

Diseases of the Respiratory System

Pathology of tuberculosis



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Respiratory block
2019
Pathology
Lecture 4

TUBERCULOSIS

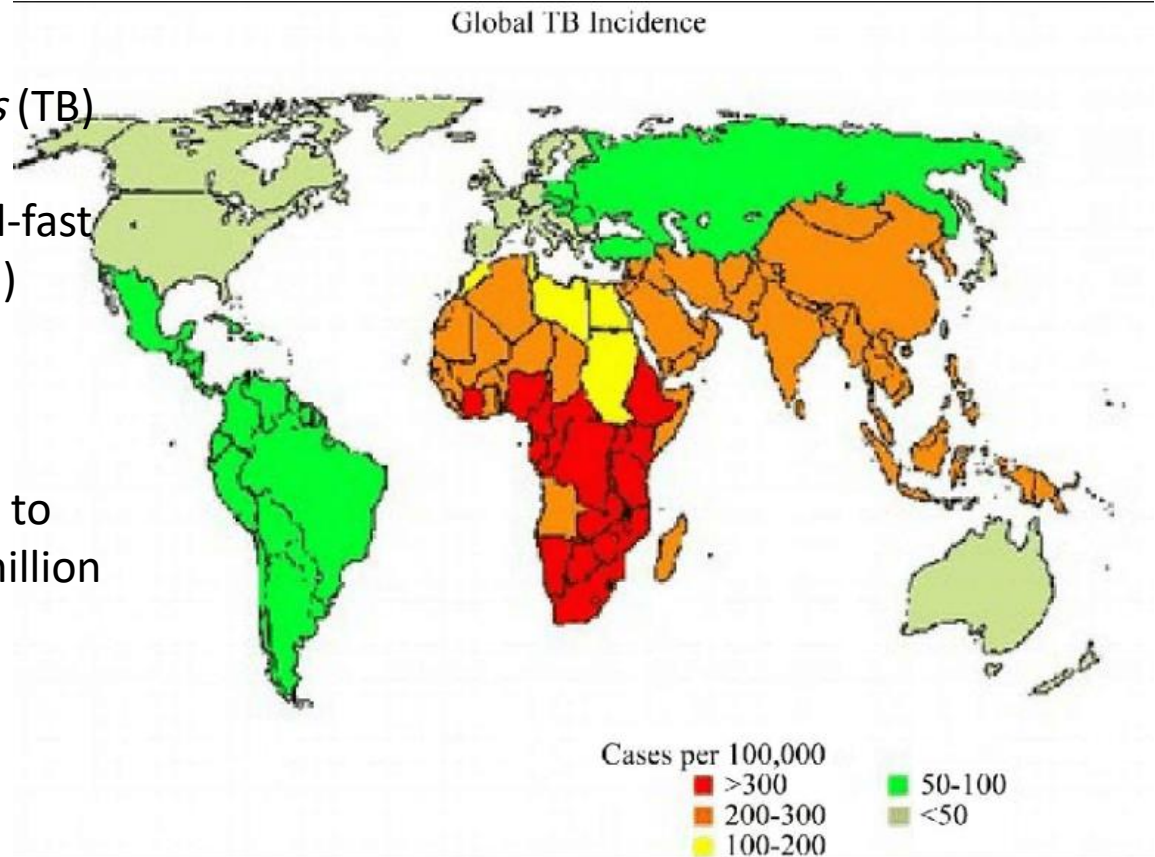
Objectives:

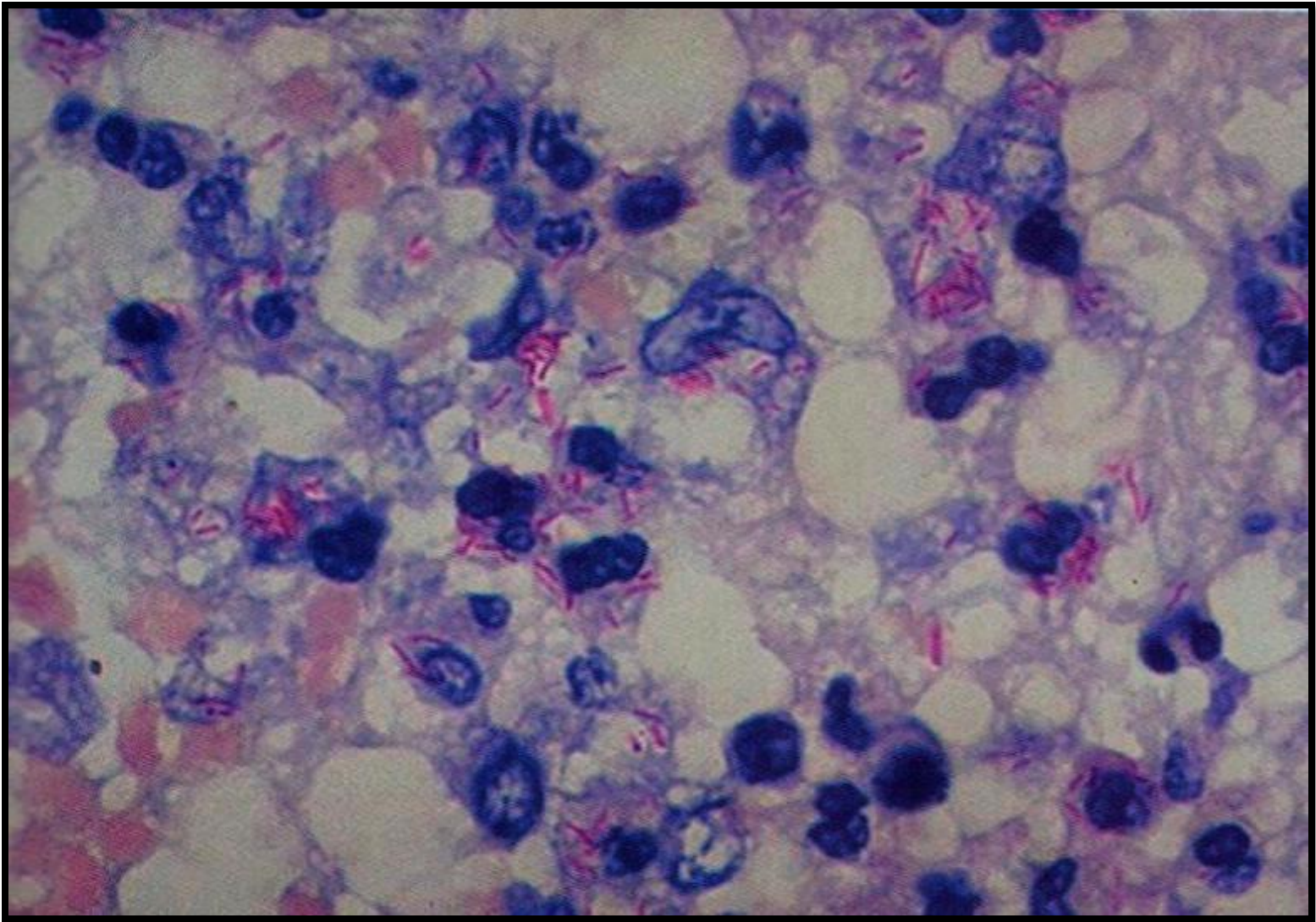
Tuberculosis is a communicable chronic granulomatous disease caused by *Mycobacterium tuberculosis*. It usually involves the lungs but may affect any organ or tissue in the body.

- Define tuberculosis
- Know the epidemiology of tuberculosis (TB)
- List conditions associated with increased risk of Tuberculosis
- Recognize the morphology of Mycobacteria and its special stain (the Ziehl-Neelsen) as well as the morphology of granulomas in TB (tubercles).
- Know the Pathogenesis of tuberculosis
- In regards to Mycobacterial lung infection: Compare and contrast the following in relation to their gross and histologic lung pathology:
 - Primary tuberculosis (include a definition of the Ghon complex).
 - Secondary or reactivation tuberculosis.
 - Miliary tuberculosis.
- List organs other than lung that are commonly affected by tuberculosis.
- Know the basis and use of tuberculin skin (Mantoux) test.
- List the common clinical presentation of tuberculosis.
- List the complication and prognosis of tuberculosis.

