International Journal of Advances in Medicine
Riadi PRY et al. Int J Adv Med. 2025 Mar;12(2):166-169
http://www.ijmedicine.com
pISSN 2349-3925 | eISSN 2349-3933
DOI: https://dx.doi.org/10.18203/2349-3933.ijam20250001

Original Research Article

Monocyte/lymphocyte ratio and neutrophil/lymphocyte ratio in HIV/AIDS patients with pulmonary opportunistic infections in Wangaya general hospital: a descriptive study

Putu Risma Y. Riadi[1]*, Ketut Suryana[2]

[1]Wangaya Regional Hospital, Denpasar, Bali, Indonesia
[2]Department of Internal Medicine, Wangaya Regional Hospital, Denpasar, Bali, Indonesia

Received: 13 December 2024
Revised: 21 December 2024
Accepted: 24 December 2024

***Correspondence:**
Dr. Putu Risma Y. Riadi,
E-mail: rismayuvriadi@gmail.com

ABSTRACT

Background: Pulmonary tuberculosis and Pneumocytis carinii pneumonia (PCP) are the most common pulmonary opportunistic infection in Human Immunodeficiency Virus/Aquired Immunodeficiency Syndrome (HIV/AIDS) patient. MLR and NLR in the context of pulmonary opportunistic infections has shown its potential in predicting risk and determining better prevention and therapy strategies. The aim of this study is to know the overview of MLR and NLR in HIV/AIDS patients with pulmonary opportunistic infections.
Methods: This is a descriptive hospital-based study conducted at Wangaya Regional General Hospital. Details including age, gender, pulmonary opportunistic infection (divided to TB, PCP, and mixed cases), monocytes count (%), neutrophils count (%), lymphocytes count (%), MLR and NLR as the variables in this study. Samples collected in this study were 103 patients.
Results: Opportunistic pulmonary infections are more common in male than female and most in the 31-40year old category. Cases of pulmonary TB are most common pulmonary opportunistic infections. MLR and NLR were calculated according to pulmonary OIs. The highest MLR value was found in mixed pulmonary opportunistic infection cases while the highest NLR value was found in mixed OIs cases.
Conclusions: Overall, MLR and NLR also shown higher value than the normal limit. Early overview of MLR and NLR in patients with pulmonary opportunistic infection can help better comprehensive treatment.

Keywords: Pulmonary opportunistic infection, MLR, NLR

INTRODUCTION

The incidence of opportunistic infections (OIs) in HIV/AIDS patients has decreased significantly in many countries. However, OIs remain a serious health problem in resource-limited countries, where access to antiretroviral (ARVs) therapy is remain limited. Globally, tuberculosis (TB) is the most common OI in HIV/AIDS patients, with approximately 1.5 million cases of HIV-associated TB each year, particularly in Sub-Saharan Africa and Southeast Asia including Indonesia. In addition to tuberculosis, *Pneumocytis carinii* pneumonia (PCP) is also the most common pulmonary OI, with a high prevalence in areas with limited access to healthcare.[1,2]

Pulmonary TB is caused by Mycobacterium tuberculosis. These bacteria specifically attack the alveoli and will be phagocytosed by macrophages. *M tuberculosis* will replicate inside the macrophages and prevent the fusion of lysosomes and phagosomes. Monocytes and neutrophils have significant role in this process so that it will increase and make their ratio higher than lymphocytes. This also occurs in PCP infection.[3,4] In immunocompromised patients, such as HIV/AIDS, various immune cell ratios,

such as monocyte/lymphocyte ratio (MLR) and neutrophil/lymphocyte ratio (NLR), are used as clinical parameters to predict the risk of opportunistic infections, especially pulmonary infections.[5,6] For the last 10 years, the development of simple hematological parameters such as MLR and NLR in the context of pulmonary opportunistic infections has shown its potential in predicting risk and determining better prevention and therapy strategies.[7,8] The aim of this study is to know the overview of MLR and NLR in HIV/AIDS patients with pulmonary opportunistic infections.

