



A Hematological Approach to Pre-eclampsia: The Role of Platelet Indices

1 Dr. C. Abinaya, Postgraduate, 2 Dr. Shilpa T Patil, Associate professor, 3 Dr. K. Janakiraman, Assistant professor, 4 Dr. R. Jenisha Elizabeth, Assistant professor, 5 Dr. N. Anusha, Professor and head of department, 1,2,3,4,5Department of Pathology, Vinayaka missions medical college and hospital, karaikal

Corresponding Author:

Dr. K. Janakiraman, Assistant professor

Vinayaka missions medical college and hospital, karaikal

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KEYWORDS

Pre-eclampsia, platelet indices, mean platelet volume, platelet distribution width, plateletcrit, maternal health

ABSTRACT:

Background

Pre-eclampsia is a disorder affecting multi organ systems, characterized by elevated blood pressure and proteinuria after 20 weeks of gestation. It continues to be a leading cause of maternal and fetal morbidity and mortality. Platelet indices, including platelet count (PC), mean platelet volume (MPV), platelet distribution width (PDW), and plateletcrit (PCT), may serve as potential biomarkers for disease severity.

Objective

To evaluate differences in platelet indices between pre-eclamptic and normotensive pregnant women and assess their correlation with disease severity.

Methods

A prospective case-control study was conducted in the Hematology Laboratory, Department of Pathology, Vinayaka Missions Medical College and Hospital, Karaikal, over six months (October 2023–March 2024). A total of 70 pregnant women (>20 weeks gestation) were included: 35 pre-eclamptic cases (BP >140/90 mmHg, proteinuria >300 mg/day) and 35 age-matched normotensive controls. Blood samples were analyzed using an automated hematology analyzer (Mindray 6000BC). Statistical analysis was performed using SPSS 25.0, with the Mann-Whitney U test for group comparisons and Spearman's correlation to assess relationships between MPV, PDW, and blood pressure ($p < 0.05$ considered significant).

Results

- Platelet count and PCT were significantly lower in pre-eclamptic patients compared to controls ($p = 0.03$).
- MPV and PDW were significantly elevated in pre-eclamptic women, with a strong positive correlation between increased blood pressure and MPV, PDW values ($r = 0.68$, $p < 0.001$).
- Patients with severe pre-eclampsia exhibited significantly higher MPV and PDW values than those with mild disease.



Conclusion

MPV and PDW serve as early, cost-effective indicators of disease severity in pre-eclampsia. Routine platelet analysis may aid in early identification and improved management of high-risk pregnancies.

Introduction

Pre-eclampsia is a pregnancy-induced hypertensive disorder characterized by endothelial dysfunction, systemic inflammation, and coagulation abnormalities [1]. It remains a leading cause of maternal and perinatal morbidity and mortality, particularly in resource-limited settings [2]. Although the pathogenesis of pre-eclampsia is not fully understood, platelet activation and consumption have been implicated in disease progression [3].

Platelet indices, such as PC, MPV, PDW, and PCT, are simple, cost-effective hematological parameters that reflect platelet turnover and function. Several studies have suggested that these indices can serve as markers for disease severity in pre-eclampsia [4,5]. However, conflicting results exist regarding their diagnostic and prognostic utility. This study aims to investigate the correlation between platelet indices and pre-eclampsia severity, providing insights into their clinical applicability.

Materials and Methods

Study Design and Setting

This prospective case-control study was conducted in the Department of Pathology, Vinayaka missions medical college and hospital over six months (October 2023–

December 2024).

Participants

Inclusion

- 35 pre-eclamptic women (>20 weeks gestation, BP >140/90 mmHg, proteinuria >300 mg/day)
- 35 normotensive pregnant women (>20 weeks gestation)

Exclusion

- Pre-existing hypertension, diabetes, renal disorders, hematological diseases
- Multiple gestations

Criteria:

Data Collection and Laboratory Analysis

- 2 mL of venous blood was collected in EDTA tubes under aseptic conditions.
- Platelet indices (PC, MPV, PDW, PCT) were measured using an automated hematology analyzer (Mindray 6000BC).

Statistical

- SPSS 25.0 software was used to analyze data.
- For all parameters, median and interquartile range (IQR) were calculated.
- Group comparison was done by Mann-Whitney U test.
- Spearman's correlation coefficient (r) was used to analyze relationships between MPV, PDW, and blood pressure.
- $p < 0.05$ was considered statistically significant.

