Original Article

Low Platelet Count Analysis as a Prognostic Indicator in Pregnancy-induced Hypertension

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Abstract

Introduction: Hypertension is one of the serious complications of pregnancy which virtually affects all maternal organs such as the liver, kidney, brain, and placenta. Changes in the hemostatic system are observed in normal and hypertensive patients. The frequency and intensity of maternal thrombocytopenia vary and are dependent on the intensity of the disease process and duration of pregnancy-induced hypertension (PIH) syndrome. In general, the lower the platelet counts, the higher the maternal and fetal morbidity and mortality. **Aims and Objectives:** The aims and objectives of the study were to study the platelet counts in cases of PIH, compare the values with normotensive pregnant participants, and study the association between thrombocytopenia and fetomaternal outcome. **Materials and Methods:** A total of 226 patients were included in the study and were evaluated for their platelet count and fetomaternal outcome. The patients were divided into two groups, with each group comprising 113 patients, namely, Group I which included controls and Group II which included patients with PIH (subgroups: gestational hypertension, preeclampsia, and eclampsia). Platelet counts in all groups were charted, compared, and correlated with various maternal parameters such as age, gravidity, severity of hypertension, gestational age of termination, maternal complications, and hospital stay. Fetal parameters studied were intrauterine growth restriction, stillbirth, neonatal intensive care unit care, and intrauterine fetal demise. **Results:** Our study found that the mean platelet count decreases with the severity of gestational hypertension. Thus, the highest platelet count was seen in the control group (D), i.e., 1.67 lakh/mm^3 and the lowest platelet count was seen in the eclamptic group, (C) i.e., 0.75 lakh/mm^3. Pregnancies complicated by thrombocytopenia were terminated at an earlier gestation (35–37 weeks). Maternal complications such as postpartum hemorrhage (56.5%) and stitch line ooze (27.5%) were found to occur more in the thrombocytopenic group. The association between birth weight and thrombocytopenia was statistically significant in our study. **Conclusion:** Thrombocytopenia associated with PIH is a reliable prognostic indicator for the severity of hypertension as well as the associated maternal and fetal morbidity.

Keywords: Complications, eclampsia, fetomaternal outcome, pregnancy-induced hypertension, thrombocytopenia

Introduction

Hypertension is one of the serious complications of pregnancy which virtually affects all maternal organs such as the liver, kidney, brain, and placenta.[1] Changes in the hemostatic system are observed in normal and hypertensive patients. The frequency and intensity of maternal thrombocytopenia vary and are dependent on the intensity of the disease process and duration of pregnancy-induced hypertension (PIH) syndrome.[2] In general, the lower the platelet count, the higher the maternal and fetal morbidity and mortality.[3] Thrombocytopenia is defined as subnormal number of platelets in the circulating blood (<1,50,000 lakh/mm^3).[4] In pregnancy, it results from a variety of causes ranging from benign disorders such as gestational thrombocytopenia to severe complicated life-threatening conditions such as hemolysis, elevated liver enzymes, and low platelets (HELLP) syndrome. Thrombocytopenia resulting from PIH is responsible for approximately 20% of all cases of thrombocytopenia during pregnancy. The platelet-specific protein, beta-thromboglobulin, and marker of platelet activation *in vivo* are increased in PIH. This correlates with proteinuria and serum creatinine and suggests a link between platelet activation with renal microvascular damage.[5]

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The criteria to diagnose gestational thrombocytopenia are as follows: platelet count is normal outside pregnancy, occurs late in gestation, no fetal/neonatal thrombocytopenia and complete recovery with normal platelet count, and function after delivery.[6] Its underlying cause cannot usually be identified in about 75% of the cases and is generally assumed to be secondary to hemodilution, increased platelet consumption within the placental circulation, and/or to hormonal inhibition of megakaryocytopoiesis. Thrombocytopenia can be due to immune thrombocytopenic purpura (ITP) which is caused mostly due to the formation of autoimmune antibodies. ITP is usually severe during pregnancy, but it improves after delivery[7] and severe thrombocytopenia may occur in about 5%–10% of offspring of the affected mothers.[8]

