Review Article

INTERNATIONAL JOURNAL OF EXPERIMENTAL AND BIOMEDICAL RESEARCH

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A Review Study on Safety and Efficacy on Second Line Anti Tubercular Drugs

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Article History:

Received on: 11 Nov 2023
Revised on: 23 Nov 2023
Accepted on: 25 Nov 2023

Keywords:

Miconazole, Nanocapsules, *Invitro* dissolution studies, FTIR & DSC

Abstract

Due to intestinal dysbiosis brought on by second-line anti-tubercular medication therapy, the patient's resistance to MTB appears to have decreased. This is likely due to an impact on immune cell proliferation and autophagic processes. therefore adversely influencing the patients' treatment results. The objectives of review articles are the safety and efficacy on the second line anti tubercular drugs. The results of these review article in the year 2015 to 2020. The conversation of these review article is the safety and efficacy of second line anti tubercular drugs . The discussion of these study about the safety and efficacy on second line anti tubercular drugs . 2016 levofloxacin is a not more safe and less effective because result insufficient control to the tuberculosis patient it adverse events is underactive thyroid. 2020 Ethionamide is a safe and effective for the TB patients. The conclusion of these review study and efficacy of the second line anti tubercular drugs. The ofloxacin are the most effective and safe when compared to the other second line anti tubercular drugs. In second line anti tubercular drugs the levofloxacin is having the less efficacy when compared to other second line anti tubercular drugs because it is having the adverse effect of the hypothyroidism. For the treatment of tuberculosis the drugs used are the levofloxacin, kanamycin, etc and these are most commonly used for the prevention of the disease.

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eISSN: 2583-116X
DOI: https://doi.org/10.26452/ijebr.v2i3.538

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INTRODUCTION

Tuberculosis is a dangerous infectious disease which poses threat to the human health. Mycobacterium tuberculosis is the main cause for the causing of the tuberculosis disease. The drugs which are used for the tuberculosis treatment are divided into two types they are first line and second line drugs. There is a growing number of children world wide connection second line antitubercular drugs for the multidrug - resistance tuberculosis [1].

According to the Global Tuberculosis treatment report 2022 published by the World Health Organisation , in 2021, there were 450,000 new cases of MT-TB globally, and 33,000 new cases of MDR-TB/RR-TB in china [2].

Children with MDR TB require longer courses of therapy with various medications. Multidrug-resistant tuberculosis (MDR-TB) has emerged as a significant worldwide health concern [3]. Typically, an aminoglycoside, ethionamide, cycloserine, pyrazinamide, ethambutol, and fluoroquinolone are used in the treatment of multidrug-resistant tuberculosis. The long-term adherence to anti-tuberculosis treatment and preventative regimens, which are expected to last many months in children, may be encouraged by fixed dose combinations that lessen the burden of pills and offer sufficient flavour masking. Therapy failure and the continued selection and dissemination of resistant mycobacteria are potential outcomes of partial adherence [4].

The main drugs of second line anti tubercular drugs are [5]:

1. Levofloxacin
2. Kanamycin
3. Streptomycin
4. Ethionamide
5. Cycloserine

World Health Organisation (WHO) Or United Nations Children's Fund (UNICEF) new 2008 Tablets that dissolve in water before consumption are recommended by the children's medication guide [6].

Its primary benefits include ease of use, portability, storage, and taste masking options. Anti-TB pills with a second line of distribution are currently available [7]. Children in particular have minimal tolerance to the highly bitter and irritating taste of the majority of the second line anti-tuberculosis medications that are now on the market. These drugs are made up of a very limited group of chemical classes. When these drugs are administered to kids, it's imperative that their tastes are kid-friendly and successfully disguise taste [8].

Comparing second-line anti-TB medications to first-line medications, there is virtually little market demand for them. In order to prevent closely linked losses, manufacturers frequently keep low inventories. Extensive testing is conducted on the items under varying storage conditions. A lot of the hard-won knowledge gained from the aforementioned projects will guide future efforts to create paediatric dispersible tablets for second-line anti-tubercular medications [9].

It is imperative to develop dispersible tablets to address the needs of paediatric formulations and, specifically, to cure tuberculosis in children. Treatment for drug-resistant tuberculosis is frequently more hazardous and difficult, resulting in fewer treatment outcomes, such as treatment failure or death, and a longer treatment period. In areas with limited resources, it is essential to closely monitor drug-resistant tuberculosis therapy, identify prognostic predictive indicators early, and closely monitor body weight to ensure medication success [10].

