

TB: Recognizing it on a Chest X-Ray

Michigan World TB Day April 8, 2016

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Disclosures

- Grant support from Michigan Department of Community Health

– Despite conflict of interest I still want to:

Stop TB



in my lifetime

– There's enough TB for job security.

Objectives

- You will
 - Be able to identify major structures on a normal chest x-ray
 - Identify and correctly name CXR abnormalities seen commonly in TB
 - Recognize chest x-ray patterns that suggest TB & when you find them you will



Basics of Diagnostic X-ray Physics

- X-rays are directed at the patient and variably absorbed
 - When not absorbed
 - Pass through patient & strike the x-ray film **or**
 - When completely absorbed
 - Don't strike x-ray film **or**
 - When scattered
 - Some strike the x-ray film



Absorption

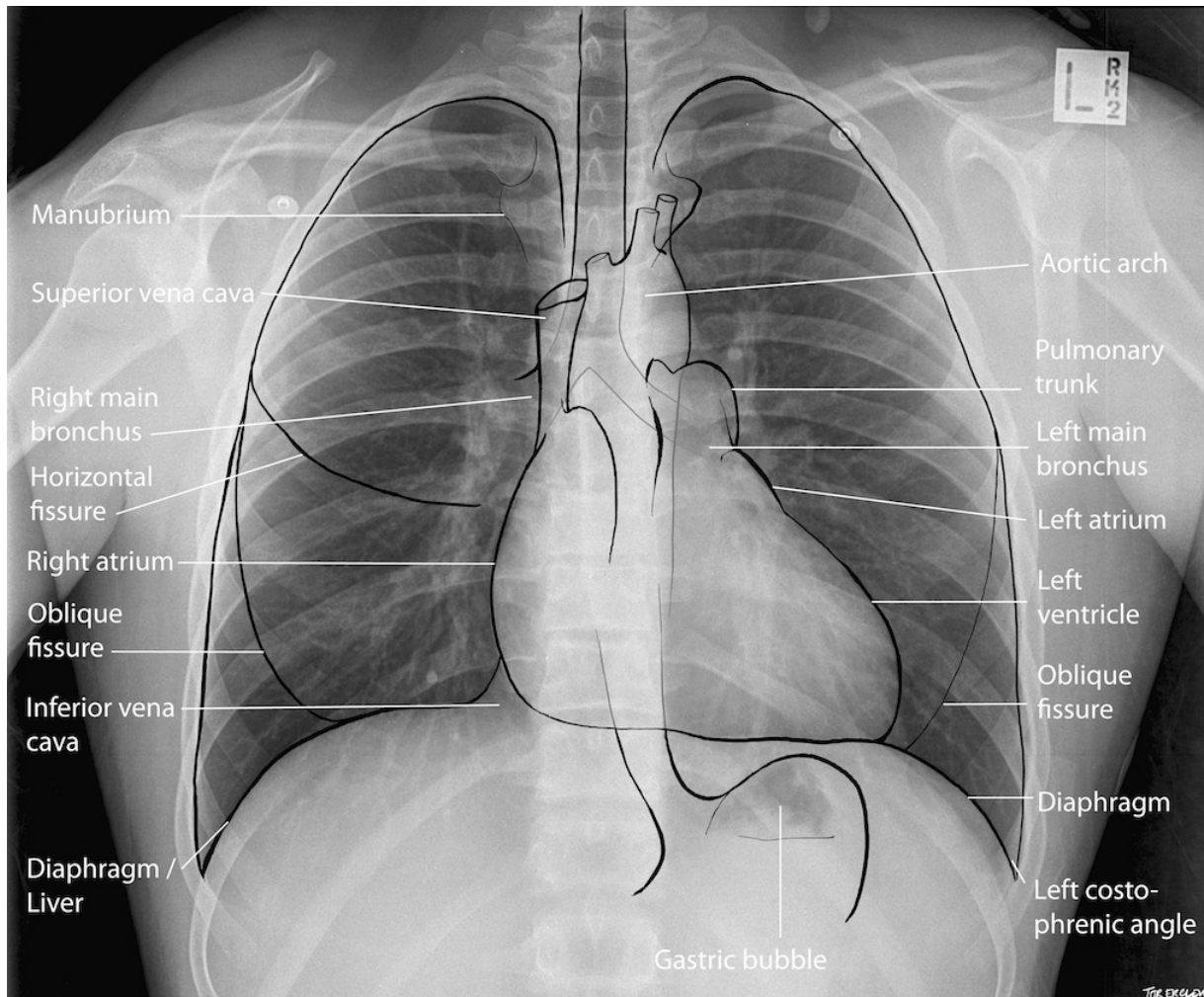
- Absorption depends on the
 - Energy of the x-ray beam
 - Density of the tissue



Shade / Density

- Whitest = Most Dense
 - Metal
 - Contrast material (dye)
 - Calcium
 - Bone
 - Water
 - Soft Tissue
 - Fat
 - Air / Gas
- Blackest = Least Dense

Normal Frontal Chest X-ray: Posterior Anterior



Note silhouette

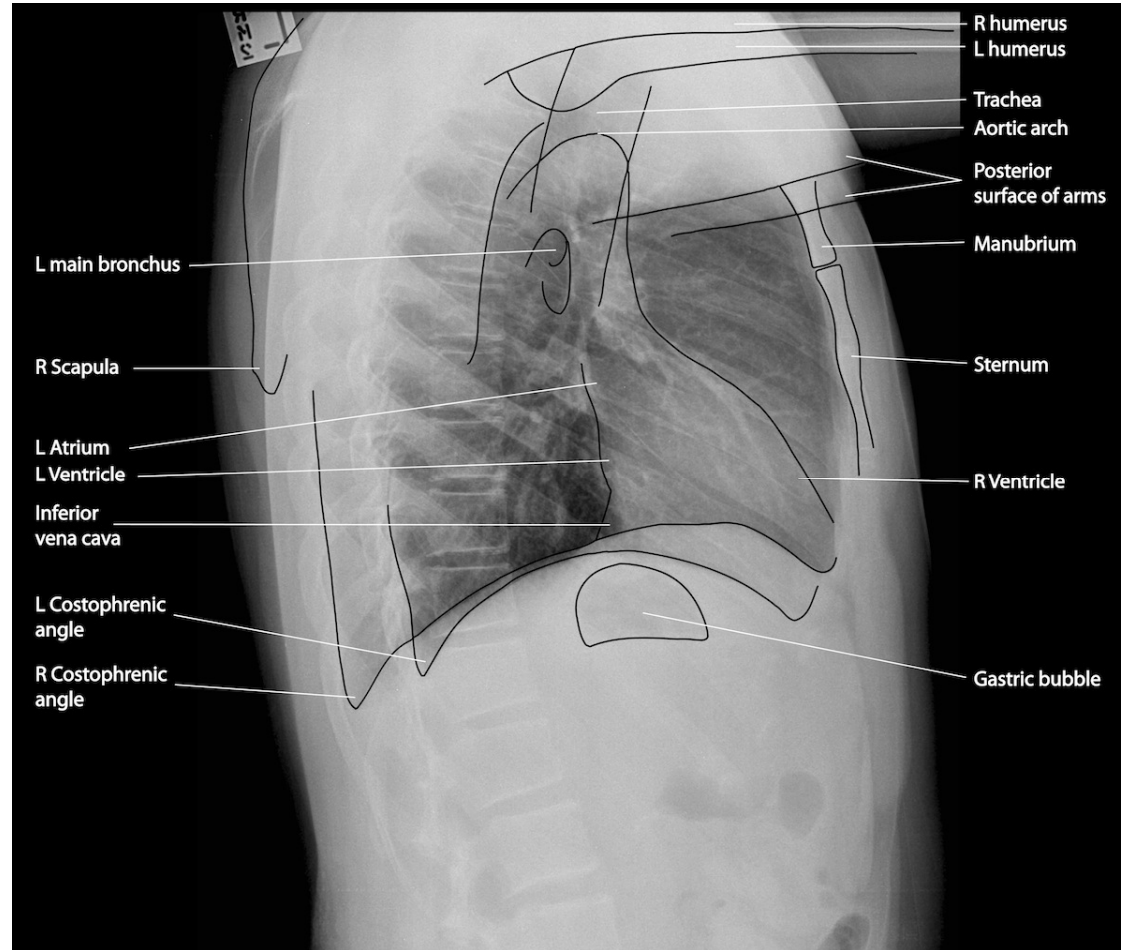
formed by

- lung adjacent to heart
- lung adjacent to diaphragm

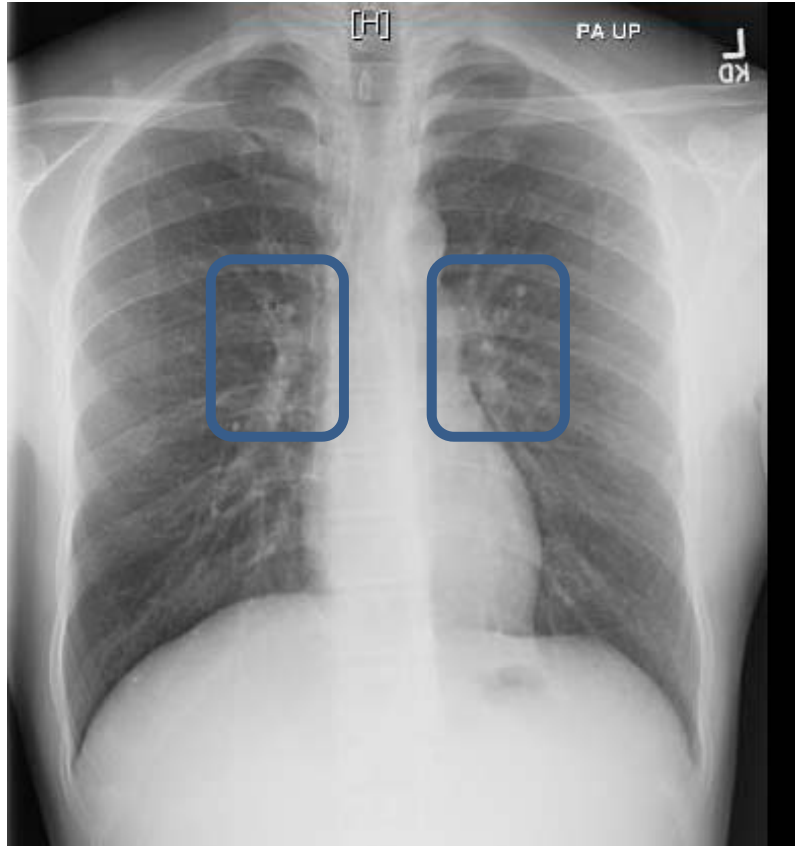


Silhouette Sign

Normal Lateral Chest X-ray

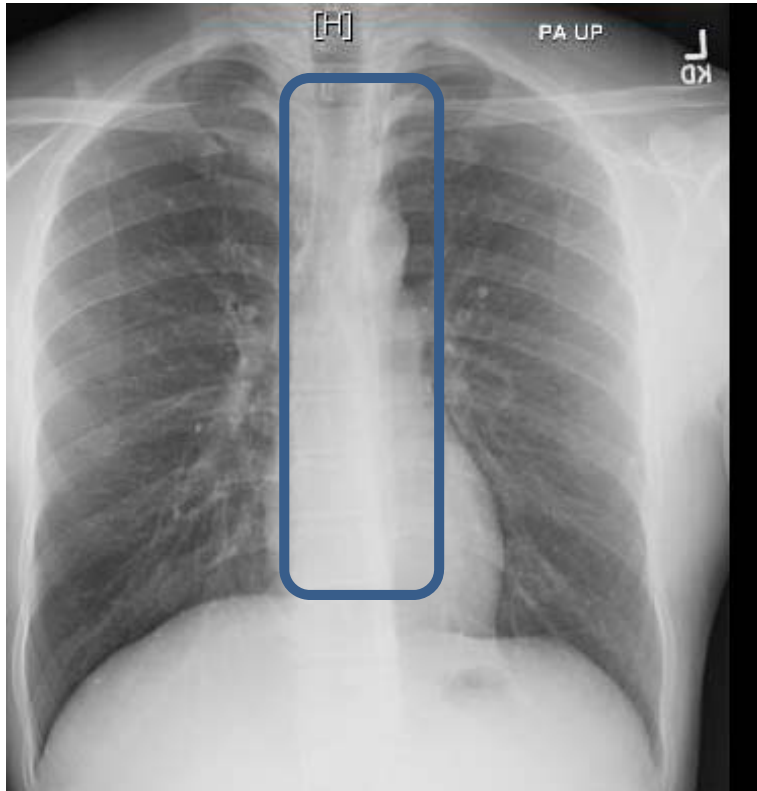


Normal PA & Lateral X-ray: Hilum



Hilum – Major bronchi, Pulmonary veins & arteries,
Lymph nodes at the root of the lung.

