

TB 101: Infection vs. Disease

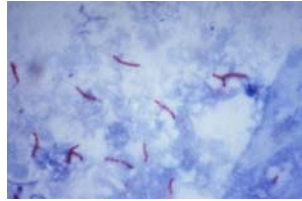
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Lindsey Totah, RN, PHN

Objectives

- ▶ Describe the basic pathophysiology of tuberculosis disease
- ▶ Describe the differences between inactive (latent) tuberculosis infection and active tuberculosis disease
- ▶ Describe the different types of TB tests used to detect TB infection
- ▶ Demonstrate proper procedure for placing and interpreting a tuberculin skin test (TST)

What is tuberculosis (TB?)



- ▶ TB is a bacterial infection caused by the acid-fast bacilli *Mycobacterium tuberculosis* (MTB)
 - ▶ Most commonly affects the lungs (pulmonary TB) but can also affect any other part of the body (extrapulmonary TB)
 - ▶ TB meningitis, renal TB, ocular TB, peritoneal TB, etc
- ▶ People who inhale these bacteria can become infected with TB, which may progress to active TB disease.

Inactive (Latent) TB Infection (LTBI)

- ▶ When TB bacteria are inhaled, they can settle in the lungs and begin to multiply.
 - ▶ TB bacteria are very slow growing! They divide every ~24 hours
- ▶ Immune cells surround the bacteria and wall them off, stopping them from replicating further (thus they are inactive/latent)
- ▶ ~5-10% of people with untreated LTBI will progress to active TB disease
- ▶ Highest likelihood of progression to active disease is within first 2 years of infection
- ▶ Progression to active disease more likely for children under 5 years old or immune compromised individuals (e.g. HIV+)

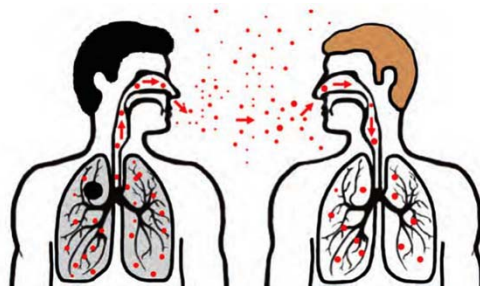
Characteristics of LTBI

- ▶ TB skin or blood test most likely positive
- ▶ Chest x-ray normal
- ▶ No symptoms
- ▶ **NOT able to transmit bacteria to others**



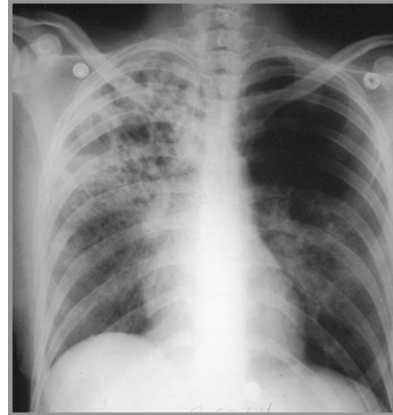
Active TB disease

- ▶ If the immune system is unable to contain the TB bacteria, inactive TB infection can progress to active TB disease.
- ▶ TB bacteria spread throughout the lung or travel to other organs.



Characteristics of active TB disease

- ▶ TB skin/blood test usually positive, but a negative result does not rule out active TB.
- ▶ Chest x-ray likely abnormal in pulmonary disease
- ▶ Symptoms may include:
 - ▶ Cough with or without hemoptysis
 - ▶ Extreme fatigue
 - ▶ Unintentional weight loss
 - ▶ Loss of appetite
 - ▶ Night sweats
 - ▶ Fever
- ▶ Can be transmitted to others
- ▶ Can be treated and cured



Diagnosing LTBI vs active TB disease

LTBI

- ▶ Skin/blood test positive
- ▶ CXR normal
- ▶ Asymptomatic



Active TB

- ▶ Skin/blood test can be positive or negative
- ▶ CXR/other imaging studies concerning for TB
- ▶ Symptoms present
- ▶ MTB isolated from specimen (sputum, urine, gastric lavage, CSF, etc.)
- ▶ Other causes of disease ruled out

Treating LTBI vs Active TB

LTBI

- ▶ Most commonly isoniazid (INH) daily for 6-9 months; shorter regimens available but not as widely used
- ▶ Generally does not require directly observed therapy (DOT)



Active TB

- ▶ Treatment generally a minimum of 6 months but is often longer depending on severity of disease and presence of drug resistance
- ▶ Treatment consists of multiple antibiotics
- ▶ Usually given by DOT



Who should be screened for TB?

