

ORIGINAL ARTICLE

Platelet Indices in Pregnancy Induced Hypertension

Thakur Bhavana¹, Kulkarni Vishal², Thakur Prashant³

1. Assistant Professor, Department of Pathology, Pt Jawaharlal Nehru Medical College, Raipur Chhattisgarh.

2. Associate Professor, Department of Pathology, Government Medical College, Rajnandgaon. Chhattisgarh.

3. Consultant Pediatric Cardiologist, Ramkrishna Care Hospital, Raipur, Chhattisgarh.

Abstract

Preeclampsia is a syndrome with both maternal and fetal manifestations. Haematological abnormalities such as thrombocytopenia and decrease in some plasma clotting factors may develop in pre-eclamptic women. The platelet count has an association at prediction of increasing grade of pregnancy induced hypertension (PIH). There is an inverse relationship between the severity of PIH and platelet count. The platelet indices of Mean Platelet Volume (MPV) and platelet distribution width (PDW) too are in consistent relationship with PIH. The greater MPV values suggest the increase grade of PIH of preeclampsia, severe preeclampsia and eclampsia. PDW too can suggest the PIH for its severity especially in the groups of preeclampsia, severe preeclampsia and eclampsia and the risk of consumptive coagulopathy. Thus, investigations with baseline complete blood cell count including platelet count and platelet indices is necessary in patients with a hypertensive disorder of pregnancy.

Keywords: Pregnancy Induces Hypertension, Platelet Count, Platelet Indices

Address for correspondence: Dr. Bhavana Thakur, C-129/5, Near Devi Lakshmi Hospital, Tagore Nagar, Raipur, Chhattisgarh. Email: anju.bhawnani@gmail.com

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Introduction

The most serious consequence for the mother and baby result from preeclampsia and eclampsia. These are associated with vasospasm, pathologic vascular lesions in multiple organ system, increased platelet activation and subsequent activation of coagulation system in the microvasculature.¹ Hypercoagulability is a constant accompaniment of hypertensive disease of pregnancy and particularly pre-eclampsia.² Haematological abnormalities such as thrombocytopenia and decrease in some plasma clotting factors may develop in pre-eclamptic women. Thus, coagulation testing is common in these patients for evidence of DIC and HELLP (Hemolysis, Elevated Liver Enzymes, Low Platelets) syndrome.³

Preeclampsia is a syndrome with both maternal and fetal manifestations,⁴ the pathogenesis of which lie vasospasm, pathologic vascular lesions in multiple organ system, increased

platelet activation and subsequent activation of coagulation system in the microvasculature.¹

In the recent years interest has also been focused in the haemostatic abnormalities that are associated with many pregnancy-related disorders including hypertensive disease complicating pregnancy.²

The major adverse outcomes of pre-eclampsia and eclampsia include central nervous system injuries such as seizures (eclampsia), ischemic heart disease, stroke, type II diabetes, and venous thromboembolism hemorrhagic and ischemic strokes, hepatic damage, HELLP syndrome, renal dysfunction as well as increased frequency of cesarean delivery, preterm delivery, and abruptio placentae, in comparison with women without history of the disease.⁵

Thus, coagulation testing with baseline complete blood cell count including platelet count and platelet indices probably sufficient in patients with a hypertensive disorder of pregnancy is common in these patients for evidence of DIC and HELLP.^{3,6}

AIM & Objectives

To study Platelet count, Platelet indices in cases of Pregnancy induced hypertension and to correlate and compare the values with Normotensive pregnant subjects.

Materials & Methods

The present prospective case control study was carried out in the Department of Pathology of Jawaharlal Nehru Medical College and Acharya Vinoba Bhave Rural Hospital at Datta Meghe Institute of Medical Sciences, Sawangi (Meghe), Wardha from August 2011 to July 2013.

The present study comprised pregnant women admitted in Obstetrics and Gynaecology Department of the hospital.

The preliminary data in regards to name, age, sex, registration number, obstetric, menstrual, and family history, general and systemic examination and investigations were recorded in a proforma after getting informed consent from the patients.

