



# Radiology Team

## Lecture 5 Lung Diseases

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★ Before starting, please check our [Radiology editing file](#)

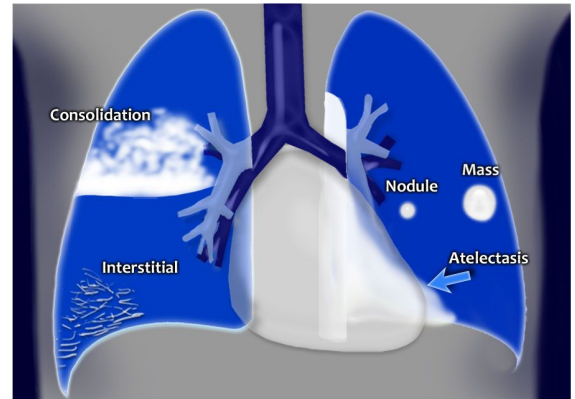


Color Index:

- Important
- Females' notes
- Males' notes
- Explanations

# Lung Diseases

- ❖ Consolidation = as pneumonia
- ❖ Nodules = small
- ❖ Mass = large
- ❖ Atelectasis = Lung collapse
- ❖ Interstitial = diffuse lung disease

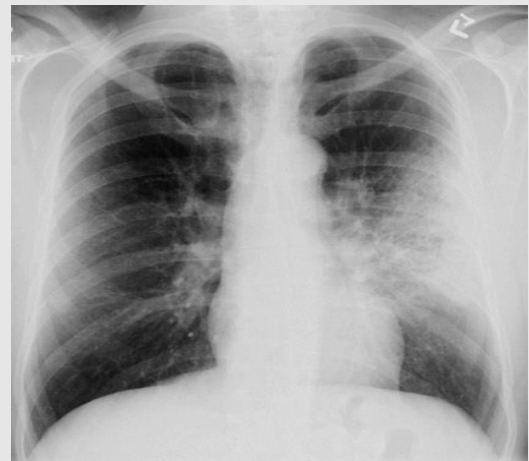
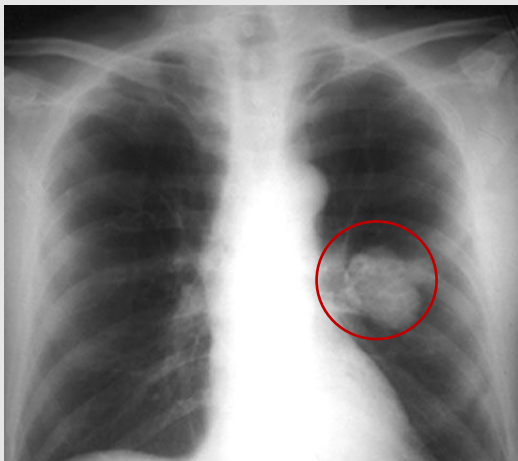


## MASS Vs. DIFFUSE INFILTRATION:

### MASS

### DIFFUSE INFILTRATION

- The basic diagnostic instance is to detect an abnormality.
- In both of the cases, there is an abnormal opacity "consolidation".



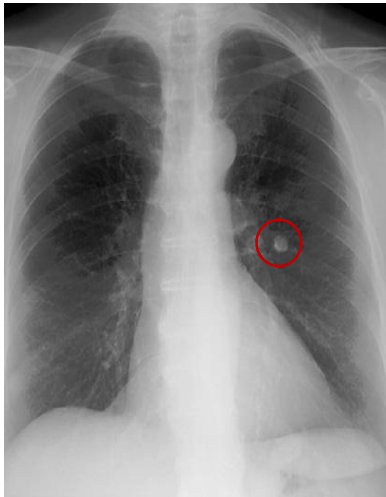
- In this case , the opacity would best be described as a **mass** because it Has edges **well-defined (clear outline)** 3-D STRUCTURE "mass like orange"
- We can see the mass in PA and lateral views which prove the 3D nature of the mass.
- In lateral view appears oval like shape "3D" .

- 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

- 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.**

**Pic 1**

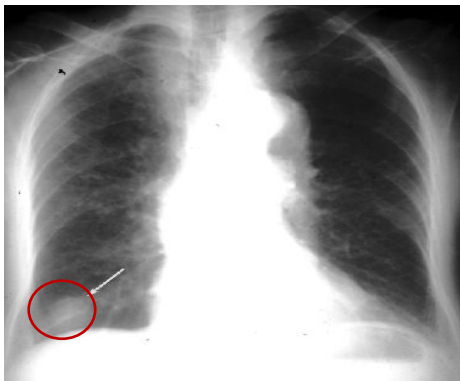


**Pic 2**



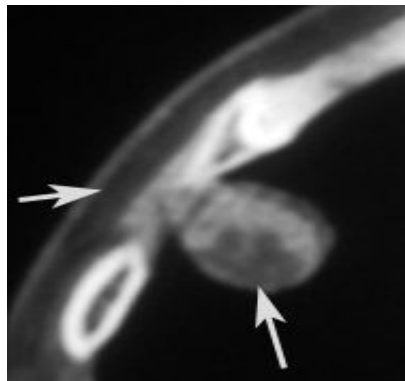
- If you see **Pic 1** you can tell that there is a small rounded lesion.. But **is it a small infiltration or a mass lesion ??**
- We will do lateral view **Pic 2** and we will see the lesion in 3D, we can know what is the exact location of that nodule which is **anterior lung solitary nodule**.

**Pic 1**



Mass lesion like orange

## MASS



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

**Pic 2**



We can see a mass lesion in PA view of the lungs (**Pic 1**), to make sure we can do lateral view or CT scan (**Pic 2**).

### What are the benefits of CT scan?

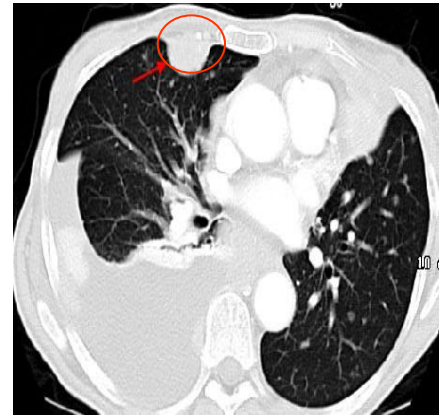
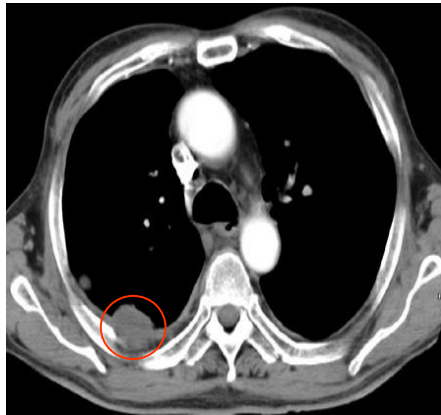
C.T give you more detailed. (it shows us the lesion in 3D)

- We can see the texture of the mass, it has hyperdense and hypodense area
- By the computer we can point at any area of the mass and we can know what the pointed area contains ( Fat , soft tissue, fluid , calcification)

When you give I.V contrast you can detect the pattern of enhancement is it benign or malignant.

