

Chest Imaging III

Pulmonary hyperlucency

Decreased lung density on images is described as pulmonary hyperlucency on conventional chest radiographs and hypoattenuation (hypodensity) on CT scans.

Pulmonary hyperlucency

Classification

- Bilateral or unilateral
 - Diffuse or focal

 - Air in the pleural cavity (pneumothorax)
 - Inside the lungs
 - excess of air in the pulmonary parenchyma (pulmonary emphysema)
 - decrease in mass of the pulmonary parenchyma caused by a reduction in vasculature or blood flow (pulmonary hypovolemia, oligemia).
- Pulmonary arterial hypovolemia may be:
- total - in congenital cardiac malformations associated with severe pulmonary artery stenosis.
 - local - in thromboembolism of one of the branches of the pulmonary artery, then it is associated with dilation of the proximal pulmonary vessels at the site of the embolism (Westermark symptom)

Pneumothorax

The presence of gas in the pleural space

- Primary spontaneous pneumothorax in no known underlying lung disease (e.g. Connective Tissue Disorders like Marfan syndrome).
- Secondary spontaneous pneumothorax when the underlying lung is abnormal (rupture of sub-pleural bulla, obstructing lung disease (e.g. asthma, COPD), pneumonia, tuberculosis, cystic fibrosis etc).
- Traumatic pneumothorax (pulmonary laceration, tracheobronchial rupture, esophageal rupture).
- Iatrogenic pneumothorax in percutaneous biopsy, central venous catheter insertion, endoscopic perforation of the esophagus

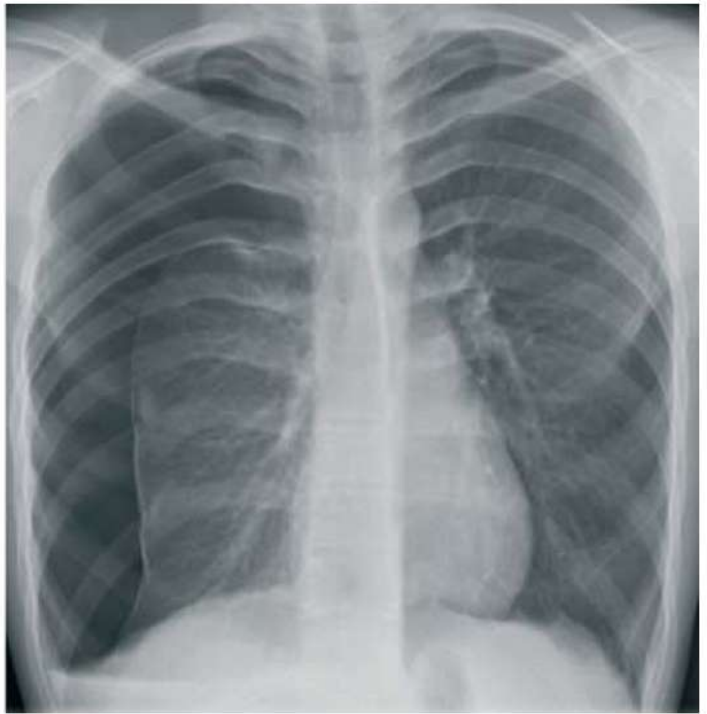
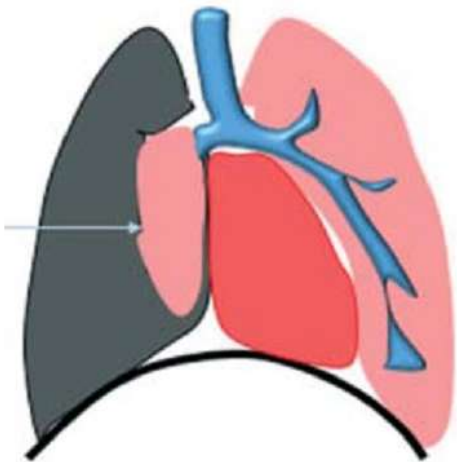
Pneumothorax

The presence of gas in the pleural space

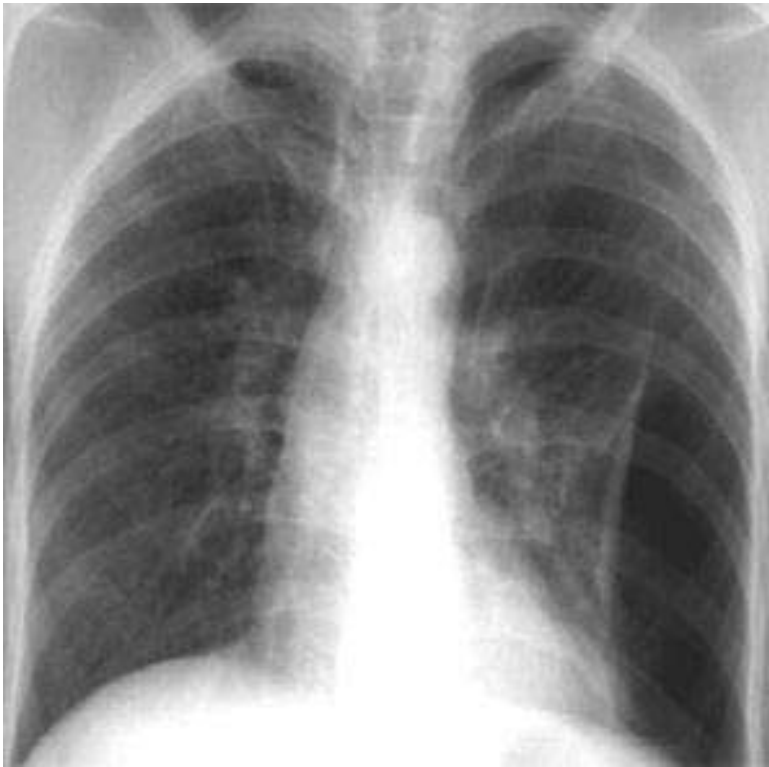
Radiographic features

- Hyperlucency
- Visible visceral pleural edge seen as thin line
- No pulmonary picture seen peripheral to pleural line
- Collapse of the lung
- In tension pneumothorax (progressive accumulation of intrapleural air) mediastinum may be shifted away, hemidiaphragm depressed

