

TUBERCULOSIS : HISTORY, EPIDEMIOLOGY, MICROBIOLOGY & TRANSMISSION

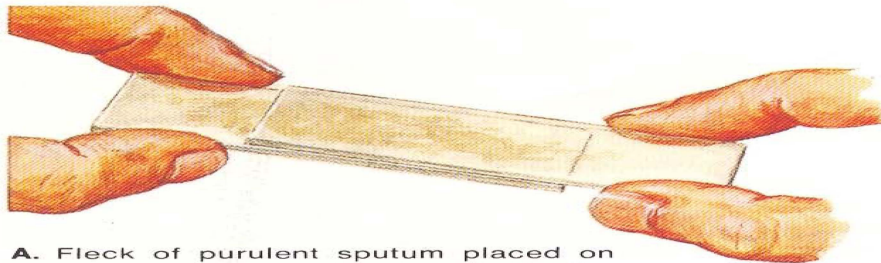


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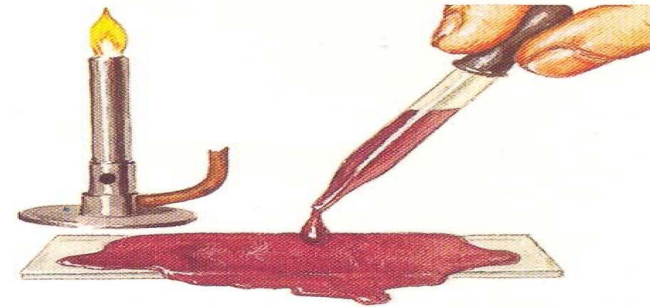
TUBERCULOSIS: an introduction

- Nature; an infection
- Cause; a bacillus→ Myco. tuberculosis
- Name, tubercle; How ?
- Myco. tuberculosis; Lehman(1896)
- Mycobacterium genus; - Tuberculosis & Leprae
 - 2 disease ever since the emergence of earth
 - greatest suffering to mankind
- Captain of all men of death; of ravages in the last centuries

Sputum Examination (Stained Smear)

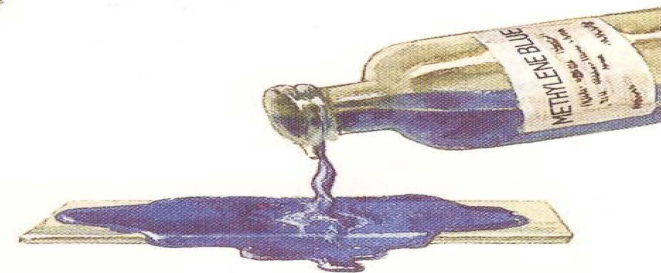
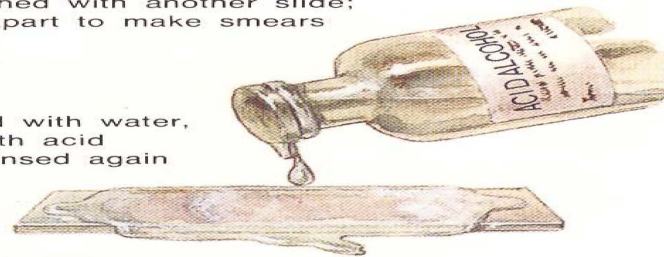


A. Fleck of purulent sputum placed on slide and crushed with another slide; slides drawn apart to make smears



B. Slide flooded with carbol-fuchsin and then heated

C. Slide rinsed with water, decolorized with acid alcohol, and rinsed again

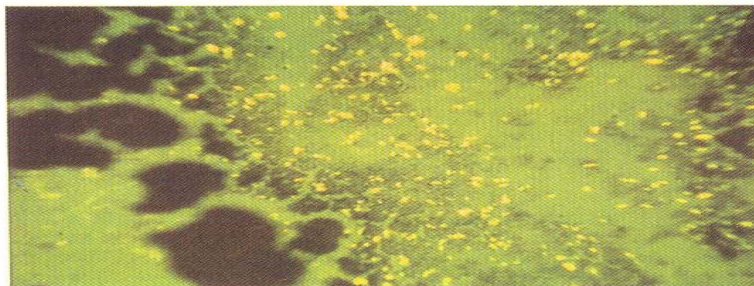


D. Counterstained with methylene blue or malachite green for 30 seconds, rinsed again, and dried



E. Slide of sputum stained with carbol-fuchsin (Ziehl-Neelsen method as above), viewed under oil immersion, showing acid-fast bacilli (*M. tuberculosis*) as bright red rods

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F. *M. tuberculosis* stained with auramine O which causes acid-fast bacilli to fluoresce (x 200)



G. Auramine O stain of *M. kansasii* (acid-fast "atypical" mycobacteria) which are much larger than *M. tuberculosis* (x 200)

HISTORY OF TUBERCULOSIS: Very ancient

- 8000 BC; - bones of prehistoric man
- 4000 BC; Egyption mummies
 - 2000 BC; Rig veda
 - 460-370 BC: Hippocrates

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ANCIENT NAMES OF TUB.

