

Lecture 6:

Radiology of the Respiratory Diseases



Radiology Team
Med433



● Slides

● Explanation

● Notes

● Additions

● Important

Mass Vs Diffuse Infiltration

Solitary nodule in the lung



Could be not-harmful or fatal lung cancer! After detection the initial step to compare with previous films if available. **A nodule that is unchanged for two years is almost certainly benign.** Evaluate for 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.

Both cases have abnormal opacity in the left upper lobe



Diffuse Infiltration

Opacity that is **poorly defined**. This is airspace disease such as **pneumonia**



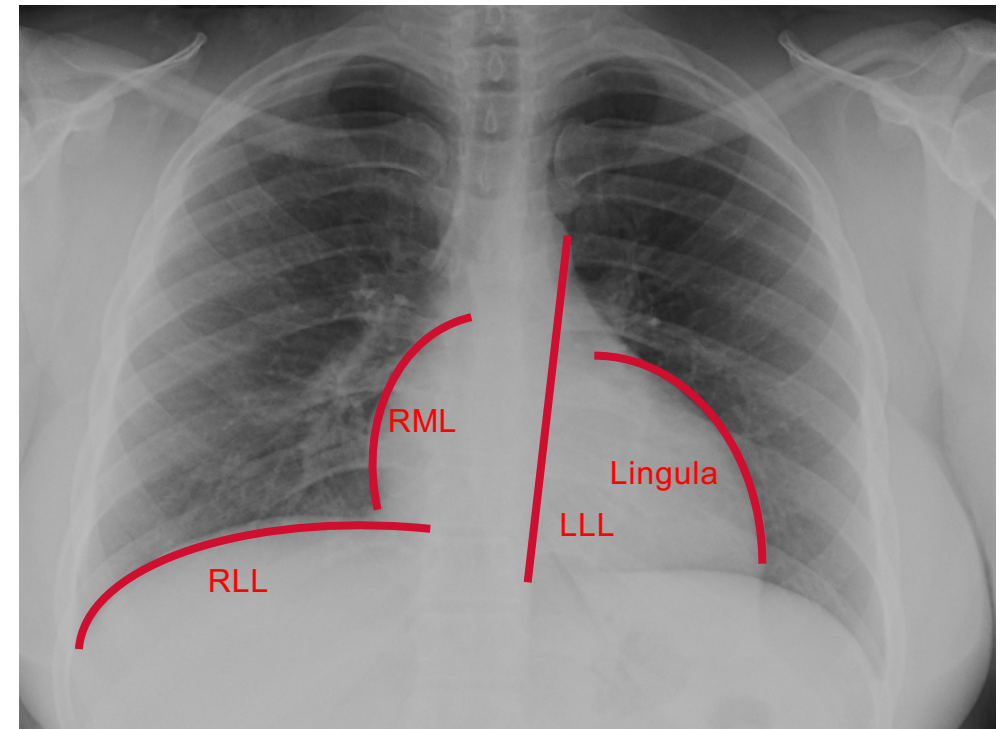
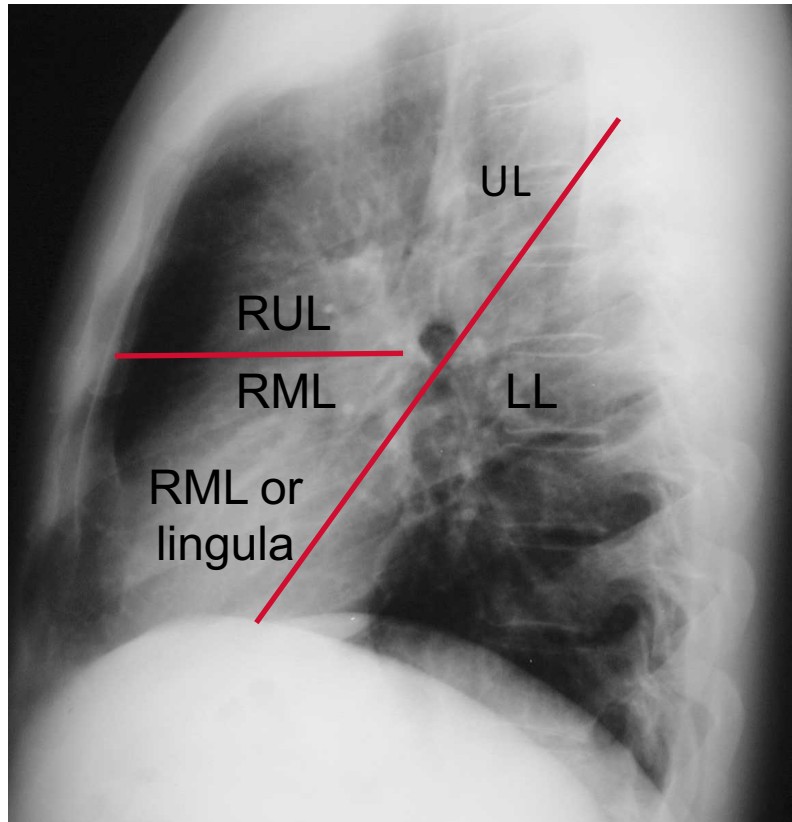
Mass

Opacity would best be described as a **mass** (nodule) because it has edges that is **well-defined** (3D structure)



The Silhouette Sign

Obscuration (not seen as sharp edge) of a normally seen border, e.g. diaphragm or heart. Indicates air space disease. Opacity with sharp edge along a fissure.



These red outlines should be fixed in place and sharp, any opacity or shifting considered abnormality (**loss of silhouette sign**)

Recognizing air space disease

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

LLL : lower left lobe, RLL : right lower lobe, RML : right middle lobe

Definitions:

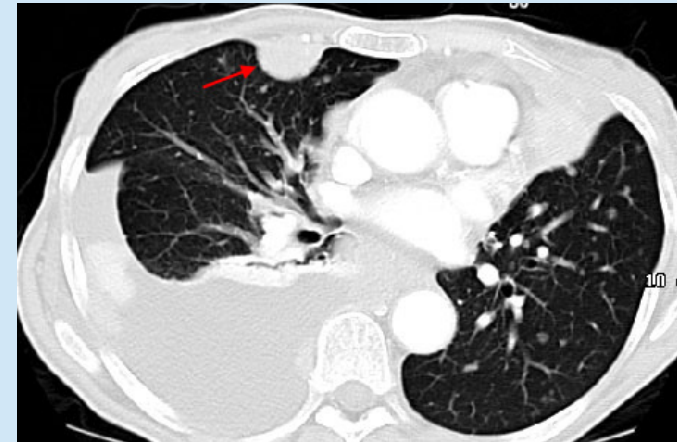
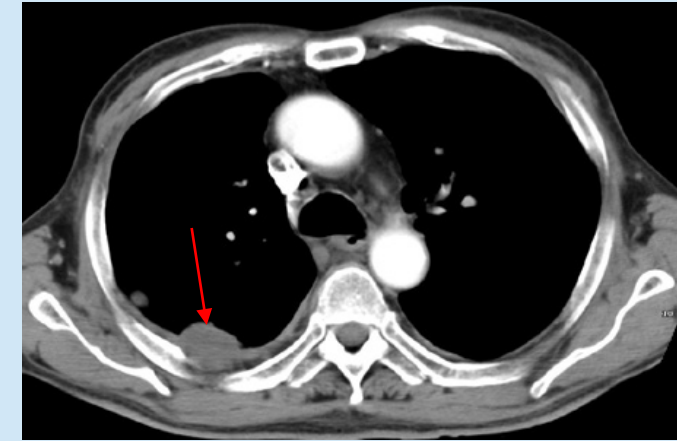
Atelectasis :

Loss of volume of lobe, segment or sub segment of the lung (Shrinkage). E.g. collapse (lung)

Consolidation:

Loss of air in lobe, segment or sub segment of the lung. E.g. pneumonia (lobe)

