



Tuberculosis in the South Asian Region: An In-Depth Review of Treatment Drugs

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ABSTRACT

Tuberculosis (TB) remains a pressing global health concern, with South Asia bearing a substantial burden. This article explores the complexities of TB control in South Asian countries, emphasizing the importance of drug treatments amidst significant challenges. The region's densely populated urban centers, drug-resistant TB strains, poverty, malnutrition, and population movements pose formidable obstacles to TB control efforts. First-line anti-TB drugs, including Isoniazid, Pyrazinamide, Rifampicin, Streptomycin, and Ethambutol, play pivotal roles in treatment. These drugs target active and dormant TB bacteria, reducing treatment duration and curbing resistance. However, challenges such as drug resistance, treatment compliance, side effects, limited healthcare access, and pediatric TB persist. The emergence of drug-resistant TB strains necessitates the use of second-line drugs in South Asia. These more potent medications broaden treatment options, offering hope in the battle against TB. Effective TB control in South Asia demands innovative strategies, improved healthcare infrastructure, and a holistic approach to combat this enduring public health threat.

Introduction

Tuberculosis (TB) remains a formidable worldwide health issue, specifically within the South Asian place. This part of the world, encompassing countries such as India, Pakistan, Bangladesh, Sri Lanka, Nepal, and Bhutan, confronts distinct challenges and intricacies in the control of TB. In this complete exploration, we will delve into the drugs used in the treatment of TB in South Asia, emphasizing their importance, demanding situations, and evolving practices.

Tuberculosis is an infectious sickness. TB is a result of a bacterial pathogen, *Mycobacterium tuberculosis*. Although it often impacts the lungs, it may also have an effect on various organs within the body. Tuberculosis is transmitted through airborne particles whilst an infected individual coughs or sneezes, rendering it incredibly contagious.

Despite vast strides in decreasing TB incidence and fatalities over time, it stays an international concern. According to the World Health Organization (WHO), about 10 million new cases and 1.5 million deaths were caused by TB globally in 2020. Demanding situations persist, specifically in high-burden regions like South Asian countries.

The South Asian TB Challenge

South Asia is home to a huge percentage of the world's TB cases. According to WHO statistics India alone contributed to around 26% of global TB cases in 2020.

Major challenges in the battle against TB in the South Asia are:

1. *Population Density*: South Asia is densely populated, featuring large urban centers where TB transmission can be particularly efficient.
2. *Drug Resistance*: Drug-resistant TB strains are emerging, such as multidrug-resistant TB (MDR-TB) and extensively drug-resistant TB (XDR-TB). These are serious concerns.
3. *Poverty*: Widespread poverty and limited access to healthcare services can prevent early diagnosis and treatment of TB, causing delays or insufficient medical care.
4. *Malnutrition*: Malnutrition is prevalent in some areas of the region, rendering individuals more vulnerable to TB and complicating treatment.
5. *Migration*: Population movements within and between countries in the region can contribute to TB spread.

In light of these challenges, effective TB control strategies, including appropriate drug treatment, are imperative in South Asia.

First-Line Anti-TB Drugs

The standard approach to TB treatment typically involves a combination of drugs, with the most effective and commonly used being the first-line anti-TB medications.

Isoniazid (INH)

INH stands for Isoniazid, it plays a central role in TB treatment in South Asia and globally. It is a first-line anti-TB drug that effectively inhibits TB bacteria growth. INH operates by disrupting the synthesis of mycolic acids, essential components of the mycobacterial cell wall.

In South Asia, INH is widely utilized as part of the standard short-course treatment regimen, usually spanning six months for drug-susceptible TB cases. INH fulfills dual purpose by killing actively dividing TB bacteria and preventing latent TB from becoming active. However, its prolonged use can lead to potential side effects like hepatotoxicity (liver damage) and peripheral neuropathy (nerve damage), necessitating vigilant monitoring during treatment.

Pyrazinamide (PZA)

Pyrazinamide, often abbreviated as PZA, is an essential component of the initial phase of TB treatment in South Asia. It uniquely targets dormant TB bacteria, especially those residing in acidic environments. PZA's mode of action involves disrupting the energy production of TB bacteria, leading to their demise.

During the first two months of TB treatment, PZA is administered alongside INH and RIF, hastening the reduction of the bacterial load and preparing for the continuation phase of treatment. By addressing dormant bacteria, PZA plays a pivotal role in shortening the overall duration of TB therapy.

Rifampicin (RIF)

Rifampicin, commonly referred to as RIF, is another pivotal first-line drug employed in TB treatment in South Asia. This bactericidal drug is indispensable for its potent action against TB bacteria. Rifampicin functions by obstructing RNA synthesis in TB bacteria, thereby impeding their replication.

In practice, RIF is frequently paired with INH during the initial phase of TB treatment. This combination therapy is highly effective and rapidly reduces the bacterial load. The inclusion of RIF significantly contributes to the overall success of TB treatment in the region.

Streptomycin

While less common today, streptomycin remains an option in specific TB treatment scenarios in South Asia. This injectable drug disrupts protein synthesis in TB bacteria.

Streptomycin is usually reserved for specific situations, such as cases of strong suspicion of drug resistance or when patients cannot tolerate other first-line drugs. Its use needs careful evaluation and monitoring due to potential side effects and the risk of resistance.

Ethambutol (EMB)

Ethambutol, known as EMB, is another crucial drug in TB treatment in South Asia. It is typically given in the initial phase of treatment alongside INH and RIF. EMB operates by interfering with the synthesis of the mycobacterial cell wall, effectively impeding bacterial growth.

One of EMB's primary roles in TB treatment is to mitigate the development of drug resistance. In regions with concerns about drug-resistant TB, the inclusion of EMB in the regimen is particularly significant as it adds an extra layer of protection against resistance to other first-line drugs.

Challenges in First-Line TB Treatment

Although first-line drugs are very useful in TB treatment, several challenges exist in South Asia:

1. **Drug Resistance:** The drug-resistant TB strains, such as MDR-TB and XDR-TB, are a significant concern, as these strains are less responsive to first-line drugs, bringing forward the need for the use of second-line drugs.
2. **Treatment compliance:** Making sure that patients complete their full course of treatment is important to prevent drug resistance and achieve a cure. Socioeconomic factors, stigma, and access to health care can influence treatment compliance.
3. **Side Effects of first-line drugs:** This is a very important point to be considered. Many first-line TB drugs, particularly INH and RIF, are responsible for side effects, ranging from mild to severe. Managing these side effects is important for the well-being of successful treatment.
4. **Access to Healthcare:** Access to healthcare facilities, such as diagnostics and medications, is not enough and needs to be improved in certain South Asian regions. Enhancing healthcare infrastructure is vital for effective TB control.
5. **Pediatric Tuberculosis:** TB in children presents unique challenges in terms of diagnosis and treatment. Ensuring the availability of appropriate formulations and dosages of anti-TB drugs for children is critical but may not always be readily accessible.

Second-Line Anti-TB Drugs

In recent years, South Asian nations have been grappling with the emergence of drug-resistant Tuberculosis strains. This development has made the use of second-line anti-TB drugs necessary, which are more potent and have a broader spectrum of activity. These can be more effective than first-line drugs in the treatment of drug-resistant TB strains.

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