Hyperlucency - pneumothorax



Hyperlucency - pneumothorax



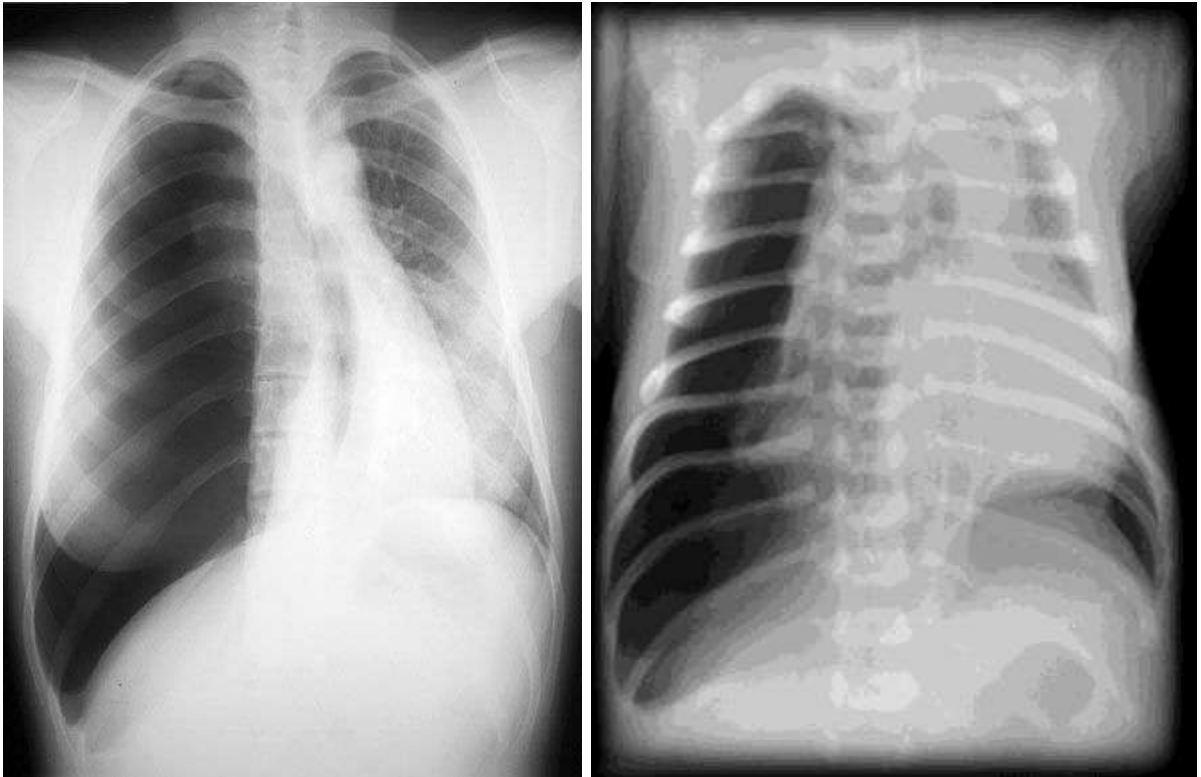
Hyperlucency - pneumothorax



Hyperlucency - pneumothorax

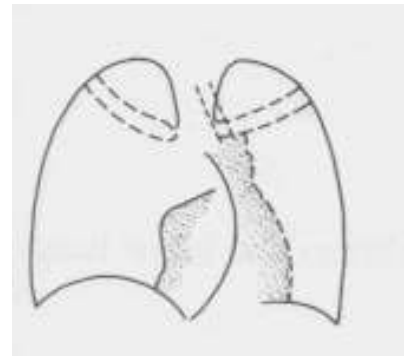


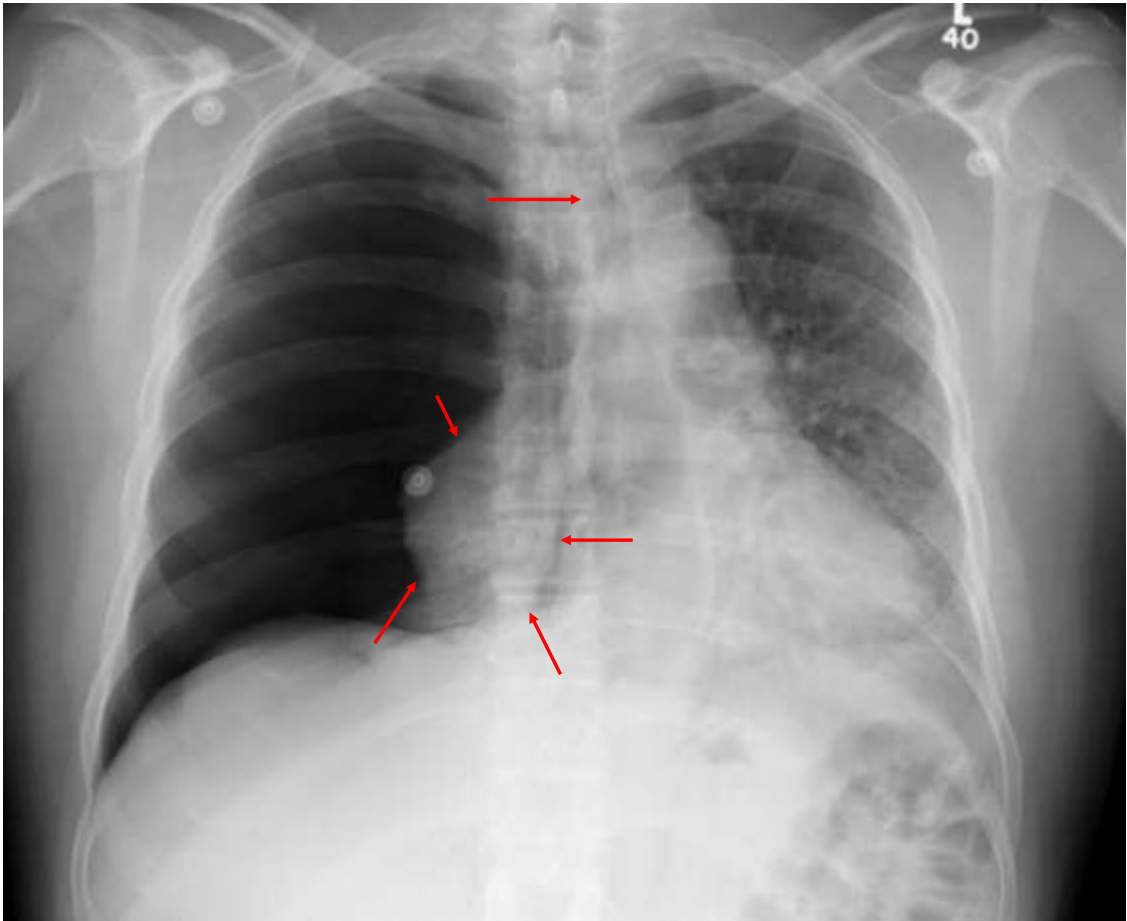


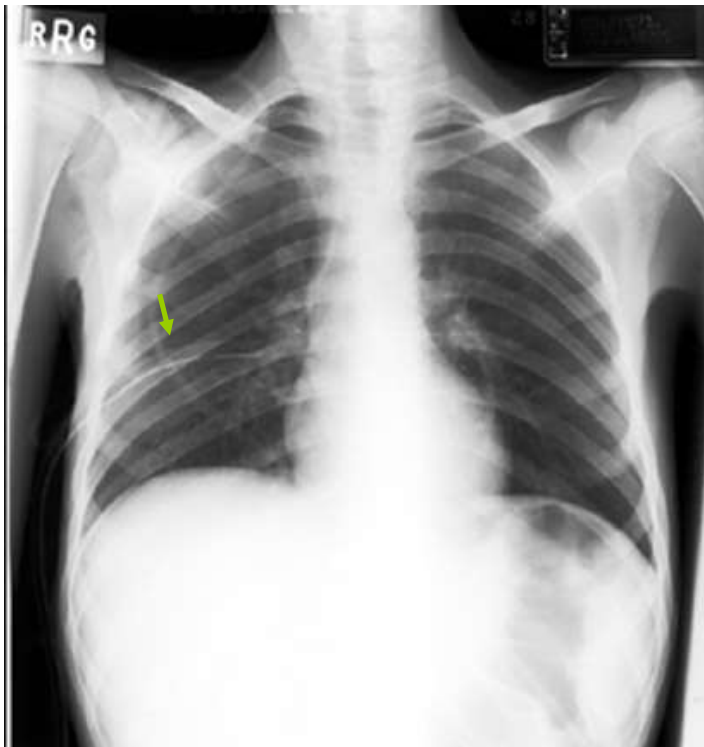


Tension pneumothorax with tracheal deviation.

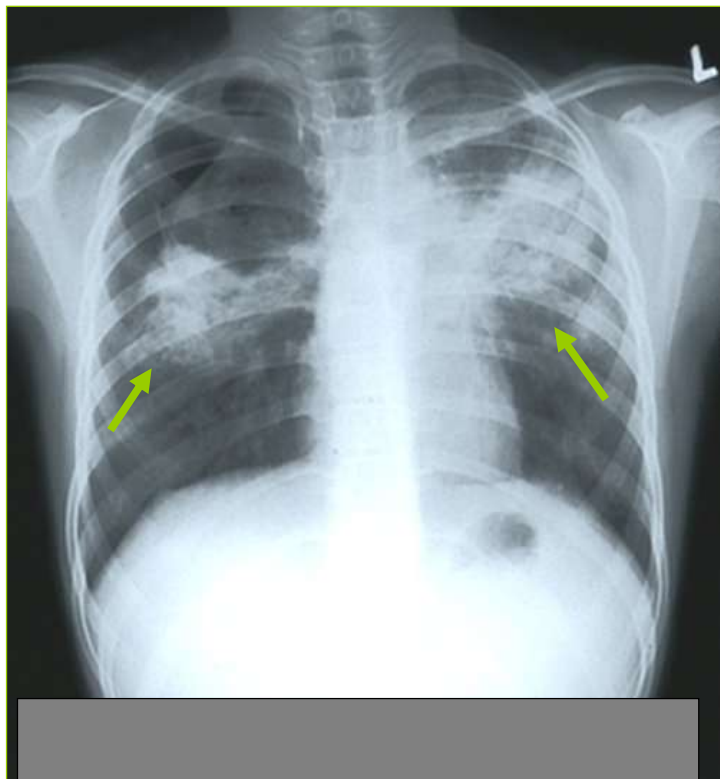
Tension Pneumothorax







Post chest tube insertion and re-expansion

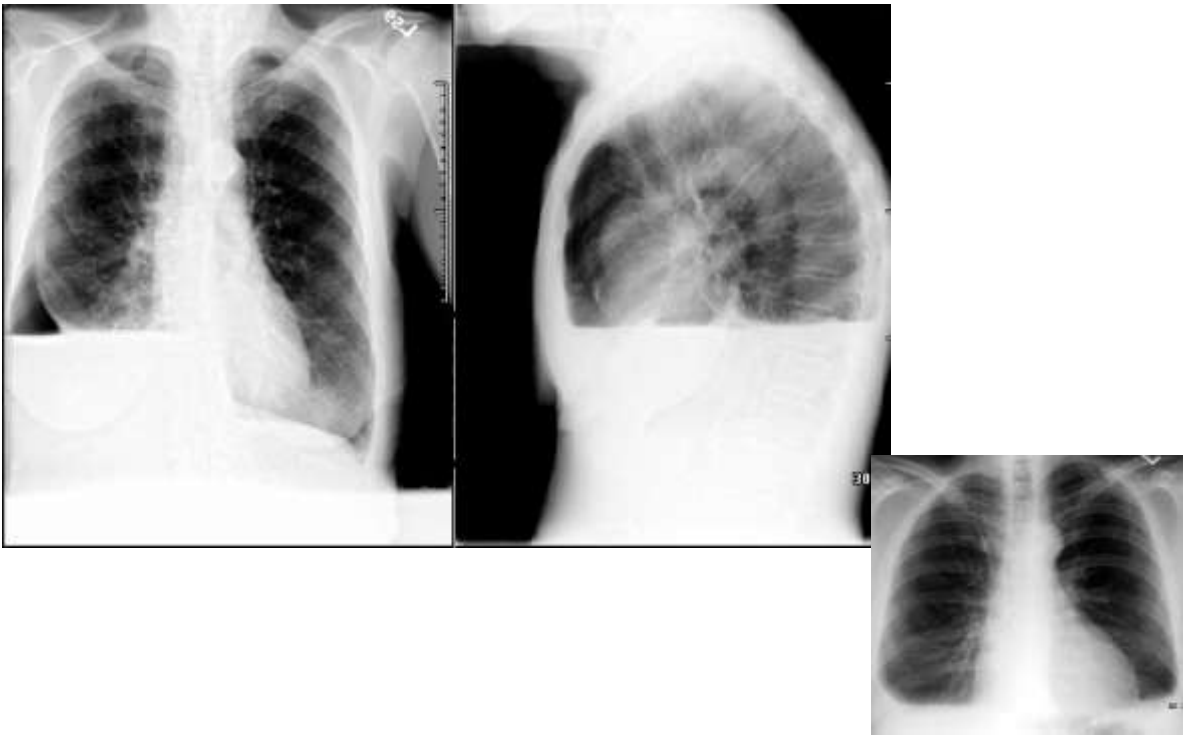


Tuberculosis

Hydroaeric level – hydropneumothorax



Hydroaeric level – hydropneumothorax

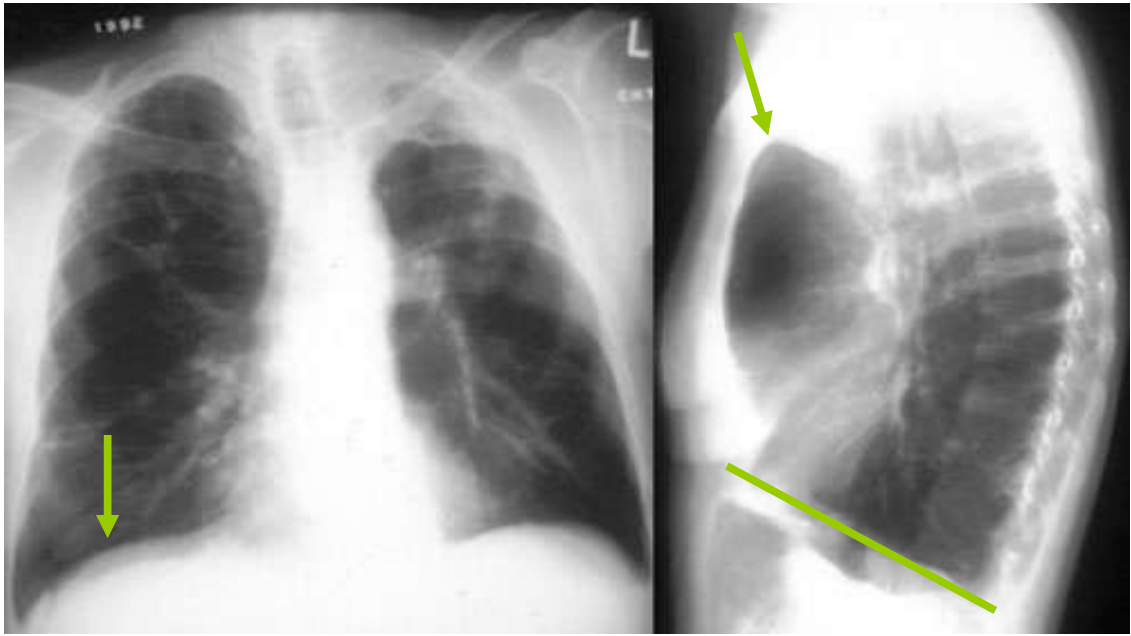


Subcutaneous emphysema



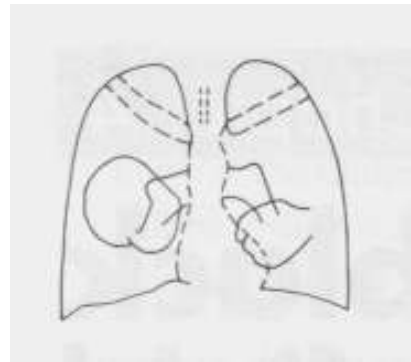
COPD

- Chronic obstructive pulmonary disease (COPD) is a chronic inflammatory lung disease that causes obstructed airflow from the lungs.
- Emphysema (alveolar septal destruction and airspace enlargement distal to the terminal bronchioles) and chronic bronchitis are the two most common conditions that contribute to COPD
- Radiographic findings
 - flattened diaphragm due to hyperexpansion
 - decreased peripheral vascular picture
 - increased lung lucency
 - bulla (round focal lucency over 1 cm)
 - prominence of the hilar vessels in pulmonary hypertension



COPD: increased heart diameter, flattening of the diaphragm, and increased size of the retrosternal air space.