METHODS

Study type

This is a descriptive hospital-based study.

The study was conducted at Wangaya Regional General Hospital. Our study involved the record review related to all HIV/AIDS with pulmonary opportunistic infection cases during the period from January 2023 to October 2024. All data were collected from the Wangaya Hospital health information system. This study used total sampling for the required sample size.

Inclusion criteria

Samples were included according to specified inclusion criteria, medical records of patients diagnosed with HIV/AIDS with pulmonary opportunistic infections at Wangaya Regional General Hospital which have complete blood count data.

Excluded criteria

Non-completed medical records were excluded. Details including age, gender, pulmonary opportunistic infection (divided to TB and PCP), monocytes count (%), neutrophils count (%), lymphocytes count (%), MLR and NLR as the variables in this study.

Statistical analysis

The data collected using Microsoft Excel 2021, will be analyzed using IBM SPSS Statistics 27 software. The descriptive measurements will be presented in the form of a distribution table based on age, gender, diagnosis of pulmonary IOs, monocyte/lymphocyte ratio, and neutrophil/lymphocyte ratio.

This study was approved by the Research Ethics Committee of the Wangaya Regional General Hospital.

RESULTS

Samples collected in this study were 103 patients. Sample characteristics based on age, gender and type of pulmonary opportunistic infection. Based on the characteristics of the sample, opportunistic pulmonary infections are more common in male (68.9%) than female (31.1%) and most in the 31–40-year-old category (33%). Cases of pulmonary TB (65%) are more common than PCP (29%) as opportunistic infections. Mixed cases of both were also found at around 8.7%. Detailed descriptives are shown in Table 1.

Table 1: Characteristics of sample.

S. no.	Characteristics of sample	Frequency	%
1.	**Age (in years)**		
	<20	1	1
	20-30	22	21.4
	31-40	34	33.0
	41-50	19	18.4
	51-60	23	22.3
	>60	4	3.9
2.	**Gender**		
	Male	71	68.9
	Female	32	31.1
3.	**Pulmonary OIs**		
	Pulmonary TB	65	63.1
	PCP	29	28.2
	Mixed cases	9	8.7

Table 2. monocyte count (%), neutrophil count (%) and lymphocyte count (%) according to pulmonary OIs.

Pulmonary OIs	Monocyte (%)	Neutrophil (%)	Lymphocyte (%)
Pulmonary TB	7.30 (1.4-22.3)	75.75 (43.8-93.8)	12.85 (2.12-48.3)
PCP	6.37 (2.0-16.4)	80.18 (49.6-93.3)	9.24 (2.4-29.7)
Mixed case	8.77 (1.3-17.6)	76.94 (38.1-96.5)	7.71 (1.5-31.3)

Table 3. MLR and NLR according to pulmonary OIs.

Pulmonary opportunistic infection	MLR	NLR
Pulmonary TB	0.84 (0.12-4.48)	10.22 (0.92-37.45)
PCP	0.86 (0.16-4.88)	12.15 (1.67-28.64)
Mixed cases	1.72 (0.41-5.03)	20.84 (1.21-66.10)

The amount of monocyte count (%), neutrophil count (%) and lymphocyte count (%) described according to pulmonary opportunistic infection. The highest number of monocytes was found in mixed infection (patient who have both TB and PCP) (8.77) and the lowest number in PCP cases (6.37), the highest number of neutrophils was found in PCP cases (80.18) and the lowest in pulmonary TB cases (75.75), the highest number of lymphocytes was found in pulmonary TB cases (12.85) and the lowest in mixed cases (7.71). Detailed descriptives are shown in Table 2.

Monocyte/lymphocyte ratio (MLR) and neutrophil/ lymphocyte ratio (NLR) were calculated according to pulmonary OIs. The highest MLR value was found in mixed pulmonary opportunistic infection cases (1.72) and the lowest in pulmonary TB cases (0.84), while the highest NLR value was found in mixed OIs cases (20.84) and the lowest in pulmonary TB cases (10.22). In other words, mixed pulmonary OI has the highest MLR and NLR values among other pulmonary OIs. Detailed descriptives are shown in Table 3.

