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A Review: First Line Used Drugs in Tuberculosis.

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Abstract
Tuberculosis is a bacterial infection caused by Mycobacterium tuberculosis. The standard treatment for TB involves a combination of antibiotics to kill the bacteria and prevent resistance**.** Tuberculosis is a bacterial infection caused by Mycobacterium tuberculosis. The standard treatment for TB involves a combination of antibiotics to kill the bacteria and prevent resistance**.** Isoniazid, Rifampicin, Pyrazinamide, and Ethambutol are the primary drugs used to treat tuberculosis (TB). These medications are typically used in combination for 6 months to effectively cure TB and prevent drug resistance**.**

Keywords: Combination therapy, TB treatment, Antitubercular drugs, First-line treatment

1. Introduction

Tuberculosis (TB) is a bacterial infection that requires effective treatment to cure and prevent resistance. The first-line anti-TB drugs are: Isoniazid, Rifampicin, Pyrazinamide, Ethambutol. These medications are used in combination to provide a comprehensive treatment regimen for TB.

These drugs are used in a standard 6-month regimen, consisting of:

1. Intensive phase (2 months): INH, RIF, PZA, and EMB

2. Continuation phase (4 months): INH and RIF

First-Line Drugs

1. Isoniazid (INH): A key drug in TB treatment, INH is bactericidal and effective against actively growing tubercle bacilli.

2. Rifampicin (RIF): RIF is a potent bactericidal drug that targets both intracellular and extracellular bacteria.

3. Pyrazinamide (PZA): PZA is effective against bacteria in acidic environments, such as within macrophages.

4. Ethambutol (EMB): EMB inhibits the synthesis of the bacterial cell wall, making it bacteriostatic.

First Line Drugs Mechanism of Action and Uses

1) Isoniazid

Isoniazid is a bactericidal antibiotic that inhibits the synthesis of mycolic acid, a key component of the Mycobacterium tuberculosis cell wall. This inhibition disrupts the cell wall's structure and function, ultimately leading to the death of the bacteria.

Mechanism of Action Steps-

1. Activation by KatG: Isoniazid is activated by the bacterial enzyme KatG (catalase-peroxidase).

2. Inhibition of InhA: The activated form of isoniazid inhibits InhA, an enzyme involved in mycolic acid synthesis.

3. Disruption of Cell Wall: The inhibition of mycolic acid synthesis disrupts the cell wall's integrity, leading to bacterial death.

Uses

1) Isoniazid is used in combination with other medications to treat active TB.

2) Isoniazid is used as monotherapy to prevent the progression of latent TB to active TB in individuals with a high risk of developing the disease.

2) Rifampicin-

Rifampicin inhibits bacterial RNA synthesis by binding to the β-subunit of RNA polymerase, encoded by the rpo B gene. This binding blocks the initiation of RNA synthesis, thereby preventing the transcription of DNA into RNA.

Mechanism of Action Steps:

1. Binding to RNA Polymerase: Rifampicin binds to the β-subunit of RNA polymerase.

2. Inhibition of Transcription: The binding inhibits the initiation of RNA synthesis, preventing the transcription of DNA into RNA.

3. Bactericidal Effect: The inhibition of RNA synthesis leads to the death of the bacteria.

Uses-

1) Rifampicin is used in combination with other medications to treat active TB.
2) Rifampicin may be used in combination with other medications to treat latent TB.
3) **Pyrazinamide**

Mechanism of Action Steps-

1. Inhibit fatty acid synthase I: Pyrazinamide inhibits the enzyme fatty acid synthase I, which is involved in fatty acid synthesis**.**

2. Disrupt membrane energetics: Pyrazinamide's active form, pyrazinoic acid, disrupts membrane energetics and acidifies the cytoplasm, ultimately leading to bacterial death.

Uses

1)Pyrazinamide is used in combination with other medications (isoniazid, rifampicin, and ethambutol) to treat active TB.

4) Ethambutol-

Ethambutol inhibits the synthesis of arabinogalactan, a key component of the Mycobacterium tuberculosis cell wall, by targeting the enzyme arabinosyl transferase.

Mechanism of Action Steps-

1. Inhibits cell wall synthesis: Ethambutol disrupts the assembly of the mycobacterial cell wall.

2. Synergistic effect: Ethambutol is often used in combination with other antitubercular agents to enhance their effectiveness.

Uses-

1)Ethambutol is used in combination with other medications (isoniazid, rifampicin, and pyrazinamide) to treat active TB.

2. Conclusion

The combination of first-line anti-TB drugs - Isoniazid, Rifampicin, Pyrazinamide, and Ethambutol - provides an effective treatment regimen for tuberculosis, offering a potent bactericidal and sterilizing effect, and helping to prevent drug resistance. That's a concise and accurate conclusion! The combination of these four first-line anti-TB drugs is indeed a cornerstone of modern TB treatment, providing a powerful and effective regimen that targets the bacteria from multiple angles. The combination of Isoniazid, Rifampicin, Pyrazinamide, and Ethambutol is a well-established and evidence-based approach to treating tuberculosis, and it's great to see the importance of this regimen acknowledged.

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