Pediatrics - Topic 31 - Vaccine preventable Diseases – Tuberculosis

Tuberculosis in Children and Adolescents

- Tuberculosis is usually caused by Mycobacterium tuberculosis and spreads through inhalation of infectious airborne particles.

Infection, Disease and Epidemiology

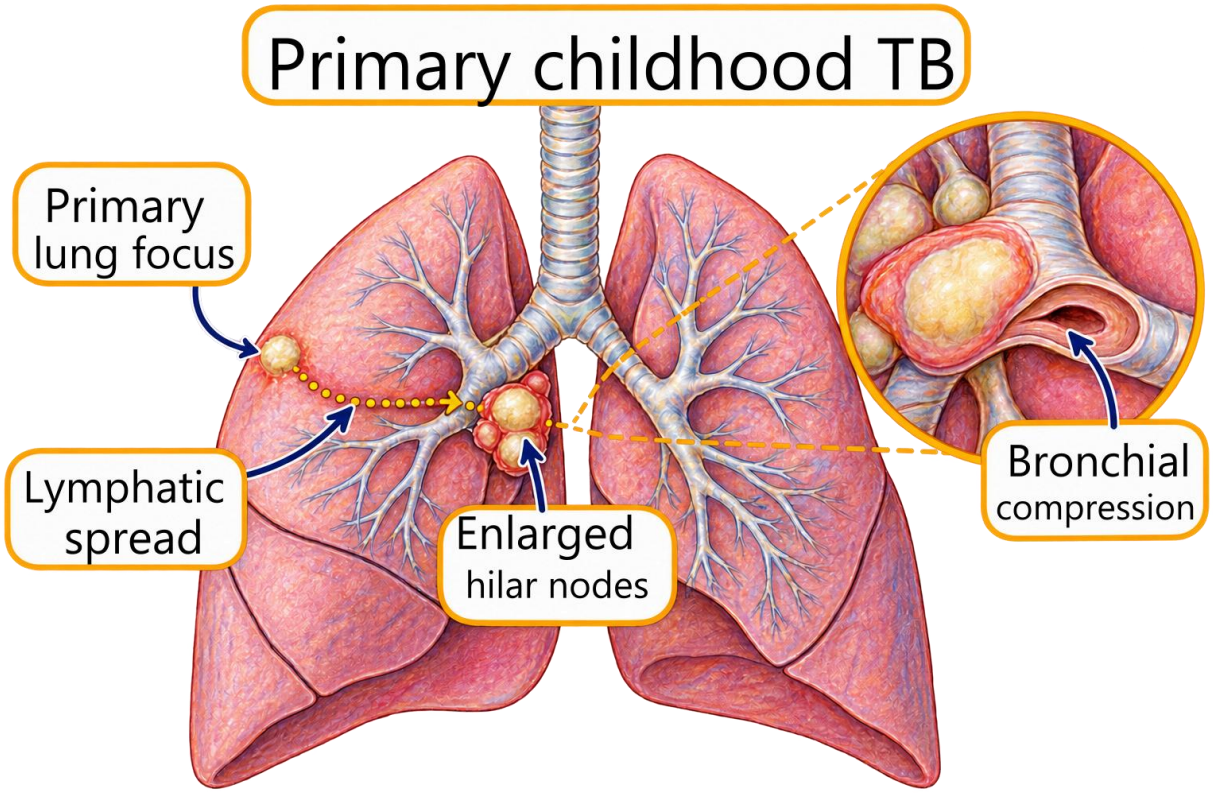
Transmission and Risk of Progression

- A young child commonly acquires infection from an infectious adult or adolescent in the household or another close setting.
- Crowding, poor ventilation, undernutrition and delayed diagnosis increase risk.
- Infants, young children, children with HIV and other immunocompromised children are particularly vulnerable to progression and disseminated disease.

