

Chest Radiology

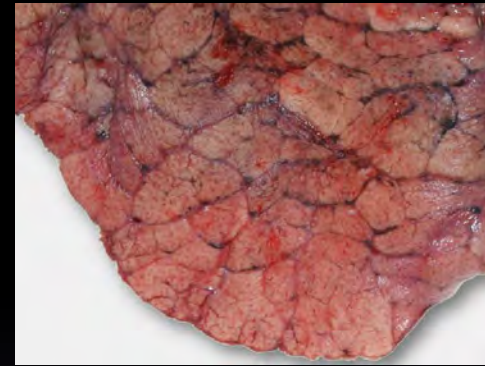
Beth Ripley, MD, PhD, Asha Sarma, MD,
Kirti Magudia, MD, Olga Laur, MD ,

Learning Objectives

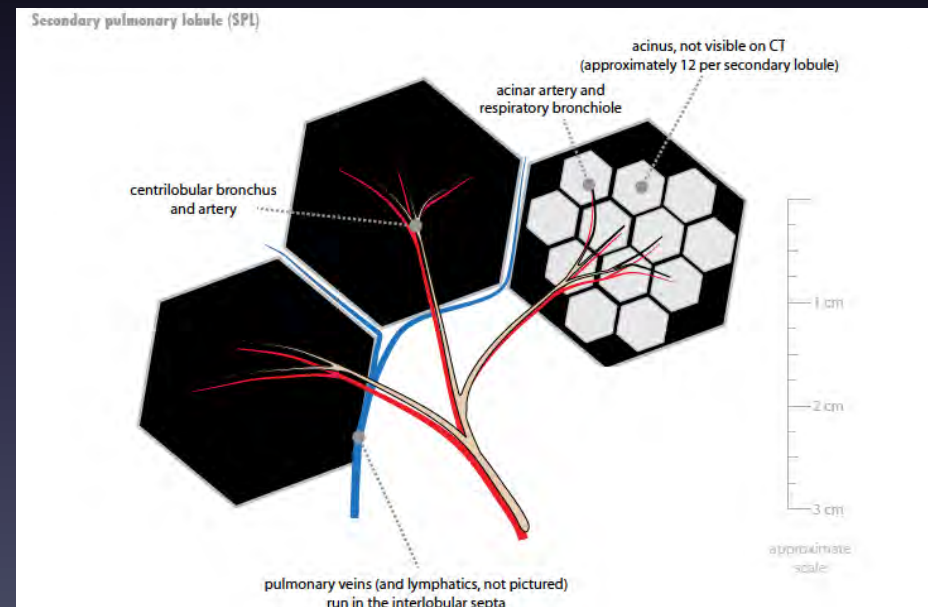
- Review imaging anatomy
- Learn a search pattern for chest x-rays
- Learn to describe and distinguish pulmonary opacities with introductory CT correlation
- Apply anatomical knowledge to lobar collapse
- Cases: learn commonly tested diagnoses

Anatomy: Secondary Pulmonary Lobule

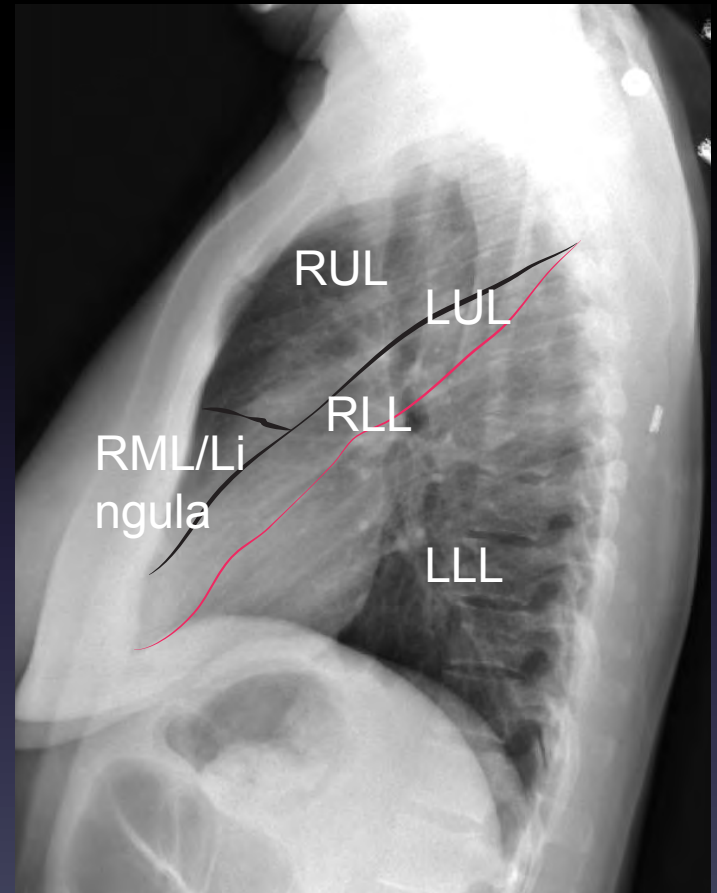
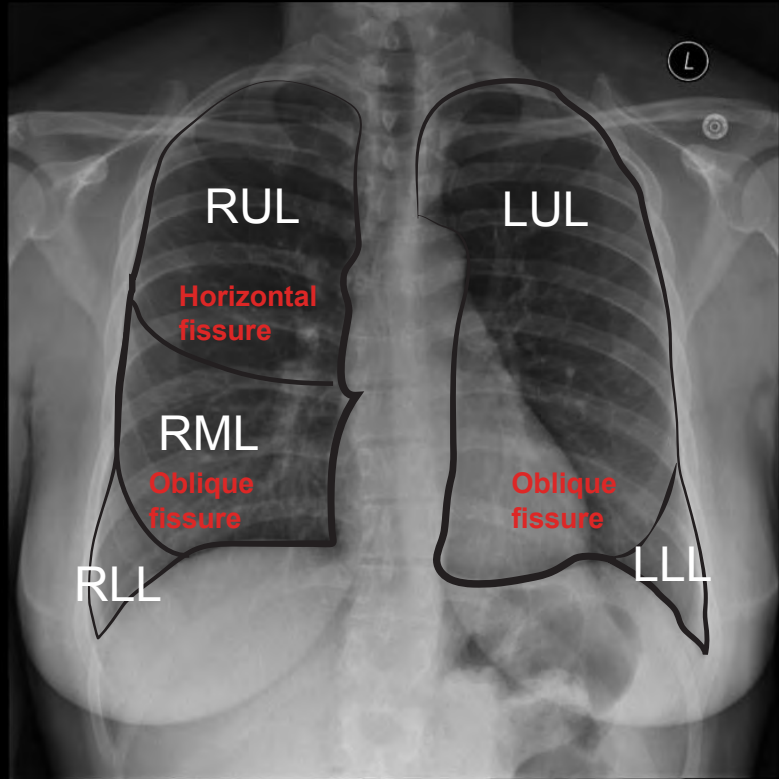
- Fundamental unit: a “lung in miniature”
- Central terminal bronchiole and PA branch. Lymphatics in peribronchovascular interstitium
- Lymphatics and veins in peripheral interstitium
- ~ 12 acini per SPL



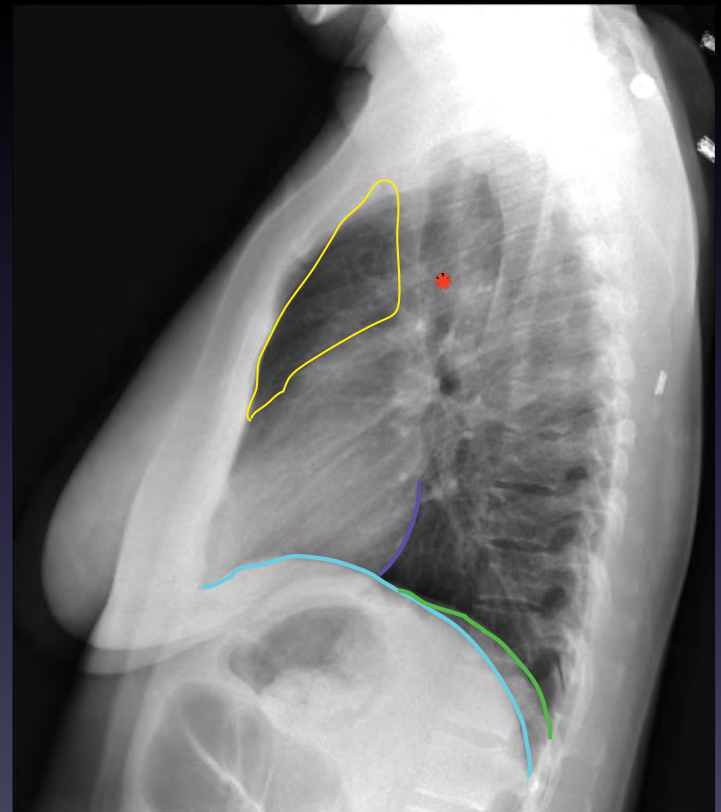
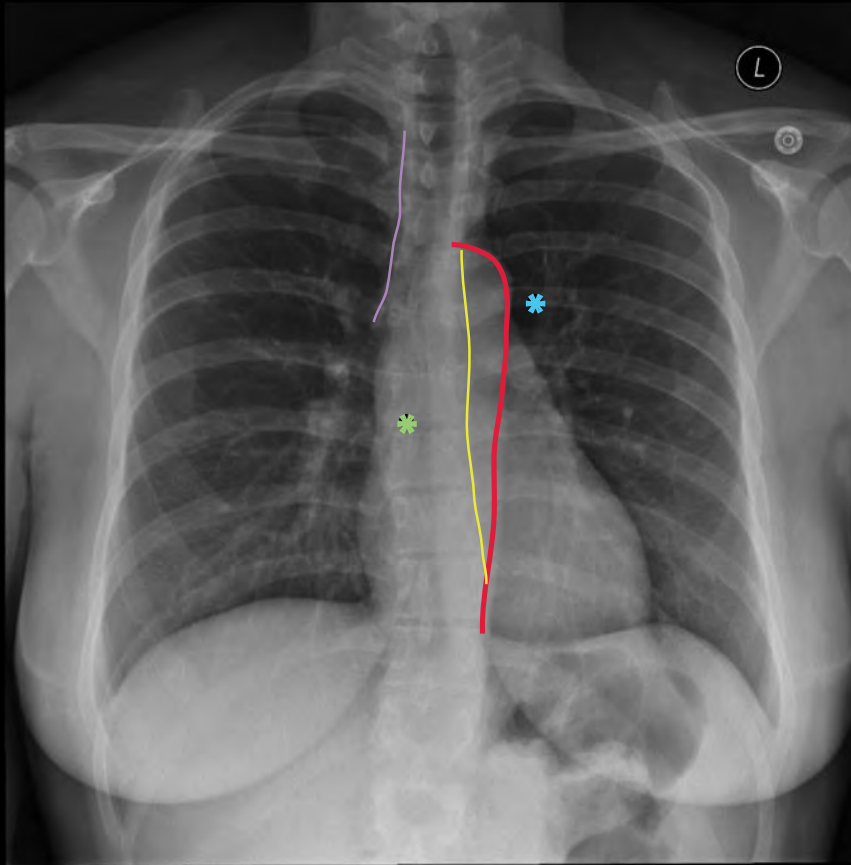
<http://www.hrct.it/M&G/lessons/pathology/anatomy/index.php>



