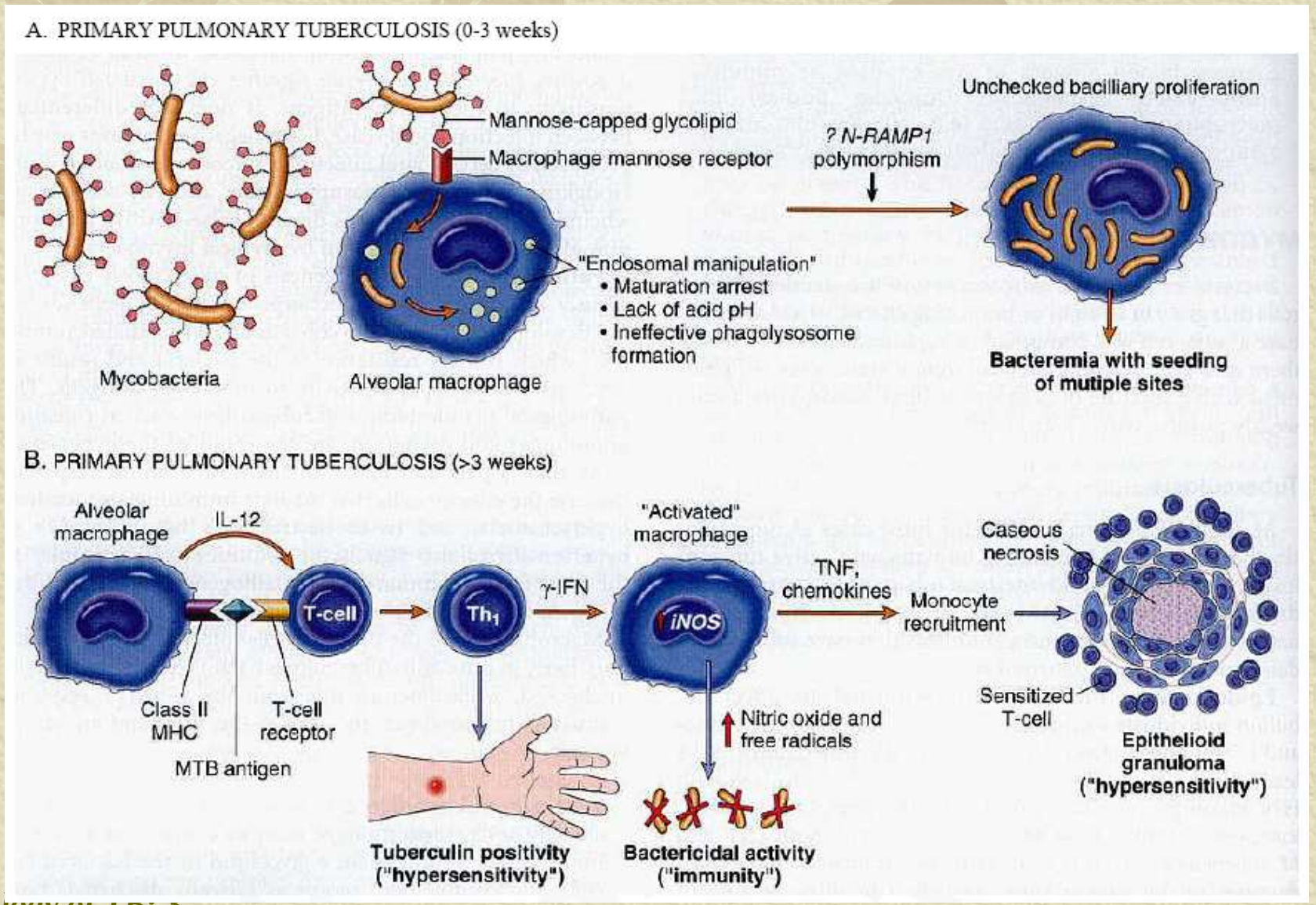
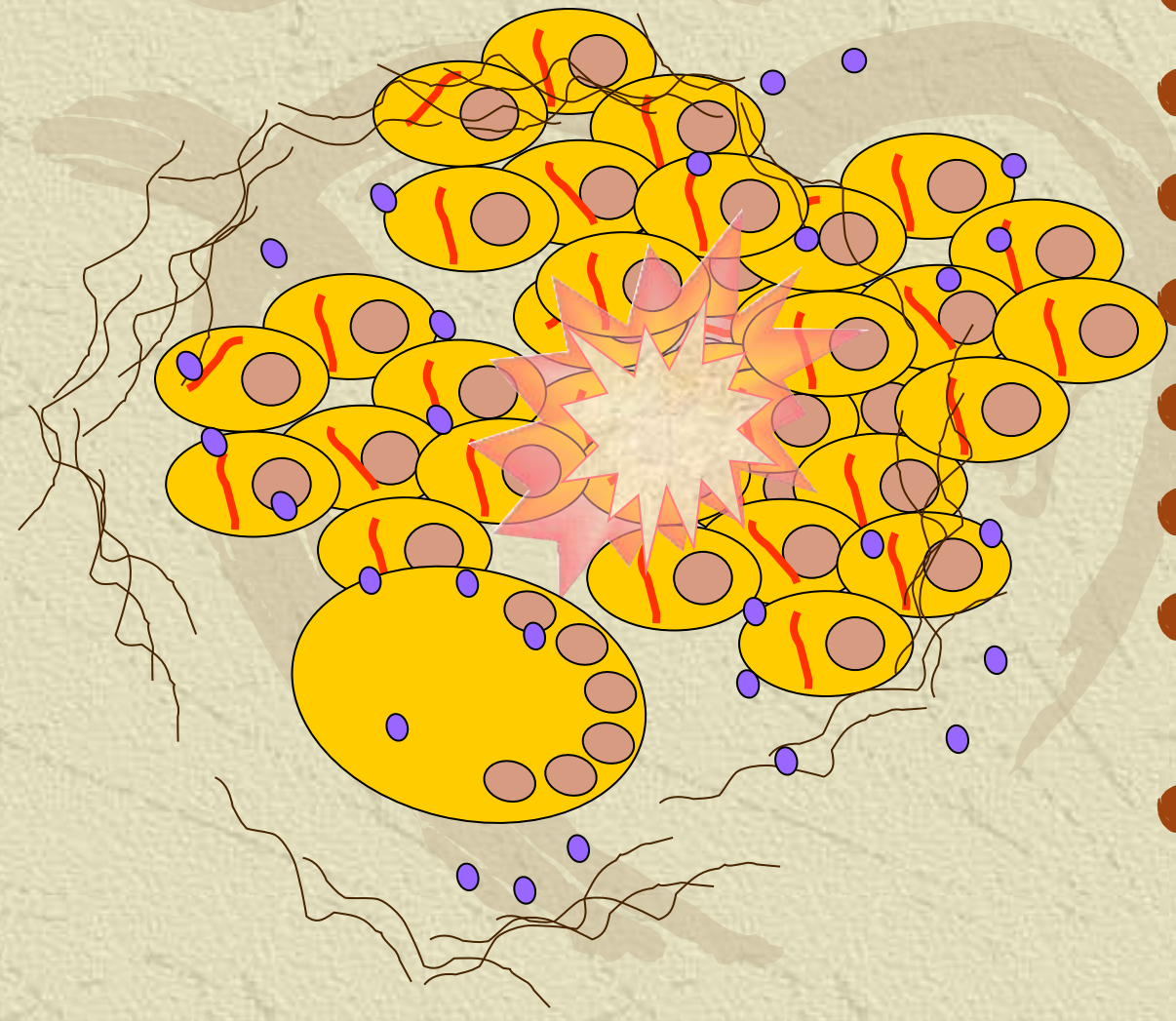
Pathology of tuberculosis of lung

- Tuberculosis is caused by bacteria mycobacterium tuberculosis.
- Acid fast bacteria.

