

## Tuberculosis

Tuberculosis (TB) is caused by a bacterium called Mycobacterium Tuberculosis that usually attacks the lungs and can be fatal.

### Cause of TB and Co-morbidities

TB is spread through the air from the infected person to other people. When infected person coughs, sneezes, spits, or speaks he/she propels the TB germs into the air. Any person who inhales these germs becomes infected. The bacteria invades the macrophages in the host's lungs and are encapsulated in a granuloma in the lungs formed by the host's immune system and remain active through the life of the host. The infection either results in latent TB or active TB. Latent TB (asymptomatic) results when the Mycobacterium Tuberculosis bacteria is able to replicate within the granuloma but do not cause symptoms and is not transmissible. People with latent TB have 10% chance of developing active TB through their lifetime [1].

Active TB (symptomatic) results when the Mycobacterium Tuberculosis bacteria escapes from the granuloma and replicates in the lungs or other tissues in the host. Symptoms include a bad cough that lasts 3 weeks or longer, pain in the chest, coughing up blood or sputum, weakness or fatigue, weight loss, loss of appetite, chills, fever, or sweating at night [3]. Lung damage is primarily attributed to the host immune response mounted against the bacteria. People with weak immune systems, such as people infected with HIV, malnutrition, diabetes, or substance abuse have a higher risk of developing active TB. When a person develops active TB, the symptoms may be mild for several months and lead to delays in seeking care, and results in transmission of the bacteria to others.

Multidrug-resistant TB (MDR-TB) is a form of TB that does not respond to the standard anti-TB drugs. Incorrect use of anti-TB drugs or use of poor quality anti-TB drugs can result in MDR-TB. Persons dealing with MDR-TB need to be treated with second-line drug treatment. If a person is infected with both HIV and TB, he/she is 21-34 times more likely to develop active TB [1]. The combination of HIV and TB accelerate each other's growth in the patient. Children and young adults are more prone to develop TB.

### Market Information

WHO categorizes TB as a global threat and is second only to HIV/AIDS that is a cause of death due to a single infectious agent. TB is most prevalent in developing countries than in the developed countries. According to the WHO 2011 TB report, 8.7 million people contracted TB, 1.4 million people died from TB, and 1.9 million people have latent TB [1]. Asia accounted for the largest number of TB cases roughly around 60% of new cases globally among which Indian and China accounted for approximately 50%. Sub-Saharan Africa accounted for the greater proportion of new cases per population with over 260 cases per 100,000 populations [1]. Patients with HIV accounted for 12% of the reported incident cases and an estimated 3% of the cases were MDR-TB. The MDR-TB results were alarming with an estimated incidence increased to 650,000 cases in 2010. China (100,000 cases), India (99,000 cases), The Russian Federation (38,000 cases), and South Africa (13,000 cases) accounted for 38% of the reported MDR-TB cases [2]. Brazil and China showed a sustained decline in TB cases over the past 20 years.

### Prevention and Treatment

Sputum smear microscopy is most commonly used to diagnose TB but does not detect extrapulmonary or latent TB. Bacterial culture from sputum can be used to determine drug susceptibility and it cannot detect latent TB. Tuberculin skin test (Mantoux test) and Cellular assay from blood can detect latent TB but cannot differentiate between latent and active TB. Diagnosing MDR-TB and HIV-associated TB can be

more complex. Nucleic acid amplification is expensive but accurately diagnoses TB and MDR-TB and is currently in use in 26 countries [2].

TB prevention can be implemented using a three-level hierarchy of control measures [3]. Administrative measures need to be put in place to reduce the risk of uninfected people who are exposed to people infected with TB. Environmental controls reduce the amount of TB in the air. Finally, the use of respiratory protective equipment in situations that pose the highest risk of exposure to TB. People living in, travelers visiting, and healthcare professionals in TB-prone regions need to be educated with the three-level hierarchy of control measures and take appropriate measures to minimize the impact of contracting TB. People exposed for a prolonged time with known TB patients should take active steps by repeatedly getting tested using Tuberculin skin test and IGRA test. The bacille Calmette-Guérin (BCG) vaccine is the only proven vaccine available for prevention of TB that has been used for more than 80 years [1].

TB is a treatable and curable disease. Proper drugs need to be provided with supervision by a health professional to the patients to effectively cure TB. People who develop latent TB should reduce the risk of developing active TB should use any of the four available treatment regimes that use the one or more combinations of drugs: Isoniazid, Rifampicin, Pyrazinamide, and Ethambutol, substituting in Streptomycin for Ethambutol if meningitis is observed. Directly observed therapy (DOT) should be used for patients with HIV-related TB where the same drugs used for treating latent TB are used but for a 6-9 month regimen. Drug interactions are a major concern in HIV-related TB and Rifabutin might be used as an alternative to Rifampicin. When the treatment lacks supervision and appropriate support, treatment adherence can be difficult to enforce and sustain and the disease can spread [3].

### **Incidence and Care Settings**

The incidence rates in developed countries (Americas – 270,000; Europe – 420,000; Eastern Mediterranean – 660,000) are significantly lower than compared to the developing countries (Africa – 2,800,000; Southeast Asia – 3,300,000; Western Pacific – 3,300,000) [2]. These differences are attributable to the improved healthcare delivery infrastructure, political commitment, standardized prevention and treatment procedures, and effective drug supply and management.

As laid out by the WHO, TB can be prevented, treated, and managed through promptly addressing active cases with short-course chemotherapy (SCC) using first-line drugs and administrated through the DOTS strategy. The following inputs are needs to effectively manage the disease [4,5]:

- Political commitment from the local government is essential to establishing a care delivery strategy.
- Active case finding strategies that include mass screening need to be implemented to gather incidence rates in the local area.
- Primary care infrastructure in rural areas through and integrated government and private setup.
- Health facilities need to be equipped with the tools to effectively diagnose TB and standardized prevention and treatment procedures need to be established to contain the spread of TB.
- SCC with effective case management to increase treatment adherence and monitoring protocol to evaluate the outcomes of the treatment.
- Regular drug supply and prevent misuse of drugs by limiting corruption.

### **Conclusion**

Delays in active and passive detection of TB can be fatal and cause TB to spread across communities. Huge costs are associated with political commitment, primary care setup, and drug supply management. The complexity of delivery arises from integrating standardized prevention and treatment procedures to educating the people and establishing treatment adherence.

## References

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