COPD

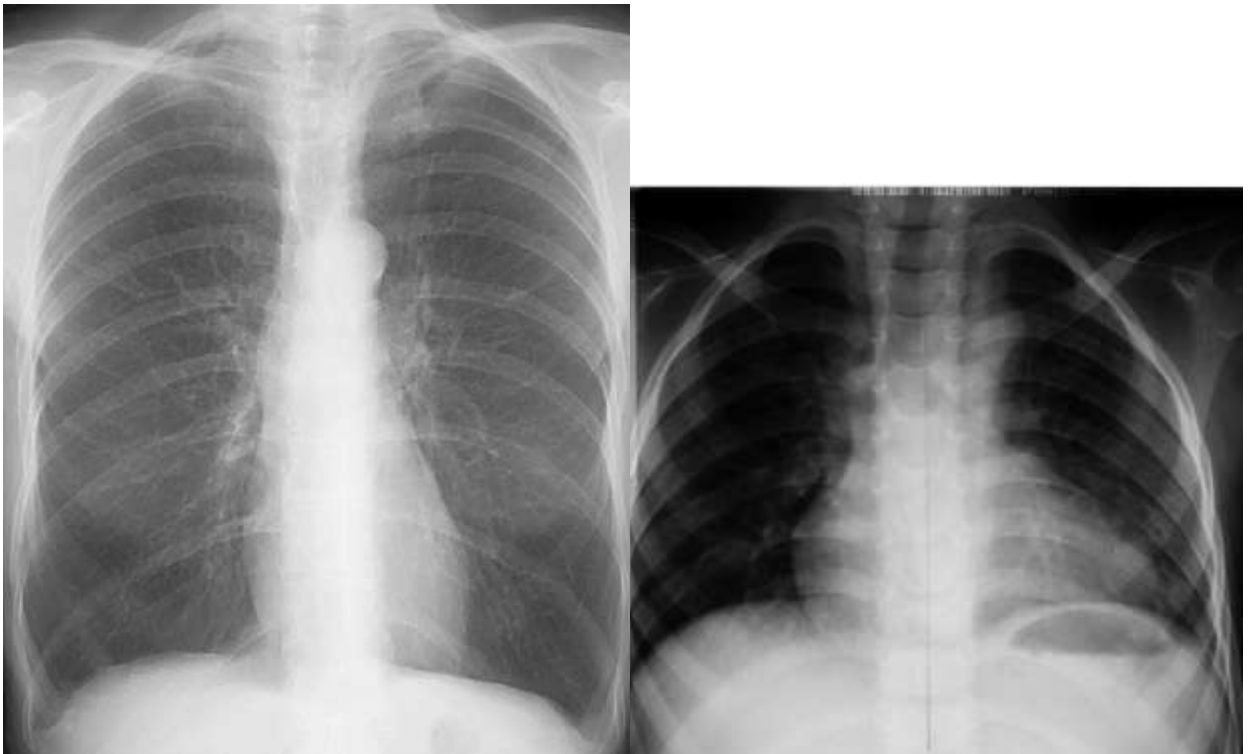


Both lungs appear blacker and larger in volume than normal. The hemidiaphragms are flattened. Fewer blood vessels are visible peripherally, especially in the upper and middle zones. The pulmonary arteries are large centrally, developing secondary pulmonary arterial hypertension

Emphisema

- **hyperinflation**
 - flattened diaphragm
 - increased radiolucency of the lungs
 - increased intercostal space
 - blunting of the lateral and posterior costophrenic angles
- **vascular changes**
 - reduction of blood vessels
 - pulmonary arterial hypertension (reduced peripheral vessels, increased caliber of central arteries, right ventricular enlargement)

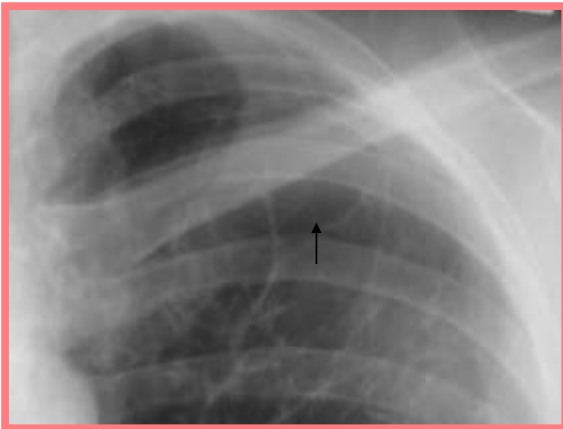
Hyperlucency - emphysema



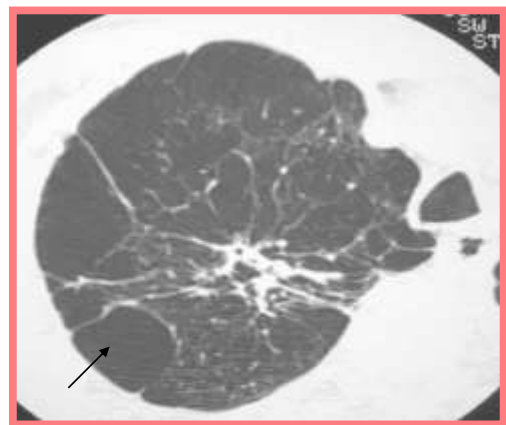
EMPHYSEMA:

Abnormally expanded air spaces distal to terminal bronchiole with destruction of walls of involved air spaces..

BULLA: Gas containing avascularity of lung measuring 1cm or more in diameter



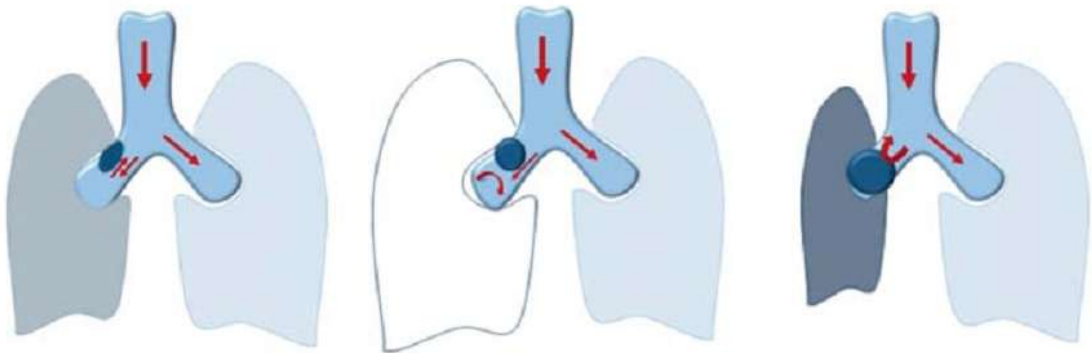
Bulla



CT of bulla

The phases of bronchial obstruction

- I. Partial obstruction (hypoventilation)
- II. Valve-type obstruction (hyperinflation/obstructive emphysema)
- III. Complete obstruction (atelectasis)



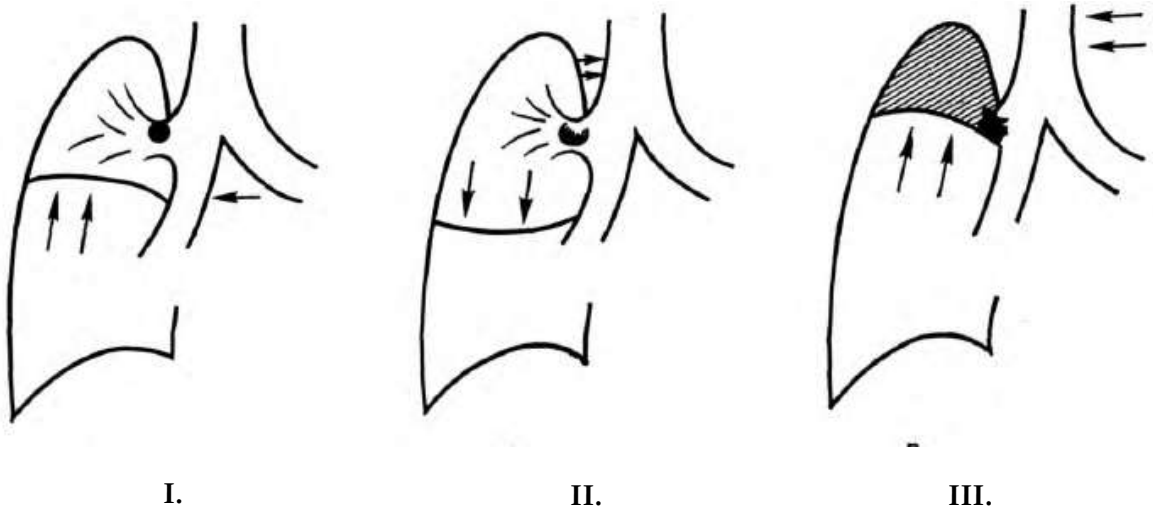
I.

II.

III.

The phases of bronchial obstruction

- I. Partial obstruction (hypoventilation)
- II. Valve-type obstruction (hyperinflation/obturative emphysema)
- III. Complete obstruction (atelectasis)



Changes of pulmonary picture

- **Enhanced** (hypervolemia, plethora, venous stasis)
- **Reduced** (hypovolemia, oligemia)
- **Deformed** (pulmonary fibrosis, pneumosclerosis)
 - In chronic respiratory pathologies: chronic bronchitis, pulmonary tuberculosis, pneumoconiosis, fibrosing alveolitis, pneumosclerosis of various etiology.

Deformation of pulmonary pattern (pulmonary fibrosis)

- Changed trajectory and shape of the elements of the lung pattern.



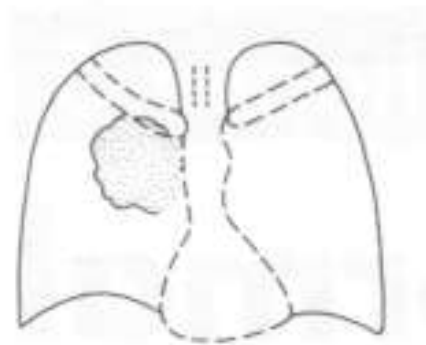
Pulmonary Hilum

- Radiological changes of the pulmonary hilum are usually secondary and most often are caused by lung diseases, cardiovascular diseases, lymphadenopathy (in tuberculosis, lymphogranulomatosis, purulent processes, lymphomas, infectious mononucleosis, viral lymphadenopathy, sarcoidosis).
- Ill-defined outline of the pulmonary hilum in perivascular edema (venous congestion), inflammatory processes
- Well-defined irregular outline is characteristic for primary tumors or metastatic processes, polycyclic outline – for enlargement of the perihilar lymphnodes

Unilateral Hilar Enlargement

- **Causes of hilar lymphadenopathy**
 - Neoplastic, e.g. spread from bronchial carcinoma, primary lymphoma
 - Infective, e.g. tuberculosis
 - Sarcoidosis (rarely unilateral)
- **Causes of hilar vascular enlargement**
 - Pulmonary artery aneurysm
 - Poststenotic dilatation of the pulmonary artery

Unilateral Hilar enlargement

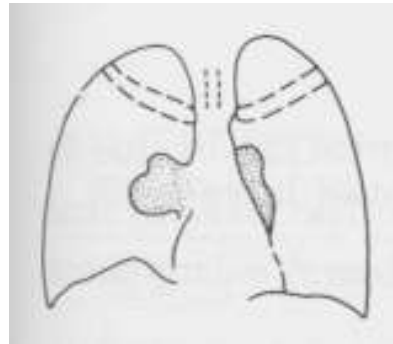


Right hilar enlargement. The hilar border is irregular - malignant cause.