Infection versus Active Disease

- TB infection means an immune response to the organism without evidence of active disease.
- Active TB involves clinical or radiological disease and requires a full treatment regimen rather than preventive treatment alone.
- Adolescents may develop adult-type pulmonary disease with cavitation and greater infectiousness.

Clinical Forms of Childhood Tuberculosis



Primary pulmonary TB can involve a lung focus, draining lymph nodes and compression of a nearby bronchus

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1. Pulmonary and Intrathoracic Disease

- A primary lung focus may spread through lymphatics to hilar or mediastinal nodes.
- Enlarged nodes can compress a bronchus and cause persistent wheeze, air trapping or collapse.
- Persistent cough, fever, reduced activity and failure to gain weight are common presenting features.
- An unexplained persistent respiratory illness requires evaluation even without a known contact.

2. Extrapulmonary Disease

A. Lymph-Node Disease

- Peripheral lymph-node TB may cause painless enlarged or matted nodes that later form a sinus.

B. Pleural Disease

- Pleural TB can cause fever, chest pain and an effusion, particularly in older children.

C. Abdominal Disease

- Abdominal TB may produce pain, distension, ascites, obstruction or growth failure.
- Small abdominal nodes alone do not establish TB and should not trigger treatment without proper evaluation.

D. Bone and Joint Disease

- Spinal or joint TB may cause pain, restricted movement, deformity or neurological compression.

E. Pericardial Disease

- Pericardial disease may cause an effusion or constriction and requires specialist assessment.

3. Severe and Disseminated Disease

- Miliary TB results from blood-borne spread and may involve several organs with diffuse tiny lung nodules.
- TB meningitis can begin with irritability, fever and poor feeding before headache, altered consciousness or focal signs develop.
- Hydrocephalus, cerebral infarction, seizures and permanent disability are important complications.
- A seriously ill child with suspected disseminated or neurological TB needs urgent admission and treatment planning.

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Contact History and Examination

History at Every Relevant Encounter

- Ask about household and close contacts with prolonged cough, diagnosed TB, treatment interruption or drug-resistant TB.
- Record the source patient's diagnosis, bacteriological results, resistance pattern and treatment dates when available.
- Ask about previous TB treatment, nutrition, HIV exposure, immunosuppressive medicines and recent travel or residence.
- Review the growth record and the duration and progression of symptoms.

Clinical Examination

- Measure weight and height and assess respiratory distress, lymph nodes, hepatosplenomegaly and signs of meningeal or bone disease.
- Inspect for a BCG scar, usually over the left upper arm, and compare the finding with the vaccination record.
- Absence of a scar does not prove that BCG was never given, and a scar does not rule out active TB.
- BCG mainly protects young children against severe disseminated and meningeal disease rather than reliably preventing every pulmonary infection.

Childhood Tuberculosis: Diagnostic Tests and Specimens

Diagnostic Modalities

1. Imaging and Blood Tests

Imaging Selection and Interpretation

- A chest radiograph may show hilar nodes, consolidation, collapse, effusion, miliary nodules or an adolescent-type cavity.
- Interpret imaging with the history and examination because no common radiographic pattern is completely specific for TB.
- Ultrasound, CT or MRI is selected according to the affected organ and the clinical question.