Pleural Lesions



Atelectasis

Volume Loss

Associated Ipsilateral Shift

Linear, Wedge-Shaped

Apex at Hilum

Pneumonia

Normal or Increased Volume

No Shift, or if Present Then Contralateral

Consolidation, Air Space Process

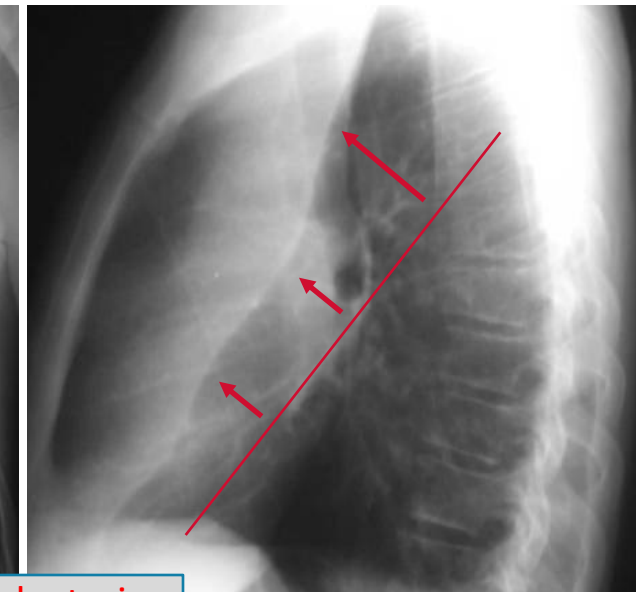
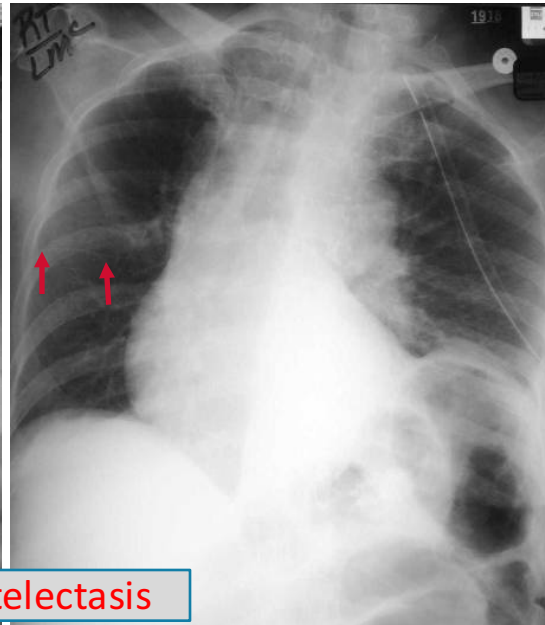
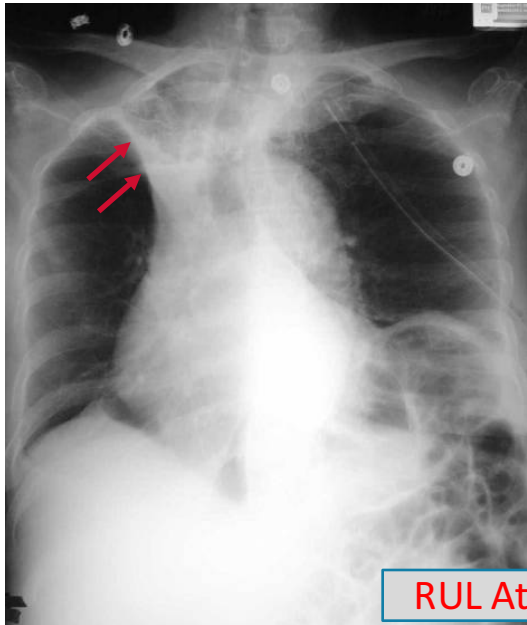
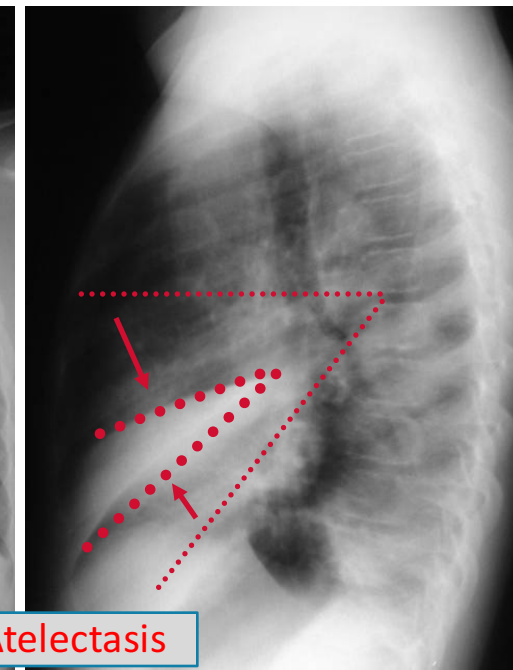
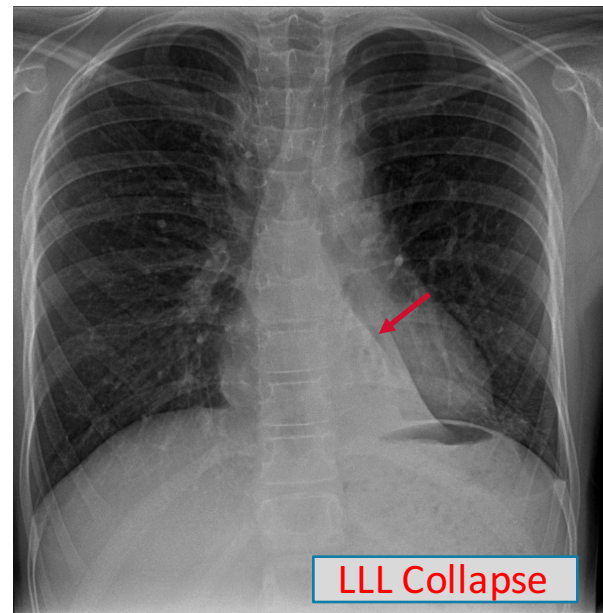
Not Centered at Hilum

Air bronchograms can occur in both.

Lobar Atelectasis:

- Best sign is **shifting of a fissure**
- **Air bronchograms** if non-obstructive
- Secondary signs:
 - Mediastinal shift
 - Elevated diaphragm
 - Ribs closer together
 - Vague increased density

Shifting of fissures is obvious in all pictures



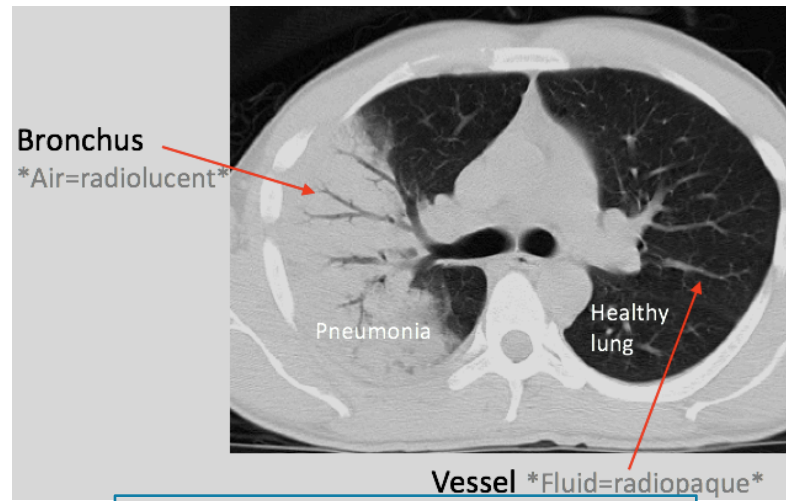
LUL Atelectasis

Pneumonia:

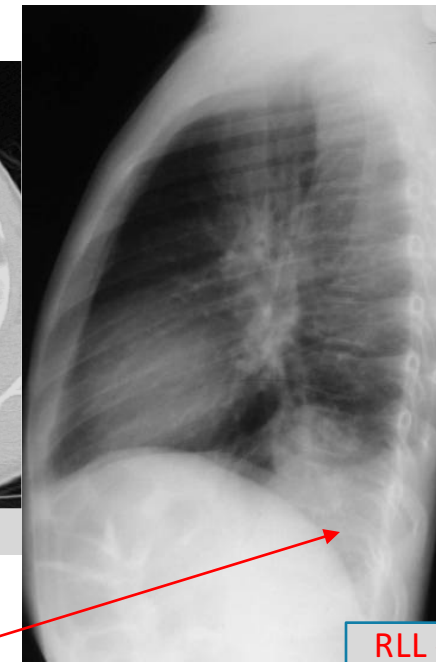
Signs:

- **Air bronchogram** *air-filled bronchi (dark) being made visible by the opacification of surrounding alveoli (grey/white) [from upper chest down]
- **Lung tissue is changing to white color.**
- Silhouette - “positive” or “negative”
- Dense hilum
- “Spine” sign *vertebrae become more white (radiopaque)

