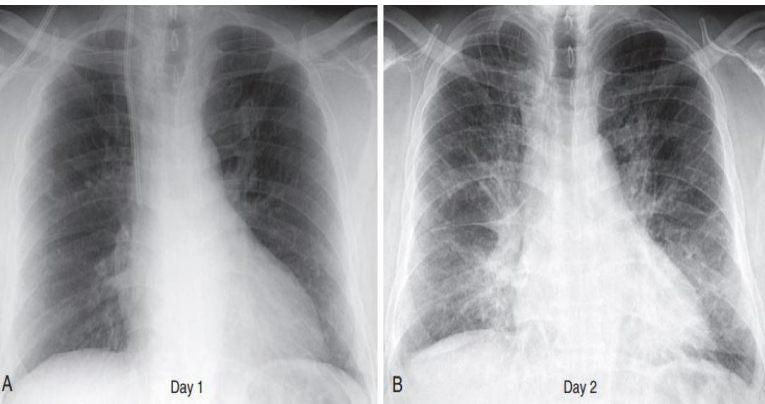
## Mucus plug



There is volume loss although its complete lung pathology

- The right border of mediastinum is not clear.
- The trachea is shifted to the right.
- The right hemithorax looks narrower than left.
- The right mainstem bronchus is cut off. So we do bronchoscopy to clear out the mucus

## Pulmonary edema

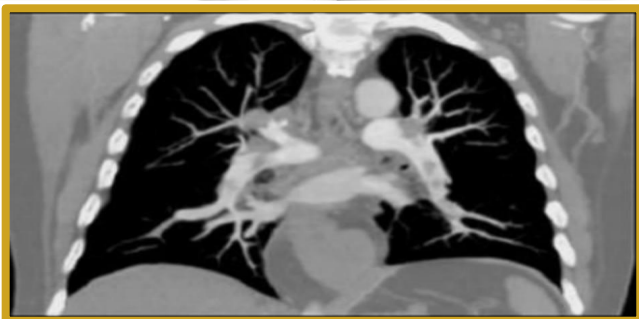
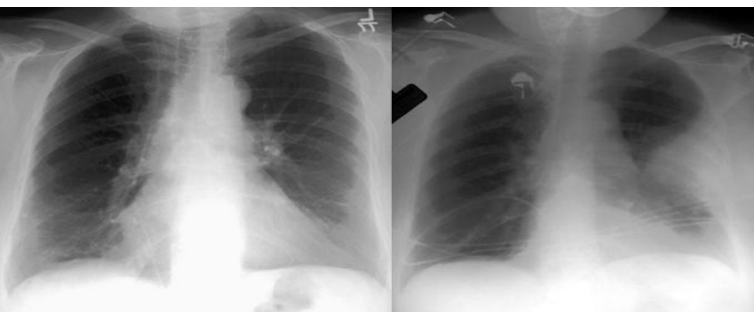


The vessel's is clear, the shadow is enlarged on Day 2 compare to Day 1, this overload in the airspaces happened in a short period of time.

alveolar oedema radiates symmetrically from the hilar regions in a 'bat's wing' distribution of airspace shadowing

Symptoms: 1-cough. 2-Dyspnea. 3-Orthopnea.

## Pulmonary embolism



Classical findings of PE:

- Hampton's hump:** wedge-shaped peripheral airspace disease.
- Westermark sign:** lucency (absence of vessels) distal to the vessel occluded by embolus.
- Knuckle sign:** prominent central pulmonary artery.

## Kerley B lines



one of the landmarks for defining lobes of the lung is the interlobular septae. When it get thickened (e.g. heart failure) you will see Kerley B lines.

## Luftsichel sign



-It's derived from the german words luft = air, sichel = sickle, describes an 'air crescent' which may be seen between the aortic arch and the medial border of the collapse  
- seen in left upper lobe collapse

## Case 1. Tension Pneumothorax

- **History:**  
27-year-old woman with chest tightness and shortness of breath presents to the Emergency Department.
- **Findings:**
  - Initial chest radiograph (Fig. 1.1) clearly demonstrates increased lucency in the right hemithorax with minimal displacement of the right hemidiaphragm inferiorly and shift of the mediastinum left ward. Note the increased distances between the ribs on the right, compared with those on the left. The right lung is partially collapsed.
  - Visceral pleural surface (white arrows in Fig. 1.2) can be seen as a thin white line, allowing distinction from a skin fold. No pulmonary vessels are seen lateral to the pleural line. The anterior junction line (black arrow in Fig. 1.2) is also displaced left ward.



