



# 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

# 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

- 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

# 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

# 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

# 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

# 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



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

- 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

# 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

# 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 cavitory TB affecting the superior segment of the RLL (right upper lobe)

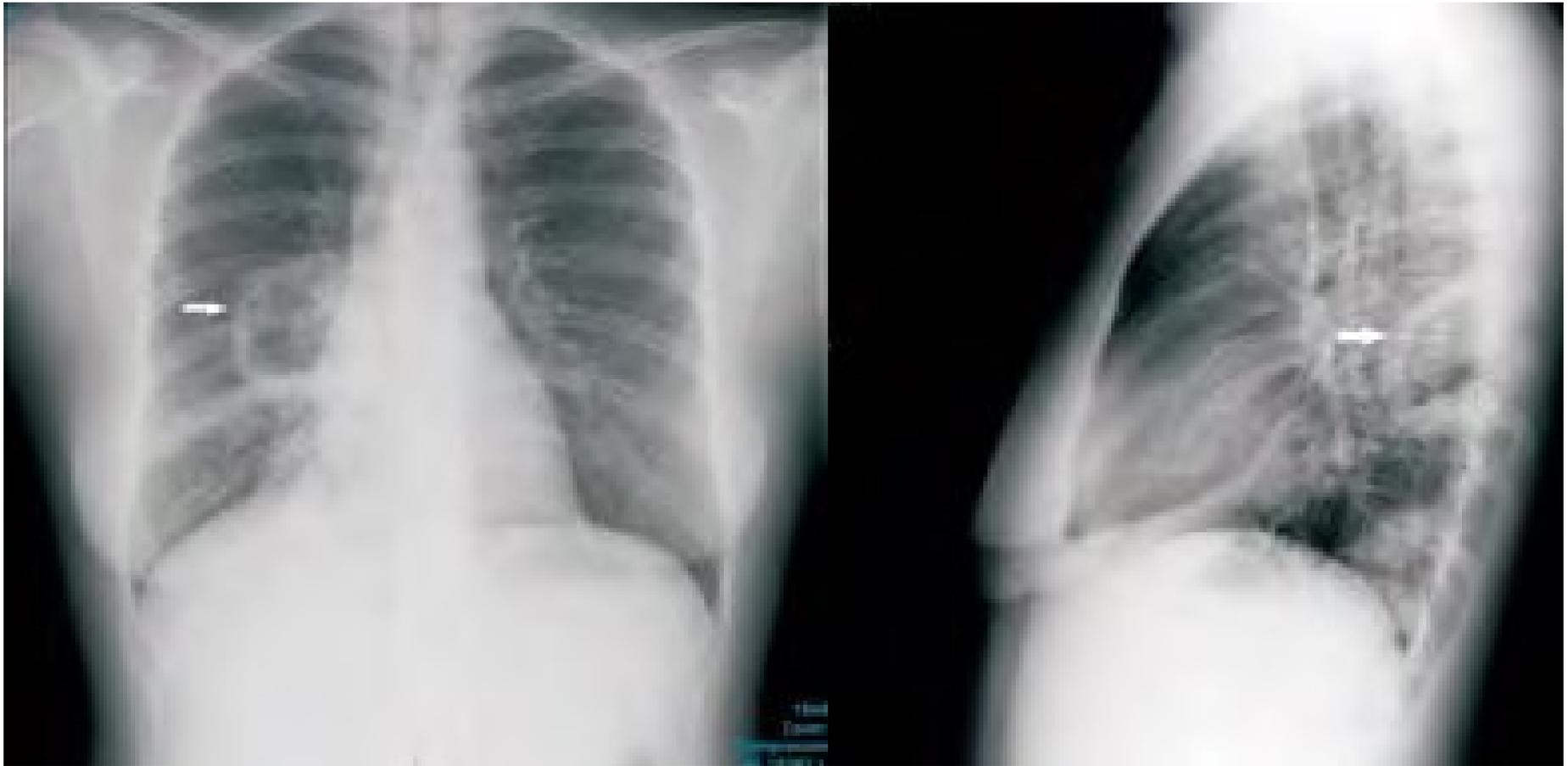


Figure 5 – Cavitory TB affecting the superior segment of the RLL (arrow points to a thick walled cavity)

