Pediatric Tuberculosis

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TB Intensive
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- No conflict of interests
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PEDIATRIC TUBERCULOSIS
Kim Connelly Smith, MD, MPH

OUTLINE
• Stages of tuberculosis
• Differences of disease in children and adults
• Diagnostic challenges of pediatric TB
• Treatment of TB in children
• Clinical cases
STAGES OF TUBERCULOSIS

Exposure to Contagious Adult with Pulmonary Disease

Household contacts

Latent TB Infection LTBI

20-30%

5-10%

Risk varies by age 5-50%

Adult Active TB Disease

Child Active TB Disease

RISK OF DISEASE WITH NO TREATMENT BY AGE INFECTED OR MEDICAL CONDITION

Bar chart showing the risk of disease without treatment by age and medical condition.

- Birth-12 months: 50%
- 1-3 years: 24%
- 4-11 years: 5%
- 12-18 years: 10%
- Healthy Adults: 7%
- Diabetes: 30%
- HIV Infected: 60%

Legend for Bar Chart:

- Birth-12 months: 50%
- 1-3 years: 24%
- 4-11 years: 5%
- 12-18 years: 10%
- Healthy Adults: 7%
- Diabetes: 30%
- HIV Infected: 60%
RISK OF PROGRESSION TO TB DISEASE BY AGE

<table>
<thead>
<tr>
<th>Age @ primary infection</th>
<th>Risk of Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth-12months</td>
<td>Disease 50%</td>
</tr>
<tr>
<td></td>
<td>Pulmonary Dis 30-40%</td>
</tr>
<tr>
<td></td>
<td>Miliary or TBM 10-20%</td>
</tr>
<tr>
<td>1-2 years</td>
<td>Disease 20-25%</td>
</tr>
<tr>
<td></td>
<td>Pulmonary Dis 75%</td>
</tr>
<tr>
<td></td>
<td>Miliary or TBM 2-5%</td>
</tr>
</tbody>
</table>

Marais BJ. Int J Tuberc Lung Dis 2004;8:392-402

TREATMENT OF TUBERCULOSIS IN CHILDREN

<table>
<thead>
<tr>
<th>Stages of TB</th>
<th>Skin Test or IGRA</th>
<th>CXR</th>
<th>SXs</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| Exposure     | TST Negative      | Normal| None | Meds: INH or Rif window prophylaxis  
Duration: 8-10 weeks  
Repeat skin test: 8-10 wks after exp if positive ≥ 5mm, see LTBI |
| Latent TB infection (LTBI) | Positive | Normal | None | Treatment Options:  
- INH x 9 months or  
- Rif x 4-6 months or  
- 3HP wkd x 12 wks, DOT only |
| Disease Pulmonary and extrapulmonary (except disseminated disease and meningitis, see below) | 90% positive | Abnormal | +/- 50% of children with no symptoms | Meds: INH, Rif, PZA, EMB (or an aminoglycoside)  
Duration: 6 mo total,  
Stop PZA after 2 mo, continue INH & Rif for susceptible disease |
| Disease Disseminated including miliary, bone/joint and multi-site disease | TST may be negative early in disseminated TB, 90% positive by end of treatment | +/- | Yes | Meds: INH, Rif, PZA and EMB or an aminoglycoside  
Duration: 9-12 mo total  
Stop PZA and EMB or aminoglycoside after 2 mo for susceptible disease |
| Disease Meningitis | Often negative early in meningitis and miliary disease 90% positive by end of tx | +/- | Yes | Meds: INH, Rif, PZA and Ethionamide or an aminoglycoside or EMB daily for 2 mo, then INH and Rif for 7-10 mo  
Duration: 9-12 mo total for drug susceptible disease  
Steroids recommended for first 1-2 months for meningitis |
### Stages of TB in Children

