



Original Article

Study on Efficacy of Platelet Indices for Evaluation of Thrombocytopenia in A Tertiary Care Centre

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ABSTRACT

INTRODUCTION: Thrombocytopenia (TCP) is a common clinical problem and its etiology varies widely. Thrombocytopenia is defined as a platelet count below 1,50,000 /mm³. This fall can be attributed to increased destruction, decreased production in bone marrow and pooling of platelets. Though the Platelet counts below 1,50,000/ mm³ define thrombocytopenia, they do not reveal the underlying pathology. Bone marrow aspiration remains the gold standard method for evaluating the cause of thrombocytopenia, but it is an invasive procedure and consumes a lot of time. Thrombocytopenia underlying pathology can be assessed with platelet indices by avoiding the use of an invasive procedures like bone marrow aspiration or biopsy. This study aims by using the parameters to identify the cause of thrombocytopenia though bone marrow aspiration is gold standard procedure for diagnosis.

AIM: To determine the efficacy of platelet indices in identifying the aetiology of Thrombocytopenia TCP.

MATERIALS&METHODS: The present study was conducted in Central Lab, Department of Pathology Government Medical College & Government General Hospital, Andhra Pradesh, India, after getting approval from Ethics and Scientific committee, over a period of six months from March 2025 to August 2025. A total of 150 cases of TCP s were encountered. Confirmation was done with bone marrow aspiration.

RESULTS: Out of total 150 cases 106 were included under the hyperdestructive type and 44 under the hypoproduective type. The platelet indices of hyperdestructive thrombocytopenias (group I) was platelet count (70.7± 32.2/mm) MPV (13.98±2.31fl) PDW (17.05±4.28fl) PLCR(41.68±16.29%). The platelet indices of hypoproduective thrombocytopenias (group II) was platelet count(30.93±13.68/mm) MPV (6.70±0.74fl) PDW (11.61±3.34fl), P-LCR (13.02±7.70%).

CONCLUSION: Platelet indices provide useful information regarding the mechanism of thrombocytopenia and form a great diagnostic tool to differentiate hyperdestructive thrombocytopenias from hypoproduective thrombocytopenias as these are simple, cost effective, non invasive & reliable.

Keywords: Hyperdestructive thrombocytopenia, Hypoproduective thrombocytopenia, Mean platelet volume, Platelet distribution width, Platelet large cell ratio, Plateletcrit.

INTRODUCTION

Platelets are non-nucleated membrane bound discoid cellular fragments produced by megakaryocytes within the bone marrow. They play a central role in haemostasis. Normal platelet count range from 1,50,000/mm³ to 4,50,000/mm³. Thrombocytopenia is defined as platelet count below 1,50,000/mm³[1]. Thrombocytopenia is a common hematologic

finding. The clinical expression of thrombocytopenia varies and is one of the most frequent causes for hematologic consultation in the practice of medicine[2].

Though the Platelet counts below 1,50,000/ mm³ define thrombocytopenia, they do not reveal the underlying pathology. Bone marrow aspiration remains the gold standard method for evaluating the cause of thrombocytopenia, but it is an invasive procedure and consumes a lot of time. Aetio-pathologically thrombocytopenias can be categorised into hypoproduative & hyperdestructive types which can be differentiated by the combined interpretation of platelet indices. Hypo-productive thrombocytopenia results from decreased bone marrow production because of primary or secondary bone marrow diseases[22]. Hyper-destructive thrombocytopenia is because of extra-medullary platelet destruction with normal or increased production of the bone marrow[23] (Table1).

Table 1 Showing causes of hypoproduative & hyperdestructive thrombocytopenias

S.no	Hypoproduative thrombocytopenia causes	Hyper-destructive thrombocytopenia causes
1	Aplastic anemia	Disseminated intra-vascular coagulopathy (DIC),
2	Acute myeloid leukemia	Immune thrombocytopenic purpura (ITP),
3	Megaloblastic anemia	Secondary ITP
4	Amegakaryocytic thrombocytopenic purpura	Dengue
5	Myelodysplastic syndrome	Viral fevers
6	Post-chemotherapy	

Automation in haematology has made it possible to measure various Platelet indices. These platelet indices include Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), Plateletcrit (PCT), and Platelet large cell ratio (PLCR) which are obtained with a simple Complete blood count and these parameters may provide some valuable information[4].