Preeclampsia prevalence is variable, the estimated incidence is 5%–10% of all pregnancies, with a higher incidence in the first pregnancy, especially in women aged <20 years.[8] The frequency and severity of thrombocytopenia increase with the severity of preeclampsia and are greater in patients with HELLP syndrome or in those who have full-blown eclampsia with disseminated intravascular coagulation (DIC).[9]

Aims and objectives

The aims and objectives of the study were to study the platelet counts in cases of PIH, compare the values with normotensive pregnant participants, and study the association between thrombocytopenia and fetomaternal outcome.

Materials and Methods

This prospective, observational study was conducted in a tertiary care hospital over 2 years. A total of 226 patients were included in the study and were evaluated for their platelet count and fetomaternal outcome after taking informed consent. The patients were divided into two groups, with each group comprising 113 patients, namely, Group I which included controls and Group II which included pregnant women with three subgroups of patients each for gestational hypertension (43 cases), preeclampsia (43 cases), and eclampsia (27 cases).

Inclusion criteria

Normal healthy women who developed hypertension for the first time during pregnancy after 20 weeks of gestation were included in PIH category. The further categorization was done according to the following diagnostic criteria.

Gestational hypertension is defined by the blood pressure elevation of >140 mmHg systolic or 90 mmHg diastolic in a previously normotensive women for the first time after mid pregnancy, but in whom proteinuria was not identified.

Preeclampsia defined by hypertension (blood pressure <140 mmHg systolic or 90 mmHg diastolic) associated with proteinuria >0.3 g/L in a 24 h urine collection or 1+ dipstick or greater in random urine collection, after 20 weeks of gestation in previously normotensive women.

Eclampsia

The onset of convulsions in women with preeclampsia that cannot be attributed to other causes is termed eclampsia.

Exclusion criteria

Participants with hemorrhagic disorders, sepsis, functional uterine bleeding, placental abruption or previa, respiratory disorders, circulatory disorders, renal and hepatic disorders, and chronic hypertension and participants taking drugs which affect platelet count were excluded from the study.

The samples were analyzed by Beckman Coulter LH-750 analyzer and samples with low platelet count were examined on peripheral blood smear for platelet morphology and number.

Statistical methods

The recorded data were compiled and entered into a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as mean ± standard deviation and categorical variables were summarized as percentages. The Chi-square test or Fisher's exact test, whichever appropriate, was used for the comparison of categorical variables. Graphically, the data were presented by bar and pie diagrams. A $P < 0.05$ was considered statistically significant.

Observations and Results

Table 1 shows the distribution of cases in our study. Our study population is divided into cases (113), i.e., Group (A + B + C) and controls (113), i.e., Group D.

The cases ranged from 24 to 39 years with no statistically significant difference between the groups with respect to platelet count. The number of primigravida cases was more than multigravida in each group; however, the difference was not statistically significant.

The mean platelet count was lower in the PIH group as compared to the control group, with the lowest seen in the eclampsia group (Group C) [Table 2].

The difference between cases and controls and also among different subgroups included in cases was statistically significant [Table 3].

Thrombocytopenia was seen in 19 out of 43 cases of gestational hypertension. Among the 43 cases of preeclampsia, 28 had associated thrombocytopenia, whereas 22 of 27 cases had

Table 1: Distribution of study patients

Group	*n* (%)
Gestational hypertension (Group A)	43 (19.0)
Preeclampsia (Group B)	43 (19.0)
Eclampsia (Group C)	27 (11.9)
Controls (Group D)	113 (50.0)
Total	226 (100)

associated thrombocytopenia in the eclampsia group. This was statistically significant [Table 4].

