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Original Article

Platelet Indices in Hematological and Non-Hematological Disorders: A Retrospective Study from a Tertiary Care Center

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ABSTRACT

Background: Platelet indices provide additional information regarding platelet number and characteristics and may vary across different hematological and non-hematological disorders. Their evaluation may provide useful supplementary information beyond platelet count alone.

Objectives: To evaluate platelet indices in various hematological and non-hematological disorders and compare their patterns across different disease groups.

Materials and Methods: A retrospective study was conducted over one year from June 2024 to June 2025. A total of 1,105 cases with hematological or non-hematological disorders were included. Platelet count (PC), mean platelet volume (MPV), platelet distribution width (PDW), and plateletcrit (PCT) were assessed using a Mindray BC-3000 Plus automated hematology analyzer. Data were analyzed using SPSS version 26.0.

Results: Of the 1,105 cases, 880 (79.6%) had hematological disorders and 225 (20.3%) had non-hematological disorders. All four platelet indices were significantly higher in hematological disorders than in non-hematological disorders: platelet count ($p = 0.013$), MPV ($p = 0.003$), PDW ($p < 0.01$), and PCT ($p < 0.01$). Among anemia subtypes, platelet count, MPV, and PDW differed significantly ($p < 0.001$), whereas PCT did not ($p = 0.38$). No significant differences in platelet indices were observed between neutrophilia and lymphocytosis. In contrast, all four indices differed significantly between thrombocytosis and thrombocytopenia ($p < 0.001$).

Conclusion: Platelet indices showed significant variation across hematological and non-hematological disorders, particularly among different anemia subtypes and platelet disorders. They may serve as useful supplementary parameters in routine hematological assessment, although further prospective studies are required to establish their diagnostic and prognostic significance.

Keywords: Platelet indices; platelet count; mean platelet volume; platelet distribution width; anemia; thrombocytosis; thrombocytopenia.

INTRODUCTION

Platelets are small, anucleate blood cells derived from bone marrow megakaryocytes and play a fundamental role in primary hemostasis and maintenance of vascular integrity. Following their release into the circulation, platelets have a relatively short lifespan of approximately 7–10 days and are continuously produced to maintain adequate platelet numbers in

peripheral blood.[1,2] The processes involved in megakaryocyte maturation and platelet production are closely regulated, and alterations in these processes may result in changes in platelet number and characteristics.[2]
Platelet count is routinely used for the evaluation of platelet abnormalities. With the increasing use of automated hematology analyzers, several additional platelet parameters can be obtained as part of the complete blood count. These parameters, collectively referred to as platelet indices, include platelet count (PC), mean platelet volume (MPV), platelet distribution width (PDW), and plateletcrit (PCT). MPV reflects the average volume of circulating platelets, PDW reflects the variability in platelet size, and PCT represents the proportion of blood volume occupied by platelets.[3] Together, these parameters may provide additional information regarding platelet production, maturation, and turnover.

In recent years, platelet indices have attracted increasing attention because alterations in these parameters have been described in a wide range of hematological and non-hematological disorders.[4] Changes in platelet indices may occur as a consequence of altered platelet production, peripheral destruction, increased platelet turnover, or platelet activation. Therefore, evaluation of platelet indices may provide information beyond the platelet count and may have potential clinical relevance in different disease conditions.

Among hematological disorders, variations in platelet indices have been reported in anemia, leukocyte disorders, thrombocytosis, thrombocytopenia, and hematological malignancies.[4,5] Differences in platelet indices have also been observed among different types of anemia, suggesting that platelet parameters may be influenced by the underlying hematological abnormality. In platelet disorders, parameters such as MPV and PDW may provide additional information regarding platelet production and peripheral platelet destruction. Studies evaluating thrombocytopenia have particularly explored the potential role of MPV in distinguishing hyperdestructive from hypoproductive mechanisms.[5]

Platelet indices have also been investigated in several non-hematological conditions. Increased MPV has been reported in cardiovascular disease and has been associated with cardiovascular risk and thrombotic events.[6] Alterations in MPV have also been described in patients with type 2 diabetes mellitus and have been investigated in relation to diabetic complications.[7] Similarly, changes in platelet indices have been reported in chronic liver disease, with MPV being studied as a potential indicator of disease severity and prognosis.[8] These observations suggest that platelet indices may reflect systemic alterations in platelet production and function associated with diseases beyond the hematological system.