Side Effects

1. Anxiety
2. Mental disorder
3. Joint pain
4. Swelling
5. Itching
6. Redness
7. Darkening of the skin
8. Hepatitis
9. Hearing loss

Ethiology

The tuberculosis complex of Mycobacterium is the infectious agent that causes tuberculosis (TB). The Mycobacterium tuberculosis is spread to the air through coughing and comes from the cough of a tuberculosis patient. The TB patient's air droplets will likewise infect those who have inhaled them [11].

Epidemology

Despite being a treatable infectious disease, 1.3 million people are thought to have passed away from TB in 2012. Drug resistance in tuberculosis (TB) is a major contributing factor. Higher cure rates are achieved in patients with drug-susceptible tuberculosis when standard treatment consists of the two most potent medications, rifampicin and isoniazid [12].

Pathophysiology

The primary medications used in the treatment of resistant tuberculosis are second-line injectable antituberculosis medications (capreomycin and aminoglycosides). The greater adverse events counterbalance their retained efficacy in the context of multidrug resistance. Aerosolization, phagocytosis, phagolysosome obstruction, and replication are the disease's pathogenesis. Depending on the state of the patient's immune system, tuberculosis may progress in each individual differently. There are various stages, such as extrapulmonary disease, primary progressive disease, latency, and primary disease. A global public health concern is tuberculosis. Gaining insight into latent tuberculosis can also help develop more effective diagnostic techniques and innovative treatment plans [13].

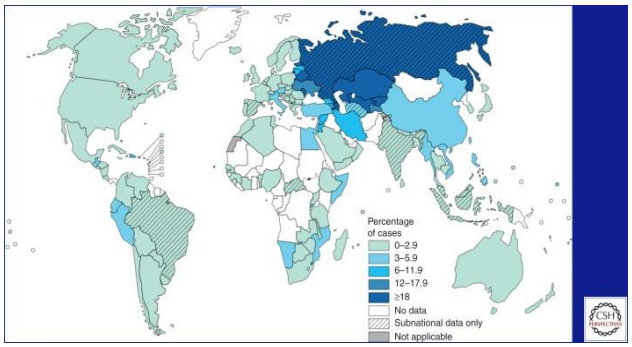

Figure 1: Drugs used to treat tuberculosis Diagnosis

Figure 2: Percentage of new TB cases with MDR-TB

The molecular assay and the first test were advised to be used in 2020 by the updated WHO recommendations for the detection of pulmonary and extrapulmonary tuberculosis (TB) and rifampicin resistance in adults and children.

Symptoms

1. Fever
2. Coughing up blood
3. Chest pain
4. Night sweat
5. Weight loss
6. Chills

Treatment

The following second-line medications are used to treat tuberculosis: imipenem-cilastain, meropenem, amikacin, ethionamide (prothionamide), cycloserine (or terizidone), para amino salicylic acid, imipenem-cilastain, bedaquiline, delamanid, imipenem-cilastain, meropenem, and amoxicillin-clavulanate [Figure 1 and Figure 2] [14][15][16].

Levofloxacin

DNA gyrase is inhibited. Adults: 10–15 mg/kg once daily for the treatment of tuberculosis. (See Annex 2 for weight-based adult dosage): For children aged five and under, administer 15–20 mg/kg divided into two doses (morning and evening). Over the age of five: once daily, 10–15 mg/kg (also see Annex 3, Weight-based dosing for children) [Figure 3].

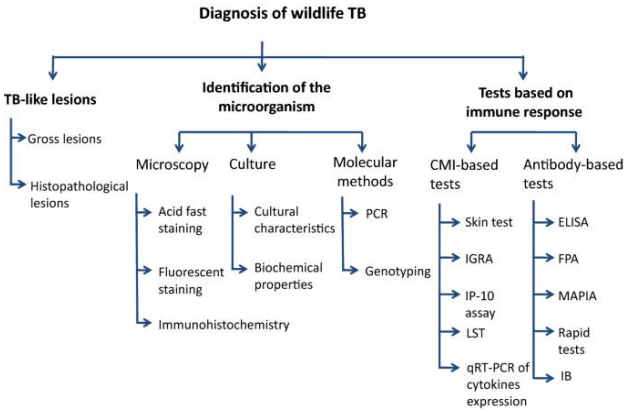

Figure 3: Identification of diagnosis of wildlife TB

Moxifloxacin

It has been tested in multiple late-stage trials, but although being used occasionally as a second-line TB medication, it does not have regulatory approval for treatment against TB or MDR-TB. DNA gyrase is an enzyme that is necessary for bacterial viability that is inhibited by doxifloxacin.

