
PASSION ACADEMIC TEAM

YU - MEDICINE

# Sheet# 6 - MICROBIOLOGY

## Lec. Date :

## Lec. Title : Mycobacterium Tuberculosis

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# RESPIRATORY SYSTEM

# *Mycobacterium tuberculosis*

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# *Mycobacterium tuberculosis*

Causative agent of tuberculosis (TB)

Chronic infection of lower respiratory tract

First largest infectious disease killer in the world 1.18 million new cases a year in the world (2017).

# Mycobacterium tuberculosis

Gram-positive bacilli; acid-fast; obligate aerobes; non-capsulated; non-motile; grow slowly on specialised media; cell walls have high lipid content.

لما نعمل culture لـ M.tuberculosis بدنا نكون طويلين روح ،، بدنا نستنى 3weeks لحتى نتأكد اذا فيه growth .

# *Tuberculosis*

Active TB infection begins when the mycobacteria reach the pulmonary  alveoli,

The primary site of infection in the lungs is called the Gohn focus

اهم اشي بميز ال TB .

What's the difference between carrier and latent M.tuberculosis ?
Carrier : No symptoms + can transmit the disease
Latent : No symptoms + can NOT transmit the disease .

Some tuberculin test show positive result for people who having TB some time .
يعني هاد الاختبار ببين انه الشخص عندو TB بس لانه كان مره معاه وهلا بكون latent ..
ف مش دقيق كتير ،، ف بستخدم Xray

بالـ Xray بشوف Gohn complex وبعتمد على وجود granuloma و Caseous

Further spread is through the bloodstream to other tissues and organs where secondary TB lesions can develop in other parts of the lung (particularly the apex of the upper lobes), peripheral lymph nodes, kidneys, brain, and bone Joints And to any area which the bloodstream reaches

# Classification

Clinical TB is divided into:

1. Primary tuberculosis In alveoli
2. Secondary tuberculosis Other parts of the lung
3. Disseminated tuberculosis Other organs and tissue

# Epidemiology

M. tuberculosis

Commonly called the tubercle bacillus (primary host humans), is the usual causative agent for tuberculosis (TB).

1. One-third of the world's population is infected with M. tuberculosis.

2. Increase in incidence is related to poverty, population displacement, HIV and drug resistance, mostly in Asia and Africa. خاصة دول العالم الثالث

معظم حالات الـ TB مرتبطه بالـ AIDS تقريبًا ٢٠٪
ليش؟ " ال AIDS يعني نقصان بال CD 4 وهي هاي المعيار لو قلت عن حد معين معناها المريض ما بقدر يقام ال TB .

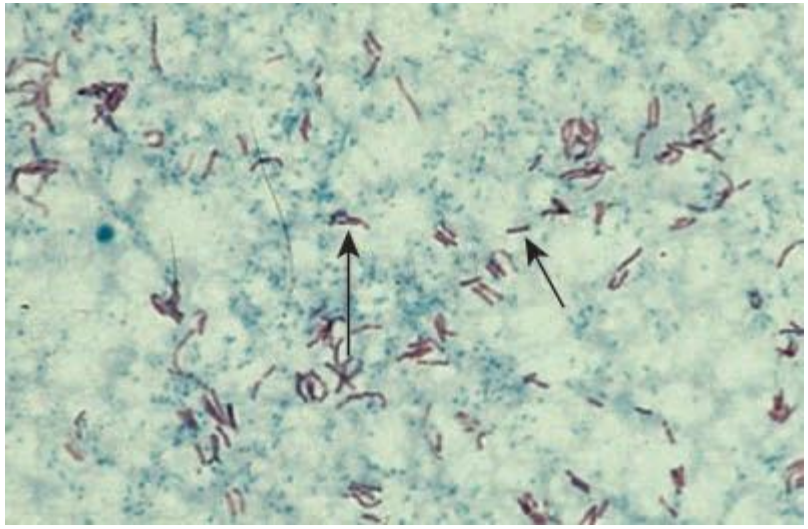
3. M. tuberculosis infections are spread usually by inhalation of 'droplet nuclei'

The difference between droplets and aerosols is the weight ..
Areosles : can spread to meters
Droplets : can spread to less than 1 meter , need face to face interaction to spread between people.

