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Research Article

Prescription Pattern Analysis of Tuberculosis Treatment at a Tertiary Care Hospital: A Cross-Sectional Study

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A B S T R A C T

Objective: Prescription analysis of tuberculosis (TB) is essential for optimising treatment and combating contagious conditions brought on by TB-causing *Mycobacterium*. TB remains a significant health challenge, particularly in high-burden countries like India. Prescription analysis evaluates the patterns of anti-tubercular medication use, aiming to ensure rational drug use and improve patient outcomes. This study is essential in cases when treatment regimens are complex, such as with extensively drug-resistant TB and multi-drug-resistant TB. By understanding prescription patterns, healthcare professionals can lessen drug resistance and improve the effectiveness of TB treatment programmes.

Materials and Method: This observational cross-sectional study was carried out in January and February 2021 and aimed to assess the prescription patterns in TB treatment at a hospital in Ranchi. The study included 119 patients, excluding critically ill individuals and those unwilling to provide informed consent. Data on socio-demographic features, prescribed medications, hospitalisation duration, and comorbid conditions were collected.

Results: The study revealed a male predominance (63.02%) and the majority of participants aged 19–30 years (31.09%). Most respondents were illiterate (39.49%) and from rural areas (89.91%). Levofloxacin was the most commonly prescribed medication (98.32%), with isoniazid being the least prescribed (87.39%). Eight treatment regimens were identified, with R3 (isoniazid, rifampicin, pyrazinamide, ethambutol, streptomycin injection, and levofloxacin) being the most prevalent (82.35%). The average hospitalisation duration was 4.01 ± 2.12 months. Comorbid conditions were present in 20.17% of patients, diabetes (41.7%) and epilepsy (25%) being the most common.

Conclusion: This study highlights that the practice of irrational use of drugs is common and there is an urgent need for prescription pattern analysis in promoting rational drug use in TB treatment.

Keywords: Tuberculosis, Prescription Analysis, Antitubercular Medications, Drug Resistance, Mdr-Tb, Xdr-Tb, Treatment Regimens

Introduction

Mycobacterium tuberculosis is the infectious agent that causes *tuberculosis* (TB), a disease that mainly affects the lungs besides many other organs of the body. Respiratory droplets from TB patients who are actively ill can transmit it. India has the highest rate of TB mortality in the world, with two deaths every three minutes.[1] The Indian government started the National *Tuberculosis* Control Program in 1962 and renamed it as National *Tuberculosis* Elimination Program (NTEP) in 2020 intending to end the spread of TB in India by 2025 by severing the disease's transmission chain. Even with improvements in detection and therapy, TB is still very common; 2,537,235 cases were recorded in 2023.[2,3]

Mycobacterium tuberculosis infections are treated with anti-tubercular drugs, such as rifampin, isoniazid, pyrazinamide, and ethambutol. The specific combination and duration of therapy depend on whether the patient has active or latent TB. The emergence of multidrug-resistant *tuberculosis* (MDR-TB) is a significant problem in the treatment of TB. A major cause of resistance is the irrational use of anti-tubercular drugs. Therefore, treatments for MDR-TB are continuously evolving. Common second-line drugs for MDR-TB include injectable antibiotics like kanamycin, capreomycin, and amikacin, as well as fluoroquinolones such as levofloxacin, moxifloxacin, and gatifloxacin. Recently, pretomanid, which is used in combination with bedaquiline and linezolid, has been approved for treating MDR-TB by the US FDA and the Indian Government. Extensively drug-resistant *tuberculosis* (XDR-TB), a more severe form, shows resistance to first-line drugs (rifampin and isoniazid), one second-line aminoglycoside, and a fluoroquinolone.[4] Prescription pattern analysis (PPA) is a valuable tool for evaluating the prescribing, dispensing, and distribution of medications. The primary objective of PPA is to promote the rational use of medicines. This study aims to examine the prescription patterns in the treatment of TB.

