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Association Between Platelet Indices and Preeclampsia Severity: A Prospective Study in Central India

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ABSTRACT

Background: While it is generally accepted that haemoglobin concentration decreases and white blood cell count increases during normal pregnancy, changes in platelet indices remain less well established. This study aimed to evaluate the relationship of platelet indices with normal pregnancy, preeclampsia, and the severity of preeclampsia. **Methods:** A total of 80 pregnant women were included in the study conducted at the Departments of Obstetrics & Gynaecology and Pathology, Saraswathi Institute of Medical Sciences, Hapur, Uttar Pradesh. Participants were divided into two groups: Group N (n=40; normotensive pregnant women) and Group P (n=40; preeclampsia patients). Platelet indices including platelet count, mean platelet volume (MPV), and platelet distribution width (PDW) were measured in all participants. Data were analyzed using IBM SPSS version 14, and a p-value <0.05 was considered statistically significant. **Results:** Platelet counts <2 lakh were observed in 52.5% of Group P and 50% of Group N participants. Thrombocytopenia (platelet count 50,000–1.5 lakh) was seen in 32.5% of Group P, whereas none in Group N had low platelet counts. PDW of 15 fl was seen in 52.5% of the overall cohort; 50% of Group N and 60% of Group P had this value. Among the 40 preeclampsia patients, 17 (42.5%) had severe preeclampsia, of which 54% had platelet counts <1.5 lakh, 82.3% had PDW between 15–16 fl, and 63.7% had MPV ranging from 10–11 fl. **Conclusions:** Platelet count tends to decrease, while MPV and PDW increase as pregnancy progresses. These changes are significantly more pronounced in preeclamptic women, especially in severe cases, than in normotensive pregnancies.

INTRODUCTION

Pregnancy-induced hypertension (PIH) is a significant complication affecting approximately 5–10% of all pregnancies. It is associated with a hypercoagulable state and a range of hematological abnormalities, of which thrombocytopenia is the most common. In some cases, thrombocytopenia may become severe enough to be life-threatening [1–3]. The underlying mechanism involves increased platelet adherence at sites of endothelial damage, leading to enhanced platelet consumption and secondary

destruction. Additionally, platelet activation and degranulation shorten the platelet life span and increase the presence of immature platelets in the peripheral blood [1,4].

Variations in platelet count are often accompanied by changes in platelet indices such as mean platelet volume (MPV), platelet distribution width (PDW), and plateletcrit. MPV reflects the average platelet size, while PDW indicates the variability in platelet size. In conditions of peripheral platelet destruction, the bone marrow responds by releasing larger, immature platelets, resulting in an increased MPV. PDW, on the other hand, increases due to the coexistence of large and normal-sized platelets, which is indicative of platelet activation. Larger platelets are generally more reactive due to a greater number and size of pseudopodia, further contributing to elevated PDW values [5].

Plateletcrit, analogous to hematocrit for red blood cells, represents the total platelet mass in circulation. It is a product of platelet count and MPV, thus reflecting both the number and size of platelets. Since larger platelets are more functionally active, plateletcrit is thought to be a more reliable indicator of hemostatic capacity than platelet count alone. It is the circulating platelet mass, rather than the absolute count, that is regulated by the body to maintain hemostasis. A low plateletcrit value indicates diminished platelet activity and function [6–9].

A platelet count below 100,000/μL is often considered a marker of severe disease. Although low platelet count is a recognized feature of worsening preeclampsia and eclampsia, studies have also shown that platelet activation and aggregation can occur even in non-thrombocytopenic patients with preeclampsia [2,10].

Platelet indices—including platelet count, MPV, and PDW—are components of the complete blood count (CBC), a routine and widely available test. While the clinical utility of these indices in vascular disorders such as preeclampsia has been investigated, their prognostic and diagnostic value remains inconclusive [11]. A progressive decline in platelet count is often observed with worsening preeclampsia, which usually returns to normal post-delivery [12]. Moreover, MPV has been found to increase during pregnancy and is significantly higher in women with preeclampsia—even before clinical symptoms manifest—suggesting its potential role as an early marker. PDW has also been proposed as a practical indicator of coagulation activation and platelet function abnormalities in thrombocytosis-related disorders [11,13]. Therefore, this study aims to evaluate whether platelet indices measured during pregnancy—specifically platelet count, MPV, and PDW—can serve as potential markers for the prediction and severity assessment of preeclampsia.

