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Original Research Article

Assessment of Platelet Indices and Counts and Their Impact in Pre- and During Eclampsia

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Abstract

Background: Three to eight percent of pregnancies are complicated by preeclampsia, one of the primary health issues that contribute to maternal morbidity and mortality. Preeclampsia's pathophysiology has been theorized to be influenced by changes in coagulation and fibrinolysis. The most serious health danger to both the mother and the fetus during pregnancy is preeclampsia. The use of platelet characteristics in preeclampsia diagnosis is not expanding in Ethiopia, despite the fact that they are one of the proposed indicators for the prediction of preeclampsia. Preeclampsia and normal pregnancy's platelet patterns are not well understood.

Aim: The purpose of this study is to determine how platelet counts and indices relate to pre-eclampsia and eclampsia. The goal of this study was to identify the platelet index pattern in preeclamptic women in our study population.

Material and Method: The study was conducted in the Department of Pathology and was prospective with case control. The study included 100 consenting patients, 50 cases of pre-eclampsia (blood pressure> 140/90 mmHg and proteinuria > 300 mg/day in patients > 20 weeks gestation) and 50 healthy pregnant women of similar age with a gestational age of at least 20 weeks. Prior to enrollment, participants received written informed consent with information on the study objectives, impact and significance of the data from. All information was anonymized to protect confidentiality. The control group for the study consisted of 100 healthy pregnant women with no diagnosis of preeclampsia, gestational or chronic hypertension, or proteinuria, with identical demographics and gestational age. An automated hematology analyzer was used to test the blood samples.

Results: In the current study, the average age of the pregnant women was 14.37 + 2.36 years. When compared to the control group, the platelet count in the pre-eclampsia and eclampsia groups had dramatically dropped. Comparing the pre-eclampsia patients to the control group, the MPV, PDW, and P-lcr levels were all elevated according to the degree of pre-eclampsia. While the fundamental characteristics (age, parity, and BMI) of the two trial groups (50 women in each arm) did not statistically differ, the gestational age was significantly lower in the preeclampsia patients.

Conclusion: The estimation of platelet indices approach can be thought of as an early, affordable, and quick procedure for determining the severity of PIH cases, to sum up. Platelet indices can be a helpful screening test for the early detection of pre-eclampsia and eclampsia in the clinical setting. Additionally, platelet indices can determine how pregnant women will fare with this illness. In both pre-eclampsia and eclampsia, platelet status can be regularly

determined with P-lcr. Thus, maternal and perinatal outcomes may be significantly impacted by platelet indices. Preeclampsia was linked to an increase in MPV and PDW.

Keywords: Preeclampsia, platelets, PDW, mean platelet volume, Platelet indices, including platelet count, platelet distribution width, and Platelet crit.

Introduction

One of the main health issues during pregnancy is preeclampsia. It significantly increases maternal and perinatal morbidity and mortality and complicates somewhere between 3% and 8% of pregnancies. [1–4] Although the precise pathophysiology of preeclampsia is not fully understood, a number of factors, such as inadequate trophoblastic invasion of the maternal vascular bed and a resulting decrease in placental blood flow, have been implicated in its development. [5,6] Maternal endothelial failure, increased vascular permeability, and extensive systemic dysfunction are brought on by placental under perfusion. [7] When platelets come into touch with damaged endothelium, the coagulation system is stimulated, increasing platelet consumption and bone marrow production. [8]

Preeclampsia is a syndrome that appears after 20 weeks of pregnancy and is characterized by hypertension and proteinuria. About 6–8% of all pregnancies are affected, mostly primigravidas. [9] It is one of the leading causes of illness and mortality in pregnant women and fetuses. There are numerous hypotheses put out for the pathophysiology of preeclampsia. Prostaglandins, endothelin, and nitric oxide are released and metabolized by placental and extraplacental tissues in an unbalanced manner as a result of fetal placental hypoxia, which develops when the uteroplacental vasculature is not developed enough to provide the growing fetus with adequate blood supply. Along with elevated lipid peroxidation and other unidentified processes, these contribute to the hypertension, platelet activation, and systemic endothelial dysfunction symptoms of preeclampsia. [10,11] The most frequent hematological anomaly found in preeclampsia is thrombocytopenia, which may result from platelet consumption during aberrant activation of the coagulation system. [12,13,14] D-dimer, soluble vascular endothelial growth factor receptor, and platelet distribution width may all be utilized as indicators of preeclampsia, according to numerous research; however, due to the variable effects of preeclampsia in late pregnancy on the coagulation-fibrinolytic system, no firm conclusions can be made. [15]

The World Health Organization (WHO) describes direction as locating recent knowledge based on research to give doctors further pre-eclampsia understanding. [16] Even though a variety of biochemical indicators have recently been identified for predicting preeclampsia and despite multiple studies over the past decade to develop a reliable test, their utility in hospitals with limited resources is debatable and some of them are still being studied. [17] Due to its ease of use, regularity, low cost, and greater accessibility in the clinical laboratory, the evaluation of platelet (PLT) indices can be considered a possible candidate marker in this context. [18] Although there is evidence connecting PLT activity to preeclampsia, the practice of using them in diagnosis is still in its early stages in our environment. Research conducted in

Ethiopia revealed that despite the clinical advantages, only 10% of physicians used the Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW) in clinical practice. [19,20] Preeclampsia is unquestionably one of the reasons of maternal thrombocytopenia, and platelet counts quickly rise following delivery. According to several research, thrombocytopenia is brought on by the accumulation of platelets in areas with endothelial injury. [21] More research is required to acquire a clear picture because reports of a significant difference in PLT indices between preeclampsia and normal pregnancy have stirred disagreement. We want to determine whether these parameters can be used to predict the prognosis of the condition and to aid in early diagnosis. This study's objective is to assess the correlation between platelet indices and the severity of preeclampsia.