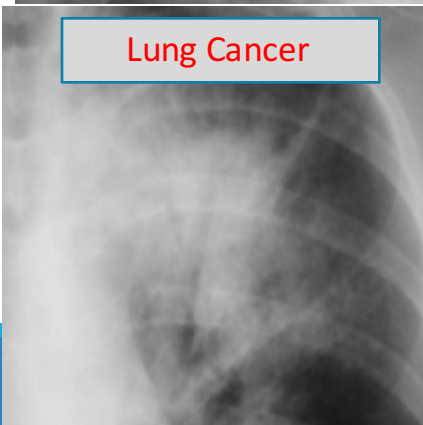
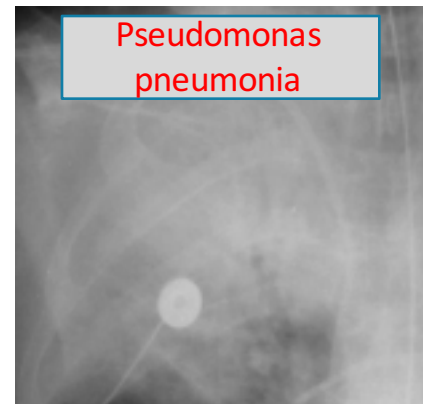
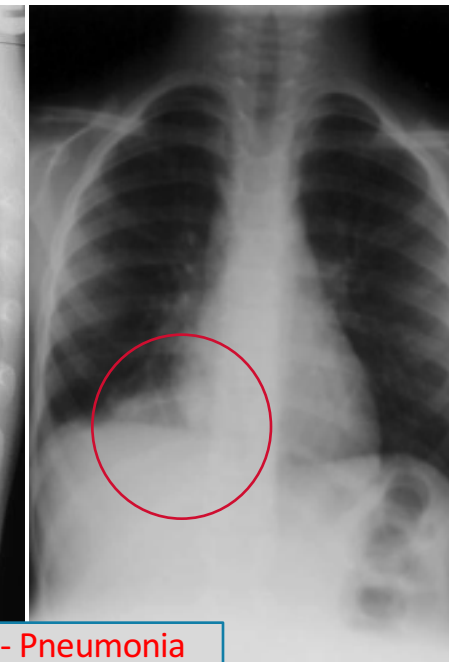
Diagnosis of pneumonia depends on appropriate clinical scenario.



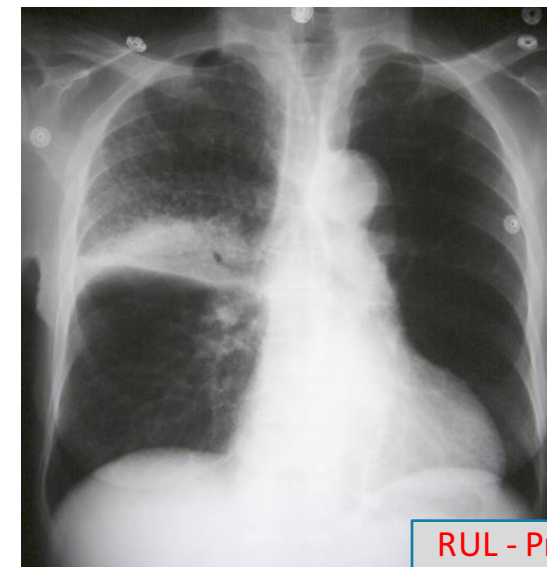
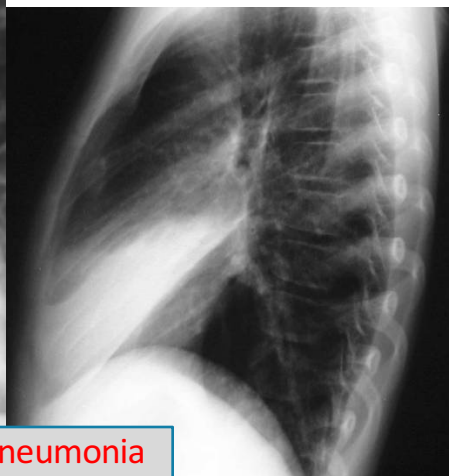
CT - Air bronchograms (Pneumonia)



