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Original Article

Obstetrics and Gynaecology Section

Platelet Indices in Preeclampsia and Normotensive Pregnancy in a Tertiary Care Centre: A Cross-sectional Study

KRATIKA KAMATH[1], E GOMATHY[2]

ABSTRACT

Introduction: Preeclampsia is a serious pregnancy-related complication. Platelets are potentially important in the pathogenesis of preeclampsia, and platelet function analyses may prove as a sensitive preeclampsia biomarkers. It is well established that pregnancy itself induces a pro-coagulant state due to a rise in the levels of pro-coagulant proteins and a lower level of some endogenous natural anticoagulants. Additionally, it has been reported that preeclampsia is associated with an increase in platelet function.

Aim: To assess the platelet indices in preeclamptic and normotensive pregnant women.

Materials and Methods: This cross-sectional study was conducted in the Department of Obstetrics and Gynaecology at RL Jalappa Hospital and Research Centre, Kolar, Karnataka, India. A total of 132 pregnant women were involved in this study. Among them 66 were preeclamptic women treated as cases (Group A) and 66 were normotensive pregnant treated as controls (Group B). The duration of the study was from October 2018 to July 2020. A detailed clinical history along with the antenatal examination was done. The Blood Pressure (BP) recording were documented and for the patient with hypertension repeat BP recording after four hours were documented. Complete blood count was done for all the patients and White Blood Cells (WBC), Platelet Count (PC), Mean Platelet Volume (MPV), Platelet Distribution Width (PDW) were documented in all the patients. Comparison was done between the platelet indices of normotensive pregnant women and women with preeclampsia using Chi-square test.

Results: In this study, majority of the subjects were in the age group of 21-30 years in group A and 18-25 years in group B. The PC was 50,000-1 lac in about 26 (39.4%) in group A. The mean PDW (fl) was 12.62±2.14 in group A and in group B it was 10.98±1.06. The mean MPV (fl) (femtoliter) was 10.27±1.11 in group A and in group B 9.81±1.01. There was a statistically significant difference in clinical parameters like PC, PDW (fl) and MPV (fl) between the study groups (p-value <0.05). In the present study, adverse foetal outcomes were more in group A than group B. In group A, 40 babies born to preeclamptic mothers showed adverse outcomes. Twelve (30%) cases suffered Intrauterine Growth Restriction (IUGR). In group A, 39 cases and in group B 26 cases showed maternal abnormalities. Placental abruption was observed in 9 (23.08%) patients of group A and 2 (7.69%) in group B and anaemia was observed in 9 (23.08%) patients in group A and 7 (26.92%) in group B.

Conclusion: This study concluded that there is decrease in PC and increase in the platelet indices like MPV, PDW, in preeclampsia women as compared to normal pregnant women. Adverse neonatal outcomes like IUGR and foetal distress were also found to be more in women with preeclampsia (not statistically significant). Particularly in developing countries like India, the platelet indices can be used as effective biomarkers which are both easy and economical to obtain. Platelet indices can be used as a prognostic tool, for prediction of preeclampsia and help in improving the feto-maternal outcome.

Keywords: Mean platelet volume, Platelet count, Platelet distribution width

INTRODUCTION

The preeclampsia is a multisystemic pregnancy complication, characterised by the presence of high blood pressure and proteinuria after the 20th week of pregnancy. It is considered as one of the major health problems associated with pregnancy and one of the causes of maternal mortality world-wide with prevalence of 5-8% [1]. In India, preeclampsia is reported to be 8-10%. The prevalence of hypertensive disorders of pregnancy in India was found to be as 7.8% with preeclampsia in 5.4%. Around 16-18% of maternal perinatal deaths and up to 40% of foetal and neonatal deaths is caused due to preeclampsia [2].

Although, the exact pathogenesis of preeclampsia remains unknown, placental vascular under perfusion, maternal endothelial damage and increased vascular permeability are thought to contribute to the pathophysiology of the disease that leads to activation of platelets [3]. These platelets activate the coagulation system leading to increase consumption as well as bone marrow production of platelets resulting in increased platelet indices such as MPV, PDW and Platelet Large Cell Ratio (PLCR) [4].

The primary well-known function of platelets is haemostasis or prevention of bleeding during the earlier stages of clot formation [5]. PC and platelet indices, such as MPV, PDW and PLCR, are a group of derived platelet parameters obtained from automatic complete blood count. Platelet parameters are suggested as a good candidate for diagnosis and prognosis preeclampsia [6].