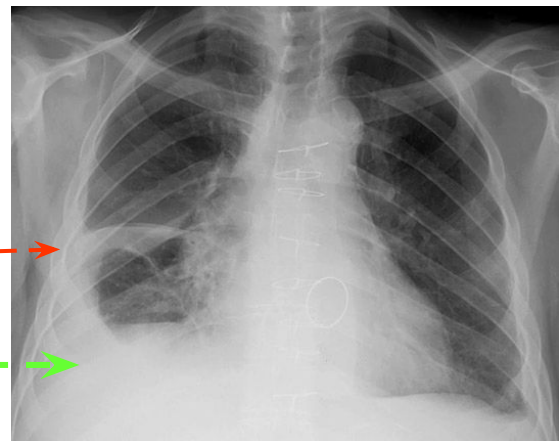
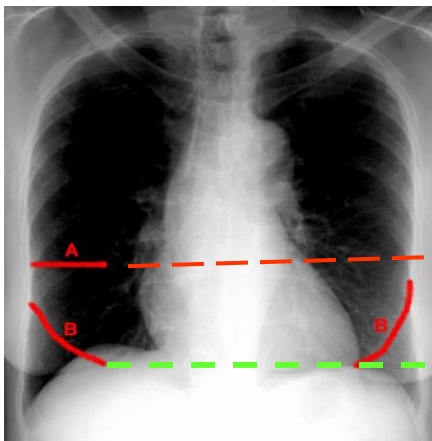
**Very hypodense = fat, air**  
**hyperdense = soft tissues**

# PLEURAL BASED LESION



- If the mass arises from the pleura (peripheral mass) it is called “**Pleural Based Lesion**” by this name it can help us to minimize and know the Differential diagnosis.
- The Differential diagnosis of pleural based masses is different, it is either pleural lesion or metastasis
- If there is a lesion in the core of the lung the first and the most important DDX is bronchogenic carcinoma

## FISSURES



Encysted pleural effusion of transverse fissure (**red arrow**) and oblique fissures (**green arrow**), so when we saw the pathology the fissure outlines becomes more clearly

One of the most important things in lung X-Ray is the **fissures**:

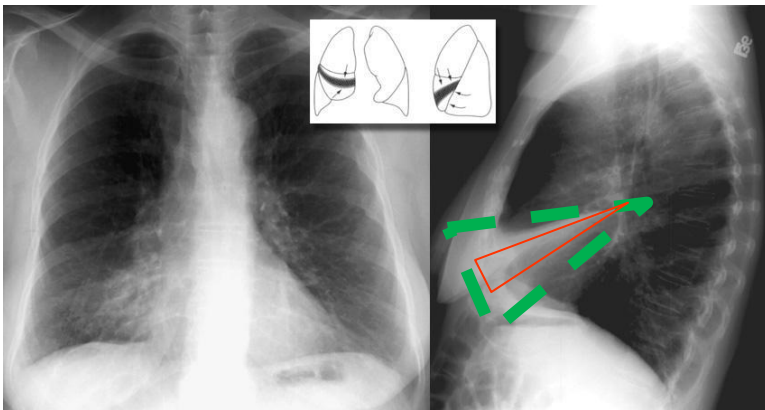
It has 2 benefits:

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 indicates something (pathology)

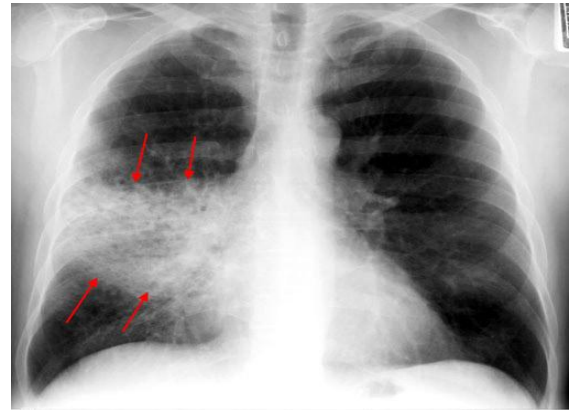
# ATELECTASIS Vs. Consolidation

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

## PNEUMONIA VS ATELECTASIS



Pic 1



Pic 2

**Pic 1** : in PA view there is an area of consolidation, **is there any loss of volume or no??**

We did a lateral view and we found opaque area:

- **the green line** → normal position of transverse and oblique fissures.
- **red line** → is the collapsed right middle lobe.

**We can see that there is loss of volume because the fissures has changed there position from the green to the red lines.**

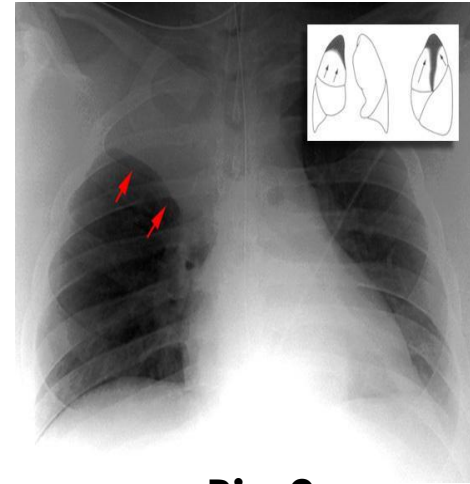
- There is displacement of the trachea toward the side that loss the volume in atelectasis "Known as effective loss" .

**Pic 2** : middle lobe consolidation typically pneumonia

# PNEUMONIA VS ATELECTASIS



Pic 1



Pic 2

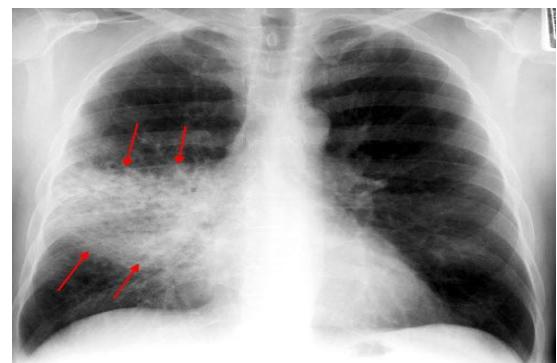
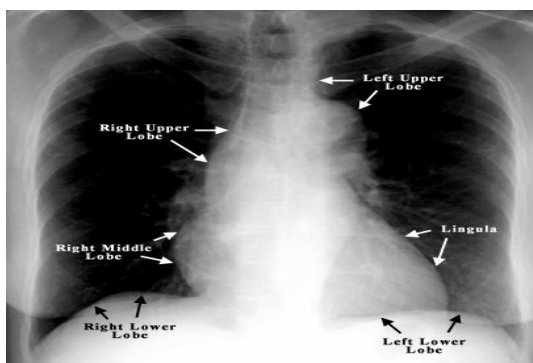
**Pic 1** : diffuse area of consolidation in PA view, we don't know if there is loss of volume or no, so we will do **lateral view**.  
And the lateral view shows **normal oblique fissure** , so the area of **consolidation that involve the upper and middle lobe is pneumonia**

