

Signs in Thoracic Imaging



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Objectives

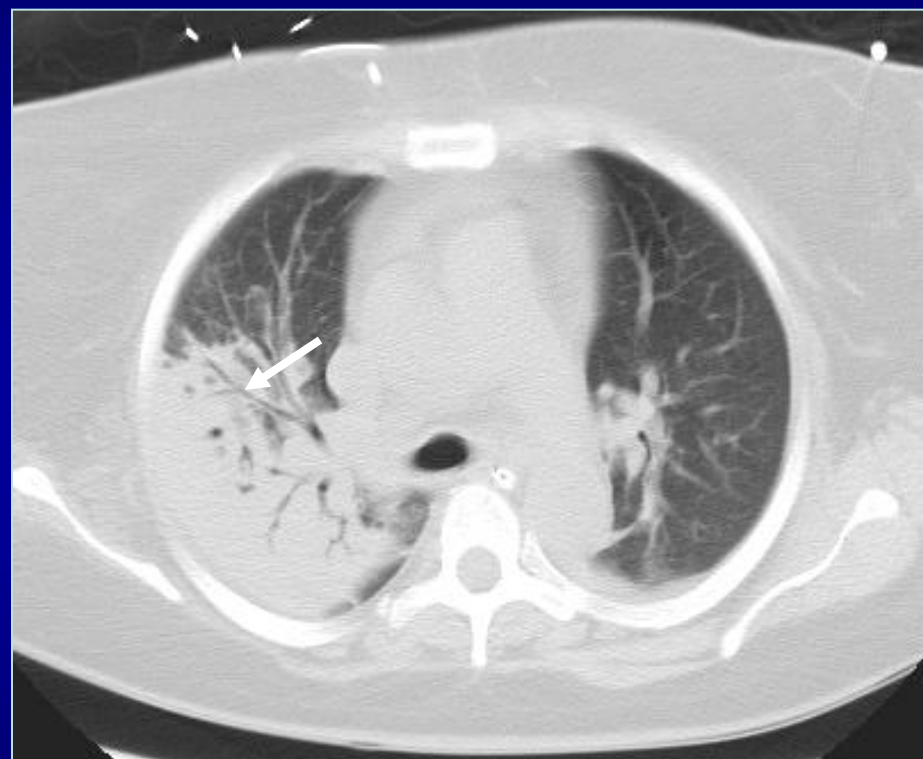
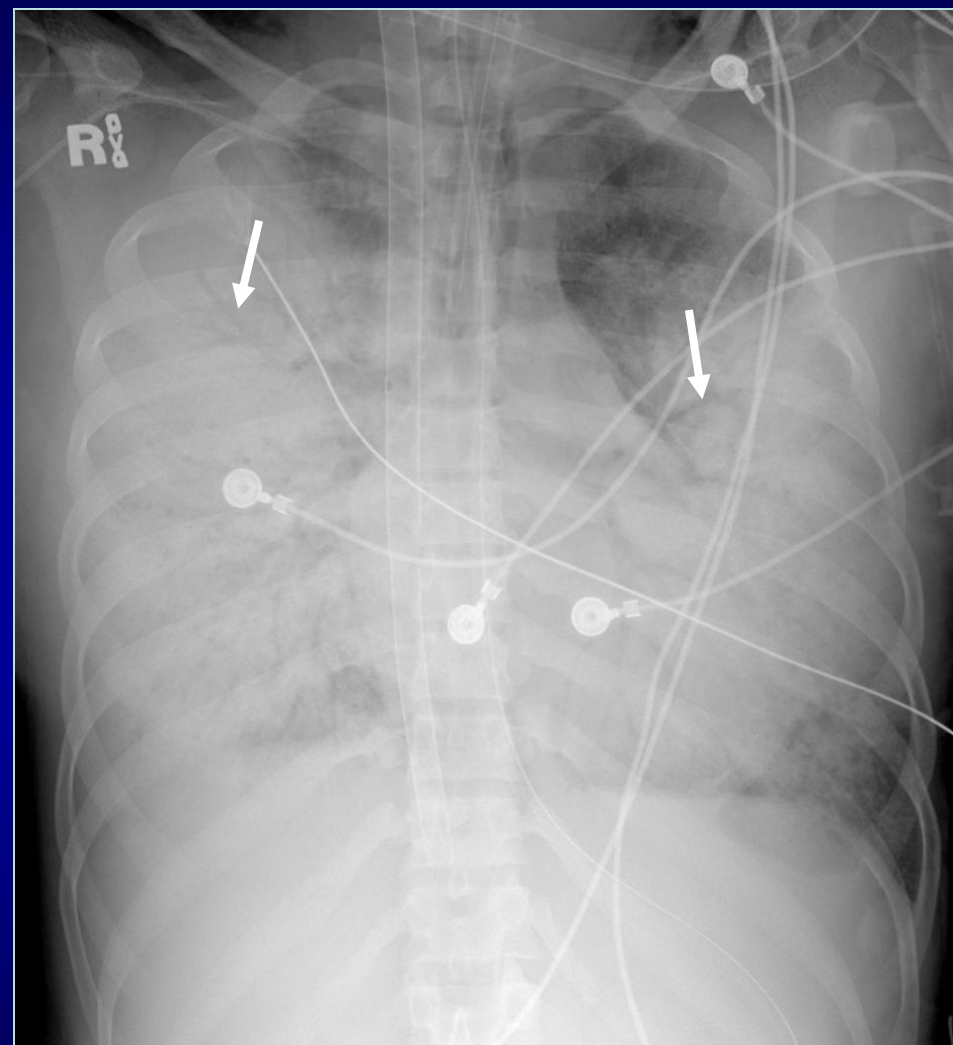
- Recognize some important radiologic signs in thoracic imaging
- Understand the mechanism of these thoracic radiologic signs
- Establish diagnosis of particular thoracic diseases using these signs

Radiologic Signs

- Radiologic signs are recognizable and characteristic patterns
- Used to describe abnormalities
- Visualized on imaging methods
- Aid in the diagnosis and subsequent treatment of different diseases

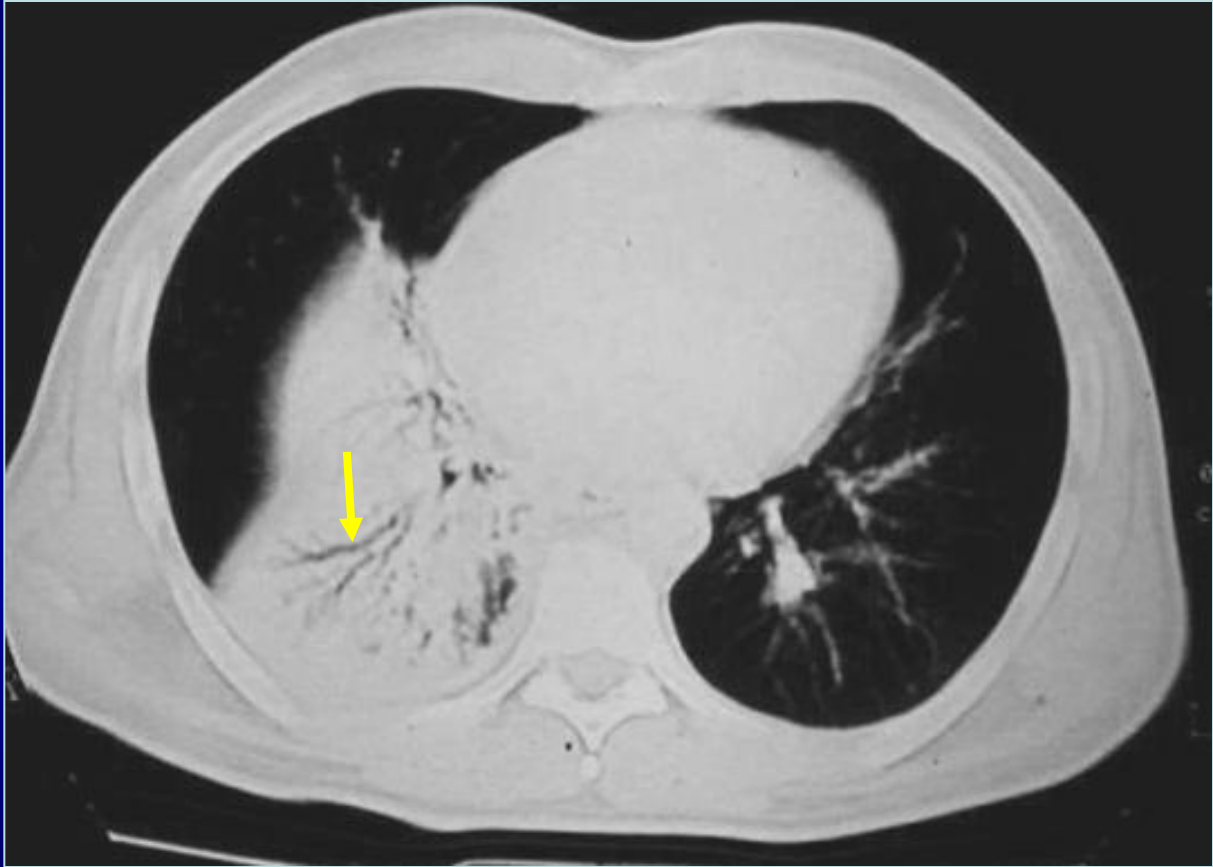
Air Bronchogram Sign

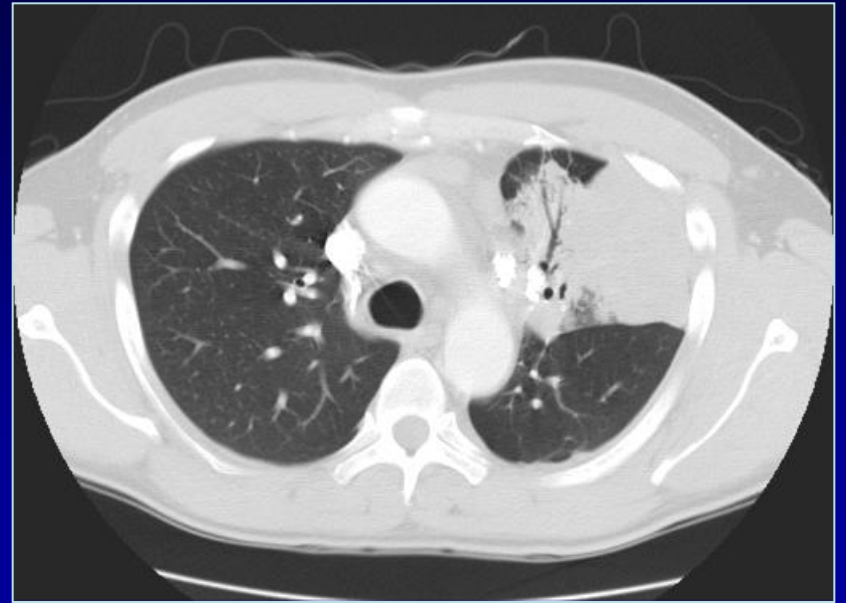
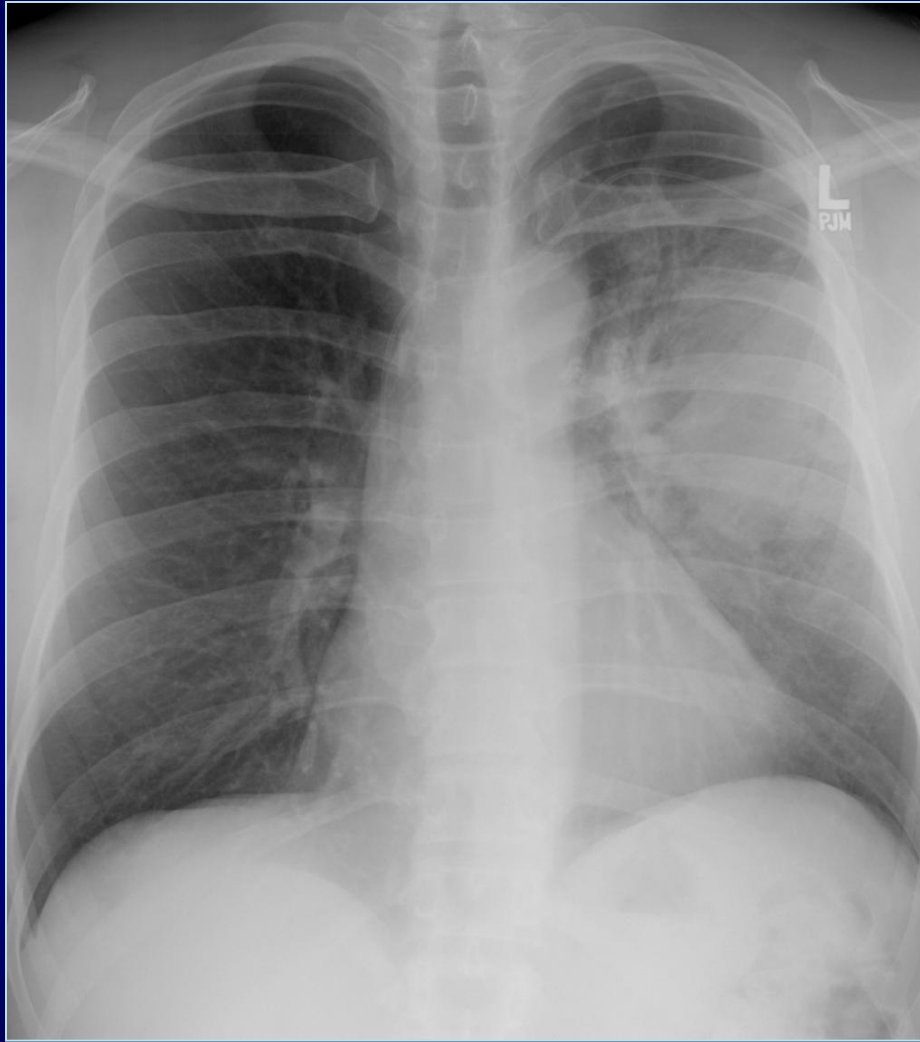
- Occurs in infiltration or edema in tissues adjacent to patent bronchi
- Visualized on chest radiographs or CT
- Associated with airspace disease
- Absence in obstructive atelectasis
- Darker tubular densities are seen



Air Bronchogram Sign

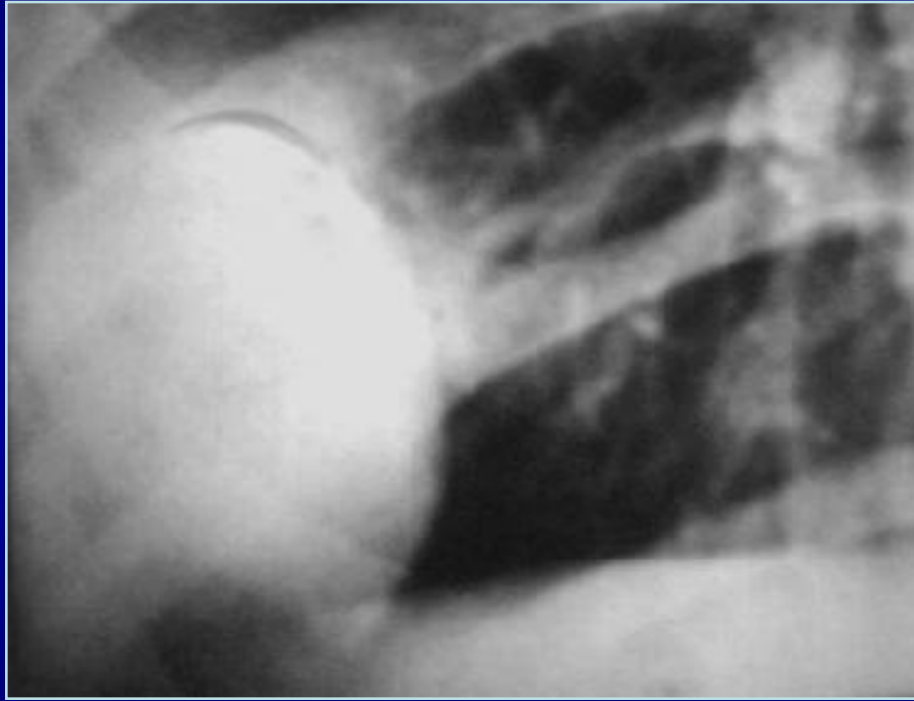
- The sign implies:
 - patency of proximal airways
 - evacuation of alveolar air by absorption (atelectasis), replacement (pneumonia) or combination of both
- Consolidation, tumor, lymphoma





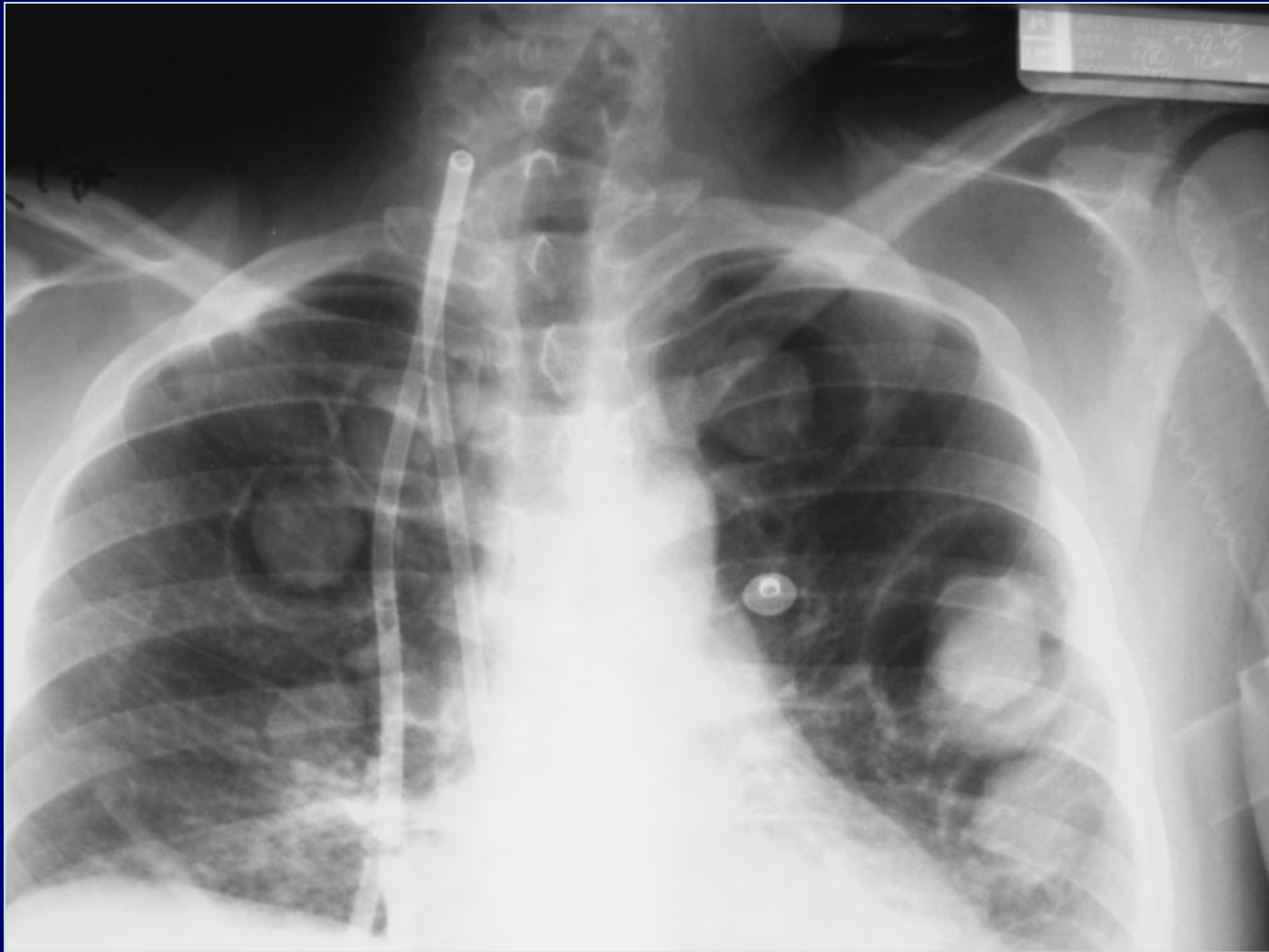
Air Crescent Sign

- Can be visualized in X-rays and CT
- Crescentic collection of air within consolidation or nodular opacity
- Seen in pulmonary cavitory process
- Usually announces recovery
- It is a result of increased granulocyte activity



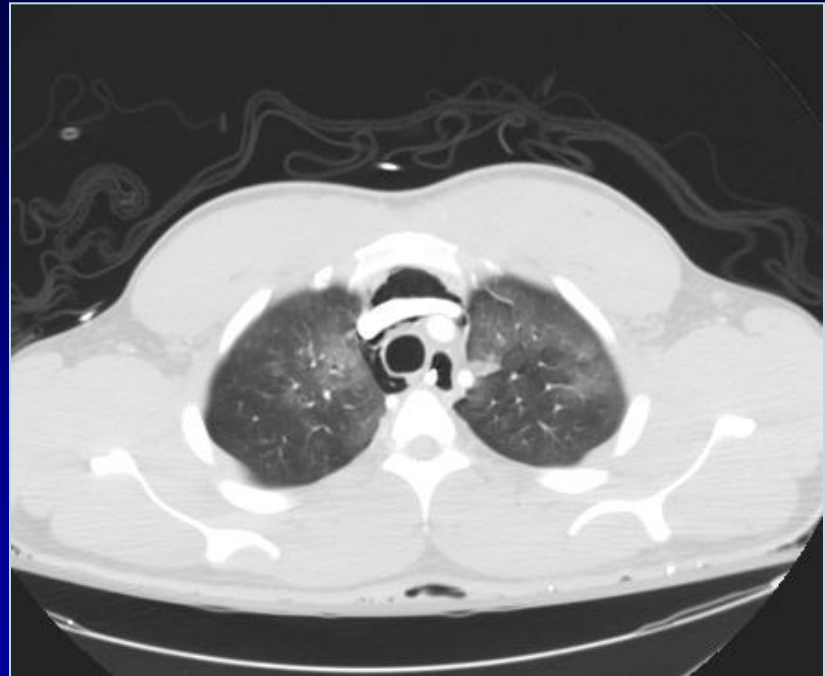
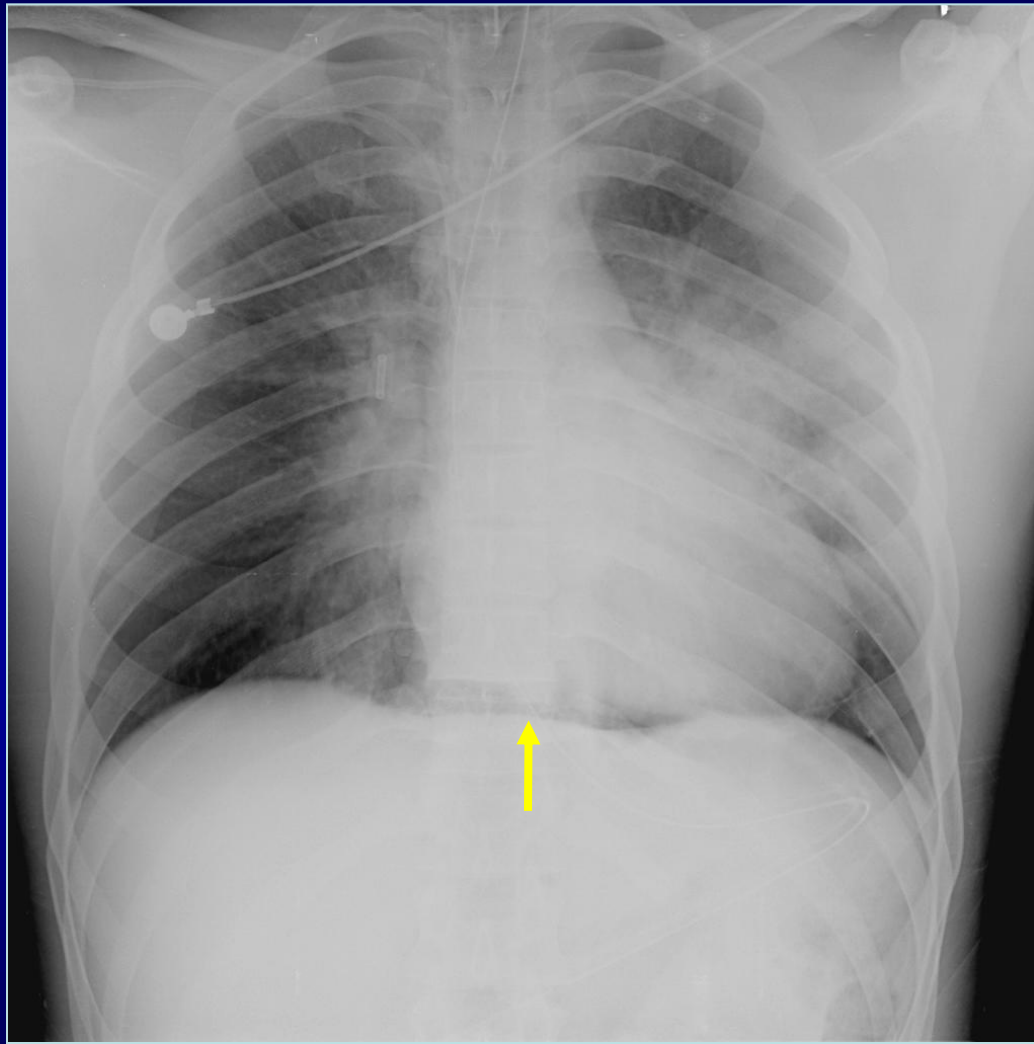
Air Crescent Sign

