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Diagnostic and Prognostic Significance of Immature Platelet Fraction in Patients with Thrombocytopenia.

Dr. Damini Rameshbhai Chaudhari[1]*, Dr. Zeel Jagdishbhai Thakkar[2], Dr. Chahat Nehalbhai Shah[3].
[1,2,3]Third Year Resident, Department of Pathology, GMERS Medical College and Hospital, Sola, Ahmedabad, Gujarat, India.

Correspondence:
Dr. Damini Rameshbhai Chaudhari.
Department of Pathology, GMERS Medical College and Hospital, Sola, Ahmedabad, Gujarat, India.

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Abstract

Background: Thrombocytopenia was a common hematological abnormality associated with various clinical conditions and resulted from decreased platelet production or increased peripheral platelet destruction. The immature platelet fraction (IPF) was considered a potentially useful marker of platelet production and turnover that could help differentiate the underlying mechanisms of thrombocytopenia and assess platelet recovery. ***Aim:*** The study aimed to highlight the importance of immature platelet fraction in the diagnosis of thrombocytopenia and explore its potential diagnostic and prognostic significance across different thrombocytopenic groups. ***Methods:*** A hospital-based observational study was conducted involving 150 patients with thrombocytopenia. Patients were categorized according to their underlying clinical diagnosis. Platelet indices, including mean platelet volume (MPV) and platelet distribution width (PDW), were evaluated. The distribution of clinical etiologies and platelet indices was analyzed using descriptive statistics. The potential role of IPF in differentiating etiological groups and assessing platelet recovery was also considered. ***Results:*** Dengue was the most common etiology of thrombocytopenia, accounting for 25.3% of cases, followed by sepsis (17.3%) and chronic liver disease (16.7%). Increased MPV was observed in 47.3% of patients, whereas increased PDW was recorded in 80.7%. These findings demonstrated the distribution of conventional platelet indices among patients with different clinical conditions. ***Conclusion:*** Thrombocytopenia was associated with diverse clinical conditions, and conventional platelet indices provided supplementary hematological information. IPF represented a potentially useful marker for distinguishing increased peripheral platelet destruction or consumption from reduced platelet production. Further studies incorporating measured IPF values, appropriate diagnostic comparisons, and follow-up outcomes were required to establish its diagnostic and prognostic utility in patients with thrombocytopenia.

Keywords: Immature platelet fraction; thrombocytopenia; mean platelet volume; platelet distribution width; platelet production; prognosis.

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INTRODUCTION

Thrombocytopenia was a common hematological disorder characterized by a reduction in peripheral blood platelet count and could arise from decreased platelet production, increased peripheral platelet destruction, or abnormal platelet sequestration [1]. Accurate identification of the underlying mechanism of thrombocytopenia was essential for establishing an appropriate diagnosis, guiding treatment decisions, and predicting clinical outcomes [2]. Conventional investigations, including complete blood count, peripheral blood smear examination, and bone marrow assessment when indicated, provided valuable diagnostic information but did not always reliably distinguish impaired platelet production from increased peripheral platelet destruction [1,2]. Therefore, additional laboratory parameters reflecting platelet production and turnover were considered useful for improving the diagnostic evaluation of patients with thrombocytopenia [1,6].

The immature platelet fraction (IPF) represented the proportion of newly released platelets containing residual ribonucleic acid in circulating blood and could be measured using specialized automated hematology analyzers [1,6]. These immature platelets reflected recent platelet production by megakaryocytes in the bone marrow and provided indirect information about the physiological response to a reduced platelet count [1,2]. An increased IPF could indicate enhanced platelet production in response to peripheral platelet destruction, whereas a relatively low or inappropriately normal IPF could suggest reduced platelet production [1,2]. However, IPF values required interpretation alongside the clinical presentation, platelet count, and other laboratory findings because different causes of thrombocytopenia could produce overlapping results [6,7]. Previous investigations evaluated the clinical utility of IPF in distinguishing immune-mediated thrombocytopenia from thrombocytopenia associated with reduced bone marrow production [3,4]. Studies also explored its potential usefulness in monitoring platelet recovery and evaluating the clinical course of thrombocytopenic conditions [5]. The diagnostic interpretation of IPF could nevertheless vary according to the underlying disease, patient characteristics,

analyzer technology, and laboratory-specific reference intervals [6,7]. Evaluation of IPF across different thrombocytopenic groups was therefore considered potentially useful for providing additional insight into platelet kinetics and the mechanisms responsible for reduced platelet counts [8–10].