Epidemiology

- Contracted by inhalation of *Mycobacterium tuberculosis* (TB)
- TB bacilli are strict aerobe, acid-fast (due to mycolic acid in cell wall)
- It is estimated that 1.7 billion individuals are infected by tuberculosis worldwide, with 8 to 10 million new cases and 1.5 million deaths per year





Acid-fast bacilli, microscopic

Epidemiology and pathogenesis

Predisposing factors

Tuberculosis flourishes wherever there is

- Poverty
- crowding
- Malnutrition
- chronic debilitating illness

Increased risk factors

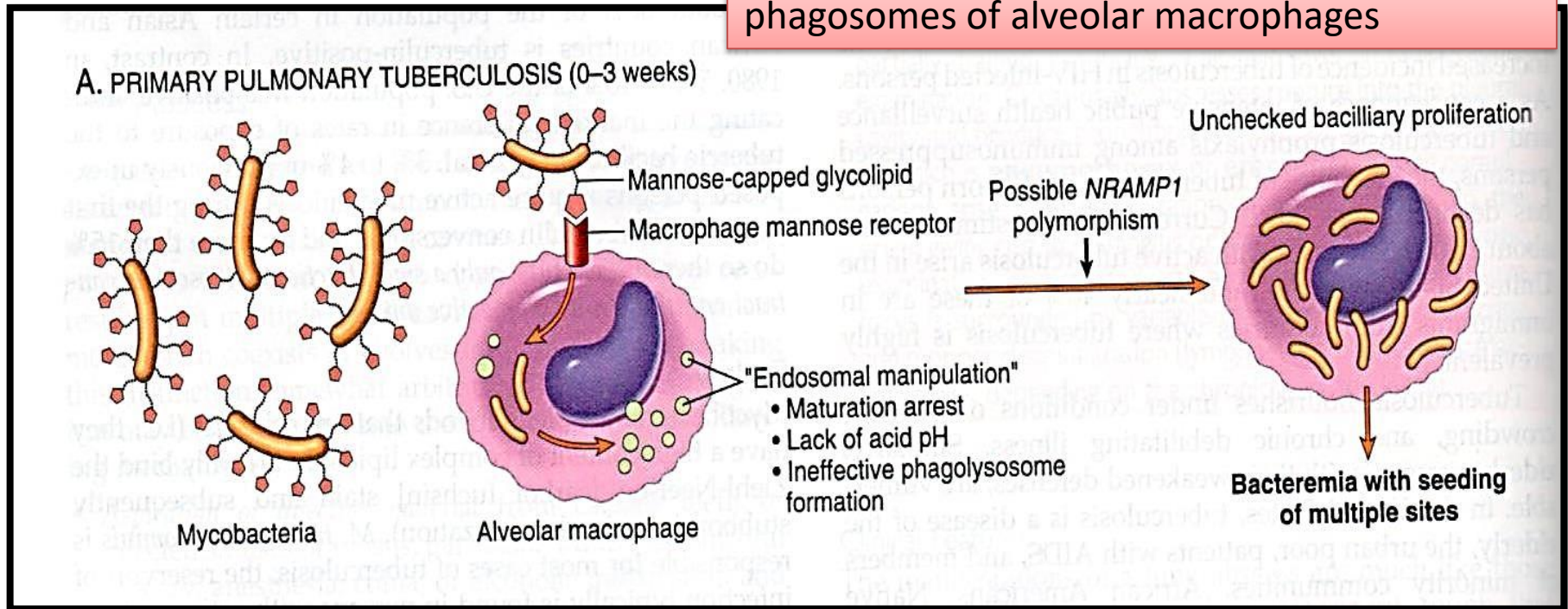
- People with AIDS
- Diabetes mellitus
- Hodgkin's lymphoma
- Alcoholism
- Chronic lung disease (particularly silicosis)
- Immunosuppression

Primary TB: First time exposure to TB

Within the first three weeks after exposure to mycobacterium tuberculosis

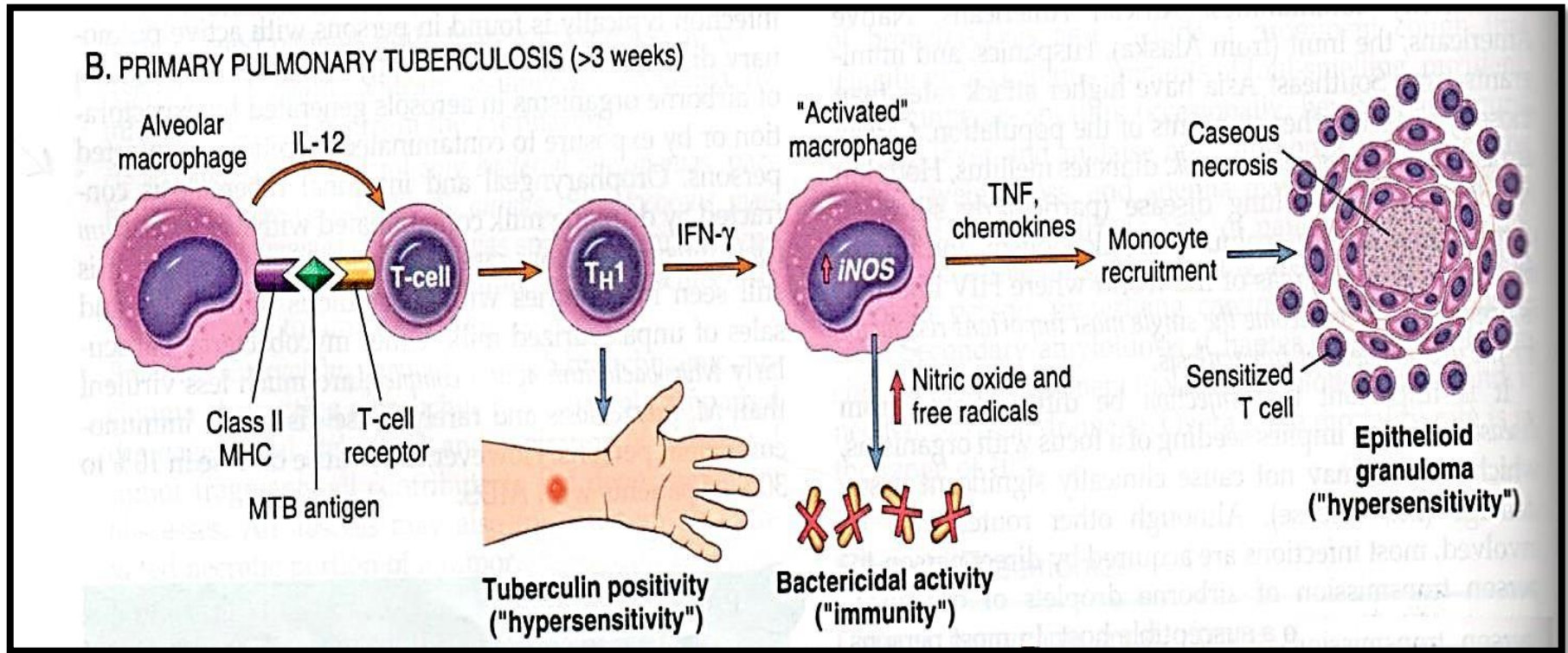
Bacilli will be phagocytosed by macrophages.
TB bacilli produces a protein (cord factor) that prevents fusion of lysosomes with phagosome

Organism resides and proliferate in the phagosomes of alveolar macrophages



Primary TB

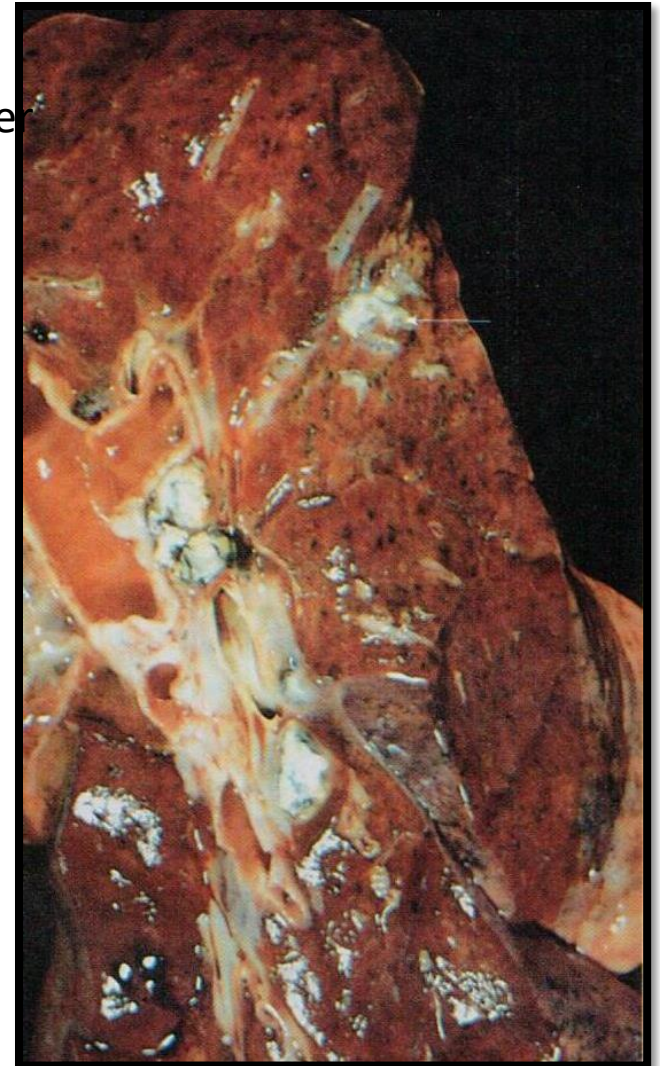
Three weeks after exposure to mycobacterium tuberculosis, formation of granuloma occur