Previous investigations have established that platelet indices can vary according to the underlying clinical condition. Studies have evaluated platelet volume indices in healthy populations and in specific hematological disorders, including acute leukemia, while other studies have examined their potential role in differentiating mechanisms of thrombocytopenia.[9–11] However, there remains a need for comparative evaluation of platelet indices across a broad range of hematological and non-hematological disorders in routine tertiary-care settings.

Furthermore, although platelet indices are automatically generated during complete blood count analysis, their clinical interpretation is often underutilized. A better understanding of variations in platelet count, MPV, PDW, and PCT across different disease categories may help determine their potential value as supplementary laboratory parameters.

Therefore, the present study was undertaken to evaluate platelet indices in patients with various hematological and non-hematological disorders at a tertiary care center in southern India. The study also aimed to compare platelet indices between hematological and non-hematological disorders and to assess their potential clinical utility in different hematological conditions, including anemia, non-neoplastic leukocyte disorders, thrombocytosis, and thrombocytopenia.

MATERIALS AND METHODS:

Study Design and Study Setting

A retrospective observational study was conducted at a tertiary care center in southern India to evaluate platelet indices among patients with hematological and non-hematological disorders.

Study Period

The study was conducted over a period of one year, from June 2024 to June 2025.

Study Population and Sample Size

The study included a total of 1,105 cases. Patients with hematological or non-hematological disorders who underwent complete blood count assessment with platelet indices during the study period were included in the analysis.

Inclusion Criteria

Patients diagnosed with hematological or non-hematological disorders who underwent assessment of platelet indices during the study period were included.

Exclusion Criteria
Patients with insufficient medical data required for the analysis were excluded from the study.
Data Collection
Relevant demographic and laboratory data were retrospectively retrieved from the available medical records. The study population was categorized into hematological and non-hematological disorders. Hematological disorders were further categorized into anemia, non-neoplastic leukocyte disorders, platelet disorders, and leukemia/lymphoma based on the diagnosis recorded in the medical records.

Anemia cases were further classified into microcytic, normocytic, and macrocytic anemia. Non-neoplastic leukocyte disorders included neutrophilia and lymphocytosis, while platelet disorders included thrombocytosis and thrombocytopenia.

Laboratory Assessment
Complete blood count (CBC) analysis was performed using the **Mindray BC-3000 Plus automated hematology analyzer** according to the manufacturer's instructions. The analyzer was calibrated daily to ensure consistency of laboratory measurements.
The platelet parameters evaluated in the study were:

1. **Platelet count (PC)** – expressed as $\times 10^9$/L.
2. **Mean platelet volume (MPV)** – expressed in femtoliters (fL).
3. **Platelet distribution width (PDW)** – expressed as a percentage (%).
4. **Plateletcrit (PCT)** – expressed as a percentage (%).

The reference ranges used for interpretation were platelet count 150–450 $\times 10^9$/L, MPV 7.5–11.5 fL, PDW 10–17%, and PCT 0.22–0.24%.

Study Variables
The primary variables analyzed were platelet count, MPV, PDW, and PCT. These platelet indices were compared between:

- Hematological and non-hematological disorders
- Different subtypes of anemia
- Neutrophilia and lymphocytosis
- Thrombocytosis and thrombocytopenia

Statistical Analysis
The collected data were entered and analyzed using IBM SPSS Statistics version 24.0. Continuous variables were expressed as mean ± standard deviation (SD). Comparisons of platelet indices between the different diagnostic groups were performed using appropriate statistical tests. A p-value <0.05 was considered statistically significant.