Anatomy: Lung Landmarks



Anatomy: Lung Landmarks

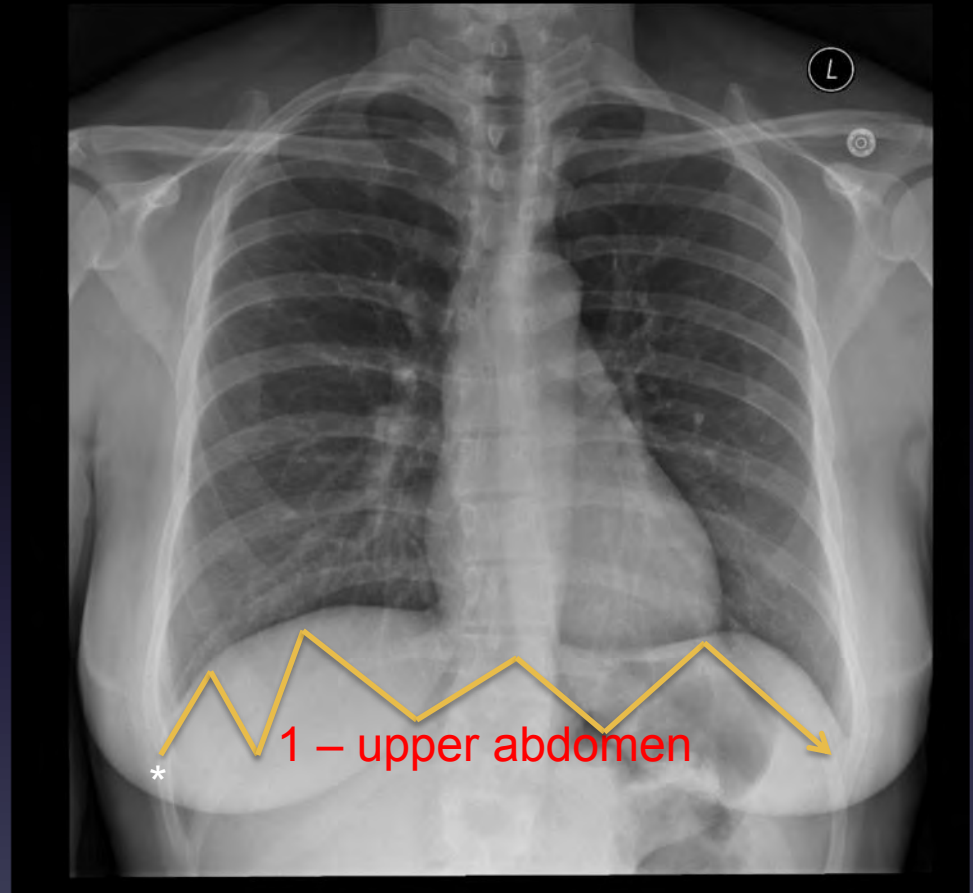


Search Pattern – Lines and Tubes Go First

- ET tubes
- NG tubes
- PICC lines
- Central lines
- Pacemakers/defibrilla
tors

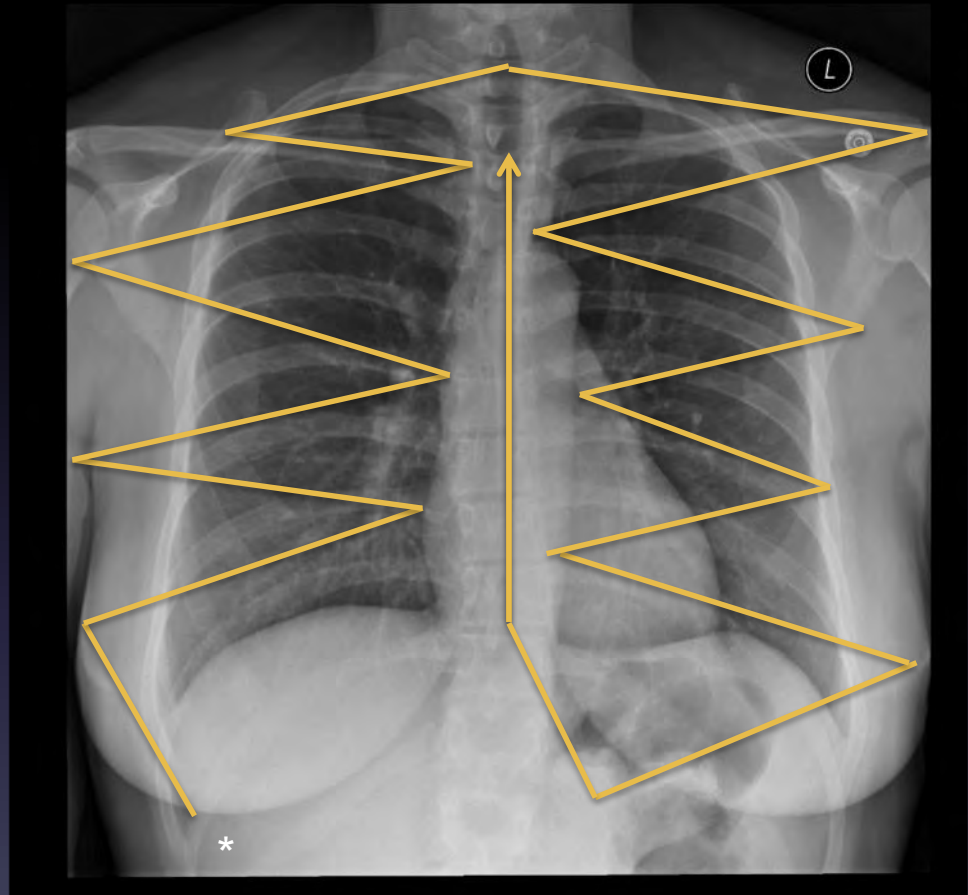
Search Pattern

- Pneumoperitoneum?
- Gastric bubble
- Dilated small bowel?
- Colon?



Search Pattern

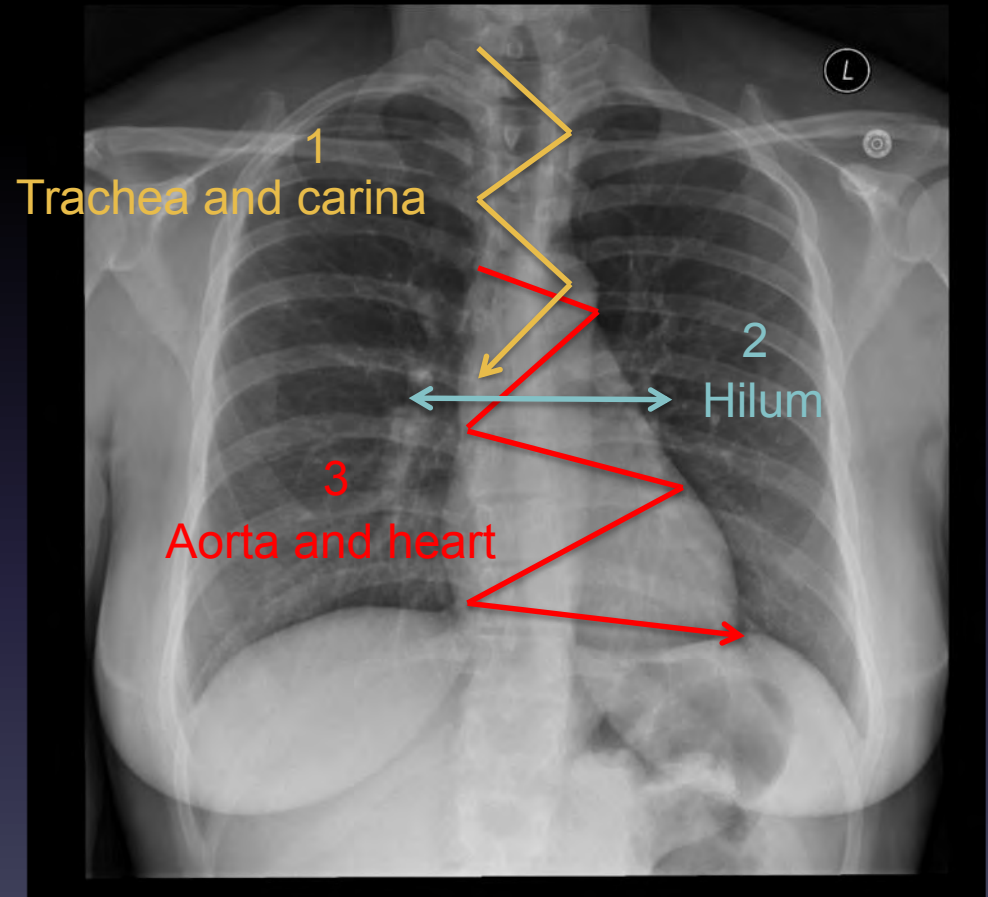
- Fractures?
- Mets?
- Post-surgical changes?
- Subcutaneous air?



2- Bones and soft tissues

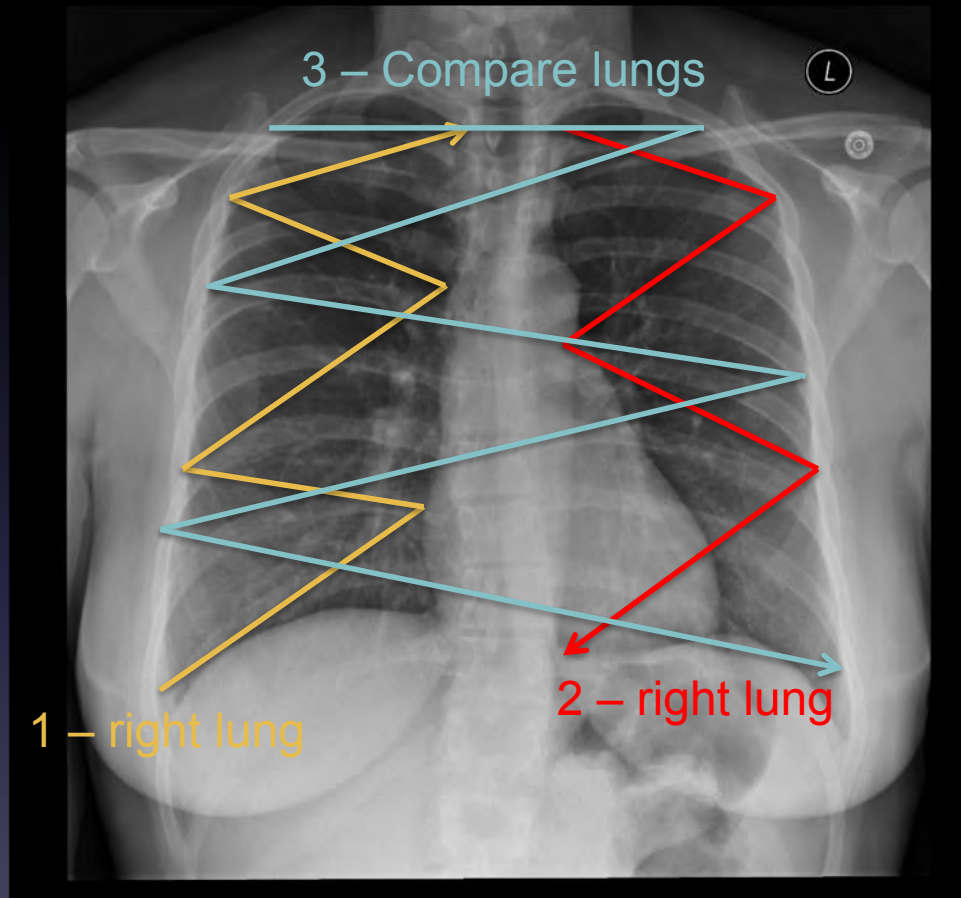
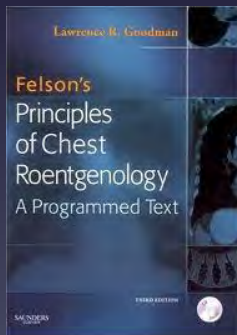
Search Pattern

- Airway pathology?
- Vascular pathology?
- Cardiac silhouette?
- Contour abnormalities?
- Adenopathy?



Search Pattern

- Interstitium
- Alveolar spaces
- Pneumothoraces
- Effusions
- Vasculature



Normal Report

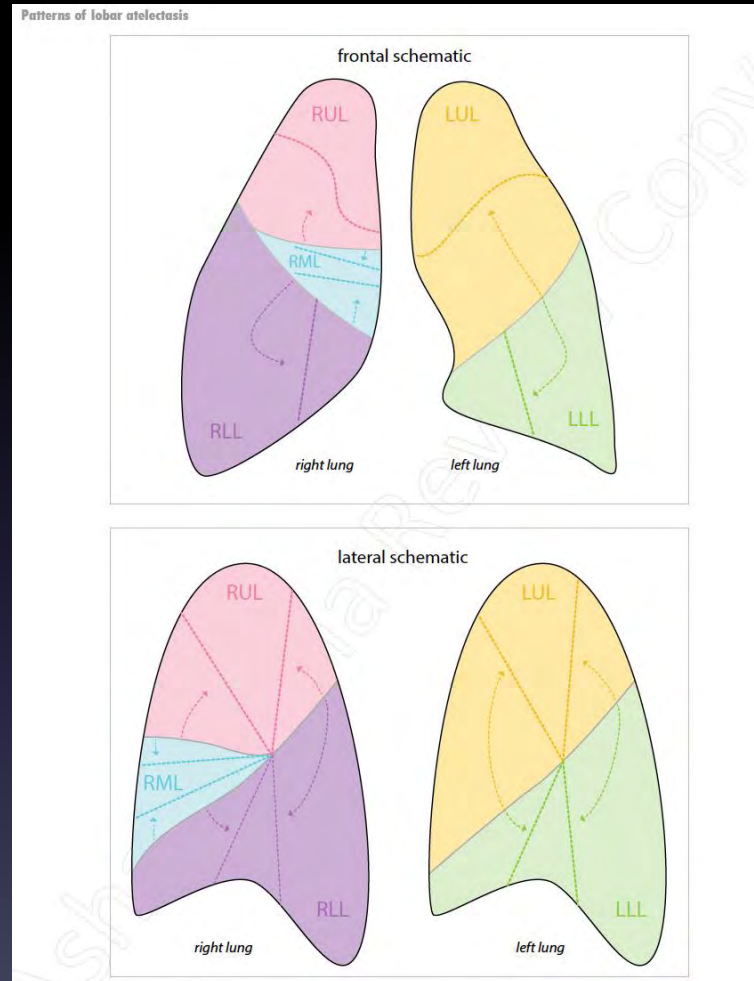
Findings:

Lung volumes are normal. There is no abnormal parenchymal opacification. There is no pneumothorax or pleural effusion. The cardiomediastinal silhouette is normal. The bones and soft tissues are normal.