The study was been conducted on two groups of pregnant women:

Group I: Control: 50 normal healthy women in the 2nd and 3rd trimester of pregnancy.

Group II: Included 150 pregnant women which were further divided into subgroups of:

1) Gestational hypertension, 2) Preeclampsia, 3) Severe preeclampsia and 4) Eclampsia.

Normal healthy women who developed hypertension for the first time during pregnancy after 20 weeks of gestation were included in PIH category.⁷ The further categorization was done according to following diagnostic criteria:

1. **Gestational hypertension**⁴- It is defined by the blood pressure elevation of greater than 140 mm Hg systolic or 90 mm Hg diastolic in a previously normotensive women for the first time after mid pregnancy, but in whom proteinuria is not identified.
2. **Preeclampsia**⁴ - It is defined by hypertension (blood pressure greater than 140 mm Hg systolic or 90 mm Hg diastolic) associated with proteinuria > 0.3g/l in a 24 hour urine collection or 1+ dipstick or greater in random urine collection, after 20

weeks of gestation in a previously normotensive women.

3. **Severe Preeclampsia**⁸ – This condition was categorised if systolic blood pressure was >160 mm Hg and diastolic blood pressure > 110 mm Hg.
4. **Eclampsia**⁴ - The onset of convulsions in women with pre-eclampsia that cannot be attributed to other causes is termed as eclampsia.

Subjects with haemorrhagic disorders, Sepsis, functional uterine bleeding, placental abruption or previa, diabetes, respiratory, circulatory, renal and hepatic disorders, known cases of hypertension and subjects taking drugs which can affect platelet count were excluded from the study.

Hemoglobin estimation, platelet count was done by Automated Haematology analyser, Sysmex Corp. KX.21, Japan. (Normal range of platelet count was considered to be 1.5-4.0 lacs/mm³). Platelet indices like Mean platelet volume (MPV) and platelet distribution width (PDW) were estimated with reference range of the laboratory for MPV being 6.5-11.0 fl and for PDW being 10.0-18.0 fl. The peripheral blood smear (PS) of the cases were stained by Leishman's stain. Platelets were studied for their adequacy and morphology.

The results were analysed statistically to draw comparison between the Groups. The statistical data was processed using Microsoft Excel to draw the values of significance for Group II and its subgroups. Tests of significance applied were Chi square and 'Z' test for statistical analysis to suggest the relation between the observed abnormal value of chosen laboratory tests in the study with hypertensive disorders of pregnancy and its importance in antenatal care.

Results

The distribution of cases in subgroups according to diagnostic criteria is depicted in Graph 01.

Table 01 shows the distribution of cases according to trimester and Parity in subgroups & controls. The platelet counts and indices according to the subgroups is depicted in Table No. 02.

TRIMESTER	STUDY GROUP (150)										CONTROL GROUP (50)	
	Gestational hypertension (19)		Preeclampsia (78)		Severe Preeclampsia (32)		Eclampsia (21)		Total (150)			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
IInd	02	10.53	06	7.69	06	18.75	07	33.33	21	14	09	18
IIIrd	17	89.47	72	92.31	26	81.25	14	66.67	129	86	41	82
Total	19	100	78	100	32	100	21	100	150	100	50	100
PARITY	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Primiparae	11	57.89	45	57.69	18	56.25	15	71.43	89	59.33	25	50
Multiparae	08	42.11	33	42.31	14	43.75	06	28.57	61	40.67	25	50
Total	19	100	78	100	32	100	21	100	150	100	50	100

