

# Chest Imaging

---

Obstructive airway diseases, infection  
and pneumothorax

## Lecture 2

**Asst Prof. Abdullateef Ali, MD**  
Consultant Radiologist  
2025-2026

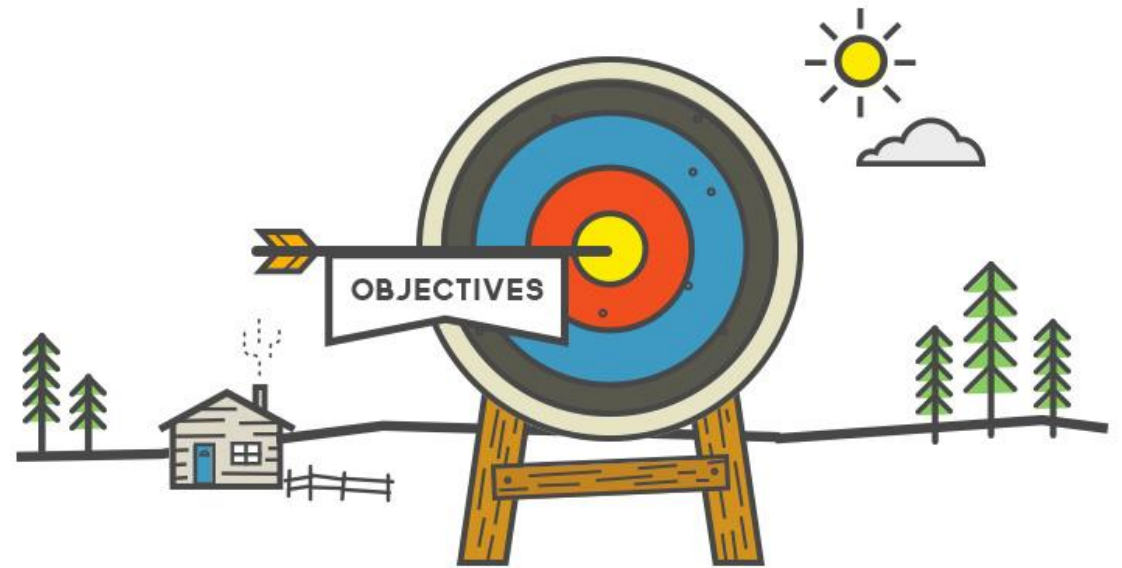


# Learning Objectives

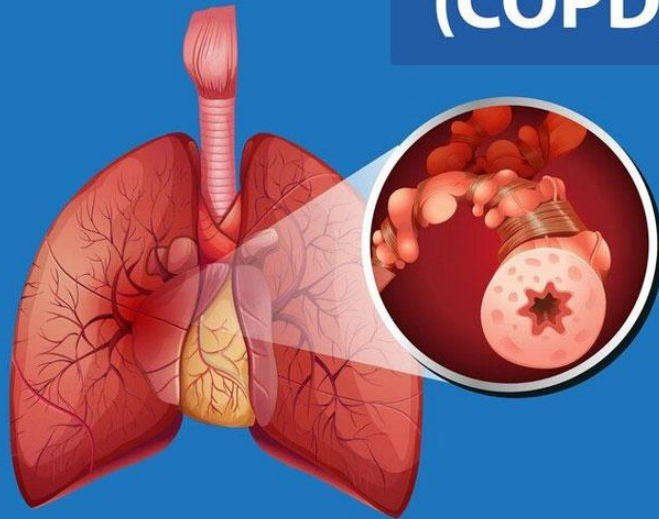
---

By the end of this lecture, you will be able to:

- Recognize the radiographic signs of COPD and bronchiectasis.
- Differentiate between lobar pneumonia, bronchopneumonia, and atypical pneumonia.
- Identify the classic imaging findings of tuberculosis (primary and post-primary).



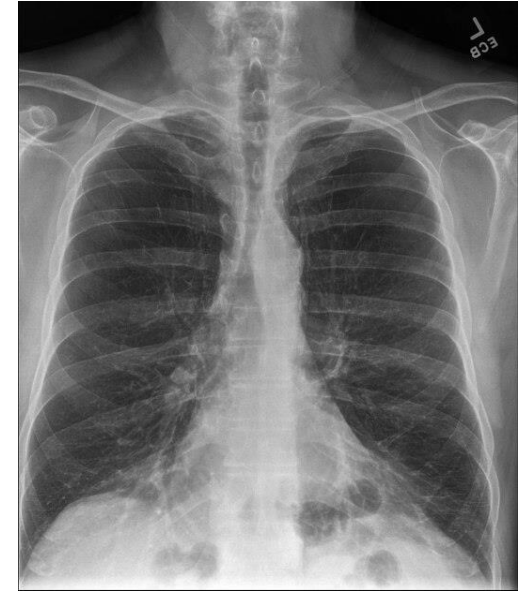
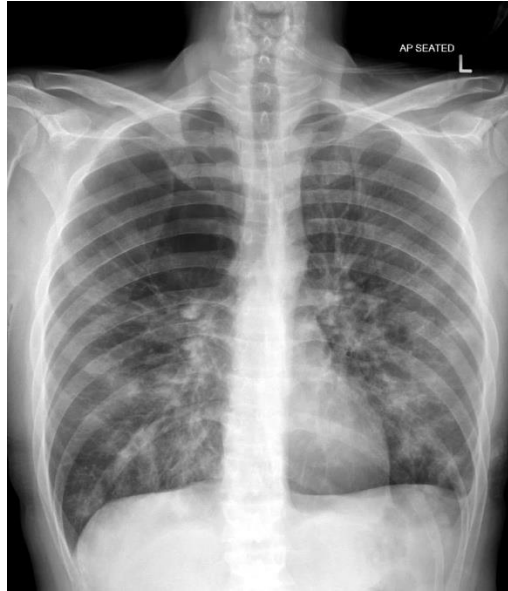
# Chronic Obstructive Pulmonary Disease (COPD)