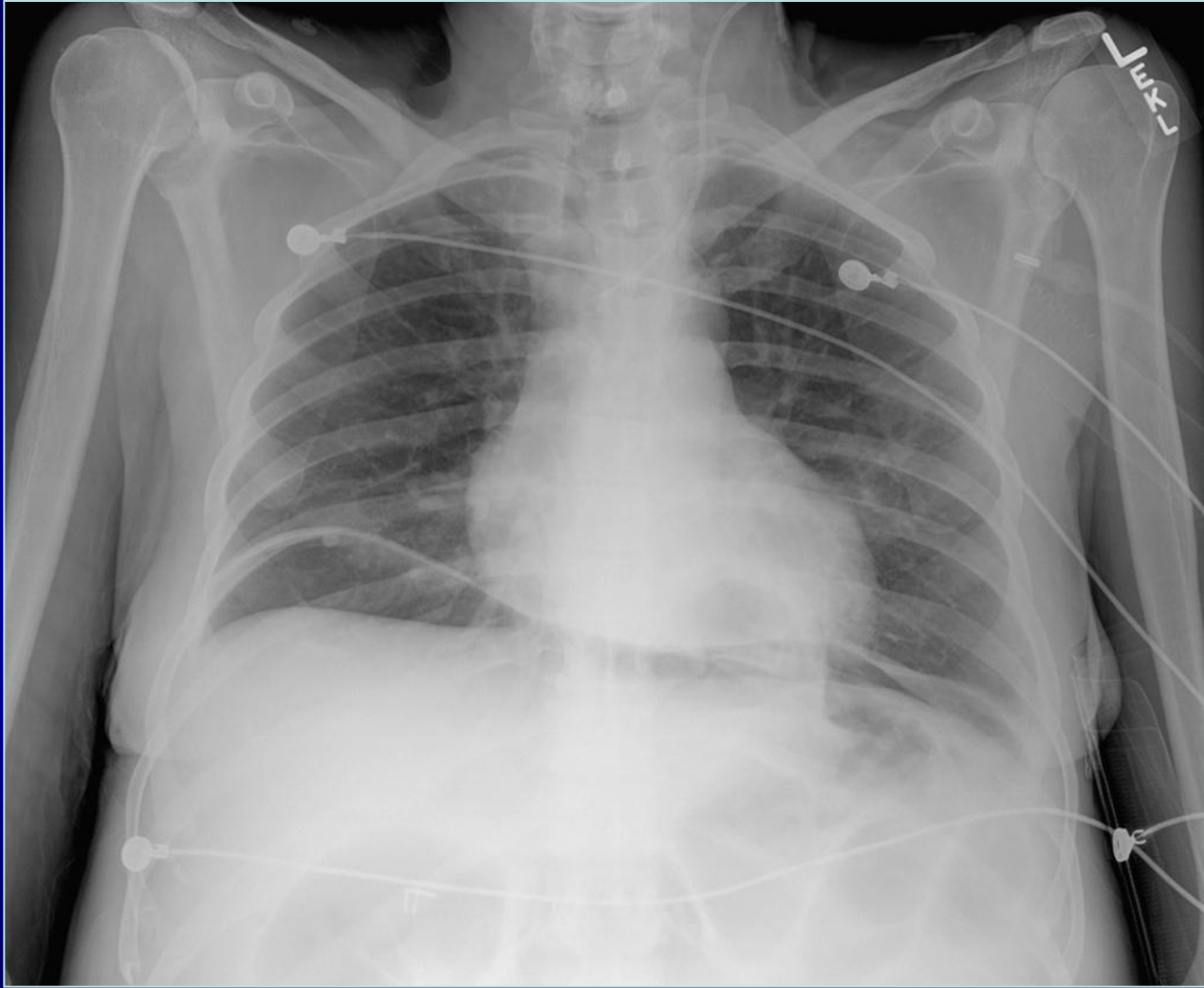
- Characteristic of invasive pulmonary aspergillosis
- Tumor, hematoma, Wegener granulomatosis, hydatid cyst, TB, nocardiosis, bacterial abscess
- Not confused with Monod's sign
 - air surrounding fungus ball or mycetoma in preexisting cavity



Continuous Diaphragm Sign

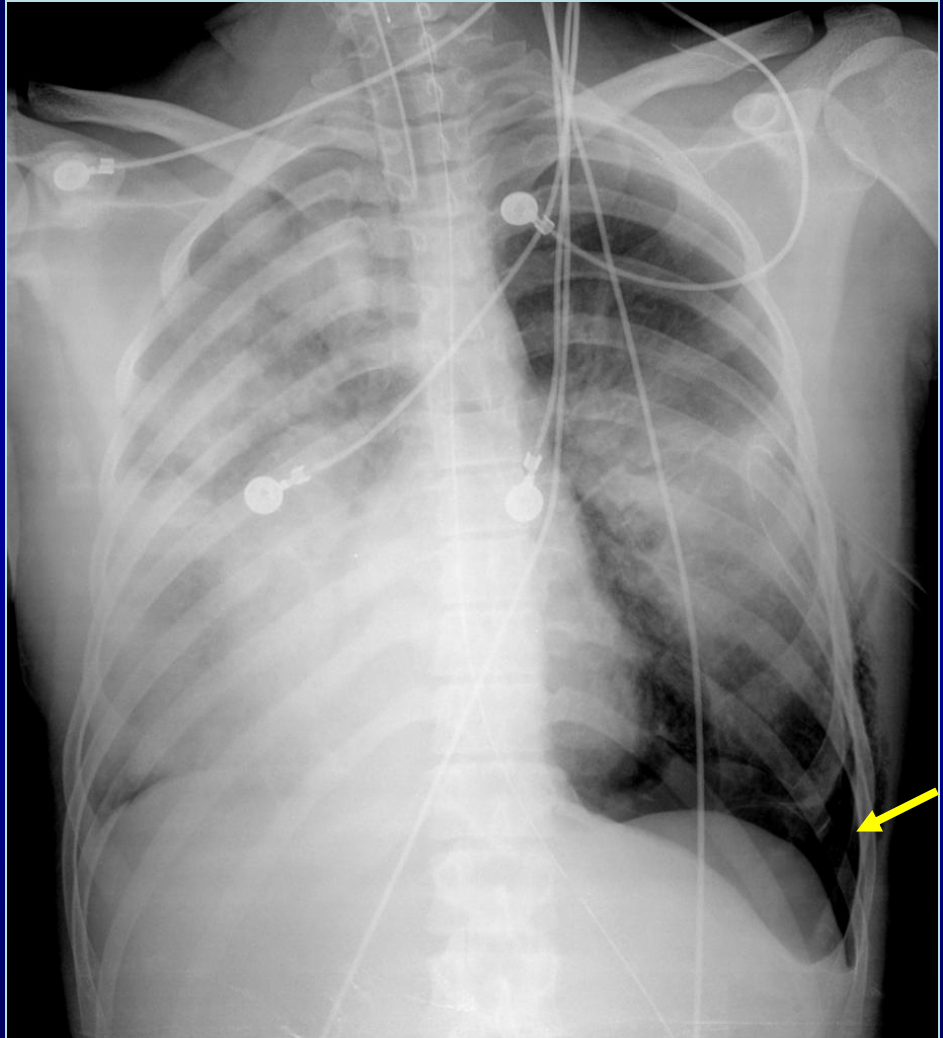
- Described by Levin in 1973
- Normally central part of diaphragm is lost due to apposition of heart
- Air interposed between the heart and diaphragm results in gas-tissue interface
- Seen on chest radiographs
- Characteristic of pneumomediastinum





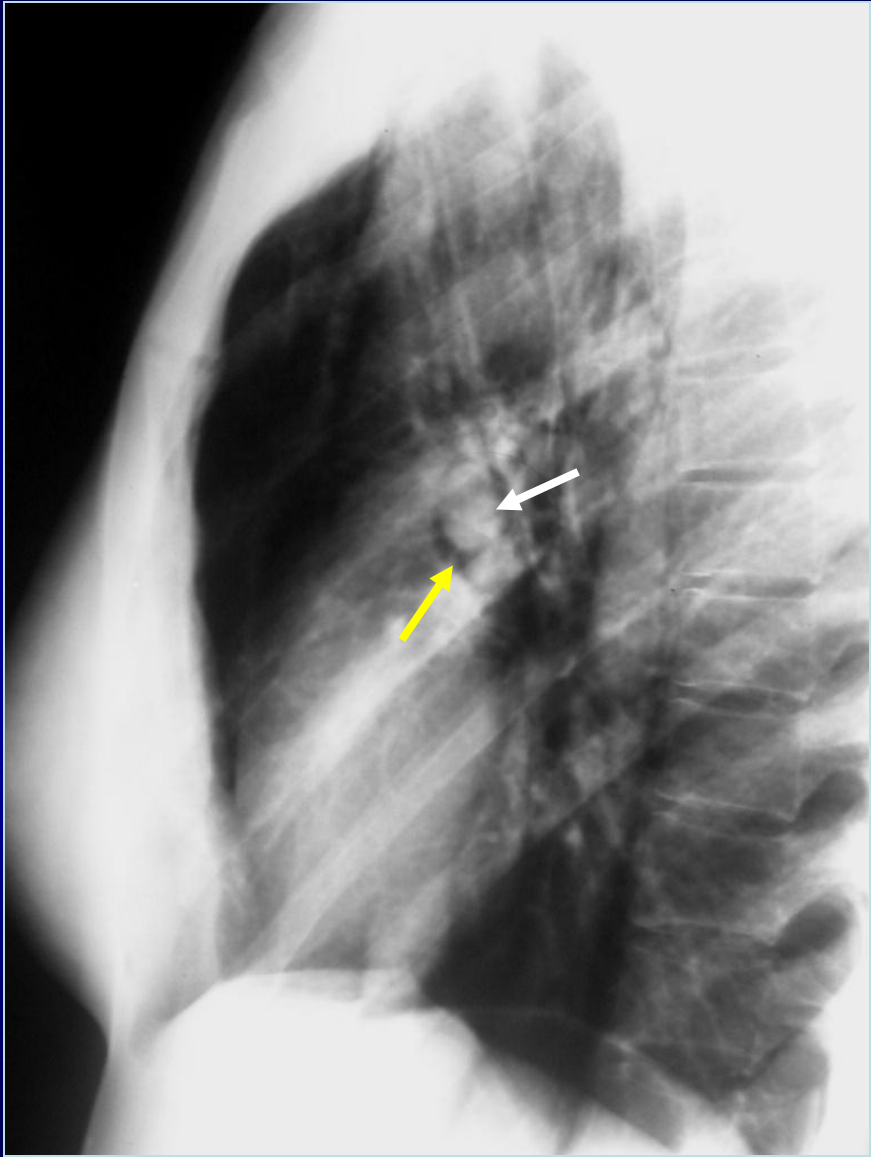
Deep Sulcus Sign

- Seen on radiographs in supine position
- Characteristic of pneumothorax
- 30% pneumothoraces are undetected
- Lucency in lateral costophrenic angle
- Air collects anteriorly and basally
- Useful in neonates and ill patients
- Include lateral costophrenic angles



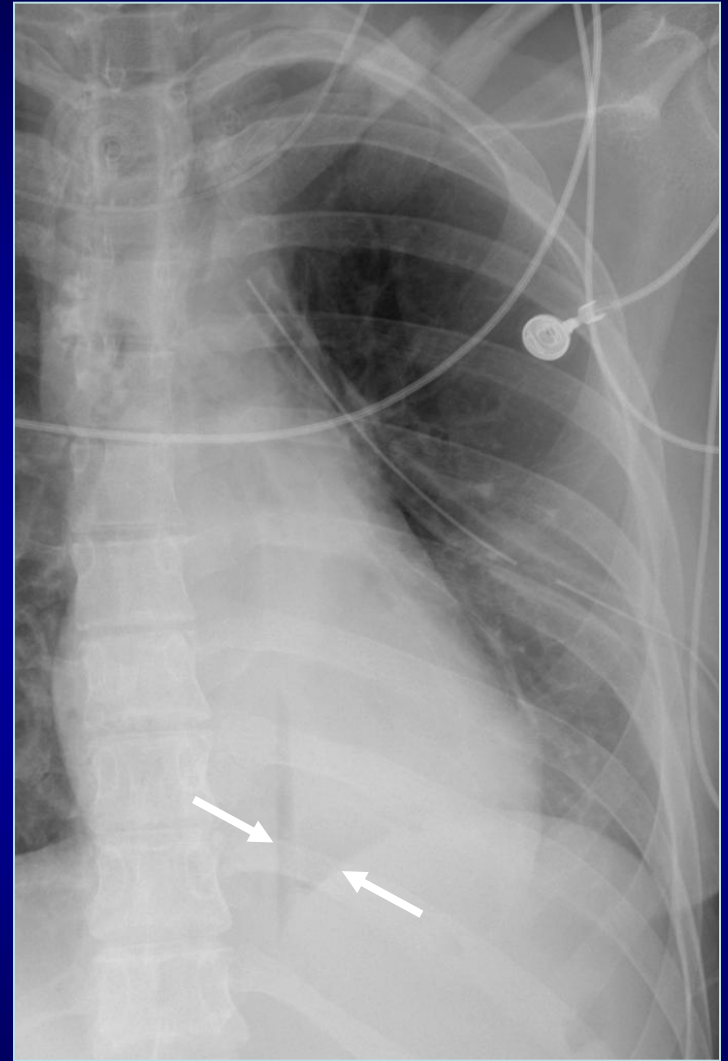
Ring Around Artery Sign

- Visualized on lateral chest radiographs
- Lucency along or surrounding RPA
- Characteristic of pneumomediastinum
- Usually is accompanied by other ancillary signs:
 - continuous diaphragm sign
 - Naclerio's V sign
 - thymic sail sign





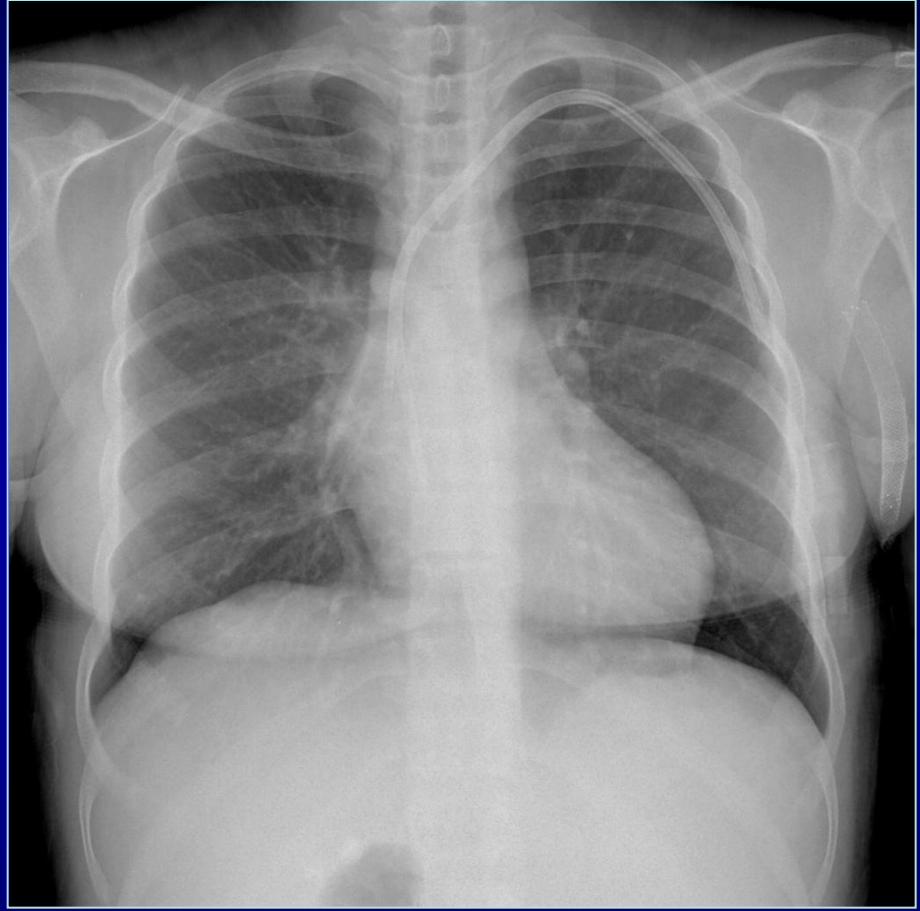
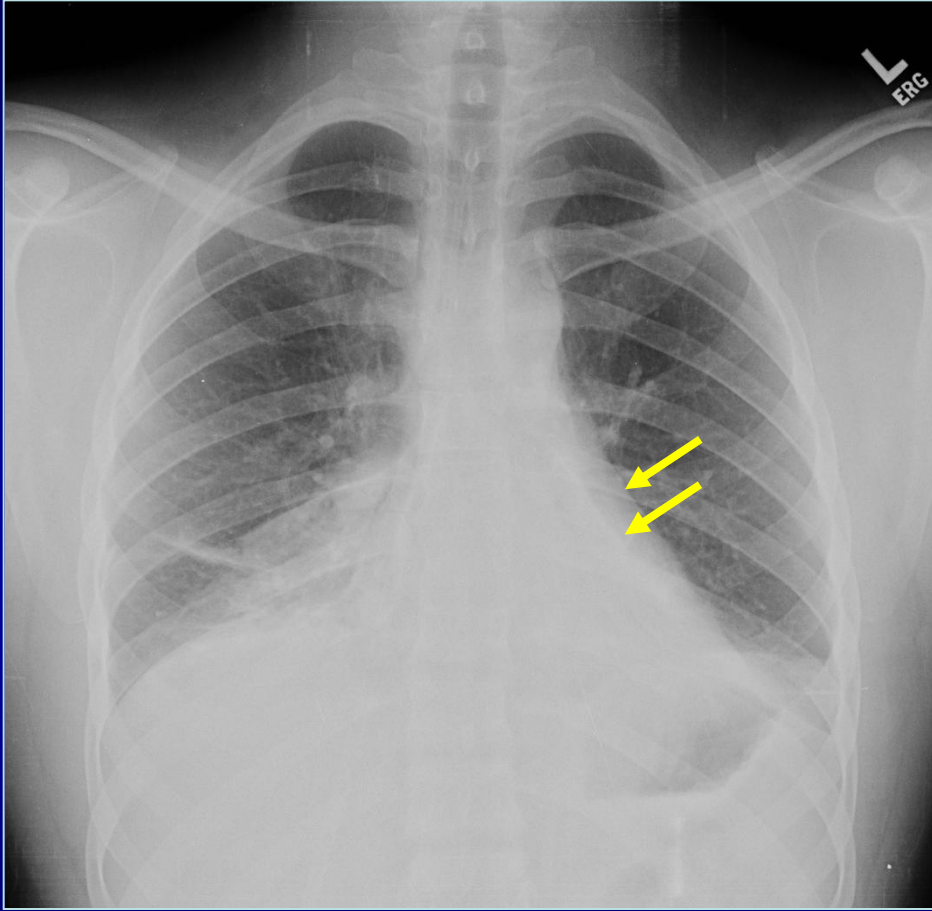
Thymic Sail Sign



Naclerio's V Sign

Flat Waist Sign

- Described by Kattan and Wlot in 1976
- Indicates left lower lobe collapse
- Visualized on frontal views
- Perfectly symmetrical PA or AP view
- Hilar structures shift downward and rotation of heart produces flattening of cardiac waist

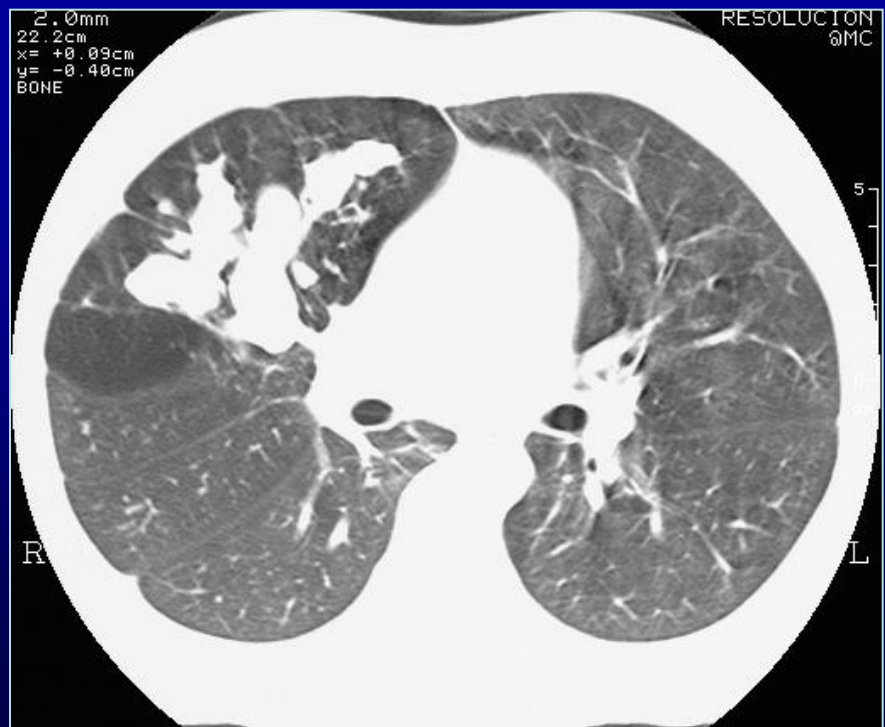
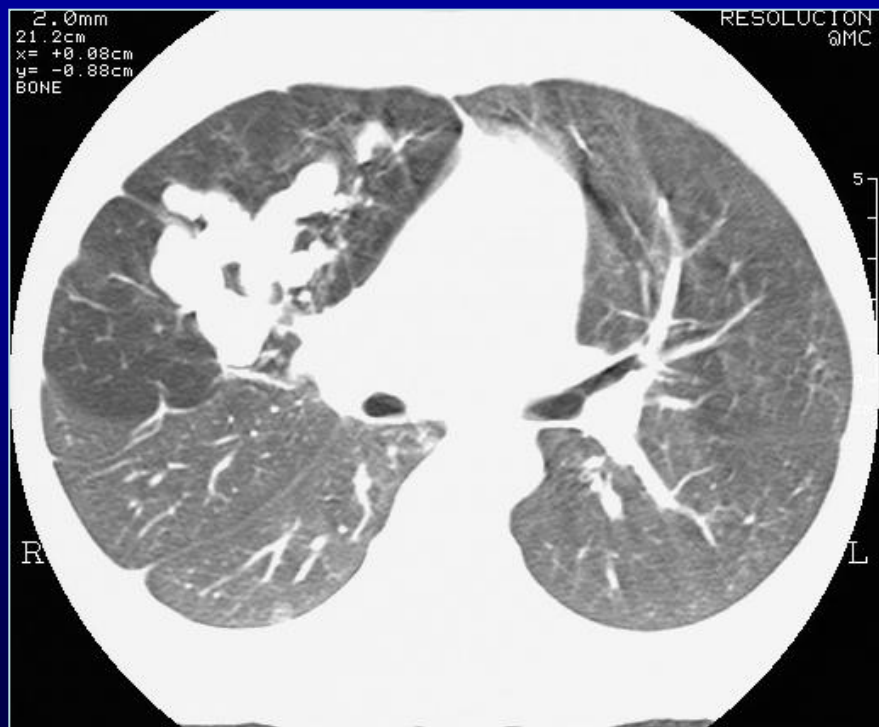
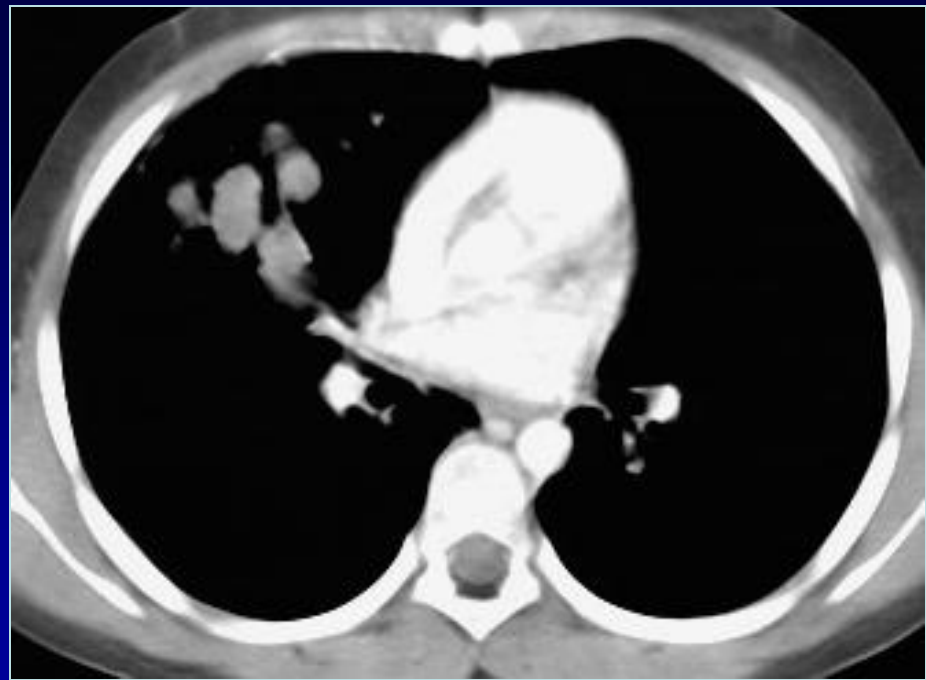
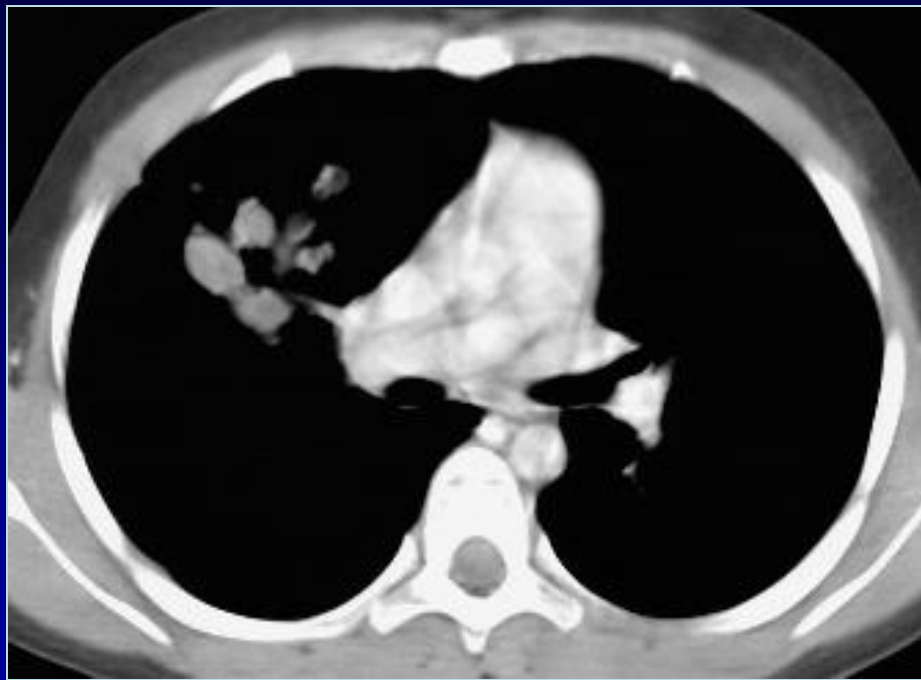


