

Case Presentation

Evaluation and Management of Childhood Contacts to Infectious Pulmonary Tuberculosis

Source Case:

A 31 year old male was admitted to the hospital after experiencing gross hemoptysis. He had a 2 month history of productive cough, a 25 pound weight loss, night sweats, and fatigue. A chest x-ray (CXR) revealed bilateral cavitory infiltrates. The initial sputum specimen was 4+ positive for acid fast bacilli (AFB) and a genetic probe assay confirmed *Mycobacterium tuberculosis*. A culture was positive for *M. tuberculosis* which was later reported to be resistant to INH and streptomycin. The patient has a history of heavy alcohol and drug use, is HIV negative but Hepatitis B and C positive. He has a long history of cigarette use and a chronic smoker's cough. The patient resides with his wife and 3 children (2 are step-children).

General Information on Contacts' History

In the course of the contact investigation, eleven children were identified to have had exposure to the source case. All were tested by tuberculin skin test (TST). Of the eleven children, six had positive TSTs (range 11mm to 25mm). One of four children under the age of 5 years tested positive.

Contact #1; High Priority Contact: Active TB

The source's 13 month old niece had a positive TST with 25mm induration. Her chest x-ray had a question of an early infiltrate and adenopathy. These findings were both confirmed by a CT scan of the chest. The child was asymptomatic and was initially started on a daily regimen of INH, rifampin (RIF) and pyrazinamide (PZA). When the susceptibility results on the source case showed resistance to INH, her treatment was changed to RIF, PZA, and ethambutol (EMB).

Contact #2; High Priority Contact: Exposed, No evidence of Disease

The youngest contact, a 7 week old infant, was TST negative (0mm). Her initial CXR was inconclusive and she had a one week history of cough. The physical exam was normal. Because of her persistent cough, initial abnormal CXR and young age, she was admitted to the hospital for a repeat CXR and CT scan of the chest. These were negative, so no further testing was done. She was started on window period prophylaxis with INH. A repeat TST was planned at 8-10 weeks post-exposure and another at age 6 months. She has since been changed to RIF. Both young children are on directly observed therapy (DOT) due to their young age and increased risk for developing life-threatening forms of TB disease.

Teaching Points

- Diagnosis of latent tuberculosis infection (LTBI) or TB disease in a young child is indicative of a recent transmission of *Mycobacterium tuberculosis*, usually from an adult source case. The best way to prevent childhood TB is via prompt contact investigation of persons with contagious tuberculosis. A complete and thorough contact investigation is one of the best methods for identifying exposed children at risk for tuberculosis and protecting them from progression to severe disease by timely institution of appropriate therapy. The risk of developing disease is highest during the first 12 months after infection.
- Twenty to fifty percent of childhood contacts will be TST positive and one to two percent may have active disease.
- Infants and children <5 years of age, even if initially TST negative, are at risk of progressing to severe forms of active tuberculosis, such as meningitis or disseminated disease before a TST can become positive. Tuberculin reactivity takes between two to ten weeks following infection to develop. The incubation period for devastating forms of tuberculosis such as meningitis and disseminated disease might be as short as 4 to 6 weeks. This period of vulnerability, when the TST may not have had adequate time following the exposure to become positive, is commonly termed the "window period." If the TST is placed less than 12 weeks following the last exposure and is negative, children <5 years and others at high risk of progression to TB disease are started on primary prophylaxis during the "window period" to protect them from progression to disease. The TST is repeated 12 weeks following the last exposure.