## Obstructive Lung Diseases: Overview

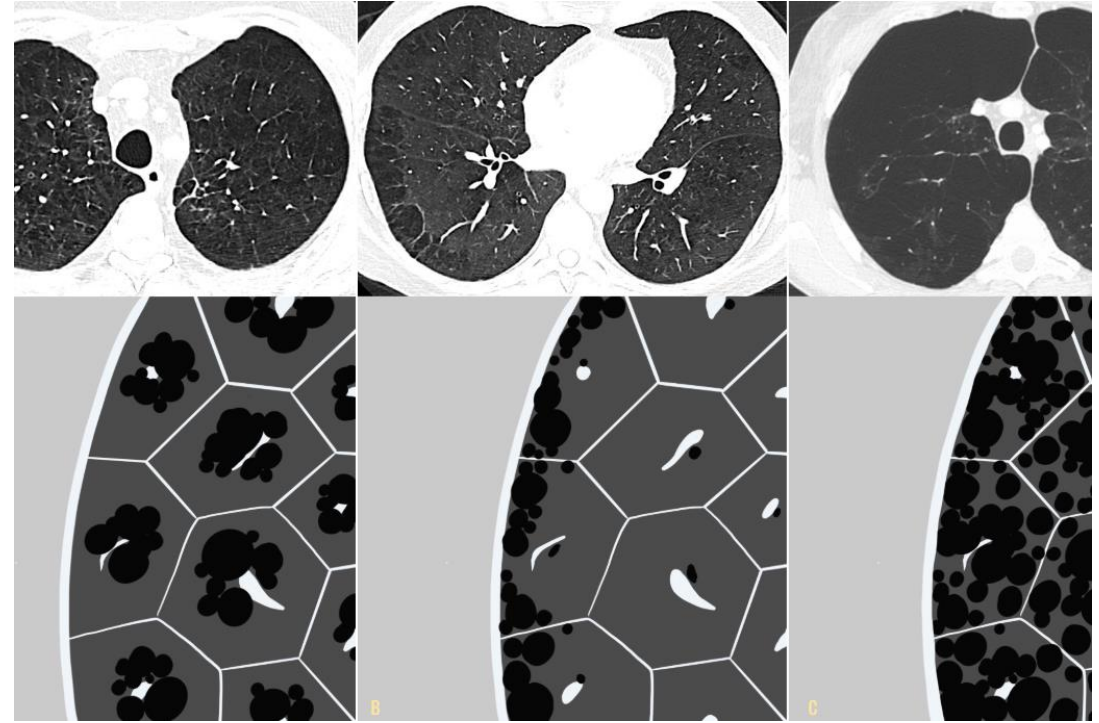
---

- **Pathology:** Airflow limitation due to airway obstruction or loss of elastic recoil.
- **Main Types:** COPD (Emphysema, Chronic Bronchitis), Asthma, Bronchiectasis.
- **General CXR Findings:** Hyperinflation.



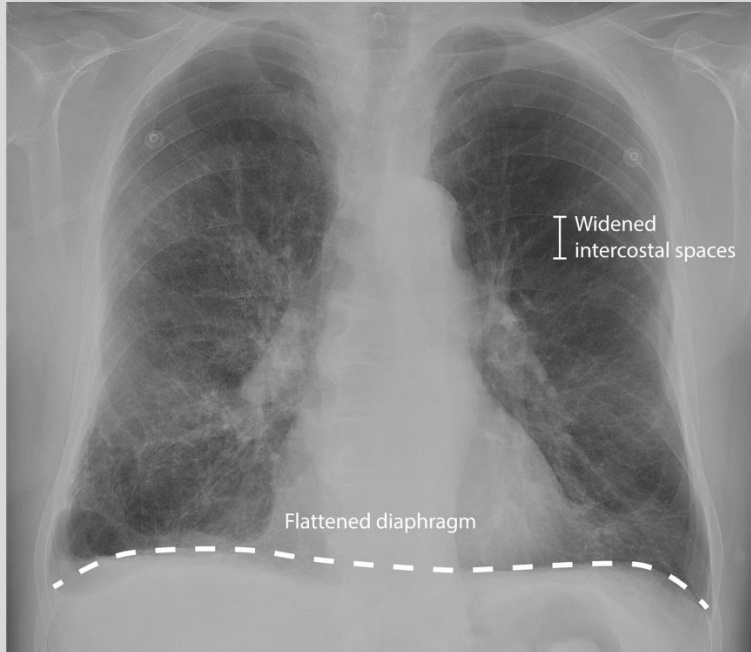
## Radiographic Signs of Hyperinflation

- **Flattened Hemidiaphragms**
- **Increased Retrosternal Airspace** on lateral view.
- **Barrel-shaped Chest** (AP diameter increased).
- **Tenting of Diaphragm at rib insertions.**
- **"Saber-Sheath" Trachea** (coronal narrowing).