Despite advances in hematological testing, differentiating the causes of thrombocytopenia remained an important clinical challenge, particularly when conventional investigations did not provide a definitive explanation for the reduced platelet count [1-4]. Assessing IPF alongside routine hematological parameters could help clarify whether thrombocytopenia was more consistent with increased peripheral platelet turnover or inadequate platelet production [5-10]. Therefore, the present study aimed to highlight the importance of immature platelet fraction in the diagnosis of thrombocytopenia by evaluating its findings across different thrombocytopenic groups and exploring its potential association with clinical prognosis and platelet recovery.

MATERIALS AND METHODS

A hospital-based observational study was conducted among 150 patients diagnosed with thrombocytopenia. Participants were recruited from the relevant clinical departments and laboratory services during the predefined study period. Written informed consent was obtained from eligible participants before enrolment, and institutional ethics committee approval was secured before commencement of the study.

Demographic characteristics, relevant clinical history, presenting complaints, provisional diagnosis, and associated laboratory findings were recorded using a structured data collection form. Blood samples were collected in appropriate anticoagulant-containing tubes according to standard laboratory procedures. Complete blood count, platelet count, and immature platelet fraction were assessed using an automated hematology analyzer capable of measuring IPF. Peripheral blood smear findings and additional investigations were reviewed when available to support clinical classification and interpretation of laboratory results.

Participants were classified into appropriate thrombocytopenic groups according to their underlying clinical diagnosis, laboratory findings, and available diagnostic records. IPF values were compared among these groups to evaluate differences in platelet production and turnover. The relationship between IPF and platelet count was also examined to determine whether IPF provided additional information beyond routine platelet enumeration.

Data were entered into a statistical software package and analyzed using appropriate descriptive and inferential statistical methods. Continuous variables were summarized using means and standard deviations or medians and interquartile ranges, depending on their distribution, while categorical variables were expressed as frequencies and percentages. Comparisons of IPF among thrombocytopenic groups were performed using suitable statistical tests based on the distribution and characteristics of the data. Correlation analysis was used, where appropriate, to assess the relationship between IPF and platelet count. Diagnostic performance was evaluated using receiver operating characteristic curve analysis when an appropriate reference diagnosis was available. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table 1 shows the distribution of 150 patients with thrombocytopenia according to their clinical etiology. Dengue was the most common diagnosis, accounting for 38 cases (25.3%), followed by sepsis in 26 cases (17.3%) and chronic liver disease in 25 cases (16.7%). PUO was identified in 13 cases (8.7%), while malaria accounted for 11 cases (7.3%). Road traffic accidents and acute leukemia were reported in 9 (6.0%) and 8 cases (5.3%), respectively. Aplastic anemia was observed in 6 cases (4.0%), followed by macrocytic anemia in 5 cases (3.3%). Pregnancy was recorded in 4 cases (2.7%), whereas chronic renal disease and microcytic anemia accounted for 2 cases each (1.3%). Hepatitis C was the least frequent diagnosis, accounting for 1 case (0.7%).

Table 2 presents the distribution of mean platelet volume (MPV) according to clinical diagnosis among the 150 patients with thrombocytopenia. Increased MPV was observed in 71 cases (47.3%), while normal MPV was recorded in 76 cases (50.7%) and decreased MPV in 3 cases (2.0%). The highest proportion of increased MPV was observed among patients with road traffic accidents (66.7%), followed by those with chronic liver disease (64.0%) and macrocytic anemia (60.0%). Among patients with dengue, 20 (52.6%) had increased MPV, whereas 18 (47.4%) had normal values. In the sepsis group, increased MPV was observed in 12 cases (46.2%), compared with normal values in 14 cases (53.8%). Decreased MPV was recorded in 1 case of malaria (9.1%) and 2 cases of acute leukemia (25.0%). No decreased MPV was observed in the remaining diagnostic groups.