Pathogenesis



TB Pathogenesis

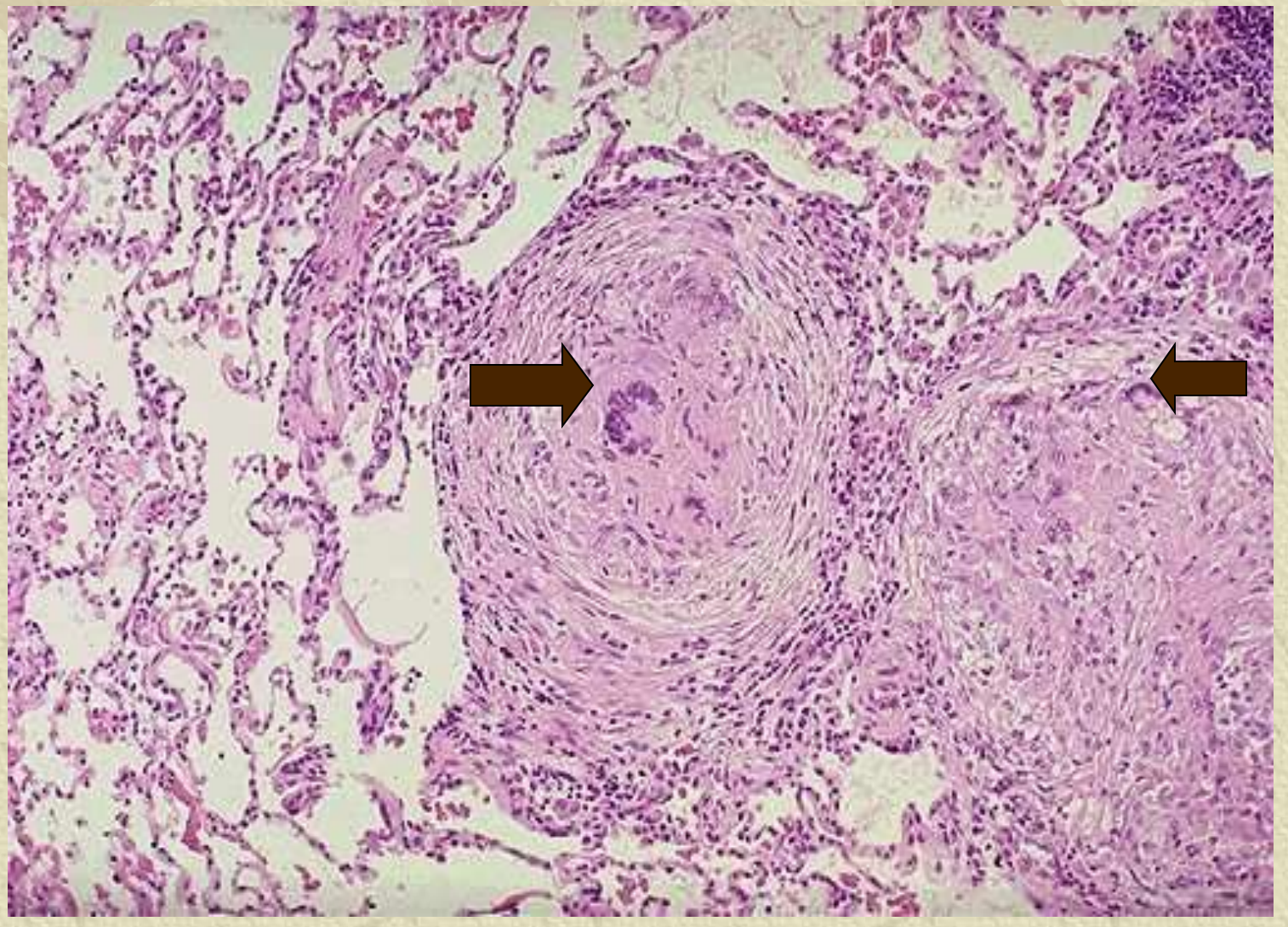


- Bacterial entry
- T Lymphocytes.
- Macrophages.
- Epitheloid cells.
- Proliferation.
- Central Necrosis.
- Giant cell formation.
- Fibrosis.

Morphology of Granuloma

1. Rounded tight collection of chronic inflammatory cells.
2. Central Caseous necrosis.
3. Active macrophages - epithelioid cells.
4. Outer layer of lymphocytes & fibroblasts.
5. Langhans giant cells – joined epithelioid cells.

Tuberculous Granuloma



Types of tuberculosis

- Primary tuberculosis: is a form of disease that develops in a previously unexposed and therefore unsensitized person.
- Secondary tuberculosis: is the pattern of disease that arises in previously sensitized or infected host.

Clinical features

- Malaise, anorexia, weight loss and fever
- The fever is usually low grade and remittent (appearing late each afternoon and then subsiding)
- With progressive pulmonary involvement: increasing amounts of sputum, which is at first mucoid and later purulent may appear.
- Haemoptysis
- Pleuritic pain

Primary tuberculosis

- Definition: Infection of an individual who has not been previously infected or immunised.
- The inhaled bacilli implant in the distal airspaces of lower part of upper lobe or upper part of lower lobe close to the pleura
- As sensitization develops, a gray-white inflammatory consolidation is formed→Ghon focus

Primary tuberculosis

GHON'S COMPLEX(Primary complex)

- Pulmonary component (Ghon's Focus)
- Lymphatic component
- Lymph node component – Hilar & Tracheo-bronchial

Ghon complex or primary complex

- Consists of 3 components
  - Pulmonary component:
    - lesion in the lung (Ghon focus or primary focus)
    - 1-2cm solitary area located peripherally in the subpleural focus in the lower part of upper lobe or upper part of lower lobe
    - Micro: the lung lesion show tuberculous granuloma with caseous necrosis
  - Lymphatic component:
    - lymphatics draining lung lesion containing phagocytes with M tuberculosis bacilli

- Lymph node component:
  - Enlarged hilar and tracheo-bronchial lymph node
  - Gross: the affected lymph nodes are matted and may show caseation necrosis
  - Micro: tuberculous granulomas, caseation necrosis and fibrosis.
  - Nodal lesions are the potential source of reinfection later.

Ghon Complex

Fate of primary tuberculosis

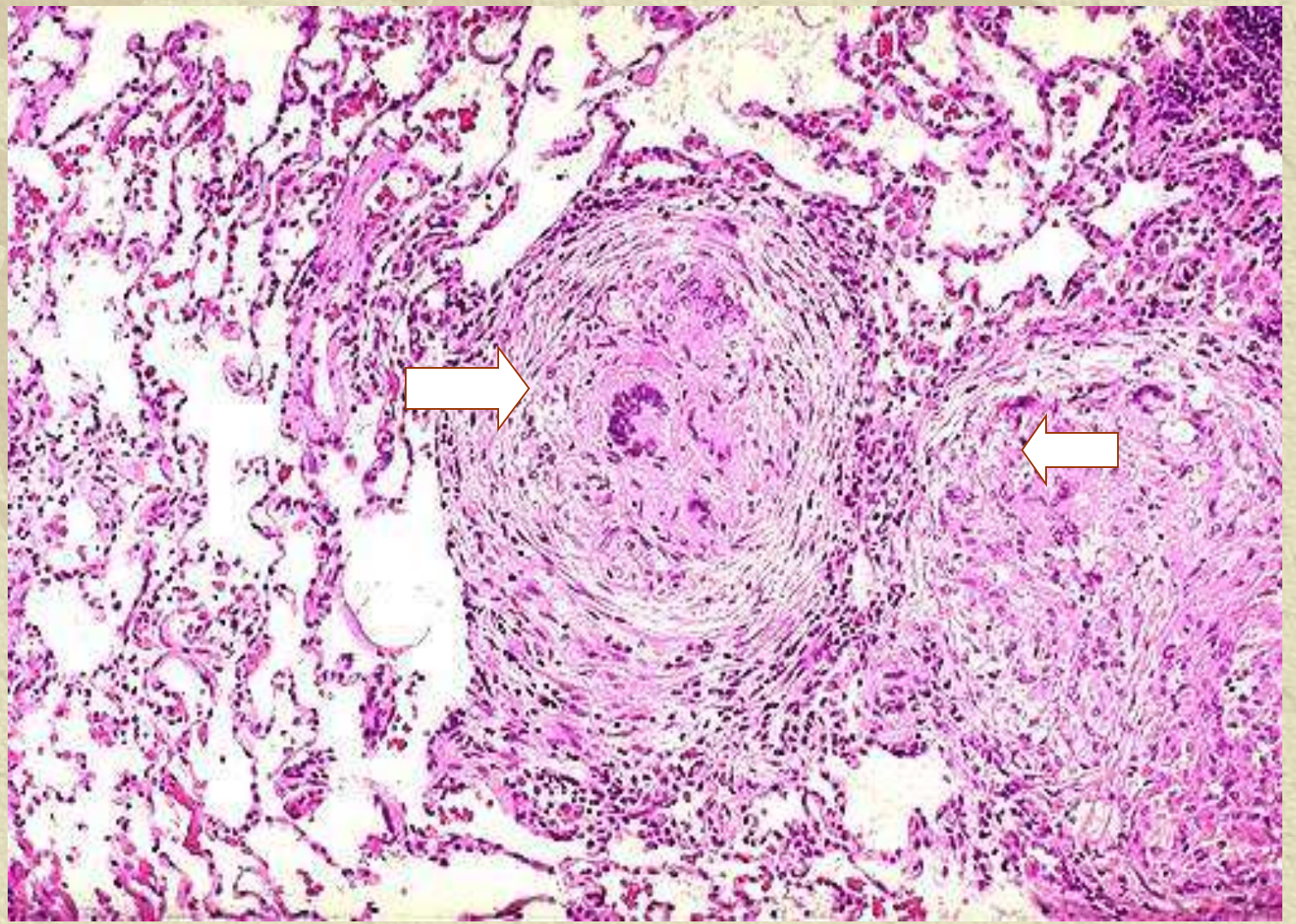
- Heal by fibrosis→ calcification
- Progressive primary tuberculosis
- Primary miliary tuberculosis