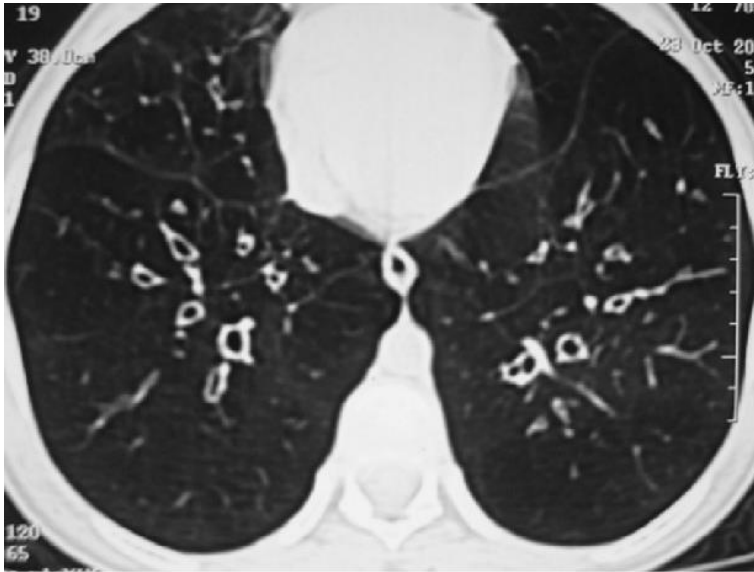
## Emphysema on Imaging

- **CXR:**
  - Hyperinflation.
  - **Attenuation of Vessels:** Lungs look too black; vessels are small and difficult to see.
  - Bullae (focal air-filled spaces).
- **CT (Gold Standard):**
  - **Centrilobular:** Focal areas of low attenuation *without walls*, upper lobe predominant.
  - **Panlobular:** Widespread destruction, lower lobe predominant (alpha-1-antitrypsin).
  - **Paraseptal:** Along the pleura and fissures; can lead to bullae.



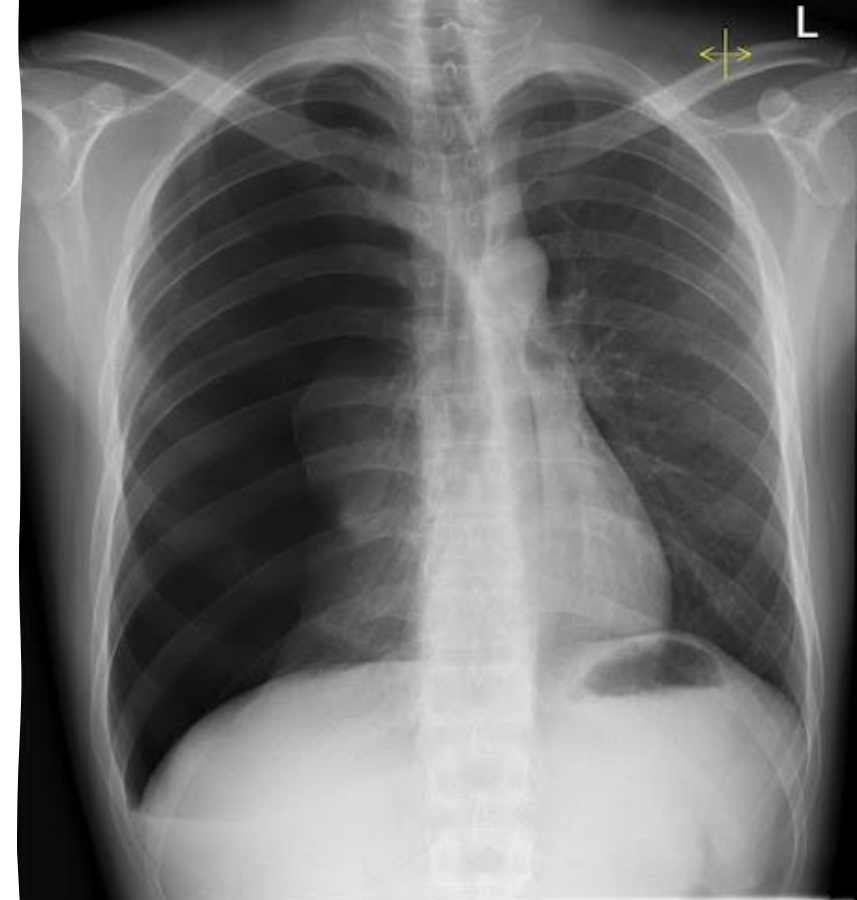
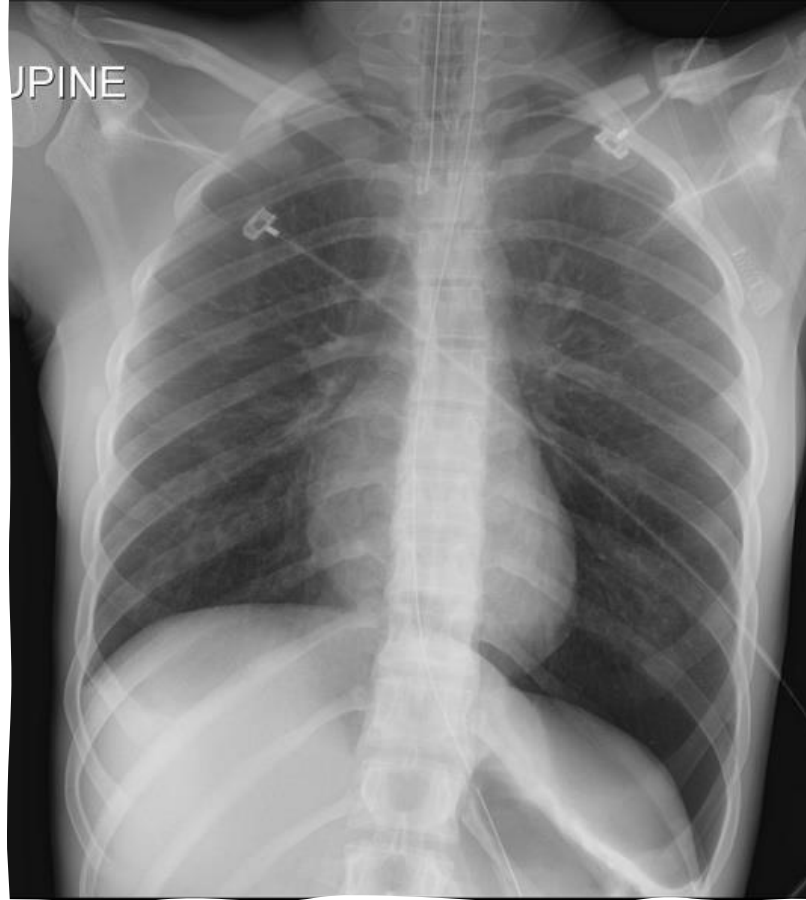
## Chronic Bronchitis & Asthma