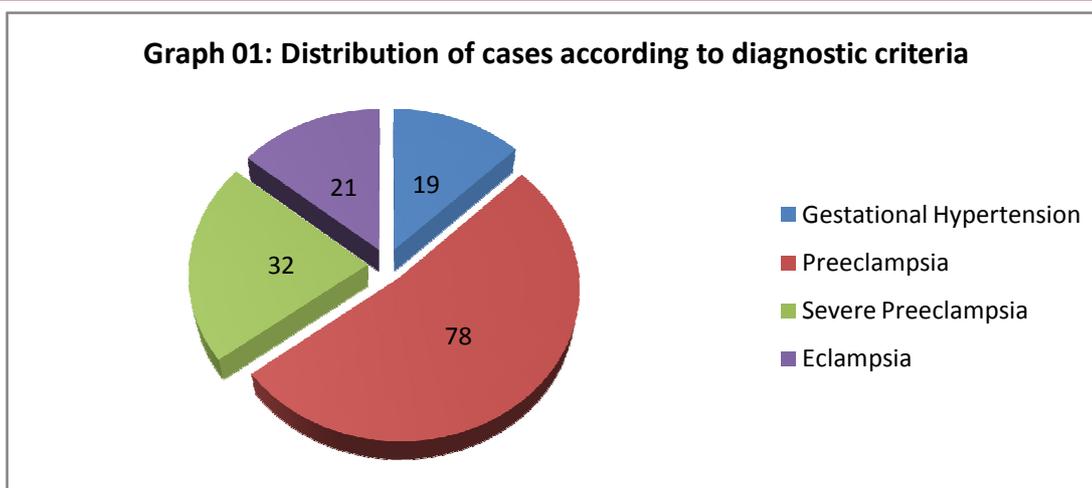
Table 01. The distribution of cases according to trimester and Parity in subgroups & controls.

PLATELET COUNT (in lacs/mm ³)	STUDY GROUP (150)										CONTROL GROUP (50)		
	Gestational hypertension (19)		Preeclampsia (78)		Severe Preeclampsia (32)		Eclampsia (21)		Total (150)				
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
≥ 1.5 (Normal range)	17	89.47	60	76.92	15	46.87	09	42.86	103	68.67	46	92	
>1 - <1.5	02	10.53	10	12.82	09	28.13	05	23.81	25	16.67	04	08	
>0.5-1	0	0	06	7.69	05	15.63	02	9.52	12	08	0	0	
≤ 0.5	0	0	02	2.57	03	9.37	05	23.81	10	6.66	0	0	
Mean	2.18		1.92		1.63		1.37		1.82		2.33		
SD	0.50		0.69		0.95		0.76		0.77		0.64		
Range	1.2 – 3.19		0.39 – 4.08		0.34 – 3.83		0.34 – 3.0		0.34 – 4.08		1.32 – 3.95		
χ²-Value	0.52		8.92		50.68		59.78		22.78				
‘p’ value	0.46 NS, p>0.05		0.011 S, p<0.05		S, p<0.0001		S, p<0.0001		S, p<0.0001				
PLATELET INDICES													
MPV (fl)	Mean	10.02		10.95		11.08		11.37		10.92		10.07	
	SD	0.80		1.18		1.52		1.77		1.36		1.2	
	Range	8.6 – 11.8		8.3 – 15.1		8.3 – 15.1		9.3 – 16.1		8.3-16.1		8.1 – 13	
	z-value	0.16		4.08		3.32		3.58		3.92			
	‘p’ value	NS,p>0.05		S,p<0.05		S,p<0.05		S,p<0.05		S,p<0.05			
PDW (fl)	Mean	13.71		15.66		17.16		18.13		16.08		13.37	
	SD	2.61		3.10		3.48		4.81		3.61		1.76	
	Range	10 – 20.5		10.3 – 27.7		11.6 – 26.2		11.7 – 27.1		10-27.7		11.1-17.7	
	z-value	0.63		4.74		6.53		6.13		5.09			
	‘p’ value	NS ,p >0.05		S, p<0.05		S ,p<0.05		S, p<0.05		S, p<0.05			

NS – Not significant, S – Significant

Table 02. Platelet counts, Platelet indices (MPV and PDW) in Study subgroups and controls.