RESULTS:
A total of **1,105 cases** were included in the present study. The study population had a mean age of 41.5 ± 19.2 years, with a slight male predominance (55.4%). (Table 1)

Table 1: Demographic characteristics of the study population

Characteristic	Mean ± SD / n (%)
Total number of cases	1,105
Age (years)	41.5 ± 19.2
Male	613 (55.4%)
Female	492 (44.5%)

Of the 1,105 cases, 880 (79.6%) were classified as hematological disorders, while 225 (20.3%) were classified as non-hematological disorders. (Table 2)

Table 2. Distribution of hematological and non-hematological disorders

Category	Number of cases	Percentage
Hematological disorders	880	79.6
Non-hematological disorders	225	20.3
Total	1,105	100

Among the hematological disorders, anemia was the most frequent category, comprising 580 cases (52.5%). Of these, 285 (25.7%) were microcytic, 160 (14.5%) were normocytic, and 135 (12.2%) were macrocytic anemia.

Non-neoplastic leukocyte disorders accounted for 143 cases (12.9%), comprising 94 cases (8.5%) of neutrophilia and 49 cases (4.4%) of lymphocytosis. Platelet disorders accounted for 126 cases (11.4%), including 56 cases (5.1%) of thrombocytosis and 70 cases (6.3%) of thrombocytopenia. Leukemia/lymphoma accounted for 31 cases (2.8%). (Table 3)

Table 3. Distribution of hematological disorders

Hematological disorder	Number of cases	Percentage
Anemia	580	52.5
Microcytic anemia	285	25.7
Normocytic anemia	160	14.5
Macrocytic anemia	135	12.2
Non-neoplastic leukocyte disorders	143	12.9
Neutrophilia	94	8.5
Lymphocytosis	49	4.4
Platelet disorders	126	11.4
Thrombocytosis	56	5.1
Thrombocytopenia	70	6.3
Leukemia/lymphoma	31	2.8

The mean values of all four platelet indices were higher in patients with hematological disorders compared with those with non-hematological disorders. The differences were statistically significant for platelet count, MPV, PDW, and PCT. (Table 4)

Table 4. Comparison of platelet indices between hematological and non-hematological disorders

Platelet parameter	Hematological disorders	Non-hematological disorders	*p*-value
Platelet count (×10⁹/L)	258.9 ± 108.3	240.5 ± 97.2	0.013
MPV (fL)	10.4 ± 1.5	10.1 ± 1.3	0.003
PDW (%)	15.6 ± 2.3	15.0 ± 2.2	<0.01
PCT (%)	0.29 ± 0.09	0.25 ± 0.08	<0.01

Significant differences were observed in platelet count, MPV, and PDW among macrocytic, microcytic, and normocytic anemia. In contrast, PCT did not show a statistically significant difference among the three groups. (Table 5)

Table 5. Comparison of platelet indices among different anemia subtypes

Parameter	Macrocytic anemia	Microcytic anemia	Normocytic anemia	*p*-value
Platelet count (×10⁹/L)	183.4 ± 74.2	230.7 ± 87.8	197.6 ± 80.5	<0.001
MPV (fL)	11.3 ± 1.9	9.4 ± 1.3	10.5 ± 1.6	<0.001
PDW (%)	16.6 ± 2.6	14.4 ± 2.2	15.3 ± 2.4	<0.001
PCT (%)	0.20 ± 0.06	0.21 ± 0.08	0.21 ± 0.07	0.38

There were **no statistically significant differences** in platelet count, MPV, PDW, or PCT between patients with neutrophilia and those with lymphocytosis. (Table 6)

Table 6. Comparison of platelet indices between neutrophilia and lymphocytosis

Parameter	Neutrophilia	Lymphocytosis	*p*-value
Platelet count (×10⁹/L)	310.4 ± 124.0	295.3 ± 118.6	0.477
MPV (fL)	9.9 ± 1.5	10.2 ± 1.5	0.257
PDW (%)	14.6 ± 2.4	14.7 ± 2.4	0.183
PCT (%)	0.32 ± 0.11	0.30 ± 0.11	0.317