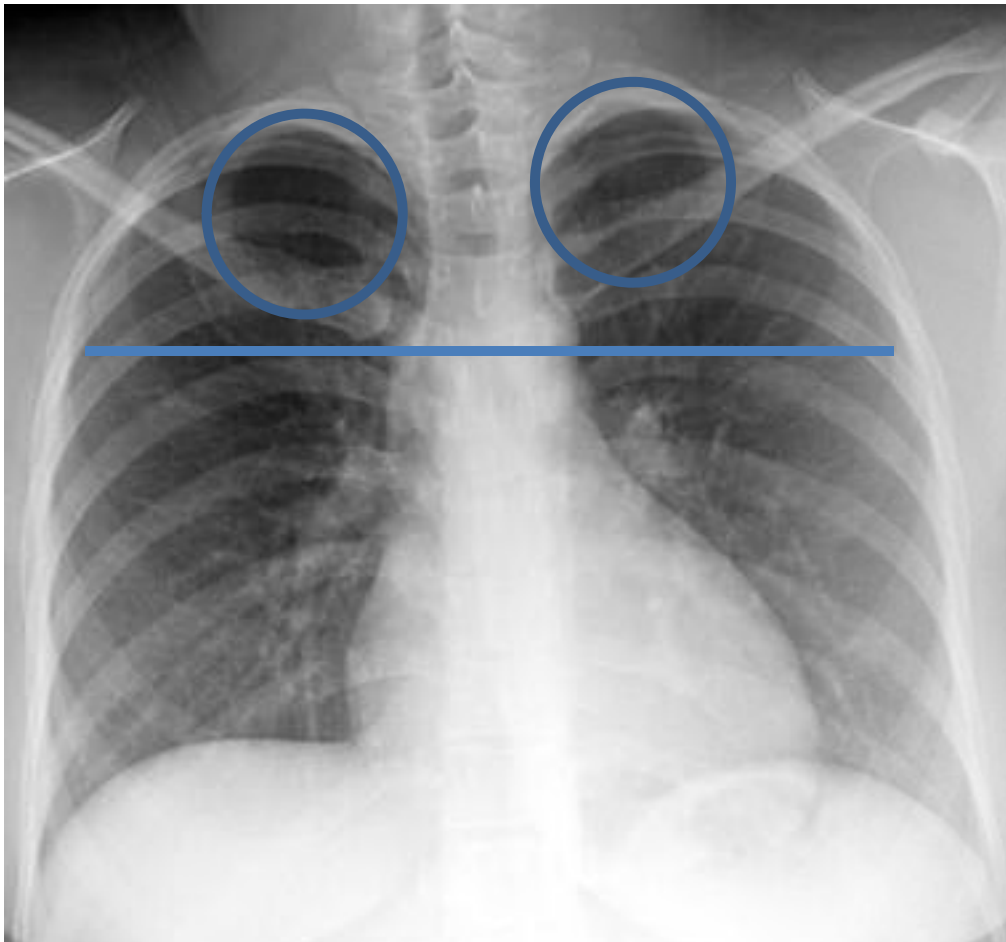
Normal PA & Lateral X-ray: Mediastinum



Mediastinum – Central chest organs (not lungs) –
Heart, Aorta, Trachea, Thymus, Esophagus, **Lymph**
nodes, Nerves

(Between 2 pleuras or linings of the lungs)

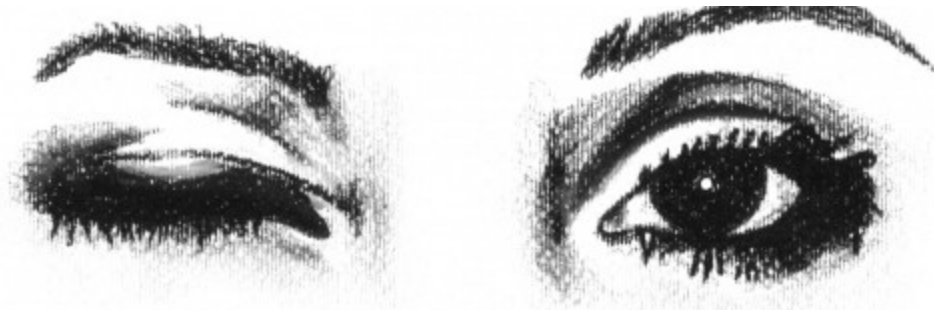
Normal PA & Lateral X-ray: Apex



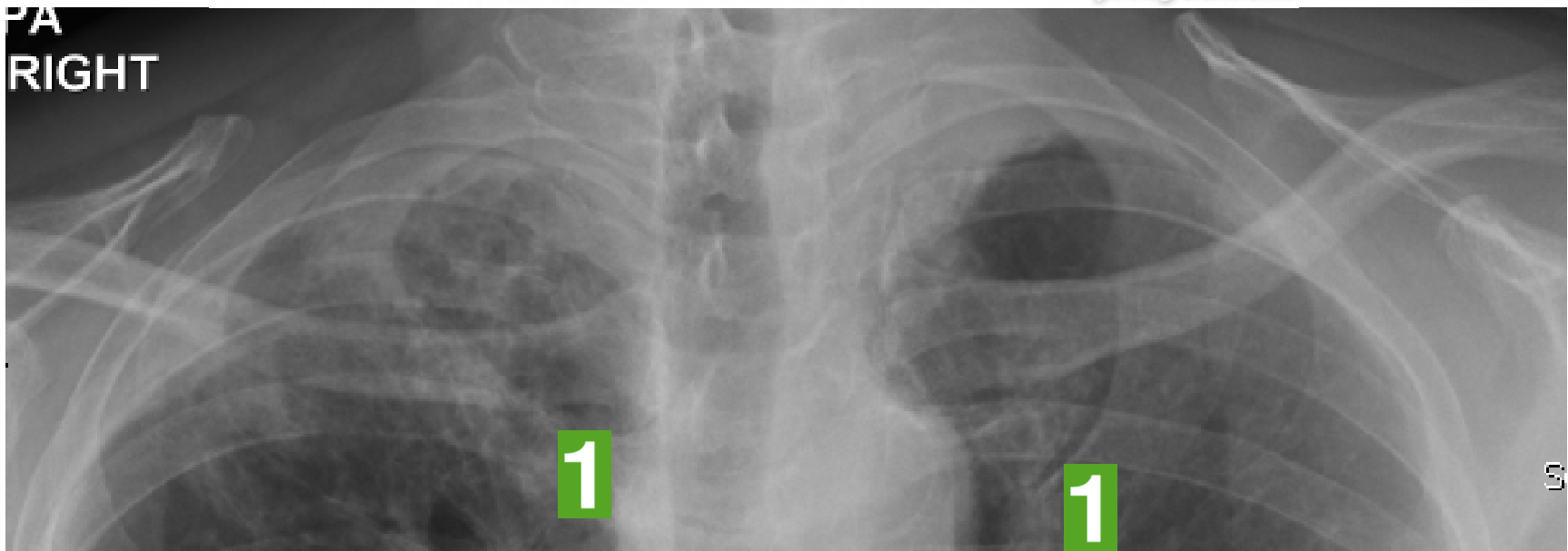
- Apex of lung
 - Area of lung above the level of the anterior end of the 1st rib



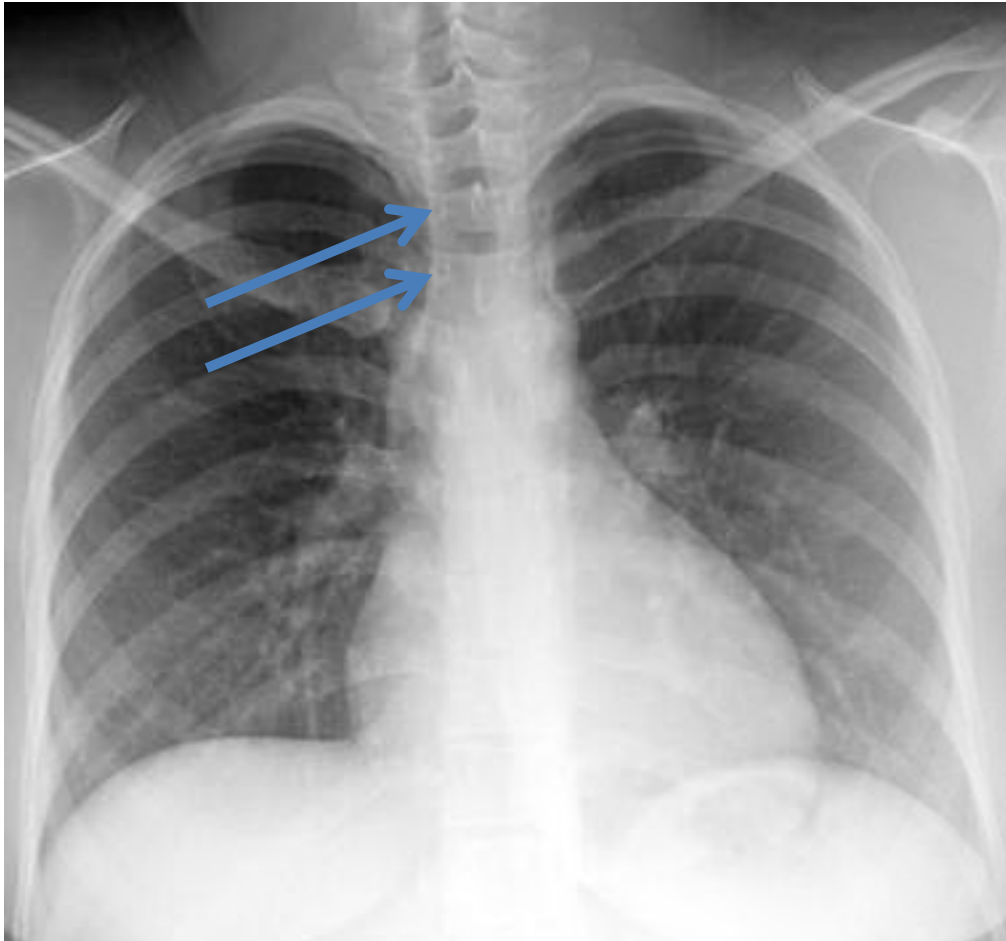
Wink Sign: Apex



pxleyes.com



Normal PA & Lateral X-ray: Right Paratracheal Stripe

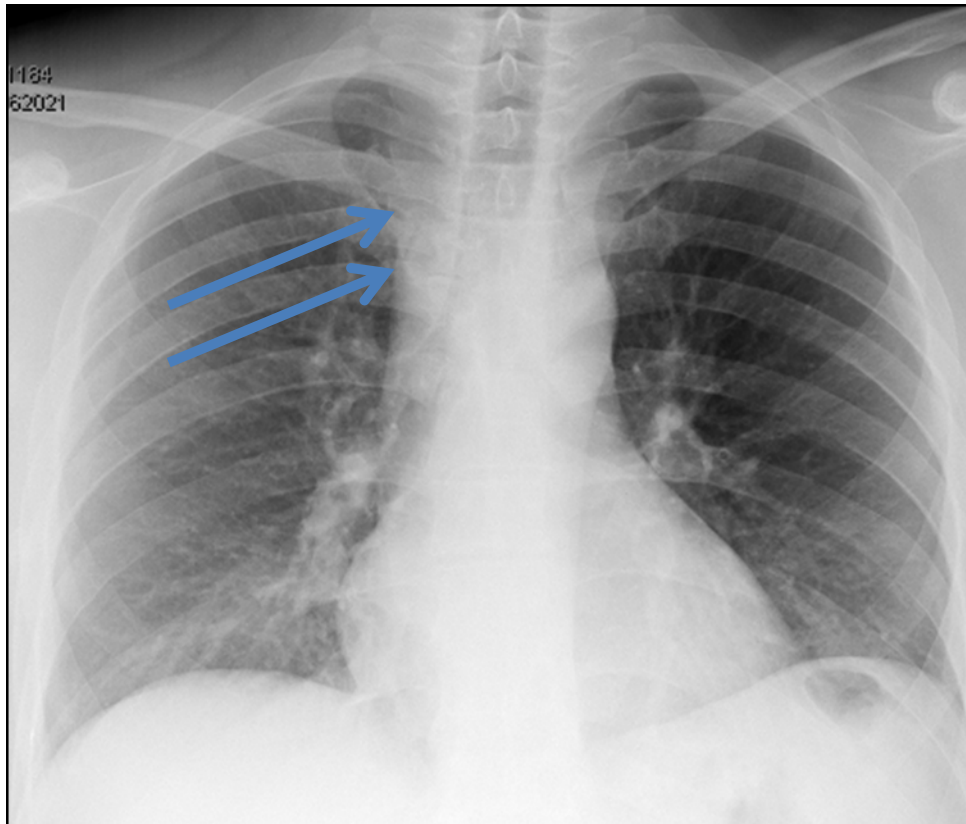


- Paratracheal stripe
 - Seen between the air in the trachea & air in the lung

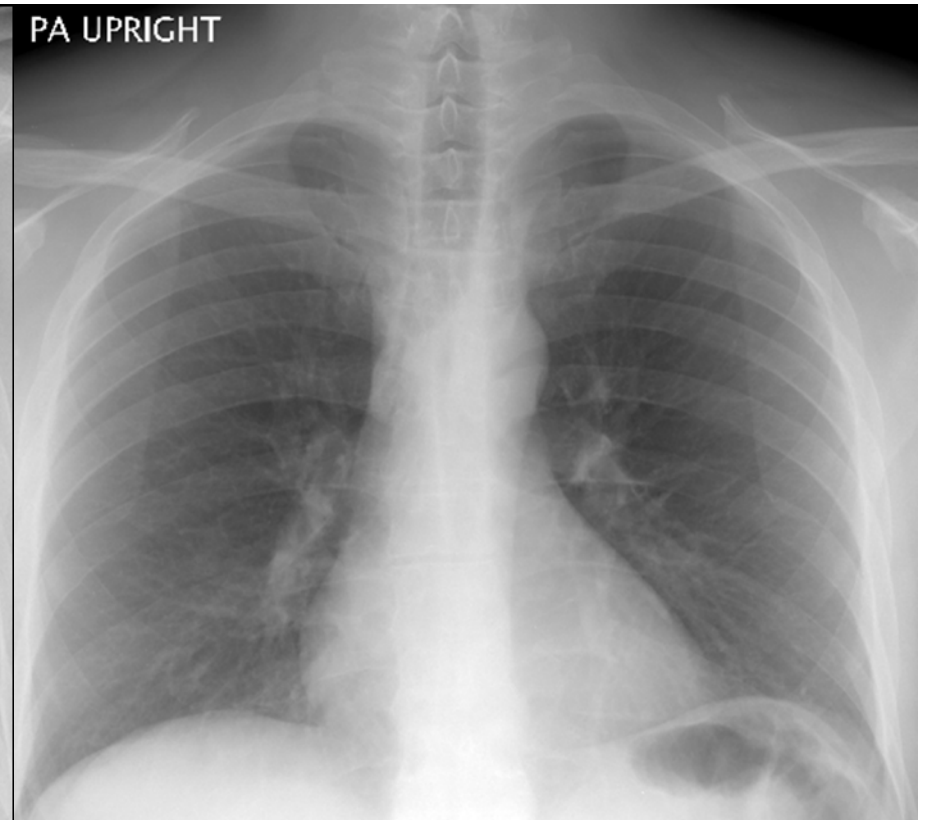


50 Year Old Iraqi with Fevers

- At Diagnosis **LN**s



- At End of Treatment





TB Radiology Image Library

Library Home

Resource Page

CITC Home

The TB Image Library is a joint project of the Curry International TB Center and Firland Northwest TB Center as an educational resource to share radiographic images related to tuberculosis.

