Pediatric TB Radiology: It’s Not Black and White Part 2

June 18, 2018

A National Webinar

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Pediatric TB Radiology: Too bad it’s not actually black and white

Thienkhai Vu, MD, PhD
Ann M. Loeffler, MD
normal neonate

cardiothoracic ratio < 65%
normal neonate
normal thymus configuration
normal thymus configuration
normal thymus configuration
normal thymus configuration: lateral projection
normal thymus configuration: Wavy thymus sign
14-month-old child
2-year-old child
3-year-old child
5-year-old child
9-year-old child
Pediatric TB Chest Findings

- atelectasis
- consolidation
- adenopathy
- bronchial narrowing
- nodules
- lungs hyperinflation
- pleural effusion
## Comparison of Radiographic Features of Pulmonary TB in Infancy and Childhood: Literature Review

<table>
<thead>
<tr>
<th>Rad Studies</th>
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<td>Mean Age</td>
<td>5.9 mos</td>
<td>65 days</td>
<td>21.5 mos</td>
<td>2 year</td>
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<td>Med LN</td>
<td>72%</td>
<td>89%</td>
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<td>92%</td>
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<tr>
<td>Consolidation</td>
<td>80%</td>
<td>71%</td>
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<td>70%</td>
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<tr>
<td>Disseminated nodules</td>
<td>24%</td>
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<td>Airway compression</td>
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## Comparison of CT Features of Pulmonary TB in Infancy and Childhood: Literature Review

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<td>Bronchial Narrowing</td>
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2-month-old TB case: Rotated study
2-month-old TB case: adenopathy, consolidation, and micronodules
2-month-old TB case: adenopathy, consolidation, and micronodules
have a systematic approach to interpretation
Pediatric TB Radiology: It’s Not Black and White Part 2
Dr. Ann M Loeffler (MD) and Dr. Thienkhai Vu (MD, PhD)
pulmonary hila
Pediatric TB Radiology: It’s Not Black and White Part 2
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Large airway contours
4-year-old TB case: hilar adenopathy
4-year-old TB case: infrahilar adenopathy
34-month-old TB case:
34-month-old TB case: hilar and infrahilar adenopathy and left lower lung nodules
6-year-old TB Case:
Left hilar adenopathy and perihilar opacities/nodules
6-year-old TB Case: Left hilar adenopathy and perihilar opacities/nodules
7-year-old TB Case: right hilar/paratracheal adenopathy and right lung consolidation and micronodules
7-year-old TB Case:
right hilar adenopathy
and right lung consolidation and micronodules
15-year-old TB Case: Right hilar Adenopathy and lung cavity
15-year-old TB Case: Right hilar Adenopathy and lung cavity
12-month-old patient: with parenchymal consolidation and pleural effusion

TB or not TB?
12-month-old patient: with parenchymal consolidation and pleural effusion

MRSA Empyema
TB Pleural Effusion

- Uncommon presenting finding in children with TB
- Tuberculous pleural effusions are rare in young children but are more frequent in adolescents and in boys
- Most are unilateral and typically associated with parenchymal disease
CASE 6:
11 year old boy emigrating from Chuuk
Presents to care for a tender mass on his thigh.

- 11 year old from Micronesia
- He had two weeks of cough / rhinorrhea
- One week of fever, malaise and anorexia and new onset leg mass.
- No comparison weights as he had been living with relatives in Chuuk
CASE 6: lateral
CASE 6: CT images at presentation

- There was a broad differential diagnosis including TB, fungal infections, Nocardia, malignancy
- The CT scan showed very large, necrotizing lymph nodes (less likely malignant) as well as parenchymal disease
CASE 6: before and after therapy

TST was positive. Cultures grew *M. tuberculosis*. Clinical improvement was initially very slow! He may well have scarring or bronchiectasis given the extensive disease.
CASE 7:
referred because mother may have tuberculosis

- 5 month old infant whose mother was screened for TB in jail. Mom had a positive IGRA and reportedly had cough.
- She was released from jail before a CXR was taken
- The baby had recurrent viral illnesses
- TST was 0 mm induration
- Baby’s CXR shows right sided likely adenopathy and airspace disease
- Siblings (who also lived with mom and baby) were all also TST negative
CASE 7: lateral

Case 7: lateral 5 weeks earlier during documented viral bronchiolitis
**CASE 7:** a few weeks into therapy - more work of breathing

Hilar & Subcarinal adenopathy

The baby got sicker despite four drug TB therapy and required ICU admission. TB cultures were negative; RSV positive
prior to TB diagnosis (viral bronchiolitis), at the time of TB diagnosis and 3 months into TB treatment. We treated him for presumed TB disease and his radiograph steadily normalized.
**Teaching point**