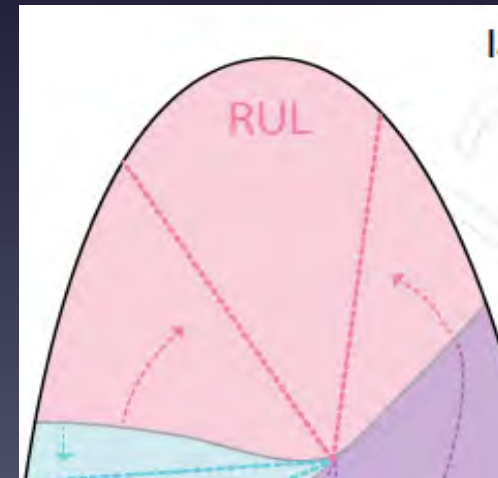
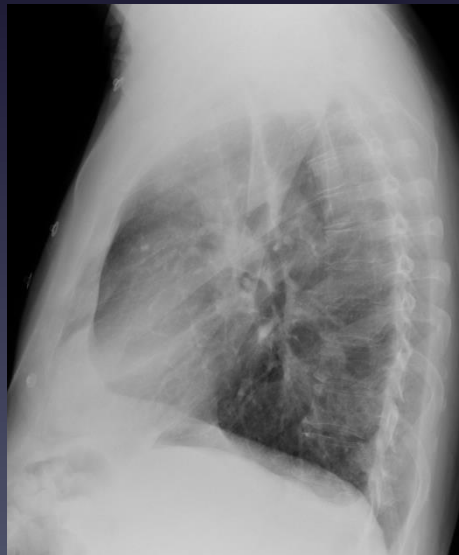
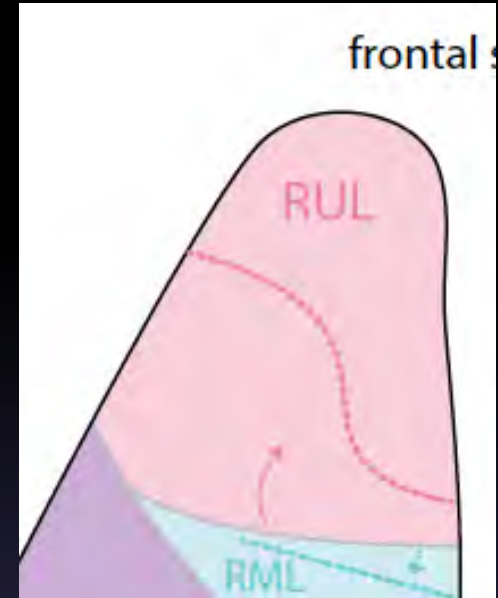
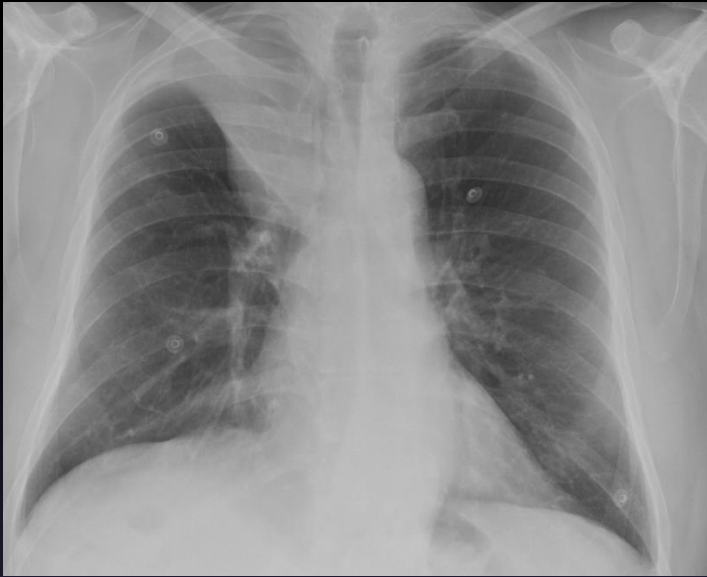
Impression:

There is no acute cardiopulmonary abnormality.

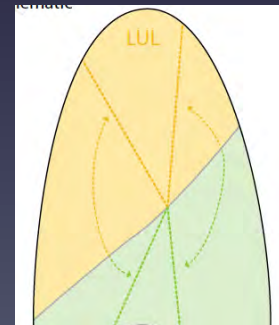
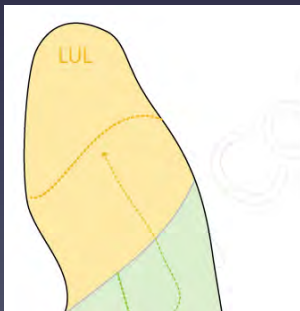
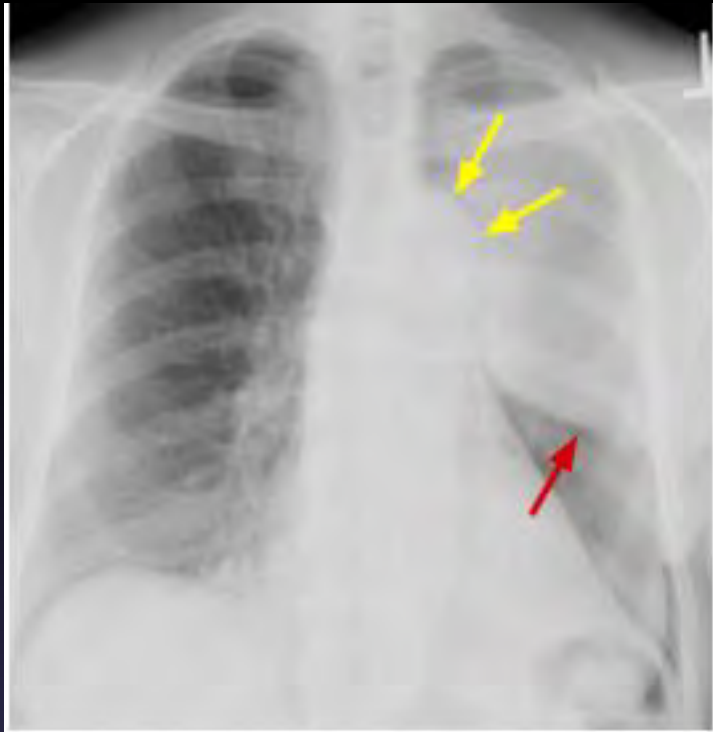
Applied Anatomy: Lobar Collapse



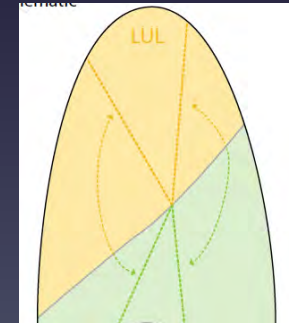
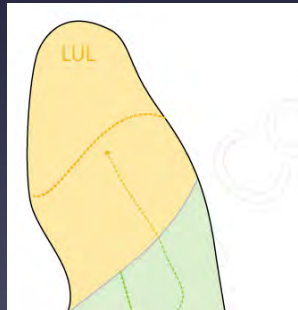
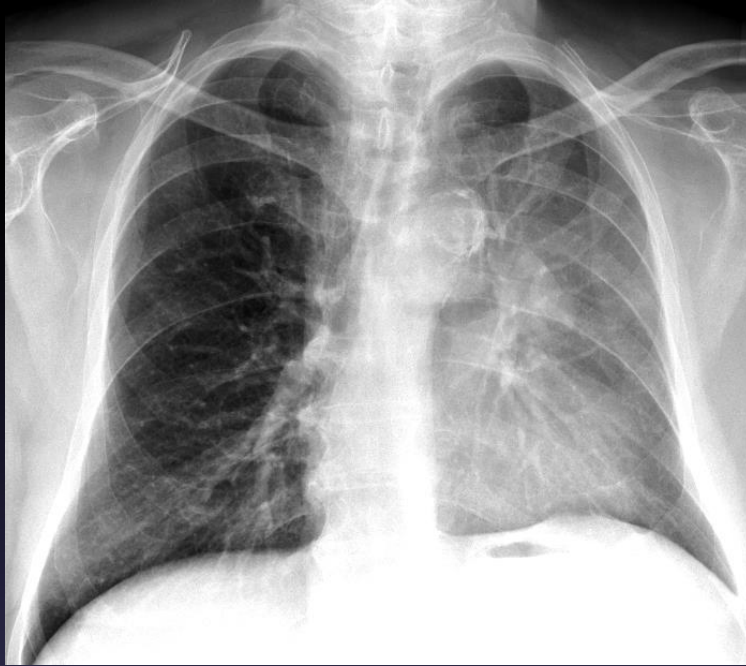
Lobar Collapse



Lobar Collapse



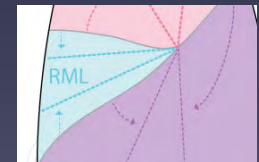
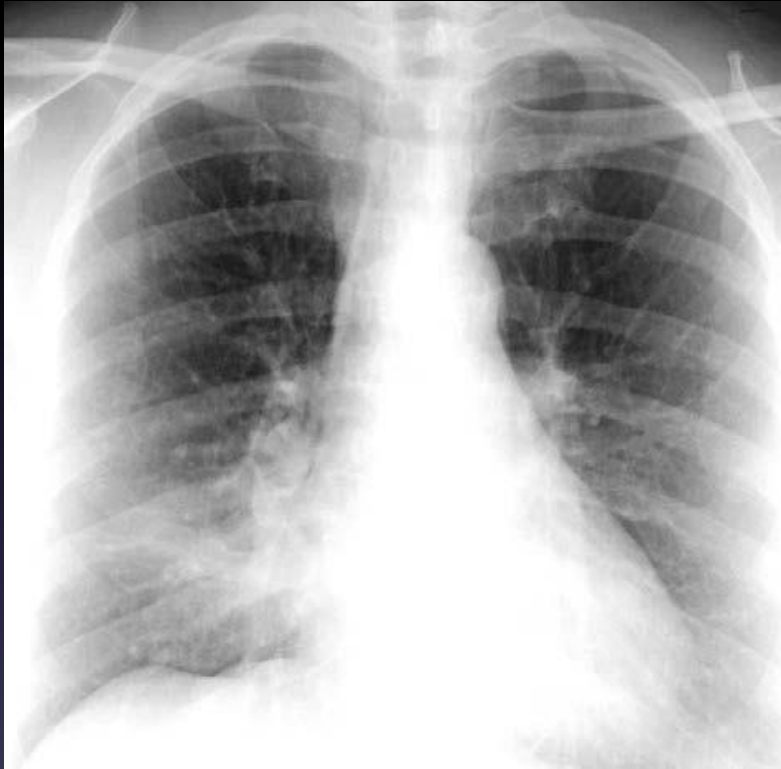
Lobar Collapse



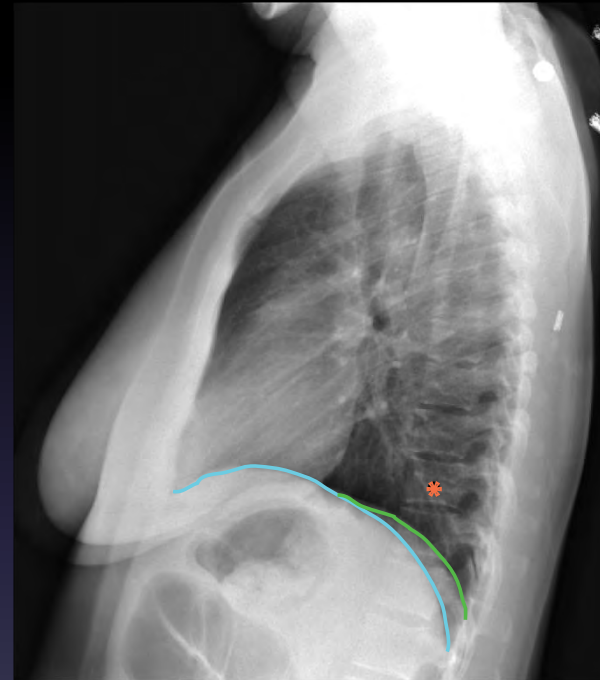
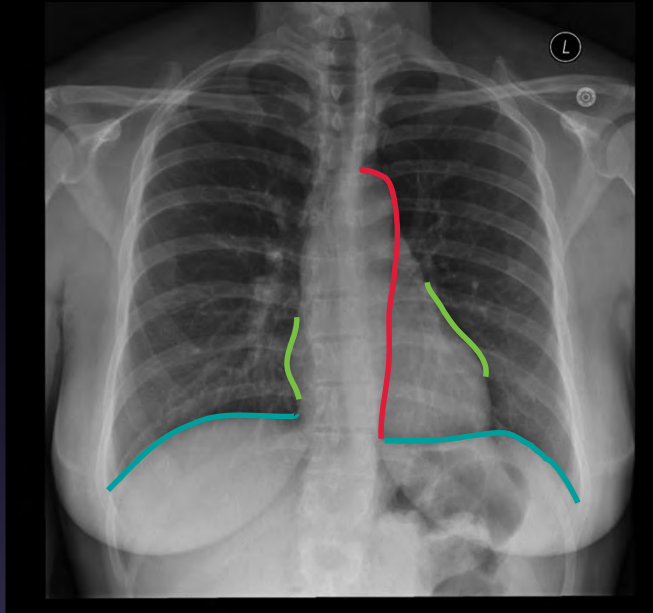
Lobar Collapse