Finger-in-Glove Sign

- Visible on chest radiographs or CT
- Indicates mucoid impaction within an obstructed bronchus
- Characterized by branching tubular or fingerlike opacities

Finger-in-Glove Sign

- Originate from the hilum and are directed peripherally
- Also seen in cases of dilated bronchi with secretions
- Distal lung remains aerated by collateral drift through interalveolar pores (pores of Kohn) and Lambert canal



Golden S Sign

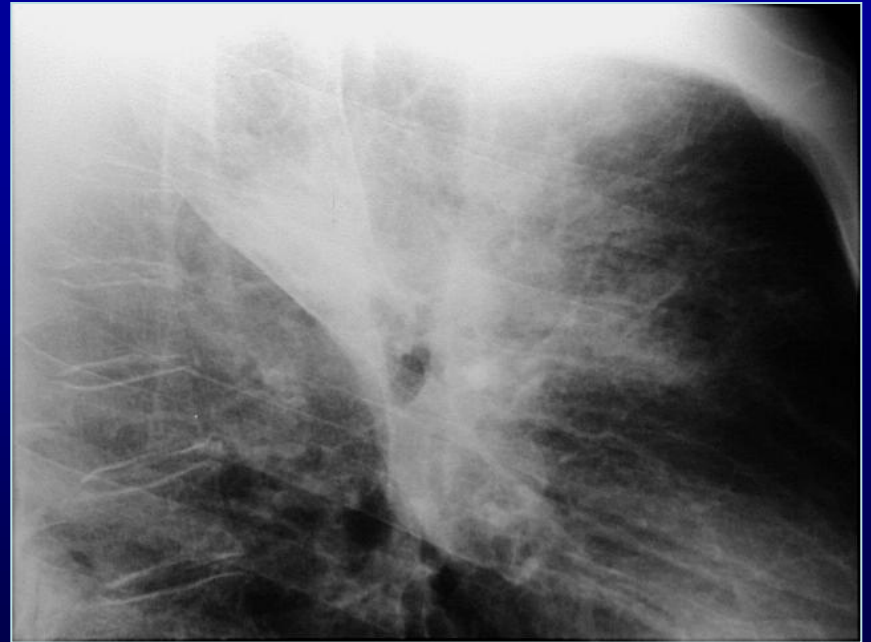
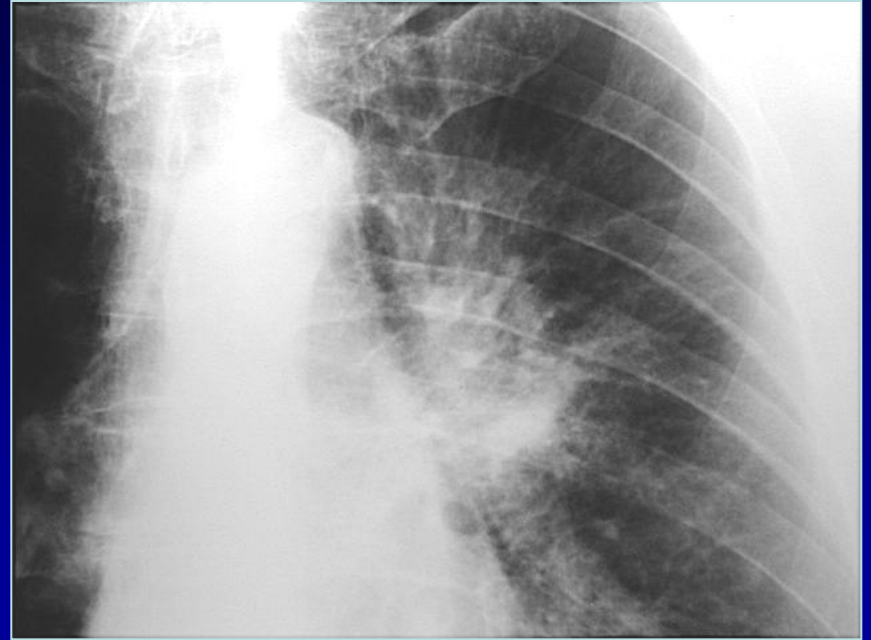
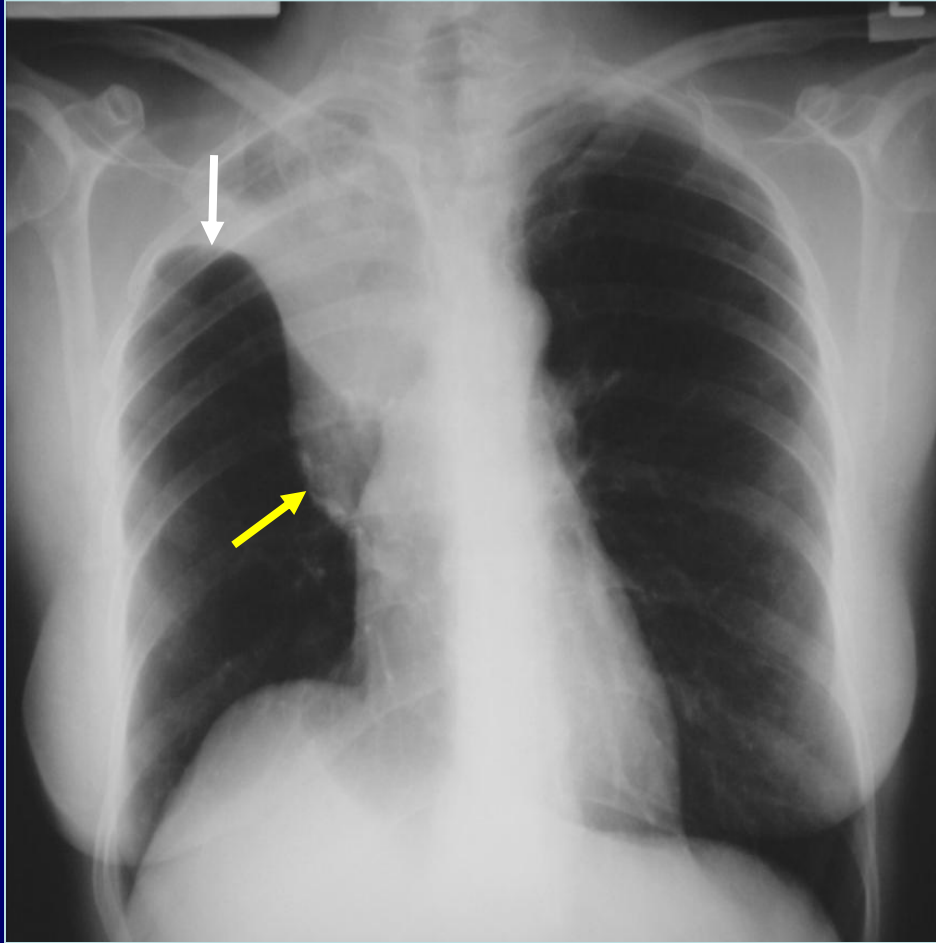
- Can be seen on PA/Lateral views & CT
- Described by Ross Golden in 1925
- Typically seen with RUL collapse, can also be seen w collapse of other lobes
- Resembles a reverse S shape also referred as reverse S sign of Golden

Golden S Sign

- Medial portion of minor fissure is convex inferiorly due to a central mass
- Lateral portion of the fissure is concave inferiorly

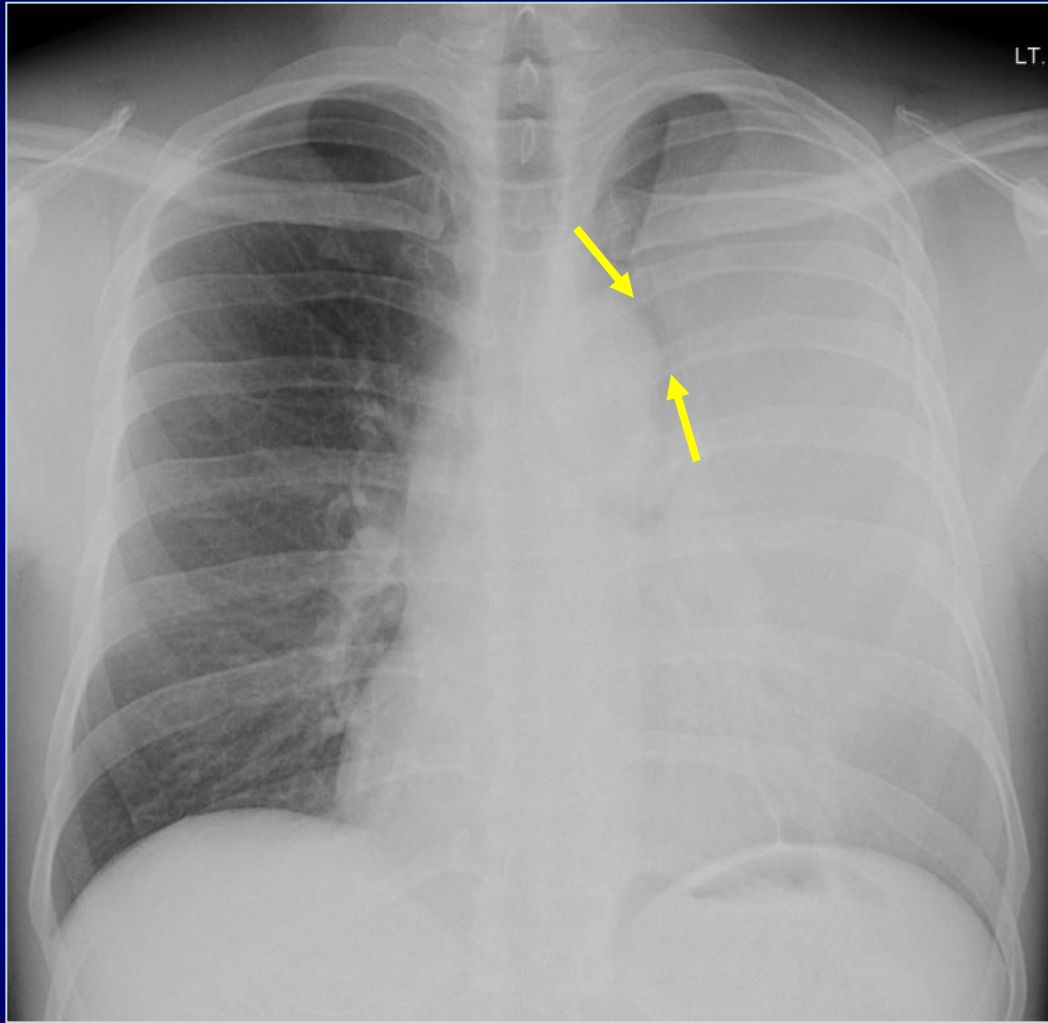
Golden S Sign

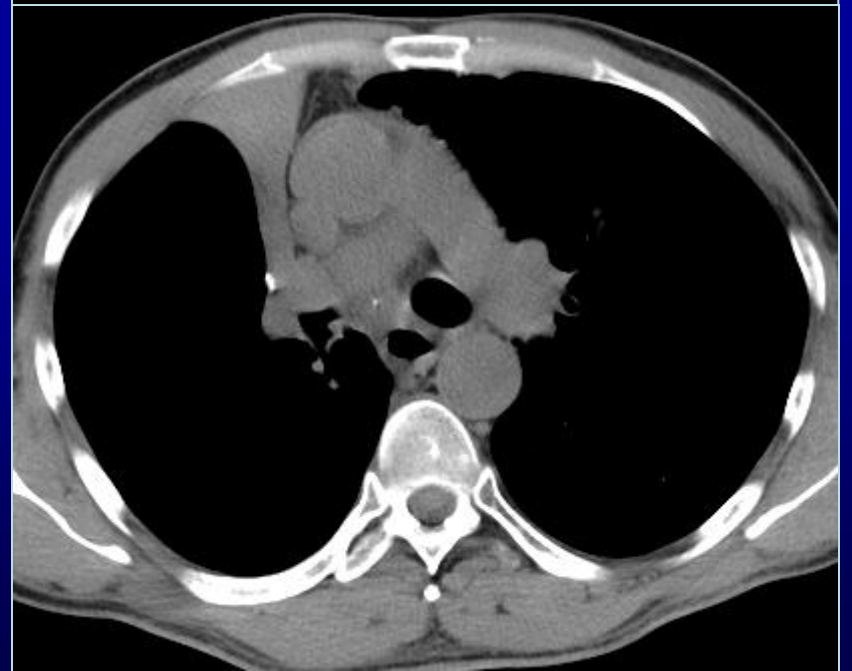
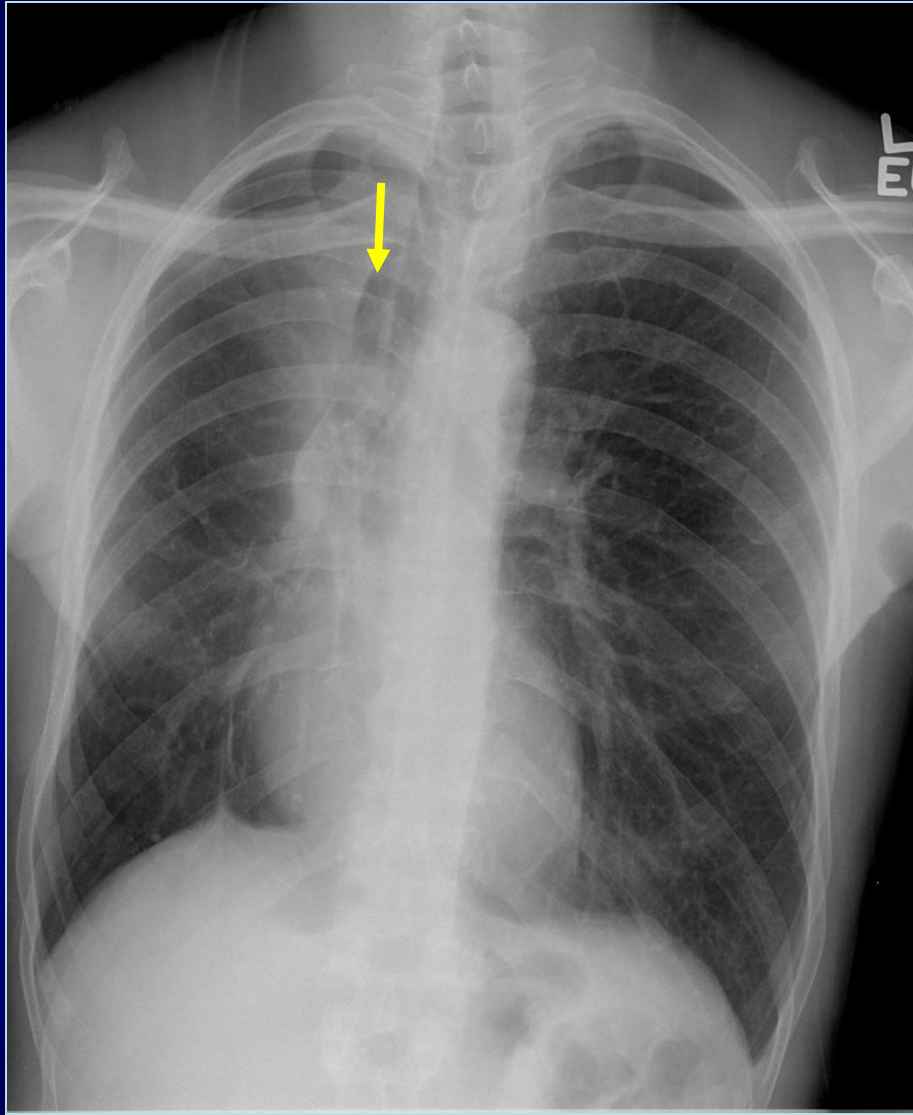
- Should raise suspicion of central neoplasm:
 - bronchial carcinoma
 - primary mediastinal tumor
 - metastasis
 - enlarged lymph nodes



Luftsichel Sign

- German for sickle of air (luft: air sichel: crescent)
- Paramediastinal lucency due to interposition of lower lobe apex between mediastinum and shrunken upper lobe
- Occurs more commonly on the left than in the right



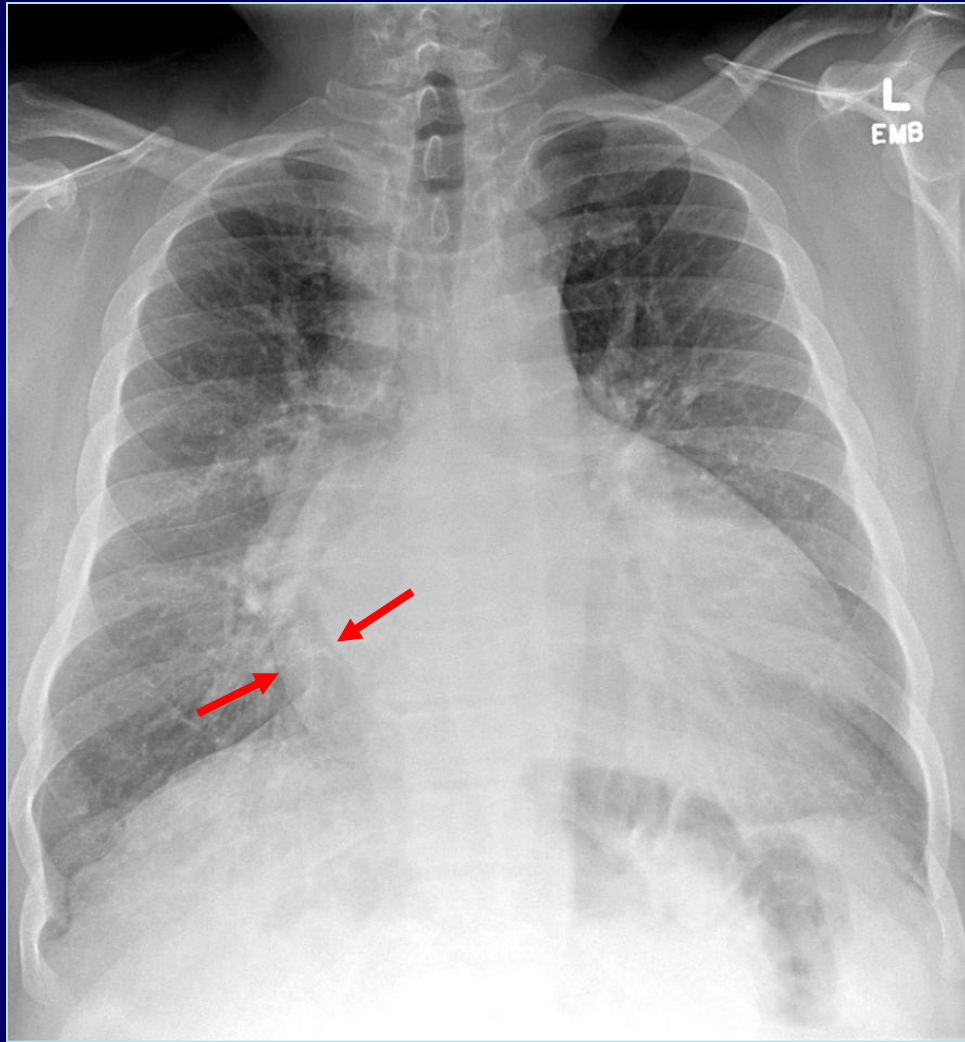


Double Density Sign

- Indicates left atrial enlargement
- Occurs when right side of the left atrium pushes into adjacent lung
- Splaying of the carina
- Superior displacement of left main stem bronchus on frontal view

Double Density Sign

- Posterior displacement of left main stem bronchus on lateral view
- Posterior displacement of esophagus on barium study

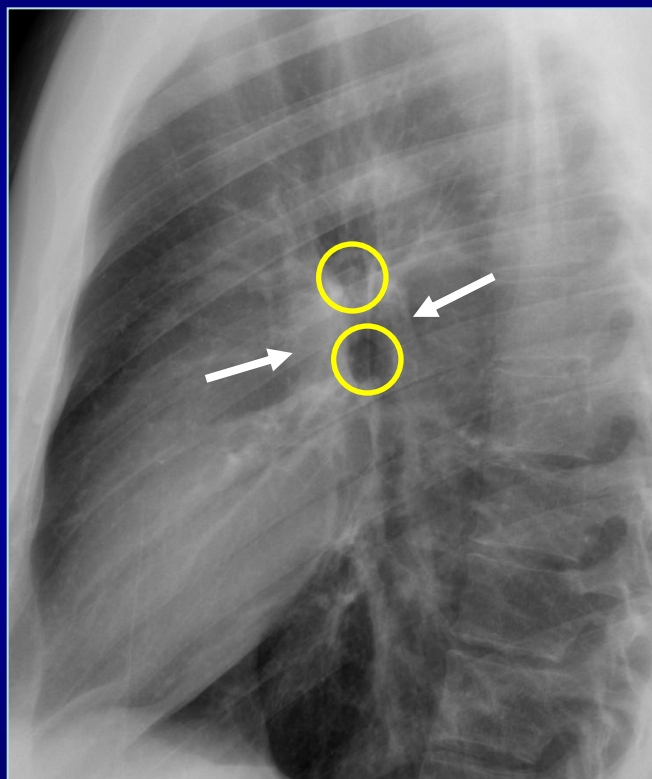


Walking Man Sign

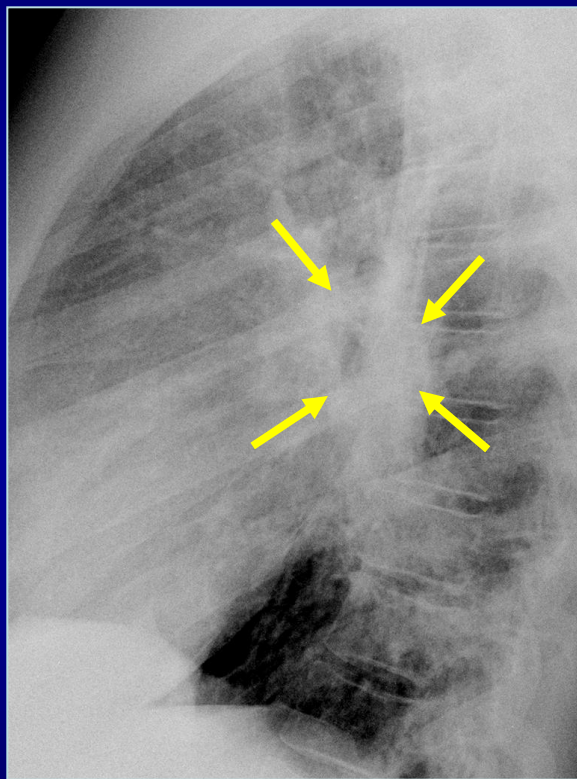
Doughnut Sign

- Detect mediastinal adenomegaly
- Lateral chest radiograph
- Subcarinal lymphadenopathy
- Mass posterior to bronchus intermedius and inferior hilar window
- CT primary modality for detecting mediastinal lymphadenopathy

