LABORATORY TESTS RELATED TO TUBERCULOSIS

Tuberculosis can affect people of all genders. In this material, the terms “male” and “man” are used to refer to people assigned male at birth. The terms “female” and “woman” are used to refer to people assigned female at birth.

WHAT IS TUBERCULOSIS?

Tuberculosis (TB) is an infectious disease that is caused by a bacterium called Mycobacterium tuberculosis, often shortened to M. tuberculosis. The bacteria mainly attack the lungs, but tuberculosis can also affect the spine, kidney, abdomen, and brain. Tuberculosis is highly infectious and spreads through droplets in the air created when people with active TB infections cough, sneeze, or spit.

TYPES OF TUBERCULOSIS

When someone is infected with tuberculosis, the bacteria can live in their body without them getting sick. Because of this there are two categories of tuberculosis: latent tuberculosis and active tuberculosis.

LATENT TUBERCULOSIS

Latent TB occurs when tuberculosis bacteria are present in the body, but the immune system is able to contain them. When a person has latent TB, they are not infectious and do not exhibit symptoms. Latent TB is also known as inactive TB. If left untreated, 5 to 10% of people with latent TB will develop active TB.

If a person is at high risk for developing active TB, doctors may recommend treatment with medication. Treatment usually involves taking one medication over 6-9 months.

ACTIVE TUBERCULOSIS (TUBERCULOSIS DISEASE)

If tuberculosis manages to overpower the immune system, latent TB develops into active TB, which is also called tuberculosis disease. People with active TB experience symptoms and can spread the bacteria to others.

Treatment for TB disease usually consists of multiple antibiotics taken over the course of 6 to 9 months. The types of antibiotics that can be used for treatment include isoniazid, rifampin, ethambutol, and pyrazinamide. Some strains of tuberculosis bacteria have evolved to resist commonly used medications. These strains are called drug-resistant tuberculosis and require additional treatments.

SIGNS AND SYMPTOMS OF TUBERCULOSIS

Common signs and symptoms of tuberculosis infection include unexplained weight loss, chills, fatigue, and loss of appetite. If TB infects the lungs, it is called pulmonary tuberculosis and symptoms can include a cough that lasts 3 or more weeks, coughing up blood, and chest pain.

Tuberculosis can also spread to different organs in the body and results in different symptoms.

- **Kidneys**: Loss of kidney function and blood in the urine.
- **Spine**: Back pain, muscle spasms and stiffness.
- **Brain**: Loss of consciousness, confusion, vomiting and nausea.

PATTERNS OF TUBERCULOSIS INFECTION

PRIMARY TUBERCULOSIS: This is the initial tuberculosis infection after a person has been exposed to tuberculosis bacteria. This type of infection is common in children and people who have not been immunized.

SECONDARY OR REACTIVATED TUBERCULOSIS: This type of infection occurs when a person has been previously exposed to M. tuberculosis but was asymptomatic or recovered from the infection. Secondary tuberculosis infections typically occur due to the immune system being weakened by a different infection.
HOW IS TUBERCULOSIS DIAGNOSED?

MANTOUX TUBERCULIN SKIN TEST (TST): This test is used to check whether a person is infected with TB. A small needle is used to inject a liquid called tuberculin under the skin of the forearm. The injection causes a small, pale bump to appear under the skin. The swollen portion of this bump is called induration. After 48-72 hours (about 3 days), a health care professional examines the bump and measures the diameter of induration. They combine this measurement with a patient’s known risk for TB for the final test result. The cut off for a positive test is lower for people with a higher risk of TB. The TST cannot tell the difference between active infection and latent TB.

INTERFERON-GAMMA RELEASE ASSAYS (IGRAS): This test is used to check whether a person is infected with TB. It is a blood test that measures the immune reaction to Mycobacterium tuberculosis. This test is important because if the person is infected with M. tuberculosis, interferon-gamma is released when mixed with antigens. A positive TB blood result means that TB bacteria are present in the blood, but it does not tell if it is an active infection or latent TB.