# 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 cavitory TB is common in India and late diagnosis and treatment is a major reason for this



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

# 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



Figure 7a – Arrows point to faint airspace disease in both upper lobes

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



Figure 7b – A CXR shows resolution of the infiltrates after TB therapy

- 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

# 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

- **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

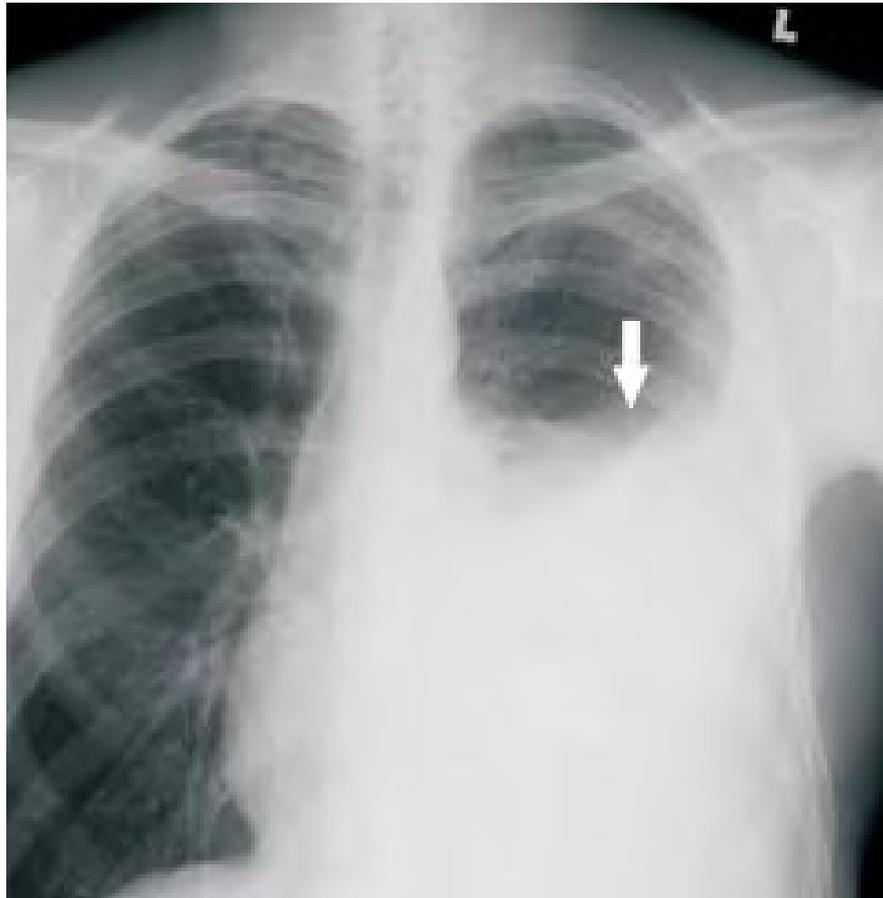


Figure 8a – This CXR shows a large left pleural effusion



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

- **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

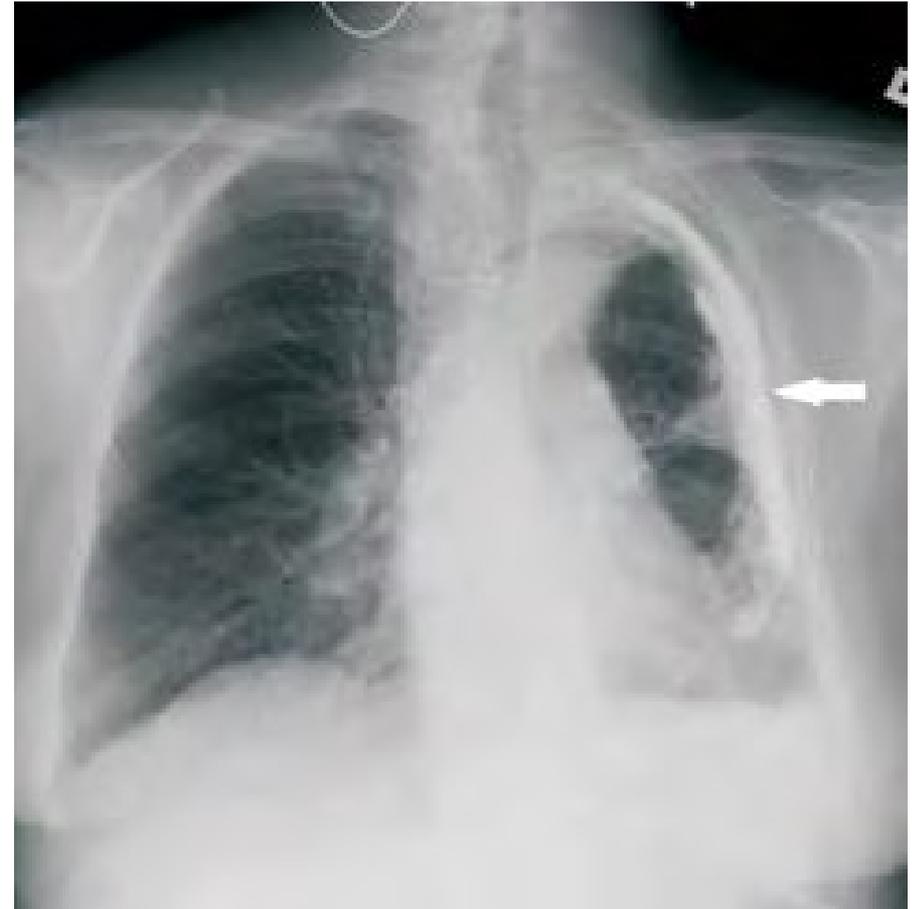


Figure 8c – This CXR shows extensive left pleural calcification

# 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 though out both lungs
- It can arise as a result of progressive primary infection or via reactivation



Figure 9 – Miliary TB, with diffuse micronodules distributed though out 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



Figure 10 – Infiltrate in lingula in a case of primary TB



Figure 11 – Arrow points to cavity in the RLL

- **Figure 11:** Case finding in a TB contact investigation showed a RLL cavity that was smear positive

