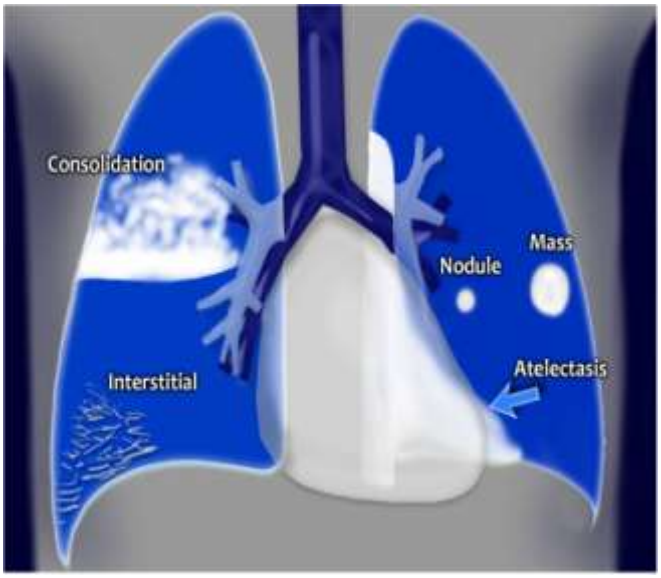
Chest Imaging II

Radiological semiology of pulmonary pathology

- Pulmonary opacity
- Pulmonary hyperlucency
- Changes of pulmonary picture
- Changes of pulmonary hilum

Pulmonary opacity is a nonspecific term describing an area of increased pulmonary attenuation caused by an intraparenchymal process resulting in the decreased ratio of gas to soft tissue (blood, lung parenchyma and stroma) in the lung.



- Identify the lesion
- Localise the lesion
- Describe the lesion
- Formulate conclusion, give differential diagnosis

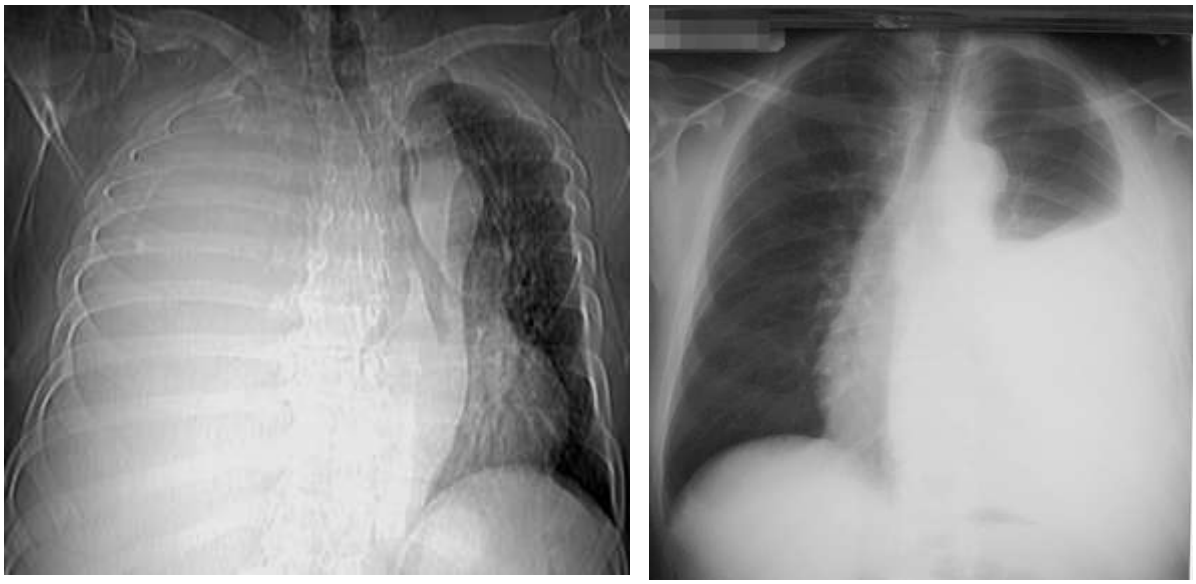
Pulmonary opacity

- **Number** (single / multiple, disseminated)
- **Location** (unilateral / by ribs / regions / lobes / segments)
- **Dimensions** (large (total, subtotal) / limited to lobe or lobar segment / mass / nodular)
- **Shape** (rounded / ring-shape (cavitary) / linear / triangle / irregular)
- **Borders** (well-defined, regular or irregular / ill-defined)
- **Structure** (homogeneous / heterogeneous)
- **Intensity** (subcostal / costal / supracostal) compared to the rib opacity
- **Relation to the mediastinum** (without displacement / shifting(pushing/ pulling))

The silhouette sign

- Loss of an interface (outline) of anatomical structures resulting from the juxtaposition of adjacent pathology of similar radiographic density

Total and subtotal opacity

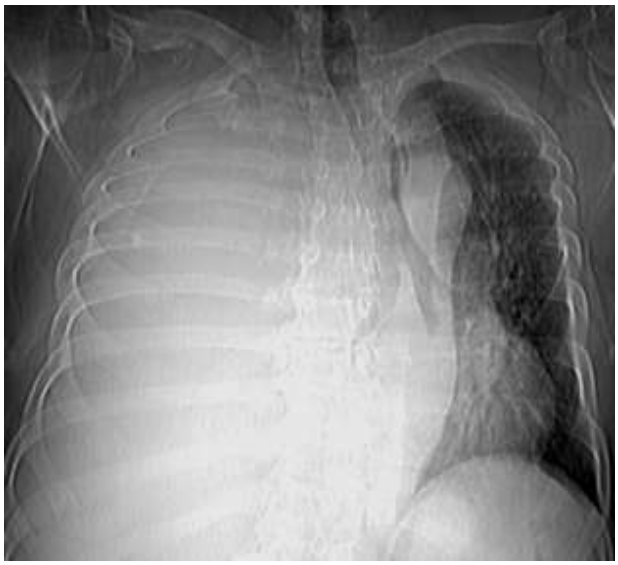


Unilateral opacity shifting mediastinum to the opposite side, homogenous

Total and subtotal opacity

Unilateral opacity shifting mediastinum to the same side, homogenous

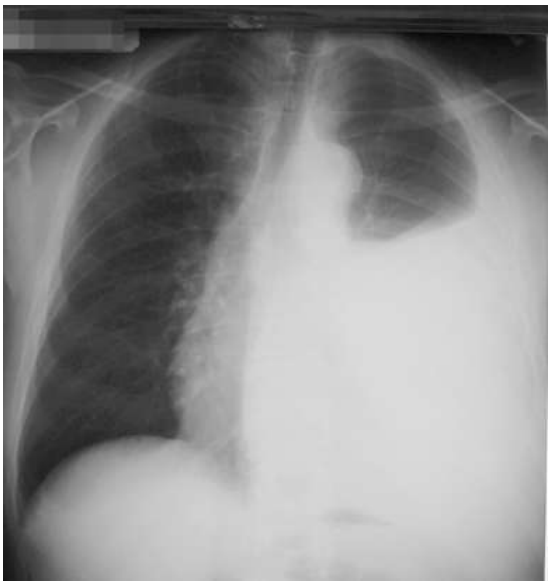
Total and subtotal opacity



shifting mediastinum to the opposite side (mass effect – pleural effusion)

shifting mediastinum to the same side (volume loss – collapse of the lung, atelectasis)

Total and subtotal opacity



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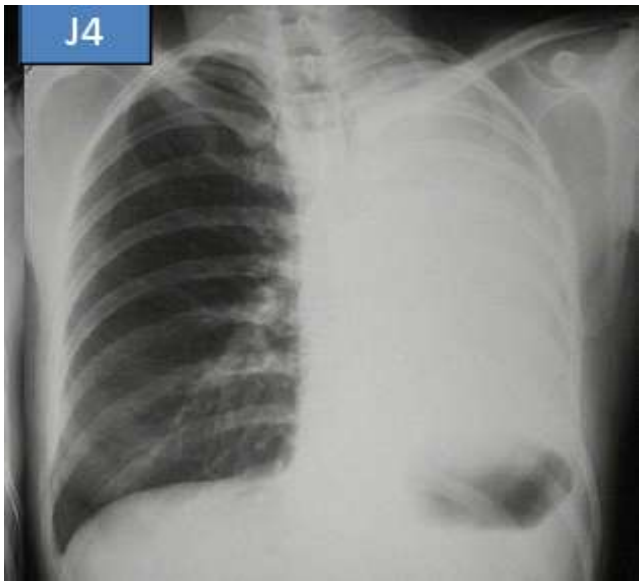
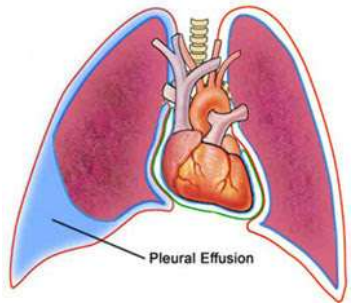


shifting mediastinum to the same side (volume loss – collapse of the lung, atelectasis)

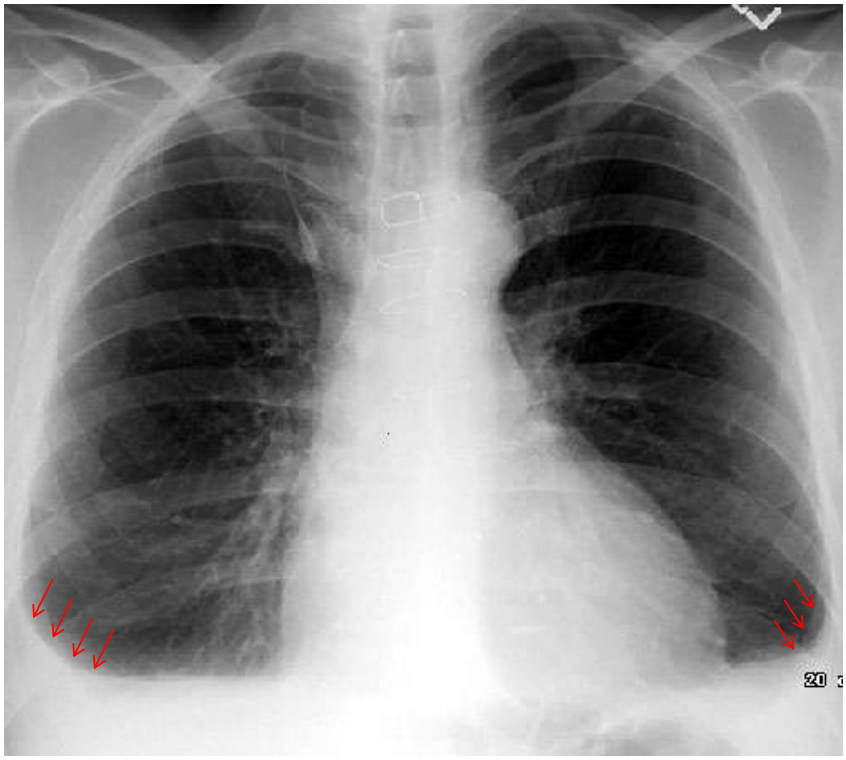
The meniscus sign

- If the patient is upright when the radiograph is taken, then fluid will surround the lung base forming a 'meniscus' – a concave line obscuring the costophrenic angle and part or all of the hemidiaphragm.