Sequence of events in the natural history of primary pulmonary tuberculosis

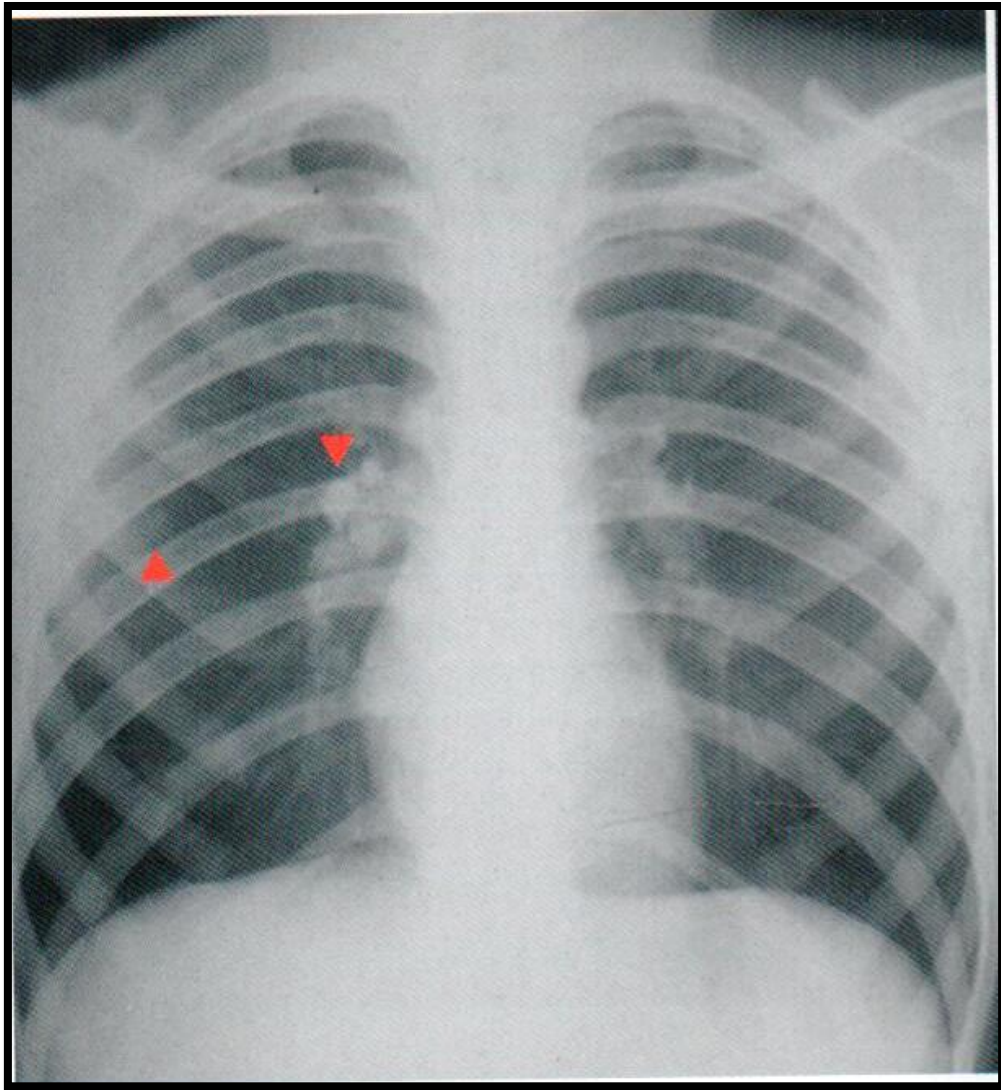
Primary pulmonary tuberculosis, Ghon complex

- Subpleural location
- Upper part of the lower lobes or lower part of the upper lobes
- Ghon focus (caseous necrosis) in periphery
- Ghon complex (caseous necrosis) in hilar lymph nodes