**Pic 2** : chest x-ray shows consolidation in the right upper lobe and very clear line (**red arrow**) which is transverse fissure , these finding represent **upper lobe atelectasis**

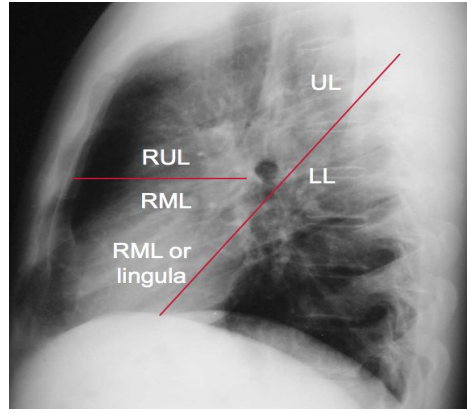
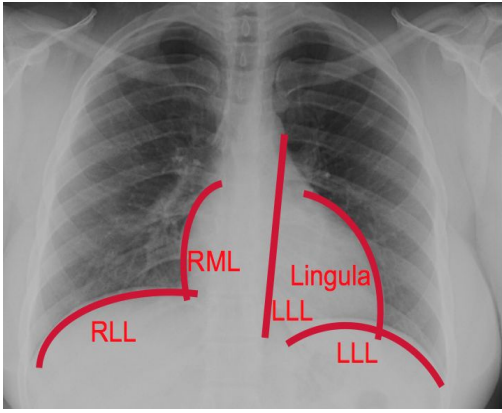
## Recognizing air space disease:

- ❖ Alveolar spaces filled with...something.
- ❖ Radiologist's report:
  - “**consolidation**”
  - “air space opacity”
  - “fluffy density”
  - “infiltrate”
- ❖ Nonspecific:  
Atelectasis, pneumonia, bleeding, edema, tumor

## SILHOUETTE SIGN



# Localizing disease from the silhouette sign:



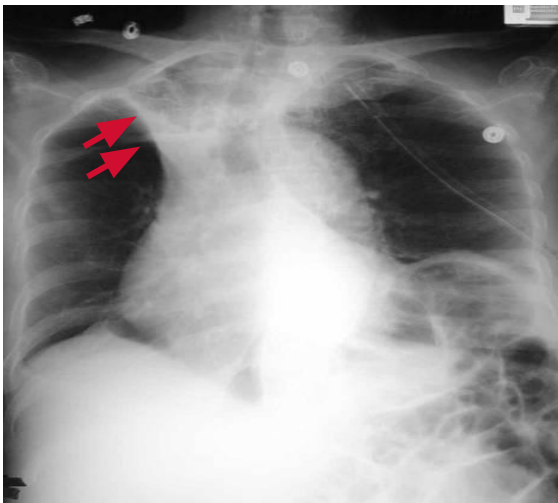
## Lobar Atelectasis:

- Best sign – **shift of a fissure**
- Rapid development and clearance
- **Air bronchograms if non-obstructive**

Secondary signs:

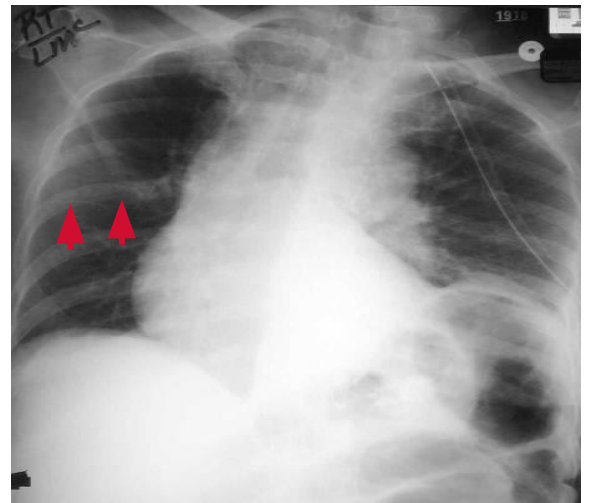
- Mediastinal shift
- Elevated diaphragm
- Ribs closer together
- Vague increased density

## Right Upper lobe Atelectasis:



**Pic 1**

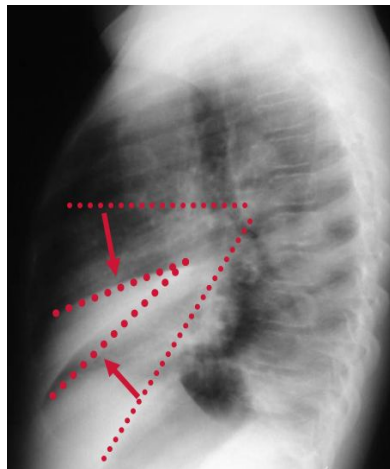
**Pic 1** : patient presented with fever, they put intratracheal tube and after they put the tube, he gets dyspnea and after that chest x ray was done and they found : **right upper lobe atelectasis**. The patient took antibiotic and the proper treatment. They also remove the tube and they did follow up chest x ray.



**Pic 2**

**Pic 2** : they found the transverse line come back to its normal position

## Right middle lobe Atelectasis:



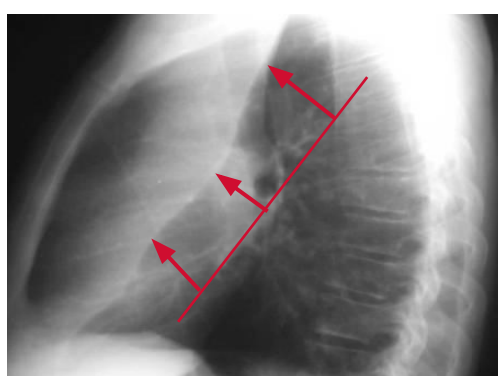
In the middle area of the right lung there is consolidation, **is it collapse ?**

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**

## Left Upper lobe Atelectasis:



Pic 1

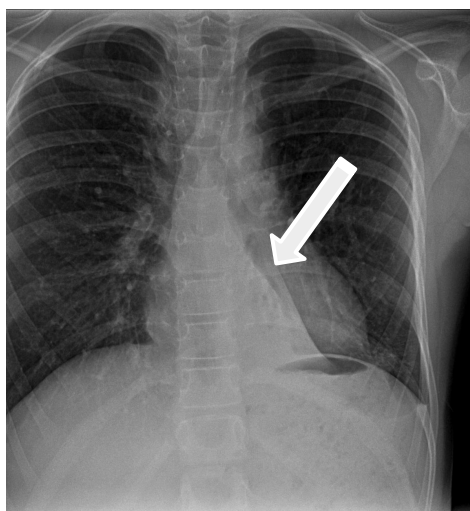


Pic 2

Pic1 : there is area of consolidation on the left lung, we will do lateral view...

Pic 2 : lateral view of the lung shows a clear cutline which is the oblique fissure **moved** from its normal position (**normal oblique line crosses the lung hilum**)

## Left Lower Lobe COLLAPSE:



The lungs are filled of air and also the bronchi , we can't see brachial tree because it's also filled with air as the lungs, so both appear in black color while vessels appears in white because it filled with blood.