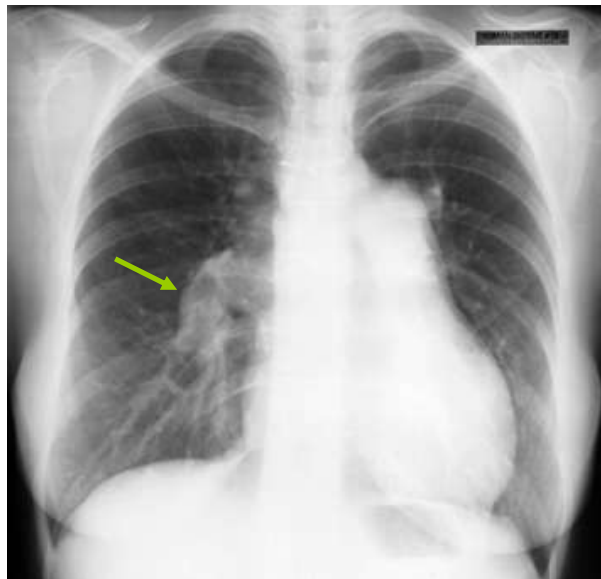
Bilateral Hilar Enlargement

- **Causes of bilateral hilar lymphadenopathy**
 - Sarcoidosis
 - Tumors, e.g. lymphoma, bronchial carcinoma, metastatic tumors
 - Infection, e.g. tuberculosis, recurrent chest infections
- **Causes of pulmonary hypertension**
 - Obstructive lung disease, e.g. asthma, COPD
 - Left heart disease, e.g. mitral stenosis, left ventricular failure
 - Left to right shunts, e.g. ASD, VSD
 - Recurrent pulmonary emboli
 - Primary pulmonary hypertension

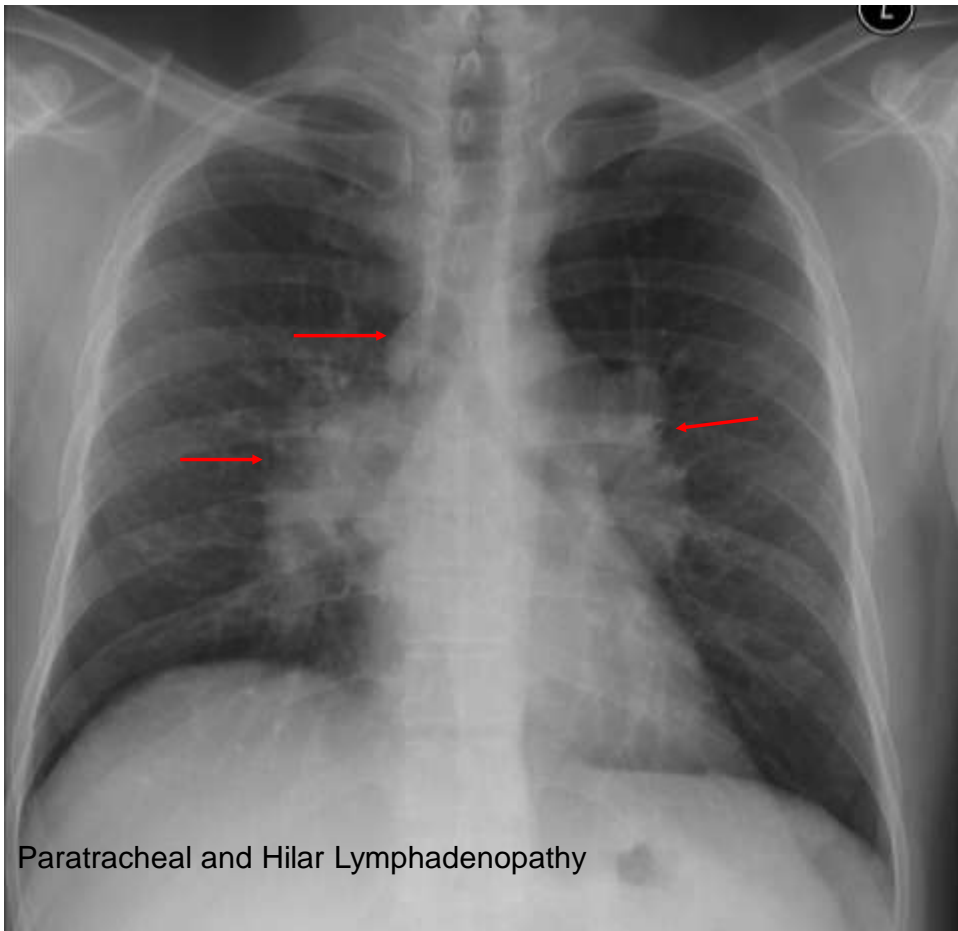
Bilateral Hilar Enlargement

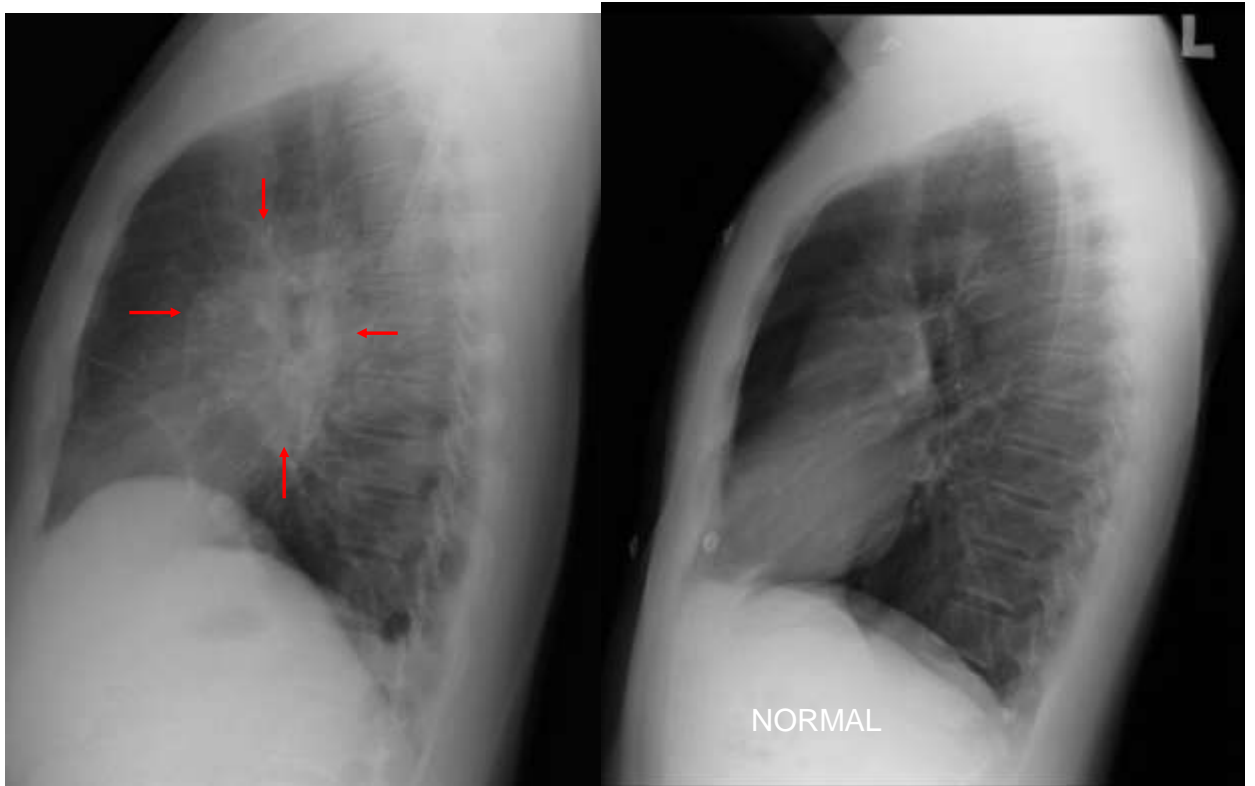


Pulmonary hypertension. Bilateral hilar enlargement and peripheral pruning. The heart is enlarged.

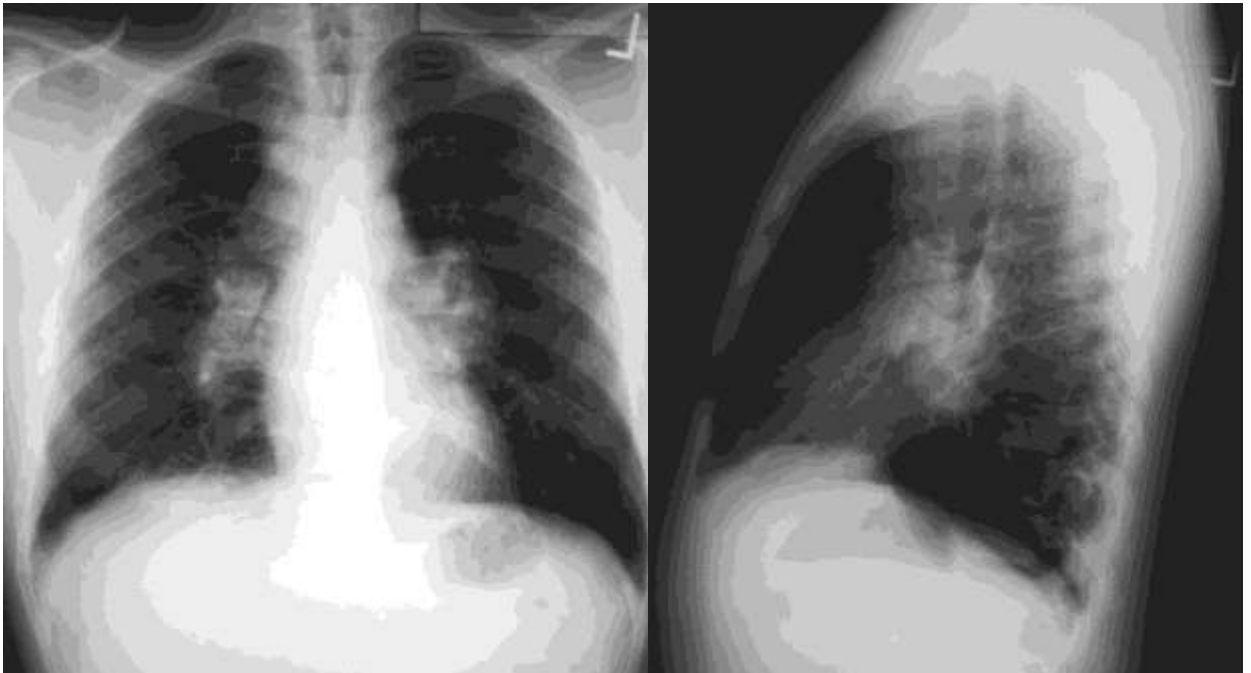


Pulmonary artery stenosis with cardiomegally secondary to stenosis.



