Role of platelet indices in hypertensive disorders of pregnancy

[1]Dr. Narendra Singh, Department of Pathology, SMS Medical College, Jaipur, Rajasthan, India.

[2]Dr. Anita Harsh, Department of Pathology, SMS Medical College, Jaipur, Rajasthan, India.

[3]Dr. Ranjana Solanki, Department of Pathology, SMS Medical College, Jaipur, Rajasthan, India.

[4]Dr. Shailesh Dixit, MD General Medicine, SMS Medical College, Jaipur, Rajasthan, India.

[5]Dr. Kumkum Mehta, Department of Obstetrics and Gynaecology, JLN Medical College, Ajmer, Rajasthan, India.

Corresponding Author: Dr. Kumkum Mehta, Department of Obstetrics and Gynaecology, JLN Medical College, Ajmer, Rajasthan, India.

Abstract

Introduction: Hypertensive disorders of pregnancy (HDP) are among the most significant and intriguing problems in obstetrics. The current study was done to evaluate the platelet markers i.e., platelet indices if it could be beneficial as diagnostic tool and to assess disease progression in hypertensive disorders of pregnancy.

Objective: To use the alterations in platelet indices as a tool in early diagnosis and to assess the severity of disease.

Patients and methods: This hospital-based cross-sectional study was done on 200 patients. 100 patients were cases, and 100 patients were controls. Patients aged above 18 weeks, with low-risk pregnancy, who have given written informed consent were included in this study. Parameters like Complete blood count (CBC), Hemoglobin concentration, Platelet count, Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), Plateletcrit, Bleeding time and clotting time were assessed.

Results: The maximum number of cases and controls were in age group 26-30 years., Most of them were Primigravida. Ankle edema was the most common complaint. Gestational age was 36 weeks in many cases and controls. A fall in platelet count was observed more in cases than controls at different week intervals during antenatal period. Significant increase in mean PDW was found in cases with the increasing duration of pregnancy in comparison to control group. There was significant difference in MPV and Plateletcrit, while no significant difference was found in coagulation profile between cases and controls.

Keywords: Platelet count, Plateletcrit, platelet distribution width, mean platelet volume, Hypertensive disorders of pregnancy.

Introduction

Hypertensive disorders of pregnancy (HDP) are among the most significant and intriguing problems in obstetrics.[1]

It may complicate 3-8% of pregnancies with higher incidence rate in developing world. It is associated with increased risk of perinatal and maternal morbidity and mortality.[2]

Several studies have suggested that platelets may play a major role in the etiopathogenesis of hypertension during pregnancy. A decreasing platelet counts is observed during the progression of pre-eclampsia & eclampsia and is suggested to be a characteristic of worsening condition.3 Platelet indices can be potentially useful markers for the early diagnosis, to assess the severity of disease and can guide for timely intervention to reduce the morbidity and mortality.

The applicability of these platelet markers for clinical and pathophysiological understanding of vascular disease including preeclampsia and eclampsia has been investigated, but their value has not been proved yet. So, the purpose of the study was to evaluate the platelet markers i.e., platelet indices if it could be beneficial as diagnostic tool and to assess disease progression in hypertensive disorders of pregnancy.

Objectives

To use the alterations in platelet indices as a tool in early diagnosis and to assess the severity of disease, to compare the changes in platelet profile between patients diagnosed with hypertension and normal pregnant patients or controls.

Patients and Methods

- Place of Study: Department of Pathology, SMS Medical College, Jaipur, Rajasthan
- Type: Descriptive type of observational study.
- Design: Hospital based cross sectional study.
- Period: Study has been done after approval of plan by Research Review Board in March 2021 to November 2021.

Inclusion Criteria

1. Completed 18 years of age

2. ANC patients of low-risk pregnancy

3. ANC patients who have given written consent

Exclusion Criteria: Women having

1. Epilepsy

2. Hypertension

3. Subjects on Drugs affecting platelet count

4. Medical illness like diabetes mellitus, renal disease, hypothyroidism etc.

5. Women with missing data and irregular follow up

Sample Size

Sample size was calculated at 95% confidence level assuming 51.21% eclampsia among all samples of hypertensive disorders of pregnancy as per the reference article. At 10% allowable error, 100 cases are required as sample size. 100 were controls. Comparison was done between cases and controls.

Diagnosis

The diagnosis of patients of hypertensive disorders of pregnancy was based on full history, clinical examination and investigations needed for accurate diagnosis. 100 normotensive pregnant women were taken as control.