Secondary tuberculosis

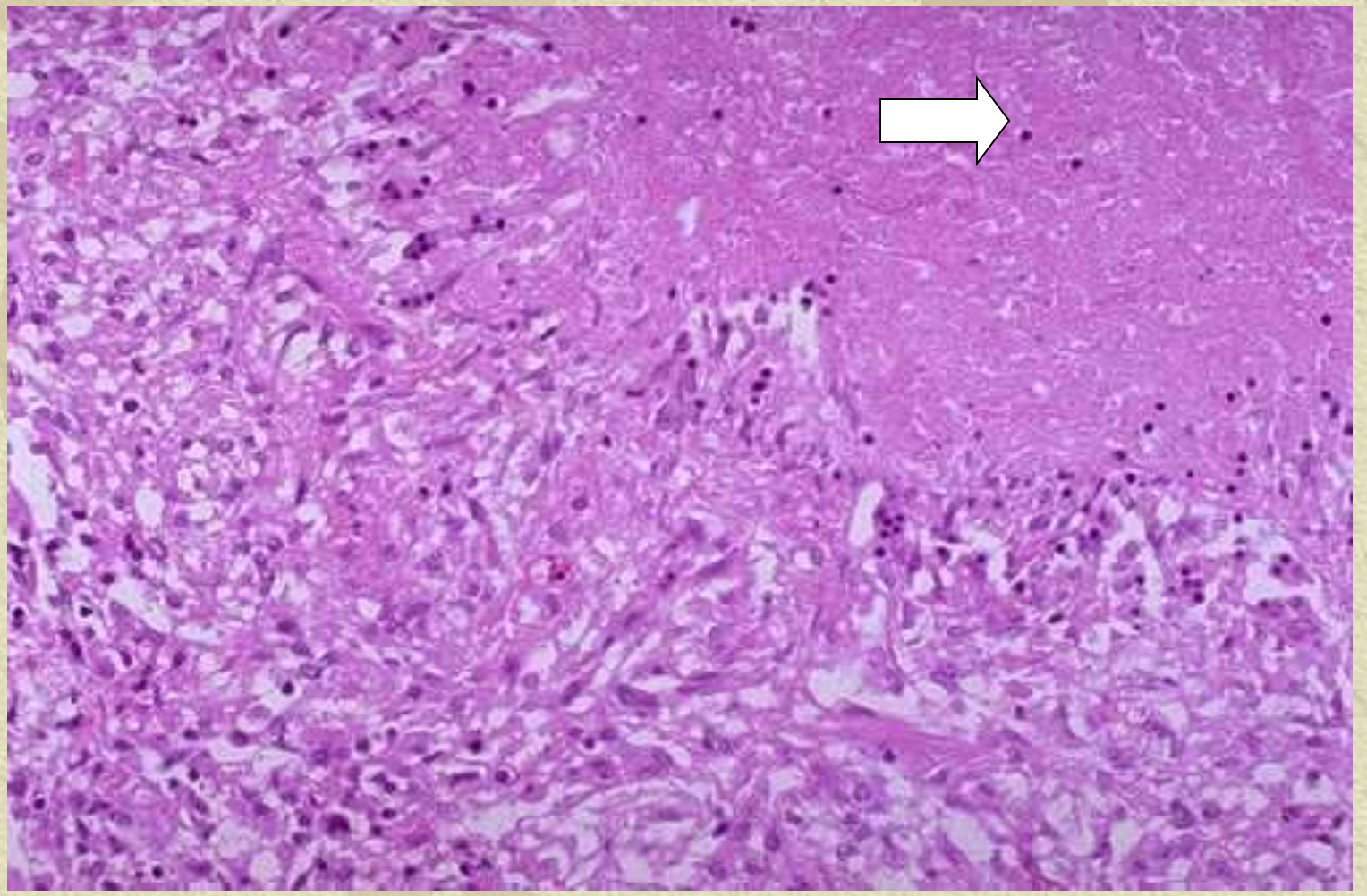
- Definition: the infection of an individual who has been previously infected or sensitized
- The infection may be acquired from
  - Endogenous source: reactivation of dormant primary complex
  - Exogenous source

- The initial lesion is a small focus of consolidation of <2cm in diameter within 1 to 2cm of apical pleura
- Gross: sharply circumscribed, firm, gray white to yellow with variable amount of central caseation necrosis
- Micro: coalescent tuberculous granulomas with central caseation necrosis.