Case Presentation, Teaching Points continued

- All persons, regardless of age, who are contacts should be regarded as TST positive if they have a reaction of ≥ 5 mm induration. A TST can be placed on a child as young as one month although results at this age are unreliable and should be repeated if initially negative. A negative TST after 6 months of age can be safely regarded as a true negative.
- All children and adolescents exposed to a contagious case of TB disease should have a TST and medical evaluation to detect signs or symptoms of TB disease. Children who are TST positive, as well as all children <5 years of age (whether TST positive or negative), should have a CXR and directed physical exam (special attention to examination of lungs and cervical lymph nodes) followed by initiation of treatment for LTBI or “window period prophylaxis” after active tuberculosis is excluded.
- Children <5 years old with negative results from the TST and CXR, identified as high priority contacts (more than incidental exposure to source) should be treated with “window period prophylaxis.” A TST should be repeated 12 weeks following the last exposure, and if the TST remains negative and contact has been broken by treatment of the source case or separation, treatment can be stopped. If the child is less than six months of age at the time of repeat TST or if there is ongoing exposure to the infectious case, treatment should continue. A final TST should be done 12 weeks after the child is last exposed to the source when the source is potentially infectious (sputum smear positive and not yet on therapy). If the repeat TST is negative and the child is asymptomatic, generally both latent TB infection and active disease can be excluded and therapy stopped.
- Decisions regarding the need to continue treatment in immunosuppressed individuals are made on a case by case assessment. Consultation with an expert in the management of TB is recommended to help in arriving at this decision.
- For children receiving “window period prophylaxis,” if the repeat TST is positive, the child should be evaluated clinically for evidence of active tuberculosis and if none exists, they should be classified as LTBI and treatment should continue to complete 9 months of therapy.
- Immunocompetent children 5 years of age and older who are TST negative do not need to be placed on window period prophylaxis with INH, but should have a repeat TST done after 12 weeks. If it is negative and exposure has ended, they need no further follow up. If the repeat TST is positive, active tuberculosis should be excluded with a CXR and a medical evaluation before treatment for LTBI is initiated.
- INH given either daily or twice weekly by DOT for nine months is the preferred treatment of LTBI in children. However, if the source case is INH resistant and RIF susceptible, or the child develops intolerance to INH, INH should be discontinued and daily RIF given in its place for 6 months.
- Tuberculosis in a child is usually diagnosed by the triad of: a history of contact with an active case, a positive TST and an abnormal CXR. The diagnosis may be overlooked, especially when there is no history of contact to a case of tuberculosis. Children are more likely to be asymptomatic but may also present with devastating forms of active disease.
- Children usually have paucibacillary disease which results in the presence of fewer mycobacteria in the sputum leading to negative AFB smears and cultures. Cultures for *M. tuberculosis* are positive in <30 to 40% of most reported cases. AFB stains of other body fluids are almost always negative.
- Sputum samples are difficult to obtain especially in young children. Induced sputum collections are helpful especially in children who are able to cooperate (usually age four and older).
- Gastric washings are helpful but are only positive in 30 to 40% and are best collected as a first morning specimen, requiring a child’s admission to the hospital. Bronchial washings, with a diagnostic yield similar to gastric aspirates, may be done as an outpatient but are more invasive.
- Children identified as part of contact investigations are more likely to be asymptomatic. If a child is asymptomatic, is a contact, and has a positive TST but the CXR is negative, there is no indication for a CT scan of the chest. A CT scan in such children may show evidence of hilar adenopathy, but when adenopathy is only detected by CT scan and the child remains asymptomatic, this is of no clinical significance. These children do well even with minor CT abnormalities if treated for LTBI with INH for 9 months. There is no benefit to the child, so there is no need to expose them to the radiation associated with the CT scan.

Teaching Points *continued*

- Anyone who has significant risk factors for tuberculosis and has radiographic or clinical manifestations of disease, regardless of age should be identified as a TB suspect and placed on anti-tuberculous therapy and re-evaluated after two months when final cultures are available to determine their definitive diagnosis. As noted earlier, the diagnosis of tuberculosis in children will most often be made on clinical grounds.
- Investigation of the household and other close contacts of a child with active TB disease is instrumental in the discovery of the adult source with disease.
- Consultation with an expert in tuberculosis (Heartland National TB Center, 1-800-TEX-LUNG) is available for any health care provider caring for a confirmed or suspected TB case involving a child.

References

American Academy of Pediatrics. "Tuberculosis" Red Book: Report of the Committee on Infectious Diseases, 27th ed., 2006.

MMWR. Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis. December 16, 2005, Volume 54(15): p. 14-15.

Nelson, L. J., Schneider, E., Wells, C.D. and Moore, M. "Epidemiology of Childhood Tuberculosis in the United States, 1993-2001: The Need for Continued Vigilance." Pediatrics August 2004, Volume 114, Number 2, p. 333-340.

Starke, Jeffrey R., "Tuberculosis in Infants & Children" in Tuberculosis & Nontuberculous Mycobacterial Infections, 5th ed. New York: McGraw Hill, Medical Publishing Division, 2006.