Graph 01: Distribution of cases according to diagnostic criteria



Discussion

Mohapatra et al.⁹, Fitzgerald et al.⁶, Kramer et al.¹⁰, Baseer¹¹, Jambhulkar et al.¹², and Rahim et al.¹³ studied hypertensive disorders of pregnancy and their subgroups along with control group of healthy pregnant women. The present study was carried out with similar framework of study design. The other studies Gader et al.², Davidson, Phillips¹⁴, Dube et al.¹⁵, Metz et al.¹⁶, Orlikowski et al.¹⁷, Sharma et al.¹⁸, and Dadhich et al.¹⁹ on the topic of PIH reviewed for present work utilized the same design but with limited subgroups of PIH.

Distribution of subjects of study group according to trimester of pregnancy

None of the studies reviewed for present work have divided their patients in subgroups for trimester except for Baseer et al.¹¹. Present study had controls as well as patients of 3rd trimester of pregnancy. The observation in present study therefore could not be compared as it had 86% in the 3rd trimester and 14% cases in the 2nd trimester. The control group had almost parallel values i.e 82% of the patients of 3rd trimester and 18% patients in the 2nd trimester.

Distribution of subjects of study group according to Parity

Metz et al.¹⁶ had 71 % of their primiparae in subgroup of gestational hypertension. The other studies have not specified about percentage of primiparae recruited in subgroup of gestational hypertension. The present study had 57.89% of the cases in similar subgroup, which is lower than that of figure reported by Metz et al.¹⁶

Metz et al.¹⁶ reported 79% subjects in subgroup of preeclampsia as primiparae while Davidson, Phillips¹⁴ and Dube et al.¹⁵ reported 58% and 66.7% of subjects as primiparae respectively in their studies. The present study had 57.69% cases of similar subgroups.

Leduc et al.²⁰ reported 65% cases as primiparae in severe preeclampsia group while the present study had 56.25% cases of similar subgroup which is lower than that reported study.

In eclampsia group, Lopez-Lleret al.²¹ reported low percentage of primiparae in 14 out of 33 cases (42.42%) and Dube et al.¹⁵ too had reported low percentage of 46.7% primiparae subjects. The present study had 71.43% cases of similar subgroup which is similar to the reported value of Rahim et al with 76.60% patients.¹³

The observation that primiparae being more affected by PIH as compared to the multiparae subjects has been highlighted by Davidson, Phillips¹⁴, Dube et al.¹⁵, Lopez-Llera et al.²¹, Leduc et al.²⁰ and Rahim et al.¹³. The present study had a concordant observation with that of the aforesaid studies as in the total study group i.e. 59.33% and 40.67 cases of primiparae and multiparae respectively.

Platelet counts in the study subgroups

The platelet count in the study subgroup of gestational hypertension has been reported to have subtle change of thrombocytopenia by many workers. Mohapatra et al.⁹ reported mean platelet count of 2.23 ± 0.19 lacs/mm³ amongst the subjects of gestational hypertension in a study while the control had the mean platelet count of 2.38 ± 0.33 lacs/mm³. The change Mohapatra et al.⁹ reported between the mean

platelet count of the control group and that of gestational hypertension was subtle.

The similar findings as that of Mohapatra et al.⁹ have been observed in present study for the mean platelet count of 2.18 ± 0.50 lacs/mm³ in gestational hypertension and 2.33 ± 0.64 lacs/mm³ in control group with minimal difference between the means of two groups. Mohapatra et al.⁹ reported maximum cases having platelet counts over 1.5 lacs/mm³ and 2 cases with counts in range of 1-1.5 lacs/mm³. The present study observed similar trend that 17 out of 19 cases of gestational hypertension were having platelet count >1.5 lacs/mm³ and only 2 cases had counts in the range of >1 - <1.5 lacs/mm³. There was no case in the study of Mohapatra et al.⁹ as well as in the present study in gestational hypertension subgroup that had platelet count <1 lac/mm³. Though, Mohapatra et al.⁹ reported significant 'p' value for platelet counts in gestational hypertension, the present study found non-significant 'p' value in subgroup of gestational hypertension when compared with controls.