Fig. 1.1



Fig. 1.2

## Case 2. Spontaneous Pneumomediastinum

- **History:**  
22-year-old man complains of severe sudden onset of chest pain.
- **Findings:**
  - Chest radiograph shows lucency adjacent to the left heart border (arrow in Fig. 3.1) on the frontal radiograph. Increased lucency is also seen around the aortic arch and in the right paratracheal region.
  - On the lateral radiograph, the anterior wall of the trachea is very well seen (arrow in Fig. 3.2). Gas is also seen anterior to the ascending aorta.
  - CT (Fig. 3.3) confirms the presence of gas centrally without fluid or evidence of tracheal rupture.

Fig. 3.1

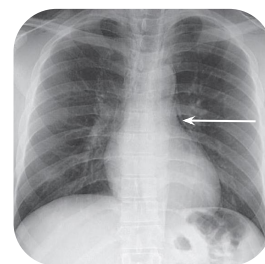


Fig. 3.2

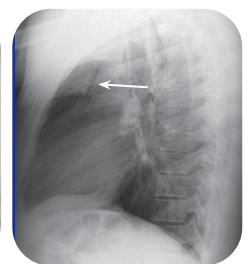
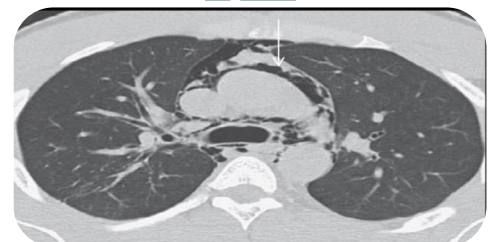


Fig. 3.3

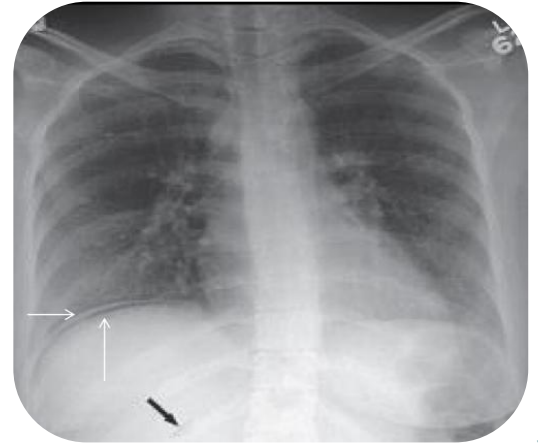


## Case 3. Pneumoperitoneum (from a Perforated Ulcer)

- **History:**  
26-year-old woman presents with sudden onset of chest and shoulder pain.
- **Findings:**
  - Chest radiograph shows a crescentic lucency below the right hemidiaphragm (Fig. 4.1).

Another lucency is seen above the right kidney (White arrow). This gas within the hepatorenal fossa has been called the “Doge’s cap” sign, as it is said to resemble the headgear of the former leaders of Venice.

Fig. 4.1



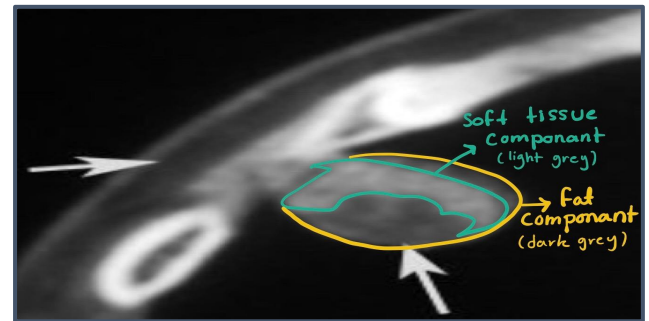
## Case 4. Left Lower Collapse (from a Mucus Plug)

- **History:**  
28-year-old man with a history of myasthenia gravis is noted to be hypoxic.
- **Findings:**
  - Initial chest radiograph shows a retrocardiac opacity. The left hemidiaphragm cannot be seen behind the heart and the left heart border appears straightened. Also note the inferior location of the left hilum.

