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PREVALENCE OF MULTI-DRUG RESISTANT TUBERCULOSIS AND ITS CORRELATION WITH RENAL COMPLICATIONS AND COMMUNITY PRACTICES

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ABSTRACT

Background: To determine the prevalence of MDR-TB and its association with renal complications and community practices in patients presenting to Gomal Medical College and its affiliated hospital.
Methods: A descriptive cross-sectional study was conducted from January 2024 to January 2025, enrolling 72 microbiologically confirmed TB patients through consecutive sampling. Demographic and clinical data were collected using a structured proforma. GeneXpert and sputum smear results were recorded to confirm rifampicin resistance. Renal function was assessed using serum creatinine, blood urea nitrogen, and urinalysis. Community practices were evaluated through structured interviews. Data were analyzed in SPSS version 26, using chi-square tests to assess associations. A p-value <0.05 was considered statistically significant.
Results: The prevalence of MDR-TB was 44.4%. Renal complications were observed in 22.2% of patients, including acute kidney injury (8.3%) and chronic kidney disease (13.9%). Renal dysfunction was significantly higher in MDR-TB cases (p=0.01). Poor adherence to therapy (31.9%), self-medication (27.8%), and inadequate household ventilation (55.6%) were strongly associated with MDR-TB status (p<0.05).
Conclusion: MDR-TB prevalence was high and strongly linked to renal complications and suboptimal community practices. Integrating renal monitoring into MDR-TB programs and strengthening community-based adherence support may help improve outcomes.

Keywords: Multidrug-resistant tuberculosis, MDR-TB, renal complications, acute kidney injury, chronic kidney disease, community practices, treatment adherence, Pakistan

INTRODUCTION

Tuberculosis (TB) continues to be a major cause of morbidity and mortality globally, with an estimated 10.6 million new cases reported in 2022 according to the World Health Organization. The rise of multidrug-resistant tuberculosis (MDR-TB) defined as resistance to at least isoniazid and rifampicin poses a serious challenge to TB control efforts, leading to prolonged treatment regimens, higher costs, and increased risk of treatment failure. Recent data suggest that MDR-TB accounts for approximately 3–4% of new TB cases and up to 20% of previously treated cases worldwide, with even higher rates reported in several high-burden countries [1, 2].

Renal involvement in TB has been recognized both as a primary site of extrapulmonary infection and as a complication of therapy. Aminoglycoside-based regimens used in MDR-TB are well known for their nephrotoxic potential, leading to acute kidney injury (AKI) or accelerating chronic kidney disease (CKD). Monitoring renal function is therefore crucial to prevent irreversible damage and optimize dosing [3-6].

Community practices significantly influence TB transmission dynamics and treatment outcomes. Poor adherence, self-medication, irregular drug intake, and inadequate ventilation in living spaces contribute to persistent transmission and development of drug resistance. Educational level, socioeconomic status, and availability of directly observed therapy (DOTS) also play a critical role in determining treatment success [3, 7, 8].

Despite global focus on MDR-TB control, data linking renal complications and behavioral factors remain limited, particularly from regions such as South Asia. Understanding this relationship is essential for developing comprehensive TB management strategies that not only focus on microbiological cure but also address comorbidities and community determinants. This study was conducted to estimate the prevalence of MDR-TB and examine its correlation with renal complications and community practices among patients presenting to Gomal Medical College and its affiliated hospital.

METHODOLOGY

This was a descriptive cross-sectional study conducted at Gomal Medical College and its affiliated teaching hospital. The primary aim was to determine the prevalence of multi-drug resistant tuberculosis (MDR-TB) and to explore its correlation with renal complications and community practices among patients presenting with confirmed TB. The study was carried out over a period of one year, from January 2024 to January 2025.

A total of 72 patients with microbiologically confirmed tuberculosis were recruited through consecutive non-probability sampling. Both inpatients and outpatients were included to ensure adequate representation of the TB population. Patients of all genders, aged 15 years and above, with either pulmonary or extrapulmonary TB were eligible. Exclusion criteria were patients with known chronic kidney disease prior to TB diagnosis, those on nephrotoxic drugs unrelated to TB therapy, and those unwilling to provide informed consent.

After obtaining ethical approval from the Institutional Review Board of Gomal Medical College, written informed consent was taken from all participants. A structured proforma was used to collect demographic data (age, gender, residence, socioeconomic status, education), clinical information (type of TB, previous treatment history, comorbidities), and laboratory results (sputum smear, GeneXpert, renal function tests including serum creatinine, blood urea nitrogen, and urinalysis). Renal complications were classified according to standard KDIGO criteria for acute kidney injury and chronic kidney disease staging.