4. Incubation period is 4–16 weeks. TB is highly infectious and outbreaks may occur.

TB can live in harsh environments because of mycolic acid in there wall .

5. Mycobacteria are able to survive for long periods in the environment, because they withstand drying.



Ziehl-Neelsen stain of Mycobacterium tuberculosis (stained red, arrowed). Acid-fast slender rods

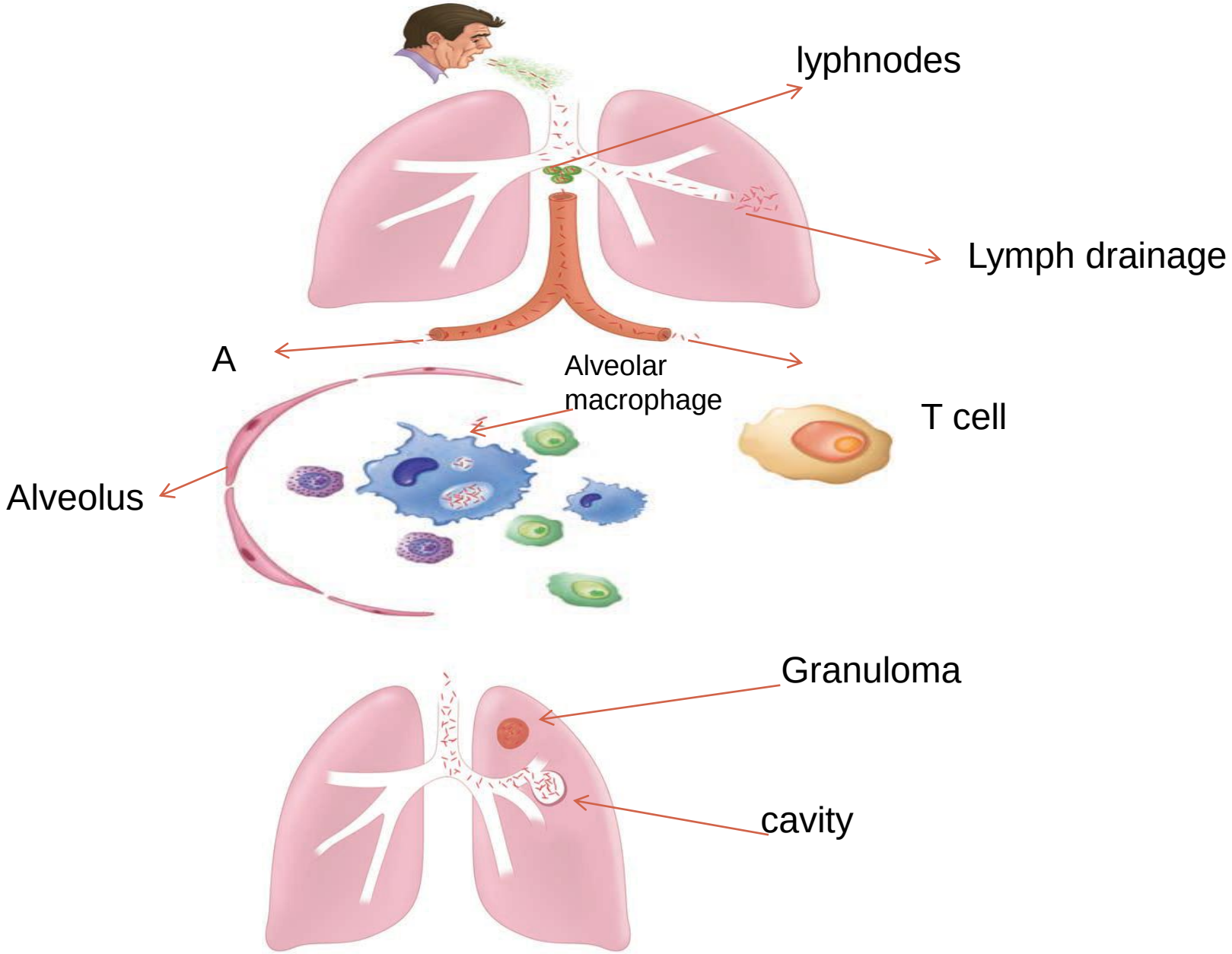
# Pathogenesis

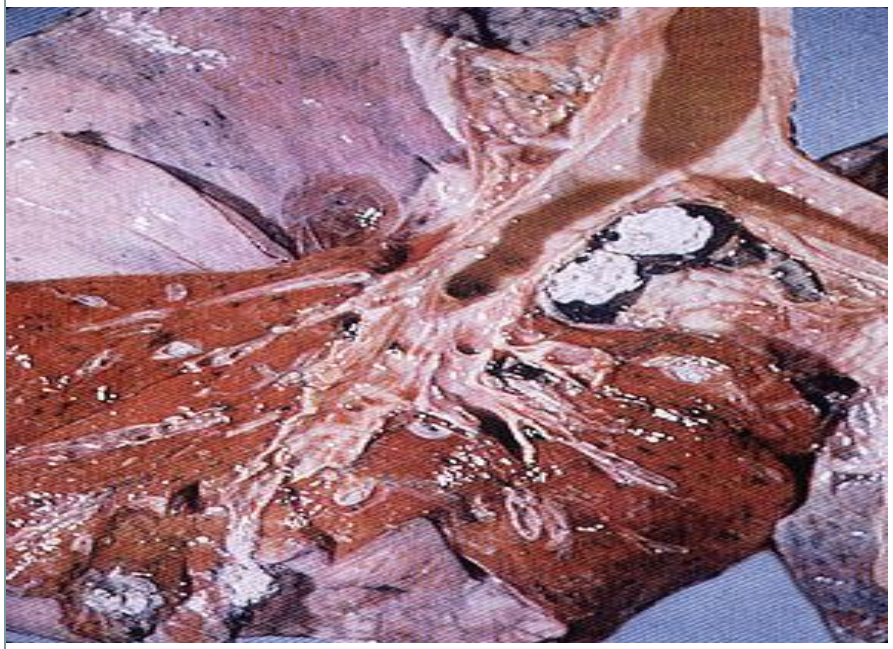
## 1. Primary TB: inhalation of M. tuberculosis results in a mild acute inflammatory reaction in the lung parenchyma

