Tuberculosis: A Global Health Challenge

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Key points:

- A major global cause of infectious mortality, primarily affecting the lungs but capable of extrapulmonary spread.
- Caused by *Mycobacterium tuberculosis* and transmitted exclusively via airborne respiratory droplets.
- Manifests as either asymptomatic Latent TB Infection (LTBI) or active, symptomatic, and transmissible TB disease.
- Requires prolonged multi-drug therapy to eradicate infection and prevent Multi-drug Resistant TB (MDR-TB).
- Focused on early diagnosis, screening high-risk populations, and Bacillus Calmette-Guérin (BCG) vaccination.

Introduction

Tuberculosis (TB) is a chronic infectious disease caused by Mycobacterium tuberculosis, which mainly affects the lungs (pulmonary tuberculosis) but can also spread to other areas such as the lymph nodes, bones, and central nervous system. This disease, although preventable and curable, remains a public health problem of great concern. According to recent global reports, millions of cases of TB are reported globally each year, especially from low- and middle-income countries.[1,5] The mode of spread of TB is through droplets that are carried through the air when a person infected with TB coughs or sneezes. TB is also linked to other socioeconomic factors, such as poverty, malnutrition, overcrowding, and immunosuppression, especially among people infected with HIV.

Epidemiology

Tuberculosis is still considered to be one of the top infectious diseases responsible for mortality globally. Recent statistics show that an estimated 10 million new cases occur annually, with over 1 million people dying from the disease annually.[5] Despite the reduction in the incidence of tuberculosis globally due to control measures, recent statistics show an increased incidence due to the disruption caused by the COVID-19 pandemic.[1] The incidence of tuberculosis is not uniform globally, with the majority of the burden being found in Asia and Africa. The risk factors associated with tuberculosis include HIV, diabetes, smoking, poor nutrition, and poor living conditions**.** These risk factors contribute to susceptibility and spread of the disease.

Pathophysiology

After inhalation, *Mycobacterium tuberculosis* reaches the alveoli, where it is engulfed by macrophages. The bacteria can survive and replicate inside these immune cells, triggering the formation of granulomas. This immune response helps contain the infection but may also cause tissue damage. TB can occur in two forms: latent TB infection (LTBI), where individuals show no symptoms and are not infectious, and active TB disease**,** which presents with clinical symptoms and carries the risk of transmission.[7]

Signs and Symptoms

The clinical presentation of TB varies based on the site of infection. Pulmonary TB typically includes: persistent cough lasting more than 2–3 weeks, hemoptysis, fever and night sweats, weight loss and fatigue. Extrapulmonary TB can present with lymphadenopathy, pleural effusion, or neurological

symptoms, depending on the organ affected. These diverse presentations often delay diagnosis, contributing to continued disease transmission.

Diagnosis

Early detection and accurate diagnosis are crucial for controlling tuberculosis. Common diagnostic methods include: sputum smear microscopy, culture techniques, molecular tests, such as nucleic acid amplification tests. For latent TB, the Mantoux tuberculin skin test and interferon-gamma release assays are used.[7] Recent advancements in molecular diagnostics have improved sensitivity and reduced delays, though access remains limited in resource-poor settings.[2]

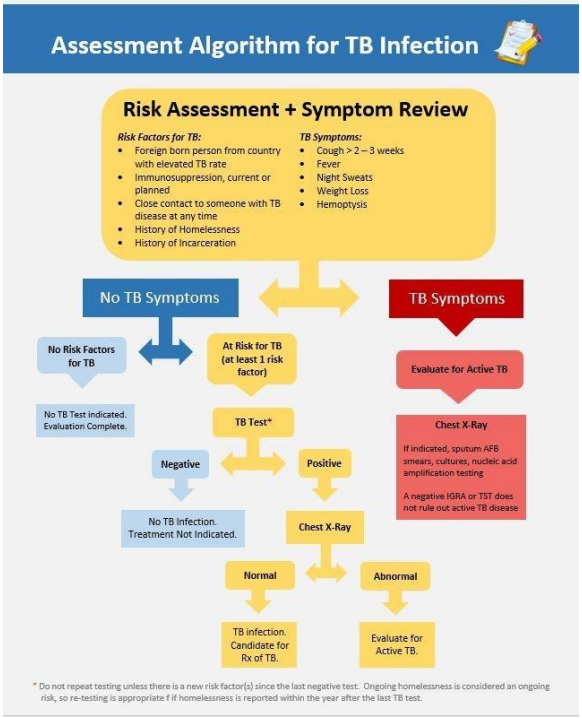


Figure 1: *Assessment Algorithm for TB infection.*[8]

Treatment

TB treatment requires prolonged multi-drug therapy to eliminate the bacteria and prevent resistance. Standard first-line drugs are isoniazid, rifampicin, ethambutol, and pyrazinamide. Adherence is crucial, as incomplete treatment can cause multi-drug resistant TB (MDR-TB). 6-Month Regimen (Drug-Sensitive TB): Intensive Phase (2 months): Isoniazid, Rifampicin, Pyrazinamide, Ethambutol. Continuation Phase (4 months): Isoniazid, Rifampicin. Newer drugs like bedaquiline and delamanid are used for drug-resistant TB.

Prevention and Control

Preventive strategies for TB focus on early detection and treatment of active cases, screening high-risk populations, vaccination with Bacillus Calmette-Guérin **(BCG)**, and improving living conditions and nutrition. Public health programs are crucial in TB control, ensuring treatment completion and reducing transmission, with contact tracing significantly enhancing outcomes.[2]

Conclusion

Despite advances in diagnosis and treatment, tuberculosis remains a major global health challenge. Continued efforts in early detection, optimised treatment regimens, and strengthened public health systems are essential for TB control and eventual elimination. Addressing socioeconomic factors and ensuring equitable healthcare access are key to achieving global TB reduction targets.

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