- **Chronic Bronchitis ("Blue Bloater"):**
  - **CXR:** Often normal. May show "Dirty Chest" - increased bronchial wall markings ("tram tracks").
  - Diagnosis is clinical, not radiographic.
- **Asthma:**
  - **CXR:** Usually normal. During an attack: may see hyperinflation, bronchial wall thickening.
  - **Main role of imaging:** To exclude complications (pneumonia, pneumothorax) or other diagnoses.



## Bronchiectasis

- **Pathology:** Irreversible, abnormal dilatation of the bronchi.
- **CXR:** May be normal. Can see "tram tracks," tubular shadows, ring shadows.
- **CT (Diagnostic):**
  - **Signet Ring Sign:** Dilated bronchus (ring) adjacent to its smaller accompanying pulmonary artery (the "gem").
  - **Lack of Bronchial Tapering**
  - Bronchi visible in the lung periphery (where they shouldn't be).



## The Pneumothorax

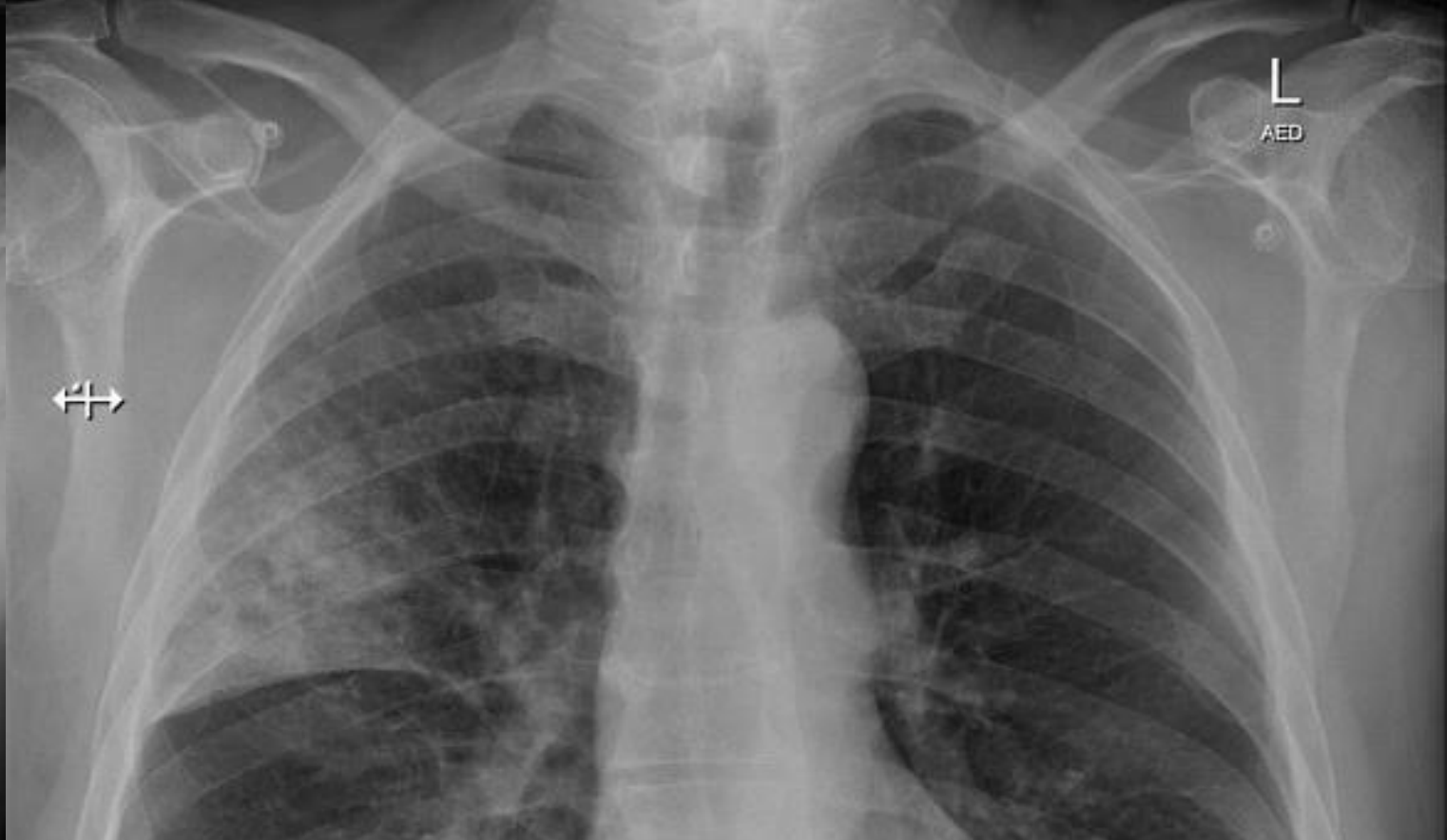
- **Pathology:** Air in the pleural space.
- **CXR (Upright):**
  - **Visceral Pleural Line:** A thin, white line seen parallel to the chest wall.
  - **Absence of Vessels** beyond this line.
  - Deep, hyperlucent sulcus sign (on supine film).
- **Tension Pneumothorax (Medical Emergency):**
  - **Mediastinal Shift away from the pneumothorax.**
  - **Depression of the Hemidiaphragm.**