- Individuals may use this site to gain an appreciation for the broad spectrum of presentation TB may have using various imaging modalities.
- The library images are free to download for non-commercial educational purposes only. All images should be credited in the format: CITC/Firland TB Image Library; contributor.
- To contribute images or offer comments/feedback/questions, please email: CurryTBcenter@ucsf.edu

Basic TB Chest abnormalities and patterns of disease

Consolidation/Opacities	Cavitations/Cysts	Linear opacities/Fibrosis
Nodules/Masses	Miliary pattern	Lymphadenopathy
Pleural abnormalities	Tracheobronchial abnormalities	

Consolidation

- Appears as a relatively homogeneous white area on chest x-ray
- Although the terms opacity and density are sometimes used, areas of consolidation are usually translucent; structures such as ribs are visible through the consolidation
- Is caused by filling of airspace with fluid, cells, pus, blood
- Without significant volume loss

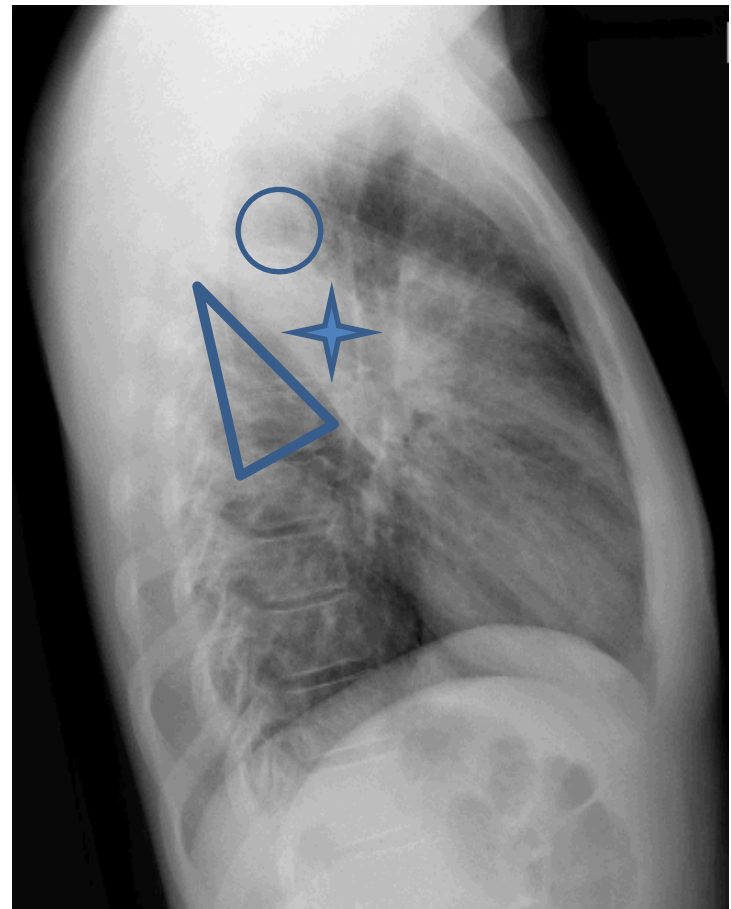
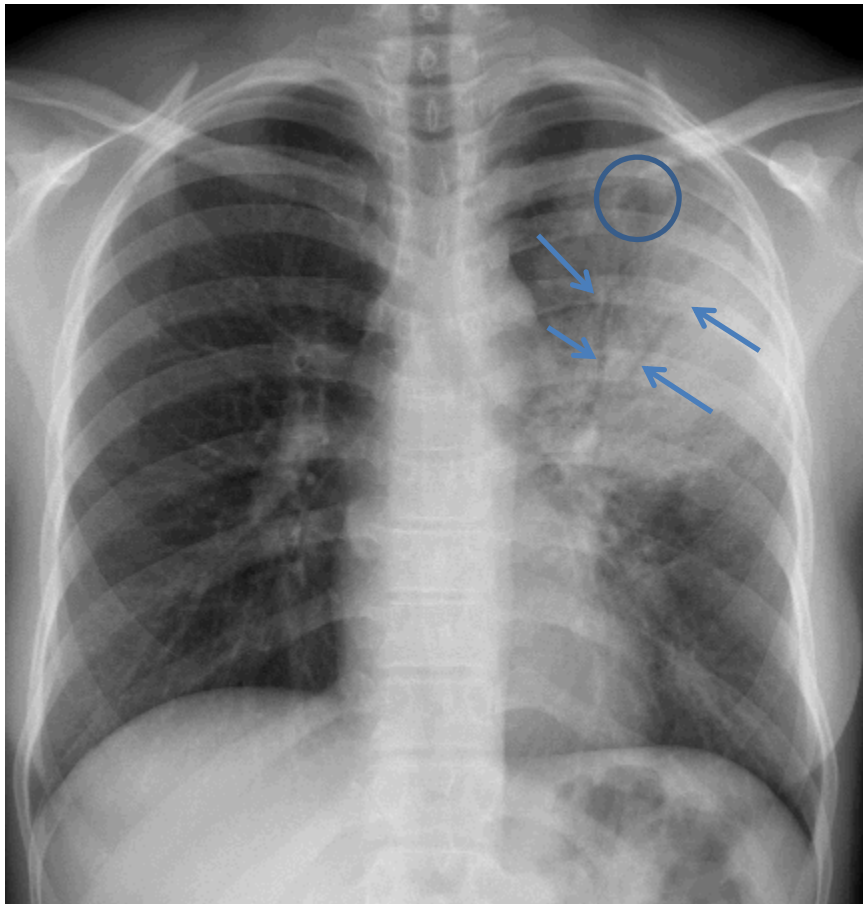
Consolidation

- Air bronchogram may be visible because air in the bronchus forms a silhouette with fluid in airspace (characteristic of consolidation; not always present).
- Silhouette sign occurs when opacity is contiguous with heart or diaphragm, causing loss of normal silhouette

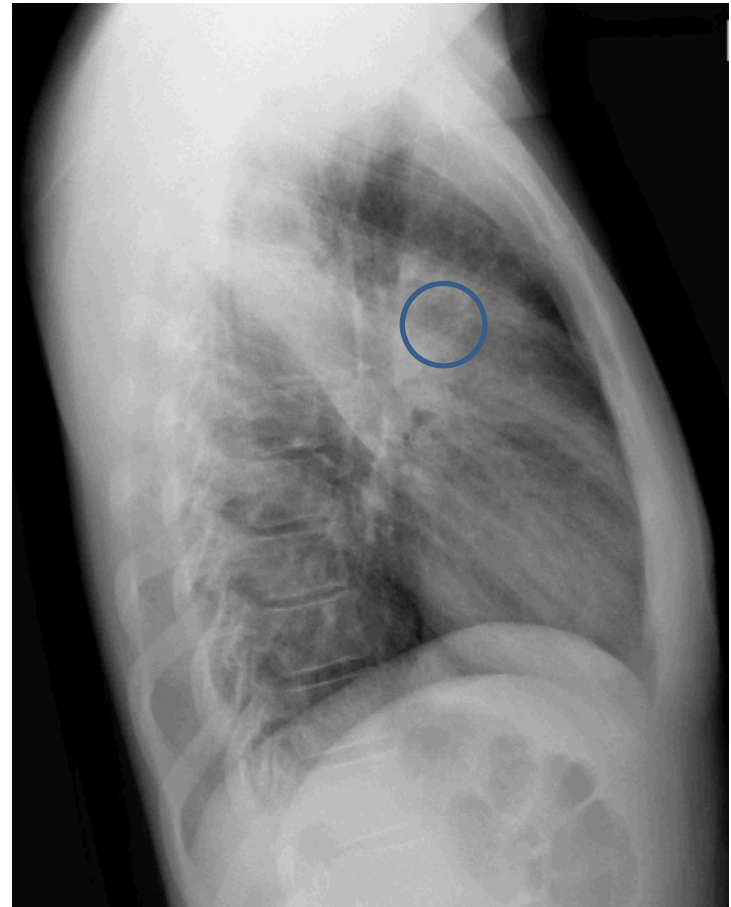
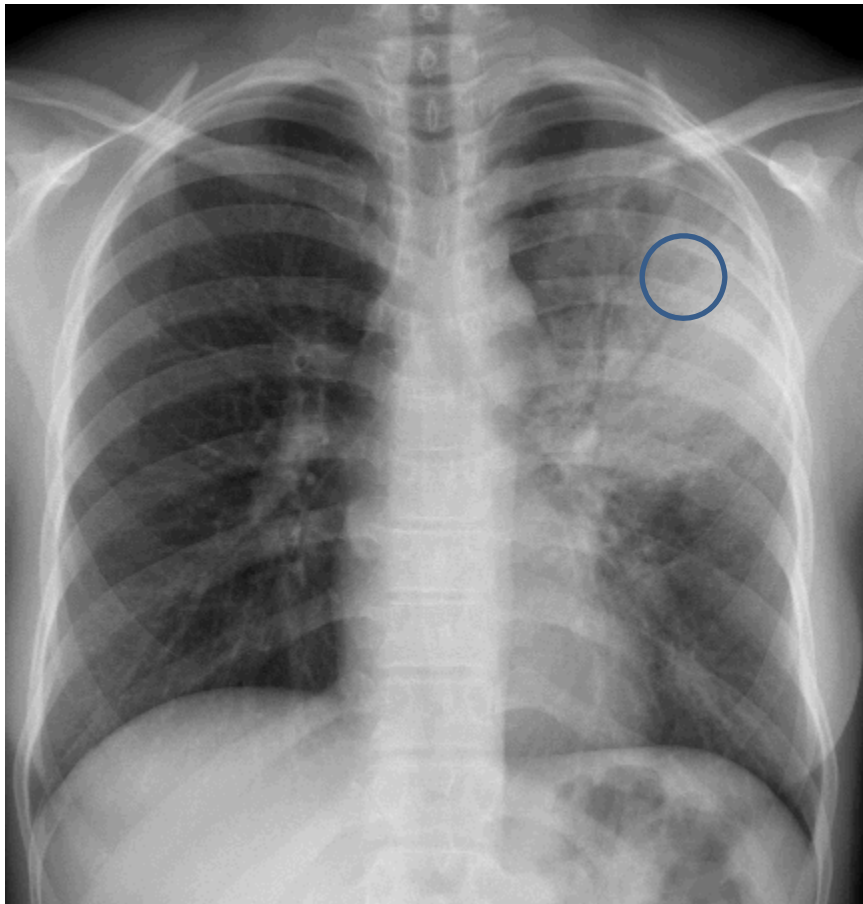
Consolidation / Opacity / Density

- The initial lesion in primary TB can be in any location in the lung
- In later (“reactivation”) TB, location is most frequently in the upper and posterior portions of the lung
 - Apical and posterior segments of the right upper lobe
 - Apical-posterior segment of the left upper lobe
 - Superior segments of the lower lobes