- Scrofula
- King's evil
- Phthisis
- Rajayakshma

DISCOVERY OF CAUSATIVE AGENT: LAND MARK

ROBERT KOCH : 1882

Experiment; isolated from patient → identified → injected in an animal → typical tubercle and disease

KOCH POSTULATES : (cause and effect relationship between agent and disease)

1. Agent Isolation from diseased animal
2. Agent grown in artificial culture
3. Agent from the culture → Similar pathology in experimental animal
4. Isolation of agent from experimental animal

Disease causing mycobacterium

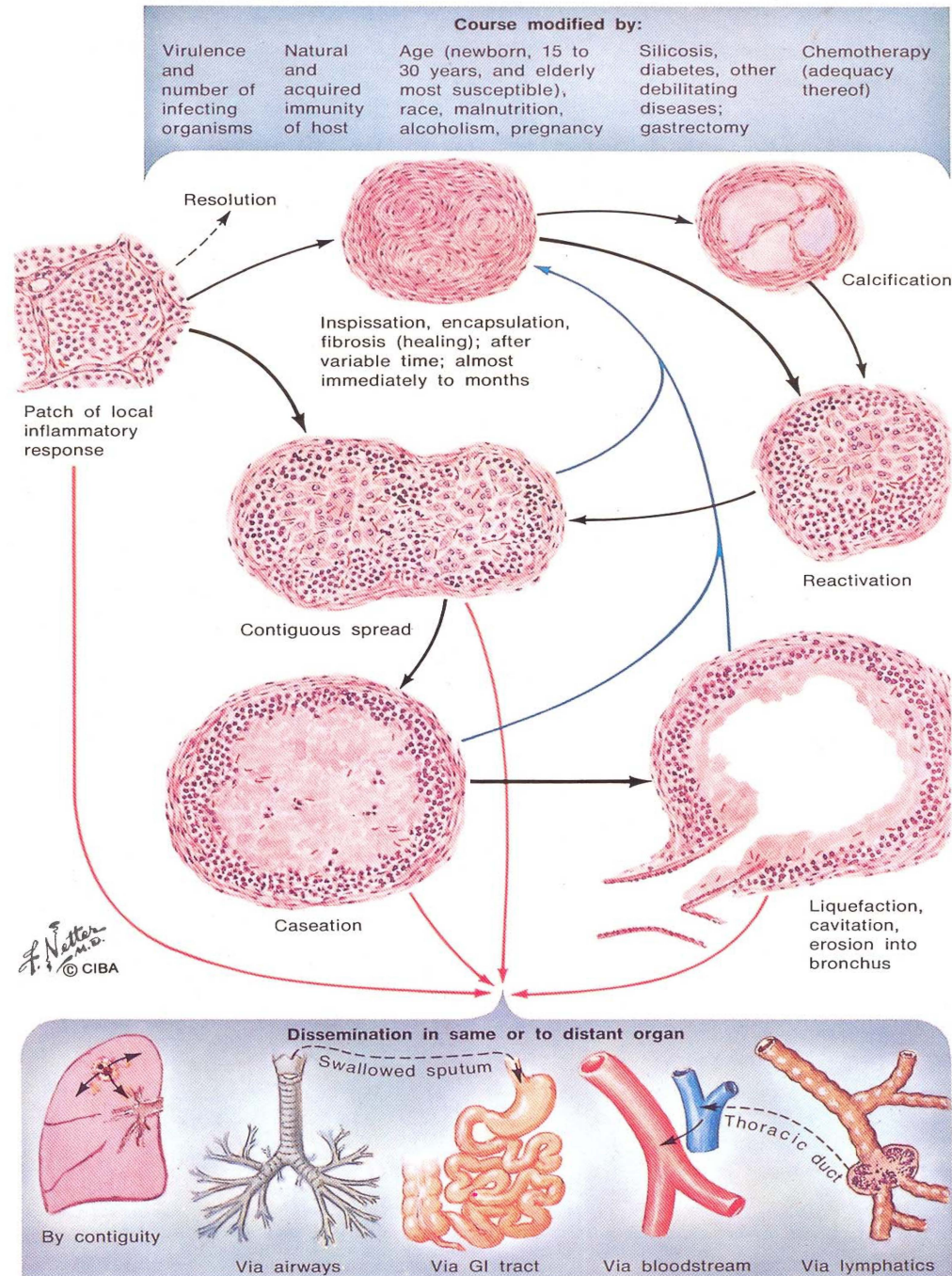
- **Typical: (Tuberculosis):**
 - I Myco. tuberculosis human type (in human)
 - II. Myco. tuberculosis bovine type (cattle)
- **Atypical: (Mycobacteriosis) MOTT:**
 - I. M. avium intercellular complex [MAC]
 - II. M. kansasii
 - III. M. marinum
 - IV. M. fortuitum

Types of Tuberculosis

A]. Pulmonary tuberculosis [85%]

B]. Extra Pulmonary tuberculosis [15%]

- L.N
- Bone of joint
- Intestinal
- CNS (TBM, tuberculoma)
- Renal
- Genital
- Disseminated [miliary]



