

# Lecture 1



## Tuberculosis

- Additional Notes
- Important
- Explanation
- Examples

# OBJECTIVES

- Know about TB
- Know about TB Pathogenesis
- Differentiate between Primary and Secondary TB
- Know about tuberculin skin test
- Know about TB treatment
- Know about TB prevention

# Tuberculosis

- TB is an ancient, chronic disease that affects all age groups of humans
- It is caused by *Mycobacterium tuberculosis complex*
- It is a major cause of death worldwide
- Most common affected organ are **lungs**
- It may be fatal in untreated cases
- It is more common in developing countries
- Pulmonary TB is mainly transmitted by **inhalation of airborne droplet**
  
- Mycobacteria characteristics:
  - ✓ Slim, rod shaped, non-motile, do not form spores and slowly growing
  - ✓ Stained by **Ziehl-Neelsen** stain **NOT** gram stain<sup>(1)</sup>
  - ✓ It is also called Acid Fast Bacilli
  - ✓ Immune response: Cell-mediated immunity with Delayed hypersensitivity reaction
  - ✓ Diagnosis: Tuberculin skin test

<sup>(1)</sup>Due to it's high concentration of Mycolic acid

- Mycobacterium tuberculosis complex:
  - ✓ M.tuberculosis “Human type”
  - ✓ M.bovis “Bovine type”
  - ✓ M.africanum
  - ✓ BCG strains “From vaccines”
- All are called Mycobacterium tuberculosis complex and cause tuberculosis TB.
- Pathogenesis of Tuberculosis:
  - ✓ It is acquired by airborne droplet reaches to the alveolar macrophages.
  - ✓ Granuloma formed, organism lives in dormant state “latent tuberculosis infection”
  - ✓ Patient show delayed CMI
  - ✓ Disease results due to destructive effect of CMI
  - ✓ Disease is divided into:
    - ✓ Primary
    - ✓ secondary

## PRIMARY TUBERCULOSIS

- Occurs in patients **not previously infected**.
- Occurs by inhalation of bacilli.
- Produce **Ghon focus** at the **periphery of mid zone of lungs**.
- Microscope: swabs must show **granuloma**.
- Clinically: Not infectious, Asymptomatic or minor illness.
- It may spread to other organs, which will be known as **Non-pulmonary TB**:
  - ✓ TB of lymph nodes
  - ✓ TB meningitis
  - ✓ TB of bone & joint
  - ✓ Genitourinary TB
  - ✓ Miliary TB "fatal disease"
- Soft tissue: lack of inflammation with caseation <sup>(1)</sup> .

## SECONDARY TUBERCULOSIS

- Occurs in **immunocompromised patients**.
- Occurs later in life.
- **Lesion** localized in **apices**. "right upper lobe"
- Microscope: large area of caseous necrosis, cavity with **granuloma** and caseation <sup>(1)</sup>.
- Clinically: Infectious & symptomatic "fever, cough, hemoptysis<sup>(2)</sup>, weight loss & weakness.
- Source:
  - ✓ Endogenous "reactivation of an old TB"
  - ✓ Exogenous "re-infection in a previously sensitized patient who has previous infection with the organism"

<sup>(1)</sup>Due to delayed hypersensitivity reaction. Contains many bacilli, enzymes, O<sub>2</sub>

<sup>(2)</sup>Blood in sputum

# Tuberculin skin test

- Uses **purified protein derivative** “PPD”
- It activates synthesized lymphocytes to produce CMI which appears as skin induration.
- It won't distinguish between active and past infection.
- Low level activity induced by environmental mycobacteria & previous vaccination.
- It is applied intradermal.
- It must be read after 48-72 hours.
- Methods of tuberculin skin test:
  - ✓ Mantoux test
  - ✓ Heaf test “screening”

- Positive tuberculin skin test:

More than 5mm induration:

- ✓ Recent contact with active TB
- ✓ HIV or high risk for HIV
- ✓ Chest X-ray consistent with healed TB

More than 10mm induration:

- ✓ IV drugs user, HIV seronegative<sup>(1)</sup> patients.
- ✓ Medical conditions e.g. diabetes, malignancy
- ✓ Residents & employee at high risk
- ✓ Mycobacteriology lab personnel.

More than 15mm induration:

- ✓ Any person including those with no risk factors of TB

- Negative tuberculin skin test:

No induration due to:

- ✓ No previous infection
- ✓ Pre-hypersensitivity stage
- ✓ Lost TB sensitivity with loss of Ag<sup>(2)</sup>

- **AIDS patients** are anergic and susceptible to infection.

(1) Patients that shows negative results however they carry HIV.

(2) Loss of Ag doesn't mean that they don't have TB it may show negative because of the wrong response.

# Laboratory diagnosis of TB

- Specimens:
  - ✓ Pulmonary TB: three early morning sputum<sup>(1)</sup> .
  - ✓ TB meningitis: Cerebrospinal fluid “CSF”
  - ✓ Genitourinary TB: three early urine<sup>(1)</sup> .
  - ✓ TB of joint & bone: joint, bone aspirate
  - ✓ TB of lymph nodes: pus or tissues **NOT** swab.
- Microscope of specimen:
  - ✓ Z-N stain
- Culture:
  - ✓ Gold standard test for identification and sensitivity
- Media:
  - ✓ Lowenstein-Jensen media “LJ” <sup>(2)</sup>
- Measurement of interferon gamma has a specific significance than tuberculin skin test in patients previously exposed to disease.
- PCR: molecular test directly from CSF.

<sup>(1)</sup>Because bacteria in the early morning sputum and urine is in large numbers.

<sup>(2)</sup>Other medias are used to speed up the growth.



# Management, treatment and prevention

- Management of TB case:
  - ✓ Isolation for 10-14 days “because patient is highly infectious”
  - ✓ Treatment must be guided by sensitivity testing
- Treatment of TB:
  - ✓ First line treatment:
    - Isoniazide “INH” + Rifampicin “RIF” + Pyrazinamide for 2 months then continue with INH + RIF for 4-6 months
    - Directly observed therapy “DOT”
  - ✓ Multidrug resistant TB is resistance to INH & RIF
  - ✓ Second line treatment:
    - Used if the bacteria was resistant to first line drugs. It is more toxic than the first line drugs.
    - PASA, Ethionamide, Cycloserine, Kanamycin, Fluoroquinolones.
- Prevention of TB:
  - ✓ Tuberculin test
  - ✓ Slaughter of infected animals and pasteurization of milk to prevent bovine TB
  - ✓ Immunization with BCG to all new born

# Quiz

1. What is the cause of tuberculosis:

- a. Mycobacterium tuberculosis complex    b. Neisseria Gonorrhoea    c. S.aureus

2. Mycobacterium tuberculosis complex is:

- a. Contact transmission    b. Airborne transmission

3. All of the following are characteristics of Primary TB except:

- a. Non-pulmonary    b. Lesions of Granuloma    c. Symptomatic

4. Tuberculin skin test takes 2-3 days to react:

- a. T    b. F

5. Tuberculin skin test is administered:

- a. Intravenous    b. Subcutaneous    c. Intradermal