



62<sup>ND</sup> ANNUAL

# Denver TB Course

(Hybrid Event)

MARCH 25-27, 2026

 National Jewish  
Health<sup>®</sup>

## **Chest X-ray Interpretation in Tuberculosis**

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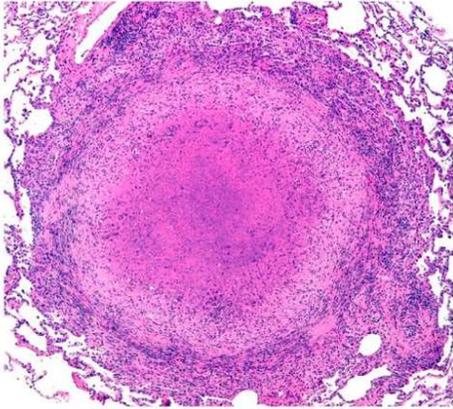
## Disclosures

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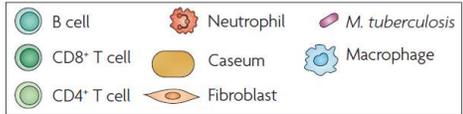
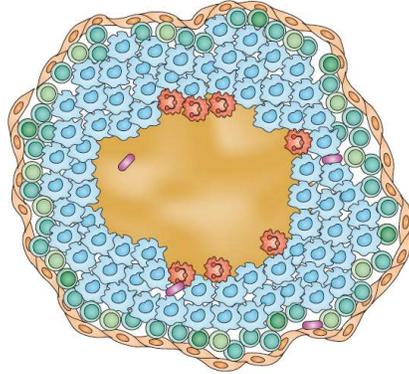
## Outline

- Conceptual morphologic understanding of pulmonary TB
- Common X-ray findings in TB
- Case-based learning

# TB granuloma as a nodular disease

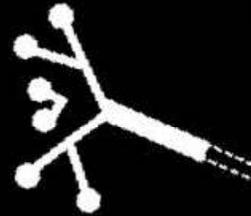
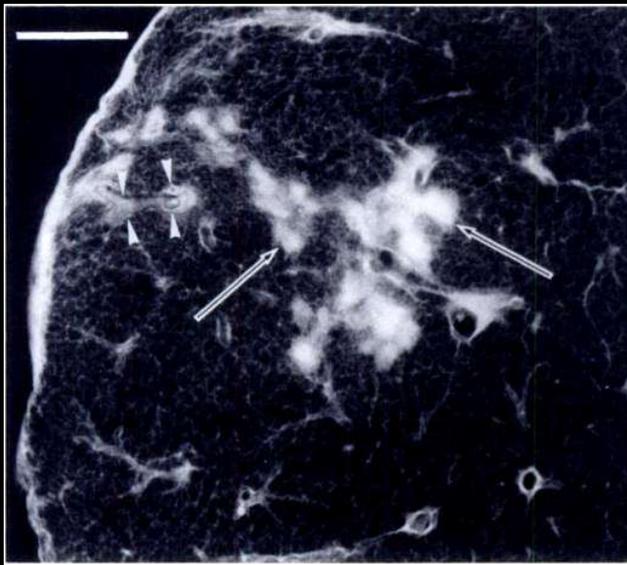


a Caseous granuloma

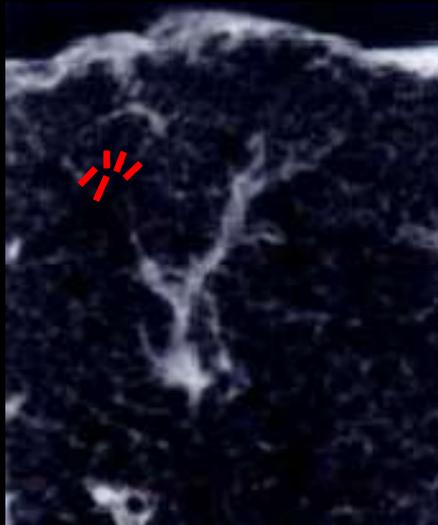
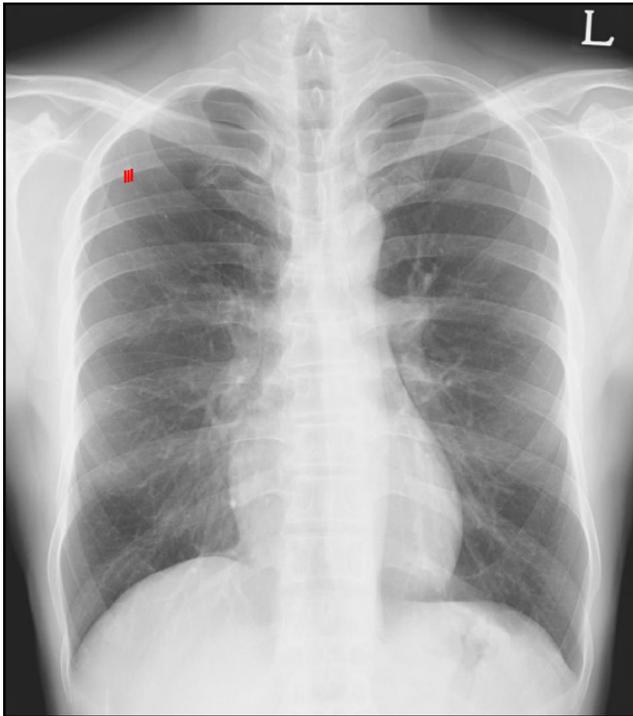


CE Barry et al. Nat Rev Microbiol. 2009 Dec;7(12):845-55.  
PL Lin, et al. Proc Natl Acad Sci U S A. 2012 Aug 28;109(35):14188-93

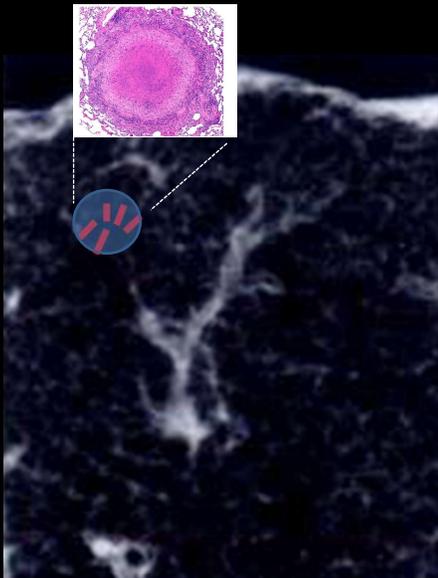
# Airway tree as a route for propagation



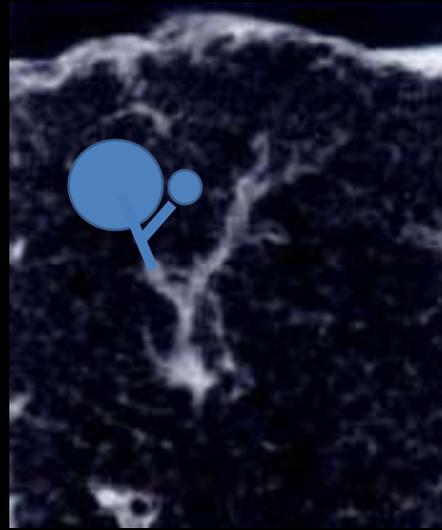
JG Im, et al. Radiology. 1993 Mar;186(3):653-660.  
JH Hong, SH Yoon, et al. PLoS One. 2020 Apr 17;15(4):e0231537



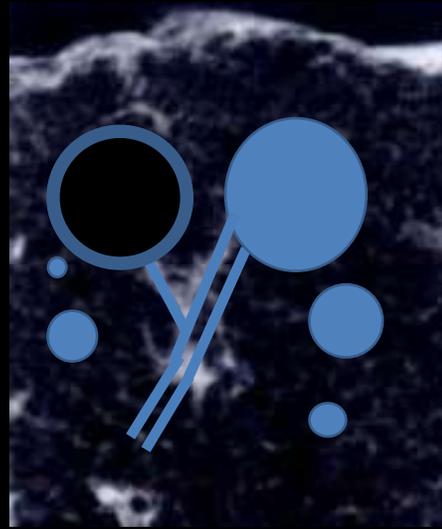
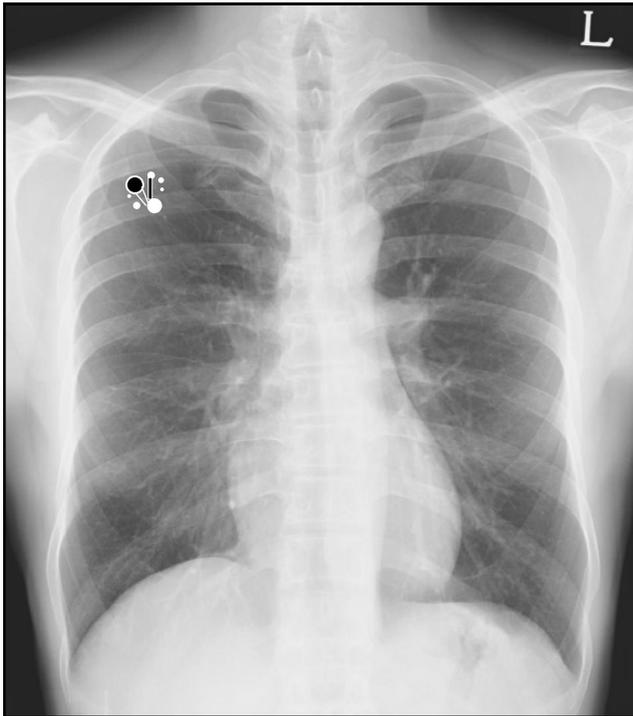
TB in immunocompetent host