<table>
<thead>
<tr>
<th>Stages of TB</th>
<th>TST/IGRA</th>
<th>CXR/Lab Physical</th>
<th>Symptoms</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| Exposure Child < 4yrs (adult source) | Negative      | Normal           | None     | Window CPX  
INH or Rif 8-10 wks  
Repeat TST 8-10 wks after last contact |
| LTBI         | Positive      | Normal           | None     | INH x 9 mo or  
Rif x 4-6 mo or  
3HP wkly x 12 wks, DOT only |
| Disease      | 90% Positive  | Abnormal CXR, PE or labs | 50% of children have symptoms | RIPE x 6-12 months, duration depends on site  
50% false neg with miliary and TBM |

### Daycare Exposure
DAYCARE EXPOSURE

- Index case, teacher assistant with AFB smear positive pulmonary disease and cough for 6 weeks
- 135 children < 4 years of age, plus adult staff members exposed

Smith, KC. *Southern Medical Journal* 93(9):877-880, 2000

DAYCARE EXPOSURE MANAGEMENT

- Who needs TST?
  - Everyone with significant contact with source case

- Who needs CXR?
  - All children less than 4 years of age even if TST negative
  - Any contacts with positive TST (> 5mm)

- Who needs treatment?
  - LTBI (positive TST >5mm and normal CXR) INH for 9 months or Rif x 4-6 months
  - Exposed children less than 4 years of age (window prophylaxis)

- Follow up:
  - Skin test conversions: 4 adults and 3 children
**WINDOW PROPHYLAXIS FOR EXPOSURE**

- Household contact with contagious person
  - Teen or adult with pulmonary TB disease
  - Usually ≥ 4 hours of contact
- Initial TST negative
  - Window period for TST conversion
    - (8-10 weeks)
- CXR and physical exam normal
- **INH or Rifampin prophylaxis recommended:**
  - For children <4 yrs of age
  - Immunosuppressed patients
  - May prevent progression to disease during window period
- Repeat TST 8-10 wks after exposure
- May stop CPX if 2nd TST negative <5mm in immunocompetent patients

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**TABLE 101-5** The timetable of tuberculosis.

*Feigin & Cherry, Text of Pedi ID*
PREVENTABLE CASE

6 month old hospitalized March 2015

- 1-2 week history of fever (Tmax 101), vomiting and diarrhea
- CXR with miliary infiltrates
- Developed respiratory failure, seizure and AMS

Family history:
- Father, uncle and mother with history of incarceration
- Father hospitalized 7 weeks prior with cavitary pneumonia, AFB smears negative, no TB treatment
- Sputum cultures grew TB at 4 weeks but Health Department unable to locate family
HOSPITAL COURSE

- Respiratory failure, intubation
- Deterioration, AMS and focal neurologic exam
- MRI brain – Acute hydrocephalus, leptomeningeal enhancement, diffuse nodular parenchymal enhancements
- CSF – RBC 300, WBC 46 (<7), 46%L, Protein 130 (<40)

OUTCOME

- All family members tested positive for TB
- Patient grew TB from tracheal aspirate
- Neurologic: hydrocephalus, VP shunt, seizure disorder, developmental delay

How could this have been prevented?
- Report to HD and start treatment when TB suspected (cavitary pneumonia)
- Timely Contact Investigation when suspect reported
- Window prophylaxis for children < 4 years
**TB Meningitis**

**Treatment and Clinical Course**

- 9-12 months RIPE therapy
- Steroids for 1-2 month with 2-3 week taper
  - decreases CNS inflammation
- Fever common for first month, symptoms may initially worsen followed by gradual improvement
- Possible complications
  - Seizures
  - Hydrocephalus
  - CNS tuberculoma, stroke, mental disabilities, CP
  - Mortality high (>90%) if not diagnosed and treated

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**Table 2**

Multivariate logistic regression analysis, at various levels of the predictor variables, for TBM cases