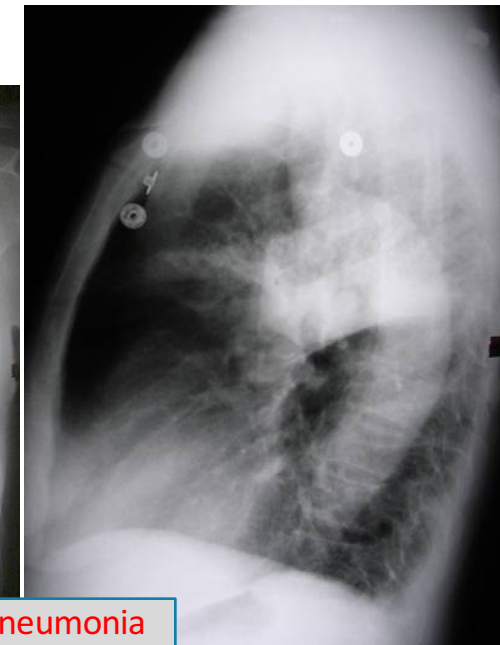
RLL - Pneumonia

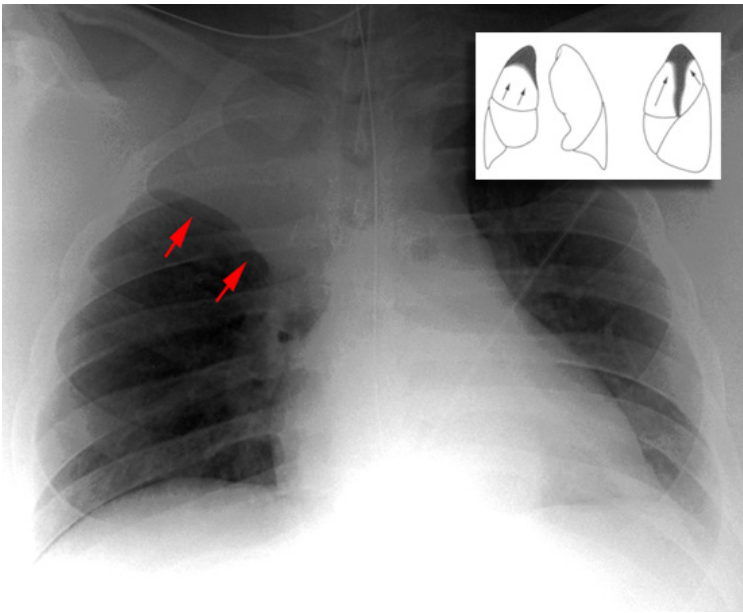


RML - Pneumonia

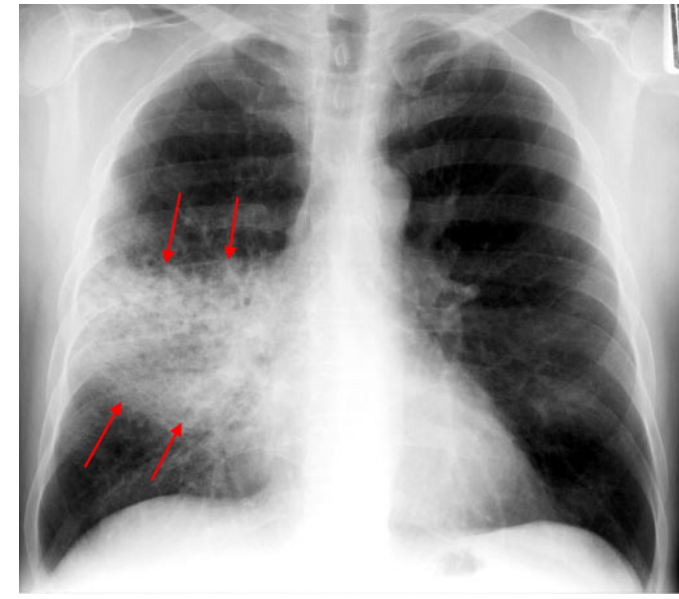


RUL - Pneumonia

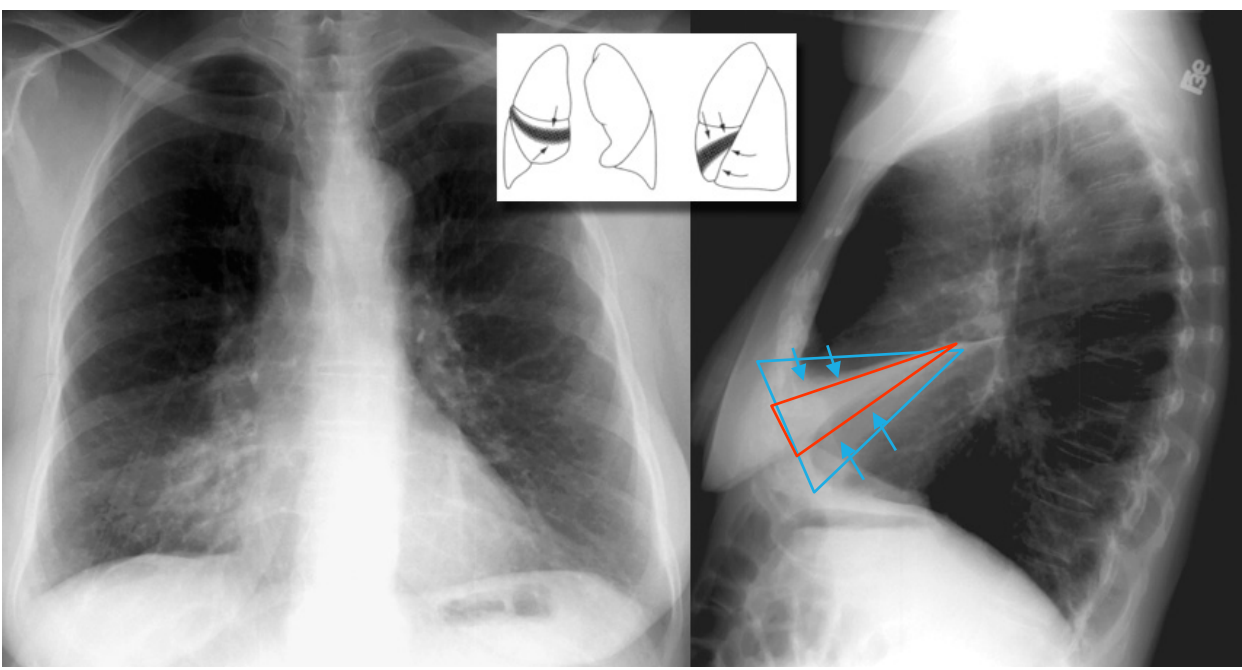




Atelectasis

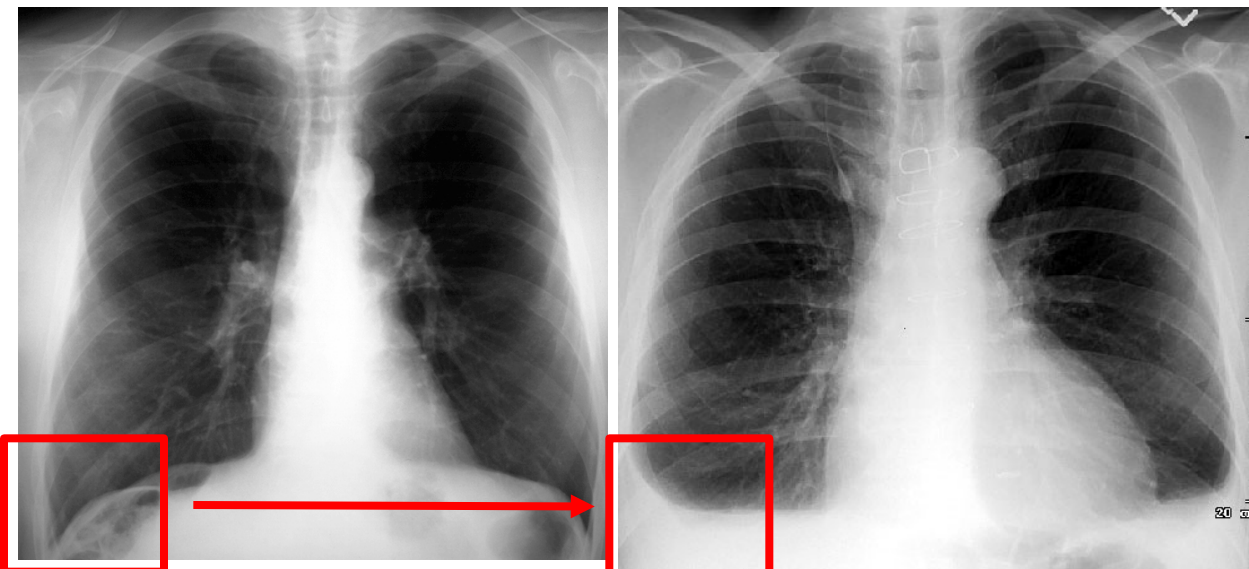


Pneumonia

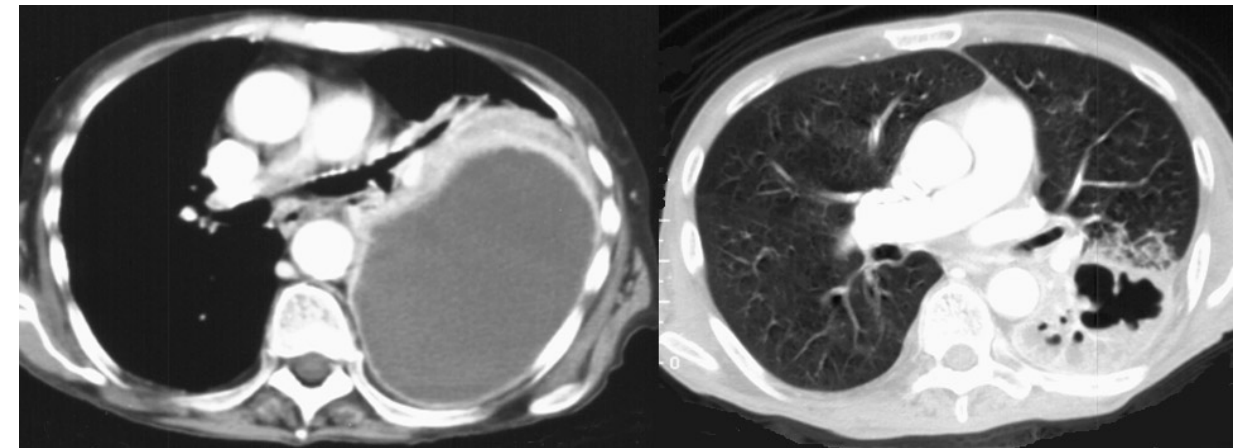


Pleural Effusion:

- On an left film, an **effusion will cause blunting of costophrenic angle** and if large enough, the posterior costophrenic sulci.
- Sometimes: a depression of the involved diaphragm, mediastinal shift away, opacity of 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.

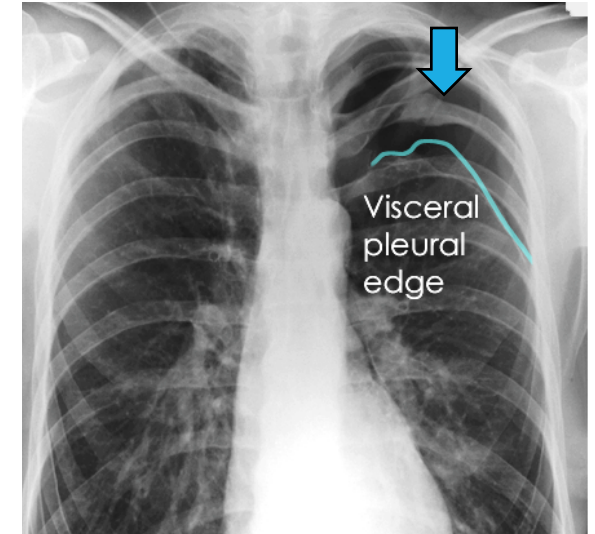


Blunting of costophrenic angle *due to collection of fluid*

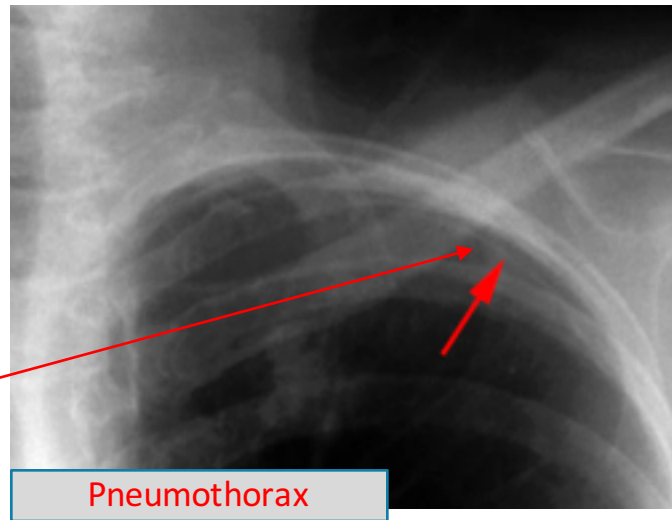


Pneumothorax Vs. Pneumomediastinum:

