

Evaluation of Platelet Count among Women with Preeclampsia: A Case-Control Study from Pakistan

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ABSTRACT

Objective: To compare the platelet count in women with preeclampsia with that in women without preeclampsia.

Methodology: A case-control study was conducted between July 2019 and March 2020 at Social Security Teaching Hospital Multan Road, Lahore. Total 60 preeclamptic female were the cases & an equal number of healthy pregnant women were the controls. Women with gestation period of 27 weeks or less, younger than 18 years and those with hypertension before 20 weeks of gestation were excluded from the study. Patients' demographics, medical and surgical history, comorbidities, reproductive history, blood pressure and other related variables were recorded on a predefined proforma. Data analysis was done with SPSS version 26.

Results: The mean platelet count of 360.54 ± 71.25 (range of 200-450) $\times 10^9$ cells/L was observed in the control group while a mean platelet count of 202.74 ± 45.57 (range 90-350) $\times 10^9$ cells/L was reported in the study group. A significant p value of 0.000 was observed. The platelet distribution width, % was high significantly in patients with preeclampsia compared to the control group (p = 0.05).

Conclusion: We reported that patients with preeclampsia had significantly lower platelet count compared to the healthy pregnant women. Further large-scale studies should be conducted to observe the role of platelets in the progression of the disease.

Keywords: hypertension, pregnancy, preeclampsia, platelets, PDW, mean platelet volume

INTRODUCTION

Preeclampsia is one of the major health problems that is encountered during pregnancy. It is responsible for complicating at least 3 to 8 percent of all pregnancies¹. It may result in death of the mother and the child if prompt treatment and strict observation is not maintained. It is a major cause of perinatal as well as maternal morbidity and mortality¹⁻³.

Preeclampsia is defined as a pregnancy-related complication that manifests as uncontrolled high blood pressure associated with organ damage, usually the liver and kidney. It often appears after 20 weeks gestation⁴.

The incidence of preeclampsia in low to moderate socioeconomic countries varies from 1.8% to 16.7%⁵. It is a major cause of prenatal mortality among women in Pakistan. Although the exact pathogenesis of preeclampsia is not known, certain risk factors increase the likelihood of preeclampsia complicating pregnancy. Previous history of preeclampsia, multiple gestation, history of chronic high blood pressure, diabetes mellitus, renal disorder, history of organ transplant, first pregnancy, and overweight are some of the known risk factors for preeclampsia^{6,7}.

Some theories about pathogenesis of this condition have been proposed in the last few decades. Evidence suggests that insufficient trophoblastic invasion plays a substantial role in the pathogenesis & progression of preeclampsia⁸. Inadequate trophoblastic invasion of the uterine wall can result in reduced placental blood flow. This leads to widespread systemic, maternal endothelial damage & increased vascular permeability⁸. The platelet coagulation system is immediately activated when platelets come in contact with the damaged endothelium leading to increased consumption of platelets which subsequently results in increased production of platelets in bone marrow^{9,10}.

Many authors have studied the role of platelet indices as a predictor marker for preeclampsia, however, reports have been controversial¹⁰⁻¹⁴. Due to the inconsistent findings on the matter, the present study was conducted to evaluate the association between platelets indices & preeclampsia among women in our setting.

MATERIAL AND METHODS

A case control study design was chosen to conduct this study at Social Security Teaching Hospital Multan Road, Lahore between September 2019 and March 2020. For participants' selection, a non-probability convenience sampling technique was used. All pregnant women with gestational age of 28.0 weeks or greater and those who were 18 years or older at the time of the study were eligible to take part in study. Women with gestation period of 27 weeks or less, younger than 18 years as well as those with hypertension before 20 weeks of gestation were excluded from the study. Participants were categorized into two groups: preeclampsia (study group) & normal pregnancy (control group). The sample size of each group was 40.

For complete blood count including the platelet indices, 5 mL of blood was extracted from the cubital vein which was then delivered to the laboratory for analysis. Platelet indices and platelet count were measured in Hematology auto analyzer (SYSMEX-XT 4000i) within 2 hours of blood collection. All patients were screened for hypertensive irregularities upon their arrival for routine checkup. The patients with a systolic blood pressure of > 140 mmHg & a diastolic blood pressure of more than 90 mmHg at two occasions, four hours apart, in conjunction with proteinuria on urinalysis were reported as preeclamptic. Patient's demographics, medical and surgical history, comorbidities, reproductive history, blood pressure and other related variables were recorded on a predefined proforma.

Data analysis: Data analyzed using SPSS 26. All continuous variables were presented as mean & SD while the categorical data or ordinal data were presented as frequency or percentages. Association between platelet count and the incidence of preeclampsia was explored through independent t-test and Pearson correlation coefficient was also obtained. A p-value < 0.05 was considered as significant.

Ethical considerations: Ethical approval was obtained from the institutional review board prior to the study. All patients' data were confidential and only the principal investigator had access to the data. The data was decoded and stripped off of any patient identifiers like names, addresses, etc. Informed written consent

was obtained from all patients before they were recruited into the study.

RESULTS

The mean \pm SD age of participants in our study was 26.4 ± 5.8 years, with 29.8 ± 3.5 years in the study group and 28.7 ± 6.5 years in the control group. The average parity was 4.2 ± 3.9 in the control group & 3.6 ± 2.4 in the group. (Table 1).

