Platelet Indices as Predictors of Disease Severity in Preeclampsia: A Cross-Sectional Study from a Tertiary Care Center in India

Priyanka Katiyar, Dolly Rastogi , Munish Rastogi , Atosh Kumar , Preeti Kanawjia, Jayvardhan Singh, Divya Dwivedi.

Abstract

Background

Preeclampsia is a major cause of maternal and perinatal morbidity and mortality. Early identification of disease severity using simple laboratory markers like platelet count and mean platelet volume, is crucial for improving outcomes.

Methods

This cross-sectional study included 283 pregnant women categorized into normotensive (n=150), non-severe preeclampsia (n=65), and severe preeclampsia (n=68). Platelet count and mean platelet volume were analyzed. Correlation and receiver operating characteristic curve analysis were performed.

Results

Platelet count decreased significantly, while mean platelet volume increased with increasing severity ($p < 0.001$). Platelet count showed a strong negative correlation ($r = -0.679$), whereas mean platelet volume showed a positive correlation ($r = 0.573$). Platelet count demonstrated an area under the curve of 0.88 with a cut-off of <1.86 lakh/mm³. Mean platelet volume showed an area under the curve of 0.80 with a cut-off of >11.1 fL.

Conclusion

Platelet indices are reliable and cost-effective markers for assessing severity of preeclampsia

JK-Practitioner2026;31(2):31-35.

Introduction

Preeclampsia is a pregnancy-specific hypertensive disorder characterized by new-onset hypertension after 20 weeks of gestation and is frequently associated with multisystem involvement.[1] It remains a leading cause of maternal and perinatal morbidity and mortality, particularly in developing countries. Worldwide it affects 2 to 8% of pregnancies, while in India its incidence varies from 5 to 15% with nulliparous females being affected more than multiparous females.[2][3][4] The criteria for diagnosis of preeclampsia is evolving and proteinuria is no longer a prerequisite to diagnose preeclampsia.[5][6][7] Hypertension in pregnancy is defined as a blood pressure of ≥140/90 mmHg, recorded on two separate occasions at least four hours apart.

Preeclampsia is classified based on the time of onset into early-onset, occurring before 34 weeks of gestation and late-onset, occurring at or after 34 weeks of gestation. Early onset form being more dangerous and detrimental to health of pregnant female and foetus than the late onset preeclampsia.[8] It may be further categorized as preeclampsia with non-severe features (blood pressure ≥140/90 mmHg without evidence of end-organ damage) and preeclampsia with severe features (Blood pressure reading ≥160 mm Hg systolic or ≥110 mm Hg diastolic with evidence of end-organ damage) [2].

Development of preeclampsia is a multifactorial process and a two stage model has been developed to address its pathophysiology.[9] The pathophysiology involves abnormal placentation, endothelial dysfunction, and an exaggerated inflammatory response.

In a normal pregnancy, cytotrophoblasts invade the uterine myometrium and spiral arteries to create a rich network of vascular anastomoses that ultimately perfuse the placenta and foetus. In patients of preeclampsia, cytotrophoblasts do not develop the invasive phenotype required to

Author Affiliations

Priyanka Katiyar , Dolly Rastogi, Atosh Kumar , Preeti Kanawjia , Jayvardhan Singh; Department of Physiology: **Divya Dwivedi;**Department of Obstetrics and Gynaecology:
G.S.V.M. Medical College
Munish Rastogi ;Institute of Health Sciences, Chhatrapati Shahu Ji Maharaj University (CSJMU):

Kanpur, Uttar Pradesh, India

Correspondence
Dr. Priyanka Katiyar
Department of Physiology
G.S.V.M. Medical College
Kanpur, Uttar Pradesh-208002, India
Email: prinkskat@gmail.com
Phone: +91-7651877989

Indexed
EMBASE, SCOPUS, IndMED , ESBCO, Google Scholar besides other national and international databases.

Cite this article as
Katiya Pr, Rastogi D , Rastogi M , Kumar A , Kanawjia P, Singh J, Dwivedi D . Platelet Indices as Predictors of Disease Severity in Preeclampsia: A Cross-Sectional Study from a Tertiary Care Center in India. JK Pract2026;31(2):31-35.