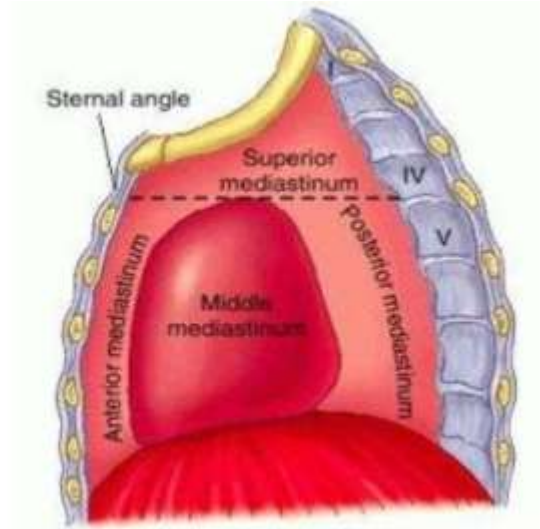


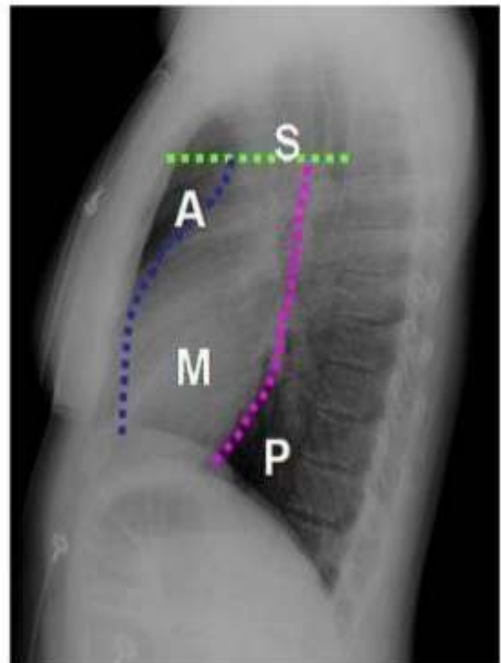
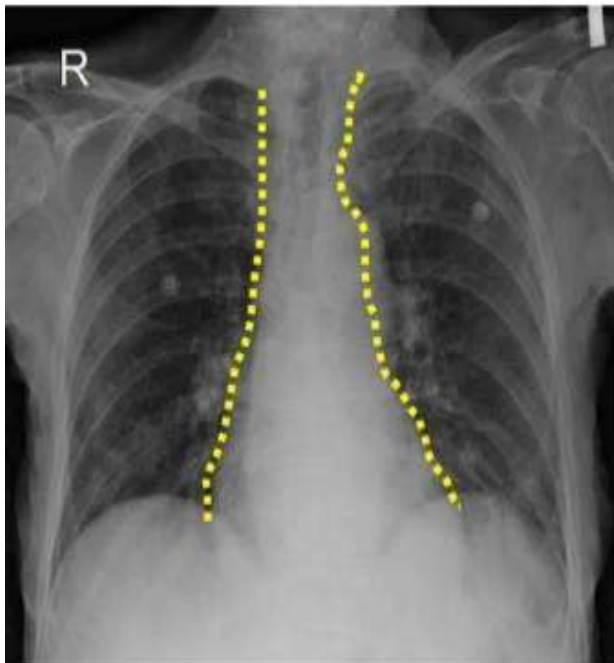
Sarcoidosis



Mediastinum

- Superior mediastinum: above the upper level of the pericardium
- Inferior mediastinum: below the manubriosternal joint
 - Anterior mediastinum : anterior to the pericardium
 - Middle mediastinum : within the pericardium
 - Posterior mediastinum : posterior to the pericardium

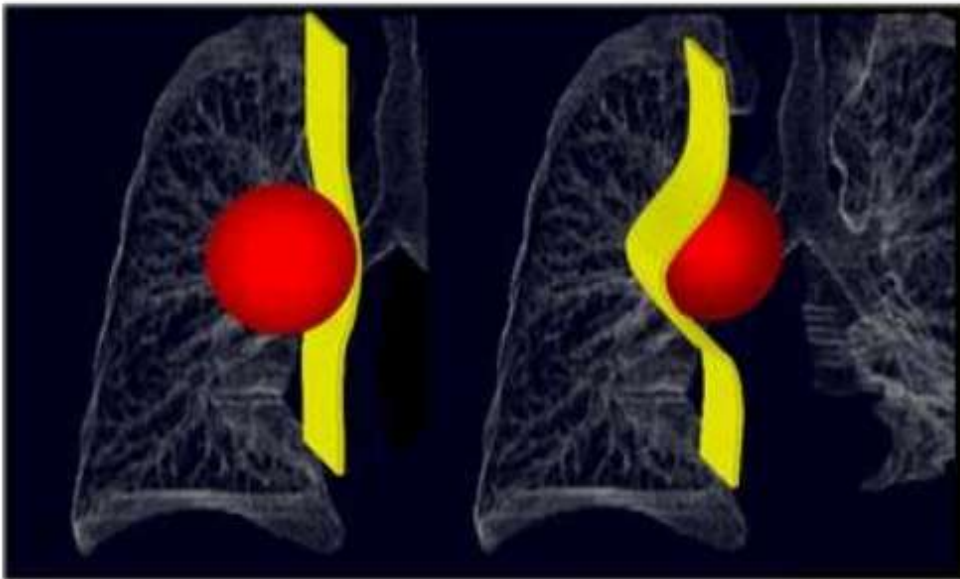




Mediastinum

- Superior an anteor: thymoma, thyroid masses, neurogenic tumors, germ cell tumors, cysts, lymphoma, lymphadenopathy.
- Middle: malignancy, lymphadenopathy, hiatus hernia, thoracic aortic aneurysm, thyroid mass, bronchogenic cysts, esophageal duplication cysts.
- Posterior: malignancies, (e.g. mesothelioma, schwannoma, teratoma, lymphoma, sarcoma), lymphadenopathy, aortic aneurysm

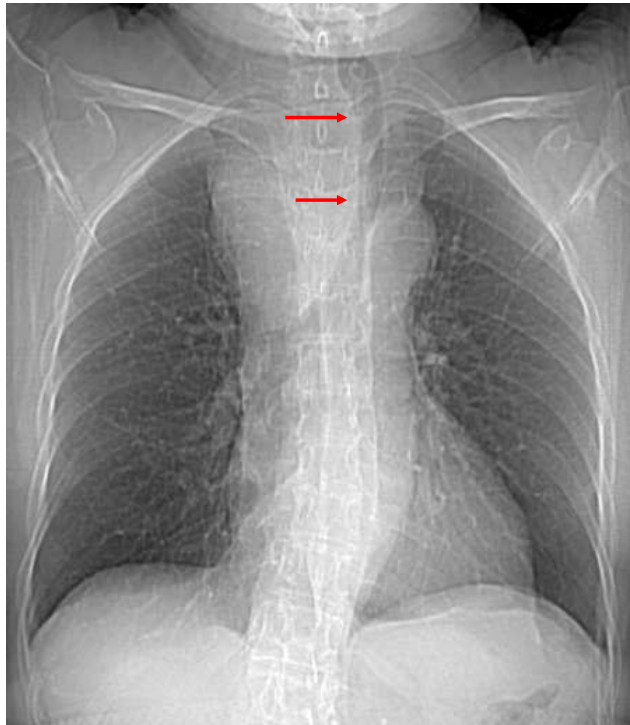
LUNG MASS OR MEDIASTINAL MASS ?



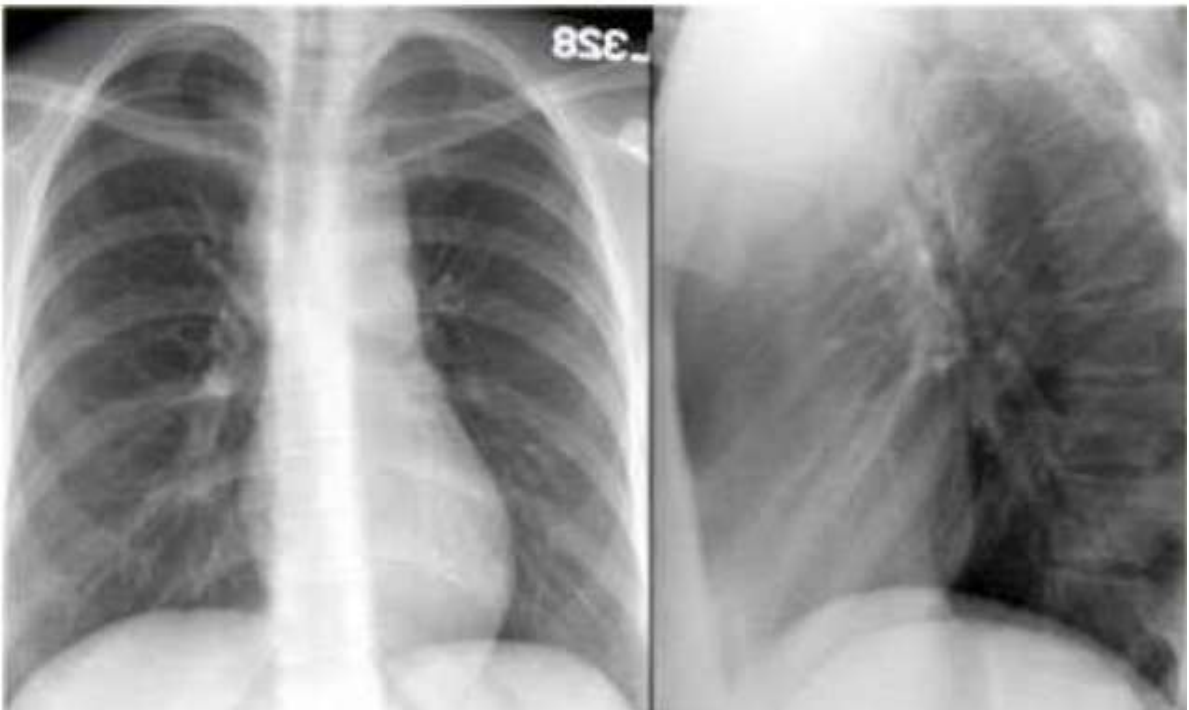
- A lung mass abutts the mediastinal surface and creates acute angles with the lung, while a mediastinal mass will sit under the surface creating obtuse angles with the lung



