Tuberculosis

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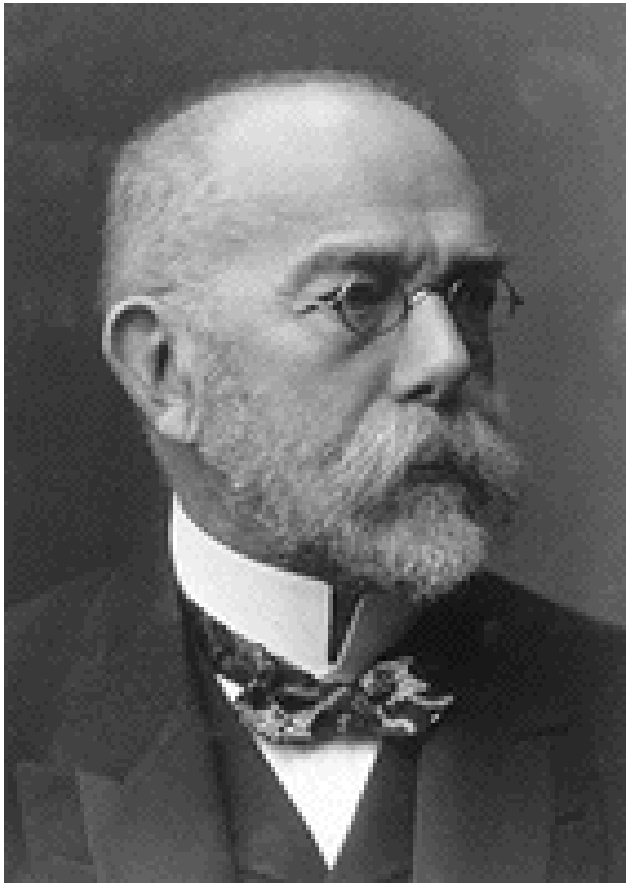
Outline

- Microbiology
- Epidemiology
- Pathophysiology
- Treatment
- PPD

- Dr. Robert Koch

- In March 24, 1882, he announced the discovery of Mycobacterium tuberculosis



Introduction

- TB is the second cause of infectious disease–related mortality worldwide
  - First is COVID
  - Third is HIV
- 2 billion have latent TB
  - a person with HIV is > 15 times more likely to develop active TB (if he has latent TB).

- a disease of poverty
- thrives where social and economic determinants of ill health prevail
- it affects mostly young adults in their most productive years
- 95% of TB deaths are in the developing world

