Original Article

Role of platelet indices in pre-eclampsia: a case-control study at teaching hospital, Nepal

Prabesh Kumar Choudhary[1], Narendra Pandit[1], Niraj Nepal[1], M Yadav[1]

[1]Department of Pathology, Nobel Medical College Teaching Hospital and Research Centre, Biratnagar, Nepal

ABSTRACT

Background: Preeclampsia is one of the major health-related ailments causing increased maternal morbidity and mortality, and complicates up to 10% of pregnancies. The study aims to find out the utility of platelet indices for early prediction of preeclampsia.

Materials and Methods: It was a prospective case-control study that included a total of 84 patients (42 in the study group with preeclampsia and 42 controls with normal blood pressure) during a one-year study period. Fresh blood samples (2 ml) were collected for the platelet indices - platelet count (PC), plateletcrit (PCT), mean platelet volume (MPV), and platelet distribution width (PDW) – and were analyzed by fully automated cell counter by impedance method, and compared between the two groups.

Results: Both groups were comparable in terms of age, parity, gestational period, and body mass index. The PC and MPV showed a significant difference; (1.98±0.7 vs. 2.42±0.8; p= 0.01) and (12.44±0.6 vs.10.0±0.48; p= 0.03) between the two groups respectively. However, the difference between the two groups was not statistically significant for PCT and PDW.

Conclusions: The low platelet count and an increased mean platelet volume were significant in patients with preeclampsia compared to the control group. It could be a marker for early diagnosis of preeclampsia in pregnancy.

Correspondence:

Dr. Prabesh Kumar Choudhary, MD
Associate Professor, Department of Pathology
Nobel Medical College Teaching Hospital and Research Centre,
Biratnagar, Nepal
ORCID ID: 0000-0001-7431-5820
Email: khushbudev.dev@gmail.com

INTRODUCTION

Preeclampsia is a pregnancy-related medical condition defined as de novo hypertension, occurring after 20 weeks of pregnancy, along with proteinuria. It is one of the major health problems causing increased maternal morbidity and mortality, and complicates 3–8% of pregnancies.[1-3] Despite intensive investigation, we still cannot adequately predict, treat, or prevent preeclampsia.

There are several markers of platelet activation, which include platelet count (PC), platelet distribution width (PDW), mean platelet volume (MPV), and plateletcrit

(PCT). These indices are claimed to have a role as early markers of thromboembolic diseases, however, they are underreported and less understood among clinicians and surgeons.[4-6] Platelet indices are easily available in our routine CBC analyzer and are cost-effective. These parameters can be used for the prediction of preeclampsia before the derangement occurs in prothrombin time (PT), activated partial thrombin time (APTT) and thrombin time (TT). Furthermore, thrombocytopenia in preeclampsia is a well-known hematological abnormality and is usually due to its consumption during abnormal activation of the coagulation system.[7-9]

This study was hence done to find out a relationship between the platelet indices; platelet count, plateletcrit, mean platelet volume and platelet distribution width with preeclampsia and try to assess whether these parameters could be used as markers for early diagnosis, as well as for prognostication of the disease.

MATERIALS AND METHODS

This study is a prospective cross-sectional study done in the Department of Pathology and Gynecology, at Nobel Medical College and Teaching Hospital from December 2021 to January 2022. The study was approved by the Institutional Review Committee (IRB- 471/2021) and informed consent was taken from the patients before enrollment. A total of 42 cases of preeclampsia and 42 cases of age-matched healthy (non-preeclampsia) pregnant females with gestational periods more than 20 weeks as control cases were included in the study. Those patients with sepsis, diabetes, renal or hepatic disorders, or prior hemorrhagic disorders were excluded. Preeclampsia was defined by the new onset of hypertension and proteinuria or the new onset of hypertension plus significant end-organ dysfunction with or without proteinuria, typically presenting after 20 weeks of gestation or postpartum. Hypertension was defined by systolic blood pressure > 140 mm Hg and/or diastolic blood pressure > 90 mmHg on two separate occasions made at least six hours apart and proteinuria was defined by urinary protein excretion > 300 mg/24h.

Two milliliters of fresh blood was collected in ethylene diamine tetra acetic acid (EDTA) tube using standard protocol in the study and control group after 20 weeks of pregnancy as part of routine investigation. All samples were analyzed by fully automated cell counter by impedance method. Platelet count and indices including mean platelet volume (MPV), platelet distribution width (PDW), and plateletcrit (PCT) were measured. The low platelet count given by the machine was always verified by the manual method (Fresh blood smear and improved Neubauer chamber). Patient demographics (age, parity, gestational age, and body mass index) were also recorded. All data were noted in Windows Excel. A comparison between the above-mentioned platelet indices was made between the study and the control group.