# 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

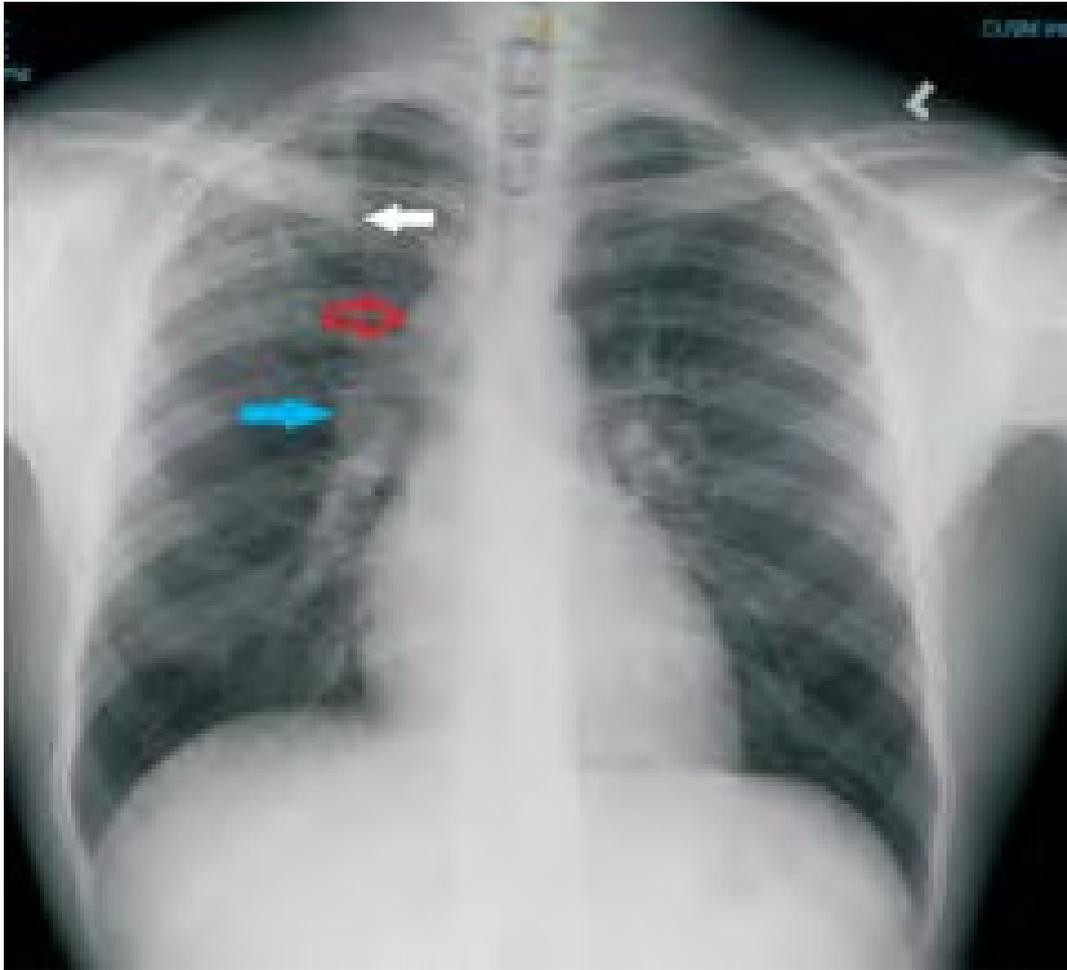


Figure 12 – The white arrow points to an infiltrate in the RUL. The red arrow shows paratracheal adenopathy. The blue arrow points to a right hilar node

