Let’s Talk TB:
A Supplement to GP CLINICS

Chapter 3: Interpretation of Chest X-rays in Tuberculosis

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Chest x-rays

- Chest x-rays serve as an invaluable adjunct in the diagnosis and follow-up of TB
- In the event of negative cultures, it can provide the only way to suspect active disease and is useful in the assessment of treatment response

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Chest x-rays

- TB may mimic other diseases on x-rays, and non TB conditions may look like TB
  - Thus chest x-rays are neither specific nor sensitive
  - Should remain a supplement to microscopy, PCR and culture

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The radiologic appearance of TB reflects the host response to infection. TB infects the lung by inhalation of droplets from a person with active disease.
TB percentages

• In 90% of patients, the infection remains latent
• In approximately 5% it progresses to active disease within a short period, causing primary disease
• In the remaining 5%, it may remain latent for many years before reactivating, causing reactivation, or post primary disease
  – The radiologic appearance of primary versus reactivation TB is very different
• Most of the cases you will see in your practice are reactivation disease

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Children

- Most children develop primary disease and their radiological presentation can be different from adults
Radiologic markers

• TB can involve the pulmonary parenchyma, interstitium, pleura, pericardium and bone
  – Each results in a different radiologic picture
• In general, the presence of upper-lobe opacities, cavities, a unilateral pleural effusion, and hilar or mediastinal lymphadenopathy may be the most useful radiological markers of pulmonary TB

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HIV

• HIV infection is the most common reason for atypical radiographic appearance in TB patients
• The altered radiographic appearance of pulmonary TB in patients with HIV is due to compromised immunity
• Quality of radiographs is important to consider, and films should be read carefully as inter and intra-reader variations are common
• All x-rays must be interpreted with relevant clinical and laboratory data

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TB CXR’s

• The following chest x-rays (CXR’s) illustrate the different radiologic manifestations of TB
• There are also cases that are not TB, but look like TB
• Finally, there are cases that look like other diseases but eventually turned out to be TB
Classical TB

- Classical picture of active pulmonary TB
- Bilateral airspace disease, much more prominent in the right lung
- Multiple cavities in the RUL (right upper lobe)
- Although this is typical of TB, if the history was an acute one, the diagnosis would more likely be an aerobic bacterial infection
- CXR’s must always be interpreted in light of the clinical history

Figure 1 – Classical picture of active pulmonary TB

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The Lordotic CXR

• The lordotic CXR is useful in visualizing the apical structures of the lung

• Overlap of clavicle, the first rib and posterior ribs
  – Lesions at the apex can be missed

• X-ray beam is angled up through the chest (Figure 2) shifting anterior structures (clavicle and first rib superiorly)
  – better view of the apices

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Figure 2 – Principle behind the lordotic CXR (Source: http://nexradiology.blogspot.ca)
Figure 3a – In this patient, a lesion was suspected (arrow), but hidden by the left 2nd rib

Figure 3b – Lordotic film on the patient in Figure 3a showed cavitary lesion (arrow) and culture grew TB

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• In **Figure 3a**, the patient was suspected of having a lesion behind the left 2nd rib (**shown by arrow**)

• The lordotic CXR in **Figure 3b** confirmed this to be a cavitary lesion, and sputum sample grew TB on culture.

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Minimal TB

• Early stages of TB can cause minimal radiologic changes
• In **Figure 4**, a routine screening film showed minor densities in the LUL (left upper lobe)
• Sputum induction was done and the sample grew active TB
• Sputum cultures are important whenever there is parenchymal disease
• If the patient is not coughing, spontaneous sputum is of little value
• Sputum induction is very helpful in getting a sample
Figure 4 – Minimal TB with minor densities in the LUL. Induced sputum grew TB on culture

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Location of Disease

- TB prefers the apices of the lung
- Also applies to the lower lobes apices (i.e. the superior segments)
- **Figure 5** illustrates a case of cavitary TB affecting the superior segment of the RLL (right upper lobe)

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Figure 5 – Cavitary TB affecting the superior segment of the RLL (arrow points to a thick walled cavity)

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Extensive Disease

- **Figure 6** shows that TB can be very extensive
- Entire left lung destroyed
  - Involving the right apex
- Lack of soft tissues under the skin of the chest wall
  - Extreme cachexia
- The patient died of his disease
- Extensive cavitary TB is common in India and late diagnosis and treatment is a major reason for this

Figure 6 – Extensive, cavitary TB, with destruction of the entire left lung

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Culture Negative TB

• In cases where the CXR and clinical history is very suggestive of TB but smears are negative, treatment can be started pending culture results

• Negative cultures but x-ray improvement on therapy is suggestive of culture-negative TB

• Even in the context of good sputum collection with induction, three sputum cultures have a sensitivity of 90%
  – Means you will miss 10% of cases of active TB

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• **Figure 7a:** the patient was from a TB endemic country, had a positive Mantoux skin test and a one month history of cough.

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Three sputum smears and cultures were done and the patient was started on TB drugs.