Parameters assessed

- Complete blood count (CBC)
- Hemoglobin concentration
- Platelet count
- Platelet indices: Mean Platelet Volume (MPV), Platelet Distribution Width (PDW) and Plateletcrit
- Bleeding time
- Clotting time

Statistical analysis

Statistical analysis was performed with the SPSS, Trial version 23 for Windows statistical software package (SPSS inc., Chicago, il, USA) and Primer. The Categorical data were presented as numbers (percent) and were compared among groups using Chi square test. The quantitative data were presented as mean and standard deviation and were compared using by students t-test.

Results

Age: The maximum number of cases and controls were in age group 26-30 years. The mean age for case and control groups was 28.68 ± 4.03 and 28.90 ± 4.22 respectively with age range of $21 - 39$ years. There was no significant difference among the case and control groups. (p=1.0) Gravida: In the present study, we have more cases and controls of primi gravida. No significant difference was found among the groups.

Presenting complaint: Ankle edema was the most common compliant among cases and controls.

Pallor: Pallor of eyes and palm was more in cases (57%) as compared to control group (36%), but there is no significant difference between cases and controls. (Chi square = 0.753 with 1 degree of freedom: P = 0.38.)

Gestational age: The maximum number of cases had gestational age 37 weeks followed by 36 weeks, while in control group the maximum gestational age was 39 weeks followed by 38 weeks. There was significant difference among the groups.

Figure 1: Distribution of the pregnancies according to gestational age.
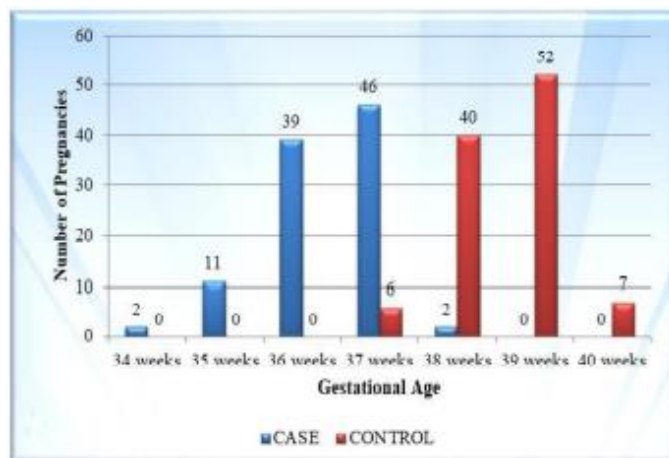
Weight gain between groups: Gradual rise in weight was seen in most of the subjects in both the groups from 12 to 38 weeks. No significant difference was seen between the groups. (p=0.1).

Proteinuria: Significant proteinuria was seen in cases than to the control group. The proteinuria was not detected before 20 weeks of gestation, while 100% cases showed significant proteinuria after 30 weeks of gestation.

Figure 2: Comparison of proteinuria between cases and controls
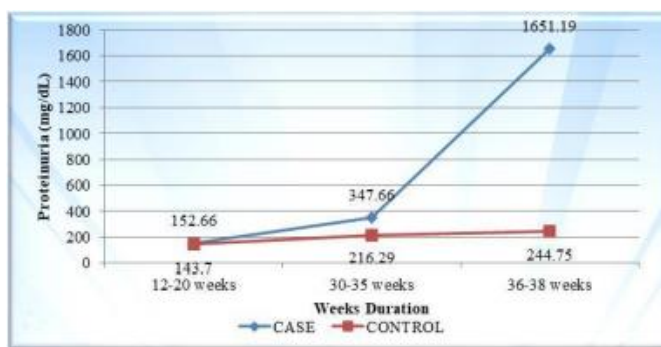
Hemoglobin and WBC: The mean hemoglobin value was decreased slightly in cases during the different weeks' timeframe, whereas in controlled group normal rise in hemoglobin was found with the progression of pregnancy. Increasing mean white cell count was observed among cases and controls, but there was no

significant difference in WBC count was seen between two groups.

Blood-pressure: The mean systolic blood pressure value was more in cases (153.91 ± 5.62) as compared to control (123.33 ± 3.7). Similar findings were seen for diastolic blood pressure (91.97 ± 1.85) in cases as compared to control (81.87 ± 1.9).

Platelet count: A fall in platelet count was observed in more cases than controls at different week intervals during antenatal period. Significant difference in platelet counts was observed between the groups during late antenatal period.