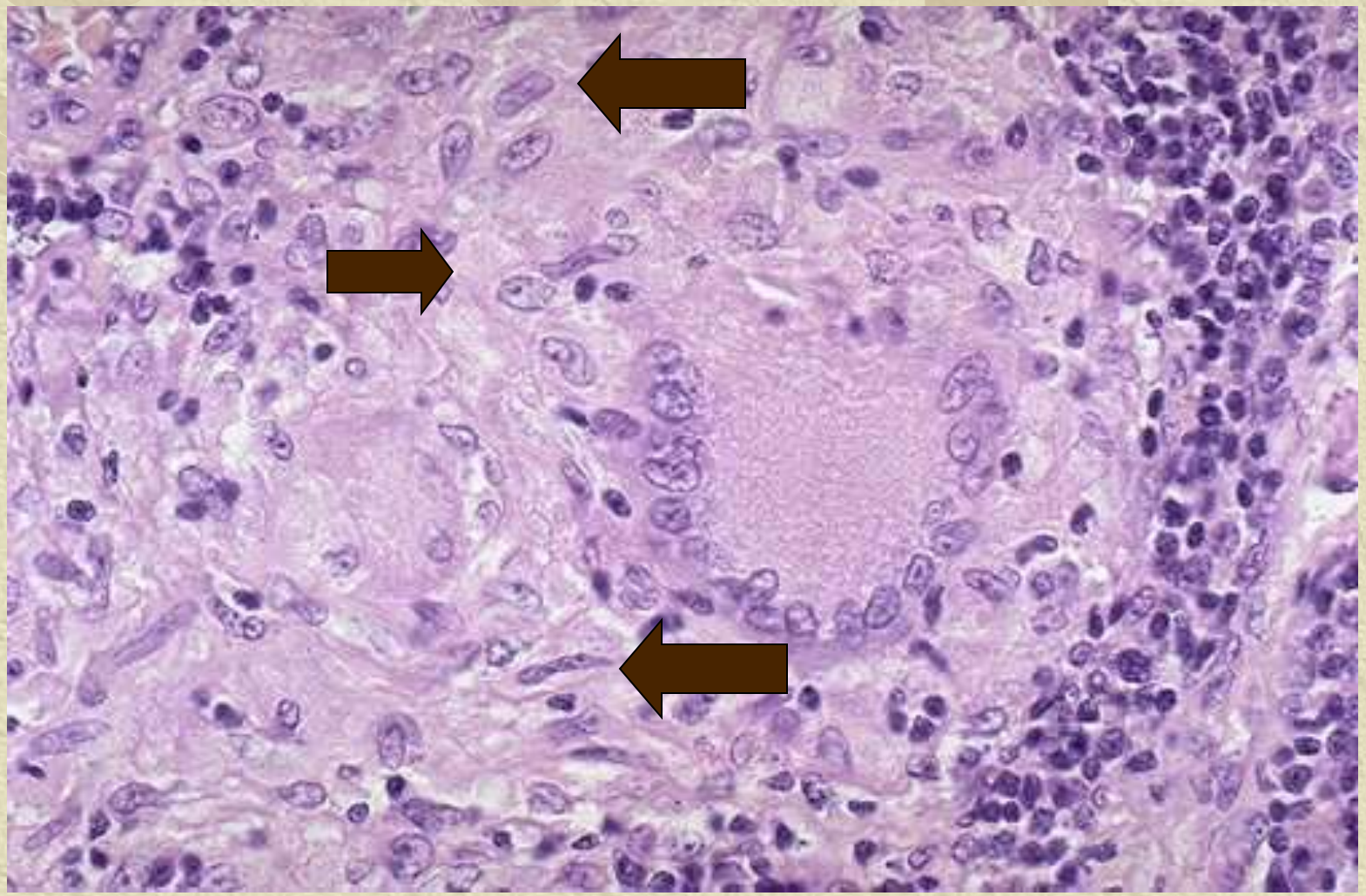
Tuberculous Granulomas



Caseation Necrosis



Epitheloid cells in Granuloma



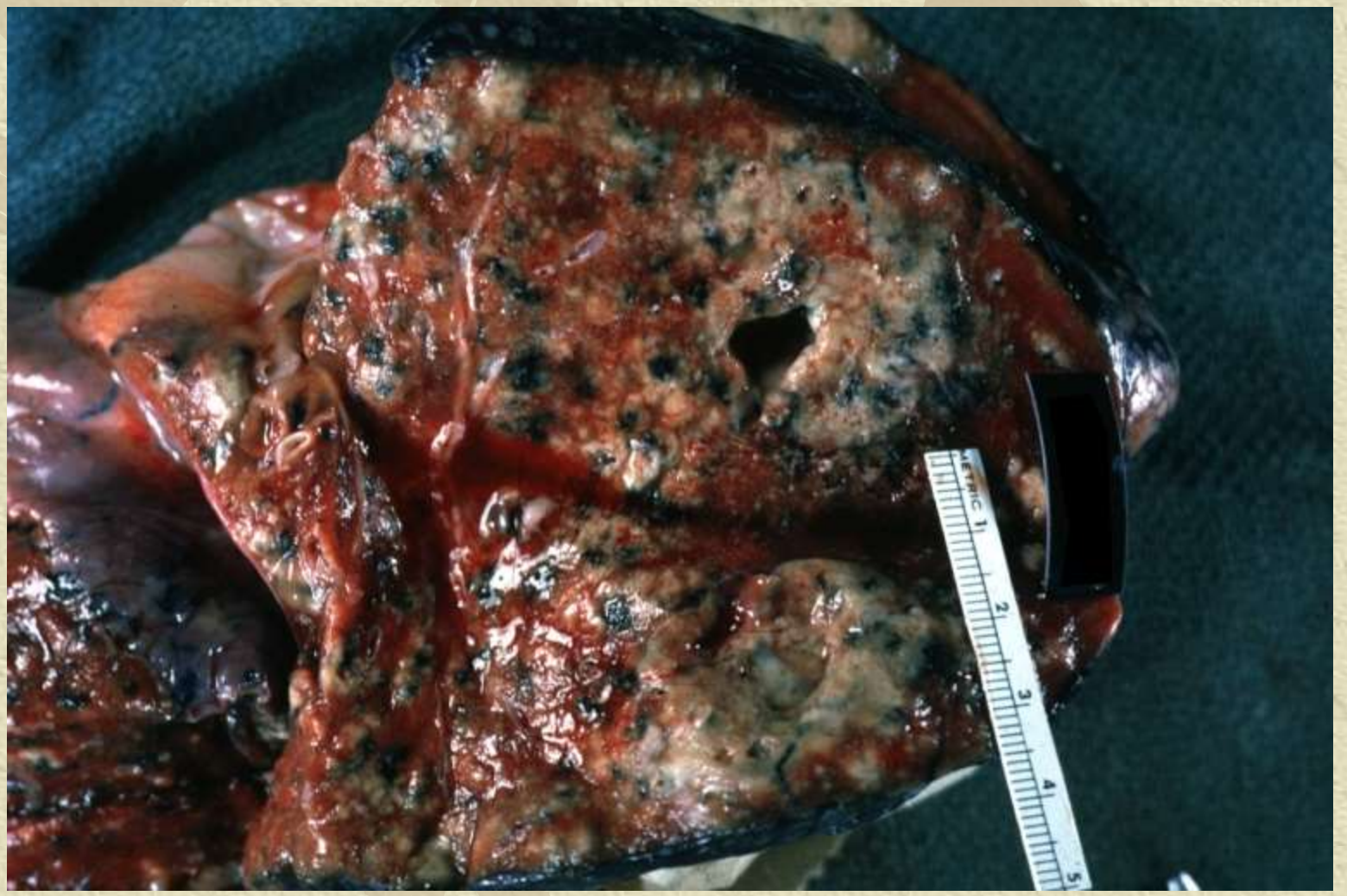
Fate of secondary tuberculosis

- The lesion may heal with fibrous scarring and calcification
- Fibrocaseous tuberculosis (progressive pulmonary TB)
- Tuberculous caseous pneumonia
- Miliary tuberculosis

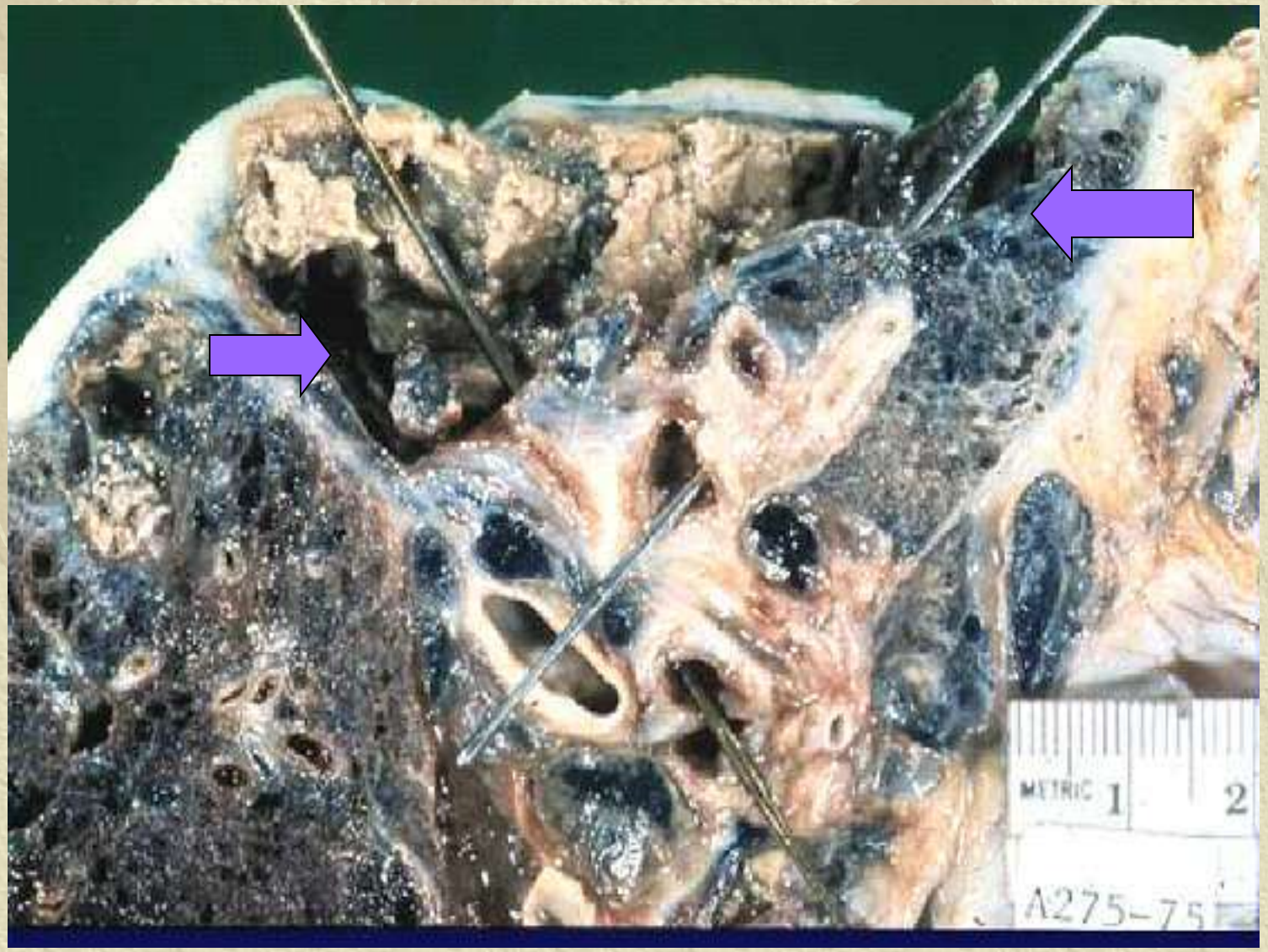
Fibrocaseous tuberculosis

- Seen usually in elderly, immunosuppressed people or untreated patients.
- Apical lesion enlarges with expansion of area of necrosis forming cavity which may either
  - break into bronchus from a cavity with evacuation of caseous material (open fibrocaseous TB)
  - Break into blood vessel producing hemoptysis