Pleural effusion

- Fluid accumulation in the pleural space
- Radiological criteria:
  - Opacity
    - in costophrenic angle in PA view, depending on the quantity of the effusion (loss of costophrenic angle)
    - allong sides in lateral decubitus position
  - Meniscus sign
  - Silhouette sign (loss of diaphragmatic and cardiac silhouette)
  - Shifting the mediastinum to the opposite side (depending on the quantity of the effusion)

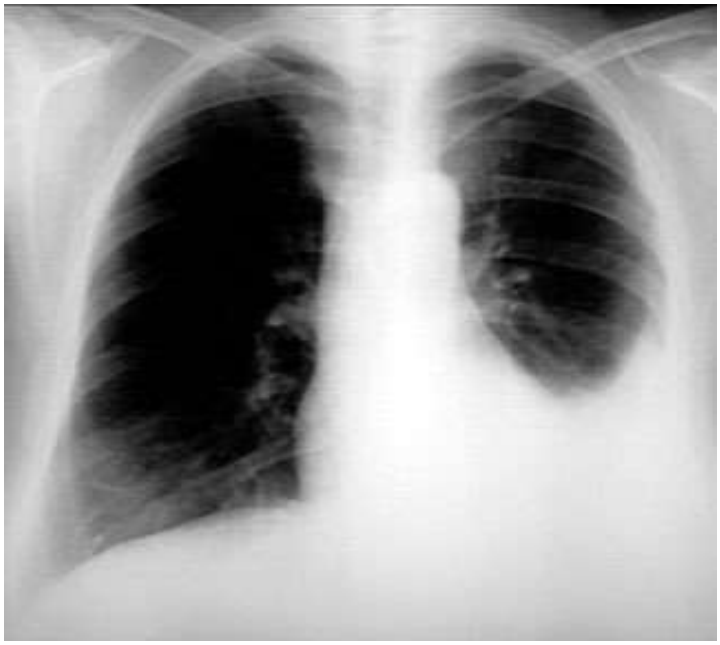


Meniscus sign (bilateral) – pleural effusion

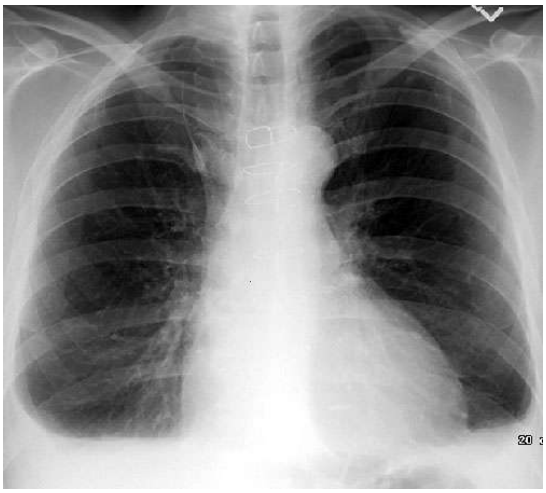
Small Pleural Effusion

Blunted posterior costophrenic sulcus

Normal:
Sharp Angles

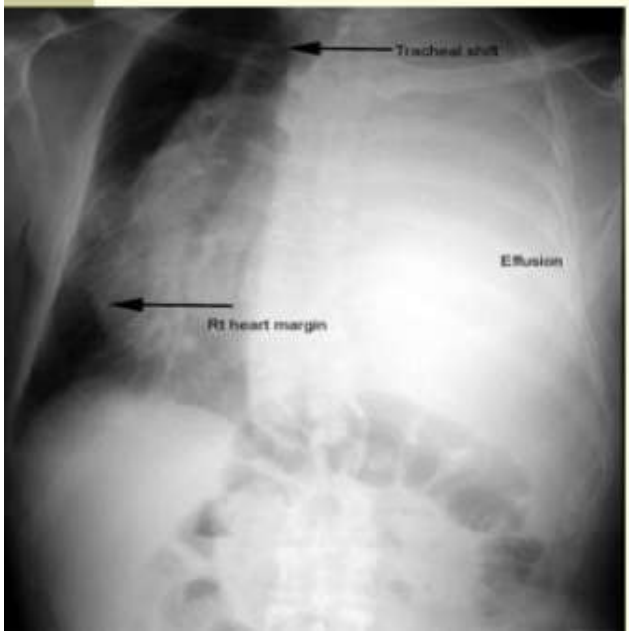


Silhouette sign (loss of left diaphragmatic and cardiac silhouette) – pleural effusion



Opacity allong sides in lateral decubitus position

MASSIVE PLEURAL EFFUSION



- Massive
- Shift of mediastinum

LOCULATED PLEURAL EFFUSION

- Homogenous density
- Loculated
- Loss of cardiophrenic angle
- Loss of lateral portion of diaphragmatic silhouette

Consolidation

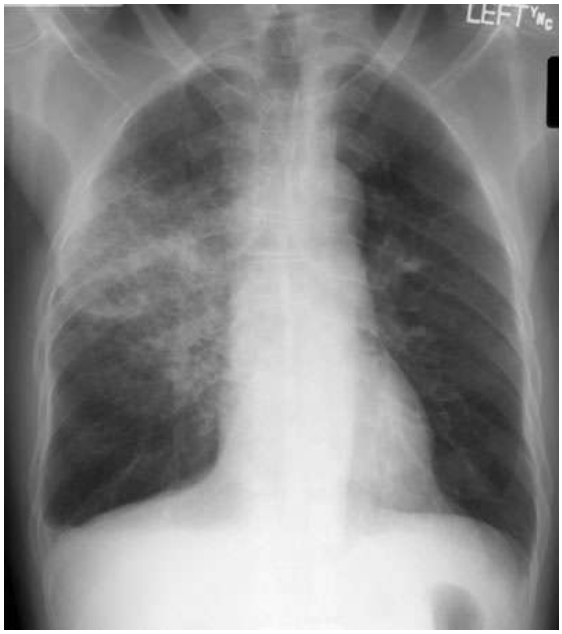
- Filling of the alveoli and bronchioles in the lung with pus (pneumonia), fluid (pulmonary oedema), blood or neoplastic cells

- **Causes of Pulmonary Consolidation**
  - **Pneumonia** - lobar pneumonia, bronchopneumonia, fungal pneumonia, viral pneumonitis, tuberculosis
  - **Fluid** - pulmonary oedema (cardiogenic / non-cardiogenic)
  - **Neoplasm** - primary lung cancer, metastases, lymphoma
  - **Vascular** - pulmonary haemorrhage, infarction, contusion, embolism
  - **Inflammation** - systemic lupus erythematosus, granulomatosis with polyangiitis etc.
  - Aspiration pneumonitis, Sarcoidosis, Cryptogenic pneumonia

Limited opacity

Right middle lobe consolidation:
•silhouette loss of the right cardiac border
•intact diaphragmatic silhouette .
•without mediastinal displacement,
•heterogenous,
•ill- defined borders

