Original Article

Platelet Distribution Width as a Severity Marker of Pre-clampsia

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Abstract

Objective: To determine the platelet distribution width among women with "mild and severe pre-eclampsia.
Methodology:: This Cross-sectional study was conducted at Department of Obstetrics & Gynecology from February 16, 2024, to February 15, 2025, CMA teaching and research hospital, Lahore. 113 women who met the inclusion criteria were enrolled after consent. Based on the dating scan, all patients at ≥28 weeks of gestation who were diagnosed with pre-eclampsia, and singleton pregnancy were included. Each patient was evaluated and further categorized as "mild" or "severe pre-eclampsia." Approximately 5 mL of venous blood was collected via venipuncture and sent to the laboratory for assessment of platelet distribution width. Data was collected on a structured proforma and analyzed using SPSS 23.
Results: The study participants' mean age was 27.7±4.4 years, and their mean gestational age was 34.3±2.0 weeks. Pre-eclampsia was diagnosed in 14 (9.3%) women; 69 (61.06%) women had "mild pre-eclampsia," and 44 (38.94%%) had "severe pre-eclampsia." The mean platelet distribution width was significantly higher in women with "severe pre-eclampsia" compared to those with "mild pre-eclampsia" (14.21±0.25 vs. 13.12±0.26 fl; p-value<0.0001). Furthermore, a statistically significant difference was observed in platelet distribution width between mild and severe pre-eclamptic women across various strata based on women's age, gestational age, parity, BMI, and platelet count.
Conclusion: Mean platelet distribution width was greater in women with severe pre-eclampsia compared to those with mild pre-eclampsia, indicating a direct association with disease severity.
Keywords: Pre-eclampsia, Proteinuria, Platelet Distribution Width, severity of pre-eclamsia

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Introduction

Pre-eclampsia is defined as "hypertension and proteinuria developing after the 20th week of pregnancy. pregnancy.[1] It complicates about 2-10% of pregnancies. It is the leading contributor to maternal morbidity and mortality, with an estimated 50,000 deaths annually worldwide.[2] In developing countries, pre-eclampsia is a significant cause of maternal morbidity, admission to intensive care units, and mortality.[3] It is a multi-organ disease. Research is necessary to identify a better prognostic marker that can serve as an early predictor for assessing the severity of pre-eclampsia and enhancing feto-maternal outcomes.[4]

Changes in the coagulation process between platelets and vascular endothelial cells significantly contribute to the development of pre-eclampsia. Numerous studies have identified platelets' role in the disease's etiology and pathogenesis. A low platelet count, likely resulting from consumption during low-grade intravascular coagulation, is believed to correlate directly with the severity of the disease.[5] In addition to a low platelet count, "platelet distribution width" (PDW) is also believed to be associated with disease severity. Due to rapid platelet turnover, larger platelets are more reactive than smaller ones because they contain more granules, mitochondria, and receptors such as P-selectin and glycoprotein IIb–IIIa, resulting in a more robust hemostatic response. Such changes are associated with poor outcomes in patients with thrombotic conditions. The increase in the number and size of pseudopodia indicates platelet activation, leading to increased platelet distribution width. [6] Platelet distribution width can serve as a valuable tool to assess the change in coagulation.[7] Currently, only pre-eclampsia-

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associated thrombocytopenia is utilized as a severity indicator. However, recent studies have emphasized the potential role of PDW in women with even normal platelet counts.[8]

Thrombocytopenia is recognized as a characteristic of disease progression, and its degree is directly linked to the severity of pre-eclampsia. If associated with severe pre-eclampsia, platelet distribution width (PDW) may predict disease progression at an earlier stage, as the abnormal activation of platelets, which causes an increase in PDW, is expected to occur before thrombocytopenia develops.[9] Considering the role of PDW in severe pre-eclampsia, this study aims to establish the importance of "platelet distribution width" as a severity marker for pre-eclampsia in non-thrombocytopenic patients.

Methodology

This cross-sectional study was conducted at a tertiary care hospital after obtaining ethical approval from the Institutional Review Board (IRB/ANMC/2024/19). The study was carried out from February 16, 2024, to February 15, 2025. A sample size of 113 patients was calculated using the Raosoft sample size calculator with a 95% confidence level and a 6% margin of error, assuming an expected prevalence of preeclampsia of 12%.[10] Participants were recruited using a non-probability consecutive sampling technique.