Full length article available at **jkpractitioner.com** one month after publication

Keywords
Mean platelet volume; Platelet count; Preeclampsia; ROC curve; Disease severity

create these robust anastomoses which leads to decreased and shallow endovascular invasion of the spiral arteries. These abnormal blood vessels have a reduced calibre, resulting in placental ischemia and impaired oxygen transfer.[10][11] In response to growing ischemia, the placenta releases reactive oxygen species, chemokines, pro-inflammatory cytokines and anti-angiogenic factors into the maternal circulation thereby damaging the maternal endothelial cells and multi-organ dysfunction.[12][13] The inflammatory changes manifest in various haematological abnormalities which can potentially be used to assess the severity of disease.[4][7][10][15][16]

Platelets play a central role in the pathogenesis of preeclampsia. Endothelial damage leads to platelet activation, aggregation and increased consumption, resulting in thrombocytopenia.[5][17][18][19][20] [21][22][23] Simultaneously, increased platelet turnover leads to the release of larger and more reactive platelets, reflected as an increase in mean platelet volume.[24]

Platelet indices such as platelet count and MPV are routinely available, inexpensive and easily measurable parameters.[25] Their potential role as predictors of disease severity makes them particularly valuable in resource-limited settings. However, variability exists in the literature regarding their predictive accuracy.

Therefore, this study aimed to evaluate platelet indices as predictors of severity in preeclampsia.

Methods

This cross-sectional study was conducted in the Department of Physiology in collaboration with the Department of Obstetrics and Gynaecology at GSVM Medical College, Kanpur, after obtaining Institutional Ethics Committee approval. (Approval No: EC/BMHR/ 2024/ 186 dated 30-08-2024).

Written informed consent was obtained from all participants before enrollment in the study.

The sample size was calculated using Slovin's formula:

$$n = N/(1+ N(e)^2)$$

Where:

n = required sample size

N = total population (Estimated OPD)

e = margin of error (commonly 5% or 0.05)

A total of 283 pregnant women with gestational age ≥20 weeks were included in the study. Participants were categorized into three groups: normotensive (n=150), non-severe preeclampsia (n=65) and severe preeclampsia (n=68), based on standard diagnostic criteria.

Women with chronic hypertension, diabetes mellitus, renal disease, liver disorders, thyroid disorders, multiple pregnancies and infectious conditions were excluded.

Venous blood samples were collected under aseptic conditions. Platelet count and MPV were measured using an automated hematology analyzer based on the electrical impedance method.

Data were analyzed using statistical software. Continuous variables were expressed as mean ± standard deviation. Intergroup comparisons were performed using the Kruskal–Wallis test after checking for normality of data by Shapiro-Wilk test. Correlation analysis was carried out using Spearman's correlation coefficient. ROC curve analysis was performed to determine the diagnostic accuracy of platelet indices, and optimal cut-off values were obtained using the Youden index. A p-value <0.05 was considered statistically significant.

The study adhered to STROBE guidelines.

Results

The study included 283 pregnant women with a mean age of 27.96 ± 4.40 years. Among them, 53% were normotensive, 23% had non-severe preeclampsia, and 24% had severe preeclampsia.

Platelet count showed a significant decreasing trend with increasing severity of preeclampsia. Women with severe preeclampsia had markedly lower platelet counts compared to non-severe and normotensive groups. In contrast, mean platelet volume showed a significant increasing trend, with the highest values observed in the severe preeclampsia group. (Table 1)

Correlation analysis demonstrated a strong negative correlation between platelet count and disease severity, indicating that platelet count decreases as severity increases. MPV showed a moderate positive correlation with severity. (Table 2)

ROC curve analysis revealed that platelet count had an AUC of 0.88, indicating excellent predictive ability. A cut-off value of <1.86 lakh/mm³ provided a sensitivity of 83.8% and specificity of 83.3%.

MPV showed an AUC of 0.80, indicating good predictive performance. A cut-off value of >11.1 fL yielded a sensitivity of 82.3% and specificity of 73.9%. (Table 3), (Figure 1)

Discussion

The present study demonstrated significant alterations in platelet indices with increasing severity of preeclampsia. Platelet count decreased while mean platelet volume increased ($p < 0.05$), reflecting enhanced platelet activation and consumption.