Limited opacity RUL



without mediastinal displacement,
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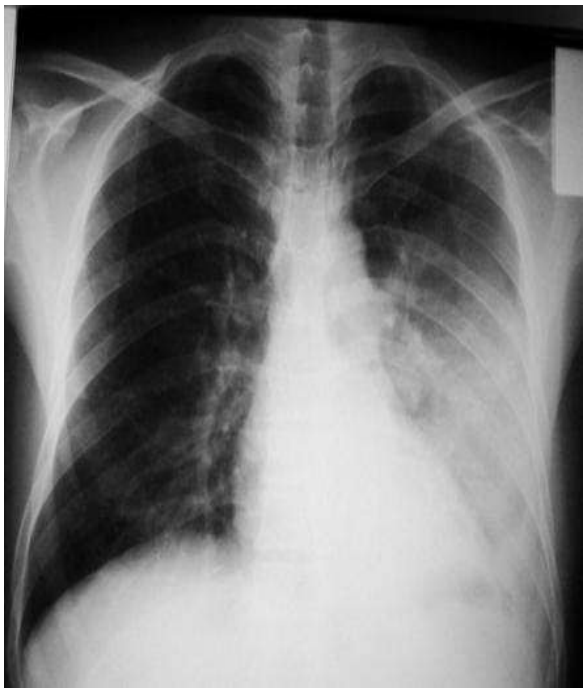
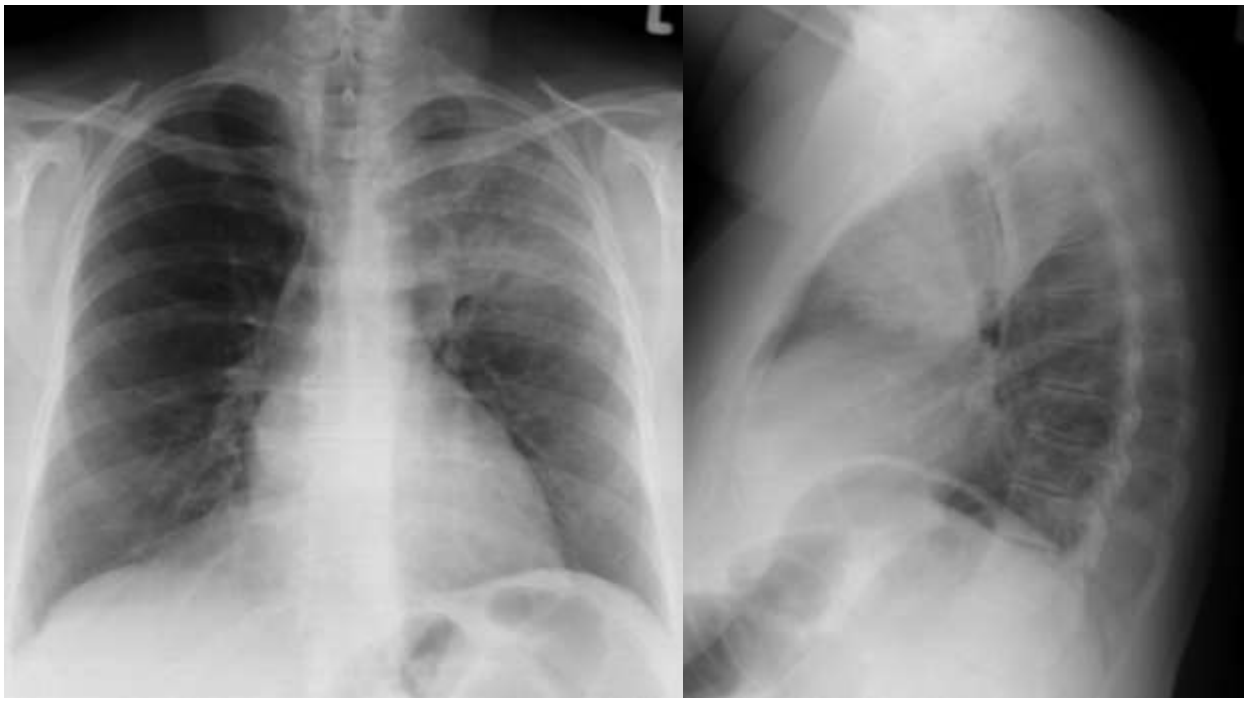
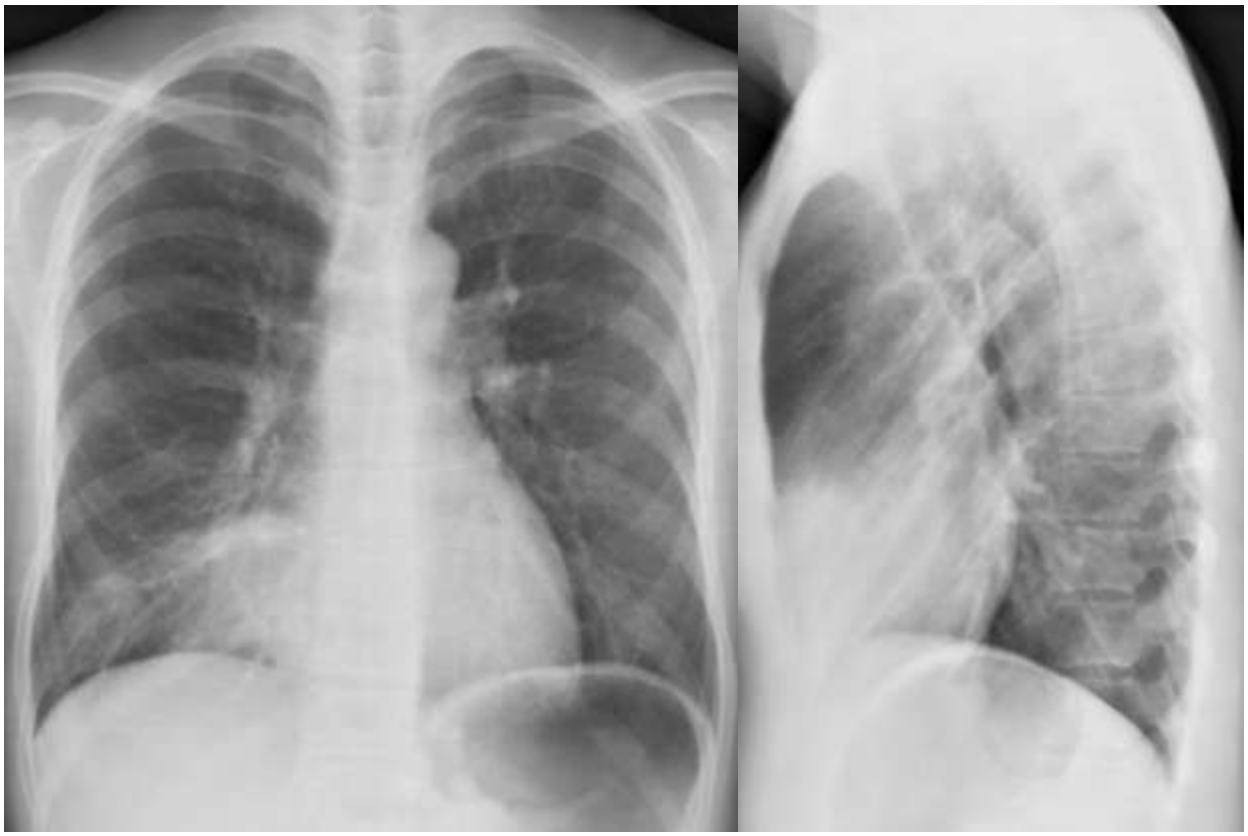


consolidation in left lower lung field

LUL Consolidation



RML Consolidation



Consolidation

- Lobar consolidation:
  - Alveolar space filled with inflammatory exudate
  - Interstitium and architecture remain intact
  - The airway is patent
  - Radiologically:
    - A density corresponding to a segment or lobe
    - Airbronchogram, and
    - No significant loss of lung volume

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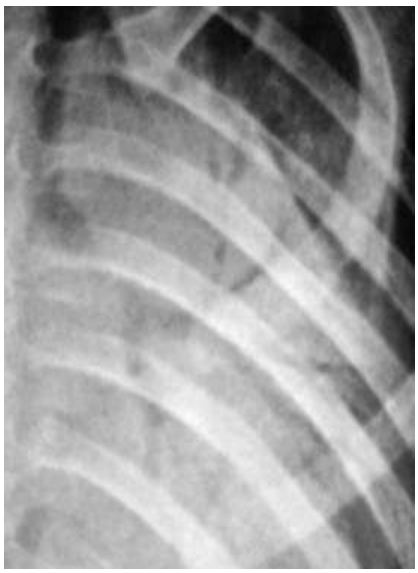
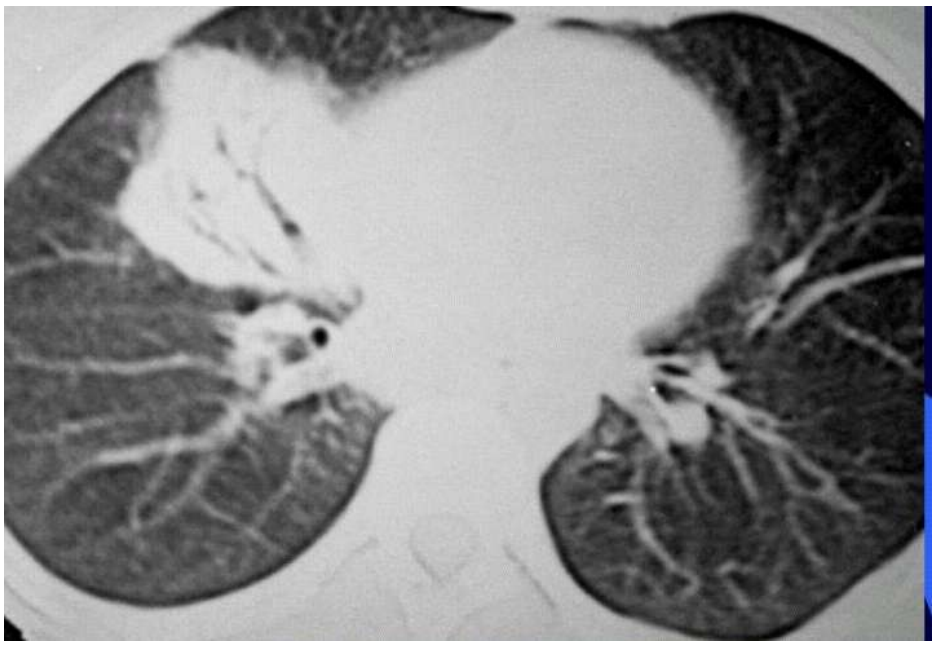
Air Bronchogram