Table 4 clearly depicts how strongly thrombocytopenia correlates to the severity of PIH, with about 81.5% of cases of eclampsia associated with thrombocytopenia.

In our study, it was observed that out of 25 cases in the gestational age of 28–34 weeks, 23 had associated thrombocytopenia. In the gestational age group of 35–37 weeks, 34 cases out of 60 cases had associated thrombocytopenia and 12 cases had thrombocytopenia out of 28 cases in the gestational age group of >37 weeks. The difference was statistically significant [Table 5].

We analyzed the association of maternal complications vis-à-vis antepartum hemorrhage (APH), postpartum hemorrhage (PPH), intensive care unit (ICU) care, stitch ooze, and hematoma formation with platelet count and found a statistically significant difference in PPH occurrence, stitch line ooze, and hematoma formation which occurred more in those with thrombocytopenia [Table 6].

The association between birth weight and thrombocytopenia was statistically significant in our study with 44 out of 53 (63.8%) cases having low birth weight (<2.5 kg) with associated thrombocytopenia as compared to 25/60 (36.2%) cases of PIH without thrombocytopenia.

Table 7 shows the association of thrombocytopenia with fetal outcome. A significant correlation was seen between thrombocytopenia and neonatal intensive care unit (NICU) admission with no statistically significant difference in intrauterine fetal demise and neonatal mortality.

With respect to the duration of hospital stay, there was no statistically significant difference between those with or without thrombocytopenia.

Table 2: Platelet count (10^5/L) among various groups

Group	*n*	Mean±SD	Range	95% CI for mean
Group A	43	1.37±0.478	0.13-1.9	1.22-1.52
Group B	43	1.03±0.516	0.28-1.9	0.87-1.19
Group C	27	0.75±0.475	0.19-1.7	0.54-0.92
Group D	113	1.67±0.599	0.56-3.2	1.56-1.79

CI: Confidence interval, SD: Standard deviation

Table 3: Intergroup comparison based on platelet count among various groups

Comparison	Mean difference	*P*
Group A versus Group B	0.34	0.005
Group A versus Group C	0.62	<0.001
Group A versus Group D	0.30	0.002
Group B versus Group C	0.28	0.025
Group B versus Group D	0.64	<0.001
Group C versus Group D	0.92	<0.001

Table 4: Analysis of severity of pregnancy-induced hypertension with and without thrombocytopenia

Age (years)	With thrombocytopenia, *n* (%)	Without thrombocytopenia, *n* (%)	*P*
Group A	19 (42.2)	24 (55.8)	0.006*
Group B	28 (65.1)	15 (34.9)	
Group C	22 (81.5)	5 (18.5)	

Table 5: Association of low platelet count with gestational age

Gestational age at termination (weeks)	With thrombocytopenia, *n* (%)	Without thrombocytopenia, *n* (%)	*P*
28-34	23 (33.3)	2 (4.5)	<0.001*
35-37	34 (49.3)	26 (59.1)	
>37	12 (17.4)	16 (36.4)	

Table 6: Association of low platelet count with maternal complications

Maternal complications	With thrombocytopenia, *n* (%)	Without thrombocytopenia, *n* (%)	*P*
APH	9 (11.3)	5 (9.0)	0.285
PPH	39 (56.5)	9 (20.5)	<0.001
ICU care	4 (5.8)	1 (2.3)	0.374
Stitch ooze	19 (27.5)	4 (9.1)	0.018
Hematoma	11 (15.9)	1 (2.3)	0.021

APH: Antepartum hemorrhage, PPH: Postpartum hemorrhage, ICU: Intensive care unit

Discussion

In the present study, 113 patients with PIH were compared to 113 normotensive pregnant patients with respect to platelet count. The cases were further subdivided into the gestational hypertension group, preeclampsia group, and eclampsia group, and fetomaternal outcome was assessed with respect to thrombocytopenia.

