

MICROBIOLOGY

BACTERIOLOGY

LECTURE (1)

هذي سلايدات مضاف عليها نوتس التيم ...
تعتبر شاملة لكل شئ سواء من أضافة الكتاب او أضافات الدكتور في المحاضرة

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Tuberculosis

Pathogenesis Epidemiology

Micro
team :

Remember:

- Mycobacteria are long, slender, rods that are nonmotile and do not form spores with lipid-rich cell walls that are resistant to penetration by chemical dyes, such as those used in the Gram stain.
- Mycobacterial infections are intracellular and generally result in the formation of slow-growing granulomatous lesions that are responsible for major tissue destruction.
- Mycobacteria are strictly aerobic.
- Mycobacteria are resistant to drying, but not to heat or ultra-violet irradiation.

Epidemiology

- About nine million new cases of TB, and nearly two million deaths from TB, are estimated to occur around the world every year. TB is the leading cause of death among curable infectious diseases
- TB usually causes disease in the lungs (pulmonary), but can also affect other parts of the body (extra-pulmonary). Only the pulmonary form of TB disease is infectious. Transmission occurs through coughing of infectious droplets, and usually requires prolonged close contact with an infectious case. TB is curable with a combination of specific antibiotics, but treatment must be continued for at least six months.

TRANSMISSION

TB is spread from **person to person** through the **air**. When a person with infectious TB disease (TB that can be spread) coughs or sneezes, tiny particles containing *M. tuberculosis* *may be expelled into the* air. These particles, called **droplet nuclei**, are about 1 to 5 microns in diameter — less than 1/5000 of an inch. Droplet nuclei can remain suspended in the air for several hours, depending on the environment.

Transmission


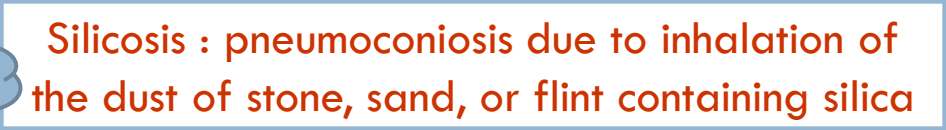
- expelled bacilli into the air once inhaled by a tuberculin free person, the bacilli multiply 4 -6 weeks and spreads throughout the body. The bacilli implant in areas of high partial pressure of Oxygen:
- lung
- renal cortex
- reticuloendothelial system

Risk Factors for TB Infection and TB Disease

□ HIV/AIDS

HIV and AIDS, which weaken the immune system, are the most important risk factors for TB infection and TB disease. A person who has TB infection and HIV or AIDS is 50-170 times more likely to develop TB disease than someone who does not have HIV. For this reason, all individuals who have HIV should be assessed for TB. Conversely, anyone with TB infection or disease should be tested for HIV for the following reasons

Other Risk Factors for TB Disease

- ☐ organ transplants (because the patient is treated with immunity-suppressing drugs);
- ☐ a type of lung disease called silicosis;
 
- ☐ chronic kidney failure requiring dialysis.
- ☐ cancer of the head and neck.
- ☐ having been infected with TB bacteria within the past two years.
- ☐ a chest x-ray showing signs of old TB.
- ☐ treatment with steroids known as glucocorticoids.
- ☐ treatment with tumour necrosis factor (TNF)-alpha inhibitors (e.g., for auto-immune disorders such as rheumatoid arthritis).
- ☐ diabetes mellitus (all types).
- ☐ being underweight (for most people, this is a body mass index under 20).
- ☐ being under five years of age when first infected with the TB bacteria.
- ☐ cigarette smoking (one pack per day or more).

Other Risk Factors for TB Infection

- ❑ In addition to persons with HIV or AIDS, certain population groups have an increased risk of TB infection. These groups include:
- ❑ those who have come into close contact with individuals with known or suspected active TB (e.g., family members sharing living spaces);
- ❑ people with a history of active TB or an x-ray suggesting they had TB in the past but did not receive adequate treatment;
- ❑ people living in communities with high rates of TB infection or disease;
- ❑ the poor, especially the urban homeless; and
- ❑ residents of long-term care and correctional facilities.

Pathogenesis

There are two major patterns of disease with TB:

- 1- Primary tuberculosis: seen as an initial infection, usually in children. The initial focus of infection is a small subpleural granuloma accompanied by granulomatous hilar lymph node infection. Together, these make up the Ghon complex. In nearly all cases, these granulomas resolve and there is no further spread of the infection.
- 2- Secondary tuberculosis: seen mostly in adults as a reactivation of previous infection (or reinfection), particularly when health status declines. The granulomatous inflammation is much more florid and widespread. Typically, the upper lung lobes are most affected, and cavitation can occur.