Consolidation, Air Bronchogram Left upper lobe apical-posterior segment

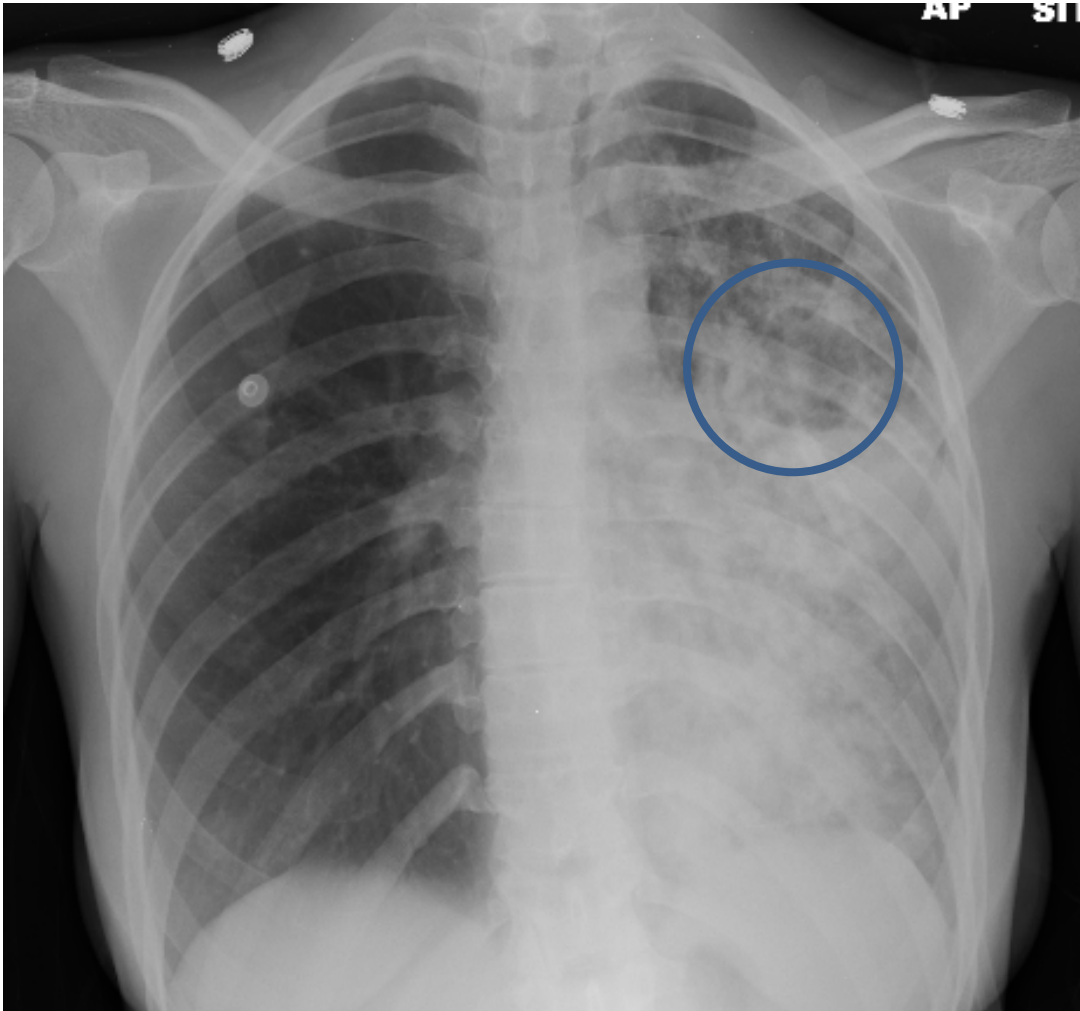


Consolidation, Air Bronchogram Left upper lobe apical-posterior segment

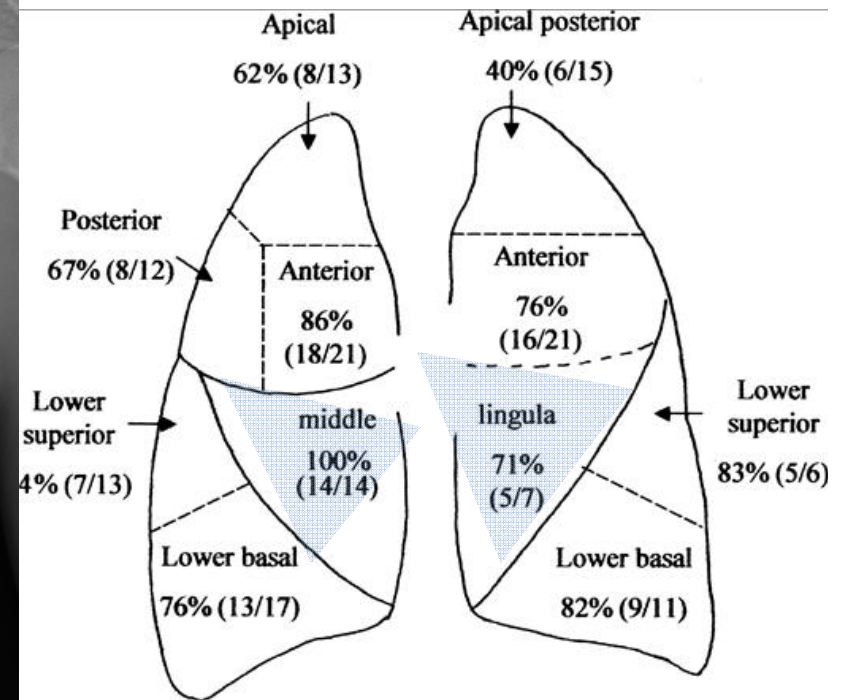


Silhouette Sign (no heart) & More

21 year old, severe agorophobia



Lingula



Nodules / Masses

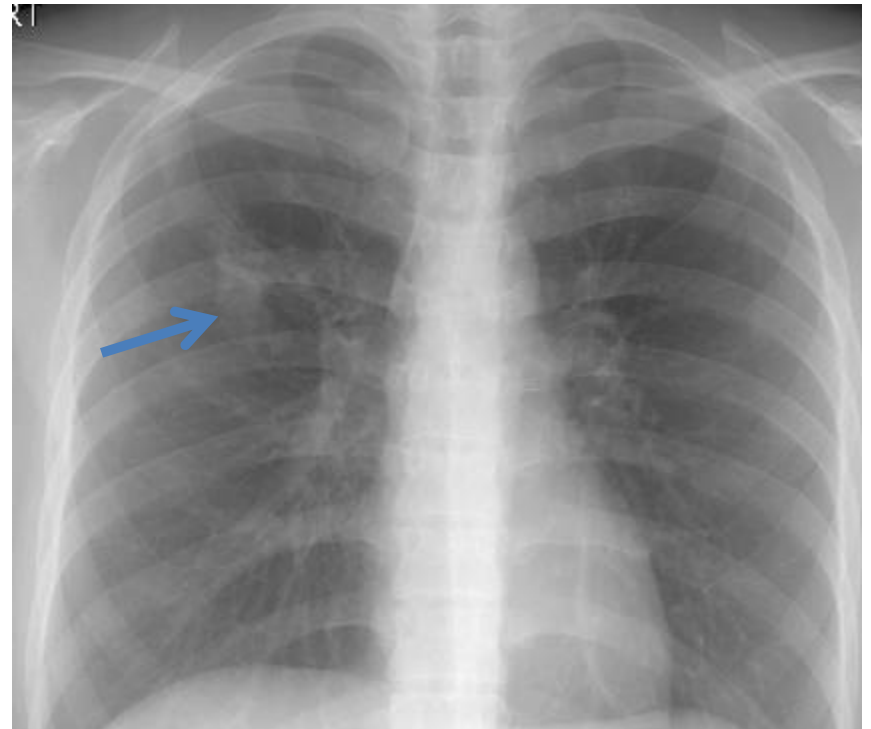
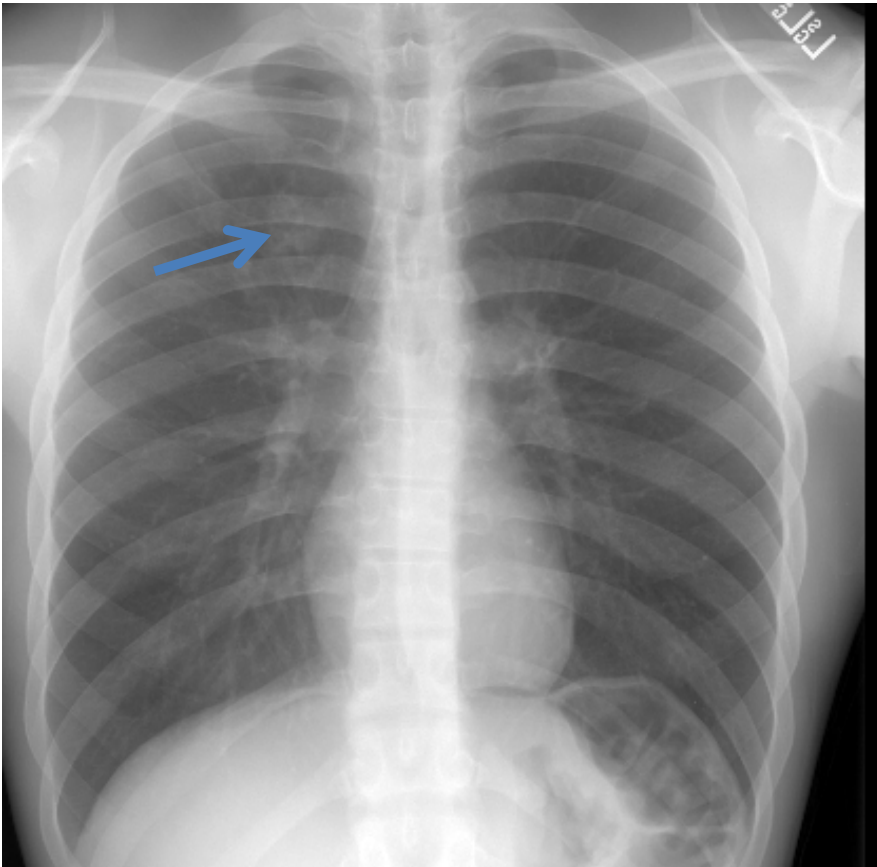
- Nodule - discrete opacity or density that is 2-30 mm in diameter
- TB nodules can be
 - Solitary
 - Multiple
 - Associated with other chest x-ray abnormalities due to TB
- A common pattern for primary TB is a nodule (the primary focus of infection) plus ipsilateral enlarged mediastinal or hilar lymph node(s)

Nodules / Masses

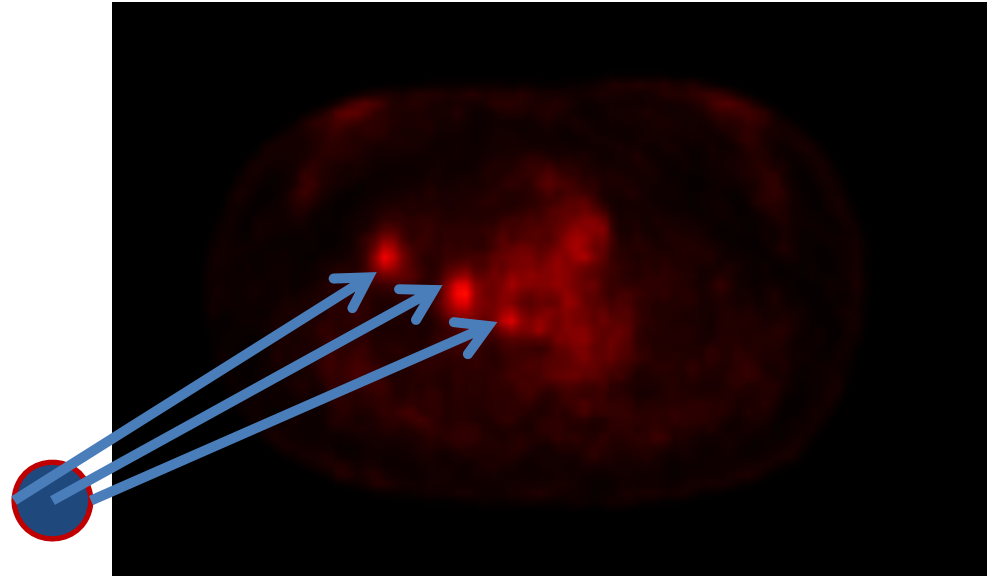
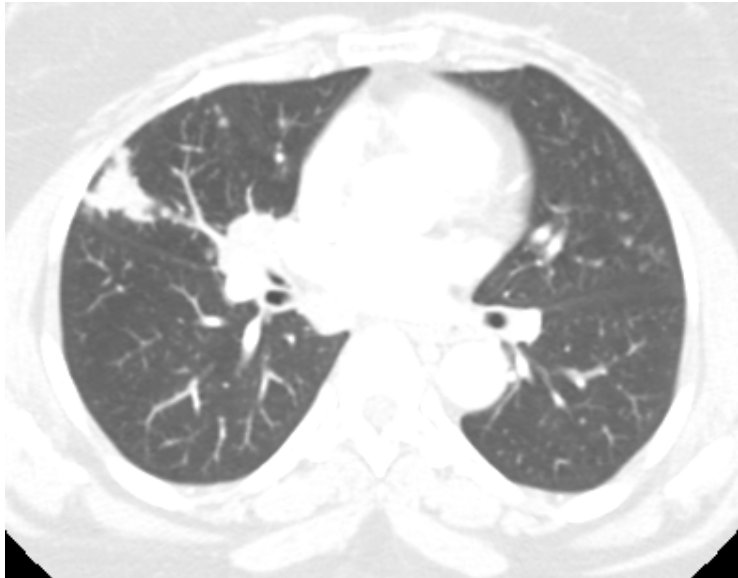
- TB nodules
 - Can cavitate (form cavities)
 - Calcify when they heal
- A mass is larger than a nodule and is not typical of TB

Screening for TB in High Risk Individuals

- 22 year old, cough for 4 days, contact of case
- OT Student from Taiwan, TB skin test + 3 years ago; no symptoms, no Rx



PET Scans do NOT Differentiate TB from Cancer: This Patient had TB



“FDG avid pulmonary nodule in the right middle lobe, along with two FDG avid lymph nodes involving the right hilum and subcarinal region. Findings suspicious for **malignancy.**”

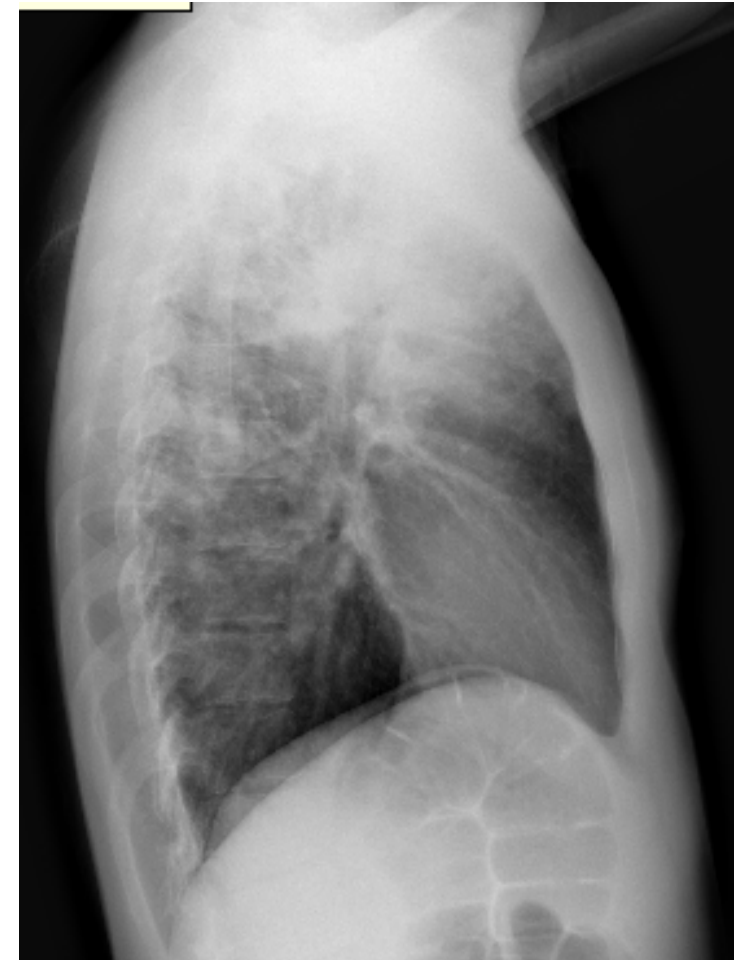
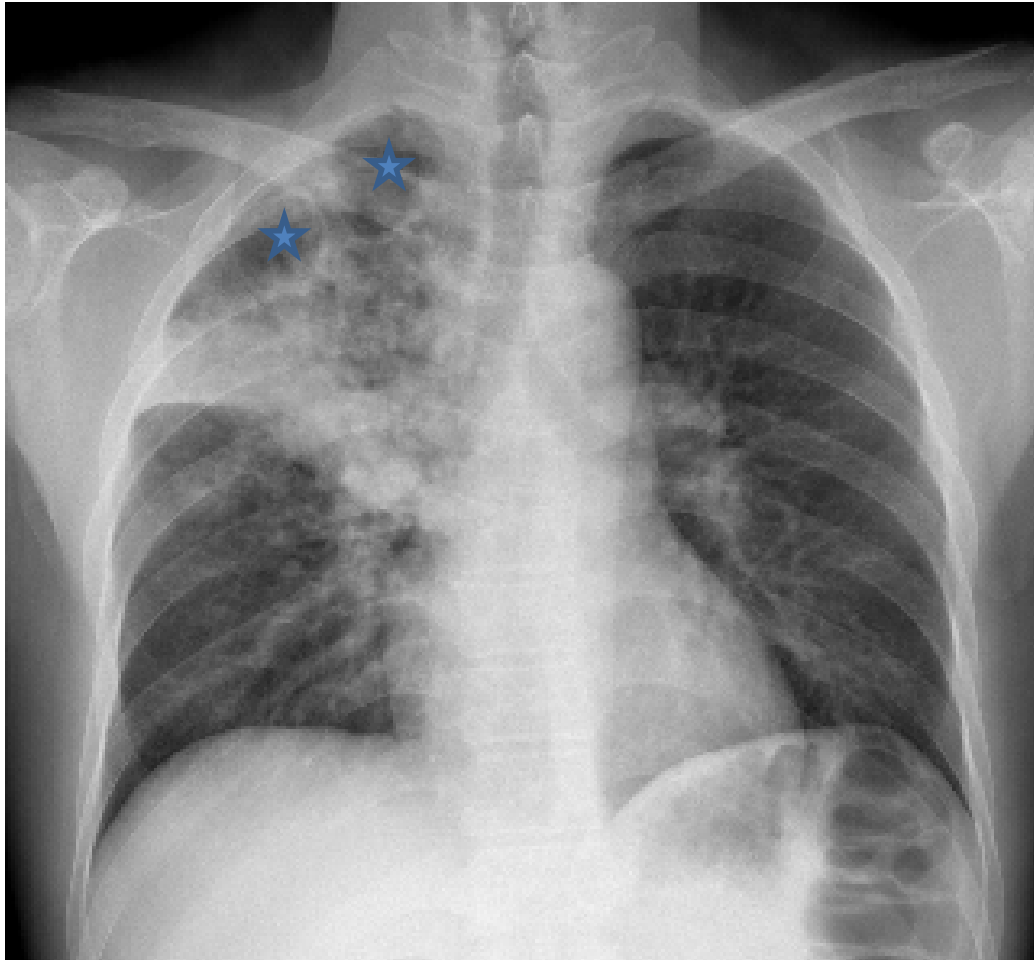
Cavities

