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Original Research Paper

Pathology

BEYOND PLATELET COUNTS: DIAGNOSTIC ROLE OF PLATELET INDICES IN ETIOLOGICAL EVALUATION OF THROMBOCYTOPENIA IN A TERTIARY CARE CENTRE IN INDIA.

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ABSTRACT

Introduction: Thrombocytopenia, characterized by low platelet count is a presenting feature of many diseases. Thrombocytopenia can be caused by a number of causes, the main pathomechanisms being 1.Decreased platelet production 2.Increased platelet destruction 3.Splenic sequestration. Although bone marrow examination is the gold standard investigation for thrombocytopenia, it is expensive, invasive and depends on availability of trained pathologists. Recent advances indicate the role of platelet indices like MPV, PDW, Plateletcrit, P-LCR as potential diagnostic markers in thrombocytopenia. The present study aims at studying the role of platelet indices as diagnostic modality in knowing the etiology of thrombocytopenia. **Material and Methods:** This prospective observational study was conducted over a period of three months from September 2025 to November 2025, in the hematology section of Pathology department of SMMH Government Medical College Saharanpur, on 100 patients with thrombocytopenia. Thrombocytopenia was identified using Medonic M 32 cell counter and confirmed by peripheral blood smear examination. Cause of thrombocytopenia was established using bone marrow examination, Serum B12 and folic acid assays and viral elisa assays. Patients were divided into two groups : Hypoproductive causes and Hyperdestructive causes and platelet indices were tabulated including MPV, PDW, Plateletcrit,P-LCR. Data analysis was done using SPSS 26 version. **Results:** The participants showed no significant difference in age group or gender between the two study groups. Plateletcrit was found to be significantly lower in the hypoproductive group whereas other platelet indices like PDW, MPV and P-LCR did not show significant difference. **Conclusion:**Bone marrow examination remains the gold standard for evaluating thrombocytopenia .However this study emphasises that platelet indices can be helpful non invasive adjunct in establishing the cause of thrombocytopenia

KEYWORDS : MPV, PDW, P-LCR

INTRODUCTION

Thrombocytopenia is defined as a reduction in platelet count below 1,50,000/mm^3 [1]. It may clinically manifest as minor bruising to life threatening hemorrhages depending on its severity[2].

Thrombocytopenia may occur from various mechanisms. The most important ones being 1.Decreased platelet production 2.Increased platelet destruction 3.Splenic sequestration or dilutional clumping.

Decreased platelet production may be due to decreased bone marrow production caused by diseases such as Aplastic anemia, Acute leukemias, megaloblastic anemia, myelodysplastic syndrome, megakaryocytic thrombocytopenia, post chemotherapy [3],alcohol use disorder, congenital platelet disorders like Alport syndrome, Bernard Soulier syndrome, drug induced non immune thrombocytopenia[1].

Increased peripheral destruction may be seen in Primary Immune Thrombocytopenic Purpura, drug induced ITP, lymphoproliferative disorders, Viral infections, autoimmune diseases eg.SLE, chronic infections including Hepatitis C, HIV, Helicobacter pylori. Non immune platelet destruction occurs in patients with heart valves, pre eclampsia or HELLP syndrome, DIC, thrombocytopenic purpura[4].

Post blood transfusions or following fluid resuscitation or causes of increased plasma volume eg. Pregnancy, may lead to dilutional thrombocytopenia.

Thrombocytopenia may also be seen because of redistribution of platelets. Approximately, a third of platelets are stored in the spleen. Conditions like splenic congestion from cirrhosis and other causes of splenomegaly can sequester platelets contributing to thrombocytopenia[5].

Platelet count alone is not indicative of pathomechanism of thrombocytopenia. Bone marrow examination is considered as the gold standard for distinguishing between hypo-productive and hyperdestructive causes of thrombocytopenia. It being an invasive, expensive test and the lack of consensus of its use in diagnosing ITP[6] warrants the need of an inexpensive, non invasive, easily available test for distinguishing between these major pathophysiological groups. Platelet induced immunoglobulin(PAIg) testing identifies antiplatelet antibodies causing platelet destruction but because of its low specificity, its use is limited.

Recent advances in automated blood analyser helps enable the measurement of various platelet parameters. Studies suggest that platelet indices such as MPV, PDW, Plateletcrit, P-LCR, play important role in distinguishing between these two mechanisms.