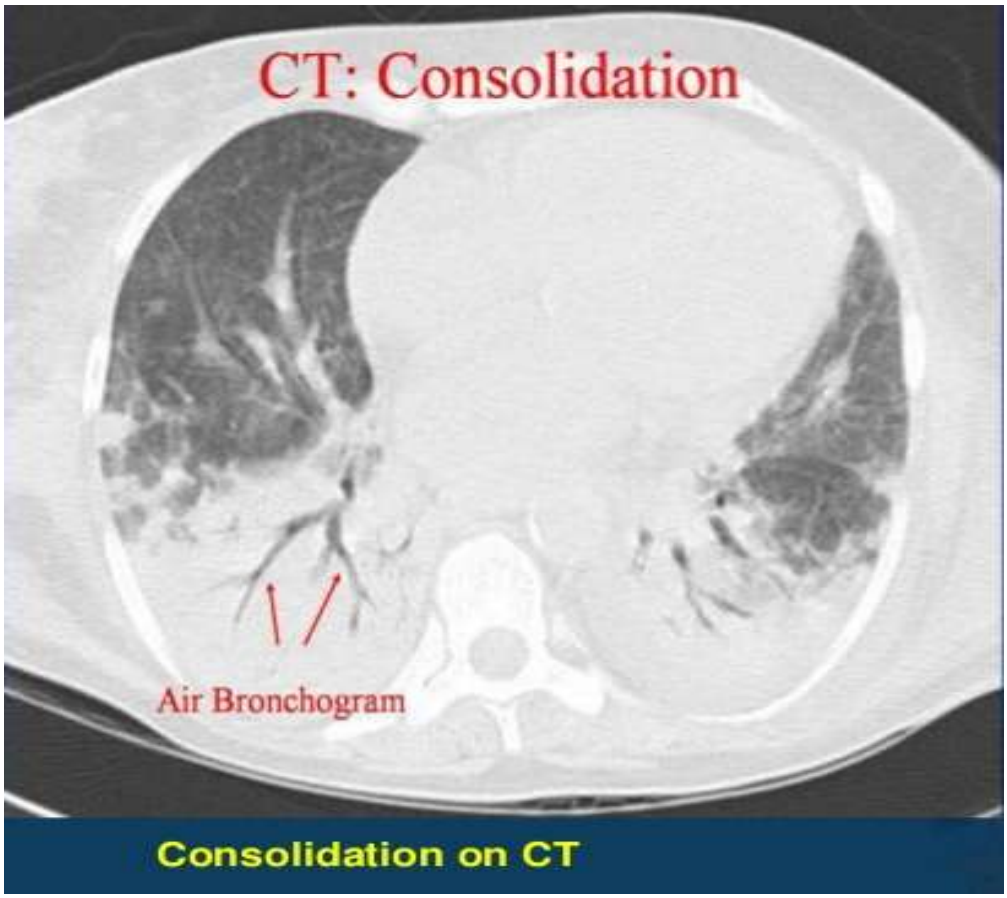
•Tubular outlines of the smaller airways.
•Appear when the alveoli surrounding the airway collapse or are filled with fluid.
•Air bronchograms will not be visible if the bronchi themselves are opacified (e.g. by fluid) and thus indicate patent proximal airways.





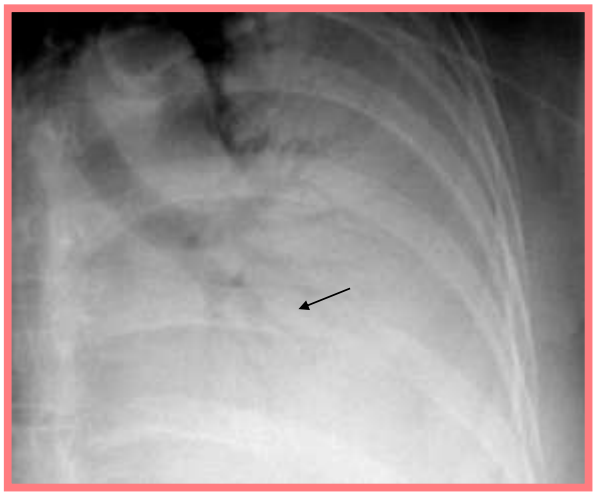
CT pulmonary window . Segmental opacity (consolidation), air bronchogram.

CT mediastinal window . Segmental opacity (consolidation), air bronchogram.

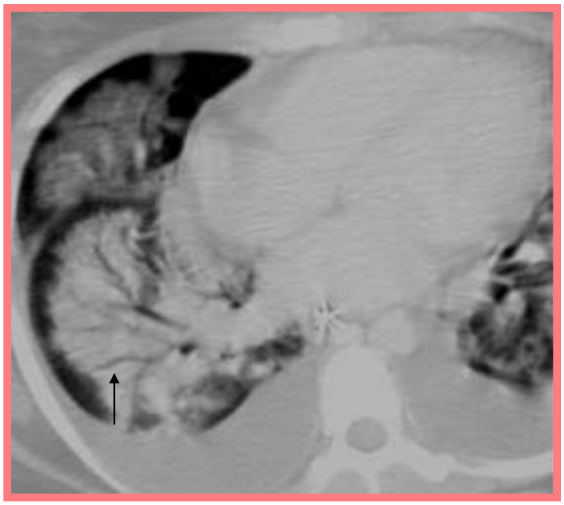

CT: Consolidation
Air Bronchogram
Consolidation on CT

AIR BRONCHOGRAM

Air containing bronchus peripheral to the hilum surrounded by airless lung



CXR



CT Scan

Air Bronchogram

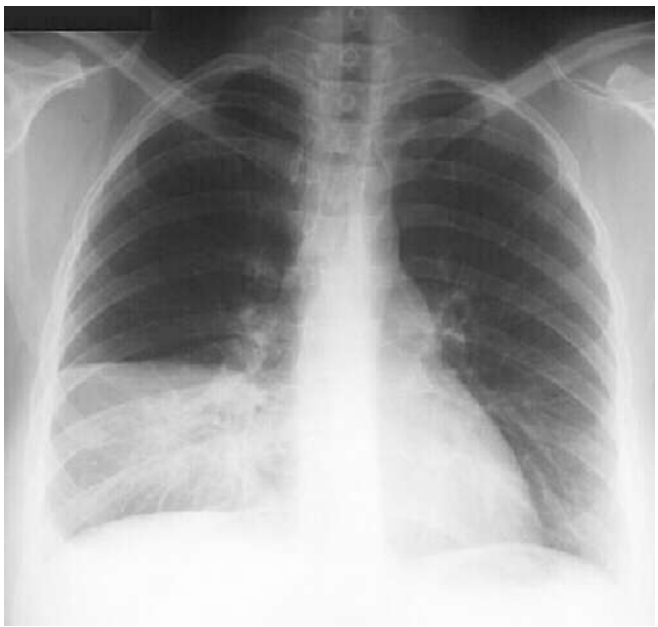
Pneumonia

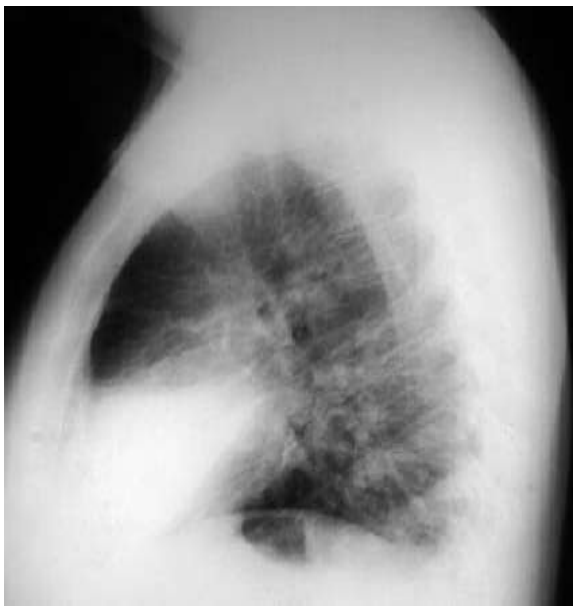
- Consolidation
- Air bronchograms would confirm an alveolar process.

- No loss of lung volume (may even be increased).

- Usually all radiographic abnormalities should disappear after 6 weeks of appropriate antibiotic therapy.

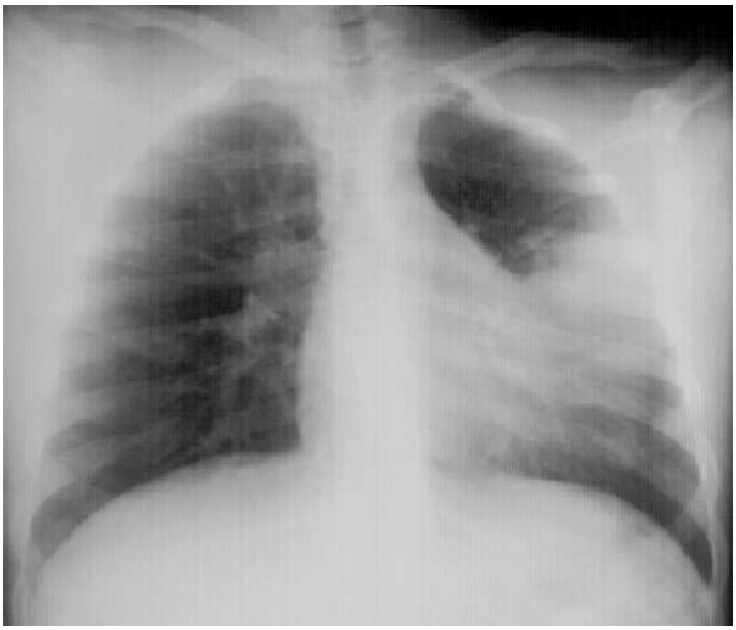
Pneumonia RML





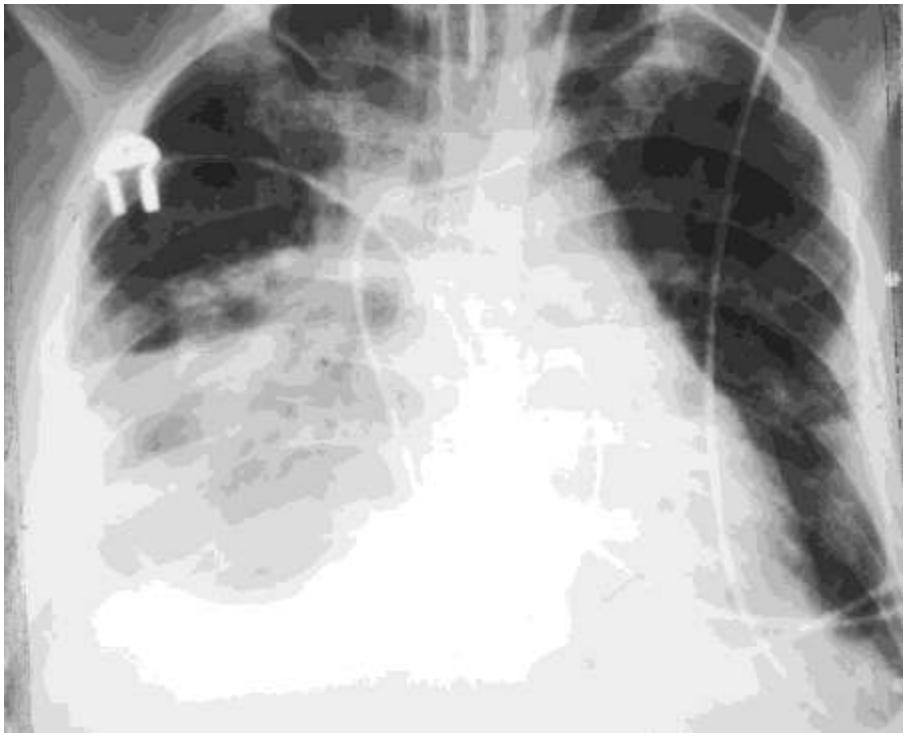
Right Upper Lobe Pneumonia

Left Lingular Pneumonia



Left Lower Lobe Pneumonia

Pneumonia RLL



Pneumonic infiltration of the right middle lobe

Atelectasis

- Collapse of lung parenchyma resulting from an obstruction of the air ways affecting part or all the one lung.
- No ventilation to lobe or segment beyond the obstruction. Trapped air is absorbed into the pulmonary circulation.
- Radiological signs
  - Lobar / segmental opacity
  - Volume loss:
    - displacement of fissures
    - mediastinal & hilar displacement to the same side
    - elevation of hemidiphragm
  - Compensatory hyperinflation of normal lung

