JKKI
SCIENTIA EST BASIC VITAE

JKKI: Jurnal Kedokteran dan Kesehatan Indonesia
Indonesian Journal of Medicine and Health
Journal homepage: https://journal.uii.ac.id/JKKI
P-ISSN 2085-4145 | E-ISSN 2527-2950

The role of platelet indices in clinical research

Prita Murani Nugraheti*[1]

[1]Clinical Pathology Department, Faculty of Medicine, Universitas Islam Indonesia, Jl. Kaliurang 14,5 Ngemplak, Sleman, Yogyakarta, Indonesia, 55584

EDITORIAL

ARTICLE INFO

***Corresponding author:**
prita.murani@uii.ac.id

DOI: 10.20885/JKKI.Vol15.Iss1.art2

Platelet indices (PI) are cost-effective parameters acquired as a component of routine blood tests. These indices reflect the morphology, activation, and proliferation kinetics of platelets. Mostly, PI include mean platelet volume (MPV), platelet distribution width (PDW), platelet-large cell ratio (P-LCR), and plateletcrit (PCT). Among these, MPV and PDW are the most reliable and widely accessible. Those parameters are appealing choices for clinical research due to their extensive availability.[1–3]

The MPV and PDW are routinely determined and computed from the platelet count using automated haematology analysers like Sysmex, Coulter, or ADVIA. Those parameters use either electrical impedance or optical fluorescence techniques.[2] The MPV is detected through impedance-based technology within a clinical profiling instrument when measured in a buffered isotonic suspension. Mean platelet volume ranges from 8-10 fL.[4] Platelet volume and additional platelet volume indices like PDW and P-LCR can be deduced from the platelet size distribution curve. PDW is defined as the distribution width at the 20% level, and P-LCR represents the percentage of platelets with a size greater than 12 fL or large platelets with MPV >15 fL.[2,3]

Recent studies indicate that platelet parameters have emerged as promising new biomarkers for a range of acute and chronic diseases, aiding in diagnosing overall patient health and providing prognostic insights into certain conditions. These parameters have found extensive application in autoimmune, inflammatory, and cardiovascular diseases, assisting in predicting platelet production, function, and destruction. Currently, assessing platelet and MPV is widely recommended by the International Committee for Standardization in Haematology (ICSH). Furthermore, measuring platelet indices does not entail extra expenses and can be easily integrated into routine blood cell counts without necessitating additional blood samples.[1,3,5]

Based on literature findings, these suggest that MPV holds significant potential in offering insights into the progression and prognosis of various pathological conditions. Elevated MPV levels have been observed in cardiovascular diseases, strokes, respiratory issues, chronic kidney failure, gastrointestinal disorders, rheumatoid conditions, diabetes, and diverse cancer types. Conversely, reduced MPV levels have been documented in ulcerative colitis, systemic lupus erythematosus in adults, tuberculosis during exacerbation, and various neoplastic diseases.[3]

Platelet indices have implications for the prognosis of patients with coronary artery disease (CAD). Both MPV and P-LCR levels exhibit a significant inverse correlation with the occurrence of premature coronary artery disease (PCAD), while P-LCR emerge as an independent risk factor for restenosis following percutaneous coronary intervention (PCI) in PCAD patients. These platelet indices, which are available and cost-effective markers, not only correlate with the presence and severity of PCAD but also influence its prognosis. Combining various platelet indices offers a more comprehensive assessment of platelet function in PCAD patients.[6]

The PI also play role in myopericarditis patient, that platelet and PCT values were increased after treatment. However, MPV and PDW values did not show significance in relation to myopericarditis, but these values may be useful for monitoring the disease, particularly during inflammatory phase suppression of platelet and PCT. Additionally, it was found that there were negative correlations between platelet count–PCT and troponin levels, consistent with previous literature findings.[7]

Preeclamptic pregnant women in the third trimester exhibit significantly higher MPV values compared to those with normotensive pregnancies. Numerous studies have highlighted the elevation of MPV particularly during the second and third trimesters in preeclampsia.[8] In preeclampsia, the contact between injured endothelium and platelets might activate the coagulation system, increasing the consumption and bone marrow production of platelet. Thus, the presence of large and enzymatically active platelets could potentially play a distinct role in the pathogenesis of the condition.[8,9] A regenerative bone marrow response to platelet usage because the predominance of larger platelets increases MPV.[10]

According to a systematic review and meta-analysis, individuals with psoriasis exhibit higher platelet (PLT), MPV, and PCT levels compared to those without the condition, although PDW measurements did not show significant differences. Furthermore, PLT, MPV, and PDW displayed a modest correlation with the Psoriasis Area and Severity Index (PASI) in psoriasis patients.[11]