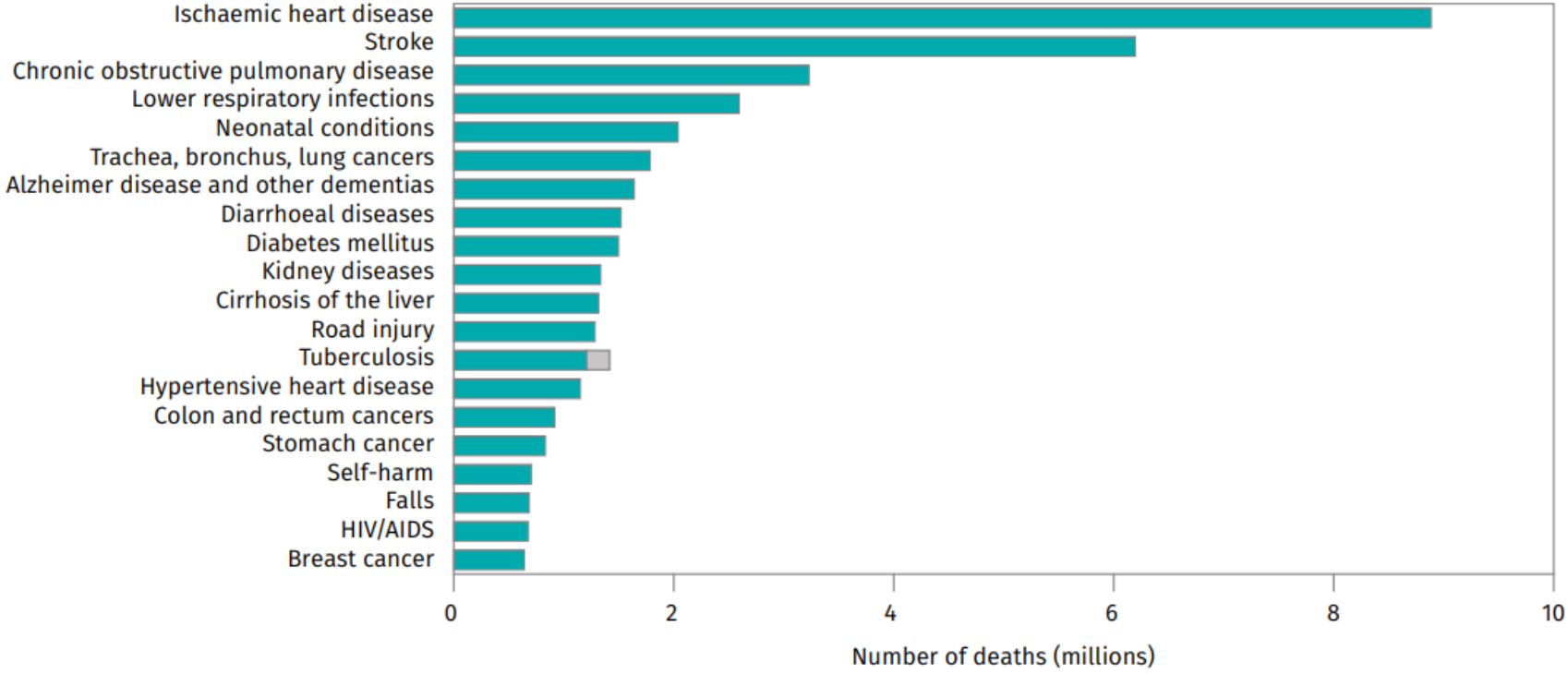
In 2020

- 10 million people fell ill with TB worldwide
  - 5.6 million men
  - 3.3 million women
  - 1.1 million children
- 1.5 million people died from TB

- Globally, TB incidence is falling at about 2% per year
- between 2015 and 2020 the cumulative reduction was 11%
- This was over half way to the "**End TB Strategy**" milestone of 20% reduction between 2015 and 2020
- Ending the TB epidemic by 2030 is among the health targets of the United Nations Sustainable Development Goals (SDGs)

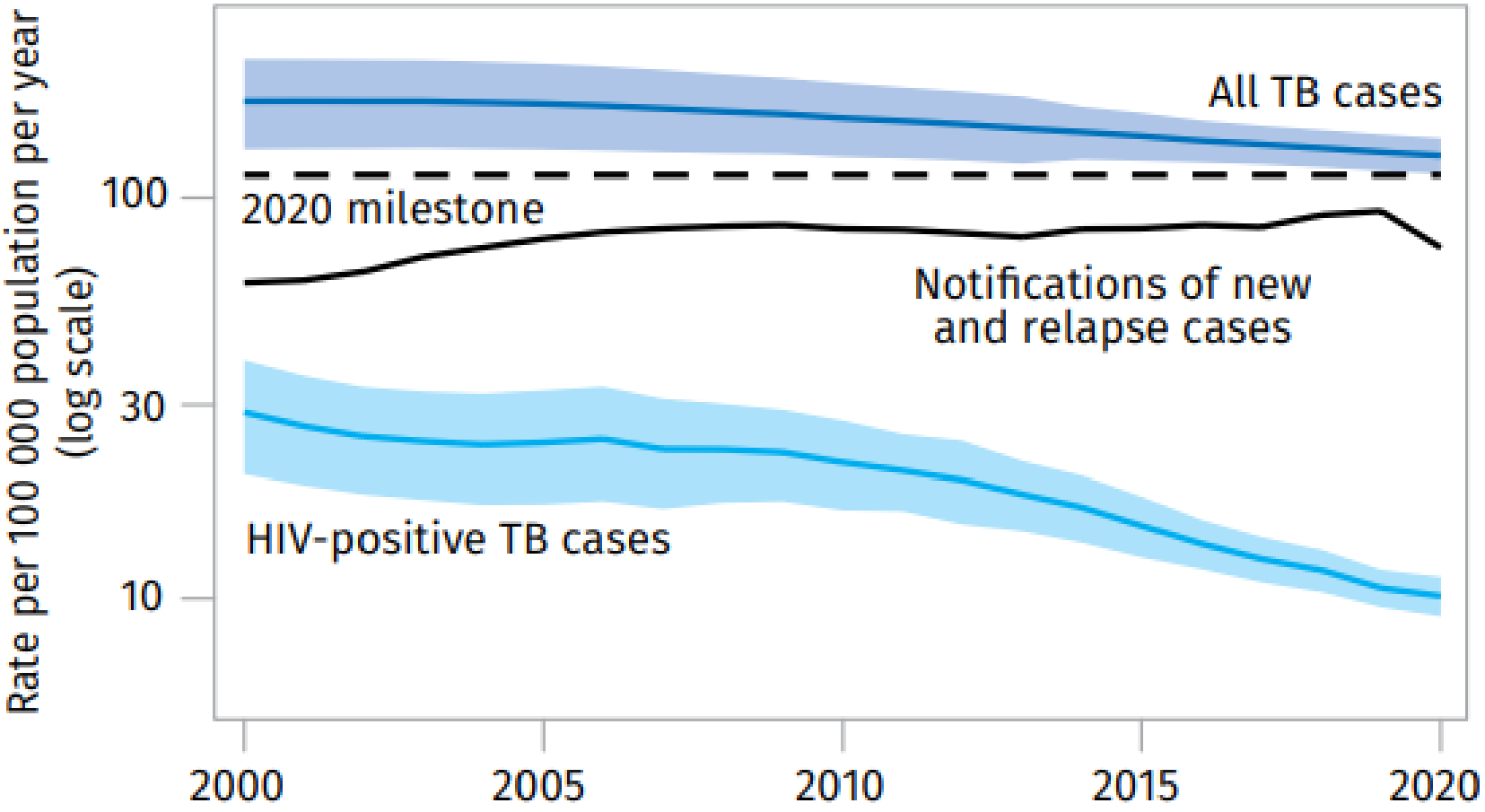
Top causes of death worldwide in 2019[a,b]