In case of pneumonia it appears as consolidation of lungs. The air is replaced by fluid or inflammatory cells. However. Bronchial tree remains as it is patent so we will be able to see bronchial tree on background of consolidation

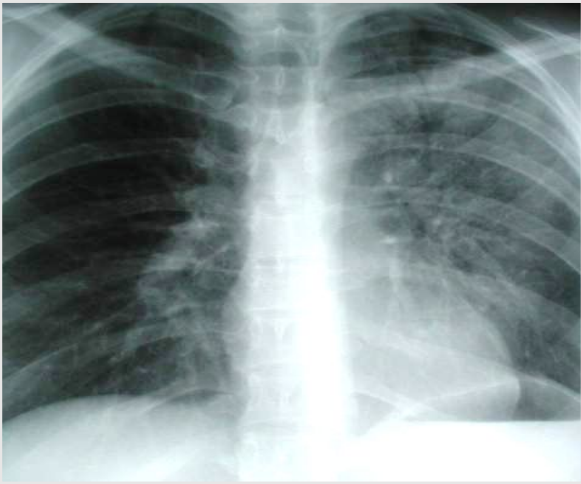


# Pneumonia:

Signs:

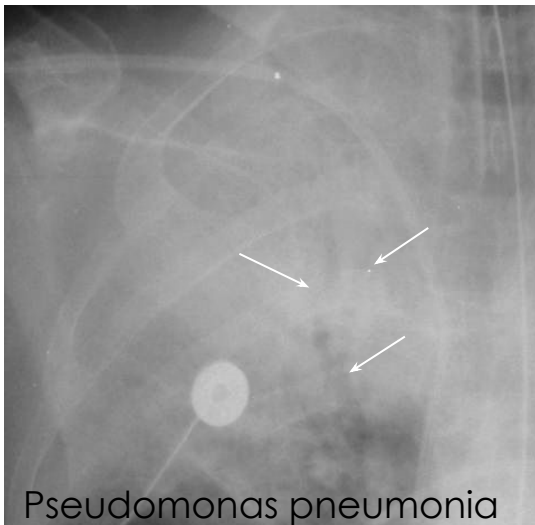
- **Air bronchogram**
  - **Silhouette** - "positive" or "negative"
  - Dense hilum
  - "Spine" sign
- All are signs of any air space process.  
- Dx of pneumonia depends on appropriate clinical scenario.

## AIR-BRONCHOGRAM



- 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.

## Air bronchogram sign



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

## Air bronchograms — CT



Pneumonia

- The **Left side is completely healthy** lung and we can't see the bronchial tree clearly because the hole lung contains air and the bronchial tree contains air so they will be all black
- The **Right diseased lung** we can see **consolidation** and that consolidation is caused by loss of air in the lung so it will be white, but the bronchial tree is still containing air so it will be black.

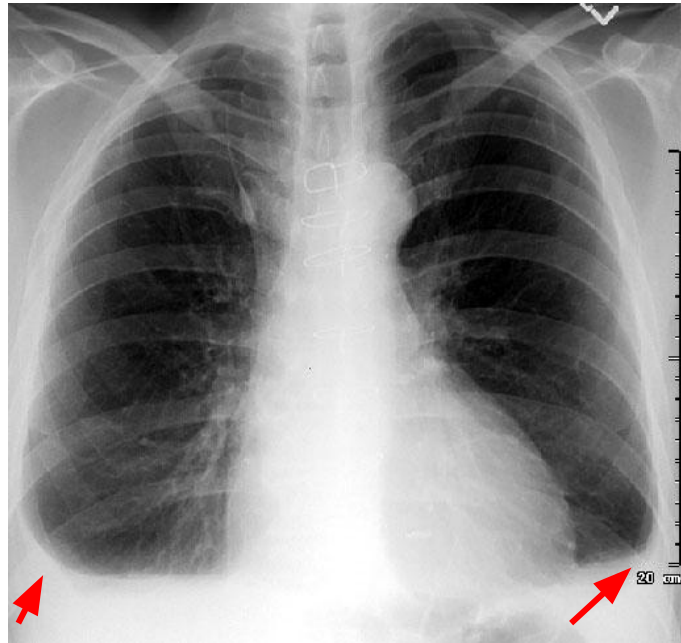
# PLEURAL EFFUSION:

## what is pleural effusion?

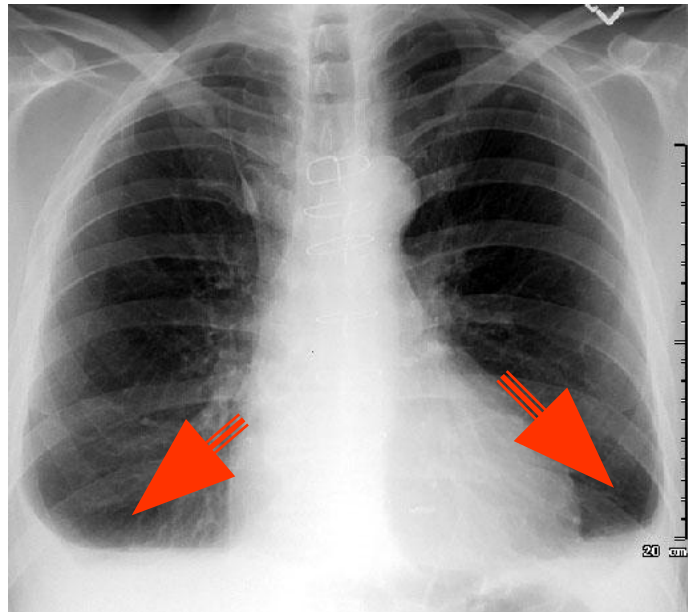
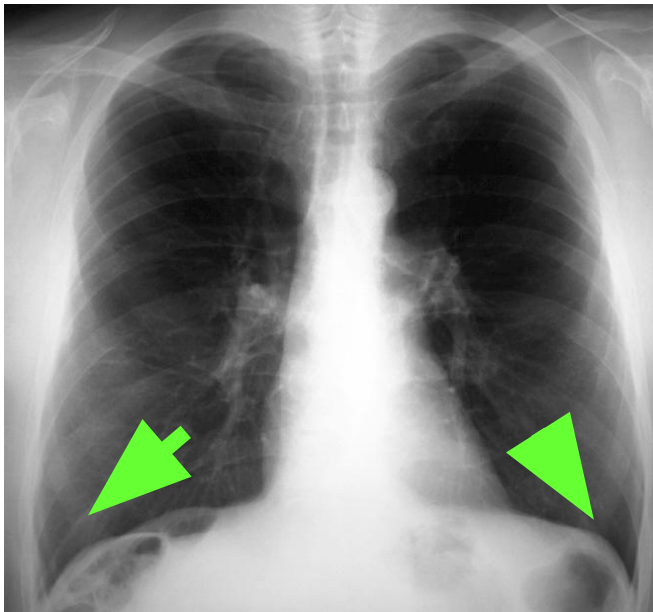
we have little fluid in the pleural cavity.