Table 1: Demographic and clinical profile of pregnant women in control group versus preeclampsia group n=309

Characteristics	Study Group (Preeclamptic)	Control Group (Normotensive)
No. of Children		
0 children	8 (20%)	7 (17.5%)
1-2 children	9 (22.5%)	12 (30%)
3-4 children	12 (30%)	14 (35%)
More than four	11 (27.5%)	7 (17.5%)
No. of abortions		
0	21 (52.5%)	18 (45%)
1	12 (30%)	13 (32.5%)
2	4 (10%)	5 (12.5%)
>=3	3 (7.5%)	4 (10%)
Outcome of last pregnancy		
Live birth	34 (85%)	36 (90%)
Still Birth	3 (7.5%)	0
Spontaneous abortion	3 (7.5%)	4 (10%)
History of hypertension	12 (30%)	4 (10%)
History of preeclampsia		

Thirty percent of the patients of preeclampsia had a positive history of hypertension prior to their pregnancy. Other risk factors noticed were primigravida: 8 and 7 in study and the control group respectively, last outcome of pregnancy: 3 (7.5%) women in study group while 4 (10%) in the control group had spontaneous abortions. See table 1 for details of the demographic and clinical profile of the study population.

Table 2:

Red blood and platelet indices	Study group	Control group	p-value
Median (Range)			
Hemoglobin (g/dl)			
White blood cells, $\times 10^9/\mu\text{L}$	8.1 (6.7–9.9)	7.9 (5.8–9.9)	0.319
Platelet count $\times 10^9/\text{L}$	202.74 \pm 45.57 (90–350)	360.54 \pm 71.25 (200–450)	0.00
Mean platelet volume, fL	9.7 (9.4–11.2)	10.3 (9.6–10.9)	0.554
Platelet distribution width, %	14.7 (12.8–15.6)	12.8 (10.4–13.6)	0.052

The mean platelet count of 360.54 ± 71.25 (range of 200–450) $\times 10^9$ cells/L was observed in the control group while a mean platelet count of 202.74 ± 45.57 (range 90–350) $\times 10^9$ cells/L was reported in group. A significant p-value of 0.000 was observed.

The Platelet distribution width, % was higher significantly in patients with preeclampsia compared to the control group ($p = 0.05$). See table 2 for details.

DISCUSSION

Preeclampsia is a life-threatening condition with a high associated maternal and neonatal mortality³. In poor-resource countries like Pakistan, a large number of complications associated with pregnancy can easily be avoided with access to proper and watchful antenatal care.

It is crucial that any woman with a high-risk profile or a previous history of a complicated delivery should be thoroughly and regularly checked vigilantly. Preeclampsia is characterized by high blood pressure concomitant with proteinuria². Despite the rising incidence of preeclampsia among the South Asian population, it is not a very well explored topic, and little is known

about the biomarkers and predictors of preeclampsia. Hence, the present study aimed to evaluate the relationship between platelet activation as a predictor of incidence of preeclampsia.

In this study, it was reported that platelet cell count was lower in pregnant women with preeclampsia compared to healthy pregnant women. The findings in the current study are consistent with previous works on this subject^{10–16}. A study by Dogan and his team claimed that in preeclampsia there is an enhanced platelet turnover due to damage of endothelium as a consequence of high oxidative stress. The high activity of platelets in turn decreases the platelet count in patients, exposing the mother and the fetus to even worse complications including bleeding, hemorrhage, eclampsia, among others. According to their study findings, platelet count can be used as an early indicator of the condition¹³.

In another study by Alsheeha et al, it was reported that a platelet count of less than 248×10^3 cells/ μL and a platelet count to platelet distribution width ratio of less than 31 are valid predictors of preeclampsia¹⁴. However, there was no significant difference in platelet distribution width (PDW) in patients with preeclampsia compared to the control group.

Platelet distribution width (PDW) is a measure of variation in platelet size as a result of platelet activation. In this study, we found that PDW was highly significant in patients with preeclampsia compared to the control group ($p < 0.05$). Other platelet indices were not significantly different in both groups. In accordance with the present study, a study by Yang et al, evaluated the role of PDW in determining the severity of preeclampsia among their study participants. They categorized their participants into three groups: mild and severe preeclamptic groups and healthy pregnant women as a control group. They reported that the more severe the condition is, the lower the platelet count and plateletcrit would be. Similarly, they claimed that in patients with severe preeclampsia the PDW was higher compared to those with mild disease and those who were healthy¹⁵.

Aside from platelet indices, we also reported lower hemoglobin, red blood cell count, and increased red distribution width (RDW) levels in patients with preeclampsia compared to the control group. These findings are consistent with earlier literature^{16–18}.

Significance of the Current Study: The role of platelet has been inconsistently reported in previous studies. Moreover, no study had been conducted in Pakistan before the index study to highlight the significance of platelet count and other blood indices as biomarkers to assess the severity of preeclampsia.

Limitations of the study: Despite the efforts to generalize the data, the study sample was limited to a certain socioeconomic class and simple convenient method of sampling may have increased bias. Also, the study design was case-control therefore, long term evaluation could not be ascertained in our study. Due to the above-mentioned facts, the findings of this study may be restricted and may not apply to a larger population. Future large-scale longitudinal studies should be conducted to observe and evaluate the role platelet count plays in the development and progression of preeclampsia.

CONCLUSION

We reported significant disturbances in the platelet count & platelet distribution width indices among patients with preeclampsia compared to the normotensive pregnant women, indicating the substantial role these markers have in predicting the disease and its outcome.

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