Deaths from TB among HIV-positive people are shown in grey.



22 countries account for 80% of the global burden

Incidence: Slow decline



Epidemiology

- Jordan 7 – 10 / 100,000
- USA: 4.4 / 100,000 (60% are foreigners)

Microbiology

M tuberculosis

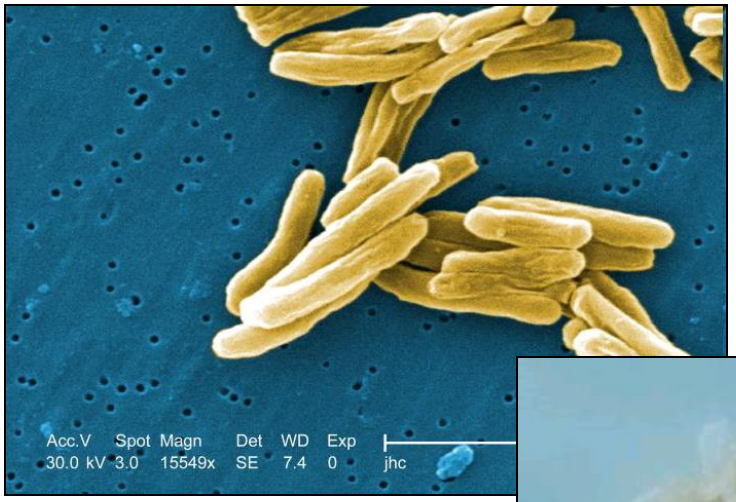
- slow-growing organism
  - 4-8 weeks for visible growth on solid medium
- Acid fast bacilli
- have been around: 3 million years

