Journal of Virology & Antiviral Research

Perspective A SCITECHNOL JOURNAL

Modern Perspectives on Tuberculosis: From Pathogenesis to Prevention and Control

Pere Godoy*

Department of Infectious Diseases, University of de Santa Maria, Lleida, Spain

***Corresponding author:** Pere Godoy, Department of Infectious Diseases, University of de Santa Maria, Lleida, Spain; E-mail: pere@ud.cat

Received date: 12 September, 2024, Manuscript No. JVA-24-147822;

Editor assigned date: 16 September, 2024, PreQC No. JVA-24-147822 (PQ);

Reviewed date: 01 October, 2024, QC No. JVA-24-147822;

Revised date: 12 June, 2025, Manuscript No. JVA-24-147822 (R);

Published date: 19 June, 2025, DOI: 10.4172/2324-8955.1000715.

Introduction

Tuberculosis (TB) remains a critical global health issue, despite advances in medical science. This manuscript explores the pathogenesis of TB, its clinical manifestations, diagnostic approaches, and treatment strategies. Understanding the complexities of TB is crucial for effective management and control, especially in high-burden regions. Tuberculosis (TB) is a chronic infectious disease caused by *Mycobacterium tuberculosis*. It primarily affects the lungs but can involve other organs. TB remains a leading cause of morbidity and mortality worldwide, particularly in low and middle-income countries. Despite significant advancements in diagnosis and treatment, TB poses substantial challenges due to drug resistance and co-infection with HIV.

Mycobacterium tuberculosis is a slow-growing, aerobic bacterium that primarily targets the lungs. The pathogenesis of TB involves several key stages. TB is transmitted *via* airborne droplets when an infected individual coughs or sneezes. The bacteria enter the respiratory tract and are inhaled into the alveoli of the lungs. Once inside the alveoli, *M. tuberculosis* is engulfed by macrophages. The bacterium has evolved mechanisms to survive within these immune cells, leading to an asymptomatic latent infection in many individuals. In individuals with effective immune responses, the infection may remain latent, with the bacteria contained within granulomas (tubercles) formed by macrophages and other immune cells. This is known as Latent TB Infection (LTBI). If the immune system is unable to contain the bacteria, or if the immune response wanes, the bacteria can multiply and cause active TB disease. Active TB leads to the destruction of lung tissue and dissemination of the bacteria to other organs.

Disease progression

Active TB disease often results from reactivation of latent infection. It can also occur as a primary infection in individuals with compromised immune systems. TB presents with a range of symptoms, which can vary depending on whether the disease is pulmonary or extrapulmonary. Persistent cough lasting more than three weeks, often producing sputum that may be blood-stained. Discomfort or pain in the chest, which can be sharp or dull. Intermittent fever and profuse night sweats are common. Unintentional weight loss, decreased appetite, and general fatigue are significant features. Swelling of lymph nodes, particularly in the neck (scrofula). Pain and swelling in bones and joints, often leading to skeletal deformities. Symptoms may include flank pain, dysuria, and hematuria. Accurate diagnosis of TB involves a combination of clinical evaluation, microbiological tests, and imaging studies. A thorough medical history and physical examination are essential, focusing on symptom duration, exposure risk, and travel history. Examination of sputum samples for Acid-Fast Bacilli (AFB) using Ziehl-Neelsen staining. This test is rapid but has lower sensitivity. Culturing *M. tuberculosis* from sputum or other specimens remains the gold standard for diagnosis. It provides definitive results and allows for drug susceptibility testing. Polymerase Chain Reaction (PCR) tests, such as the GeneXpert MTB/RIF, offer rapid detection and can identify resistance to rifampicin, a critical TB drug. Helps visualize lung abnormalities and assess the extent of disease. Common findings include cavitary lesions and consolidation. Computed Tomography (CT) Scan Provides detailed imaging for better assessment of complicated cases or extra-pulmonary TB. Tuberculin Skin Test (TST) Measures the immune response to Purified Protein Derivative (PPD). It is useful for screening but has limitations, including false positives in those who have had prior BCG vaccination or have been exposed to non-tuberculous mycobacteria. Interferon Gamma Release Assays (IGRAs) Blood tests that detect immune responses to specific TB antigens.

Treatment of tuberculosis

The treatment of TB involves a combination of antibiotics over an extended period to ensure eradication of the bacteria and prevent resistance. Typically includes a combination of isoniazid, rifampin, ethambutol, and pyrazinamide for the initial two months, followed by isoniazid and rifampin for an additional four to six months. This regimen is effective for drug-sensitive TB. Multidrug-Resistant TB (MDR-TB) Caused by strains resistant to at least isoniazid and rifampin. Treatment requires second-line drugs such as fluoroquinolones and injectable agents, often for 18-24 months. Extensively Drug-Resistant TB (XDR-TB) resistant to first-line drugs and at least one second-line drug. Treatment is highly complex and requires individualized regimens and close monitoring. Latent TB Infection (LTBI) Include isoniazid for nine months, rifampin for four months, or a combination of isoniazid and rifapentine for three months. LTBI treatment aims to prevent progression to active TB.

Conclusion

Tuberculosis continues to be a major global health challenge, demanding comprehensive strategies for effective management and prevention. Advances in diagnostic techniques and treatment regimens are crucial for combating TB, but addressing social determinants and ensuring access to healthcare are equally important in controlling its spread. Continued research, public health initiatives, and global cooperation are essential to reducing the burden of TB worldwide.

Citation: *Godoy P (2025) Modern Perspectives on Tuberculosis: From Pathogenesis to Prevention and Control. J Virol Antivir Res 14:2.*

All articles published in Journal of Virology & Antiviral Research are the property of SciTechnol and is protected by copyright laws. Copyright © 2025, SciTechnol, All Rights Reserved.