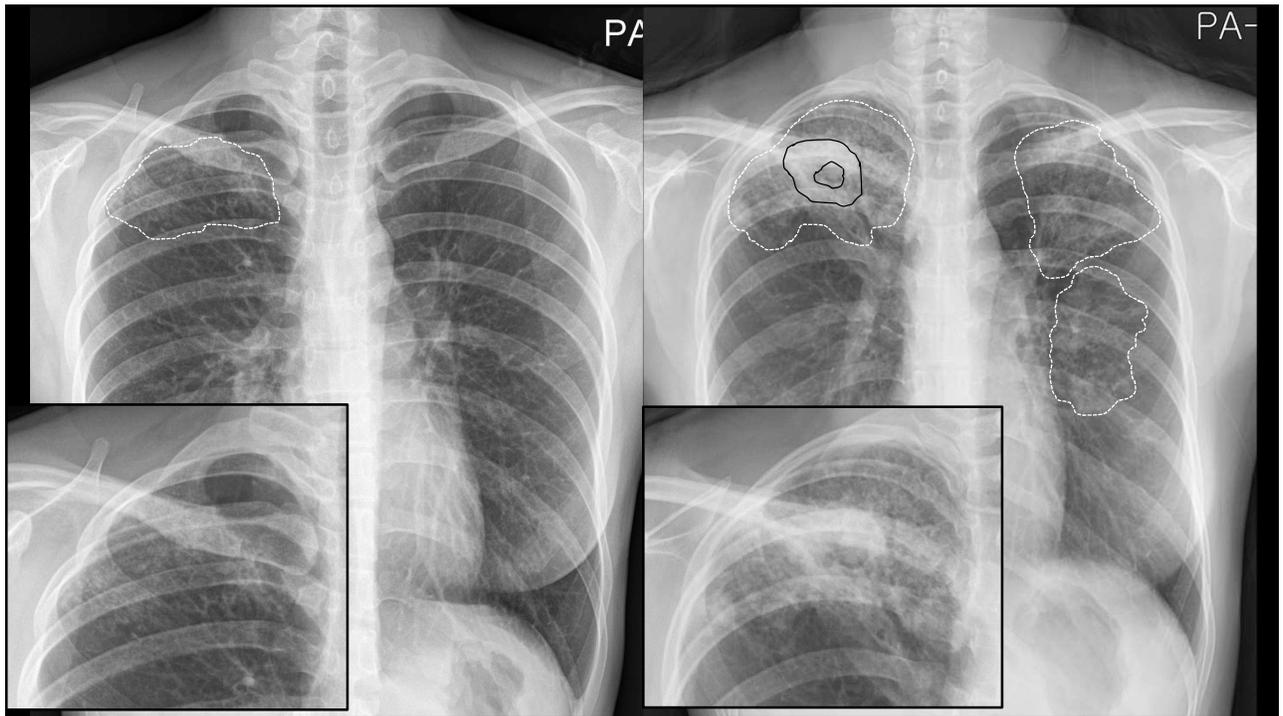
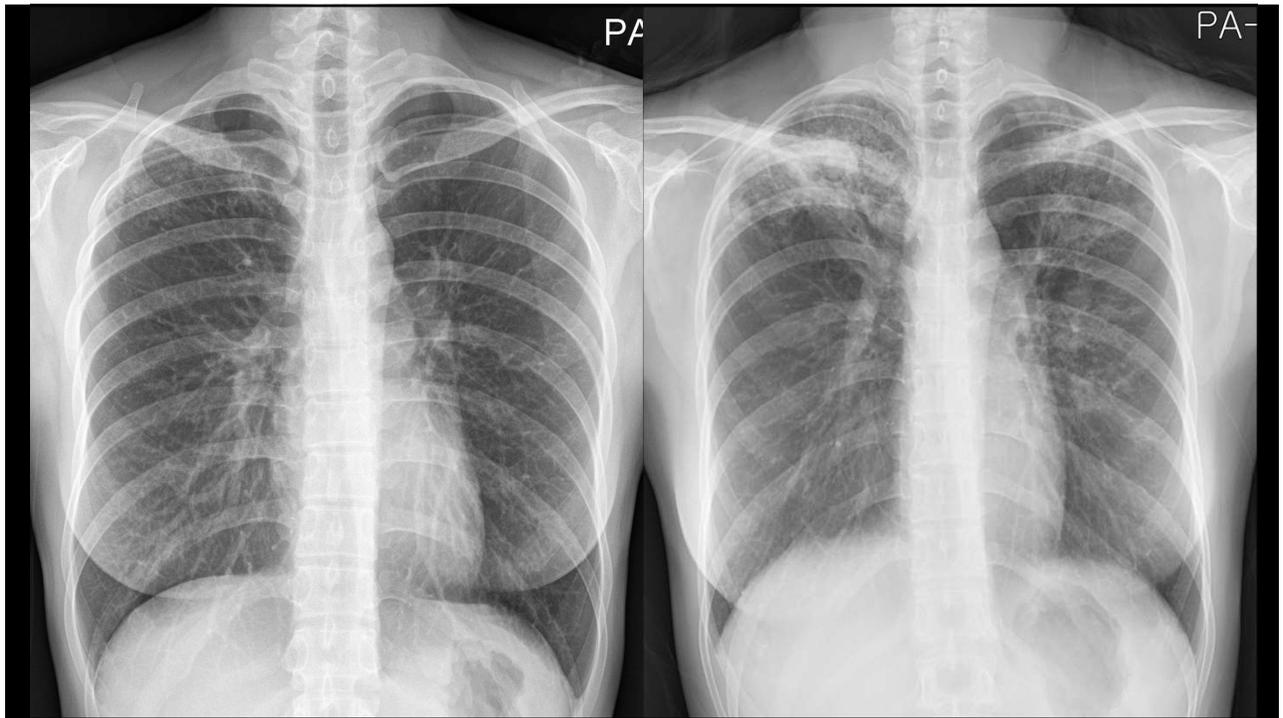
TB in immunocompetent host

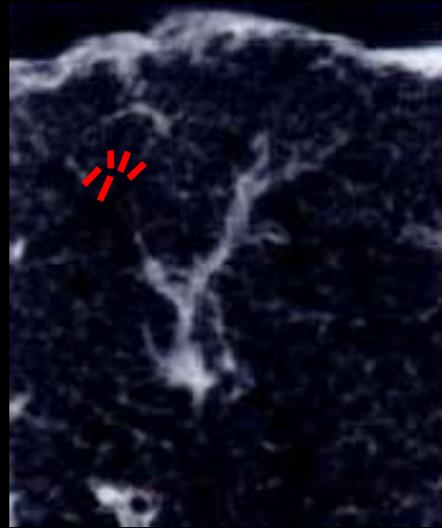
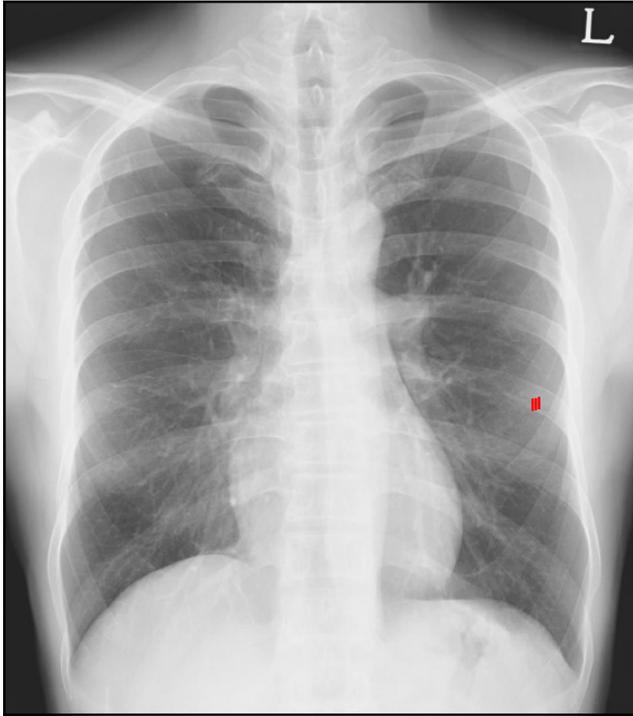


TB in immunocompetent host

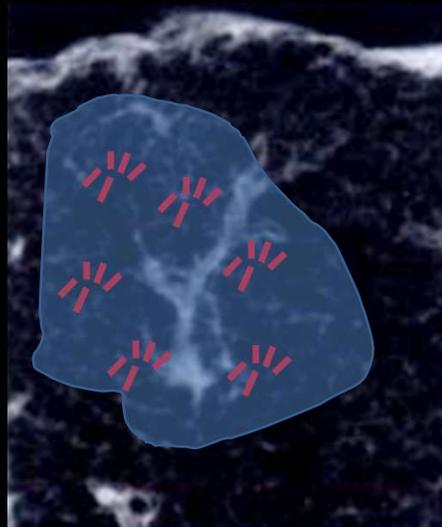
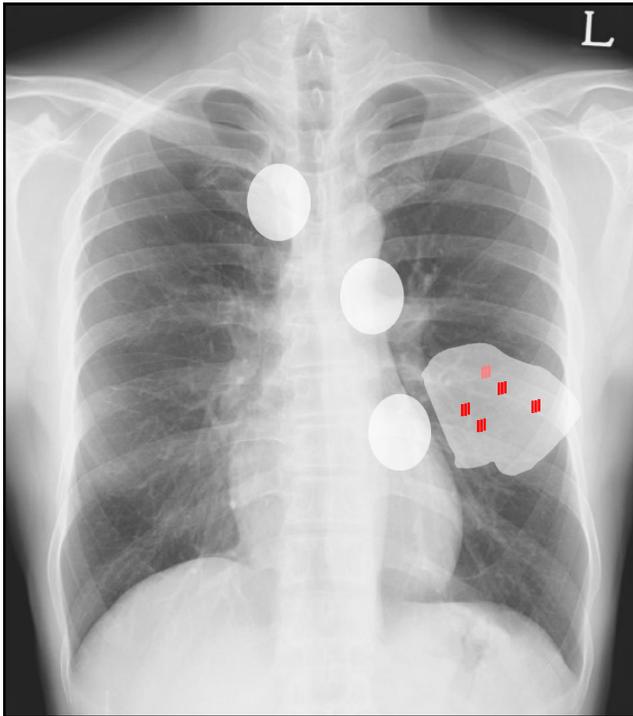


TB in immunocompetent host

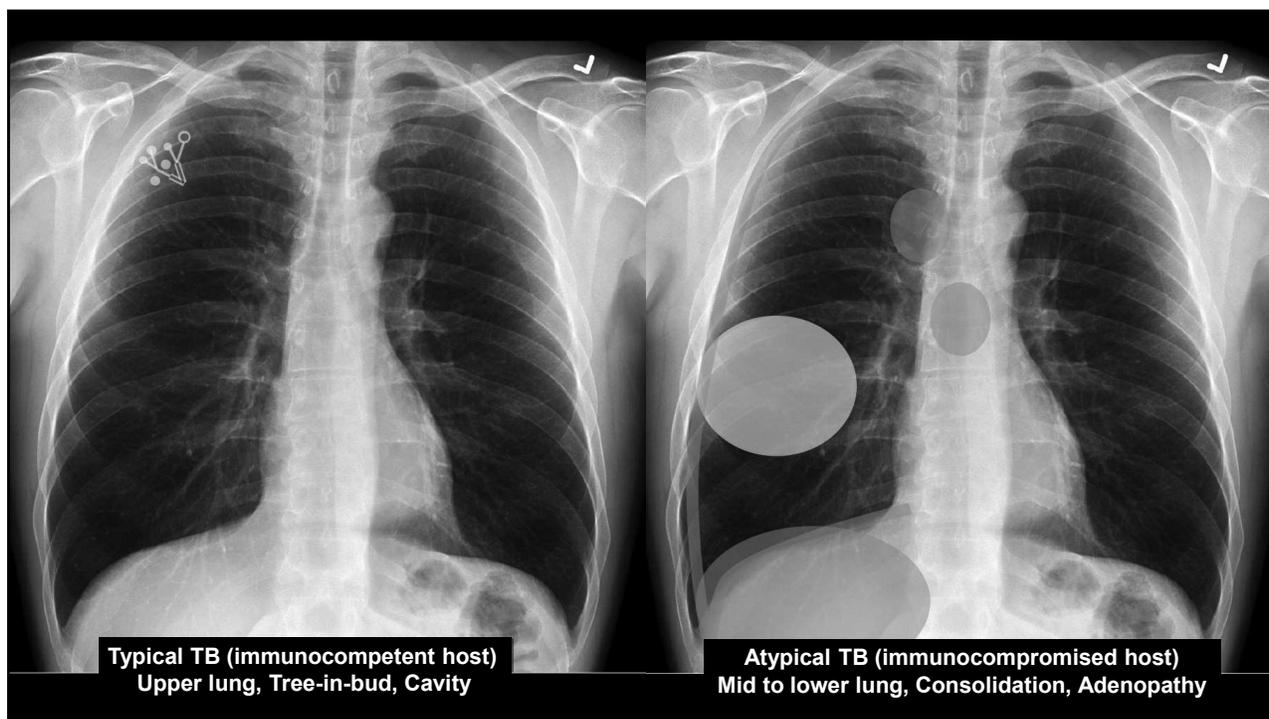




TB in immunocompromised host



TB in immunocompromised host



## Common Chest X-ray Findings in TB

### • Opacity

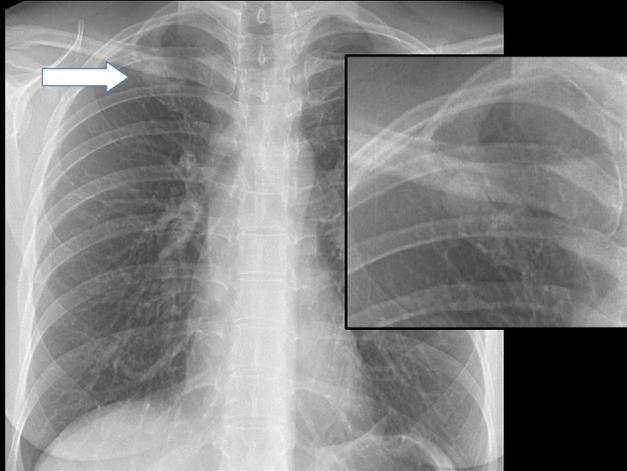
- Nodule
- Nodular pattern
- Consolidation
- Atelectasis
- Pleural effusion

