Diagnosis of Tuberculosis Disease: Radiology
Patricio Escalante, MD, MSc
September 23, 2008
Goal:

To describe the timely diagnosis of tuberculosis (TB) using radiology as a tool

Objectives:

• Primary TB
• Reactivated TB
• Less common radiographic presentations
  • Primary TB
  • Reactivated TB
  • TB in HIV-infected adults
  • TB in children
• Extrapulmonary TB
• CT scan findings
Necrotizing granulomatous reaction is the hallmark of host’s tissue immune response against TB.

TB Presentation

- Host factors
- Environmental factors?
- Bacterial factors?
Clinical Manifestations: Primary TB

- Can occur at any age, usually in children but also in the elderly
- Usually affects the lower and middle lungs and heals with no clinical symptoms in more than 90% of cases
- Can heal by fibrosis and calcification
- Other radiographic appearances:
  - patchy bilateral infiltrates
  - no obvious infiltrates
  - mediastinal lymphadenopathy, signs of pleural disease, miliary pattern, etc.

Radiological Manifestations: Primary TB

Ghon’s focus and Rhanke complex
Primary TB

Clinical Manifestations: Active (Reactivated) Pulmonary TB

- **Upper lobes** and the apical segment of the lower lobes
- Progression is variable
- **Granulomatous** bronchopneumonic infiltration → caseation → “cavity” in the lung
- Infected sputum can be aspirated to other segments in the lung → bronchogenic spread
**Reactivated Pulmonary TB**

- Chronic parenchymal lesions: upper lobe destruction, fibrosis, and overdistended emphysema
- Hemoptysis: erosion of blood vessels within the TB lesion
- The lesions can also erode into blood vessels → hematogenous dissemination: → lungs, CNS, genito-urinary, skeletal, lymph nodes, etc

---

**Pulmonary Reactivated TB**
Less Common Presentations

Miliary TB

- Insidious in onset, with general malaise, fever, weight loss, and sweats
- Typical diffuse miliary pattern often appears in the chest x-ray
- Sputum smear for AFB are only positive in 30% of cases
- Other organ involvement is not uncommon
Miliary TB

Active pulmonary TB: HIV vs. Non-HIV

- Patients with HIV and TB:
  - Normal chest x-ray, or with infiltrates in any lobes and any location
  - No radiological appearance is pathognomonic of TB
Pulmonary TB and HIV infection

- Usually progression from primary TB
  - Lower lobes
  - Bulky lymphadenopathy
  - LAD compression of bronchi
  - Non-apical cavities
  - Miliary forms
- Extrapulmonary
  - Head and neck LAD (60%)
  - Meningeal (10%)

Pediatric TB
Extrapulmonary TB

- Pleural TB
- CNS TB
- Spinal TB
- TB Lymphadenopathy
- Others

Pleural TB

- Peripheral subpleural lesions → pleural cavity → tubercles effusion and empyema
- Pleural fluid: exudate with lymphocyte predominance
- Pleural fluid smear and culture is only positive in 1/3
- Pleural tissue culture and granulomatous histology: diagnostic yield >70%
Pleural TB

- TB meningitis the most common presentation
- Radiologic findings
  - Hydrocephalus with or without other lesion
  - Tuberculomas single or multiple
  - Leptomeningitis with basal cisterns involvement
  - Infarction, usually MCA
  - Abscess


CNS TB

- TB meningitis the most common presentation
- Radiologic findings
  - Hydrocephalus with or without other lesion
  - Tuberculomas single or multiple
  - Leptomeningitis with basal cisterns involvement
  - Infarction, usually MCA
  - Abscess
Spinal TB or Pott’s disease

- Vertebral ± disc space involvement
- Location
  - Cervical (10%)
  - Thoracic (60%), Thoracolumbar (15%)
  - Lumbar (20%)
- # of vertebral bodies
  - Mean 2.5, range 1-6
- Characteristics
  - Disc space involvement: 85% (usually occur later)
  - Paraspinal mass: 95%
  - Epidural compression: 65%
  - Angulation: 50%

Cooper PR et al. In Tuberculosis, 1996
CASE
Patient from Burma with h/o liver transplant, ill-defined infiltrates and persistent fever

How would you approach the pulmonary infiltrates?

Dx FOB with BALs: AFB (-) smear from RLL/RML

CT Chest
CT Guided Biopsy

CT Scan Findings

- Detection of occult disease
  - More sensitive than CXR
  - Miliary TB
  - Early infiltrates
  - Subtle adenopathy
  - Occult bronchiectasis and small cavities

- Disease extension
  - Mediastinum, pleural spaces, chest wall, etc.

- Disease activity
  - Centrolobular branching + nodules of 5-8 mm: “Tree in bud”
  - Non calcified nodules
  - Consolidation
  - Cavities

References:
- Im, JG, et al. Radiology 1998
- McGuinness G, Naidich DP. In Tuberculosis 1996
Conclusions

• Primary TB usually involves lower lobes
• Reactivation TB usually involve upper lobes
• TB-HIV co-infected can present with normal chest x-ray, or with infiltrates in any lobes and any location
• No radiological appearance is pathognomonic of TB
• CT scan can improve chest X-ray evaluation
• Other image modalities such as MRI can be helpful

Questions?