Reservoirs and Spread of Infection

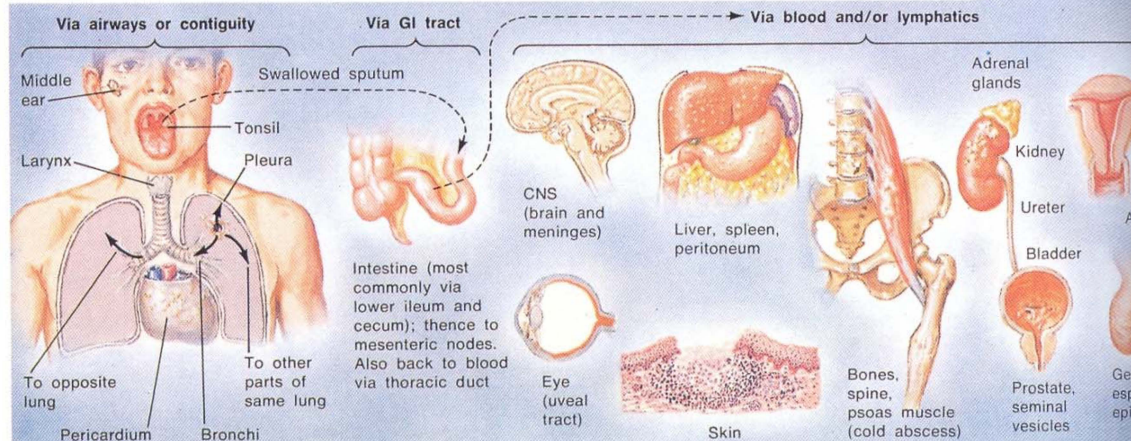
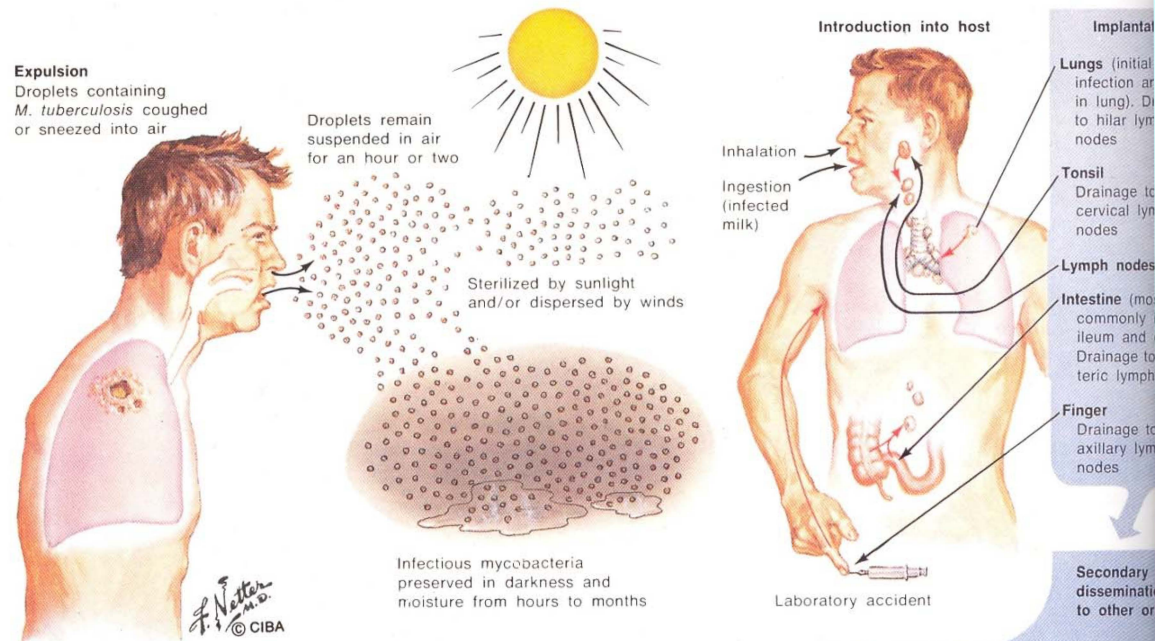
Reservoirs

- Human patients (main)
- Infected cattle

Mode of Spread

- (A) Man to man: I. Micro droplet (airborne)
(coughing, spitting, sneezing, talking etc.)
II. Dried Sputum (may survive dried sputum for months without sun exposure)
- B) Cattle to man: I. by drinking infected milk
II. Infected meat

Tuberculosis – Dissemination of Tuberculosis



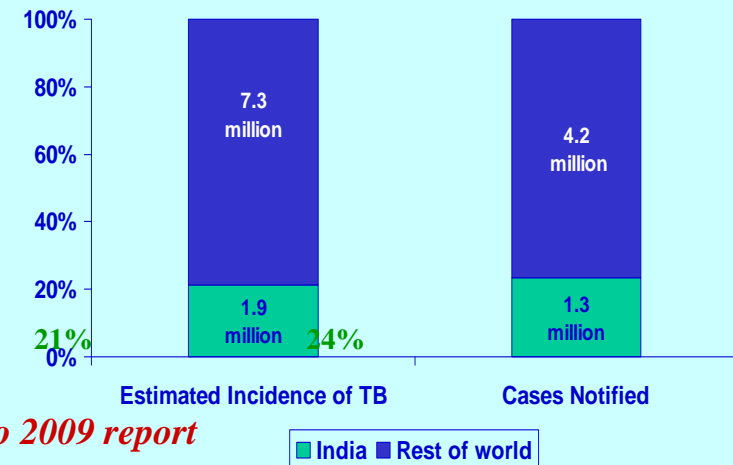
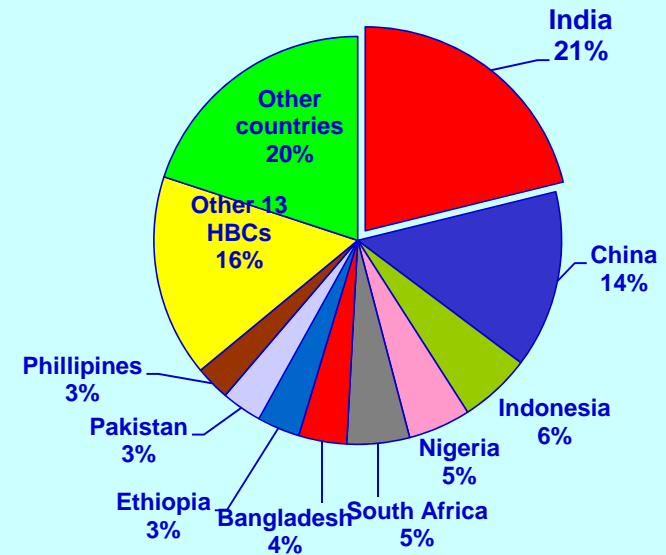
Predisposing factors for the Disease