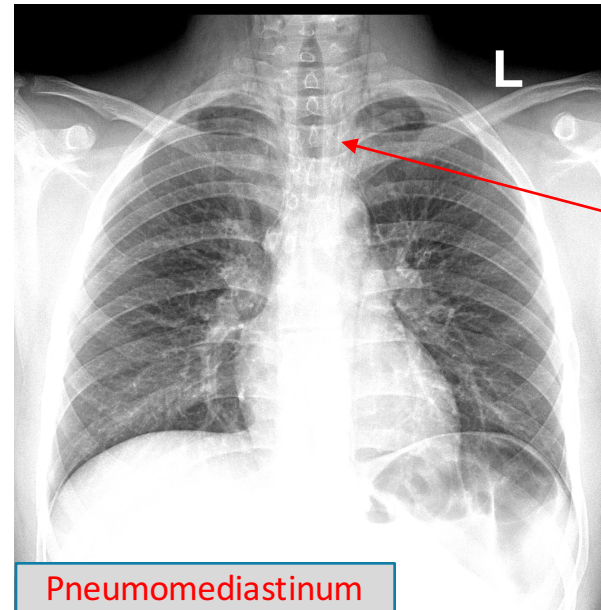
- **Pneumothorax:** is air inside pleural cavity.
- Spontaneous pneumothorax (PTX) is one that occurs **without an obvious invasive incident**. Some causes of spontaneous PTX are; idiopathic, or result of underlying disease (**asthma, COPD, pulmonary infection, neoplasm, Marfan's syndrome, and smoking cocaine.**)
- The most common cause of pneumothorax is **trauma**, with laceration of the visceral pleura by a fractured rib.
- **Pneumomediastinum:** is air in mediastinum.



Lungs markings (**vessels**) aren't visible beyond this edge



Pneumothorax

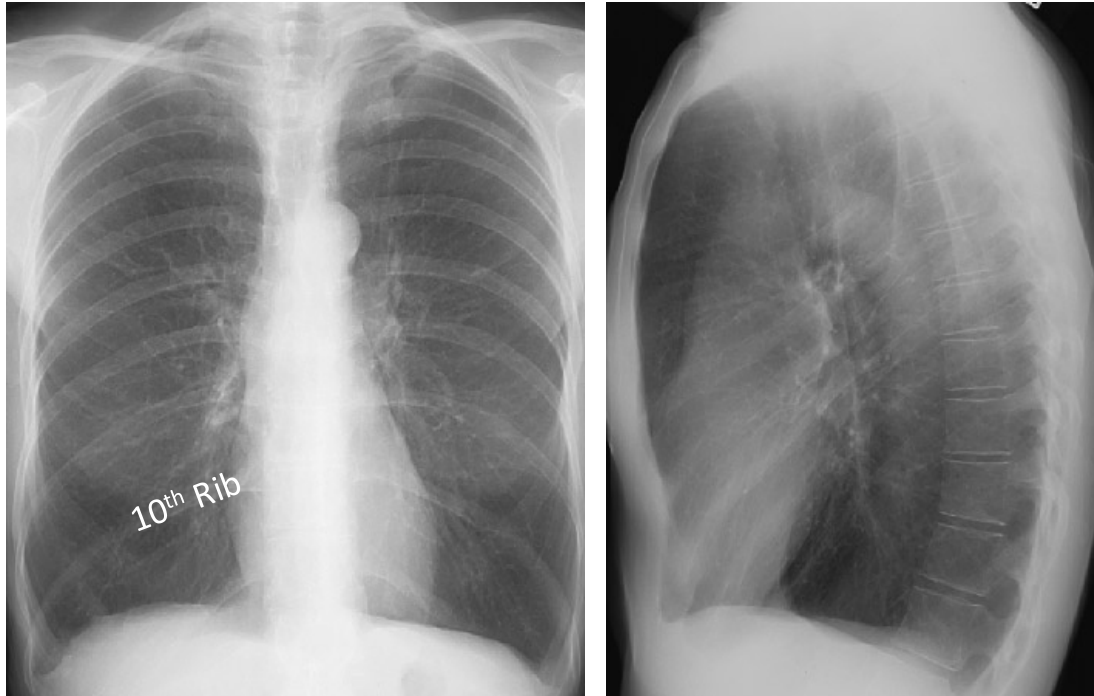


Pneumomediastinum



Emphysema:

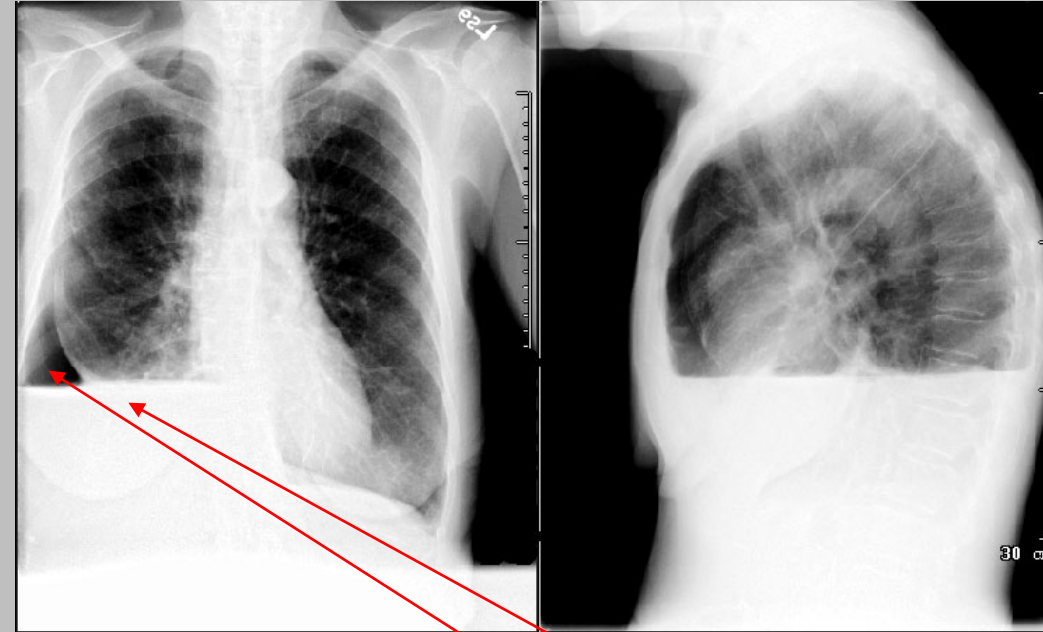
- Emphysema is loss of elastic recoil of the lung with destruction of pulmonary capillary bed and alveolar septa. It is caused most often by **cigarette smoking** and less commonly by **alpha-1 antitrypsin deficiency**.
- **Signs:**
 - Commonly seen on CXR as **barrel shaped. Diffuse hyperinflation, flattening of diaphragms, increased retrosternal space, the spaces between the ribs increased.**
 - **Bullae** (lucent, air-containing spaces that have no vessels that are not perfused).
 - Enlargement of pulmonary artery/right ventricle (secondary to chronic hypoxia *Cor-Pulmonale*).
 - **Hyperinflation** and **bullae** are the best radiographic predictors of emphysema.



Hydro-pneumo-thorax

(also called hemo-pneumo-thorax)

Collection of fluid and air in pleural cavity.