Goiter



LYMPHOMA

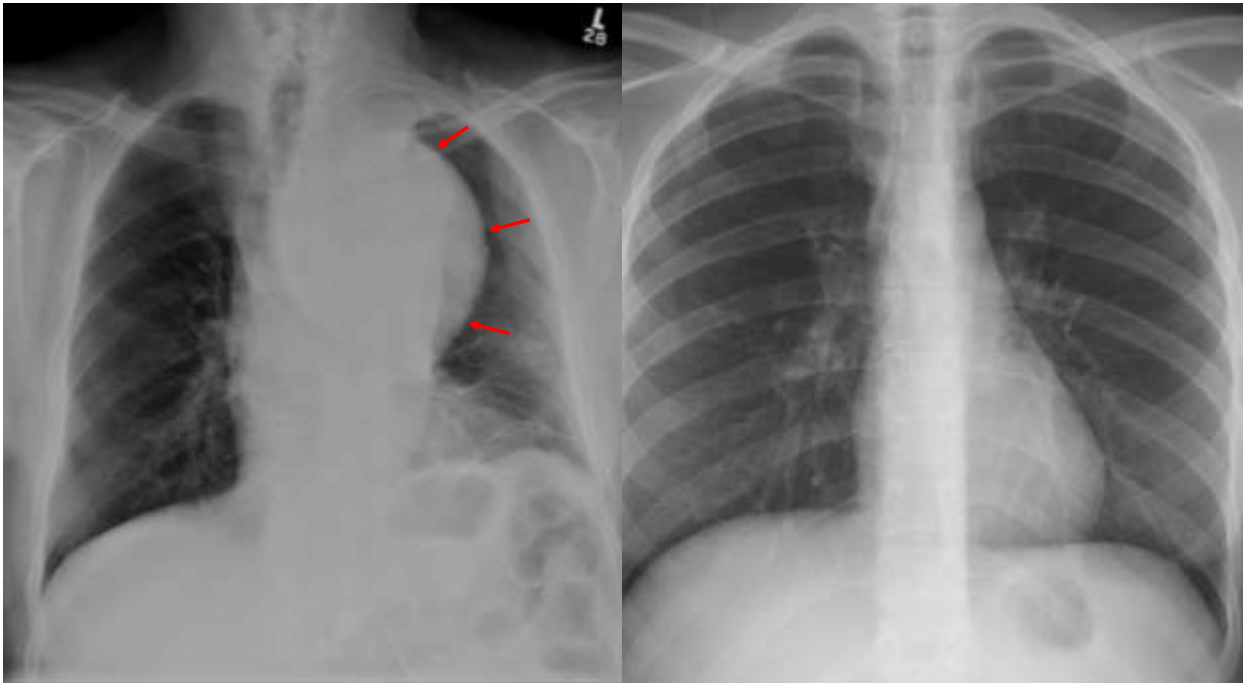


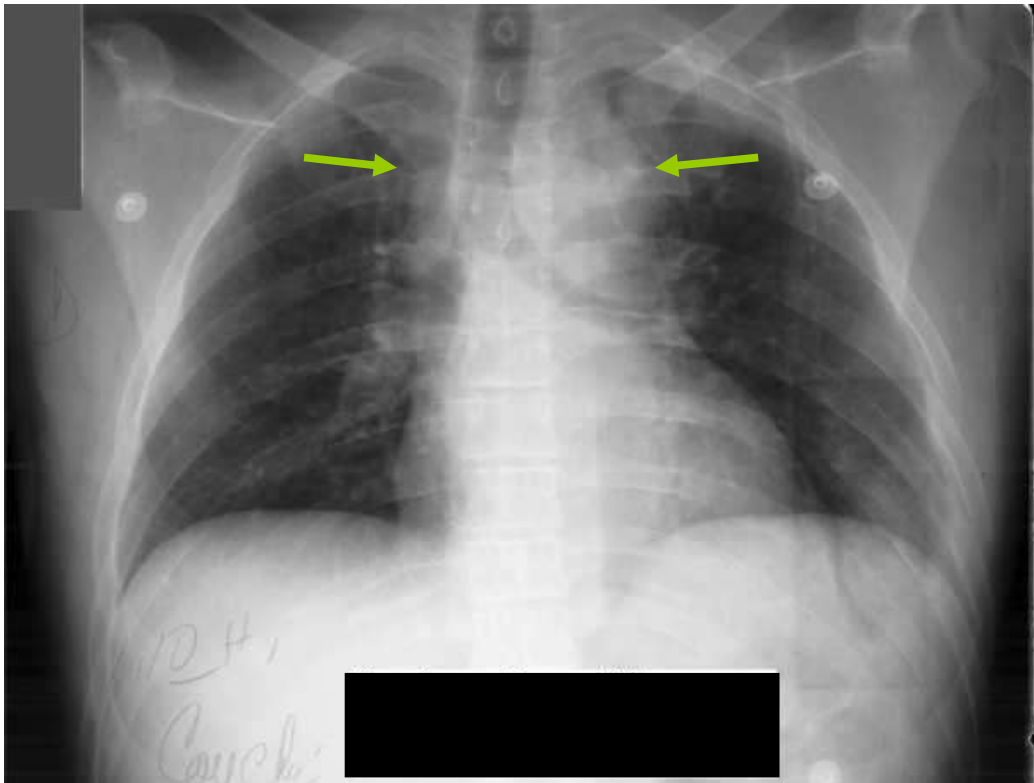


Posterior mediastinal mass.