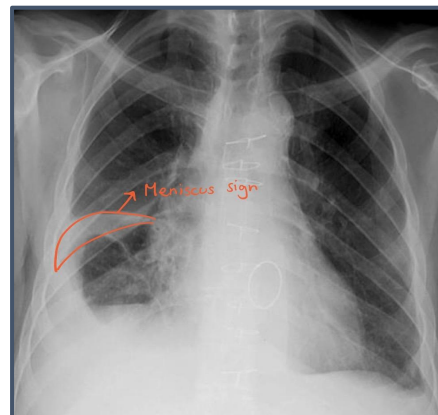
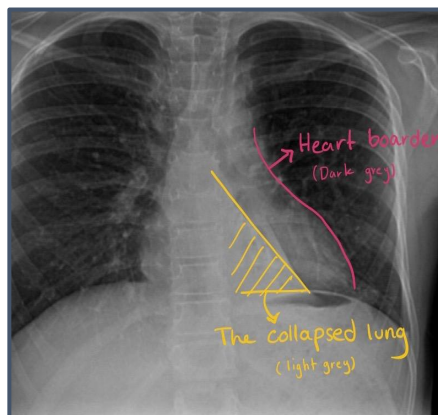
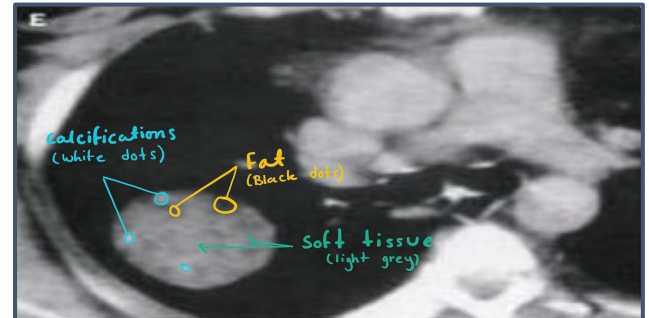


## Team 436 explanation notes:

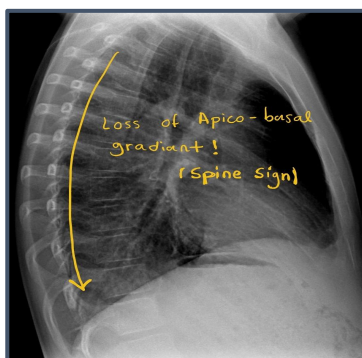
- Notice that the two arrows points to the same color gradient, which tells us that we know it is fat (Right arrow) because it has the same color of the subcutaneous fat (Left arrow) once you see fat, you don't need to do biopsy to rule out any other pathology.



- When the fat is a component of a lesion or a mass, it is a sign that it is benign.

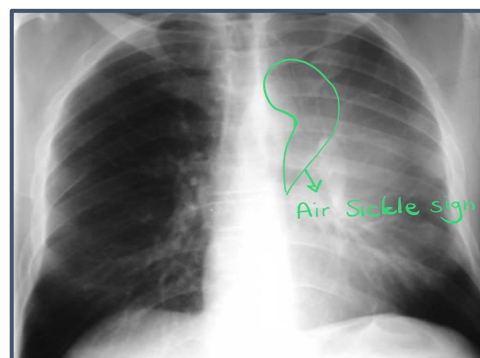


### Dorsal Spine Sign:



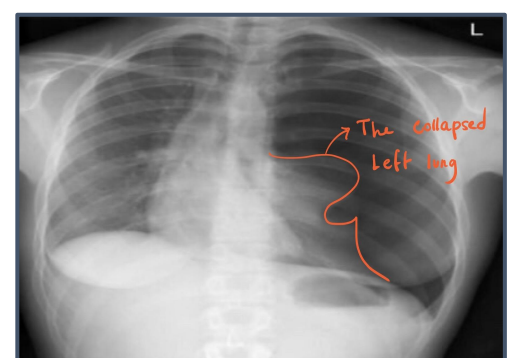
The whole spine appears with no change in color gradient. (It could be grey or white, but no change in gradient).

### Air sickle sign:

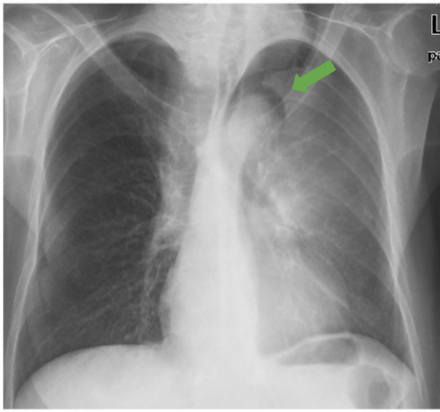


Air crescent which may be seen between the aortic arch and medial border of the collapsed lung especially with the left lung.

### Pneumothorax slide



The lung condensed in a small area which increases its thickness and appear whiter than the surroundings.

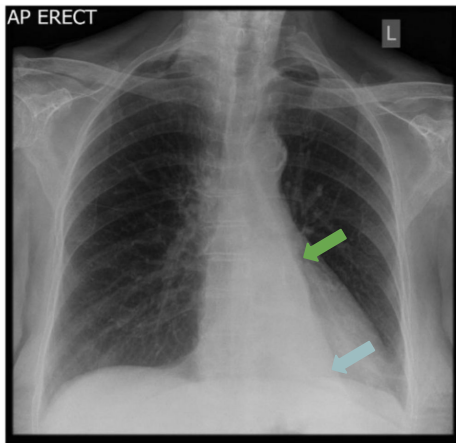


## Q1: What is the Diagnosis?

1. Large Pleural effusion
2. Left upper lobe collapse
3. Complete lung consolidation
4. Left sided hemothorax

**Tracheal deviation:** If the pathology is on the left side and the trachea deviates toward it, this means that the pathology is a volume loss, such as a collapse. However, if the trachea deviates away, it means that something is pushing it, such as hemothorax or pleural effusion.