Atelectasis

- Loss of air
- Obstructive atelectasis:
  - No ventilation to the lobe beyond obstruction
  - Radiologically:
    - Density corresponding to a segment or lobe
    - Significant loss of volume
    - Compensatory hyperinflation of normal lungs

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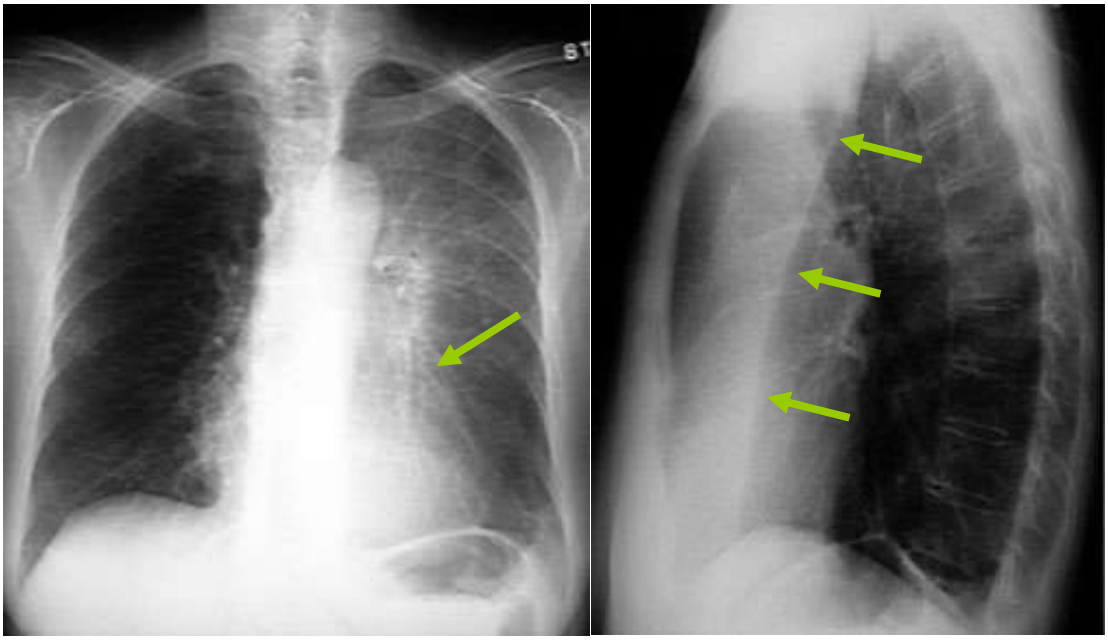
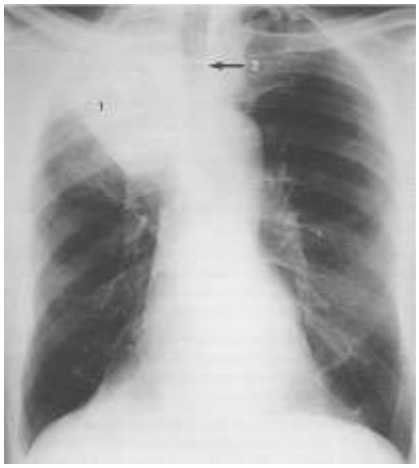
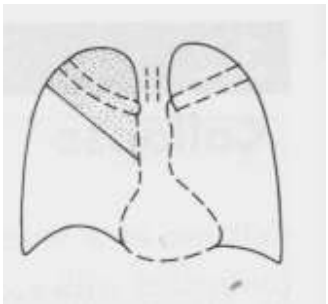
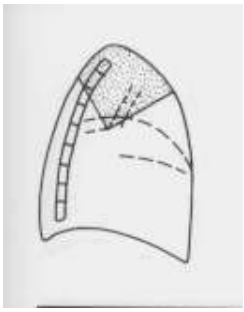


LUL Atelectasis: Loss of heart borders/silhouetting. Notice over inflation on unaffected lung

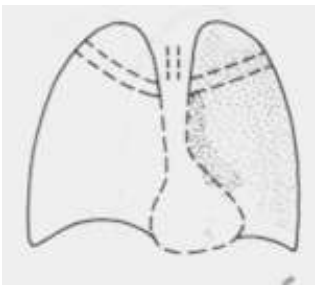
Collapse RUL

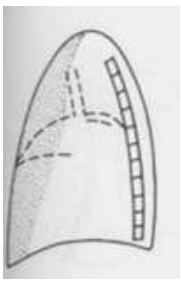


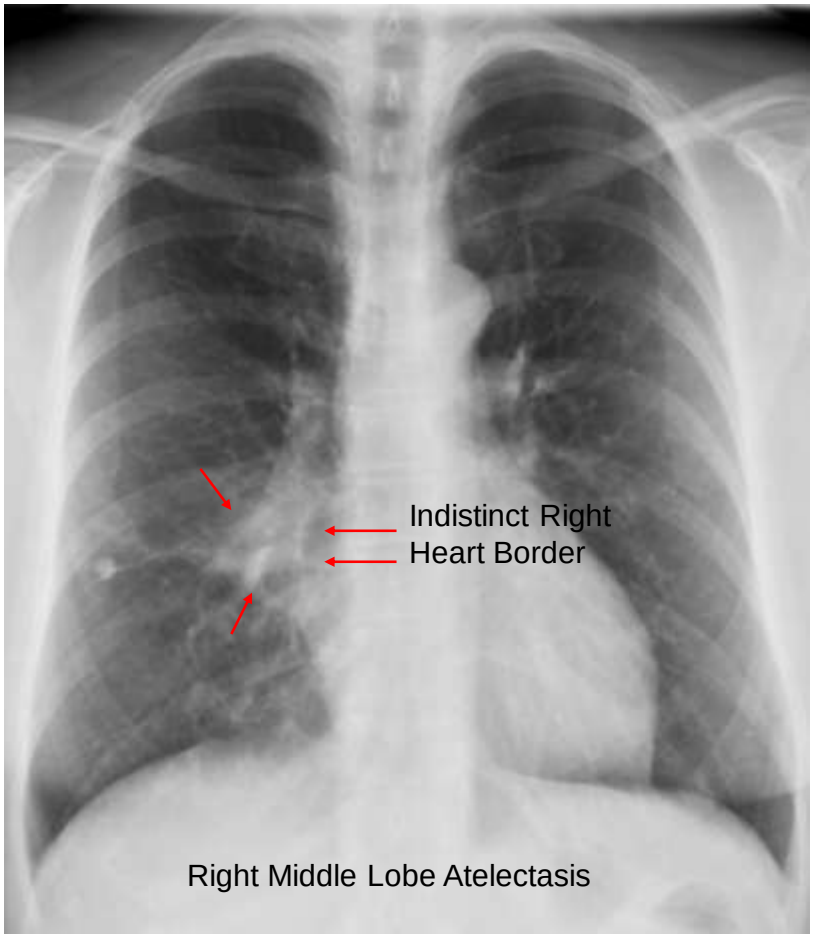




Collapse LUL







Right Middle Lobe Atelectasis

Right Middle Lobe Atelectasis

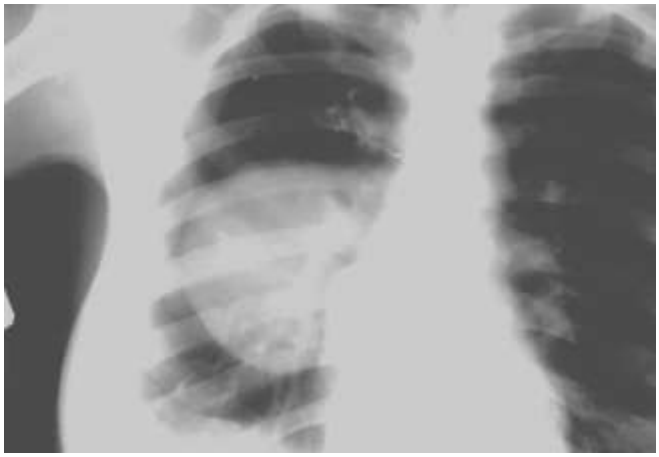
Rounded opacity

- Opacity (mass) larger than 3 cm in diameter.
- Solitary or multiple
- without mediastinal displacement, homogenous structure,
- well-defined regular borders

Causes

- Benign tumors, e.g. hamartoma
- Malignant tumors, e.g. bronchial carcinoma, metastases
- Infection, e.g. pneumonia, abscess, tuberculosis, hydatid cyst
- Infarction

