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To Evaluate The Role Of Platelet Indices In Determining The Etiology Of Thrombocytopenia

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Abstract

Background:
Thrombocytopenia is a common hematological finding with diverse etiologies ranging from decreased platelet production to increased peripheral destruction. Differentiating these causes is crucial for appropriate management. Platelet indices obtained from automated hematology analyzers may serve as a rapid, non-invasive diagnostic tool.

Aim:
To evaluate the role of platelet indices in determining the etiology of thrombocytopenia.

Materials and Methods:
This cross-sectional study was conducted on 150 patients with mild to moderate thrombocytopenia at a tertiary care center. Platelet indices including mean platelet volume (MPV), platelet distribution width (PDW), plateletcrit (PCT), and platelet large cell ratio (PLCR) were analyzed using automated hematology analyzers. Patients were categorized into hypoproductive and hyperdestructive groups. Statistical analysis was performed using SPSS version 23.

Results:
The mean age of patients was 33.24 ± 18.16 years, with male predominance (61.33%). Fever was the most common clinical presentation (36.1%). Platelet indices such as MPV, PDW, and PLCR were significantly higher in hyperdestructive thrombocytopenia compared to hypoproductive cases ($p < 0.05$). PCT showed variable association.

Conclusion:
Platelet indices, particularly MPV, PDW, and PLCR, are useful adjuncts in differentiating the etiology of thrombocytopenia and may reduce the need for invasive investigations like bone marrow examination.

Keywords: Thrombocytopenia, MPV, PDW, PLCR, Platelet indices, Etiology

Introduction

Thrombocytopenia, defined as a platelet count below 150,000/µL, is a frequently encountered clinical condition with varied etiologies. It may result from decreased platelet production (hypoproductive) or increased peripheral destruction (hyperdestructive). Accurate differentiation between these mechanisms is essential for appropriate management.

Bone marrow examination remains the gold standard for evaluation but is invasive, time-consuming, and not always feasible. Automated hematology analyzers provide platelet indices such as MPV, PDW, PCT, and PLCR, which reflect platelet size, variability, and activity.

These indices may provide valuable clues regarding the underlying mechanism of thrombocytopenia.

Larger platelets (high MPV and PLCR) are typically associated with peripheral destruction, while smaller platelets indicate decreased production.

Aim And Objectives:

This study aims to evaluate the role of platelet indices in establishing the etiology of thrombocytopenia and to evaluate the efficiency of platelet indices to differentiate hyperdestructive type from the hypoproductive type of thrombocytopenia.

Materials And Methods:

Study Design

A cross-sectional observational study conducted in the Department of Pathology at RUHS Medical College and Hospital, Jaipur.

Study Duration

2024–2025

Sample Size

150 patients with thrombocytopenia

Study Population: It was decided by applying

Inclusion Criteria –

1. Blood samples of patients with thrombocytopenia.
2. Patients who gave written informed consent.

Exclusion Criteria –

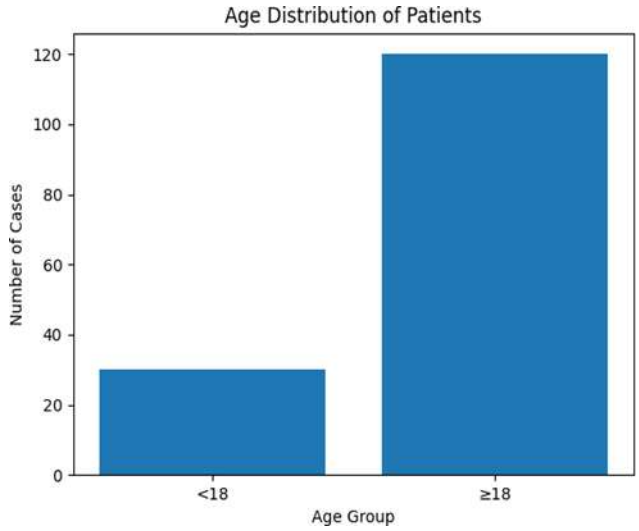
1. Blood samples of patients with severe thrombocytopenia.
2. Patients on antiplatelet drugs.
3. Clotted or hemolysed sample.
4. Inadequate blood sample.
5. Inadequate storage condition of sample.
6. Delay in transporting sample to lab.

Blood Sample Collection: For blood sample collection, 19-gauge or 21-gauge needle for adults and 23-gauge needle for children was more suitable. Sample was collected in EDTA (ethylenediaminetetra-acetic acid) vacutainer which often had a mark (2ml) indicating the amount of blood to be added. Tube was inverted 8-10 times for proper mixing of blood and anticoagulant. It was labelled with adequate patient identification immediately. RBC, WBC, PLT count are stable for up to 8 hours after blood collection. Blood can be kept at 4 degree celsius for up to 24 hours. Peripheral blood film was also prepared within 6 hours of sample collection for examination.

Various blood parameters were evaluated by automated hematology analyzer (Sysmex XN 1000 or Sysmex XT 4000i). It worked on a combination of different principles like electrical impedance, light scattering and flow cytometry.