M bovis

  - From cattles

Microbiology

- *Mycobacterium tuberculosis*
- *M. bovis*
- *M. microti (rodents)*
- *M. africanum*
- *M. canetti*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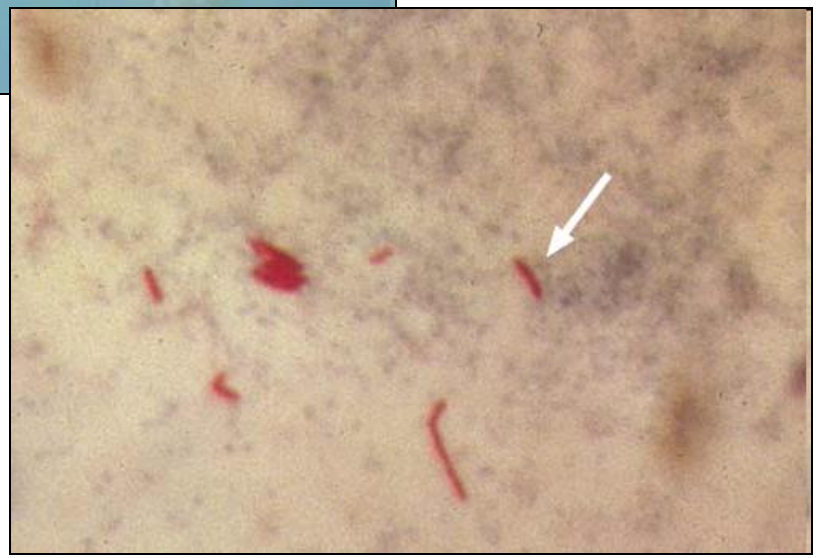


Transmission

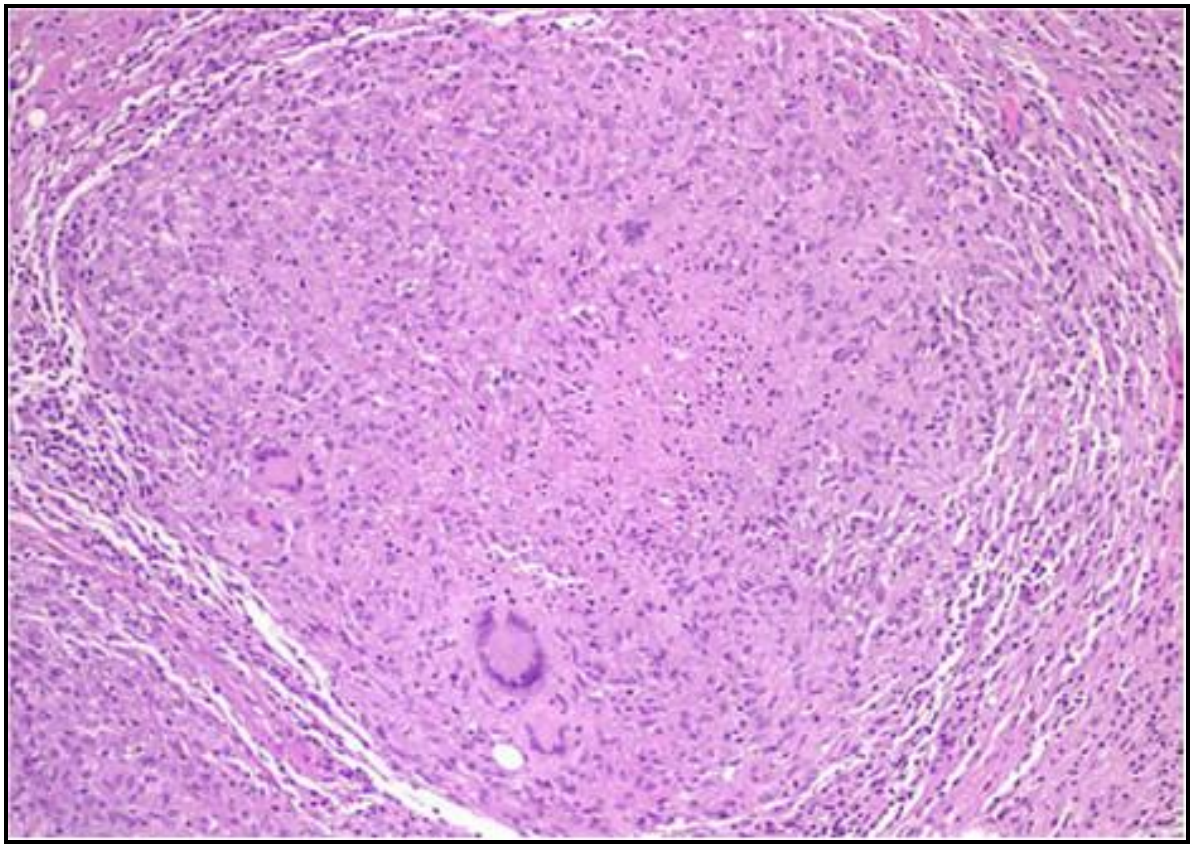
- Airborne
- People with active TB can infect 5–15 other people through close contact over the course of a year