DISCUSSION

In general, the number of monocytes and neutrophils in patients with bacterial infections will be higher than normal values, including in pulmonary opportunistic infections. The number of monocytes can be normal or lower.[9] This is because based on the pathophysiology of pulmonary infectious diseases, monocytes and neutrophils play a role in this process so that their number will increase and make the ratio higher than lymphocytes.[10,11] In this study, the mean number of monocytes and neutrophils in opportunistic pulmonary infections (pulmonary TB, PCP, or mixed) showed a higher value than the normal value, while the mean number lymphocyte showed a tendency to be lower to normal value.

In this study, MLR results were obtained higher than normal values. This occurs generally in both pulmonary TB, PCP and mixed cases, and the highest mean MLR value was obtained in PCP cases. In patients with HIV infection, there is an impairment in monocyte activity. Compared to healthy individuals, patients with HIV infection reported increased levels of both the overall monocyte count and the inflammatory monocyte subset.[12] HIV viral replication, microbial translocation, and coinfection with an infectious pathogen can all activate monocytes during HIV infection. A combination of pulmonary opportunistic infection led to higher result of MLR value.[13]

In this study, the NLR were higher than normal values. This generally occurs in both pulmonary TB, PCP and mixed cases, and the highest mean MLR value was found in mixed cases. Increased neutrophil or decreased lymphocyte numbers can result in elevated NLR in HIV infection. The rise in neutrophils is caused by basal hyperactivation of polymorphonuclear cells, which is driven by increased proinflammatory cytokine production during chronic inflammation, such as TGF-B, IL-8, IL-18 and IL-22.[6,14] The same result proven with a cross-sectional study by Miyahara et al, which shown high NLR as a risk factor in pulmonary tuberculosis on HIV-infected patient.[15,16]

Increased neutrophils and/or reduced lymphocytes are indicated by a high NLR. The predominant of infected white blood cells in the early stages of *M. tuberculosis* and *P. jirovecii* infection are neutrophils, which can cause granuloma formation or lung damage.[6] High mortality sputum *M. tuberculosis* positive is associated with high neutrophil levels. Moreover, T-lymphocyte subsets in particular are crucial immune cells that protect against tuberculosis infections. In particular, there is a negative correlation between the severity of TB and lymphocyte levels.[15,17]

MLR and NLR are hematological parameters that are starting to be widely studied as modalities in assessing risk or prognosis in patients with infections especially in HIV with pulmonary opportunistic infection. This descriptive retrospective study has important role to provide basic data for this research centre. The result of this study can be used for further research and publication.