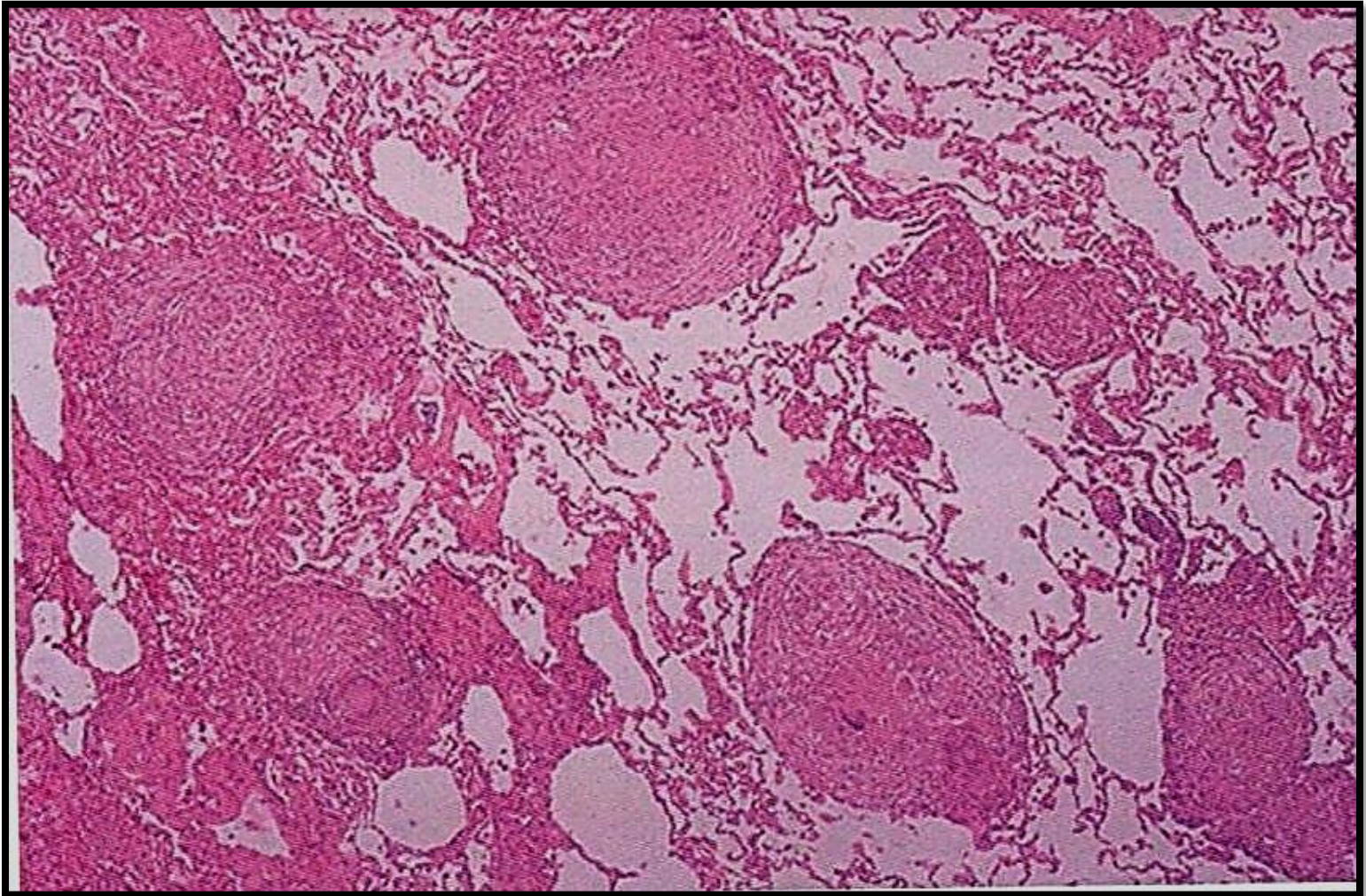




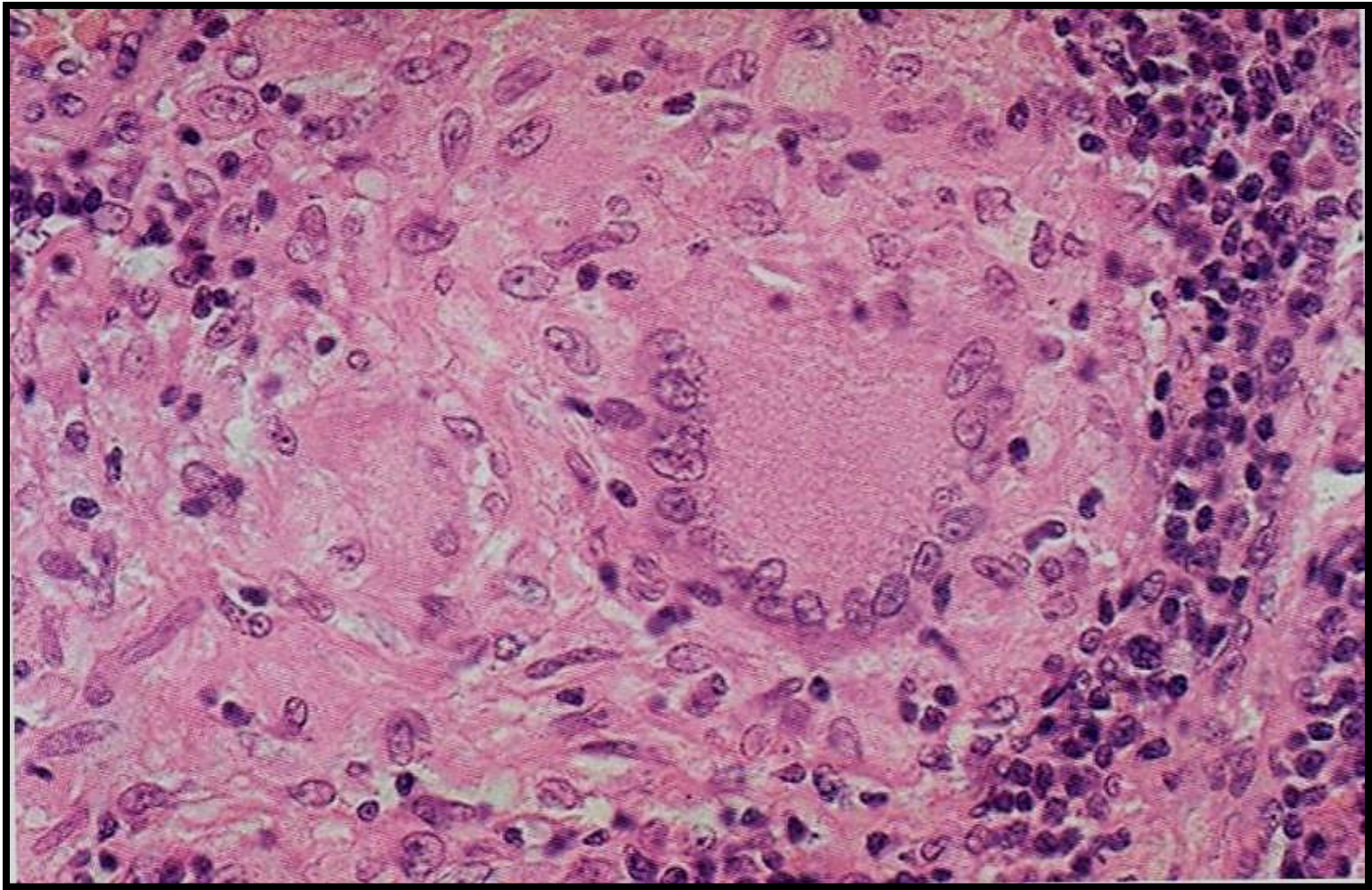
Primary tuberculosis, microscopic
Ghon complex



Primary tuberculosis, radiograph
Ghon complex with calcification



Tuberculosis, microscopic
Granuloma with caseation necrosis



Tuberculosis, microscopic
List cells seen granuloma

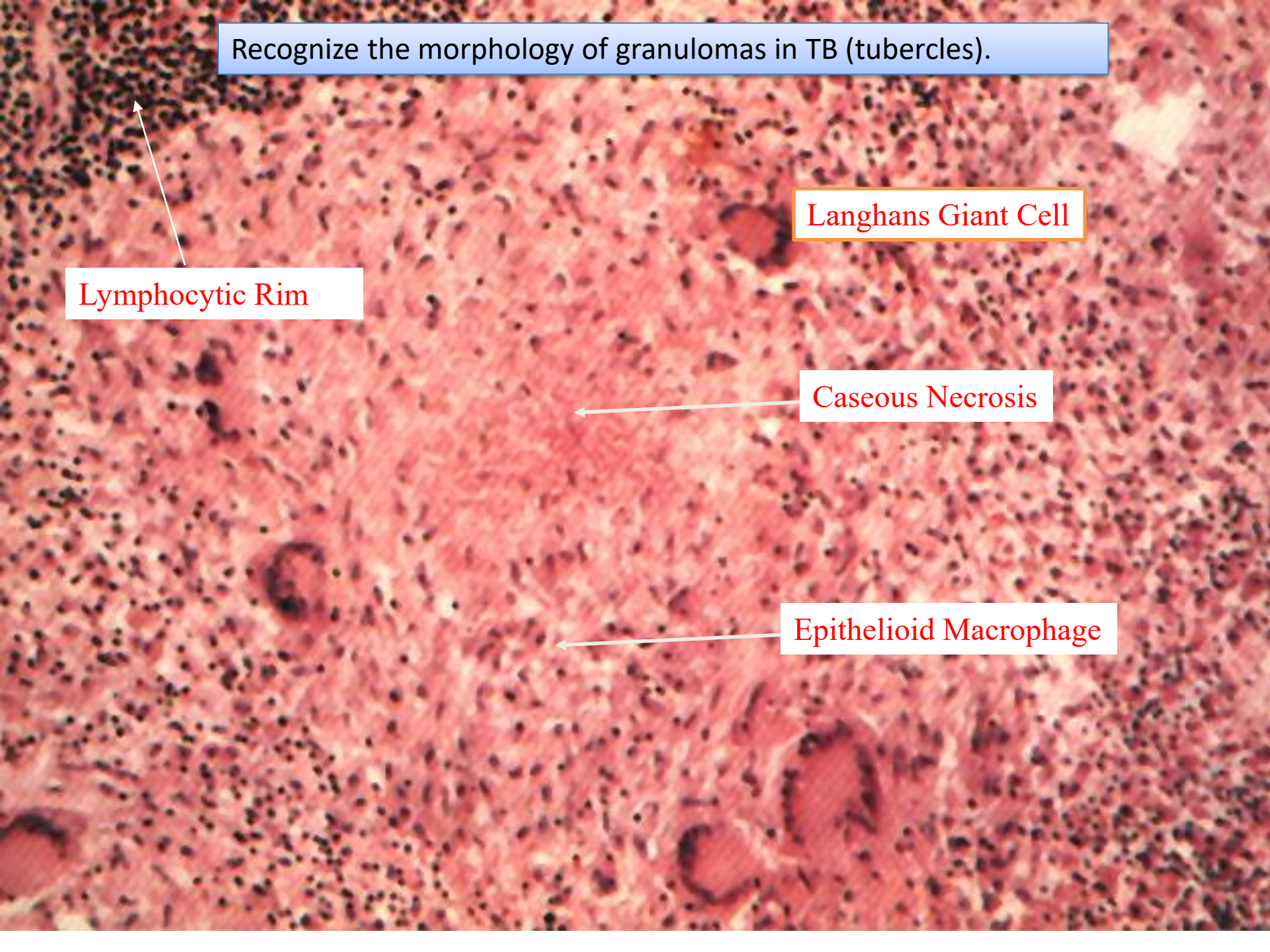
Recognize the morphology of granulomas in TB (tubercles).

