

Hypertensive Disorders in Pregnancy: Role of Platelet Indices

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Abstract

Introduction: The present study aimed to assess whether changes in platelet indices, during pregnancy could be used as markers for prediction of development of hypertensive disorders of pregnancy. **Methods:** A total of 255 antenatal patients matching the inclusion and exclusion criteria was taken up for this study. Platelet count and its indices (MPV & PDW) were done at 10-12 weeks and repeated again at 28-30 weeks. Clinical manifestation of development of hypertensive disease and its relation with platelet indices in respective patients were analyzed. **Results:** Mean platelet count at 10-12 weeks was 2.53 lakhs in normotensives as compared to 2.21 lakhs in cases who developed HDP ($p < 0.05$). Mean platelet volume (MPV) at 10-12 weeks was 9.74 fl in normotensives as compared to 10.81 fl in cases who developed HDP ($p < 0.05$). Mean platelet distribution width (PDW) at 10-12 weeks was 11.89% in normotensives as compared to 14.15% in cases who developed HDP ($p < 0.05$). Derangement of platelet indices was seen in 33 cases out of total 255 cases at 10-12 weeks. Out of these 33 cases, 6 (18.2%) developed HDP while out of the remaining 222 cases of normal platelet indices, 14 (6.3%) developed HDP. **Conclusion:** Platelet indices provide an effective tool to monitor HDP. The increase in PDW provides a tool in the early diagnostic assessment of

HDP. Currently, the platelet count is only used as one of the criteria for the diagnosis of preeclampsia. However, assessing the PDW and MPV may be beneficial as an indicator of preeclampsia and eclampsia.

Keywords: Hypertensive disorders of Pregnancy; Mean platelet volume, Platelet Count; Platelet distribution width; Platelet indices.

Introduction

Hypertensive disorders of pregnancy and their complications is a major cause of maternal mortality and result in pregnancy complications in approximately 0.34-11.5% of pregnancies [1]. It is generally regarded as a multisystem disorder specific to pregnant women characterised by widespread endothelial damage which originates from the uteroplacental circulation but ultimately involves a variety of other organs such as kidney, liver and brain [1,2].

Many researchers gave their efforts to recognize the exclusive screening test that would predict the risk of developing preeclampsia before the typical symptoms appear. There are number of studies which suggest platelet may play a chief role in the etiopathogenesis of preeclampsia. Changes in

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coagulation system in established HDP are well known. It is observed that preeclamptic mother having coagulation indices in severely abnormal ranges were associated with substantial maternal and fetal jeopardy [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 [5]. This platelet count decline returns rapidly to its normal range after delivery. 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 [4]. Furthermore, it has been suggested that PDW can be a practical tool to evaluate activation of coagulation [6,7].

The aim of this study was, therefore, to assess whether changes in platelet indices, during pregnancy could be used as markers for prediction of development of HDP.

Methods

Study Area: Department of Obstetrics and gynecology in a tertiary care hospital, Bharati hospital and research centre at Bharati Vidyapeeth (Deemed to be University), Pune.

Study Design: A Prospective, observational, Clinical study

Study Duration: August 2016 to July 2018.

Inclusion Criteria

1. Completed 18 years of age.
2. ANC patients of low risk pregnancy.

Exclusion Criteria

1. Women having:
2. Epilepsy
3. Hypertension
4. Thrombophilias

5. Obesity BMI > 35 kg/m²
6. On Drugs affecting platelet count
7. Multiple pregnancy
8. Medical illness like diabetes mellitus, renal disease, hypothyroidism

Methodology: Samples of predetermined number of 255 antenatal patients matching the inclusion and exclusion criteria was taken up for this study. Platelet count and its indices (MPV & PDW) were done at 10-12 weeks of pregnancy and repeated again at 28-30 weeks counting from the first day of last menstrual period and confirmed by USG. Subjects were followed up till term and during delivery, detailed records of clinical status of subject was maintained. Clinical manifestation of development of hypertensive disease and its relation with platelet indices in respective patients were analyzed in details.

Statistical Analysis: The quantitative data was represented as their mean \pm SD. Categorical and nominal data was expressed in percentage. The t-test was used for analysing quantitative data, or else non parametric data was analyzed by Mann Whitney test or Wilcoxon test and categorical data was analyzed by using chi-square test. The significance threshold of p-value was set at < 0.05. All analysis was carried out by using SPSS software version 21.