# Pulmonary Infections

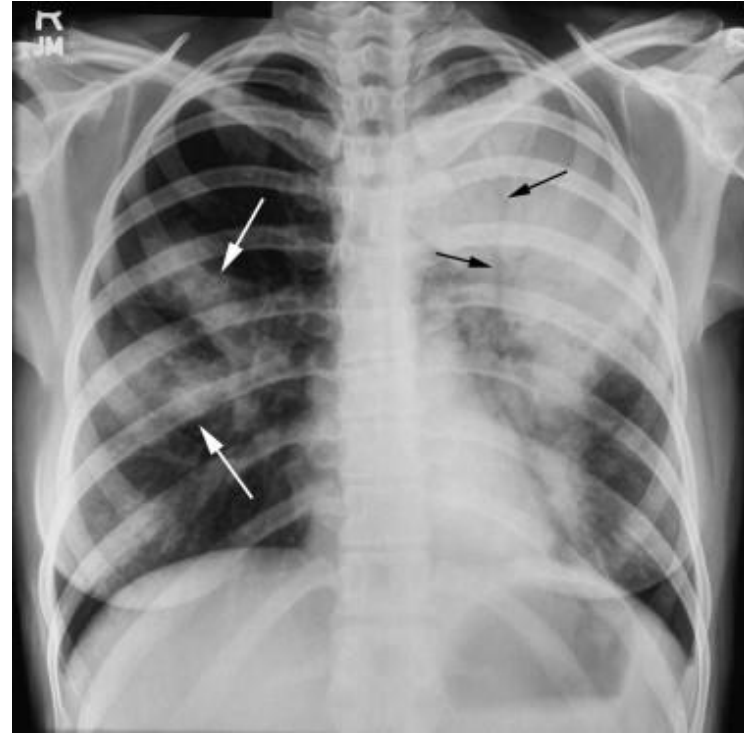
## Classifying Pneumonias by Pattern

- **Lobar Pneumonia**
- **Bronchopneumonia (Lobular)**
- **Interstitial (Atypical) Pneumonia**
- *(Note: Pattern suggests, but does not confirm, the causative organism)*



## Lobar Pneumonia

- **Organisms:** *Streptococcus pneumoniae*, *Klebsiella*.
- **Pathology:** Inflammatory exudate fills the alveoli in a entire lobe.
- **Imaging:**
  - **CXR:** Homogeneous consolidation confined to a lobe. Air bronchograms are common.
  - **Key Feature:** Respects the fissures (non-crossing).



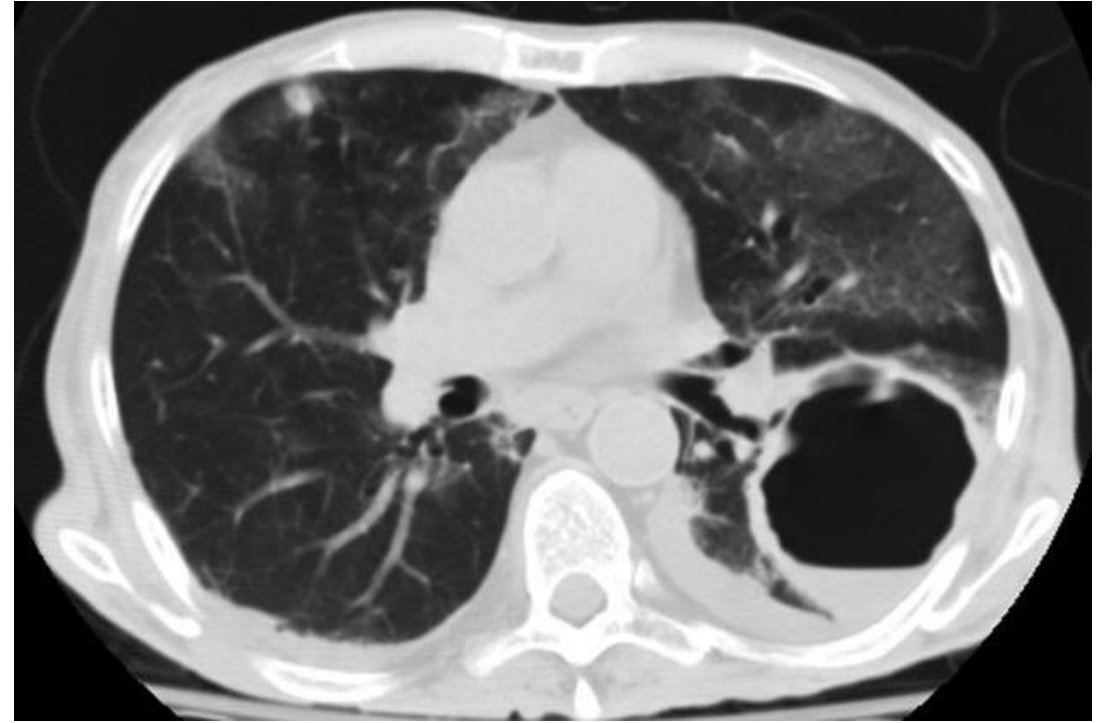
## Bronchopneumonia

- **Organisms:** *Staphylococcus aureus*, *Haemophilus influenzae*, anaerobes.
- **Pathology:** Patchy consolidation centered on the airways and bronchioles.
- **Imaging:**
  - **CXR:** Multifocal, patchy opacities, often bilateral.
  - No lobar predominance.
  - Can be confluent.
- **Image:** CXR showing bilateral, patchy, ill-defined opacities.



