Journal of Population Therapeutics & Clinical Pharmacology

ORIGINAL RESEARCH ARTICLE
DOI: 10.53555/rtb9w684

PREVALENCE OF MDR TB AND XDR TB IN ALL SPUTUM POSITIVE TB PATIENTS AT A TERTIARY CARE HOSPITAL

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ABSTRACT

Background

Multidrug-resistant tuberculosis is difficult to treat and poses a health risk to the community, particularly in developing nations. We evaluated the prevalence of MDR TB and XDR TB among sputum-positive TB patients at Nodal DRTB centre of Tertiary Care Hospital in Vidharbha region of Maharashtra.

Method

This was a hospital based observational study conducted among 139 sputum-positive TB patients aged above 18 years from 1st January 2023 to 31st December 2024. Upfront CBNAAT/TrueNAAT test (True Nucleic Acid Amplification Test) was done in all patients and those with rifampicin resistance were further subjected to first-line and second-line Line Probe Assay at the Intermediate Reference Laboratory, STDC, Nagpur after obtaining clearance from institutional ethics committee.

Results

We found 7.2% prevalence of MDRTB (Multi Drug Resistant Tuberculosis), with resistance primarily to Rifampicin and Isoniazid. Importantly, no cases of XDRTB (Extensive Drug Resistant Tuberculosis) were detected. The prevalence of MDR TB was slightly higher in the older age group (>40 years), males (9.0%) and rural residents (8.2%), although neither differences reached statistical significance. However, the association between HIV status and MDRTB was significant, with 33.3% of HIV-positive patients having MDRTB, compared to 4.7% of HIV-negative patients.

Conclusion

MDR TB is the ongoing public health challenge, especially in vulnerable populations like older age group, calls for enhanced focus on HIV co-infection and rural health interventions to effectively combat this dual epidemic.

Keywords: MDR TB, XDR TB, CBNAAT, TrueNAAT, DST, LPA, DRTB (Drug Resistant Tb).

INTRODUCTION

Mycobacterium tuberculosis is the pathogen that causes tuberculosis (TB), an infectious disease. Pulmonary TB mostly affects the lungs.[1] In addition, it affects the skin, lymph nodes, bones, joints, intestines, and meninges. Typical symptoms of tuberculosis include cough with or without haemoptysis, low-grade evening fever, loss of appetite, weight loss, and chest pain.[2] Along with HIV, tuberculosis is one of the major illnesses that affect people from low socioeconomic backgrounds. M. tuberculosis affects one-third of the world's population and spreads to other people at a pace of one every second. Young individuals are primarily infected.[3] The majority of tuberculosis deaths occurred in underdeveloped nations. An individual with active TB disease who is left untreated will infect roughly ten to fifteen persons annually, which leads to the spread of TB. People with HIV disease are more likely to get tuberculosis. People with diabetes mellitus, chronic illnesses that impair immunity, those with low socioeconomic level, and smokers are at a higher risk of contracting tuberculosis.[4] By estimating the prevalence of drug resistance for tuberculosis in the community, new strategies, and treatment with effective medications to cure the disease completely can be developed, preventing the development of drug resistance. This raises the operational costs of the drugs and their distribution, as well as the need to monitor the toxicity of the medications and supervise their administration to ensure regular intake.[5]

Despite the well-established effectiveness of the medications in treating pulmonary tuberculosis, their widespread use in home-based treatment programs raises concerns because of practical challenges. The number of patients with drug-resistant TB bacilli in the community has significantly increased as a result of patients poor compliance. Resistance to any of the first-line TB medications, such as isoniazid and rifampicin, is referred to as MDR-TB. The term XDR-TB refers to tuberculosis that is resistant to at least isoniazid and rifampicin (defining multidrug-resistant TB or MDR-TB), plus resistance to any fluoroquinolone and at least one of the second-line injectable drugs (amikacin, capreomycin, or kanamycin).[6] MDR-TB is becoming more prevalent globally. Multidrug-resistant tuberculosis is difficult to treat and poses a health risk to the community, particularly in developing nations.[7] According to data currently available from numerous drug resistance surveillance studies, our nation has less MDR-TB cases than other developing nations. The burden of drug-resistant tuberculosis may increase and present a public health emergency as a result of insufficient treatment of MDR-TB.[8] Drug-resistant tuberculosis shares few clinical characteristics with non-drug-resistant tuberculosis. Tubercle bacilli are referred to as "sensitive strains" if they exhibit homogeneous sensitivity to low medication concentrations.[9] A resistant strain of tubercle bacilli is one that can thrive at higher medication concentrations. Other methods, which can be described as a decrease in drug sensitivity, allow it to develop considerably at higher drug concentrations and unquestionably exhibit distinct traits from those of the wild strain, which had never seen it.[10] In 1969, the WHO convened an international panel of experts to develop the criteria of antibiotic resistance of Mycobacterium TB.[11]

The minimal inhibitory concentrations (MIC) of three medications that were then on the market were determined by testing a large number of wild strains against them in starch-free Lowenstein Jensen (LJ) medium.[12] It was proposed that if one percent or more of the bacterial population exhibited resistance to a specific medication concentration, the strain would be deemed resistant. The "Fall and Rise" phenomenon describes how the number of susceptible bacilli in the lung cavities of tubercular patients declined while the number of resistant bacilli grew when monotherapy, such as streptomycin alone, or insufficient therapy was used.[13] First- and second-line LPA (Line Probe Assay) and liquid culture & DST (Drug Sensitive Tb) for certain medicines are employed for the rapid detection of DR-TB-combination of NAAT (CBNAAT/Truenat).