Results

Mean age of the study cases was 24.1 year with over half of them (56.1%) were in age group of 20-25 years old. Out of the total 255 cases, 11 (4.3%) developed gestational hypertension, 6 (2.4%) developed pre-eclampsia and 3 (1.2%) had eclampsia. Overall prevalence of hypertensive disorder of pregnancy was 7.8% (Chart 1). Mean platelet count at 10-12 weeks was 2.53 lakhs in normotensives as compared to 2.21 lakhs in cases who developed HDP ($p < 0.05$). The platelet count reduced to 2.34 and 1.73 lakhs respectively in normotensives and HDP cases at 28-30 weeks ($p < 0.01$). Mean platelet volume (MPV) at 10-12 weeks was 9.74 fl in normotensives as compared to 10.81 fl in cases who developed HDP ($p < 0.05$). The MPV increased to 10.66 and 15.65 fl respectively in normotensives and HDP cases at 28-30 weeks ($p < 0.01$). Mean platelet distribution width (PDW) at 10-12 weeks was 11.89% in normotensives as compared to 14.15% in cases who developed HDP ($p < 0.05$). The PDW increased to 16.17% and 21.88% respectively in normotensives and HDP cases at

28-30 weeks ($p < 0.01$) (Table 1). Derangement of platelet indices (platelet count or MPV or PDW) was seen in 33 cases out of total 255 cases (12.94%) at 10-12 weeks. Out of these 33 cases, 6 (18.2%)

developed HDP while out of the remaining 222 cases of normal platelet indices, 14 (6.3%) developed HDP. The difference was statistically significant ($p < 0.05$) (Graph 1).

Table 1: Comparison of Mean platelet count and platelet indices among study groups

Platelet Count	Group	N	Mean	SD	p-value
10-12 weeks	Normotensives	235	2.53	0.39	<0.05
	HDP	20	2.21	0.18	
28-30 weeks	Normotensives	235	2.34	0.41	<0.01
	HDP	20	1.73	0.31	
<i>MPV</i>					
10-12 weeks	Normotensives	235	9.74	0.77	<0.05
	HDP	20	10.81	1.12	
28-30 weeks	Normotensives	235	10.66	2.18	<0.01
	HDP	20	15.65	1.78	
<i>PDW</i>					
10-12 weeks	Normotensives	235	11.89	0.71	<0.01
	HDP	20	14.15	1.80	
28-30 weeks	Normotensives	235	16.17	2.08	<0.01
	HDP	20	21.88	2.01	

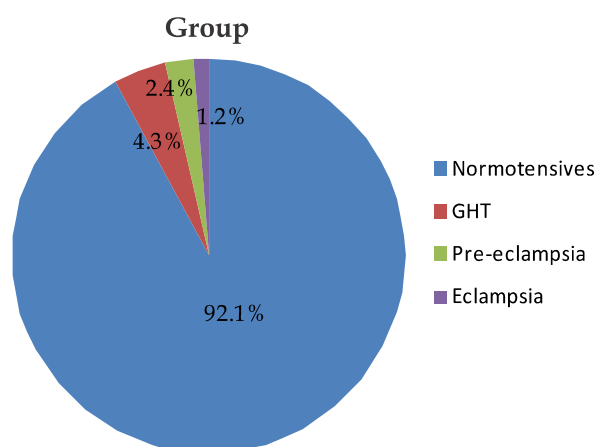
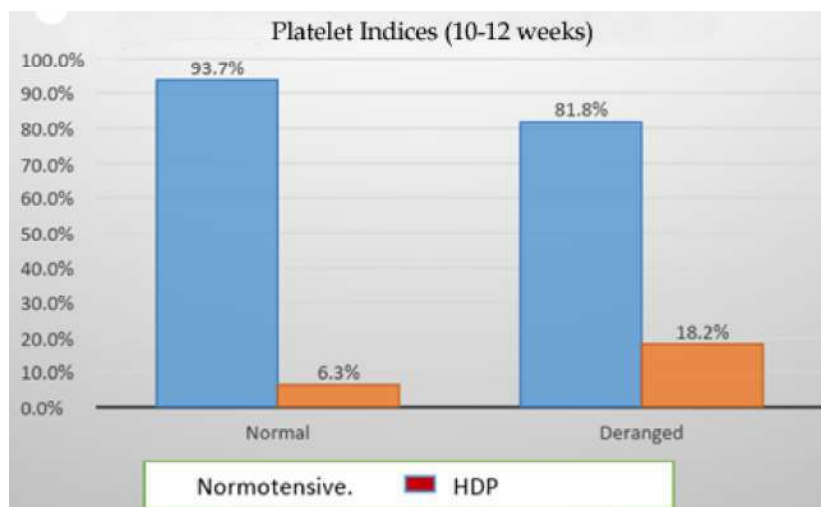


Chart 1: Distribution of cases as per development of hypertensive disorder of pregnancy



Graph 1: Platelet indices at 10-12 weeks & development of hypertensive disorders of pregnancy

Discussion

The changes in platelet indices that appear in pre-eclamptic pregnancy are divided into two major groups, numerical abnormalities which include the structural changes regarding size and distribution width which can be quantified numerically and functional platelet abnormalities. In this study, we discuss the numerical abnormalities of the platelets and to determine whether changes in platelet indices can be used to predict hypertensive diseases of pregnancy before they clinically manifest.