1. Poor socioeconomic status:
 - over crowding
 - ↓ hygienic & sanitary conditions
 - Nutritional deficiency
 - Stress & strain
2. Exposure to silica;
3. Hormonal factor:
 - D.M,
 - Corticosteroids / hypothyroidism
5. HIV/AIDS;
 - Silicosis
 - Potent facilitator
6. Constitutional/genetic:
 - Common in blood relation/siblings
7. Racial:
 - white

-

BURDEN OF TB IN INDIA

- Estimated prevalence: 3.3 million cases [half; SP]
256 / lac population
- India is highest TB burden country: an annual 1.98 million incident cases [Half; SP]
- Annual deaths due to TB: 2,76,000 [1 death/2 min]
- TB/HIV Prevalence: :
 - 2.31 million population living with HIV;
 - ~ 0.9 million co-infected
 - ~5% of TB patients estimated to be HIV +
- [10 % annual risk /50% lifetime risk of developing active disease]



Source: WHO Geneva; WHO Global Report 2009 & Short update to 2009 report

TB Burden in India (contd)

- **Prevalence of TB infection**

- 40% (~400m) infected with *M. tuberculosis*

- * Infection at 5 years age :15%

- * Infection at 25 year age :75%

[with a 10% lifetime risk of TB disease]

- **Estimated Multi-drug resistant TB**

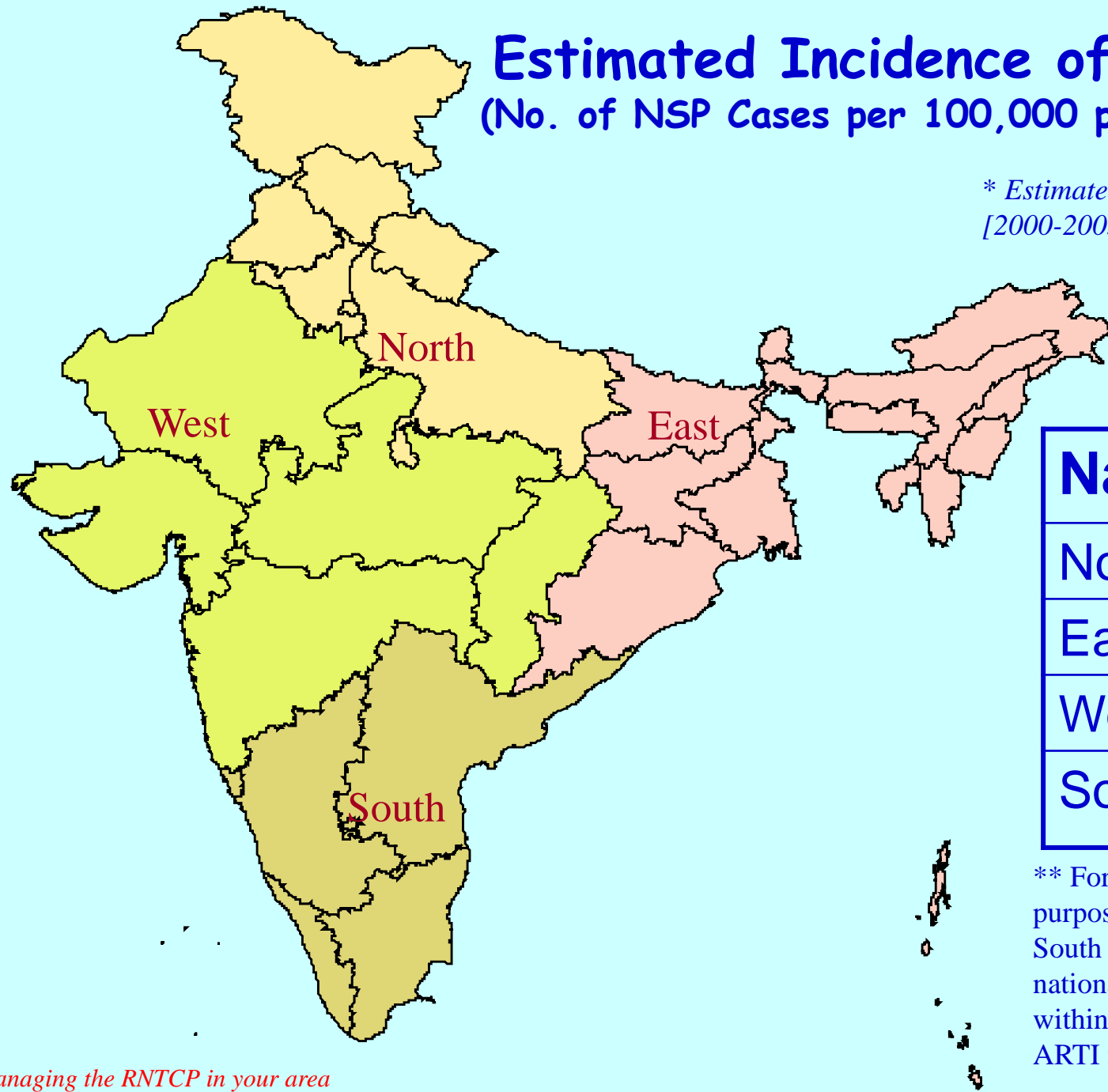
- < 3 % in new cases

- 14 % in re-treatment cases

Estimated Incidence of TB in India*

(No. of NSP Cases per 100,000 population, per year)