### • Lucency

- Cavity
- Bronchiectasis

## Nodule

Rounded opacity,  
well or poorly defined,  
measuring up to 3 cm



## Nodular Pattern



Innumerable discrete rounded opacities measuring 2-10 mm

## Consolidation

Homogeneous increase  
in lung opacity

Often poorly defined and  
confluent

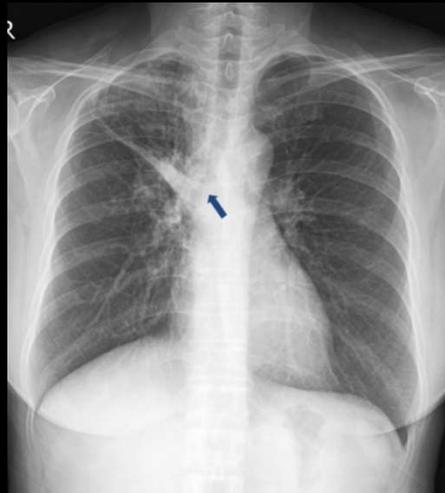


## Atelectasis

Increased opacity  
with volume loss

Displacement of  
mediastinum,  
airway, or fissures

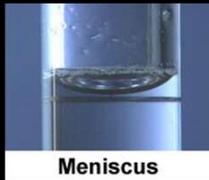
Sharp margin  
outlined by fissures



## Pleural Effusion

Fluid in the pleural space

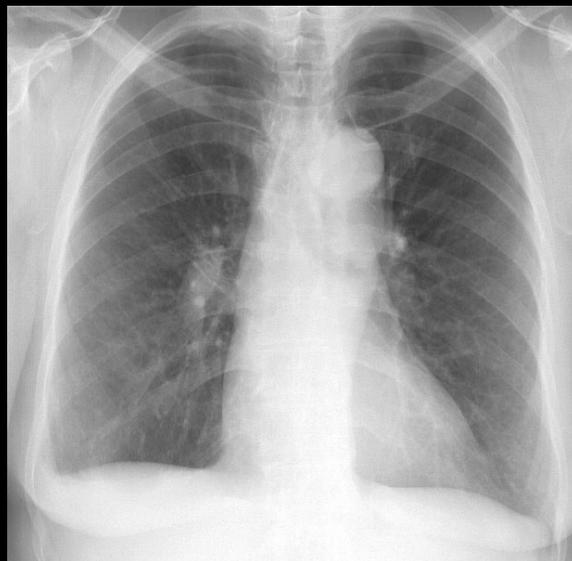
On erect chest radiograph, characterized by blunting of costophrenic angle and meniscus sign



## Pleural Thickening (vs Effusion)

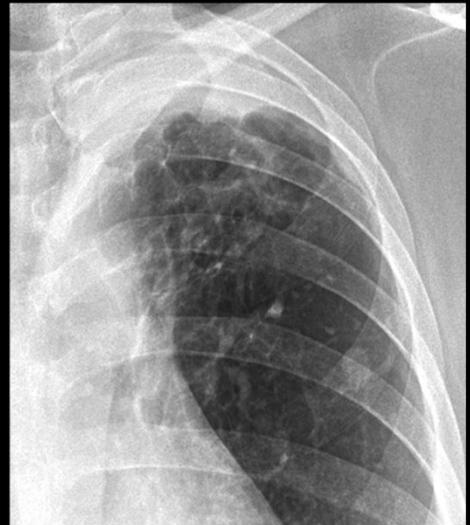
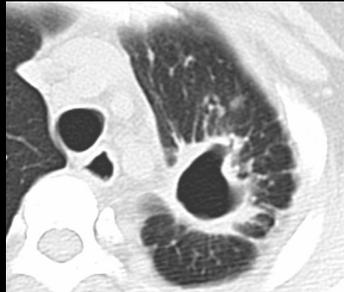
Blunted costophrenic angle is not curved

Thickening usually extends up the chest wall



## Cavity

Gas-filled space within consolidation, mass, or nodule



## Bronchiectasis



Ring shadows and tram-track opacities

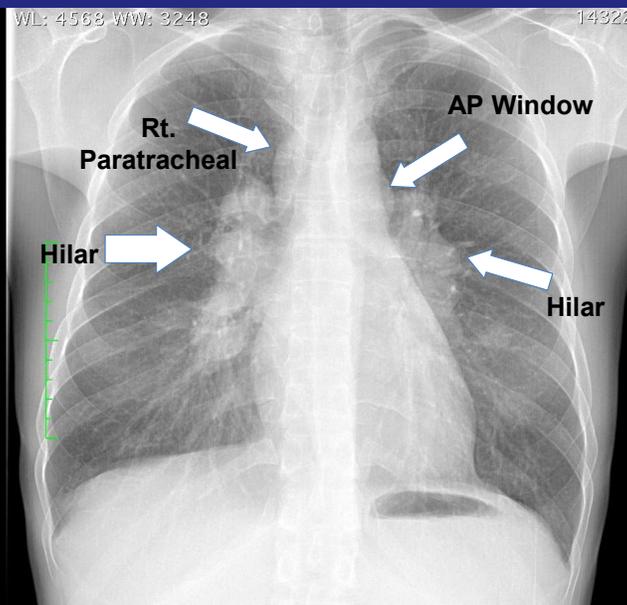
## Adenopathy

May be difficult to detect on chest radiographs unless bulky

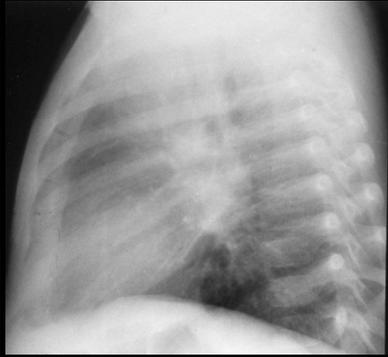
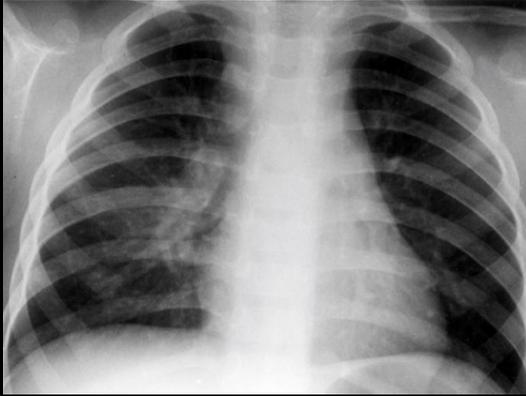
Tuberculous adenitis is often relatively conspicuous and may provide an important clue to the diagnosis

Hilar > mediastinal

## Mediastinal and Hilar Adenopathy



## Hilar Adenopathy



Vs. Normal  
Lateral  
Hilum

## AP "Window"



Region between the aortic arch and  
the left pulmonary artery

Normally concave or straight

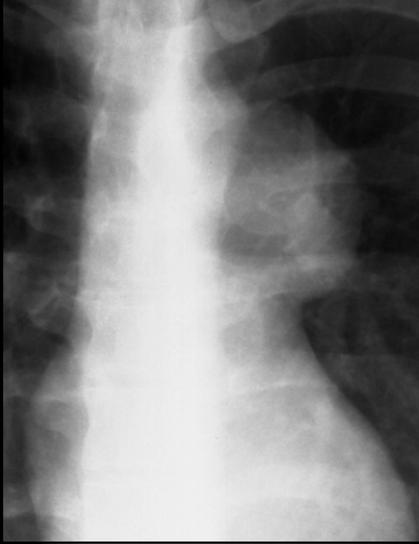
Abnormal convexity may suggest  
lymph nodes  
mediastinal mass  
vascular abnormality

## AP "Window" Adenopathy

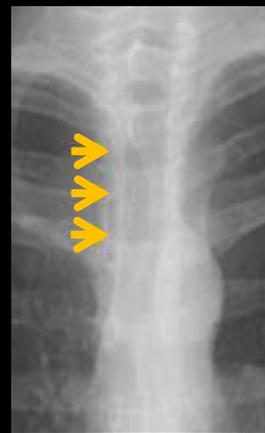
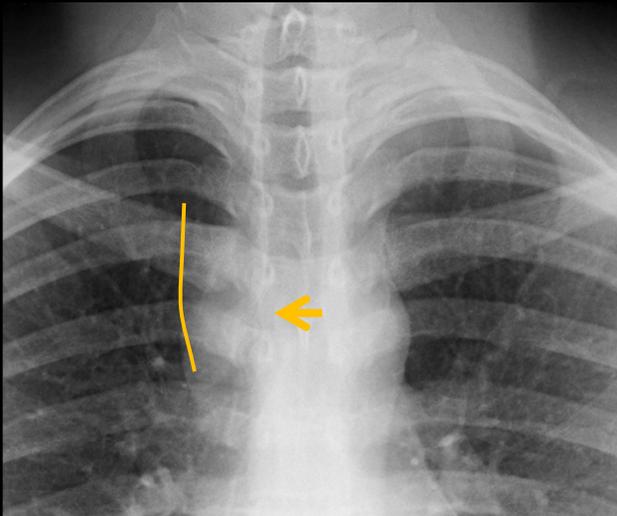
Abnormal AP Window

vs.