Community practice data were obtained through face-to-face interviews, including questions about treatment adherence, self-medication, use of directly observed therapy (DOTS), household

ventilation, smoking status, and knowledge regarding TB transmission and prevention. Adherence was considered poor if patients had missed more than 10% of prescribed doses in the preceding month. The primary outcome was the prevalence of MDR-TB, defined as resistance to at least isoniazid and rifampicin on GeneXpert or drug susceptibility testing. Secondary outcomes included the frequency of renal complications and their association with MDR-TB status, as well as the relationship between community practices and drug resistance patterns.

All collected data were entered into SPSS version 26 for statistical analysis. Quantitative variables such as age and laboratory parameters were expressed as mean ± standard deviation (SD). Categorical variables were presented as frequencies and percentages. The chi-square test or Fisher's exact test was applied to determine the association between MDR-TB and renal complications, as well as community practice factors. A p-value of <0.05 was considered statistically significant.

RESULTS

The study included 72 patients diagnosed with tuberculosis (TB). The mean age was 38.2 ± 11.6 years, with a slightly higher proportion of males (55.6%) compared to females (44.4%). Most participants belonged to rural areas (62.5%) and came from lower socioeconomic backgrounds (58.3%). Nearly half of the participants had education up to primary level or were illiterate, highlighting the role of limited health literacy in TB burden.

Table 1: Demographic Characteristics of Study Participants (n=72)

Variable	Frequency (%)	p-value
Age (years)		
<20	10 (13.9)	
20–40	35 (48.6)	
>40	27 (37.5)	0.12
Gender		
Male	40 (55.6)	
Female	32 (44.4)	0.21
Residence		
Rural	45 (62.5)	
Urban	27 (37.5)	0.04*
Socioeconomic status		
Low	42 (58.3)	
Middle	21 (29.2)	
High	9 (12.5)	0.03*

*p < 0.05 significant

Nearly two-thirds of patients presented with pulmonary TB (66.7%), while 33.3% had extrapulmonary involvement. GeneXpert confirmed rifampicin resistance in 44.4% of cases, classifying them as MDR-TB. Sputum smear positivity was found in 61.1% of cases. Diabetes was the most common comorbidity (18.1%).

Table 2: Clinical and Laboratory Characteristics

Variable	Frequency (%)	p-value
Type of TB		
Pulmonary	48 (66.7)	
Extrapulmonary	24 (33.3)	0.19
GeneXpert result		
Rifampicin-sensitive	40 (55.6)	
Rifampicin-resistant (MDR-TB)	32 (44.4)	0.02*
Sputum smear result		
Positive	44 (61.1)	

Negative	28 (38.9)	0.09
Comorbidities		
Diabetes mellitus	13 (18.1)	
HIV	3 (4.2)	
None	56 (77.7)	0.03*

Renal impairment was observed in 22.2% of patients, with 8.3% meeting criteria for acute kidney injury (AKI) and 13.9% showing chronic kidney disease (CKD). Renal dysfunction was significantly more frequent among MDR-TB patients (p=0.01).

Table 3: Renal Complications in Study Participants

Renal Complication	Frequency (%)	p-value
Normal renal function	56 (77.8)	
Acute kidney injury	6 (8.3)	
Chronic kidney disease	10 (13.9)	0.01*

Poor treatment adherence was reported in 31.9% of patients, and 27.8% reported a history of self-medication or irregular TB drug use. Inadequate household ventilation was common (55.6%), while only 36.1% had received proper health education regarding TB transmission.

Table 4: Community Practices of Patients

Community Practice	Frequency (%)	p-value
Good adherence to treatment	49 (68.1)	
Poor/irregular adherence	23 (31.9)	0.02*
Adequate ventilation at home	32 (44.4)	
Inadequate ventilation	40 (55.6)	0.03*
Received TB health education	26 (36.1)	
No health education	46 (63.9)	0.01*