Analysis

Results

Demographic Characteristics

Parameter	Pre-eclampsia (n=35)	Controls (n=35)	p-value
Mean Age (years)	27.1 ± 3.4	26.8 ± 3.1	0.56 (NS)
Mean Gestational Age (weeks)	24 ± 2.5	25 ± 2.2	0.44 (NS)

Comparison of Platelet Indices

Parameter	Pre-eclampsia (n=35)	Controls (n=35)	p-value
Platelet Count ($\times 10^9/L$)	142 ± 26	225 ± 30	0.03*



Mean Platelet Volume (MPV, fL)	11.8 ± 1.9	9.2 ± 1.5	<0.001**
Platelet Distribution Width (PDW, fL)	16.4 ± 2.5	13.1 ± 1.8	<0.001**
Plateletcrit (PCT, %)	0.18 ± 0.03	0.28 ± 0.04	0.02*

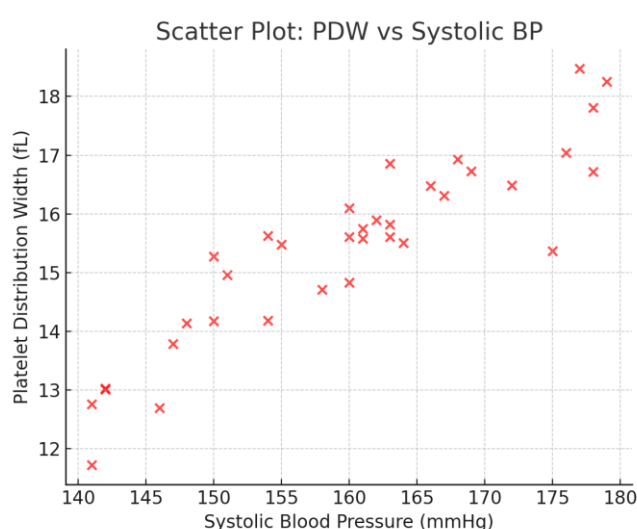
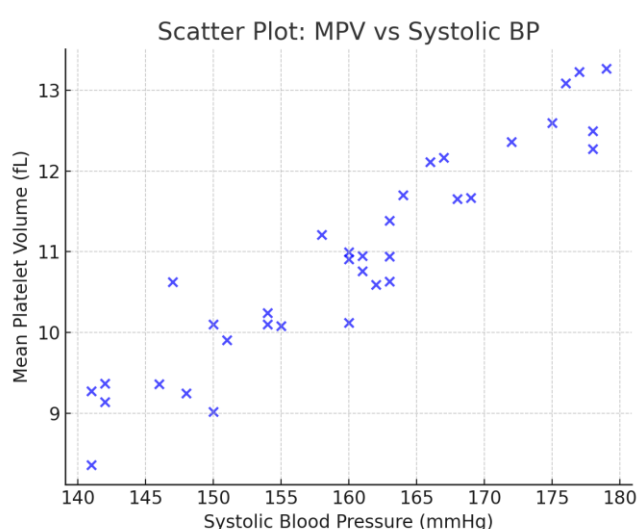
*p<0.05 significant, **p<0.001 highly significant

Correlation Analysis

A strong positive correlation was observed between MPV, PDW, and systolic blood pressure (r=0.68, p<0.001).

Graphical Representation

Below are scatter plots illustrating the correlation between platelet indices and systolic blood pressure:



Discussion

The present study provides significant insights into the relationship between platelet indices and pre-eclampsia. Our findings demonstrate that these platelet indices differ markedly between pre-eclamptic women and normotensive controls, with MPV and PDW serving as potential early indicators of disease severity.

Platelet Count and Platelet Indices in Pre-eclampsia

Pre-eclampsia is associated with a decrease in platelet count, attributed to platelet activation and consumption due to endothelial damage [6]. This study revealed a significant decrease in PC in pre-eclamptic women, consistent with previous findings [7]. Severe cases, including HELLP syndrome, show pronounced platelet depletion due to disseminated intravascular coagulation (DIC) [8].

Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW)

Our study demonstrated a marked increase in MPV and PDW in pre-eclamptic women, correlating with increased blood pressure and disease severity [9,10]. Increased MPV suggests heightened platelet turnover, commonly seen in endothelial dysfunction-related conditions such as pre-eclampsia [11]. Elevated PDW reflects variability in platelet size, suggesting an abnormal response to inflammation and endothelial injury [12].

Plateletcrit (PCT) as a Marker of Pre-eclampsia

Plateletcrit, a measure of total platelet mass, was found to be significantly lower in pre-eclamptic women. Our findings align with previous studies indicating that PCT can serve as a sensitive marker of platelet abnormalities in pre-eclampsia [13,14].



Correlation with Blood Pressure and Disease Severity

The positive correlation between MPV, PDW, and systolic blood pressure in our study supports the role of these platelet indices in monitoring disease progression [15]. Patients with severe pre-eclampsia exhibited significantly higher MPV and PDW values, reinforcing their utility in assessing disease severity [16].

Clinical Implications and Future Directions

Routine platelet analysis, particularly MPV and PDW, could offer valuable insights into pre-eclampsia severity, facilitating early detection and targeted management. Further research is warranted to explore the mechanistic pathways linking platelet activation to pre-eclampsia progression.

Conclusion

This study highlights the potential of platelet indices, particularly MPV and PDW, as early and reliable markers of disease severity in pre-eclampsia. Their incorporation into routine antenatal screening could enhance early detection and improve the management of high-risk pregnancies. Given the simplicity and low cost of platelet analysis, these markers hold promise for improving maternal and fetal outcomes, particularly in resource-limited settings.

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