Materials And Method

This cross-sectional observational study was conducted with a sample size of 119 from January 2021 to February 2021. Prescriptions were collected from patients admitted to a TB hospital in Jharkhand. Individuals of any age and gender with prescriptions that included symptoms, signs, and a provisional or definitive diagnosis of the disease, along with the prescribed drugs, were included in the study. Excluded from the study were critically ill patients and those unable or unwilling to provide informed consent. Data was collected on the socio-demographic features of the patients, including age, sex, residence, education, and marital status. Furthermore, prescriptions were also analysed by SPSS software for the medications prescribed, duration of hospitalisation, and the comorbid conditions the patients were suffering from tuberculosis. This observational study was conducted at Ramakrishna Mission T.B. Hospital, Ranchi, Jharkhand, with prior approval from the ethics committee.

Results

Prescriptions were collected from a total of 119 patients who were admitted to the hospital. This cross-sectional study revealed a significant male predominance, reflecting 63.02% of the study participants. Figure 1 highlights the sex distribution of the study subjects.

The present study reported that the majority (37, 31.09%) of the participants belonged to the age group 19 to 30 years. This was followed by 27.73% (33) in the age group of 31 to 40 years, 21.01% (25) in the age group of 41 to 50 years, and 14.28% (17) above 51 years (Figure 2). Only 7 participants were in the paediatric age group.

Other demographic characteristics (Table 1) showed that the majority of respondents (n = 47, 39.49%), were illiterate. Approximately 38 (31.93%) had attended primary school, 31 (26.05%) had studied up to secondary school, and 3 (2.52%) were graduates or had higher qualifications. The data also revealed that most respondents, 87 (73.11%), were married, 31 (26.05%) were unmarried, and 1 (0.84%) was divorced. Additionally, 107 (89.91%) respondents were from rural areas, while 12 (10.08%) were from urban areas.

Prescription analysis revealed that 6 different types of antitubercular medicines in varied combinations were prescribed to the patients. Table 2 highlights the frequency of usage of these medicines in the prescriptions. It was found that levofloxacin was the most commonly prescribed medicine (98.32%), whereas isoniazid was the least prescribed (87.39%).

A detailed study revealed that there were eight different regimes, as follows:

R1- Ethambutol, streptomycin injection, levofloxacin

R2- Rifampicin, pyrazinamide, ethambutol, streptomycin, levofloxacin

R3- Isoniazid, rifampicin, pyrazinamide, ethambutol, streptomycin, levofloxacin

R4- Isoniazid, rifampicin, pyrazinamide, levofloxacin

R5- Isoniazid, rifampicin, pyrazinamide

R6- Rifampicin, streptomycin, levofloxacin

R7- Isoniazid, rifampicin, ethambutol, levofloxacin

R8- Isoniazid, rifampicin, pyrazinamide, ethambutol, levofloxacin

It was revealed that R3 was the most prevalent regime prescribed to 82.35% of the patients, followed by R1 (Table 3).

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The average duration of hospitalisation was reported to be 4.01 ± 2.12 months (ranging from 0.5 months to 1 year). The comorbid conditions were noted in 20.17% of the patients, among which 41.7% were diabetic and 25% epileptic. Other comorbid conditions like asthma, hepatitis, cardiovascular problems, hypertension, and psychological disorders were also recorded in the study.