Figure 3: Comparison of Platelet count in between the groups.
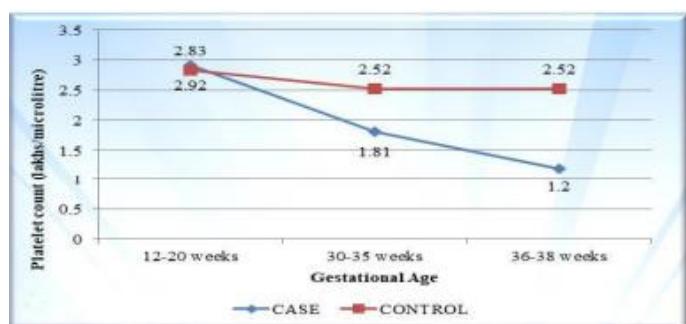
PDW: In the study, significant increase in mean platelet distribution width was found in cases with the increasing duration of pregnancy in comparison to control group.

Gestational age (in weeks)	Case (100)		Control (100)		p value
	Mean of PDW	Std. Deviation	Mean of PDW	Std. Deviation	
At 12 to 20 weeks	10.64	0.71	10.58	0.61	0.423
At 30 to 35 weeks	15.01	0.57	13.62	1.18	0.002
At 36 to 38 weeks	20.40	1.64	16.53	1.05	<0.001
Mean ± SD	15.36 ± 0.97		13.58 ± 0.95		
Range	14.39 - 16.33		12.63 - 14.53		

Table 1: Comparison of Platelet distribution width (in fL) between the groups

MPV: There is a significant increase in MPV in cases at different week intervals.

Figure 4: Comparison of Mean platelet volume (in FL) in between the groups.
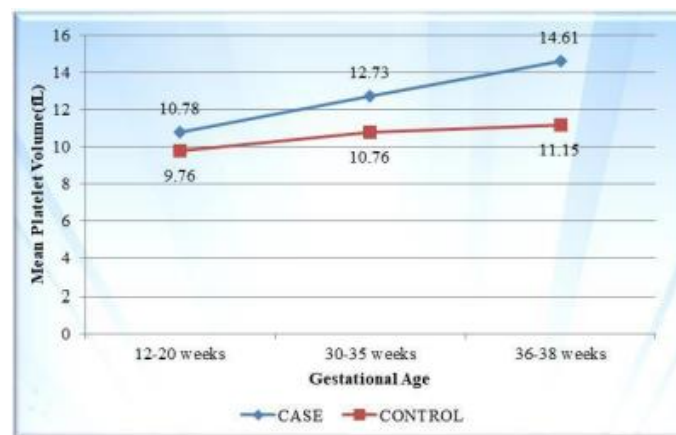
Plateletcrit (%): There is significant difference in Plateletcrit among cases and controls from 30 to 38 weeks

Gestational age (in weeks)	Cases (100)		Controls (100)		p value
	Mean of PCT	Std. Deviation	Mean of PCT	Std. Deviation	
At 12 to 20 weeks	0.37	0.03	0.36	0.23	0.09
At 30 to 35 weeks	0.21	0.07	0.33	0.04	<0.001
At 36 to 38 weeks	0.17	0.02	0.30	0.06	<0.001
Mean ± SD	0.25 ± 0.04		0.33 ± 0.11		
Range	0.21 - 0.29		0.22 - 0.44		

Table 2: Comparison of Plateletcrit (in %) in between the groups

Coagulation profile: The table shows the comparison of mean of coagulation parameters between the case and control groups. No significant difference was seen between the groups.

Gestational age	Coagulation parameters	Cases (100)		Controls (100)		p value
		Mean	Std. Deviation	Mean	Std. Deviation	
36-38 weeks	BT in minutes	4.64	1.21	4.36	0.96	0.069
	CT in minutes	11.71	1.55	11.37	1.38	0.102
	PT in seconds	12.74	1.37	12.40	1.22	0.065
	APTT (seconds)	34.84	2.55	34.50	2.47	0.340

Table 3: Comparison of coagulation profile between cases and controls

Convulsions: Proportion of pre-eclampsia cases was more in our study constituting 83% of cases, while 17% cases were of eclampsia.