** Estimated from recent ARTI survey
[2000-2003]*



National	75
North Zone	95
East Zone	75**
West Zone	80
South Zone	75**

** For programme monitoring purpose estimated cases in East & South zones have been kept at the national level of 75 and this is within the upper limit of CI or ARTI in these zones

Epidemiology

Definition: Study of distribution of disease in society and the factors affecting this distribution

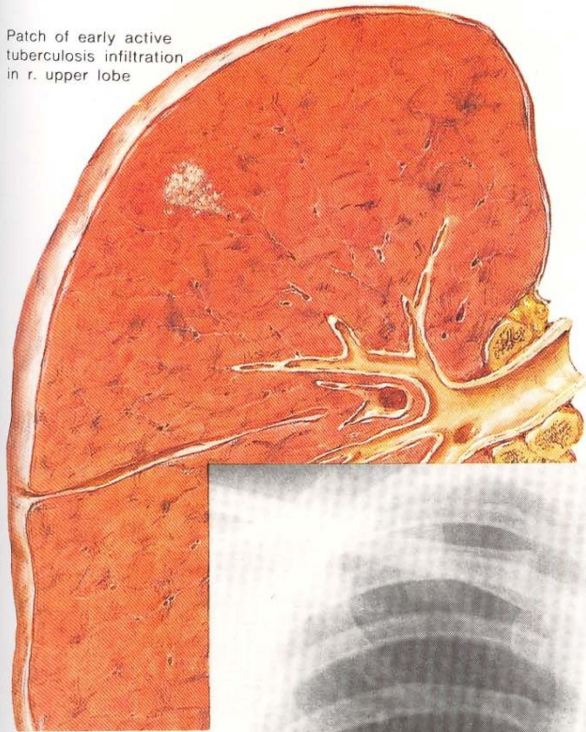
National Sample Survey (ICMR) 1955-58

1. Prevalence of disease : 13-25/1000 (i.e. 2% approx.)
2. Sputum +ve disease prevalence: $\frac{1}{4}^{\text{th}}$ of total cases [ie 0.5%]
3. Rural Vs urban: equal
4. Gender : \uparrow common in men than women after 35 years age
5. Urban slums: \uparrow Prevalence
6. Stage: Majority have moderately advance disease
7. Incidence of infection 1-2%
8. Incidence of sputum +ve disease : 0.1.%

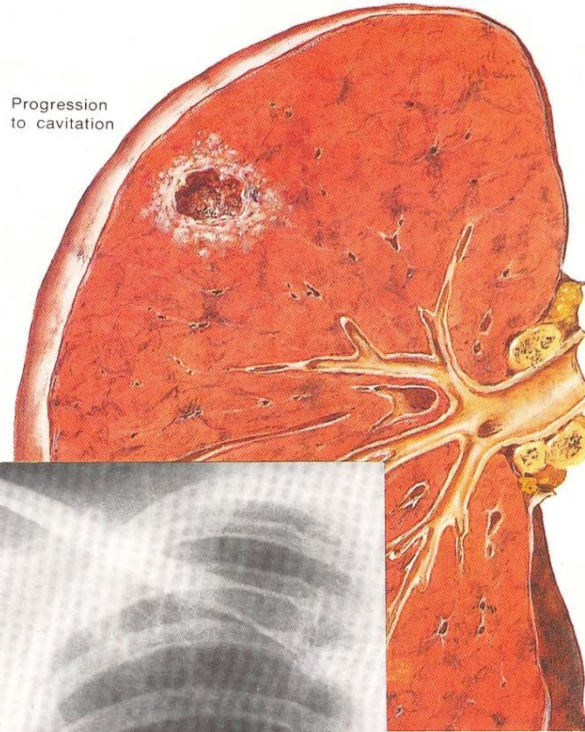
Magnitude of Tuberculosis Problem

- Infection : 1/3rd of World population
- No. of patients in World : 20 M approx.
- In India : 14 M
- Sp +ve cases in India : 3.5 M
- Annual death in world : 3 M
- Annual death in India : 5 lac
- Every minute
- Infection prevalence in India: 50%
- Infection at 5 years age :15%
- Infection at 25 year :75%
- Mortality: India: 1 person dies due to tub in India : 54/Lac/year

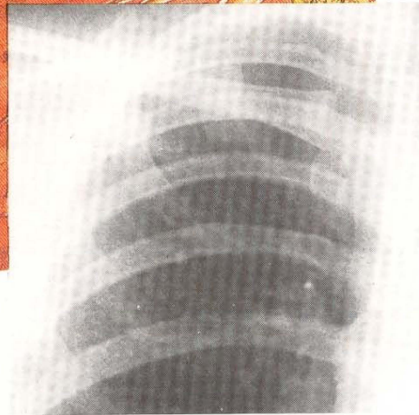
Patch of early active tuberculosis infiltration in r. upper lobe



Progression to cavitation



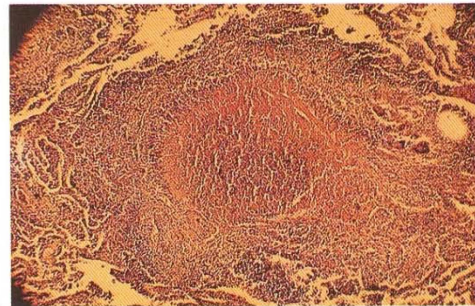
X-ray film showing early small lesion in lateral portion of 3rd posterior (1st anterior) inter-space; easily missed