METHODS

A prospective case-control study was conducted on 100 pregnant women at the Departments of Obstetrics & Gynaecology and Pathology, Saraswathi Institute of Medical Sciences, Hapur, Uttar Pradesh. The study cohort was divided into two groups: Group N (n = 40; normotensive pregnant women) and Group P (n = 40; patients with preeclampsia). Institutional Ethics Committee approval was obtained prior to the study, and written informed consent was taken from all participants.

Patients diagnosed with preeclampsia were categorized based on the American College of Obstetricians and Gynecologists (ACOG) guidelines. Mild preeclampsia was defined

as blood pressure ≥140/90 mmHg measured on two occasions at least 4 hours apart, with or without significant proteinuria. Severe preeclampsia was defined as blood pressure ≥160/110 mmHg and proteinuria >5 g/24 hours.

Exclusion criteria included postpartum patients and those with known coagulation disorders or systemic illnesses such as idiopathic thrombocytopenic purpura, sickle cell disease, viral hepatitis, cholestatic jaundice, acute fatty liver, malaria, drug-induced jaundice, dengue fever, and chronic hypertension.

Blood pressure and urine protein levels were measured in all participants. Additional clinical data such as presence of nausea, vomiting, headache, oliguria (urine output <400 mL/24 hours), and laboratory findings including haemogram, hypoproteinaemia, elevated liver enzymes, deranged kidney function tests (KFT), and evidence of haemolysis were recorded. Platelet indices including platelet count, mean platelet volume (MPV), and platelet distribution width (PDW) were measured as part of the evaluation.

Data Analysis

All data were analyzed using IBM SPSS software version 14. Frequency distribution and cross-tabulations were used to generate tables. Quantitative variables were analyzed using Student's *t*-test, and categorical variables were compared using the Chi-square test. A p-value <0.05 was considered statistically significant.

OBSERVATION AND RESULT:

Mean age of study cohort was 25.9±5.03years. Most of the subjects in Group P [36 (90%)] and Group N [34 (85%)] belong to age group of 21-25 years.

Table no.1: Comparing platelet indices and platelet distribution width between normal pregnancy and preeclampsia patients

Platelet indices		Group N (%)	Group P (%)
Platelet count	<50000	0(0)	2(5)
	51000-1 Lakhs	0(0)	4(10)
	1.1-1.5 Lakhs	0(0)	7(17.5)
	1.51-2 Lakhs	19 (47.5)	17(42.5)
	2.1-2.5 Lakhs	11(27.5)	8(20)
	2.51-3 Lakhs	6(15)	6(15)
	>3 Lakhs	4(10)	6(15)
Platelet distribution width (fl)	10	2(5)	0(0)
	11	5(12.5)	1(2.5)
	12	2(5)	0(0)
	13	0(0)	0(0)

	14	6(15)	4(10)
	15	21(52.5)	25(62.5)
	16	4(10)	9(22.5)
	17	0(0)	1(2.5)

Data is expressed as no of patients (percentage), Group N (n = 40, normal pregnant women) and Group P (n = 40, pre-eclampsia patient). In pre-eclampsia 32.5% had platelet count between 50 thousand to 1.5 lac. No normal case had such low value. 67.5% of pre-eclampsia and 47.5% of normal patients had count less than 2 lac. Maximum (52.5%) had PDW as 15fl. 62.5% of normal patients had PDW value as 15 fl. However, 60% of pre-eclampsia had PDW value as 15 fl

Table 2: Showing platelet indices with severity of preeclampsia.

Platelet indices		**Severe preeclampsia (n=17)**
Platelet count	<50000	2(11.8)
	51000-1 Lakhs	4(23.5)
	1.1-1.5 Lakhs	4(23.5)
	1.51-2 Lakhs	1(5.9)
	2.1-2.5 Lakhs	3(17.6)
	2.51-3 Lakhs	2(11.8)
	>3 Lakhs	1(5.9)
Platelet distribution width (fl)	14	2(11.8)
	15	10 (58.8)
	16	4 (23.5)
	17	1 (5.9)
MPV	9	3 (17.6)
	10	7 (41.2)
	11	4 (23.5)
	12	1 (5.9)
	13	2 (11.8)
	>13	1 (5.9)

Data is expressed as no of patients (percentage), MPV; mean platelet volume, 17 cases of severe pre eclampsia were analysed for platelet count. Out of which maximum (47%) had platelet count <1.5 lac and rest had normal count. 82.3% of severe pre-eclampsia had PDW as 15-16fl. 63.7% Severe Pre-eclampsia had MPV range as 10-11fl.