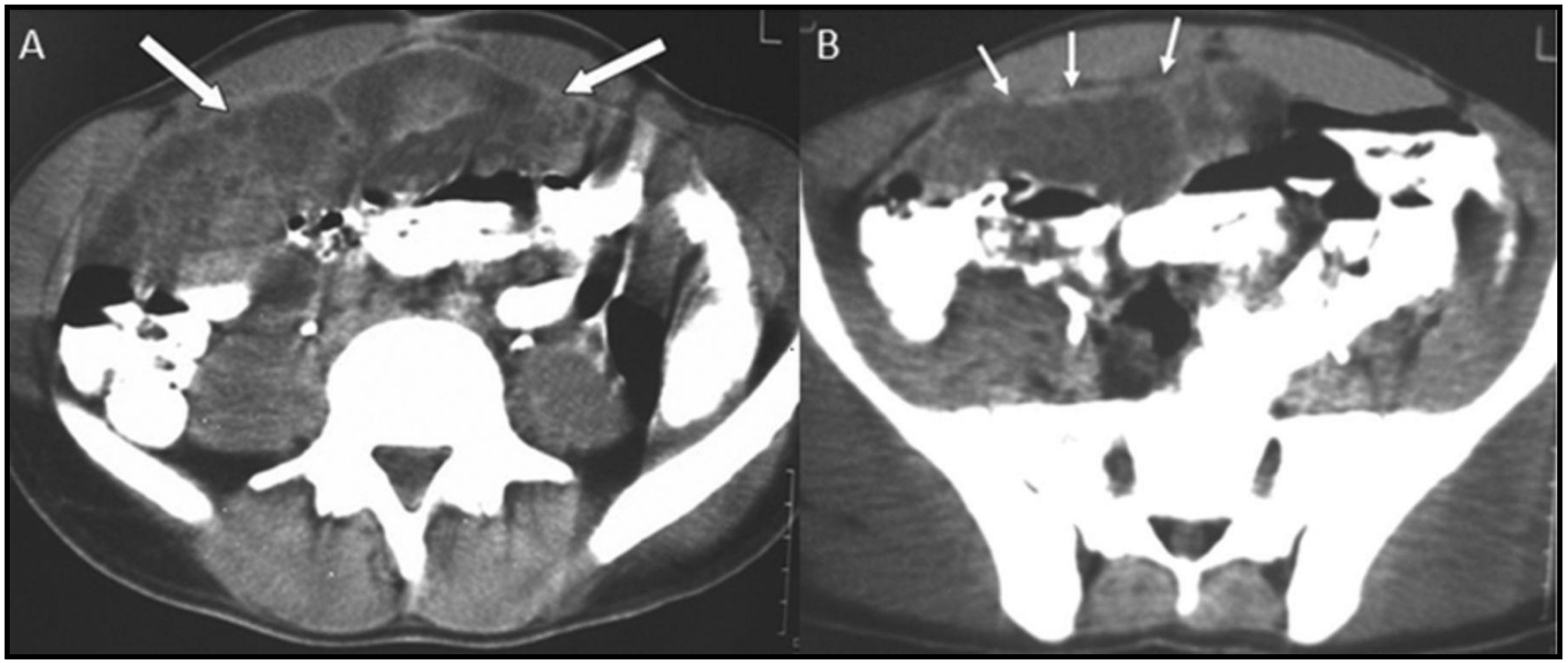
Pathophysiology

- Humans are the only known reservoir for *Mycobacterium tuberculosis* (MTB)
- Transmission: airborne droplet nuclei

1. When inhaled, droplet nuclei are deposited within the terminal airspaces of the lung
2. macrophages ingest and transport the bacteria to regional lymph nodes
   A. may be killed by the immune system
   B. they may multiply and cause primary TB
   C. may become dormant and remain asymptomatic
   D. may proliferate after a latency period (reactivation disease)

Histological examination: caseous necrotic granuloma





Axial contrast-enhanced CT images showing large amount of loculated viscous fluid (arrows; A) and enhanced diffuse peritoneal thickening (arrows; B). Posteriorly displaced small bowel loops could be seen.