Same patient, 4 months later; progression of lesion with cavitation

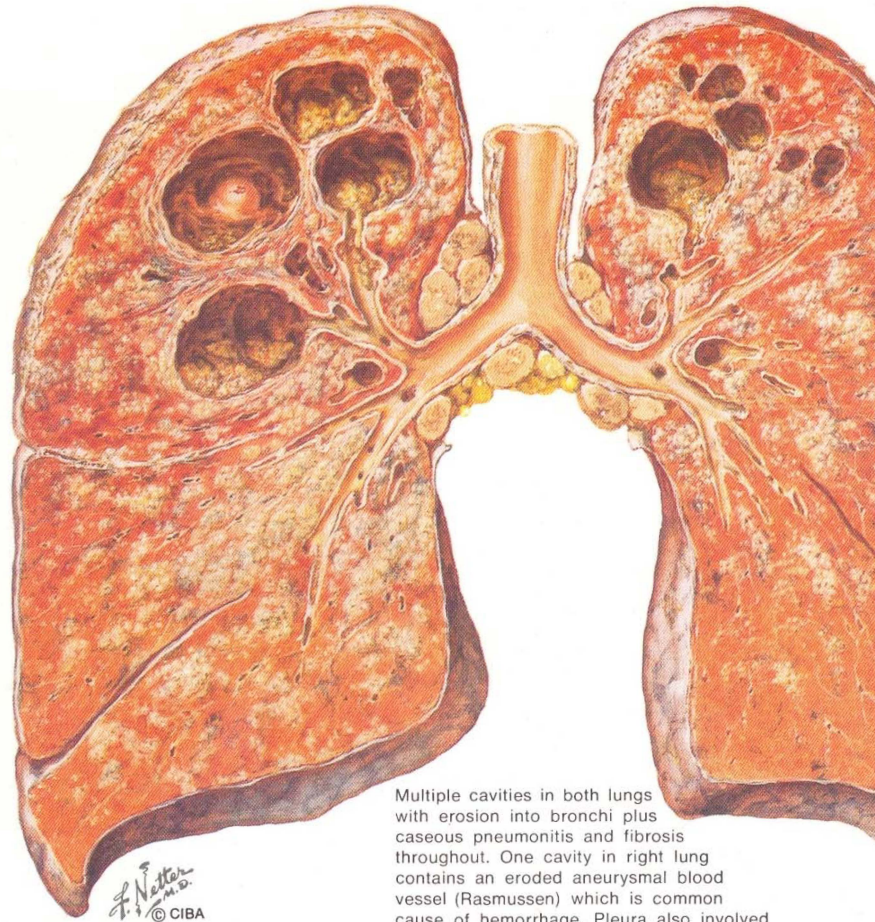


Histologic section of tubercle beginning to caseate

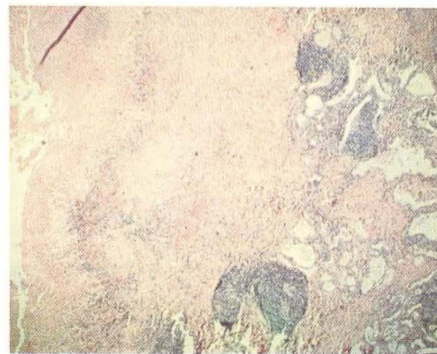


Caseous pneumonia which may closely simulate any other bacterial pneumonia

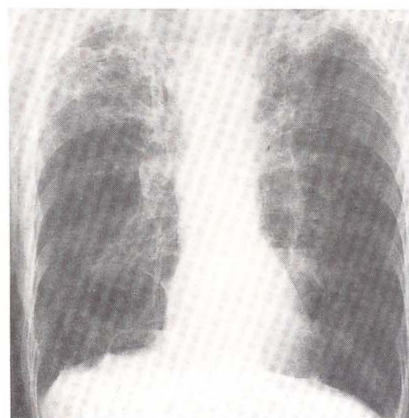
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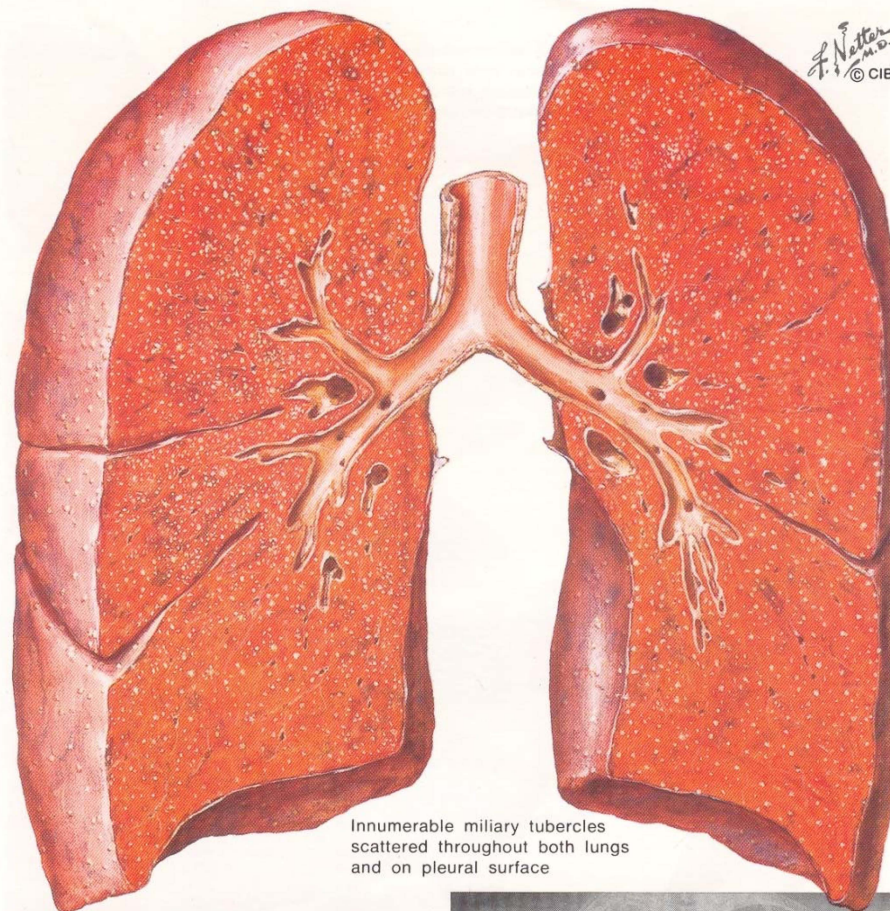
Multiple cavities in both lungs with erosion into bronchi plus caseous pneumonitis and fibrosis throughout. One cavity in right lung contains an eroded aneurysmal blood vessel (Rasmussen) which is common cause of hemorrhage. Pleura also involved