CHEST RADIOGRAPH: If a person has a positive reaction to a TST or IGRAs, their doctor will use a chest x-ray to examine the lungs and see if there are any abnormalities or signs of previous TB infection. If there are no abnormalities, then the patient likely has latent TB. If there are signs of previous infection, the patient likely has latent TB but is at risk of developing secondary TB. If there are new abnormalities, it is possible that the patient has active TB. Chest x-rays cannot be used to definitively diagnose TB.

ACID-FAST-BACILLI (AFB) TESTS: Acid-fast-bacilli is the category of bacteria that includes M. tuberculosis. AFB tests are usually performed on sputum, the thick mucus that is coughed up from the lungs.

To get sputum samples, the provider will have the patient cough deeply and spit into a sterile container. Because bacteria levels can vary day-to-day, the patient will have to do this multiple days in a row. If the patient cannot cough up enough mucus, the provider may have them breathe in a saline mist to help them cough more deeply. If they still cannot cough up enough sputum to sample, the provider may opt to perform a procedure called a bronchoscopy. During this procedure, the patient is put under anesthesia and a doctor collects samples from the lungs with a small lighted tube.

If the suspected TB infection is affecting areas other than the lungs, providers can take a tissue sample of the affected area and send it to the lab for AFB testing.

UNDER THE MICROSCOPE

A tissue section from a patient with tuberculosis shows granulomatous inflammation with necrosis (black arrow) and a prominent giant cell (blue arrow). Granulomas are a type of inflammation that can be caused by tuberculosis and consist of a group of inflammatory cells used to fight infections called histiocytes. Giant cells are formed when individual histiocytes combine together to form one cell.

THERE ARE TWO MAIN TYPES OF AFB TESTS:

AFB Smear: This tests for the presence of any acid-fast-bacilli. The sample is “smeared” on a glass slide, stained with specific dyes, and examined under a microscope. The results will show if any acid-fast-bacilli are present in the sample, but the results cannot be used for a definite TB diagnosis. These tests return results in about 1-2 days.

AFB Culture: The sample is put into a special container that promotes bacterial growth. TB organisms are often slow-growing so it is monitored for up to 6-8 weeks to see whether bacteria grow. If they do, this can confirm a probable TB diagnosis.

DRUG SUSCEPTIBILITY TESTING (DST):

Because there is a growing rate of drug-resistant TB, labs often test samples to see which drugs work best to kill the bacteria. The sample is placed in two different environments: one that has been treated with drugs and one that has not. After a month, the growth in the two different environments are compared to see what drugs were the most effective.
MEET ALI

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When a lab test is ordered, it is important to understand why the test needs to be done, how it will be done, and what your provider expects to learn from the results”

Ali grew up in Lala Musa, Pakistan. When he was 28, he started to experience weakness, unexpected weight loss, lack of appetite and an occasional dry cough. The first round of tests did not detect TB, so his doctor ordered more complex laboratory tests. These lab tests showed that Ali had reactivated TB. His doctor recommended lung surgery to remove the diseased part of his lungs. During his surgery, laboratory testing played an important role in determining Ali’s blood type so he could safely receive blood transfusions before, during, and after his surgery. The surgery was successful, and after three months of recovery, Ali’s lungs were working properly.

After recovering from TB, Ali restarted his career as a medical laboratory professional and found another passion in advocating and helping people. Now that he’s fully recovered with a career he loves, Ali feels ready to enjoy things again and be excited about life!

To learn more about Ali, go to www.ascp.org/patients

ASK YOUR DOCTOR

- What type of TB do I have?
- What is the difference between active TB and latent TB?
- Are there any lifestyle changes that I should make?
- What is the risk of transmitting TB to my family?
- How often should my family members get tested?
- Which screening tests do you recommend for TB?
- What are all my treatment options?
- What are the follow-up tests and what are we looking for?
- Based on my lab results, what is the course of action?

ADDITIONAL RESOURCES

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