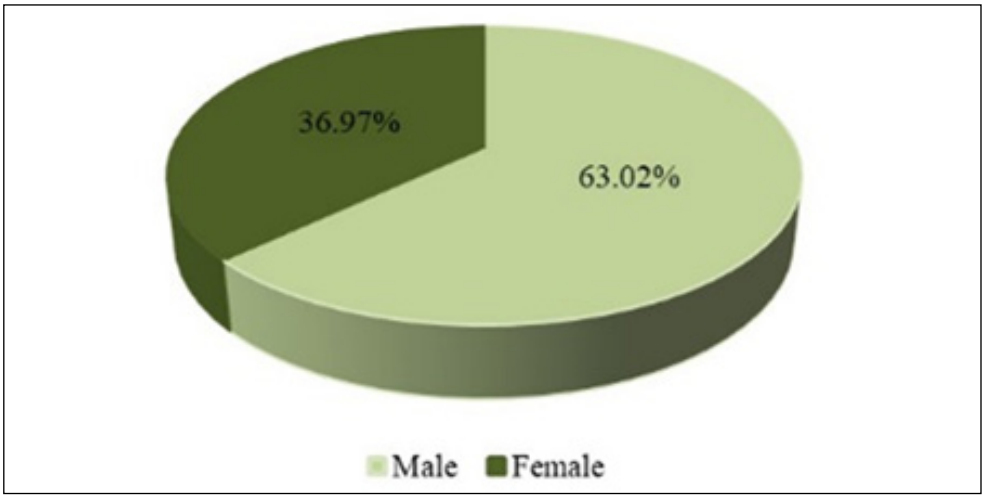

Figure 1.Sex Distribution of the Study Participants

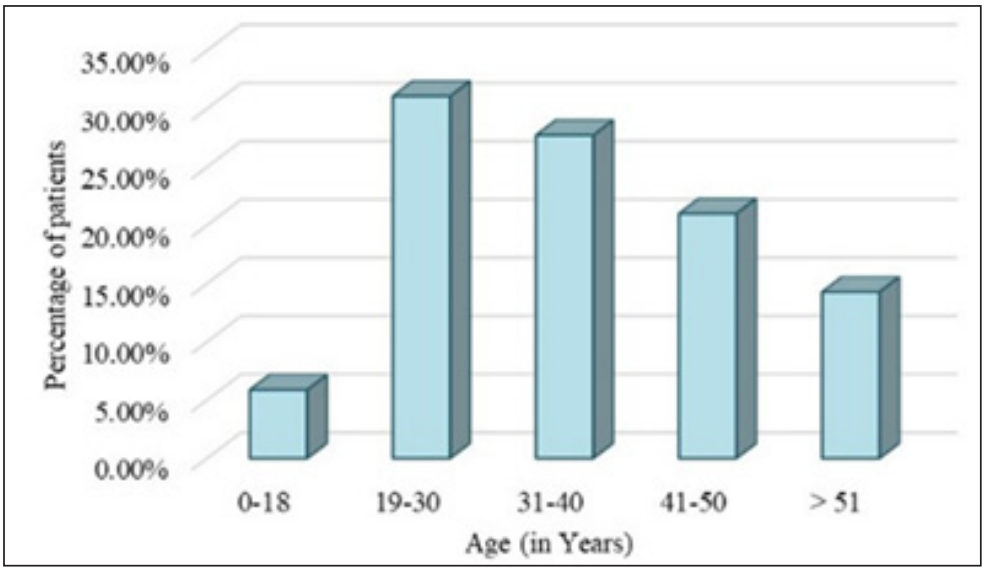

Figure 2.Age Distribution of the Study Participants

Table 1.Socio-Demographic Characteristics of the Study Population

Characteristics	Parameters	Number	Percentage
Education	Illiterate	47	39.49
	Primary school	38	31.93
	Secondary school	31	26.05
	Graduation	2	1.68
	Postgraduation	1	0.84
Marital status	Married	87	73.11
	Unmarried	31	26.05
	Divorced	1	0.84
Residence	Urban	12	10.08
	Rural	107	89.91

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Table 2.Frequency of Prescription of Different Antitubercular Drugs

Name of Medicines	Frequency	Percentage
Isoniazid	104	87.39
Rifampicin	108	90.75
Pyrazinamide	105	88.24
Ethambutol	115	96.64
Streptomycin injection	113	94.96
Levofloxacin	117	98.32