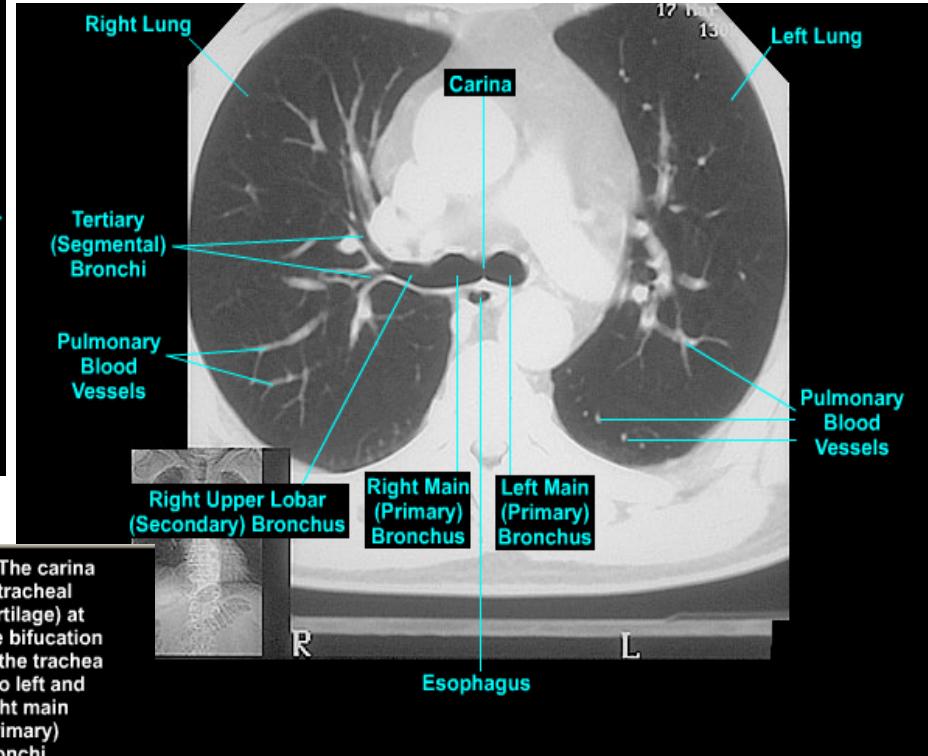
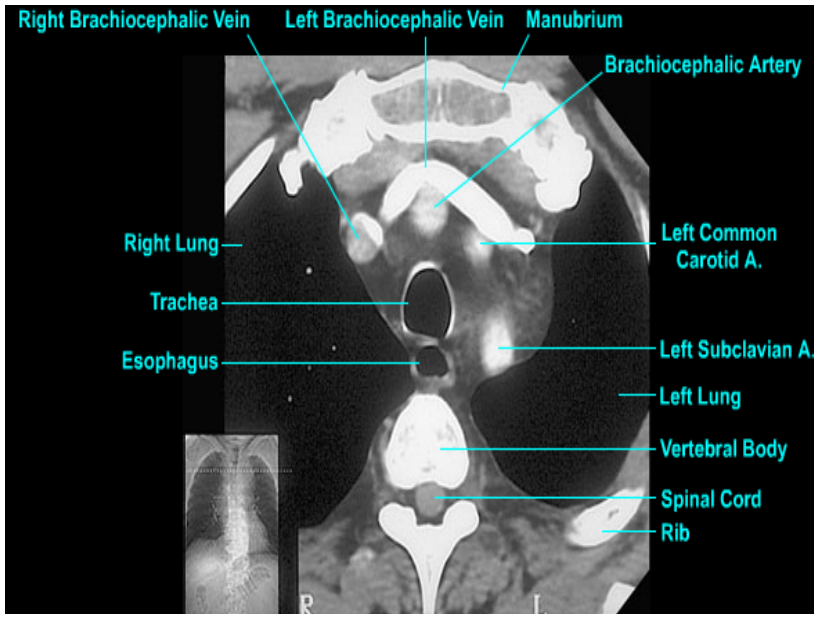


Seen as **air-fluid level**.

you can notice:

- Some degree of flattened diaphragm
- **Hyperinflation** *lungs enlarged and exceeded 10th rib*

CT - Anatomy of Chest



Thoracic CT scan #1 of 7 in series from the same patient (radiographs #12 - #18). Intravascular contrast was injected into the left antecubital vein of the arm. This CT lies at the level of the superior mediastinum. Note:

- 1) The esophagus positioned directly anterior to the vertebral column and the trachea directly in front of the esophagus.
- 2) The brachiocephalic, left common carotid, and left subclavian arteries.
- 3) The left brachiocephalic vein crossing from left to right anterior to the ascending branches of the aortic arch. The left brachiocephalic will join the right brachiocephalic vein at a slightly lower level.

Pass the pointer over the "Notes"

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#12

The three arteries are ascending from the more inferior arch of the aorta. Note their positions from anterior to the trachea (brachiocephalic artery) to left of the esophagus (left subclavian artery), reflecting the position of the aortic arch at a lower level (see CT scan #2 of the sequence).

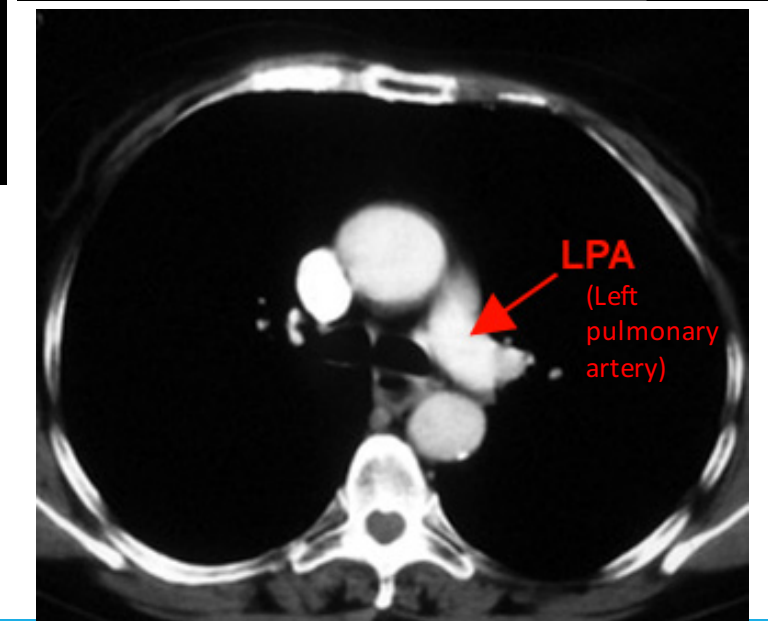
CT scan #1 of 2 from the same patient; level of the bifurcation of the trachea. The radiographic technique emphasizes pulmonary anatomy at the expense of soft tissue anatomy in the mediastinum. Bronchi are identified by their air-filled lumens, pulmonary blood vessels have dense blood-filled lumens. Note:

- 1) The carina (a tracheal cartilage) at the bifurcation of the trachea into left and right main (primary) bronchi.
- 2) The right upper lobar (secondary) bronchus and its subsequent branching into tertiary bronchi.
- 3) Various profiles of pulmonary blood vessels.