Table 3 describes the distribution of platelet distribution width (PDW) according to clinical diagnosis among the study participants. Increased PDW was observed in 121 cases (80.7%), whereas normal PDW was recorded in 28 cases (18.7%) and decreased PDW in 1 case (0.7%). Increased PDW was observed in all cases of chronic renal disease and hepatitis C

(100.0% each). High proportions of increased PDW were also recorded among patients with dengue (92.1%), road traffic accidents (88.9%), chronic liver disease (88.0%), sepsis (84.6%), and PUO (84.6%). Among patients with malaria, 6 (54.5%) had increased PDW, while 5 (45.5%) had normal values. All patients with microcytic anemia exhibited normal PDW. Overall, increased PDW was the predominant finding among the study participants.

Table 1: Distribution of Cases of Thrombocytopenia According to Etiology

Clinical diagnosis	No. of patients (n=150)	Percentage (%)
Dengue	38	25.3
Sepsis	26	17.3
Chronic liver disease	25	16.7
PUO	13	8.7
Malaria	11	7.3
Road traffic accident	9	6.0
Acute leukemia	8	5.3
Aplastic anemia	6	4.0
Macrocytic anemia	5	3.3
Pregnancy	4	2.7
Chronic renal disease	2	1.3
Microcytic anemia	2	1.3
Hepatitis C	1	0.7
Total	150	100.0

Table 2: Association Between Mean Platelet Volume and Clinical Diagnosis

Clinical diagnosis	Total (n)	Decreased MPV n (%)	Normal MPV n (%)	Increased MPV n (%)
Dengue	38	0 (0.0)	18 (47.4)	20 (52.6)
Sepsis	26	0 (0.0)	14 (53.8)	12 (46.2)
Chronic liver disease	25	0 (0.0)	9 (36.0)	16 (64.0)
PUO	13	0 (0.0)	7 (53.8)	6 (46.2)
Malaria	11	1 (9.1)	8 (72.7)	2 (18.2)
Road traffic accident	9	0 (0.0)	3 (33.3)	6 (66.7)
Acute leukemia	8	2 (25.0)	4 (50.0)	2 (25.0)
Aplastic anemia	6	0 (0.0)	5 (83.3)	1 (16.7)
Macrocytic anemia	5	0 (0.0)	2 (40.0)	3 (60.0)
Pregnancy	4	0 (0.0)	2 (50.0)	2 (50.0)
Chronic renal disease	2	0 (0.0)	1 (50.0)	1 (50.0)
Microcytic anemia	2	0 (0.0)	2 (100.0)	0 (0.0)
Hepatitis C	1	0 (0.0)	1 (100.0)	0 (0.0)
Total	150	3 (2.0)	76 (50.7)	71 (47.3)

Table 3: Association Between Platelet Distribution Width and Clinical Diagnosis

Clinical diagnosis	Total (n)	Decreased PDW n (%)	Normal PDW n (%)	Increased PDW n (%)
Dengue	38	0 (0.0)	3 (7.9)	35 (92.1)
Sepsis	26	0 (0.0)	4 (15.4)	22 (84.6)
Chronic liver disease	25	0 (0.0)	3 (12.0)	22 (88.0)
PUO	13	0 (0.0)	2 (15.4)	11 (84.6)
Malaria	11	0 (0.0)	5 (45.5)	6 (54.5)
Road traffic accident	9	0 (0.0)	1 (11.1)	8 (88.9)
Acute leukemia	8	0 (0.0)	4 (50.0)	4 (50.0)
Aplastic anemia	6	1 (16.7)	1 (16.7)	4 (66.7)
Macrocytic anemia	5	0 (0.0)	1 (20.0)	4 (80.0)
Pregnancy	4	0 (0.0)	2 (50.0)	2 (50.0)
Chronic renal disease	2	0 (0.0)	0 (0.0)	2 (100.0)
Microcytic anemia	2	0 (0.0)	2 (100.0)	0 (0.0)
Hepatitis C	1	0 (0.0)	0 (0.0)	1 (100.0)
Total	150	1 (0.7)	28 (18.7)	121 (80.7)