AIM AND OBJECTIVES

To evaluate the prevalence of Multidrug-Resistant Tuberculosis (MDR TB) and Extensively Drug-Resistant Tuberculosis (XDR TB) among sputum-positive TB patients.

MATERIALS AND METHODS

The current hospital based observational study conducted at a tertiary care centre on 139 sputum positive TB patients attending the outpatient and inpatient departments of Respiratory Medicine, from 1st January2023 to 31st December 2024.

Inclusion Criteria

All sputum-positive TB cases aged 18 years and above.

Exclusion Criteria

Critically ill patients, Patients with Chronic Obstructive Pulmonary Disease, Interstitial Lung Diseases and post-TB fibrosis, Lung malignancies were excluded.

Microbiological Investigations

- Sputum samples were subjected to Ziehl-Neelsen or fluorescent staining and CBNAAT (Cartridge Based Nucleic Acid Amplification Test)/Truenat testing. Patients detected with MTB and rifampicin resistance were further tested with first-line and second-line LPA at the IRL, STDC, Nagpur.

Statistical Methods

Data was compiled, tabulated, and analyzed using EPIINFO VERSION 7.2. Quantitative variables were expressed as numbers and percentages. Relevant statistical tests were applied, and a p-value of less than 0.05 was considered statistically significant.

OBSERVATION AND RESULTS

	MDRTB Status					
	Notdetected (n=129)		**Detected(n=10)**		**Total (n=139)**	
Agegroup(years)	**n**	**%**	**N**	**%**	**n**	**%**
≤40	83	93.3	6	6.7	89	100.0
>40	46	92.0	4	8.0	50	100.0
Total	129	92.8	10	7.2	139	100.0
P-value by Chi-Square test. P-value < 0.05 is considered to be statistically significant. NS–Statistically non-significant. Chi-Square value=0.076, DF=1, P-value= 0.783^{NS}						
Table 1: Distribution of Prevalence of MDRTB according to age						

The prevalence of MDRTB did not differ significantly between age group (P-value>0.05).

	MDRTB Status					
	Notdetected (n=129)		**Detected(n=10)**		**Total(n=139)**	
Gender	n	%	N	%	n	%
Male	91	91.0	9	9.0	100	100.0
Female	38	97.4	1	2.6	39	100.0
Total	129	92.8	10	7.2	139	100.0
P-value by Chi-Square test. P-value < 0.05 is considered to be statistically significant. NS– Statistically non-significant. Chi-Square value=1.741, DF=1, P-value= 0.282^{NS}						
Table 2: Distribution of Prevalence of MDRTB according to Gender						

The prevalence of MDRTB is relatively higher in males, however the difference did not reach statistical significance (P-value>0.05).

	MDRTB Status					
	Notdetected (n=129)		**Detected(n=10)**		**Total(n=139)**	
Residentialstatus	**n**	**%**	**N**	**%**	**n**	**%**
Rural	112	91.8	10	8.2	122	100.0
Urban	17	100.0	0	0.0	17	100.0
Total	129	92.8	10	7.2	139	100.0
P-value by Chi-Square test. P-value < 0.05 is considered to be statistically significant. NS–Statistically non-significant. Chi-Square value =1.501, DF=1, P-value= 0.611^{NS}						
Table 3: Distribution of Prevalence of MDRTB according to residential status						

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The prevalence of MDR TB is relatively higher in group of cases from rural areas, however the difference did not reach statistical significance (P-value>0.05).

	MDRTB Status					
	Notdetected (n=129)		**Detected(n=10)**		**Total(n=139)**	
HIVstatus	**n**	**%**	**N**	**%**	**n**	**%**
Non-Reactive	121	95.3	6	4.7	127	100.0
Reactive	8	66.7	4	33.3	12	100.0
Total	129	92.8	10	7.2	139	100.0
P-value by Chi-Square test. P-value < 0.05 is considered to be statistically significant. ***P- value < 0.001. Chi-Square value =13.440, DF =1, **P-value= 0.001*****						
Table 4: Distribution of Prevalence of MDRTB according to HIVstatus						

The prevalence of MDR TB is significantly higher in group of cases with HIV positive status compared to group of cases with HIV negative status (P-value<0.05).