<table>
<thead>
<tr>
<th>Predictor variables</th>
<th>P</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>History of illness &gt; 5 days</td>
<td>0.000</td>
<td>6.1</td>
<td>2.5–14.8</td>
</tr>
<tr>
<td>WBC count &lt; 1000/mm³</td>
<td>0.009</td>
<td>2.9</td>
<td>1.3–6.4</td>
</tr>
<tr>
<td>Lymphocytes &gt; 30%</td>
<td>0.000</td>
<td>10.1</td>
<td>4.5–22.6</td>
</tr>
<tr>
<td>Protein content &gt; 100 mg/dL</td>
<td>0.002</td>
<td>2.5</td>
<td>1.2–6.1</td>
</tr>
<tr>
<td>Headache</td>
<td>0.001</td>
<td>5.4</td>
<td>2.0–14.2</td>
</tr>
<tr>
<td>CSF appearance (clear)</td>
<td>0.002</td>
<td>2.4</td>
<td>1.2–5.9</td>
</tr>
</tbody>
</table>

CI = confidence interval.

DIFFERENCES IN ADULT AND PEDIATRIC TB

- Occurs years after primary infection
- Typical of adult disease
- Occasionally seen in teens
- Often cavitary disease
- High numbers of organisms (AFB +)
- Usually symptomatic and contagious
PRIMARY TB DISEASE

- Typical of childhood TB
- Usually not cavitary

- Classic x-ray:
  - Hilar lymphadenopathy +/- infiltrates or
  - Miliary pattern

- Low numbers of organisms
  - AFB smears negative (95%)
  - Cultures negative in 60% of cases

- Most children <12 yrs not contagious
- Often asymptomatic (50%)
RADIOGRAPHIC FINDINGS IN PEDIATRIC TB DISEASE

**Typical of TB**
- Hilar and interthoracic lymphadenopathy
- Miliary pattern
- Basilar enhancement on brain imaging
- Apical cavitary lesions in adults and teens

**Not specific but common**
- Lobar pneumonia
- Pleural effusion in adults and teens
TB Disease

**Adult TB Disease**

- Pulmonary: 85%
- Extrapulmonary: 15%

**Pediatric TB Disease**

- Pulmonary: 75%
- Extrapulmonary: 25%

**Adult Extrapulmonary TB Disease (15%)**

- Lymphatic: 25%
- Pleural: 23%
- GU: 16%
- Meningeal: 4%
- Bone/Joint: 10%
- Miliary: 9%
- Other: 13%
Extrapulmonary TB Disease in Children (25%)

- Lymphatic: 65%
- Meningeal: 14%
- Pleural: 6%
- Miliary: 5%
- Other: 5%
- Bone/Joint: 5%

Common Symptoms of TB Disease in Children (Nonspecific)

- Cough and/or respiratory distress
- Pulmonary findings on examination
- Lymphadenopathy or lymphadenitis
- Sx/Sx of meningitis including seizures
- Persistent fever (FUO)
- Weight loss or failure to thrive
- Unlike adults, up to 50% of children with TB disease have no symptoms
DIAGNOSIS OF TB IN CHILDREN

- **Gold Standard** – Positive TB Culture
- OR, **Clinical Diagnosis:** Abnormal CXR, laboratory, or physical examination consistent with TB AND 1 or more of the following:
  - Positive tuberculin skin test or IGRA
  - Contagious adult source case identified
  - Clinical course consistent with TB disease, or
  - Improvement on TB therapy

**DIAGNOSTIC TRIAD**

PEDI TB DISEASE

1. Positive TST
2. Abnormal CXR
3. Infectious source case
**GASTRIC ASPIRATES**

- Inpatient procedure
- Overnight fasting
- Lavage with normal saline
- Collected in morning x 3 days
- Inpatient costs substantial
- AFB smear yield: <5%
- Sensitivity of culture 20-50%
- Future: possible use of NAAT’s in children

**INDUCED SPUTUM**

- Outpatient procedure
- 2-3h fasting period
- Pretreatment:
  - Nebulized bronchodilator and hypertonic saline
  - Chest physiotherapy (CPT)
- Nasopharynx suctioned
- One specimen sufficient
- Minimal costs
- Yield equivalent to GA’s

