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Pathology

A Study of Platelet Parameter as a Diagnostic and Predictive Biomarker for Preeclampsia

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Abstract		Original Research Article

Background: Preeclampsia is one of the major health problems during pregnancy. It complicates 3%–8% of pregnancies and causes marked increase in perinatal, maternal morbidity, and mortality, Although the exact pathophysiology of preeclampsia is not completely understood. *Objective:* The Objective of the study is to measure platelet count(PC), mean platelet volume(MPV) and platelet distribution width(PDW) in preeclampsia patients and compared its results with normal pregnant females to diagnose and assess the severity of preeclampsia. *Methodology:* A Retrospective study of sixty preeclamptic women were the cases and an equal number of healthy pregnant women were the controls of 28-32 weeks of gestation of age group 25-35 year. Preeclamptic patients were separated into three groups as mild (30), moderate (15) and severe preeclampsia (15).Platelet count, mean platelet volume and platelet distribution width was measured from all participants and results between preeclamptic and normal pregnant women were compared by calculating p value by using online student t test calculator.p value less than 0.01 was considered as a difference of significance. *Results:* The mean concentration of platelet in preeclampsia group is 1.705±.60000 as compared to 2.60 ±65000 in control group. The mean concentration of Mean platelet volume (fl) platelet in preeclampsia group is 9.408±1.30 as compared to 9.120 ±0.98 in control group. The mean concentration of platelet distribution width in preeclampsia group is 15.56±2.56 as compared to 10.58 ± 1.52 in control group. *Conclusion:* The present study revealed that low platelet count is associated with preeclampsia and eclampsia. The estimation of platelet indices can be considered as early, economical and rapid procedures of assessment of severity of PIH cases. Clinically platelet indices can be a useful screening test for early identification of preeclampsia and eclampsia. Also platelet indices can assess the prognosis of this disease in pregnant women and can be used as an effective prognostic marker because it correlates with severity of the disease.
Keywords: Preeclampsia, Mean platelet volume, Platelet distribution width, Platelet count.

INTRODUCTION

Preeclampsia is a pregnancy-specific multisystem disorder characterized by abnormal vascular response to placentation which is associated with increased systemic vascular resistance, enhanced platelet aggregation, activation of the coagulation system, and endothelial cell dysfunction with resultant reduced organ perfusion. Despite extensive research, the cause of preeclampsia remains elusive [1, 2].

Preeclampsia is a complex, multisystem disorder of unknown etiology that is unique to human pregnancy. It is a disorder of widespread vascular endothelial malfunction and vasospasm that occurs after 20 weeks gestation and can present as late as 4-6 weeks postpartum [3].

Platelet indices [platelet count, mean platelet volume (MPV) and platelet distribution width (PDW)] constitute part of the data detectable by complete blood count (CBC) test. Applicability of these indices for the clinical and pathophysiological understanding of vascular diseases, including preeclampsia, has been investigated but their value has not yet been fully substantiated [4]. A decreasing platelet count is observed during the progression of preeclampsia, and is suggested to be a characteristic of worsening

preeclampsia. This platelet count decline returns rapidly to its normal range after delivery [5]. It has also been noted that MPV increases during pregnancy and is higher in women with preeclampsia. Increased MPV occurs before onset of preeclampsia symptoms. Therefore, it may be a valuable marker for development of preeclampsia. Furthermore, it has been suggested that PDW can be a practical tool to evaluate activation of coagulation or thrombocytosis related disease [6]. The aim of this study was, therefore, to assess whether changes in platelet indices, detectable on CBC during pregnancy could be used as markers for prediction of development of preeclampsia.

The present study compared three platelet parameters i.e., platelet count, MPV and PDW in preeclamptic and normotensive pregnant women, to evaluate their role in diagnosing and assessing the severity of preeclampsia.

MATERIAL AND METHODS

This case control study was conducted by the department of Pathology Parul sevashram hospital, Parul institute of medical science and research, Vadodara, Gujarat, India from June 2017 to July 2018.

Study Design

The study includes pregnant women diagnosed with preeclampsia in 28-32 weeks of gestation of age group between 25-35 year who visited Gynec OPD of our hospital (n=60).

60 normotensive pregnant women, similar age and gestational weeks were taken as a control.

Exclusion Criteria

Pregnancy with thrombocytopenia due to other causes like infections (viral) or autoimmune disease, renal disease in pregnancy, gestational or chronic hypertension etc were excluded from pregnancy.

Criteria for inclusion of patients in Preeclampsia (PE)

- 1.Systolic BP greater than 140 mmHg, diastolic BP greater than 90 mmHg on two measurements taken 6 hours apart or on one measurement >150/110 mmHg plus
- Proteinuria more than 300 mg in 24 hours urine were included in the preeclampsia group

This PE group was further divided into three categories as:

- **Mild Preeclampsia-** If diastolic BP is between 90 and 100 mmHg
- **Moderate Preeclampsia-** If diastolic BP is between 100 and 110 mmHg
- **Severe Preeclampsia-** If BP > 160/110 mmHg, oliguria (<400 ml in 24 hours urine), headache, blurred vision, right epigastric- right upper quadrant pain, pulmonary edema and cyanosis, >5 gr proteinuria in 24 hours urine or > +++ proteinuria in spot urine sample, thrombocytopenia (<100.000/mm3), abnormal liver function tests.

Platelet parameters like Platelet count, MPV and PDW was measured from all participants in bene sphere fully automated haematology 5 part cell counter.