In our study, the mean age of Group A was 30.4 years, the mean age of Group B patients was 29 years, and the mean age of Group C patients was 28.3 years, whereas the mean age of Group D patients was 29.6 years. Our spectrum of age distribution closely resembles a study conducted by AlSheeha *et al*.[10] to evaluate platelets indices in women with preeclampsia, where the mean age of patients in cases was 30.6 years and that of controls was 30 years.

Our study found that the mean platelet count decreased as the severity of gestational hypertension increased. Thus, the highest platelet count was seen in the control group (D), i.e., 1.67 lakh/mm^3, and the lowest platelet count was seen in the eclamptic group, (C) i.e., 0.75 lakh/mm^3. The study of Annam *et al*.[11] have reported the mean platelet count

Table 7: Association of low platelet count with fetal outcome

Fetal outcome	Platelet count <1.5 lakhs, *n* (%)	Platelet count ≥1.5 lakhs, *n* (%)	*P*
IUFD	4 (5.7)	3 (4.0)	0.102
NICU admission	37 (58.7)	7 (15.9)	<0.001*
Neonatal mortality	9 (14.3)	2 (4.5)	0.191

*Shows association with neonatal ICU admissions. IUFD: Intrauterine fetal demise, NICU: Neonatal intensive care unit

of 1.31 lakh/mm^3 in the PIH group which is closer to our mean platelet count of 1.37 ± 0.76 lakh/mm^3. Studies by Mohapatra *et al*.[12] and Lopez-Llera *et al*.[13] have reported still lower mean platelet count of 1.21 ± 0.49 lakh/mm^3 and 1.13 ± 0.71 lakh/mm^3, respectively. In our study, the difference in the platelet counts between cases and controls and also among different subgroups included in cases was statistically significant.

It was observed that the mean duration of pregnancy was significantly higher in the control group, which means most of them were full-term deliveries, whereas the duration of pregnancy was reduced in patients with thrombocytopenia. The difference was statistically significant showing earlier age of termination in cases with associated thrombocytopenia. This is because early delivery acts as prompt treatment of the disease and thereby preventing complications (Gupta *et al*., 2018)[14] which was also confirmed by earlier study by Vrunda and Saila.[15]

Maternal complications such as APH, hematoma formation, and ICU admissions were not statistically different between the cases and the controls. However, PPH (56.5%), hematoma formation (15.9%), and stich line ooze (27.5%) were found to occur more in the thrombocytopenic group. Tejeswini *et al*.[16] conducted a study in which there were three cases of maternal mortality due to PPH eclampsia which deteriorated to cerebral edema and leading to death and abruption leading to DIC.

The association between birth weight and thrombocytopenia was statistically significant in our study with 44 out of 53 cases having low birth weight (<2.5 kg). Vinodhini and Kumari.[17] conducted a study aimed at the early detection of platelet count abnormalities in preeclampsia and eclampsia. The average birth weight of patients in the control group was 2.85 kg, whereas in the test group, it was 2.15 kg. Thus, the birth weight was significantly lower in the test group due to placental factors in preeclampsia and associated thrombocytopenia. In our study, a significant association was seen between thrombocytopenia and NICU admission. Out of 44 cases in our study with NICU admission at birth, 37 had associated thrombocytopenia, out of which nine cases had neonatal mortality.

Conclusion

From our study, it is concluded that platelet count is a very important investigation for every pregnant woman having PIH, as it is directly related to maternal and perinatal outcomes. Estimation of platelet count can be considered an early, simple, and cost-effective procedure in the assessment of severity of preeclampsia and follow-up of such pregnancies. Platelet count can be used to predict pregnancies which may need early termination and steroids can be administered to reduce perinatal morbidity.

However, due to the smaller sample size in our study and data taken from admitted patients only, the generalization of this data may need further studies.

Ethical standard

Ethical approval was obtained.

Informed consent

Informed consent was taken from all patients undergoing the procedure.

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Conflicts of interest

There are no conflicts of interest.

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