Capreomycin

Treatment for tuberculosis involves the use of capreomycin. Capreomycin is typically used to treat patients who are resistant to other medications due to its toxicity. Capreomycin

shouldn't be administered as a monotherapy due to the quick evolution of resistance [Figure 4, Figure 5 and Figure 6].

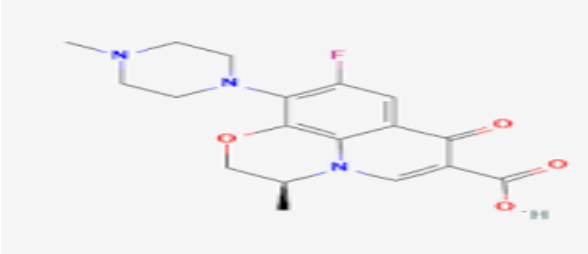

Figure 4: Structure of Ofloxacin

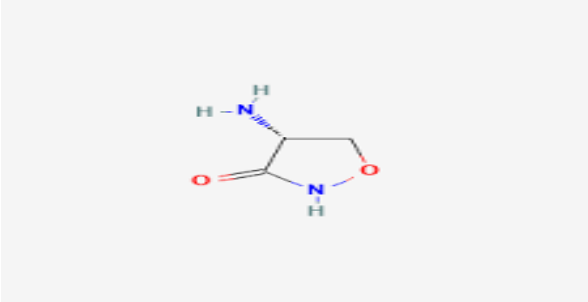

Figure 5: Structure of Cycloserine

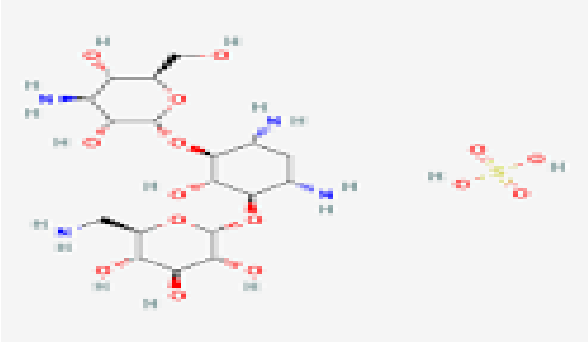

Figure 6: Structure of Kanamycin

Kanamycin

Streptomyces kanamyceticus is the source of the aminoglycoside antibiotic kanamycin. By attaching to the 70S ribosomal unit, kanamycin prevents protein synthesis and prevents tuberculosis from spreading. Serious bacterial infections in a variety of body locations are treated with kanamycin injections. Only brief usage—usually seven to ten days—is advised for this medication.

Streptomycin

The bacterium Streptomyces griseus is the source of streptomycin, the first aminoglycoside antibiotic ever found. It is currently mostly utilised in combination with other medications to treat pulmonary tuberculosis. It's the best recognised antibacterial treatment for tuberculosis. In vitro, it exhibits a strong bacteriostatic effect on the tubercle bacillus, and in vivo, it typically has a preventive impact on the disease in both humans and animals [Figure 7 and Figure 8].