**Luftsichel sign** (Arrow) → due to hyperinflated left lower lobe. **The diaphragm is elevated** (normally the left diaphragm is always at a lower position than the right diaphragm).

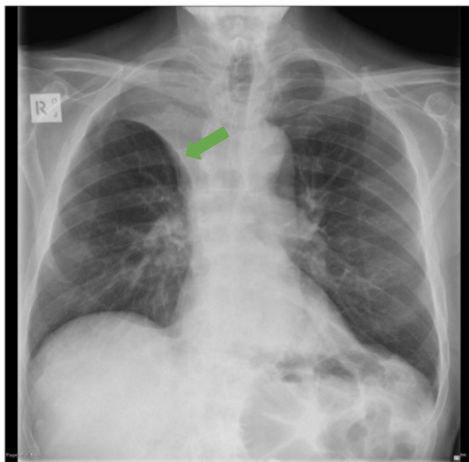


## Q2: What is the diagnosis?

1. Mass
2. Hiatal Hernia
3. Pneumonia
4. Collapse

Normally one border in each side of the heart, but there is two borders in side (arrow).

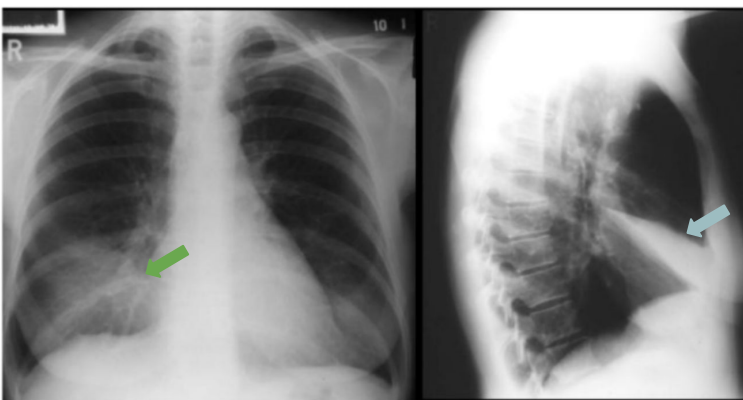
(Arrow) the left lower lobe collapse medially and inferiorly, and left diaphragm disappears (arrow) **Silhouette Sign**



## Q3: What is the diagnosis?

1. Pancoast tumor
2. Apical fibrosis
3. Right upper lobe collapse
4. Pneumonia

Right opacity (focal or local) "not diffuse", and the lower lobe of opacity very well sharp due to horizontal fissure pull up by this process. (arrow)



## Q4: What is the diagnosis?

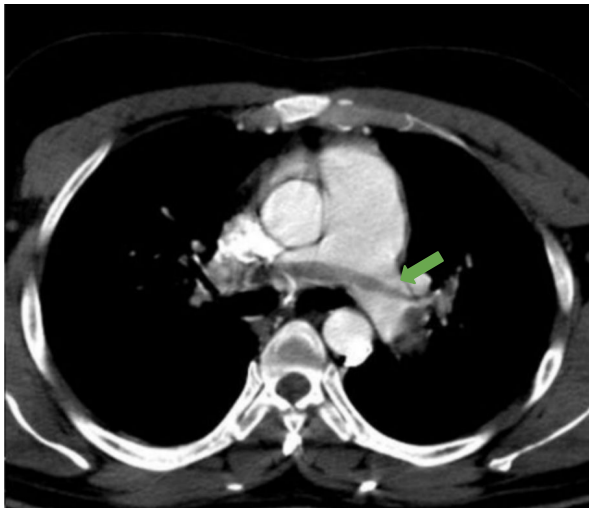
1. Pseudotumor
2. Pulmonary contusion
3. Pleural plaque
4. Right middle lobe collapse

Right lower and middle lobe opacity (arrow). Silhouette sign (we cannot see the lower right border of the heart very clearly).

When the silhouette sign interacts with the right cardiac border, it must be in the right middle lobe.

To confirm this, you need a lateral chest X-ray: this opacity in the lateral CXR is **triangular in shape and points toward the hilum** (arrow).





**Q5: 40 years old male with acute chest pain and tachycardia, where is the abnormality?**

Pulmonary embolism (arrow).