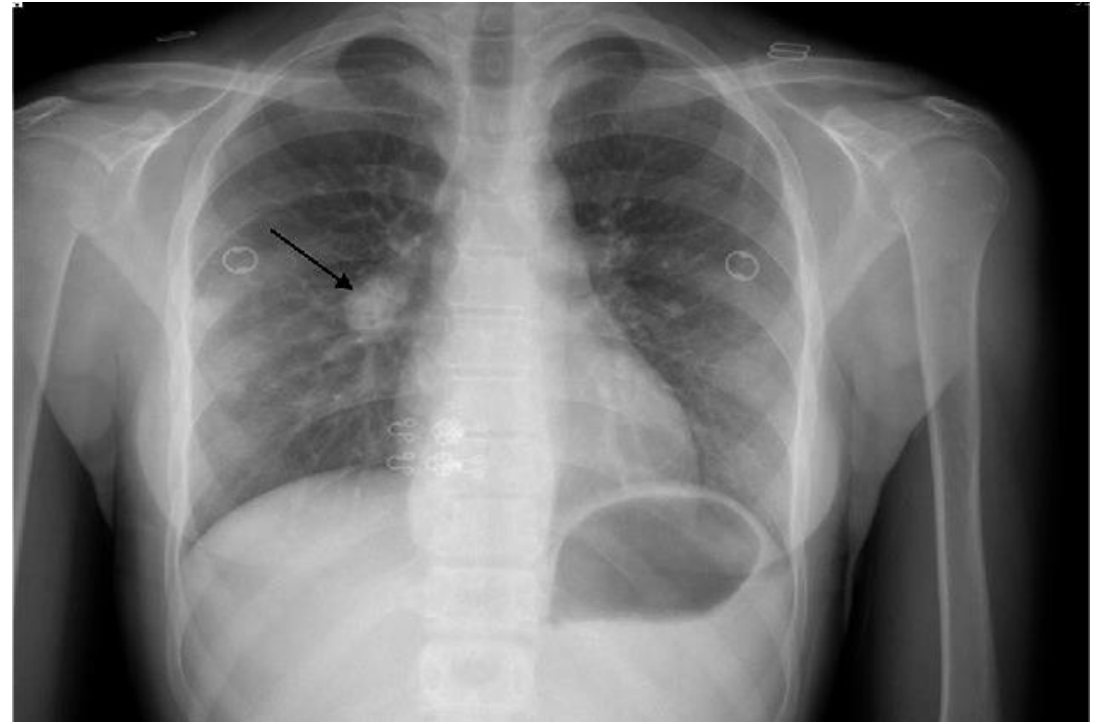
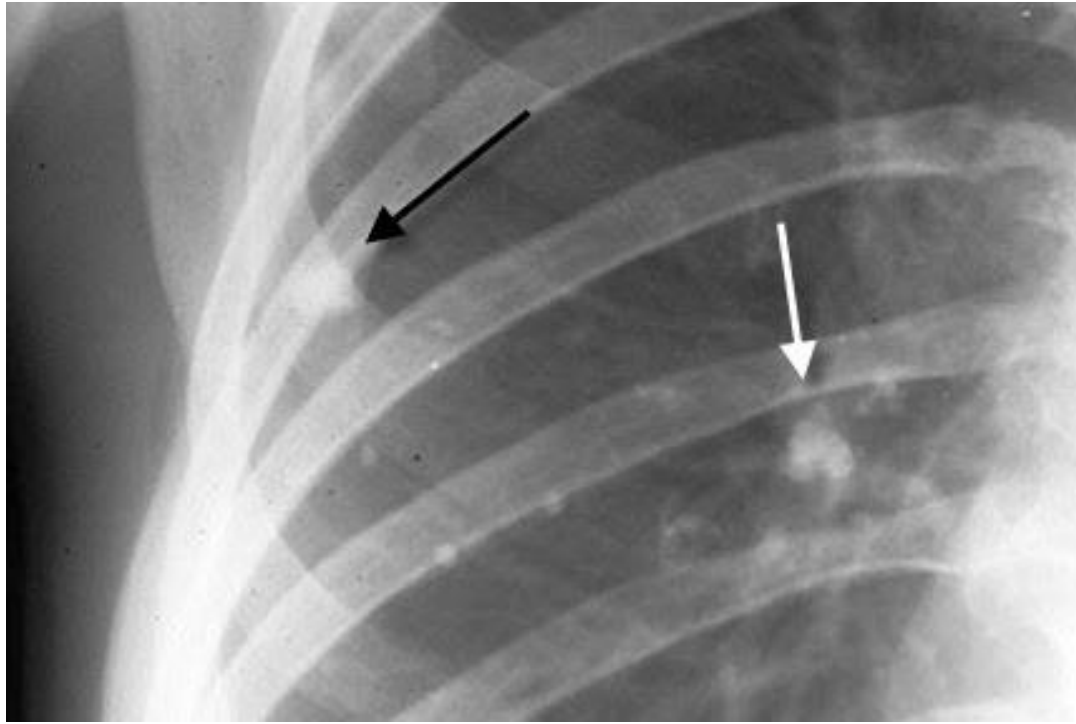
## Interstitial/Atypical Pneumonia

- **Organisms:** Viruses, *Mycoplasma*, *Chlamydia*.
- **Pathology:** Inflammation primarily in the interstitium.
- **Imaging:**
  - **CXR:** Fine reticular or reticulonodular opacities.
  - Can be difficult to see early on.
  - **CT:** "Ground-Glass Opacities" (hazy increased lung attenuation that does not obscure vessels) and septal thickening ("crazy-paving").
- **Image:** CT chest showing extensive ground-glass opacities in a patient with viral pneumonia.