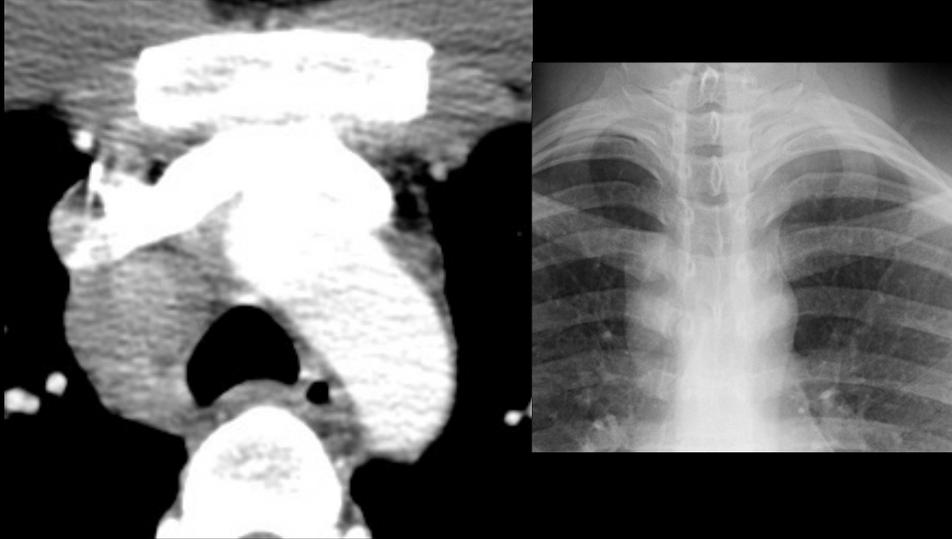
Normal AP Window



## Right Paratracheal Adenopathy

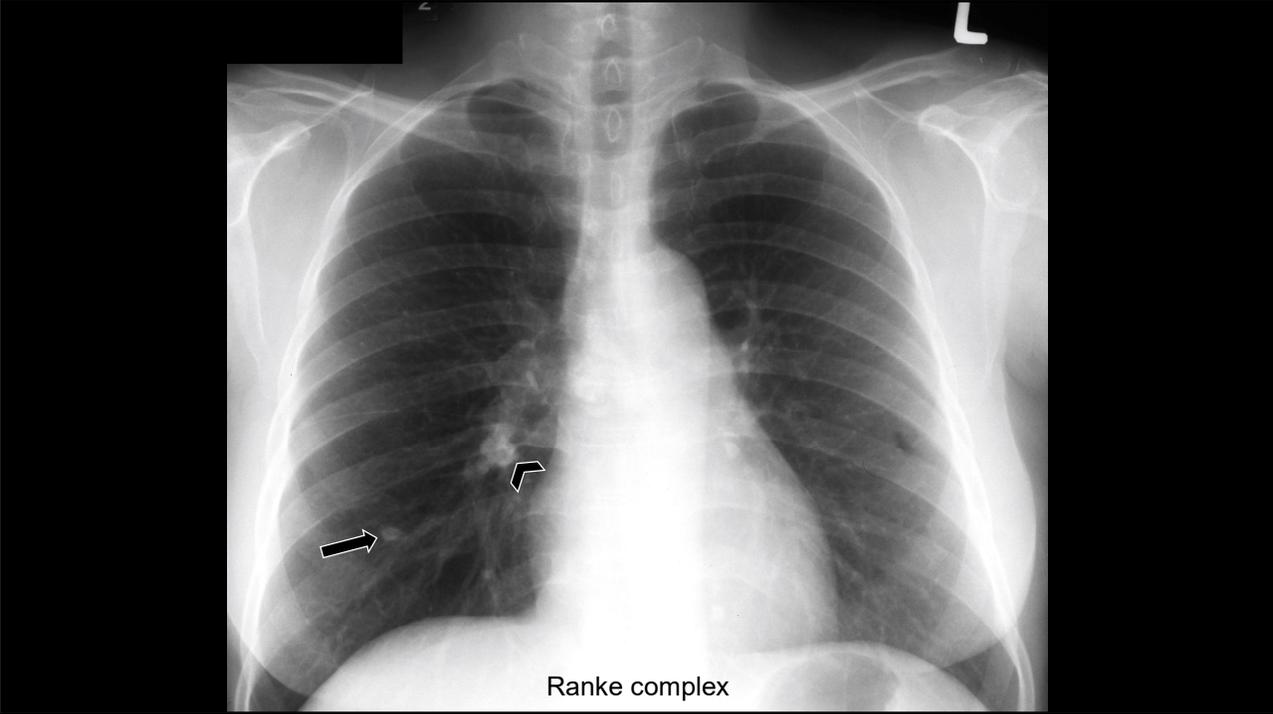
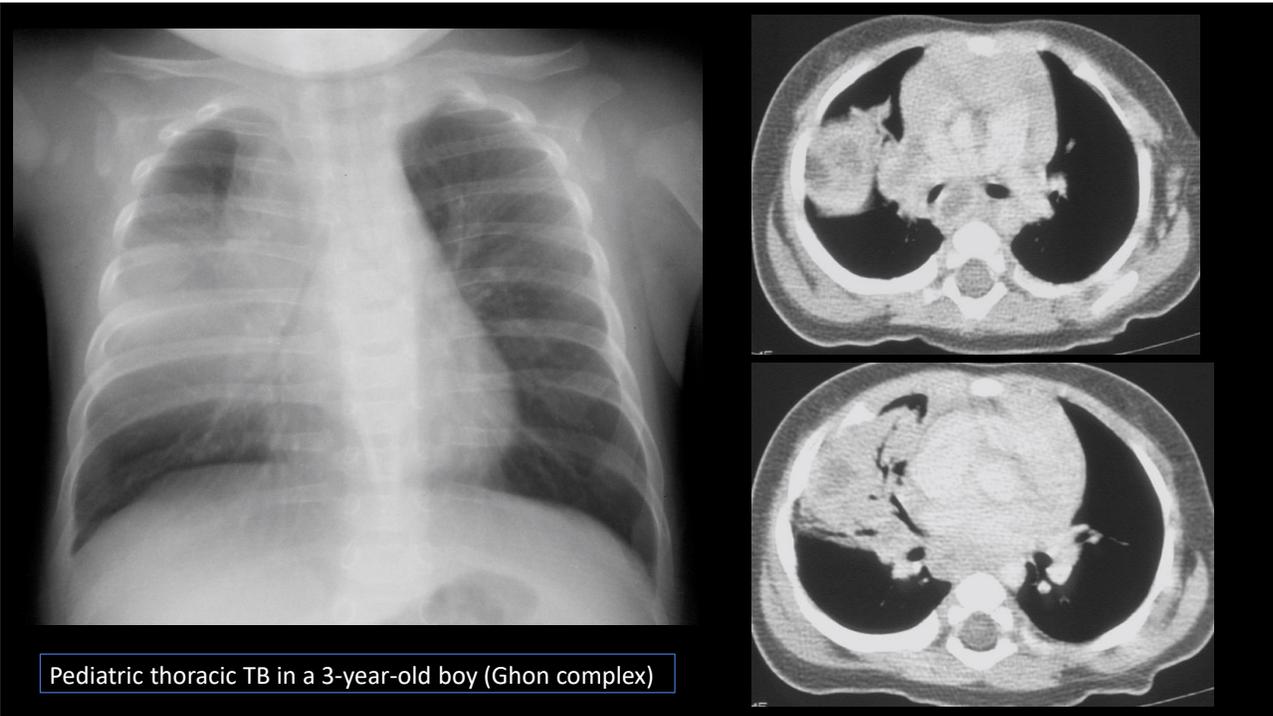


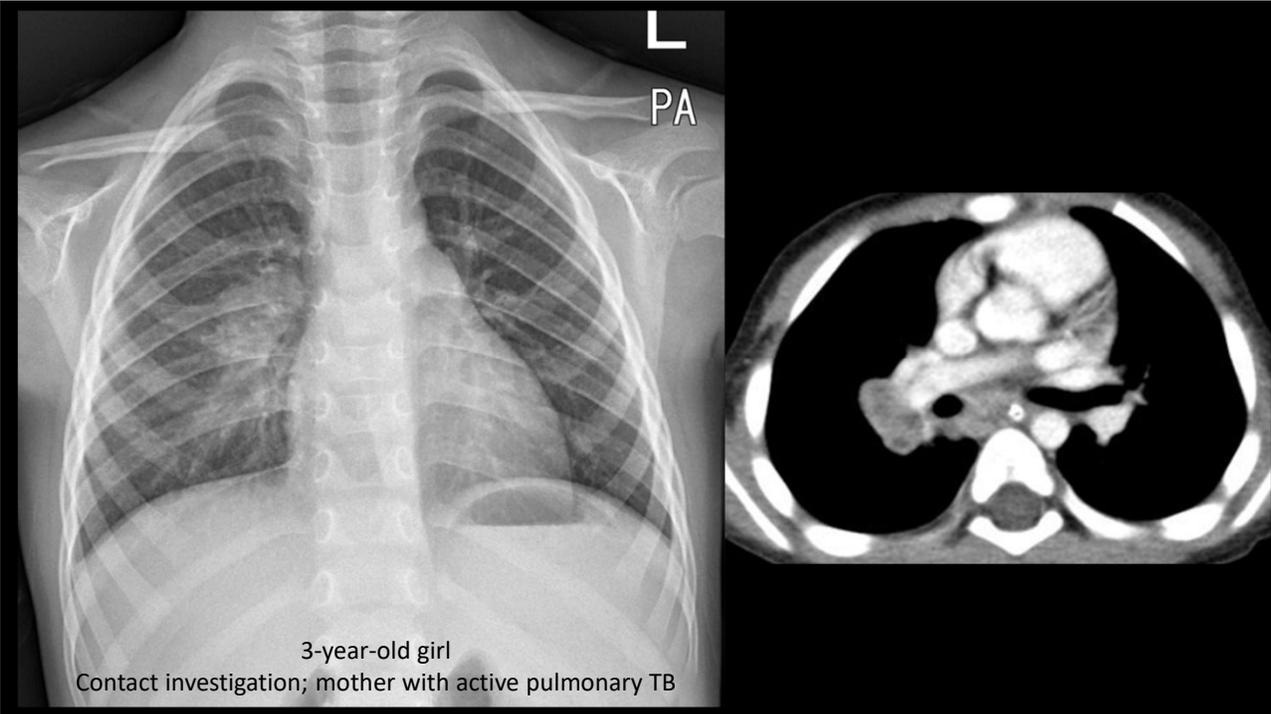
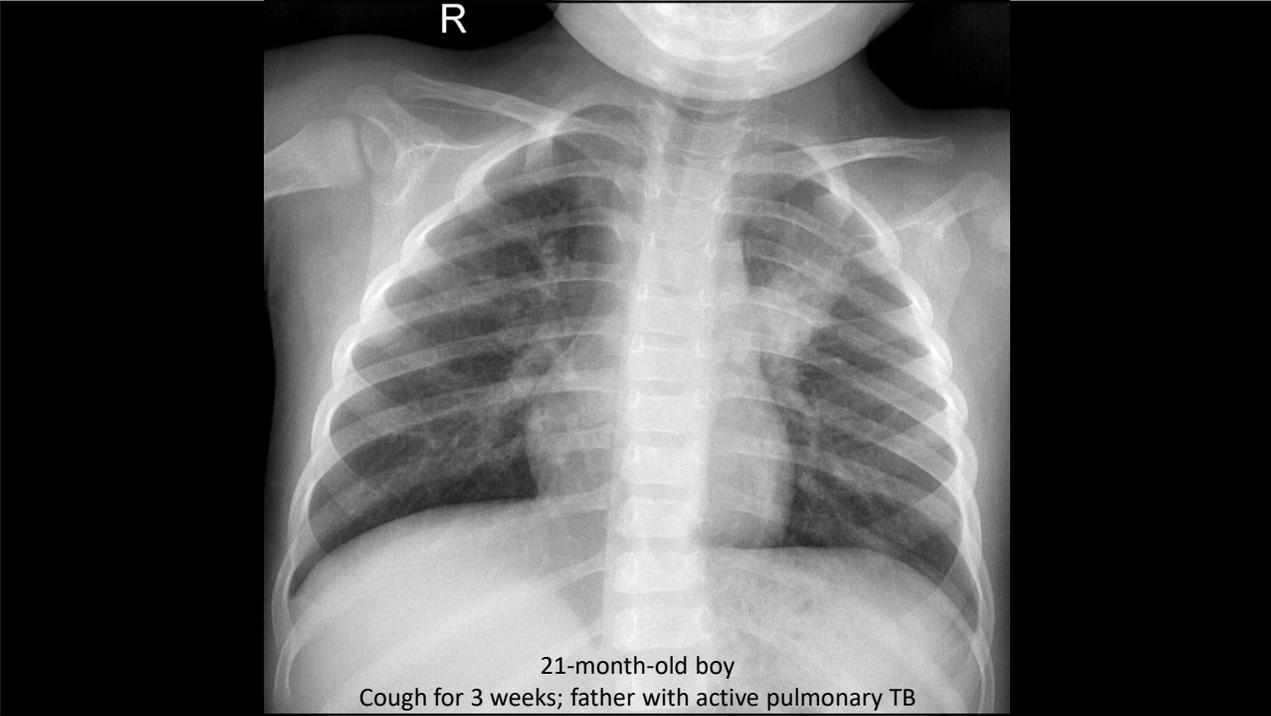
## Right Paratracheal Adenopathy



## Pediatric TB

- Less mature immunity than in adults
  - Parenchymal disease in the middle and lower lung, **resembling pneumonia**
  - Often accompanied by hilar or mediastinal lymphadenopathy
  - Pleural effusion may be present
  - May also progress to miliary TB
- Ghon complex (primary complex)
  - Parenchymal disease with hilar or mediastinal lymphadenopathy
- Ranke complex
  - Healed calcified residual lesions



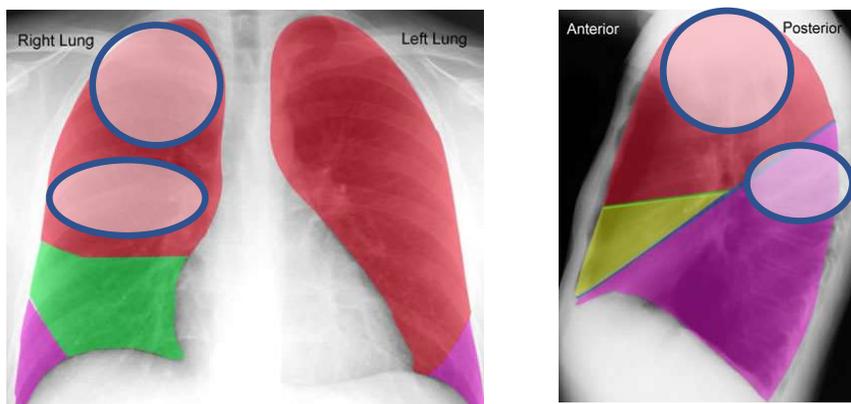


## Adult TB

- **Immunocompetent patients**
  - Typical findings: upper-lung parenchymal disease with cavitation
  