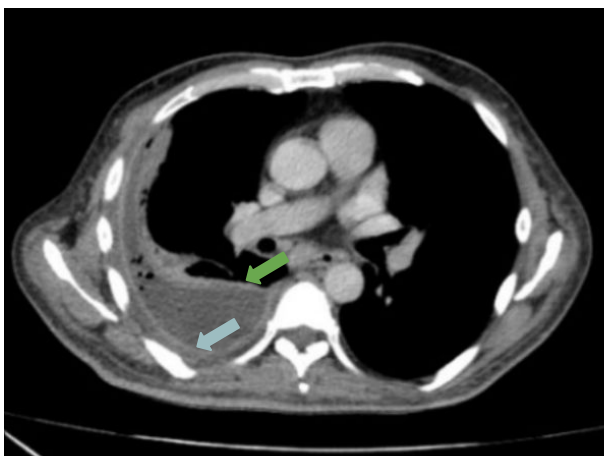


**Q6: Where is the abnormality?**

Left lower lobe Collapse (arrow) "lung parenchyma full with contrast that why it is appear white".



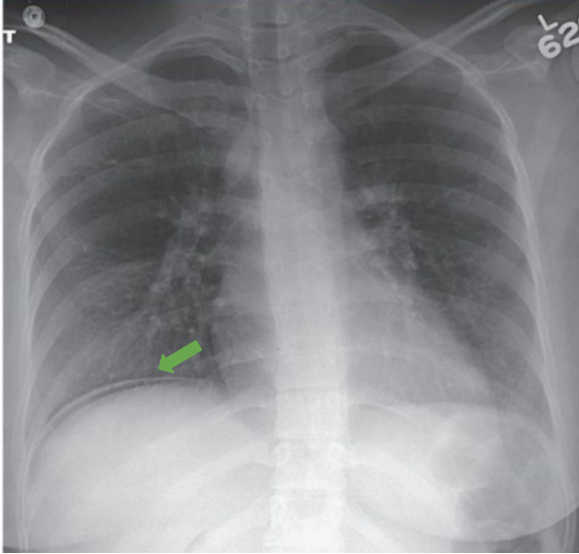
**Q7: Patient with septic shock and respiratory failure, what is the most likely diagnosis?**



**Q8: Patient with fever and chest pain, what is the diagnosis?**

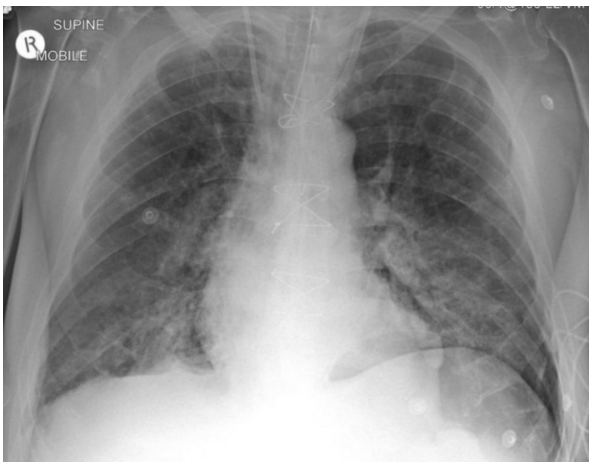
1. Pleural effusion
2. Pneumonia
3. **Empyema** Pus in pleural space
4. Hemothorax

The pleural membranes are two: parietal (arrow) and visceral (arrow). However, we can see a split between them (pus in between). How do we know if it is pus or blood? If the membranes are enhanced, it means that they are inflamed and contain pus (arrows). We can also tell by the clinical scenario.



**Sudden onset of chest and shoulder pain, where is the abnormality?**

Double border. something below it (air) so this is pneumoperitoneum.



**Where is the abnormality?**



**Chronic shortness of breath**

1. Normal
2. Over exposure (technical)
3. Hyperinflated lungs
4. Pneumothorax

These tables are extra from outer source.

Source: Respiratory Medicine - eureka

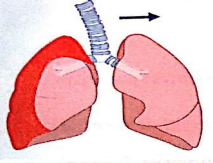
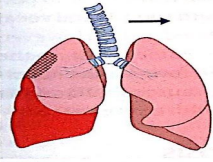
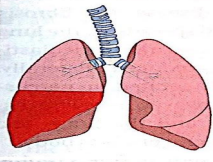
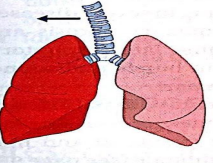
Examination findings for common respiratory presentations					
Respiratory presentation	Trachea	Expansion	Percussion	Auscultation	Vocal resonance
<b>Pneumothorax</b> 	Central or deviated away, depending on size	Reduced on affected side	Hyper-resonant	Absent breath sounds No added sounds	Reduced or absent
<b>Pleural effusion</b> 	Central or deviated away, depending on size	Reduced on affected side	Dull ('stony dull')	Absent breath sounds Pleural rub (sometimes) Bronchial breathing at the top (sometimes)	Reduced or absent
<b>Lobar consolidation</b> 	Central	Reduced on affected side	Dull (if dense; resonant if less dense)	Bronchial breathing (if dense) Coarse crepitations	Increased or bronchial
<b>Lobar collapse</b> 	Deviated towards	Reduced on affected side	Dull	Absent breath sounds No added sounds	Reduced