- Most common in advanced disease (reactivation TB)
- Highly contagious, contain many actively multiplying organisms
- Endobronchial spread to other areas of lung
- Higher risk of developing drug resistance
- May take longer to treat
- Wall thickness thin to medium
- Significant air / fluid levels are rare

Cavities: Think Swiss Cheese

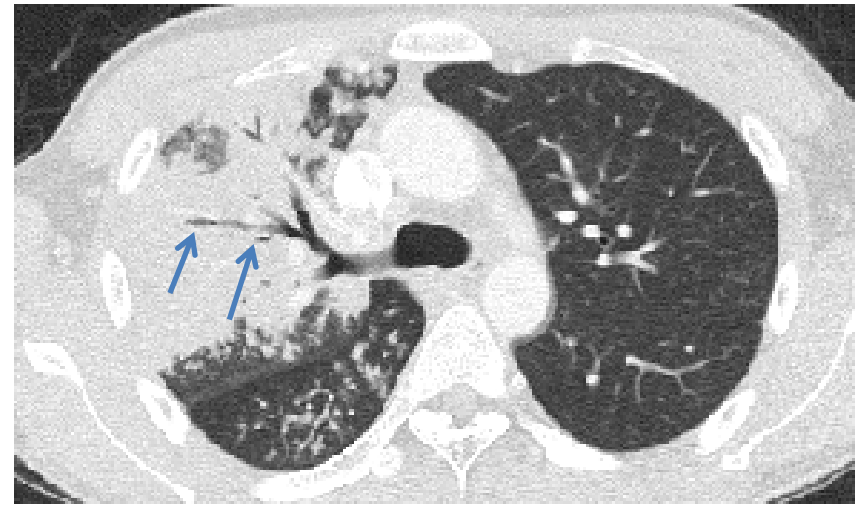
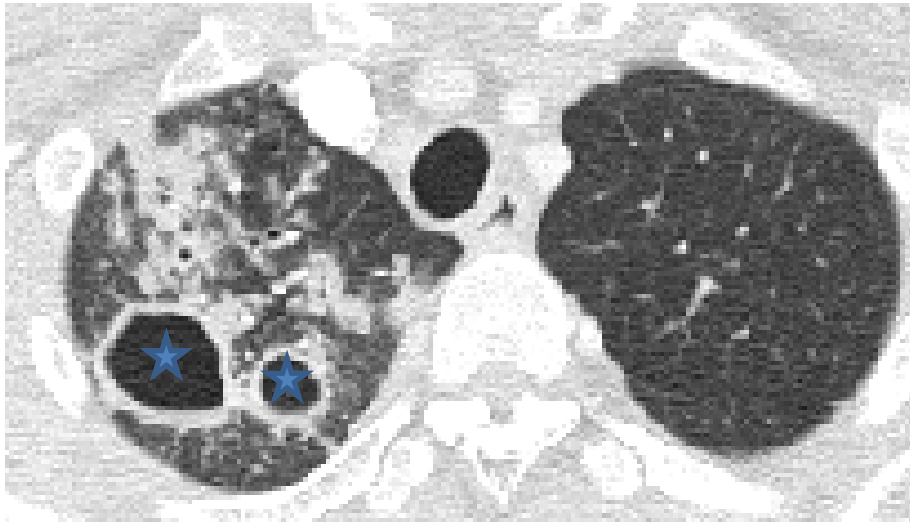


Young Man from Vietnam: Negative TB skin test, T-Spot, and QFT

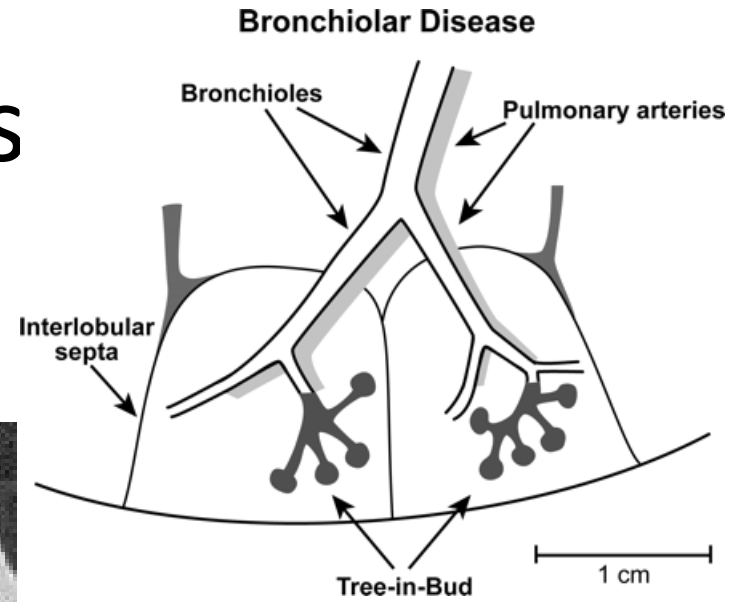
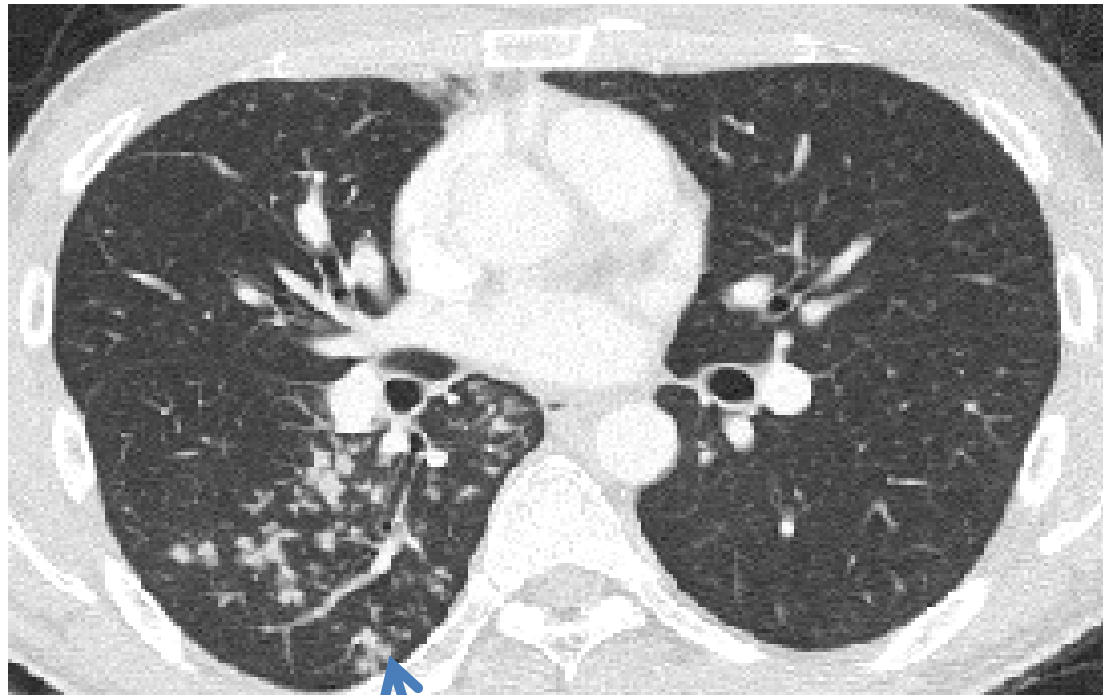


Multiple Findings on CT Scan

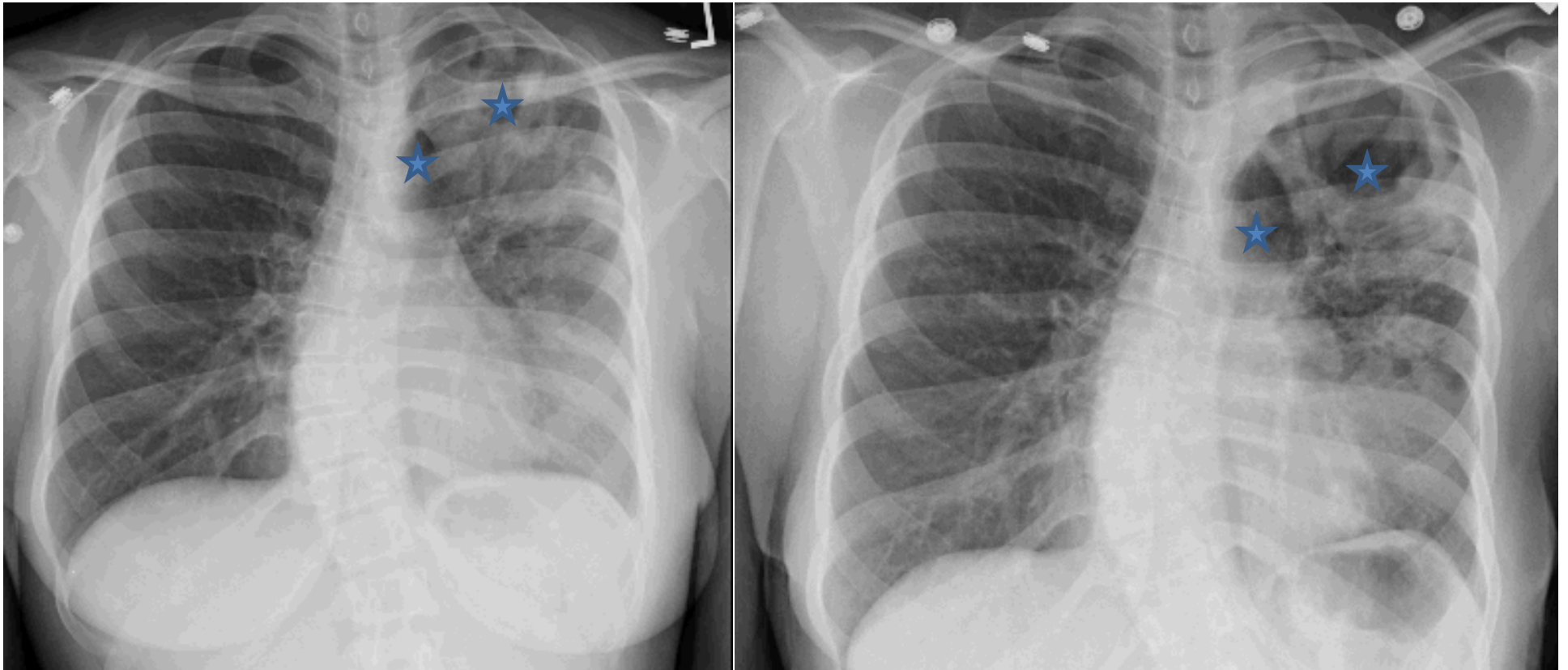
- Cavities, consolidation with air bronchograms, nodules, “tree-in-bud” densities



