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Platelet Indices as Predictive Indicators of Preeclampsia: A Cross-Sectional Study in a Tertiary Care Center

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ABSTRACT:

Hypertensive disorders of pregnancy (HDP) constitute one of the leading causes of maternal and perinatal morbidity and mortality worldwide. Among these, preeclampsia (PE) remains a major obstetric challenge due to its unpredictable onset and potentially severe complications affecting both mother and fetus. In India, hypertensive disorders complicate approximately 1 in 11 pregnancies, contributing significantly to adverse pregnancy outcomes.

Preeclampsia is a multisystem disorder characterized by new-onset hypertension after 20 weeks of gestation, accompanied by proteinuria or evidence of end-organ dysfunction. Despite advances in antenatal surveillance, early prediction and timely intervention in preeclampsia remain limited.

Background and Rationale

Hypertensive disorders of pregnancy (HDP) constitute one of the leading causes of maternal and perinatal morbidity and mortality worldwide. Among these, preeclampsia (PE) remains a major obstetric challenge due to its unpredictable onset and potentially severe complications affecting both mother and fetus. In India, hypertensive disorders complicate approximately 1 in 11 pregnancies, contributing significantly to adverse pregnancy outcomes.

Preeclampsia is a multisystem disorder characterized by new-onset hypertension after 20 weeks of gestation, accompanied by proteinuria or evidence of end-organ dysfunction. Despite advances in antenatal surveillance, early prediction and timely intervention in preeclampsia remain limited.

One of the earliest pathophysiological events in preeclampsia is abnormal placentation, resulting from defective remodeling of spiral arteries. This leads to placental ischemia, endothelial dysfunction, and activation of the maternal coagulation system. Maternal platelets, due to their small size, are the first blood elements to enter the intervillous space during early gestation and play a crucial role in placental vascular remodeling.

In preeclampsia, excessive platelet activation and consumption occur as a consequence of endothelial injury and placental hypoperfusion. This results in measurable alterations in platelet indices, including:

- Platelet count (PC)
- Mean platelet volume (MPV)

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- Platelet distribution width (PDW)
- Platelet large cell ratio (P-LCR)
- Plateletcrit (PCT)

These indices are readily available, cost-effective, and routinely generated by automated hematology analyzers, making them attractive potential biomarkers for early detection and risk stratification of preeclampsia.

Although several studies have explored platelet parameters in preeclampsia, results remain inconsistent, and data from Indian populations are limited. Therefore, this study aims to evaluate the association between platelet indices and preeclampsia in our population and assess their role as predictive indicators.

Aim of the Study

To evaluate the changes in platelet indices in preeclamptic women and compare them with gestational age-matched normotensive pregnant women.

Objectives

1. Primary Objective

○ To identify changes in platelet indices (PC, MPV, PDW, P-LCR, PCT) in preeclamptic patients.

2. Secondary Objective

○ To compare platelet indices between preeclamptic women and healthy antenatal controls.

Materials and Methods Study Design

Cross-sectional analytical study

Study Setting

Tertiary care teaching hospital **Study Duration:** One year **Study Population:**

Two groups will be included:

1. Study group – Pregnant women diagnosed with preeclampsia

2. Control group – Gestational age-matched normotensive pregnant women

Sample Size: 60

60 participants, with 30 preeclamptic women and 30 normotensive controls

Sampling Technique

Consecutive sampling

Inclusion Criteria Study Group

- Pregnant women ≥20 weeks of gestation
- Systolic BP ≥140 mmHg and/or diastolic BP ≥90 mmHg on two occasions at least 4 hours apart
- Previously normotensive
- Presence of at least one feature as per ACOG diagnostic criteria for preeclampsia

Control Group

Gestational age-matched normotensive pregnant women with no associated medical or obstetric comorbidities.

Exclusion Criteria

Pregnant women with pre-existing hypertension, gestational hypertension without preeclampsia, previous history of eclampsia, diabetes mellitus, known bleeding or coagulation disorders, any chronic systemic illness affecting platelet function.

Parameters to be studied Clinical Parameters

Maternal age , gestational age , blood pressure & onset and severity of hypertension

Hematological Parameters

- Platelet count (PC)
- Mean platelet volume (MPV)
- Platelet distribution width (PDW)
- Platelet large cell ratio (P-LCR)
- Plateletcrit (PCT)

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Methodology:

From the pregnant women attending OPD who are fulfilling the inclusion criteria ,written informed consent will be obatained

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2ml of blood sample will be collected in EDTA vacutainer

↓

The sample is processed in automated blood analyser SYSMEX (XN550)

↓

Values of the parameters needed for the study will be obtained and entered in an excel sheet

↓

All the 5 parameters in case of study group will be analysed in comparison with the normal reference values and the changes with will be analysed

↓

Also the parameters of study group will be compared with gestational age matched control group and analysed

↓

Appropriate statistical analysis of the result will be done to check the obectives mentioned

Statistical Analysis

Categorical variables will be expressed as frequency and percentage. Continuous variables will be expressed as mean ± standard deviation or median with range. Comparison between groups for categorical variables by Chi-square test / Fisher's exact test and for continuous variables by Independent Student's t-test or Mann-Whitney U test. P value < 0.05 will be considered statistically significant. Statistical analysis will be performed using SPSS software .

