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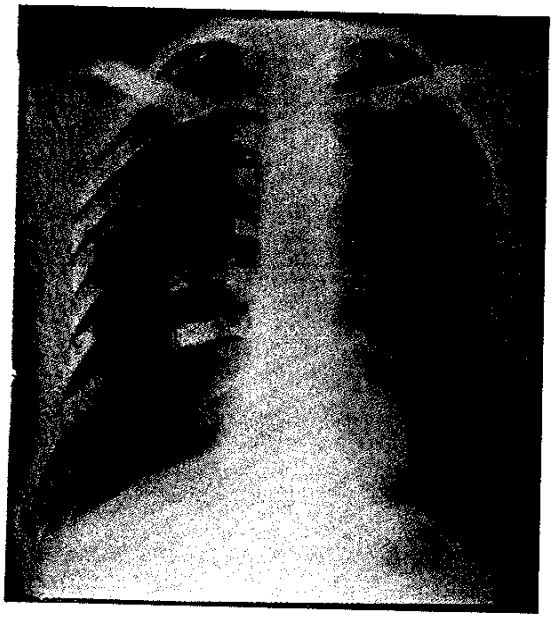
CONTACT HOUR

TB-Your vigilance IS VITAL

Although the incidence of tuberculosis is on the wane in the United States, each year the disease affects thousands of Americans. The best way to help TB patients is to ensure that they understand their condition and complete their long-term treatment.



This chest X-ray reveals pulmonary infiltrates, suggestive of TB.

Earlier this year, a new tuberculosis vaccine entered the first phase of human testing—the first TB vaccine trial to take place in this country in 60 years. The study has sparked renewed interest in preventing a disease that, until the mid-1980s, was believed by many to have been virtually eliminated from this country.

We now know, however, that TB is still very much alive. It claimed the lives of about 800 people in the United States in 2002, and it was diagnosed in 14,874 Americans in 2003.[1]

Although the number of new cases of TB in this country has been falling since 1992, the decline was only 1.3% from 2002 to 2003—the smallest annual decrease in a decade. Several states, including California, Texas, and New York, reported more cases in 2003 than they did the year before.[1]

While a vaccine for TB already exists—the Bacillus of Calmette and Guérin (BCG) vaccine—its effectiveness is so limited that it's rarely used in this country. As the search for a better vaccine continues, you can play an indispensable role in fighting TB by teaching patients about the disease and its treatment.

Many get infected but few become sick

TB is caused by the bacillus *Mycobacterium tuberculosis* and is transmitted through airborne droplet nuclei when an infected patient talks, coughs, laughs, or sings.[2] While anyone who's exposed to TB can become infected, it usually takes repeated contact with someone who is contagious. Certain groups, including residents and employees of long-term care facilities and shelters, prison inmates, the homeless, alcoholics, IV drug users, family members of TB patients, people born in a country where TB is common, and those with HIV or other diseases that suppress the immune system are at increased risk.[3]

Not everyone who becomes infected with TB will get sick. People who are infected but don't develop symptoms are said to have latent TB, rather than active TB. An estimated 10 million Americans have latent TB, but only about 10% will ever develop active disease.[3]

In latent TB, a healthy immune system often keeps the bacteria in check and prevents the asymptomatic individual from spreading the disease. However, some bacteria lie dormant and wait for the chance to proliferate when the patient's immune system is weakened, typically by disease or age.[2]

A patient is at greatest risk for developing active TB in the first year after becoming infected. Often, however, active disease does not occur for many years.[2] In addition to those with a weakened immune system,[2] people treated with the tumor necrosis factor-alpha (TNF-α) antagonists infliximab (Remicade), etanercept (Enbrel), and adalimumab (Humira) are at increased risk of developing active disease. Used to treat certain autoimmune diseases, these drugs can cause active TB to emerge.[4]

Patients with active disease experience early symptoms such as coughing, night sweats, fever, and chills.[3] They often complain of feeling tired and weak and may have shortness of breath on exertion. Later, the patient may exhibit hemoptysis (coughing up blood) and anorexia and weight loss. ➤

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TB primarily affects the lungs (pulmonary TB), but can also affect other organs and tissues, including the lymph nodes, reproductive organs or urinary tract, meninges, and peritoneum (extrapulmonary TB). Pulmonary TB can range from a short bout of bronchopneumonia to diffuse inflammation complicated by pleural effusion, necrosis, and extensive fibrosis.