Lancet. 2005;365:130
TB CULTURES FROM CHILDREN

- Bronchoalveolar lavage (BAL)
  - Single specimen with similar yield to 3 GA’s
  - Sensitivity 40% (20-50% range)
- Lymph nodes
  - Biopsy or FNA for path and culture
  - Sensitivity 30-70% on culture
- CSF in TB meningitis
  - High volume (> 6 ml) improves yield
  - Sensitivity 20% average (12-50% range)
- Nucleic acid amplification tests (NAAT) in children
  - Data limited especially from U.S.
  - Sensitivity estimated at 60-85%
- Bottom line
  - Negative test does not rule out disease

TUBERCULIN SKIN TEST AND INTERFERON GAMMA RELEASE ASSAYS (IGRA)

**Tuberculin Skin Test**
- Sensitivity 90%
  - 50% in disseminated TB
- Specificity 85%
  - Lower in BCG vaccinated
- Cross reacts with
  - BCG vaccine
  - Many NTM

**IGRA (QFT or TSPOT)**
- Sensitivity 75-90%
  - Children 90%
  - Lower in developing countries and children <5 years of age (50-90%)
- Specificity 90-99%
- Cross reactions
  - None with BCG
  - Only 3 NTM
    - *M. kansasii*, *M. marinum*, *M. szulgai*

Both TST and IGRA tests may be helpful in difficult cases
### Quantiferon and TST in Children

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Test Type</th>
<th>TB Burden</th>
<th>Age (yr)</th>
<th>Sample Size</th>
<th>No. TB Cases</th>
<th>TST Cutoff (mm)</th>
<th>Sensitivity (%)</th>
<th>Specificity (CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Okada et al., 2008</td>
<td>QFT-G</td>
<td>High</td>
<td>&lt;5</td>
<td>185</td>
<td>19</td>
<td>10</td>
<td>79% (79-100)</td>
<td>93% (88-99)</td>
</tr>
<tr>
<td>Doga et al., 2006</td>
<td>QFT-G IT</td>
<td>High</td>
<td>1-12</td>
<td>105</td>
<td>8</td>
<td>10</td>
<td>63% (58-89)</td>
<td>93% (84-100)</td>
</tr>
<tr>
<td>Bianchi et al., 2009</td>
<td>QFT-G IT</td>
<td>Low</td>
<td>&lt;16</td>
<td>336</td>
<td>15</td>
<td>10</td>
<td>48% (38-60)</td>
<td>92% (87-99)</td>
</tr>
<tr>
<td>Haustein et al., 2009</td>
<td>QFT-G IT</td>
<td>Low</td>
<td>&lt;16</td>
<td>237</td>
<td>27</td>
<td>6</td>
<td>72% (67-76)</td>
<td>93% (88-99)</td>
</tr>
<tr>
<td>Bramford et al., 2009</td>
<td>QFT-G IT</td>
<td>Low</td>
<td>&lt;16</td>
<td>322</td>
<td>15</td>
<td>10</td>
<td>55% (50-60)</td>
<td>92% (87-99)</td>
</tr>
<tr>
<td>Kaupumaa et al., 2009</td>
<td>QFT-G IT</td>
<td>Low</td>
<td>&lt;16</td>
<td>269</td>
<td>63</td>
<td>15</td>
<td>60% (55-65)</td>
<td>92% (87-99)</td>
</tr>
</tbody>
</table>

*Year of publication.

QFT indicates Quantiferon; TST, tuberculin skin test; TB, tuberculosis; QFT-G, Quantiferon Gold; QFT-G IT, Quantiferon Gold In-Tube.

Machingaidze et al. PIDJ 2011; 30: epub

### IGRA Sensitivity in Children < 5 yrs of Age Insufficient to Replace TST

<table>
<thead>
<tr>
<th>Test</th>
<th>Sensitivity &lt;5 years (CI)</th>
<th>Sensitivity &gt;5 years (CI)</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>TST</td>
<td>90% (79-100)</td>
<td>98% (93-100)</td>
<td>NA, ref standard</td>
</tr>
<tr>
<td>QFT-G IT</td>
<td>73% (58-89)</td>
<td>93% (84-100)</td>
<td>93% (88-99)</td>
</tr>
<tr>
<td>T-SPOT.TB</td>
<td>63% (46-80)</td>
<td>83% (75-90)</td>
<td>92% (87-99)</td>
</tr>
</tbody>
</table>


