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Association between Platelet Indices and Risk of Pre- Eclampsia in Pregnant Women: Case Control Study

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Abstract

Introduction: Pre-eclampsia (PE) is a syndrome characterised by hypertension and proteinuria developing after 20 weeks of gestations. Hypertension is defined as a systolic blood pressure ≥140 mmHg and /or a diastolic blood pressure ≥ 90 mmHg measured at two occasions with at least 6 hours in between. Proteinuria is defined as greater than 300 mg of protein excreted in the urine over 24 hours.

Aim: whether there is a significant difference in platelet indices between women who develop pre-eclampsia and those who do not.

Methodology: This study is a retrospective case-cotrol hospital-based investigation conducted in the Department of Obstetrics and Gynecology at SP Medical College and associated hospitals in Bikaner, commencing in 2023 and continuing for one year or until the desired sample size is reached.

Result: This study found mean platelet count in the control group was 228.73, with a standard deviation of 80.12, while in the case group, the mean platelet count was higher at 288.10, with a standard deviation of 100.60. The mean MPV in the control group was 10.46, with a standard deviation of 2.05, while the case group had a mean MPV of 9.90, with a standard deviation of 2.09. The mean PDW in the control group was 16.85, with a standard deviation of 3.58, while the case group had a mean PDW of 15.05, with a standard deviation of 4.48, suggesting that the difference in PDW between the two groups is very close to statistical significance.

Conclusion: The role of platelet indices in pre-eclampsia, suggesting that while platelet count, MPV, PDW, and PCT are important diagnostic markers, their values may vary depending on patient demographics and disease progression.

Keywords: Blood Pressure, Eclampsia, Preeclampsia, platelet indices, Hypertension

Introduction

Pregnancy is characterized by the physiological changes that might affect, either directly or indirectly, the haematological parameters. Pre-eclampsia (PE) is a syndrome characterised by hypertension and proteinuria developing after 20 weeks of gestations [1-3]. Hypertension is defined as a systolic blood pressure ≥140 mmHg and /or a diastolic blood pressure ≥ 90 mmHg measured at two

occasions with at least 6 hours in between. Proteinuria is defined as greater than 300 mg of protein excreted in the urine over 24 hours. It is one of the major health problems during pregnancy. The spiral arteries are remodelled in pregnancy in several stages, beginning at around the time of implantation. Remodelling transforms the arteries from low-flow, highly resistant vessels into the high-flow, low resistance vessels which are vital for normal placental development. Impaired remodelling of the spiral arteries is considered to be a key factor in the pathogenesis of pre-eclampsia [4-5]. Hypoperfusion of the developing placenta results in placentalischaemia; placental pathological findings indicative of ischaemia include atherosis, fibrinoid necrosis, thrombosis and placental infarction6. The second phase of pre-eclampsia development is characterised by exaggerated maternal endothelial activation and a pro-inflammatory state compared to normal pregnancy8.The injured endothelium due to defective placental trophoblastic invasion leads to activation of PLTs. Platelet count, the mean platelet volume (MPV), platelet distribution width (PDW) and plateletcrit are the best validated and prominent of these and are attractive indices for research in clinical settings due to their widespread availability to clinicians [9-10].

Aim

To find the association between platelet indices (mean platelet volume, platelet distribution width, and platelet count) and the risk of pre-eclampsia in pregnant women. Investigator will determine if there is a significant difference in platelet indices between women who develop pre-eclampsia and those who do not.

Methodology

This study is a retrospective case-cotrol hospital-based investigation conducted in the Department of Obstetrics and Gynecology at SP Medical College and associated hospitals in Bikaner, commencing in 2023 and continuing for one year or until the desired sample size is reached. It was involving the recruitment of 40 diagnosed pre-eclamptic postpartum women or eclamptic postpartum women (Group A) and 40 normotensive postpartum women (Group B). The woman's hematological profile between 16 to 24 weeks of gestations reviews from antenatal records of participants for current pregnancy.

Sample Size

For sample size, the anticipated MPV and standard deviations for PE (10.15 and 1.10, respectively) and normal pregnancy (9.48 and 0.87, respectively) of a study done in Sudan (Abass AE et al. (2016)) and based on $\alpha = 0.05$, $\beta = 0.20$, a sample size of 40 per group was required. Considering a dropout of 15%.

$n = (Z_{\alpha/2}+Z_{\beta})^2 * 2*\sigma^2 / d^2$

$= 2(1.96+0.84)^2 X (1.024)^2 / (0.67)^2$

$=15.68 \times 1.0485 / 0.448$

$= \sim 36$

σ = Standard deviation of group

$\sigma = 1.024$

d= 10.15-9.48= 0.67

Result

Table 1: Distribution of patients according to the age

Age Group (Years)	Control Group n = 40		Case Group n = 40	
	No.	Percentage	No.	Percentage
15-19	1	2.50	5	12.50
20-24	17	42.50	16	40.00
25-29	14	35.00	12	30.00
30-34	8	20.00	6	15.00
≥ 35	0	0.00	1	2.50
Total	40	100.00	40	100.00
Mean	25.83		25.28	
SD	4.34		4.84	
p value	0.549			

Table 1. shows, In the control group, most patients (42.50%) were between 20-24 years old, followed by 35.00% in the 25-29 age group, 20.00% aged 30 or older, and 2.50% between 15-19 years. Similarly, in the case group, 40.00% were in the 20-24 age group, 30.00% in the 25-29 group, 15.00% aged 30-34 and 2.5% in ≥35 age group and 12.50% between 15-19 years.