DISCUSSION

The present study evaluated the distribution of thrombocytopenia according to etiology and the association of mean platelet volume (MPV) and platelet distribution width (PDW) with different clinical diagnoses among 150 patients. Dengue was the most common cause of thrombocytopenia, accounting for 25.3% of cases, followed by sepsis (17.3%) and chronic liver disease (16.7%). These findings highlighted the diverse clinical conditions associated with thrombocytopenia and emphasized the importance of identifying the underlying etiology rather than relying exclusively on platelet counts. The interpretation of platelet indices provided additional information regarding platelet production and turnover [11,12].

In the present study, increased MPV was observed in 47.3% of patients, whereas 50.7% had normal MPV and 2.0% had decreased MPV. Increased MPV was particularly frequent among patients with chronic liver disease (64.0%), road traffic accidents (66.7%), and macrocytic anemia (60.0%). Increased MPV may reflect the release of larger, younger platelets into the circulation in response to increased peripheral platelet consumption or destruction. However, MPV is influenced by several factors, including the underlying disease, platelet morphology, sample handling, and the analytical characteristics of the hematology analyzer. Therefore, MPV could not be considered an independent or definitive indicator of the mechanism responsible for thrombocytopenia [11,12,14].

The distribution of PDW showed that 80.7% of patients had increased values, while 18.7% had normal values and 0.7% had decreased values. Increased PDW was observed in several diagnostic groups, including dengue (92.1%), chronic liver disease (88.0%), road traffic accidents (88.9%), sepsis (84.6%), and PUO (84.6%). PDW reflected variation in platelet size and provided information about the heterogeneity of circulating platelet populations. Nevertheless, increased PDW was not specific to a single cause of thrombocytopenia, and its diagnostic significance required interpretation alongside clinical findings and other hematological parameters [12,14].

The immature platelet fraction (IPF) was an important parameter for evaluating thrombopoietic activity. Unlike conventional platelet indices, IPF estimated the proportion of newly released platelets containing residual ribonucleic acid and could help distinguish increased peripheral platelet destruction or consumption from reduced bone marrow platelet production. An increased IPF could occur when bone marrow activity compensated for peripheral platelet loss, whereas a relatively low IPF could indicate impaired platelet production. However, these patterns were not absolute, and IPF values required interpretation in the context of the underlying clinical condition [11,13,14].

The potential prognostic value of IPF was also relevant to the assessment of thrombocytopenia. Serial assessment of immature platelet parameters could provide information about changes in platelet production before a substantial increase in the total platelet count became apparent. This approach could be useful for monitoring platelet recovery in selected conditions, including immune-mediated thrombocytopenia and treatment-associated bone marrow suppression. However, the predictive value of IPF could vary according to the underlying etiology, treatment received, analyzer used, and timing of sample collection [11,13,14]. Serial assessment of platelet counts and IPF was therefore necessary to evaluate its prognostic usefulness.

The findings related to MPV and PDW highlighted the importance of evaluating platelet indices alongside routine hematological investigations. However, these parameters alone could not establish the diagnostic or prognostic performance of IPF. The assessment of IPF across different etiological groups, together with its relationship to platelet counts, clinical diagnoses, and subsequent platelet recovery, remained important for determining its clinical utility. Appropriate statistical analyses, including receiver operating characteristic curve analysis when a valid reference diagnosis was available, could help establish the sensitivity, specificity, and discriminatory ability of IPF [13–15].

Several limitations were relevant when interpreting the findings. The study results described the distribution of thrombocytopenia and conventional platelet indices but did not establish the diagnostic or prognostic performance of IPF. Furthermore, the observational design did not permit causal relationships to be established between specific diagnoses and changes in platelet indices. Differences in disease severity, treatment, and the timing of sample collection could also have influenced platelet parameters. Standardized IPF measurement, clearly defined diagnostic groups, and longitudinal follow-up were therefore important considerations for further investigations into the diagnostic and prognostic utility of IPF [12,14,15].