A significant difference was observed in **all four platelet indices** between thrombocytosis and thrombocytopenia. Patients with thrombocytosis had higher platelet count and PCT, whereas MPV and PDW were higher in thrombocytopenia. (Table 7)

Table 7. Comparison of platelet indices between thrombocytosis and thrombocytopenia

Parameter	Thrombocytosis	Thrombocytopenia	*p*-value
Platelet count (×10⁹/L)	750.1 ± 290.3	55.8 ± 29.6	<0.001
MPV (fL)	8.4 ± 1.6	12.7 ± 2.2	<0.001
PDW (%)	12.4 ± 2.3	18.8 ± 2.8	<0.001
PCT (%)	0.61 ± 0.22	0.08 ± 0.04	<0.001

DISCUSSION:

The present study evaluated platelet count (PC), mean platelet volume (MPV), platelet distribution width (PDW), and plateletcrit (PCT) in 1,105 patients with hematological and non-hematological disorders. Significant variations in platelet indices were observed between the two groups and among different hematological conditions, particularly anemia subtypes and platelet disorders.

Platelet indices in hematological and non-hematological disorders

All four platelet indices were significantly higher in patients with hematological disorders compared with non-hematological disorders. These findings suggest that platelet indices may vary according to the underlying disease process and provide additional information beyond platelet count alone.

The findings are broadly comparable with those of Bhardwaj et al., who reported differences in platelet indices between hematological and non-hematological disorders.[12] Similar observations regarding platelet volume indices have been reported by Maluf et al., emphasizing the importance of these parameters in hematological assessment.[13]

The observed differences may be related to alterations in platelet production, maturation, turnover, or activation associated with different disease processes. However, the retrospective design of the present study does not allow determination of the mechanisms responsible for these changes.

Platelet indices in anemia

Significant differences in platelet count, MPV, and PDW were observed among macrocytic, microcytic, and normocytic anemia, whereas PCT did not differ significantly. Macrocytic anemia showed lower platelet count and higher MPV and PDW compared with the other anemia subtypes.

These findings indicate that platelet parameters may vary with the type of anemia. Schoorl et al. also demonstrated the usefulness of hematological indices in the evaluation and differentiation of anemia-related conditions.[14] However, as detailed etiological information was not available for all anemia cases in the present study, these findings should be interpreted cautiously.

Platelet indices in leukocyte disorders

No significant differences were observed in platelet count, MPV, PDW, or PCT between neutrophilia and lymphocytosis. This suggests that isolated non-neoplastic leukocyte abnormalities may not be associated with substantial alterations in platelet indices.

Platelet indices in thrombocytosis and thrombocytopenia

The most prominent differences were observed between thrombocytosis and thrombocytopenia. All four platelet indices differed significantly between the two groups. Thrombocytosis was associated with higher platelet count and PCT, whereas thrombocytopenia showed higher MPV and PDW.

The increased MPV in thrombocytopenia may reflect increased platelet turnover and the release of larger, younger platelets into the circulation. Numbenjapon et al. demonstrated the potential usefulness of MPV in distinguishing hyperdestructive from hypoproductive thrombocytopenia, supporting the relevance of platelet size in the evaluation of thrombocytopenia.[15]

Clinical significance

Platelet indices are readily available from routine automated complete blood count analysis and therefore may serve as useful supplementary parameters without requiring additional blood sampling. MPV has also been investigated in several non-hematological conditions, including cardiovascular disease, diabetes mellitus, and chronic liver disease. Chu et al. reported an association between MPV and cardiovascular risk, while studies by Papanas et al. and Giannini et al. demonstrated its potential relevance in diabetes and cirrhosis, respectively.[16–18]

CONCLUSION:

The present study demonstrated significant variations in platelet indices across hematological and non-hematological disorders, including different anemia subtypes and platelet disorders. Thrombocytopenia showed higher MPV and PDW, whereas thrombocytosis showed higher platelet count and PCT.

Platelet indices may therefore serve as useful supplementary parameters in routine hematological assessment. Further prospective studies are needed to establish their diagnostic and prognostic significance.

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