Tree-in-Bud Opacities



Young Woman Treated for Pneumonia And 6 Months Later



Miliary TB

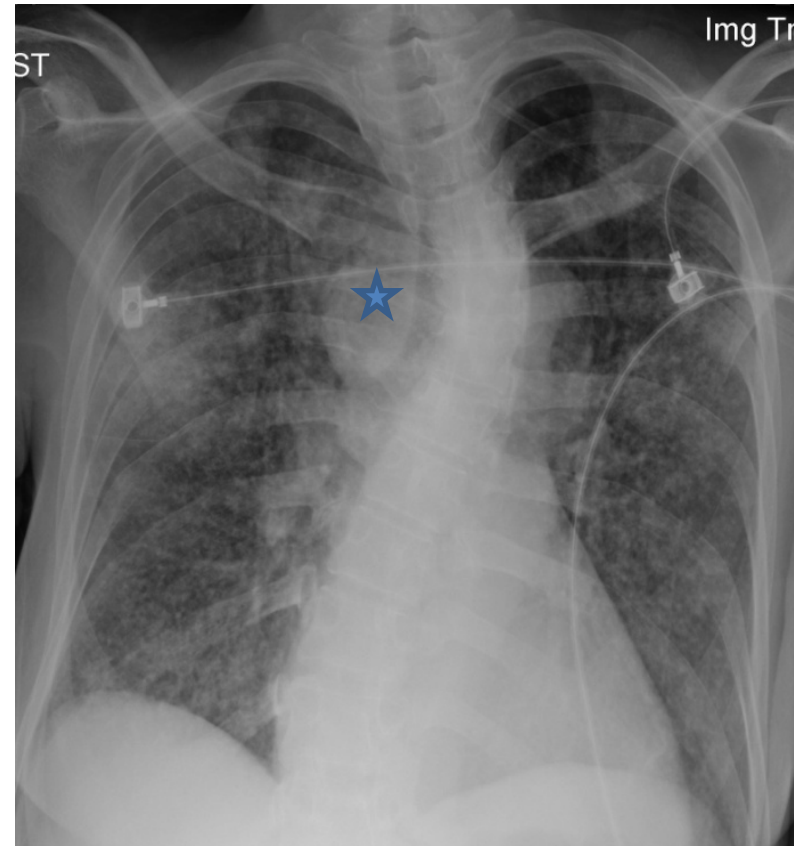
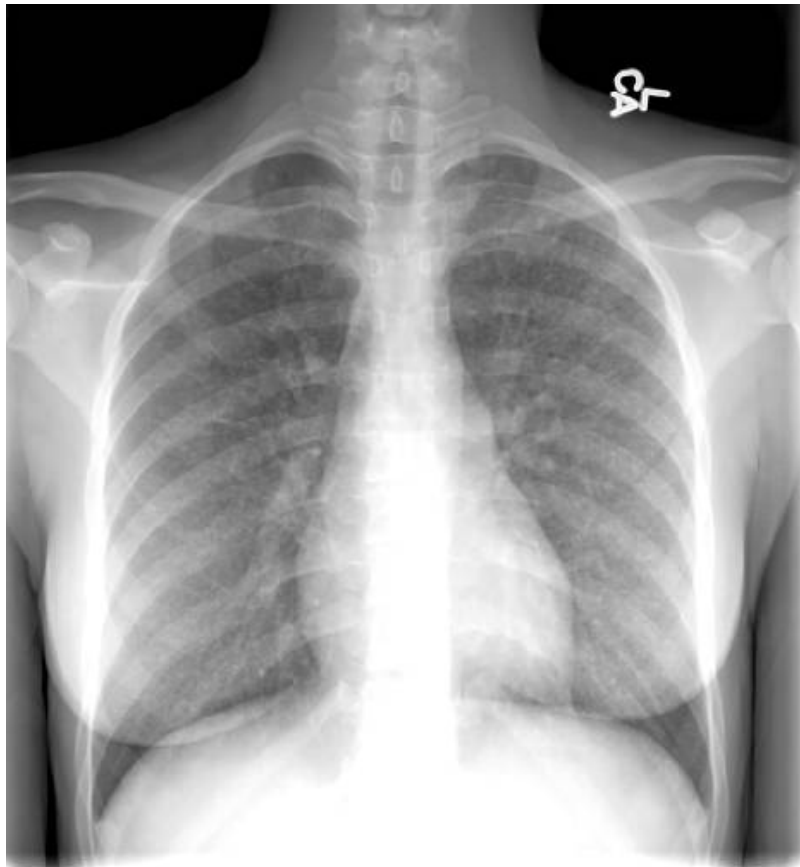
- Disseminated disease
- *Usually* occurs during initial (primary) infection with hematogenous spread of MTB
- Uniformly distributed nodules ~ 2 mm. in size
- May progress to septic shock and acute respiratory failure
- After infection, miliary TB &/or meningitis occur in ~ 10-20% of babies < 1 year old

NEJM – New@NEJM.org Oct, 2013



Miliary Pattern

- 15 year old with disseminated MDR TB
- Substance abuser, treated with prednisone for misdiagnosis of sarcoidosis



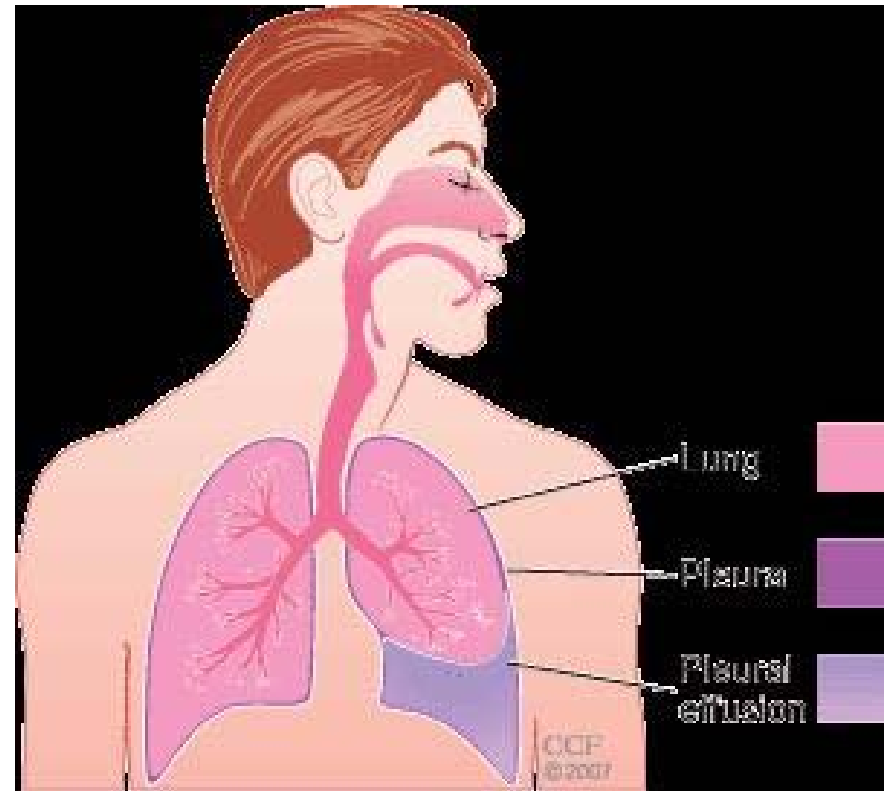
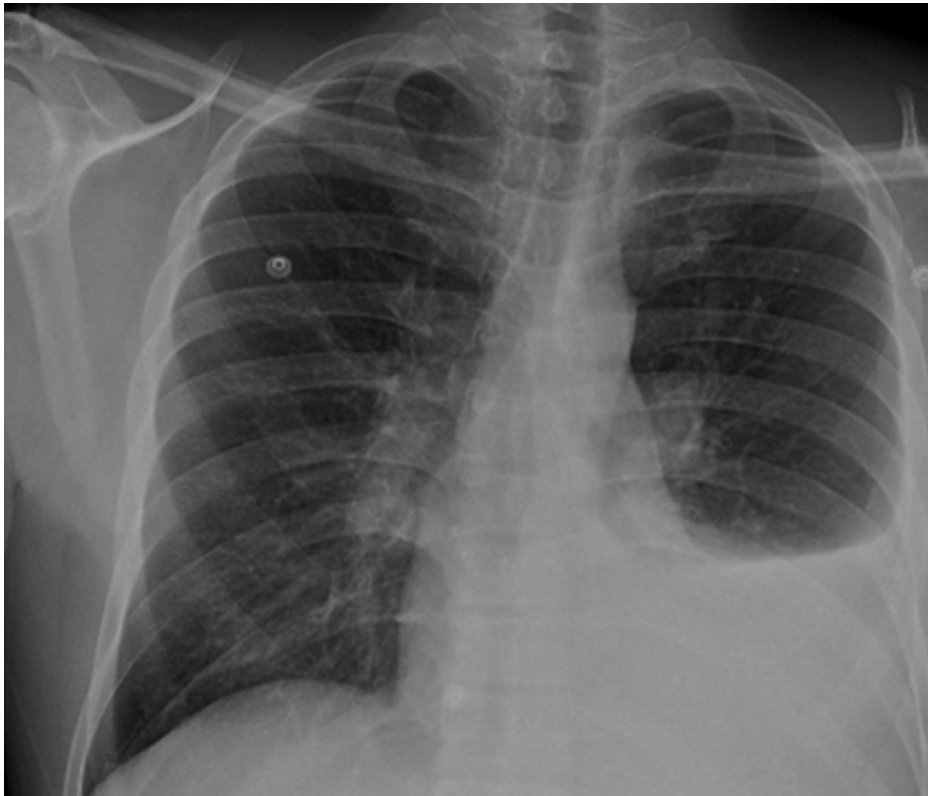
TB Pleural Effusions and Other Abnormalities

- Small to very large, can loculate
- Usually unilateral
- Primary (or post primary disease)
- Fluid can be serous, thick & congealing, or bloody
 - not frank pus unless complicated
- Exudate – high protein and LDH, white cells predominantly lymphocytes
- ↑ Adenosine deaminase and IFN- γ levels
- Bronchopleural fistulas can occur



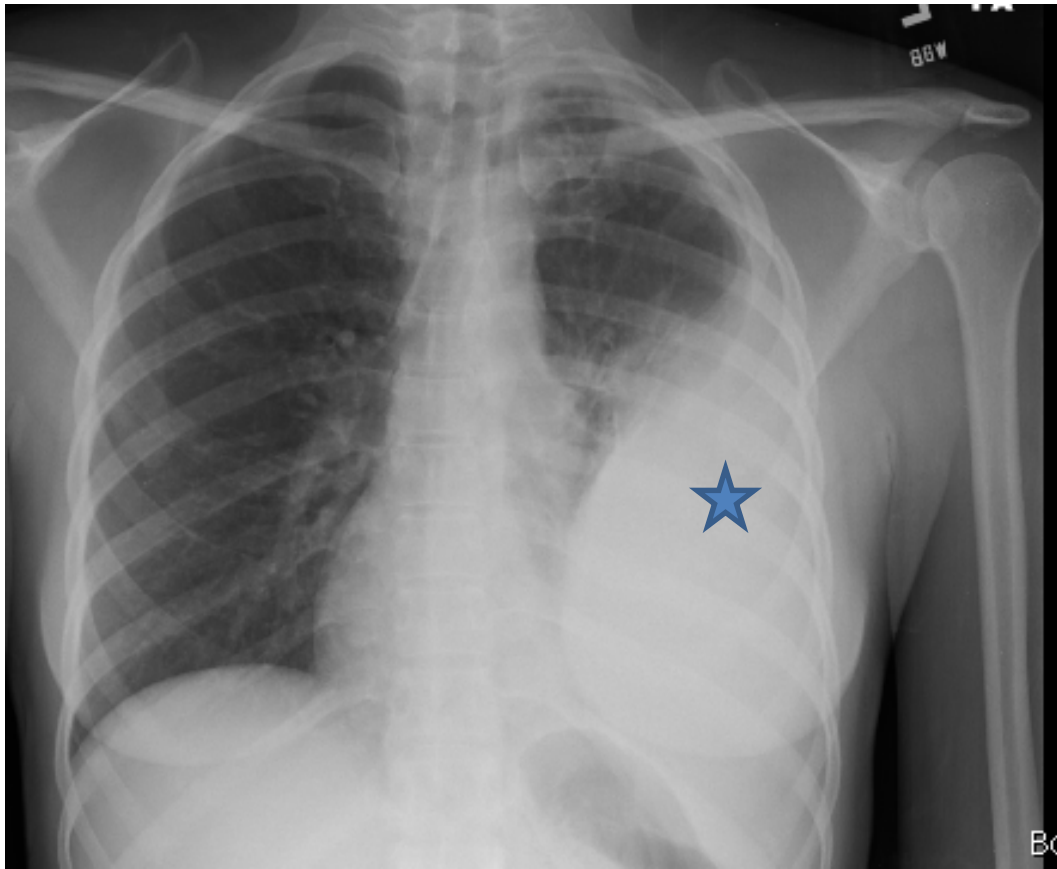
44 Year Old Man: Homeless Shelter Outbreak

- Note meniscus sign, silhouette sign, less translucency than consolidation



40 Year Old with Known Exposure to Contagious Case 1-2 Months Ago

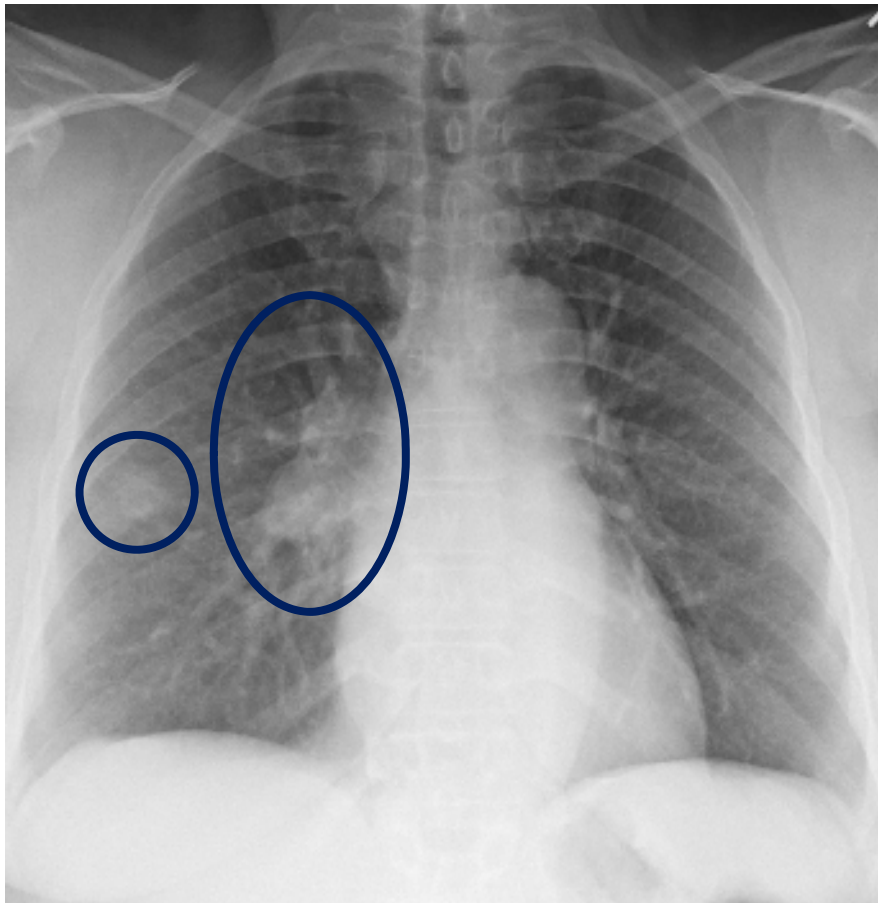
- IV dye helps distinguish **lung** from **pleural fluid**



Lymphadenopathy

- Frequent in primary disease
- In children can be massive and compress airways
- Rim enhancement with dye and low attenuation centrally suggests TB