in normal image of chest we suppose to see costophrenic angle peaks but once there is a fluid in pleural cavity cause **blunted costophrenic angle**

✓ we have bilateral costophrenic angle blunting

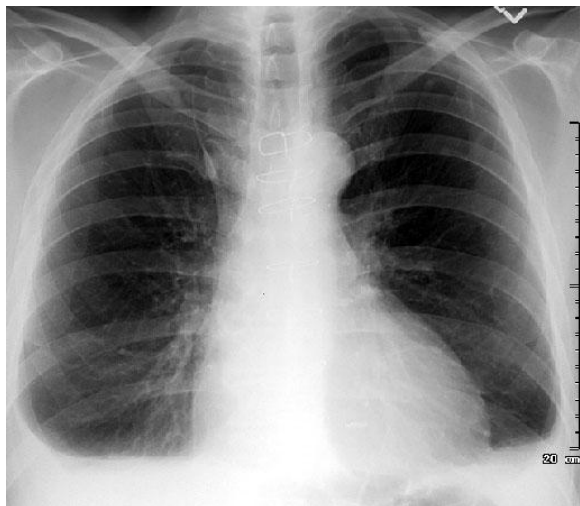


## COMPARE COSTO-PHRENIC ANGLES:

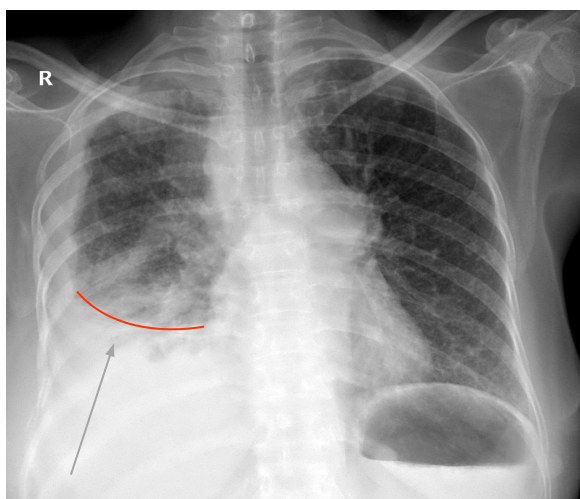


•let us compare between the normal chest in which you can see costophrenic angle in both side **(green arrow)** with the other picture that angles are **blunted (red arrow)** this is the **early sign of pleural effusion**

# PLEURAL EFFUSION



- 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 75ml for the lateral.
- Larger effusions, especially if unilateral, are more likely to be caused by malignancy than smaller ones.



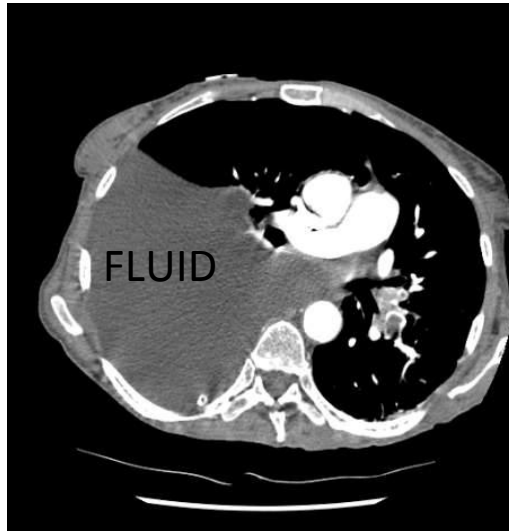
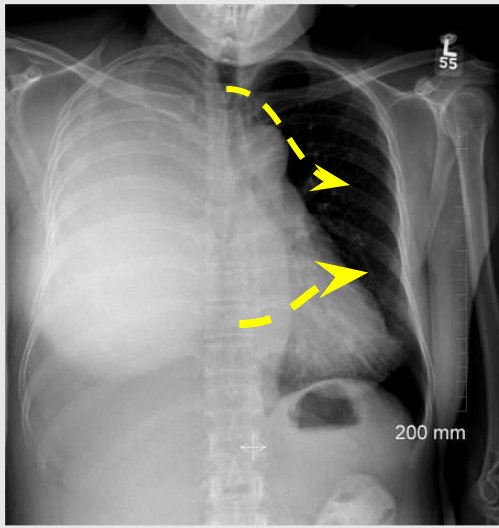
**Moderate**



**mild**

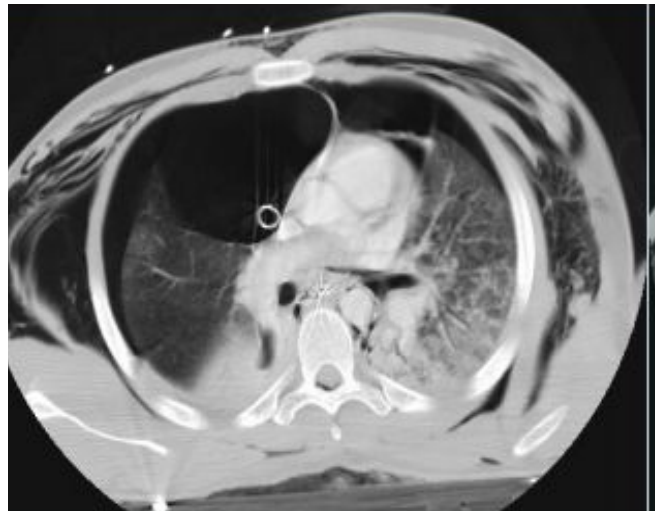
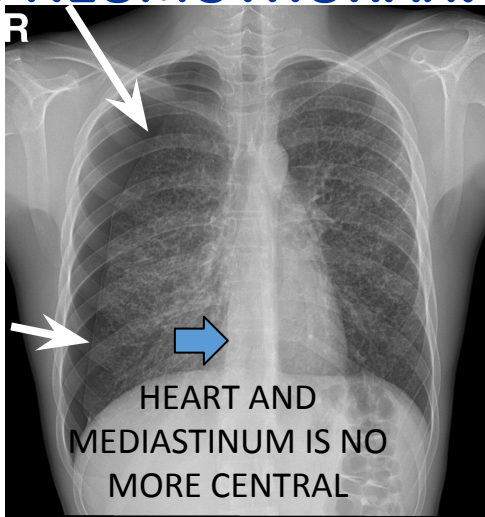
- once fluid increase it goes up in **curve line level**, it is not like a cup of water with flat line level, costophrenic angle blunted once amount of fluid increase
- The doctor mentioned an experience in school we used to do it, we bring cup of water half empty when we see it from outside we see fluid level in flat line. 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.
- naturally it has a low pressure because once fluid inside it, it will be sucked out
- 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 right picture, if we have **Moderate** pleural effusion we will get picture like in the left

## SEVER PLEURAL EFFUSION :



- The Right lung completely filled with fluid **“opaque right side”**.
- “Yellow arrow” Air on right side push mediastinum to the other side so there is pressure to space mediastinum to the other side.
- In CT image there is fluid in right lung.
- if we insert needle it will suck out the fluid from the right hemidiaphragmatic angle
- if we measure( Fluid evaluation value) you will see it as a fluid .

