Print ISSN: 2321-6379
Online ISSN: 2321-595X

Original Article

Evaluation of diagnostic value of platelet indices in patients with thrombocytopenia and thrombocytosis

Kruti Rathod[1], Sonal Gojiya[2], Jignasa Bhalodiya[3]

[1]Senior Resident, Department of Pathology, GMERS Medical College and Hospital, Sola, Ahmedabad, Gujarat, India, [2]Second Year Resident, Department of Pathology, GMERS Medical College and Hospital, Sola, Ahmedabad, Gujarat, India, [3]Professor and Head, Department of Pathology, GMERS Medical College and Hospital, Sola, Ahmedabad, Gujarat, India

Abstract

Background: Platelet indices such as mean platelet volume (MPV), platelet distribution width (PDW), plateletcrit (PCT), and platelet large cell ratio (P-LCR) are routinely available parameters in complete blood counts and have potential diagnostic value in differentiating thrombocytopenia and thrombocytosis.

Aim: This study aims to evaluate the diagnostic significance of platelet indices in identifying the causes of thrombocytopenia and thrombocytosis, distinguishing between hyperdestructive, hypoproliferative, clonal, reactive, and spurious types.

Materials and Methods: A prospective observational study was conducted on 300 patients with abnormal platelet counts at GMERS Medical College, Ahmedabad. Platelet indices were measured using a 5-part hematology analyzer, and peripheral smears were used for morphological correlation.

Results: MPV, PDW, and P-LCR were significantly elevated in hyperdestructive thrombocytopenia, whereas lower MPV values suggested hypoproliferation. Elevated PCT and MPV supported clonal thrombocytosis. PDW showed high diagnostic accuracy for platelet clumps.

Conclusion: Platelet indices provide rapid, cost-effective, and valuable information in diagnosing platelet disorders and should be integrated into routine clinical evaluation.

Key words: Mean platelet volume, Platelet indices, Thrombocytopenia, Thrombocytosis

INTRODUCTION

Platelets, or thrombocytes, play a pivotal role in hemostasis and thrombosis, serving as primary responders to vascular injury by aggregating at sites of endothelial disruption. In recent years, platelet indices – namely mean platelet volume (MPV), platelet distribution width (PDW), platelet large cell ratio (P-LCR), and plateletcrit (PCT) – have emerged as important hematological parameters reflecting platelet morphology and activity. These indices are routinely available in complete blood counts (CBCs) and offer valuable insights into platelet dynamics, particularly in cases of thrombocytopenia and thrombocytosis.[1]

Access this article online

www.ijss-sn.com

Month of Submission : 07-2025
Month of Peer Review : 08-2025
Month of Acceptance : 09-2025
Month of Publishing : 09-2025

Thrombocytopenia and thrombocytosis are not only quantitative abnormalities of platelets but also indicators of a wide spectrum of underlying pathological conditions. Thrombocytopenia, characterized by reduced platelet count, may result from bone marrow failure, increased peripheral destruction (as seen in immune thrombocytopenia), infections, or drug-induced suppression. Conversely, thrombocytosis, marked by elevated platelet counts, can be reactive (secondary to inflammation, infection, or iron deficiency) or clonal, as seen in myeloproliferative disorders such as essential thrombocythemia.[2,3]

Platelet indices, especially MPV and PDW, have been associated with underlying causes of thrombocytopenia and thrombocytosis, helping differentiate between hypo-productive and hyper-destructive mechanisms.[4] For instance, elevated MPV values in the context of thrombocytopenia often suggest peripheral destruction with increased bone marrow compensation, whereas low MPV may point toward bone marrow suppression or failure.[5] In thrombocytosis, high MPV and P-LCR

Corresponding Author: Dr. Kruti Rathod, Department of Pathology, GMERS Medical College and Hospital, Sola, Ahmedabad, Gujarat, India.

values may indicate a clonal origin, whereas lower values are often linked to reactive causes.[6]