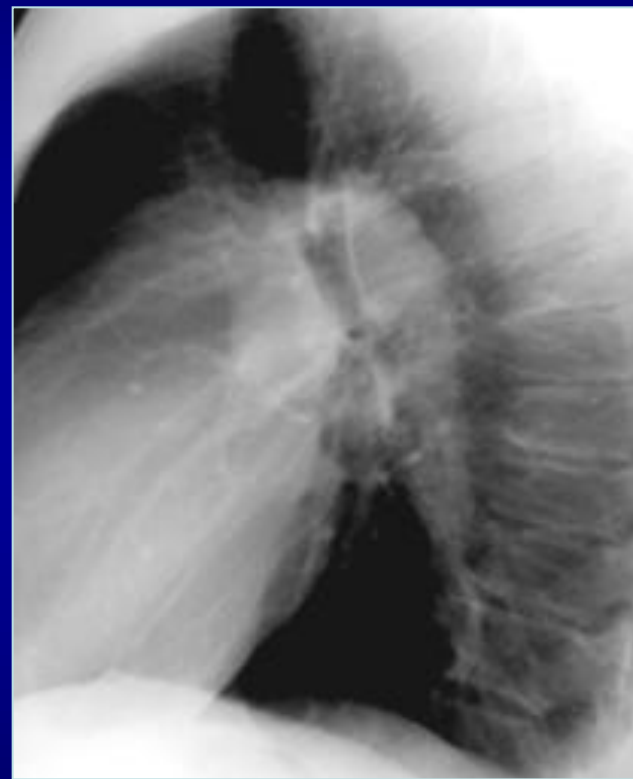
Normal



Lymphadenopathy



Pulmonary hypertension

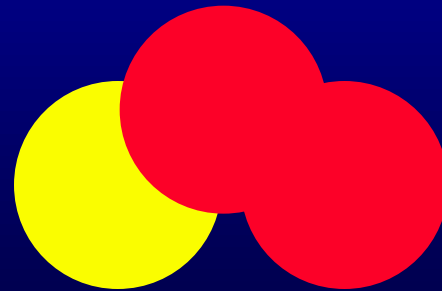
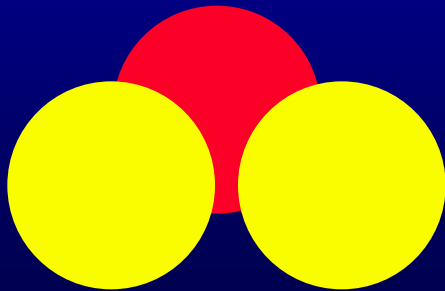


Silhouette Sign

- If an intra-thoracic radio-opacity is in anatomic contact with a border of heart or aorta will obscure that border
- An intra-thoracic lesion not anatomically contiguous with a border or a normal structure will not obliterate that border
- Definition given by B. Felson in 1950

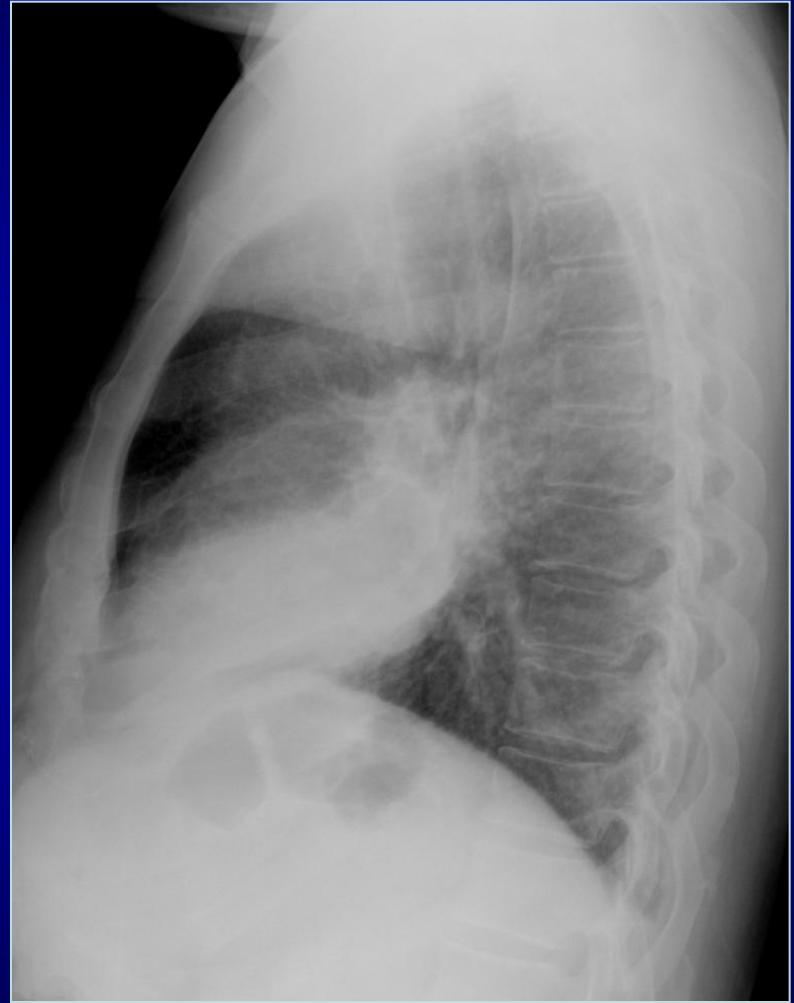
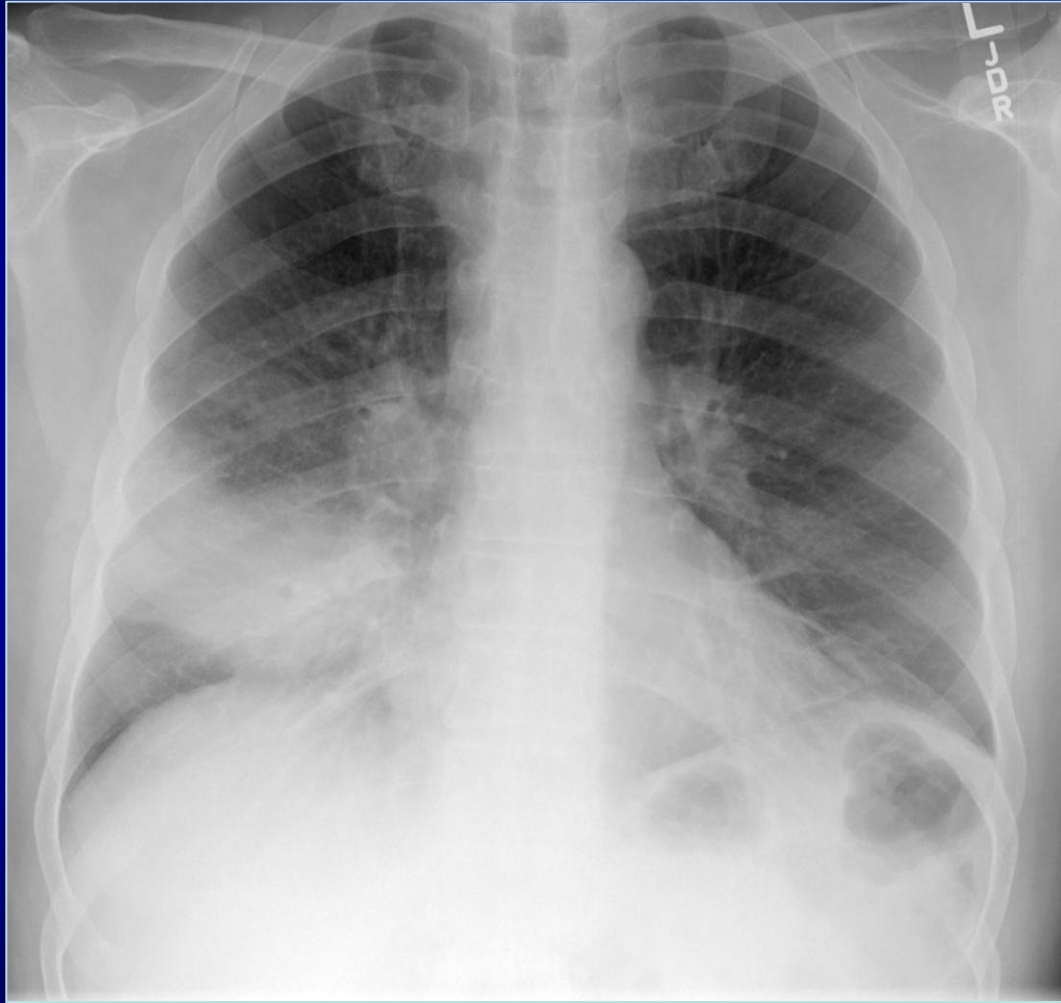
Silhouette Sign

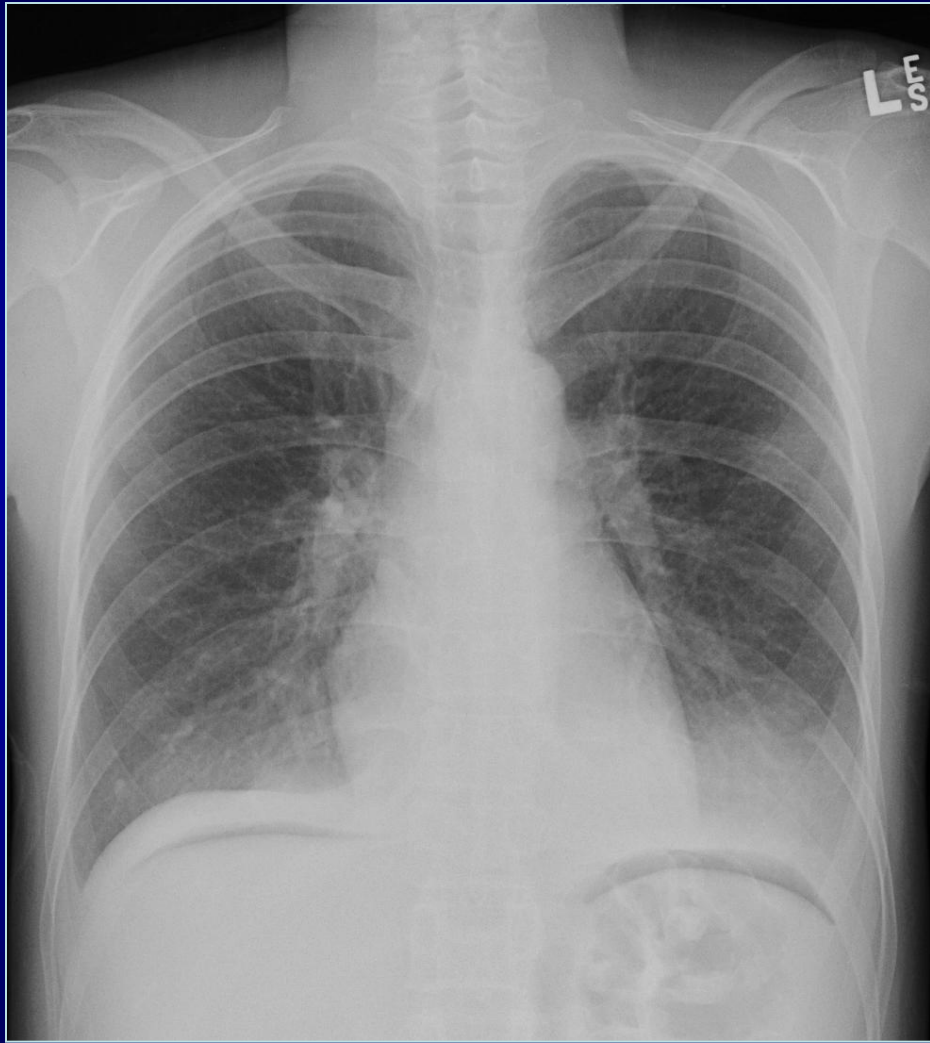
- Reliable sign distinguishing anterior lung lesions from posterior or lower lesions
- When two objects same density touch each other the edge between them disappears



Silhouette Sign

Silhouette/structure	Contact with lung
<ul style="list-style-type: none">• Upper R heart/asc. Ao• Right heart border• Upper left heart border• Left heart border• Aortic knob• Hemidiaphragm	<ul style="list-style-type: none">• Ant segment RUL• RML (medial)• Ant segment LUL• Lingula (anterior)• Apical portion LUL• Lower lobes



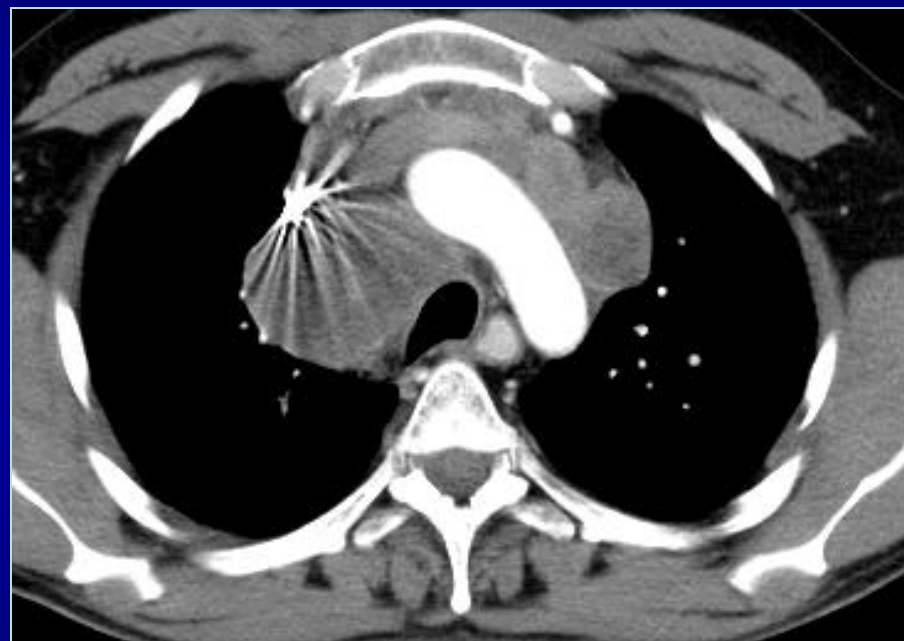


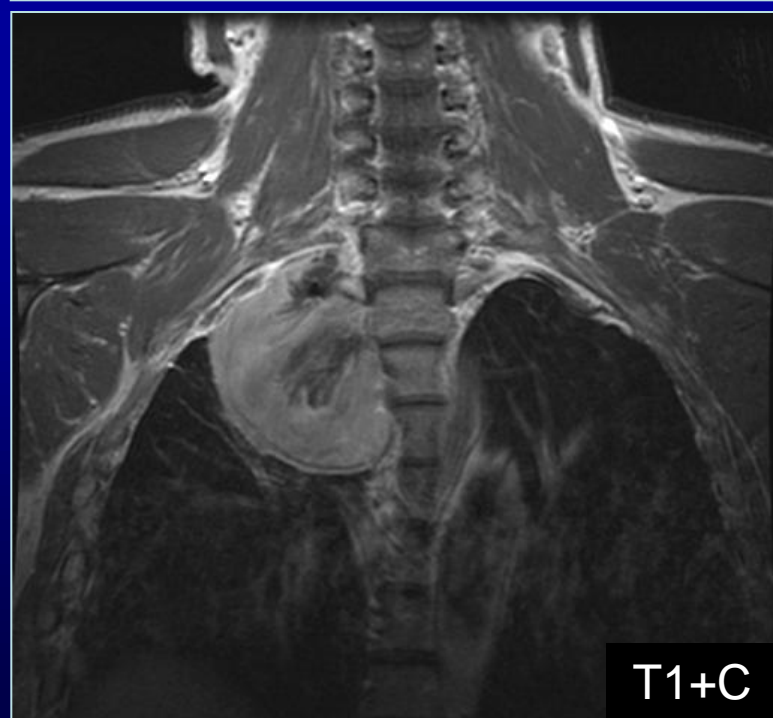
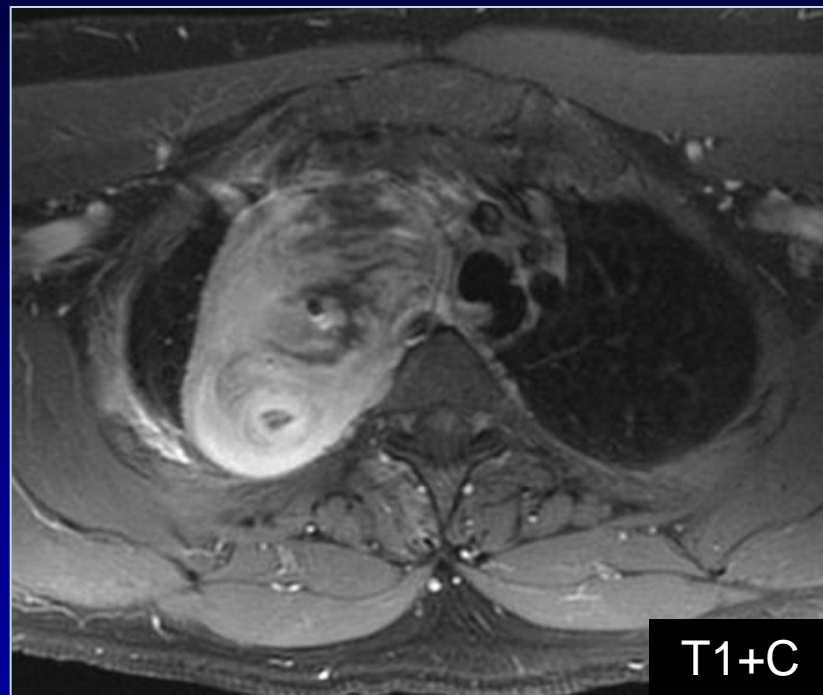
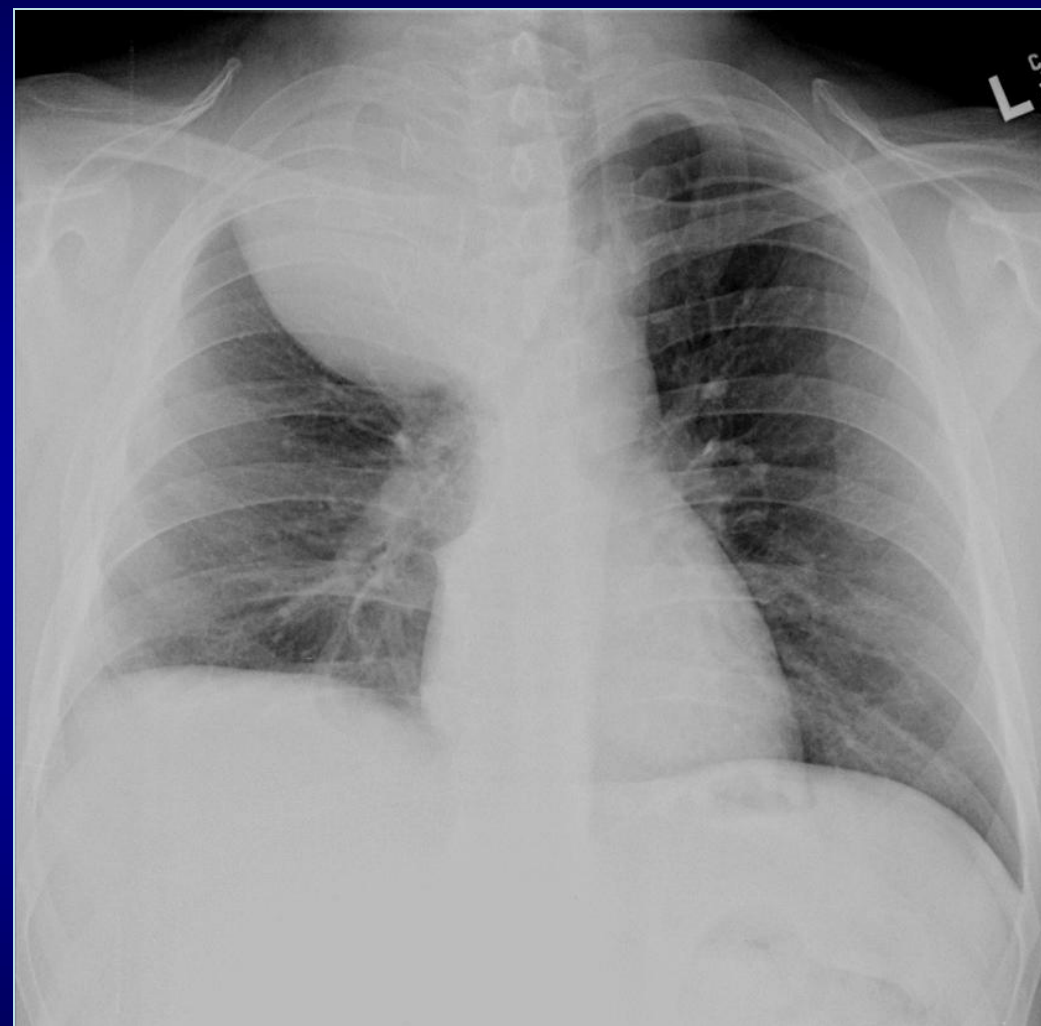
Cervicothoracic Sign

- Used to determine location of mediastinal lesion in the upper chest
- Based on principle that an intrathoracic lesion in direct contact with soft tissues of the neck will not be outlined by air
- Uppermost border of the anterior mediastinum ends at level of clavicles

Cervicothoracic Sign

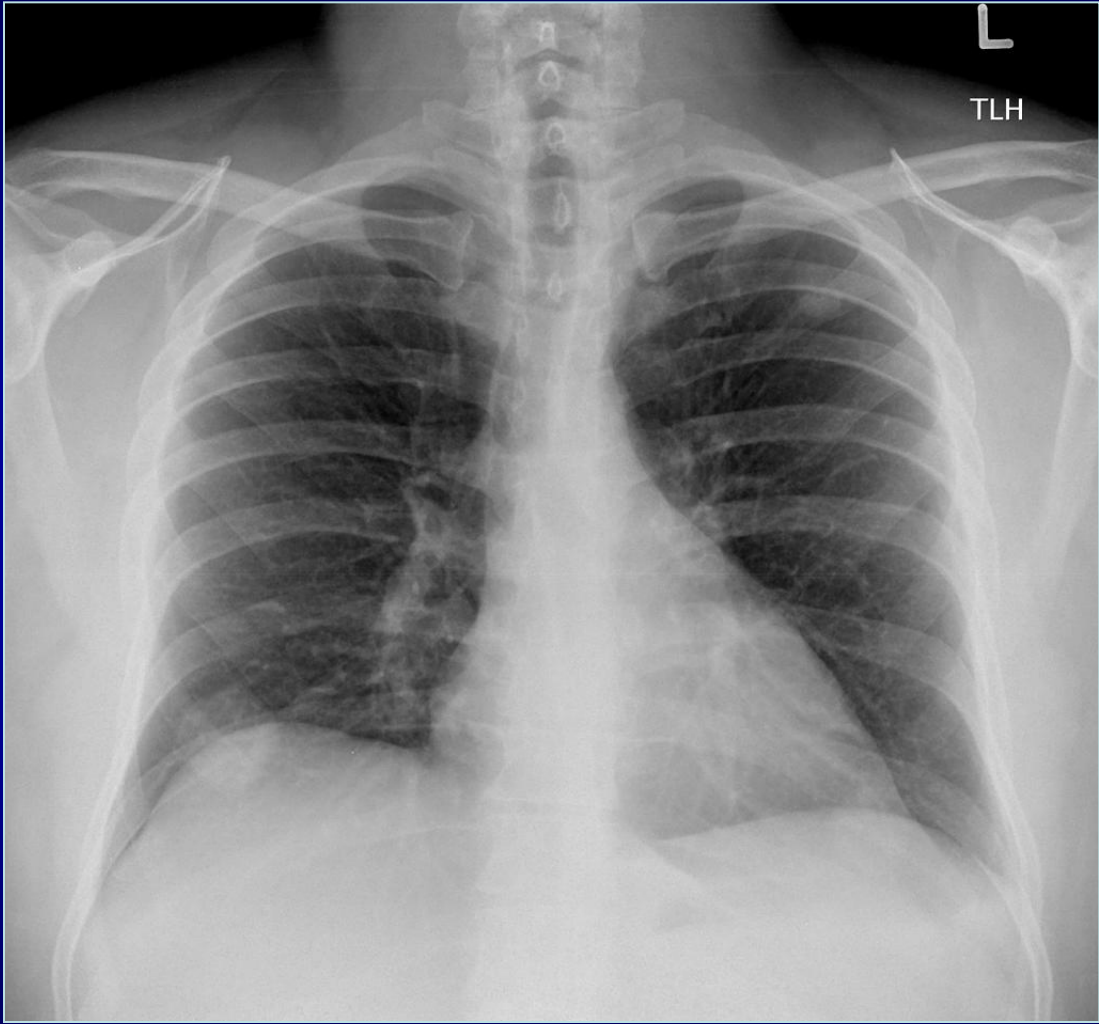
- Middle and posterior mediastinum extends above the clavicles
- Mediastinal mass projected superior the level of clavicles must be located either within middle or posterior mediastinum
- More cephalad the mass extends the most posterior the location