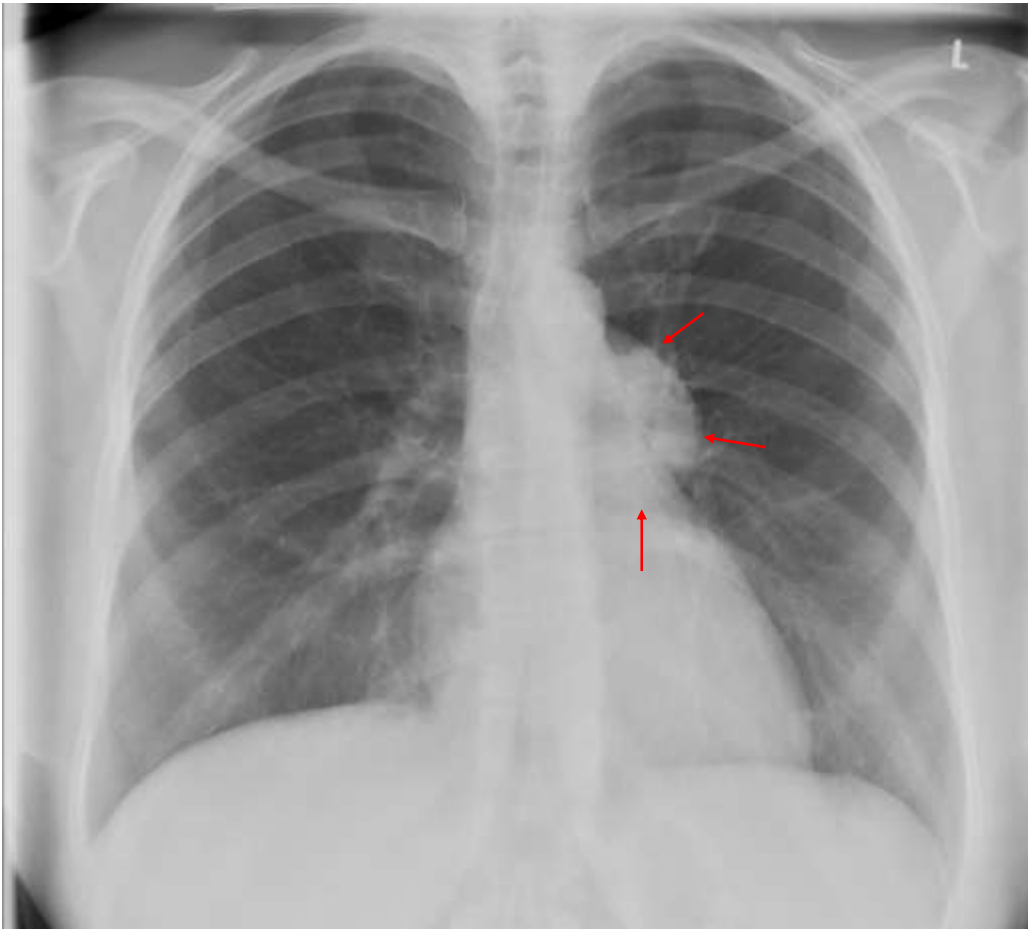


Aortal aneurysm

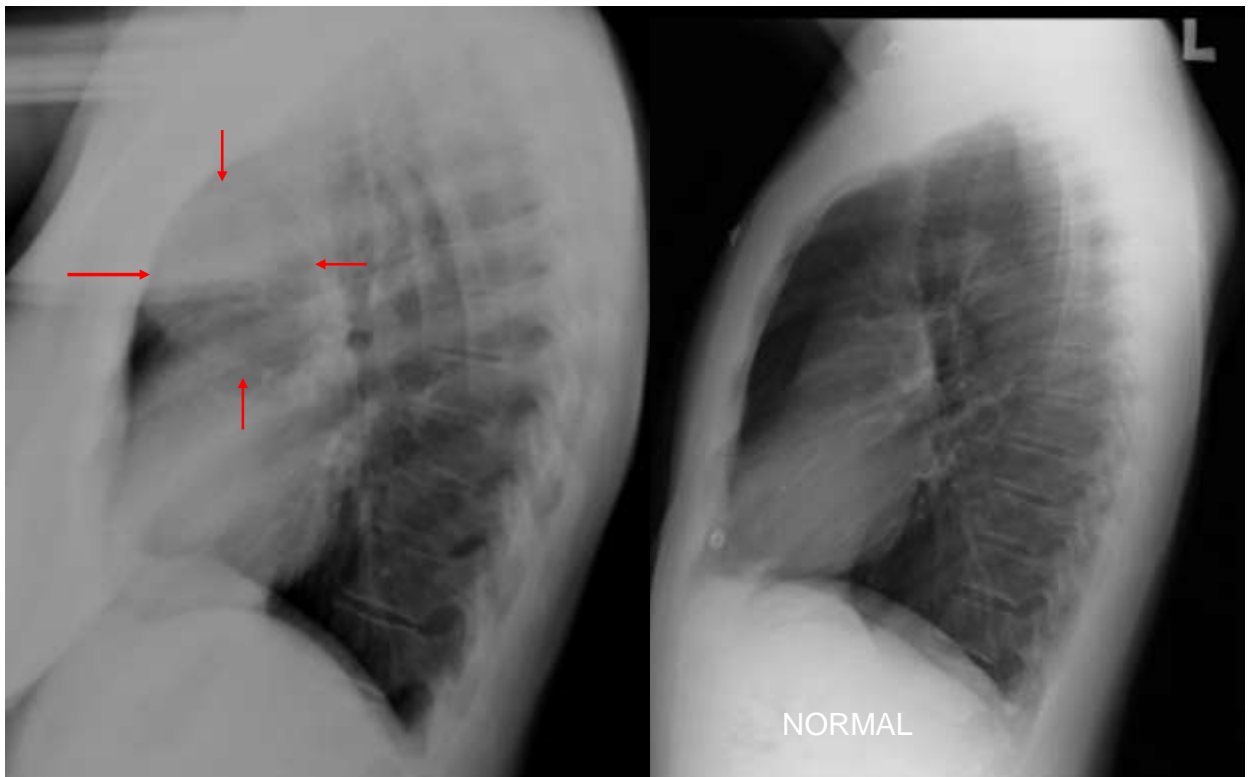


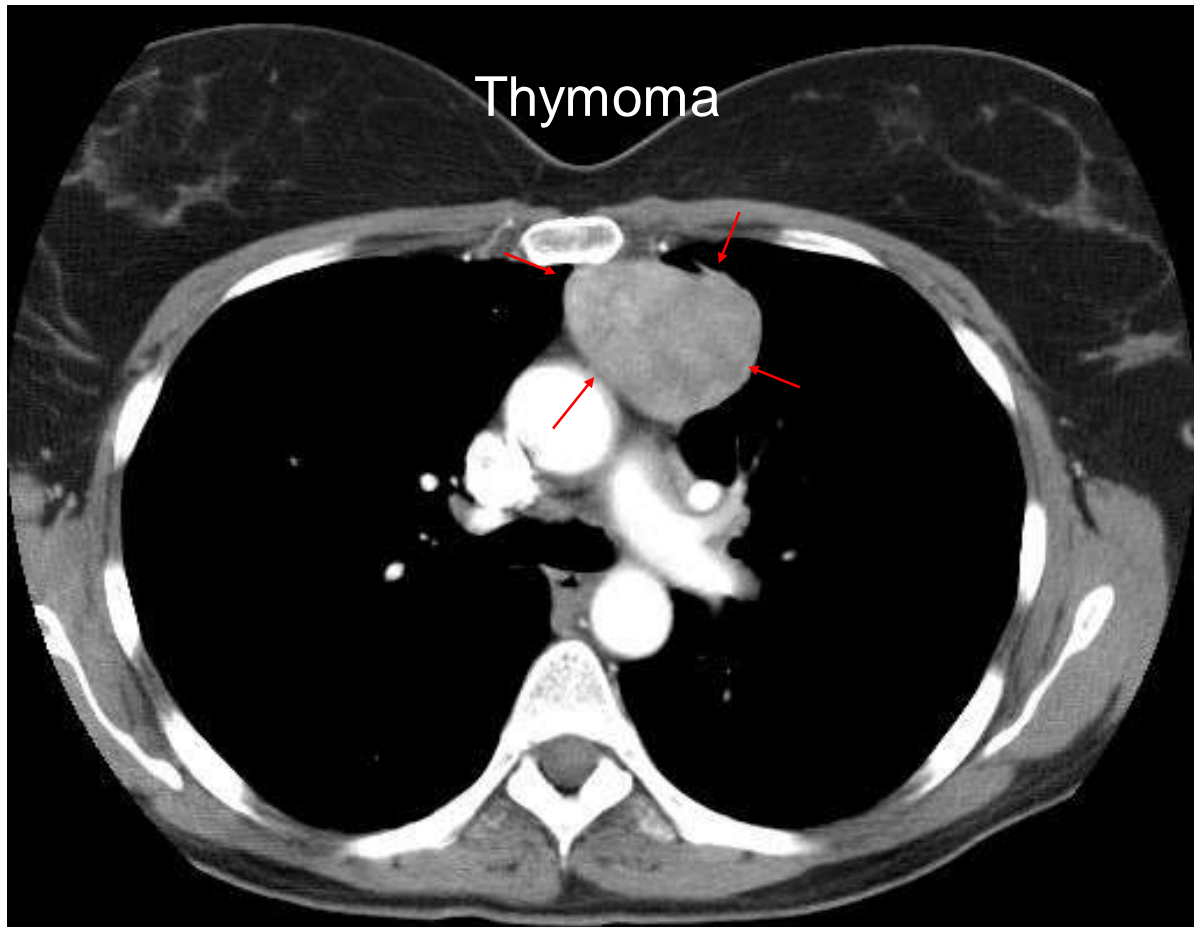


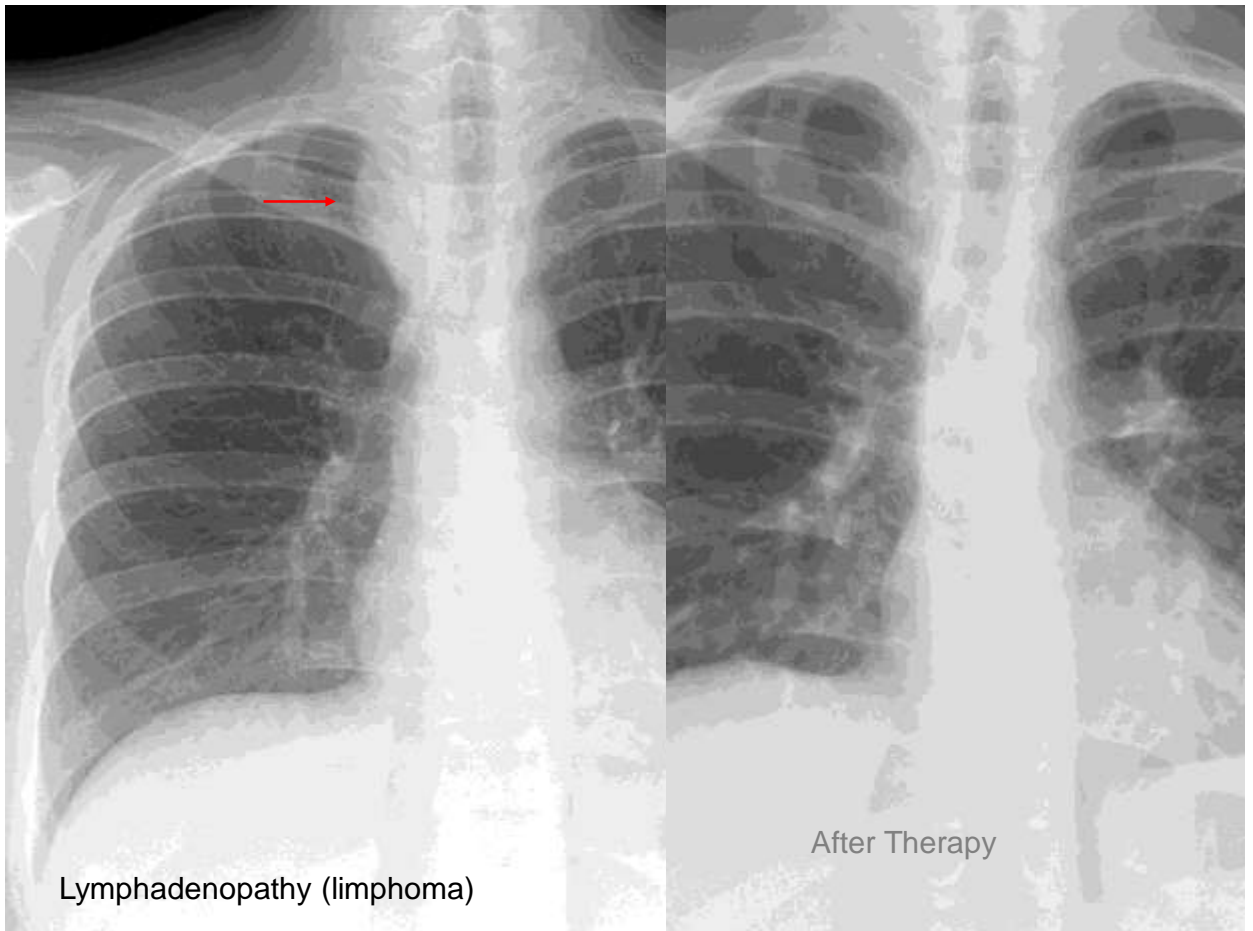
Widened Mediastinum: Aortic Dissection

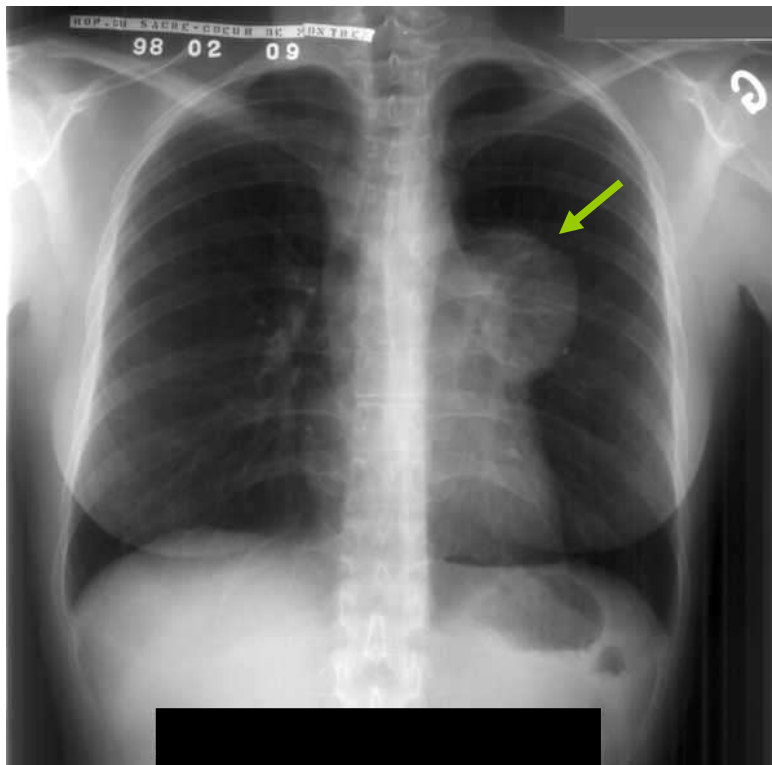


Mass is anterior mediastinum



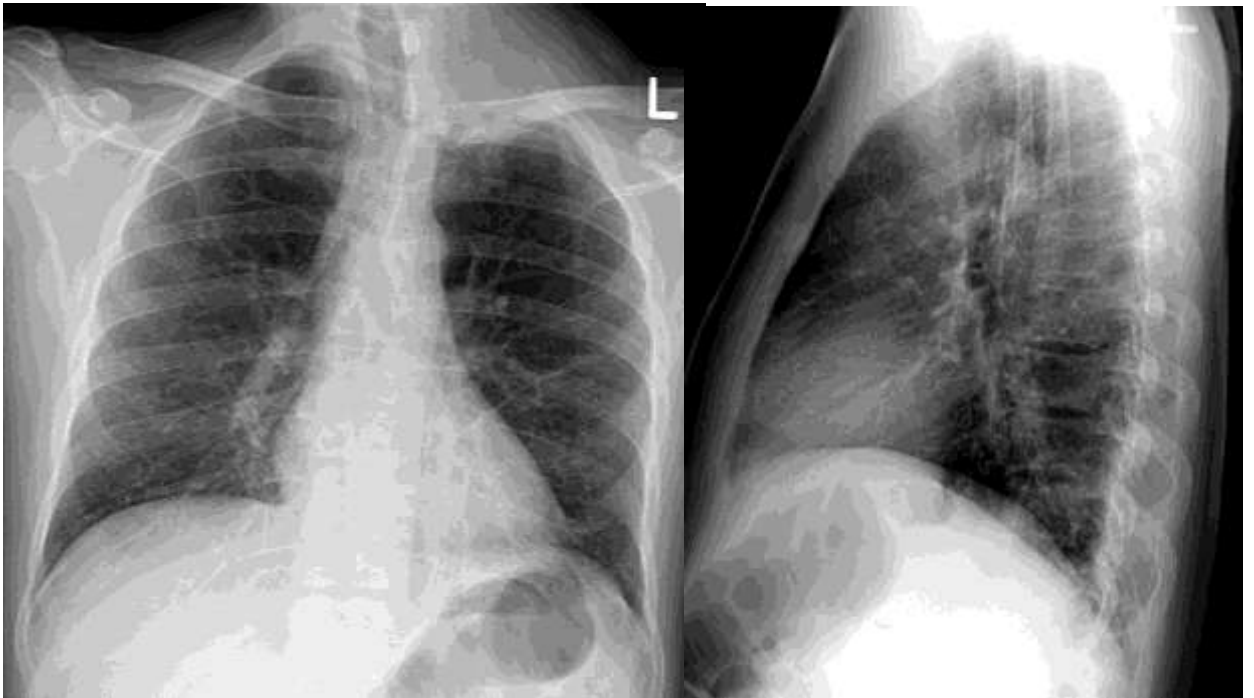




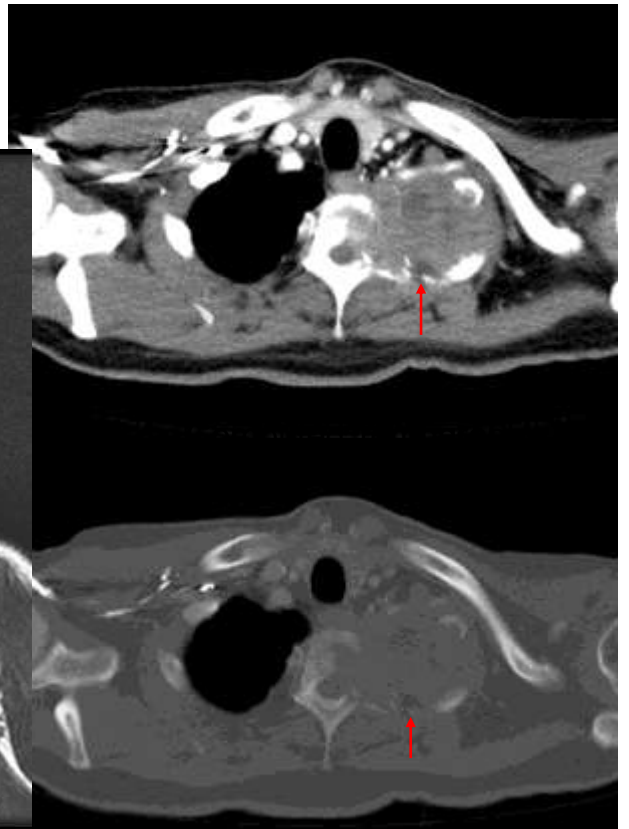
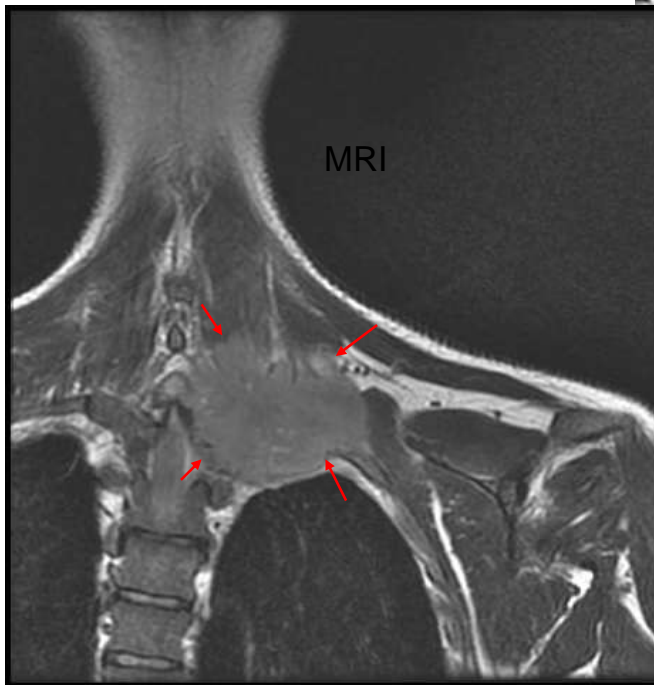


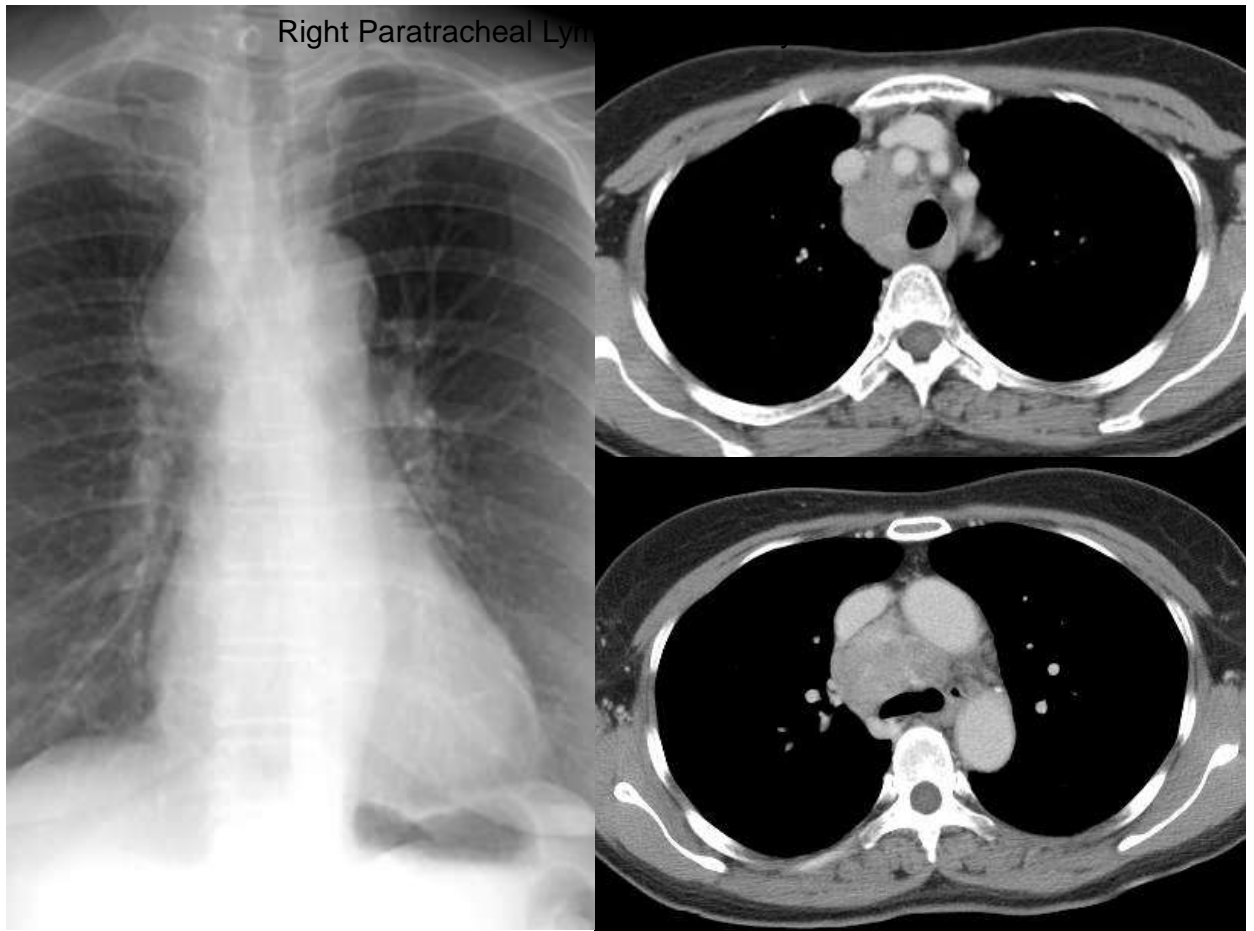
Perihilar mass: Hodgkin's disease

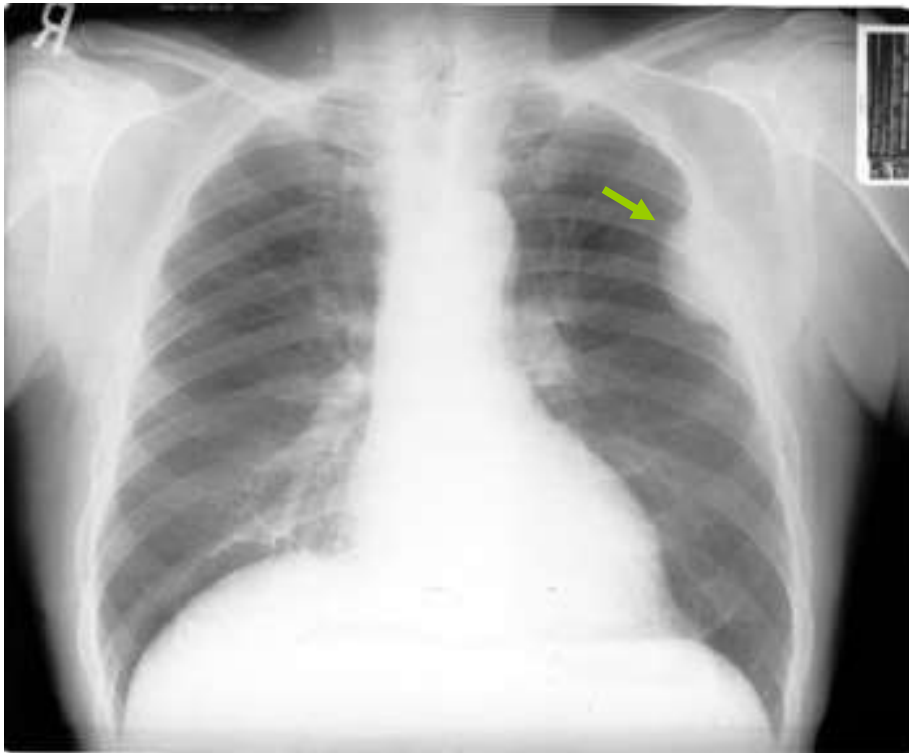
Pancoast tumour











Chest wall lesion: arising off the chest wall and not the lung

Hiatus hernia



Steps (order) of radiograph reading and reporting

- **1 Patient information**
 - name, date of birth, sex, old films
- **2 Imaging technique data**
 - time of image acquisition, radiograph, projection (view), contrast materials and other medications administered
- **3 Quality control**
 - rotation (is the film centered?)
 - penetration (is it exposed properly?)
 - inspiration (is it a good inspiration film?)
- **4 Observations, description of findings**
 - soft tissues, bony structures
 - mediastinum
 - diaphragms, costophrenic angles
 - lung fields
- **5 Summary (impression, conclusion)**

Steps (order) of radiograph reading and reporting

- **4 Observations, description of findings**
 - soft tissues, bony structures
 - mediastinum and pulmonary hilum (outline, dimensions),
 - diaphragms, costophrenic angles
 - lung fields
 - Opacity (number, dimensions, location, shape, borders, structure, intensity, relation to the mediastinum)
 - Lucency (bilateral/unilateral, in pleural space/ inside the lungs).

Evaluating an Abnormality

1. Identify the abnormal findings
2. Anatomically localize the lesion
3. Identify pathological process
4. Identify the etiology

Complex problems

- Introduction of contrast medium
- CT chest
- MRI scan