When TB is diagnosed early, more than 90% of patients can be successfully treated with antibiotics.[2] Without treatment, about a third of patients will die within weeks to months.[2]

Take steps to prevent TB from spreading

The most important step you can take to limit the spread of TB is to quickly identify any patient who might be infected. If a patient has active TB or symptoms that suggest it, protect yourself and others by using airborne precautions, which include wearing an approved and properly fitted respirator and placing the patient in a negative airflow isolation room, as recommended by the CDC.[5]

Have dedicated equipment, such as a BP cuff, stethoscope, and thermometer, in the room. Teach the patient to cover his nose and mouth with a tissue when coughing or sneezing and to dispose of tissues in a designated container. Put a surgical mask on the patient during transport.

Patients with active TB should remain in isolation until they are no longer contagious, typically until they have had about two weeks of drug therapy. [2] Once they're no longer contagious, patients can usually be discharged and return to normal activities while they continue to take their medication at home.[3]

Diagnosis starts with a skin test

Latent or active TB infection is typically diagnosed by a Mantoux skin test, in which a dose of tuberculin is injected under the top layers of the skin, usually on the forearm.[6] The patient is evaluated to see if an induration forms around the injection site within 48 – 72 hours.

The test result is interpreted based on the size of the reaction in millimeters and the patient's risk factors for TB. An induration ≥5 mm is considered positive in a patient who has been exposed to someone with active TB, has a chest X-ray that suggests TB, or is HIV-positive or otherwise immunocompromised.[6] A welt ≥10 mm is considered positive in IV drug users, recent immigrants from a country where TB is common, and people who live or work in a high-risk setting, such as a prison; ≥15 mm is positive in people with no known risk factors for TB.[6]

TB cannot be ruled out in a patient whose skin test result is negative, however.[6] Due to a weak immune system or other factors, some patients may not be able to react to tuberculin.[6] Also, because it can take up to 12 weeks after exposure to *M. tuberculosis* for an infected person to develop an immune response, a patient who has recently become infected with TB may not react to a skin test.[2] Those suspected of having been exposed to TB but have a negative initial test should be tested again within 12 weeks.[7]

Regardless of the test result, a patient with suspected TB usually undergoes additional testing, including a chest X-ray and sputum tests. If a patient has active pulmonary TB, a chest X-ray will show infiltrates, and possibly lymph node enlargement, pleural effusion, and cavities in the lungs, and a sputum smear may show acid-fast bacilli.[7]

A culture for *M. tuberculosis* is used to confirm a diagnosis of TB; however, because the organism multiples very slowly, the results may not be available for weeks. Therefore, patients in whom active TB is highly suspected are

Quick facts

- California, Texas, and New York each reported more cases of tuberculosis in 2003 than they did in 2002.
- Only 10% of patients who become infected with TB will ever develop symptoms, but for those who do, the disease can quickly turn fatal.
- Patients who fail to complete treatment for TB can develop and spread a form of the disease that is multidrug-resistant.

Drugs used to treat TB

The recommended initial treatment regimen for active TB almost always consists of the four antibiotics described below. Two combination medications are also available: Rifamate and Rifater. Adverse effects are relatively common, especially during the first few weeks of therapy, but patients should not discontinue treatment because of minor side effects. If more serious side effects—particularly drug-induced hepatitis—develop, isoniazid, rifampin, and pyrazinamide should be stopped immediately and then restarted one-by-one to determine which drug was causing the problem. (Ethambutol does not damage the liver.) Patients with latent TB are sometimes prescribed drug therapy—typically isoniazid once daily for six months to a year—to prevent the disease from progressing to active TB.