Main causes of preeclampsia are placental vascular under perfusion, maternal endothelial damage and increased vascular permeability. Platelet consumption increases during preeclampsia due to abnormal platelet endothelium interaction. Platelets are activated by injured endothelium leading to increased platelet consumption which in turn triggers bone marrow to produce more platelets. The platelets produced are bigger in size resulting in increase of platelet indices like MPV, PDW [7]. Clinical presentation of preeclampsia is highly variable and can sometimes be even asymptomatic. Early onset of preeclampsia causes foetal growth restriction while late onset causes many long-term consequences like metabolic syndromes, inflammation, and chronic endothelial impairment.

Preeclampsia requires earlier diagnosis and appropriate intervention as it can progress rapidly. Preeclampsia can progress to eclampsia and cause adverse foetal outcomes such as preterm birth, small-for-gestational-age babies, placental abruption, perinatal death and increase the risk of cardiovascular and cerebrovascular diseases and venous thromboembolism later in life [8]. It has been found that identifying women at risk of developing preeclampsia and administration of prophylactic aspirin reduces risk of preeclampsia by 17% and 14% reduction of foetal death risk [9]. Measurement of blood pressure and proteinuria are told to be gold standards for diagnosis of preeclampsia are difficult in low resource settings and the measurements may not be always accurate. Sensitive, cost-effective, easy to perform biomarkers are necessary particularly in developing countries like India for detection of pregnant patients at risk of developing preeclampsia. Blood or urinary biomarkers that help in diagnosis of preeclampsia will help in easy detection and subsequent management which helps in reducing preeclampsia associated complications [10].

Platelet indices can be easily be obtained through routine blood investigations and can used to predict preeclampsia. Early detection or prediction of preeclampsia is imperative and non invasive diagnostic methods based on biomarkers holds a potential use [11].

In India, preeclampsia is reported to be 8-10%. PC decreases while MPV and PDW increase as pregnancy advances, and these changes are more pronounced in preeclampsia than normotensive pregnancy [12]. Another study by Singh A and Varma R performed on 150 pregnant women admitted in Obstetrics ward in India concluded that platelet indices showed a significant variation along with the severity of the disease [13]. Platelet indices, especially PDW and plateletcrit, can be used along with PC to evaluate the severity of preeclampsia and eclampsia instead of relying on PC alone.

There is a need for evaluation of markers of platelet activation in cases of preeclampsia as it has been seen that platelet-related parameters are not seriously analysed in cases having normal PC. Evaluation of platelet indices can also help to asses such cases. However, their functions as a tool for predicting and suggesting the prognosis of preeclampsia have not been extensively studied in developing countries specially in India. There is dearth of literature regarding changes in platelet indices during pregnancy. Thus, the purpose of this study was to compare PC, and platelet indices (MPV, PDW, between preeclampsia and normotensive) pregnant women and to assess their role in diagnosis and prediction of preeclampsia development.

MATERIALS AND METHODS

A cross-sectional study was conducted in Department of Obstetrics and Gynaecology at RL Jalappa Hospital and Research Centre, Kolar, Karnataka, India, for a period of 20 months from October 2018 to July 2020. Normotensive and preeclampsia pregnant females attending Outpatient Department (OPD) in Department of Obstetrics and Gynaecology at RL Jalappa Hospital and Research Centre, Kolar, Karnataka, constituted the study population. Study was approved by Institutional human Ethics Committee (IEC) (No. SDUMC/KLR/IEC/149). Informed written consent was taken from all the participants and only those participants willing to sign the informed consent were included in the study.

Sample size calculation: The sample size was deduced based on the data as per study between normotensive pregnant women and preeclamptic women in the study [14]. A total of 132 patients were divided into 66 each in group A and B were recruited by convenient sampling.

Group A- Singleton pregnancy with hypertension developed after 20 weeks of pregnancy.

Group B- Singleton normotensive pregnant women.

Inclusion criteria:

Pregnant women between 18-40 years of age.

- Hypertension developed after 20 weeks of pregnancy (group A).

Healthy normotensive pregnant women of ≥20 weeks gestation with a live singleton foetus were eligible and approached for recruitment (group B).

Exclusion criteria: Patient with coagulation disorders like idiopathic thrombocytopenia, sickle cell disease, viral hepatitis, cholestatic jaundice, acute fatty liver, malaria, drug induced hepatitis, dengue chronic hypertension.

Study Procedure

A detailed clinical history along with the antenatal examination was done. The BP recording was documented. Patient with hypertension repeat BP recording after four hours were documented. Urine was examined for protienuria. Complete blood count was sent for all the patients and WBC, PC, MPV, PDW were documented in all patients. Then a comparison was made between the platelet indices of Normotensive (NT) pregnant women and women with preeclampsia. An attempt was made to find out whether there was an association between platelet indices and the severity of preeclampsia. Foetal outcome and maternal outcome were considered as primary outcome variable. Age, gestational age, PC, MPV (fl), PDW (fl) and mode of delivery was considered as other study relevant variables.