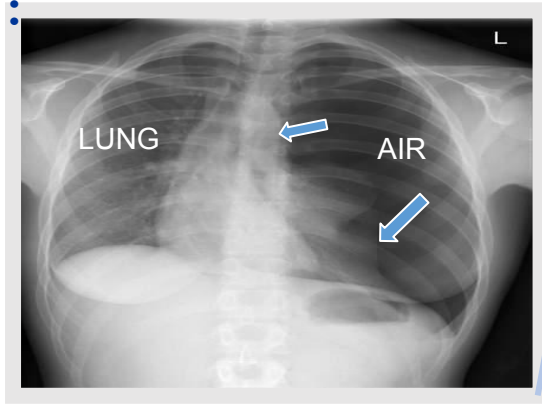
## PNEUMOTHORAX:



- A pneumothorax is defined as air inside the thoracic cavity but outside the lung.
- A spontaneous pneumothorax is one that occurs without an obvious inciting incident.

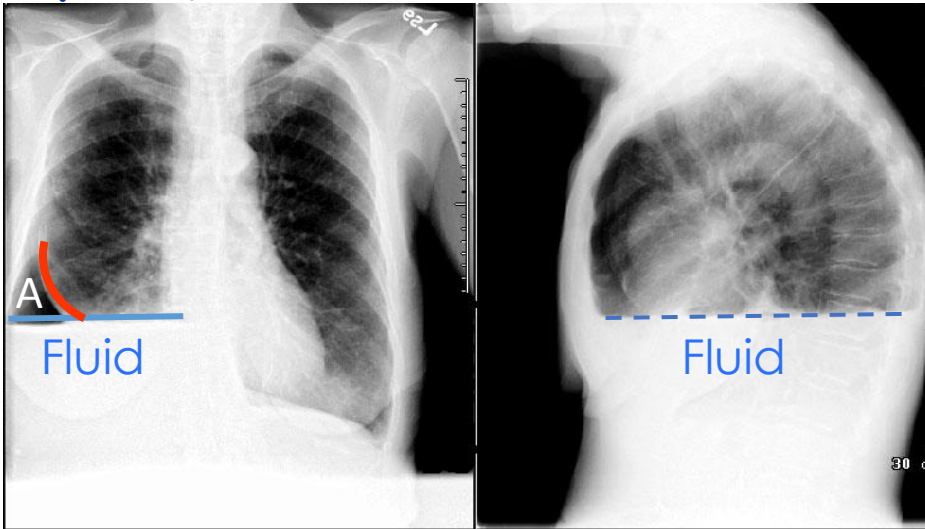
- pneumothorax it is serious a problem you can see it as hair in chest x-ray will have pleural line
- air goes inside the pleural cavity that compresses lung and result in lung collapses as a result there is some sort of displacement of mediastinum from pressure as what happened with the fluid before but here air itself make a pressure and move mediastinum slitley to other side.
- if we do CT scan we can see the difference between lung that have vesael and jet black (normal) and air in pleural cavity which is the pneumothorax .

## Continue.. PNEUMOTHORAX



- Right side lung with vessels
- On the Left side **Jet black air**, takes all left hemithorax we don't have any lung here you can see the difference between Rt side and Lt side.

## Hydro-pneumo-thorax:



- When will have air fluid level appears flat as this image ?
- **In Hydro-pneumo-thorax**
- remember the example of covered cup filled with fluid.
- we have three things in right side: **air – fluid level**, **above it jet black air** so we have fluid, air and the lung.

## EMPHYSEMA:



- Increased Lung Volume
- **Flattened Diaphragms**
- **Increase in Retrosternal Airspace**
- **Barrel chest**
- Small Vessels
- Small, narrow cardiac shadow.

**Emphysema is loss of elastic recoil** of the lung with destruction of pulmonary capillary bed and alveolar septa. It is caused most often by cigarette smoking and less commonly by alpha-1 antitrypsin deficiency.

- Patient with emphysema take deep inspiration and can't expire it out this will cause distention of the lung all the time will be full with air .
- Ability to take short inspiration and expiration.
- Cyanosed and has problem in inspiration and most of the times will be in ER.

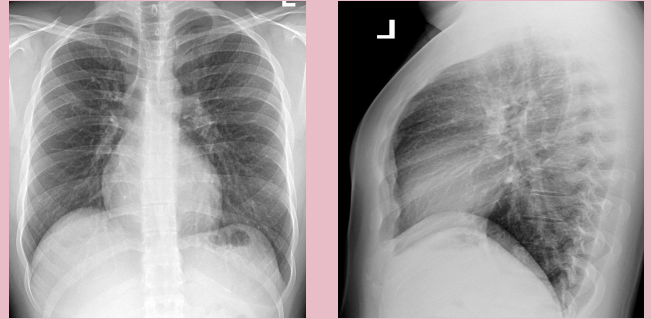
## EMPHYSEMA



- patient with emphysema have **lost elastic recoil** of lungs
- lung is rigid, so if the patient take deep inspiration will have problem in exhalation of that air as a result **distention** of lung.

emphysema : diaphragmatic cupola flatten ,heart decreased in size retrosternal air increases.

## Normal



normally if we take deep breath there will be normal recoiling and emptying the air without exertion.

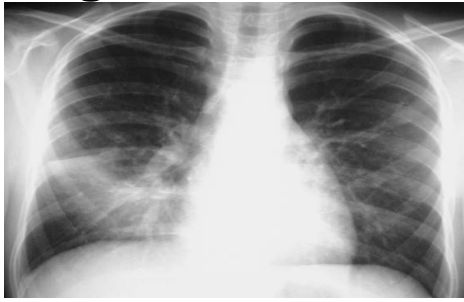
normally diaphragmatic cupola curved , heart broad , retrosternal air small and in lateral view diaphragmatic cupola not flatten

- **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).

### • signs of emphysema :

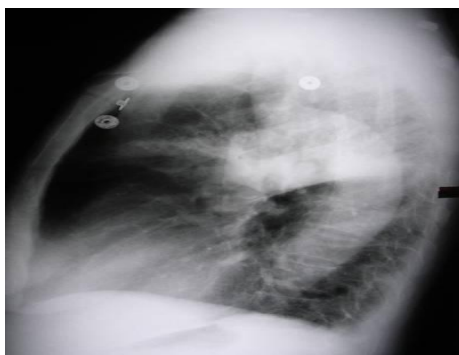
- 1-shortness of breath
- 2- cyanosis
- 3- diaphragmatic cupola will not raise as a result of increased lung volume flattening diaphragmatic cupola increased
- 4- increase retrosternal air in lateral view
- 5- barrel chest
- 6- attenuated vessels
- 7- hilar shadow " heart " smaller in size due to the air compression from each side .