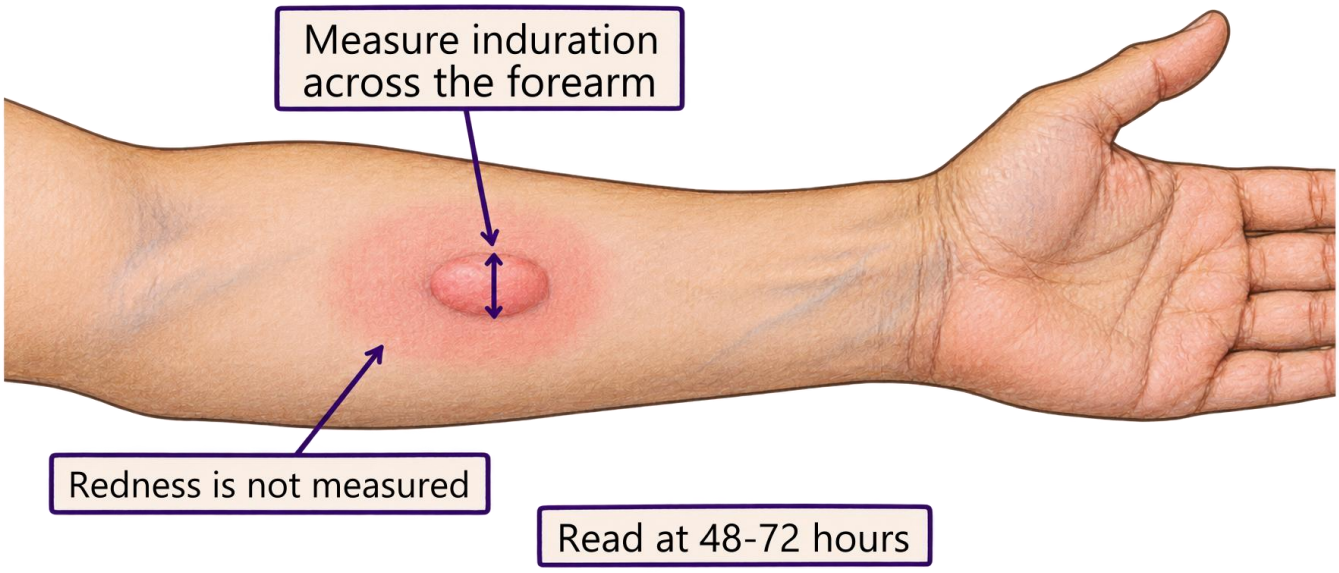
Blood Tests, HIV Assessment and Unreliable Serology

- Anaemia, a raised ESR or inflammatory markers can support concern about chronic illness but cannot confirm TB.
- Normal blood counts or inflammatory markers do not exclude childhood TB.
- Offer HIV testing with appropriate counselling and consent when indicated by the diagnostic pathway.

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- Commercial antibody tests are not a reliable basis for diagnosing active TB.

2. Tuberculin Skin Testing and IGRA



The Mantoux reaction is read by measuring palpable induration across the forearm, rather than measuring redness

Mantoux Technique and Reading

- The Mantoux test measures delayed hypersensitivity to injected tuberculin rather than directly detecting living organisms.
- Use the programme-approved tuberculin strength and intradermal technique with trained supervision.
- Read the test at 48–72 hours by palpating and measuring the transverse diameter of induration in millimetres.
- Measure firm swelling rather than the surrounding redness and record the actual diameter.

Thresholds and Limits of Infection Tests

- In Indian paediatric guidance, induration of at least 10 mm is generally positive, with 5 mm used for a child with HIV.
- A positive test supports infection but cannot distinguish active disease from infection without disease.
- A negative test may occur with recent infection, severe TB, undernutrition or immunosuppression.
- An interferon-gamma release assay also indicates immune sensitization and cannot by itself confirm or exclude active TB.