Lymphocytic Rim

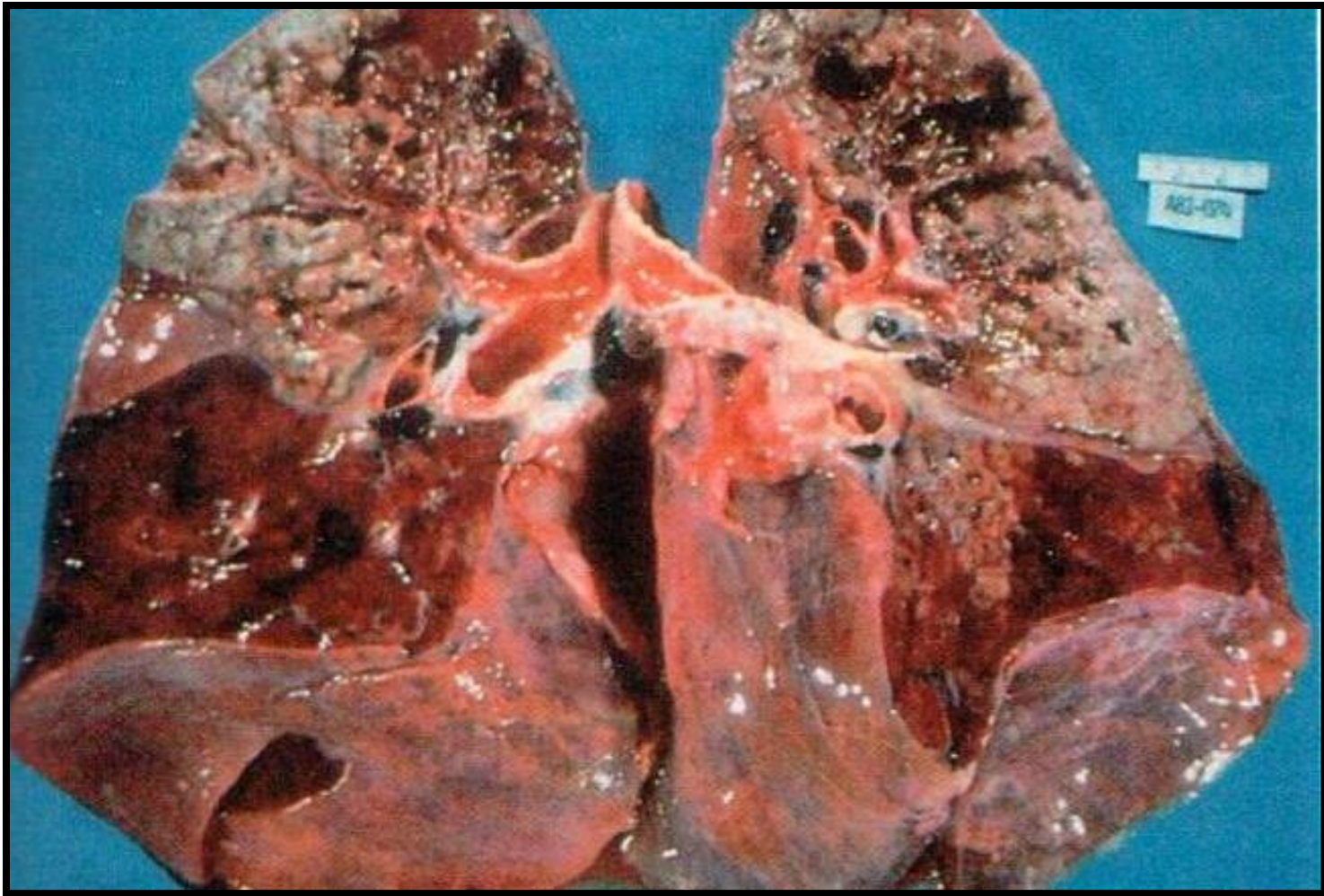
Langhans Giant Cell

Caseous Necrosis

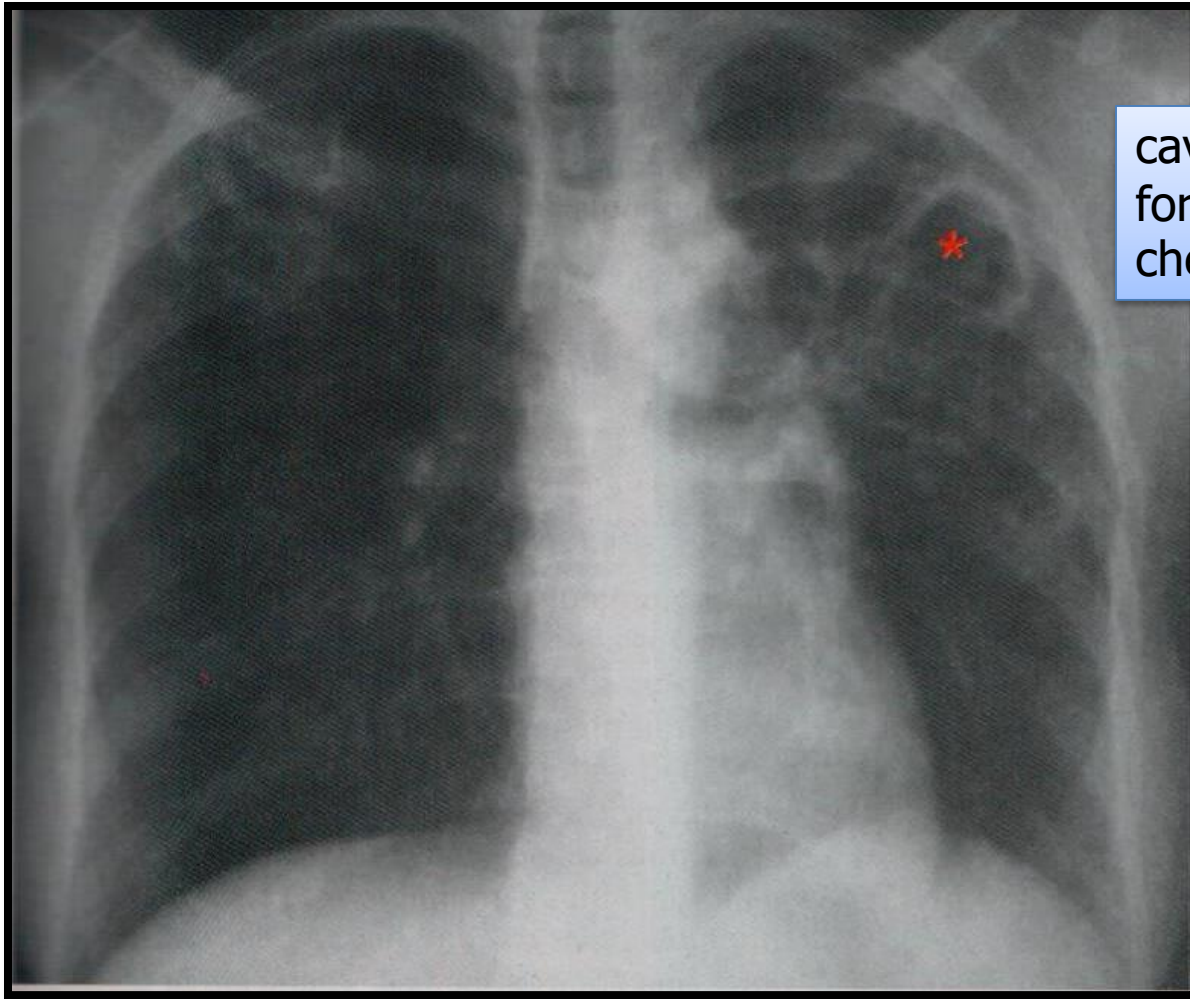
Epithelioid Macrophage



Secondary Tuberculosis (Reactivation Tuberculosis)



The apex of one or both upper lobes are affected with cavitation leading to erosion into and dissemination along airways, patient become infective