338 children total, 210 not infected, 58 LTBI, 42 probable TB disease by clinical criteria, 28 culture confirmed disease
Algorithm for TB Testing in Children

TB Risk Questionnaire positive?
- Yes
  - Age < 5 years?
    - Yes
      - TST Preferred
    - No
      - BCG Vaccinated?
        - Yes
          - IGRA Preferred
        - No
          - TST or IGRA Acceptable

Screening Complete

WHAT TO DO WITH DISCORDANT IGRA AND TST RESULTS?

- For healthy patients (5 yrs or older) with low risk for disease
  - Choose the more specific test (IGRA)

- If the patient is sick, under 5 years of age or at high risk of disease
  - Consider either test positive for highest sensitivity

- Indeterminate results means the control failed
  - Repeat the test
MONITORING CHILDREN ON TB TREATMENT

- Risk of drug toxicity very low
- Monitor clinical signs
  - regular clinical visits (4-6 wks)
  - patient education
- Routine blood work not necessary unless
  - symptoms
  - risk factors for toxicity (obesity, other hepatotoxic medications)
- Monitor and reinforce adherence
- When to follow up CXR’s for pulmonary TB
  - Beginning and end of therapy
  - Anytime if clinical change
- Completion of therapy certificate

TB MEDICATIONS IN KIDS

- Hepatotoxicity rare
- INH liquid vs tablets
- Medication refusal in children
  - Crush tablets, medication sandwich
- Vitamin B6
  - Not needed for all kids
  - Important for
    - Breastfed infants
    - Teens and/or picky eaters
    - Patients with symptoms of peripheral neuropathy
- Going back to school
  - Children <12 yrs of age are not contagious
### CENTRAL NERVOUS SYSTEM TB DRUG PENETRATION

<table>
<thead>
<tr>
<th>Drug</th>
<th>CNS Penetration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isoniazid</td>
<td>Good</td>
</tr>
<tr>
<td>Rifampin</td>
<td>Inflamed meninges only</td>
</tr>
<tr>
<td>PZA</td>
<td>Good</td>
</tr>
<tr>
<td>Ethambutol</td>
<td>Inflamed meninges only</td>
</tr>
<tr>
<td>Ethionamide</td>
<td>Good</td>
</tr>
<tr>
<td>Aminoglycosides</td>
<td>Inflamed meninges only</td>
</tr>
<tr>
<td>Fluoroquinolones</td>
<td>Good except Cipro poor</td>
</tr>
</tbody>
</table>

### ETHAMBUTOL IN CHILDREN

- **Risk of optic neuritis:**
  - Visual acuity
  - Color perception
  - Dose related
  - Usually reversible
  - Risk around 1-3% in adults
  - Risk in children about the same

- **EMB safe in children with monitoring**
  - Monitor vision on treatment
  - Infants – visual evoked potentials (VEP)
Ethambutol in Children

Table 2. Studies that have specifically sought optical toxicity in children treated with Ethambutol

<table>
<thead>
<tr>
<th>Reference</th>
<th>Patients (n)</th>
<th>Age range</th>
<th>Method of evaluation</th>
<th>Length of follow up (months)</th>
<th>Number with toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>47</td>
<td>3-13 years</td>
<td>Visual evoked responses</td>
<td>15-18</td>
<td>0</td>
</tr>
<tr>
<td>25</td>
<td>36</td>
<td>4 months to 16 years</td>
<td>Acuity/field/colour</td>
<td>24-48</td>
<td>0</td>
</tr>
<tr>
<td>Fox*</td>
<td>45</td>
<td>1-15 years</td>
<td>Acuity/field/colour</td>
<td>9-18</td>
<td>0</td>
</tr>
<tr>
<td>26</td>
<td>30</td>
<td>4-5 years</td>
<td>Acuity/field/colour</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>27</td>
<td>27</td>
<td>5-15 years</td>
<td>Acuity/field/colour</td>
<td>12-36</td>
<td>0</td>
</tr>
<tr>
<td>28</td>
<td>6</td>
<td>9-16 years</td>
<td>Computerized visual field examination</td>
<td>9</td>
<td>0</td>
</tr>
</tbody>
</table>