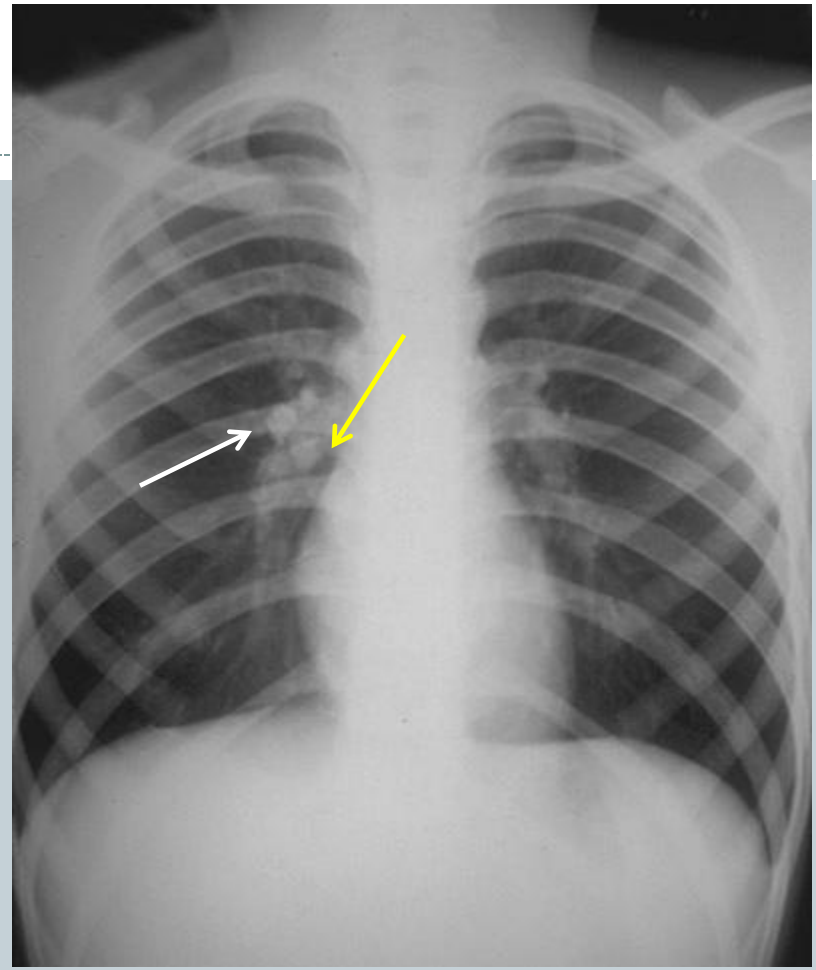
In Immunocompetence people ➡️ granuloma وبتكون M. Tuberculosisال بتحاصر inflammatory cells ال

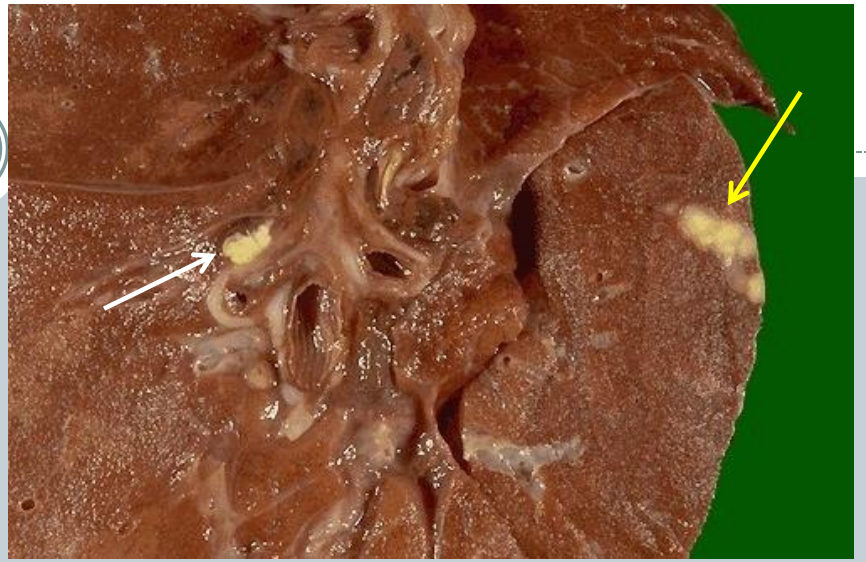
لمتى بتضل محاصرة ؟؟
طالما هالشخص مناعتو قويه بضل في granuloma والcell محاصره ال M. Tuberculosis.