Criteria for diagnosis of preeclampsia and NT pregnancy

Preeclampsia: Onset of a new episode of hypertension during pregnancy, characterised by:

- Persistent hypertension (Diastolic Blood Pressure (DBP) ≥90 mmHg, which was measured manually by single observer) and
- Substantial proteinuria (>0.3 g/24 hours) [15].

This disorder can have an early onset (preeclampsia starting before 34 weeks of gestation) or late onset (after 34 weeks of gestation) and can be classified as mild or severe, depending on the severity of the symptoms present.

Mild preeclampsia: Systolic ≥140 mmHg or diastolic ≥90 mmHg, over 20 weeks of gestation (in a woman with previously normal blood pressure) and 24 hour urine collection protein ≥0.3 g (urine dipstick test ≥1+).

Severe preeclampsia: Systolic ≥160 mm Hg or diastolic ≥110 mmHg (on two occasions at least six hours apart; in a woman on bed rest) and 24 hour urine collection protein ≥5 g (urine dipstick test ≥3+; in two random urine samples collected at least four hours apart) [16].

Pregnancy Induced Hypertension (PIH) is defined as a Systolic Blood Pressure (SBP) reading of at least 140 mmHg and/or a DBP reading of at least 90 mmHg. According to the American College of Obstetrics and Gynaecology (ACOG), PIH is attributed to four main conditions, pre-existing chronic essential hypertension; gestational hypertension; preeclampsia; and chronic hypertension exacerbated by preeclampsia or gestational hypertension (ACOG Practice Bulletin., 2019). New-onset hypertension that appears after 20 weeks of gestation in two episodes at least four hours apart is mainly due to gestational hypertension or preeclampsia. If this elevation in blood pressure is coupled with evidence of systemic involvement, such as proteinuria, the patient is said to be preeclamptic [17].

Normotensive (NT): Pregnant women who had SBP readings below 140 mmHg and DBP readings below 90 mmHg were considered normotensive. Hypertensive: Hypertensive women (Group II) were diagnosed according to the American College of Cardiology (ACC) criteria, with SBP of at least 140 mmHg and/or DBP of at least 90 mmHg (ACC criteria, 2018) [17].

The normal values for MPV are 8.4-12.0 fl, PDW 8.0- 14.0 fl, normal PC 150,000-450,000 microlitre of blood [18].

STATISTICAL ANALYSIS

The results were represented as Mean±SD (Standard Deviation), categorical variables were represented as percentages. For normally distributed quantitative parameters the mean values were compared between study groups using independent sample t-test (two groups). Categorical outcomes were compared between study groups using Chi-square test. The p-value <0.05 was considered significant statistically. Statistical analysis was done by using coGuide version V.1.0 was used for statistical analysis [19].

RESULTS

A total of 132 participants were included in the final analysis with 66 participants in each group A (preeclamptic) and Group B (normotensive). Out of 66 participants in group A, majority 43 (65.1%) were in between 21-30 years of age and 52 (78.7%) in group B were in between 18-25 years of age, as shown in [Table/Fig-1].

Age (years)	Study group		Chi-square	p-value
	Group A (N=66)	Group B (N=66)		
18-20	13 (19.7%)	23 (34.85%)	6.840	0.145
21-25	27 (40.91%)	29 (43.94%)		
26-30	16 (24.24%)	10 (15.15%)		
31-35	8 (12.12%)	3 (4.55%)		
36-40	2 (3.03%)	1 (1.52%)		

[Table/Fig-1]: Comparison of age between study group (N=132).

Comparison of platelet parameters across the groups: Mean and SD of platelet parameters of the groups are shown in [Table/Fig-2]. The average platelet parameters showed a significant difference among the categories of women. The mean PDW (fl) was 12.62±2.14 in group A and in group B it was 10.98±1.06. The mean MPV (fl) was 10.27±1.11 in group A and in group B 9.81±1.01. There was a statistically significant difference in clinical parameters like PC, PDW (fl) and MPV (fl) between the study groups (p-value <0.05).

Parameters	Preeclampsia (Group A) (n=66)	Normotensive (Group B) (n=66)	p-value
Platelet count			
50,000-1.5 lacs	26 (39.4%)	4 (6.1%)	<0.001#
1.5 lacs-2 lacs	21 (31.8%)	13 (19.7%)	
>2 lacs	19 (28.8%)	49 (74.2%)	
Platelet count	173409.09±53296.84	222530.3±43418.61	<0.001*
PDW (fl)	12.62±2.14	10.98±1.06	<0.001*
MPV (fl)	10.27±1.11	9.81±1.01	0.018*

[Table/Fig-2]: Comparison of clinical parameters between preeclamptic and healthy pregnant women (n=132).
#Denotes Chi-square test; *denotes Independent Samples t-test

Comparison of mode of delivery between groups: Out of 66 participants in group A, 43 (65.15%) preeclamptic cases had Lower Segment Caesarean Section (LSCS) whereas in group B, 40 (60.6%) healthy pregnant women had LSCS. Mode of delivery was not statistically significant among two groups as shown in [Table/Fig-3].