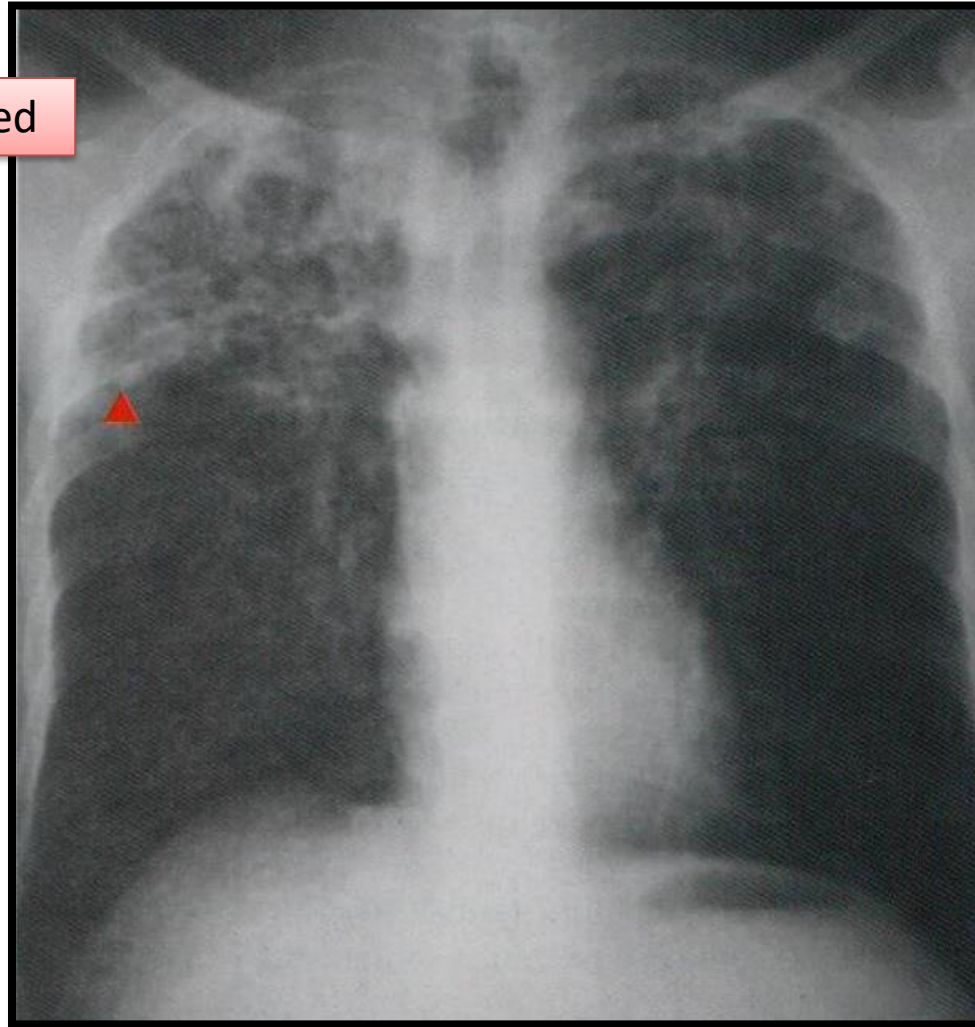


cavity
formation on
chest x-ray

Secondary tuberculosis, radiograph

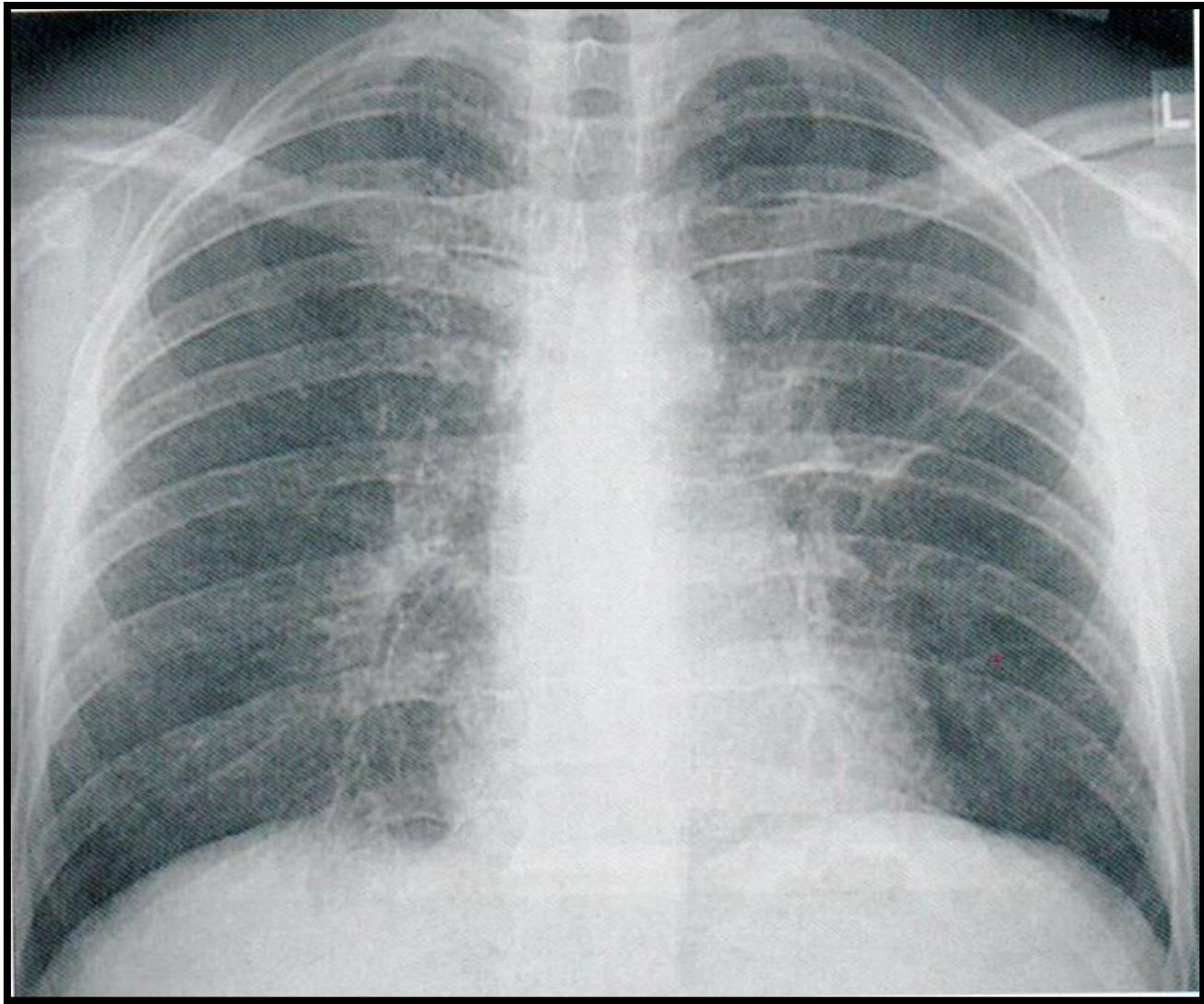
Secondary tuberculosis, radiograph

both upper lobes are affected



Systemic spread via:

- Vein – via left ventricle to whole body
- Artery – miliary spread within the lung



Miliary tuberculosis, radiograph

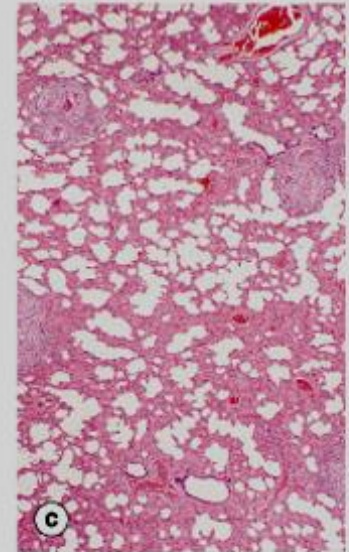
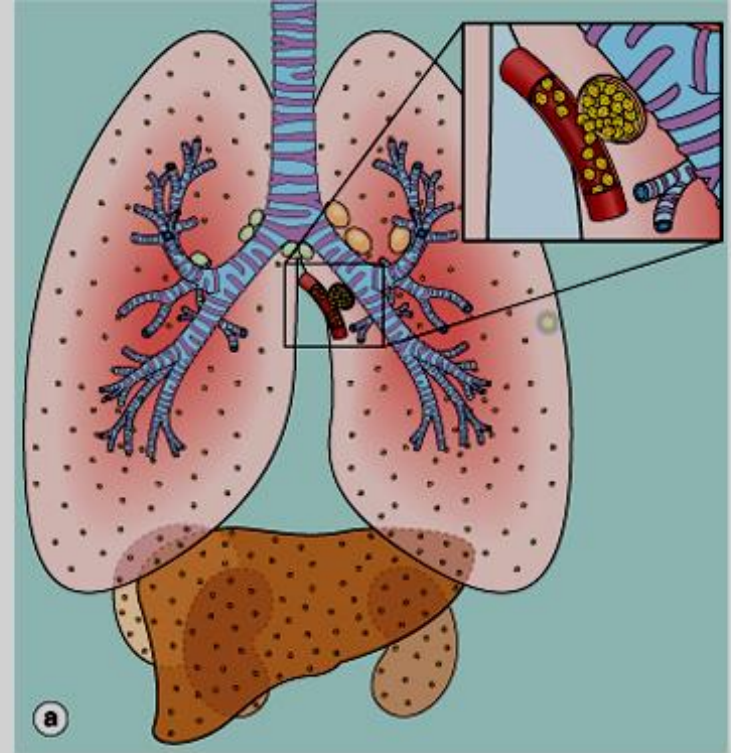
Miliary Tuberculosis:

Haematogenous spread of TB organism throughout the body

- when bacteria in the lungs enters the pulmonary venous return to the heart; the organisms subsequently disseminate through the systemic arterial system and the lymphatic channels

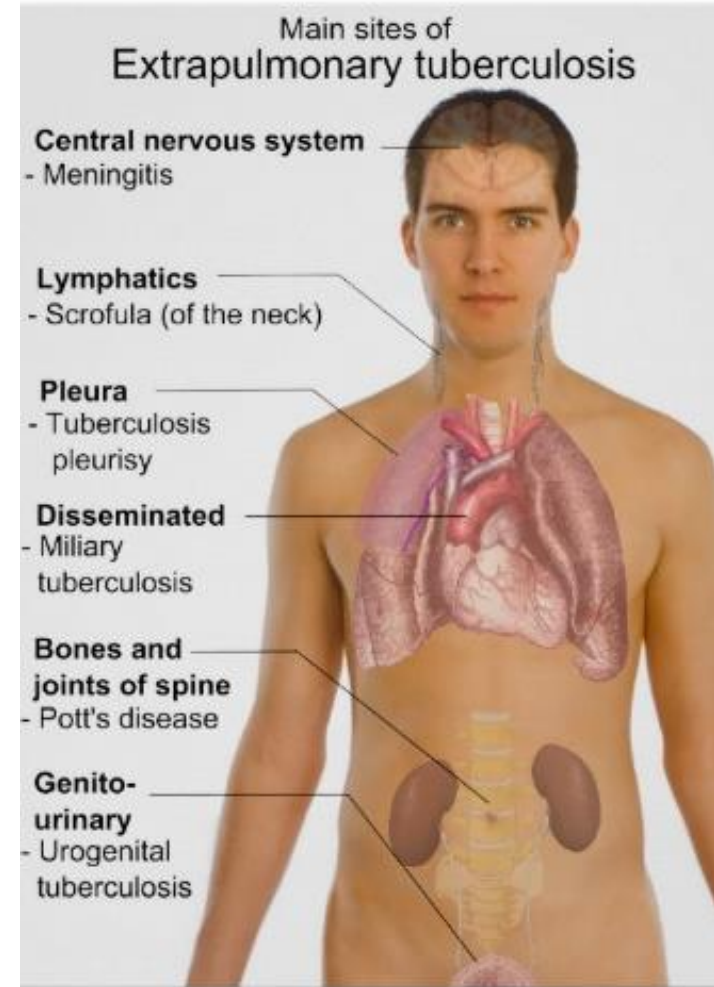
Systemic miliary tuberculosis

- It produces multiple small yellow nodular lesions in several organs. Almost every organ in the body may be seeded. Lesions resemble those in the lung.
- In the lungs there multiple lesions either microscopic or small, visible (2-mm) foci of yellow-white consolidation scattered throughout the lung parenchyma.

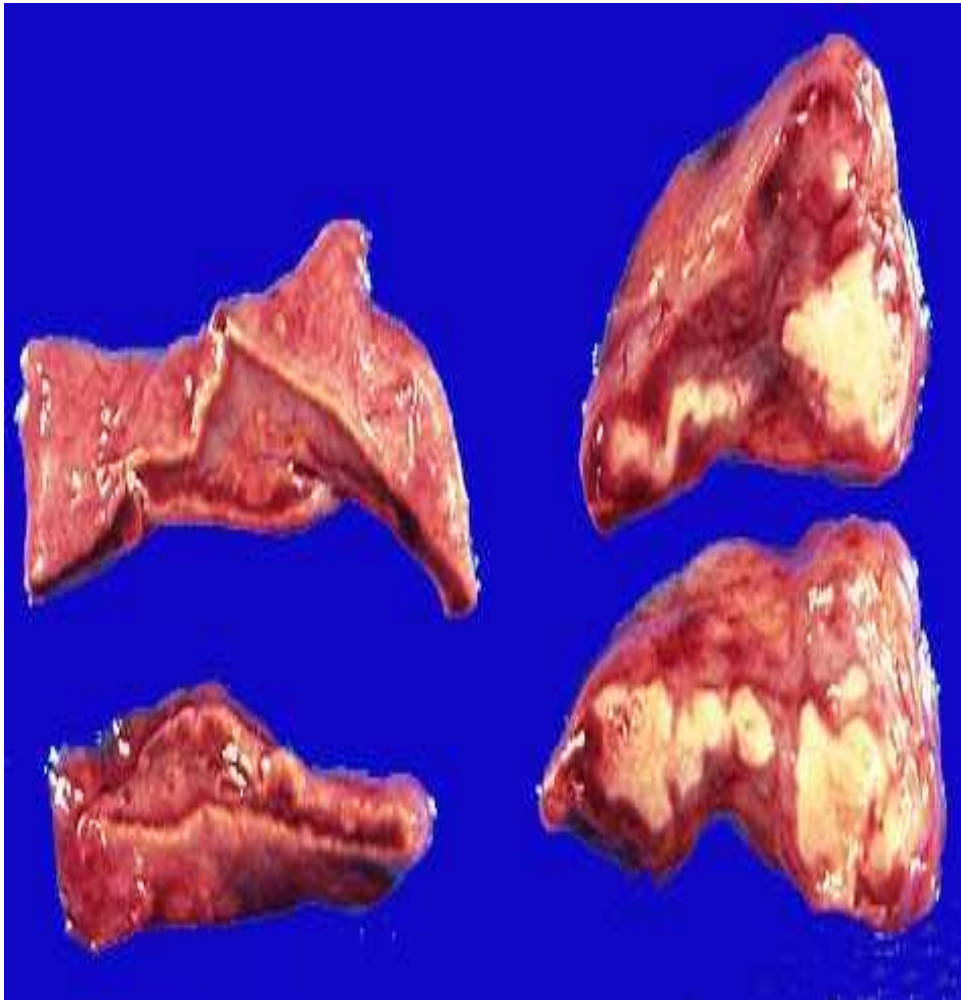


Extrapulmonary tuberculosis

- **Lymph nodes (tuberculous lymphadenitis):** are the most frequent form of extrapulmonary tuberculosis esp. in the cervical region
- **Pleura with pleural effusion (exudate)**
- **Liver and spleen**
- **adrenals**
- **fallopian tube and endometrium**
- **Epididymis and prostate**
- **kidneys**
- **meninges around the base of the brain (tuberculous meningitis),**
- **Bone marrow**
- **Vertebrae (Pott's disease)**
- **Intestinal tuberculosis**



