Journal of Innovative and Creativity
Journal Homepage: https://joecy.org/index.php/joecy
e-mail: journaljoecy@gmail.com

Faculty of Education
University of Pahlawan Tuanku Tambusai
ISSN 2775-771X (Online)
ISSN 2962-570X **(Printed)**
5 (2) 2025, Page: 3047-3051

Evaluation of Hematological and Biochemical Parameter Changes in MDR-TB Patients Undergoing OAT Treatment at RSUD Anutapura Palu in 2022-2025

Indriani[1], Andi Meutiah Ilhamjaya[1], Andrini Suryana Mangopa[1], Tri Fadila Maharani[1]
[1]Faculty of Medicine, University of Alkhairaat, Indonesia
Corresponding Author: Indriani, e-mail: indriani.fk.unisa@gmail.com

Published: May , 2025

ABSTRACT

Multidrug-resistant tuberculosis (MDR-TB) is a major challenge in the control of tuberculosis in Indonesia. Long-term treatment with anti-tuberculosis drugs (OAT) is known to cause significant side effects on hematological and biochemical functions. This study aims to evaluate changes in leukocyte count, neutrophil-lymphocyte ratio (NLR), hematocrit, platelet count, hemoglobin, SGOT, SGPT, urea, and creatinine levels in MDR-TB patients undergoing OAT treatment at RSUD Anutapura Palu during the period of 2022-2024. The research employed a retrospective cohort design using secondary data from patient medical records. The results showed a decrease in leukocytes, NLR, platelets, and hemoglobin, as well as an increase in SGOT, SGPT, urea, creatinine and hematocrit after treatment. This study emphasizes the importance of regular monitoring for OAT side effects to improve treatment effectiveness and patient safety.

Keywords: MDR-TB, OAT, leukocytes, hemoglobin, NLR, hematocrit, platelets, SGOT, SGPT, urea, creatinine

© The Author(s). 2021 Open Access This article is licensed under a Creative Commons Atibution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. To view a copy of this licence, visit http://creativecommons.org/licenses/by/4.0

INTRODUCTION

Multidrug-resistant tuberculosis (MDR-TB) is an infection caused by Mycobacterium tuberculosis that is resistant to two first-line drugs, isoniazid and rifampicin (WHO, 2020). Indonesia ranks high in MDR-TB cases, with an estimated 24.000 cases nationwide (Ministry of Health RI, 2023).

In Central Sulawesi, 240 cases were recorded in 2023, including 77 cases in Palu City. Long-term OAT use poses risk of side effects affecting the hematopoietic system and liver-kidney function (Fauziah et al., 2015; Oehadian, 2019).

This Study was conducted because RSUD Anutapura has a dedicated MDR-TB clinic and a high number of patient visits. MDR-TB is classified as a form of tuberculosis that does not respond to isoniazid and rifampicin, the two most potent first-line anti-TB drugs. This resistance complicates treatment and prolongs the duration of therapy, often requiring the use of second-line drugs that are more toxic and less effective (WHO, 2020). Globally, drug-resistant TB remains a serious threat to public health and a major obstacle to TB control efforts. According to the WHO, in 2020 there were an estimated 500.000 new cases of rifampicin-resistant TB, 78% of which had MDR-TB.

Factors Contributing to the development of MDR-TB include inappropriate or incorrect use of anti-TB drugs, inadequate or incomplete treatment regimens, and poor patient adherence (Fregona et al., 2017). The emergence of MDR-TB is also influenced by social determinants such as poverty, overcrowding, and limited access to healthcare services, which hinder early diagnosis and treatment (Aristiana & Wartono, 2019).

In response to this crisis, the WHO has recommended the implementation of standardized shorter regimens and improved diagnostic tolls such as GeneXpret for faster detection of drug resistance (WHO, 2019).

METHOD

Study participants

This study included all MDR-TB patients who were treated with OAT at RSUD Anutapura Palu between January 2022 and December 2024. Patients were selected using a total sampling method, where all patients who met the inclusion criteria having a confirmed MDR-TB diagnosis and complete laboratory data were included. Patients who had incomplete data or comorbidities that could affect the studied parameters were excluded.

Study organization

This retrospective cohort study, used secondary data obtained from the hospital's laboratory and medical records. Baseline and post-treatment values of hematological and biochemical parameters were collected. the study focused on key laboratory values, including leukocytes, NLR, hematocrit, platelets, hemoglobin, SGOT, SGPT, urea, and creatinine.

Statistical analysis

Descriptive statistics were used to summarize the demographic and clinical characteristics of participants. Paired t-test were used to compare the means of each laboratory parameter before and after treatment with OAT. A p-value of less than 0.05 was considered statistically significant. All statistical analyses were performed using SPSS version 25.

Results

Most patients were in the 41-50 age group and predominantly male.

Parameter	Before OAT	After OAT	Change
Leukocyte (x10³/μL)	9.46	8.31	-1.15
NLR	3.9	2.29	-1.61
Hematocrit (%)	39.14	39.2	0.06
Platelets (x10³/μL)	364.74	273.3	-91.44

Parameter	Before OAT	After OAT	Change
Hemoglobin (g/dL)	14.15	13.45	-0.7
SGOT (IU/L)	24.19	35.19	11.0
SGPT (IU/L)	21.28	26.52	5.24
Urea (mg/dL)	15.05	21.8	6.75
Creatinine (mg/dL)	0.72	0.79	0.07

In addition to these averages, 65 % of patients experienced leukopenia and 20% had persistently elevated NLR after over six months of treatment. Significant thrombocytopenia (>30% reduction) occured in 40% of patients, raising bleeding risk. Hemoglobin fell below 12 g/dL in 35% of cases, indicating mild to moderate anemia. Elevated SGOT and SGPT were found in over 50% of patients, suggesting hepatotoxicity. Urea and creatinine increased in 28% of patients who previously had normal renal function.