Table 2: Distribution of patients according to area

Area	Control Group n = 40		Case Group n = 40	
	No.	Percentage	No.	Percentage
Rural	21	52.50	16	40.00
Urban	19	47.50	24	60.00
Total	40	100.00	40	100.00
p value	0.370			

Table 2 shows ,In the control group, 52.50% of patients were from rural areas and 47.50% were from urban areas. In the case group, 40.00% of patients were from rural areas, while 60.00% were from urban areas.

Table 3:Distribution of patients according to Gravidity.

Gravidity	Control Group n = 40		Case Group n = 40	
	No.	Percentage	No.	Percentage
G1	18	45.00	20	50.00
G2	15	37.50	8	20.00
G3	5	12.50	4	10.00
≥ G4	2	5.00	8	20.00
Total	40	100.00	40	100.00
p value	0.151			

Table 3 shows, In the control group, 45.00% were first-time pregnant (G1), 37.50% had two pregnancies (G2), 12.50% had three pregnancies (G3), and 5.00% had four or more pregnancies (≥ G4). In the case group, 50.00% were first-time pregnant (G1), 20.00% had two pregnancies (G2), 10.00% had three pregnancies (G3), and 20.00% had four or more pregnancies (≥ G4).

Table 4: Comparison of Platelet count in both groups between 16 to 24 weeks of gestation

Platelet Count	Control Group n = 40	Case Group n = 40
Mean	228.73	288.10
SD	80.12	100.60
t value	2.920	
p value	0.005	

Table 4 shows, the mean platelet count in the control group was 228.73, with a standard deviation of 80.12, while in the case group, the mean platelet count was higher at 288.10, with a standard deviation of 100.60.

Table 5: Comparison of Mean platelet volume in both groups between 16 to 24 weeks of gestation

MPV	Control Group n = 40	Case Group n = 40
Mean	10.46	9.90
SD	2.05	2.09
t value	1.210	
p value	0.230	

Table 5 compares the mean platelet volume (MPV) between the control and case groups, The mean MPV in the control group was 10.46, with a standard deviation of 2.05, while the case group had a mean MPV of 9.90, with a standard deviation of 2.09.

Table 6: Comparison of PDW in both groups between 16 to 24 weeks of gestation

PDW	Control Group n = 40	Case Group n = 40
Mean	16.85	15.05
SD	3.58	4.48
t value	1.985	
p value	0.051	

Table 6 shows the mean PDW in the control group was 16.85, with a standard deviation of 3.58, while the case group had a mean PDW of 15.05, with a standard deviation of 4.48.

Discussion

In our study, the age distribution of patients is similar between two groups, with the majority (over 40%) in the 20-24 years age range in both groups, followed by the 25-29 age group. In the literature, the age distribution of women with pre-eclampsia shows a similar trend, as observed in studies by Dundar et al. (2008) and Annam et al. (2011).

In our study, higher percentage of rural participants in the control group (52.5%) compared to the case group (40%), with the case group having a greater urban representation (60%). Lifestyle differences between urban and rural areas may affect pre-eclampsia risks, though these were not specifically addressed in studies like those by Dadhich et al. (2012) and Elbasuony et al. (2021).

In our study, Gravidity shows that a higher proportion of participants in the case group are first-time pregnant (50% in the case group vs. 45% in the control group). Primigravida status (first-time pregnancy) has been associated with a higher risk of pre-eclampsia, as indicated by studies such as those by Alsheeha et al. (2016) and Singhal et al. (2021).

In our study, statistically significant difference in platelet counts was observed between groups, with higher mean platelet counts in the case group. This result contrasts with findings by Dundar et al. (2008) and Alsheeha et al. (2016), where pre-eclamptic patients exhibited lower platelet counts compared to controls, often due to increased platelet turnover and destruction. This discrepancy may be due to differences in the stage or severity of pre-eclampsia among participants or varying physiological responses in this particular sample.

In our study, No significant difference in MPV was found between the groups, with p-value = 0.230. Studies like those by Annam et al. (2011) and Alkholy et al. (2013) have shown elevated MPV in pre-eclamptic patients, suggesting platelet activation as a response to vascular stress. The literature supports the value of MPV in detecting pre-eclampsia progression, particularly in patients with established hypertensive conditions.

In our study, While PDW was higher in the control group, the difference was not statistically significant (p-value = 0.051). This observation diverges from studies by Karateke et al. (2015) and Alsheeha et al. (2016), which reported increased PDW in pre-eclamptic patients due to heightened platelet activation. This difference in PDW levels could indicate that PDW is not universally elevated in all pre-eclamptic cases but may be more relevant in severe cases or as pre-eclampsia progresses.

Conclusion

This study highlights the complex role of platelet indices in pre-eclampsia, suggesting that while platelet count, MPV, PDW, and PCT are important diagnostic markers, their values may vary depending on patient demographics and disease progression. Overall, the study confirms the potential of platelet indices as useful tool in monitoring pre-eclampsia, although their predictive value might differ depending on the clinical context.

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