# 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.

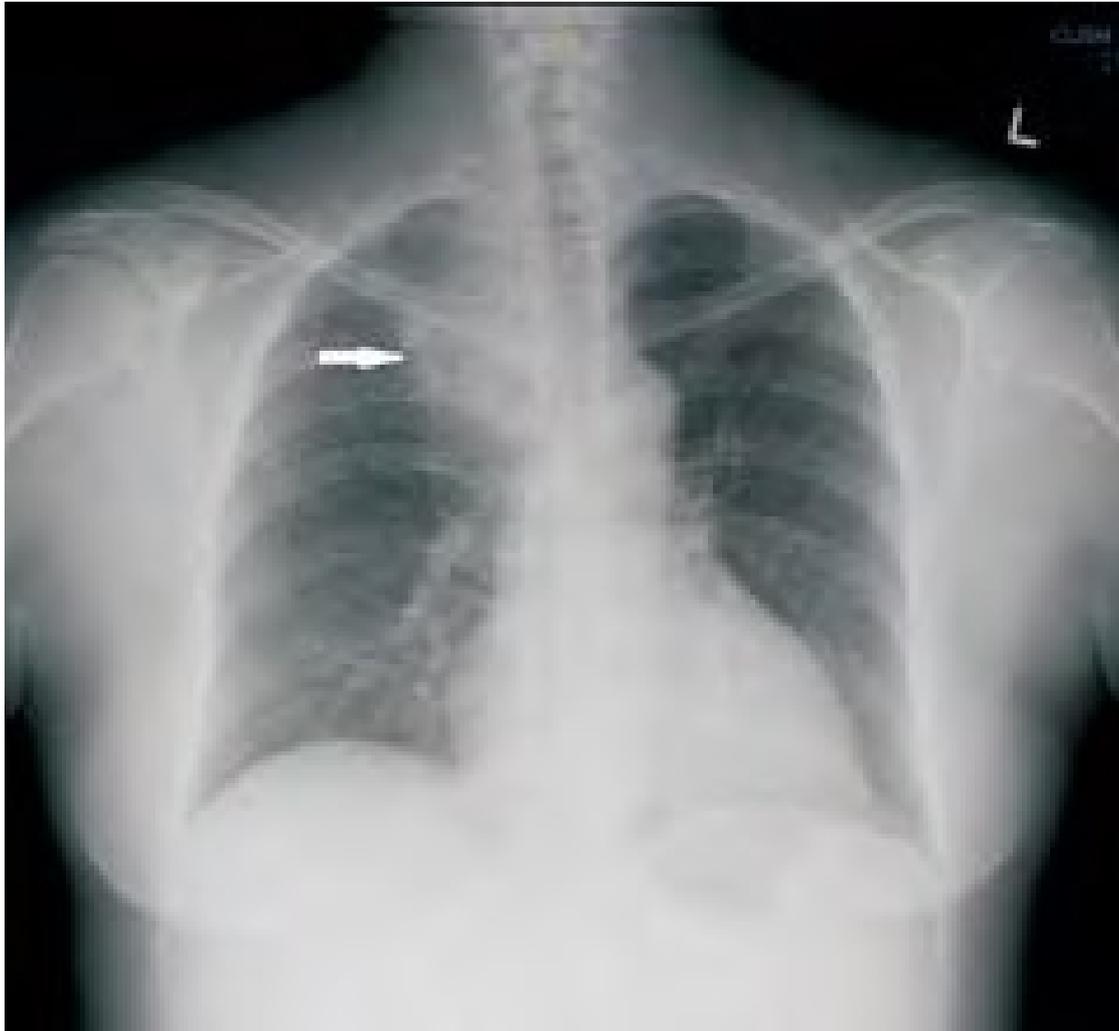


Figure 13 – Mass abutting the mediastinum in the RUL. While cancer was suspected, cultures grew MTB