- **Immunocompromised patients**
  - Atypical findings: resembling pediatric TB

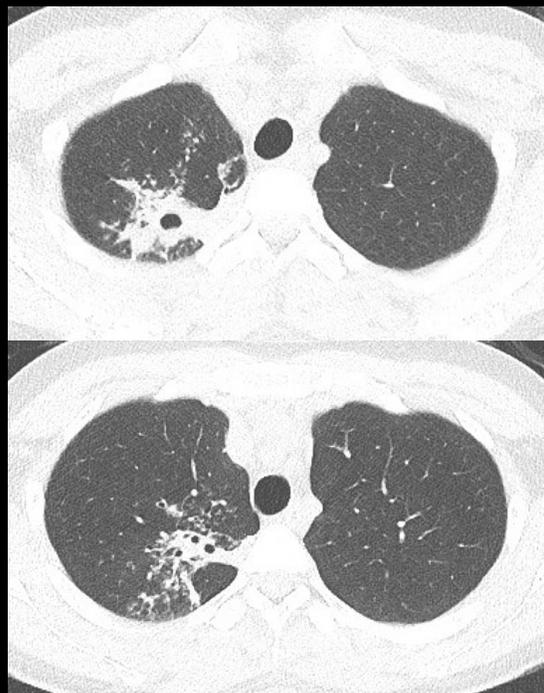
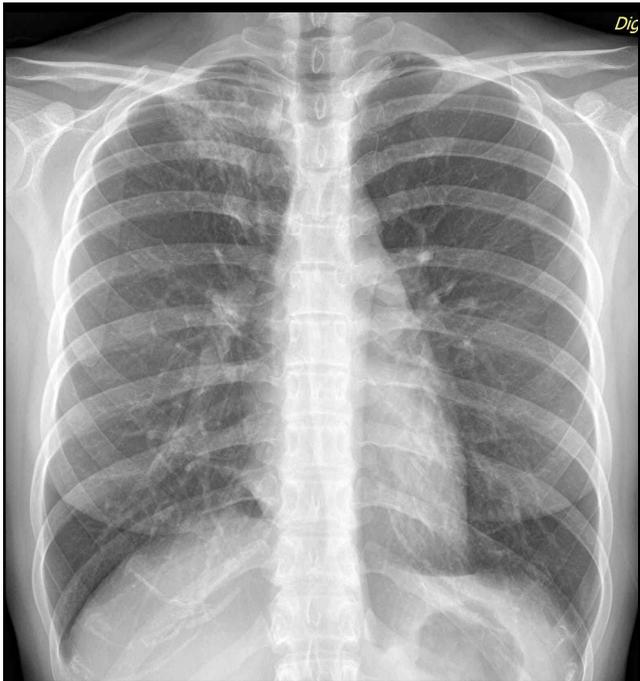
## Adult TB: typical findings

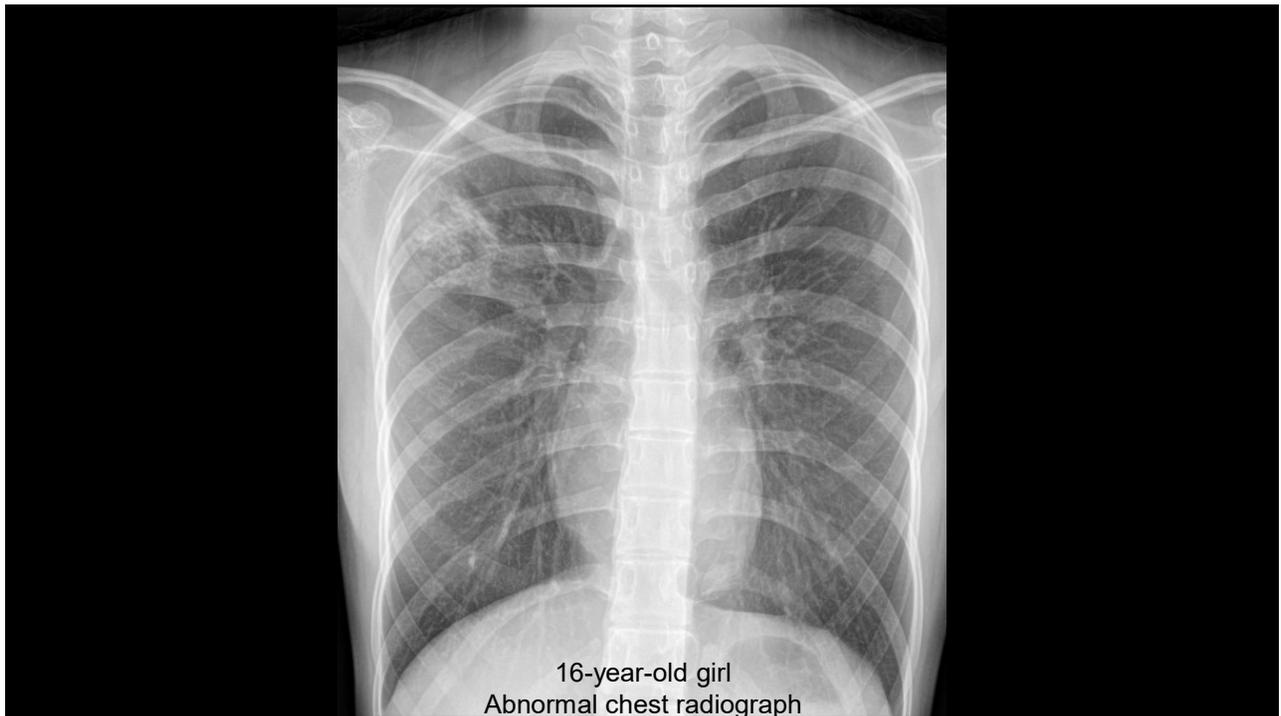
- Most commonly involves the apical and posterior segment of the upper lobes and the superior segments of the lower lobes

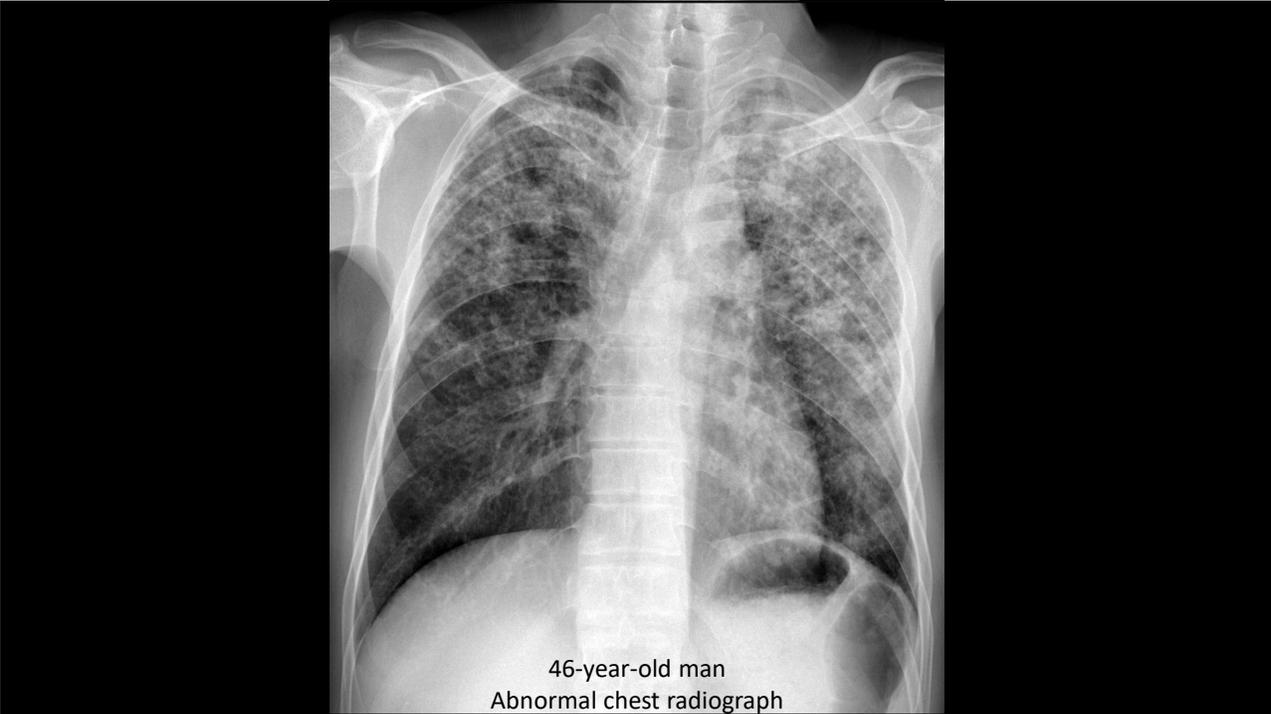


## Adult TB: typical findings

- 1) Ill-defined increased opacity with surrounding satellite nodules
  - 2) As disease progresses, consolidation and cavitation develop
- \* Rarely, central airway involvement causes obstruction leading to atelectasis, usually in the upper lobes