Several studies have reported the mean platelet counts less than 2 lacs/mm³ in subgroup of preeclampsia which include studies of Mohapatra et al.⁹ (1.82 ± 0.45 lacs/mm³), Dube et al.¹⁵ (1.95 ± 0.61 lacs/mm³), Annam et al.²² (1.55 ± 0.31 /mm³) and Sultana et al.²³ (1.44 ± 0.96 lacs/mm³). But the mean platelet count in the studies of Davidson, Phillips¹⁴ (2.27 lacs/mm³) and Davies et al.⁸ (2.30 ± 0.83 lacs/mm³) were over 2 lacs/mm³ but less than 2.5 lacs/mm³. The present study had mean platelet count of 1.92 ± 0.69 lacs/mm³ in the preeclampsia subgroup which is close and similar to reported counts of Dube et al.¹⁵ but in disagreement with reported mean platelet count in studies of Davidson, Phillips¹⁴ and Davies et al.⁸

In 30 cases of preeclampsia subgroup of Mohapatra et al.² the platelet counts in 13 patients were in the range of 1-1.5 lacs/mm³ and in 5 patients were <1 lacs/mm³. The present study had 78 cases in the subgroup of preeclampsia of which 10 patients had platelet counts between >1 - <1.5 lacs/mm³, 6 were having platelet count in the range of $>50,000$ - 1 lacs/mm³ and there were 2 cases which had counts $\leq 50,000$ /mm³. These observations of present study are incompatible with observation by Mohapatra et al.⁹ The 'p' value for platelet

count for comparison with control group was found to be significant which is similar to that reported by Mohapatra et al.⁹

A few studies have reported low mean values of platelet count in subgroup of severe preeclampsia which includes Davidson, Phillips¹⁴ (1.51 lacs/mm³), Jambhulkar et al.¹² (1.70 ± 0.57 lacs/mm³) and Davies et al.⁴¹ (1.77 ± 0.81 lacs/mm³). These observations for mean platelet count in above studies are close to the low mean platelet count reported in present study of 1.63 ± 0.95 lacs/mm³. The studies of Davidson, Phillips¹⁴, Jambhulkar et al.¹² and Davies et al.⁸ however have not distributed their cases for the ranges of platelet count showing thrombocytopenia.

The study of Leduc et al.²⁰ has reported 14% of their cases in the range of platelet count 1-1.5 lacs/mm³, 22% in the range of 50,000-1 lacs/mm³, and 14% of the cases having counts $<50,000$ /mm³ among 100 cases of severe preeclampsia. The rest had counts over 1.5 lacs/mm³. The present study though does not match for distribution of cases over individual platelet range in severe preeclampsia, yet has close observations. The present study observed 28.13% of cases of severe preeclampsia with platelet count in the range of >1 - <1.5 lacs/mm³, 15.63% cases in range of $>50,000$ - 1 lacs/mm³, and 9.37% of cases with counts $\leq 50,000$ /mm³. The rest of the cases had platelet counts over 1.5 lacs/mm³. However total percentage of cases in the subgroup of severe preeclampsia with platelet counts <1.5 lacs/mm³ in the study of Leduc et al.²⁰ was 50%, while in the present study it was 53.13%. The 'p' value was significant at its comparison for subgroup of severe preeclampsia for platelet count in the present study similar to that observed by Leduc et al.²⁰.

The study of Annam et al.²² has reported the mean platelet count of 1.31 ± 0.33 lacs/mm³ in the eclampsia subgroup which is close to mean platelet count of 1.37 ± 0.76 lacs/mm³ in eclampsia subgroup of present study. Studies of Mohapatra et al.⁹, Lopez-Lleret al.²¹, and Shete et al.²⁴ have reported still lower mean platelet count of 1.21 ± 0.49 lacs/mm³, 1.13 ± 0.71 /mm³, and 1.27 ± 0.13 lacs/mm³ respectively. Dube et al.¹⁵ reported a little higher mean platelet count of 1.81 ± 0.60 /mm³ as compared to above said studies while Baseer et al.¹¹ reported the lowest

mean platelet count of $58.26 \pm 3.68 \times 10^9/l$ in the subgroup of eclampsia. Pritchard et al.²⁵ in their cases of eclampsia reported 31.1% cases with mean platelet count $<1.5 \text{ lacs/mm}^3$, 16.8% cases with counts $<1 \text{ lac/mm}^3$ and 3 cases with platelet count $<50,000/\text{mm}^3$. In rest of the cases platelet count was over 1.5 lacs/mm^3 .