Thrombocytopenia in preeclampsia is attributed to endothelial dysfunction and microvascular thrombosis, leading to increased platelet destruction. Elevated mean platelet volume indicates the release of larger

Table 1: Comparison of Hematological parameters across the study groups

Parameter	Normotensive (n = 150) Mean ± SD (Median)	Non-severe PE (n = 65) Mean ± SD (Median)	Severe PE (n = 68) Mean ± SD (Median)	H-value (χ^2)	p-value
Platelet Count ($\times10^5$/mm^3)	2.69 ± 0.57 (2.70)	1.96 ± 0.66 (1.96)	1.39 ± 0.61 (1.22)	130.1	<0.001*
MPV (fL)	10.19 ± 1.04 (10.10)	11.35 ± 1.25 (11.40)	12.08 ± 1.40 (12.25)	92.8	<0.001*

*Values expressed as mean ± standard deviation (SD) with median in parentheses.
Kruskal–Wallis test applied.

Table 2: Spearman's correlation between hematological parameters and severity of preeclampsia

Parameter	r-value (Spearman's)	p-value	Interpretation
Platelet Count ($\times10^5$/mm^3)	-0.679***	<0.001*	Strong negative correlation
Mean Platelet Volume (MPV) (fL)	0.573***	<0.001*	Moderate positive correlation

Spearman's correlation coefficient (r) used for analysis.
***p < 0.001, statistically highly significant.*

Table 3: ROC curve analysis of platelet count and mean platelet volume (MPV) for prediction of severe preeclampsia

Parameter	Cut-off	Sensitivity (%)	Specificity (%)	AUC (95% CI)
Platelet Count ($\times10^5$/mm^3)	1.86	83.8	83.3	0.88 (0.83–0.93)
MPV (fL)	11.10	82.4	74.0	0.80 (0.74–0.86)

ROC: Receiver operating characteristic; AUC: Area under the curve; CI: Confidence interval. Cut-off values derived using Youden index.

and more reactive platelets from the bone marrow.

These findings are consistent with previous studies of Salvi et al. (2022) [26] ($p < 0.001$), Tesfay et al. (2019) [27] ($p < 0.05$) and Dadhich et al. (2012) [28], all of whom reported similar trends. Walle et al. (2022) [29] and Sachan et al. (2021) [30] also highlighted MPV as a significant diagnostic marker. However, Mandala et al. (2024) [31] did not find a statistically significant difference in platelet indices ($p > 0.05$) and Umezuluike et al. (2021) [17] also reported non-significant differences between mild and severe groups, indicating variability across studies.

In contrast to studies where MPV showed superior predictive ability, the present study found that platelet count had better diagnostic performance than MPV, as reflected by a higher AUC. This difference may be due to variations in population characteristics, disease severity distribution and methodological differences.

These findings support the use of platelet indices as simple screening tools in routine antenatal care, especially in low-source settings.

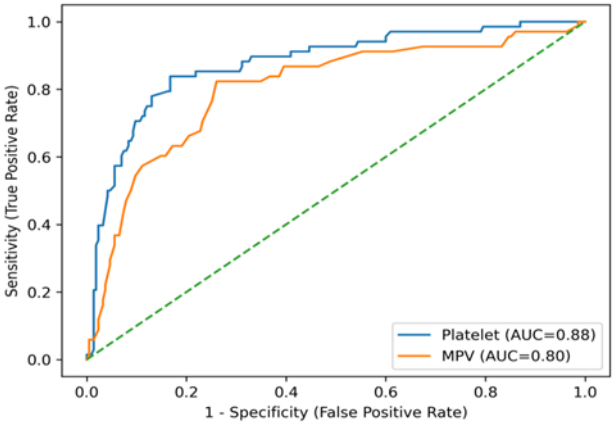

Figure 1: Receiver operating characteristic (ROC) curves of platelet count and mean platelet volume (MPV) for prediction of severe preeclampsia.