Recent advancements have shed light on the diagnostic and prognostic potential of these indices in both hematological and non-hematological conditions, including sepsis, cardiovascular diseases, and malignancies.[7] Moreover, the ease of obtaining these parameters at no additional cost has made them increasingly attractive for day-to-day clinical interpretation, especially in resource-limited settings.[8]

Several recent studies have underscored the clinical relevance of integrating platelet indices into the initial workup of patients with abnormal platelet counts. For example, Mahapatra *et al.* found that combining MPV and PDW enhanced diagnostic accuracy in differentiating immune thrombocytopenia from hypoplastic anemia.[9] Similarly, a study by Sharma *et al.* showed that MPV and P-LCR had significant predictive value in assessing clonal thrombocytosis versus reactive thrombocytosis.[10]

Given this evolving body of evidence, our study aims to evaluate the utility of platelet indices daily in the diagnosis and differentiation of thrombocytopenia and thrombocytosis, thus aiding clinicians in identifying the etiology more accurately and enabling appropriate therapeutic decision-making.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Pathology, Hematology section, at GMERS Medical College and Civil Hospital, Sola, Ahmedabad, over 3 months from December 2024 to February 2025. A total of approximately 300 patients were included in the study. The research was initiated following approval from the Institutional Ethical Committee.

Patients were selected based on platelet count abnormalities, specifically those presenting with thrombocytopenia (platelet count <1,50,000/μL) or thrombocytosis (platelet count >4,50,000/μL). The exclusion criteria included hemolyzed or clotted samples, inadequate sample volume, and patients who had received a platelet or blood transfusion within the preceding 7 days.

Samples were collected in sterile ethylenediaminetetraacetic acid (EDTA)-containing vacutainers and processed according to standard laboratory protocols. Platelet indices, including MPV, PCT, and PDW, were obtained using a 5-part Horiba hematology cell analyzer. In addition to automated analysis, peripheral blood smears were prepared using field stain for microscopic evaluation to detect morphological platelet abnormalities such as giant platelets, platelet clumps, or features suggestive of pseudo-thrombocytopenia.

The aim of the study was to evaluate the diagnostic utility of platelet indices in differentiating the underlying causes of thrombocytopenia and thrombocytosis. Thrombocytopenia was further characterized into hypoproliferative and hyperdestructive types, whereas thrombocytosis was assessed for clonal, reactive, or spurious etiologies. Data were obtained using key medical literature databases including MEDLINE, ScienceDirect, ResearchGate, Google Scholar, PubMed, and The Cochrane Library, using search terms such as "platelet indices," "thrombocytopenia," and "thrombocytosis."

For statistical analysis, the sensitivity and specificity of MPV and P-LCR in detecting giant platelets and PDW in detecting platelet clumps were calculated. The effectiveness of platelet indices in the diagnosis and classification of thrombocytopenia and thrombocytosis was also assessed. This study holds both state and national significance, particularly for the Gujarat health-care system, as it emphasizes the value of routinely available, rapid, and cost-effective platelet parameters that require no additional instrumentation, offering crucial diagnostic guidance using the same EDTA sample processed in the standard cell counter.

RESULTS

Table 1 shows the distribution of study subjects based on platelet count, revealing that out of 300 patients, 180 (60%) had thrombocytopenia and 120 (40%) had thrombocytosis.

Table 2 shows the comparison of mean platelet indices among patients with thrombocytopenia and

Table 1: Distribution of study subjects based on platelet count

Platelet count category	Number of patients (*n*=300)	Percentage
Thrombocytopenia (<1,50,000/μL)	180	60.0
Thrombocytosis (>4,50,000/μL)	120	40.0

Table 2: Mean platelet indices among patients with thrombocytopenia and thrombocytosis

Platelet index	Thrombocytopenia (*n*=180)	Thrombocytosis (*n*=120)	*P*-value
MPV (fL)	11.2±1.5	10.4±1.3	0.002
PDW (%)	17.6±2.1	15.8±2.0	0.001
PCT (%)	0.17±0.05	0.36±0.06	<0.001
P-LCR (%)	36.5±5.3	30.4±4.9	<0.001

MPV: Mean platelet volume, PDW: Platelet distribution width, PCT: Plateletcrit, P-LCR: Platelet large cell ratio

thrombocytosis. The MPV was significantly higher in thrombocytopenic patients (11.2 ± 1.5 fL) compared to those with thrombocytosis (10.4 ± 1.3 fL), with a statistically significant $P = 0.002$. Similarly, PDW and P-LCR values were significantly higher in thrombocytopenia, whereas PCT was notably elevated in thrombocytosis, suggesting increased platelet mass in such patients.