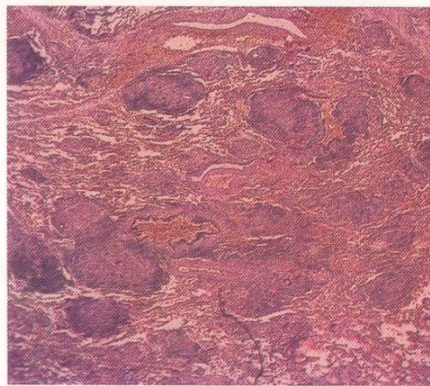
Section through wall of cavity. Cavity is to the left and is bordered by liquefying caseation with degenerating tubercles and collections of lymphoid cells



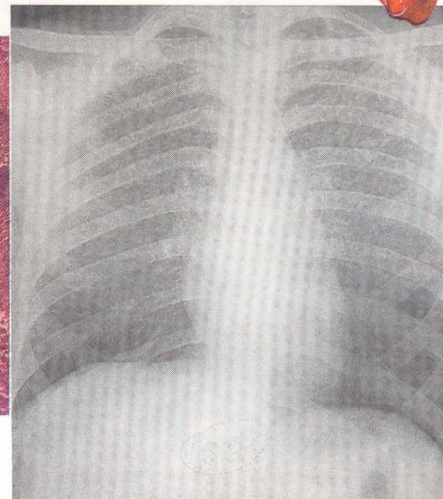
Bilateral advanced fibrocavitary tuberculosis

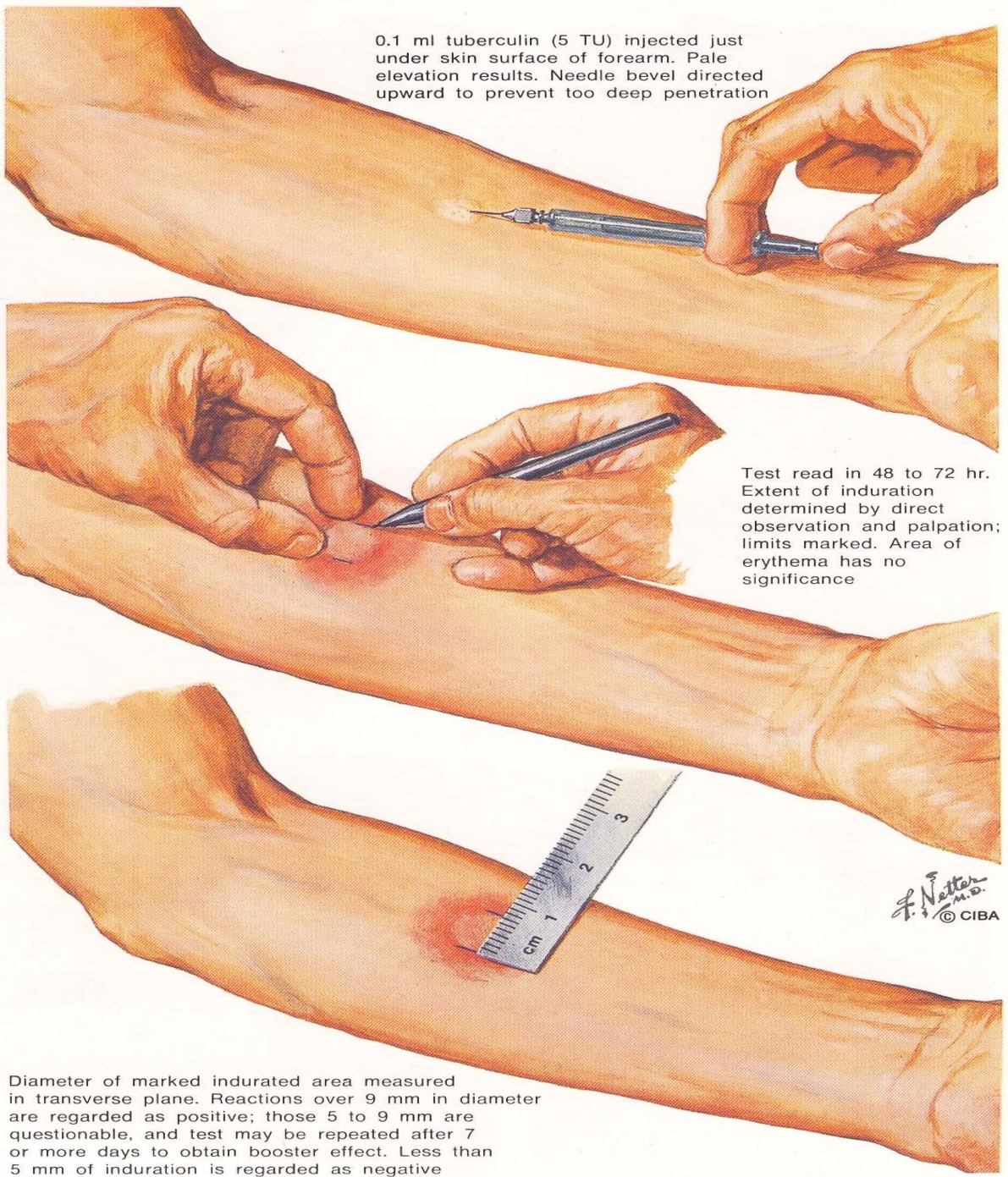


Innumerable miliary tubercles scattered throughout both lungs and on pleural surface