Lobar Collapse



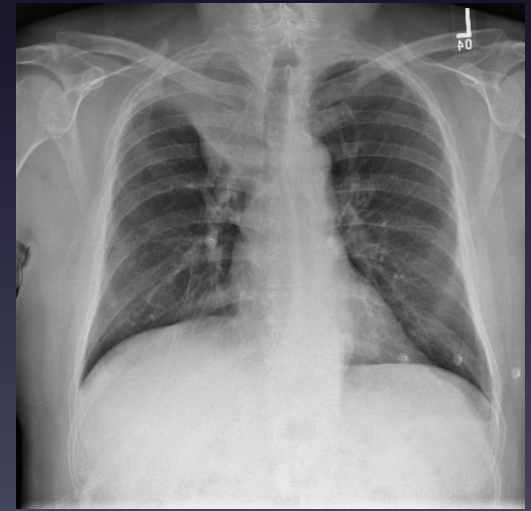
Applied Anatomy: Silhouette Sign



Vital for localizing lesions on a chest x-ray
*Remember to look “through” the heart

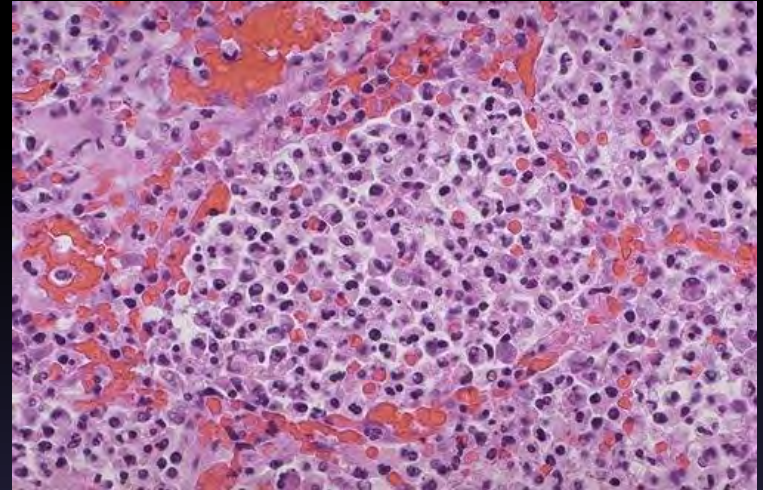
Types of Pulmonary Opacity

- **Airspace Opacity** - Alveolar Filling, consolidation
- Interstitial Opacity (reticular, nodular, linear, reticulonodular)
- Atelectasis/collapse

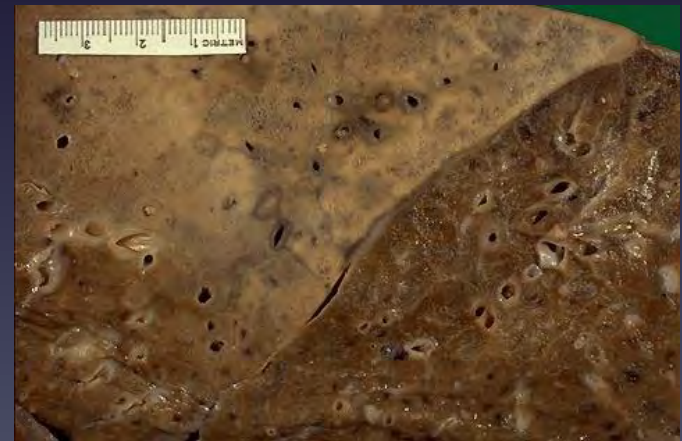


What is replacing the air in the alveoli?

- Blood
- Pus (bacterial, viral, fungal, PCP, eosinophilic, organizing PNA)
- Water (Edema: heart failure, ARDS, acute interstitial pneumonia)
- Cells (Neoplasm: adenoCa in situ, lymphoma)

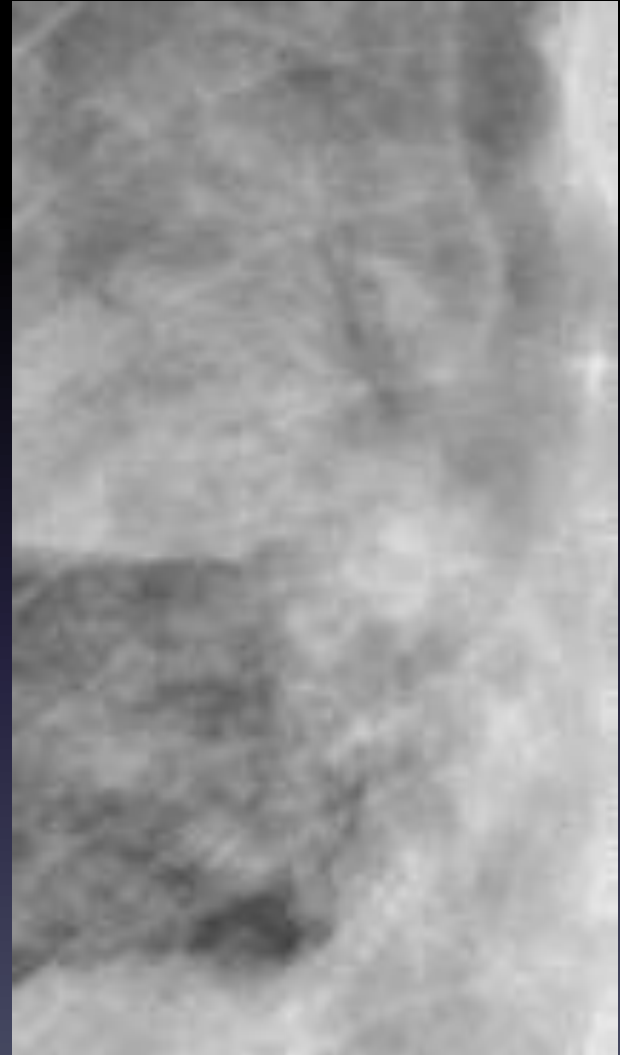


Webpath, University of Utah School of Medicine



Identifying Alveolar/airspace Opacities

1. Air Bronchograms.
2. Vessels not visible through dense consolidation (unlike hazy or ground glass opacity).
3. Lobar or segmental distribution is suggestive, but can also be seen with atelectasis. Other anatomical descriptors include central/batwing, or peripheral.
4. Opacities may be nodular, fluffy, patchy, and poorly marginated ("alveologram" – airway spread) or coalescent/consolidative (spread through alveoli via Pores of Kohn).
5. Silhouette sign – missing normal contours.

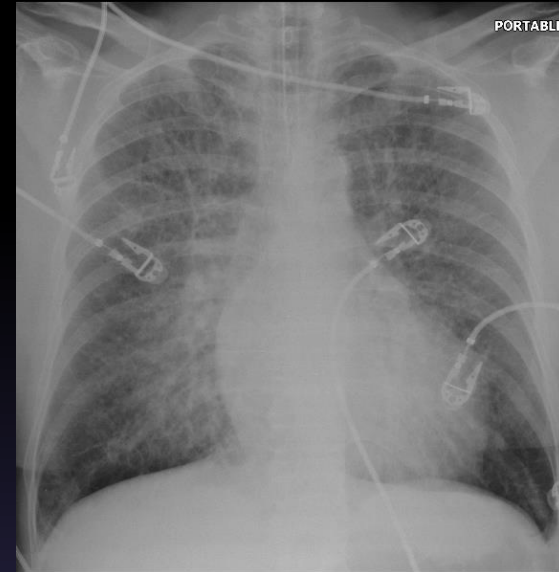


Consolidation DDx: Blood, Pus, Water, Cells

HEMORRHAGE



PULMONARY EDEMA



PNEUMONIA

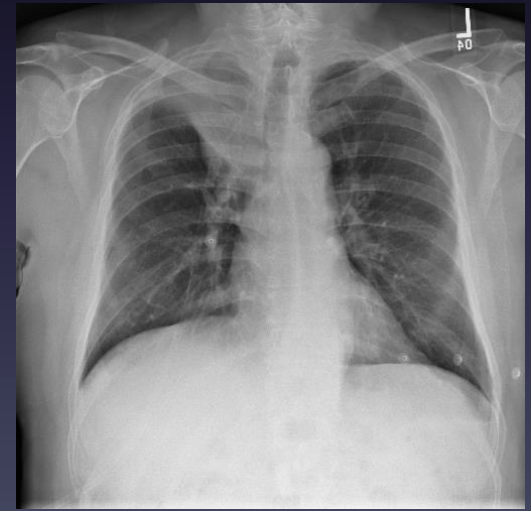


ADENOCARCINOMA



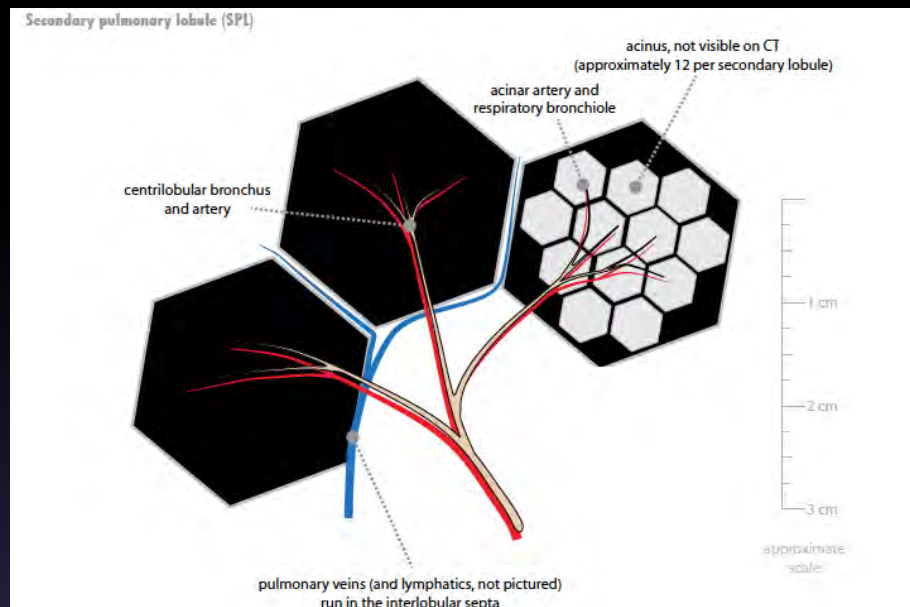
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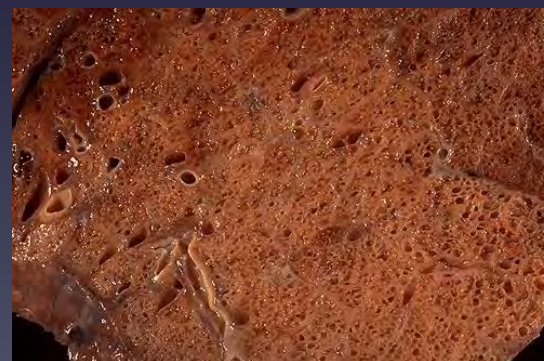


Interstitium

- Scaffolding of the lung
- Provides support for airways and vessels and contains lymphatics
- Can be thickened by fluid, fibrous tissue or infiltration of cells



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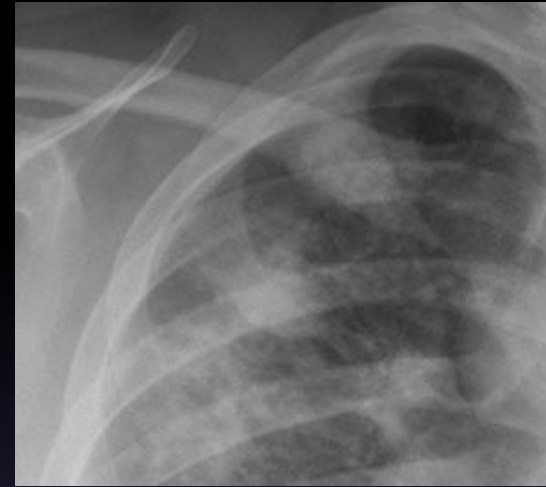