Drug	Daily adult dose	Side effects
isoniazid (Laniazid, Nydrazid), also called INH	5 mg/kg up to 300 mg	Hepatitis (rare), excessive tiredness, weakness, loss of appetite, upset stomach, vomiting, dark yellow or brown urine, yellowing of the skin or eyes, diarrhea, vision problems, eye pain, numbness or tingling in the hands and feet, rash, fever, swollen glands, sore throat, stomach pains or tenderness
rifampin (Rifadin, Rimactane), also called RIF	10 mg/kg up to 600 mg	Hepatitis (rare), headache, muscle pain, bone pain, heartburn, upset stomach, vomiting, stomach cramps, chills, diarrhea, rash, sores on skin or in the mouth, fever, yellowing of the skin or eyes. Urine, stools, saliva, sputum, sweat, and tears may turn red-orange.
pyrazinamide, also called PZA	1,000 mg for patients weighing 40 – 55 kg (88 – 121 lbs) 1,500 mg for patients weighing 56 – 75 kg (123 – 165 lbs) 2,000 mg for patients weighing 76 – 90 kg (167 – 198 lbs)	Hepatitis (rare), upset stomach, fatigue, rash, fever, vomiting, loss of appetite, yellowing of the skin or eyes, darkened urine, pain and swelling in the joints, unusual bleeding or bruising, difficulty urinating
ethambutol (Myambutol), also called EMB	800 mg for patients weighing 40 – 55 kg (88 – 121 lbs) 1,200 mg for patients weighing 56 – 75 kg (123 – 165 lbs) 1,600 mg for patients weighting 76 – 90 kg (167 – 198 lbs)	Blurred vision, sudden changes in vision, inability to see the colors red and green, loss of appetite, upset stomach, vomiting, numbness and tingling in the hands or feet, rash, itching

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usually started on drug therapy before the diagnosis is confirmed by a culture.[8]

All infected patients should be tested for HIV. Those with both TB and HIV are much more likely to develop active TB than those infected with TB alone.[2]

A combination of drugs is always required

Before starting treatment for TB, patients should undergo lab testing to establish baseline levels of alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), creatinine, and platelets.[8] Knowing these values will help in the identification and management of adverse effects. Patients who will be taking ethambutol (Myambutol), also called EMB, should be tested for visual acuity and red/green color discrimination, as the drug can affect both.[8]

Four multidrug regimens are recommended for patients with active TB.[8] Each has a two-month initial phase, during which the patient typically receives four drugs, five or seven days a week. A continuation phase, during which the patient takes only

two drugs as often as every day or as infrequently as once a week,[8] lasts another four or seven months. The regimens vary based on age, the number of bacilli in the sputum smear, susceptibility to drug therapy, and patient adherence.[7]

Because many patients will have TB that's caused by drug-resistant organisms,[8] most patients receive a combination of isoniazid (Laniazid, Nydrazid), also called INH; rifampin (Rifadin, Rimactane), also called RIF; pyrazinamide, also called PZA; and ethambutol.[8] Typical doses and side effects for these drugs appear in the box on page 33. To achieve higher, more effective serum drug levels, the drugs should be taken together.[8]

In addition, there's rifapentine (Priftin), the newest anti-tuberculosis agent. Approved for use in adults in 1999, it's similar to rifampin and used in the continuation phase in two of the recommended regimens.[8]

Although not approved for treating TB, rifabutin (Mycobutin) is sometimes used as a substitute for rifampin for patients with rifampin-resistant TB.[8] This drug is also used for patients who take a medication that causes an interaction with rifampin (such as a beta-blocker) or who are intolerant to rifampin.[8]

Two combination agents are also available for either stage of therapy. Rifamate contains rifampin and isoniazid, and Rifater contains rifampin, isoniazid, and pyrazinamide. Using these fixed-dose combination medications can minimize medication errors and make it easier for patients to adhere to therapy. They're recommended when directly observed therapy (DOT) is not possible. (DOT, as the name implies, requires that you actually watch the patient ingest each dose of the anti-TB medication.[8]) The combination meds need to be taken with other medications and, occasionally, with additional doses of some of the drugs they contain to make sure that the patient receives the recommended regimen.[8]

To determine if treatment is working, all patients with pulmonary TB should have sputum cultures monthly until two consecutive tests are negative.[8] If cultures are still positive after the first four months of drug therapy and the patient has complied with his regimen, treatment is considered to have failed. The clinician will need to change the patient's medication regimen to address possible drug resistance.[8]

Several drugs, either alone or in combination, are used to treat TB that is resistant to one or more first-line drugs. Second-line agents include cycloserine (Seromycin), ethionamide (Trecator-SC), p-aminosalicylic acid (PAS), streptomycin, amikacin/kanamycin, capreomycin (Capastat), and the fluoroquinolones levofloxacin (Levaquin), moxifloxacin (Avelox), and gatifloxacin (Tequin).[8]

Drug-induced hepatitis: Rare but dangerous

Adverse effects of anti-tuberculosis drugs range from mild to serious. Teaching patients what to expect and how to manage side effects is key to successful therapy.