Recent Contact with TB Case: PET Scan Shown Before

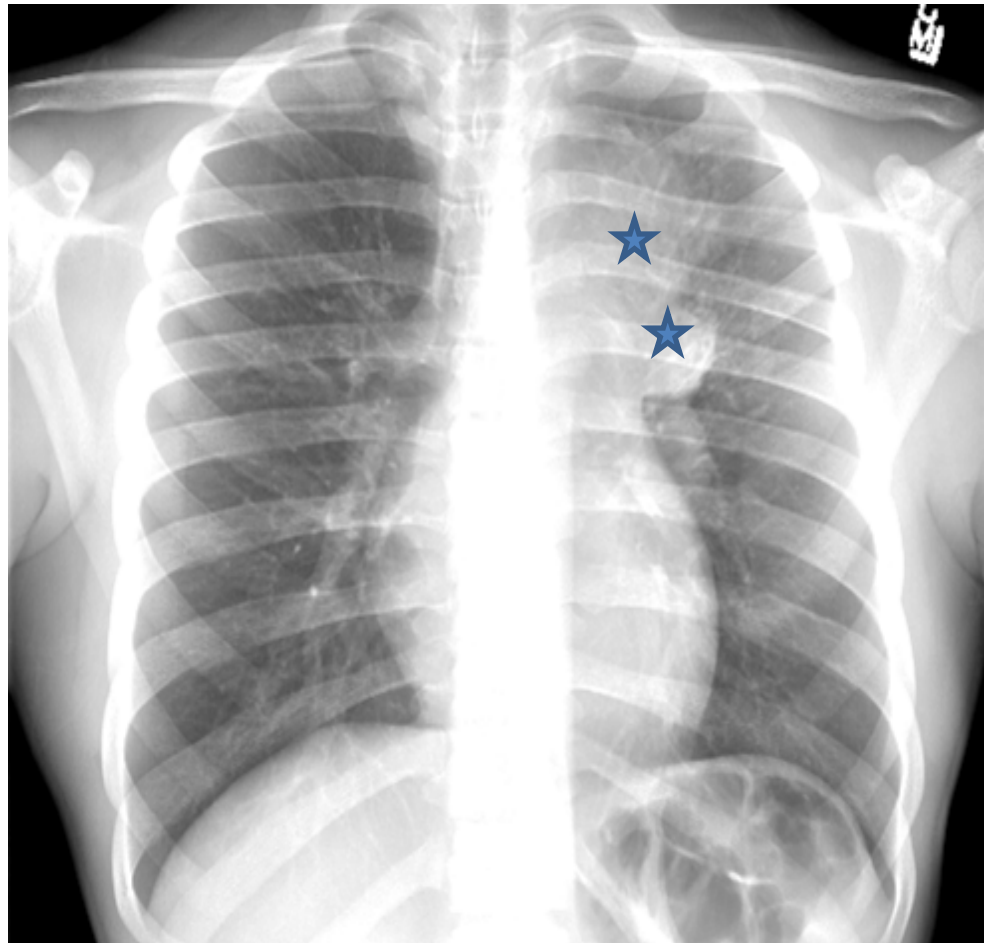


**Ghon
Complex**

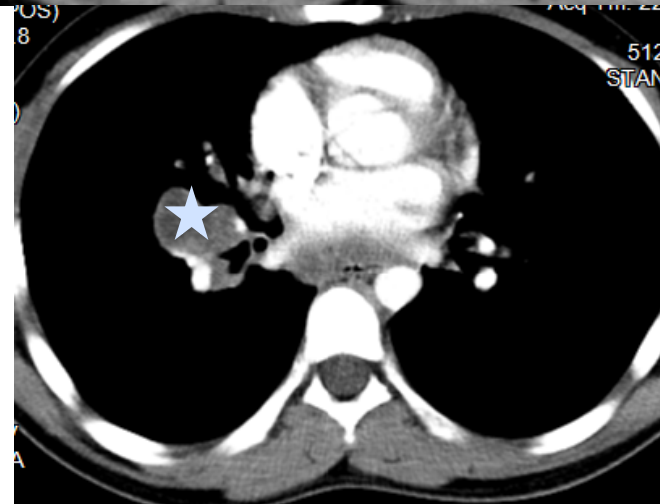
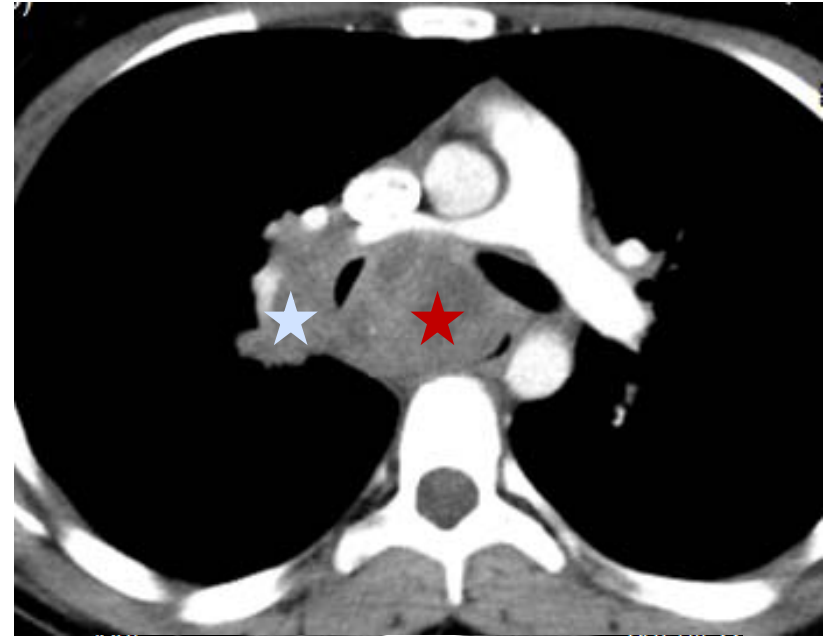
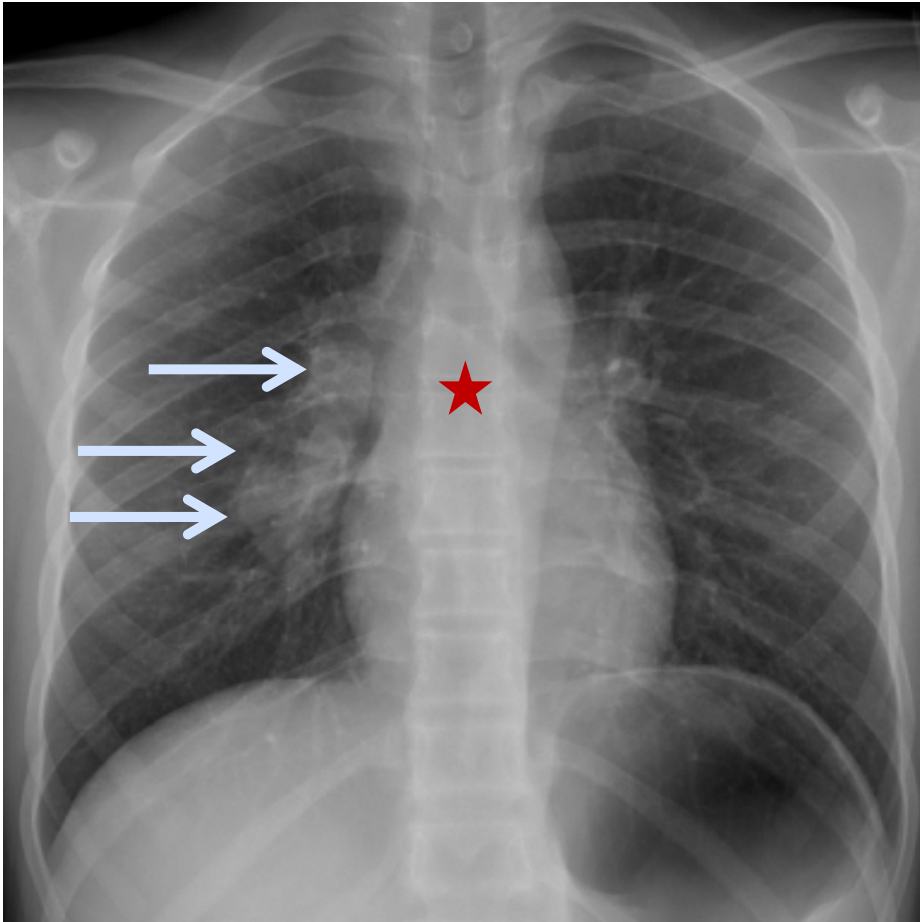
Frank Netter

15 Year Old Boy with Cough Contact to Aunt with MDR TB

- Sputum culture + for MDR TB



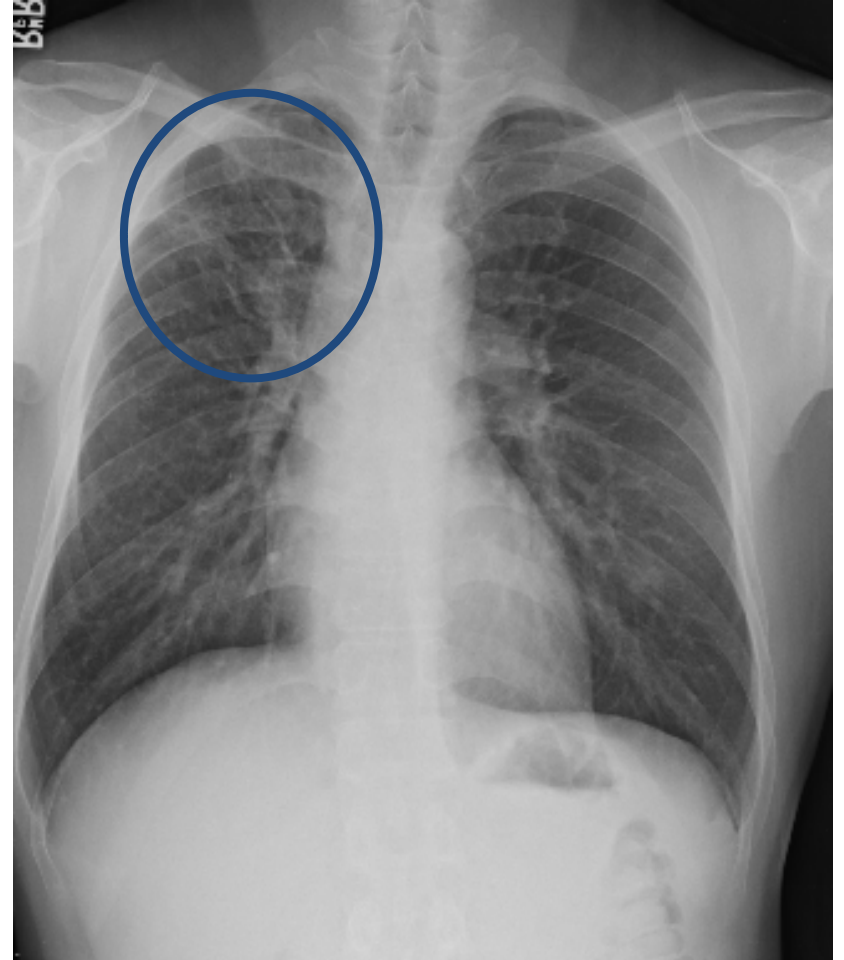
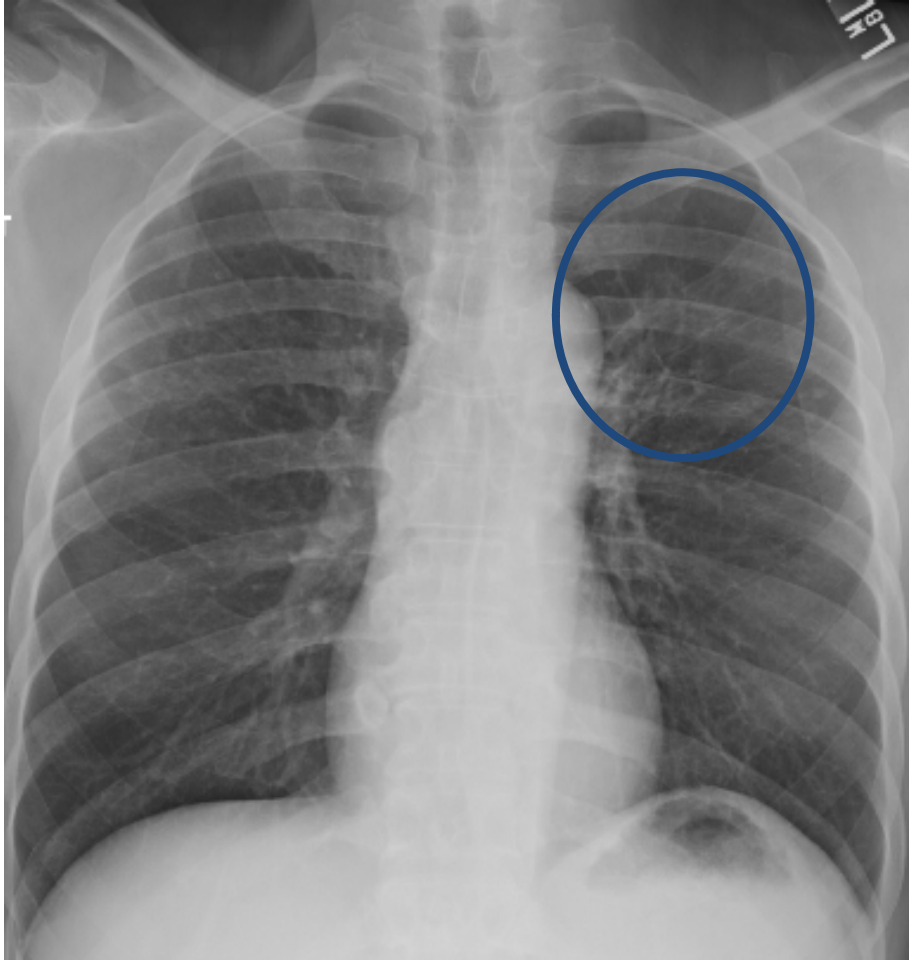
15 Year Old Somali Boy. Chest pain, Difficulty Eating



Linear Shadows / Fibrosis

- Can be old healed TB or active chronic TB
- Often seen with immigrants labeled B1
- Can be associated with volume loss