Summary of Comparison of parameters between preeclampsia and eclampsia

Figure 5: Comparison of parameters between preeclampsia and eclampsia.
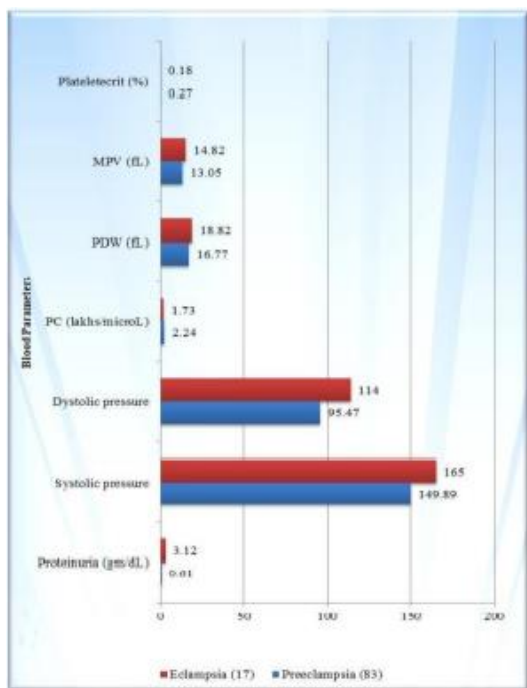
Discussion

Hypertensive disorders of pregnancy (HDP) are major health problems and have serious consequences both to mother and baby. The identification of this entity and effective management has significant role in the outcome of pregnancy.

In the present study, maximum number of cases and controls were in 26-30 years age group. The mean age for case and control groups was comparable with the study of Alsheeha et al4. Singh[3] et al. found cases and controls in lower age group.

The incidence of HDP was more in primigravida in our study similar to the studies of Donthi5 et al and Udhnawala PJ et al[6].

In our study, gestational age was comparable with the study of Eman Abdel7 et al., but contrasts with Abd El Rahman et al[8], who found low gestational age in their study.

In present study, all cases showed significant proteinuria after 30 weeks of gestation. Three control subjects showed mild proteinuria. It could be because of infection in urinary tract or kidney. Most other studies considered >300 mg/dL as proteinuria for cases, hence extent of it could not be compared with other studies.

In present study, fall in hemoglobin was noted in cases and it was comparable with studies of Ceyhan T et al9 and Priyanka P[10].

The reference WBC count was increased in pregnancy due to physiological stress induced by change in hormonal milleu[17]. Similar results were obtained in our study and were in accordance with Ceyhan T et al.[9] and Muneer A Alsheeha et al.[11]

The significant increase in both systolic and diastolic blood pressure was seen in cases. This was compatible with studies of Singh et al.[3] and Eman Abdel[7] et al

In the present study, the platelet count was decreased within the normal range and no thrombocytopenia was seen. However, a significant difference in mean platelet count was seen in cases as compared to control group.

This was consistent with Singh et al.[3], Eman Abdel. et al.[7]

Ray Chaudhuri et al[12] and Donthi et al.[5] also noted lower mean platelet count in cases, but no significant difference was noted. The platelet count was slightly higher in cases in the study of Ceyhan T et al.[9], may be due to significant number of multigravidas which tends to have higher platelet count. The PDW is an indicator of volume variability of platelets that changes with platelet activation.

In our study, PDW was significantly increased in cases than the control group. This was in accordance with the study of Singh et al.3, Eman Abdel et al7 and Donthi et al.[5]

Ray Chaudhuri et al.12 did not find statistically significant difference, may be due to random case selection. Mean platelet volume is a measurement of the average platelet size.

In pregnancy MPV is increased due to release of large immature platelets as a result of stress. Our study also showed increased mean MPV in cases than controls. This was compatible with Singh et al.[3], Eman Abdel et al. 7 MPV was increased in cases in the study of Donthi et al.[5], but not statistically significant.

Ray Chaudhuri et al.[12] did not find statistically significant difference between two groups probably due to difference between the method and equipment used.

In the current study, Plateletcrit was lower in cases than control subjects. This was in accordance with Singh et al3, Ray Chaudhuri et al[12]. This was presumably due to increased platelet consumption and hemodilution.

In our study, the cases were categorised as pre-eclampsia (83%) and eclampsia (17%). The proportion of preeclampsia and eclampsia was not comparable with other studies due to differences in sample size. Eclampsia cases had significantly higher systolic and diastolic blood pressure similar to the study of Singh et al.3 [6].

Conclusion

Platelet indices showed a significant alteration in hypertensive pregnancies. An inverse relationship between platelet count, Plateletcrit and severity of disease was observed. The platelet distribution width (PDW) and mean platelet volume (MPV) showed consistent relationship in cases. The estimation of platelet variables by automated hematology analyser is an easy, reliable, economic and rapid method.

The serial estimation of these variables can be used as tool for prediction of HDP, as an adjunct with clinical parameters for diagnosis, assess the severity of disease and guide the treatment.[7]

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