## Lung Abscess

- **Pathology:** A localized collection of pus (necrosis) within the lung.
- **Imaging:**
  - **CXR/CT:** Thick-walled cavity with an air-fluid level.
  - Often in dependent segments (posterior upper lobes, superior lower lobes) due to aspiration.



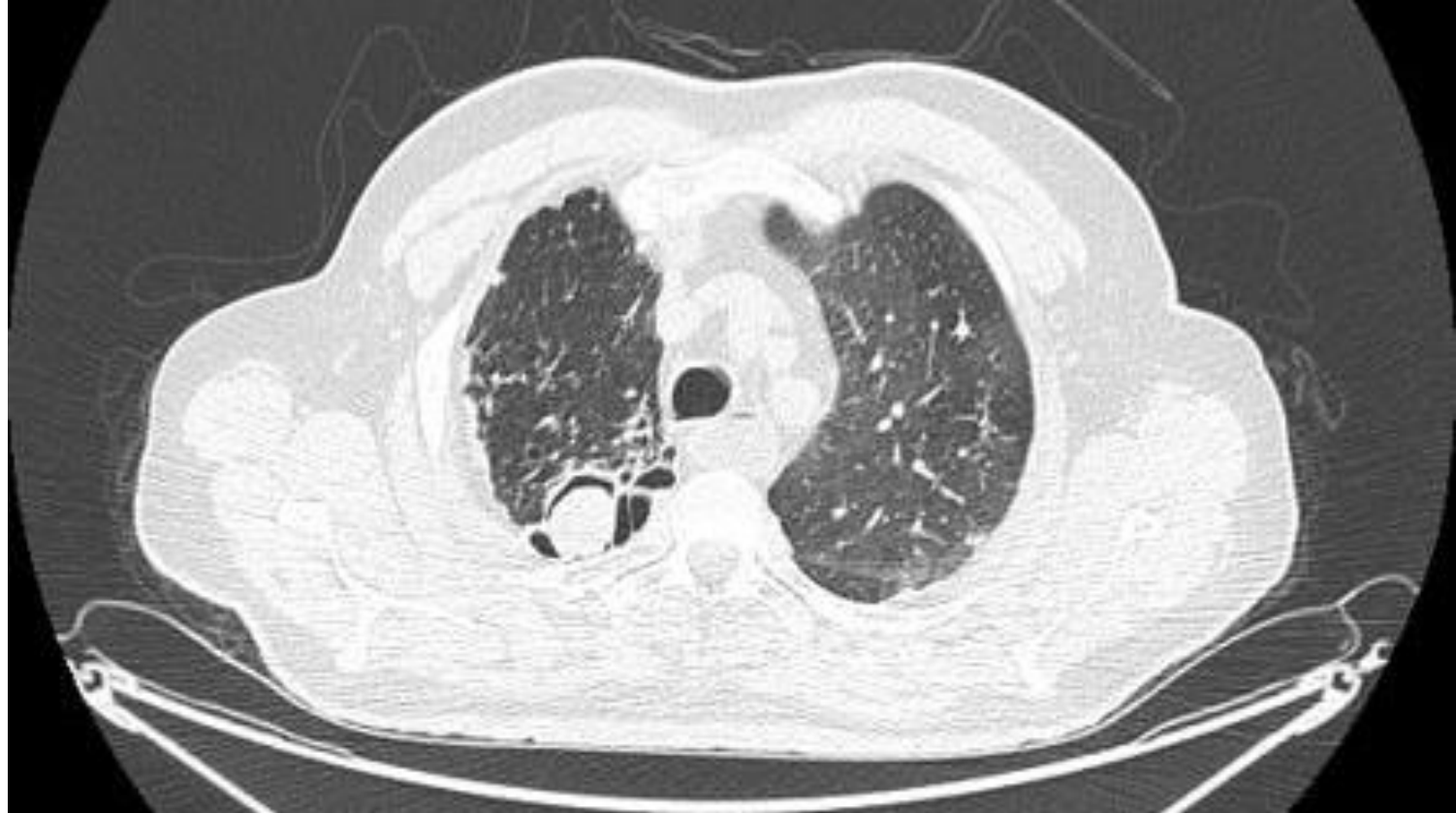
## Tuberculosis (TB) - Primary

- **Initial infection.**
- **Imaging:**
  - **CXR:** Often resembles atypical pneumonia.
  - **Ghon Focus:** Parenchymal opacity (usually lower/mid lobe).
  - **Ranke Complex:** Ghon Focus + Calcified Hilar Lymph Node.
  - Pleural effusion is common.
  - **Miliary TB** occurs due to hematogenous dissemination, which may occur at anytime following primary infection. On CXR, Miliary TB appears as tiny densities of approximately 2 mm diameter spread evenly through both lungs.