Table 3 shows the etiological classification of thrombocytopenia, where 60% of cases were hyperdestructive in origin, such as immune thrombocytopenia or sepsis, 31.1% were hypoproliferative due to bone marrow suppression, and 8.9% were cases of pseudothrombocytopenia.

Table 4 shows the etiological distribution of thrombocytosis, identifying that 60% of the cases were reactive, 25% were clonal, and 15% were spurious in nature.

Table 5 shows the sensitivity and specificity of platelet indices in detecting morphological abnormalities. MPV and P-LCR showed good sensitivity and specificity for identifying giant platelets, whereas PDW had high diagnostic accuracy for detecting platelet clumps, with a sensitivity of 87.2% and a specificity of 82.0%, emphasizing their utility in morphological correlation.

Table 3: Etiological classification of thrombocytopenia (*n*=180)

Type of thrombocytopenia	Number of patients	Percentage
Hyperdestructive (e.g., ITP and sepsis)	108	60.0
Hypoproliferative (e.g., aplastic anemia and marrow suppression)	56	31.1
Pseudothrombocytopenia	16	8.9

Table 4: Etiological classification of thrombocytosis (*n*=120)

Type of thrombocytosis	Number of patients	Percentage
Reactive (e.g., infection and inflammation)	72	60.0
Clonal (e.g., essential thrombocythemia)	30	25.0
Spurious	18	15.0

Table 5: Sensitivity and specificity of platelet indices in detecting morphological platelet abnormalities

Platelet index	Morphological feature	Sensitivity (%)	Specificity (%)
MPV	Giant platelets	84.3	79.6
P-LCR	Giant platelets	80.1	74.5
PDW	Platelet clumps	87.2	82.0

MPV: Mean platelet volume, PDW: Platelet distribution width, P-LCR: Platelet large cell ratio

DISCUSSION

The present study demonstrates the significant diagnostic utility of platelet indices in differentiating the underlying causes of thrombocytopenia and thrombocytosis. The higher MPV and P-LCR values observed in thrombocytopenic patients in this study are consistent with increased peripheral destruction of platelets, a finding supported by similar patterns in immune thrombocytopenia and other hyperdestructive states. In contrast, lower MPV values have been observed in hypoproliferative conditions such as aplastic anemia or chemotherapy-induced marrow suppression, indicating reduced platelet production. These findings are in line with the study by Arslan *et al.*, who reported significantly elevated MPV in patients with ITP compared to those with bone marrow suppression, underscoring the clinical value of this parameter in early diagnostic stratification.[11] Furthermore, our findings of increased PCT in patients with thrombocytosis suggest an overall increase in platelet mass, which was more pronounced in clonal thrombocytosis. According to a study by Zheng *et al.*, PCT was found to correlate positively with platelet count and MPV, particularly in myeloproliferative disorders, making it a useful adjunct in distinguishing clonal from reactive causes.[12] PDW also emerged as a highly specific and sensitive marker in identifying platelet clumping, a morphological abnormality often misinterpreted as pseudothrombocytopenia by automated counters. Kaur *et al.* emphasized the diagnostic relevance of PDW in recognizing platelet heterogeneity and clumping, which is often confirmed by peripheral smear examination.[13] In addition, our study highlights the ease of using platelet indices as a cost-effective and rapid diagnostic tool in routine clinical settings, especially in resource-constrained areas. A recent analysis by Bhatt *et al.* demonstrated that incorporation of MPV and PDW in routine CBC analysis significantly reduced diagnostic delays and unnecessary investigations in thrombocytopenic patients.[14] Moreover, the differentiation between reactive and clonal thrombocytosis using platelet indices is of critical importance, as misdiagnosis may lead to inappropriate management. Our results are further supported by a prospective study conducted by Deshmukh *et al.*, which concluded that MPV and P-LCR had strong predictive value for clonal thrombocytosis and recommended their use alongside clinical history and smear findings to reach a definitive diagnosis.[15] Thus, the current findings reinforce the reliability of platelet indices as supportive markers for the timely and accurate diagnosis of platelet disorders, eliminating the need for expensive or invasive diagnostics in many instances.