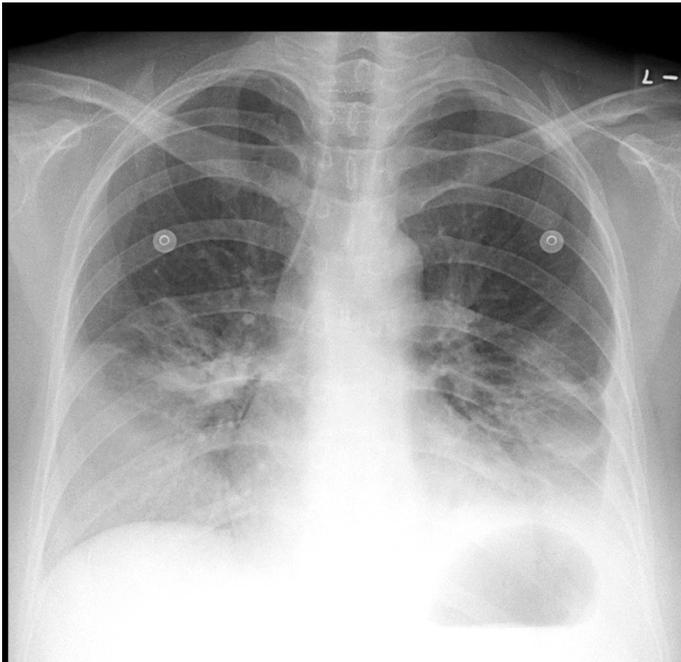




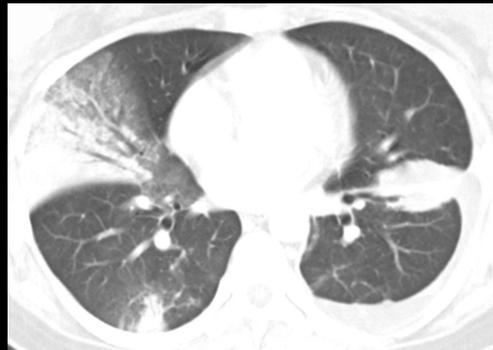


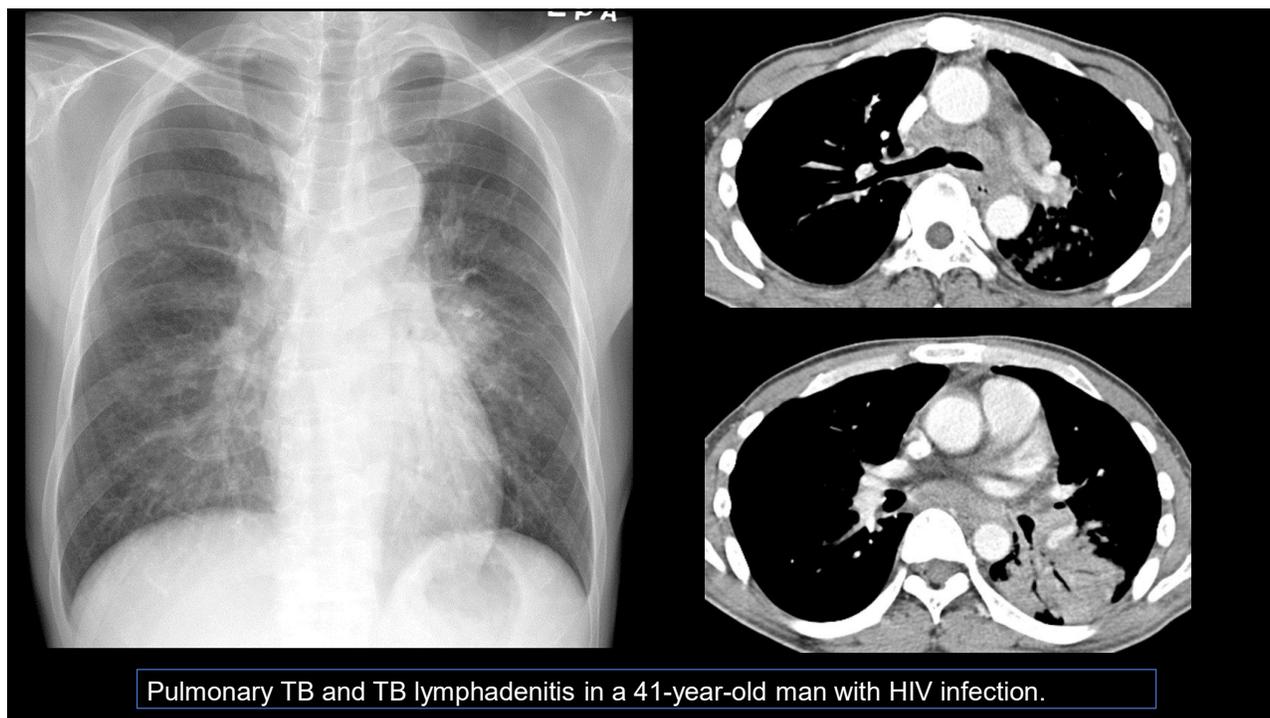
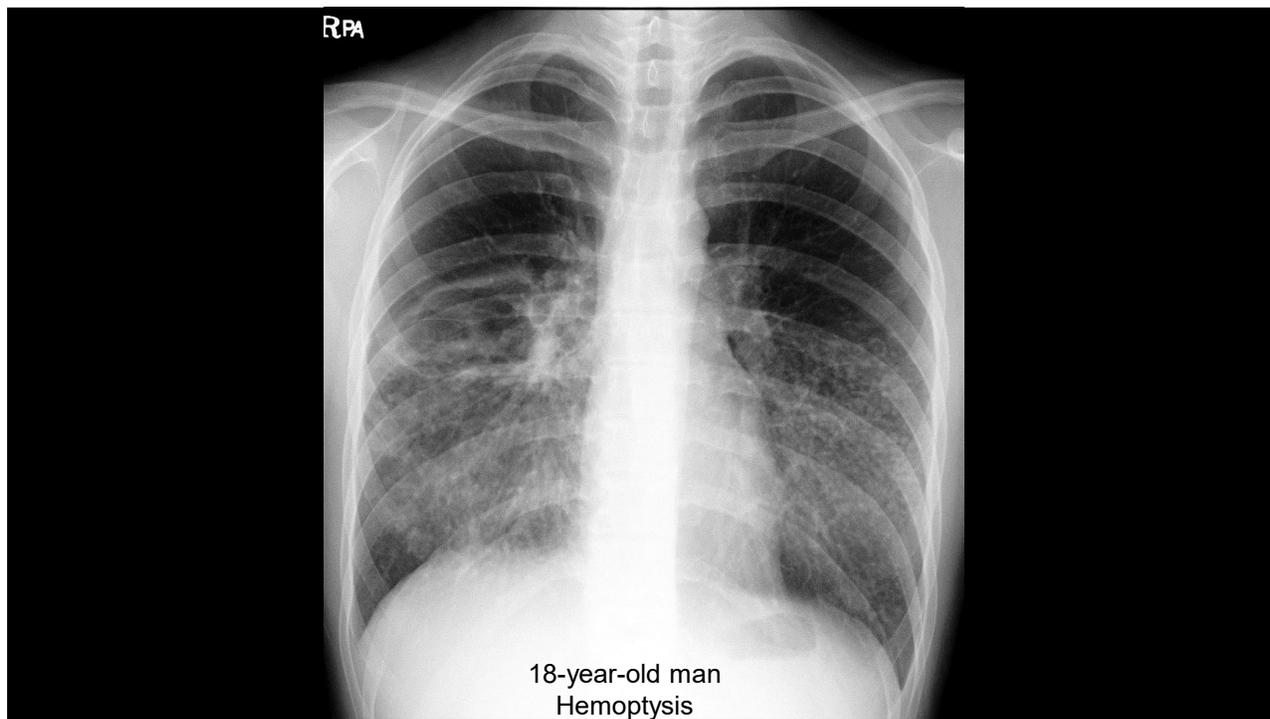
## Adult TB: atypical findings

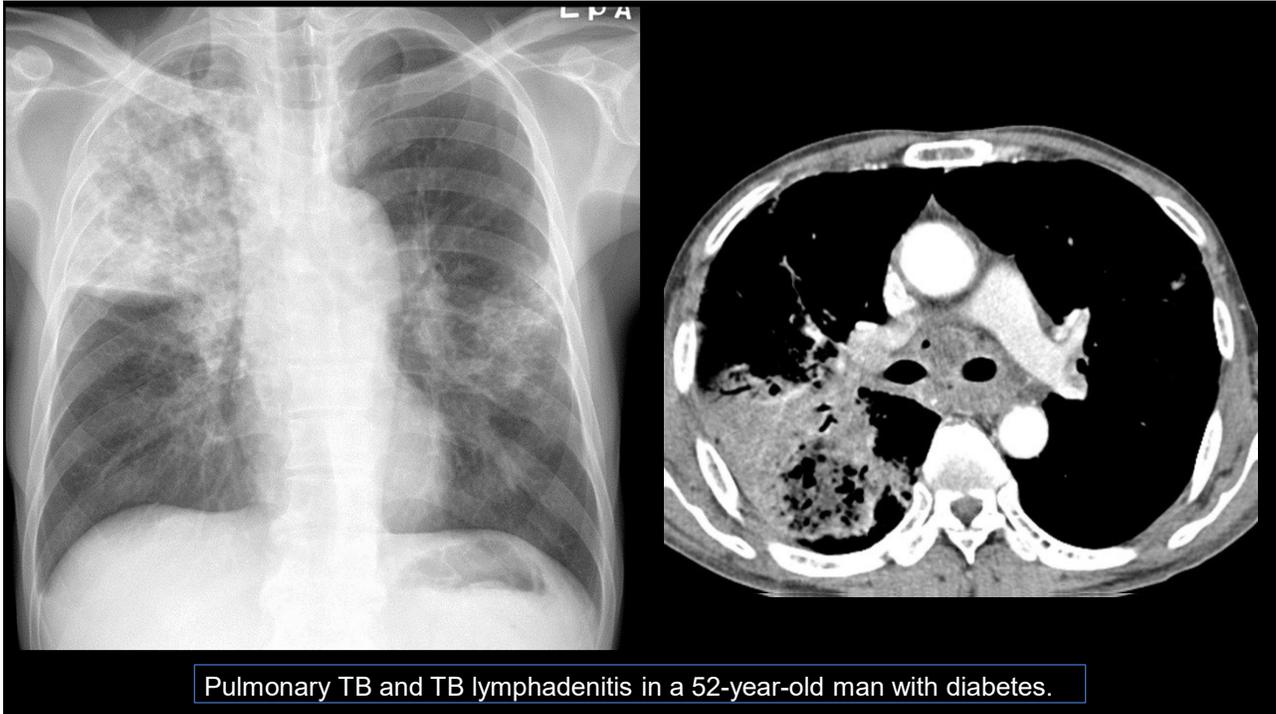
- Middle/lower lung parenchymal disease, lymphadenopathy, and pleural effusion
- May be difficult to distinguish from bacterial pneumonia; slower interval change on follow-up may help differentiate it from bacterial pneumonia



Atypical active pulmonary TB in a 28-year-old woman.





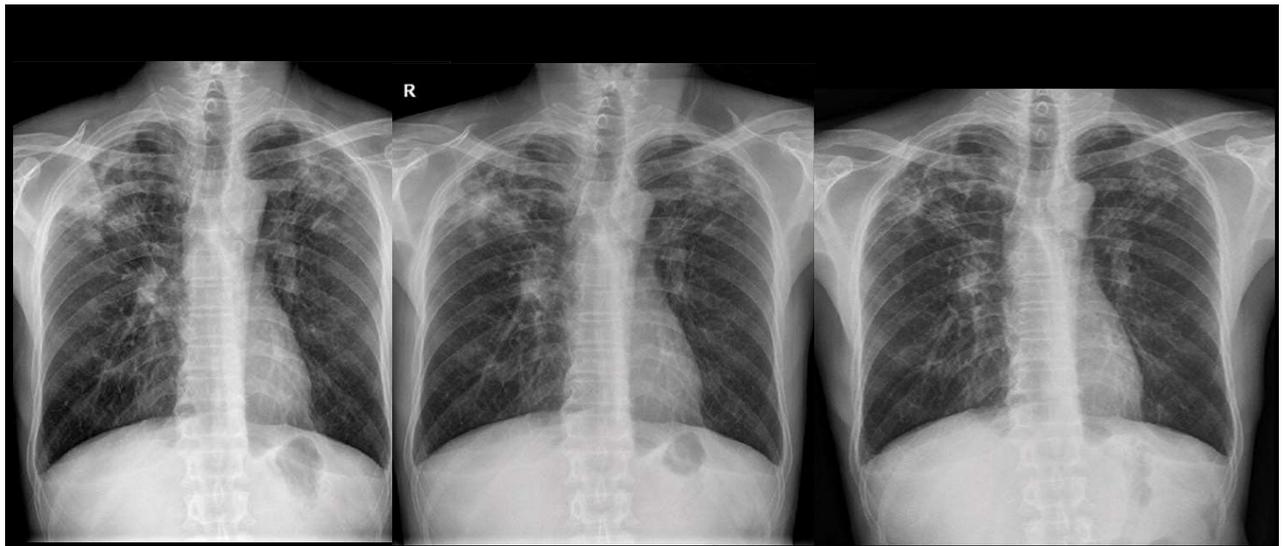


## Adult TB: post-treatment findings

- Complete healing without sequelae is uncommon; fibrosis and calcification usually remain
- Consolidation or ill-defined nodular lesions gradually resolve into well-defined nodules or fibrotic linear opacities, with gradual volume loss
- Cavities decrease in size and develop thinner walls; they may remain as small nodules or scars, or rarely persist as thin-walled cavities