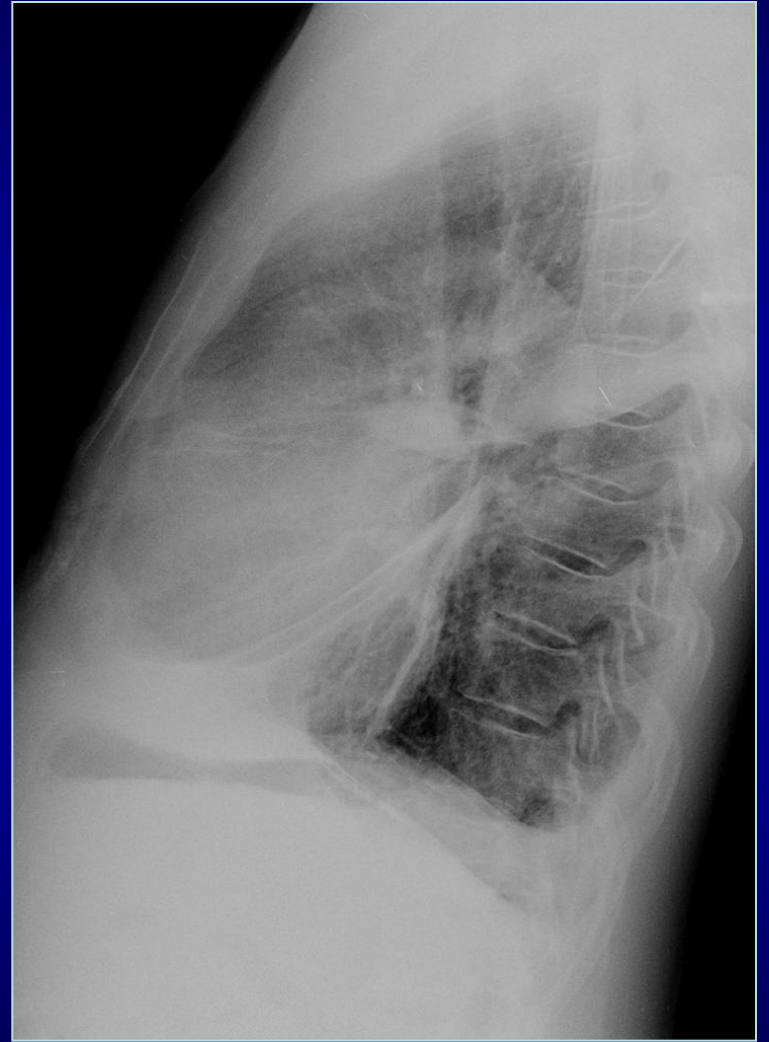
Thoracoabdominal Sign

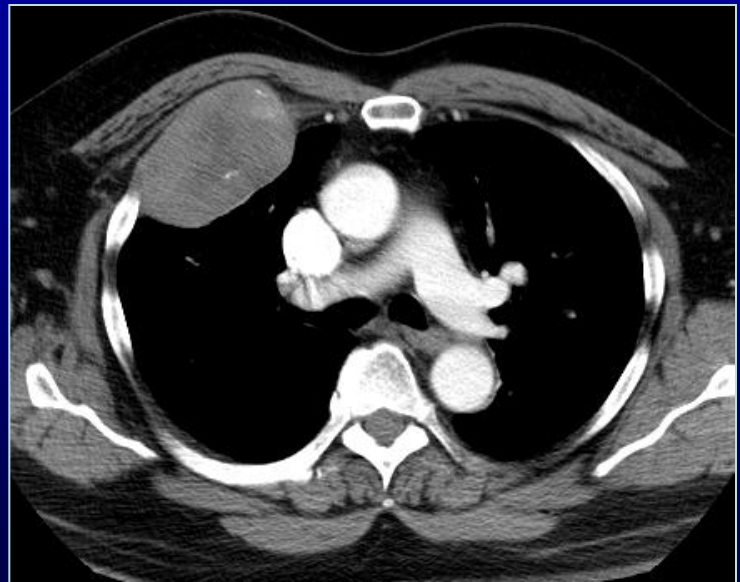
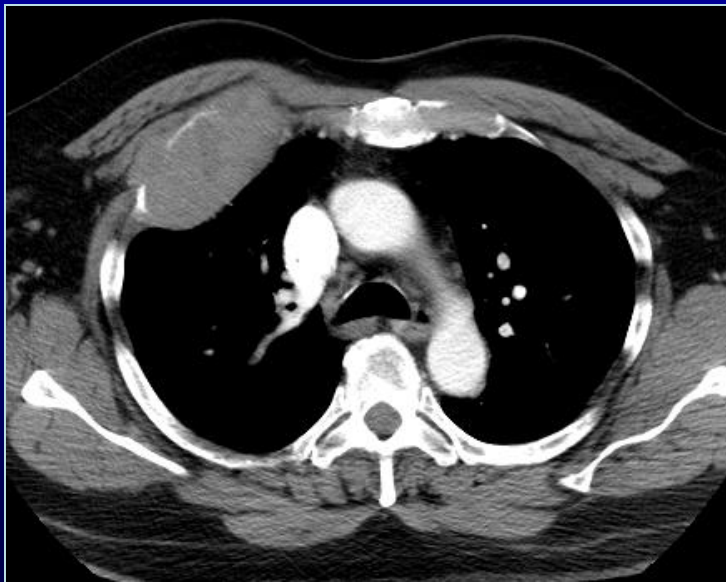
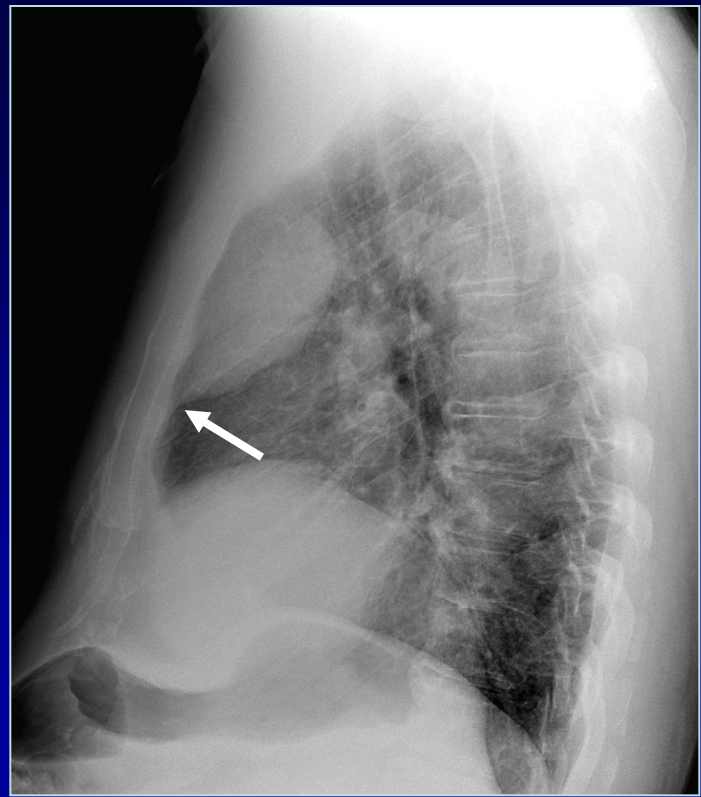
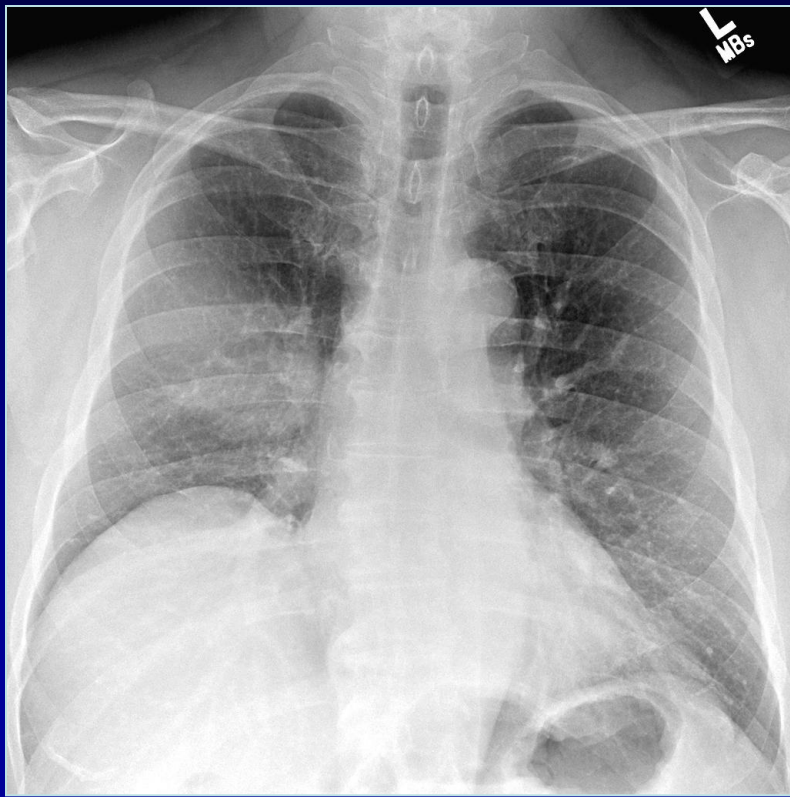
- Posterior costophrenic sulcus extends more caudally than anterior basilar lung
- Lesion extends below the dome of diaphragm must be in posterior chest whereas lesion terminates at dome must be anterior
- Cervicothoracic and thoracoabdominal signs were described by Felson



Tapered Margins Sign

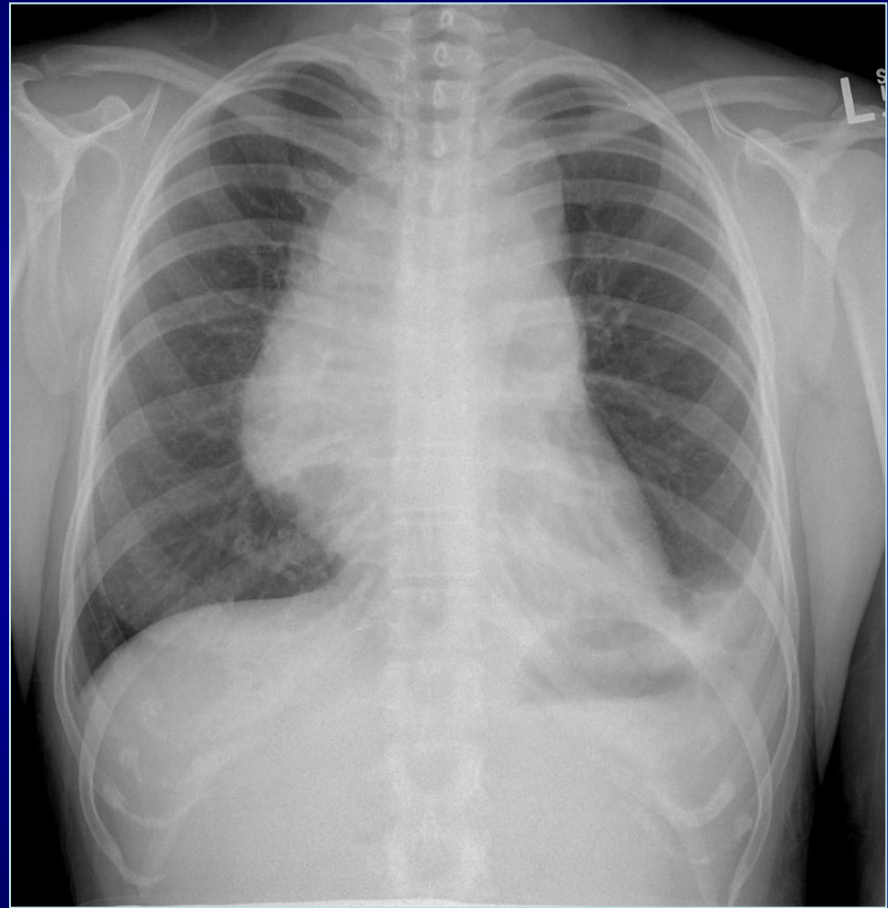
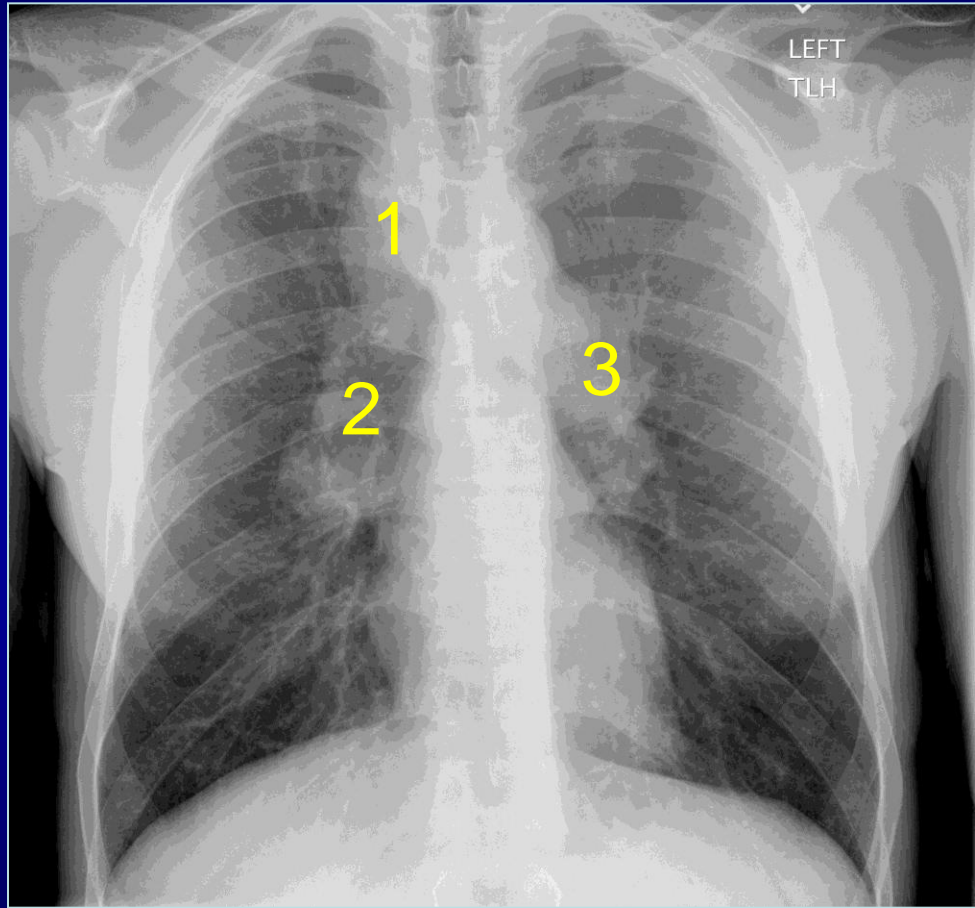
- A lesion in the chest wall, pleura or mediastinum have smooth tapered borders and obtuse angles
- While parenchymal lesions usually form acute angles





1-2-3 Sign

- Characterized by bilateral hilar and right paratracheal lymphadenopathy
 - so-called Garland triad or 1-2-3 sign
- Suggestive of sarcoidosis
- Separation between nodes and heart which is not seen in lymphoma



Epicardial Fat Pad Sign

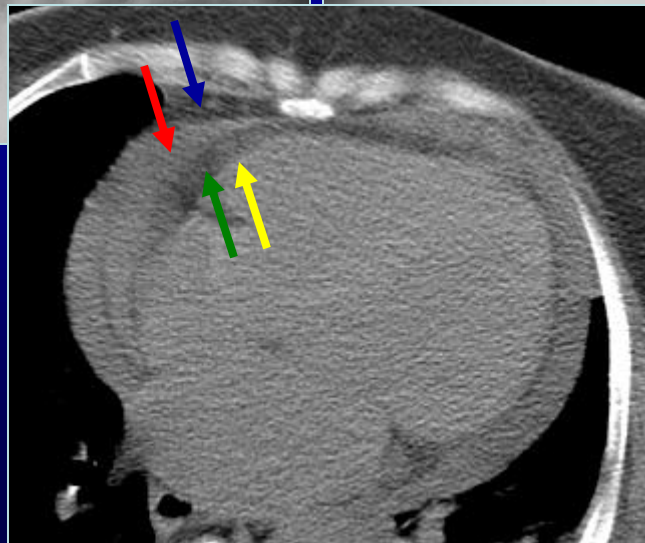
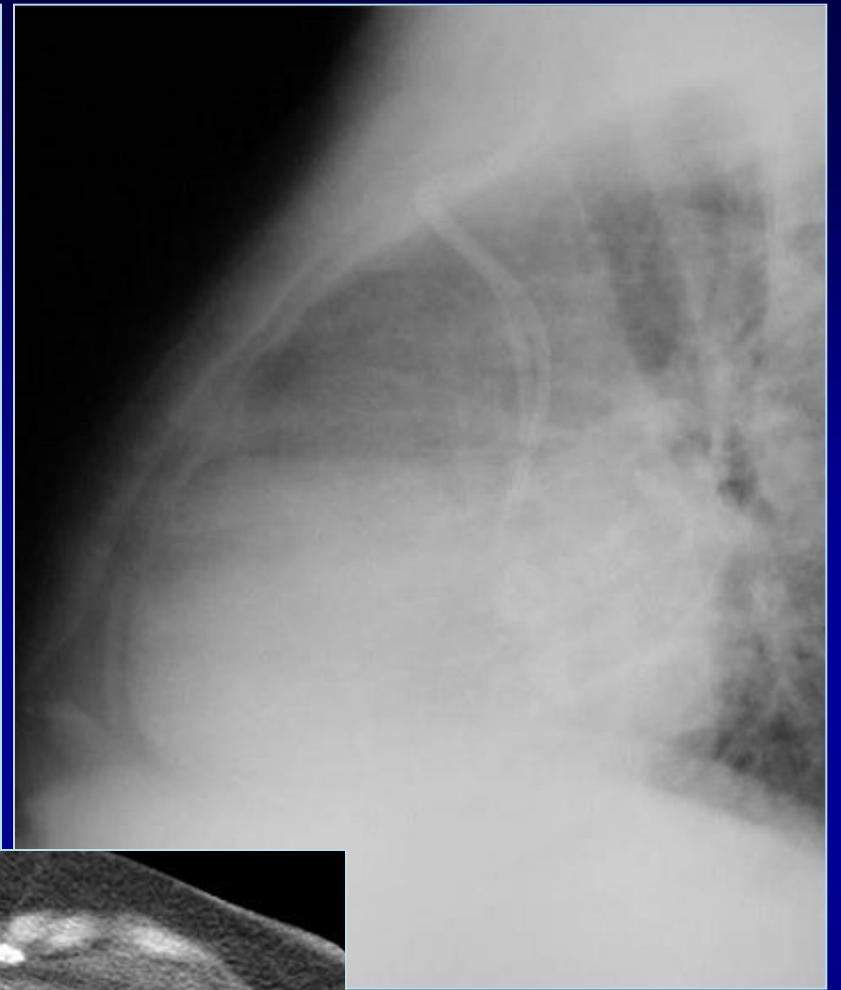
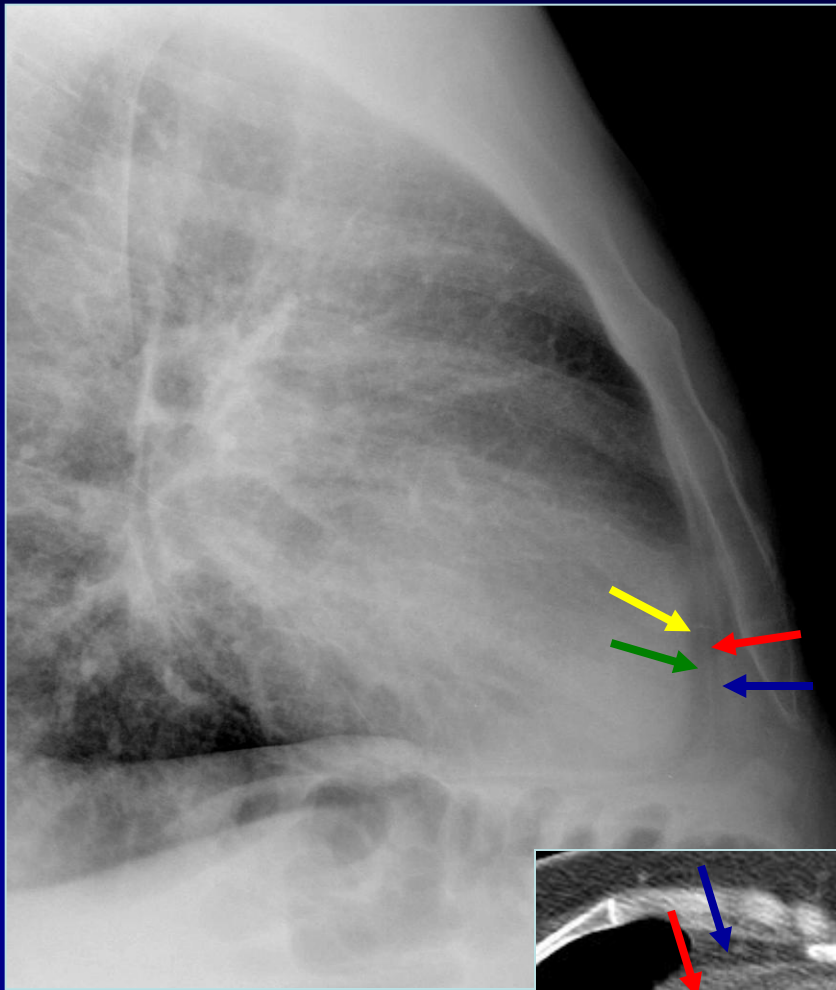
- Indicates pericardial effusion
- Kremens and Torrance in 1955 were the first to draw attention in this sign
- Epicardial fat allows the silhouette of two layers pericardium to appear separate from the heart
- Normally pericardium measures 1-2 mm