Platelet Distribution Width(PDW) measures variability in platelet size. Normal value is 9-14%.

Platelet large cell ratio(P-LCR) indicates the platelet larger than 12fl in the circulating pool. It reflects platelet activity and provides information about the platelet stimulation. It has direct relation to PDW and MPV, but inversely proportional platelet count[5]. Standard value is 15-35%.

Plateletcrit is a measure of total platelet mass. It is calculated in percentage using the formula: Platelet count X MPV /10000.

It is effective in detecting quantitative platelet defects[6]. Normal value ranges from 0.22-0.24%.

Immature Platelet Fraction(IPF) indicates percentage of immature platelets.It increases as production of platelet increases. Normal range in healthy individuals is 1.1-6.1%.

Measurement of platelet indices helps in measuring disease severity and gives insight into potential etiology that resulted in change in platelet indices. For example, simultaneous reduction in platelet count and PCT indicates excessive consumption of platelets[6].

MATERIAL AND METHODS

This prospective, observational study was conducted in the hematology section of Central Pathology Laboratory of SMMH Government Medical College, Saharanpur betweenSeptember'2025 to November'2025.

100 patients with platelet count below 1,50,000/mm^3 were selected for the study, after doing CBC analysis by collecting blood in 2ml EDTA anticoagulant tubes using hematology analyser Medonic M32. Platelet counts were confirmed by peripheral smear examination after Leishman stain. Clinical history and demographics were taken by using collecting performa.

Etiology of thrombocytopenia was established using peripheral blood smear examination, bone marrow examination, serum B12 and folic acid essays, Elisa for dengue, Chikungunya, Hepatitis B and C. Based on etiology the 100 cases were divided into two groups : 1. Hypoproductive or hypoproliferative causes(megaloblastic anemia, acute and chronic leukemia, aplastic anemia etc) 2. Hyperdestructive causes(i.e. causing peripheral destruction including immune thrombocytopenic purpura, infections such as dengue, malaria chikungunya, Hepatitis).

Platelet indices using including MPV, PDW, PCT LCR were tabulated and indices of the two study groups were compared using unpaired t test and Pearson correlation. Data were analysed using statistical methods using SPSS 26 with a p value <0.05 being significant.

Inclusion Criteria: All patients with established diagnosis of thrombocytopenia and consenting for study.
Exclusion Criteria: Patients where cause of thrombocytopenia could not be established, patients on antiplatelet drugs, pregnant patients or patients with recent surgery which may affect platelet count.

RESULTS

Out of 100 patients selected for the study 24 were found to be in the hypoproductive group and 76 in the hyperdestructive group.

Male to female ratio was 0.8:1 in hypoproductive group and 0.9:1 in the hyperdestructive group, with slight female predominance in both groups which was not statistically significant.

Mean age group in hypoproductive group is 37.91 ± 8.6 years and 40.51 ± 8.5 years.

Table 1: Socio-demographic Characteristics of Patients

Variable	Number of cases	Male	Female
Hypoproductive	24	11	13
Hyperdestructive	76	37	39
Total	100	48	52

Table 2: Platelet Indices in Hypoproductive and Hyperdestructive Groups

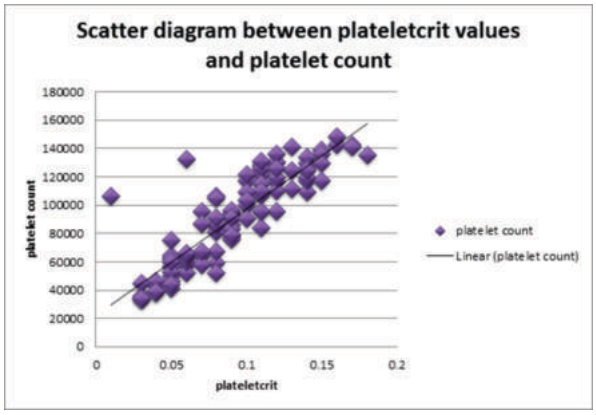
Disease Category	Total number of cases
Hypoproductive thrombocytopenia	24
1. Aplastic anemia	1
2. Megaloblastic anemia	20
3. Plasma cell dyscrasia	1
4. Chronic Myeloid leukemia	2
Hyperdestructive thrombocytopenia	76
1. ITP	1
2. Dengue	31
3. Chikungunya	41
4. Hepatitis C	2
5. Hepatitis B	1