Table 2.19 Examination findings for common respiratory presentations. *Continued opposite.*

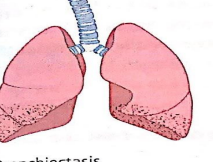
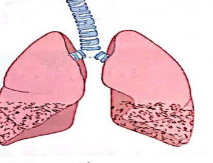
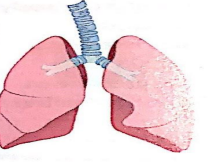
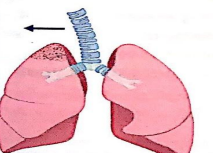
Examination findings for common respiratory presentations <i>continued</i>					
Respiratory presentation	Trachea	Expansion	Percussion	Auscultation	Vocal resonance
<b>Pulmonary fibrosis</b> 	Central	Reduced bilaterally	Resonant	Fine inspiratory bibasal crepitations (Velcro crepitations)	Normal
<b>Bronchiectasis</b> 	Central	Reduced bilaterally	Resonant	Coarse inspiratory bibasal crepitations	Normal or increased
<b>COPD or asthma</b> 	Central	Reduced bilaterally	Resonant	Prolonged expiration Quiet breath sounds throughout Expiratory wheeze	Normal or reduced throughout
<b>Apical scarring (post-tuberculosis)</b> 	Deviated towards	Reduced unilaterally	Resonant or dull	Bronchial breathing (tracheal) Focal crepitations	Normal or increased

Table 2.19 Examination findings for common respiratory presentations (*continued*).

## main symptoms occurring with each disease

(golden notes)

Pneumothorax	Pneumonia	Pulmonary edema	Pleural effusion	Pulmonary emboli
-car accident	-fever	-cough	-chest pain	-long immobilization
-acute chest pain	-cough	-dyspnea	-shortness of breath	-taking oral contraceptive
-smoker		-lower limb edema	-discomfort	
		-Orthopnea		
		-diabetic		

this works most of the time just by knowing those symptoms, BUT dont 100% rely on it.

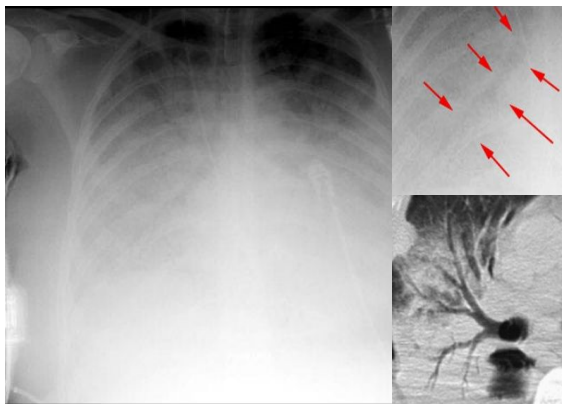
Also i know dyspnea is the same as shortness of breath but whenever asked about:  
 -dyspnea; they're mostly referring to pulmonary edema  
 - shortness of breath; they're mostly referring to pleural effusion

## » CXR Signs « Silhouette



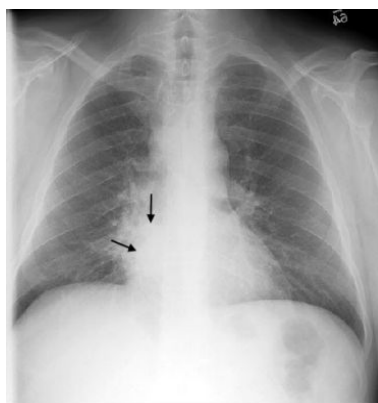
Loss of lung/soft tissue interface caused by a mass or fluid in the normally air-filled lung.