MATERIALS&METHODS

This was an observational study done in the Department of Pathology, Government Medical College & Government General Hospital, Vizianagaram after getting approval from Ethics and Scientific committee, for a period of 6 months from March 2025 to August 2025. Confirmation was done with bone marrow aspiration.

During this period 150 cases of thrombocytopenia were studied. Control group included 150 cases with normal platelet count, RBC count and WBC count. Detailed history was obtained regarding age, sex, clinical diagnosis and other haematological parameters. Haematological analysis was done on SYSMEX 6-PARTHEMATOLOGY- ANALYZER with 2ml blood collected in EDTA vacutainer to determine the platelet indices. All cases of thrombocytopenia with a platelet count below 1,50,000/cu mm were included. Patients on medications causing thrombocytopenias, with unavailable platelet indices and those who received multiple platelet transfusions are excluded from study. Normal range of mean platelet volume(MPV) is around 7.5 to 11.5fl , platelet distribution width (PDW) around 10 -18%, plateletcrit (PCT) around 0.12 -0.24% and platelet large cell ratio (P-LCR) is around 15 -35%

RESULTS

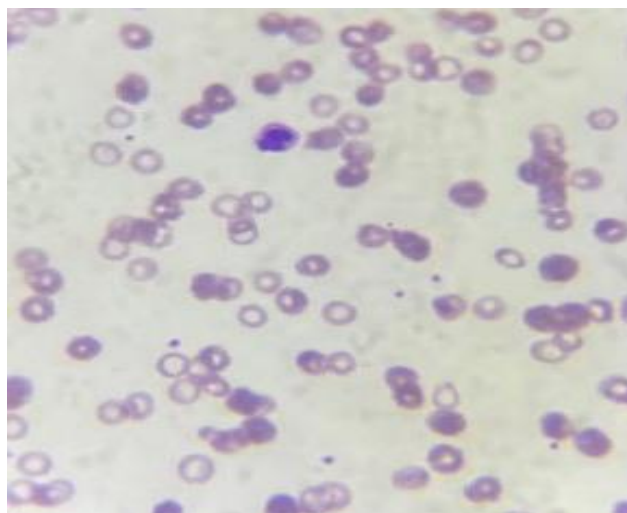
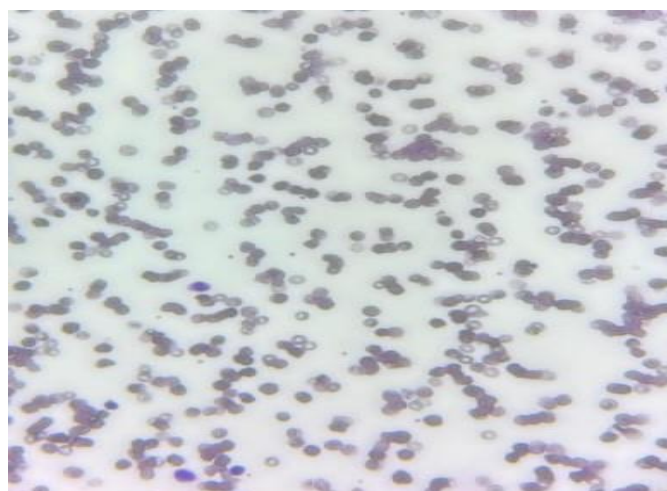
The present study included 150 patients of thrombocytopenia who were again classified into hypoproduative and hyperdestructive group. In the hypoproduative we had 44 cases and in the hyperdestruction there were 106 cases. Age range of patients was between 9 yrs and 80 yrs. The mean age of the patients is 38.16 years in hypoproduative, 21.12 years in hyperdestructive group. A total of 150 patients and 150 controls were included in the study. All cases were grouped into three groups based on the predominant mechanism of thrombocytopenia. Group A – Hyperdestructive TCP, Group B – Hypoproduative TCP and Group C -Control group. Out of total number of cases(n=150),62 patients (42%) were under the severe thrombocytopenia category with platelet count less than 50000/cu mm(Figure1), 65 patients (43%) were under the moderate category with platelet count between 50000 to 1,00,000/cu mm, and 23patients (15%) under the mild category with platelet count between 1,00,000 to 1,50,000/cu mm (Table 2)(Figure2). Among 150 cases, 81were males (54%) and 69 were females (46%) M: F ratio was 1.17:1(Table 2). Males are more commonly affected. Fever was the the most common complaint by 83 patients (55%), followed by weakness in 55 patients (38.6%), body pains in 10 patients (6.6%) and rash in 2 patients (1.3%) (Table 3)