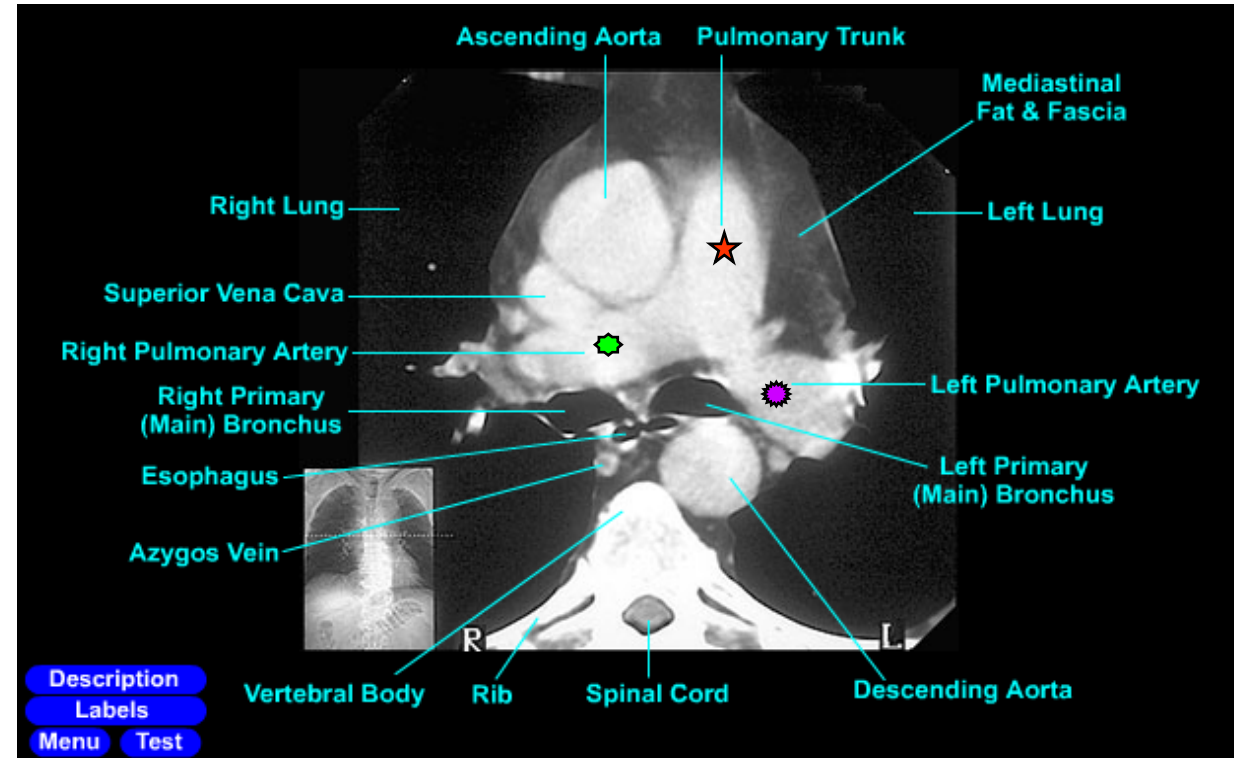
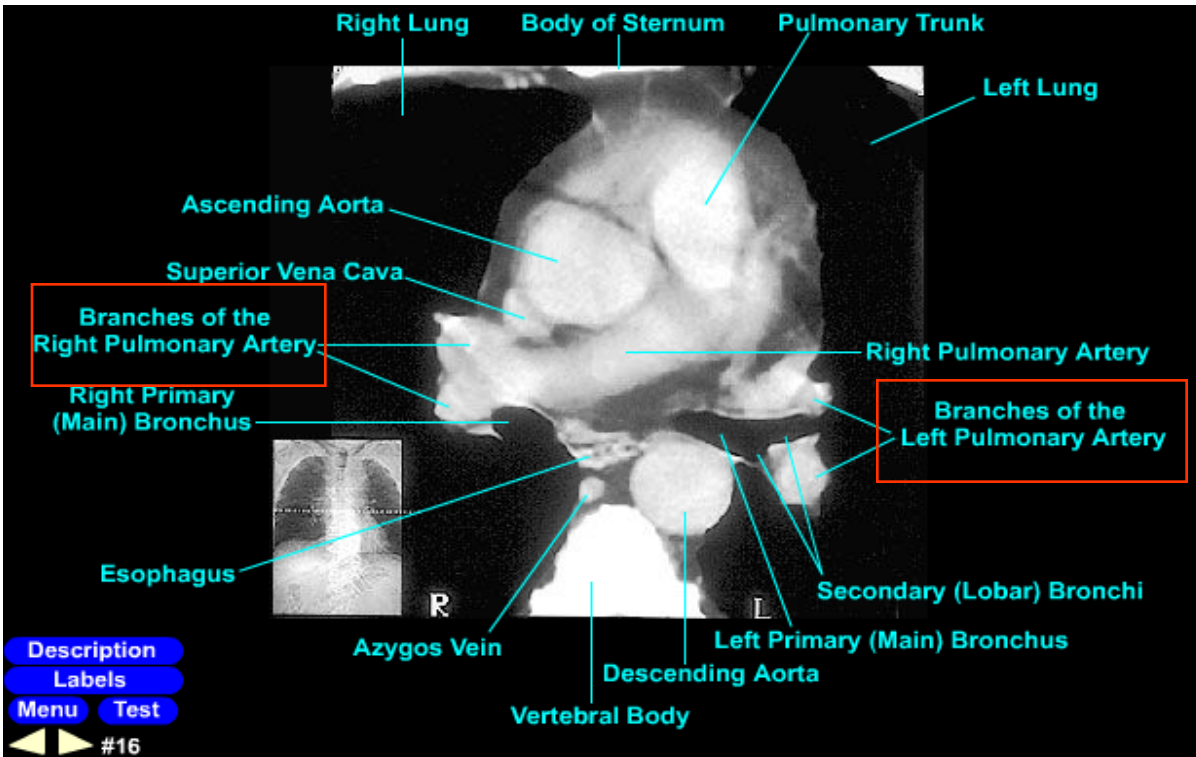
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Just go through them.
 # Know the normal, so that you can catch the abnormal.



Vascular Anatomy of the Chest



Mercedes Sign:

In the mid-chest at the level of the hilum.

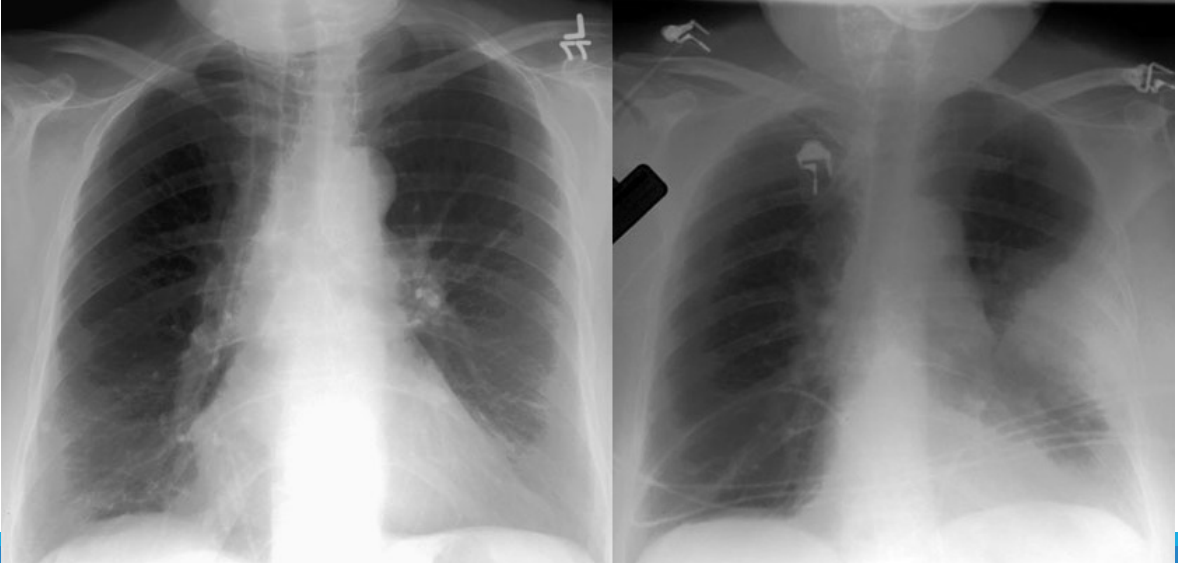
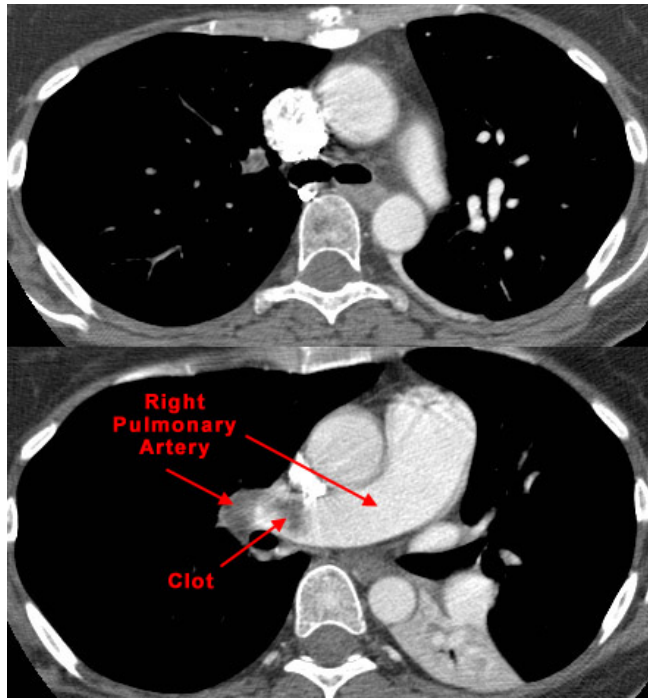
3 structure:

