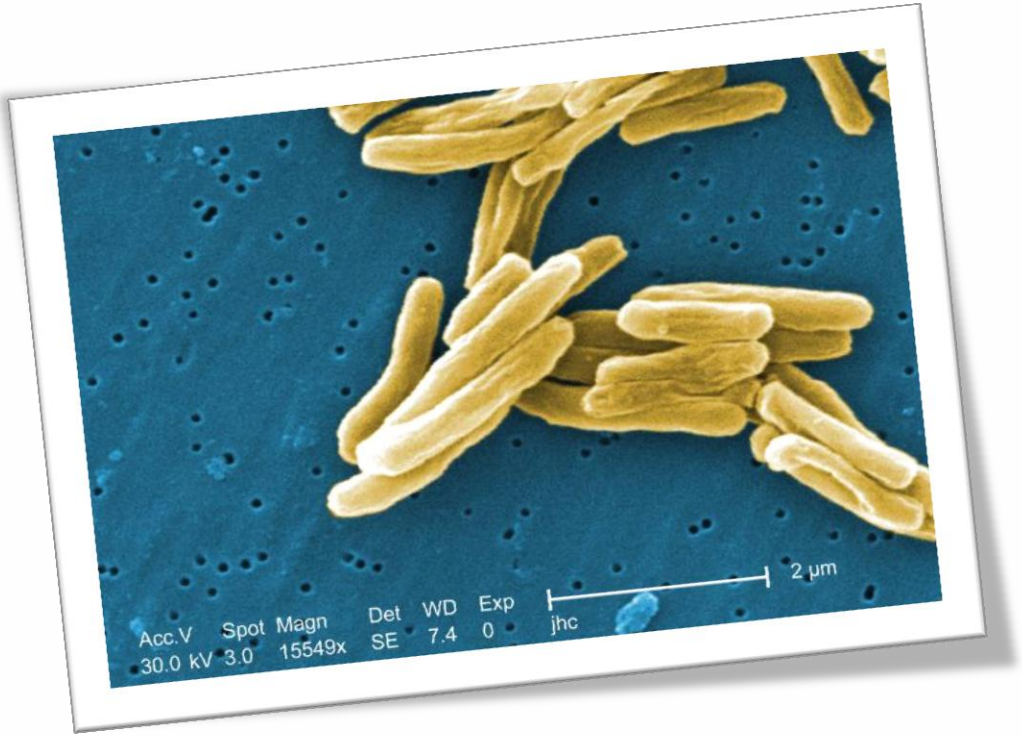
Microbiology
TEAM 432

Lecture (2)

Tuberculosis

Objectives

Were not given



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Mind map
(Tuberculosis)

Types

- TB meningitis
- TB of lymph nodes
- genitourinary
- TB bone & joint
- military
- Pulmonary

Etiology

mycobacterium complex

- M.tuberculosis
- M. bovis
- M. Africanum
- BCG strains

Tuberculosis

Tuberculosis a chronic disease affects humans, caused by Mycobacterium tuberculosis complex. Usually affects the lungs.

1) Epidemiology :

* TB affects a large number of people at latent dormant stage
* common in developing countries (especially if coupled with HIV)
* affects all age groups
* mild or dormant TB usually infect children
*transmission by airborne droplet
* pulmonary TB is transmitted by inhalation mainly.

Characteristics of Mycobacteria

The genus that causes TB

Properties	
Structural	Slim, rod shape , non motile. Has a mycolic acid -lipid layer- covers piptidoglycan
Proliferation & developing	has no spores, slowly growing , strict aerobe (cant divide without O2), multiply intracellular.
Staining	Not stained by gram stain due to (mycolic acid). it could be confirmed by another type of staining called Z-N stain (Ziehl-Neelsen)
Immune response	Cell mediated immunity instead of antigen-antibody ➔ delayed hypersensitivity reaction

mycobacterium TB complex:

1- ***M.tuberculosis*** **(most common)**

2- ***M. bovis***

3- ***M. Africanum***

4- ***BCG strains***

Pathogenesis of TB

1) transmission: by airborne droplet

2) targeting: alveolar macrophage, it survive there for a long time (forming a virulence factor = leading to viral infection)

3) immune response: it doesn't kill the bacterium, but delays it's multiplication, disease results due to destructive effect of CMI .