- ▶ Contacts of a person with active TB disease
- ▶ Persons who are immunosuppressed (e.g. HIV, organ transplant recipient, on immunosuppressive medication)
- ▶ Foreign-born persons from a country with an elevated TB rate (any country other than the US, Canada, Australia, New Zealand, or western/northern Europe)
- ▶ Foreign travel or residence in a country with an elevated TB rate

Testing for TB Infection: Tuberculin Skin Test

- ▶ Interchangeably called TST, Skin test, PPD, Mantoux test
- ▶ Contains purified protein derivative (PPD) of MTB bacteria
- ▶ Involves injecting 0.1mL of solution intradermally and evaluating, or reading, the reaction of the test 48-72 hours later
- ▶ People infected with TB bacteria will have a local immune reaction to the PPD solution that appears as induration (a palpable raised, hardened area) that is measured in mm
 - ▶ Erythema (redness) is NOT measured



TSTs: Pros and Cons

Pros

- ▶ Cost effective
- ▶ Minimally invasive
- ▶ Widely available
- ▶ Can be used for children as young as 6 months old

Cons

- ▶ Requires two visits (one to place and one 48-72 hours later to read)
- ▶ May need to be "boosted" if infection occurred many years ago
- ▶ Can be affected by BCG vaccine, recent live virus vaccine (such as MMR), or skin sensitivity
- ▶ Results more susceptible to errors in reading

Testing for TB Infection: Interferon Gamma Release Assays (IGRAs)

- ▶ Two main tests, Quantiferon-TB Gold and TSPOT
- ▶ Blood test used to detect cell mediated immune response to TB bacteria



IGRAs: Pros and Cons

Pros

- ▶ Only requires one visit
- ▶ Is not affected by BCG vaccination
- ▶ Result is more objective (either positive, negative, or indeterminate)
- ▶ Does not need to be “boosted”

Cons

- ▶ More invasive, blood draw procedure may be more traumatic for some
- ▶ More costly
- ▶ Tests can be “finicky” - need to be processed within certain time period, results may be altered if tubes are shaken too vigorously, etc
- ▶ Limited data in sensitivity in children under 5 years old

Questions?

Placing a TST - History and Risk Assessment

2. Previous TST (PPD) History

Has patient ever had a TB skin test? Yes No
 Has patient ever had a reaction to a TB skin Test? Yes No
 - Prior documented TST _____ mm. (induration) Date Placed: _____ Date Read: _____ Where: _____
 - Prior undocumented TST (per pt report) Positive Negative Date: _____ Where: _____
 Has patient had a Measles/Mumps/Rubella immunization in the past 6 weeks? Yes No
 Has patient ever had BCG vaccine? Yes No

6. Symptoms

Cough No Yes Onset Date _____
 Fatigue No Yes Onset Date _____
 Fever No Yes Onset Date _____
 Anorexia No Yes Onset Date _____
 Night Sweats No Yes Onset Date _____
 Hemoptysis No Yes Onset Date _____
 Weight Loss No Yes Onset Date _____

7. Risk Factors

Contact to TB Case No Yes Unk
 Foreign Born No Yes Unk
 Recent Travel No Yes Unk
 HIV + No Yes Unk
 Homeless No Yes Unk
 IVDU No Yes Unk
 Recent Incarceration No Yes Unk
 Diabetic No Yes Unk
 Other: _____

If during your screening you discover...

- ▶ Patient is less than 6 months of age - OK to place now but will need repeat at 6 months of age.
- ▶ Patient has a history of a previous positive TST or IGRA - do not repeat test, refer directly for CXR.
- ▶ Patient has had MMR or Varicella vaccine within the past 6 weeks - wait until 6 weeks are up.
- ▶ Patient is foreign born from high prevalence country or has received BCG vaccine - refer for IGRA.
- ▶ Patient will not come back in 48-72 hours to have test read - reschedule or refer for IGRA.