Prognosis

- Historical data:
  - left untreated, smear positive TB has a 10-year case mortality bet 53 and 86%, with a mean of **70%**
  - TB killed 1 / 7 people in the USA and Europe
  - Great White Plague" (due to the extreme paleness of those affected)
  - “Captain of all these men of death”
- **Now with treatment**
  - **mortality = 3%**

The sick child 1885

symptoms

Pulmonary tuberculosis (TB)

- cough
- fever
- weight loss
- hemoptysis
- chest pain
- anorexia, fatigue, and night sweats

symptoms

TB meningitis

- headache that is either intermittent or persistent for 2-3 weeks
- Subtle mental status changes may progress to coma over a period of days to weeks
- Fever may be low-grade or absent

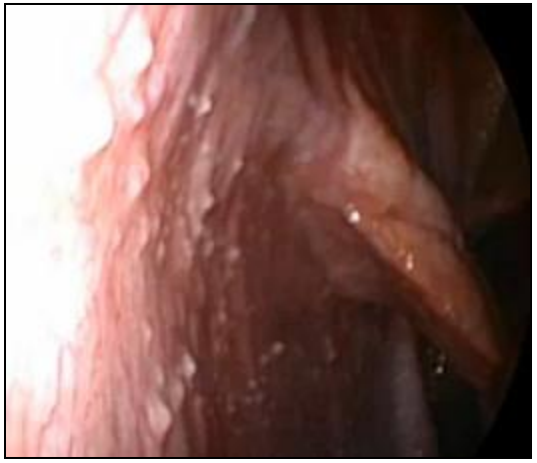
Skeletal TB

- most common is the spine (Pott disease)
  - back pain or stiffness
  - Lower-extremity paralysis occurs in 50%
- TB arthritis usually involves one joint
  - the hips and knees are affected most commonly > the ankle > elbow > wrist > and shoulder

Gastrointestinal TB

Any site in the GI may become infected:

- non healing ulcers of the mouth or anus
- difficulty swallowing
- abdominal pain mimicking peptic ulcer disease
- malabsorption
- diarrhea
- hematochezia



A peritoneal laparoscopy showing multiple extensive yellow-white nodules on the peritoneal surface