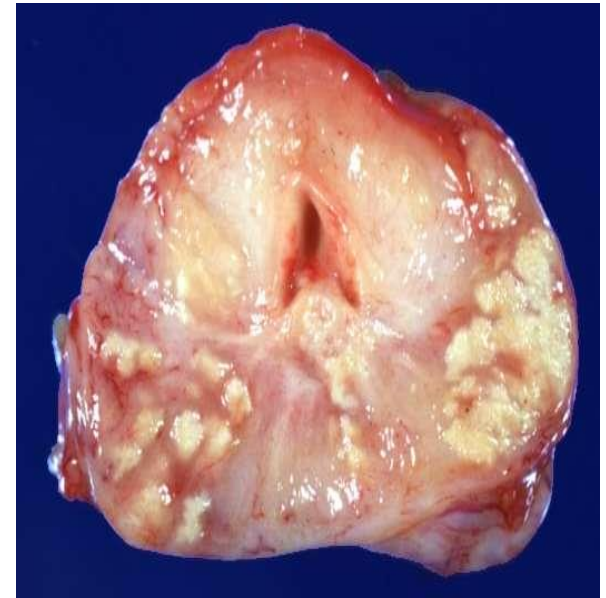
TB adrenal gland



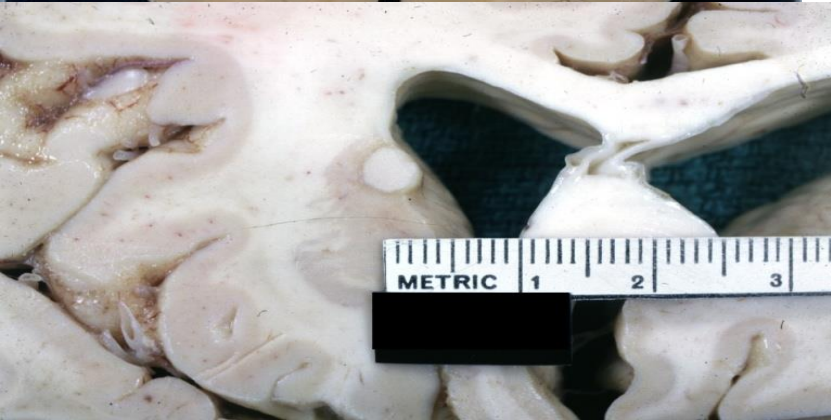
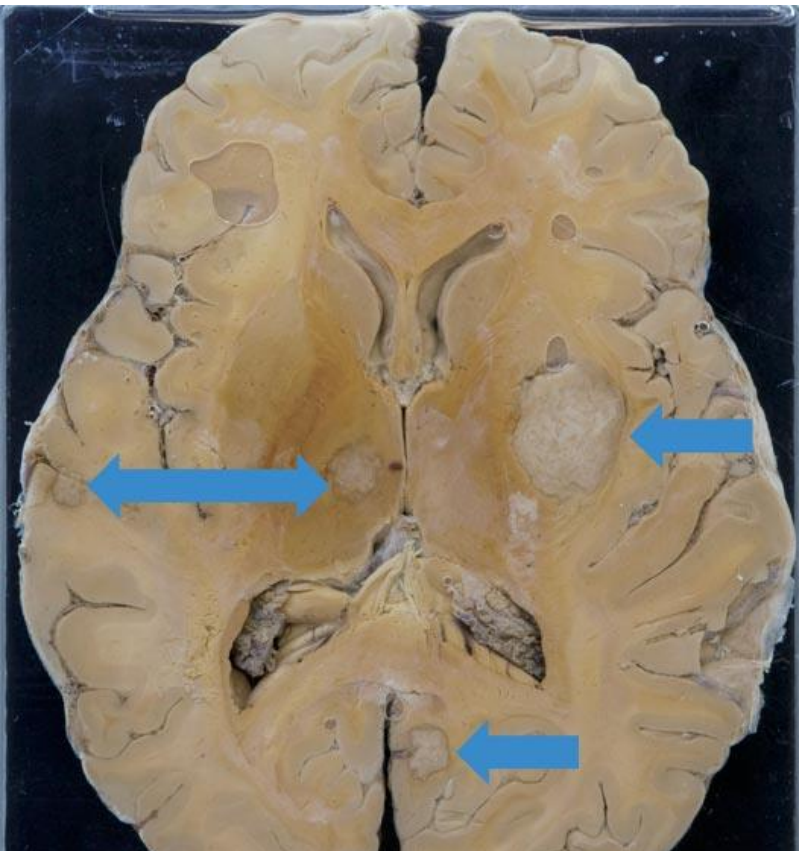
TB epididymis



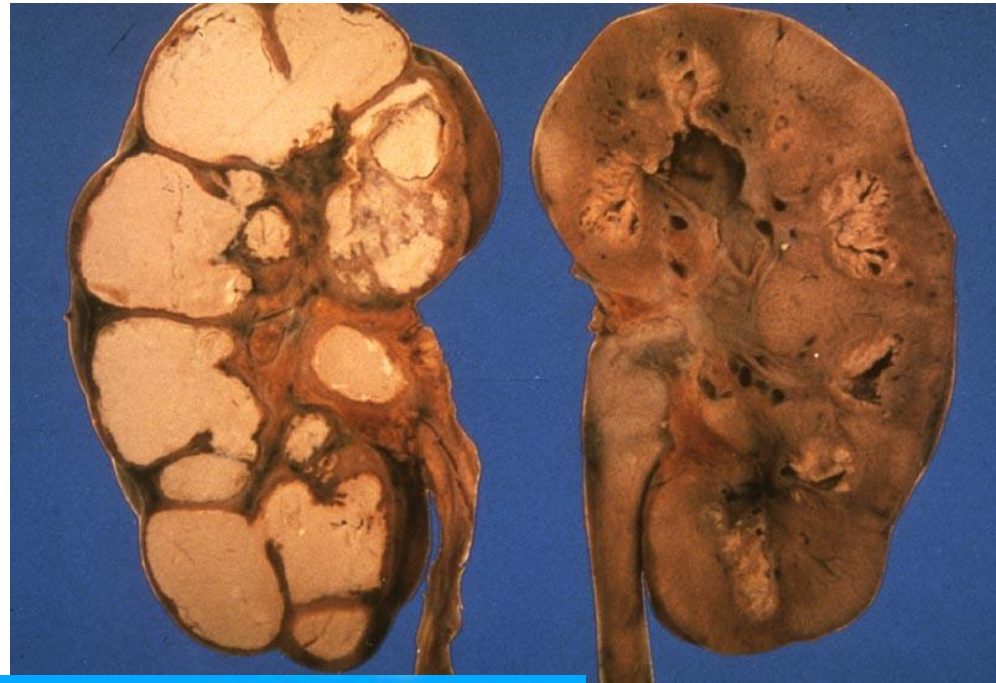
TB Prostate



Tuberculoma

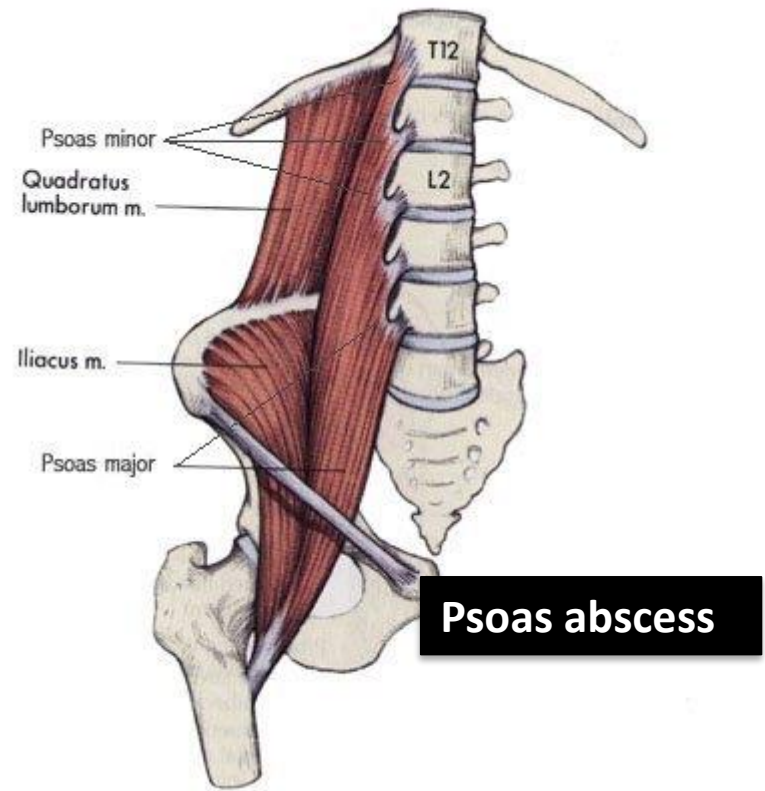


Renal TB



TB Vertebra
(Potts
Spine)

Pott's disease



- **Vertebrae** (Pott's disease). It collapses the spine and leads to paraspinal "cold" abscesses
- in these patients, infected material may track along the tissue planes to present as an abdominal or pelvic mass

Clinical Features

- May be asymptomatic
- Systemic manifestations:
 - malaise, anorexia, weight loss, fever (low grade), cough, shortness of breath, night sweat
 - hemoptysis is present in about half of all cases of pulmonary tuberculosis.
- Depend on the organ system involved (e.g., tuberculous salpingitis may present as infertility, tuberculous meningitis with headache and neurologic deficits, Pott disease with back pain and paraplegia).

Diagnosis

- Demonstration of acid-fast organisms in sputum (*Sputum analysis: ZN stain, culture and PCR*)
- Chest X-ray
- Mantoux skin test

Diagnosis: Mantoux skin test



A positive tuberculin skin test result signifies cell-mediated hypersensitivity to tubercular antigens, but does not differentiate between infection and disease.

The size of induration is measured 48–72 hours later

Positive results: induces a visible and palpable induration (at least 5 mm in diameter)

False-negative reactions may be produced by certain viral infections, sarcoidosis, malnutrition, Hodgkin lymphoma, immunosuppression and AIDS.

False-positive reactions may result from infection by atypical mycobacteria



Prognosis

- The prognosis with proper treatment is generally good if infections are localized to the lungs, except when they are caused by drug-resistant strains or occur in aged debilitated, or immunosuppressed persons, who are at high risk for developing miliary TB
- The outcome depends on the adequacy of the host immune response and treatment