Table 3.Frequency of Prescription of Different Antitubercular Regimes

Regime	Frequency	Percentage
R1	11	9.24
R2	3	2.52
R3	98	82.35
R4	1	0.84
R5	2	1.68
R6	1	0.84
R7	2	1.68
R8	1	0.84

Discussion

One of the top 10 causes of death globally and the primary cause of infectious agent-related mortality is TB, which continues to pose a serious threat to global health. Almost 60 million lives have been saved by TB therapy, but a significant portion of the population still lacks access to a reliable diagnosis and treatment. The Philippines, South Africa, Indonesia, and India collectively bear 44% of the world's TB cases. India accounts for one-fifth of the cases of TB globally.[1] This study utilises prescription pattern analysis to evaluate the rational use of these medications, highlighting the importance of understanding prescribing trends to optimise TB treatment outcomes.

Gender has a high correlation with TB transmission, testing, treatment, adherence, and results, according to epidemiological research. Consequently, it is advised to do gender analysis and use gender-responsive TB programming. To address this, India unveiled in 2019 its national framework, in line with the National Strategic Plan (NSP), for a gender-responsive strategy to TB. The gender-specific elements of TB diagnosis, management, and treatment results in India have been extensively studied in recent times. Nevertheless, the majority of research focuses primarily on patient populations receiving TB therapy or on small sample sizes.[5] A male predominance in TB prevalence was reported in the present survey. This finding was in line with the Global TB report of 2018 where the ratio of TB prevalence was found to be approximately 2:1 among the males and females in India.[6] The present study revealed that the prevalence of TB was higher in individuals of the age group of 19 to 30 years. Several studies in India have reported a higher prevalence of TB with advancing age.[7] The increased frequency of social interactions and the use of public transportation, which lead to greater exposure to the disease, may contribute to a higher prevalence of TB with advancing age.[8]

The Standard Treatment Workflow (STW) Guidelines for drug-sensitive TB treatment as per NTEP recommend standardised regimens for anti-TB treatment that include five essential medications referred to as "first line": isoniazid (H), rifampicin (R), pyrazinamide (Z), ethambutol (E), and streptomycin (S).[9] Levofloxacin, a fluoroquinolone antibiotic, is an important component in the treatment of TB, particularly for cases resistant to first-line drugs. Its broad-spectrum antibacterial activity makes it effective against a wide range of *Mycobacterium tuberculosis* strains, including those resistant to other medications. This property is especially valuable in managing multidrug-resistant TB (MDR-TB) and is utilised in various combination therapies to enhance treatment efficacy and reduce the bacterial load.[10] It was observed in the present study that there were eight different regimens for TB therapy am/.ong which the regimen comprising isoniazid, rifampicin, pyrazinamide, ethambutol, streptomycin, and levofloxacin was the most prevalent regime prescribed. The drug which was most commonly prescribed to the patients was levofloxacin. A cross-sectional study in a tertiary care hospital in Andhra Pradesh reported six different regimens, with the most prevalent regimen being isoniazid, rifampicin, pyrazinamide, and ethambutol.[2]

With an average hospitalisation duration of four months and a notable presence of comorbidities like diabetes and epilepsy, the study highlights the need for targeted strategies to improve TB treatment efficacy and address associated health challenges. Overall, this study emphasises the importance of continuous prescription pattern analysis to ensure the rational use of anti-tubercular medications. By understanding and optimising prescription practices, healthcare providers can improve patient outcomes, manage drug resistance more effectively, and contribute to the broader goal of TB elimination as outlined in NTEP 2020.

Conclusion

This study emphasises the significance of prescription pattern analysis in TB treatment at a TB hospital. The eight types of regimens including isoniazid, rifampicin, pyrazinamide, ethambutol, streptomycin injection, and levofloxacin, differ from the recommended regimens of the National TB Elimination Program.

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