CXR Examples of Interstitial Opacification

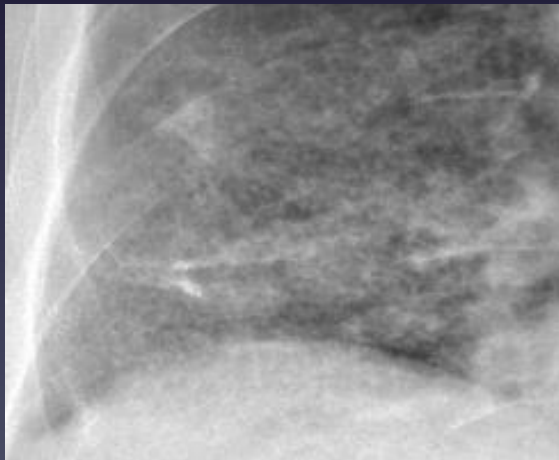
LINEAR



NODULAR



RETICULAR

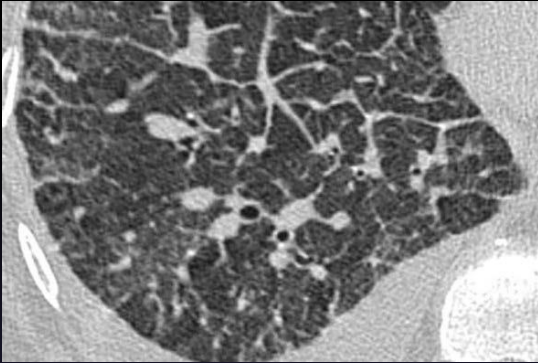


RETICULONODULAR



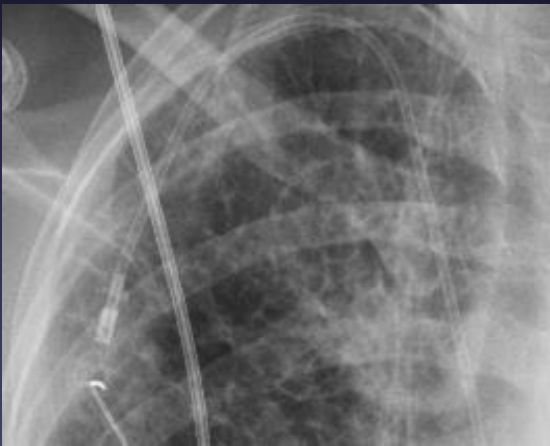
Linear Interstitial Opacities

- Opacities that thicken the bronchovascular (axial) or peripheral interstitium
- Often referred to as septal thickening or Kerley lines



Kerley B lines are thickened peripheral septa, 1-2 cm long

Kerley A lines are 2-6 cm long, course towards the hila, and are lymphatic connections between arterial and venous system



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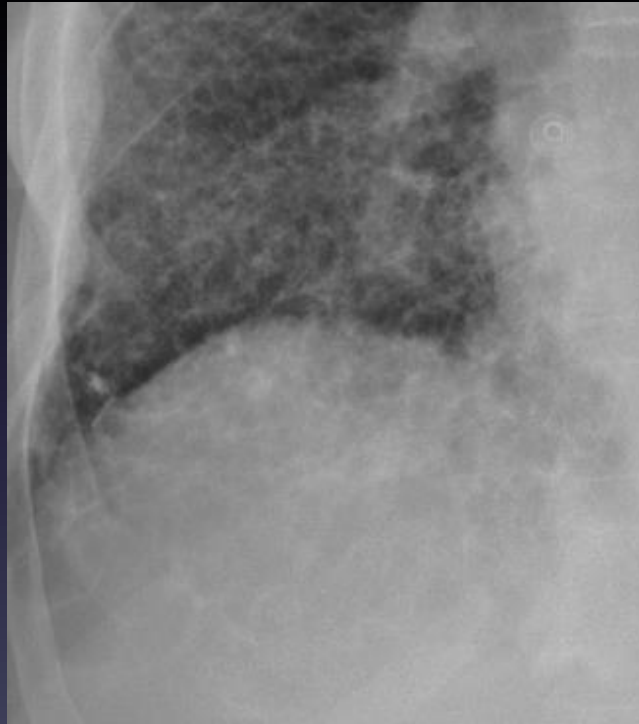
DDx: Interstitial Pulmonary Edema, Lymphangitic spread of malignancy, resolving hemorrhage

Reticular Interstitial Opacities

Fine, can look like
ground glass



Medium, honeycombing



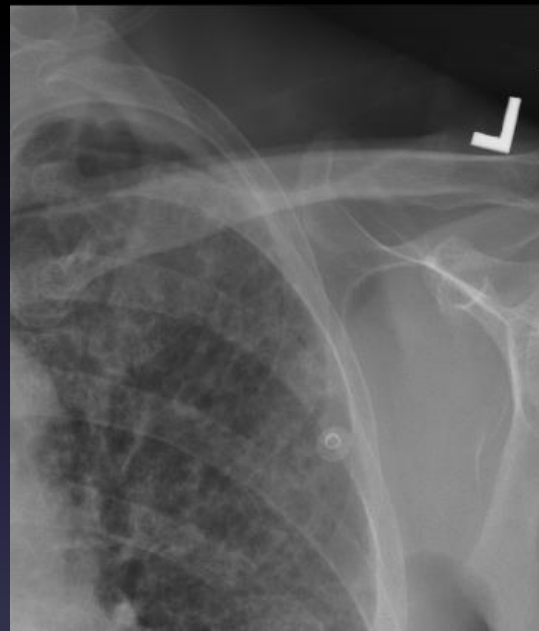
**Most Common Dx:
Pulmonary Fibrosis**

Coarse, cystic



**DDx: Superimposed cysts
(LAM, EG), bronchiectasis
(CF)**

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**Common DDx: interstitial
edema, UIP**

Nodular Opacities

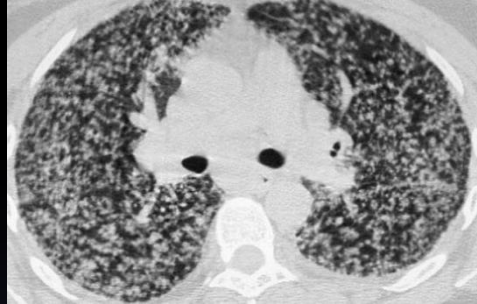
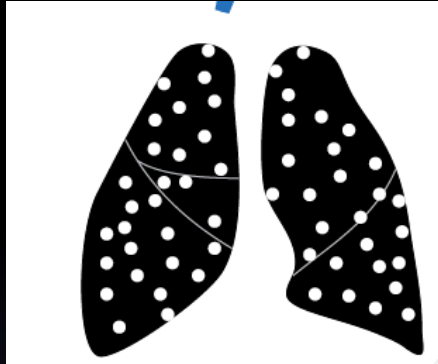
- Miliary (< 2 mm) and micronodular (2-7 mm):
 - Granulomatous processes (Miliary TB, Histoplasmosis)
 - Hematogenous mets (thyroid, RCC)
 - pneumoconioses (silicosis)



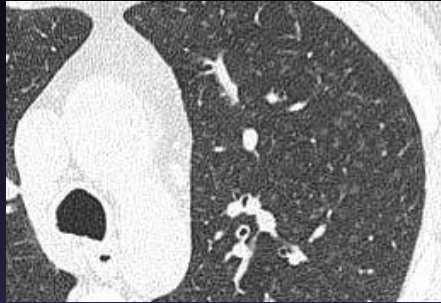
- Nodules (7-30 mm) and masses (>30 mm)
 - Metastases
 - Benign neoplasm
 - Primary lung cancer
 - Infection/septic emboli



Nodular Opacities - CT Distribution

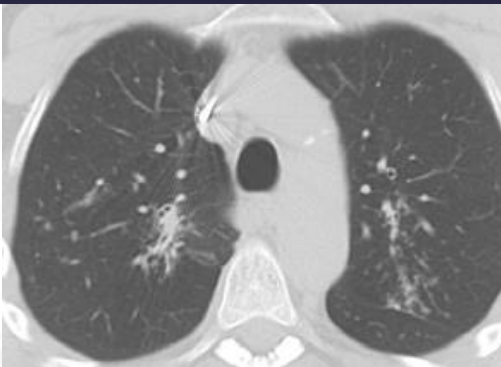
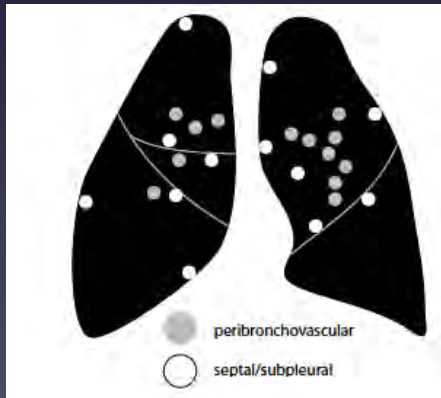


RANDOM – HEMATOGENOUS
Miliary TB
Fungal Infection
Mets



**CENTRIOLOBULAR AND TREE IN BUD
BRONCHIOLITIC**

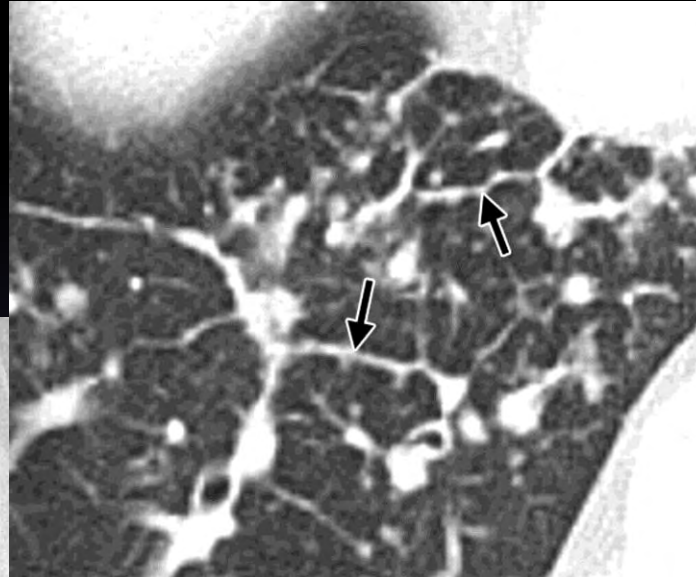
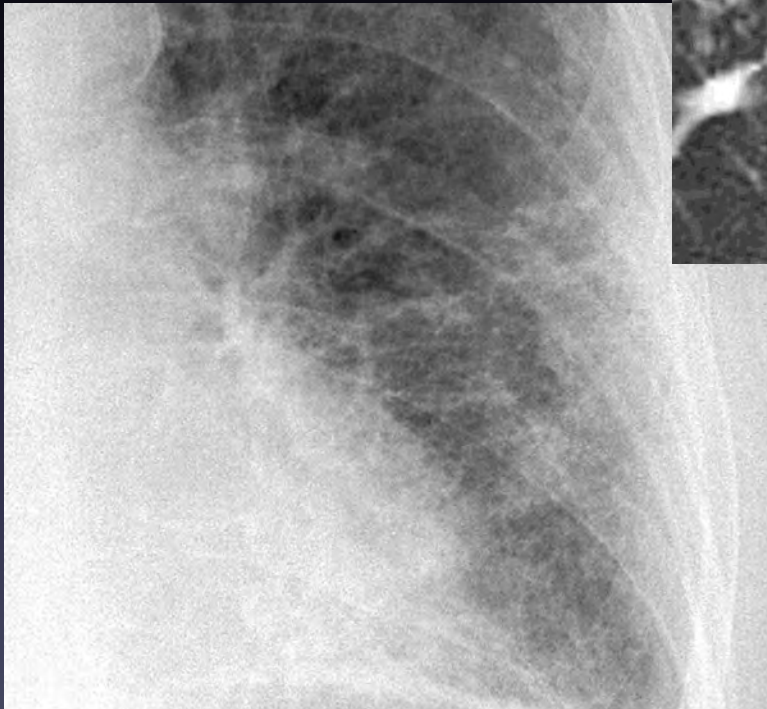
Hypersensitivity Pneumonitis
Respiratory bronchiolitis
Bronchoalveolar carcinoma
Infectious diseases