All obtained were analysed statistically by calculating p value by using online student t test calculator. p value less than 0.01 was considered as a difference if significance.

RESULTS

Study includes 60 preclamptic women of age group 25-35 year of 28-32 weeks of gestational age.

The mean age of preeclampsia group was 27.50 ±3.0 years and that of control group (n=60) was 26.30 ±2.0 years.

The mean gestational age of preeclampsia group 30.90 ±4 week and control group was 30.50 ±5.0 week.

Number of primigravida in preeclampsia group is 35(58.33%)

Mild Preeclampsia :n=30
Moderate Preeclampsia :n=15
Severe Preeclampsia :n=15

Platelet count was lower in the preeclampsia group as compared to control group and this was statistically significant (p <0.01) (Table-1).

Though MPV was higher in preeclampsia group as compared to control group, the finding was not statistically significant (p>0.01)

However PDW was significantly higher in preeclampsia group as compared to the control group (p< 0.01) (Table-1).

Table-1: Comparison of various platelet parameter between preeclamptic group and normal healthy pregnant women group

Parameters	Preeclampsia (n=60)	Control (n=60)	P value
Platelet count(Lakhs/ Cumm) (Mean±SD)	1.705 ±60000	2.60 ±65000	<0.01
Mean Platelet volume (fl) (Mean±SD)	9.408 ± 1.30	9.120±0.98	<0.01
Platelet distribution width (Mean±SD)	15.56 ± 2.56	10.58±1.52	>0.01

Table-2: Comparison of platelet count (PC), mean platelet volume (MPV) and platelet distribution width (PDW) between mild, moderate and severe preeclampsia patients

Parameters	Mild Preeclampsia (n=30)	Moderate Preeclampsia (n=15)	Severe Preeclampsia (n=15)	p value
Platelet count(Lakhs/ Cumm) (Mean±SD)	2.10 ±0.59	1.20 ±0.30	1.05 ±0.28	<0.01
Mean Platelet volume(fl) (Mean±SD)	9.216 ± 1.23	9.40 ± 1.12	9.70 ± 1.20	>0.01
Platelet distribution width (Mean±SD)	16.32 ± 2.50	16.20 ± 2.45	17.083 ± 2.71	>0.01

Table-3: Comparison of platelet count between present and past studies

Parameters	Mohapatra *et al.*, [7]	Vrunda *et al.*, [8]	Vamseedhar *et al.*, [9]	Present study
Normal	2,38,000	2,20,000	2,18,440	**2,60,000**
Preeclamptic	1,30,000	1,40,000	1,55,550	**1,70,000**

PDW was significantly higher in PE group as compared to normotensive pregnant group (p<0.01) (Table-1). There was increase in the PDW values with increasing severity of hypertension from mild to severe but was non-significant (p>0.01) (Table-2). The MPV values in case of mild preeclampsia patients were high when compared to moderate preeclampsia and highest in severe preeclampsia patients. However, these findings were not statistically significant (p >0.01).

DISCUSSION

Preeclampsia continues to be a major cause of maternal and fatal morbidity and mortality, as it is associated with a high risk of IUGR, preterm delivery, placental abruption etc.

Many theories are proposed for the pathophysiology of preeclampsia [10]. The formation of a uteroplacental vasculature insufficient to supply adequate blood to the developing fetus results in fetoplacental hypoxia, leading to imbalances in the release and metabolism of prostaglandins, endothelin, and nitric oxide by placental and extraplacental tissues. These as well as enhanced lipid peroxidation and other undefined factors contribute to the hypertension, platelet activation and systemic endothelial dysfunction characteristics of preeclampsia. Activation of coagulation system in small vessels and increased platelet aggregation is present in preeclampsia. It is clear that preeclampsia is one of the cause of maternal thrombocytopenia and the platelet count increases rapidly after the delivery. There are studies suggesting the storage of platelet in the areas with endothelial damage, as the cause of thrombocytopenia [11, 12].

Ceyhan *et al.*, observed no prognostic significance of complete blood count, platelet count and MPV on presence and/or severity of preeclampsia condition [13]. However there are studies which establish significant difference in platelet count and platelet parameters in preeclampsia and normotensive pregnant women, thus suggesting these tests for diagnosis and predicting the severity of preeclampsia.

In the present study there was no significant increase in MPV with increasing severity of preeclampsia. Though several studies demonstrate a direct relationship between MPV and preeclampsia severity our findings did not correlate with these studies [14]. However a recent study by Altibas also observed that MPV is not a significant predictor of preeclampsia severity [15].

Aside from platelet parameters, there are several biomarkers of preeclampsia including soluble endoglin (sEng) or soluble fms-like tyrosine kinase-1 (sFlt-1) [16]. One limitation of this study is the lack of a comparative analysis between platelet parameters and sEng/sFlt-1. However, platelet parameters are simple laboratory markers and easy to check during antenatal care.

The reason for increased PDW is explained by increased platelet turnover which would support the idea that platelet survival time is decreased resulting in increased destruction of platelets. This may be also because of increased bone marrow activity of unknown stimulus.

CONCLUSION

The present study revealed that low platelet count is associated with preeclampsia and eclampsia. The estimation of platelet indices can be considered as early, economical and rapid procedures of assessment of severity of PIH cases. Clinically platelet indices can be a useful screening test for early identification of preeclampsia and eclampsia. Also platelet indices can assess the prognosis of this disease in pregnant women and can be used as an effective prognostic marker because it correlates with severity of the disease.

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