CONCLUSION

Monocytes and neutrophils in pulmonary opportunistic infections (pulmonary TB, PCP, or mixed) showed a higher value than normal, while lymphocyte showed a tendency to be lower to normal value. MLR and NLR also shown higher value than the normal limit. This is caused by an increase in the number of neutrophils and monocytes or a decrease in lymphocytes as a result of the opportunistic infection process. Early overview of MLR and NLR in patients with pulmonary opportunistic infection can help better comprehensive treatment.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Franquet T, Domingo P. Pulmonary Infections in People Living with HIV. Radiol Clin North Am. 2022;60(3):507–20.
2. Dockrell DH, Breen R, Collini P, Lipman MCI, Miller RF. British HIV Association guidelines on the management of opportunistic infection in people living with HIV: The clinical management of pulmonary opportunistic infections 2024. HIV Med. 2024;25(2):3–37.
3. José RJ, Brown JS. Opportunistic bacterial, viral and fungal infections of the lung. Medicine. 2016;44(6):378-83.
4. Hasna ZR, Sunggoro AJ, Marwanta S, Harioputro DR, Misganie YG, Khairunisa SQ. Neutrophil-to-lymphocyte and platelet-to-lymphocyte ratio as predictors of CD4 count among people living with HIV. Indonesian J Trop and Infect Dis. 2024;12(1):1.
5. Simadibrata DM, Calvin J, Wijaya AD, Ibrahim NA. Neutrophil-to-lymphocyte ratio on admission to predict the severity and mortality of COVID-19 patients: A meta-analysis. Am J Emerg Med. 2021;42:60-9.
6. Hasna ZRA, Sunggoro AJ, Sri Marwanta, Harioputro DR, Yimam Getaneh Misganie, Siti Qamariyah Khairunisa. Neutrophil-to-lymphocyte and Platelet-to-lymphocyte Ratio as Predictors of CD4 Count among People Living with HIV. Indones J Trop Infect Dis. 2024;12(1):1–13.
7. Naranbhai V, Hill AVS, Abdool Karim SS, Naidoo K, Abdool Karim Q, Warimwe GM, et al. Ratio of monocytes to lymphocytes in peripheral blood identifies adults at risk of incident tuberculosis among HIV-infected adults initiating antiretroviral therapy. J Infect Dis. 2014;209(4):500–9.
8. Haile K, Timerga A, Alemayehu M, Mose A. Diagnostic utility of haematological parameters in predicting the severity of HIV infection in southwestern Ethiopia: a comparative cross-sectional study. BMJ Open. 2023;13(10):72678.
9. Wu H, Cao T, Ji T, Luo Y, Huang J, Ma K. Predictive value of the neutrophil-to-lymphocyte ratio in the prognosis and risk of death for adult sepsis patients: a meta-analysis. Front Immunol. 2024;15:1336456.
10. Rini TY, Abadi S, Katu S, Bakri S, Rasyid H, Kasim H, et al. Association of bacterial/viral infections withneutrophil-lymphocyte ratio, monocyte-lymphocyte ratio, and platelet-lymphocyte ratio in patients presenting with fever. European J Mole & Clin Med. 2020;7(3):1500-9.
11. Ohji H, Shinohara T, Kadota N, Okano Y, Naruse K, Iwahara Y, et al. Pneumocystis jirovecii pneumonia in an HIV-infected patient mimicking acute eosinophilic pneumonia: a case report with a review of the literature. J Thorac Dis. 2018;10(11):774–8.
12. Kadek Aditya Nugraha I, Suryana K. Association of Neutrophil-Lymphocyte Ratio and Monocyte-Lymphocyte Ratio with Opportunistic Infections in Patients with HIV Infection. Int J Sci Res IJSR. 2021;10(8):1201–5.
13. Obeagu EI, Obeagu GU. Utilization of immunological ratios in HIV: Implications for monitoring and therapeutic strategies. Medicine. 2024;103(9):37354.
14. Kurniawati VV, Harioputro DR, Susanto AJ. Evaluasi Kadar Sel Cd4, Viral Load, Dan Neutrophil Lymphocyte Ratio (Nlr) Terhadap Infeksi Oportunistik Pada Pasien HIV/AIDS. Biomedika. 2022;14(2):99-107.
15. Miyahara R, Piyaworawong S, Naranbhai V, Prachamat P, Kriengwatanapong P, Tsuchiya N, et al. Predicting the risk of pulmonary tuberculosis based on the neutrophil-to-lymphocyte ratio at TB screening in HIV-infected individuals. BMC Infect Dis. 2019;19(1):667.
16. Wikanningtyas TA, Farhan F, Maulana A. Hubungan neutrophil lymphocyte ratio, absolute lymphocyte counts, absolute monocyte counts dengan c-reactive protein pada penderita COVID-19. E Journal Kedokt Indones. 2022;3:246–50.
17. Pratikto BC, Suryana K. Association between neutrophil-lymphocyte ratio and viral load with opportunistic pulmonary infections in human immunodeficiency virus/acquired immunodeficiency syndrome patients. Int J Adv Med. 2023;10(8):596–600.

Cite this article as: Riadi PRY, Suryana K. Monocyte/lymphocyte ratio and neutrophil/ lymphocyte ratio in HIV/AIDS patients with pulmonary opportunistic infections in Wangaya general hospital: a descriptive study. Int J Adv Med 2025;12:166-9.