- Period of hidden infection- asymptomatic or accompanied by mild fever
- After 3 to 4 weeks, immune system mounts a cell-mediated assault- large influx of mononuclear cells into lungs
- Frequently the centers of tubercles break down into necrotic **caseous lesions** that gradually heal by calcification


lyphnodes
Lymph drainage
A
Alveolar
macrophage
T cell
Alveolus
Granuloma
cavity







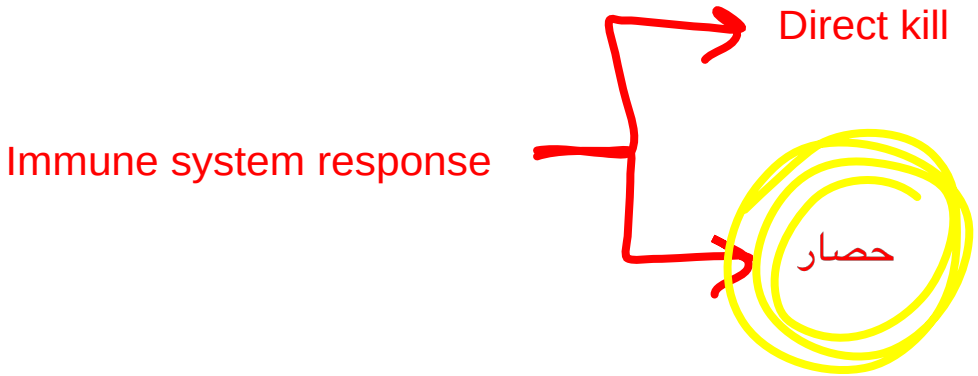
The most common abnormality associated with primary TB on chest radiography is hilar adenopathy (white arrows). Subpleural granulomas (yellow arrow) are also common. These two findings constitute the Ghon complex. This is also shown in the gross specimen to the right.



**Tuberculosis of the lung, with a large area of caseous necrosis containing yellow-white and cheesy debris**

- The host response to mycobacterial infection is cell-mediated and results in the formation of granulomata.

Histologically, granulomas consist of epithelial cells and giant cells, which eventually undergo caseous necrosis.



- In a small number of cases, a defensive barrier is built round the infection but the TB bacteria are not killed and lie dormant.

This is called latent tuberculosis; the person is not ill and is not infectious.

If the immunity decreases ➡️ Latent will transform to active
Re-exposure to M.tuberculosis

سببين بحولو ال
primary لـ
. secondary

2. Secondary TB: may arise in two ways:

I. Dormant mycobacteria may reactivate, often as a result of lowered immunity in the patient

II. A patient may become re-infected after further exposure to an exogenous source.

## Clinical features

Pulmonary TB: chronic cough, haemoptysis, weight loss, malaise and night sweats.

اهم شي

Chest radiograph: apical shadowing, often with cavities

## 3. Extrapulmonary TB:

Pleural tuberculosis: pleural effusion, tuberculous empyema

- Lymph glands: the most common site of non-pulmonary TB, typically cervical lymph nodes, particularly in children

