PULMONARY TUBERCULOSIS

RADIOLOGY

Homework

- 1. Describe the types of primary tuberculosis.
- 2. Explaine Ranke complex.
- 3. Describe the types of secondary tuberculosis.
- 4. Explaine the clinico-radiological types of secondary tuberculosis.

RADIOLOGICAL MODALITIES

- Radiography
- Fluoroscopy
- Linear (conventional) tomography
- Computed tomography
- Tomosinthesis
- Pulmonary angiography, bronchography
- Ultrasonography, MRI, pulmonary scintigraphy (ventilatory, perfusional)

Radiological modalities help to:

- detect pathology
- identify the location and extent of disease;
- determine the phase of the disease;
- detect complications;
- achieve differential diagnosis;
- detect concomitant diseases;
- follow up and monitor efficiency of the various methods of treatment.

Radiographic screening for active TB in high-risk populations may demonstrate findings consistent with prior and/or current infection.



Pulmonary Tuberculosis

- Primary Tuberculosis
- Postprimary (secondary) Tuberculosis

Primary Tuberculosis

- Primary tuberculosis is seen in patients not previously exposed to *M.tuberculosis*.
- It is most common in infants and children.

Primary Tuberculosis

Radiologicaly, primary tuberculosis of the chest, manifests as three main entities:

- parenchymal disease, including milliary disease
- lymphadenopathy
- pleural effusion

Also, just pulmonary primary tuberculosis can be divided into:

- primary tuberculous complex (**Ranke complex**) that include Ghon focus, lymphangitis and lymphadenopathy
- tuberculosis of lymph nodes.

- a **Ghon focus** is an area of consolidation at the initial site of parenchymal involvement at the time of first infection;
- a **Ranke complex** is the combination of a Ghon focus and enlarged or calcified lymph nodes.



Ranke complex: 1- Ghon focus, 2- lymphangitis, 3lymphadenopathy



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Parenchymal Disease

- Typically, parenchymal disease manifests as dense, homogeneous parenchymal consolidation in any lobe, however, predominantly in the lower and middle lobes. Can be differentiated from bacterial pneumonia on the basis of radiographic evidence of lymphadenopathy and the lack of response to conventional antibiotics.
- In approximately two-thirds of cases, the parenchymal focus resolves without sequelae at conventional radiography; this resolution can take up to 2 years. In the remaining cases, a radiologic scar persists that can calcify, an entity that is known as a **Ghon focus**.

Lymphadenopathy

- Lymphadenopathy is typically unilateral and right sided, involving the hilum and right paratracheal region, is bilateral in about one-third of cases. Lymphadenopathy is usually associated with other manifestations of tuberculosis, it can be the sole radiographic feature, a finding that is more common in infants and decreases in frequency with age. CT is more sensitive than chest radiography for assessing lymphadenopathy.
- With treatment, there is usually slower resolution of the lymphadenopathy than of the parenchymal disease, and nodal calcification may develop. However, this calcification usually occurs 6 months or more after the initial infection.











Primary Tuberculosis sequella:

- •Calcification in pulmonary parenchima and in regional lymph nodes
- •Apical and subclavicular foci



Milliary Disease

- Clinically significant milliary disease affects between 1% and 7% of patients with all forms of tuberculosis. It is usually seen in the elderly, infants, and immunocompromised persons, manifesting within 6 months of initial exposure. Chest radiography is usually normal at the onset of symptoms.
- The classic radiographic findings are evenly distributed diffuse small 2–3-mm nodules, with a slight lower lobe predominance. High-resolution CT is more sensitive than conventional radiography. The nodules usually resolve within 2–6 months with treatment, without scarring or calcification; however, they may coalescence to form focal or diffuse consolidation.



Pleural Effusion

• A pleural effusion is seen in approximately one-fourth of patients with proved primary tuberculosis. The effusion is often the sole manifestation of tuberculosis and usually manifests 3–7 months after initial exposure. Pleural effusion is a very uncommon finding in infants. The effusion is usually unilateral. Residual pleural thickening and calcification can result. Ultrasonography (US) often demonstrates a complex septated effusion.



Postprimary (secondary) Tuberculosis

- Postprimary tuberculosis is a disease of adolescence and adulthood. It occurs in patients previously sensitized to *M*. *tuberculosis*. The term *postprimary tuberculosis* is generally used to refer to both reinfection and reactivation of tuberculosis.
- Primary tuberculosis is usually self-limiting, whereas postprimary tuberculosis is progressive, with cavitation as its hallmark, resulting in hematogenous dissemination of the disease as well as disease spread throughout the lungs. Healing usually occurs with fibrosis and calcification.
- The distinguishing features of postprimary tuberculosis include a predilection for the upper lobes, cavitation and the absence of lymphadenopathy.

Secondary Tuberculosis

Radiologicaly, postprimary tuberculosis may manifest as:

- parenchymal disease
- airway involvement
- pleural extension.

Parenchymal Disease

- The earliest finding in parenchymal disease is poorly defined consolidation, particularly in the apical and posterior segments of the upper lobes. In the majority of cases, more than one pulmonary segment is involved, with bilateral disease up to two-thirds of cases.
- Cavitation, the hallmark of postprimary tuberculosis, affects about 50% of patients. The cavities typically have thick, irregular walls, which become smooth and thin with successful treatment. Cavities are usually multiple and occur within areas of consolidation. Resolution can result in emphysematous change or scarring. A minority of cavities demonstrate air-fluid levels (these findings can indicate the presence of superinfection).
- If there is airway disease and, in particular, endobronchial spread of infection, tree-in-bud opacities may develop (resemble a branching tree with buds at the tips of the branches). These findings, which are usually visible in the lung periphery are indicative of active tuberculosis.

Airway Involvement

- Airway involvement is characterized by bronchial stenosis, leading to lobar collapse or hyperinflation, obstructive pneumonia, and mucoid impaction.
- Bronchial stenosis is seen in 10%–40% of patients with active tuberculosis and is best demonstrated with CT, which usually shows long segment narrowing with irregular wall thickening, luminal obstruction, and extrinsic compression. It also results in tree-in-bud opacities and traction bronchiectasis, particularly of the upper lobes.

Pleural Extension

- Pleural effusions occur most often in primary tuberculosis but are seen in approximately 18% of patients with postprimary tuberculosis; they are usually small and associated with parenchymal disease.
- The effusions are typically septated and can remain stable in size for many years. The pleura may become thickened, which can result in a tuberculous empyema and an associated risk of developing a bronchopleural fistula.
- Residual pleural thickening and calcification may also occur.

Secondary Tuberculosis

Clinico-radiological, secondary tbc can be:

- disseminated (hematogenous, lymphogenous, mixed) can be with acute, subacute or chronic evolution
- nodular (unique or multiple, assimetric spreaded in 1-2 segments uni- or bilateral)
- infiltrative (limited Graw form, round Assman-Redeker form and the tuberculom, nebulous form, periscisurtis, lobitis, caseous pneumonia)
- fibro-cavitary.

Disseminated acute tuberculosis



Disseminated subacute tuberculosis



Nodular tuberculosis



Round infiltrate Assman-Redeker





Caseous pneumonia





Fibro-cavitary tuberculosis



Pulmonary tuberculoma















Bronchiectasis on left

Tb infiltration on right