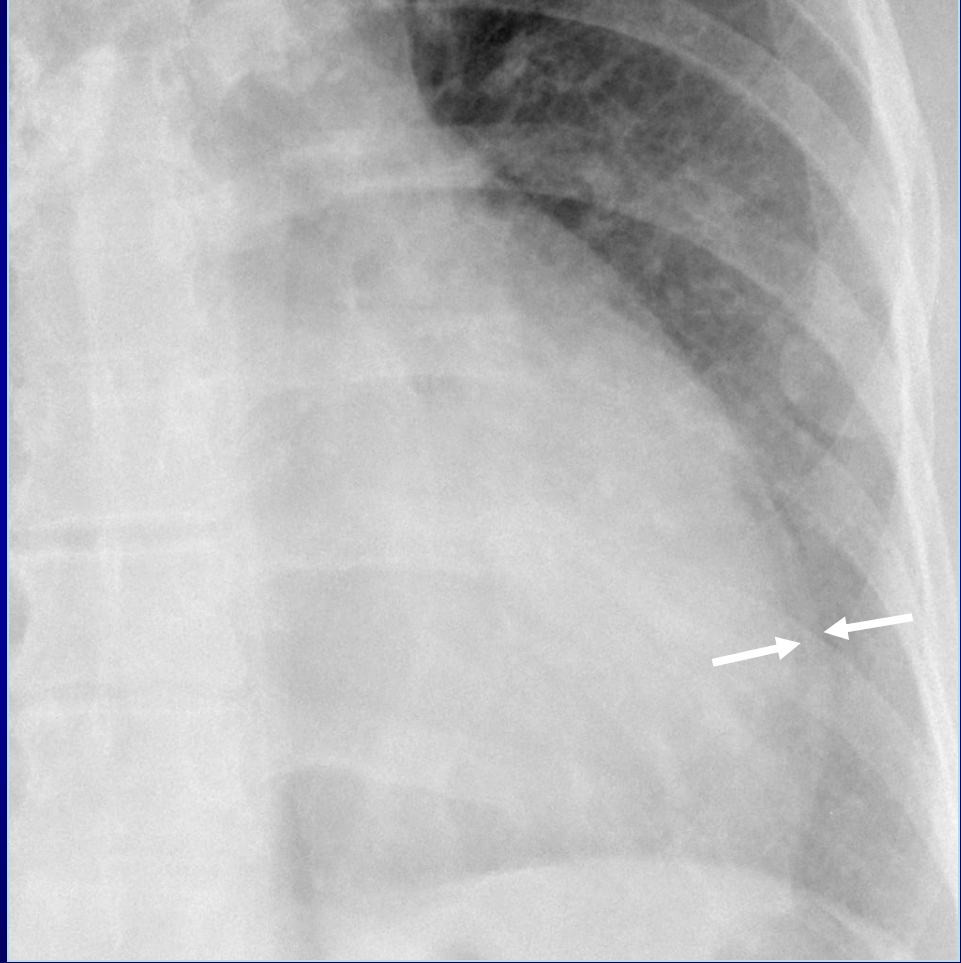
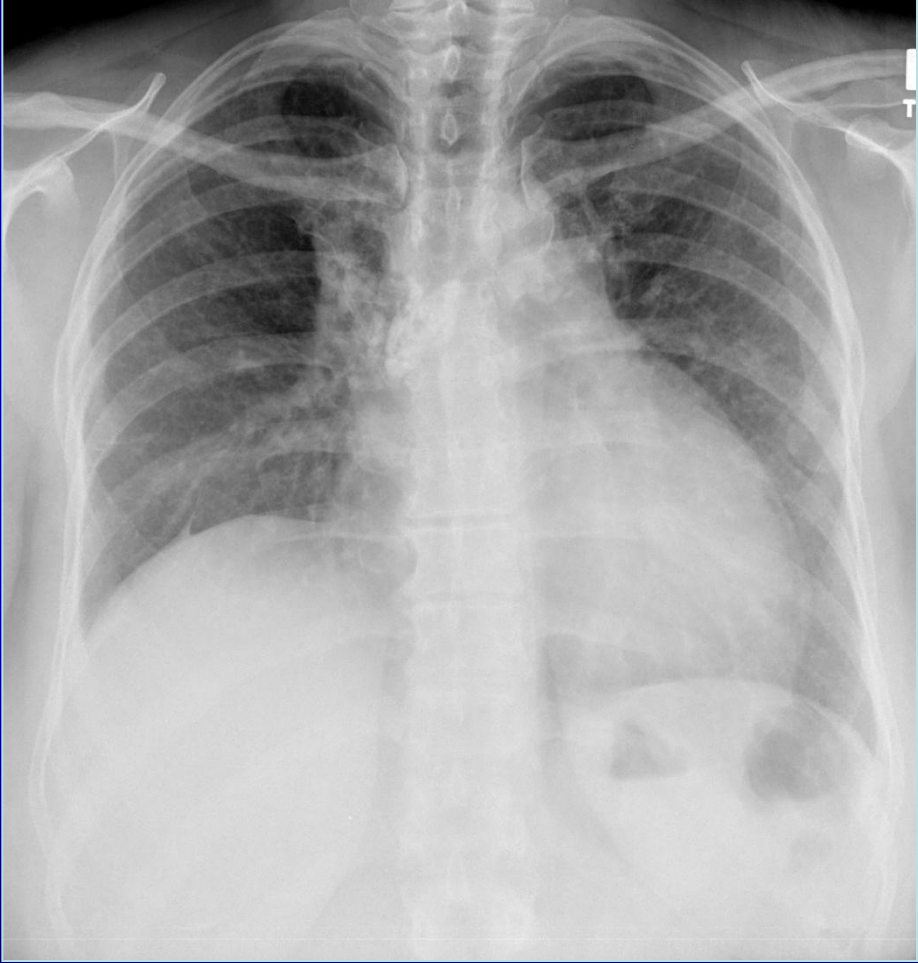
Epicardial Fat Pad Sign

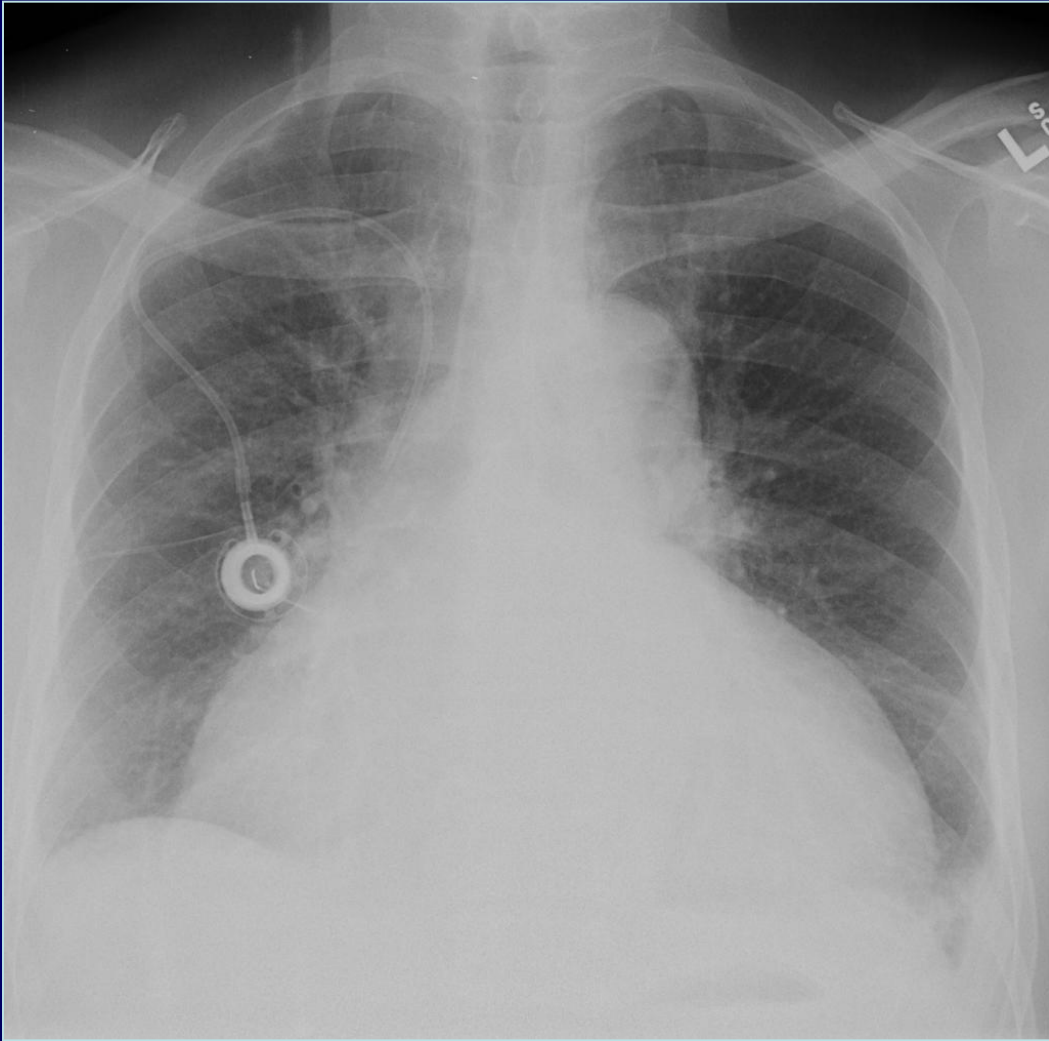
- Thickness exceeding 2 mm suggests pericardial effusion
- Widening of pericardial shadow creates appearance of inward displacement of epicardial fat
- Rarely is due to extrapericardial disease

Pericardial Effusion Imaging Findings

- Conventional radiography
 - water bottle configuration
 - loss of retrosternal clear space
 - epicardial fat pad sign
- Echocardiogram study of choice
- CT may detect small effusions (50 cc)
- MRI characterize fluid





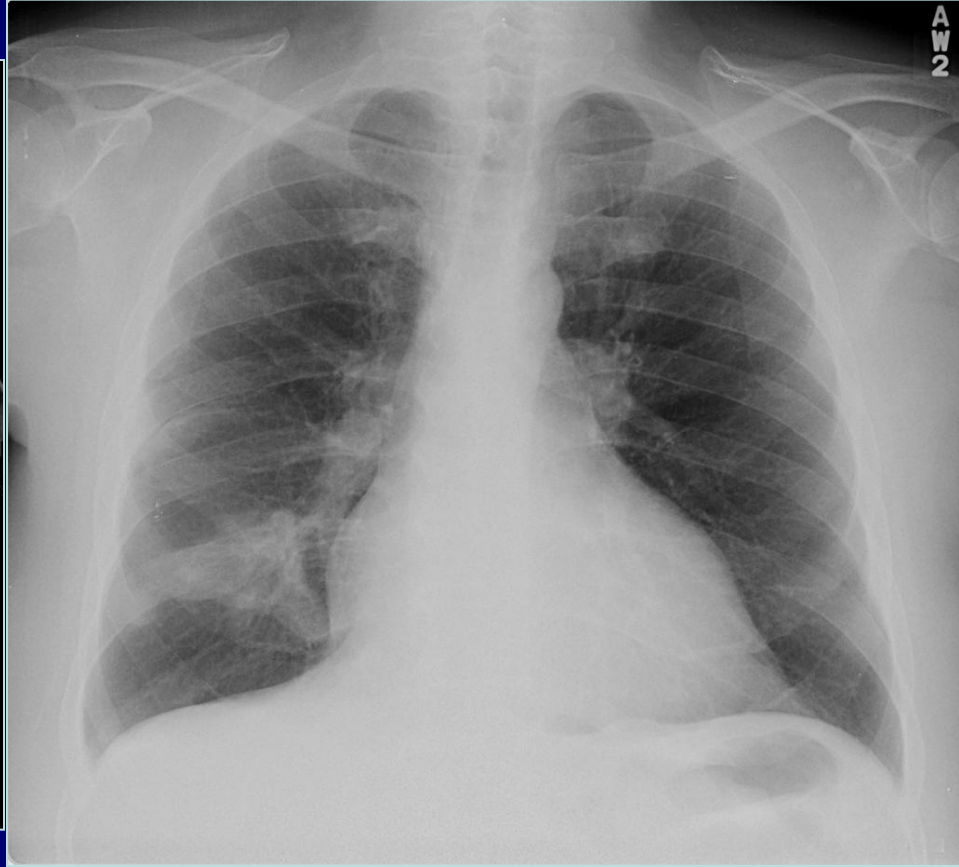
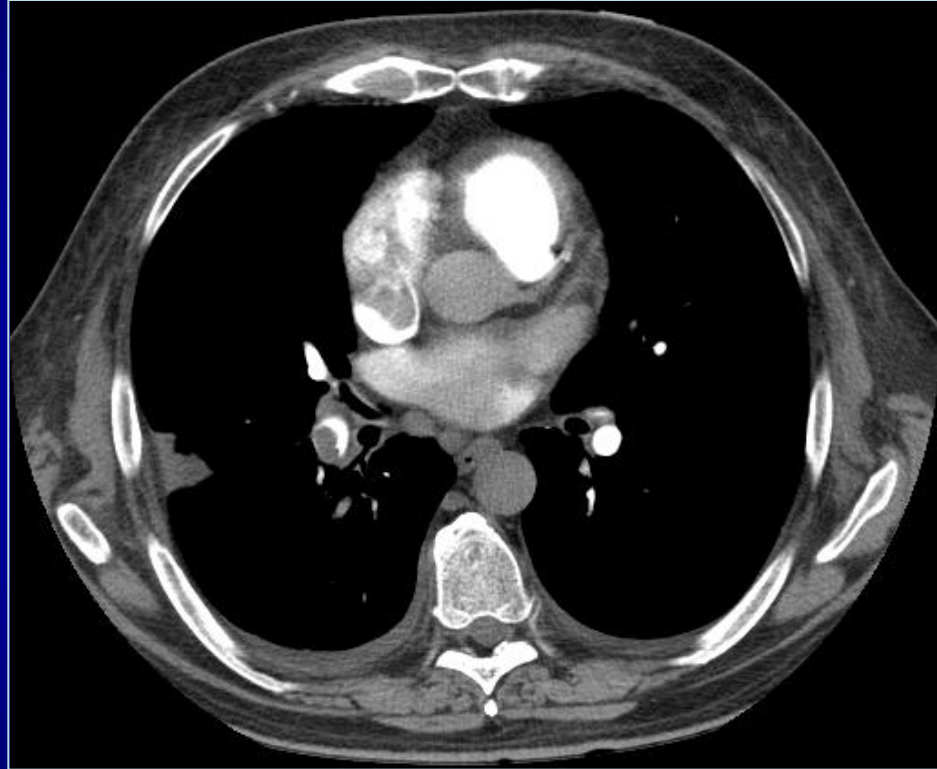


Water Bottle Sign



Hampton's Hump Sign

- Described by Audrey Hampton in 1940
- Peripheral wedge-shaped opacity due to infarction
- Pleura-based consolidation in the form of truncated cone w base against pleural surface and apex pointing toward hilum

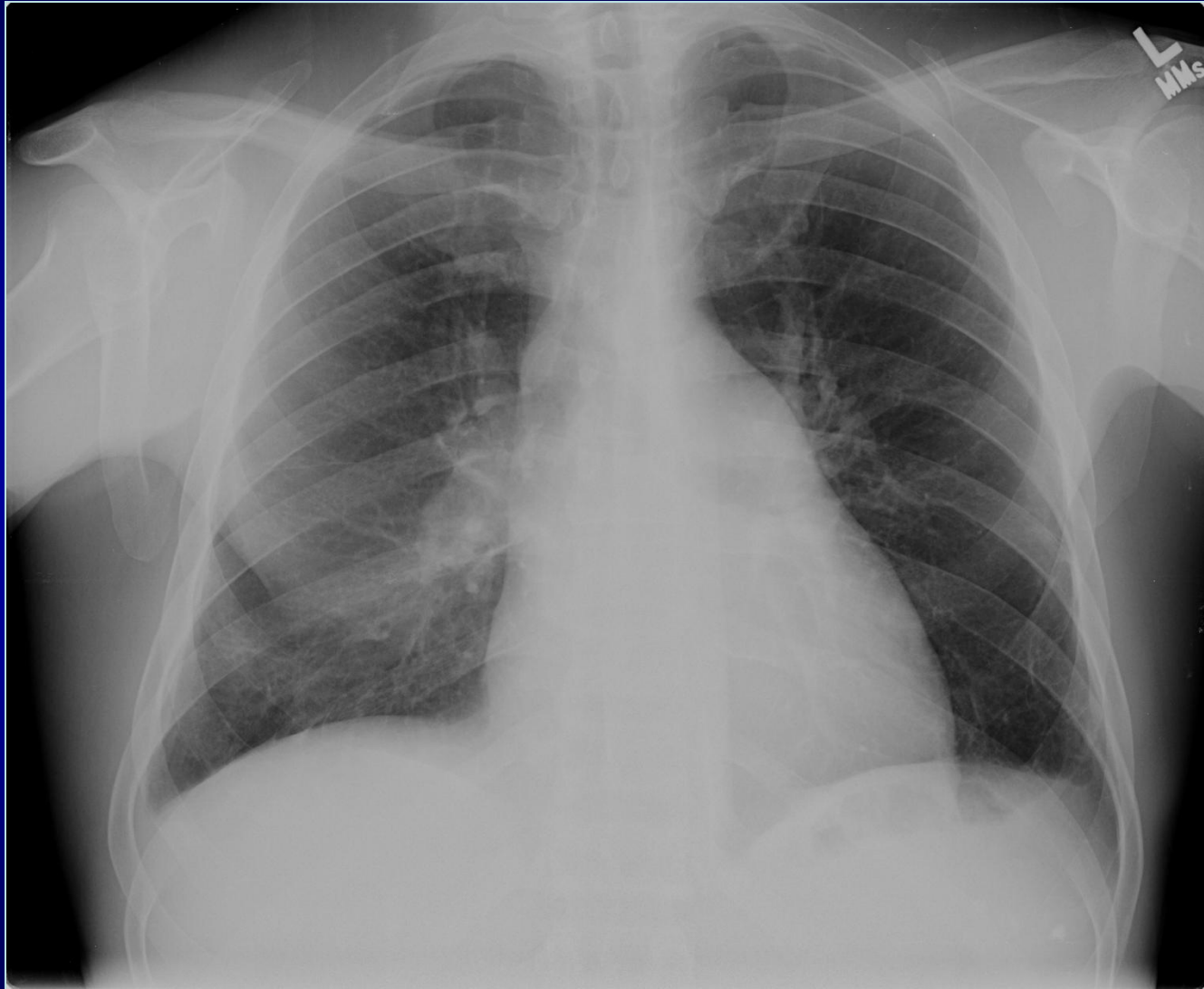


Westermarck Sign

- Described by Neils Westermarck in 1938
- Chest radiograph and CT show increased lucency or hypoattenuation
- Typically signifies either occlusion of a larger lobar/segmental artery or widespread small vessel occlusion

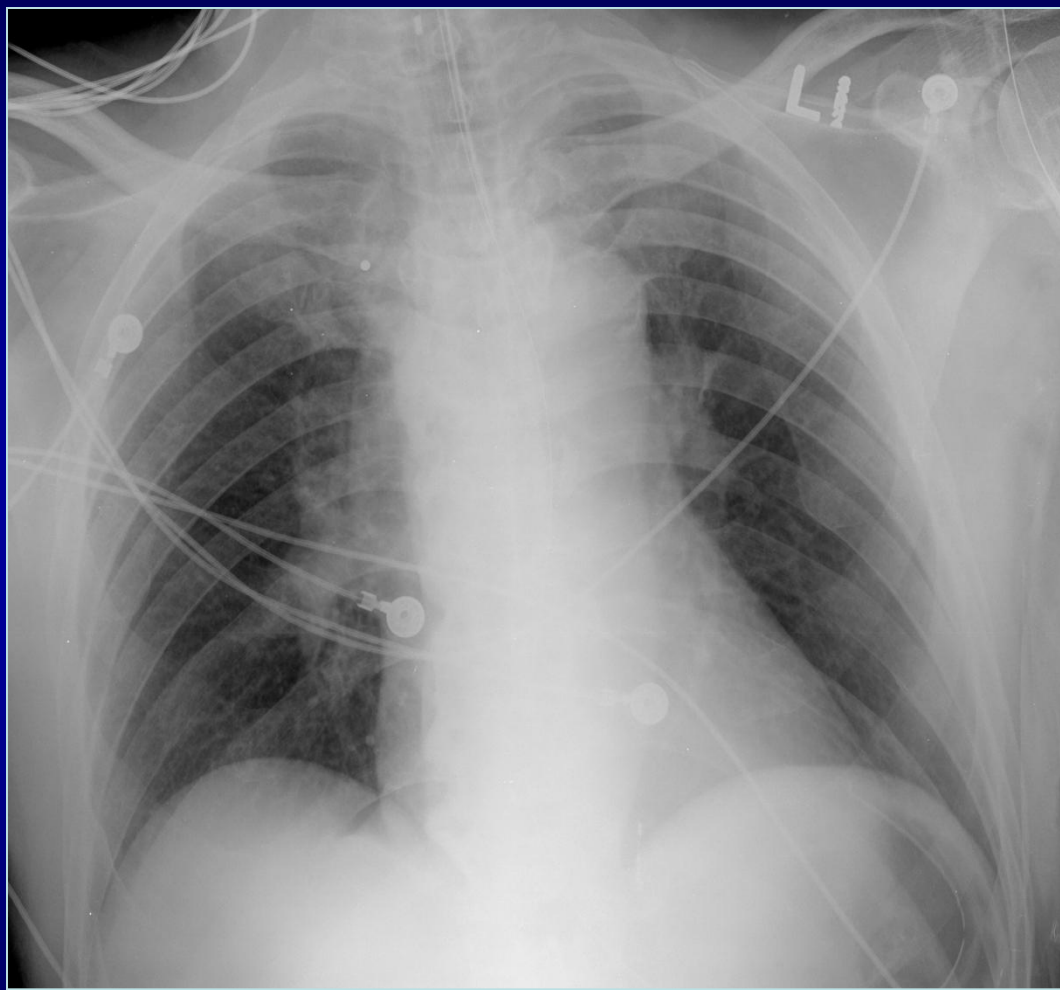
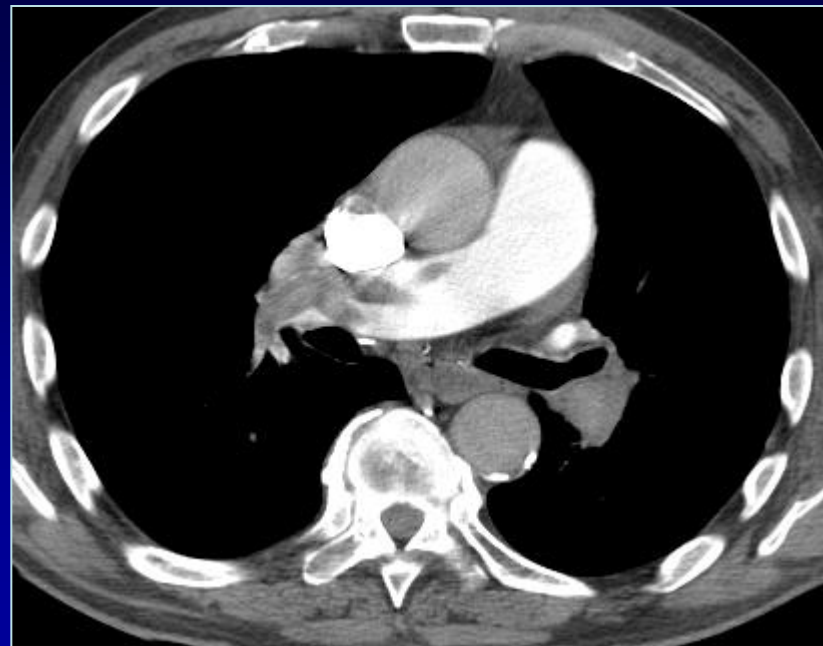
Westermark Sign

- Represents oligemia distal to PE
- Seen only in 2% of patients
- Sign results from combination of
 - dilatation pulmonary arteries proximal embolus
 - collapse of distal vasculature
- Low sensitivity 11%, high specificity 92%