## Right middle lobe

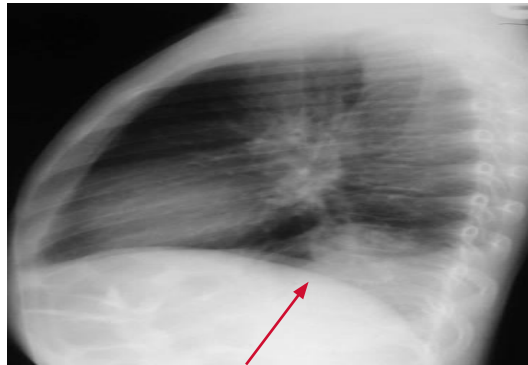
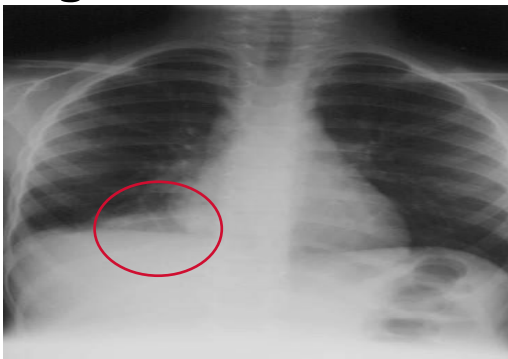


**NOTE:**  
In this slide and the coming slides images that the doctor didn't explain!

## Right upper lobe

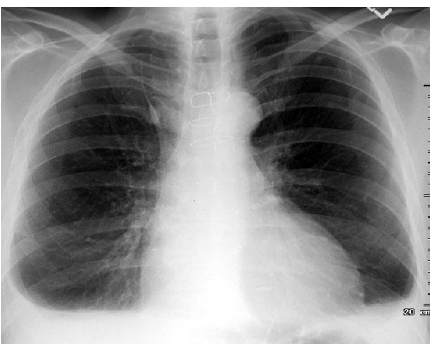


## Right lower lobe



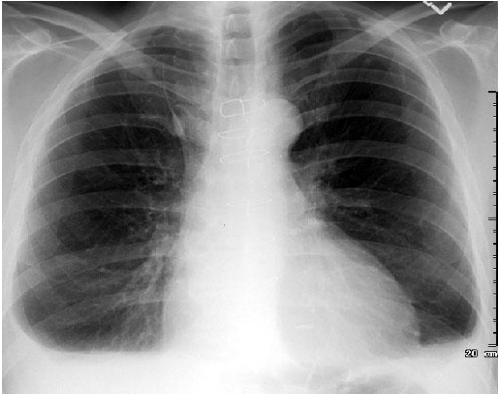
Posterior diaphragm silhouetted

## PLEURAL EFFUSION

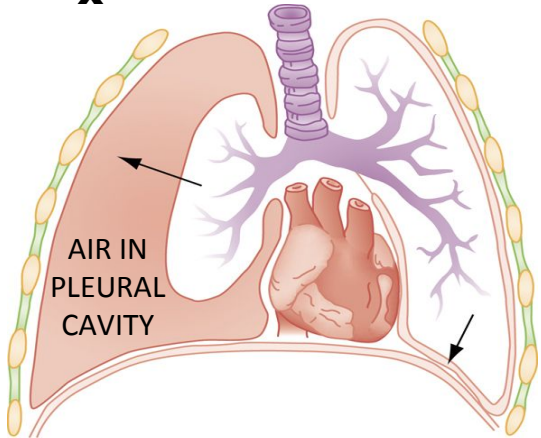


On an upright film, an effusion will cause blunting on the lateral and if large enough, the posterior costophrenic sulci. Sometimes a depression of the involved diaphragm will occur. A large effusion can lead to a mediastinal shift away from the effusion and opacity the hemithorax. Approximately 200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

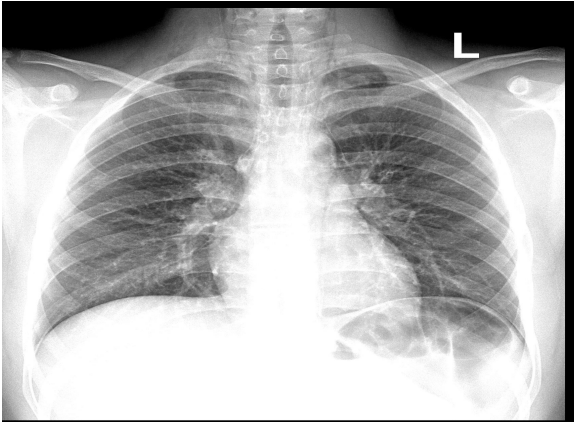
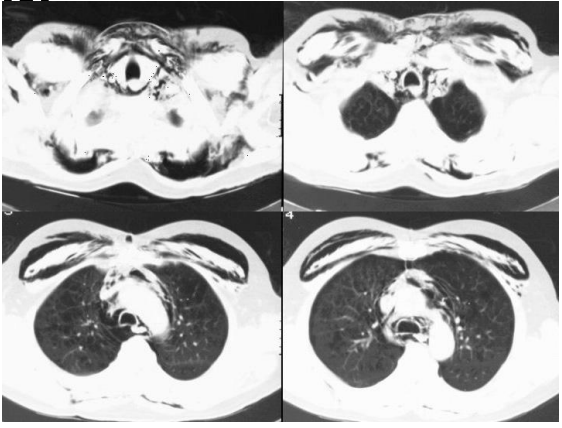
# BLUNTED C/P ANGLE BOTH SIDES



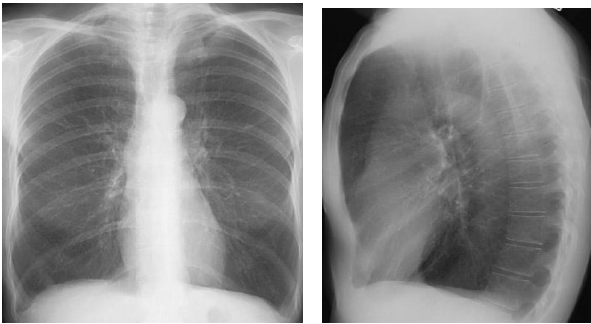
# PNEUMOTHORAX



# PNEUMOMEDIASTINUM

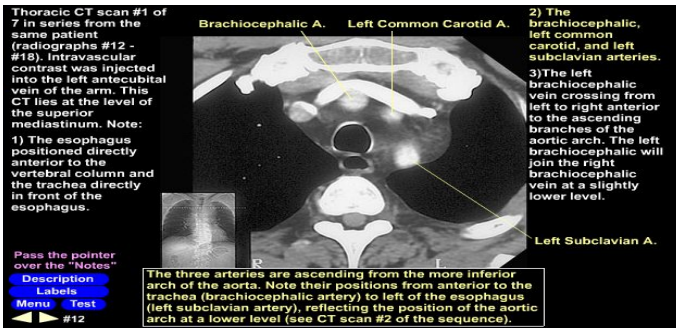
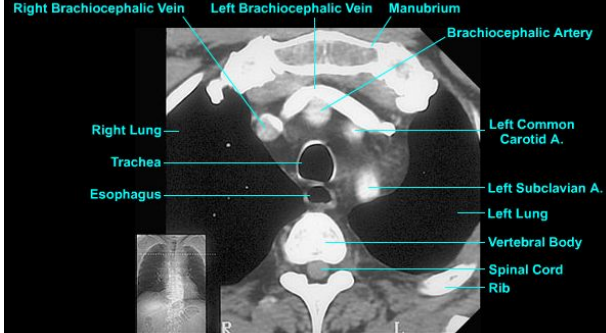