Placing a TST - Preparation

- 1) Ensure vial of PPD solution has been stored at proper temperature (35°F - 45°F), is not expired and does not appear contaminated, and was not opened more than 30 days ago
- 2) Note the lot number and expiration date
- 3) Perform hand hygiene
- 4) Clean stopper of vial with an alcohol swab
- 5) Inject 0.1mL of air into the vial with a tuberculin syringe and draw 0.1mL of solution, tap out any large bubbles.

Placing a TST - Administration

- 1) Perform hand hygiene and don gloves.
- 2) Select an appropriate site.
 - Forearm most popular site
 - Find an area that will be easy to read - not overly hairy, no tattoos, birthmarks, scars, ingrown hairs, etc.
- 3) Prep skin with alcohol swab or other appropriate disinfectant
- 4) Insert the needle into the most superficial layer of skin with the bevel of the needle pointing up and slowly inject the solution. Properly dispose in sharps container.
 - If using a vanish-point syringe, continue to press the plunger until the needle retracts into the syringe.
- 5) Proper injection will result in a noticeable bleb/wheel at the injection site. This will disperse within minutes.
 - If no wheal, repeat at least 2 inches away from original site, or on other arm.
- 6) Offer a cotton ball/cotton round if there is bleeding but avoid putting an adhesive bandage over the injection site to avoid a reaction to the adhesive being mistaken for a positive reaction.
- 7) Doff gloves and perform hand hygiene.
- 8) Note which arm and the date/time that the test was placed.

<https://www.fda.gov/downloads/biologicsbloodvaccines/vaccines/approvedproducts/ucm114924.pdf>

Reading a TST

- 1) Ensure that it has been between 48 and 72 hours since the TST was placed.
- 2) Perform hand hygiene.
- 3) Feel the area where the TST was placed for any induration (a hard, raised area).
- 4) Measure, in mm, the widest area of induration.
 - Erythema (redness) should **not** be measured.
- 5) If no induration noted, record as 0mm.

Tips:

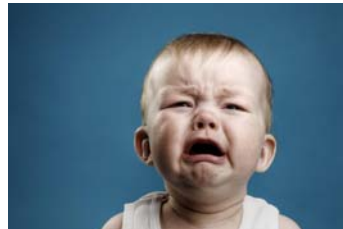
- Sometimes veins, muscles, or fatty tissue can mimic induration. If you are not sure, feel the other arm to compare.
- If you are not sure whether you feel induration, try palpating with your eyes closed.
- Mark the borders of the induration with a pen before measuring.
- Ask for a second (or third) opinion if you are still unsure!

Interpreting a TST

- ▶ 0mm-4mm: Negative
 - ▶ Because TB is slow growing, a negative result less than 8 weeks from exposure to a person with active TB must be repeated at a minimum of 8 weeks from the last known exposure.
- ▶ 5mm-9mm: Positive in immune compromised individuals or known contacts to a person with active TB
- ▶ 10mm-14mm: Positive in persons with known risk factors for TB or higher likelihood of progression to active disease (e.g. recent immigrants from high prevalence countries, residents and employees of high risk congregate settings, persons with diabetes)
- ▶ 15mm+: Positive in all persons regardless of risk factors for TB
 - ▶ However, why you are testing someone if they have no known risk factors for TB?
- ▶ Counsel persons with a positive result that their result with ALWAYS be positive. If they ever need to be tested for TB again, they will need to obtain a chest x-ray and symptom review.

Placing TSTs on young children

- ▶ Prepare injection out of eyesight from the child if possible.
- ▶ Have parent or other nurse accompany child to help hold them still.
 - ▶ Explain procedure to parent and explain that it is very important they help hold the child still so you do not need to repeat the test.
 - ▶ Ensure their free arm is well restrained
- ▶ Firmly hold forearm steady and hold skin taught; if you don't get a wheal you will have to repeat the test!
- ▶ Bribes work...sometimes.
 - ▶ Get parents permission before giving any food



Questions & Practice