DISCUSSION

Preeclampsia remains a major cause of maternal and fetal morbidity and mortality, being associated with complications such as intrauterine growth restriction (IUGR), preterm delivery, and placental abruption [8]. In addition, women who experience preeclampsia are at increased risk for long-term health issues including premature cardiovascular, cerebrovascular, and peripheral arterial diseases [15,16].

This prospective case-control study included 80 pregnant women, with 40 normotensive controls and 40 preeclampsia cases. The objective was to evaluate the role of platelet indices in the assessment of preeclampsia severity. In developing

countries like India, pregnancy-induced hypertension (PIH) continues to be a significant contributor to maternal and perinatal morbidity and mortality [17].

In the present study, the mean age of patients was 25.9 ± 5.03 years, which aligns with findings by Prakash et al. (24.75 ± 3.36 years) [18], although Onisai et al. reported a slightly higher mean age [19].

The mean platelet count in the preeclampsia group was 1.89 lakh/cu mm, comparable to results from Mohapatra et al. (1.8 lakh/cu mm) [14]. These findings are consistent with those from several other studies [12,21]. Siddiqui et al. reported thrombocytopenia in nearly 50% of preeclampsia patients; similarly, our study observed thrombocytopenia in 35% of cases [22]. The thrombocytopenia in PIH is likely due to increased platelet consumption from enhanced adherence to damaged vascular endothelium.

A significant increase in MPV and PDW was observed in preeclamptic patients compared to normotensive women. In our study, the mean MPV in preeclampsia was 9.74 fl, similar to the findings of Giles et al. (9.9 fl) [23]. The mean PDW was 15.4 fl, also comparable with Giles et al. (16 fl) [23], and similar results were reported by Siddiqui et al. in a study involving 125 patients [22].

Notably, MPV showed a progressive rise in preeclamptic patients. Nooh et al. reported that MPV increases significantly in preeclamptic women (with and without severe features) starting from 24 weeks gestation until delivery ($p = 0.003$) [14]. They also noted that MPV elevation preceded clinical diagnosis of preeclampsia by 2–8 weeks. Similarly, Dundar et al. reported MPV increase occurring approximately 4.6 weeks (range 2.8–5.9 weeks) before symptom onset [11]. These findings support the potential role of MPV as a modest yet useful early marker for predicting preeclampsia severity [12,15].

PDW was also found to rise with increasing severity of preeclampsia in our study, consistent with previous research [12,24]. Yang et al. suggested a PDW cut-off value of >13.5 fl for predicting preeclampsia severity [6], while Freitas et al. proposed a higher cut-off of >18.3 fl [24].

However, literature reveals some conflicting evidence regarding changes in platelet indices between normotensive and preeclamptic pregnancies. While some researchers have found significant differences, others have not [11–13, 25–27]. These discrepancies may be attributed to variability in measurement techniques. Platelet indices measured using EDTA are known to vary with time, and differences in automated analyzers can yield results that differ by as much as 40% [25].

In our study, among the 40 preeclamptic patients, 17 (42.5%) had severe preeclampsia. Of these, 47% had platelet counts below 1.5 lakh/cu mm. Moreover, 82.3% had PDW values between 15–16 fl, and 63.7% had MPV in the range of 10–11 fl. These findings are supported by Annam et al., who also reported that MPV and PDW values increased proportionally with the severity of preeclampsia [28]. This positive correlation between thrombocytopenia and PIH severity is consistent with findings from studies by Mohapatra et al., Walker et al., and Taylor et al. [20,29,30].

CONCLUSION

This study demonstrates that platelet count decreases, while MPV and PDW increase as pregnancy progresses—changes that are significantly more pronounced in preeclampsia than in normotensive pregnancies. Platelet indices (platelet count, MPV, and PDW), being simple, cost-effective, and rapidly obtainable through routine complete blood count testing, may serve as valuable tools for monitoring the progression and severity of PIH.

The study findings support the potential role of platelet indices as consistent and reliable markers for the early detection and prognosis of preeclampsia. Monitoring these indices could assist clinicians in predicting disease progression and tailoring timely interventions to reduce maternal and fetal risks.

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