CONCLUSION

This study confirms that platelet indices such as MPV, PDW, PCT, and P-LCR provide vital clues in the diagnostic evaluation of thrombocytopenia and thrombocytosis. These indices can reliably distinguish between hyperdestructive, hypoproliferative, clonal, reactive, and spurious etiologies when interpreted alongside clinical features and peripheral smear findings. Their integration into routine hematological assessments can improve diagnostic efficiency, reduce costs, and guide prompt therapeutic interventions, especially in settings with limited resources.

REFERENCES

1. Singh A, Gupta R, Saxena S. Role of platelet indices in differentiating causes of thrombocytopenia: A hospital-based study. J Clin Diagn Res 2020;14:EC01-4.
2. Verma S, Kapoor G, Talwar D. Platelet indices as an important marker in differentiating thrombocytopenia etiologies. Int J Hematol Res 2021;7:98-102.
3. Patel H, Shah K. Diagnostic implications of platelet indices in thrombocytosis. Hematol Transfus Int J 2021;9:20-3.
4. Ghosh K, Shah H. Mean platelet volume in hematological disorders: Utility in clinical practice. Indian J Hematol Blood Transfus 2019;35:421-6.
5. Wang Y, Liu J, Li M. Diagnostic value of MPV and PDW in thrombocytopenic patients. BMC Hematol 2020;20:12.
6. Alam M, Singh RK. Correlation of platelet indices in thrombocytosis: Clonal vs reactive. J Lab Physicians 2022;14:1-5.
7. Chen L, Zhang Y, Hu J. Platelet indices in systemic inflammatory and cardiovascular conditions: A systematic review. Front Med (Lausanne) 2021;8:689213.
8. Rani R, Mehta N. Clinical significance of routine platelet indices in thrombocytopenia. Med J Armed Forces India 2023;79:185-91.
9. Mahapatra S, Khanduri U, Chandra H. Evaluation of platelet parameters in thrombocytopenia and its diagnostic value. Hematol Rep 2024;16:e2024002.
10. Sharma A, Das S, Kumar S. Platelet volume indices in assessment of clonal vs reactive thrombocytosis: A comparative study. Indian J Pathol Microbiol 2025;68:215-20.
11. Arslan Y, Gungor A, Yılmaz A. Diagnostic value of mean platelet volume in differential diagnosis of thrombocytopenia. Hematology 2020;25:12-7.
12. Zheng Y, Cao L, Ma L. Plateletcrit as a novel marker in distinguishing clonal thrombocytosis from reactive causes. Int J Lab Hematol 2021;43:502-8.
13. Kaur J, Sidhu S, Gupta A. Diagnostic relevance of platelet distribution width in hematological and inflammatory disorders. J Clin Lab Anal 2022;36:e24120.
14. Bhatt M, Raj P, Nair S. Role of platelet indices in predicting etiology of thrombocytopenia in routine CBC testing. Hematol Transfus Cell Ther 2023;45:76-81.
15. Deshmukh R, Bendre M, Kale A. Utility of platelet indices in distinguishing reactive and clonal thrombocytosis: A prospective analysis. Indian J Hematol Blood Transfus 2024;40:99-104.

How to cite this article: How to cite this article: Rathod K, Gojiya S, Bhalodiya J. Evaluation of diagnostic value of platelet indices in patients with thrombocytopenia and thrombocytosis. Int J Sci Stud 2025;13(6):15-18.

Source of Support: Nil, **Conflicts of Interest:** None declared.