FLUOROQUINOLONES IN CHILDREN

- Initial clinical trials in children not done
- Some children have been treated without problems:
  - CF, chronic UTI, shigellosis and TB
- Most consider safe in children:
  - Some case series and RCT with good results
  - Germany study: 2030 patients treated, 31 (1.5%) with self resolving arthralgia*
- Not indicated for routine infections in children
- Consider risks and benefits
- Monitor clinically for joint and tendon problems

Comparison of Side Effects with Ciprofloxacin vs Ceftazidime/Tobramycin in Children

<table>
<thead>
<tr>
<th>Event</th>
<th>Ciprofloxacin</th>
<th>Ceftazidime/Tobramycin</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 67 (%)</td>
<td>N = 62 (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any 52 (78)</td>
<td>43 (69)</td>
<td>0.288</td>
<td></td>
</tr>
<tr>
<td>Abnormal liver function tests 17 (25)</td>
<td>13 (21)</td>
<td>0.554</td>
<td></td>
</tr>
<tr>
<td>Injection 16 (24)</td>
<td>5 (8)</td>
<td>0.015</td>
<td></td>
</tr>
<tr>
<td>Injection site pain 13 (19)</td>
<td>7 (11)</td>
<td>0.203</td>
<td></td>
</tr>
<tr>
<td>Rash 10 (15)</td>
<td>5 (8)</td>
<td>0.225</td>
<td></td>
</tr>
<tr>
<td>Phlebitis 7 (10)</td>
<td>1 (2)</td>
<td>0.063</td>
<td></td>
</tr>
<tr>
<td>Vomiting 11(16)</td>
<td>4 (6)</td>
<td>0.078</td>
<td></td>
</tr>
<tr>
<td>Central nervous system, any 1 (1)</td>
<td>6 (10)</td>
<td>0.055</td>
<td></td>
</tr>
<tr>
<td>Respiratory, any 7 (10)</td>
<td>3 (5)</td>
<td>0.328</td>
<td></td>
</tr>
<tr>
<td>Musculoskeletal, any 15 (22)</td>
<td>13 (21)</td>
<td>0.845</td>
<td></td>
</tr>
<tr>
<td>Joint Disorder 8 (12)</td>
<td>10 (16)</td>
<td>0.493</td>
<td></td>
</tr>
<tr>
<td>Arthralgia 7 (10)</td>
<td>7 (11)</td>
<td>0.878</td>
<td></td>
</tr>
<tr>
<td>Arthritis 1 (1)</td>
<td>0 (0)</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Leg cramps 0 (0)</td>
<td>1 (2)</td>
<td>0.481</td>
<td></td>
</tr>
<tr>
<td>Myalgia 1 (1)</td>
<td>0 (0)</td>
<td>1.000</td>
<td></td>
</tr>
</tbody>
</table>

LYMPHADENOPATHY

CLINICAL CASE
CERVICAL LYMPHADENOPATHY

- 8 yr old with cervical lymphadenopathy

**History:**
- LAN for 3 months
- PMHx: Healthy
  - BCG vaccine at birth
  - TB skin test 10 mm

**Physical Exam:**
- 3 cm anterior cervical LAN
- 1.5 cm supraclavicular lymphadenopathy

**CXR:**
- Hilar LAN, no infiltrates

Is this TB disease?
What else could it be?
HILAR & CERVICAL LYMPHADENOPATHY

❖ Differential Dx
  ➢ Tuberculosis
  ➢ Non TB mycobacteria (NTM)
  ➢ Lymphoma/Leukemia
  ➢ HIV
  ➢ Other causes

❖ Diagnostic tests
  ➢ Biopsy (FNA or surgical for culture and path)
  ➢ Interferon γ blood test for TB infection