Pathogenesis

primary infection.

- The patient will heal and a scar will appear in the infected loci. There will also be a few viable bacilli/spores may remain in these areas (particularly in the lung). The bacteria at this time goes into a dormant state, as long as the person's immune system remains active and functions normally this person isn't bothered by the dormant bacillus.
- When a person's immune system is depressed., a secondary reactivation occurs. 85-90% of the cases seen which are of secondary reactivation type occurs in the lungs.

Pathogenesis

- When resistance to infection is particularly poor, a "miliary" pattern of spread can occur in which there are a myriad of small millet seed (1-3 mm) sized granulomas, either in lung or in other organs.

Secondary TB




Latent TB

Preventing Latent TB Infection from Progressing to TB Disease

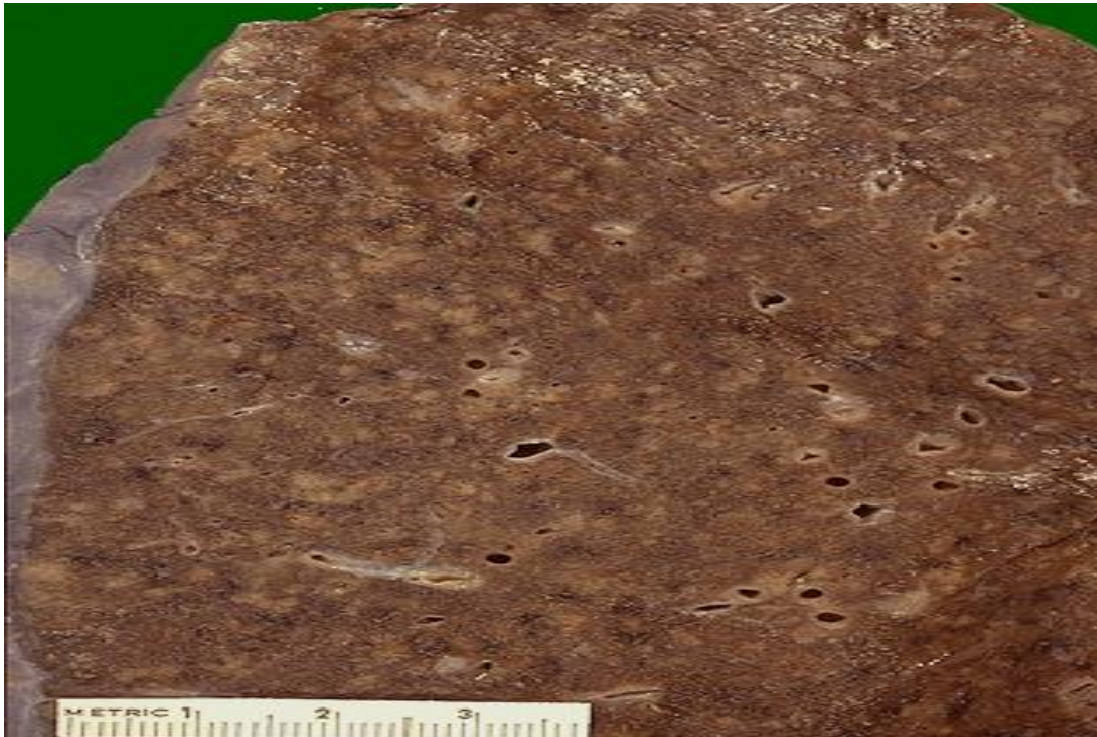
- ☐ People with HIV infection
- ☐ People who became infected with TB bacteria in the last 2 years
- ☐ Babies and young children
- ☐ People who inject illegal drugs
- ☐ People who are sick with other diseases that weaken the immune system
- ☐ Elderly people
- ☐ People who were not treated correctly for TB in the past

- ☐ INH for 9 months is the preferred regimen

Extra-pulmonary TB

- ❑ **Skeletal Tuberculosis:** TB osteomyelitis involves mainly the thoracic and lumbar vertebrae (known as Pott's disease) followed by knee and hip.
- ❑ **Genital Tract Tuberculosis:**
- ❑ **Urinary Tract Tuberculosis:**
- ❑ **CNS Tuberculosis**
- ❑ **Gastrointestinal Tuberculosis**
- ❑ **Adrenal Tuberculosis**
- ❑ **Scrofula:**  Old name for the tuberculous cervical lymphadenitis
- ❑ **Cardiac Tuberculosis:** The pericardium is the usual site for tuberculous infection of heart.