Gender	Frequency	Percentage
Male	22	52.4%
Female	20	47.6%

The gender distribution showed a slight male predominance (52.4%), which aligns with epidemiological patterns indicating higher TB incidence among males. Most patients were between 41 – 50 years old (34.8%), indicating that MDR-TB affects individual in their productive age range. Regarding occupational background, a largre proportion of the sample were housewives (38.1%), followed by laborers and private-sector employees.

Laboratory results also revealed that over 50% of patients experienced decreased leukocyte and hemoglobin levels post-treatment, with 35% developing mild to moderate anemia as defined by WHO standartds. The drop in platelet thrombocytopenia-related complications such as prolonged bleeding time.

Liver function test showed that more than half of the patients had SGOT and SGPT values above the normal range after treatment, with values increasing by an average. of 11.000 IU/L for SGOT and 5.24 IU/L for SGPT. These findings suggest hepatocellular damage potentially induced by hepatotoxic effects of secon-line OAT.

Renal function monitoring showed that 28% of patients experienced elevated urea and creatinine levels potentially indicating early nephrotoxicity. Although the average increase in creatinine (0.07 mg/DL) remained within the upper limit of normal, the trend highlights the importance of continued renal surveillance during therapy.

The observed male predominance in MDR-TB patients supports previous findings that men are at higher risk due to greater exposure, smoking habits, and lower health-seeking behaviors. The high prevalence in the productive age group highlights the significant socioeconomic impact of MDR-TB, as individuals in this age range often represent the primary earners in a household.

The Hematological abnormalities such as decreased hemoglobin and leukocyte counts suggest bone marrow suppression or chronic inflammation caused by TB infection and intensified by the prolonged use of second-line anti-TB drugs. Anemia, found in 35% of patients, may also result from nutritional deficiencies and chronic disease anemia.

Thrombocytopenia observed in 40% of the cases might be linked to drug-induced toxocity or immune-mediated platelet destruction. These findings indicate the need for regular blood count monitoring during therapy.

The significant increase in liver enzymes (SGOT and SGPT) in over half of the patients ilinical, indicates hepatocellular stress or damage, possibly due to drug-induced hepatoxicity. This highlights the necessity for liver function monitoring especially when second-line drugs known to be hepatotoxic are administered.

Renal function changes were evident in 28% of patients. showing increased levels of urea and creatinine post-treatment. While the average increase remained within normal limits, this trend underscores the potential nephrotoxic effect of agents such as aminoglocosides or rifampicin, and calls for routine renal screening especially in patients with preexisting conditions.

Collectively, these results clarify the dual challenge of managing drug resistance and minimizing adverse drug reactions in MDR-TB patients, thus emphasizing the importance of integrated clinical, laboratory, and pharmacovigilance approaches in MDR-TB treatment programs.

These findings align with Kassa et al. (2016), who reported a significant reduction in platelet and hematocrit levels after two months of MDT-TB treatment. The decline in leukocyte and platelet counts may results from the immunosuppresive effects of isoniazid on heatopoietic cell lines. Anemia could be exacerbated by chronic infection, nutritional deficiencies, and drug-induce absorption issues. Elevated liver enzymes likely result from hepatocellular damage due to OAT metabolism in the liver. OAT-associated nephrotoxicity, particularly from rifampicin and streptomycin, was evident in patients with increased urea and creatinine levels. Therefore, individualized dosing strategies and routine monitoring of organ function are crucial to prevent complications and ensure treatment success.

CONCLUSION

There were significant changes in both hematological and biochemical parameters among MDR-TB patients following OAT therapy. These findings underline the importance of routine laboratory monitoring to detect early side effects and maintain the effectiveness and safety of the treatment regimen.

ACKNOWLEDGEMENT

The authors would like to express sincere gratitude to the staff and management of RSUD Anutapura Palu for providing access to patient data. We also thank the Faculty of Medicine at University Alkhairaat for guidance and support throughout the research process. Special appreciation goes to our academic advisors and colleagues who contributed their insights during the preparation of this research.

REFERENCES

Aristiana, Y., & Wartono, D. (2019). Risk factors for MDR-TB in pulmonary TB patients at Malang City General Hospital. Indonesian Journal of Epidemiology, 3(1), 20–28.

Fauziah, N., et al. (2015). The Effect of Isoniazid on Hematopoiesis and Sideroblastic Anemia. Indonesian Biomedical Journal.

Fregona, G., et al. (2017). Risk factors associated with multidrug-resistant tuberculosis in Espírito Santo, Brazil. Revista de Saúde Pública, 51, 41. https://doi.org/10.1590/S1518-8787.2017051006688

Kassa, D., Habte, A., & Tsegaye, A. (2016). Hematological and immunological profiles of multidrug-resistant tuberculosis patients before and after intensive phase treatment. Journal of Clinical Tuberculosis and Other Mycobacterial Diseases, 5, 18–24. https://doi.org/10.1016/j.jctube.2016.01.003

Ministry of Health of the Republic of Indonesia. (2023). Indonesia Health Profile 2023. Jakarta: Ministry of Health.

World Health Organization. (2019). WHO Consolidated Guidelines on Drug-Resistant Tuberculosis Treatment. Geneva: WHO.

World Health Organization. (2020). Global Tuberculosis Report 2020. Geneva: WHO.