Lung TB - Cavitation



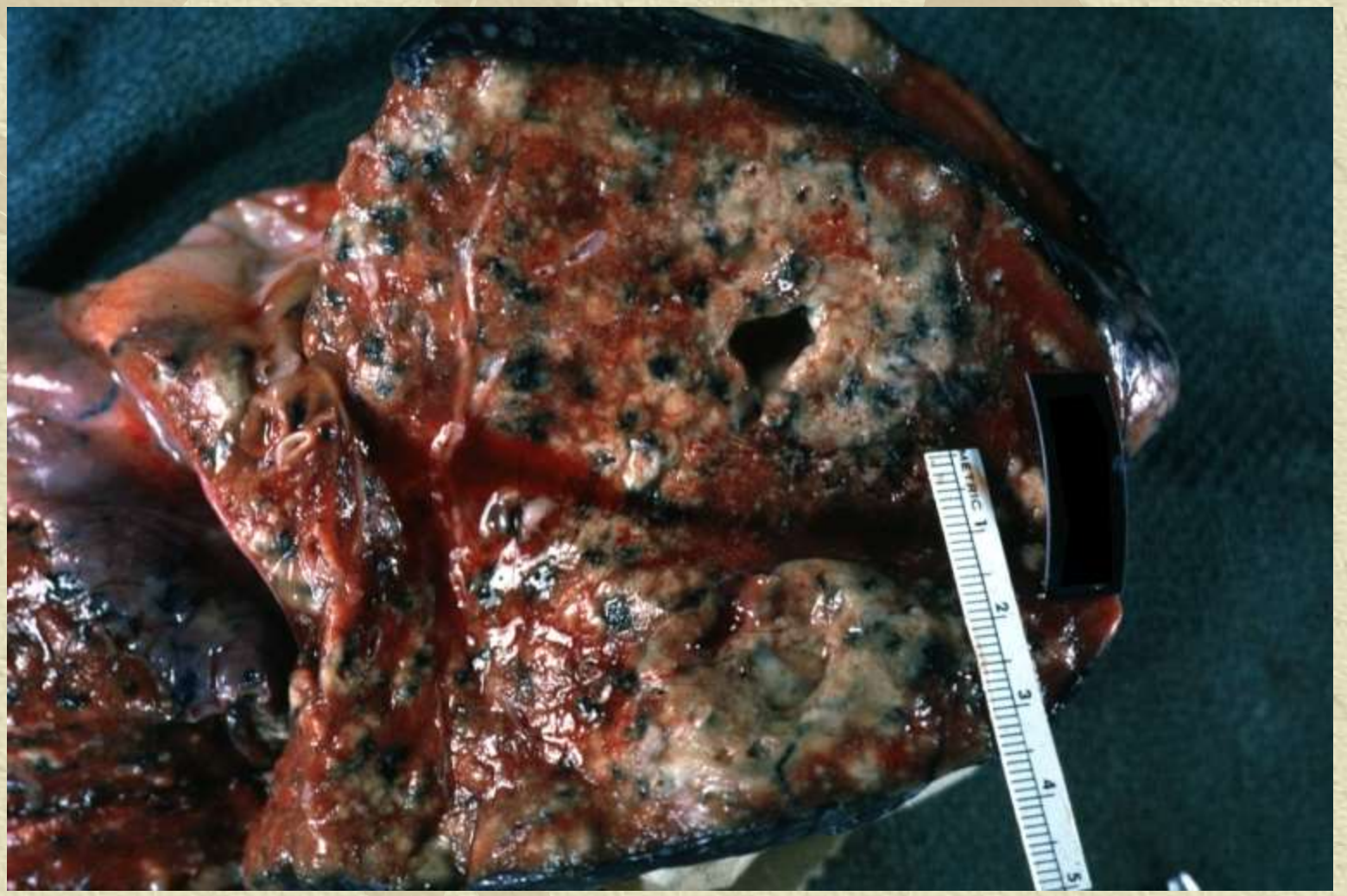
Cavitary Secondary TB



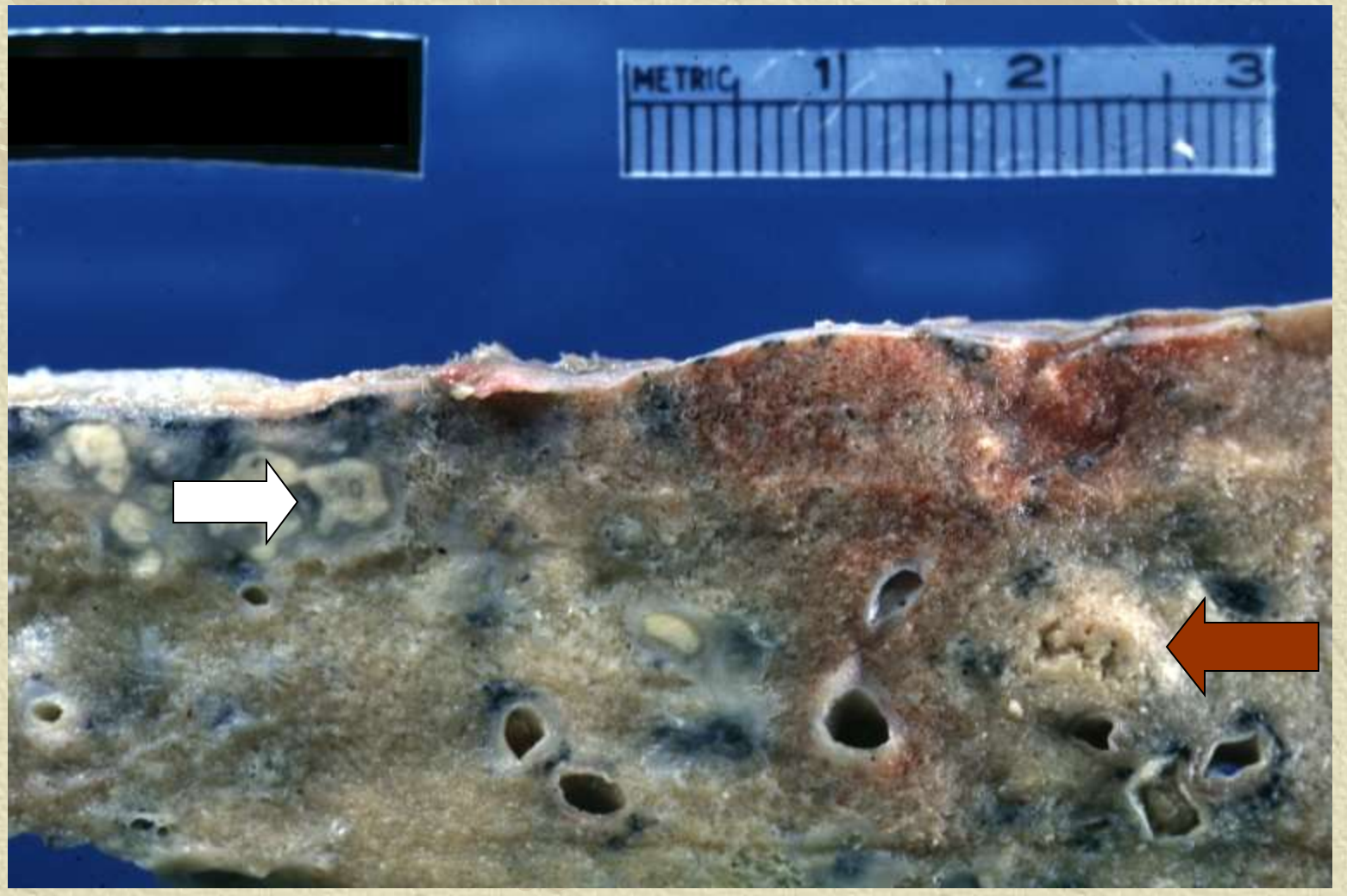
- The cavity provides a favourable environment for the proliferation of a bacilli due to high oxygen tension
- The open case of secondary TB may implant tuberculous lesion on the mucosal lining of air passages producing endobronchial / endotracheal TB