Miliary TB



Diagnosis of TB disease

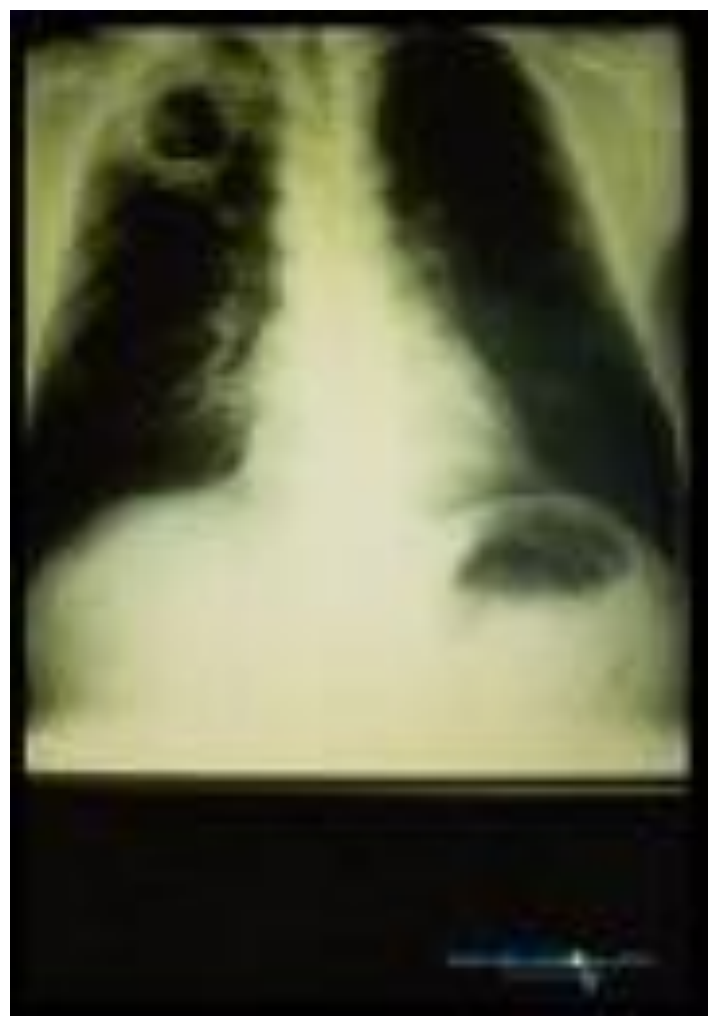
Persons suspected of having TB disease should be referred for a medical evaluation, which should include a

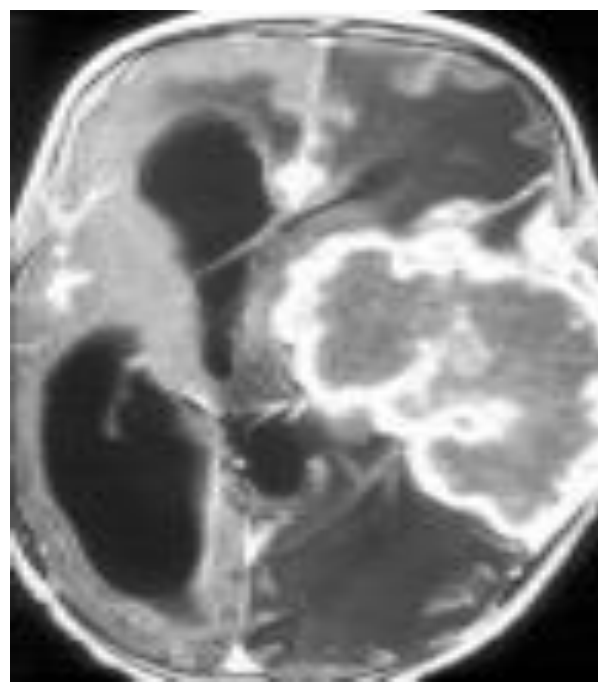
- Medical history (TB exposure).
- Physical examination.
- Test for TB infection (TB skin test or **QuantiFERON**)
- Chest radiograph (X-ray) (posterior-anterior chest radiograph)
- Bacteriologic or histologic examinations (sputum culture).



