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Original Research Article

Prospective study of platelet count as a prognostic marker in predicting feto-maternal outcome in gestational hypertension

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ABSTRACT

Background: Hypertensive disorders of pregnancy are one of the leading causes of maternal and neonatal morbidity and mortality worldwide. Hypertensive disorders of pregnancy (HDP) affects approximately 5-7% of all pregnancies. The reported incidence of HDP in India ranges from 5% to 15%. These disorders form a deadly triad-in conjunction with hemorrhage and infection, in significantly contributing to maternal morbidity and mortality. Objectives were to determine the correlation between the severity of HDP and low platelet count; to analyze maternal and fetal outcomes in relation to thrombocytopenia; to aid in early diagnosis and management and to prevent complications and thereby improving maternal and fetal outcomes.
Methods: A hospital-based prospective study was conducted in women with a provisional diagnosis of gestational hypertension over a period of 18 months. The study group comprised of pregnant women who were more than 20 weeks and were subjected to detailed history: pre-obstetric history, family history, general physical examination, abdominal examination, routine laboratory investigations, and ultrasonography and Doppler.
Results: In the study, platelet count at ≤275000 cut-offs had the highest sensitivity of 52.11%, specificity of 82.76%, PPV of 88.1%, and NPV of 41.4% in predicting feto maternal complications. Platelet count at ≤275000 cut-offs had the highest sensitivity of 62.86%, specificity of 69.23%, PPV of 52.4%, and NPV of 77.6% in predicting preeclampsia.
Conclusions: From the study, it was concluded that in gestational hypertension the estimation of platelet count is thus a reliable method for early detection and management of hypertensive disorders of pregnancy. Platelet count was significantly decreased in subjects with maternal complications, fetal complications, and with respect to the severity of preeclampsia. Platelet count however had moderate validity in predicting fetomaternal complications.

Keywords: Gestational hypertension, Preeclampsia, Fetomaternal complications, HELLP syndrome

INTRODUCTION

HDP are one of the leading causes of maternal and neonatal morbidity and mortality worldwide. HDP affects approximately 5-7% of all pregnancies. The reported incidence of HDP in India ranges from 5% to 15%.[1] These disorders form a deadly triad in conjunction with hemorrhage and infection, in significantly contributing to maternal morbidity and mortality.[2] The presentation can vary from mild to life-threatening disease process, manifesting with hemostatic abnormalities ranging from thrombocytopenia, and consumptive coagulopathy to the triad of hemolysis, elevated liver enzymes, and low platelets (HELLP) associated with complications like cerebral hemorrhage, hepatic failure, acute renal failure (ARF) and abruptio placenta.[3,4]

As recommended by the National high blood pressure education program (NHBPEP), 2000, and the American College of Obstetrics and Gynecology (ACOG), 2013, the hypertensive disorders of pregnancy are classified into four categories: gestational hypertension; preeclampsia-

eclampsia; chronic hypertension of any etiology; preeclampsia superimposed on chronic hypertension.[2,5]

Aim

Prospective study of platelet count as a prognostic marker in predicting feto-maternal outcome in gestational hypertension was the aim of the study.

Objectives

The objectives were to determine the correlation between the severity of HDP and low platelet count; to analyse maternal and fetal outcomes in relation to thrombocytopenia; to aid in early diagnosis and management and to prevent complications and thereby improving maternal and fetal outcomes.

Review of literature

History

Eclampsia was not distinguished from epilepsy until 1739. It was only then that de Sauvages wrote saying epilepsy was chronic with recurrent convulsions, whereas eclampsia was acute. In the early 19th century, eclampsia was believed to be a special form of epilepsy (convulsio) associated with pregnancy. Discoveries by Rayer in France in 1840 and John Lever in London in 1843 showed that eclampsia was associated with albuminuria. Lever also mentioned that eclampsia was more common in first pregnancies than the subsequent ones.[6]

Gracia in his study on pregnancies complicated with HELLP syndrome found that there were significant differences in platelet count, LDH, AST, and ALT between different classes of HELLP syndrome. The mean peak serum levels of LDH, AST, and ALT were significantly higher in class I and showed a decrease between class I and III, indicating the disease severity. Thus, the study concluded that patients with class I HELLP syndrome, including those with platelet count <50,000 /µl, LDH >2000 IU/l, AST >500 IU/l, ALT >300 IU/l, and hematuria are at an increased risk for serious maternal complications.[7]

This was followed by many theories. Eclampsia was initially thought to be a renal disorder, due to the presence of edema and nephritis, the convulsions being attributed to uremia. Ancient Indian, Egyptian, and Chinese literature have been alleged to have made a mention of eclampsia.8 A few people thought the cause was compression of the ureters, while Delore in 1884 was certain that the causative agent was *Bacillus eclampsiae*.[8] Ahlfeld in 1894 said that the disorder was due to specific toxins of pregnancy and thus it came to be called toxemia.[8]