- Gross :
  - Tuberculous cavity is spherical with thick fibrous wall, lined by yellowish, caseous, necrotic material.
  - The overlying pleura may also be thickened
- Microscopy:
  - The wall of the cavity shows
    - Eosinophilic granular caseous material
    - Widespread tuberculous granulomas composed of central caseous necrosis, epithelioid cells, Langhans giant cells and peripheral zone of lymphocytes
    - The outer wall of the cavity shows fibrosis

Lung TB - Cavitation



Typical cavitating granuloma



Complications of cavitatory secondary TB

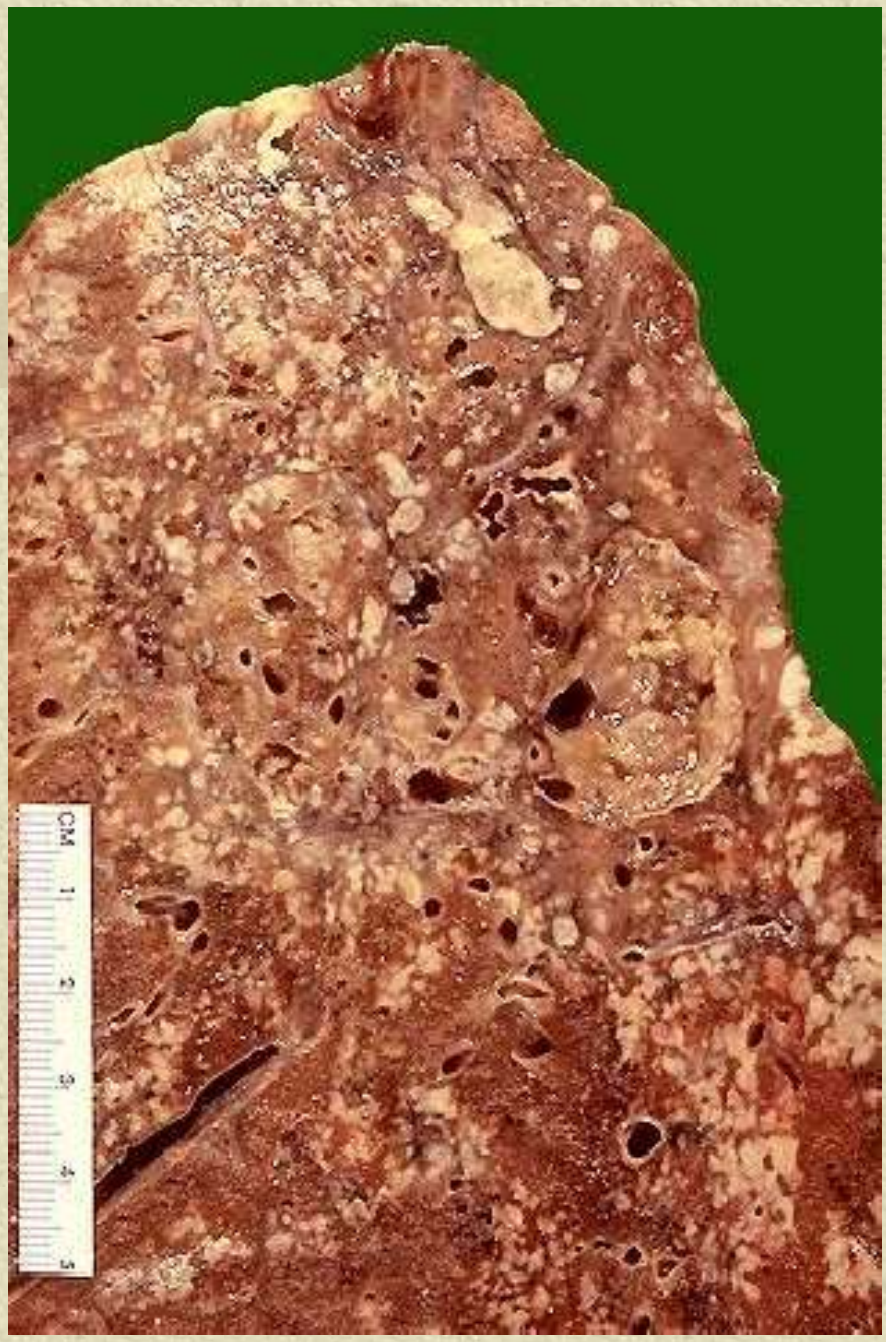
- Extension to pleura producing bronchopleural fistula
- Tuberculous empyema
- Thickened pleura
- Pleural effusions
- Obliterative fibrous pleuritis