Strengths and limitations:

The major strength of this study lies in the use of simple, routinely available hematological parameters and the application of ROC analysis to derive clinically useful cut-off values. All laboratory investigations were performed using standardized and validated methods with automated analyzers, ensuring accuracy,

consistency and reproducibility of results. Additionally, the study design incorporated appropriate statistical analysis, including non-parametric tests and correlation analysis, which strengthened the validity of associations observed.

Despite its strengths, the present study has certain limitations. Being a cross-sectional study, it does not allow for establishing a causal relationship between the investigated parameters and the progression of preeclampsia. The study was conducted at a single tertiary care centre, which may limit the generalizability of the findings to the broader population. Additionally, the use of a non-probability convenience sampling technique may introduce selection bias. The study did not include longitudinal follow-up, which could have provided better insight into temporal changes in parameters and their predictive value for outcomes.

Conclusion

Platelet indices, particularly platelet count, are routinely available, cost-effective markers for assessing severity of preeclampsia and can aid in early identification of high-risk patients, particularly in resource-limited settings and facilitate timely intervention.

Acknowledgements: Nil

Declarations: NIL

Conflict of Interest: None

Funding: None

Ethical approval: Institutional Ethics Committee approval. (Approval No: EC/BMHR/ 2024/ 186 dated 30-08-2024).

References:

1.**Cunningham, F. G., Spong, C. Y., Casey, B. M., & Sheffield, J. S.** (2014). *Williams obstetrics* (24th ed.). McGraw Hill Education.

2.**American College of Obstetricians and Gynecologists**. (2020). Gestational hypertension and preeclampsia: ACOG practice bulletin No. 222. *Obstetrics & Gynecology, 135*(6), e237–e260.

3.**Jindal, M., Jindal, D., Naik, V., Sahasrabhojanee, M., & Pednekar, G.** (2021). Epidemiology and fetomaternal outcomes in cases of imminent eclampsia and eclampsia: A retrospective study. *Indian Journal of Obstetrics and Gynecology Research, 8*(1), 39–48.

4.**Kang, A., & Struben, H.** (2008). Pre-eclampsia screening in the first and second trimester. *Therapeutische Umschau, 65*(11), 663–666.

5.**Magee, L. A., Brown, M. A., Hall, D. R., Gupte, S., Hennessy, A., Karumanchi, S. A., et al.** (2022). The 2021 international society for the study of hypertension in pregnancy classification, diagnosis & management recommendations. *Pregnancy Hypertension, 27*, 148–169.

6.**Hurrell, A., Duhig, K., Vandermolen, B., & Shennan, A. H.** (2020). Recent advances in the diagnosis and management of pre-eclampsia. *Faculty Reviews, 9*, 10.

7.**Lambert, G., Brichant, J. F., Hartstein, G., Bonhomme, V., & Dewandre, P. Y.** (2014). Preeclampsia: An update. *Acta Anaesthesiologica Belgica, 65*(4), 137–149.

8.**Than, N. G., Romero, R., Györffy, D., Posta, M., Bhatti, G., Done, B., et al**. (2022). Molecular subclasses of preeclampsia characterized by longitudinal maternal proteomics study. *Journal of Perinatal Medicine, 51*(1), 51–68.

9.**Walle, M., Getu, F., Gelaw, Y., & Getaneh, Z.** (2022). Diagnostic value of hepatic and renal biochemical tests for detection of preeclampsia. *International Journal of General Medicine, 15*, 7761–7771.

10.**Bisson, C., Dautel, S., Patel, E., Suresh, S., Dauer, P., & Rana, S.** (2023). Preeclampsia pathophysiology and adverse outcomes. *Frontiers in Medicine, 10*, 1144170.

11.**Ridder, A., Giorgione, V., Khalil, A., & Thilaganathan, B**. (2019). Preeclampsia and uterine artery blood flow. *International Journal of Molecular Sciences, 20*(13), 3263.

12**,Phipps, E., Prasanna, D., Brima, W., & Jim, B.** (2016). Preeclampsia: Updates in pathogenesis and guidelines. *Clinical Journal of the American Society of Nephrology, 11*(6), 1102–1113.

13.**Mannaerts, D., Heyvaert, S., De Cordt, C., Macken, C., Loos, C., & Jacquemyn, Y.** (2019). Predictive parameters for preeclampsia. *Journal of Maternal-Fetal & Neonatal Medicine, 32*(9), 1412–1419.