Mohapatra et al.⁹ reported in a total of 30 patients of eclampsia, 8 patients to have platelet count $>1.5 \text{ lacs/mm}^3$, 10 with counts in the range of $1-1.5 \text{ lacs/mm}^3$, and 12 having platelet counts $<1 \text{ lacs/mm}^3$. If taken in percentile, present study had 23.81% of cases having platelet count in the range of $>1-1.5 \text{ lacs/mm}^3$, 9.52% in the range of $>50,000 -1 \text{ lac/mm}^3$, while 23.81% cases had counts $\leq 50,000/\text{mm}^3$. On comparison of findings of Mohapatra et al.⁹ and Pritchard et al.²⁵, the observations in present study are similar; there is a definite lowering of platelet counts below 1 lac/mm^3 in the subgroup of eclampsia.

The 'p' value for lowered platelet count was highly significant in above said studies probably indicating the consistent association of eclampsia with marked reduction in the platelet count over 50% of the cases. As has been observed by above studies there is definite lowering of mean platelet counts as the PIH progresses from gestational hypertension to eclampsia.

Platelet indices in the study subgroups

Annam et al.²² studied the platelet indices on two accounts of mean platelet volume (MPV), and platelet distribution width (PDW) and reported the MPV of $10.38 \pm 1.65 \text{ fl}$ in 82 subjects of preeclampsia subgroup. In present study MPV was $10.95 \pm 1.18 \text{ fl}$ in 78 cases of preeclampsia which is comparable to that of Annam et al.²² which quoted MPV as $11.03 \pm 2.23 \text{ fl}$ in eclampsia subgroup comprising of 63 cases which is parallel to the value of MPV of $11.37 \pm 1.77 \text{ fl}$ in 21 cases of eclampsia of present study.

There were no studies that observed the MPV values in other subgroups of the study and therefore could not be compared with the present study so also with that of control. However present study has made a noteworthy observation that MPV for the groups other than gestational hypertension and 'p' value in these groups were significant enough to correlate with subgroup of higher degrees of PIH. Annam et

al.²² have observed PDW of $15.51 \pm 2.67 \text{ fl}$ in preeclampsia group of 82 cases which is parallel to the values observed for PDW of $15.66 \pm 3.10 \text{ fl}$ of present study. Annam et al.²² have observed PDW value of $16.78 \pm 3.12 \text{ fl}$ in eclampsia group of 63 cases. However the present study differs a little for observation of PDW in eclampsia subgroup of 21 cases where observed value was $18.13 \pm 4.81 \text{ fl}$. The other studies were not available for PDW for rest of the study subgroups as their format for observation were different than that adopted for the present study. However a generalized observation was that mean PDW showed upward values as compared to the control with severity of PIH. A generalization for the observation that MPV and PDW were significantly more when normotensive pregnancy control group was taken in account giving it an edge that these values signify the various classes of PIH.

Conclusion

The platelet count has an association at prediction of increasing grade of PIH. There is an inverse relationship between the severity of PIH and platelet count. The depleted platelet counts are concluded to be consistently associated with clinical groups of severe preeclampsia and eclampsia and the risk of consumptive coagulopathy.

The platelet indices of MPV and PDW too are in consistent relationship with PIH. The greater their values suggest the increase grade of PIH, and they suggest the PIH for its severity especially in the groups of preeclampsia, severe preeclampsia and eclampsia and the risk of consumptive coagulopathy.

There is definite statistical difference in values of platelet count, platelet indices in PIH groups when compared with normotensive pregnant women.

As PIH is known to land in consumptive coagulopathy, the present study concludes and suggest that the estimation of platelet count, platelet indices offer an early, simple, rapid assessments of the disease for its severity and the risk of complications. Therefore these tests may be considered as screening tests to be routinely performed in antenatal workup of women with PIH.

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