Rounded opacity



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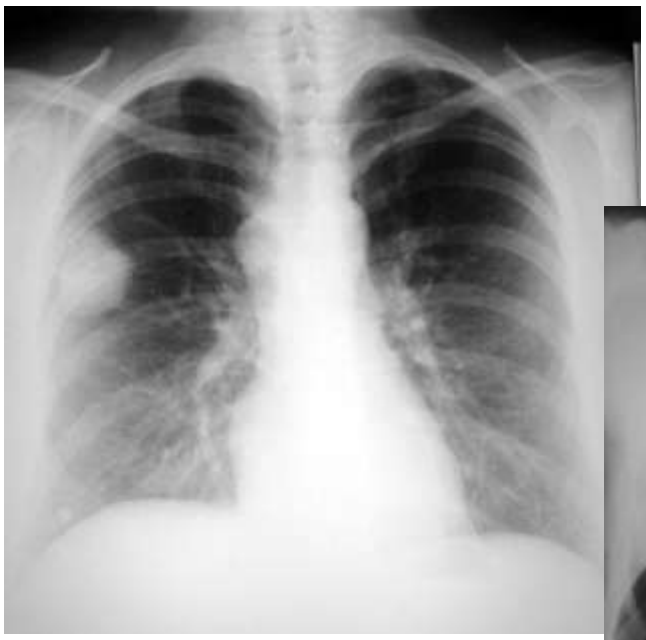
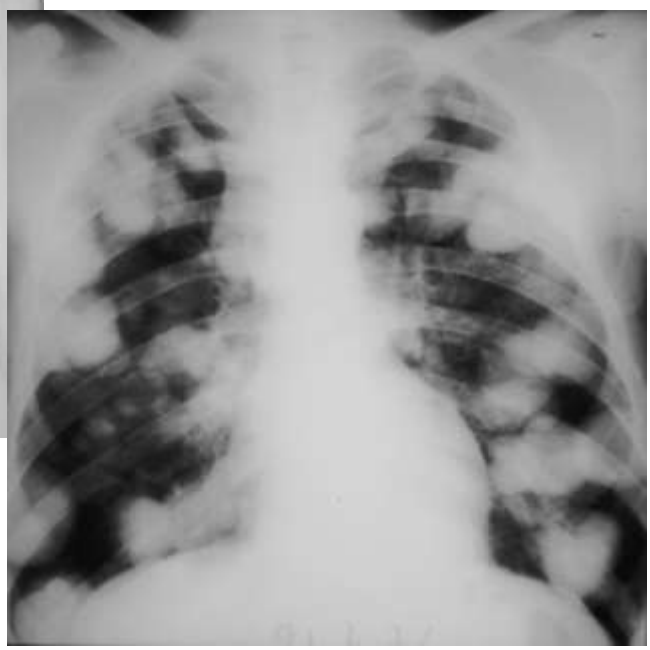
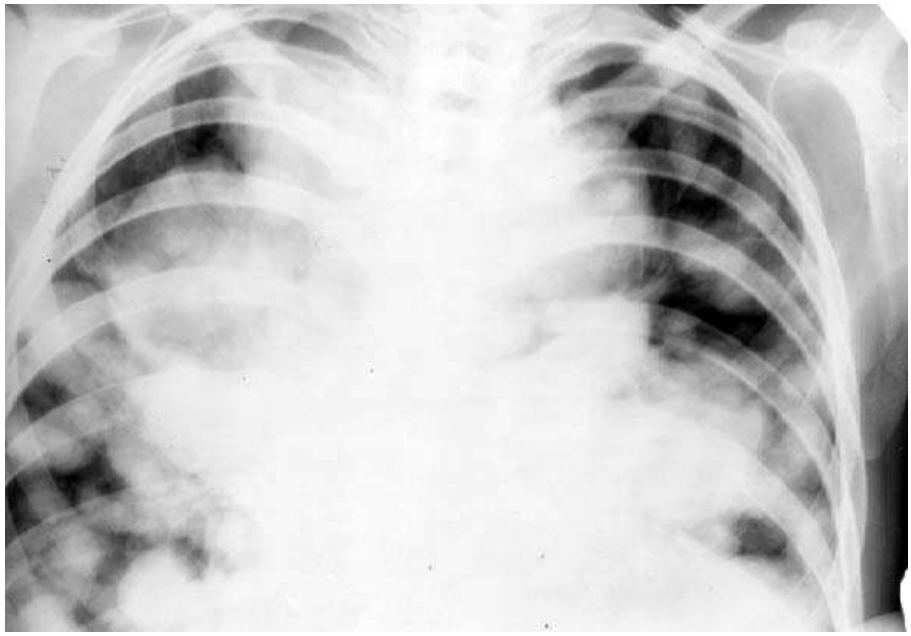
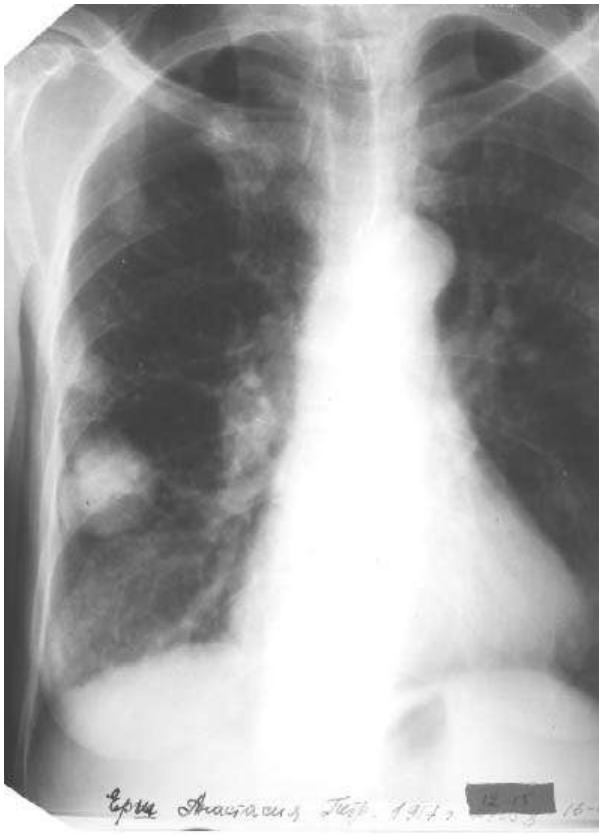
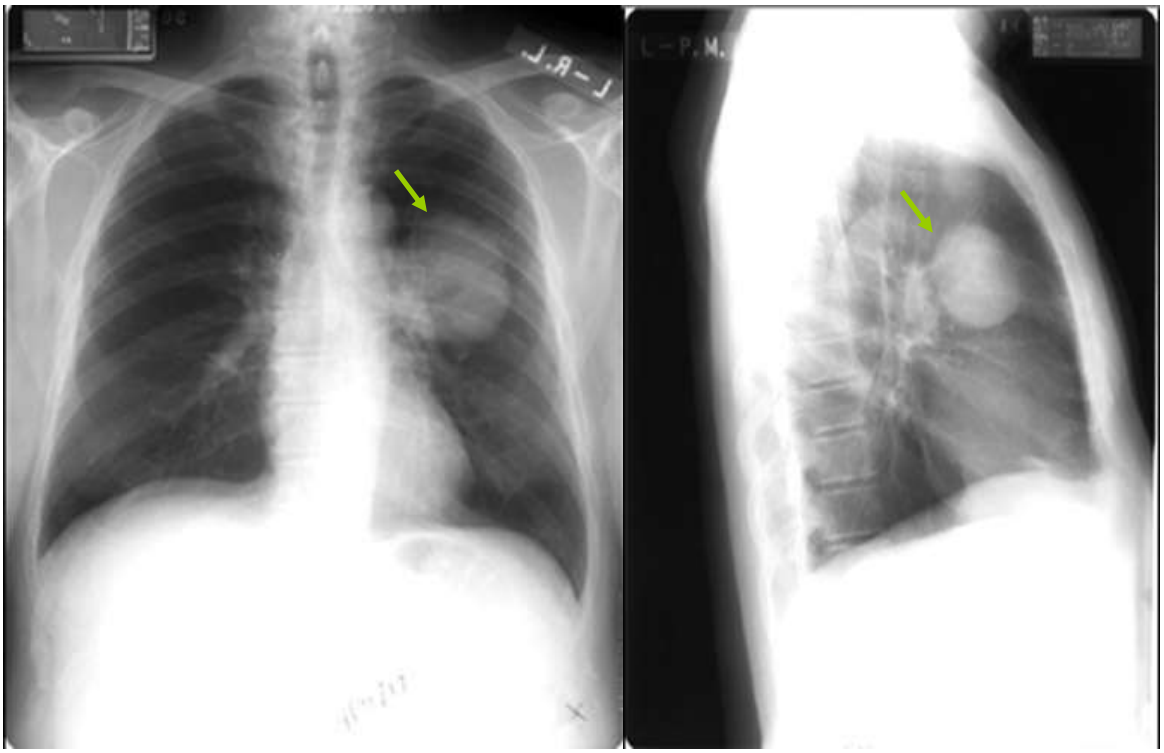
Rounded opacity











Lung Mass

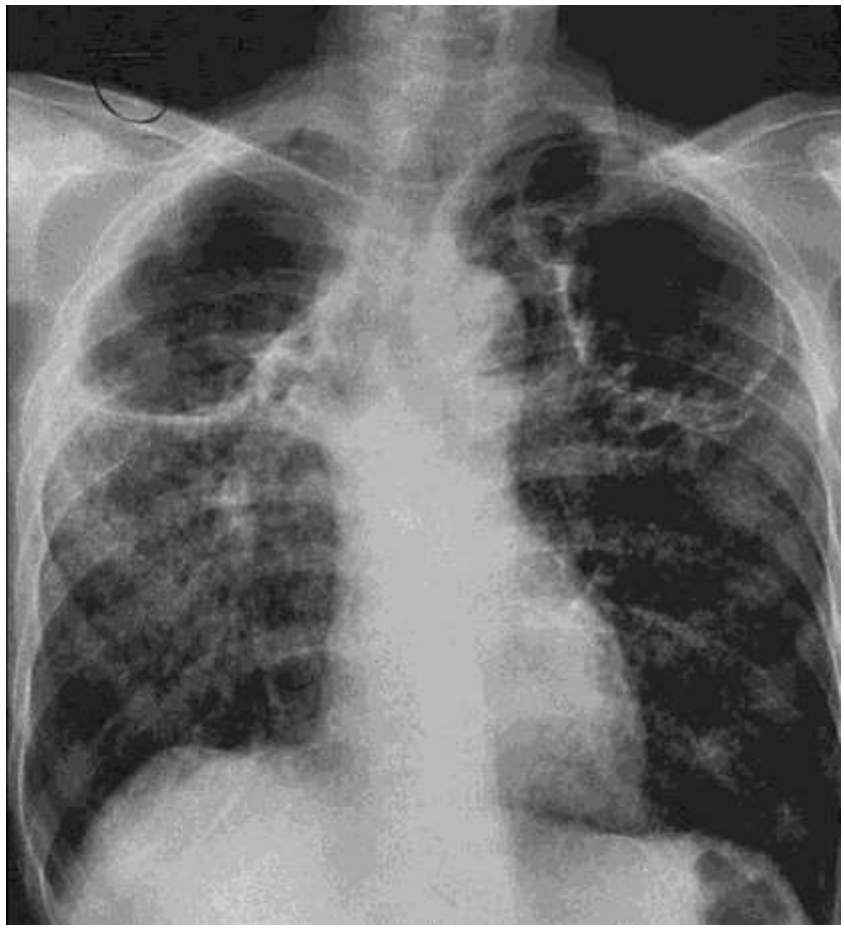
Cavitary lesions of the lung (ring-shaped opacity)