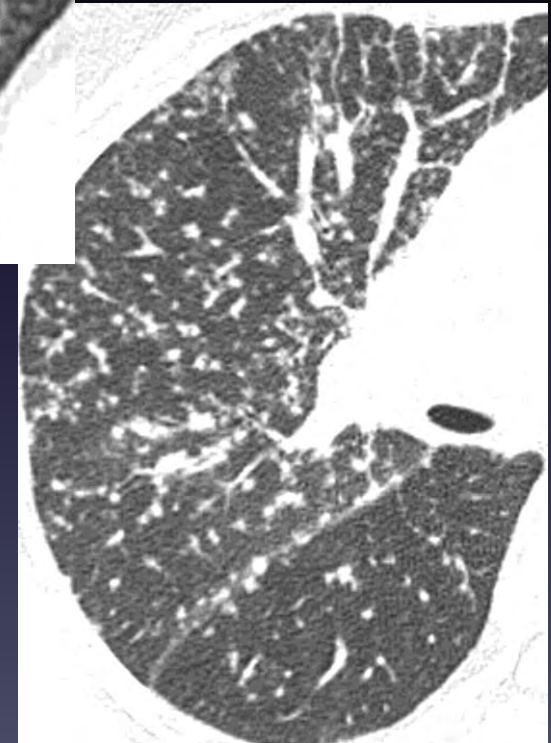
**PERILYMPHATIC/SUBPLEURAL
LYMPHATIC**

Sarcoid
Silicosis
Lymphangitic carcinomatosis

Reticulonodular Opacity

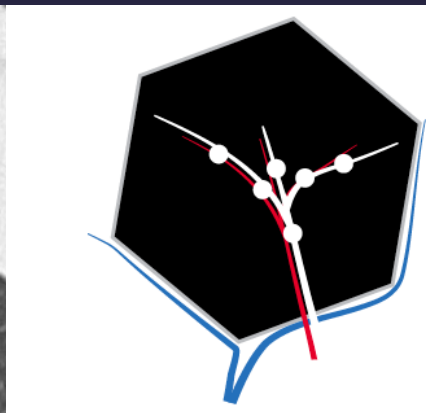
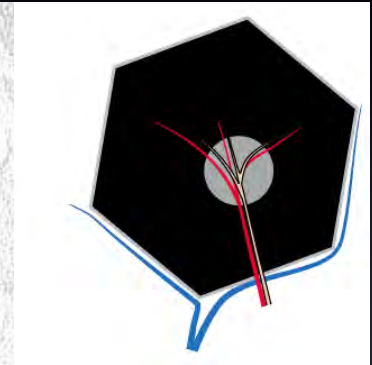
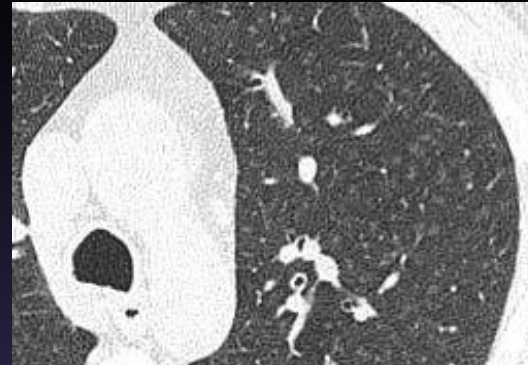
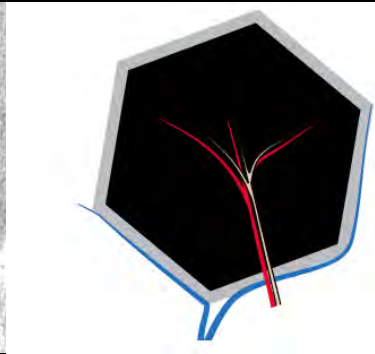
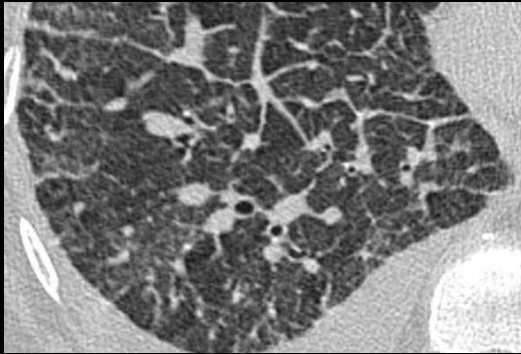


"Beaded septum"



DDx: Silicosis, Sarcoidosis and lymphangitic carcinomatosis

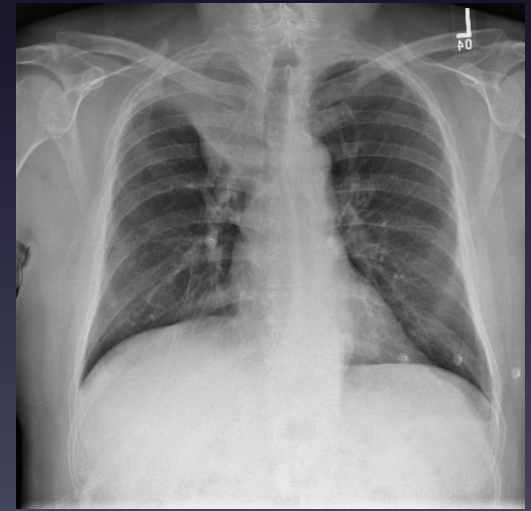
HRCT and Interstitial Opacities



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Types of Pulmonary Opacity

- Airspace Opacity - Alveolar Filling, consolidation
- Interstitial Opacity (reticular, nodular, linear, reticulonodular)
- Atelectasis/collapse



Atelectasis: “Incomplete Expansion”

- Any condition in which there is loss of lung volume, usually leading to increased opacity
- Distinguish from pneumonia based on loss of volume
- Multiple causes:

Type	Example
Resorptive	Bronchogenic carcinoma (endobronchial)
Passive (relaxation)	Pleural effusion, PTX
Compressive	Bulla
Cicatricial	Post 1° TB, Radiation fibrosis
Adhesive	Respiratory distress syndrome of newborn

Distributions of Atelectasis

Lobar Collapse



Segmental Atelectasis



Subsegmental (platelike) Atelectasis



Brant and Helms

Rounded atelectasis

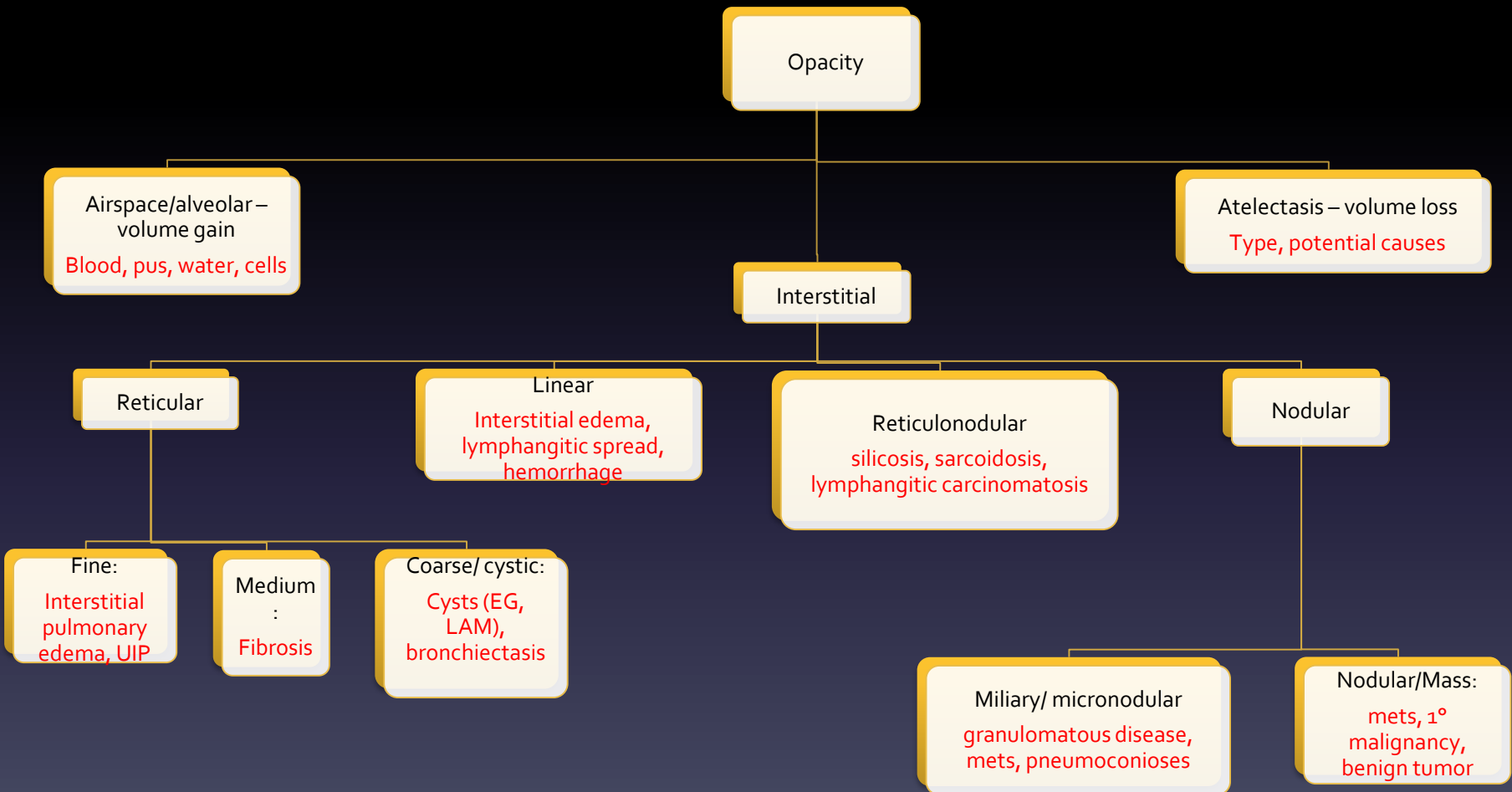


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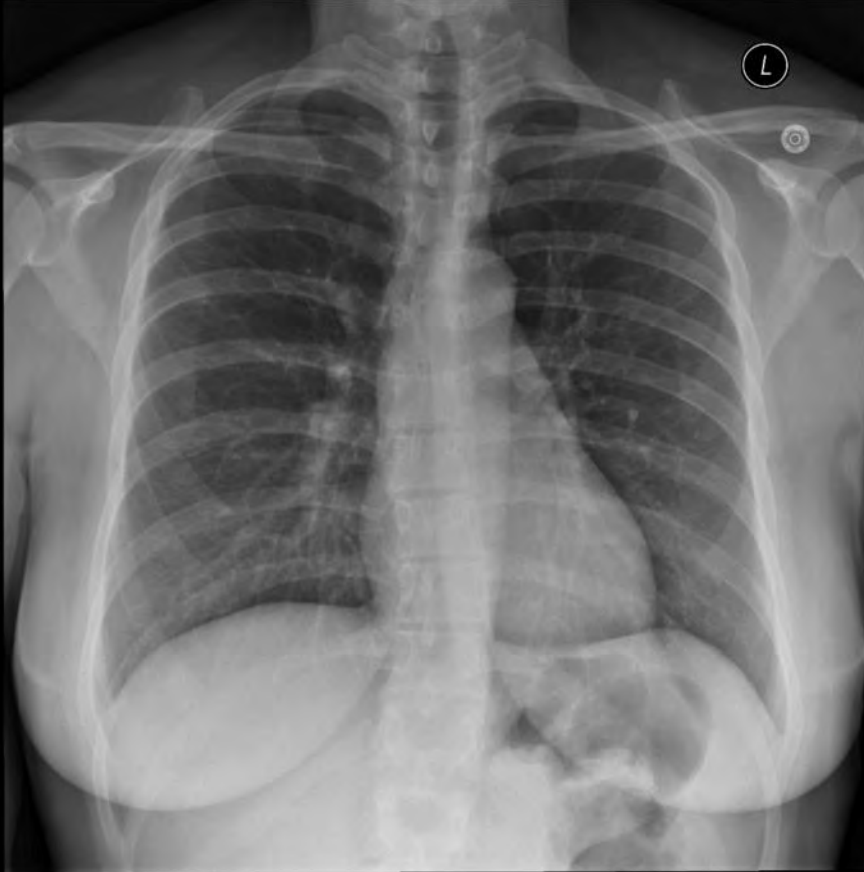
Signs of Atelectasis

DIRECT SIGNS	INDIRECT SIGNS
Displacement of interlobar fissure	Increased density of atelectatic lung
	Bronchovascular crowding
	Ipsilateral diaphragm elevation
	Ipsilateral tracheal/cardiac/mediastinal shift
	Hilar elevation (upper lobe atelectasis) or depression (lower lobe atelectasis)
	Compensatory hyperinflation of other lobes
	Shifting granuloma
	Ipsilateral small hemithorax
	Enhancing lung (distinction from pneumonia)
	Ipsilateral rib space narrowing

