TUBERCULOSIS: NOT JUST A HOLE IN THE LUNG

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Introduction

- Tuberculosis is an old and well known disease;
- Clinical findings, diagnostic approach (including laboratorial and imaging tests), source of infection, natural history, patients with increased risk of infection, complications, prognosis and treatment are all well recognized by medical community;
- Even though, TB remains a public health problem.
TB as a Global Epidemic Disease

• Worldwide efforts and programs have been implemented to eradicate TB in a near future;
• Early diagnosis is a crucial step for all these programs, preventing spread of the disease, complications and drug resistance;
• TB is the leading infectious disease killer globally alongside HIV.
Diagnostic Approach

- There are many laboratorial tests available to search latent and/or active TB;
- Imaging is another important step in diagnosis;
- X-Ray, CT and MRI can provide diagnostic clues for pulmonary and extra-pulmonary disease.
Sites of Infection

• Lungs are the major site for *Mycobacterium tuberculosis* infection and disease;
• Imaging tests may show different findings according to type of infection (primary or reactivation) and hosts immune status;
• Extra-thoracic TB may affect almost any organ and/or system from *head to toe*. 
Learning Objectives

1 – To review typical and atypical findings of thoracic TB;
2 – To show some extrathoracic findings of TB infection for thoracic radiologists.
Thoracic TB

- Primary: TB acquired in patients not previously exposed to *Mycobacterium tuberculosis*
- Post-primary or reactivation: occurs in patients previously exposed to *Mycobacterium tuberculosis*, from re-infection or reactivation of a latent focus.
Lungs and Airways

Post-primary **typical pattern**: Upper lobe cavitary lesion with surrounding consolidation and tree in bud opacities.

- Thick walls
- Surrounding consolidation
- Tree in bud opacities

**Signs of active disease and bronchogenic spread**

Radiology 1999; 210:307-22
Airway involvement presents with **stenosis** (arrow) and **wall thickening** (curved arrow). These findings may be found in active or residual disease. Note slight enhancement of right inferior lobe bronchus and endobronchial content, which suggests active disease.
Non cavitary disease poses extra challenge for diagnosis. **Millary TB** presents with **micronodular pattern in a random distribution** indicative of hematogenous dissemination.

**Lobar consolidation** is another form of non cavitary TB. Classically it is the presentation of **primary TB** in adults.

Both milliary pattern and lobar consolidation may be found in immunosuppressed hosts with low CD4 levels in primary or post-primary disease.
Lungs and Airways

Non cavitary opacities.

TB may mimic other diseases. Multi focal peribronchovascular opacities and micronodules similar to sarcoidosis.

Upper lobe retractile opacities with irregular margins, traction bronquiecthasis, cystic changes and calcification may be found in healed TB as well as sarcoidosis, silicosis or talcosis. Unlike pneumoconiosis TB tends to be assimetric.
Lungs and Airways

Non cavitary opacities.

Single or dominant nodule (tuberculoma). This kind of presentation is often hard to differentiate from lung cancer. Satellite lesions as in this case favors a benign disease.

TB presenting with left hilar mass and lymphadenopathy mimicking advanced lung cancer.
Lungs and Airways

Non cavitary opacities.

TB mimicking advanced lung cancer. Follow up CT after anti-tuberculosis drug therapy showing regression of left hilar mass.
When lung cancer is a concern, even PET/CT may not help. The case presented above shows a lung nodule with FDG uptake. **Tuberculomas can be FDG avid** and difficult to differentiate from lung cancer.
Bronchial stenosis, obstruction and bronchiectasis.

Bronchial stenosis may lead to atelectasis, hyperinflation and air trapping. It may be seen in active disease (10%-40%) or as sequela. Left lower lobe bronchus is more frequently involved.

Right upper lobe bronchus stenosis with associated lobar volume loss and bronchiectasis in a patient with healed TB.
Bronchiolitis: **centrilobular nodules, tree in bud opacities and lobular consolidations** are signs of small airways diseases and in patients with TB means **endobronchial dissemination**.

These patients have active disease, are probably infective and should be isolated.

Radiology 1999; 210:307-22
Eur Radiol 2003; 13:1771-85
Clin Infect Dis 2016; 63(7):e147-95
Pleural TB is one of the most common forms of extra-pulmonary disease. It can occur in primary (up to 38%) and post-primary TB (18%) and usually manifests as pleural effusion. Pleural thickening, enhancement and loculated effusions are signs of empyema. Air-fluid levels within pleural space may be due to bronchopleural fistula.

Radiology 1999; 210:307-22
Pleuro-pericardial TB

Chronic pleuro-pericardial TB manifests as pleuro pericardial thickening with calcification;

So-called fibrothorax may prevent adequate lung expansion, causing chest pain, restrictive atelectasis and thoracic deformities;

Cardiac tamponade or constrictive pericarditis may develop secondary to pericardial effusion and/or pericardial thickening and calcification.
Ganglionar TB manifests as **lymphadenopathy**. Lymph nodes usually have a **rim enhancement** and a **hypodense necrotic center**. This kind of presentation is far more common in **primary TB**, especially in **childhood** when it is the most common abnormality, seen in 90%-95% of cases.

Radiology 1999; 210:307-22
Eur Radiol 2003; 13:1771-85
Musculoskeletal tuberculosis most often affects spinal column, pelvis, hip and knee;

Half of cases of skeletal TB affects spine with lower thoracic and upper lumbar levels more frequently involved;

Classic pattern of spondylitis includes involvement of more than one vertebral body and intervening disks;

Paraspinal abscess may occur and, in late phases, vertebral collapse, kyphosis and ankylosis of vertebral bodies may develop;

Chest wall TB may occur secondary to pleural disease or due to hematogenous dissemination. Imaging findings are rib destruction and soft tissue masses and/or abscess that may fistulize to skin.
Extra-thoracic TB

- Tuberculosis is usually limited to the chest;
- However the disease can involve almost any organ, especially in immunocompromised hosts;
- Hepato-esplenic, genito-urinary, gastrointestinal, peritoneum and lymph nodes are possible abdominal sites;
- Central nervous system include meningeal and parenchymal involvement;
- TB can also affect joints, eyes, tympanic cavity and mastoid.
Lymphadenopathy is the most common manifestation of abdominal TB. It shares the same characteristics as mediastinal ganglionar TB with rim enhancement and central necrosis.
Hepato-esplenic TB is generally secondary to hematogenous dissemination. It can be micronodular with multiple tiny lesions (arrow) or macronodular with a single tumorlike mass. Macronodular form is rare.
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Abdominal TB

Peritoneal TB. **Wet type** (most common) with **ascitic fluid, mesentery infiltration and peritoneal enhancement**. Dry type and fibrotic type are rarer forms.

RadioGraphics 2000; 20:449-70
Am Fam Physician 2005; 72:1761-8
Central Nervous System TB

CNS TB. Patterns of involvement with multiple **tuberculomas** and **meningitis**. Parenchymal and meningeal involvement may be concomitant or not. CNS infections are due to hematogenous spread. Meningeal TB is more frequent than parenchymal involvement.

RadioGraphics 2000; 20:449-70
Am Fam Physician 2005; 72:1761-8
Suggested Readings


Pulmonary Tuberculosis: Up-to-Date Imaging and Management. AJR 2008; 191:834-44.


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