Thrombocytopenia can be associated with pre-eclampsia which is life threatening if it gets complicated with HELLP syndrome. Thromboxane A which is released by thrombocyte has known to play a major role in pre-eclamptic pathophysiology. There is also evidence of increase in the thromboxane/prostacyclin ratio. Thromboxane A increases invoking platelet aggregation and endothelial damage promoting platelet dysfunction and platelet consumption causing thrombocytopenia. Platelets are activated by P selectin, CD 63 and PECAM- platelet surface glycoprotein which also are markers of activation. Platelet activation is associated with increased endothelial dysfunction with micro thrombi formation causing end organ degenerative necrosis and placental infarction [8]. This is followed by the bone marrow responding to the decrease in platelets by release of younger platelets bearing increased MPV [9].

Several studies have evaluated platelet indices in prognostication and understanding the pathogenesis of preeclampsia. Some studies concluded that it is considered as an early, economical and rapid method of assessing the severity of hypertensive disorders of pregnancy [10].

In present study, mean platelet count at 10-12 weeks was 2.53 lakhs in normotensives as compared to 2.21 lakhs in cases who developed HDP ($p < 0.05$). The platelet count reduced to 2.34 and 1.73 lakhs respectively in normotensives and HDP cases at 28-30 weeks ($p < 0.01$).

A study by Monteiro G et al. [11], studied a typical Indian population with retrospective data which showed that the mean platelet count was significantly decreased in the group that contained pregnant women with hypertension from 20th week onwards when compared to controls. Their study also states that platelet count is a predictor of progression of severity of hypertensive disorder of pregnancy. Alkholi EA et al. [12] observed that

Platelet count was significantly lower in women with severe PE compared to women with mild PE and normal pregnant women groups (139.340 ± 32.610 , 183.940 ± 37.380 and 249.120 ± 38.350 with $p < 0.001$) respectively.

In present study, Mean platelet volume (MPV) at 10-12 weeks was 9.74 fl in normotensives as compared to 10.81 fl in cases who developed HDP ($p < 0.05$). The MPV increased to 10.66 and 15.65 fl respectively in normotensives and HDP cases at 28-30 weeks ($p < 0.01$). Similarly, mean platelet distribution width (PDW) at 10-12 weeks was 11.89% in normotensives as compared to 14.15% in cases who developed HDP ($p < 0.05$). The PDW increased to 16.17% and 21.88% respectively in normotensives and HDP cases at 28-30 weeks ($p < 0.01$).

Similar to our study, Nooh A et al. [13] also observed that mean platelet volume (MPV) and platelet distribution width (PDW) increases as PE progressed and these changes are more pronounced in PE than normotensive pregnancy. Alkholi EA et al. [12] observed that MPV and PDW were significantly higher in women with severe PE compared to women with mild PE and normal pregnant women groups (11.07 ± 1.08 vs. 9.82 ± 0.68 and 8.50 ± 0.75 with $p < 0.001$ for MPV and 17.09 ± 2.12 vs. 14.26 ± 1.84 and 11.01 ± 1.77 with $p < 0.001$ for PDW).

The increase in PDW probably reflects increased platelet turnover which would support the idea that platelet survival time is decreased resulting in increased destruction of platelets [14]. The variation in the platelet distribution width would also suggest that endothelial dysfunction seen in pre-eclampsia, would result in production of younger and larger platelets of varying sizes in order to compensate for the reduction in platelet count as the disease progresses [15]. Kurtoglu E et al. [7] also concurred with the present study that platelet indices are a beneficial indicator of pre-eclampsia and eclampsia.

Conclusion

The study concluded that platelet count and platelet indices are simple and routine test which can be easily estimated by automated hematology analyzer. They provide a simple, cheap and effective tool to monitor hypertensive disorder of pregnancy. Additional studies with PDW and the increase in MPV seen in preeclampsia and eclampsia may yield further insights on the underlying pathophysiology

of this conditions. The increase in PDW provides a tool in the early diagnostic assessment of pre-eclampsia and eclampsia. Currently, the platelet count is only used as one of the criteria for the diagnosis of preeclampsia. However, assessing the PDW and MPV, along with platelet count may be beneficial as an indicator of preeclampsia and eclampsia. Changes in platelet indices may provide a clue towards potential worsening of pre-eclampsia and eclampsia status of the patient.

In conjunction, the alteration of MPV and PDW values can be assessed for using it as a tool for predicting pre-eclampsia or used as adjunct to clinical parameters of diagnosing preeclampsia. Any significant deviation during the course of pregnancy can forewarn impending HDP.

Hence close surveillance of patient along with platelet indices parameters would allow an early diagnosis and a timely pregnancy intervention.

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