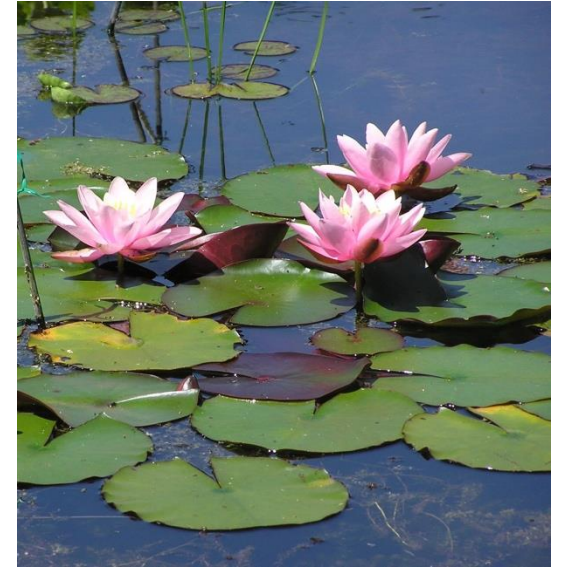
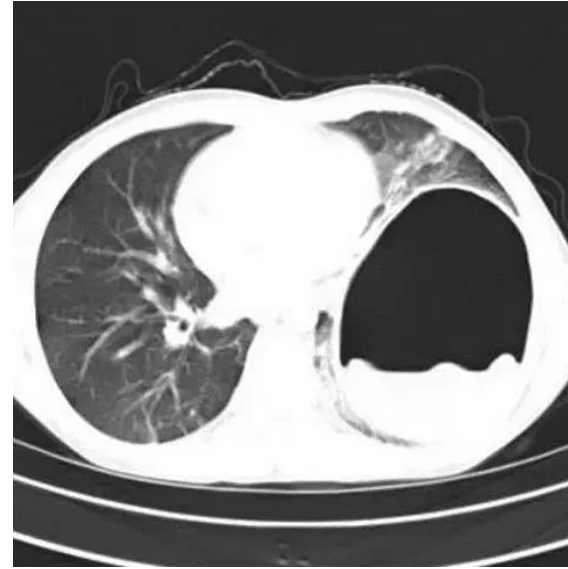
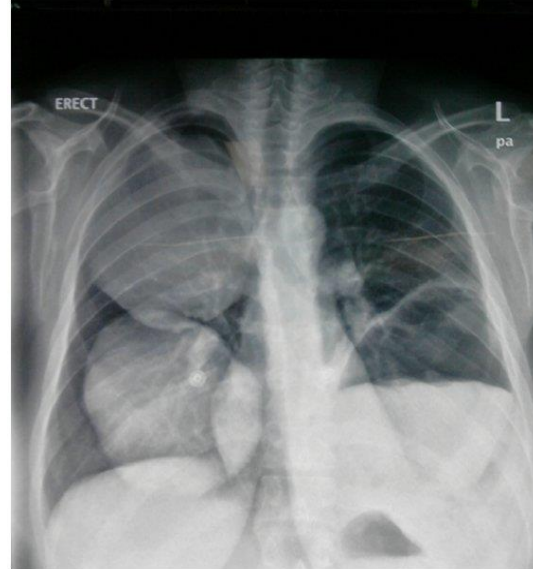
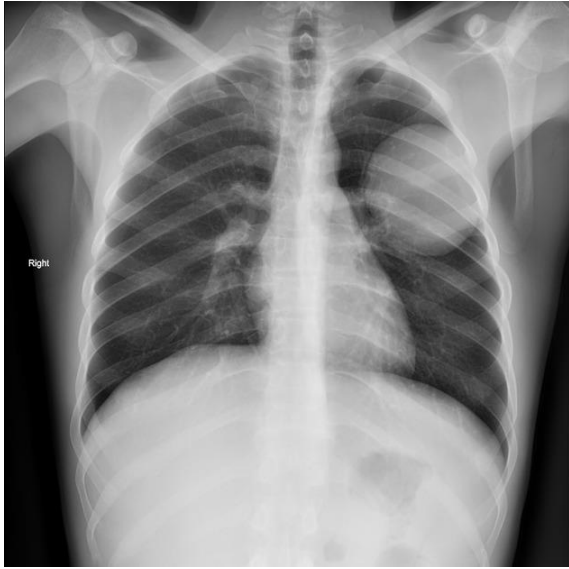
## Post-Primary TB (Reactivation)

- **Reactivation of latent infection.**
- **Imaging (Classic Locations):**
  - **Apical and Posterior segments of the upper lobes.**
  - **Superior segments of the lower lobes.**
  - **Findings:** Consolidation, Cavitation (very common), Fibrosis, Volume Loss.
  - "Tree-in-Bud" opacities on CT (endobronchial spread).
  - **Tuberculoma** refers to a tuberculous granuloma in the form of a spherical nodule. The edge is usually sharply defined, and the lesions are often partly calcified.



## TB: Complications & Activity

- **Complications:**
  - **Mycetoma:** Fungus ball (*Aspergillus*) in a pre-existing cavity.
  - Pleural effusion and empyema.
- **Signs of Activity:**
  - Development of new opacities or cavities on serial films.
  - Ill-defined consolidations.
  - *Lack of change over years suggests inactivity.*



## Parasitic [Hydatid] disease

- Pulmonary infection with *Echinococcus granulosus*
- May result in cysts in the lung or pleural cavity.
- These cysts may be solitary or multiple and are seen as spherical opacities with very well-defined borders.
- Hydatid cysts occasionally rupture to produce complex cavities with undulated air fluid level called **waterlily sign**.