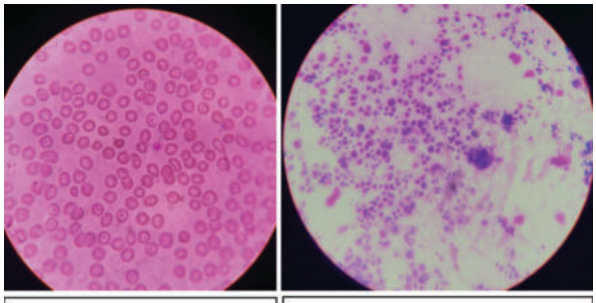
Megaloblastic Anemia comprised the majority of cases in the hypoproductive group, whereas viral infections Chikungunya and dengue comprised the majority of cases in hyperdestructive group.

Correlation was assessed between platelet indices and mechanism of thrombocytopenia by applying unpaired t test and pearson correlation.Among the platelet indices plateletcrit was significantly increased in the hyperproductive group as compared to hypoproductive group. Other platelet indices like MPV, PDW and P-LCR were higher in the hyperdestructive group but not statistically significant.

Table 3: Correlation of Platelet Indices in Both Groups

Category	Total cases	Platelet count	MPV	Plateletcrit	PDW	P-LCR
Hypo-productive thrombocytopenia	24	12196± 29860	10.57 ±1.23	0.0820 ± 0.032	15.28 ±1.91	15.02 ± 2.01
Hyper-destructive thrombocytopenia	76	2128± 13159	10.76 ±1.30	0.1020 ± 0.040	15.02 ±2.01	34.60 ± 9.54
P value		0.121	0.519	0.016	0.569	0.331





Giant Platelet (Leishman, 100X)

Hypolobated Megakaryocyte on BMA in a Case of ITP (Giemsa, 40X)

DISCUSSION

Platelet indices are biomarkers of platelet activation. Recent

advances in pathology have made it possible to record various platelet indices such as MPV, PDW, Plateletcrit, Platelet large cell ratio with automated hematology analysers. Although bone marrow examination is considered the gold standard in establishing the etiology of thrombocytopenia. Platelet indices offer a non- invasive, cheap, and easily available diagnostic tool for studying thrombocytopenia.

Elevated level of MPV is an indicator of increased shedding of platelets, although it is raised in hyperdestructive causes of thrombocytopenia, it is still not an easy parameter to calculate quantitatively due to wide physiological variations in MPV[7].

Platelet distribution width (PDW) is a marker of platelet anisocytosis which describes the size distribution of platelets produced by megakaryocytes and increases upon platelet activation.[8]

Platelet large cell ratio(P-LCR) is another marker of platelet activity expressed in percentage of volume occupied in blood. It is non linearly correlated to platelet count.

In the present study conducted on 100 thrombocytopenic patients,24 patients were characterised as hypoproductive marrow and 76 as hyperdestructive marrow. Male to female ratio in hypoproductive group was 0.8:1 and that in hyperdestructive group is 0.9:1 which was not statistically significant. Mean age group for hypoproductive group was 37.9±18.6 years and that in hyperdestructive group is 40.5±18.5 years which was not statistically significant.
Majority of the patients in our study were viral infections Chikungunya and dengue in the hyperdestructive group, which was similar to Nathan et al[2]. This finding could be because of the seasonal peak of these infections in Saharanpur region.

In our study MPV was 10.57±1.23 in hypoproductive group and 10.76±1.30 in hyperdestructive group which was not statistically significant. This finding was different compared to other studies like Nathan et al[2] and Malladi et al[9] but similar to Saran et al[3].Possible reason for this finding could be hematology analysers are not able to distinguish between platelets from similarly sized fragmented RBCs, WBCs or cell debris.

Comparing PDW we found no significant difference between hypoproductive(15.28±1.91)and hyperdestructive groups (15.02±2.01) which was different from Borkataky et al[10] and Shah et al[11]. Elsewefy et al[12] recorded a similar recorded a similar finding is not statistically significant when both groups are compared.