The inclusion criteria comprised pregnant women diagnosed with preeclampsia who attended the antenatal clinic with a singleton pregnancy at ≥28 weeks of gestation, as determined by the last menstrual period and confirmed by first-trimester ultrasonography.

Women with chronic hypertension, chronic kidney disease, chronic hepatitis, or diabetes mellitus were excluded. In addition, patients with a history of anticoagulant therapy, HELLP syndrome, or thrombocytopenia (platelet count <100,000/µL) were excluded. Eligible women who fulfilled the inclusion criteria and provided written informed consent were enrolled in the study.

Blood pressure was measured using an appropriately sized sphygmomanometer with the participant in the sitting position and confirmed in the supine position with a left lateral tilt. Five milliliters of venous blood were collected in EDTA-containing tubes for the estimation of platelet count and platelet indices using an automated hematology analyzer. Midstream urine samples were collected for the assessment of proteinuria by dipstick analysis.

Participants were classified as having mild preeclampsia (blood pressure ≥140/90 mmHg with +1 or +2 proteinuria on dipstick) or severe preeclampsia (blood pressure ≥160/110 mmHg with ≥+3 proteinuria on dipstick).

Data collected included maternal age, parity, gestational age, body mass index (BMI; kg/m²), platelet distribution width (PDW), and platelet count, which were recorded on a structured proforma. To minimize measurement bias, all platelet parameters were analyzed in the same laboratory using the same automated hematology analyzer. The exclusion criteria were applied to minimize potential confounding factors.

All data were entered into and analyzed using SPSS version 23. Continuous variables, including age, gestational age, BMI, platelet count, and PDW, were expressed as mean ± standard deviation (SD), while categorical variables, including parity and severity of preeclampsia, were presented as frequencies and percentages. An independent-samples t-test was used to compare the mean PDW between women with mild and severe preeclampsia. A p-value ≤0.05 was considered statistically significant. Stratified analyses were performed to evaluate the potential effects of relevant effect modifiers.

Results

The age of the participants ranged from 20 to 35 years, with a mean age of 27.76 ± 4.4 years. The majority of women (n=89, 59.3%) were aged between 20–27 years, followed by 61 (40.7%) women aged 28–35 years. The gestational age ranged from 28 to 38 weeks, with a mean of 34.3 ± 2.0 weeks. Parity ranged from 1 to 4; 64 (42.7%) women were primiparous, while 86 (57.3%) were multiparous.

The BMI of participants ranged from 21.8 to 33.7 kg/m², with a mean of 26.7 ± 2.9 kg/m². Obesity was observed in 41 (27.3%) patients. The platelet count ranged from 134,000/mm³ to 501,000/mm³, with a mean of 250.0 ± 77.9/mm³, while platelet distribution width (PDW) ranged from 9.3 to 28.2 fL, with a mean of 14.6 ± 3.8 fL.

Preeclampsia was diagnosed in 14 women (9.3%). Among the study participants, 69 (61.1%) had mild preeclampsia, whereas 44 (38.9%) had severe preeclampsia. As shown in Table I, no statistically significant differences were observed in the distribution of mild and severe preeclampsia across subgroups

based on age, gestational age, parity, BMI, and platelet count.

Table I: Frequency of mild/severe pre-eclampsia across various subgroups of pregnant women.

Subgroups	Mild Preeclampsia n=69 (%)	Severe Preeclampsia n=44 (%)	P-value
Age			
20-27 years	42 (60.87%)	29 (65.90%)	0.733
28-35 years	27 (39.13%)	15 (34.10%)	
Gestational Age			
28-33 weeks	45 (65.22%)	31 (70.45%)	0.709
34-38 weeks	24 (34.78%)	13 (29.55%)	
Parity			
Primiparas	39 (56.52%)	30 (68.18%)	0.297
Multiparas	30 (43.48%)	14 (31.82%)	
BMI			
<30Kg/m^2	44(63.77%)	28 (63.63%)	0.952
≥30Kg/m^2	25 (36.23%)	16 (36.37%)	
Platelet Count			
134-230x10^3/mm^3	43 (62.32%)	25 (56.82%)	0.699
230-501x10^3/mm^3	26 (37.68%)	19 (43.18%)	

The mean PDW was significantly higher among women with severe preeclampsia compared with those with mild preeclampsia (14.21 ± 0.25 vs. 13.12 ± 0.26 fL; p < 0.0001), as shown in Table II. A statistically significant difference was observed between women with mild and severe preeclampsia across various subgroups based on age, gestational age, parity, BMI, and platelet count, as presented in Table III.