Material and Methods

The study was carried out in the Department of Pathology and was prospective, case-controlled. The trial involved 100 consenting patients, 50 cases of preeclampsia (BP >140/90mmHg and proteinuria >300mg/day in patients of >20 weeks gestation), and 50 healthy pregnant women of similar ages who had gestations of at least 20 weeks. Participants signed a written consent form that explained the purpose of the study, its implications, and the value of the collected data before they were admitted. To ensure confidentiality, all data were rendered anonymous. Cases of preeclampsia were defined as having a systolic blood pressure between 140 and 160 mmHg, a diastolic blood pressure between 90 and 110 mmHg on two measurements taken six hours apart, or cases with increases in blood pressure of 30 mmHg in the systolic range and 15 mmHg in the diastolic range compared to pre-pregnancy values in addition to proteinuria greater than 300 mgThe eclampsia group includes cases that meet the following criteria: Blood pressure greater than 160/110 mmHg, thrombocytopenia, oligouria (5 gm of protein in 24 hours' worth of urine or > +++ of protein in a spot urine sample).

For obstetrics history, the medical records of the patients and controls were examined (age, parity, and gestational age). An already created questionnaire was used to gather the data. Body mass index (BMI), expressed as kg/m2, was computed using the mother's height and weight. Maternal hemogram data were obtained at the presentation. Hemoglobin level, white blood cell (WBC) count, and platelet indices, including PC, MPV, PDW, and PC to MPV ratio, were all included in the hemogram. Hematology analyzers that are automated were used to perform the hemogram. Patients with pre-existing renal, hematological, diabetic mellitus, or hypertension were not allowed to participate in the trial.

Sample Collection:

The sample (2 ml) was gathered in ethylene diamine tetraacetic acid (EDTA) vials under aseptic conditions. The platelet indices, such as platelet count (PC), mean platelet volume (MPV), platelet distribution width (PDW), and platelet crit, were measured on the Automated Counter Sysmex XN1000 during the analysis of the samples (PCT). Between cases and controls, a comparison of the aforementioned platelet indices was done.

Preeclampsia: When a previously normotensive woman's blood pressure rises to at least 140/90 after the 20th week of pregnancy, along with protein urea (protein excretion at least 0.3g per 24 hours, +2 protein by dipstick), the condition is referred to as hypertension in pregnancy, according to the International Society for the Study of Hypertension in Pregnancy.[22]

Non-Severe preeclampsia: two measurements of systolic blood pressure >140-160 mmHg and diastolic blood pressure 90-110 mmHg, taken 4-6 hours

apart, after 20 weeks of pregnancy, with proteinuria of >300 mg/l in 24 hours or more, with/without edema, and after 20 weeks of gestation. SBP>160 & DBP>110mmHg after 20 weeks of gestation indicate severe preeclampsia. Epigastric discomfort or right upper quadrant pain, oliguria, Eclampsia, HELLP (Haemolysis, Elevated Liver enzymes, and Low Platelet count) syndrome, an elevated blood creatinine level, IUGR (Intra Uterine Growth Restriction), and pulmonary edema are possible symptoms. [22]

Statistical analysis

For both cases and controls, the median and interquartile ranges of each parameter were calculated. The Mann-Whitney test was used to compare the platelet indices between the cases and controls, and a significance level of $p<0.05$ was deemed appropriate. The Spearman's rank correlation coefficient (r) and the p-value were evaluated in order to determine a correlation between the MPV and BP as well as the PDW and BP (r). P 0.05 was regarded as a significant value.

Result: -

In the current study, the average age of the pregnant women was 14.37 + 2.36 years. When compared to the control group, the platelet count in the pre-eclampsia and eclampsia groups had dramatically dropped. Comparing the pre-eclampsia patients to the control group, the MPV, PDW, and P-lcr levels were all elevated according to the degree of pre-eclampsia.

Table 1: Comparison of Platelet Indices between the control group and Eclampsia.