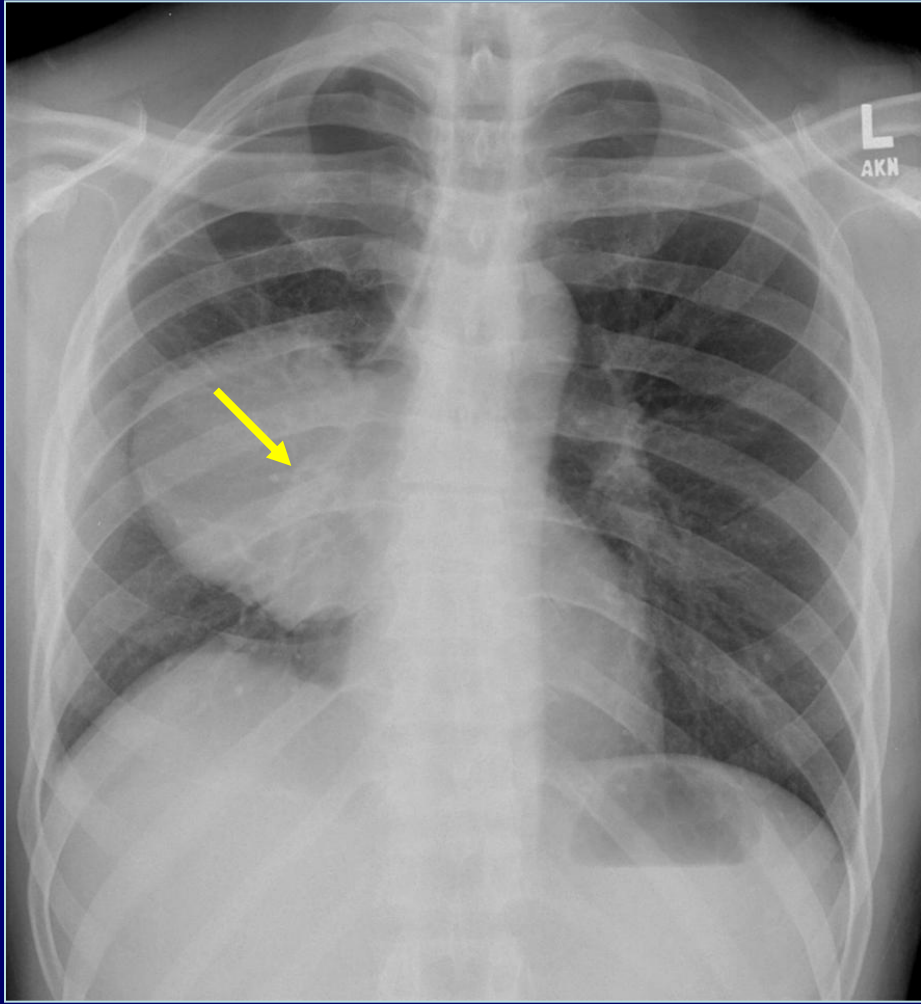
Fleischner Sign

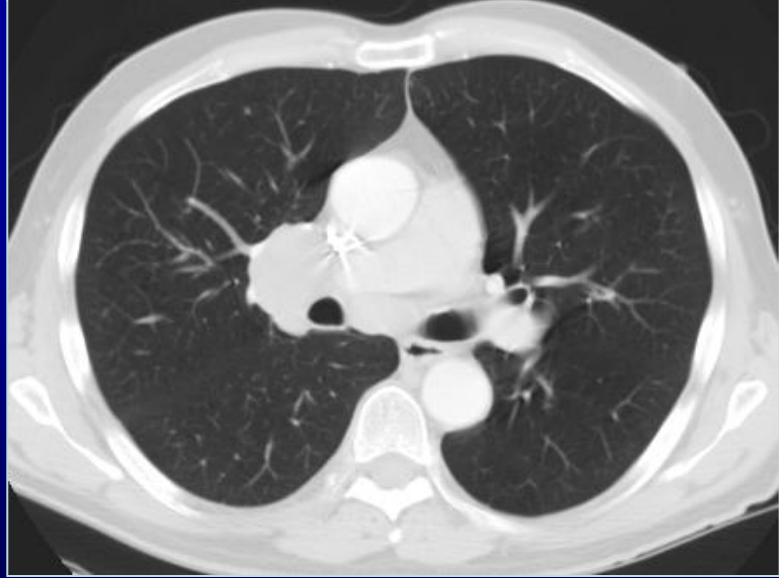
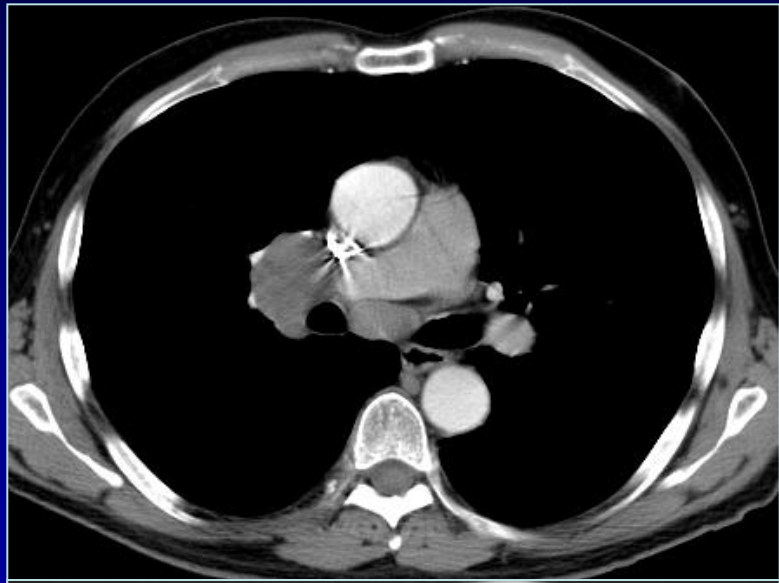
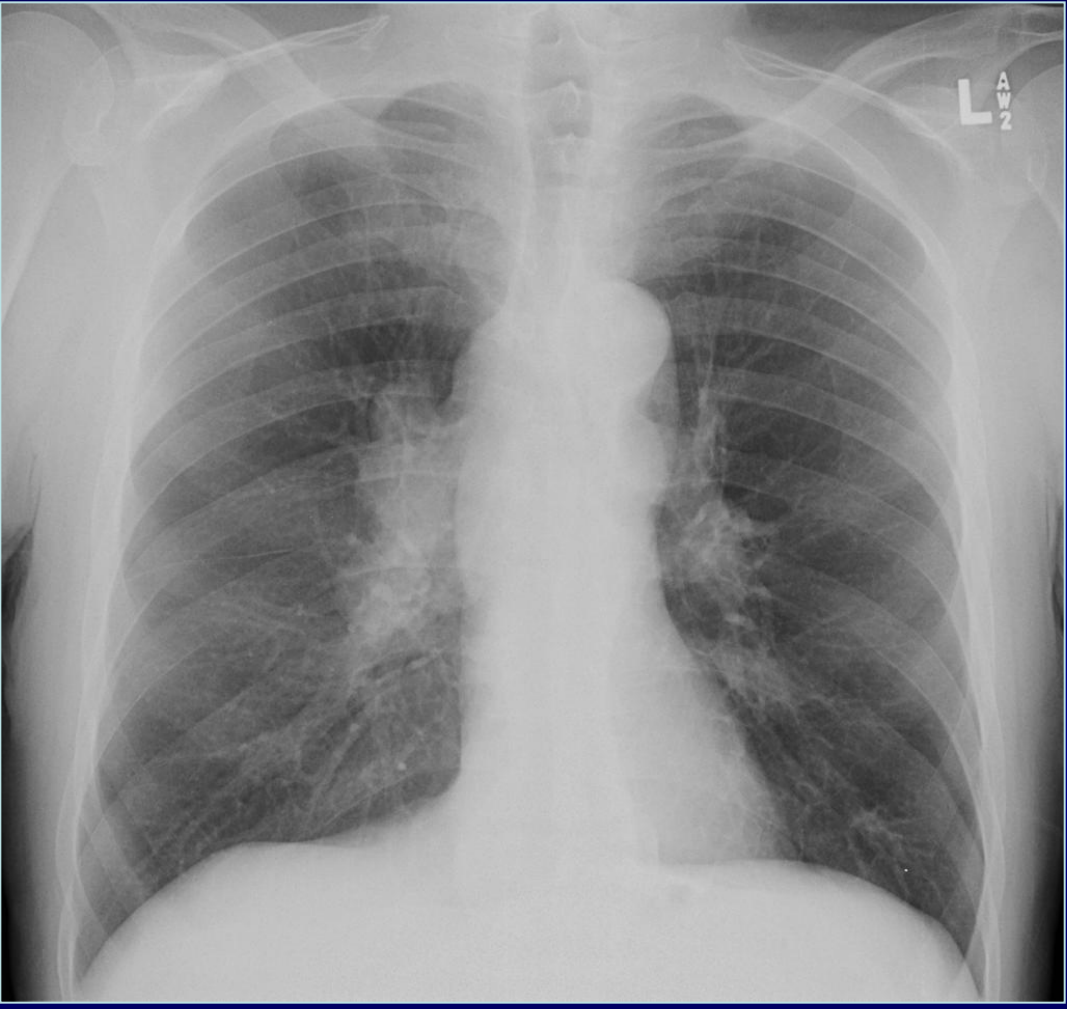
- Described by Felix Fleischner
- Enlargement proximal pulmonary arteries on plain film or angiography
- PA enlargement due to embolus
- Commonly in the setting of massive PE
- It has relatively low sensitivity
- Abrupt tapering of an occluded vessel distally (knuckle sign)



Hilum Overlay Sign

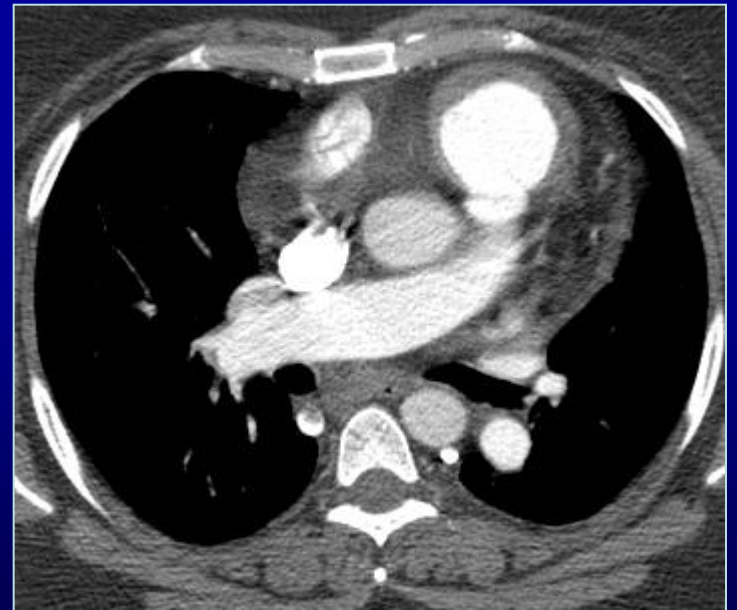
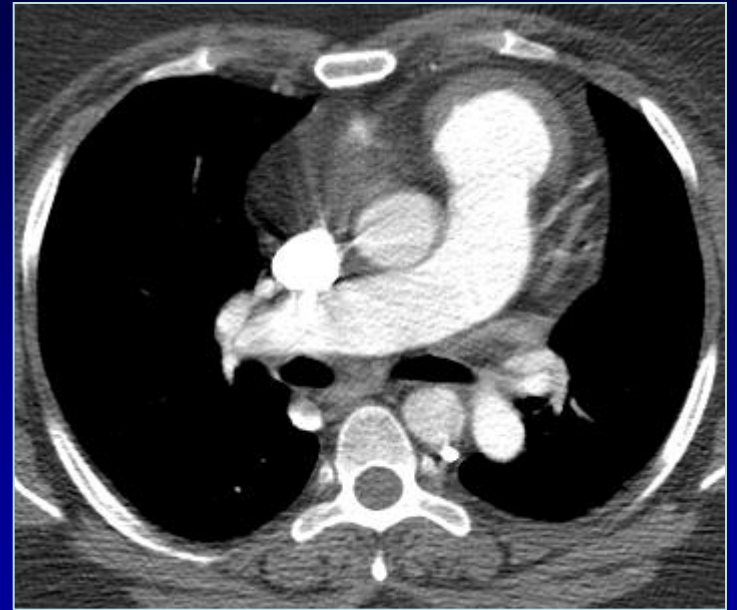
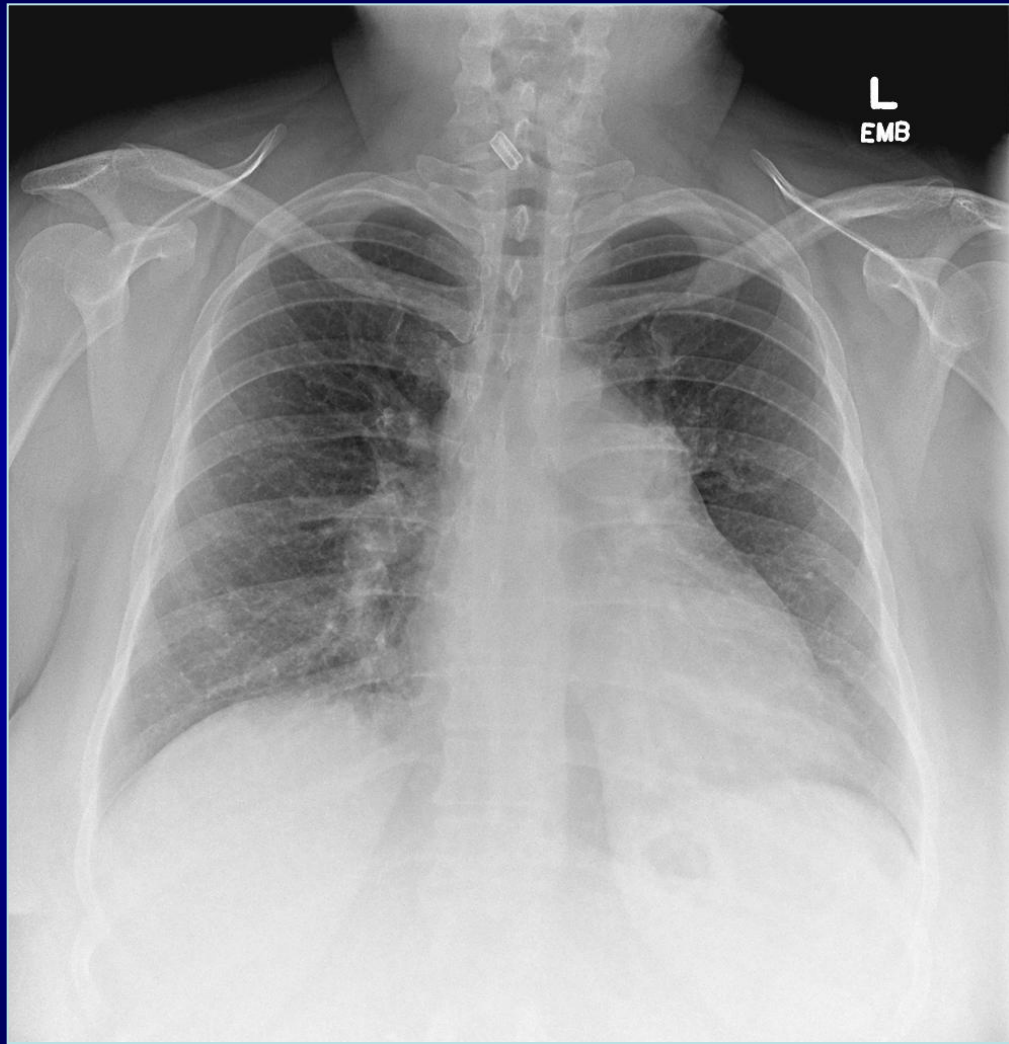
- Described by B. Felson
- If hilar vessels are sharply delineated it can be assumed that the overlying mass is anterior or posterior
- If mass inseparable pulmonary arteries structures are adjacent to one another





Hilum Convergence Sign

- Described by B. Felson
- Used to distinguish between a prominent hilum and an enlarged pulmonary artery
- If branches of PA converge toward central mass is an enlarged PA
- If branches of PA converge toward heart rather than mass is a mediastinal tumor

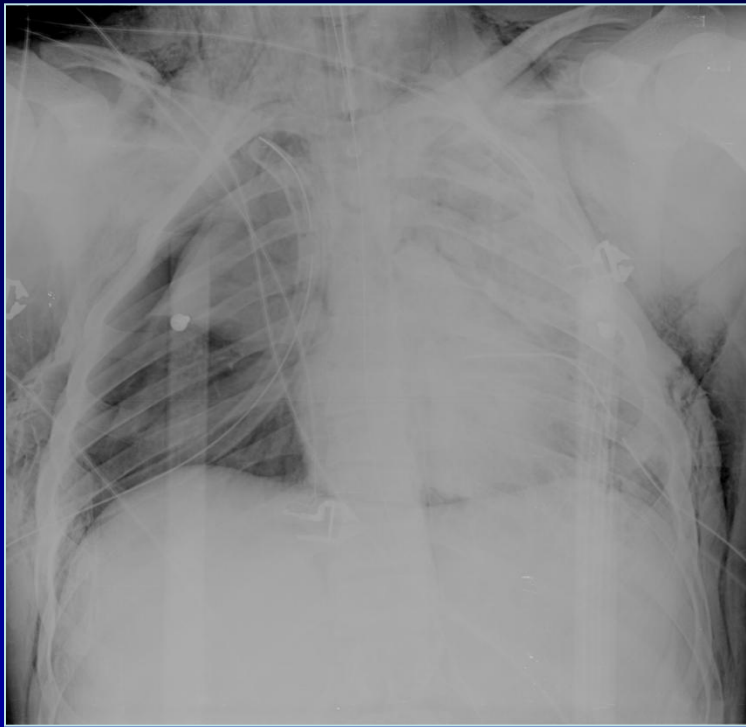


Fallen Lung Sign

- Partial or complete tear of tracheal/mainstem or lobar bronchi is a result of penetrating or blunt trauma (high speed road accident)
- 1.5% of cases of blunt chest trauma
- 80% tracheo-bronchial ruptures within 2.5 cm of carina
- Fallen lung sign is highly specific but uncommon finding

Fallen Lung Sign

- Two mechanisms in blunt trauma:
 - reflex closure glottis causes rise pressure
 - shearing forces produced deceleration and rotation
- Airway injury may be obscured by other injuries
- Many cases remain undiagnosed until complications develop



CT Angiogram Sign

- Finding may be seen on CT of chest after IV contrast material administration
- Consists of enhancing branching pulmonary vessels in homogeneous low-attenuating consolidation
- Low-attenuating component can be caused by production of mucin within air spaces

CT Angiogram Sign

- Initially described by Im in 1990 as a specific sign (92%) of lobar BAC
- Also seen in:
 - pneumonia
 - pulmonary edema
 - obstructive pneumonitis central tumor
 - metastasis from GI carcinomas
 - lymphoma



CT Halo Sign

- Ground glass attenuation surrounding a pulmonary nodule/mass on CT images
- Described by Kuhlman in 1985 in patients with invasive aspergillosis
- Associated w hemorrhagic nodules and may be caused neo or inflammatory
- Disease pathologically active with tumor spread, hemorrhage or inflammation

CT halo sign: Diseases

Infectious diseases

Fungus; aspergillosis^a, mucormycosis, candidiasis, coccidioidomycosis, cryptococcosis

Septic embolism

Mycobacteria; tuberculosis, *Mycobacterium avium* complex

Rickettsia; *Coxiella burnetti*

Virus; herpes simplex virus, varicella-zoster virus, cytomegalovirus, myxovirus

Neoplastic diseases

Primary tumours; squamous cell carcinoma, Kaposi sarcoma, bronchioloalveolar carcinoma^b, adenocarcinoma

Metastatic tumours; angiosarcoma, choriocarcinoma, osteosarcoma, melanoma, hydatidiform mole, metastatic tumours from gastrointestinal malignancies

Lymphoproliferative disorders

Non-neoplastic, non-infectious, inflammatory diseases

Wegener's granulomatosis

Eosinophilic lung disease; parasitic infestation (schistosomiasis), simple pulmonary eosinophilia, hypereosinophilic syndrome

Pulmonary endometriosis

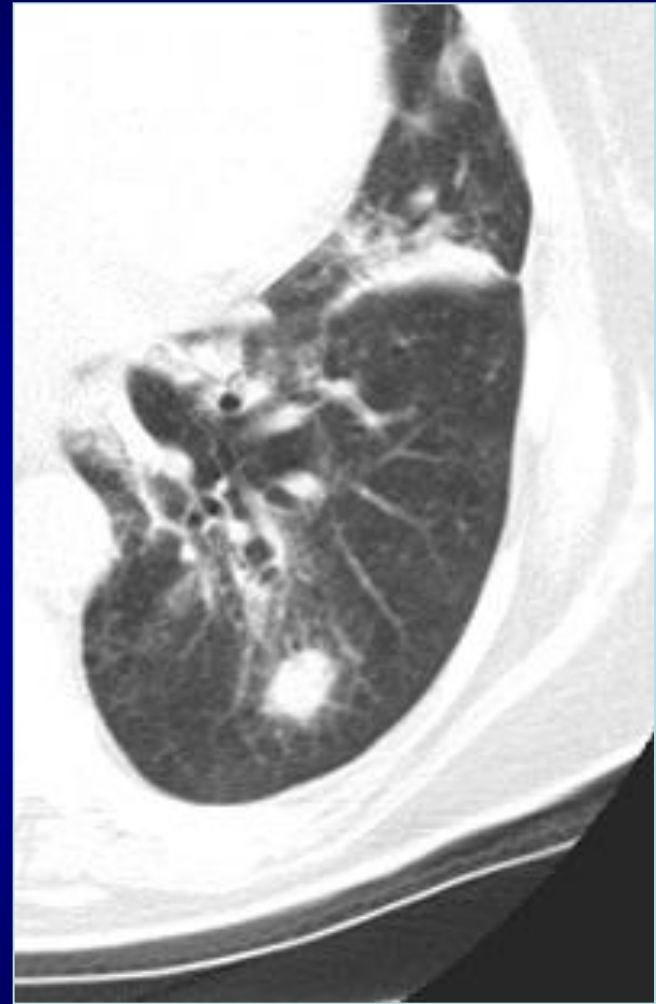
Organizing pneumonia

Hypersensitivity pneumonitis

Iatrogenic injury; transbronchial lung biopsy, catheter-induced pulmonary pseudoaneurysm

Halo Sign

- Should be familiar with adequate clinical setting help to narrow differentials
 - multiple nodules immunocompromised patients could be infections, Kaposi or lymphoma
 - leukemia or BMT and fever may represent invasive aspergillosis
 - immunocompetent patients with a solitary nodule may indicate BAC

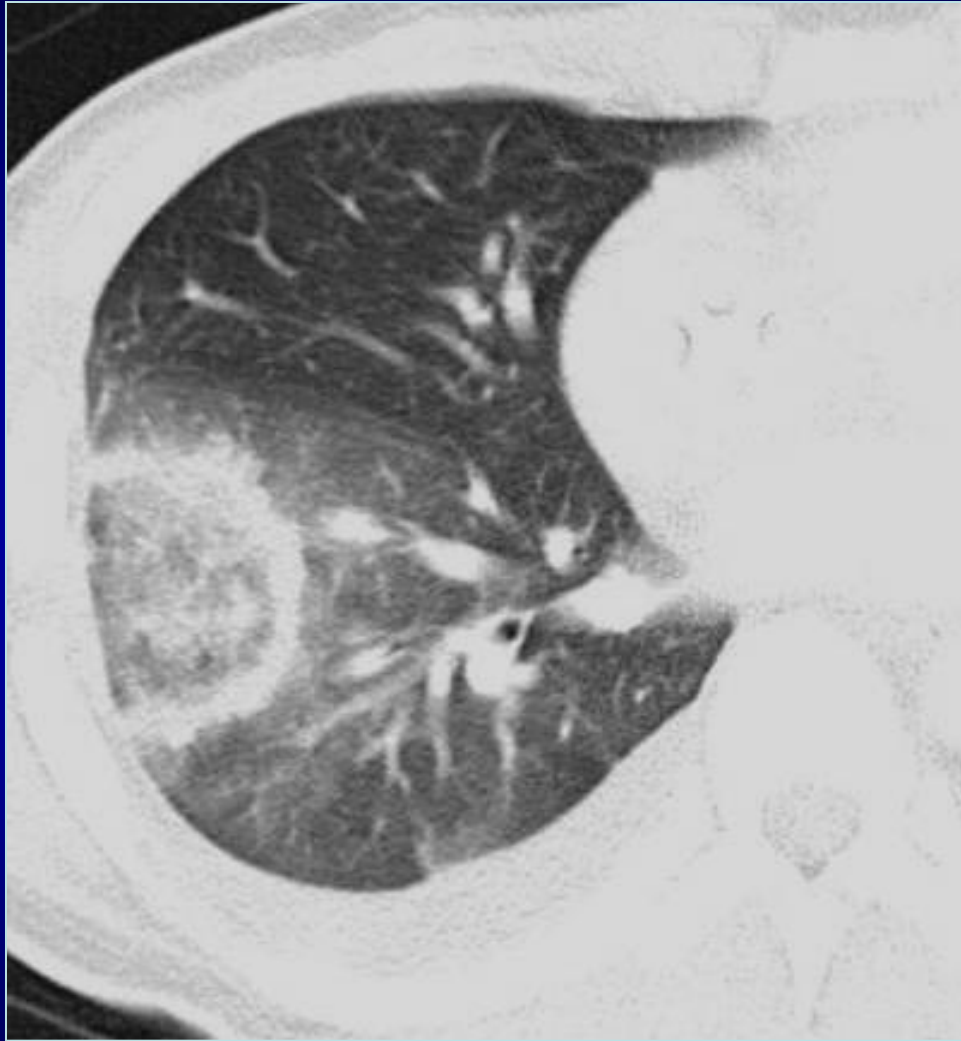


Reverse Halo Sign

- Central ground-glass opacity surrounded by denser consolidation of crescentic or ring shape, at least 2 mm thick
- First described by Voloudaki in 1996
- Kim in 2003 used the term reverse halo
- Found to be relatively specific for cryptogenic organizing pneumonia (COP)