The statistical data were entered in Microsoft Excel and analysis was done by SPSS version 17. The mean and standard deviation of all the parameters were calculated for the study and control group. The comparison of platelet indices between the cases and control was done using the student 't' test or Chi-square test (where appropriate) and the p-value < 0.05 was considered to be significant.

RESULTS

A total of 84 patients were included in the study. There were 42 patients in preeclampsia (study group) and 42 in the control group who were normotensive. Both the groups were comparable in terms of age (yrs) (26.5 vs. 28.01; p=0.40), parity (2.5±1.5 vs.2.3±1.4; p=0.42), gestational week (31.8±4.1 vs. 33.4±4.0; p=0.04) and body mass index (29.0 vs. 30.7; p=0.72).

Looking at the platelet indices of the two groups; the platelet count was significantly lower in the study group compared to the control group (1.98±0.7 vs. 2.42±0.8; p= 0.01). Similarly, the Mean Platelet Volume (MPV) too, was significantly increased in the study group compared to the control group (12.44±0.6 vs.10.0±0.48; p= 0.03). However, the Platelet Distribution Width and Plateletcrit were comparable between the two groups and were non-significant as shown in Table 1.

Table 1: Comparison of Platelet Indices between the study group (preeclampsia) and control (normotensive) group

Platelet Indices	Study group (n=42)	Control group (n=42)	P-value
Platelet count (mean) (x103/mm3)	1.98±0.7	2.42±0.8	0.01
MPV (fL)	12.44±0.6	10.0±0.48	0.03
PDW	12.5±2.55	11.8±1.2	0.54
PCT (%)	0.20±0.07	0.21±0.06	0.48

DISCUSSION

The present study found that the platelet count (PC) was significantly decreased in patients with preeclampsia compared to the control group; and similarly, the mean platelet volume (MPV) too was significantly increased in the study group compared to the control group. Hence, our study emphasizes that the common, cheap, and easily available platelet indices should not be ignored when evaluating complete blood profile in pregnancy, as they may predict the state of preeclampsia in these patients.

Mean Platelet Volume in our study was increased compared to the control group. Many studies are showing increased MPV values, especially in the second and third trimesters in preeclampsia.[5,10-11] This is because of the disruption of the microcirculation with endothelial damage in patients with preeclampsia. This endothelial damage leads to micro-

thrombus formation that decreases platelet count increasing platelet destruction. There is an increase in MPV values of younger and larger platelets as a result of bone marrow stimulus for platelet production with increased MPV values.[6] This MPV value was also compared in other studies, where it was increased in preeclampsia, and was higher with severe form of disease, with a highly significant correlation between increased blood pressure and MPV value.[4,7,12]

Similar to MPV, a significantly low platelet count was observed in the patients with preeclampsia compared to the control group, and similar results have been observed in various other studies and have been suggested to be an early marker of preeclampsia.[8-9] It occurs as a result of the injured endothelium activating platelets, leading to elevated consumption of platelets. Preeclampsia causes about 20% of cases of thrombocytopenia in pregnancy Further, very low platelet (< 1,00,000 cells/mm³) suggests a severe form of preeclampsia. A study by Reese JA et al commented that, when a pregnant woman's platelet count falls below 150,000 per μL, evaluation and continued monitoring are warranted to exclude preeclampsia and its severe form.[13] Similarly, in a study by Benjamin S et al, a progressive decrease in mean platelet count was noted in mild and severe pre-eclamptic compared to normotensive participants, and suggested the use of these indices for early disease identification.[14] The observed decline in PCT may be due to accelerated platelet destruction while increased MPV, a marker of platelet activation, suggests an ongoing increased marrow activity.

Several studies have found a significant increase in platelet distribution width observed in preeclampsia patients compared to the normotensive group. The values were higher in the severe form of preeclampsia. Similar findings were reported by various authors.[6-7,15] A few authors have also reported no significant difference as was seen in the present study. The increase in PDW is a marker of platelet activation suggesting active turnover of platelet production from the bone marrow due to peripheral platelet consumption. Similarly, the PCT was normal in the present study with no significant difference between the two groups as reported by several other studies.[11,16] The PCT was normal because of the low normal platelet count in our patients with preeclampsia.

CONCLUSIONS

The low platelet count and an increased mean platelet volume were significant in patients with preeclampsia compared to the control group. It could be a marker for early diagnosis of preeclampsia in pregnancy. Similarly, PDW and PCT were similar between the two groups. As these tests are easily available and economical and done as a part of routine investigations, they could be used as an early prediction of preeclampsia, however, further larger studies with large sample sizes in our setup are required.

Conflict of interest: None

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