Strategy for Taking a Case

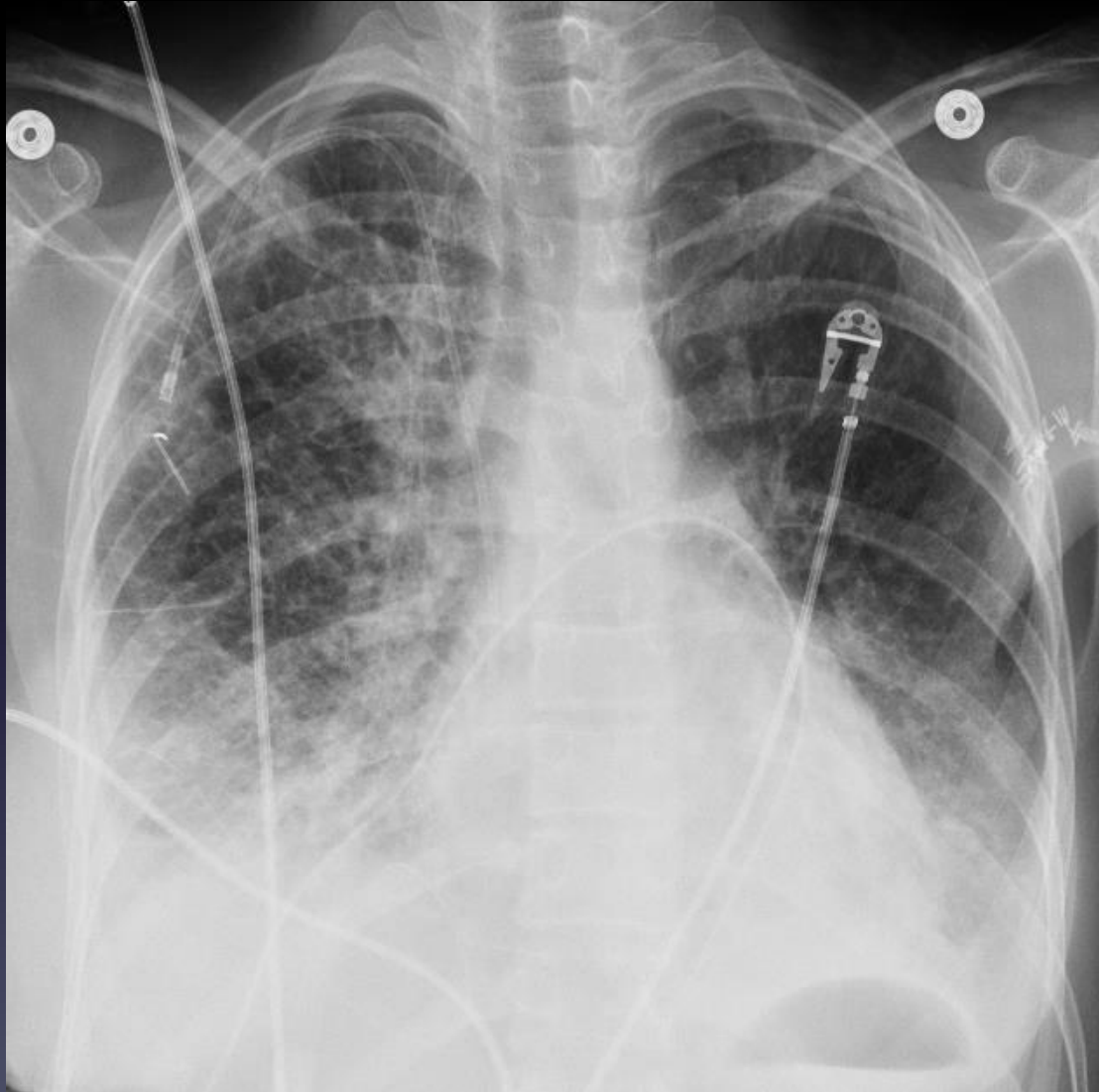


Review Search Pattern



Case 1

Case courtesy of
Jeremy Wortman,
MD



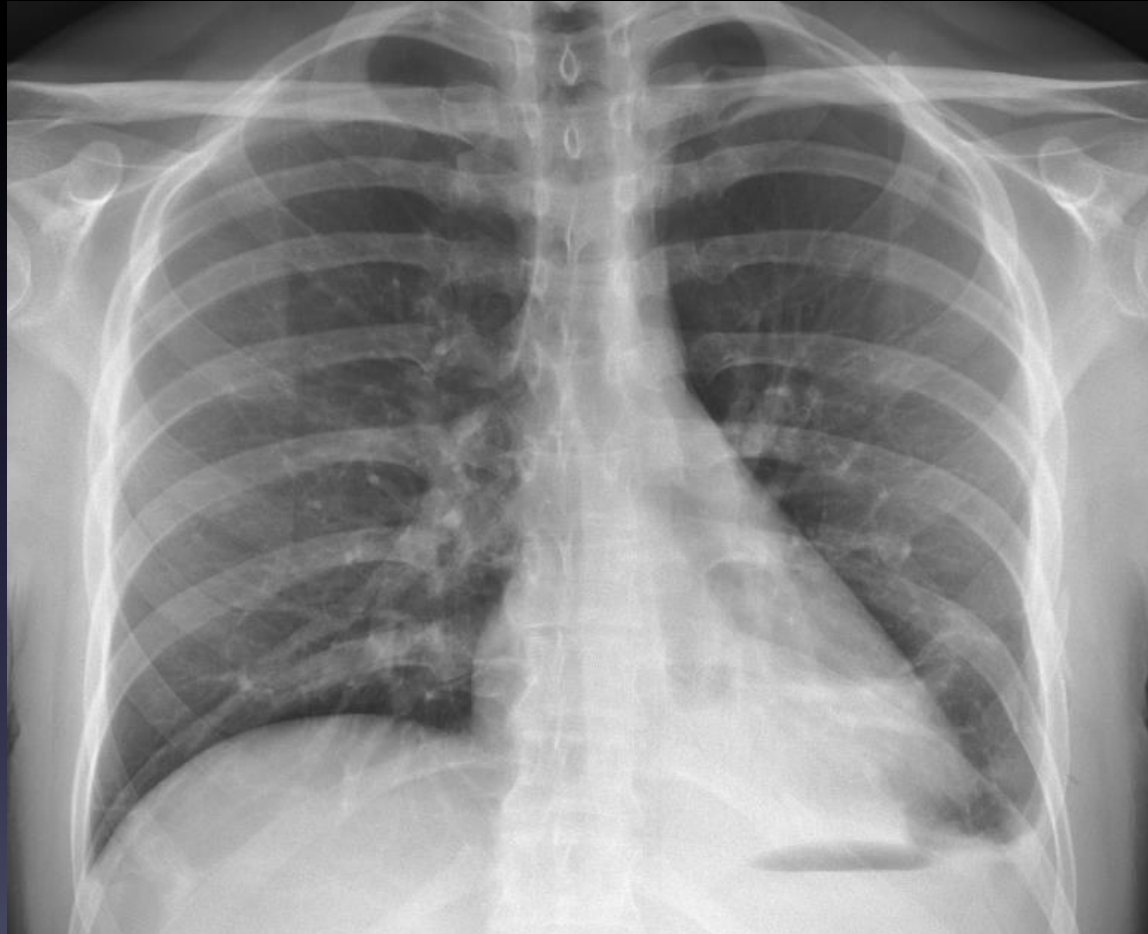
Case 2



Case 3



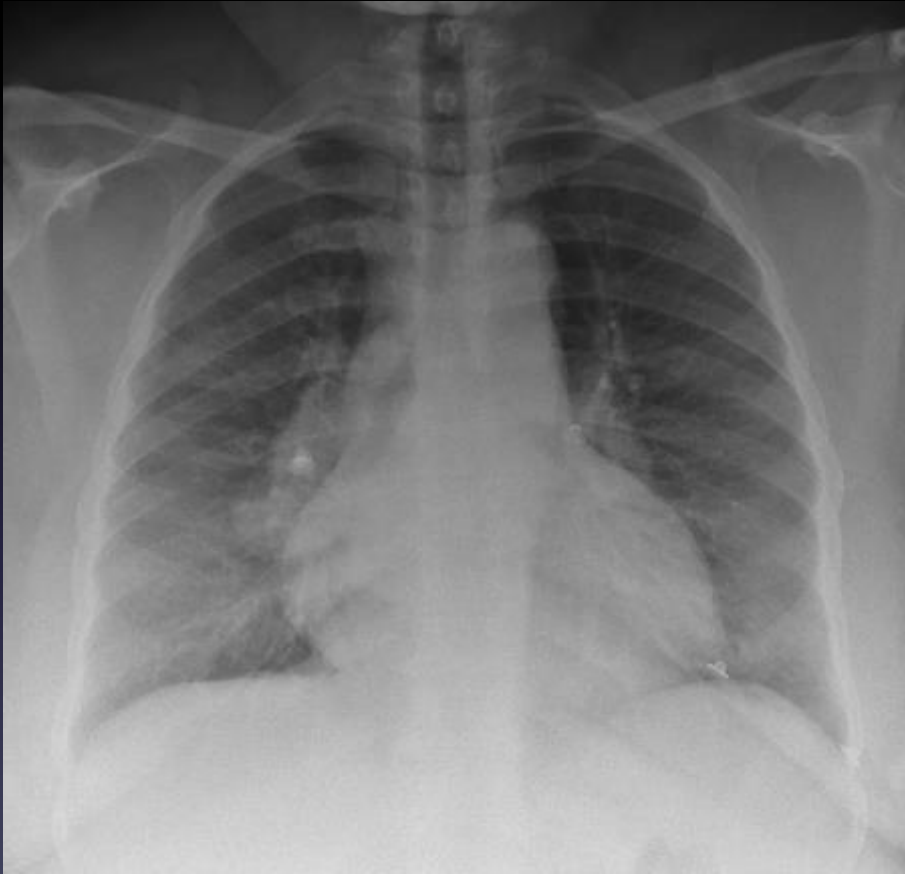
Case 4 - Trauma



Case 4



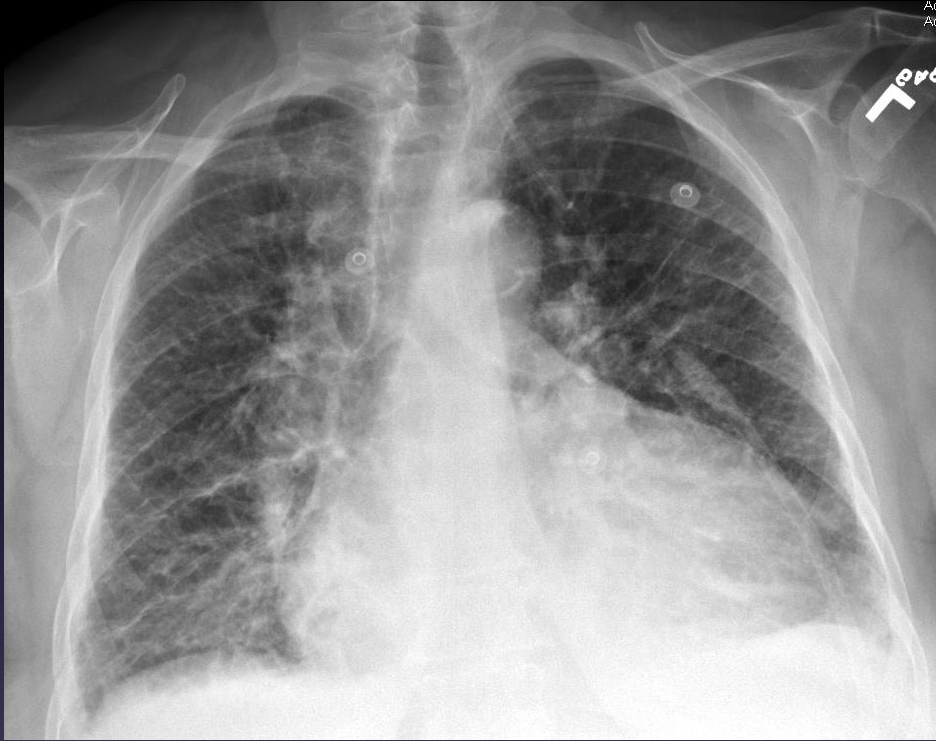
Case 5



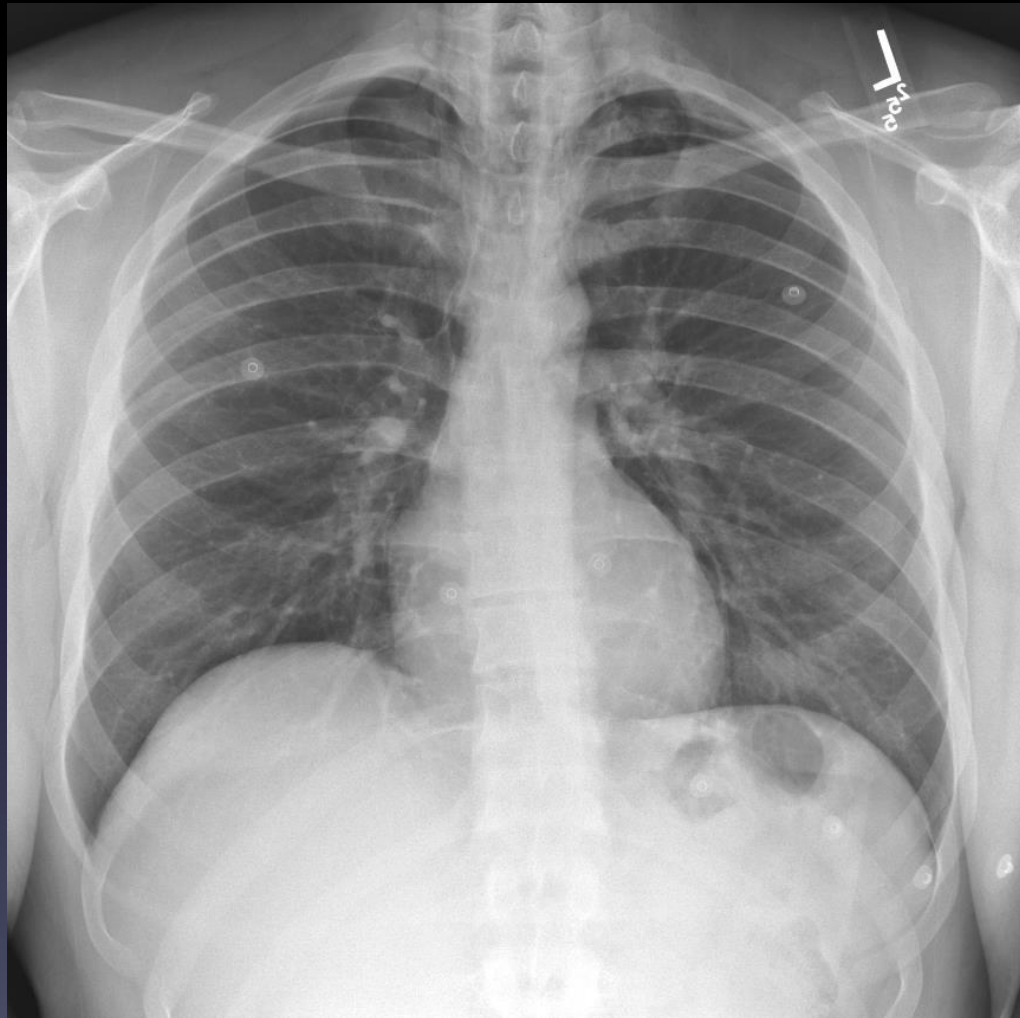