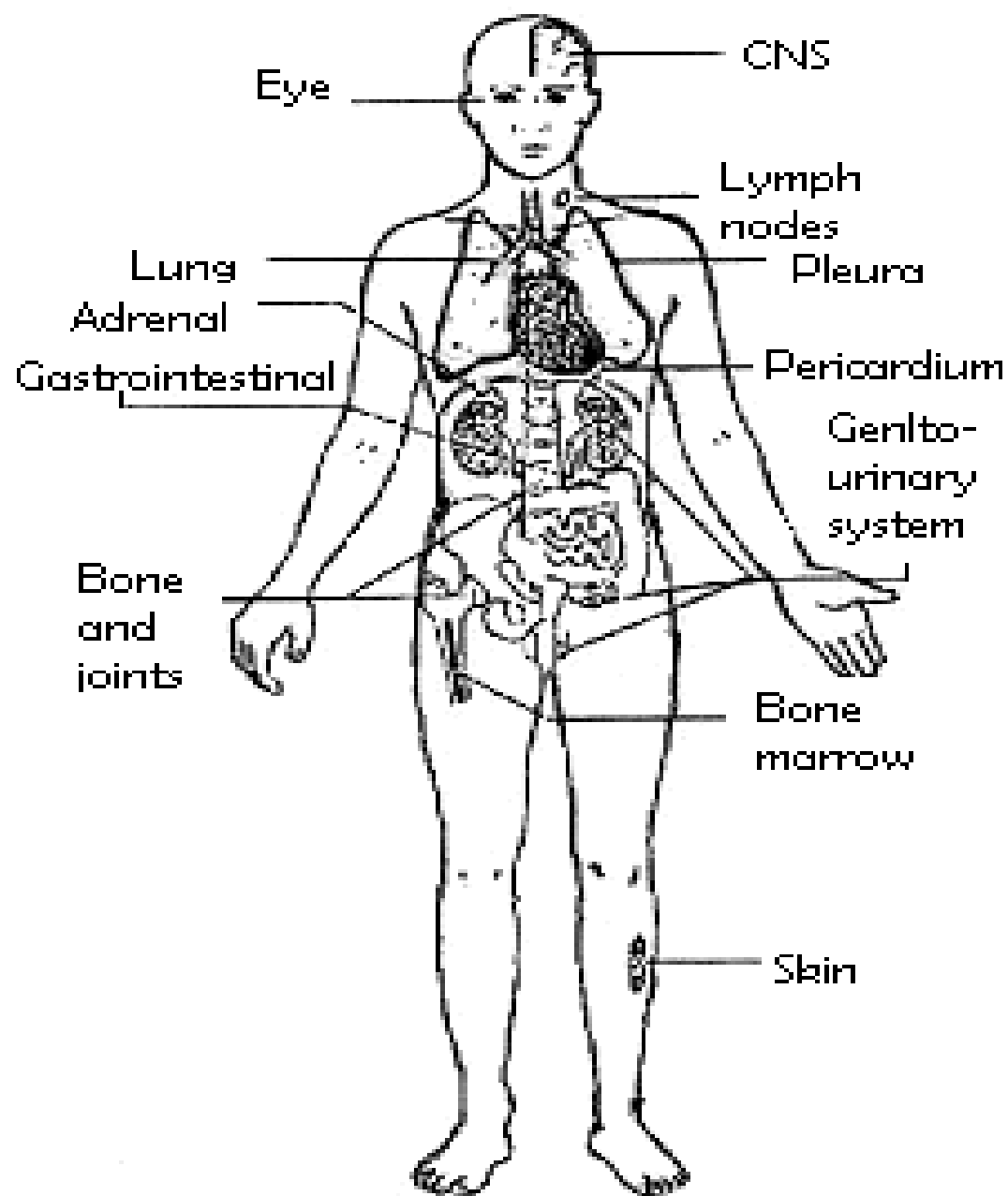
3 in the early lung







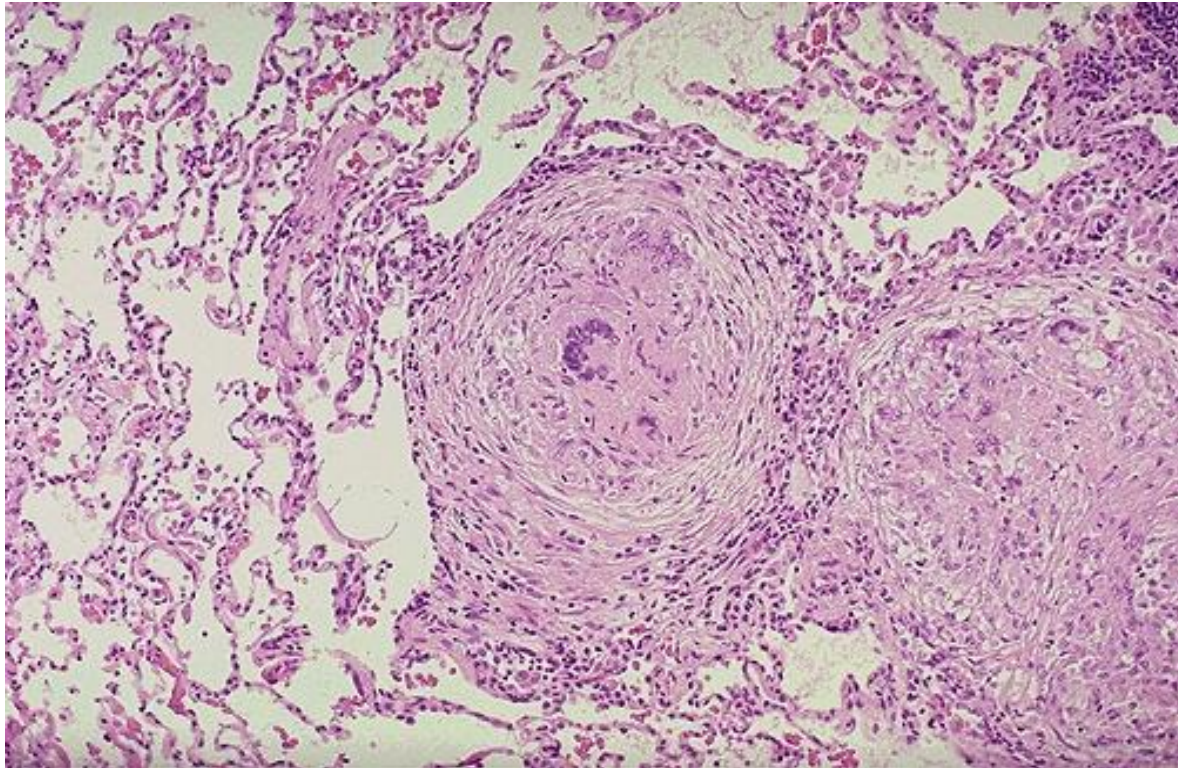




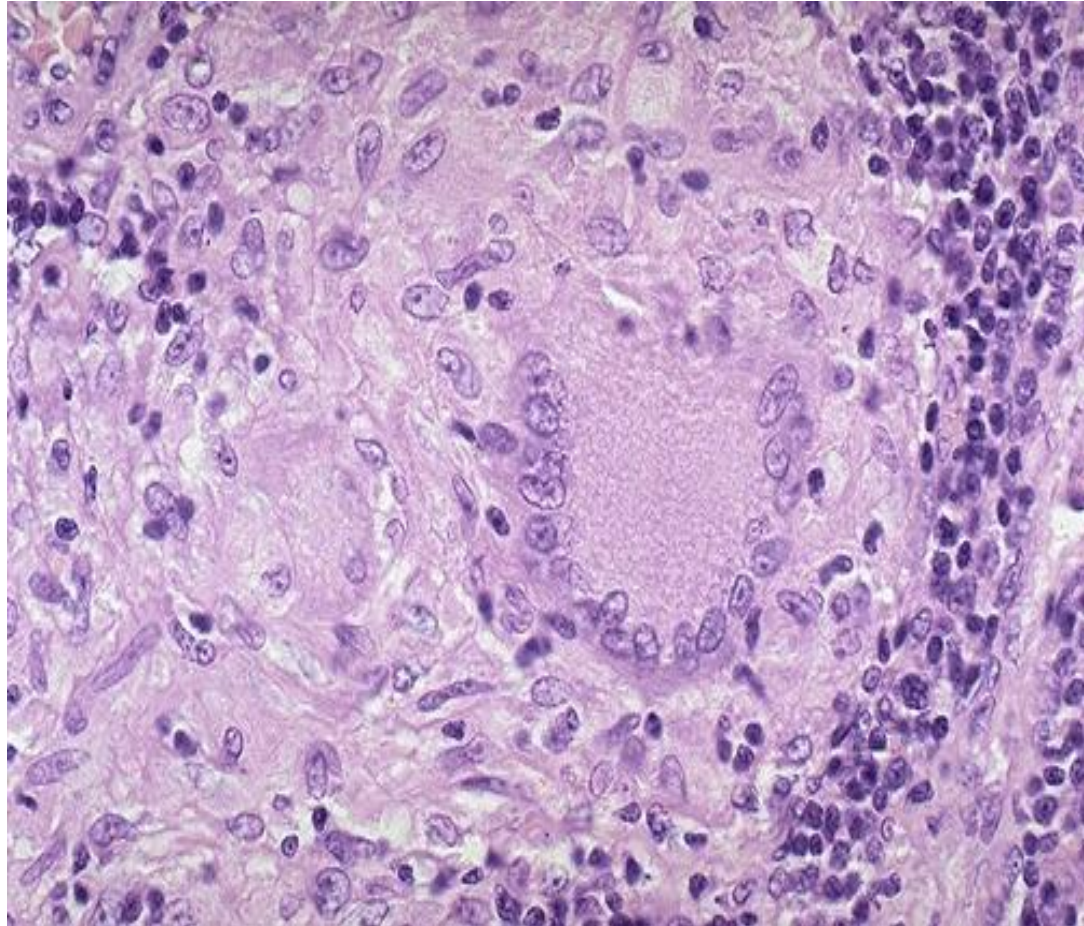
Signs and symptoms

- ☐ Signs & Symptoms of Active TB
- ☐ Infection
- ☐ - Cough for greater than 3 weeks
- ☐ - Weight loss
- ☐ - Coughing up blood
- ☐ - Fever and/or night sweats
- ☐ - Anorexia
- ☐ Patients with the above symptoms and/or patients who have orders for sputum
- ☐ for AFB must be started on Airborne Isolation immediately. (Patient should
- ☐ wear surgical mask until placed in an isolation room with negative air pressure.