## Air Bronchogram



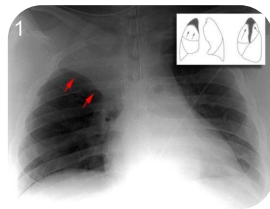
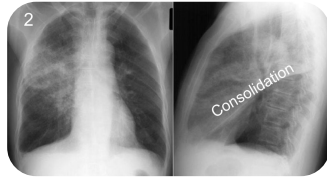
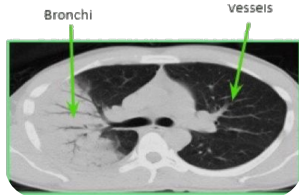
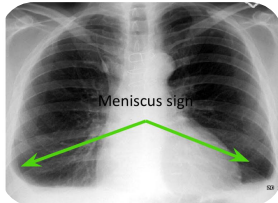
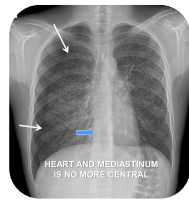
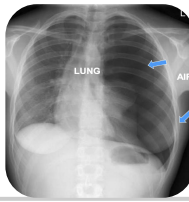
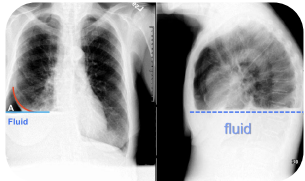

Bronchial airway made visible by filling the adjacent structures with fluid, exudate, pus, or blood

## Double Borders

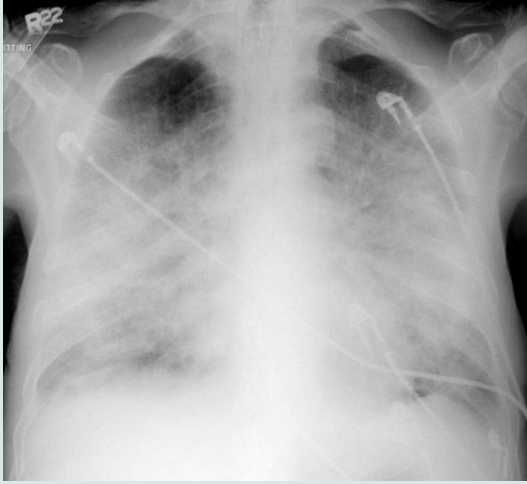


You're only allowed to have one cardiac border. A problem posterior to the heart, mediastinum or lungs will show double cardiac border

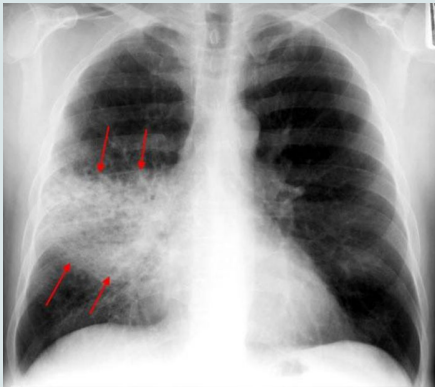
# Summary

Disease	Definition	Radiological finding	Picture
<b>Lobar Atelectasis</b>	<b>Loss of volume</b> of lobe, segment or sub segment of the lung. (Which leads to collapse)	<ol style="list-style-type: none"> <li>1) <b>Best sign is → Shift of a fissure.</b></li> <li>2) Rapid development and clearance.</li> <li>3) Air bronchograms if non-obstructive.</li> <li>4) Secondary signs: Mediastinal shift, Elevated Diaphragm, Ribs closer together, Vague increase density.</li> </ol>	
<b>Pneumonia</b>	<b>Loss of air</b> in lobe, segment or sub segment of the lung. The air is replaced by something else (Which leads to consolidation).	<p>- Signs of pneumonia: signs of any air space process. <b>Dx of pneumonia depends on appropriate clinical scenario.</b></p> <ol style="list-style-type: none"> <li>1) <b>Air bronchogram sign:</b> It's either collapse or consolidation.</li> <li>2) <b>Silhouette:</b> Positive or negative.</li> <li>3) Dense Hilum.</li> <li>4) <b>Spine sign:</b> Dorsal spine sign.</li> </ol>	 
<b>Pleural Effusion</b>	Accumulation of <b>fluid</b> in the pleural cavity outside the lung.	- blunted costophrenic angle. So we have bilateral costophrenic angle blunting.	
<b>Pneumothorax</b>	Accumulation of <b>air</b> in the pleural cavity outside the lung.	<p>- <b>Fig 1</b> There will be Pleural lines of the lungs, loss of lung markings (blood vessels) and it will appear as extremely black structure.</p> <p>- <b>Fig. 2</b> Tension pneumothorax: Massive compression of lungs and shifting of mediastinum, left pneumothorax (no lung margin), flattening of the left hemidiaphragm, widening of intercostal spaces.</p>	 <p>Fig. 1 HEART AND MEDIASTINUM IS NO MORE CENTRAL</p>  <p>Fig. 2 LUNG AIR</p>
<b>Hydropneumothorax:</b>	The presence of <b>both air and fluid</b> within the pleural space.	<p>- Air fluid level appears flat.</p> <p>- 3 things in right side: air-fluid level, above it jet black air so we have fluid, air and the lung.</p>	
<b>Emphysema</b>	Loss of elastic recoil of the lung with destruction of pulmonary capillary bed and alveolar septa. Most often by cigarette smoking and less commonly by alpha-1 antitrypsin deficiency.	<ol style="list-style-type: none"> <li>1) Increased Lung Volume: Flattened Diaphragm, Increase in Retrosternal Airspace, Barrel chest.</li> <li>2) Small Vessels.</li> <li>3) Small, narrow cardiac shadow.</li> </ol>	