# EMPHYSEMA



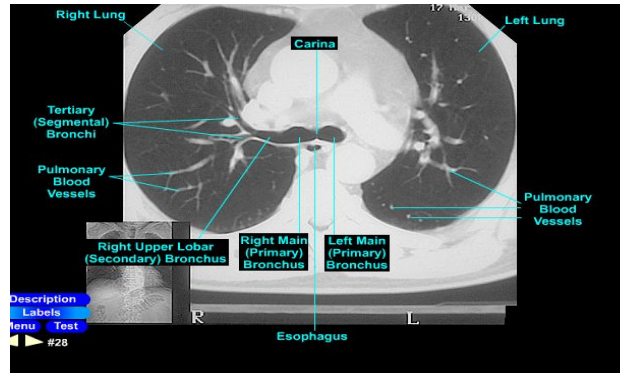
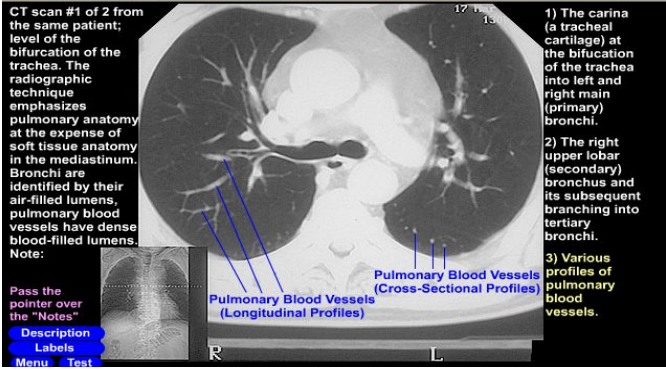
• Emphysema is commonly seen on CXR as diffuse hyperinflation with flattening of diaphragms, increased retrosternal space, bullae (lucent, air-containing spaces that have no vessels that are not perfused) and enlargement of PA/RV (secondary to chronic hypoxia) an entity also known as cor pulmonale. Hyperinflation and bullae are the best radiographic predictors of emphysema.

# CT anatomy

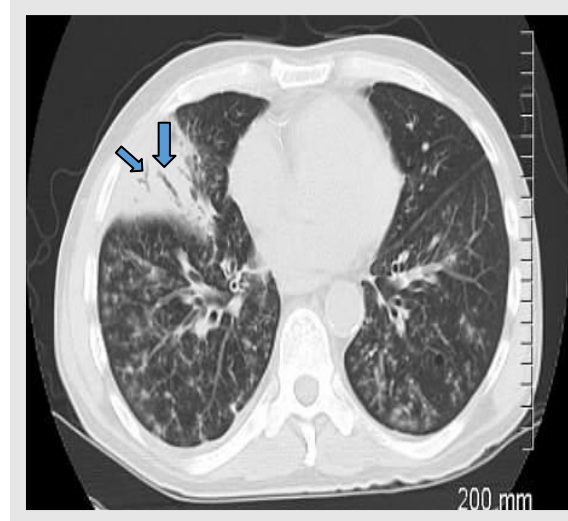
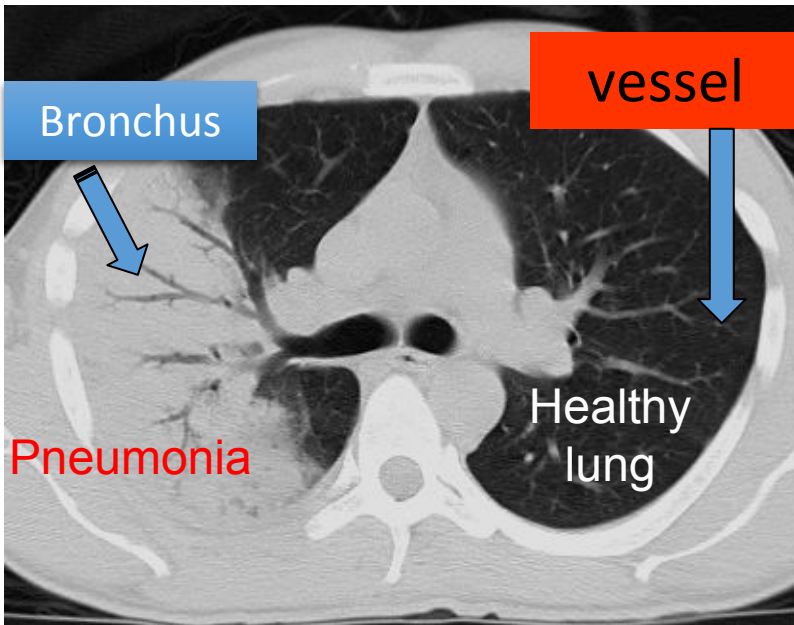




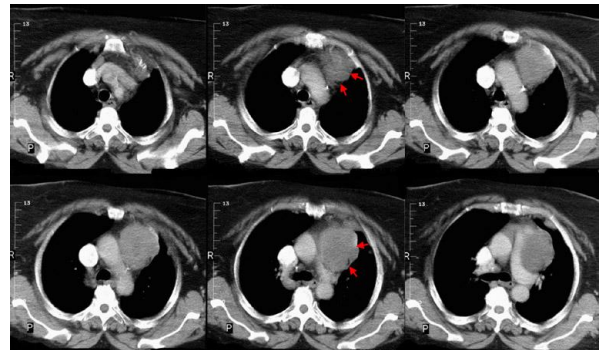
# CT



## Air bronchograms — CT



## Anterior Mediastinal Mass



- Anterior mediastinal masses consist of the 4 "T's" (Terrible lymphadenopathy, Thymic tumors, Teratoma, Thyroid mass) and aortic aneurysm, pericardial cyst, epicardial fat pad. Usually CT or fine needle aspiration is needed to make the definitive diagnosis of an anterior mediastinal mass.

# Don't Forget !

- ✓ A nodule that is unchanged for two years is almost certainly **benign**.
- ✓ If the mass arises from the pleura (peripheral mass) it is called "**Pleural Based Lesion**" by this name it can help us to minimize and know the Differential diagnosis.
- ✓ If there is a lesion in the core of the lung the first and the most important DDx is bronchogenic carcinoma
- ✓ 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 and if it moves up or down on x-ray it indicates something (pathology)
- ✓ **what is pleural effusion?**
- ✓ we have little fluid in the pleural cavity in normal image of chest we suppose to see costophrenic angle peaks but once there is a fluid in pleural cavity cause **blunted costophrenic angle**
- ✓ A pneumothorax is defined as air inside the thoracic cavity but outside the lung.
- ✓ **signs of emphysema** : shortness of breath cyanosis, diaphragmatic cupola will not raise . as a result of increased lung volume flattening diaphragmatic cupola increased retrosternal air in lateral view , barrel chest attenuated vessels, heart small in size because air compressor it