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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. Pregnancy induced hypertension (PIH) affects approximately 5-7% of all pregnancies. The reported incidence of PIH 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].

Aim: Prospective Study of Platelet Count as A Prognostic Marker in Predicting Feto-Maternal Outcome in Gestational Hypertension.

Material and Methods

Study Design: Hospital based observational study.

Study area: Study was conducted in Department of General Medicine & Department of Obstetrics & Gynaecology, both outpatient and ward admissions, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, W.G (Dist.), Andhra Pradesh.

Study Period: Feb. 2017 – July 2017.

Study population: Pregnant women between 18-24 weeks, visiting for antenatal screening, to the department of Obstetrics Gynaecology and Department of General Medicine both outpatient and ward admissions.

Sample size: study consisted a total of 100 study subjects.

Sampling method: Simple random sampling method.

Study tools and Data collection procedure: The study group will comprise of pregnant women who are more than 20 weeks, diagnosed with gestational hypertension, fulfilling the inclusion and exclusion criteria and detailed clinical history, clinical history, clinical examination, ultrasound Doppler, blood and urine analysis done. Written and informed consent will be taken from all pregnant women participating in the study. The pregnant women in the study group will be subjected to a detailed history and general examination.

Results: 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 significant difference in Platelet count with respect to severity of Preeclampsia. With increase in severity there was decrease in platelet count.

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.

Keywords: Gestational Hypertension, platelet count, maternal and neonatal morbidity

Introduction

Hypertensive disorders of pregnancy are one of the leading causes of maternal and neonatal morbidity and mortality worldwide. Pregnancy induced hypertension (PIH) affects approximately 5-7% of all pregnancies. The reported incidence of PIH 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 a life-threatening disease process, manifesting with hemostatic abnormalities ranging from thrombocytopenia, consumption 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

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[3, 4].

PIH is defined as hypertension that occurs in pregnancy for the first time after 20 weeks of gestation, disappearing following delivery [5]. To be defined as PIH, one of the following criteria has to be fulfilled: Blood Pressure (BP) of 140/90 mm Hg or more after 20th week of pregnancy in a woman who was previously normotensive and BP rise of 30 mm Hg systolic or 15 mm Hg diastolic above the values obtained in the first half of pregnancy.

Hematological parameters which may get deranged in some women with PIH are: Numerical and functional platelet anomalies: Platelet dysfunction and thrombocytopenia, Alterations of hemoglobin (Hb) and erythrocytic parameters: Increased hematocrit (HCT), microangiopathic hemolytic anemia (MAHA) and Coagulation changes [6].

As recommended by the National High Blood Pressure Education Program (NHBPEP), 2000 and American College of Obstetrics and Gynecology (ACOG), 2013, the hypertensive disorders of pregnancy are classified into 4 categories:

1. Gestational hypertension
2. Preeclampsia – Eclampsia
3. Chronic hypertension of any etiology
4. Preeclampsia superimposed on chronic hypertension [2, 7]

The HELLP syndrome is considered to be a complication of severe PE, which leads to both maternal and fetal morbidity and mortality [8]. Though the role of serum urea, uric acid and creatinine have been studied by many researchers, there is a constant ongoing search for better predictors and prognostic factors, hematological parameters being one among them [9]. PIH monitoring is required for early detection of preeclampsia and its life-threatening complications and is possible by investigations like Complete Blood Count (CBC) and Platelet Indices, which are simple, cost-effective and help in better prediction of the disease [10].

Decrease in platelet count is proportional to severity of disease. Assessment of platelet count is simple and cost effective & sensitive method to know the prognosis & feto-maternal outcome in eclampsia and preeclampsia. Hence this study was conducted in the present institute to determine the role of Platelet count in prediction of feto-maternal complications in Gestational HTN.

Aim

Prospective Study of Platelet Count as A Prognostic Marker in Predicting Feto-Maternal Outcome in Gestational Hypertension.

