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Research Article

THE LIVER FUNCTION TEST (TRANSAMINASE ENZYMES AND BILIRUBIN) AND THE KIDNEY FUNCTION TESTS (UREA, CREATININE) ANALYSIS IN MDR-TB DURING TREATMENT

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ABSTRACT

Background:
Multi Drug Resistance Tuberculosis (MDR-TB) treatment caused side effects such as hepatotoxicity and acute kidney injury (AKI). Monitoring liver and kidney function in patients during treatment is crucial to prevent complication.
Methods: A retrospective study of 19 patients confirmed MDR-TB in the period 2022-2025. Liver function test (transaminase enzymes and bilirubin) and kidney function test (urea and creatinine) during the first three month of treatment were analyzed.
Results: Statistically, there was no difference in all parameters ($p>0.05$). Increases in total bilirubin, SGOT, SGPT levels occurred in the third month of TB treatment. While urea and creatinine levels increased in the second and third months.
Conclusion: Monitoring of liver and kidney function during MDR-TB treatment is necessary to monitor patient condition.

Keywords: *Multi-drug Resistance, Tuberculosis, Liver Function, Kidney Function*

INTRODUCTION

Tuberculosis remains global health threat in infectious disease. More than 10 million people infected yearly and this number is increasing every year (1). MDR-TB (Multi-drug resistance Tuberculosis) is a variant which resistant to the two main TB drugs (rifampicin and isoniazid) (2). MDR-TB presents new obstacles and challenges in TB control programs. The incidence of MDR-TB increases by more than 20% annually (3). Poor treatment progress, high mortality rates, longer treatment duration (up to 2 years), high costs and various complications make MDR-TB treatment more complicated than drug-sensitive TB (SO-TB) (4).

MDR-TB mostly occurs with patient non-compliance with standard TB treatment (5). Another risk factors include discontinuing treatment or misstreatment in drugs admission (6). A history of contact with an MDR-TB patient also increases the risk of infection with drug-resistant strains. Research shows that more than 50% of new MDR-TB cases are caused by direct transmission (2).

TB treatment causes various adverse side effects. Gastrointestinal disease such as nausea and vomiting are common mild side effects. Other side effects that can occur include gastrointestinal dysfunction, hepatotoxicity, and in some cases, acute kidney injury (AKI). Hepatotoxicity is one of the most common side effects in patients undergoing TB treatment. An early marker of hepatotoxicity is an increase in serum transaminase enzymes, including glutamate oxaloacetate transaminase/aspartate aminotransferase (GOT/AST), which are released simultaneously with glutamate pyruvate transaminase/alanine aminotransferase (GPT/ALT), which are specific markers for detecting liver damage (7).

In some TB patients, particularly MDR-TB patients, OAT can cause kidney dysfunction. In severe cases, it can even result in dialysis. Kidney function can be monitored by checking creatinine and urea levels (8). Monitoring and evaluating liver and kidney function by laboratory assays in MDR-TB patients is necessary to prevent complications from MDR-TB treatment.

MATERIAL AND METHODS

Restrospective study by analyzing the results of total bilirubin, SGOT, SGPT, urea, and creatinine levels in patients diagnosed with MDR-TB at PKU Muhammadiyah Gamping General Hospital during year 2022-2025. This study was approved by the KEPK of Aisyiyah University of Yogyakarta with No. 5075/KEP-UNISA/I/2026 dated January 6, 2026. Informed consent was waived because this study was retrospective and there was no interaction with patients.

A total of 33 MDR-TB patients were selected according to the inclusion criteria including: confirmed MDR-TB by molecular methods (Gen Xpert), all ages and genders, and underwent liver and kidney function tests in the first, second, and third months of treatment. Patients who discontinued treatment for various reasons (drug withdrawal, death), as well as patients with HIV positive status and extrapulmonary TB were excluded from this study. A total of 19 patients with examination data were then analyzed.

Descriptive and statistical analysis using One Way Anova and Kruskal Wallis statistical tests were carried out on total bilirubin, SGOT, SGPT, urea and creatinine levels when patients received Anti-Tuberculosis Drug (OAT) therapy during the first three months of treatment.

RESULTS

The mean age of MDR-TB patients was 43 years. This is accordance with several studies showing that the highest incidence of TB occurs in productive age groups (15-49 years) (9). The number of male respondents n=10 (53%) in this study was greater than the number of female respondents n=9 (47%).

Tabel 1. Laboratory Examination Results

Parameter	Mean±SD			Sig
	1st Month	2nd Month	3rd month	(p<0.05)
Total Bilirubin (mg/dL)	0,49±0,25	0,40±0,14	0,47±0,25	0.611
SGOT (U/L)	31,4±35,9	30±17.,2	36,3±46,1	0.757
SGPT (U/L)	31,1±60,3	19,2±16,2	22,7±20,8	0.862
Ureum (mg/dL)	24,1±6,88	24,9±10,69	26,0±11,0	0.833
Creatinine (mg/dL)	0,86±0,26	0,89±0,31	0,97±0,37	0.546
Sample (n)	19	19	19	

Based on Table 1, there were no statistically significant differences in the five parameters examined in the first three months of treatment (p value > 0.05). However, the mean levels of total bilirubin, SGOT, and SGPT in MDR-TB patients decreased in the second month and then increased in the third month. Different results were found for urea and creatinine levels, which increased monthly until third month of treatment.