Delic et al conducted a study to know the optimal laboratory panel for predicting preeclampsia and concluded that serum uric acid, creatinine, urea, AST, and leukocytes were significantly higher and platelets and HCT were significantly lower in preeclamptic women as compared to control group. Thus, it was concluded that selected laboratory tests which include serum uric acid, urea, platelet count, AST, PCV, and leukocytes, when taken as a panel, have significant prognostic value in PE.[9]

Han et al conducted a study to compare and contrast the changes in platelet indices in normal and preeclamptic pregnancies. It was found that there was a reduction in platelet count in both the groups in late pregnancy when compared to early pregnancy and hence it should not be considered an absolute marker for the progression of PE. However, the study concluded that MPV can be taken as a potential marker for predicting the severity of PE in early pregnancy.[10]

A study of erythrocyte morphology in women with severe PE and eclampsia using scanning electron microscopy was done by Cunningham et al. Evidence suggestive of MAHA was seen in women with eclampsia, which was shown by reticulocytosis and thrombocytopenia.[11]

A study on newly diagnosed PE patients by Ata et al showed that WBC and neutrophil count, MPV, and neutrophil-lymphocyte ratio (NLR) were higher and platelets and lymphocytes were lower in patients with PE than in the control group. Also, higher values of WBC, MPV, and NLR with lower values of platelets and lymphocytes are seen in severe PE as compared to mild PE, thus indicating the severity of PE.[12]

Chan et al showed that in women with proteinuric PE, the incidence of adverse maternal outcome increases with advancing maternal age and increasing spot urine protein: creatinine ratio.[13]

Ahmed et al did a study involving 428 women in normal pregnancy and 74 women with pre-eclampsia who had platelet measurements between 27 and 30 weeks of pregnancy. Between the first trimester to the conclusion of pregnancy, the mean platelet volume and quantity remained stable in normal pregnancies. Between 24 and 38 weeks of pregnancy, 14 out of 15 pre-eclamptic patients had a consistent increase in mean platelet volume, compared to only 13 out of 428 normal pregnant women. In 12 of the 15 individuals with pre-eclampsia, platelet counts were lower. Changes in platelet levels may be a less accurate evaluation of the formation of pre-eclampsia in 10% of the normal pregnant population, indicating that changes in platelet numbers may be a less accurate assessment of the development of pre-eclampsia.[14]

METHODS

Study settings

The study was conducted in the department of obstetrics and gynaecology, at Narayana Medical College and Hospital, Nellore, Andhra Pradesh.

Study population

Pregnant women between 18-24 weeks, visiting for antenatal screening, the department of obstetrics, both outpatient and ward admissions to this hospital were the study population.

Inclusion criteria

All female patients that were admitted to Narayana hospital with a provisional diagnosis of gestational hypertension were included in the study.

Exclusion criteria

Patients with any vaginal infections, premature rupture of membranes, patients with blood dyscrasias, patients on anti-coagulant treatment and patients with any H/O fever were excluded.

Study design

A hospital-based prospective study of women with a provisional diagnosis of gestational hypertension in and hospital.

Study duration

The study duration was over a period of 18 months from 2019 to 2021.

Sampling

This study was a hospital-based prospective study conducted in the department of obstetrics and gynaecology, Narayana medical college Nellore on 100 patients with a provisional diagnosis of gestational hypertension. the women in the study group was subjected to detailed history: pre-obstetric history, family history, general physical examination, abdominal examination, routine laboratory investigations, ultrasonography, and Doppler.

Methodology

The study group comprised of pregnant women who were more than 20 weeks, diagnosed with gestational hypertension, fulfilling the inclusion and exclusion criteria, and detailed clinical history, clinical history, clinical examination, ultrasound Doppler, and blood and urine analysis was done. Written and informed consent were taken from all pregnant women participating in the study. The pregnant women in the study group were subjected to a detailed history and general examination.

Techniques

The results were subjected to appropriate statistical analysis. The data was tabulated and analyzed.

Statistical analysis[15-17]

Data were entered into a Microsoft Excel data sheet and analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. The Chi square test was used as a test of significance for qualitative data.

RESULTS

The mean age of subjects was 26.96±4.353 years. The majority of subjects were in the age group 26 to 30 years (48%).

In the study 52% were primigravida and 48% were multigravida.

In the study, 22% had a family history of hypertension.

In the study, 65% did not develop preeclampsia. 25% had mild and 10% had severe preeclampsia.

In the study 10% had previous preeclampsia, 8% had previous LSCS, 3% had GDM, and 1% had epilepsy and bronchial asthma respectively.

In the study 32% were preterm and 68% were term pregnancies.

In the study, 56% were delivered by LSCS, 36% by FTVD, and 8% by PTVD.

In the study most common Fetal complication was Preterm (25%), followed by Fetal growth retardation (16%).