Objectives

- To determine the correlation between severity of PIH & low platelet count.
- To analyse maternal and fetal outcome in relation to thrombocytopenia.

Material and Methods

Study Design: Hospital based observational study.

Study area: Study was conducted in Department of General Medicine & Department of Obstetrics & Gynaecology, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, W.G (Dist.), Andhra Pradesh.

Study Period: Feb. 2017 – July 2017.

Study population: Pregnant women between 18-24 weeks, visiting for antenatal screening, to the department of Obstetrics Gynaecology and Department of General Medicine both outpatient and ward admissions.

Sample size: study consisted a total of 100 study subjects.

Sampling method: Simple random sampling method.

Inclusion criteria: Female patients admitted with provisional diagnosis of gestational hypertension.

Exclusion criteria:

- Any vaginal infections
- Premature rupture of membranes
- Blood dyscrasias
- On Anti-coagulant treatment
- Any H/O fever

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Ethical consideration: Institutional Ethical committee permission was taken prior to the commencement of the study.

Study tools and Data collection procedure

This study is a hospital based prospective study conducted in Department of General Medicine & Department of Obstetrics and Gynaecology, on 100 patients with provisional diagnosis of gestational hypertension. The women in the study group will be subjected to Detailed History- pre-obstetric history, family history, General physical examination, Abdominal examination, Routine laboratory investigations and Ultrasonography and doppler.

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

Statistical Analysis

The data was collected, compiled and compared statistically by frequency distribution and percentage proportion. Quantitative data variables were expressed by using Descriptive statistics (Mean±SD). Qualitative data variables were expressed by using frequency and Percentage (%). P values of <0.05 were considered statistically significant. Data analysis was performed by using SPSS Version 20. Chi – square test/ Independent sample t-test/ ANOVA/Paired t- test was used to assess statistical significance.

Observations and Results

Table 1: Age distribution of subjects

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

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

Table 2: Preeclampsia distribution

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

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

Table 3: Risk factors distribution

Risk factors	Count	%
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%

In the study 10% had previous Preeclampsia, 8% had previous LSCS, 3% had GDM, 1% had Epilepsy and Bronchial asthma respectively.

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Table 4: Fetal Complications distribution

Fetal Complications*	Count	%
Absent	60	60.0%
Preterm birth	20	20.0%
FGR	11	11.0%
FGR/preterm birth	5	5.0%
Abruption	3	3.0%
IUD, Abruption	1	1.0%

*Multiple responses possible

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

Table 5: Maternal and Fetal complications distribution

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

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

Table 6: Mean platelet count with respect to Preeclampsia

		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

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 significant difference in Platelet count with respect to severity of Preeclampsia. With increase in severity there was decrease in platelet count.

Table 7: Platelet count comparison with respect to maternal complications

Maternal Complications	Platelet count			P value
	N	Mean	SD	
No	39	287025.64	54131.656	0.047*
Yes	61	264500.66	55105.805	

Mean Platelet count among subjects with maternal complications was 264500.66±55105.805 and among subjects without Maternal Complications was 287025.64±54131.656. There was significant difference in platelet count with respect to maternal complications.

Table 8: Platelet count comparison with respect to Fetal Complications

Fetal Complications	Platelet count			P value
	N	Mean	SD	
No	60	301716.67	38247.230	<0.001*
Yes	40	242100.00	57132.235	

Mean Platelet count among subjects with Fetal Complications was 242100.00±57132.235 and among subjects without Maternal Complications was 301716.67±38247.23. There was significant difference in platelet count with respect to Fetal Complications.

