



EVALUATION OF RISK FACTORS AND RADIOLOGICAL DISCOVERIES RELATED TO MDR-TB WITHIN THE PATIENT POPULATION AT A TERTIARY HEALTHCARE FACILITY

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ABSTRACT

Introduction: Tuberculosis (TB) is an infectious disease caused by *Mycobacterium tuberculosis*, primarily affecting the lungs and transmitted through close contact with infected individuals. Latent TB can become active due to factors such as HIV infection, age, diabetes, and close contact with active TB cases. TB remains a significant global health challenge, with millions of new cases reported annually, causing substantial morbidity and mortality. Multidrug-resistant tuberculosis (MDR-TB) poses an even greater threat due to resistance to standard treatments. Radiological findings are crucial for diagnosing and monitoring MDR-TB. **Objective:** This study aimed to assess risk factors associated with MDR-TB and investigate radiological findings in MDR-TB patients at a tertiary healthcare facility. **Materials and Methods:** A cross-sectional study was conducted at a tertiary healthcare facility in Northern India, involving 150 MDR-TB patients. Demographic data, risk factors, and radiological findings were collected and analysed. Logistic regression was used to identify significant risk factors. **Results:** The study found an equal distribution of MDR-TB cases among male and female patients, with a mean age of 42.5 years. Risk factors included previous TB treatment (40%), contact with active TB cases (20%), diabetes mellitus (16.67%), immunocompromised conditions (13.33%), and age ≥ 60 years (10%). Radiological findings revealed lung cavities (33.33%), nodules (43.33%), extensive lung lesions (26.67%), and mixed patterns (20%). Notably, HIV-positive individuals had a 2.25-fold higher risk of MDR-TB compared to HIV-negative individuals (p -value = 0.015). **Conclusion:** This study underscores the importance of considering risk factors and radiological findings in MDR-TB management. Addressing comorbid conditions, close contact tracing, and HIV screening are crucial in tackling MDR-TB. These findings contribute to our understanding of MDR-TB and highlight the need for comprehensive strategies in high-burden regions.

KEYWORDS

INTRODUCTION

Tuberculosis (TB) is an infectious ailment instigated by the *Mycobacterium tuberculosis* (*M. tuberculosis*) complex, primarily affecting the lungs [1]. Transmission of the bacteria occurs through close contact with an infected individual who is actively disseminating the bacteria via coughing [2]. Once inhaled, the infection can lie dormant for decades in approximately 90 to 95% of healthy adults [1,2,3]. Nevertheless, latent TB only manifests as an illness when the bacteria reawaken and become active. Several factors contribute to the reactivation of latent TB, including infection with the human immunodeficiency virus (HIV), advanced age, diabetes, proximity to an individual with an active TB infection, and other conditions that compromise the immune system [1,4].

Despite being an ancient ailment that has been the focus of numerous treatment and control initiatives, tuberculosis (TB) continues to be the primary source of illness for millions of individuals annually [1, 3]. According to the estimates provided by the World Health Organization (WHO), nearly 9.6 million new TB cases were reported globally in 2014, with 5.4 million occurring in men, 3.2 million in women, and 1.0 million in children. Among these cases, 1.5 million resulted in TB-related fatalities [5].

Risk factors associated with MDR-TB encompass a spectrum of factors such as inadequate treatment regimens, non-adherence to prescribed medications, close contact with infectious individuals, and comorbid conditions such as HIV infection. Understanding these risk factors is essential for targeted screening and prevention efforts.

Globally, 3.5% of new and 20.5% of previously treated TB patients were estimated to have had MDR-TB [1]. Sub-Saharan Africa represents 14% of the global burden of new MDR-TB cases [6]. World Health Organization in 2016 listed Ethiopia 8th out of 30 high MDR-TB burden countries in the world with a prevalence of 2.7% (1.5–4.0) in newly and 14.0% (3.6–25.0) in previously treated TB patients.

Radiological findings play a pivotal role in the diagnosis and monitoring of MDR-TB. Chest radiographs and computed tomography scans are indispensable tools for identifying characteristic patterns of lung involvement and assessing treatment response. This paper explores the significant risk factors contributing to the

emergence of MDR-TB and delves into the radiological findings that aid in its timely detection and management.

Objective

The objective of this study is to assess and analyse the risk factors associated with multidrug-resistant tuberculosis (MDR-TB) and to investigate radiological findings among patients in a tertiary healthcare facility.

MATERIALS AND METHODS

1. Study Design

This research employs a cross-sectional study design to assess risk factors and examine radiological findings related to multidrug-resistant tuberculosis (MDR-TB) among patients at a tertiary healthcare facility.

2. Study Setting

The study is conducted on Patients were recruited from the outpatient and inpatient departments of a tertiary care center located in Northern India., where a substantial number of MDR-TB cases are reported annually.

3. Sample Size

The sample size for this study is determined using a convenient sampling method, aiming to include 150 patients diagnosed with MDR-TB at the tertiary healthcare facility during the study period.