Results

Graph 1: Age Distribution



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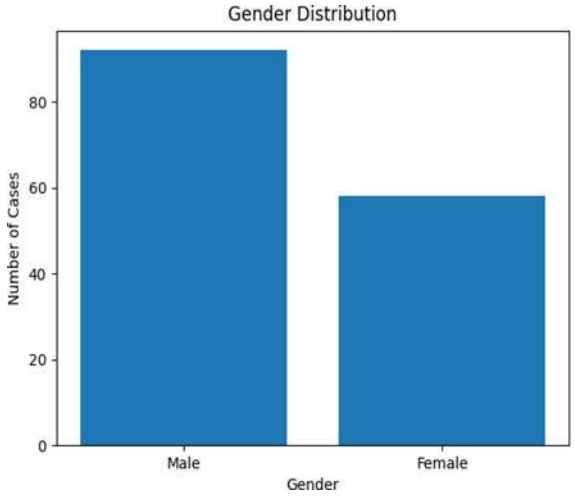
As shown in graph1 , Mean age of cases was (Mean ±SD) 33.24±18.16 years with range from 1 to 80 years. Out of total 150 patients, 30 (20%) patients were less than 18 years old and 120 (80%) patients were more than 18 years old. Majority of them were > 18 years old.

Graph 2: Gender Distribution



Graph2 is showing gender distribution of study population. Out of total 150 patients, 92 (61.33%) patients were male and 58 (38.67%) patients were female.

Table 1: Classification of thrombocytopenia

Classification of thrombocytopenia	Number (n=150)	Percentage (%)
Hyperdestruction	114	76.00
Hypoproduction	36	24.00

As shown in table 1, thrombocytopenia in patients was classified among 2 groups. Out of total 150 cases, 114 (76%) cases were coming into hyperdestruction type and remaining 36 (24%) patients were coming into hypoproduction type. Most common group was hyperdestruction type.

Table 2: Comparison of Hyperdestructive and Hypoproductive type of thrombocytopenia

Parameters	Hyperdestruction (n=114)	Hypoproduction (n=36)	P value
Hb (g/dL)	11.02±2.76	6.89±4.86	0.001
TLC (10^3 /□L)	7.06±7.79	34.19±58.89	0.001
Platelet count (10^3 /□L)	73.87±20.41	65.86±15.48	0.032
PCT (%)	0.07±0.03	0.06±0.02	0.004
MPV (fL)	12.45±1.12	11.39±1.37	0.000

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PDW (fL)	17.80±3.24	14.67±3.68	0.000
P-LCR (%)	38.63±6.11	35±8.65	0.006

As shown in table 2, mean hemoglobin in hyperdestruction and hypoproduction type was (mean ± SD) 11.02±2.76 (g/dL) and 6.89±4.86 (g/dL) respectively. Mean TLC counts in hyperdestruction and hypoproduction groups was 7.06±7.79 (103 /µL) and 34.19±58.89 (103 /µL) respectively. Mean platelet count in two groups was 73.87±20.41 (103 /µL) and 65.86±15.48 (103 /µL) respectively (p value <0.05). Mean ± SD of PCT, MPV, PDW, P-LCR were 0.07±0.03 (%), 12.45±1.12 (fL),17.80±3.24 (fL), 38.63±6.11 (%) in hyperdestruction group and 0.06±0.02 (%), 11.39±1.37(fL), 14.67±3.68 (fL), 35±8.65 (%) in hypoproduction group respectively with statistically significant p value (<0.05) as shown in table 2.

Most common symptom in enrolled patients was fever (56, 36.1%) followed by generalized weakness (22, 14.66%), pain abdomen (16, 10.66%), fever and vomiting (12, 8%), shortness of breath (6, 4%).

Most common etiology was dengue (79, 52.67%) followed by acute leukaemia (18, 12%), megaloblastic anemia (17, 11.33%), scrub typhus (9,6%), Chronic liver disease (8, 5.33%), malaria (6, 4%), sepsis (6, 4%), ITP(4, 2.67%) and DIC (2, 1.33%).

Discussion:

Thrombocytopenia is a multifactorial condition requiring prompt etiological differentiation. This study demonstrated that platelet indices can serve as reliable, non-invasive markers.

Higher MPV and PLCR in hyperdestructive thrombocytopenia reflect increased release of larger, immature platelets from bone marrow. Increased PDW indicates variability in platelet size due to active platelet turnover.

These findings are consistent with previous studies, which have also shown elevated MPV and PDW in immune-mediated and infectious causes of thrombocytopenia.

Thus, platelet indices can reduce reliance on invasive procedures like bone marrow examination, especially in resource-limited settings.

Conclusion:

Platelet indices are valuable, cost-effective tools in evaluating thrombocytopenia. Thus, we conclude that combined interpretation of MPV, PDW, PCT and P-LCR by automated hematology analyzer can be very useful parameter to differentiate thrombocytopenia due to hypoproduction and hyperdestruction. These platelet indices have great diagnostic tool to differentiate ITP from acute leukemia.Platelet parameters like PCT, PDW and PLCR are helpful in differentiating mild and moderate thrombocytopenia of hyperdestructive etiology.These parameters can guide early clinical decision-making. May reduce unnecessary invasive investigations.

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