Table 9: Validity of Platelet count in predicting Preeclampsia Area under the ROC curve (AUC)

Area under the ROC curve (AUC)	0.634
Standard Error	0.0610
95% Confidence interval	0.532 to 0.728
z statistic	2.196
Significance level P (Area=0.5)	0.0281

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Youden index

Youden index J	0.3209
Associated criterion	≤275000

Criterion values and coordinates of the ROC curve

Criterion	Sensitivity	95% CI	Specificity	95% CI	+PV	-PV
<172000	0.00	0.0 - 10.0	100.00	94.5 - 100.0		65.0
≤172000	2.86	0.07 - 14.9	98.46	91.7 - 100.0	50.0	65.3
≤180000	5.71	0.7 - 19.2	96.92	89.3 - 99.6	50.0	65.6
≤195000	11.43	3.2 - 26.7	96.92	89.3 - 99.6	66.7	67.0
≤198000	17.14	6.6 - 33.6	93.85	85.0 - 98.3	60.0	67.8
≤200000	28.57	14.6 - 46.3	90.77	81.0 - 96.5	62.5	70.2
≤260000	54.29	36.6 - 71.2	70.77	58.2 - 81.4	50.0	74.2
≤265000	54.29	36.6 - 71.2	69.23	56.6 - 80.1	48.7	73.8
≤275000	62.86	44.9 - 78.5	69.23	56.6 - 80.1	52.4	77.6
≤280000	62.86	44.9 - 78.5	64.62	51.8 - 76.1	48.9	76.4
≤285000	65.71	47.8 - 80.9	63.08	50.2 - 74.7	48.9	77.4
≤289000	68.57	50.7 - 83.1	61.54	48.6 - 73.3	49.0	78.4
≤298000	68.57	50.7 - 83.1	47.69	35.1 - 60.5	41.4	73.8
≤300000	74.29	56.7 - 87.5	38.46	26.7 - 51.4	39.4	73.5
≤309000	77.14	59.9 - 89.6	38.46	26.7 - 51.4	40.3	75.8
≤310000	77.14	59.9 - 89.6	30.77	19.9 - 43.4	37.5	71.4
≤315000	85.71	69.7 - 95.2	26.15	16.0 - 38.5	38.5	77.3
≤328000	85.71	69.7 - 95.2	13.85	6.5 - 24.7	34.9	64.3
≤340000	88.57	73.3 - 96.8	12.31	5.5 - 22.8	35.2	66.7
≤360000	91.43	76.9 - 98.2	7.69	2.5 - 17.0	34.8	62.5
≤365000	100.00	90.0 - 100.0	6.15	1.7 - 15.0	36.5	100.0
≤380000	100.00	90.0 - 100.0	0.00	0.0 - 5.5	35.0	

In the study Platelet count at ≤275000 cut off had highest sensitivity of 62.86%, specificity of 69.23%, PPV of 52.4% and NPV of 77.6% in predicting Preeclampsia.

Discussion

Gestational Hypertension is the most common medical complication of pregnancy and is important cause of maternal and perinatal morbidity and mortality [11]. Preeclampsia is one of the commonest and intractable medical disorders during pregnancy which complicates 5-10% of pregnancy [12]. It is a progressive disorder, of varying severity where delivery is needed to halt the progression to the benefit of mother and foetus. Though many studies have explained the pathogenesis of preeclampsia, the precise pathogenetic mechanism and definitive treatment remains unknown. One of the explained mechanisms is deficient trophoblastic invasion of maternal vascular bed which results in reduced maternal blood flow to the placenta resulting in ischemic changes [13].

Basic research has demonstrated that plasma thrombopoietin which is inversely related to platelet mass, is increased in patients with PE. Therefore, MPV and PDW which serve as parameters for platelet activation, are increased in PE more than in normal healthy pregnant women [14]. Studies have shown that platelet count and Plateletcrit is decreased, along with increased platelet distribution width and mean platelet volume in preeclampsia and eclampsia. Despite an increase in volume of literature regarding the changes in platelet indices, its clinical relevance is not well correlated [15].