4) type of inflammation: granuloma

* usually indicates TB in dormant state *

TB stage : **primary** **secondary**

Primary Tuberculosis

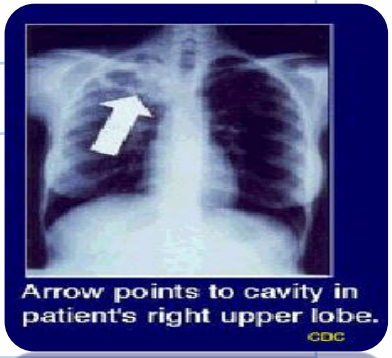
1) **Patient:** has no previous infection
2) **Pathogenesis:** Inhalation of bacilli => Phagocytosis => lymph nodes calcify to produce GHON focus (Primary Complex).
3) **microscopy:** shows Granuloma
4) **clinically:** asymptamatic
5) might affect other sites, by spreading from the lung which is called:

non pulmonary TB

- **TB of lymph nodes** (affect children usually cervical, mesenteric).
- **TB meningitis** (pediatric)
- **TB bone & joint**
- **genitourinary**
- **military:** over the whole body by blood vessels
  leads to: affection of soft tissue, where the patient will have cold abscess.

Secondary Tuberculosis

Common site	Lung	
Microscopy	Bacilli are seen, large area of caseous necrosis The cavity (if it was open TB) will present with granuloma and caseation	
Clinically	fever, cough, hemoptysis ,weight loss & weakness.	
Source of the disease	Endogenous	reactivation of an old TB
	Exogenous	re-infection in patient who has previous infection with the organism
Infectious	√	
symptomatic	√	
notes	▪The lesion is usually localized in apices of the lung. ▪Occur late in life. ▪Mostly seen in immunocompromised patients.	



Note:
Open TB means that the disease at this stage is infectious

Immunity to tuberculosis

- Cell-mediated immunity associated with delayed hypersensitivity reaction.
- Detected by **tuberculin skin test**.

+ive Tuberculin Skin Test

Tuberculin Skin Test

A test that reacts with tuberculin (Tuberculin is an extract of any of the mycobacterium TB complex). It takes 2-10 weeks to become positive.

- Activity of the disease is expressed by "Tuberculin unit". (which will be detected)
- Activates synthesized lymphocytes to produce cell mediated immunity which appear as skin induration.
- May not distinguish between active and past infection.
- Low level activity induced by environmental mycobacteria , previous
- Vaccination

Methods of Tuberculin Skin Test	
Mantoux test	Heaf test

The results of tuberculin Skin Test

+ve Tuberculin Skin Test			-ve Tuberculin Skin Test
induration	>5mm	It means either: 1) Recent contact with active TB. 2) HIV or high risk for HIV	No induration due to: • No previous infection • Pre-hypersensitivity stage • Lost TB sensitivity with loss of Ag.
	> 10mm	1) IV drugs user, HIV seronegative patient. 2) Medical conditions eg. diabetes , 3) Children < 4yrs or exposed to adult high risk group. 4) Mycobacteriology lab. personnel. 5) malignancy	
	>15 mm	any persons including those with no risk factors for TB	

Laboratory diagnosis of TB

Specimens	Direct microscopy of specimen	Culture
We take sample NOT swab Pulmonary TB: 3 early morning sputum sample "Repeat the sample if needed" PCR: molecular test directly from specimen (CSF)	Z-N or (Auramine) stain	Culture is a gold standard Media used: Lowenstein-Jensen media (L J) or plus L J media.

- Colonies appear in L J media after 2-8 weeks (growth is enhanced by glycerol (if it was *MTB*) or by pyruvate (if it was *M.bovis*)).
- **other diagnostic methods:** MGIT (mycobacteria growth indicator test)
- Measurement of IF-γ secreted from sensitized in a patient previously exposed to disease. Has a specific significance than tuberculin skin test.

Identification of the TB:

1) Biochemical tests : Niacin production & Nitrate test.
2) Sensitivity testing

Management and Treatment

- Isolation for 10-14 days (for smear positive cases “infectious cases”.
- Triple regimen of therapy. **Why?**
  - To prevent resistant mutants
  - To cover strains located at different sites of the lung.
  - To prevent relapse
- Treatment must be guided by sensitivity testing.

First Line Treatment	Second Line Treatment
• Isoniazide (INH) • Rifampicin (RIF) • Pyrazinamide (P)	Used if the bacteria was resistant to first line drugs. More toxic than the first line drugs
INH+ RIF +P for 2 months then continue with INH+RIF for 4-6 months. Multidrug resistant TB is resistance to INH & RIF. Note: it should be: Directly Observed Therapy (DOT).	

Questions

1) Mycobacterium has high levels of mycolic acid in the cell wall which is highly stained (F)
2) Mycobacterium is a rapid growing organism (F)
3) Microscopy of primary TB lesion would show granuloma (T)
4) Secondray TB is asymptomatic (F)
5) The immunity to tuberculosis can be detected by tuberculin skin test (T)
6) Previous vaccination will increase the activity to tuberculin skin test (F)
7) For diagnosing TB, we take a swab (F)
8) Tuberculin skin test has specific signification for TB more than MGIT(F)
9) As a first line treatment we use Isoniazide, Rifampicin for only 2 months (F)
10) The BCG is a vaccine given to the new borns to prevent TB (T)