Multiple solitary and conglomerate tubercles composed mostly of epithelioid cells with an occasional giant cell of the Langhans type and surrounded by numerous lymphoid cells



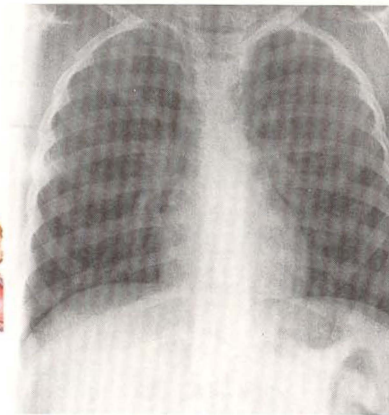
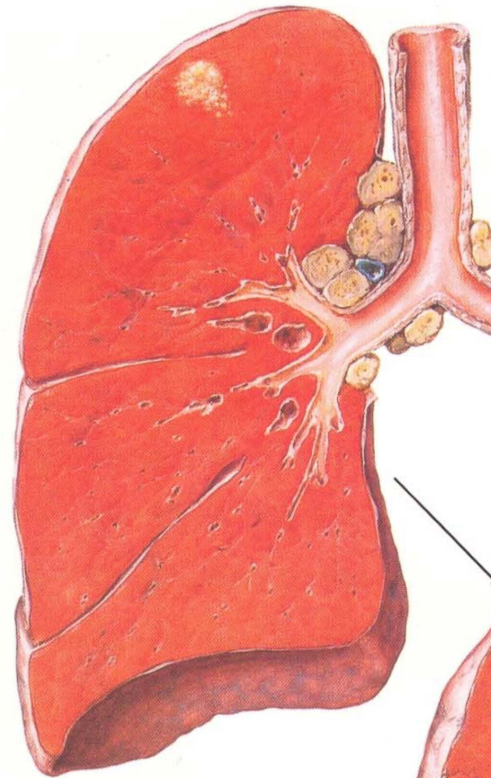
The illustration is divided into three horizontal panels showing the steps of a tuberculin skin test. The top panel shows a hand injecting a small amount of fluid into the skin of a forearm with a syringe. The middle panel shows a hand using a pen to mark the edges of a red, raised area on the forearm. The bottom panel shows a hand holding a ruler against the forearm to measure the diameter of the marked red area. The entire illustration is set against a white background with light blue vertical bars on the left and right sides.

0.1 ml tuberculin (5 TU) injected just under skin surface of forearm. Pale elevation results. Needle bevel directed upward to prevent too deep penetration

Test read in 48 to 72 hr. Extent of induration determined by direct observation and palpation; limits marked. Area of erythema has no significance

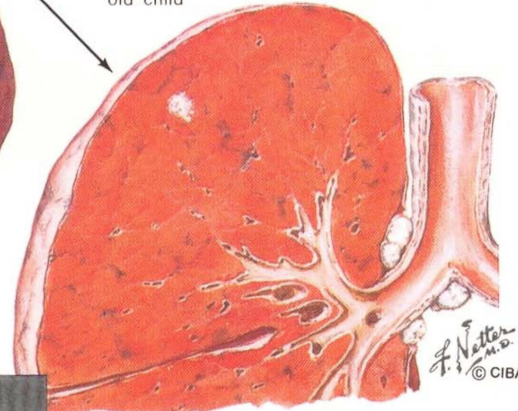
Diameter of marked indurated area measured in transverse plane. Reactions over 9 mm in diameter are regarded as positive; those 5 to 9 mm are questionable, and test may be repeated after 7 or more days to obtain booster effect. Less than 5 mm of induration is regarded as negative

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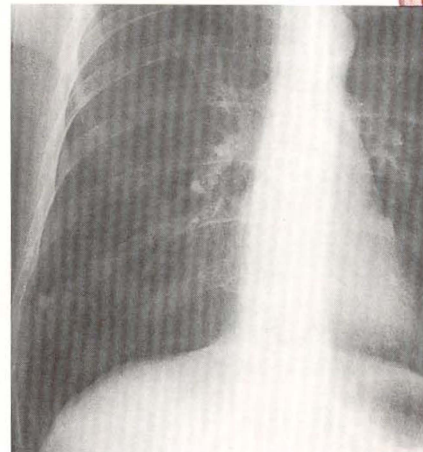


X-ray film showing ill-defined shadow of initial infective focus in lateral upper zone of r. upper lobe with enlarged lymph nodes in hilar and azygos vein areas in a 6-year-old child

Initial tuberculous infection. Small bronchopneumonic infiltrate in r. upper lobe (first infection may be anywhere in lungs) with greatly enlarged hilar and tracheobronchial lymph nodes



In time, pulmonary focus often heals to a fibrosed, calcified "Ghon lesion" and lymph nodes regress and calcify as shown here



Calcified "Ghon lesion" in lateral portion of r. lower lobe



Section of a very inspissated, dried-out focus with fibrous capsule

Thank You