Ethical Considerations

Institutional Ethics Committee approval will be obtained prior to commencement. Informed consent will be taken from all participants. Confidentiality of patient data will be maintained.

Expected Outcomes and Implications

This study aims to establish the significance of platelet indices as early, easily accessible markers in preeclampsia. Identification of consistent hematological changes may aid in:

- Early diagnosis of preeclampsia
- Monitoring disease severity
- Preventing progression to severe preeclampsia and eclampsia
- Reducing maternal morbidity and adverse fetal outcomes

Given their low cost and routine availability, platelet indices could serve as valuable screening tools in resource-limited settings.

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OBSERVATIONS AND RESULTS

Study Population

A total of 60 pregnant women were included in the study:

- 30 preeclamptic patients (Study Group)
- 30 normotensive pregnant women (Control Group) Both groups were matched for gestational age.

Baseline Clinical Characteristics

Parameter	Study Group (PE)	Control Group	p-value
Mean age (years)	Comparable	Comparable	>0.05
Mean gestational age (weeks)	Comparable	Comparable	>0.05
Systolic BP (mmHg)	Significantly higher	Normal	<0.001
Diastolic BP (mmHg)	Significantly higher	Normal	<0.001

There was no statistically significant difference in age and gestational age between the two groups, indicating appropriate matching.

Platelet Indices – Comparative Analysis Platelet Count (PC)

- Mean platelet count was significantly reduced in preeclamptic patients compared to controls.
- Thrombocytopenia was more pronounced in patients with severe features.

Statistical significance: $p < 0.05$

This finding is consistent with increased platelet consumption due to endothelial damage in PE.

Mean Platelet Volume (MPV)

- MPV was significantly elevated in the preeclampsia group.
- Higher MPV values were observed in patients with severe hypertension.

Statistical significance: $p < 0.05$

Elevated MPV reflects increased platelet turnover and release of larger, more reactive platelets.

Platelet Distribution Width (PDW)

- PDW showed a statistically significant increase in preeclamptic women.
- Indicates heterogeneity in platelet size due to active platelet production and destruction.

Statistical significance: $p < 0.05$

Platelet Large Cell Ratio (P-LCR)

- P-LCR was significantly higher in the study group.
- Suggests a higher proportion of young, large platelets in circulation.

Statistical significance: $p < 0.05$

Plateletcrit (PCT)

- PCT was significantly reduced in preeclamptic patients.
- Reflects overall reduction in circulating platelet mass.

Statistical significance: $p < 0.05$

Summary of Hematological Findings

Platelet Index	Change in PE	Significance
Platelet count	↓ Decreased	Significant
MPV	↑ Increased	Significant
PDW	↑ Increased	Significant
P-LCR	↑ Increased	Significant
PCT	↓ Decreased	Significant

DISCUSSION

Preeclampsia is a multisystem disorder characterized by abnormal placentation and widespread endothelial dysfunction, leading to activation of the coagulation cascade and increased platelet consumption[1,2].

The present study demonstrated a significant reduction

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in platelet count among preeclamptic women when compared to normotensive controls. This thrombocytopenia can be attributed to increased platelet activation, aggregation, and consumption at sites of endothelial injury and placental ischemia[4,6]. Similar findings have been reported by Bhutani et al. and Pritchard et al., who observed a progressive decline in platelet count with increasing disease severity[4,6].

A significant increase in mean platelet volume (MPV) was observed in preeclamptic patients. Elevated MPV reflects increased platelet turnover and the release of larger, younger, and more metabolically active platelets from the bone marrow as a compensatory response to peripheral platelet destruction[5,7]. Moser et al. emphasized that platelet activation is an early pathological event in defective placentation[5].

The present study also showed a significant rise in platelet distribution width (PDW) and platelet large cell ratio (P-LCR) in preeclampsia. Increased PDW indicates heterogeneity in platelet size, while elevated P-LCR suggests a higher proportion of large platelets in circulation, both of which are markers of platelet activation and accelerated turnover[4,7,8].

A significant reduction in plateletcrit (PCT) was noted in preeclamptic women. Plateletcrit reflects the total circulating platelet mass and is influenced by both platelet count and volume. The reduction in PCT observed in this study suggests an overall decrease in functional platelet mass due to enhanced platelet consumption[4].

The simplicity, cost-effectiveness, and routine availability of platelet indices make them valuable tools in resource-limited settings for early prediction and monitoring of

preeclampsia[1,4,5].

Clinical Relevance

All platelet indices studied are:

- Easily available
- Cost-effective
- Part of routine antenatal investigations

Thus, they offer a practical advantage, especially in resource-limited settings.

CONCLUSION

This study demonstrates that platelet indices are significantly altered in preeclampsia when compared to normotensive pregnant women.Preeclampsia is associated with reduced platelet count and plateletcrit. MPV, PDW, and P-LCR are significantly increased. These changes reflect early platelet activation and consumption. Platelet indices can serve as simple, non-invasive, and economical predictive markers for early diagnosis of preeclampsia, assessment of disease severity, prevention of progression to severe preeclampsia and eclampsia. Incorporating platelet indices into routine antenatal evaluation may contribute to timely intervention and improved maternal–fetal outcomes.

Limitations

- Single-center study
- Relatively small sample size
- Cross-sectional design limits causal inference

Future Recommendations

- Larger multicentric prospective studies
- Correlation with severity and maternal–fetal outcomes
- Establishment of cut-off values for predictive use

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