When comparing plateletcrit, mean value in hypoproductive group was 0.082±0.03 and that in hyperdestructive group was 0.102±0.040 which was statistically significant. This finding is similar to Saran et al[3] but different from Khaleel et al[13].Although plateletcrit generally has a linear correlation with MPV, the latter is more likely to be affected by the type of anticoagulant, temperature and cell counter.Plateletcrit is indicative of overall mass and MPV of platelet activation.

While comparing P-LCR no significant difference was found in the two study groups in our study, this finding was different from Yalavarthi et al[7] and Elsewefy et al[12].

CONCLUSION

Evaluation of thrombocytopenic patients is necessary for determining the cause and directing the course of treatment. Platelet indices are easily available, affordable and accessible tests, some studies show significant statistical relation between MPV, PDW, Plateletcrit and P-LCR, but in the present study only Plateletcrit was significantly lower in the hypoproductive group. Plateletcrit is directly related to platelet count and MPV, but studies have shown MPV to be affected by type of anticoagulant, temperature and coulter technique. Another reason for this finding could be a smaller sample size and shorter duration of study.Bone marrow remains the gold standard for evaluating thrombocytopenia. However this study emphasises that platelet indices can be helpful non invasive adjunct in establishing the cause of thrombocytopenia.

REFERENCES

1. Gauer RL, Whitaker DJ. Thrombocytopenia: Evaluation and Management. Am Fam Physician. 2022 Sep;106(3):288-298.
2. Senthil Nathan S, Varadaraj P, Nallusamy G, Reddy KSS. The Significance of Platelet Indices in the Evaluation of Thrombocytopenia. Cureus. 2024 Jul 30;16(7):e65756.
3. Saran K, Vidya K, Seema K, Prasad A, Prakash J. Study of platelet indices and their role in evaluation of thrombocytopenia. J Family Med Prim Care. 2022 Oct;11(10):6236-6242.
4. Jinna S, Karra S, Penney SW, Khandhar PB. Thrombocytopenia. 2025 Dec 1. In: StatPearls [Internet]. Treasure Island (FL).
5. Straus G, Vollert C, Stackelberg AV, et al. Immature platelet count: a simple parameter for distinguishing thrombocytopenia in paediatric acute lymphocytic leukaemia from immune thrombocytopenia. Pediatr Blood Cancer 2011;57:641-
6. Budak YU, Polat M, Huysal K. The use of platelet indices, plateletcrit, mean platelet volume and platelet distribution width in emergency non-traumatic abdominal surgery: a systematic review. Biochem Med (Zagreb). 2016;26(2):178-93
7. Yalavarthi S, Halder N, Pagidikalava A. Utility of platelet indices in diagnosing the underlying cause of thrombocytopenia due to accelerated platelet destruction. Anals of pathology and laboratory medicine.2018.Vol 5 Issue 4: 297-98.
8. Pogorzelska K, Kr□towska A, Krawczuk-Rybak M, Sawicka-□ukowska M. Characteristics of platelet indices and their prognostic significance in selected medical condition - a systematic review. Adv Med Sci. 2020 Sep;65(2):310-315.
9. Malladi, S. S., Atla, B. L., None, M. S., Sharma, M. S., Guruvelli, P. S. R. & None, S. M. (2025). Role of Platelet Indices in Thrombocytopenic Febrile Illness. Journal of Contemporary Clinical Practice, 11(4), 291-296.
10. Borkataky S, Jain R, Gupta R, Singh S, Krishan G, Gupta K, Kudesia M. Role of platelet volume indices in the differential diagnosis of thrombocytopenia: a simple and inexpensive method. Hematology. 2009 Jun;14(3):182-6
11. Shah A, Chaudhary S, Shah M. Role of platelet indices in diagnosing various clinical conditions.2013 National Journal of Medical Research.3(2)162-65
12. Elsewefy, DA; Farweez, BA MD; Ibrahim, RR. Platelet indices: consideration in thrombocytopenia.2014 The Egyptian Journal of Haematology 39(3):p 134-138.
13. Khaleel K, Ahmed A, Alwash M et al. Platelet indices and their relations to platelet count in hypo-productive and hyper-destructive Thrombocytopenia. 2014. Kabla Journal of Medicine, Vol.7, No.2, 1955-56.