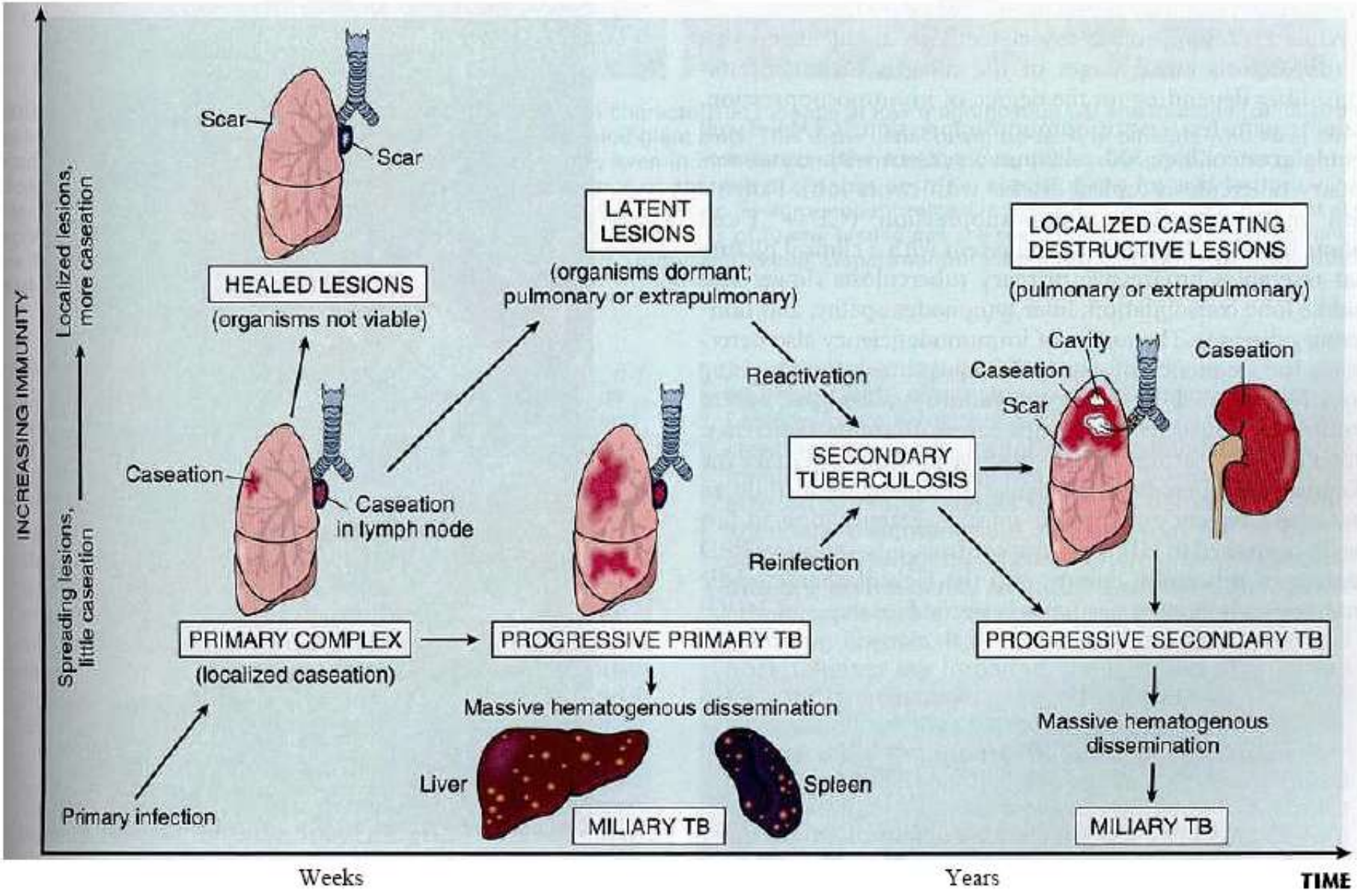
Miliary pulmonary tuberculosis

- Occurs when organisms drain through lymphatics into→ lymphatic ducts→ venous return on the right side of heart→ pulmonary arteries
- Individual lesions are either microscopic or small, visible (2mm) foci of yellow-white consolidation scattered through the lung parenchyma (resembling millet seeds)
- Micro: the lesion shows structure of granuloma with minute areas of caseous necrosis.


METRIC 1
2
3

Miliary TB



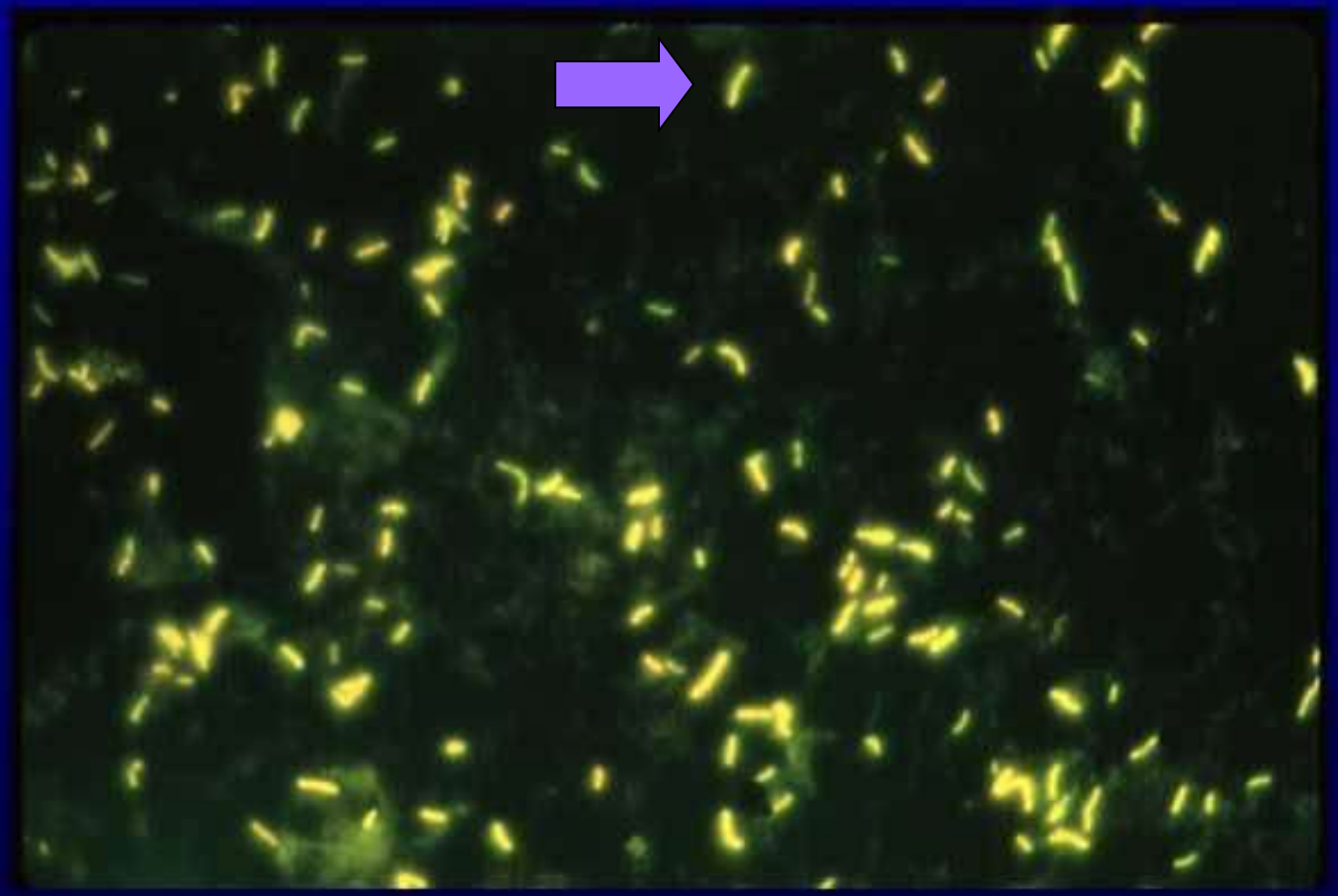

INCREASING IMMUNITY
Localized lesions, more caseation
Spreading lesions, little caseation
Scar
Scar
HEALED LESIONS
(organisms not viable)
LATENT LESIONS
(organisms dormant; pulmonary or extrapulmonary)
LOCALIZED CASEATING DESTRUCTIVE LESIONS
(pulmonary or extrapulmonary)
Reactivation
Cavity
Caseation
Scar
Caseation
Caseation
Caseation in lymph node
SECONDARY TUBERCULOSIS
Reinfection
PRIMARY COMPLEX
(localized caseation)
PROGRESSIVE PRIMARY TB
PROGRESSIVE SECONDARY TB
Massive hematogenous dissemination
Massive hematogenous dissemination
Liver
Spleen
MILIARY TB
MILIARY TB
Primary infection
Weeks
Years
TIME

Diagnosis of TB

- Clinical features are not confirmatory.
- Zeil Nielson Stain
- Adenosine deaminase test
- Culture most sensitive and specific test.
  - Conventional Lowenstein Jensen media 3-6 wks.
  - Automated techniques within 9-16 days
- PCR is available, but should only be performed by experienced laboratories
- Mantoux test

AFB - Ziehl-Nielson stain

Sputum - TB Auromine/Rhodamine



Colony Morphology – LJ Slant

Mantoux test

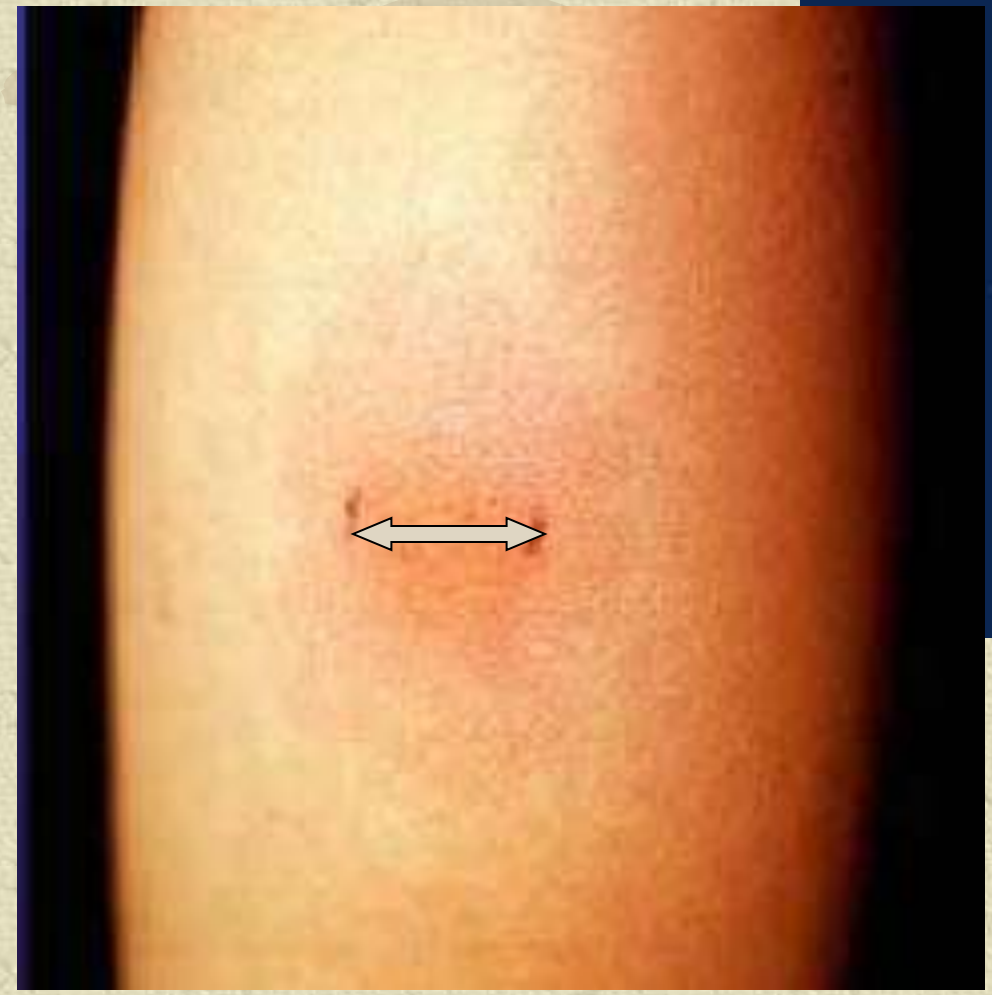
- Infection with mycobacterium tuberculosis leads delayed hypersensitivity reaction which can be detected by Mantoux test
- About 2 to 4 weeks after infection, intracutaneous injection of purified protein derivative (PPD) of M.tuberculosis induces a visible and palpable induration that peaks in 48 to 72 hours