14,**LaMarca, B., Cornelius, D. C., Harmon, A. C., Amaral, L. M., Cunningham, M. W., Faulkner, J. L., & Wallace, K.** (2016). Immune mechanisms in hypertension during preeclampsia. *American Journal of Physiology-Regulatory, Integrative and Comparative Physiology, 311*(1), R1–R9.

15.**Redman, C. W., & Sargent, I. L.** (2009). Placental stress and pre-eclampsia. *Placenta, 30*(Suppl A), S38–S42.

16.**Ives, C., Sinkey, R., Rajapreyar, I., et al**. (2020). Preeclampsia—Pathophysiology and clinical presentations. *Journal of the American College of Cardiology, 76*(14), 1690–1702.

17.**Umezuluike, B. S., Anikwe, C. C., Nnachi, O. C., Iwe, B. C. A., Ifemelumma, C. C., & Dimejesi, I. B. O.** (2021). Platelet parameters and outcomes in severe preeclampsia. *Heliyon, 7*(12), e08484.

18.**Mohammed, B. A. B. B.** (2017). Platelet indices among Sudanese pregnant women. *International Journal of Sciences, 6*, 71–75.

19.**Ciobanu, A. M., Colibaba, S., Cimpoca, B., Peltecu, G., & Panaitescu, A. M.** (2016). Thrombocytopenia in pregnancy. *Medica – Journal of Clinical Medicine, 11*(5), 55–60.

20.**Gernsheimer, T., James, A. H., & Stasi, R. (**2013). Thrombocytopenia in pregnancy. *Blood, 121*, 38–47.

21.**Freitas, L. G., Alpoim, P. N., Komatsuzaki, F., Carvalho, M. D., & Dusse, L. M.** (2013). Platelet indices in preeclampsia. *Hematology, 18*(6), 360–364.

22.**Bowersox, N. A., Talavera, F., Ramus, R. M., & Vera, E. V.** (2016). Thrombocytopenia in pregnancy. Medscape. Retrieved from https://emedicine.medscape.com/article/27867-overview#a1

23.**Annam, V., Srinivasa, K., Yatnatti, S., & Suresh, R.** (2011). Evaluation of platelet indices in preeclampsia and eclampsia.

24.**Mohapatra, S., Pradhan, B. B., Satpathy, U. K., Mohanty, A**., **& Pattnaik, J. R**. (2007). Platelet estimation and prognostic value. *Indian Journal of Physiology and Pharmacology, 51*(2), 160–164.

25.**Bellos, I., Fitrou, G., Pergialiotis, V., & Daskalakis, G.** (2018). Mean platelet volume in pre-eclampsia. *Hypertension in Pregnancy, 37*(4), 174–180.

26.**Salvi, P., Gaikwad, V., & Ali, R**. (2022). Platelet indices in preeclamptic patients. *New Indian Journal of Obstetrics and Gynecology, 9*(1), 69–73.

27.**Tesfay, F., Negash, M., Alemu, J., Yahya, M., Teklu, G., Yibrah, M., et al.** (2019). Platelet parameters in prediction of preeclampsia. *PLoS One, 14*(11), e0225536.

28**.Dadhich, S., Agrawal, S., Soni, M., Choudhary, R., Jain, R., Sharma, S., & Saini, S. L**. (2012). Predictive value of platelet indices. *Journal of South Asian Federation of Obstetrics and Gynaecology, 4*(1), 17–21.

29.**Walle, M., Asrie, F., Gelaw, Y., & Getaneh, Z.** (2022). Role of platelet parameters in diagnosis of preeclampsia. *Journal of Clinical Laboratory Analysis, 36*(4), e24305.

30.**Sachan, R., Patel, M. L., Vandana, Sachan, P., & Shyam, R.** (2021). Platelet indices and prediction of preeclampsia. *Journal of Family Medicine and Primary Care, 10*(2), 838–843.

Mandala, D., Puligujja, P., & Kumar, K. H. (2024). Haematological parameters in preeclampsia. *Journal of Academic Medicine and Pharmacy, 7*(2), 1186–1190