Table 2. Distribution of cases based on severity of thrombocytopenia

	PLATELET COUNT	NO:OF CASES 150	PERCENTAGE OF CASES
MILD	1,00,000-1,50,000/cu mm	23	15%
MODERATE	50,000-1,00,000/cu mm	65	43%
SEVERE	<50000/cu mm	62	42%
TOTAL		150	100%

Table 3- Chief complaints of cases (n=150)

CHIEF COMPLAINT	NO OF PATIENTS	%
FEVER	83	55%
WEAKNESS	55	36.6%
BODYPAINS	10	6.6%
RASH	2	1.3%
TOTAL	100	100%

**Fig 1: Peripheral smear showing decreased number of platelets .(Leishman's stain 1000x)****Fig 2: Peripheral smear showing decreased number of platelets .(Leishman's stain 1000x)**

The mean platelet count in the hypoproduction group is $30.9 \pm 13.6 \times 10^3 / \text{mm}$ and in the hyperdestruction group is $70.7 \pm 32.2 \times 10^3 / \text{mm}$. The mean MPV in the hypoproduction group is $6.70 \pm 0.74 \text{ fl}$ and in the hyperdestruction group is 13.98 ± 2.31 . The mean PDW in the hypoproduction group is $17.05 \pm$ and in the hyperdestruction group is 17.05 ± 4.28 . The mean PLCR in the hypoproduction group is 13.02 ± 7.70 and in the hyperdestruction group is 41.68 ± 16.29 (Tables 4&5).

Table control 4: Comparison of mean of PLT indices between group A(Hyperdestructive) and Control

PARAMETER	GROUP A	CONTROL
PLATELET COUNT(mean \pm SD)	$70.7 \pm 32.2 \times 10^3 / \text{mm}$	$256.7 \pm 92.6 \times 10^3 / \text{mm}$
MPV (mean \pm SD)fl	$13.98 \pm 2.31 \text{ fl}$	$9.77 \pm 1.29 \text{ fl}$
PDW (mean \pm SD)fl	$17.05 \pm 4.28 \text{ fl}$	$13.12 \pm 2.60 \text{ fl}$
PLCR (mean \pm SD)%	$41.68 \pm 16.29\%$	$26.64 \pm 8.31 \%$

Table 5 : Comparison of mean of PLT indices between group B(Hypoproductive) and Control

PARAMETER	GROUP B	CONTROL
PLATELET COUNT (mean \pm SD)	30.93 \pm 13.68 x10 ³ /mm	274.4 \pm 91.63 x10 ³ /mm
MPV(mean \pm SD)fl	6.70 \pm 0.74fl	8.59 \pm 1.21 fl
PDW(mean \pm SD)fl	11.61 \pm 3.34fl	14.27 \pm 2.55 fl
PLCR(mean \pm SD)%	13.02 \pm 7.70%	23.60 \pm 8.47 %

DISCUSSION

Thrombocytopenia (TCP) can be due to hyperdestruction of platelets, hypoproduction of platelets[5]. Platelets play a vital role in the primary hemostasis. Bone marrow examination is an invasive procedure, so it is not necessary to use it as a first-line diagnostic procedure in thrombocytopenia. The complete blood counts generated by automated analyzer values for platelet indices are also given along with the platelet counts.[18] These platelet indices vary according to platelet production and activation. Therefore, platelet indices can be used to categorize the cause of the thrombocytopenia so that the treatment is started at the earliest.

A recent development in technology has made it possible to know platelet indices such as MPV, PCT, and PDW with an automated hematology analyzer[3]. Measurement of platelet indices in automated analysers has many advantages over manual estimation, as it is very simple, quick and inexpensive test which also eliminates the observer bias. [6&7] [8].

In the present study 150 cases were studied. Most common chief complaint was fever (55%) similar complaint was noted in 48.4% of patients in study done by Glen et al. [12]. Similar complaint was noted in >50% of patients in study done by Shigeki H. et al [20].

Male population was predominant in this study(81cases) (54%) which was also a finding in studies of Choudhary et.al[14] (60cases) (61.9%), Gupta et.al[15] (61cases) (58%) and Muhury et.al [16](65.9%) (58cases).

Out of total 150 thrombocytopenia cases in this study 70.6% (106 cases) were of hyperdestructive type and 29.4%(44cases) hypoproductive type which correlate with the study done by Shaheena et al[13] (16 cases) in which out of 120 cases hyperdestructive cases were 78.3% (94 cases) and hypoproductive cases were 21.7%(26 cases) and Glen et al[12] in which hyperdestructive cases 61.6% and hypodestructive cases are 38.4%.