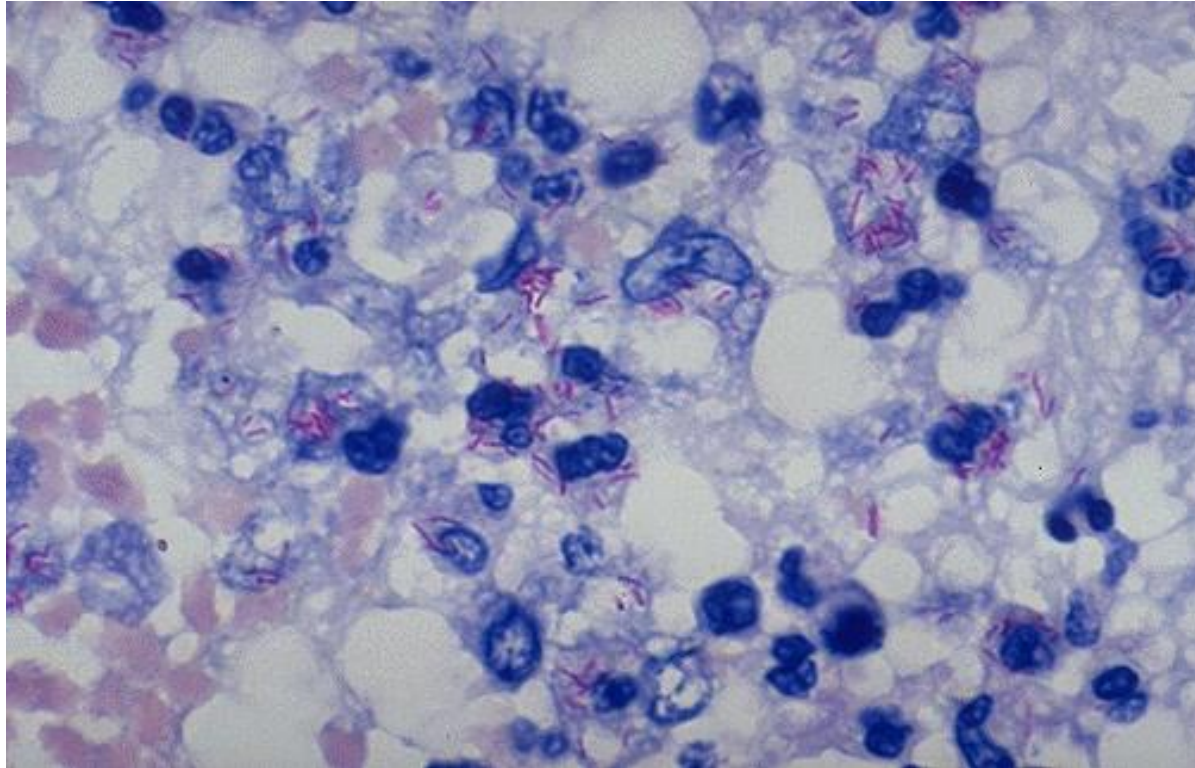
Granuloma

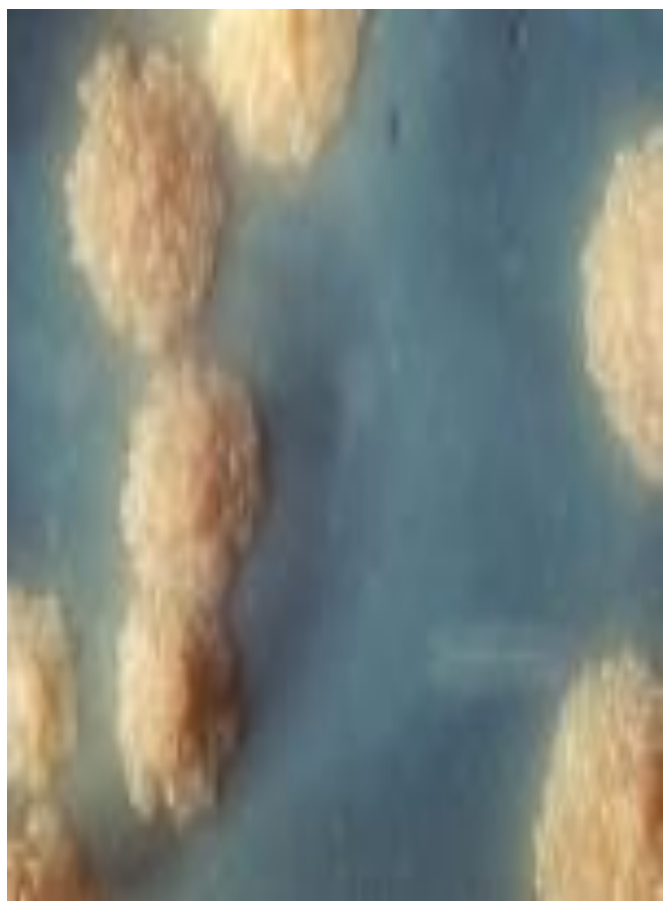


Giant cells

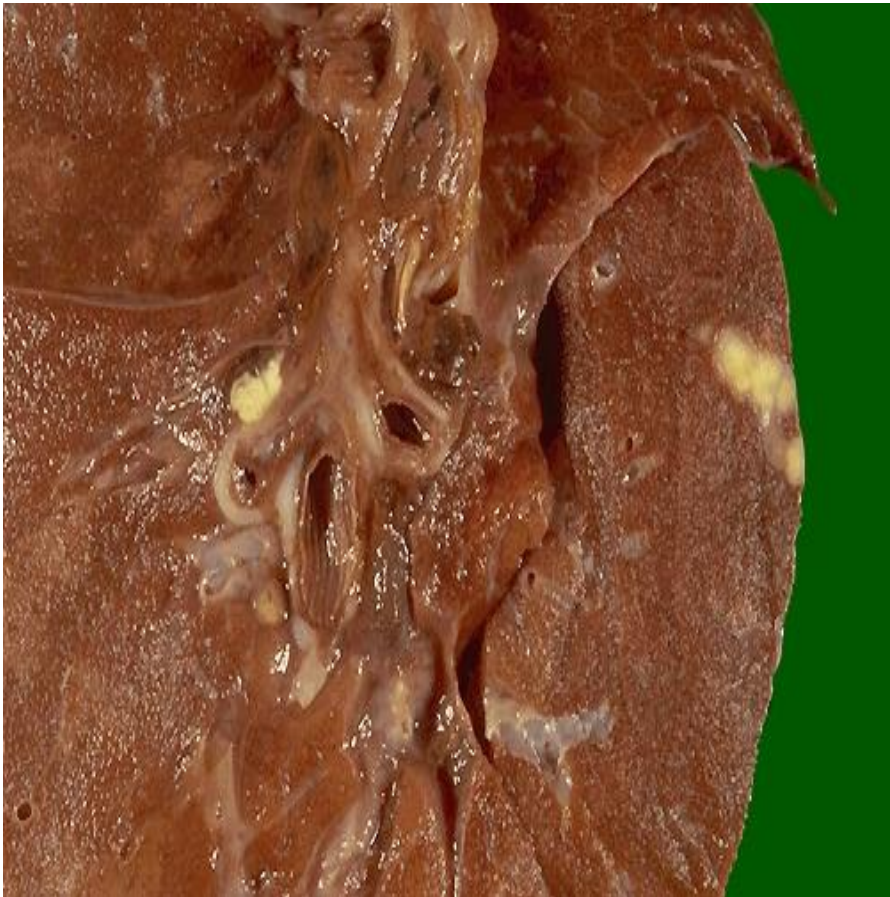


AFB in histopathology specimen





On closer inspection, caseous tan necrotic tissue is seen to constitute the granulomas in this gross appearance of a Ghon complex. Most patients with primary tuberculosis are asymptomatic, and the granulomas resolve.