Gastrointestinal complications such as nausea, vomiting, anorexia, and abdominal pain are common, especially in the first weeks of therapy.[8] All patients with GI symptoms should have their AST levels measured to see if they're the result of liver toxicity.[8]

Isoniazid, rifampin, and pyrazinamide can all cause liver injury, including drug-induced hepatitis, which is defined as a serum AST level more than three times the upper limit of normal in a patient with GI symptoms, or more than five times the upper normal limit in a patient without symptoms.[8] All three drugs should be stopped in a patient with an AST level that suggests hepatitis, and the patient should be tested for hepatitis A, B, and C, as well.[8] Once the AST level drops to less than two times the upper limit of normal, the medications can be restarted one at a time.[8]

If a patient with GI symptoms has an AST level less than three times higher than normal, his GI symptoms are assumed not to be due to liver toxicity.[8] Teach these patients that they may be able to lessen their symptoms by changing the time they take the drugs, perhaps to bedtime or closer to mealtime.

All anti-TB agents can cause a rash.[8] A minor rash can be treated with antihistamines without interrupting therapy. A petechial rash may indicate thrombocytopenia from rifampin, so the rifampin should be stopped and patient's platelet count should be monitored until it returns to normal.[8] Patients who develop a generalized erythematous rash often have to stop all medications and then restart them

sequentially to identify and eliminate the source.[8]

Although the fever of TB infection can persist for up to two months after treatment begins, "drug fever" is something quite different. Suspect drug fever if your patient has a temperature that exceeds 39° C (102.2° F) but otherwise looks and feels well and has no signs of superinfection or worsening TB infection.[8] A patient with drug fever should stop taking all anti-TB drugs.[8] The fever will usually resolve within 24 hours, and the drugs can then be restarted one at a time.

Drug interactions are always a nursing concern, and adding four powerful antibiotics to a patient's regimen greatly increases the risk. So take a thorough drug history of any patient who begins TB treatment. The anti-TB meds are more likely to change the effectiveness of other medications than to be affected by them.[8] By inducing hepatic metabolism, the rifamycins (rifampin, rifabutin, and rifapentine) can potentially reduce the concentration of many drugs, including antiinfectives, hormones, narcotics, anticoagulants, anticonvulsants, immunosuppressive agents, cardiovascular agents, bronchodilators, sulfonyluric hypoglycemics, hypolipidemics, and psychotropics.[8] Isoniazid can also cause interactions, particularly with anticonvulsants and benzodiazepines.[8]

DOT helps ward off drug-resistant TB

Because side effects are common and because many patients feel better after only a few weeks of treatment, they may be tempted to stop taking their TB medications.[3] Not completing the course of anti-TB therapy is dangerous because if the TB becomes active again, it can develop resistance to multiple drugs, making it far harder to treat.[2,3] In addition, a patient who stops therapy and develops active TB a second time will be in the contagious phase again.[2]

For these reasons, DOT is recommended for all patients with TB.[8] It allows you to immediately identify those who don't adhere to treatment and to intervene appropriately. Studies strongly suggest that DOT leads to the best outcomes.[8]

You can implement DOT relatively easily while your patient is in the hospital or other institution. But even then, carefully check that your patient does, in fact, fully ingest every dose of medication and doesn't hide it in his mouth ("cheeking"), spit it out, or regurgitate it.

A trained healthcare worker—often a public health nurse—can provide DOT in a physician's office or clinic, at the patient's home or job site, or any other mutually agreeable location.[8] Obviously, DOT is particularly important for patients whose regimen calls for them to take medications only once or twice a week, as well as those who may not be able to afford the medications, are homeless, or have a substance abuse problem that makes it difficult to follow their treatment plan.[8]

In addition to watching the patient take the drugs, you can also promote adherence by addressing any issues that may make it difficult for him to stick with treatment, such as homelessness, alcohol or drug abuse, mental illness, language barriers, or a lack of transportation.[8] Refer patients with such problems to the appropriate social service agency. They may also benefit from enablers—interventions such as transportation vouchers, child care, interpreters, and appointment reminders and follow-ups—and incentives such as snacks or meals, food stamps or coupons, clothing, or help in locating housing.[8]

While we've made much progress toward eliminating TB in the United States, vigilance is still essential. Until an effective vaccine is available, you can help stem the spread of TB by educating patients and their families about the disease and by reinforcing the importance of completing treatment. **RN**

Web extra For more information on TB vaccines, visit www.rnweb.com, click on "TB—Your vigilance is vital," and scroll to the end.

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