In the present study the mean age of the patients is 38.16 years in hypoproductive group, 21.12 years in hyperdestructive group. In a study by Waseem et al[19] patients who have hypoproductive causes of thrombocytopenia presented with a mean age of 38.97 years, along with 39.35 years representing the mean age for those patients with destructive causes of thrombocytopenia. The mean age of the patients in a study by sharan etal [21] was 41.56 years in hypoproductive and, 28.54 in hyperdestructive group,

The mean platelet count in the hypoproduction group is 30.9 \pm 13.6 x10³ /mm and in the hyperdestruction group is 70.7 \pm 32.2 x10³ /mm were observed in the present study.

In the study by Parveen et al[3] the mean platelet count in the hypoproduction group is 75.9 \pm 36.4 x10³ /mm and in the hyperdestruction group is 79.6 \pm 36.3 x10³ /mm. Glen et al[12] in their study found that mean platelet count in hyperdestructive and hypoproductive cases were 72.51 x10³ /mm and 50.79 x10³ /mm respectively.

Numbenjapon et al [22] found that MPV was significantly higher in hyperdestruction group compared to hypoproductive thrombocytopenia. In hyper destructive thrombocytopenia, bone marrow compensates actively for the platelet loss and start releasing young larger platelets (“left shift”) which tend to decrease in size during its 7-10 days life span. [10]. In study by Parveen etal[13] also found a significant low (10.17 \pm 1.3fl) mean MPV in the hypoproduction group than in the hyperdestruction group (12.3 \pm 0.9fl). In the present study also a low (6.70 \pm 0.74 fl) mean MPV in the hypoproduction group than in the hyperdestruction group (13.98 \pm 2.31fl). In the study by Saran etal[21], the cutoff value of MPV was 8.99 fl in the hypo-productive group and 11.35 fl in the hyper-destructive group.

MPV has evoked much interest of all the platelet indices and many studies have suggested that MPV and other platelet indices are potentially useful markers for the early diagnosis and categorization of TCP and can play a role in the rapid evaluation of bone marrow activity of patients with platelet-associated disorders[5]. MPV is a marker of bone marrow activity and platelet activation and also a surrogate marker of bleeding[21].

PCT is a representation of volume percent of platelets and its value is not altered by severity of thrombocytopenia of either hypoproductive or hyperdestructive etiology.

In the study by Parveen et al[13] they did not find any significant difference in PDW between the two subgroups. Kaito et al [10] suggested that a PDW value of more than 17fl and Ntaios et al [11] suggested a value between 15 and 17fl discriminate these two subgroups. In this study PDW is 11.61 ± 3.34 fl in hypoproducer group and 17.05 ± 4.28 fl in hyperdestructor group. In a study by Saran et al[21] there was no significant difference between hypo-productive and hyper-destructive groups and also between both groups and the control group. However, in the other studies of Borkatky and Shah AR et al[7&17] PDW was higher in patients with ITP when compared with AML patients and non-megaloblastic patients, respectively

The mean PLCR in the hypoproduction group is $13.02 \pm 7.70\%$ and in the hyperdestruction group is $41.68 \pm 16.29\%$ were observed in the present study. In the study by Glen et al[12] Mean PLCR in hyperdestructor cases was increased (42.3%) and decreased (19.9%) in hypoproducer cases. P-LCR was significantly higher in hyperdestructor group of thrombocytopenia with mean value of $38.41 \pm 8.14\%$ compared to mean value of $16.12 \pm 4.82\%$ for hypoproducer group in the study by Waseem et al[19].

Mean PCT, MPV and PDW were significantly higher in patients with destructive causes than those with hypo-productive causes of thrombocytopenia[19].

CONCLUSION

Platelet indices such as MPV, PCT, and PDW are significantly higher in hyper-destructive causes of thrombocytopenia and may discriminate hyper-destructive from hypo-productive causes of thrombocytopenia. In the majority of patients, it may help in delaying or avoiding unnecessary, invasive bone marrow examination. Thus, in all cases of thrombocytopenia, the clinicians need to look into platelet indices which can help in arriving at probable pathophysiology of thrombocytopenias.

DECLARATION

The authors certify that they have obtained approval from Ethics Committee and Scientific Committee of the Institution and appropriate patient consent forms.

CONFLICTS OF INTEREST

There are no conflicts of interest.

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