Table II: Comparison of Mean Platelet Distribution Width (fl) between Mild and Severe Preeclampsia.

	Mild Preeclampsia (n=69)	Severe Preeclampsia (n=44)	P-value
Platelet Distribution Width (mean±SD)	13.12±0.26	14.21±0.25	<0.0001*

Table III: Comparison of Mean Platelet Distribution Width (fl) across Various Subgroups of Mild and Severe Preeclampsia.

Sub groups	N =113	Platelet Distribution Width (mean±SD)		P-value
		Mild Preeclampsia (n=69)	Severe Preeclampsia (n=44)	
Age				
20-27 years	42/29	13.07±0.25	14.14±0.29	0.002
28-35 years	27/15	13.17±0.32	14.33±0.15	0.005
Gestational Age				
28-33 weeks	45/31	13.35±0.07	14.33±0.15	0.004
34-38 weeks	24/13	13.00±0.24	14.14±0.29	0.001
Parity				
Primiparas	39/30	13.13±0.24	14.20±0.36	0.005
Multiparas	30/14	13.10±0.42	14.22±0.22	0.004
BMI				
<30Kg/m^2	44/28	13.15±0.26	14.17±0.27	0.001
≥30Kg/m^2	25/16	13.05±0.35	14.35±0.21	0.047
Platelet Count				
134-230x10^3/mm^3	43/25	12.90±0.17	14.20±0.27	0.001
230-501x10^3/mm^3	26/19	13.33±0.06	14.30±0.1	0.005

Discussion

Pre-eclampsia carries significant maternal and fetal risks. Early detection and severity assessment are crucial for better outcomes. Platelet Distribution Width (PDW), an index that reflects variation in platelet size, has been explored as a potential marker for the severity of pre-eclampsia.[11]

According to the current study, the mean platelet distribution width was significantly higher in women with severe preeclampsia than in those with mild preeclampsia. (14.21±0.25 vs. 13.12±0.26 vs. 11.07±0.94 fl; p-value<0.0001). A statistically significant difference was observed across various subgroups based on age, gestational age, parity, BMI, and platelet count.

Yang et al. conducted a study on Chinese pregnant women and reported significantly higher mean platelet distribution width in pre-eclamptic women, both with severe and mild disease, compared to normotensive women (14.6±2.11 vs. 13.0±2.1 vs. 11.6±1.8 fl; p-value<0.001).[12]

In a study conducted by Tesfay et al., researchers observed a significant difference in the mean platelet distribution width between Ethiopian women with severe and mild preeclampsia when compared to controls (14.3±3.4 vs. 11.1±1.6 vs. 10.8±1.8 fl; p-value<0.001) (137).[5] Alkholy et al, revealed a significant difference in the mean platelet distribution width among pre-eclamptic women with severe and mild disease compared to normotensive pregnant women (17.09±2.12 vs. 14.26±1.84 vs. 11.01±1.77 fl; p-value<0.001) in Egypt.[13]

Ghaffari et al. suggested that higher PDW values predict early-onset pre-eclampsia, showing an AUC of 0.909,

which indicates strong diagnostic ability potential.[14] According to Adukauskienė et al., the platelet indices, including PDW, were altered in pre-eclamptic women and could predict the disease progression.[15]

Sufian et al. highlighted the practical benefits of integrating PDW measurements into routine antenatal care, enhancing early detection and management.[16] Zhou et al. demonstrated that incorporating PDW measurements into clinical practice could improve risk stratification and manage high-risk pregnancies.[17]

Monitoring PDW and other platelet indices can help facilitate early intervention, potentially improving maternal and fetal outcomes.[18,19] Moreover, platelet indices are cost-effective, as they are generated during routine blood tests without incurring additional costs.[20]

This study adds value to the local context and existing international research evidence. One limitation of the current study is that the mean platelet distribution width is not correlated with maternal-fetal outcome measures among these women, such as mode of delivery, postpartum hemorrhage, low APGAR scores, and the need for NICU admission. This finding could have further emphasized the role of this novel biomarker in the management planning for these women. Therefore, large randomized controlled trials should be conducted for further research.

Conclusion

Women with severe pre-eclamsias as compared to women with mild pre-eclampsia. Women with severe preeclampsia exhibited substantially higher mean platelet distribution width than those with mild pre-eclampsia indicating its direct association with disease severity.

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