Parameters	Control group	Pre-eclampsia	Eclampsia
Platelet count (lacs/mm)	1,15,430±22,180	1,22,300±21,250	1,11,000±27,245
Mean Platelet Volume (fl)	6.33 ±1.12	8.28 ± 1.25	9.01± 1.13
Platelet Distribution Width (fl)	9.05 ± 1.37	12.41 ± 1.56	13.68 ± 2.10
Platelet large cell ratio (%)	14.42± 2.11	20.71 ± 3.18	20.49 ± 3.34

Table 2: Characteristics of the cases and controls

Variable	Cases (n=50)	Controls (n=50)
Age, years	20.3 ± 3.0	20.0±11.1
Parity	1.2± 1.4	1.3± 1.2
Gestational age, weeks	22.4± 2.1	22.4± 2.0
Body mass index, kg/m2	21.0 ± 3.3	26.5± 3.1

Age, parity, and BMI did not significantly differ between the two trial groups (50 women in each arm), however gestational age was significantly lower in preeclampsia patients.

Discussion

One of the most prevalent obstetric issues experienced by pregnant women is hypertension. [23] Laboratory testing are used more and more by obstetricians to treat pregnant patients. Performing numerous laboratory tests on groups of patients and reporting the results with a mean and standard deviation or expressing limitations as multiples of the median has come to be considered normal procedure with the assumption that individuals will follow these mean changes. While this is generally true for some trends, such as a drop in hemoglobin or an increase in the total number of white blood cells, the variety between people is so great that even for these specific indices, the mean values are poor indicators of how people will react. [24]

In the present investigation, PDW did not significantly differ from each other. This supports earlier research by Doan et al. [25], who discovered no discernible

change in PDW between women with severe preeclampsia, moderate preeclampsia, and healthy controls. Nevertheless, new research has shown that women with preeclampsia had a much greater amount of PDW. [26,27,28]

The work by Han, Xiaojie, Hongmei, et al. [15] and our findings on platelet count are in agreement. They also found no difference between patients with normal, moderate preeclampsia, and severe preeclampsia, and they proposed that the lower platelet count may be caused by the gestation itself rather than the preeclampsia. As a result, even though the platelet count is a key indicator of preeclampsia, it cannot be utilized as a reliable diagnostic tool.

The MPV values rose with the length of gestation and the severity of the condition, according to Dadhich et al. [29] In our study, patients with more severe disease had higher MPV levels, and there was also a highly significant association between the elevated BP and MPV values. A large rise in the MPV was discovered by Dundar et al. [30] weeks before preeclampsia was identified. But according to Al Sheeha et al. [31] and Altinbas et al. [32], there is no appreciable distinction between preeclampsia patients and healthy pregnant women in general. As a result, it can be inferred that the MPV can be a useful marker in the diagnosis, prediction, and prognosis of preeclampsia.

The current study found that pre-eclamptic pregnant women had a lower PCT value than pregnant normotensive women. This is consistent with research results from Brazil and Korea. [33,34] In contrast to the current study, research from Sudan [35] and Turkey [36] reported no appreciable differences in PCT between pregnant women with pre-eclampsia and normotensive blood pressure. The differences can be caused by variations in the hematological analyzer, delays in sample processing, or the anticoagulant being used. Because EDTA-induced PLT activation and time-dependent activation could raise MPV values, which could have an impact on PCT calculations.

The platelet concentration in preeclampsia has been shown to significantly decrease by Karateke et al. [37] and Freitas et al. [38] This may be because the PCT is computed using platelet counts, and in our study, the platelet count in preeclampsia patients goes toward normal. [39]

The coagulation system is activated when platelets come into contact with damaged endothelium, which can enhance both bone marrow output and platelet consumption. Younger platelets are created by enhanced thrombopoiesis and are larger (have a higher MPV) and more metabolically and enzymatically active than older platelets. [8]

All of the participants in both groups had normal platelet counts, but the preeclampsia group's platelet count appeared to be slightly lower. In preeclampsia patients, both the MPV and PDW had higher values, and in situations where the blood pressure had increased more, both the MPV and PDW had increased values. Blood pressure was high and there was a noticeable elevation in the MPV. On the other hand, the preeclampsia group's PCT was lower, indicating a lower platelet concentration. These findings would suggest ongoing consumption and platelet activation. As a result, our study suggests that the MPV and PDW platelet indices could be employed as indicators of preeclampsia severity as well as detection markers. Although comparable across the two groups, the preeclampsia group's platelet count and platelet crit revealed lower values, but statistical significance could not be established, therefore their validity as indicators of preeclampsia cannot be discussed.

Conclusion

The estimation of platelet indices approach can be thought of as an early, affordable,

and quick procedure for determining the severity of PIH cases, to sum up. Platelet indices can be a helpful screening test for the early detection of pre-eclampsia and eclampsia in the clinical setting. Additionally, platelet indices can determine how pregnant women will fare with this illness. In both pre-eclampsia and eclampsia, platelet status can be regularly determined with P-lcr. Thus, maternal and perinatal outcomes may be significantly impacted by platelet indices. Preeclampsia was linked to an increase in MPV and PDW. The MPV and PDW substantially linked with elevated blood pressure. However, there was no statistically significant link in our study between preeclampsia, PCT, and platelet count. Thus, the platelet indices, particularly MPV and PDW, which are easily accessible and reasonably priced, can also be used in the prediction and early diagnosis of preeclampsia as well as markers for the severity of preeclampsia, although more research with larger patient populations is required.

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