1. Pulmonary trunk
2. Right pulmonary artery
3. Left pulmonary artery



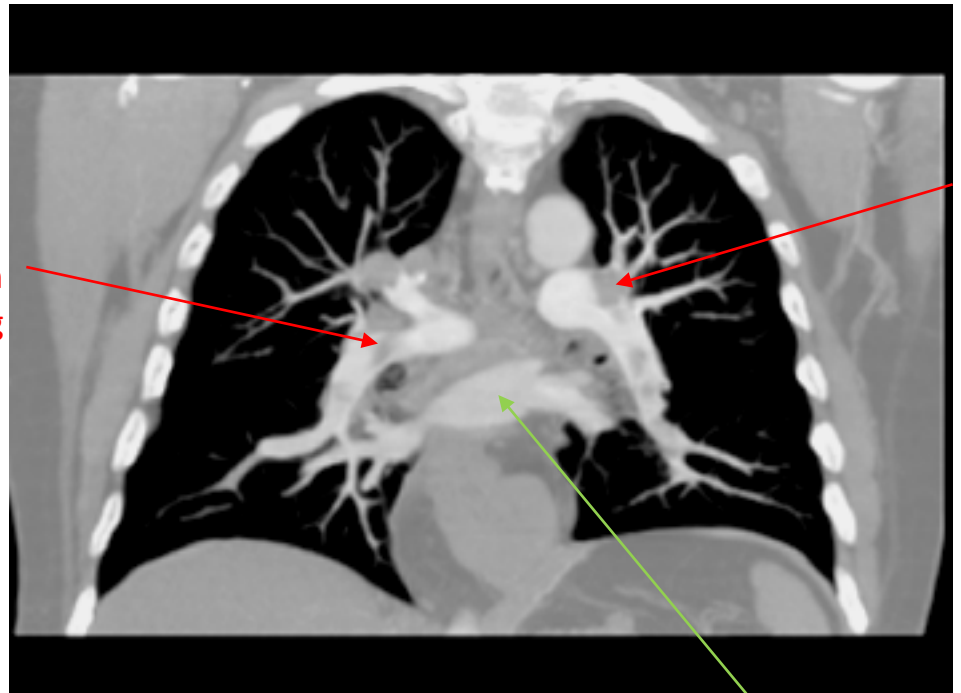
Pulmonary Embolism: IMPORTANT

- **Spiral CT** is the best choice to diagnose PE.
- X-Ray is mostly normal (could show enlarged pulmonary artery, pleural effusion, atelectasis, consolidation)
- **Clot in right pulmonary artery**
- **Enlarged right pulmonary artery**



The most common finding on x-ray in PE is a normal CXR.

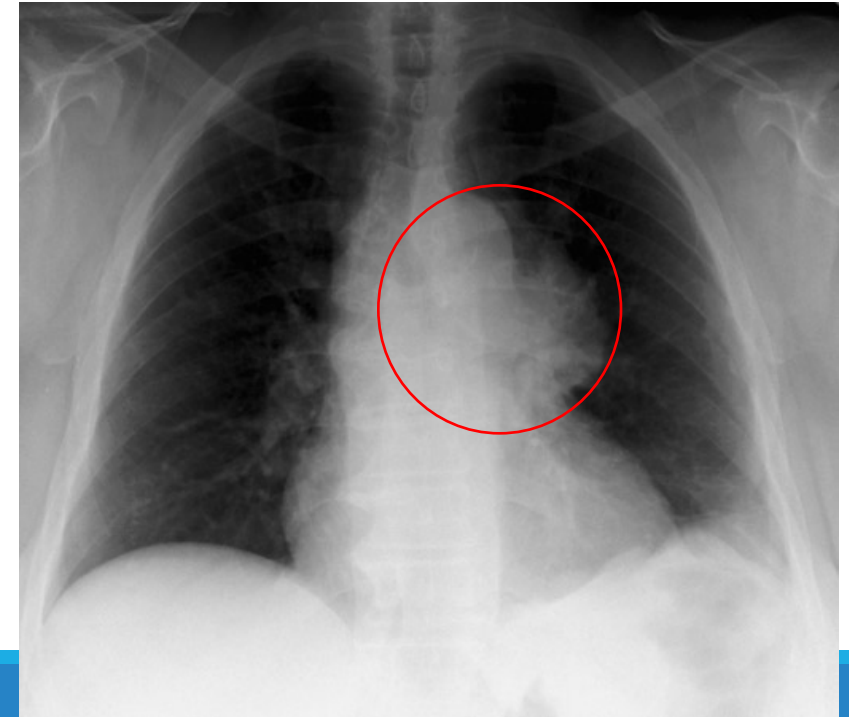
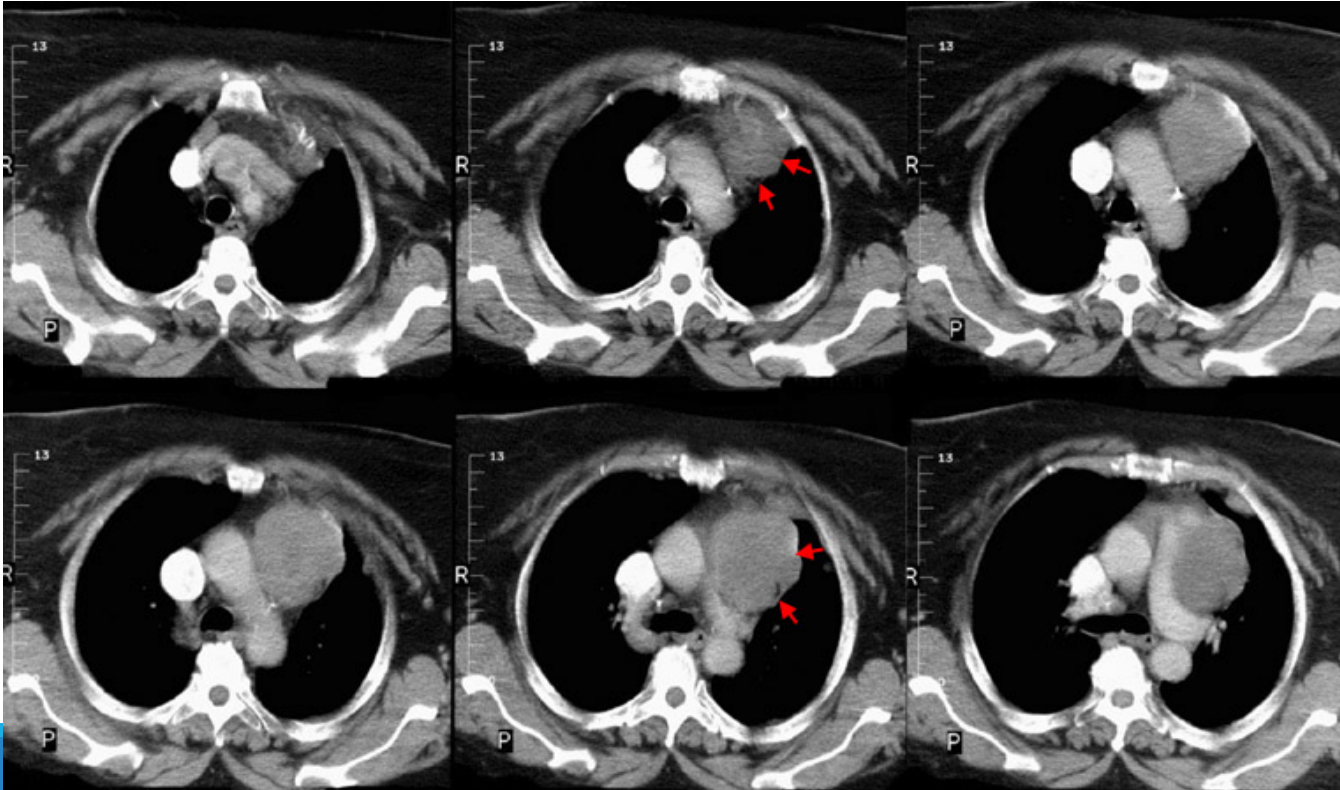
CTA (CT angiography)
Coronal Reconstruction



CT only provide axial sections, but now a days the computer could process these sections (**Coronal Reconstruction**) to give us coronal sections.

Anterior Mediastinal Mass:

- Anterior mediastinal masses consist of the 4 "T's":
 1. Terrible lymphadenopathy
 2. Thymic tumors
 3. Teratoma
 4. Thyroid mass
- Also could be: 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.



Thank You!

We hope you found this helpful and informative.

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