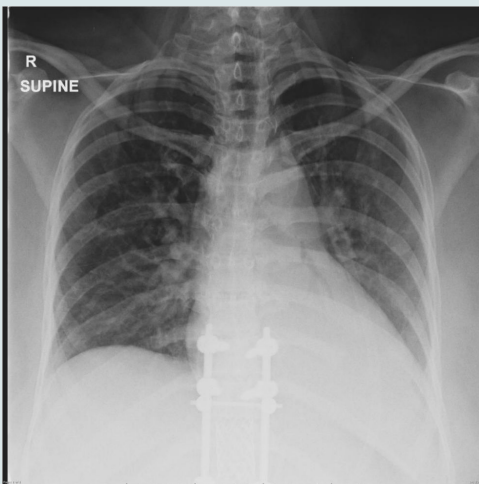
## Pulmonary edema



## Pneumomediastinum

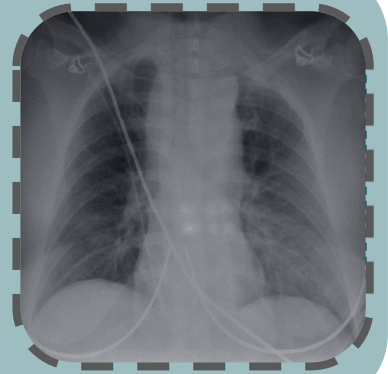


## Pneumonia



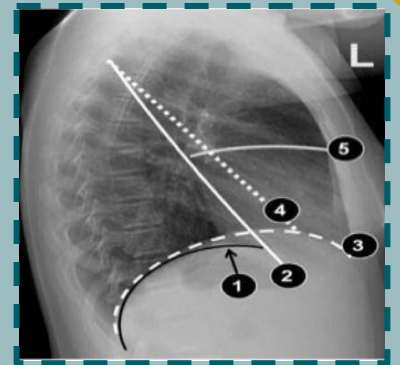
1-26 year -old pregnant female is imaged post motor vehicle collision (MVC). Which of the following is the next best step?

- CT angiogram of the chest
- non contrast CT of the chest
- MR angiogram of the chest
- direct angiography



2-What is the normal anatomical landmark shown in the picture?

- Left hemidiaphragm is completely shown
- The solid line represent the left oblique fissure
- The dotted line represent the azygos fissure
- The horizontal fissure is not present



3-Which one of the following is a sign of improper position ?

- Cardiomegaly
- Darker spine
- Bright muscles
- Patchy appearance in lung fields

4-Which one of the following is characteristic of pulmonary pneumonia?

- Volume loss
- Shifting of lung fissure
- Calcification
- Air bronchogram

5-Which of the following statements about taking a routine chest x-ray are true?

- It is normally taken in expiration
- It is normally taken as an anteroposterior view
- It is normally taken as a posteroanterior view
- It is hazy when the patient has taken a deep inspiration

6-On a normal chest x-ray, which of the following statements are true?

- The dome of the right hemidiaphragm lies at the level of the anterior end of the sixth rib
- The trachea usually lies to the left of the midline
- The contours of the breast shadows are not seen
- Usually about two-thirds of the heart lies to the right of the midline

[The doctor's questions from the lecture](#)

Answers  
1)A  
2)B  
3)A  
4)D  
5)C  
6)A



1- What is the salient finding in the following chest X-ray?

- a. Consolidating
- b. Atelectasis
- c. Mass
- d. Pleural Effusion



2- In a patient with Atelectasis, what change is associated with the position of the trachea?

- a. Deviate away from the affected lung
- b. Deviate toward the affected lung
- c. No change

3- What does blunting of the costophrenic angles suggest?

- a. Pneumothorax
- b. Consolidation
- c. Collapse
- d. Pleural Effusion

4- “Presence of air inside the thoracic cavity but outside the lung” is a definition of:

- a. Pleural effusion
- b. Pneumothorax
- c. Hydropneumothorax
- d. Emphysema

5- In which of the following the air fluid level appears flat?

- a. Pneumonia
- b. Pleural effusion
- c. Pneumothorax
- d. Hydropneumothorax

6- Increase lung volume in emphysema will lead to all the following, Except:

- a. Flattened diaphragm
- b. Shift of a fissure
- c. Barrel chest
- d. Increase in retrosternal air space

[Quiz containing images from this lecture](#)

Answers  
1)C  
2)B  
3)D  
4)B  
5)D  
6)B