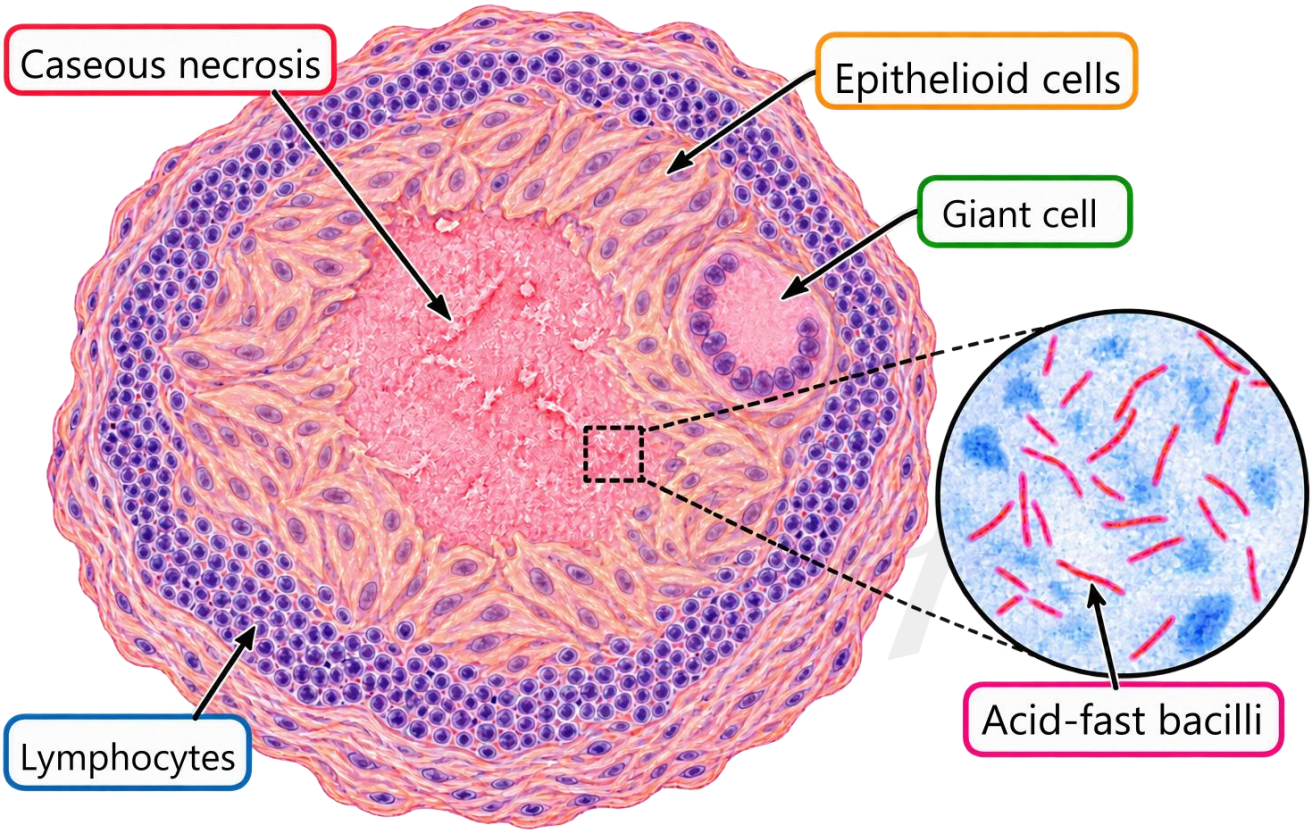
3. Rapid Molecular Testing

- Obtain a suitable specimen for a rapid molecular test whenever possible, including in a clinically diagnosed case.
- Cartridge-based nucleic acid amplification tests detect mycobacterial genetic material and can identify selected resistance markers rapidly.

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- Xpert platforms and Truenat-based pathways are used according to the national diagnostic network.
- A negative result does not exclude paucibacillary disease, especially in young children or extrapulmonary TB.
- A rifampicin-resistance result requires prompt linkage to the drug-resistant TB pathway and further susceptibility testing.
- Molecular positivity may persist after organisms are no longer viable, so it is not a simple standalone test of cure.

4. Microscopy, Culture and Histology



A tuberculous granuloma may contain caseation, epithelioid cells and giant cells; microbiological confirmation remains important

A. Smear Microscopy

- Smear microscopy can show acid-fast bacilli but has limited sensitivity in many children.

B. Culture and Culture Systems

- Culture demonstrates viable organisms and allows phenotypic drug-susceptibility testing.
- Solid culture is slow, while automated liquid culture systems such as MGIT can provide earlier growth detection.
- BACTEC refers to a family of culture systems, and current laboratory platforms should not be confused with older radiometric methods.

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