- A gas containing space within the lung surrounded by a complete wall.
- Occurs when an area of necrosis communicate with a patent airway.
- Features
  - wall thickness, outline, fluid level, surrounding lung

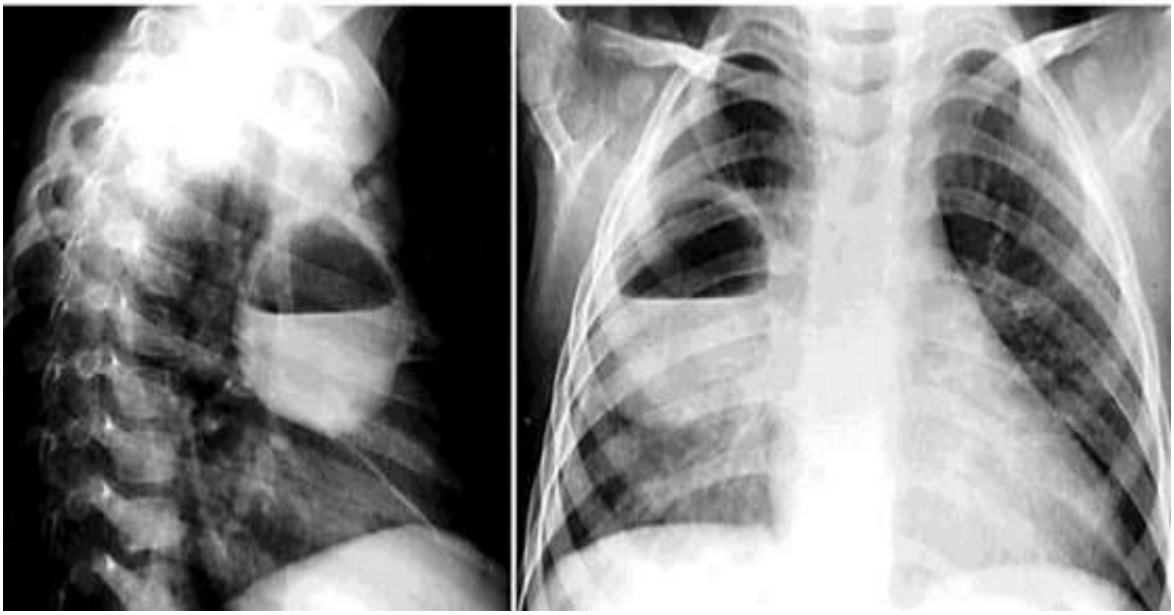
Causes

- Abscess.
- Neoplasm.
- Cavitating pneumonia.
- Cavitations in infarcts.

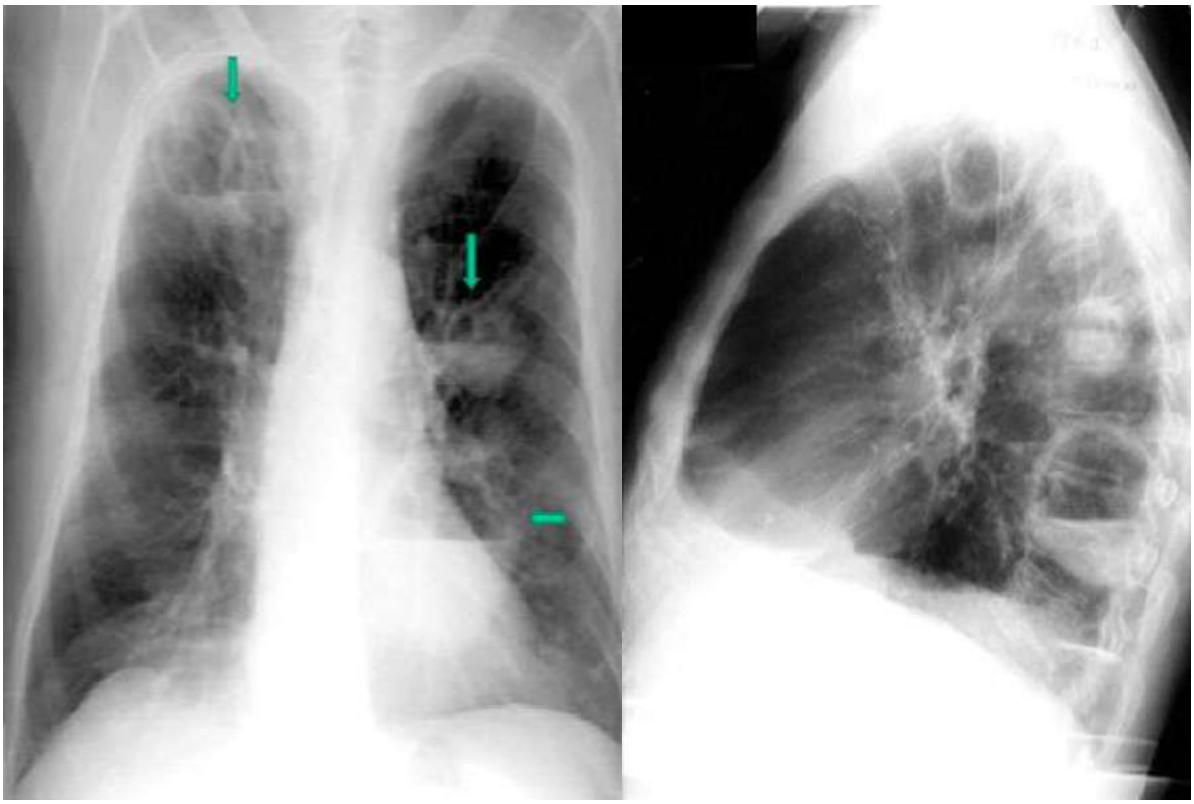
Ring-shaped opacity



Lung abscess (air fluid level)

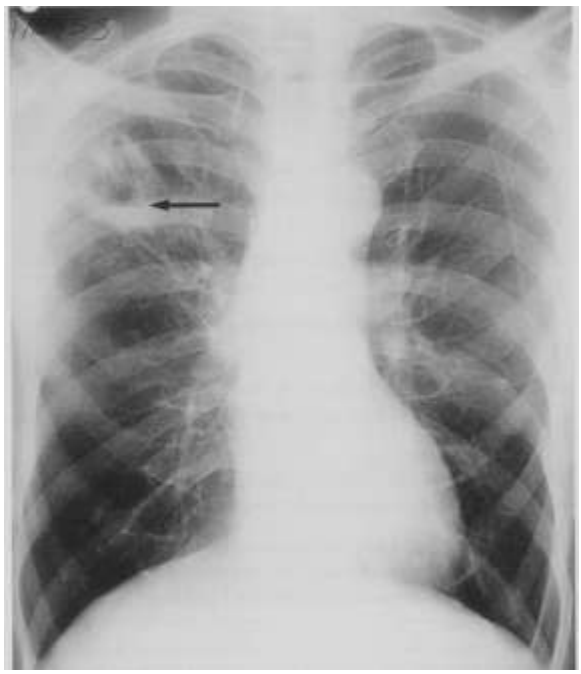


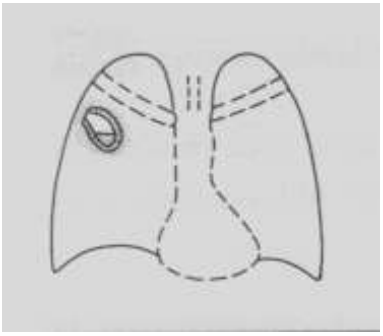
Ring-shaped opacity



Multiple abscesses.

Cavitating lung lesion





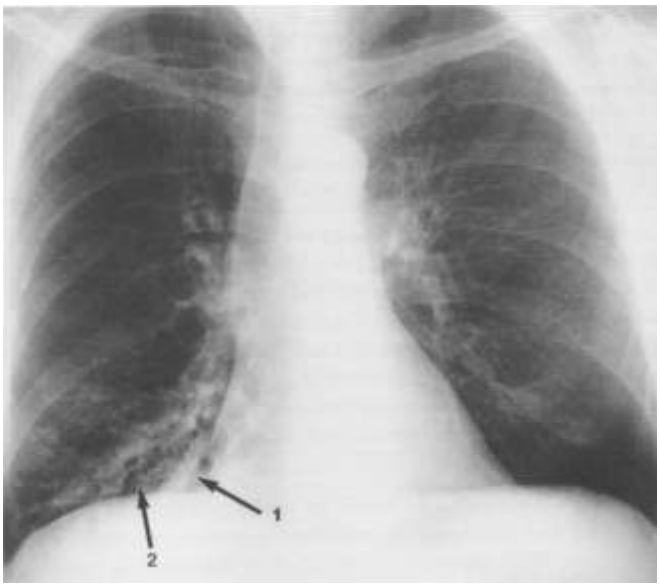
Bronchiectasis

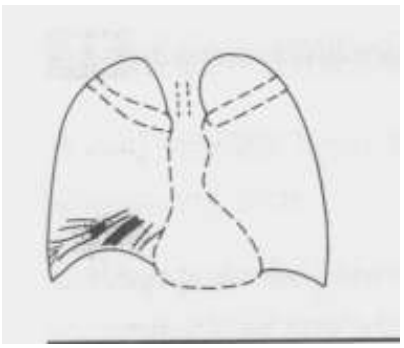
- Irreversible abnormal dilatation of the bronchial tree, leading to a build-up of excess mucus that can make the lungs more vulnerable to infection.