RESULTS

❖ Fine needle aspirate of node:
  ➢ Pathology: lymphoma, no TB by culture or microscopy

❖ Interferon γ Blood test for TB
  ➢ T-SPOT Positive

❖ Diagnoses:
  ➢ Hodgkin's Lymphoma
  ➢ LTBI

❖ Treatment:
  ➢ Chemotherapy for lymphoma
  ➢ Treatment for LTBI (INH, Rif or 3HP)
Skin Test in Foreign Born

- 6 year old with positive TST for school entry
- Born in Asia
- BCG documented on vaccination records at birth and BCG scar present
- TST measures 12mm
CXR NORMAL

- How do you interpret the 12 mm skin test?
- Is this BCG effect or LTBI?
- Are there any other tests that may help?

TREATMENT OF LATENT TB INFECTION (LTBI)

Traditional
- INH for 9 months
  - Clinically monitor for hepatitis and peripheral neuropathy
  - Supplement Vit B6 if breastfed, poor diet or symptoms
  - Caution: liquid INH causes diarrhea
  - Crushed tablets preferred
  - Dose: daily or twice weekly (DOT)

Newer option
- Rifampin daily for 4-6 months
  - Potential drug interactions (OCA’s, protease inhibitors)
  - Discolors urine and tears
  - Cost 5-8 x higher than INH
  - Capsules or can be compounded into liquid formulation

Health Department Only
- INH-Rifapentine (3HP) once weekly for 12 doses
  - Must be DOT
  - Not approved for children < 2 years

DOT = Directly Observed Therapy
## LTBI Treatment Options and Drug Cost

<table>
<thead>
<tr>
<th>Drug</th>
<th>Duration</th>
<th>Daily Dose</th>
<th>Intermittent Dose</th>
<th>Max Dose</th>
<th>Drug Cost only Not DOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>INH</td>
<td>9 months</td>
<td>10-15 mg/kg</td>
<td>20-30 mg/kg</td>
<td>300 mg daily 900 mg BIW</td>
<td>$45-$180/daily $13-$55/BIW</td>
</tr>
<tr>
<td>Rifampin</td>
<td>4-6 months</td>
<td>10-20 mg/kg</td>
<td>Not recommended for LTBI</td>
<td>600 mg daily</td>
<td>$190-$500/4 mo $290-$730/6 mo</td>
</tr>
<tr>
<td>INH/RPT (3HP)</td>
<td>12 weeks</td>
<td>NA</td>
<td>INH 15 mg/kg RPT 20-30 mg/kg</td>
<td>INH 900 mg RPT 900 mg</td>
<td>INH $5-$9 RPT $100-$300</td>
</tr>
</tbody>
</table>


## Baby Exposed to TB Disease

- 2 month old infant
- Mother with pulmonary TB
  - Cavitory disease on CXR
  - AFB smear positive

Mother’s CXR
BABY EXPOSED TO TB DISEASE

- Baby with cough and respiratory distress
- TST 0 mm
- What would you do next?
  - CXR
  - Diagnosis?
  - Lumbar puncture?
    - CSF normal
    - Treatment?
NEW MOTHER WITH POSITIVE TST

- Newborn infant in hospital nursery
- Mother with 15 mm TST
- CXR: calcified granuloma no active disease
- Not on treatment
  - What is mother’s diagnosis?
  - Do mother or baby need isolation?
  - May baby breast feed and room with mother?
Maternal TB disease or LTBI during pregnancy

Is mother contagious?

If no exposure to contagious household TB contacts:
• No treatment for baby
• Okay to breastfeed

Exposure to contagious household TB contact:
• Window prophylaxis for baby
• Multivitamin for baby
• Okay to breastfeed
• If MDR-TB, separate baby from source

PREVENTION OF TB DISEASE IN CHILDREN

❖ Contact Investigation
❖ Window Prophylaxis
❖ Treatment of LTBI
RESOURCES

- HNTC Pedi TB Toolbox
  - Guidelines and clinical tools
  - Reference materials
  - Patient education materials

- TB Testing in Children Brochure

- Pediatric Radiology for Clinicians