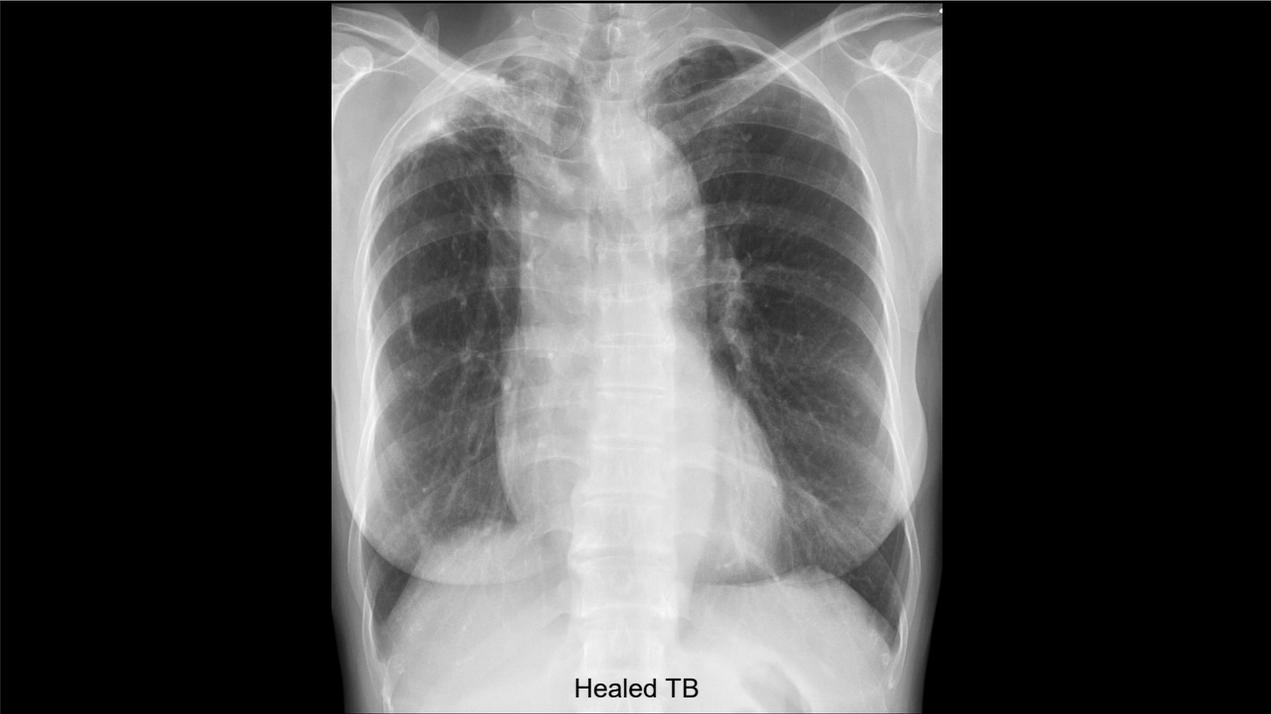
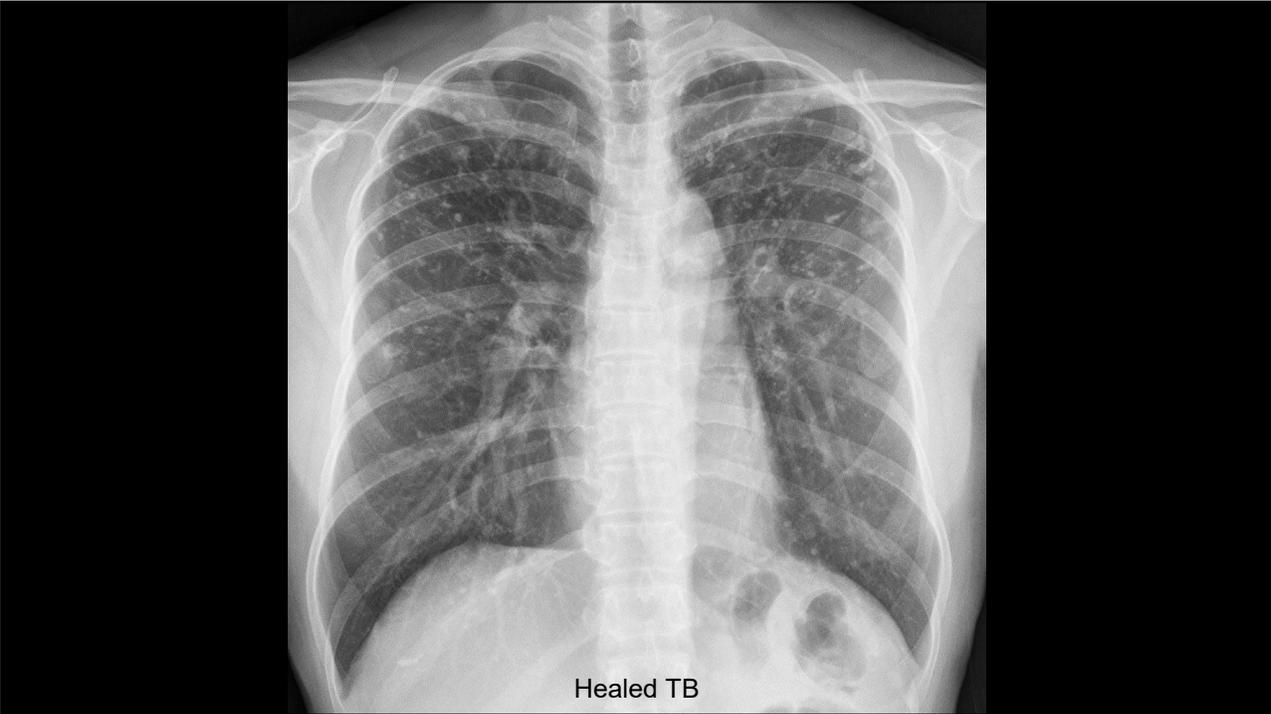
Pulmonary TB before and after treatment in a 67-year-old woman.

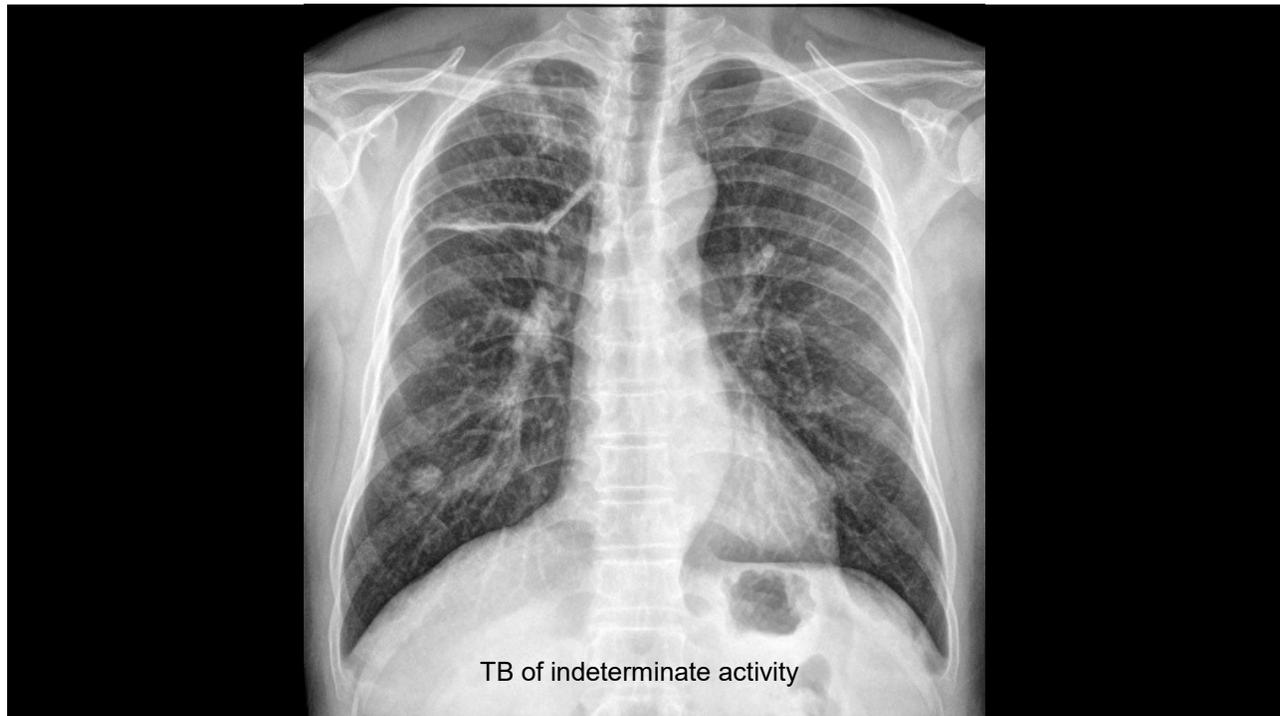


Before treatment

2 months

6 months

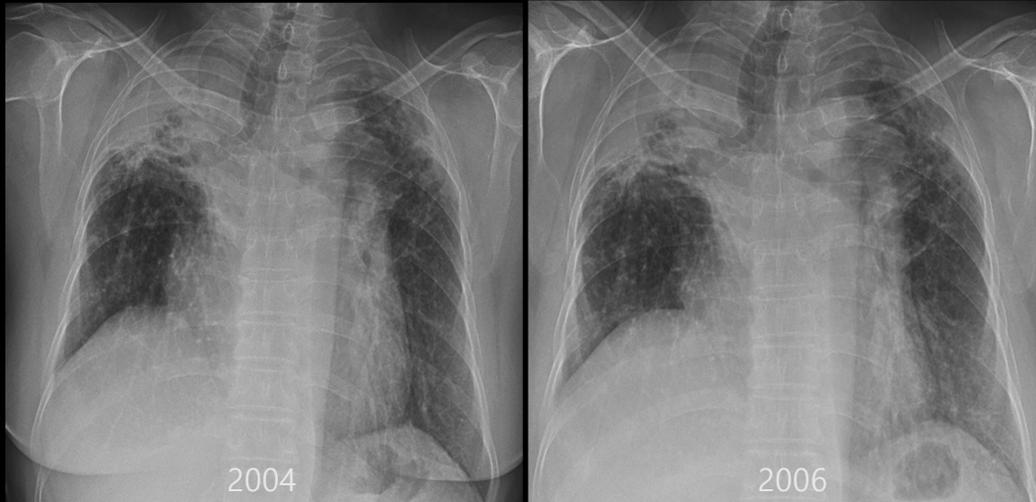




## Assessing TB Activity on Chest X-ray

- Activity cannot be determined from single chest radiograph.
- Progressive disease indicates activity.
- Cavitation and bronchogenic spread suggest activity.

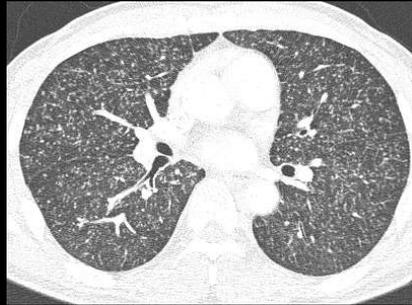
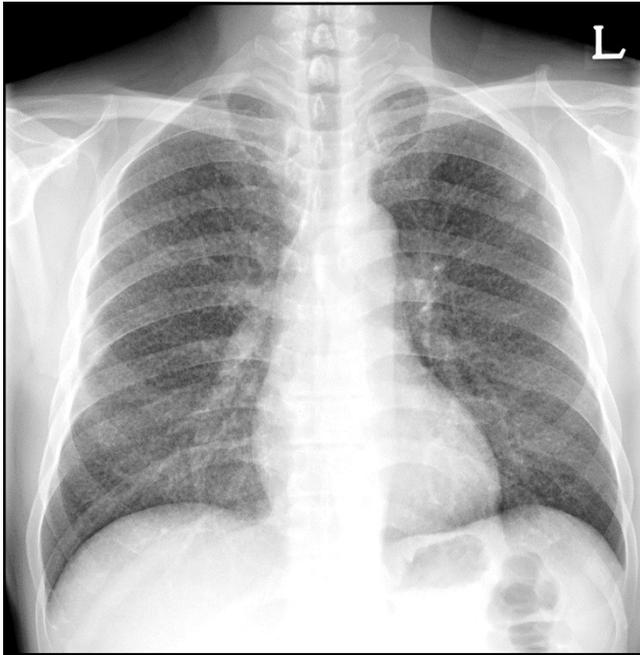
## Stable Tuberculosis



Prior radiographs are often helpful; stability for >6 months favors inactive disease.

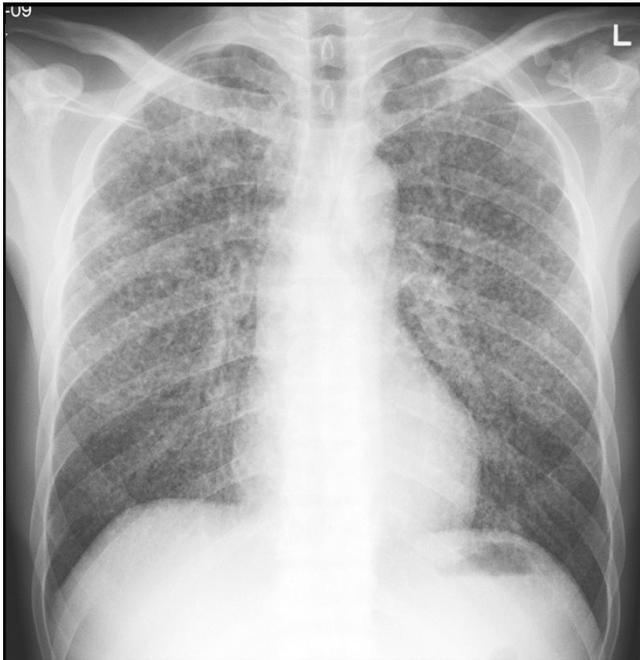
## Miliary TB

- Caseous necrosis may invade vessel walls, allowing tubercle bacilli to spread hematogenously throughout the body, particularly diffusely through the lungs
- Chest radiographs may initially be normal in up to 50% of cases
- Uniformly distributed 2-3 mm miliary nodules throughout the lungs