Causes of Bronchiectasis

- Structural
- obstruction (carcinoma, foreign body)
- Infection, e.g. childhood pertussis or measles, tuberculosis, pneumonia
- Immune, e.g. hypogammaglobulinaemia, allergic bronchopulmonary aspergillosis
- Metabolic, e.g. cystic fibrosis

Bronchiectasis





Cystic lesion in the left lower pulmonary field – pneumatocele

Nodular opacity

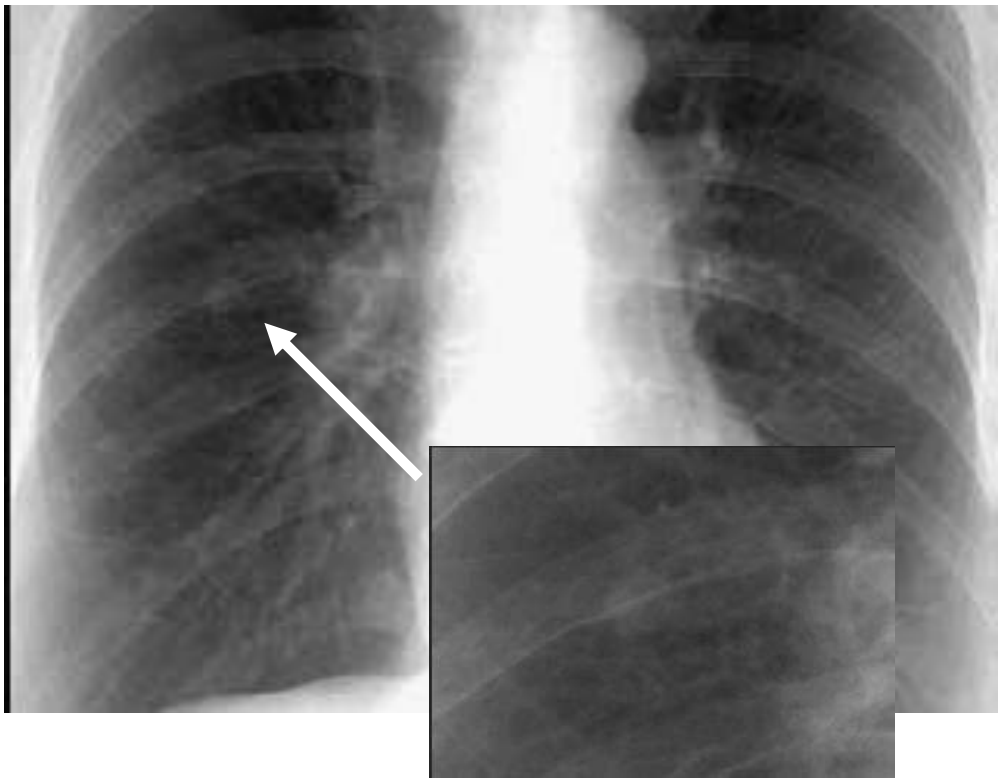
- Opacities less than or equal to 3cm in diameter
- Solitary pumonary nodule
  - Benign tumor
  - Malignant tumor, secondary (metastasis)
  - Granuloma, tuberculosis, histoplasmosis, sarcoidosis etc.
  - Lung cyst, infarct, hematoma, amiloidosis etc.
- Multiple pumonary nodules
  - Sarcoidosis, pneumoconiosis (silicosis, asbestosis), tuberculosis, infective bronchiolitis, fungal infection, metastases, pumonary lymphoma, pumonary amiloidosis

- Miliary opacities – multiple small shadows 1-4mm in diameter

Nodular opacity

Right upper lower lobe pulmonary nodule

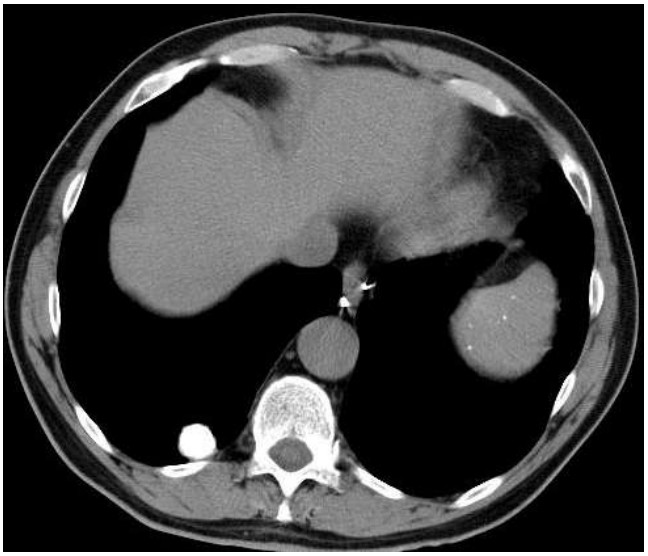
Nodular opacity

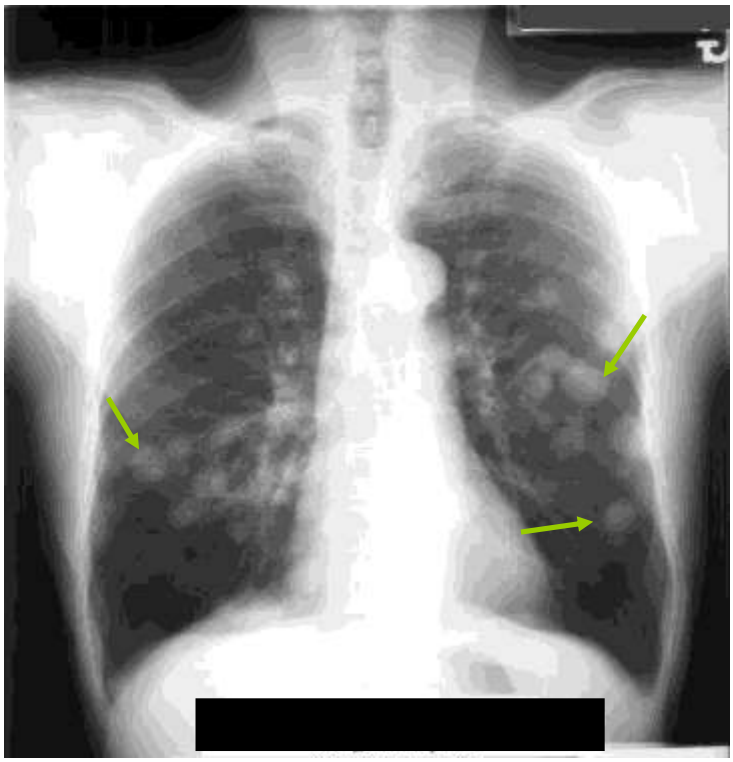


Solitary Pulmonary Nodule can be:

Malignant: Adenocarcinoma

Benign: Densely calcified nodule



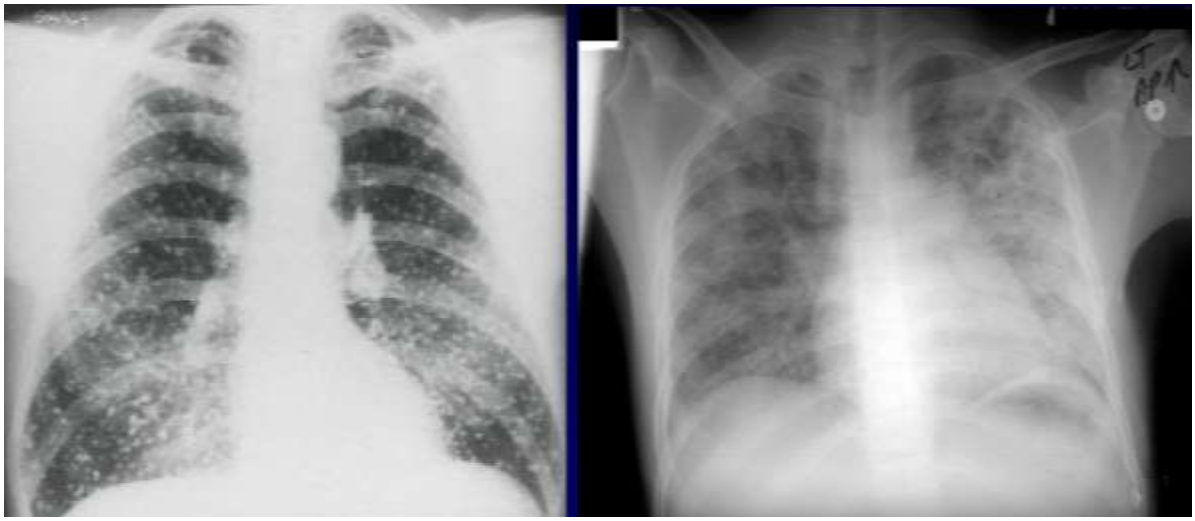


Metastatic Lung Cancer: multiple nodules seen

Miliary opacities

Miliary TB

Military T.B.



NODULAR PATTERN

Collection of innumerable small, linear and nodular opacities together producing a net with small superimposed nodules.

Reticular and linear opacification

- Due to a pathological process centered in or around the pumonary interstitium. This includes thickening of any of the interstitial compartments by blood, water, tumor, cells, fibrous disease.

Pulmonary edema

Steps (order) of radiograph reading and reporting

- **1 Patient information**
  - name, date of birth, sex, old films
- **2 Imaging techique data**
  - time of image acquisition, radiograph, projection (view), contrast materials and other medicantions 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)**