**Figure 7b:** All cultures were negative but a CXR one month later showed resolution of the infiltrates.

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Pleural Effusion

• Pleural effusion is a common manifestation of TB
  – It can be a consequence of both primary and reinfection TB
  – It often resolves with proper antibiotic therapy, but can leave residual pleural thickening and even calcification

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Figure 8a: young patient from a TB endemic country who presented with a one month history of fever and left sided chest pain

- Thoracentesis revealed an exudate with low glucose, low pH and a high lymphocyte count
- A presumptive diagnosis of TB was made and TB medications were started
- The fluid was smear negative (as is often the case in pleural TB) but the cultures grew MTB

Figure 8b: the subsequent CXR taken six months later shows reabsorption of the fluid with residual pleural thickening

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Figure 8a – This CXR shows a large left pleural effusion

Figure 8b – On this CXR, the arrow points to pleural thickening (earlier CXR shown in Figure 8a)

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• **Figure 8c**: Extensive pleural calcification has developed.

• This often occurred in the pre-antibiotic era
  
  – Recurrent pneumothoraces were induced in the hope of reducing the size of the cavity

• These pneumothoraces often resulted repeated infections of the pleural space and subsequent calcification

Figure 8c – This CXR shows extensive left pleural calcification

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Miliary TB

• Miliary TB is a result of hematogenous dissemination of the mycobacteria

• **Figure 9:** It presents as a micronodular (1-4 mm in size) pattern distributed diffusely throughout both lungs

• It can arise as a result of progressive primary infection or via reactivation

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Figure 9 – Miliary TB, with diffuse micronodules distributed throughout both lungs
Primary TB

- Primary TB results from the failure of the host to suppress the initial infection
- It present as pneumonia in the lower lobes, lingula or right middle lobe (RML)
  - opposed to reactivation TB, which tends to favor the apical regions
- It can also cause pleural effusion or miliary TB
- **Figure 10:** the CXR of a TB contact who had a 2 week history of cough and fever
  - Sputum smears and culture were positive

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Figure 10 – Infiltrate in lingula in a case of primary TB
• **Figure 11**: Case finding in a TB contact investigation showed a RLL cavity that was smear positive

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TB Adenopathy

• TB adenopathy is a common presentation of extrapulmonary TB
• It is often a manifestation of primary TB
• **Figure 12**: It can affect both mediastinal and hilar lymph nodes

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Figure 12 – The white arrow points to an infiltrate in the RUL. The red arrow shows paratracheal adenopathy. The blue arrow points to a right hilar node
Mimicking Diseases

- **Figure 13**: 55 year old woman, 30 pack-year smoker, who presented with a one month history of cough and weight loss
  - No fever
  - The CXR shows a mass abutting the mediastinum in the RUL
  - Cancer was suspected and a bronchoscopy was done
  - Pathology revealed necrotizing granulomas and cultures were positive for TB.
Figure 13 – Mass abutting the mediastinum in the RUL. While cancer was suspected, cultures grew MTB
• **Figure 14**: 65 year old man, 40 pack-year smoker who had a routine CXR which showed a cavitary nodule in the RUL

• Asymptomatic

• A CXR done a year previously was normal

• Biopsies were negative

• Lung cancer was suspected and a thoracotomy was done

• The resected lobe showed TB
Figure 14 – Arrow points to a cavitary nodule in the RUL
Diseases that may mimic TB

• **Figure 15a:** 40 year old woman who comes from a TB endemic country
  – Consolidation in the RUL
  – One week history of fever, chills and cough with purulent sputum
  – Due to the short history, an acute bacterial pneumonia was suspected and treatment with **azithromycin** was started

• **Figure 15b:** Promptly became afebrile and the CXR improved within a week

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Figure 15a – CXR shows a consolidation in the RUL

Figure 15b – CXR shows improvement after antibiotic treatment with azithromycin

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Upper Lobe Pneumonias

• Upper lobe pneumonias in patients from endemic countries SHOULD NOT be treated with *fluoroquinolones*

• Because if it is TB, it will temporarily respond to this class of antibiotics, and make it much harder to diagnose TB later

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• 56 year old man with extensive travel to Asia
• 4 month history of recurrent cough and fever and wheezing
• Received many courses of antibiotics with temporary improvement
• Known to have asthma
• **Figure 16a:** The CXR showed a dense infiltrate in the LUL
• Sputum AFB was negative (because of the history of asthma allergic bronchopulmonary aspergillosis was suspected)
• Serum IgE was 9,000 and aspergillus precipitins were positive
Figure 16b: Given a course of prednisone, with clinical and radiologic resolution

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• **Figure 17:** 17 year old girl from Burundi
• 4 month history of intermittent fever and cough
• Micronodular pattern
• Because of her country of origin and her symptoms, military TB was suspected
• Started on TB therapy
  – no improvement after 2 weeks
• Transbronchial biopsy was done: revealed metastatic thyroid carcinoma.
  – Fever was due to malaria

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Figure 17 – CXR shows micronodular pattern. Metastatic thyroid carcinoma was the final diagnosis

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References


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