Millet Seeds

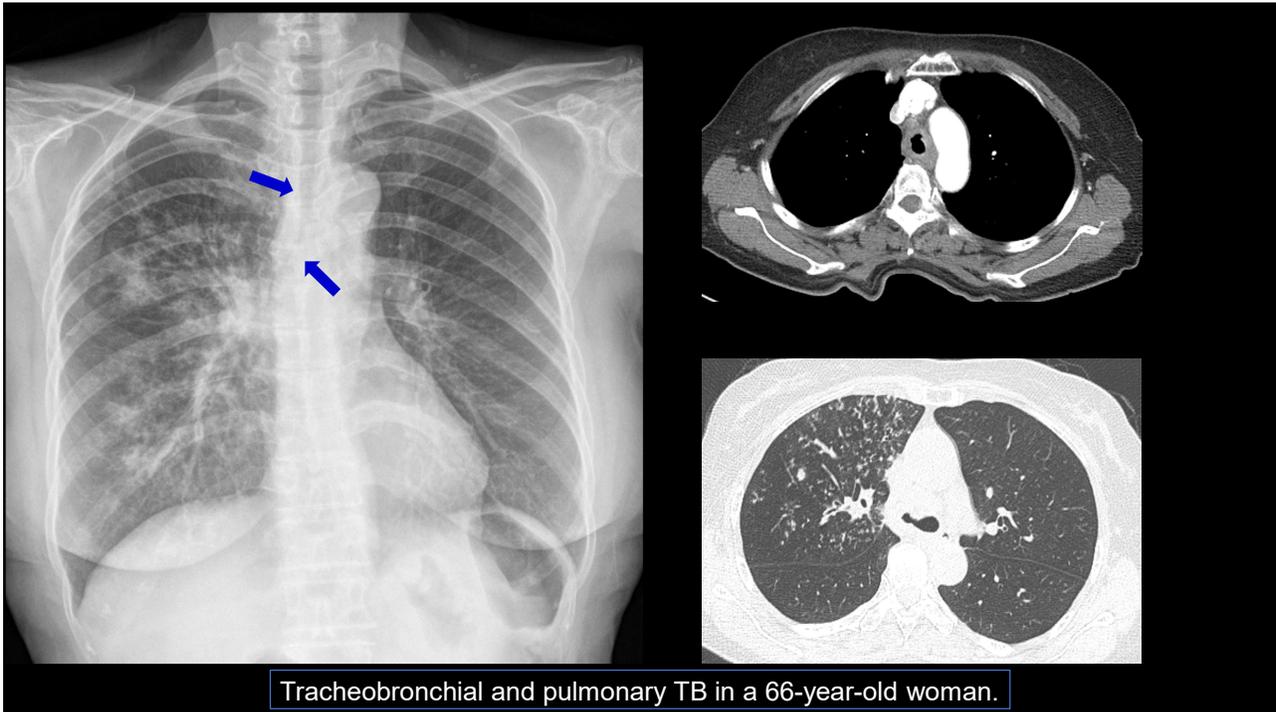
Miliary TB in a 46-year-old man.

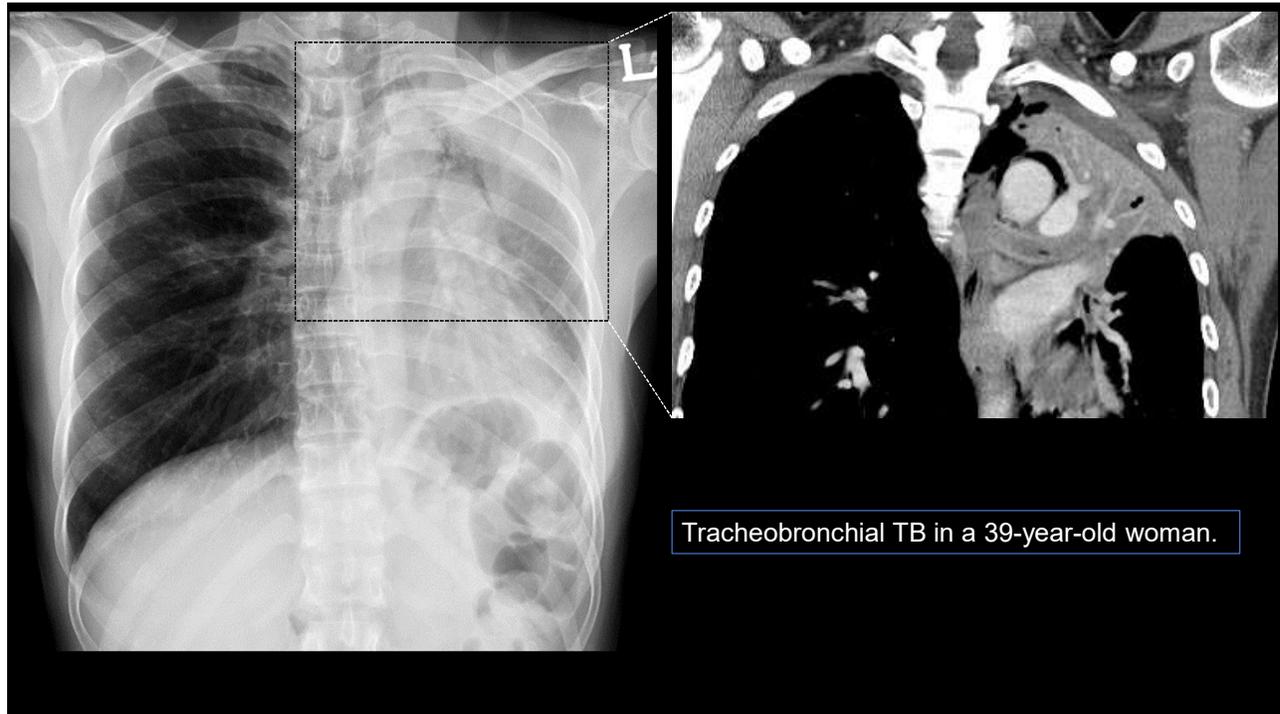


Miliary TB in a 34-year-old man.

## Tracheobronchial TB

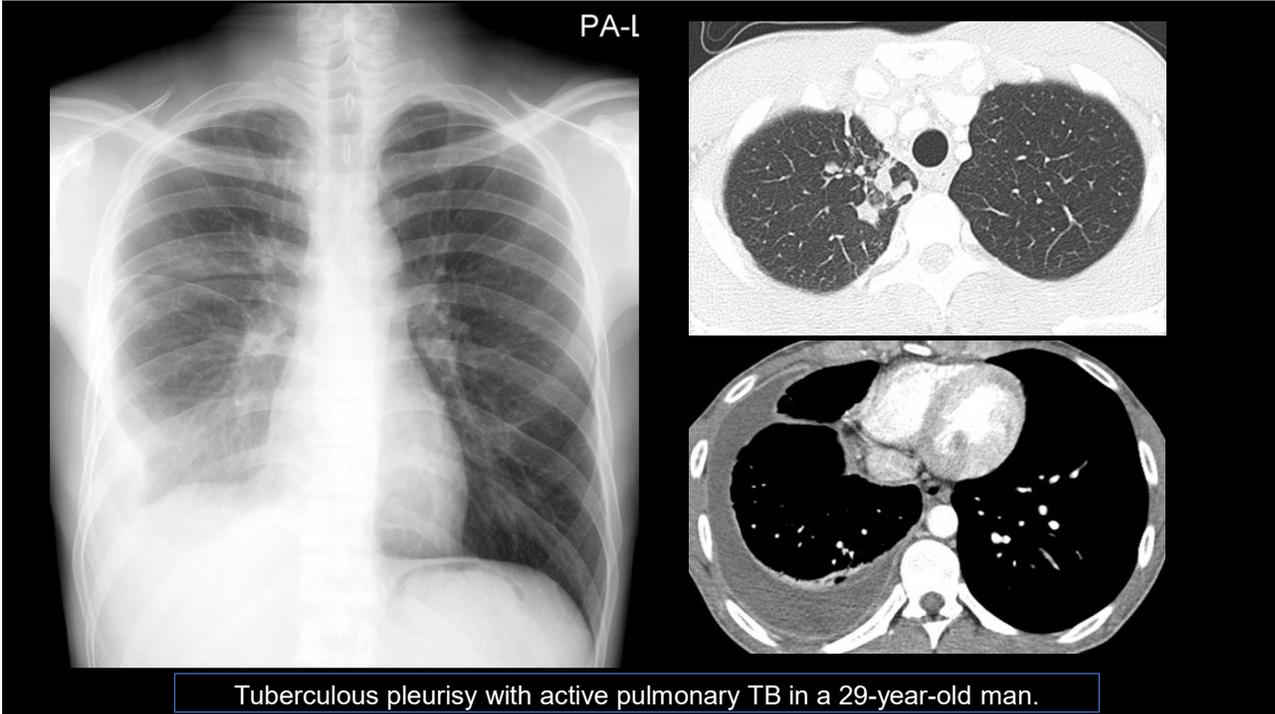
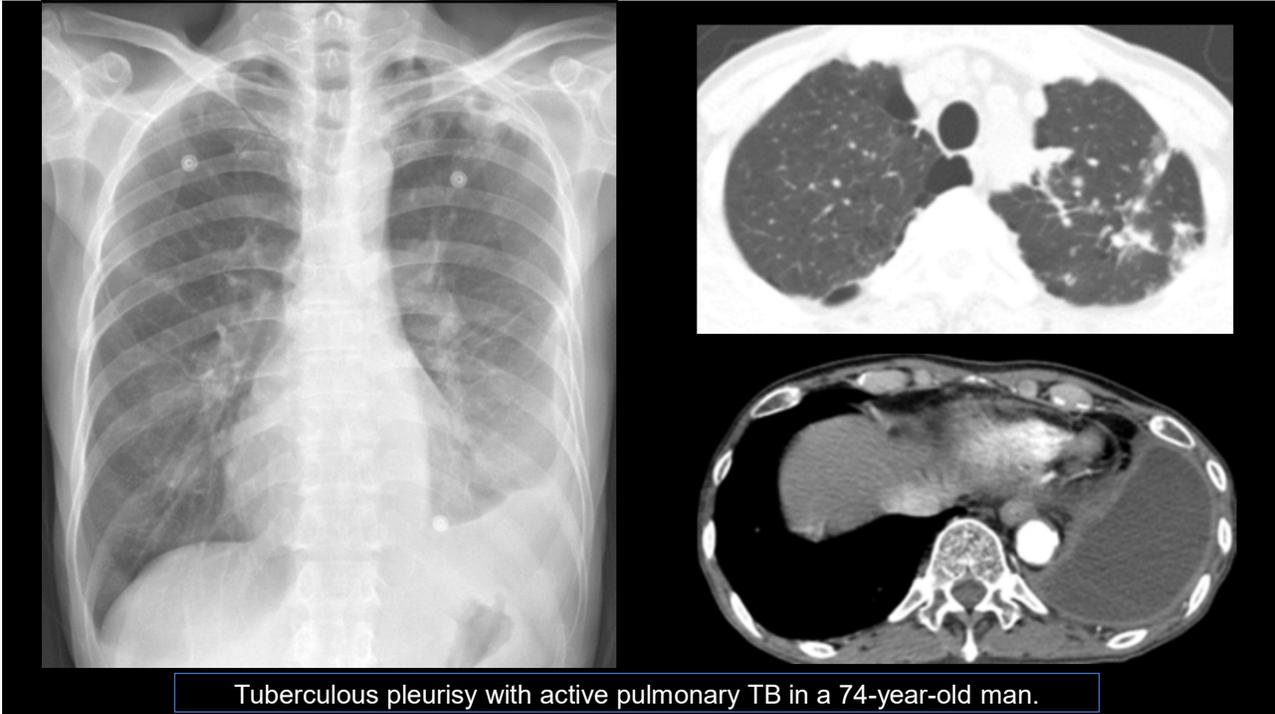
- Caused by involvement of the trachea, main bronchi, or lobar bronchi
  - Occurs in up to 10% of patients, especially young women
- May present with persistent atelectasis, hyperinflation, or obstructive pneumonia
  - Often associated with central airway wall thickening and stenosis





## Tuberculous pleurisy

- The most common form of extrapulmonary TB
- may result from a hypersensitivity reaction after rupture of subpleural focus into the pleural space or from direct pleural involvement by TB
  
- Typically presents as unilateral pleural opacity with a crescentic appearance, with variable degrees of upper-lung infiltrates; healing may leave pleural thickening and calcification



## Drug-resistant TB

- Findings are not substantially different from drug-susceptible TB
- However, multidrug-resistant TB more often shows the following than drug-susceptible TB:
  - bilateral lung involvement
  - segmental or lobar consolidation
  - multiple cavities



54-year-old man with sputum, and weight loss  
History of TB treatment but not completed



## Summary