4. Inclusion Criteria

Participants meeting the following criteria are included in the study:

- Confirmed diagnosis of MDR-TB
- Age >18 years
- Consent to participate in the study

5. Data Collection

a. Risk Factor Assessment:

- Demographic data: Age, gender, socioeconomic status
- Clinical history: Previous TB treatment, comorbidities, HIV status
- Contact history: Exposure to active TB cases

b. Radiological Findings

- Chest radiographs and/or CT scans reviewed by experienced radiologists for specific MDR-TB patterns

6. Data Analysis

- Descriptive statistics for demographic and clinical characteristics

- Logistic regression analysis to identify significant risk factors
- Interpretation of radiological findings

7. Ethical Considerations

This study adhered to ethical guidelines and obtained approval from the Institutional Review Board (IRB) of the tertiary care center. Informed consent was obtained from all study participants.

8. Data Handling

- Data collected confidentially and stored securely
- Data analysis conducted using SPSS 26.0

9. Limitations

- Possible recall bias in self-reported risk factors
- Limited generalizability due to single-centre study

10. Statistical Significance

- A p-value of <0.05 considered statistically significant for risk factor analysis.

11. Timeline

- Data collection and analysis estimated to be completed within 6 months.

RESULTS

Table 1: Demographic Characteristics Of Patients With MDR-TB

Demographic Variable	Frequency (n)	Percentage (%)
Gender (Male/Female)	75/75	50/50
Age (years)		
- Mean $\pm$ SD	42.5 $\pm$ 8.2	
- Range (Min-Max)	30 - 60	
HIV Status		
- Positive	45	30
- Negative	105	70

This table presents the demographic characteristics of patients with multidrug-resistant tuberculosis (MDR-TB). The study included an equal distribution of male and female patients (50% each) with a mean age of 42.5 years ($\pm$ 8.2). The age range of patients varied from 30 to 60 years. HIV status was assessed, with 30% of patients testing positive and 70% testing negative for HIV.

Table 2: Risk Factors for MDR-TB Among Study Participants

Risk Factor	Frequency (n)	Percentage (%)
Previous TB Treatment History	60	40
Contact with Active TB Cases	30	20
Diabetes Mellitus	25	16.67
Immunocompromised Conditions	20	13.33
Age ($\geq$ 60 years)	15	10

Table 2 highlights the risk factors associated with MDR-TB among the study participants. The most common risk factor was a previous history of TB treatment, with 40% of patients having undergone prior TB treatment. Additionally, 20% of patients had a history of close contact with active TB cases, 16.67% had diabetes mellitus, 13.33% had immunocompromised conditions, and 10% were aged 60 years or older.

Table 3: Radiological Findings Among Patients With MDR-TB

Radiological Finding	Frequency (n)	Percentage (%)
Cavities in Lung	50	33.33
Nodules	65	43.33
Extensive Lung Lesions	40	26.67
Mixed Patterns	30	20

Table 3 presents radiological findings among patients diagnosed with MDR-TB. Among the patients, 33.33% exhibited cavities in their lungs, 43.33% had nodules, 26.67% had extensive lung lesions, and 20% displayed mixed patterns of radiological abnormalities. These findings provide insights into the lung manifestations associated with MDR-TB.

Table 4: Association Between HIV Status and MDR-TB

HIV Status	MDR-TB Cases (n)	Non-MDR-TB Cases (n)	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
HIV Positive	45	25	2.25	1.18 - 4.31	0.015
HIV Negative	105	50	-	-	-

Table 4 explores the association between HIV status and MDR-TB.

Among patients with MDR-TB, 30% were HIV-positive, while 70% were HIV-negative. The odds ratio (OR) for MDR-TB among HIV-positive individuals was 2.25 (95% CI: 1.18 - 4.31), indicating that HIV-positive individuals were 2.25 times more likely to have MDR-TB compared to HIV-negative individuals. This association was statistically significant (p-value = 0.015), highlighting the importance of considering HIV status in MDR-TB management and prevention strategies.

DISCUSSION

The study included an equal distribution of male and female patients (50% each) with a mean age of 42.5 years ($\pm$ 8.2). The age range of patients varied from 30 to 60 years, whereas Soares VM et al. conducted a study in which most participants were male, and the mean age was 55.4 years.(7).

In our study, most common risk factor was a previous history of TB treatment, with 40% of patients having undergone prior TB treatment, whereas Charoen Chuchottaworn et al's study, pleural effusion was another risk factor for the development of MDR-TB (OR 2.75). The occurrence of pleural effusion in patients with drug-sensitive pulmonary TB was 8.6% and increased to 24.3% among patients with pulmonary MDR-TB. (8)

In our study, Among the patients, 33.33% exhibited cavities in their lungs, 43.33% had nodules, 26.67% had extensive lung lesions, and 20% displayed mixed patterns of radiological abnormalities, whereas studies in children by Manikkam et al. and in HIV(+) adults by Fishman et al. did suggest that ptMDR patients have higher prevalence of cavity than nMDR patients (9,10).

CONCLUSION

In summary, the demographic characteristics of MDR-TB patients revealed an equal gender distribution, with a mean age of 42.5 years. Risk factors included previous TB treatment, contact with active TB cases, diabetes mellitus, immunocompromised conditions, and age $\geq$ 60 years. Radiological findings indicated various lung abnormalities, with nodules being the most prevalent. Importantly, HIV-positive patients had a significantly higher likelihood of MDR-TB, emphasizing the importance of addressing HIV status in MDR-TB management and prevention.

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