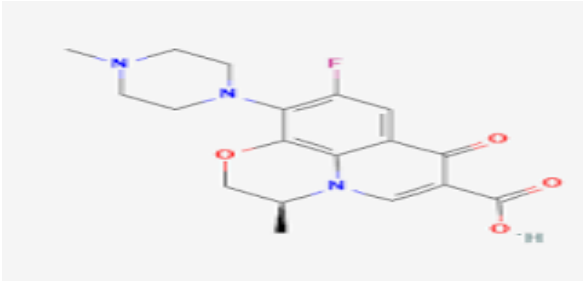

Figure 7: Structure of Levofloxacin

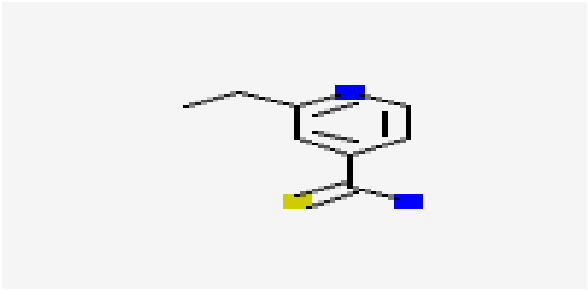

Figure 8: Structure of Ethionamide

Ethionamide

Tuberculosis (TB) is treated with ethionamide in addition to other medications. Ethionamide is a medication that works to either kill or stop the growth of bacteria. It is categorised as an antibiotic. Colds, the flu, and other viral infections, however, will not be treated by it.

Adverse Effects

1. Streptomycin - Vestibular and auditory nerve damage, renal damage.
2. Ethambutol - Retrobulbar neuritis, ocular side effects.
3. Kanamycin - Vertigo, auditory nerve damage, nephrotoxicity.
4. Ethionamide - Diarrhoea, abdominal pain, hepatotoxicity.
5. Cycloserine - Dizziness, headache, depression, psychosis, convulsions.
6. Levofloxacin - Redness and sweeling of skin [17].

METHODS

Eligibility Criteria

We included a systemic mini review that reported the safety and effective on the second line anti tubercular drugs are reviewed by reviewed articles [18]. The data information was then collected from the published articles and it includes the eligibility criteria.

Selection Process

According to the systemic review article first independently reviewed all review articles to get an idea about the safety and the efficacy on second line anti tubercular drugs. After review the articles includes data information for the review article about the second line anti tuberculosis drugs which is safe and effective [19].

Data Analysis

The data was collected from review articles after the collection it has been analysed to conclude from the published review articles. To these review articles the data was collected by using the design of systemic analysis [20] .

RESULTS

Pharmacokinetics of Second Line Anti Tubercular Drugs

In 2015 the author sang –in park was studied about Pharmacokinetics characteristics of second line anti tubercular drugs is commonly used multiple using regimens for TB. The drug interactions were absorbed where fluoroquinolones where co administered with cycloserine and prothionamide.

Mechanism of Second Line Anti Tubercular Drugs

1988: P. Marone

Ofloxacin

It is more effective and safer agent when compared to other 2nd line antituberculosis drugs in the treatment of various infections especially TB.

2005: Jain A MD

Cycloserine

It is more effective and safer as injection when it is given as initially 4 to 6 months of treatment

2015: Ken Ohta

Kanamycin

Addition of kanamycin is safe and effective even after failure of initial chemotherapy and should be considered as a treatment option for TB.

2016: Giovanni Battista Migliori

Levofloxacin

The levofloxacin is a not more safe and less effective because it results insufficient control to the tuberculosis patients it adverse events is hypothyroidism.

2020: Anneke c. hesseling.

Ethionamide

The ethionamide is a safe and effective to the tuberculosis patients. It is having more resistance.

DISCUSSION

The discussion of this study about the safety and efficacy on 2nd line anti-tuberculosis drugs. In 1988 ofloxacin are more effective and safer agent to all infections. 2005 Cycloserine is more effective and safer as injection when it is given as initially 4 to 6 months of treatment. 2015 Kanamycin is safe and effective even after failure of initial chemotherapy and should be considered as a treatment option for TB. 2016 levofloxacin is a not more safe and less effective because it result insufficient control to the tuberculosis patients it adverse events is hypothyroidism. 2020 Ethionamide is a safe and effective to the tuberculosis patients.

CONCLUSION

The conclusion of the review study about safety and the efficacy on the second line anti tuberculosis drugs. The ofloxacin are the most effective and safe when compared to other second line tuberculosis drugs. The levofloxacin are less safety and less effective when compared to the other second line antitubercular drugs because of adverse effects.

ACKNOWLEDGEMENT

The authors are thankful to the Principal (Dr. Y. Prapurna Chandra) & Guide (Bachu Naveena) from Ratnam Institute of Pharmacy, Pidathapolur, SPSR Nellore, for providing the necessary facilities to carry out this review work.

Funding Support

The Author declares that there is no funding.

Conflict of Interest

The Author declares that there is no conflict of interest.

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