- Approximately 20% of children ultimately diagnosed with culture proven tuberculosis have a negative TST or IGRA at the time of dx.
- Most of these will children (but not all) will eventually have a positive TST / IGRA
- Gastric aspirates (and other microbiologic specimens for TB) in children have suboptimal sensitivity. The yield for 3, first morning gastric aspirate cultures is as high as 80% for young infants, but <50% for children in general. Smears are even less often positive
- Re: Gene Xpert for gastric aspirates: more sensitive than smear, less sensitive than culture. Not FDA approved per my lab: they won’t release results
- The dx of TB disease is often made based on a combination of clinical, radiographic, immunologic, demographic and exposure features.
- Once TB therapy is started in a child, we often need to finish therapy as it is really hard to prove that another process was causing the illness
CASE 8

3 month old evaluated during contact investigation of potentially contagious adult
CASE 8: lateral

- 3 month old baby screened several weeks into a contact investigation
- A former roommate was found to have smear positive TB
- The baby was symptomatic with work of breathing, noisy breathing, night sweats, and subjective fever
- On exam – no breath sounds heard on the right anteriorly, diminished posteriorly
- Radiographic interpretation, hyperinflation on the right concerning for airway obstruction, as well as airway opacification and lymphadenopathy.
  Retrocardiac density suggests left lower lobe
CASE 8

We treated him for TB disease as well as with steroids for symptomatic airway obstruction. His radiograph showed resolution of air trapping.
CASE 8

Completion of therapy – beautiful normalization of the radiographic abnormalities (unchanged 6 months off therapy)
Teaching points

- Young children are a high priority during contact investigation of a potentially contagious TB case.
- Infants less than 1 year of age have a 40% chance of developing TB disease if infected. The risk gradually declines to 5-10% around age 4 yrs.
- Pre-school aged children should have a high quality two view chest radiograph and history / physical looking for any evidence of TB disease (regardless of TST / IGRA result)
- If TB disease is ruled out by CXR / H&P in a young child, window prophylaxis is recommended
- TST / IGRA is repeated 8 – 10 weeks after contact is broken with source case / or source non-contagious. No need to repeat a chest radiograph unless the child has new symptoms. Infants < 6 - 12 months may need longer treatment (consult an expert)
Teaching points - continued

- Children with TB meningitis (TBM) initially have very non-specific clinical features and the diagnosis is often delayed. Infants and children under 2 years of age are at much risk of disseminated TB and TBM.

- The diagnosis of TBM should be considered for any child with systemic symptoms and especially for infants. The 2018 AAP RedBook notes that “most experts” recommend lumbar puncture for any infant < 12 mo of age with TB disease.

- Symptomatic children with TBM benefit from corticosteroid with their TB treatment as well as consideration of alternate TB medications.

- Consult a pediatric TB expert with any questions
CASE 9: Immigration screening

13 year old Burmese girl
Initial chest radiograph for immigration screening was subtly abnormal? Right hilar adenopathy

Subsequent CXR after screening IGRA was positive showed a vague density over the LLL. She was treated for LTBI. She had developed a chest wall fluctuance which was not correlated with the radiographic abnormalities. The mass was drained twice (recurred) and treated for staph without culture.
CT scan showed cortical rib defect and fluid collection, soft tissue swelling. Rib debridement was culture and path negative after INH monotherapy, but sputum culture was positive for pan-susceptible M. tb.
Teaching points

• Do not start INH monotherapy (or any other LTBI regimen) without good quality chest radiograph, history and physical exam looking for pulmonary AND extrapulmonary TB!

• Collect AFB cultures from any site possible

• Collect sputum for AFB, even from patients with only apparent extrapulmonary TB. Sometimes they’re positive and exceedingly helpful

• Unclear connection between parenchymal disease (Positive sputum), lymphadenopathy, bone / soft tissue disease). It would seem that she must have been bacillemic.
CASE 10:  
15 year old with hip pain  
(recent Vietnamese immigrant)
CASE 10:
15 year old with hip pain

Chest radiograph obtained when IGRA was strongly positive in anticipation of treatment for presumed autoimmune arthritis

Right apex showed small linear abnormalities
CASE 10

after high dose steroids for hip arthritis

RUL before and after steroids
Marked worsening of right
Apical abnormalities - ? cavity
CASE 10:
before and after 9 months of MDR- TB treatment

Sputum cultures grew M. tb – resistant to INH, rifampin, ethambutol
Joint aspirate / synovial biopsy showed no evidence of TB!
CASE 10: after 27 months of treatment

Completion of therapy
4/2018

Worst 4/2016

Completion of therapy CT obtained in case he clinically worsens off TB Therapy. Few right tiny nodules (2 calcified) and left apical blebs noted
Teaching points

- Chest radiographic abnormalities that look like they may represent old TB disease or scarring should be evaluated by obtaining high quality sputum cultures and repeating the radiograph in 2-3 months. Radiographic stability and negative cultures suggest scarring rather than TB disease. Do not treat for LTBI until these are done. Treat for TB disease instead if treatment must be initiated before radiographic stability can be documented.

- A TST and/or IGRA should be obtained before initiating immunosuppression. The result should be reviewed and acted upon before starting immunosuppression.

- In this case, TB was considered only because of the positive IGRA and then abnormal right apical radiographic findings.

- In our case, the worsening of pulmonary disease was advantageous as he was than able to submit smear and culture positive MDR-TB.