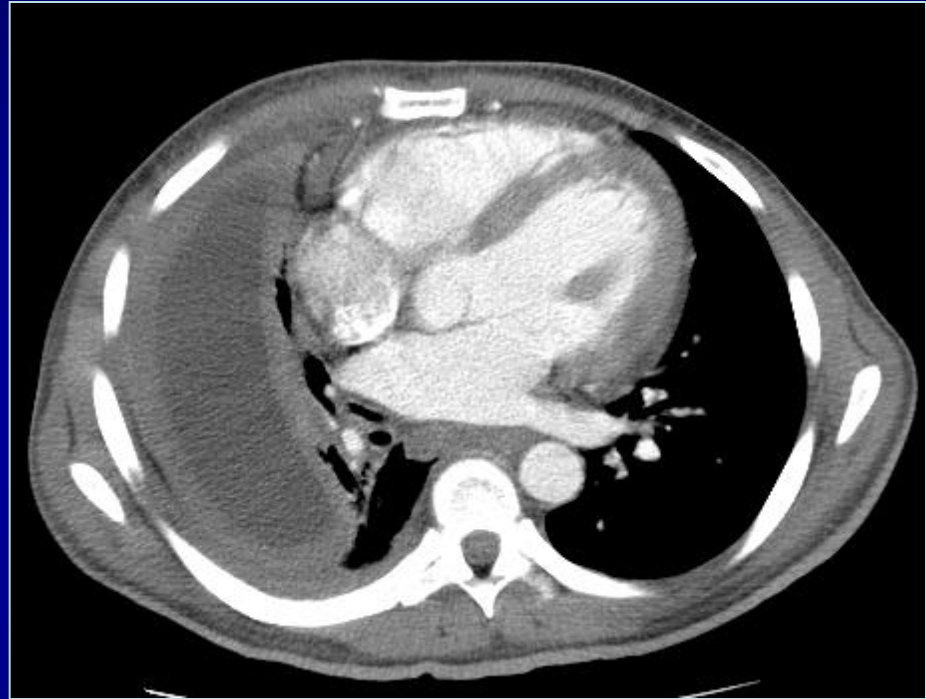
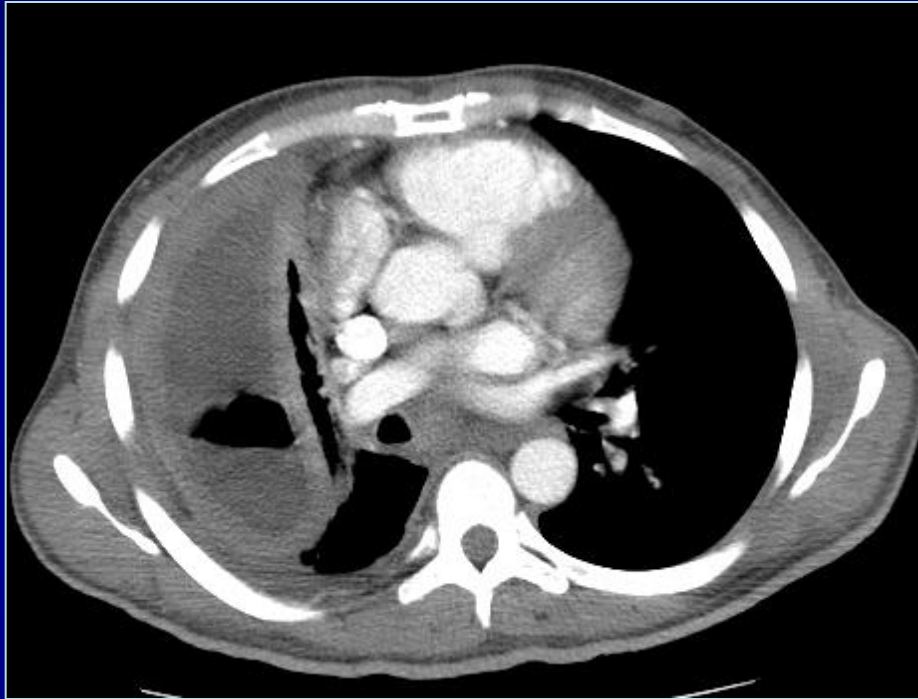
Reverse Halo Sign

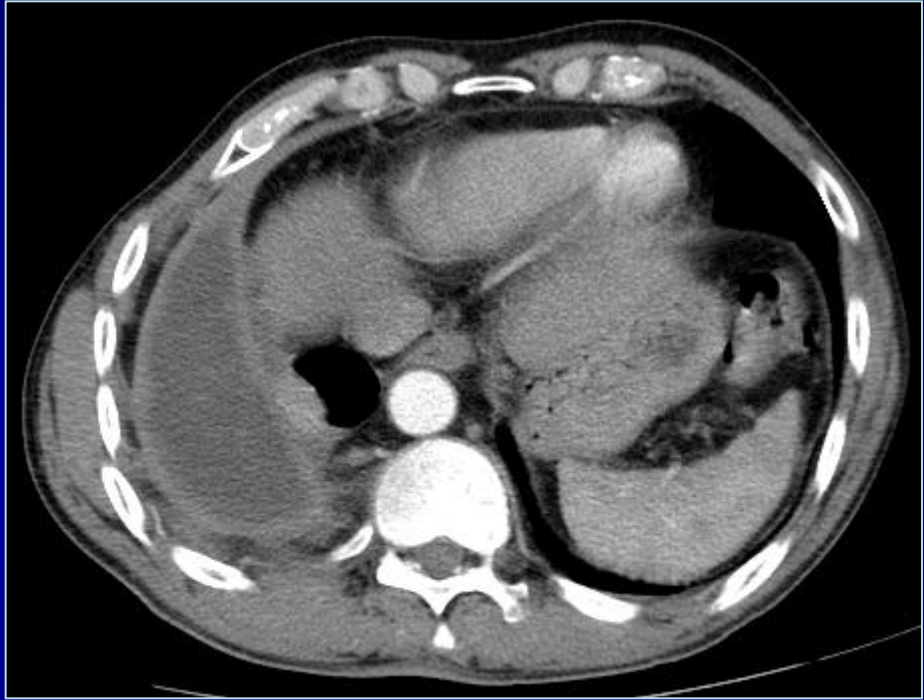
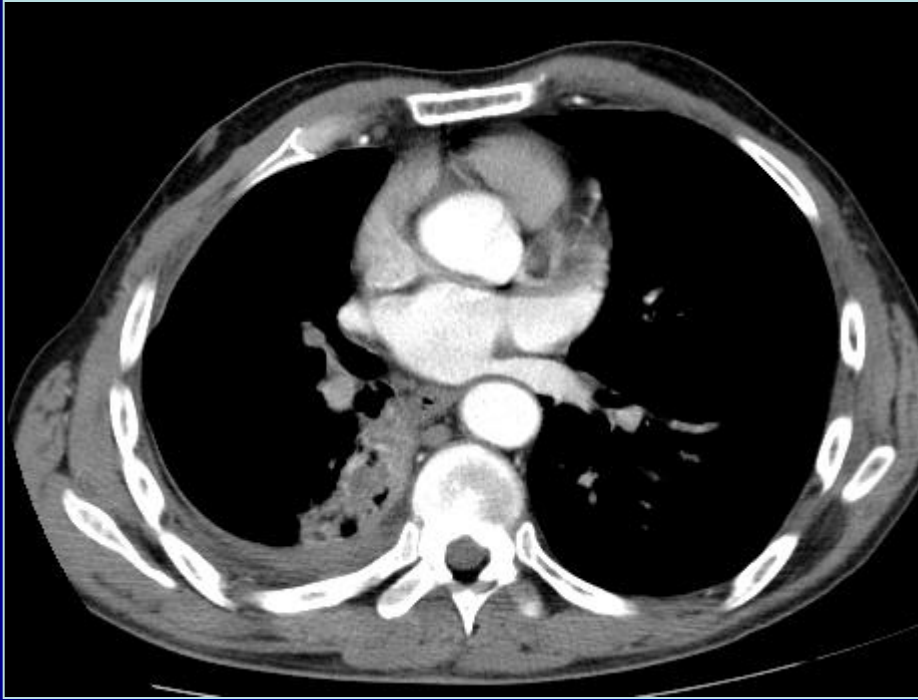
- Seen in other conditions:
 - Wegener's granulomatosis
 - lymphomatoid granulomatosis
 - paracoccidioidomycosis
 - neoplastic (metastasis)
 - invasive aspergillosis
 - lipoid pneumonia



Split Pleura Sign

- Seen on contrast enhanced CT of chest
- Thickened visceral and parietal pleura with separation by a collection
- Empyema or exudative effusion
- Exudative: bacterial pneumonia, cancer, viral infection, PE





Tree-in-Bud Sign

- Commonly seen at thin-section CT
- Initially described in endobronchial spread of Tuberculosis
- Recognized in diverse entities
- Small centrilobular nodules soft-tissue attenuation connected to multiple branching structures

Tree-in-Bud – Causes

Peripheral airway disease

Infection

Bacterial

Mycobacterium tuberculosis

M avium-intracellulare complex

Staphylococcus aureus

Haemophilus influenzae

Fungal

Aspergillus

Viral

Cytomegalovirus

Respiratory syncytial virus

Congenital disorders

Cystic fibrosis

Kartagener syndrome

Idiopathic disorders

Obliterative bronchiolitis

Diffuse panbronchiolitis

Aspiration

Inhalation

Toxic fumes and gases

Immunologic disorders

Allergic bronchopulmonary aspergillosis

Connective tissue disorders

Rheumatoid arthritis

Sjögren syndrome

Peripheral pulmonary vascular disease

Neoplasms

Gastric cancer

Breast cancer

Ewing sarcoma

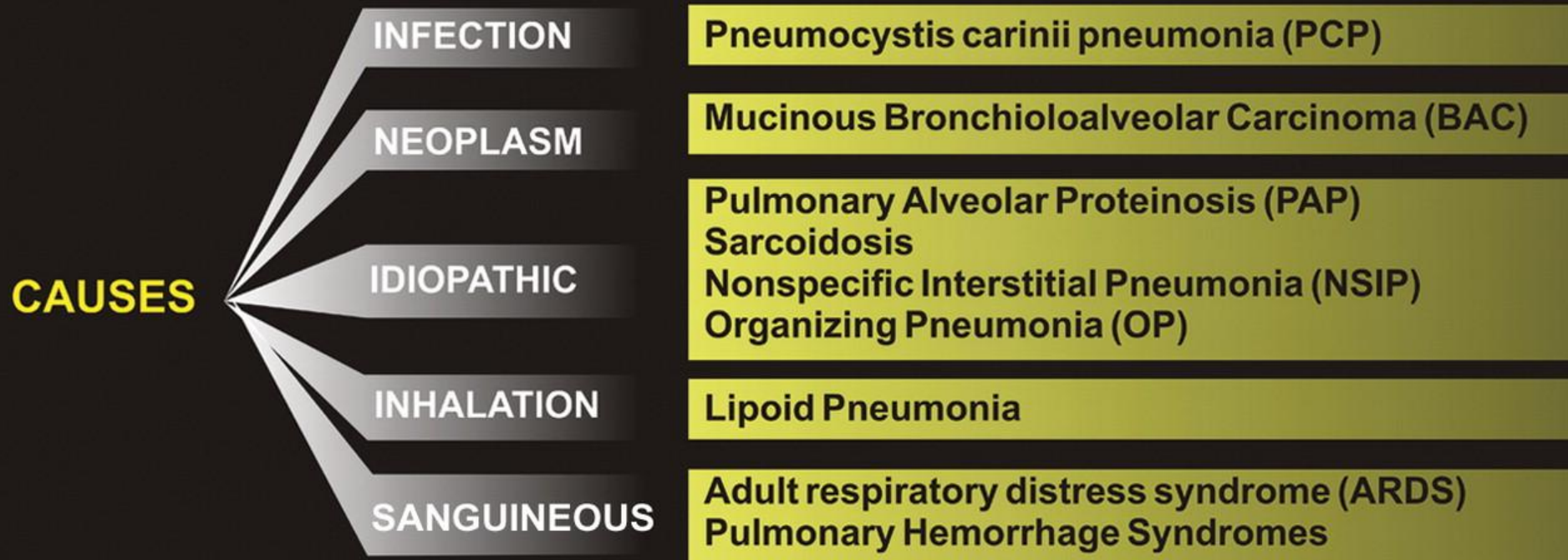
Renal cancer

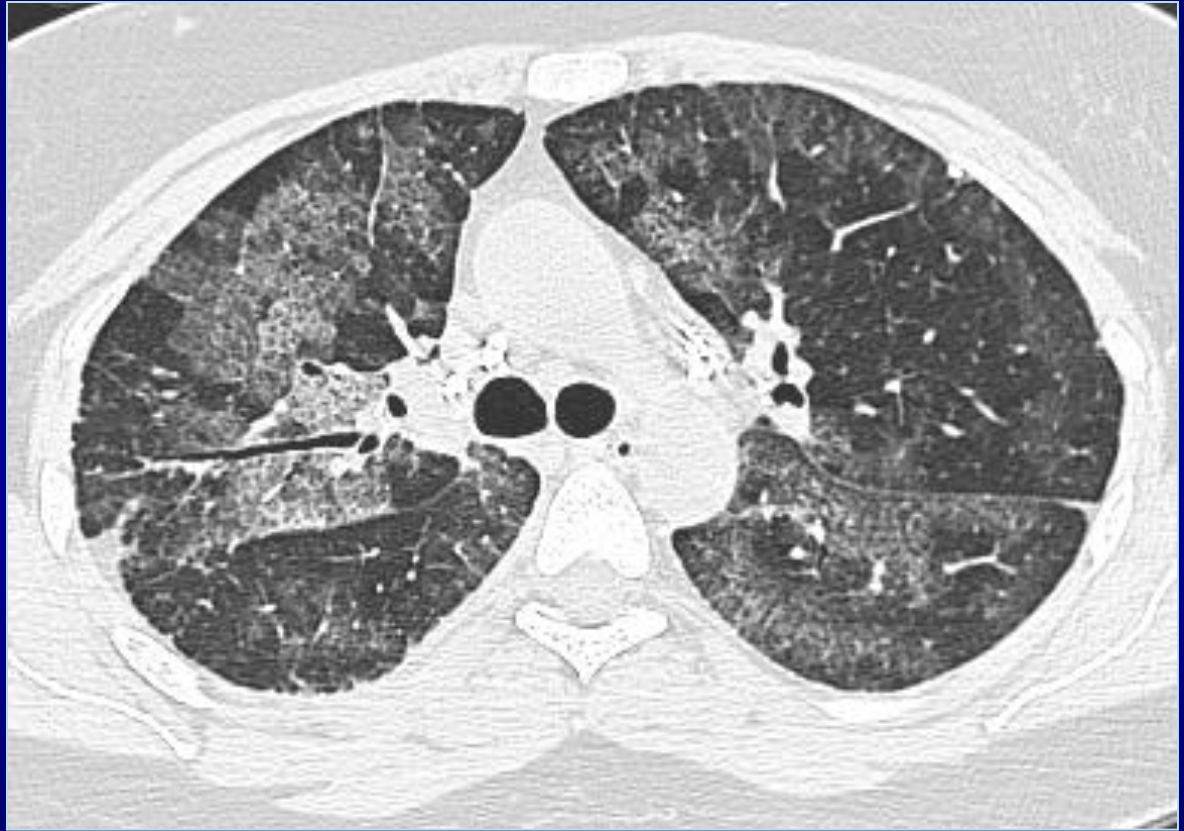


Crazy Paving Sign

- Scattered or diffuse GG attenuation w superimposed intralobular and interlobular septa thickening
- Commonly seen at thin-section CT
- Initially described in PAP
- Recognized in diverse entities

Crazy-Paving – Causes



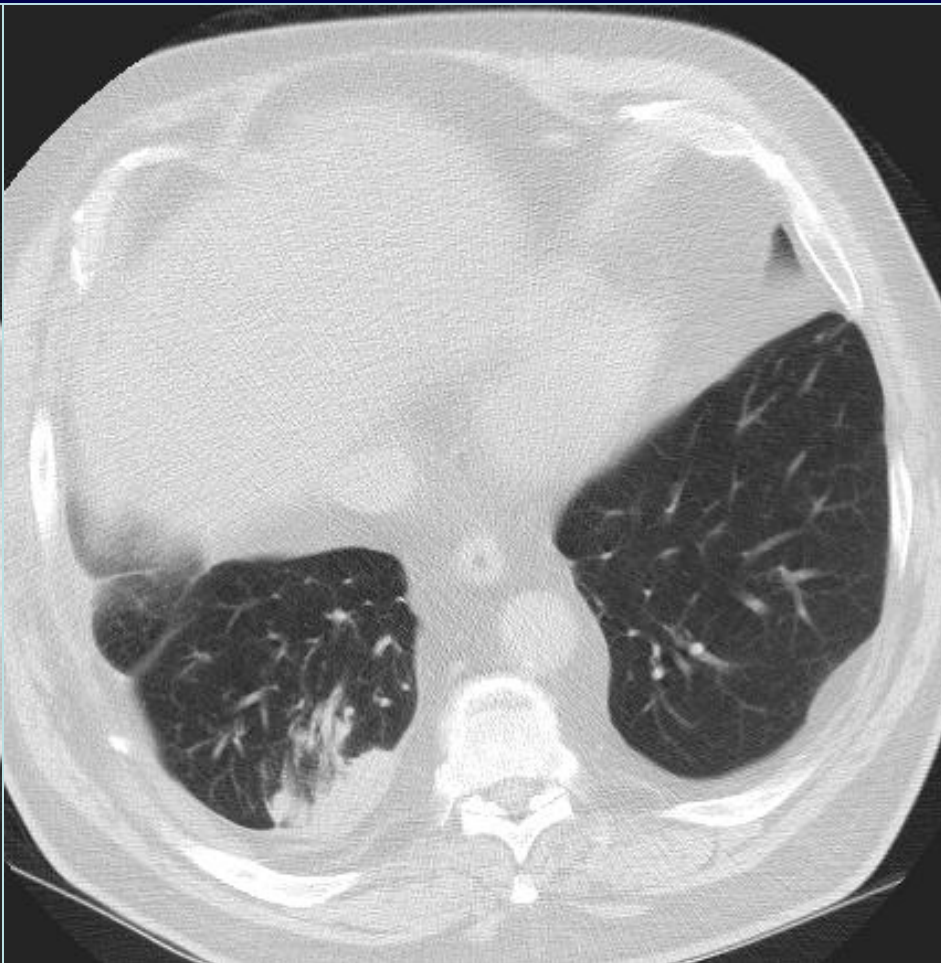
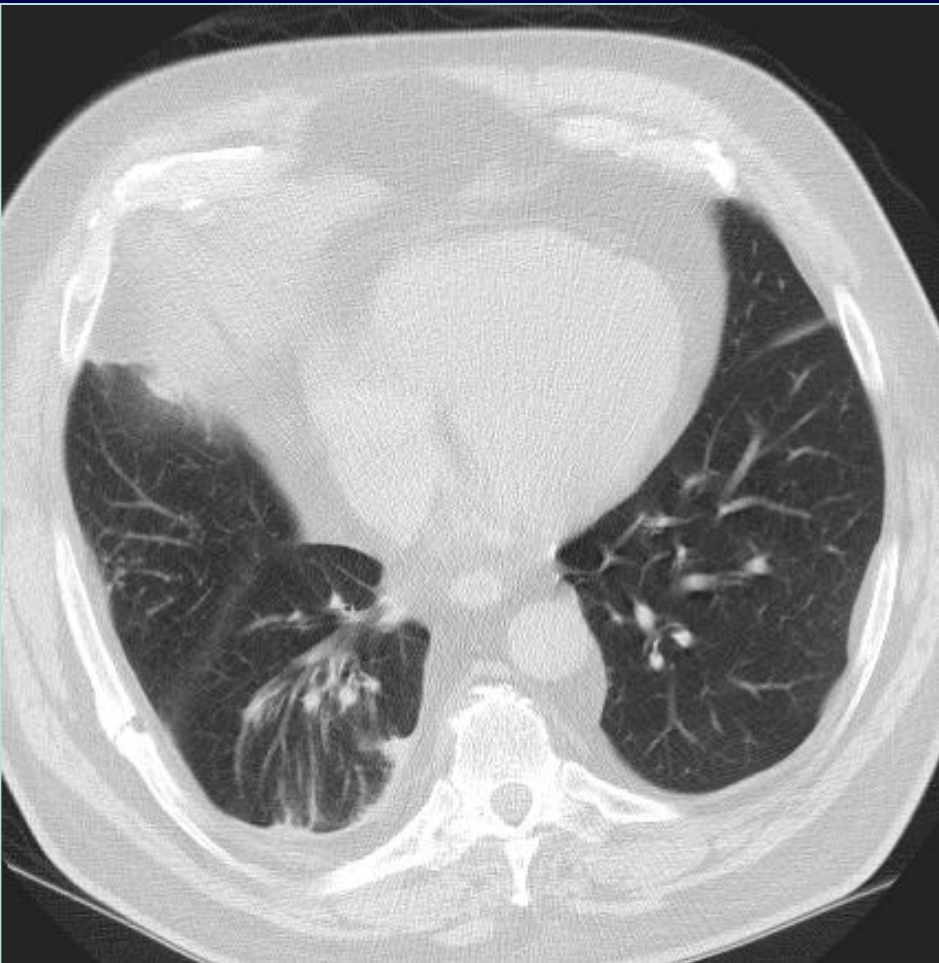


Comet Tail Sign

- Seen on CT of the chest
- Consists of curvilinear opacity extending from subpleural mass toward hilum
- Produced by the distortion vessels and bronchi that lead to adjacent rounded atelectasis

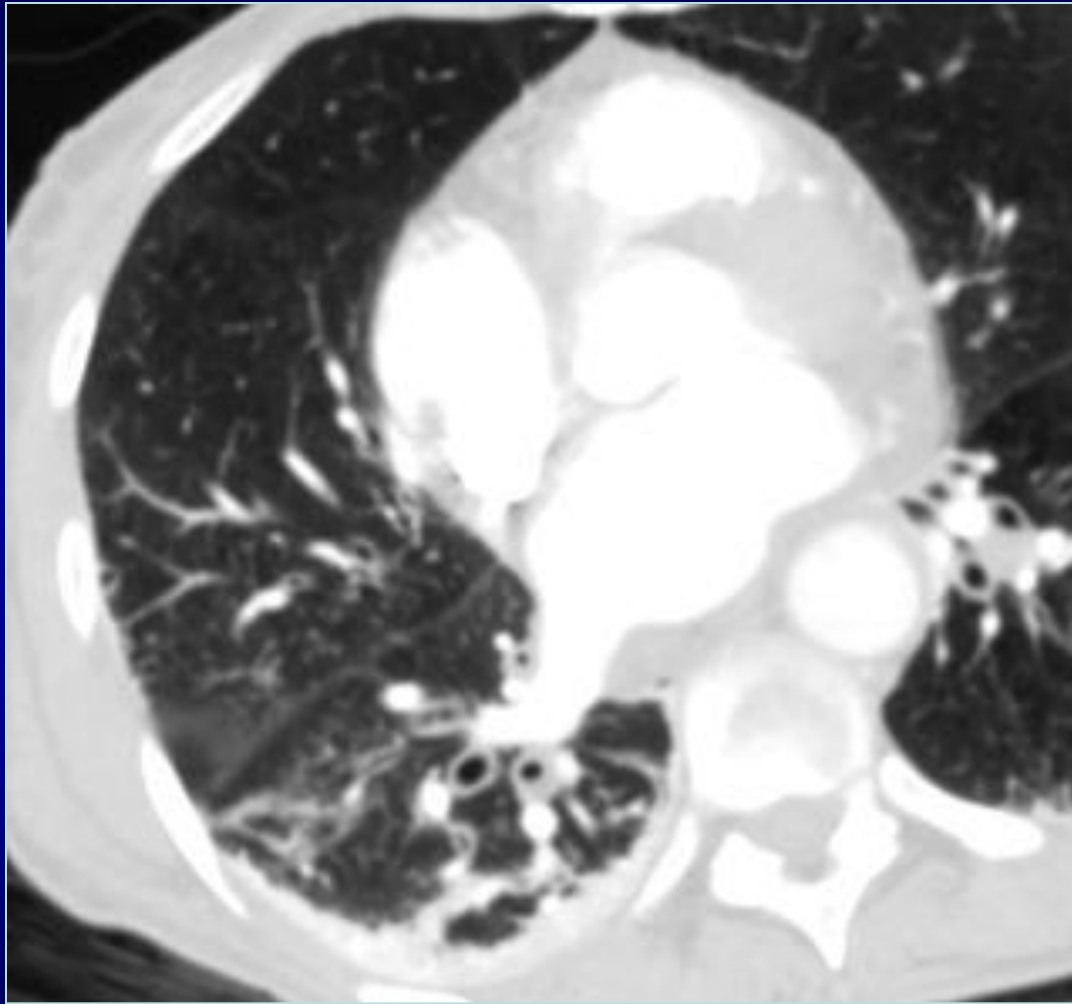
Comet Tail Sign

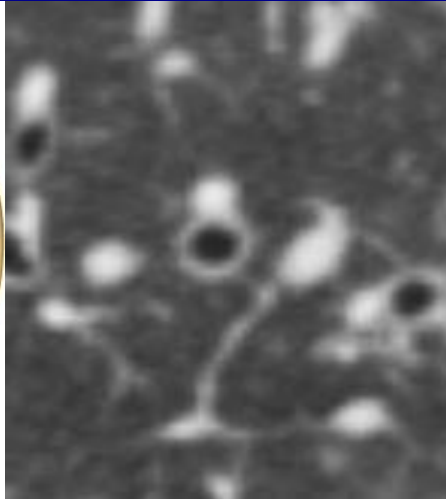
- Rounded atelectasis is not rare, described in patients with asbestosis
- Other conditions: CHF, Dressler, infarct, TB or parapneumonic effusions, histoplasmosis
- Round or oval opacity 2.5-8 cm, acute angles, lower lobes, enhancement
- DD includes bronchogenic Ca



Signet Ring Sign

- Seen on CT/HRCT scans of chest
- CT finding in patient with bronchiectasis
- Ring shadow representing dilated thick-walled bronchus associated a nodular opacity representing pulmonary artery
- Distinguish from cystic lung lesions





Pearl ring sign

Thank you!!