Mean age of subjects was 26.96±4.353 years. Majority of subjects were in the age group 26 to 30 years (48%). 52% were primi gravida and 48% were multigravida. 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, 1% had Epilepsy and Bronchial asthma respectively. 56% were delivered by LSCS, 36% by FTVD and 8% by PTVD. The age distribution was comparable with the study by Sogani S *et al*., [16] study where it is 23.14±2.97 and the Chauhan *et al*., [17] where the mean age is 24±3.4 years. Similarly, in the studies by Rahim R (2010) [18] and Rabia Prabin Sidiqui (2015) [19] mean age was 23.12 and 23.45±3.25 respectively.

Platelet activation in normal pregnancy and PE leads to thrombocytopenia. However, further decrease in the platelet count in preeclamptic patients is due to increased platelet consumption because of unchecked intravascular platelet activation and deposition of fibrin [20]. In the present study mean platelet count in subjects with preeclampsia was 261942.86±58426.899 and among subjects without Preeclampsia was 286446.15±51414.684.

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Table 10: Mean platelet count in cases and controls in various studies

	Platelet count (lakhs/cumm)	
Various studies	**Preeclampsia**	**No Preeclampsia**
Parkash M [21] (2016)	1.33	2.97
Sultana *et al*., [22] (2012)	1.44	1.98
Koopmans *et al*., [23] (2010)	2.00	2.27
Piazze J *et al*., [24] (2006)	2.00	2.21
Karateke *et al*., [25] (2015)	2.16	2.52
Delic R & Stefanovic M [26] (2010)	2.12	2.49
S.Sivakumar *et al*., [27] (2007)	2.30	2.57
Present study	2.61	2.86

Platelet count has an association with increasing severity of PIH [28]. Degree of thrombocytopenia is said to determine the severity of PIH [2]. In the Present 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 significant difference in Platelet count with respect to severity of Preeclampsia. With increase in severity there was decrease in platelet count.

Mean Platelet count among subjects with maternal complications was 264500.66±55105.805 and among subjects without Maternal Complications was 287025.64±54131.656. Mean Platelet count among subjects with Fetal Complications was 242100.00±57132.235 and among subjects without Maternal Complications was 301716.67±38247.23. 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 significant difference in platelet count with respect to Maternal, fetal and Feto Maternal Complications.

In the study Platelet count at ≤275000 cut off had highest sensitivity of 52.11%, specificity of 82.76%, PPV of 88.1% and NPV of 41.4% in predicting Fetomaternal complications. In the study Platelet count at ≤275000 cut off had highest sensitivity of 62.86%, specificity of 69.23%, PPV of 52.4% and NPV of 77.6% in predicting Preeclampsia. In the study by Bawore SG *et al*., [29] showed that Platelet count can differentiate normotensive pregnant women from preeclamptic pregnant women at a cut-off value ≤ of 224x10 3/µl with a sensitivity of 88.3%, the specificity of 64.2%, PPV of 71.1%, and NPV of 84.5% with an AUC of 0.858. The study had lower cut off compared to the present study.

Similarly, lower cutoff was observed in the studies conducted in Brazil and Egypt [30, 31] and in Saudi Arabia, in Egypt and Turkey [32, 33] also revealed a lower cut-off value. The discrepancy in the hematological analyzer could be the cause and certain analyzers tend to exaggerate some metrics while underestimating others [34].

In ROC analysis, Tesfay F *et al*., [35] found that a threshold for PC of 233x109/L had a sensitivity of 70.97 percent and a specificity of 89.3 percent for predicting PE development. This finding is similar to that of Eman *et al*., (2013) [32], who found a cut off value of 198,000 (with 90% sensitivity and 92% specificity) to distinguish NT for mPE pregnant women and a cut off value of 149,000 (with 84 percent sensitivity and 92% specificity) to distinguish mPE from sPE groups. Our findings, however, contradict the findings of other studies. This variance could be explained by the fact that various platelet indicators are measured differently.

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. Platelet count was significantly decreased in subjects with Fetal complications. Platelet count was significantly decreased with respect to the Severity of Preeclampsia. Platelet count however had Moderate validity in predicting Fetomaternal complications.

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