- **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

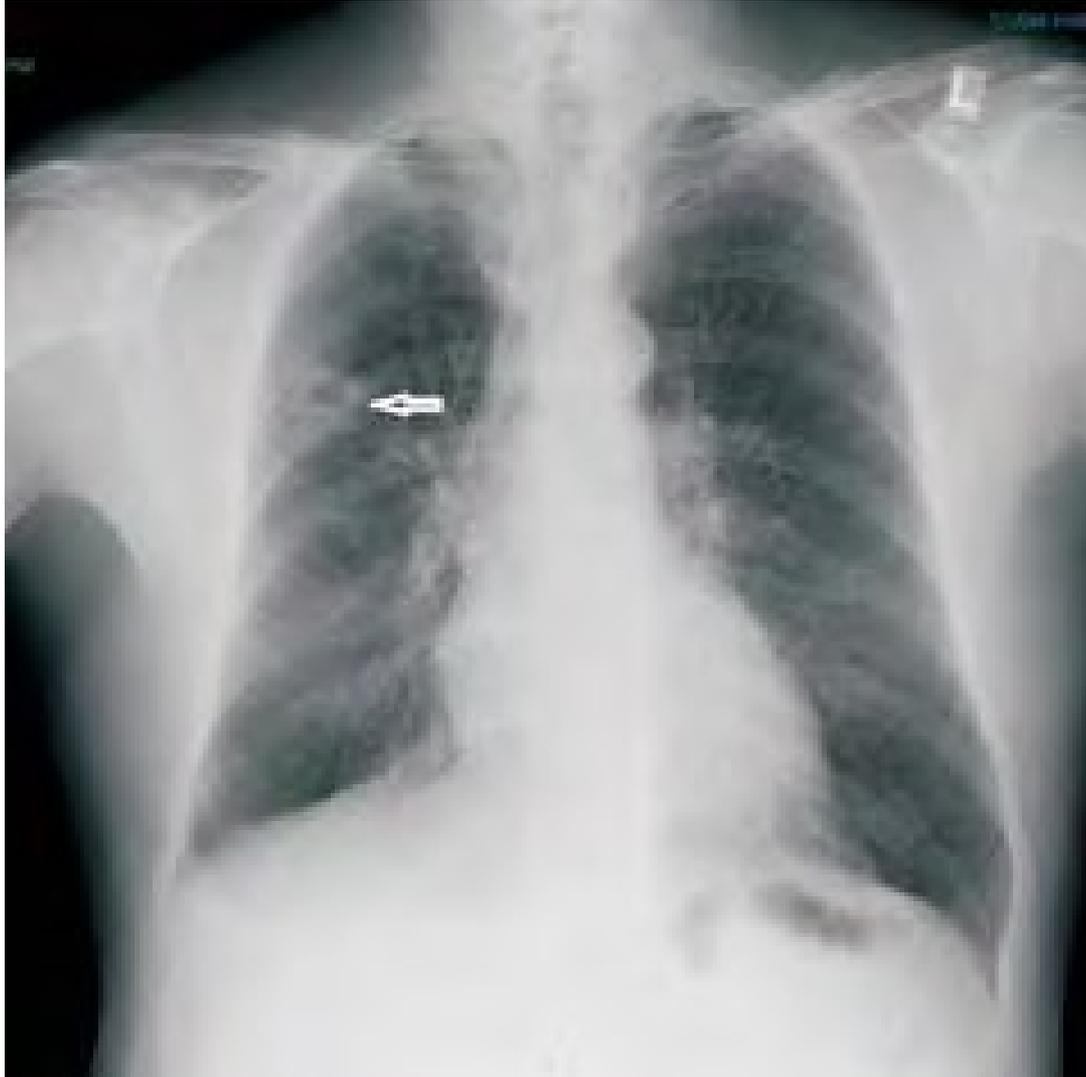


Figure 14 – Arrow points to a cavitary nodule in the RUL

# 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

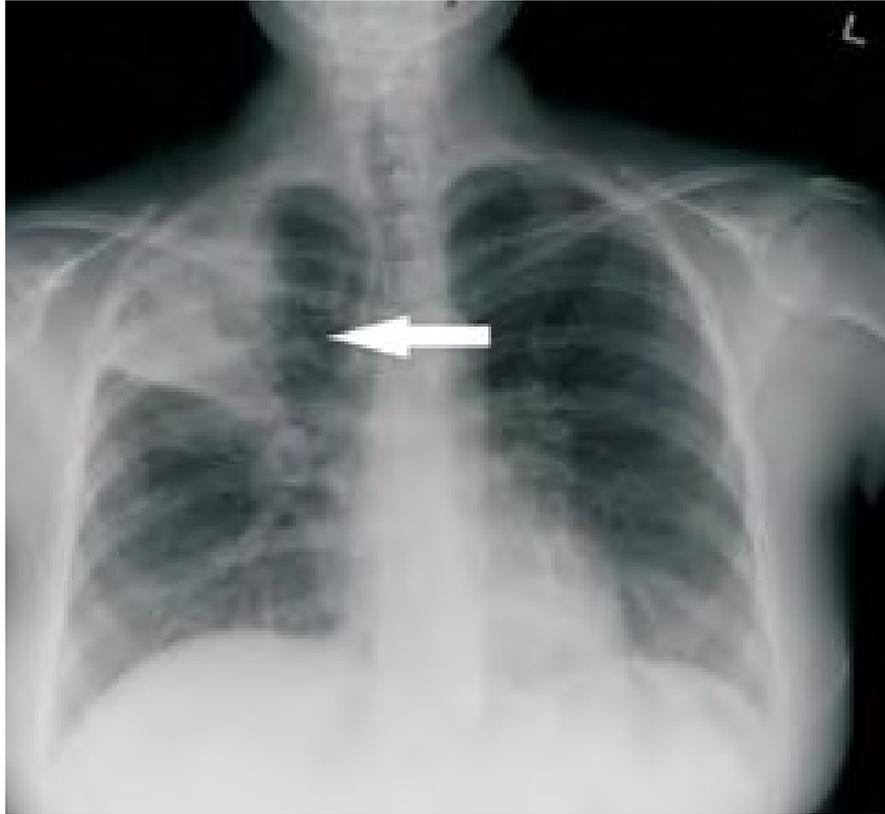


Figure 15a – CXR shows a consolidation in the RUL



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

# 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

- 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 16a – CXR shows a dense infiltrate in the LUL.



Figure 16b – CXR shows resolution

- **Figure 16b:** Given a course of prednisone, with clinical and radiologic resolution

- **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



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

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