Skin test

□ Tuberculin Skin Testing

- Skin testing for tuberculosis is useful in countries where the incidence of tuberculosis is low, and the health care system works well to detect and treat new cases. In countries where BCG vaccination has been widely used, the TB skin test is not useful, because persons vaccinated with BCG will have a positive skin test.
- The TB skin test is based upon the type 4 hypersensitivity reaction
- **TST does not tell whether or not the person has progressed to TB disease.**

TST interpretation

False-Positive Reactions:

Some persons may react to the TST even though they are not infected with *M. tuberculosis*.

- ☐ Infection with nontuberculosis mycobacteria
- ☐ Previous BCG vaccination
- ☐ Incorrect method of TST administration
- ☐ Incorrect interpretation of reaction
- ☐ Incorrect bottle of antigen used

TST interpretation

False-Negative Reactions

Some persons may not react to the TST even though they are infected with *M. tuberculosis*.

- ☐ Cutaneous anergy (anergy is the inability to react to skin tests because of a weakened immune system)
- ☐ Recent TB infection (within 8-10 weeks of exposure)
- ☐ Very old TB infection (many years)
- ☐ Very young age (less than 6 months old)
- ☐ Recent live-virus vaccination (e.g., measles and smallpox)
- ☐ Overwhelming TB disease
- ☐ Some viral illnesses (e.g., measles and chicken pox)
- ☐ Incorrect method of TST administration
- ☐ Incorrect interpretation of reaction

PPD test

Within 48 to 72 hours, a positive TB skin test is marked by an area of reddish induration greater than 10 mm.



QuantiFERON

- **TB Blood Tests.** Blood tests to detect TB infection, unlike the TST, are not affected by prior BCG vaccination and are less likely to give a false-positive result.
- is a whole-blood test for use as an aid in diagnosing *Mycobacterium tuberculosis* infection, including latent tuberculosis infection (LTBI) and tuberculosis (TB) disease. This test was approved by the U.S. Food and Drug Administration (FDA) in 2005.
- After incubation of the blood with antigens for 16 to 24 hours, the amount of interferon-gamma (IFN-gamma) is measured.

Diagnosis

Diagnostic Microbiology

- The presence of acid-fast-bacilli (AFB) on a **sputum smear** or other specimen often indicates TB disease. Acid-fast microscopy does not confirm a diagnosis of TB because some acid-fast-bacilli Atypical. Therefore, a **culture** is done on all initial samples to confirm the diagnosis. A positive culture for *M. tuberculosis* confirms the diagnosis of TB disease. Culture examinations should be completed on all specimens, regardless of AFB smear results. Laboratories should report positive results on smears and cultures within 24 hours by telephone or fax to the primary health care provider or local TB control program.

Diagnosis

☐ **Isolation of mycobacteria**

- ☐ Mycobacteria should be isolated by rapid automated liquid culture and by conventional solid culture
- ☐ Identification is based on macroscopic and microscopic appearances, growth, biochemical characteristics and drug resistance.
- ☐ Drug susceptibility testing has three main goals:
 - To facilitate the management of individual patients, particularly if drug resistance is likely.
 - To provide data on which to plan drug combinations for treatment.
 - To provide a surrogate measure of the relative effectiveness of tuberculosis control programmes .

Prevention and control

- Proper Isolation
- - For suspected or confirmed tuberculosis the proper
- isolation is Airborne Isolation in a private room
- (Example of Airborne Isolation Sign with
- Instructions - sign has white lettering on a red
- background)

Prevention and control



- ☐ prompt detection
- ☐ airborne precautions
- ☐ treatment of persons who have suspected or confirmed
TB disease

Vaccine and immunization

- BCG or bacille Calmette-Guerin is a vaccine for tuberculosis (TB) disease. BCG is used in many countries with a high prevalence of TB to prevent childhood tuberculous meningitis and miliary disease.

- **Health Care Workers**

- Contraindications**

- **Immunosuppression.** BCG vaccination should not be given to persons who are immunosuppressed (e.g., HIV infected) or who are likely to become immunocompromised (e.g., candidates for organ transplant).
- **Pregnancy**