The PI also have a role in patients with obstructive sleep apnoea (OSA). In OSA patients, particularly those with severe OSA, only PDW displays elevated levels and demonstrates correlations with the apnoea-hypopnea index and oxygen desaturation index. This observation suggests that PDW can potentially serve as an indicator of OSA severity. However, a large-scale, prospective, and meticulously standardized studies are necessary to establish the utility of PI in routine clinical settings.[12]

Despite numerous efforts to establish clinical correlations for these parameters, their direct relevance to clinical practice in terms of both diagnosis and prognosis remains largely unverified.[1] Furthermore, there are certain limitations to consider. Preanalytical factors such as the method of vein puncture (with or without stasis), choice of anticoagulant (EDTA or citrate), blood sample temperature, and duration between sampling and testing can significantly influence PI measurements. Factors like ensuring proper blood tube filling and thorough sample mixing are also critical. For instance, EDTA can alter platelet shape, leading to variations in MPV values. Temperature fluctuations can affect platelet volume, with lower temperatures causing volume reduction and warming leading to volume increase. However, extended sample storage time can decrease PDW. It was suggested that MPV should always be interpreted alongside platelet count due to a nonlinear inverse relationship between platelet count and MPV. In addition, genetic variations, lifestyle (including diet), race, age and gender can influence MPV and platelet count. High heritability rates of more than 80% for PLT and more than 70% for MPV have been reported due to genetic variability. Moreover, differences in measurement methods (optical or impedance techniques) and analyser calibrations can impact measurement outcomes, underscoring the pressing need for standardization in PI measurements.[1,3]

The utilization of automated haematological analysers facilitates the convenient evaluation of PI within a complete blood count. Platelet indices have garnered substantial attention in research due to the crucial functions of platelets. Moreover, alterations in PI have diagnostic and prognostic significance in various pathologic conditions. Nevertheless, further investigations are needed to assess the role of PI in many medical conditions comprehensively.

REFERENCES

1. Pogorzelska K, Krętowska A, Krawczuk-Rybak M, Sawicka-Żukowska M. Characteristics of platelet indices and their prognostic significance in selected medical condition – A systematic review. Adv Med Sci. 2020;65(2):310–5. DOI:10.1016/j.advms.2020.05.002.
2. Leader A, Pereg D, Lishner M. Are platelet volume indices of clinical use? A multidisciplinary review. Ann Med. 2012;44(8):805–16. DOI:10.3109/07853890.2011.653391.
3. Korniluk A, Koper-Lenkiewicz OM, Kamińska J, Kemona H, Dymicka-Piekarska V. Mean platelet volume (MPV): New perspectives for an old marker in the course and prognosis of inflammatory conditions. Mediators Inflamm. 2019;2019:9213074. DOI:10.1155/2019/9213074.
4. Jeske WP. Platelet production, structure, and function. In: Keohane EM, Otto CN, Walenga JM, editors. Ro-

dak's hematology clinical principles and applications. Sixth Edition. Canada: Elsevier; 2020. p. 136–53.
5. Zuo Y, Wang J, Zhang X, Gu C, Zhang J. Role of variation in platelet indices in pregnancy-related pathological complications and the prediction of postpartum hemorrhage: A case-control study. Ann Palliat Med. 2022;11(12):3712–7. DOI:10.21037/apm-22-1196.
6. Chen K, Zhang R, Chen S, Fan X, Shen L, Yuan H. Clinical value of platelet indices in premature coronary artery disease. Int Heart J. 2023;64(3):336-343. DOI:10.1536/ihj.22-442.
7. Soysal DG, Özdemir R. Is there any relationship between platelet indices and myocarditis in children? Cardiol Young. 2022;32(2):203–7. DOI:10.1017/S1047951121001773.
8. Temur M, Taşgöz FN, Çift T, Serpim G, Üstünyurt E. Role of platelet indices in prediction of preeclampsia. Ginekol Pol. 2021;92(11):792–796. DOI:10.5603/GP.a2021.0056.
9. Dogan K, Guraslan H, Senturk MB, Helvacioglu C, Idil S, Ekin M. Can platelet count and platelet indices predict the risk and the prognosis of preeclampsia? Hypertens Pregnancy. 2015;34(4):434–42. DOI:10.3109/10641955.2015.1060244.
10. Keohane EM. An overview of clinical laboratory hematology. In: Keohane EM, Otto CN, Walenga JM, editors. Rodak's hematology clinical and applications. Sixth Edition. Canada: Elsevier; 2020. p. 1–7.
11. Liu Z, Perry LA, Morgan V. The association between platelet indices and presence and severity of psoriasis: A systematic review and meta-analysis. Clin Exp Med. 2022;23(2):333–46. DOI:10.1007/s10238-022-00820-5.
12. Bülbül Y, Aydin Özgür EA, Örem A. Platelet indices in obstructive sleep apnea: The role of mean platelet volume, platelet distribution widht and plateletcrit. Tuberk Toraks. 2016;64(3):206–10. DOI:10.5578/tt.29170