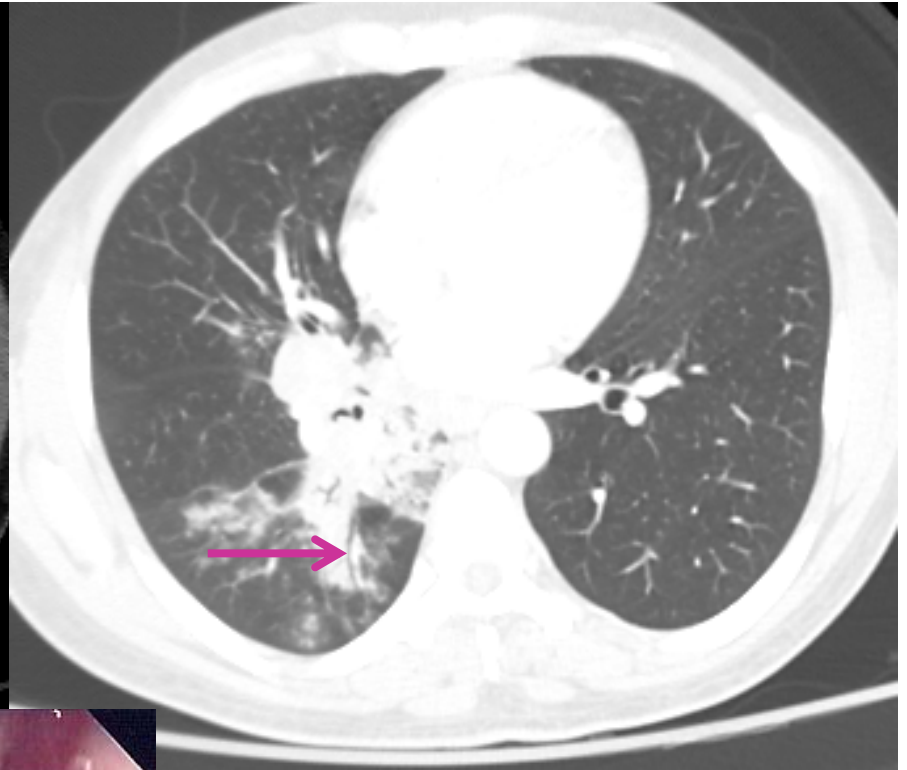
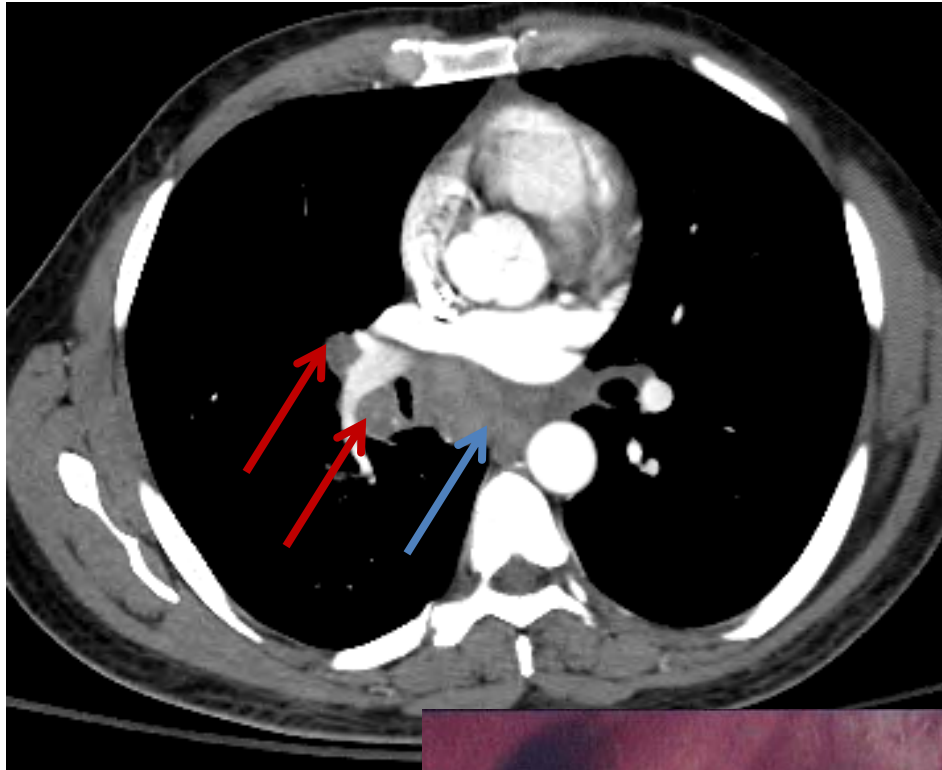
Treated TB: Note Volume Loss



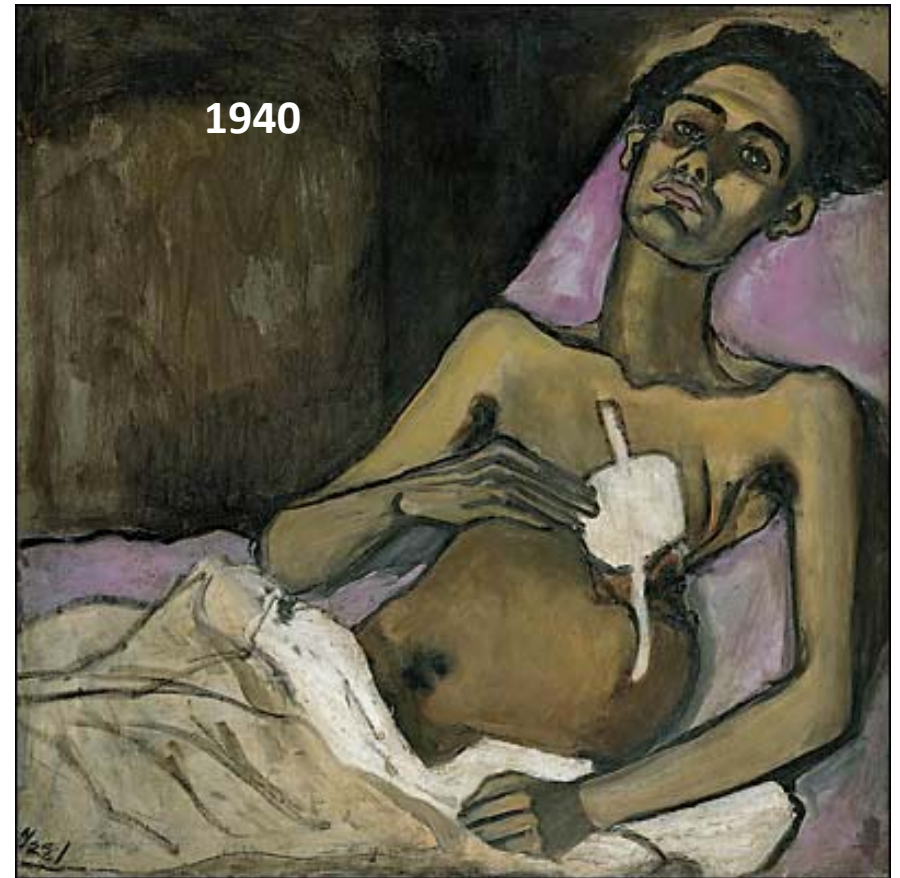
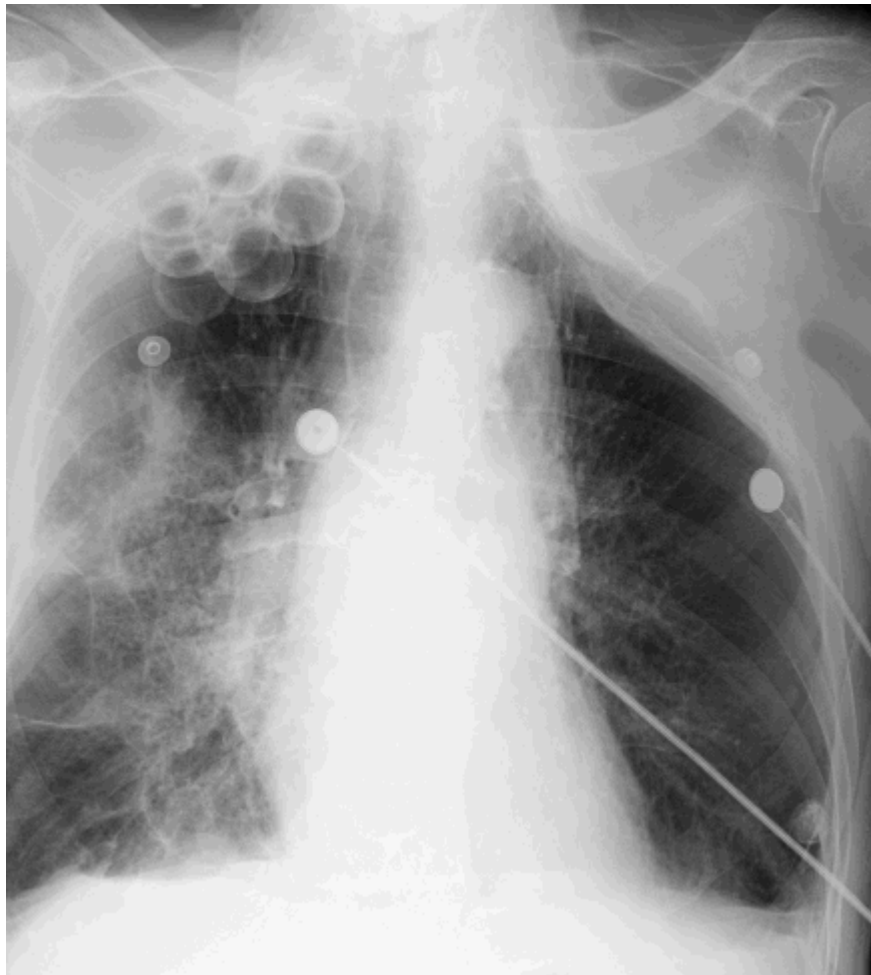
Tracheobronchial TB

- Airways can be compressed by large lymph nodes
- TB can be endobronchial
- Bronchiectasis and bronchostenosis are common sequelae
- Atelectasis or collapse of the lung beyond an obstructing lesion can occur (similar to lung cancer)

Homeless Man

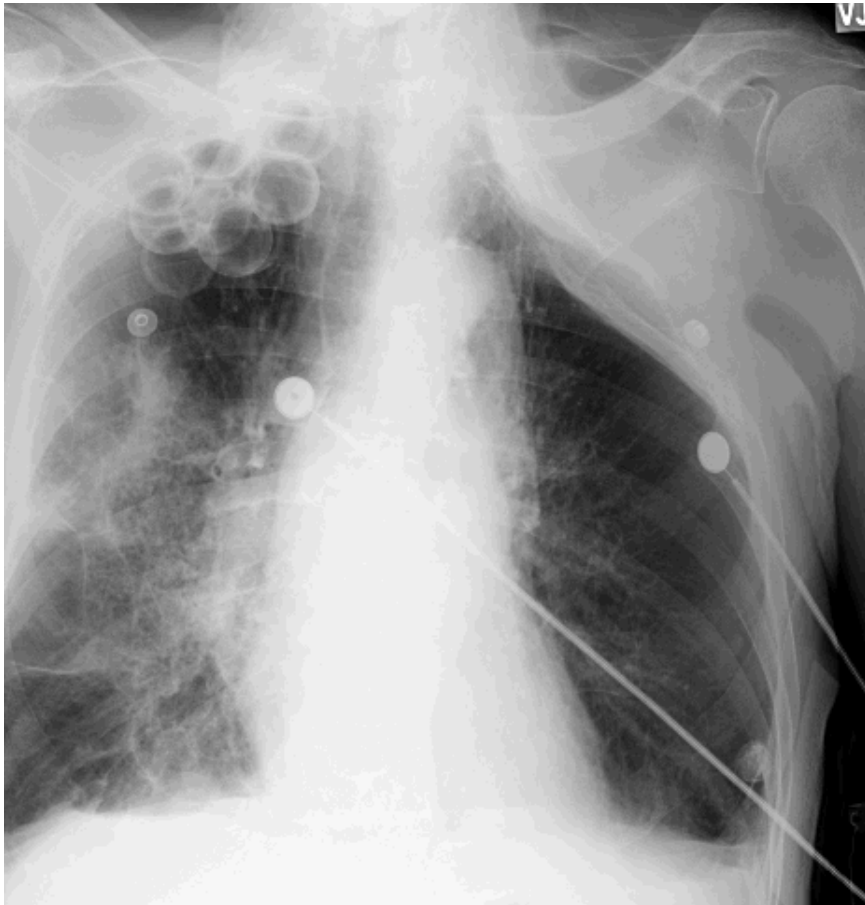


Who can name the 2 surgical procedures performed on this patient?

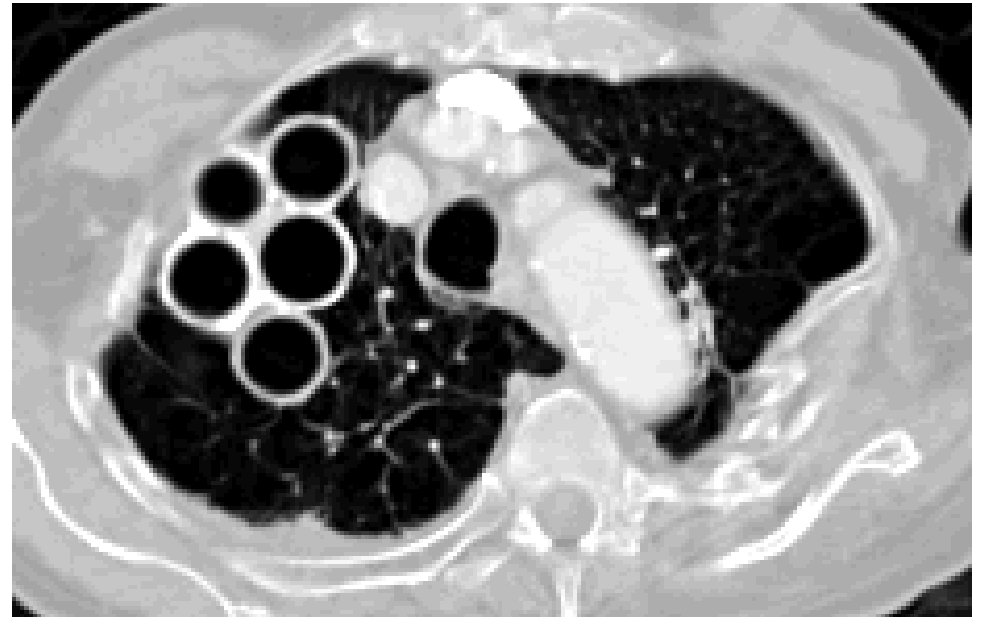


Alice Neel (1900-1984) TB Harlem

And The Names Are:



- Right plombage
- Left thoracoplasty



Conclusion: You can Learn to
Recognize
TB When You See It!

Ed Neuhauser and
Ben Felson