DISCUSSION

This study provides an analytical overview of liver and renal function test in patients undergoing treatment for Multi drug resistant Tuberculosis (MDR-TB). MDR-TB is characterized by resistance to first-line antituberculosis drugs. The risk of contracting MDR-TB increases significantly upon exposure to individuals with the same condition. The therapeutic regimen for MDR-TB is prolonged, typically spanning 18 to 24 months depending on the patient's clinical status. Furthermore, this treatment is more complex, costly, and associated with higher toxicity, frequently causing various clinical complications (2).

The three liver function parameters (total bilirubin, SGOT, and SGPT) exhibited a consistent pattern, characterized by a decrease in mean levels during the second month of treatment followed by an elevation in the third month. These findings are in line with previous research indicating that the incidence of hepatotoxicity typically occurs during the third month of Isoniazid (INH) administration (9). Hepatotoxicity during tuberculosis therapy occurs in approximately 2% to 8% of patients receiving antituberculosis drugs. Several risk factors contribute to this condition, including age, malnutrition, co-infections, and comorbid diseases (10).

Elevations in SGOT and SGPT levels provide clinical indicators of drug-induced liver injury (DILI). Although the levels of SGOT, SGPT, and total bilirubin in this study remained within normal ranges, research indicates that MDR-TB patients possess a higher susceptibility to hepatotoxicity after six months of therapy. This is attributed to the fact that second-line regimens exhibit greater toxicity compared to first-line drugs; consequently, liver

function assessments should be conducted periodically until the completion of treatment. The American Thoracic Society recommends performing baseline liver function tests at the onset of TB therapy, followed by continuous monitoring, particularly in patients with pre-existing liver disease, a history of alcohol consumption, HIV or hepatitis co-infections, and the concurrent use of other hepatotoxic medications (11). In contrast, in Indonesia, routine liver function monitoring for MDR-TB patients frequently does not extend through the sixth month of treatment. Certain MDR-TB therapeutic regimens have been associated with the development of hepatotoxicity in approximately 28% of patients. Isoniazid, the most widely utilized agent, can induce peripheral neuropathy and drug-induced liver injury (DILI); furthermore, it may generate reactive metabolites that trigger immune-mediated hepatic injury (9).

To assess the impact of MDR-TB regimens on renal health, serum urea and creatinine levels are utilized as primary biomarkers for nephron integrity. Drugs such as pyrazinamide, rifampicin, and streptomycin are known to compromise the renal tubules, potentially leading to functional decline. In this context, any deviation from the normal reference ranges—0.6–1.3 mg/dL for creatinine and 8–23 mg/dL for urea—serves as a critical indicator of drug-induced renal injury.

In the present study, the mean levels of urea and creatinine among MDR-TB patients remained within normal physiological limits. These findings are consistent with a study conducted at Abdul Wahab Regional Hospital involving 24 MDR-TB patients (8). Statistical analysis revealed no significant differences in urea and creatinine concentrations during the first three months of treatment ($p > 0.05$). This is congruent with previous research indicating that there is no significant variation between baseline levels and those recorded at the six-month treatment (12). Nevertheless, this study observed a progressive increase in urea and creatinine levels over two consecutive months. Such a trend may indicate a decline in renal function, necessitating clinical vigilance.

Evidence suggests that nephrotoxicity frequently manifests in MDR-TB patients following the second month of the intensive treatment phase. Although these antituberculosis agents are toxic, the resulting renal damage is categorized as reversible, with physiological function typically normalizing within three to four months post-treatment. Nevertheless, for high-risk cohorts such as those with Chronic Kidney Disease (CKD), it is imperative for practitioners to provide intensive monitoring and calibrate dosages strictly according to clinical protocols to avoid further renal deterioration (13). Increased attention must be directed toward the expanding cohort of CKD patients infected with TB. The correlation between impaired renal function and adverse tuberculosis treatment outcomes is well-documented, with such individuals facing an escalated risk of fatality during the TB therapy (14).

Routine monitoring of hepatic and renal functions throughout the duration of MDR-TB therapy is highly recommended. Patients with MDR-TB exhibit a significantly higher risk of developing various complications compared to those with drug-susceptible tuberculosis (DS-TB). Implementing periodic assessments from the onset to the completion of treatment is

essential to mitigate complications that could potentially worsen the patient's prognosis.

CONCLUSION

Hepatic and renal functions test remained stable during the first three months of MDR-TB treatment in this study. The limited scope and sample size represent significant constraints. Future investigations are warranted to track these physiological parameters until the conclusion of the therapeutic regimen. Expanding the study population and extending the follow-up period in a cohort-based framework will be essential to validate these preliminary findings and assess long-term treatment effects.

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