In the study, 61% had maternal complications and 40% had fetal complications.

In the study mean platelet count among subjects without preeclampsia was 286446.15±51414.68, among subjects with mild preeclampsia was 274440.00±54619.20 and among subjects with severe preeclampsia was 230700.00±58501.76.

There was a significant difference in platelet count with respect to the severity of preeclampsia. With the increase in severity, there was a decrease in platelet count.

The mean platelet count among subjects with feto maternal complications was 268295.77±56906.790 and among subjects without maternal complications was 301310.34 ± 42163.884. There was a significant difference in platelet count with respect to feto maternal complications.

In the study platelet count at ≤275000 cut-offs had the highest sensitivity of 52.11%, specificity of 82.76%, PPV of 88.1%, and NPV of 41.4% in predicting feto maternal complications.

Table 1: Age distribution of subjects.

Age distribution (years)		Count	%
Age	<20	5	5.0
	21 to 25	31	31.0
	26 to 30	48	48.0
	31 to 35	12	12.0
	>35	4	4.0
	Total	100	100.0

Table 2: Preeclampsia distribution.

Preeclampsia distribution		Count	%
Preeclampsia	Nil	65	65.0
	Mild	25	25.0
	Severe	10	10.0

Table 3: Risk factors distribution.

Risk factors distribution		Count	%
Risk factors	Not significant	77	77.0
	Previous PE	10	10.0
	Previous LSCS	8	8.0
	GDM	3	3.0
	Epilepsy	1	1.0
	Bronchial asthma	1	1.0

Table 4: Period of gestation.

Gestation		Count	%
Period of gestation	Preterm	32	32.0
	Term	68	68.0

Table 5: Maternal and fetal complications distribution.

Complications		Count	%
Maternal Complications	No	39	39.0
	Yes	61	61.0
Fetal Complications	No	60	60.0
	Yes	40	40.0

Table 6: Mean platelet count with respect to preeclampsia.

Parameter		Platelet count		P value
		Mean	SD	
Preeclampsia	Nil	286446.15	51414.68	0.01*
	Mild	274440.00	54619.20	
	Severe	230700.00	58501.76	

ANOVA test.

Table 7: Platelet count comparison with respect to feto maternal complications.

Comparison		Platelet count			P value
		N	Mean	SD	
Feto maternal complications	No	29	301310.34	42163.884	0.006*
	Yes	71	268295.77	56906.790	

Table 8: Validity of platelet count in predicting feto maternal complications the area under the ROC curve (AUC).

Area under the ROC curve (AUC)	0.663
Standard error	0.0552
95% confidence interval	0.562 to 0.755
z statistic	2.963
Significance level P (area=0.5)	0.0031

DISCUSSION

Gestational hypertension is the most common medical complication of pregnancy and is an important cause of maternal and perinatal morbidity and mortality.[18] Preeclampsia is one of the commonest and intractable medical disorders during pregnancy which complicates 5-10% of pregnancy.[19] It is a progressive disorder, of varying severity where delivery is needed to halt the progression to the benefit of the mother and fetus. Though many studies have explained the pathogenesis of preeclampsia, the precise pathogenetic mechanism and definitive treatment remain unknown. One of the explained mechanisms is a deficient trophoblastic invasion of the maternal vascular bed which results in reduced maternal blood flow to the placenta resulting in ischemic changes.[20]

Basic research had demonstrated that plasma thrombopoietin which was inversely related to platelet mass, was increased in patients with PE. Therefore, MPV and PDW which served as parameters for platelet activation, were increased in PE more than in normal healthy pregnant women.[21] Studies had shown that platelet count and plateletcrit were decreased, along with increased platelet distribution width and mean platelet volume in preeclampsia and eclampsia. Despite an increase in the volume of literature regarding the changes in platelet indices, its clinical relevance was not well correlated.[22]

There are several technical issues as well limiting their clinical use. The main concern was the influence exerted by three components of the measuring process: the type of hematology analyzer, the anticoagulant applied, and the time from sampling to analysis. There were potential discrepancies in platelet counts between the impedance and optical methods, and thus validation by immuno-platelet procedures may be required when making important clinical decisions. Each hematology analyzer utilized one or both of these methods. Instrument-dependent differences between platelet counts may result in different platelet indices. These inaccuracies were especially seen in severe thrombocytopenia.[23]

Limitations

Small size and purposive sampling method were used. Hence generalizability of results was not possible. Other platelet indices were not estimated and not evaluated.

CONCLUSION

From the study, it was concluded that in gestational hypertension the estimation of platelet count is thus a reliable method for early detection and management of hypertensive disorders of pregnancy.

Platelet count was significantly decreased in subjects with maternal complications, fetal complications, and those with respect to the severity of preeclampsia. Platelet count however had Moderate validity in predicting fetomaternal complications.

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