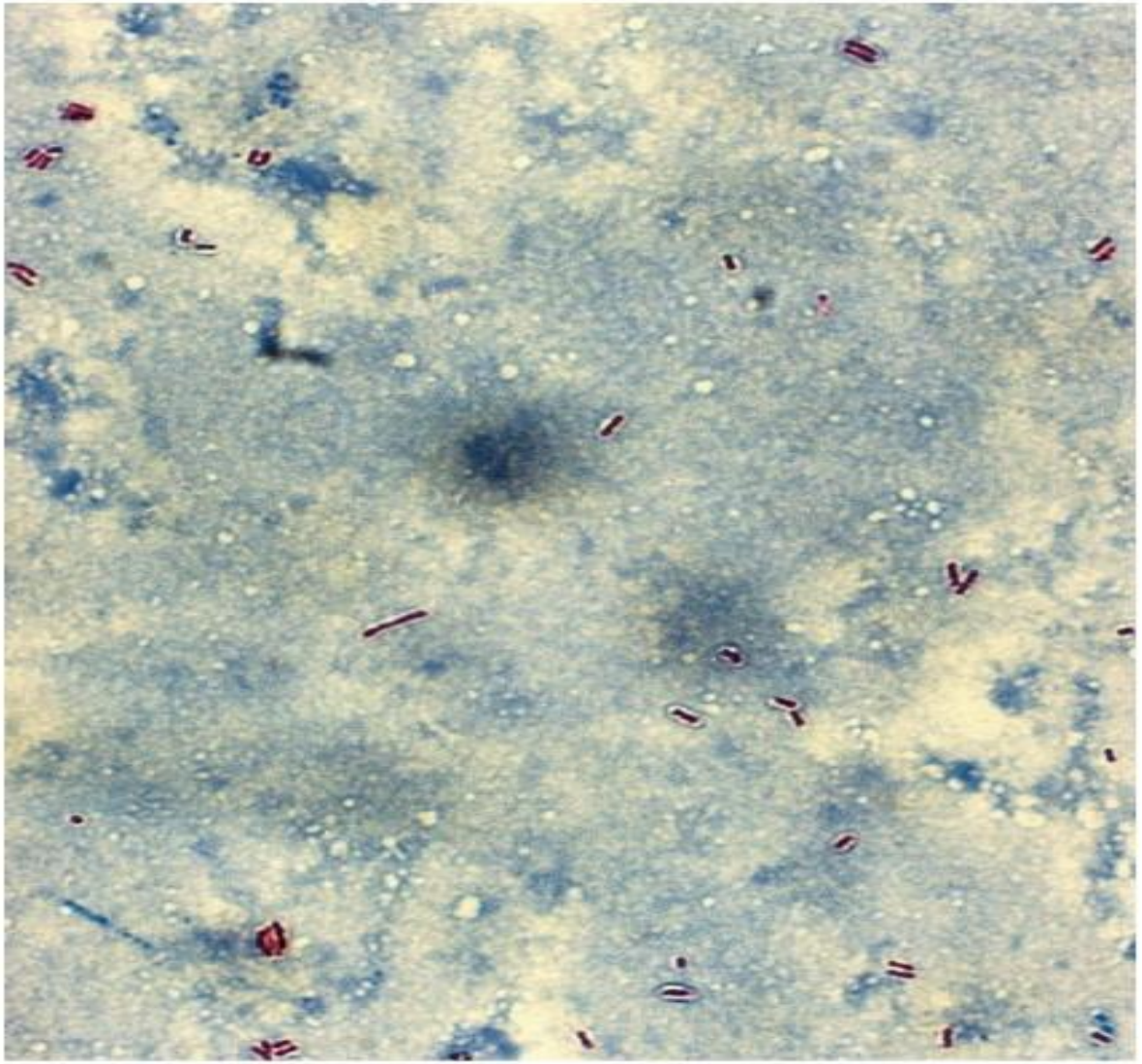
- Genitourinary: sterile pyuria, with haematuria, pyrexia and malaise
- Meningitis: insidious onset, with high mortality
- Bone and joints: most commonly affects the lumbar spine
- Miliary: multisystem involvement.

Laboratory diagnosis

Diagnosis of active infection:

1. Microscopy of relevant specimens, including sputum, bronchoscopy material, pleural fluid, urine, joint fluid, biopsy tissue and cerebrospinal fluid.

ZN stain



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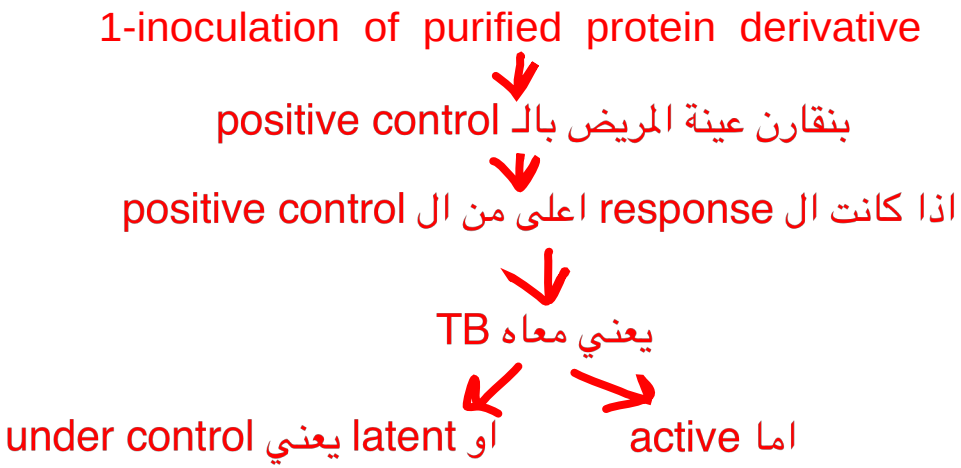
2. Culture on special media for up to 12 weeks, e.g. Lowenstein–Jensen medium,