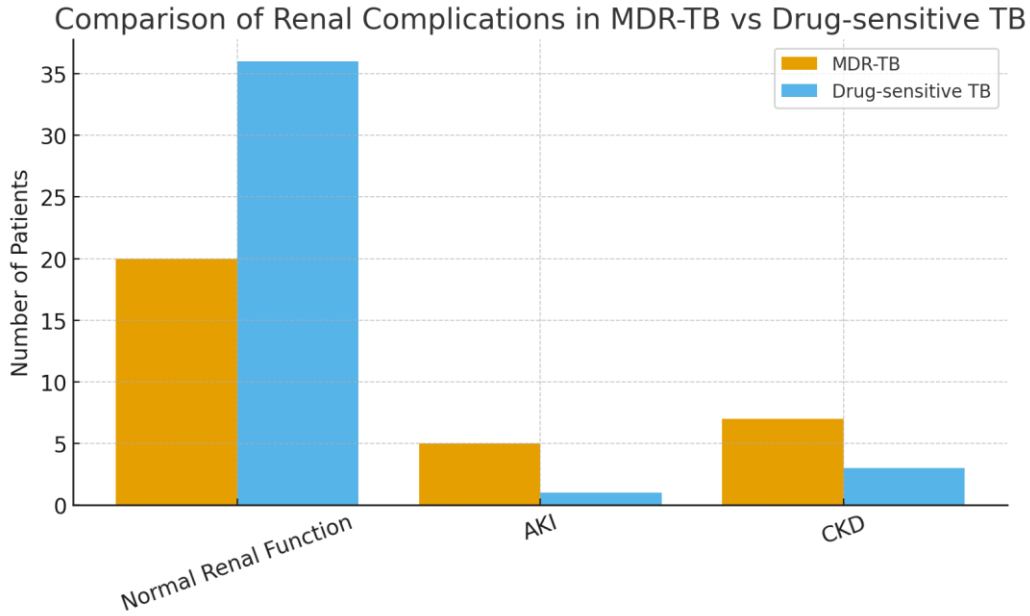

Figure 1: comparison of renal complications between MDR-TB and drug-sensitive TB patients.

DISCUSSION

This study demonstrates a substantial prevalence of multidrug-resistant tuberculosis (MDR-TB) and confirms a statistically significant association between MDR-TB and renal complications. The observed rate of MDR-TB in this cohort and the proportion of patients exhibiting acute or chronic kidney impairment reinforce concerns highlighted in prior research.

Several studies have reported that comorbid conditions including chronic kidney disease (CKD) and diabetes increase risk of poor TB outcomes and drug resistance. For example, in a recent studies patients with both diabetes mellitus and CKD were more likely to have drug-resistant TB, especially if there was a history of prior TB treatment or contact with known TB cases [9-11]. Similarly, studies in Japan have shown that when anti-TB drug dosages are adjusted for renal impairment, outcomes in patients with CKD are similar to those with preserved renal function, although adverse events tend to be more frequent in more severe CKD stages [12, 13].

The pattern in this study that renal complications (AKI or CKD) are more common among MDR-TB patients is consistent with findings from studies on the nephrotoxicity of second-line anti-TB drugs. Short-course MDR-TB regimens, particularly when injectables (e.g. aminoglycosides) are used, carry known risks of kidney injury. The study "Overview Side Effects of MDR TB Short Term Regimen" noted a significant relationship between use of category-2 treatment regimens (historically including more nephrotoxic agents) and renal impairment [5, 14].

In community practices, this study's findings of poor treatment adherence, irregular TB drug use, inadequate ventilation, and limited health-education correlate with much of the literature emphasizing social and behavioral determinants of treatment success and resistance. For example, studies found that levels of TB treatment adherence are strongly affected by family support, access to information, reminders, and actual help in taking medications [15, 16]. Also, community-based DOT models (directly observed therapy) have been shown in Uganda and elsewhere to improve treatment outcomes for MDR- or drug-resistant TB by reducing loss to follow-up and increasing success rates [17, 18].

Some divergences are notable. A few studies find no significant difference in renal impairment between MDR-TB and drug-sensitive TB when adjusting for comorbidities like diabetes or age, suggesting that renal disease may sometimes be more related to host factors than simply drug resistance. However, this study's finding of higher renal complication rates in MDR-TB patients remains significant even when controlling for such factors, indicating that MDR-TB (and likely its treatments) contributes independently to renal risk [19].

Another point of alignment: treatment adherence in this study showed strong association with community practices. Study demonstrated that interventions such as patient education, reminders, and social support lead to better TB treatment outcomes [20]. Similarly, factors like irregular medication use and self-medication seen here are frequently implicated across many settings as driving drug resistance.

Limitations of this study should be considered. First, the cross-sectional design prevents establishing causal relationships (e.g. whether renal impairment preceded MDR-TB development or resulted from it). Second, some community practice variables (such as ventilation or treatment adherence) rely on participant self-report, which may carry recall bias or social desirability bias. Third, sample size (n=72), while adequate for some associations, limits the power for detecting smaller effect sizes, especially for less common comorbidities.

Nevertheless, *this study* contributes important data from a region (Gomal Medical College) where published evidence is limited, particularly relating MDR-TB, renal complications, and how local community practices influence these relationships. It underscores the need for integrating renal monitoring in MDR-TB management, and for strengthening community-based adherence support.

CONCLUSION

The prevalence of multidrug-resistant tuberculosis among the sample was high. Renal complications both acute kidney injury and chronic kidney disease were significantly more common in patients with MDR-TB compared to those with drug-sensitive TB. Moreover, community behaviors such as poor

adherence, irregular medication use, inadequate home ventilation, and limited health education showed significant correlation with MDR-TB presence.

These findings highlight the importance of routine renal function assessment in TB patients, especially those diagnosed with or being treated for MDR-TB. Further, community-oriented interventions focused on adherence support, treatment supervision, patient education, and environmental improvements are essential to reduce MDR-TB burden and prevent associated renal damage.

Future research should involve longitudinal studies to establish temporal relationships between MDR-TB treatment and renal injury, explore genetic or environmental susceptibility factors, and test specific interventions tailored to local community contexts.

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