CONCLUSION

Thrombocytopenia was associated with a wide range of clinical conditions, with dengue, sepsis, and chronic liver disease representing the most frequent etiologies among the study participants. Increased MPV was observed in 47.3% of patients, while increased PDW was recorded in 80.7%, indicating that alterations in conventional platelet indices were common across the diagnostic groups. IPF represented a potentially useful parameter for differentiating increased peripheral platelet destruction or consumption from reduced platelet production and for monitoring platelet recovery. However, its diagnostic

and prognostic significance remained to be established through direct IPF measurements and longitudinal assessment. Further investigations incorporating IPF values, platelet counts, etiological classification, and serial clinical outcomes were required to determine its clinical utility in patients with thrombocytopenia.

REFERENCES

1. Briggs C, Kunka S, Hart D, Oguni S, Machin SJ. Assessment of an immature platelet fraction (IPF) in peripheral thrombocytopenia. Br J Haematol. 2004;126(1):93-9.
2. Jung H, Jeon HK, Kim HJ, Kim SH. Immature platelet fraction: establishment of a reference interval and diagnostic measure for thrombocytopenia. Korean J Lab Med. 2010;30(5):451-9.
3. Adly AAM, Ragab IA, Ismail EAR, Farahat MMM. Evaluation of the immature platelet fraction in the diagnosis and prognosis of childhood immune thrombocytopenia. Platelets. 2015;26(7):645-50.
4. Naz A, Mukry SN, Shaikh MR, Bukhari AR, Shamsi TS. Importance of immature platelet fraction as predictor of immune thrombocytopenic purpura. Pak J Med Sci. 2016;32(3):575-9.
5. Jeon K, Kim M, Lee J, Lee JS, Kim HS, Kang HJ, et al. Immature platelet fraction: a useful marker for identifying the cause of thrombocytopenia and predicting platelet recovery. Medicine (Baltimore). 2020;99(7):e19096.
6. Buttarello M, Mezzapelle G, Freguglia F, Plebani M. Reticulated platelets and immature platelet fraction: clinical applications and method limitations. Int J Lab Hematol. 2020;42(4):363-70.
7. Goel G, Semwal S, Khare A, Joshi D, Amerneni CK, Pakhare A, et al. Immature platelet fraction: its clinical utility in thrombocytopenia patients. J Lab Physicians. 2021;13(3):214-8.
8. Adly AAM, Ragab IA, Ismail EAR, Farahat MMM. Evaluation of the immature platelet fraction in the diagnosis and prognosis of childhood immune thrombocytopenia. Platelets. 2015;26(7):645-50.
9. Reeves HM, Maitta RW. Immature platelet dynamics in immune-mediated thrombocytopenic states. Front Med (Lausanne). 2021;7:597734.
10. Bajaj H, Rajpal T, Sharma M, Singh P, Hemal A, Kumar V. Role of immature platelet fraction in etiological diagnosis of thrombocytopenia. J Lab Physicians. 2024;16(4):496-500.
11. Ferreira FLB, Colella MP, Medina SS, Costa-Lima C, Fiusa MML, França CN, et al. Evaluation of the immature platelet fraction contribution to the differential diagnosis of hereditary, immune and other acquired thrombocytopenias. Thromb Res. 2017;152:35-41.
12. Ko YJ, Hur M, Kim H, Choi SG, Moon HW, Yun YM. Reference interval and clinical utility of immature platelet fraction measured by a Sysmex XN-10 automated hematology analyzer. Ann Lab Med. 2019;39(1):1-8.
13. Dadu T, Sehgal K, Joshi M, Khodaiji S. Evaluation of the immature platelet fraction as an indicator of platelet recovery in dengue patients. Int J Lab Hematol. 2014;36(5):499-504.
14. Hoffmann JJML. Reticulated platelets: analytical aspects and clinical utility. Clin Chem Lab Med. 2014;52(8):1107-17.