	MDRTB Status					
	Notdetected (n=129)		**Detected(n=10)**		**Total(n=139)**	
Co-morbidity	**n**	**%**	**n**	**%**	**n**	**%**
Nil	95	92.2	8	7.8	103	100.0
Diabetesmellitus	16	94.1	1	5.9	17	100.0
Hypertension	17	100.0	0	0.0	17	100.0
Diabetesmellitus+Hypertension	1	50.0	1	50.0	2	100.0
Total	129	92.8	10	7.2	139	100.0
P-value by Chi-Square test. P-value < 0.05 is considered to be statistically significant. NS–Statistically non-significant. Chi-Square value = 6.901, DF = 3, P-value = 0.075^{NS}						
Table 5: Distribution of Prevalence of MDRTB according to Co-morbidities						

The prevalence of MDRTB did not differ significantly between group of cases with or without the presence of co-morbidity (P-value>0.05).

DISCUSSION

In the present study majority, 41.7% were between 21–30 years, 20.9% between 31– 40 years, Which is similar to a study conducted by Singh et al[14] with the majority of cases falling within the 25–34 age range. This consistency reflect the higher social mobility and exposure risk among younger adults.

Males (71.9%) outnumbered females (28.1%) . The male to female ratio was 2.56:1. Study by Rao et al.[15], male-to-female ratio was 2.3:1, aligning closely with the ratio observed in the present

study. This pattern has been attributed to several socio-behavioral and biological factors, including differences in exposure to risk factors such as smoking, occupational exposure, and social behavior that increase contact rates, particularly in regions where men have more active roles outside the household. Additionally, healthcare-seeking behavior differs between genders, with men more likely to seek treatment earlier than women, which may contribute to the higher detection rates among men.

In our study majority of cases were from rural area 87.8%, and 12.2% from urban area. However, Patel et.al[16] reported a higher prevalence of TB among rural populations, approximately 82%. The study attributed this to limited access to healthcare facilities, delayed diagnosis, poor nutritional status, and a lack of awareness about TB symptoms in rural regions.
In present study, 74.1%. cases did not have any co-morbidities, Diabetes mellitus seen in 12.2%, hypertension in 12.2% and 1.5% had both diabetes and hypertension which is similar to study by Jeon et.al[17]. In study by Dooley et.al[18] diabetes prevalence ranged between 15-20%, slightly higher than our study.

Outcome of CBNAAT Test
In our study out of 139 cases 22.3% cases had very low, 9.4% cases had low, majority of cases i.e. 36.0% had medium and 32.4% cases detected high MTB organism. Sharma et al,[19] reported a slightly higher proportion of cases with high MTB levels in 45% and medium in 28% of cases which is quite similar to our study.

Detection of multiple gene mutations in anti-TB drugs
In present study, 7.2% of cases had Rifampicin resistance, 5.8% of cases had Isoniazid resistance (High level) and 1.4% of cases had Isoniazid resistance (Low level) on first line LPA. However, Aung et al[20] have also reported similar prevalence rates, with Rifampicin resistance occurring in 6-8% of TB patients. And study by Huyen et.al.[21]shows that Isoniazid resistance occurred in 8-10% of patients in high-burden countries, consistent with the findings in our study.

Prevalence of MDR TB
In present study 7.2% had MDR TB cases,which is similar to study by Sharma et.al[22] A study from Northern India reported a similar prevalence of MDRTB, ranging from 6% to 8% in sputum-positive TB patients. This closely aligns with the findings of our study, indicating that high MDRTB prevalence across similar regions with comparable health care challenges.

Prevalence of XDRTB
In our study none had XDR TB. In Global Tuberculosis Report 2022,[23] the global prevalence of XDRTB remains relatively low,accounting for less than 1% of all TB cases. This low prevalence aligns with the findings of the present study.
Of the 127 cases with HIV negative status, 4.7% of cases had MDR TB. Out of 12 cases with HIV positive status 33.3% had MDR TB. The distribution of prevalence of MDR TB is significantly higher in group of cases with HIV positive status compared to group of cases with HIV negative status (P-value<0.05). Which is similar to study by Gandhi et.al[24] they reported 30% MDR TB prevalence in HIV-positive TB patients, underscoring the synergistic effect of HIV and TB in driving drug resistance. The immune suppression caused by HIV likely exacerbates the difficulty of effectively treating TB, leading to the emergence of drug resistance.

CONCLUSION
We found that 7.2% prevalence of MDR TB among sputum-positive TB patients, with significant association observed between MDRTB and HIV-positive status. The prevalence of MDR TB was higher among males, older adults, and rural residents, these differences are not statistically significant. The absence of XDRTB cases is a positive finding, but the presence of MDRTB in a

significant portion of the population, particularly among those with HIV, highlights the critical need for vigilant monitoring, early detection, and tailored treatment strategies. This study also highlights the ongoing public health challenge posed by MDRTB, especially in vulnerable populations, and calls for enhanced focus on HIV co-infection and rural health interventions to effectively combat this dual epidemic.

ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

Study was conducted after approval from Institutional Ethics Committee, IEC letter no.185/2022 dated 28/11/2022 and written consent obtained from all participants.

AUTHORS CONTRIBUTION

Dr. Bhagyashri Barve conducted literature search, analysis, interpretation of data, manuscript writing, Dr. Juhi Kadukar reviewed manuscript. All authors read and approved final manuscript.

CONFLICT OF INTEREST: Nil.

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