The Radiology of TB

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Objectives

- How to read a Chest X-Ray
- Descriptive terminology and types of imaging
- Indications for a Chest X-Ray to detect TB
- Primary TB (basic images and sequelae)
- Post Primary TB (basic images and sequelae)
- Atypical presentations of Pulmonary TB on a Chest X-Ray
HOW TO READ A CHEST X-RAY

1. Orientation, Exposure, Inspiratory effort
2. Diaphragm
3. Heart
4. Trachea
5. Hila
6. Lung fields
   (vasculature and parenchyma)
7. Minor fissure
8. Bones
   (clavicles, scapula, ribs, sternum, spine))
9. Soft tissues
10. Compare with old films
Keys to Reading CXRs (Objectives)

- Be systematic in your approach to reading a chest X-ray
  - don’t jump to the obvious abnormality
- Assure the film is technically adequate
- Understand the anatomy
  - basic lobar, mediastinal, and fissure anatomy
  - anatomic relationships
Keys to Reading CXRs (Objectives)

- Understand the radiographic signs
  - silhouette sign
  - air bronchogram sign

- Practice by always reading your patient’s CXR before reading the Radiologist’s report
  - reinforces what you are doing right and highlights what you need to work on
Posteroanterior CXR

- Standard frontal view
- Better known as PA CXR
- Patient upright with chest against X-ray film
- X-ray beam travels from back to front of patient
Advantages of PA CXRs

- Provides a sharp image
- Shows more of lung, since diaphragm is lower
- Easy and quick to obtain
Disadvantages of PA CXRs

- Patient must be able to stand or sit upright
- Patient must be able to go to the Radiology Department
Lateral CXR

- Standard side view
- Patient is upright with left side of chest against X-ray film
Advantage of Lateral CXRs

- Shows lesions located behind left side of heart or base of lung which are not seen in PA view because heart and diaphragm hide them

Sergew A et al. Chest 2008;133:805-808
Lateral Positioning

- Right ribs (red arrows) are larger due to magnification.
- Right ribs are usually posterior to left ribs in true lateral position.
Lateral CXR

- Right hemidiaphragm (red arrows) is higher than left
- Right hemidiaphragm (blue arrows) continues past smaller left ribs
- Left hemidiaphragm (black arrow) disappears anteriorly
Anteroposterior CXR

- Better known as AP CXR
- Patient is usually supine, lying on the X-ray film
- X-ray beam travels from front to back of patient
Advantages of AP CXRs

- Substituted for PA view
  - in very sick patients, infants, or anyone else unable to stand or sit
  - in any patient unable to be transported to Radiology Department
Disadvantages of AP CXRs

- Image is less sharp than PA view
- Shows less lung and distorts structures since diaphragm is higher
Decubitus CXR

- Patient is lying on his/her side
- X-ray beam is parallel to floor
Advantages of Decubitus CXRs

- Reveals free-flowing pleural fluid
- Confirms air-fluid levels in the lung
CXR Reading

- When reading films put PA and lateral side by side
CXR Comparison

New PA

Old PA

New Lateral

Old Lateral
CXR Reading

- Be systematic in how you approach them
- Use same system each time you view a CXR
- Do not skip to obvious abnormalities as you may miss other important abnormalities and clues
CXR Reading: One System

• Preparation
  – turn off lights, view films in order

• Assure Quality
  – view, technically adequate, correct patient
CXR Reading: One System

- Abdomen: look for liver, normal gas filled structures (stomach and colon)
  - Abnormalities: free air
CXR Reading: One System

- Thorax: look at soft tissues (muscle, breasts), chest wall, ribs, shoulder girdle
  - Abnormalities: foreign bodies (metal), air, mastectomy, fractures, missing bone
CXR Reading: One System

- Mediastinum: trachea, carina, aorta, heart, and hilum
  - Abnormalities: diffuse or focal widening, tracheal deviation, splaying of carina, shape of cardiac silhouette, pulmonary artery enlargement, hilar masses, or lymphadenopathy
CXR Reading: One System

• Lung Parenchyma and Pleura
  – Abnormalities: effusion, pleural thickening/calcification, fissure displacement, abnormal shadows, or lucencies
CXR Reading: One System

- Lateral view: systematically same as frontal view
  - Abdomen (A), Spine (B), Chest wall (C), Mediastinum (D), and Lungs (E)
Technically Adequate: Inspiration

• Should be examined in full inspiration

• Diaphragm should be found at about $8^{th}-10^{th}$ posterior rib or $5^{th}-6^{th}$ anterior rib
SUSPECTING TB

TB is suspected on epidemiological, clinical and radiographic grounds.

- High Risk Groups for TB:
  - Those with a high risk of TB exposure and LTBI
  - Those with a high risk that LTBI will progress to TB disease.
GENERAL INDICATIONS FOR A CHEST X-RAY TO DETECT POSSIBLE TB

1. UNEXPLAINED Pulmonary and/or Systemic symptoms
   - cough (> 3 weeks)
   - cough with fever (> 3 days)
   - pleuritic chest pain, hemoptysis, dyspnea (promptly)
   - fever, night sweats, weight loss

2. Routine Screen in persons found to have a positive tuberculin skin test

3. Routine screen in persons found to have HIV Infection

4. Routine Screen in select high risk populations
CLASSIC CHEST X-RAY FINDINGS IN TB

1. Hilar and/or mediastinal lymphadenopathy with or without a noncavitary infiltrate anywhere in the lung (Primary TB)

2. Upper lung field infiltrate with or without cavitation (Reactivation TB)

3*. Large unilateral pleural effusion

4*. Pericardial effusion

5*. Miliary pattern

* Primary or Reactivation TB
NON-CLASSIC (ATYPICAL) CHEST X-RAY FINDINGS IN TB

1. Lower lobe infiltrates
2. Single or multiple nodules with or without cavitation
3. Diffuse non-miliary interstitial or alveolar infiltrates
PRIMARY TB
SUMMARY - PRIMARY TB

- Hilar and/or mediastinal lymphadenopathy with or without an ipsilateral non-cavitary infiltrate anywhere in the lung

- Pleural Effusion

- Sequelae
  - progressive primary TB
  - compression/invasion of bronchi by hilar lymph nodes
  - broncholithiasis
  - hematogenous dissemination
  - Ghon lesion, Ranke complex
POST PRIMARY TB
(Re-activation TB)
SUMMARY- POST PRIMARY TB

- Upper lung field infiltrate with or without cavitation. No hilar or mediast. adenopathy

- Sequelae
cavity formation and scarring
endobronchial spread
bronchiectasis
aspergilloma
bronchopleural fistula and TB empyema
tuberculous pericarditis
miliary TB
Atypical Presentations of Pulmonary Tuberculosis on a Chest X-Ray
Paradoxical Responses
CLASSIC CHEST X-RAY FINDINGS IN TB

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NON-CLASSIC (ATYPICAL) CHEST X-RAY FINDINGS IN TB

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SUSPECTING TB

TB is suspected on epidemiological, clinical and radiographic grounds.

- High Risk Groups for TB:
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SUMMARY: CONSIDER THE POSSIBILITY OF TB* WHEN THE CHEST X-RAY REVEALS ANY UNEXPLAINED:

1. Focal or diffuse infiltrate anywhere in the lung.
2. Intrathoracic lymphadenopathy
3. Pericardial or pleural effusion

* Especially in high risk groups for TB
Some Non TB Pulmonary Diseases Can Mimic Classic TB on Chest X-Ray

(e.g. non-tuberculous mycobacterial diseases, fungal diseases, sarcoid)
Extra Pulmonary Tuberculosis