Other sites

- TB lymphadenitis (scrofula)
- Genitourinary TB
- Cutaneous TB

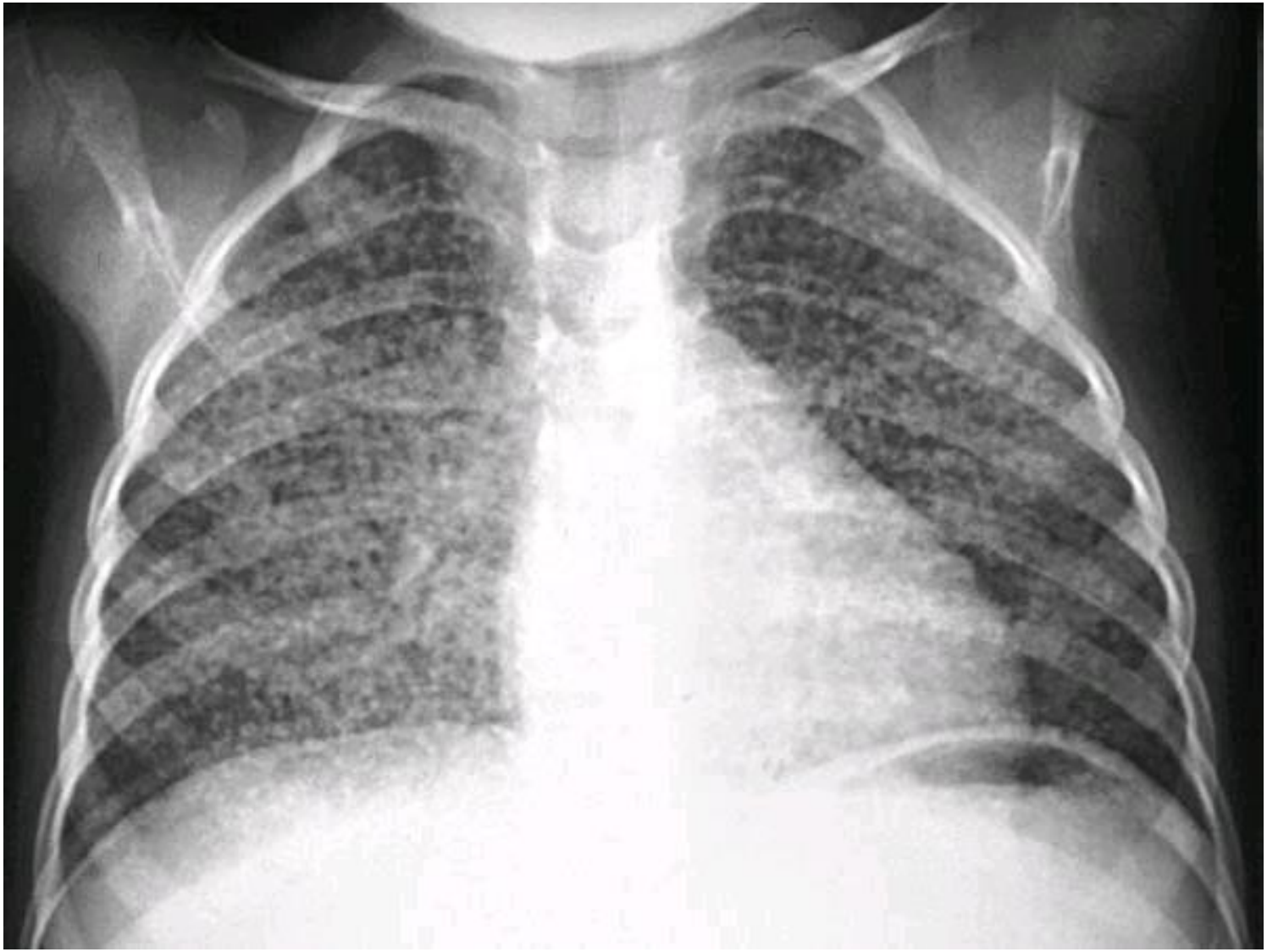
Diagnosis

- sputum: in the early morning on 3 days
  - every 8 hours (hospital)
  - Children: early-morning gastric aspirate
- bronchoscopy with biopsy and bronchial washing
- bone marrow Bx
- liver Bx
- ± blood cultures

- PCR on smears

Diagnosis

- Obtain HIV in all patients with TB
- CXR
  - may show a patchy
  - nodular infiltrate
  - upper-lobe involvement is most common
  - in any part of the lung
  - cavity: indicates advanced infection
    - high bacterial load
- Miliary TB: appearance of numerous small nodular lesions that resemble millet seeds on CXR



PPD

- PPD: tuberculin skin testing (Mantoux test)
  - is the most widely available test for diagnosing TB in the absence of active disease (**Latent infection**)
  - intradermal injection
  - 48-72 hours
  - size of induration, not the erythema
  - Booster effect
  - ? Dx role in TB

PPD

- PPD testing for tuberculosis (TB) is done among persons at **high risk** for the development of TB disease who would benefit from treatment of latent TB infection (LTBI)

- All testing activities should be accompanied by a **plan** for the necessary follow-up medical evaluation and treatment

Groups that should be tested for LTBI

- Persons at higher risk for exposure to or infection with TB
  - Close contact of a person known or suspected to have TB
  - Residents and employees of high risk settings
  - HCW
  - Low income populations
  - Children exposed to adults in high risk

Groups that should be tested for LTBI

Persons at higher risk for TB once infected

- Illicit drug use
- Certain medical conditions
- HIV
- Recently infected with *M. TB* (2 yrs)

PPD

igure 2. Measurement of PPD in millimeters where induration diameter is larger.

Treatment

- Initial empiric treatment of TB
- Start on a 4-drug regimen
  - INH (ioniazid)
  - Rifampin
  - Pyrazinamide
  - Ethambutol or streptomycin
- Prolonged course > 6 months

Risk for TB in latent TB

- On medicines such as steroids or TNF-a inhibitors
- DM
- Renal insufficiency
- Silicosis

Infection control in hospital

- Respiratory isolation
  - negative pressure room
  - N95 mask

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