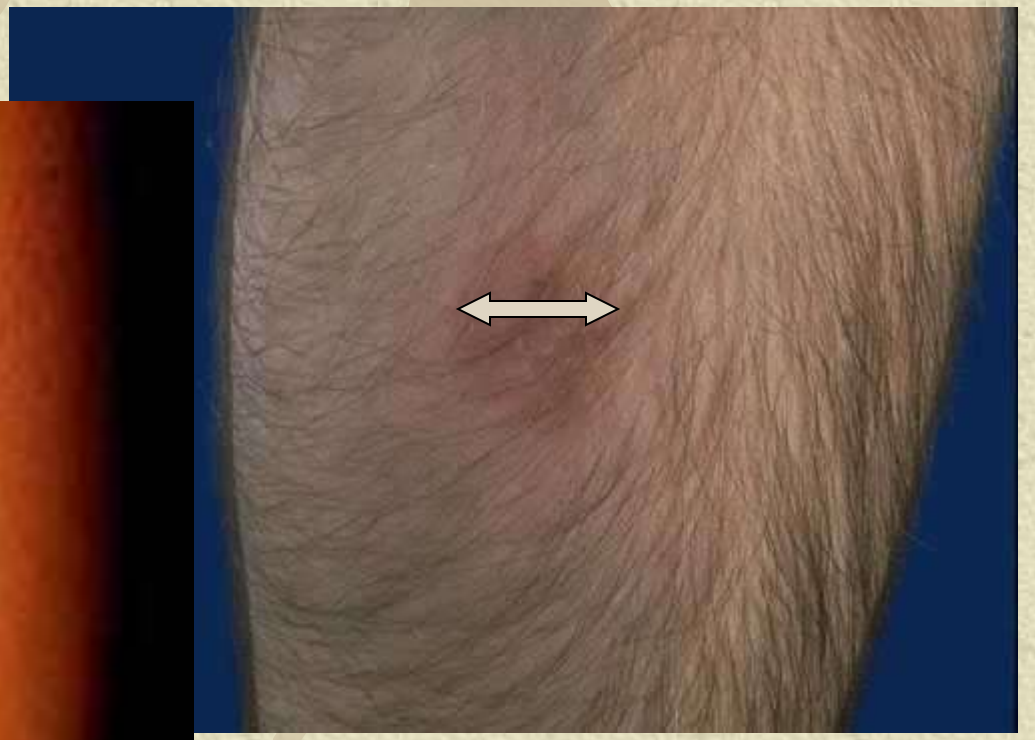
PPD Tuberculin Testing

- Sub cutaneous
- Weal formation
- Itching – no scratch.
- Read after 72 hours.
- Induration size.
- 5-10-15mm

- (*i*) Induration less than 5 mm – no exposure to tubercular bacilli.
- (*ii*) Induration between 5-9 mm – this can be due to atypical mycobacteria or BCG vaccination. It may suggest infection in immunocompromised children such as HIV infection or other immunosupression;
- (*iii*) Induation 10 mm or more – an induration of 10 mm or more at 48-72 hours in a child with symptoms of tuberculosis should be interpreted as tubercular disease

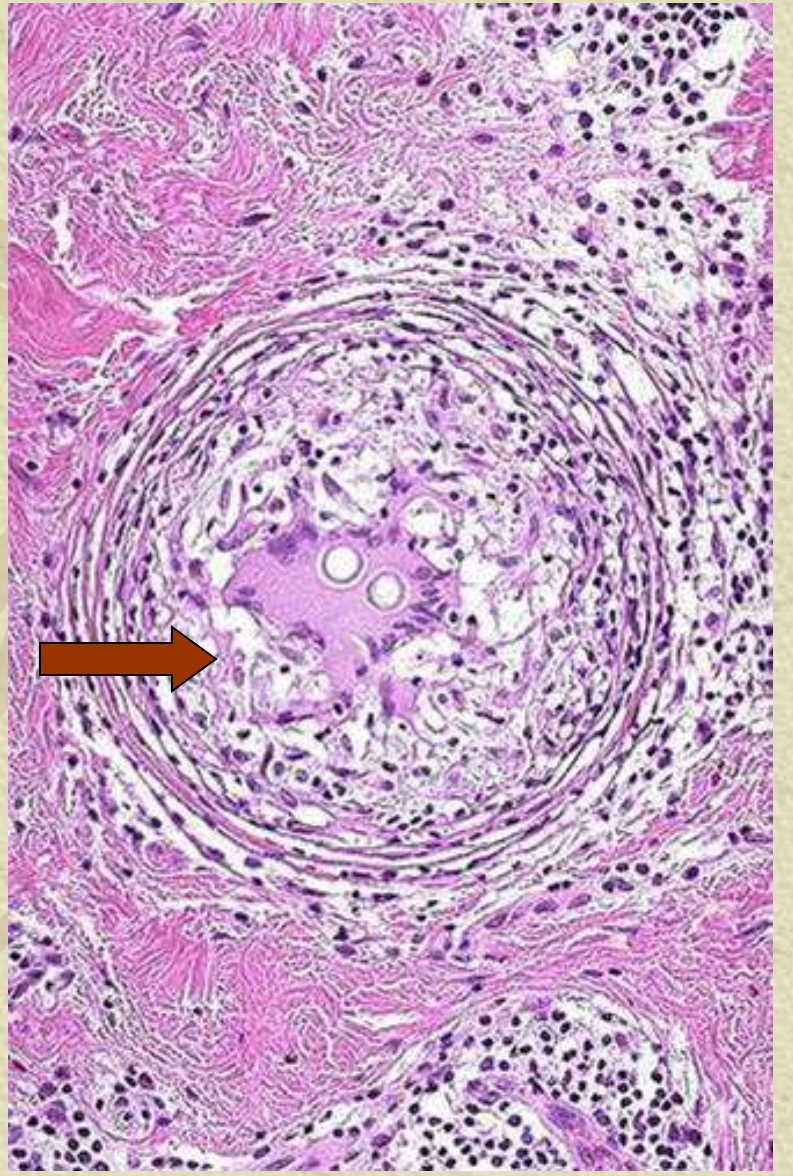
PPD result after – 72 hours.





*Granuloma or giant cell is **not** pathagnomonic of TB…*

- Foreign body granuloma.
- Fat necrosis.
- Fungal infections.
- Sarcoidosis.
- Crohns disease.



Conclusions:

- Chronic, Mycobacterial, infection - Weight loss, fever, night sweats, lung damage.
- Commonest fatal infection in the world.
- CXR - apical lesions.
- AIDS, Diabetes, malnutrition & crowding.
- Two forms Primary, Secondary
- Pulmonary, extrapulmonary, miliary.
- Multi drug to prevent selection of resistance

"Troubles are often the tools by which God fashions us for better things." Exams…!

- Henry Ward Beecher