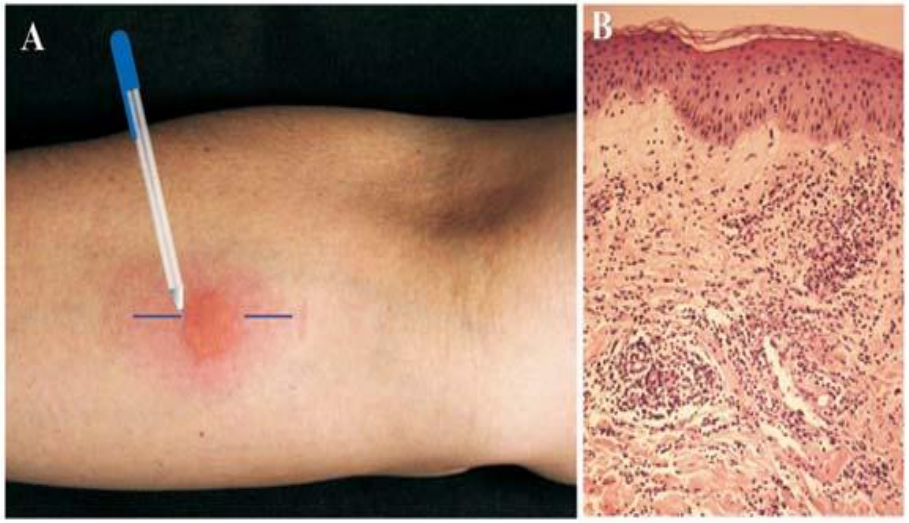
Specimens, e.g. sputum

Löwenstein-Jensen (LJ) medium

# Diagnosis of latent infection

1 .Tuberculin skin test (e.g. Mantoux test): based on the inoculation of purified protein derivative (PPD)




A
B

2. Interferon Gamma test: measures the release of interferon-gamma from lymphocytes in whole Blood

## Treatment and prevention

Long term treatment .

1. Combinations of up to four anti-mycobacterial drugs (e.g. rifampicin, isoniazid, pyrazinamide and ethambutol) for 2 months (initial phase), followed by 4 months (continuous phase) of rifampicin and isoniazid).

.. الحد الادنى للعلاج 6months
.. بعد هيك يخضع مرة اخرى لصورة x ray لتأكد

Second-line antimycobacterial agents include fluoroquinolones, macrolides, cycloserine, amikacin, kanamycin and capreomycin.

2. Strategies for prevention include:

A. Improving living standards (housing, nutrition)

B. Immunisation with a live attenuated vaccine (BCG)

C. Isolation plus prompt treatment of cases as appropriate

D. Chemoprophylaxis when latent infection is found.

# *Mycobacterium tuberculosis* Vaccine

BCG (**Bacillus Calmette-Guérin**)

- PPD test works and if you take vaccine you will always tests positive and then everyone will have to get the chest X rays.

- If PPD is positive NEVER take another test because you might become anaphylactic

مشكلتو بغطي بس 60% من الـ TB
وهذا الي ادى الى Re-emerged TB
** الناس بتفكر حالها immune اذا اخذت ال BCG , بس هوه في الواقع بحمي بس ٦٠٪.