Case 6



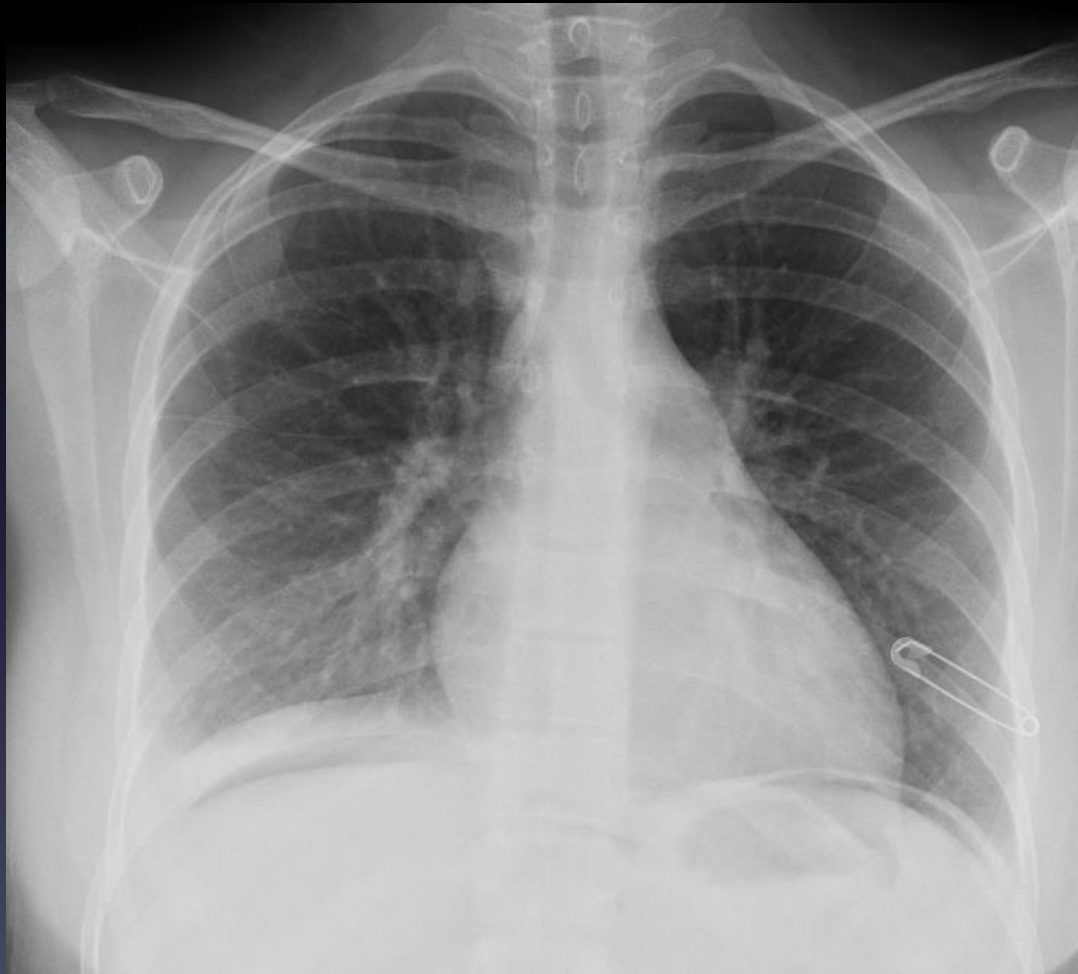
Case 7



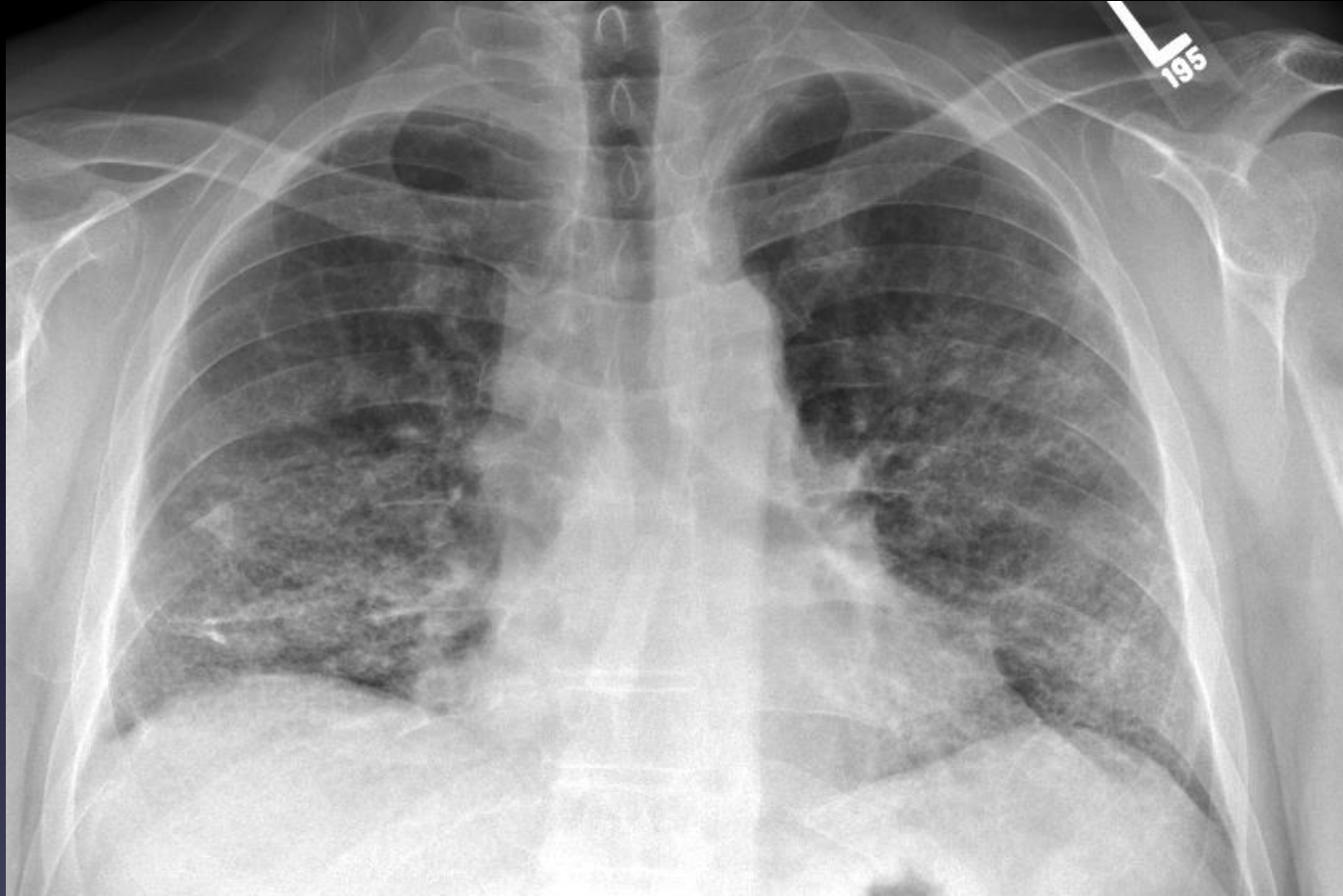
Case 8



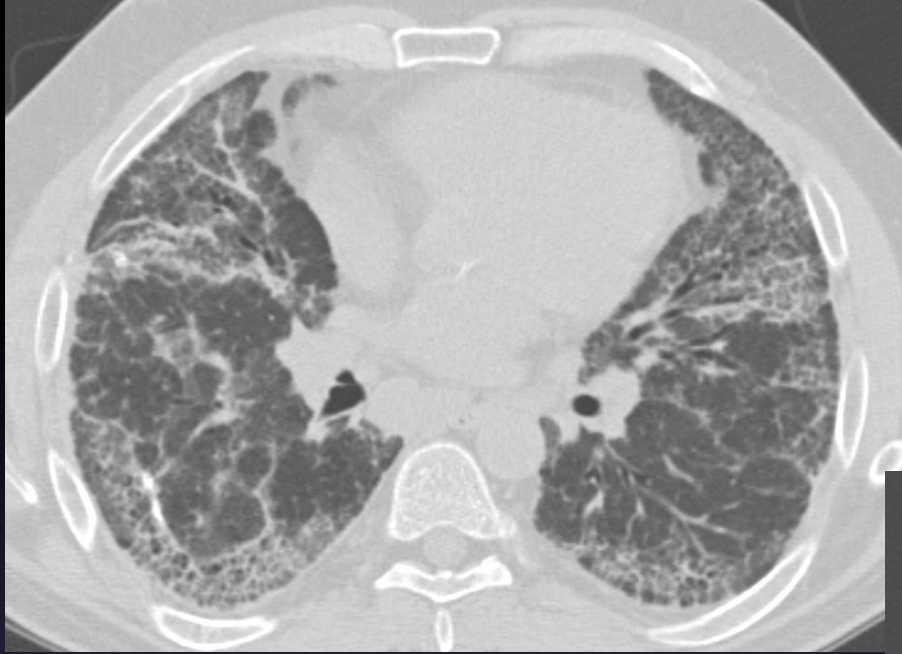
Case 9



Case 9



Case 9

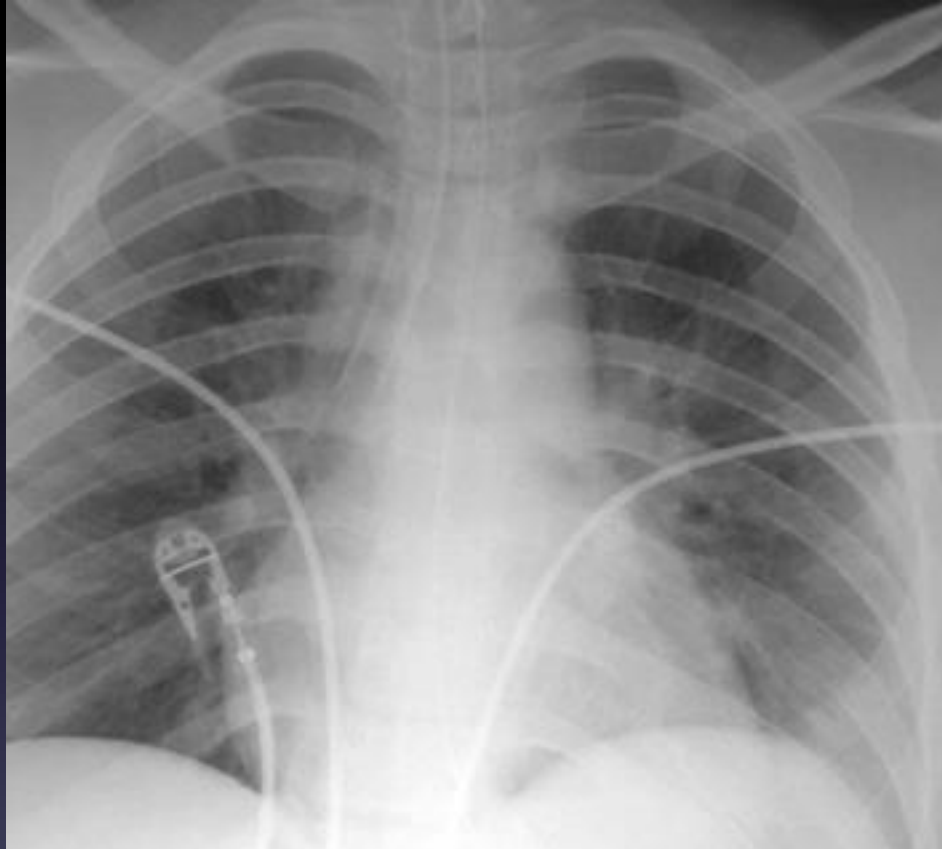


Case 10



Case 11

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Case 12

Case courtesy of
Rob Gordon, MD



Prior



Current