Comparison of foetal outcome between groups: In the present study, adverse foetal outcomes were more in group A than group B. In group A, 40 babies born to preeclamptic mothers showed adverse outcomes. Foetal parameters did not show any significance among groups [Table/Fig-4].

Comparison of maternal condition between groups: In group A, 39 cases and in group B, 26 cases showed abnormalities. There was no statistically significant difference noted in maternal conditions among groups as shown in [Table/Fig-5].

Comparison of baby outcomes between groups: Neonatal Intensive Care Unit (NICU) admission was reported more in preeclampsia group as 28 (42.42%) compare to normotensive group as 25 (37.88%) where as the baby outcomes shown statistically not significant difference between two study groups (p-value=0.239) as shown in [Table/Fig-6].

	Study group		Chi-square	p-value
	Group A (n=66)	Group B (n=66)		
Mode of delivery				
Vaginal	23 (34.85%)	26 (39.39%)	0.292	0.589
LSCS	43 (65.15%)	40 (60.61%)		
Gestational age (weeks)	36.51±3.16	36.22±3.89		
Gestational age (weeks)				
25-25±6	3 (4.55%)	5 (7.58%)	2.240	0.692
30-32±6	6 (9.09%)	5 (7.58%)		
33-35±6	9 (13.64%)	6 (9.09%)		
36-36±6	6 (9.09%)	10 (15.15%)		
37-39±6	42 (63.64%)	40 (60.61%)		
Primigravida				
Primi Gravida	31 (46.97%)	25 (37.88%)	2.310	0.511
Gravida 2	21 (31.82%)	22 (33.33%)		
Gravida 3	11 (16.67%)	12 (18.18%)		
Gravida 4	3 (4.55%)	7 (10.61%)		

[Table/Fig-3]: Comparison of obstetric parameters between preeclamptic (Group A) and normotensive pregnant (Group B) women.

Foetal outcome	Study group		p-value
	Group A (n=40)	Group B (n=13)	
IUGR	12 (30%)	3 (23.08%)	0.818
Foetal distress	12 (30%)	6 (46.15%)	
Doppler changes	7 (17.5%)	1 (7.69%)	
Intrauterine foetal demise	6 (15%)	2 (15.38%)	
Fetomaternal insufficiency	3 (7.5%)	1 (7.69%)	

[Table/Fig-4]: Comparison of foetal outcome between preeclamptic (Group A) and Normotensive pregnant (Group B) women.
Chi-square test was used

Maternal condition	Study group		Chi-square	p-value
	Group A (n=39)	Group B (n=26)		
Abruption	9 (23.08%)	2 (7.69%)	9.116	0.105
Anaemia	9 (23.08%)	7 (26.92%)		
Premature rupture of membranes	8 (20.51%)	1 (3.85%)		
Oligohydramnios	5 (12.82%)	4 (15.38%)		
Hypothyroidism	5 (12.82%)	6 (23.08%)		
Rh negative	3 (7.69%)	6 (23.08%)		

[Table/Fig-5]: Comparison of maternal condition between preeclamptic (Group A) and normotensive pregnant (Group B) women.

Baby outcome	Group		Chi square	p-value
	Preeclampsia (Group A) (N=66)	Normotensive (Group B) (N=66)		
IUD #	6 (9.09%)	2 (3.03%)	2.860	0.239
Mothers side	32 (48.48%)	39 (59.09%)		
NICU*	28 (42.42%)	25 (37.88%)		

[Table/Fig-6]: Comparison of baby outcome between group (N=132).
#Intrauterine Foetal Demise; *Neonatal Intensive Care Unit;
Baby shifted to Mother's side included neonates who did not need any active intervention or needed any NICU admission

Comparison of indication for LSCS between groups: Among the preeclamptic women (Group A) in study population, indication for LSCS was previous LSCS for 6 (13.95%) participants, previous 2 LSCS for 2 (4.65%) participants, Foetal distress for 15 (34.88%) participants, Severe preeclampsia with uncontrolled BP readings for 4 (9.3%) participants, cephalopelvic disproportion for 3 (6.98%)

participants, prolonged labour for 6 (13.95%) participants, placenta previa for 1 (2.33%) participants, malpresentation for 2 (4.65%) participants and maternal desire for 4 (9.3%) participants as shown in the [Table/Fig-7].

The distribution of BP in the preeclamptic patients has been shown in [Table/Fig-8].

Indication for LSCS	Preeclampsia (Group A) (n=43)	Normotensive Group B (n=40)
Previous LSCS	6 (13.95%)	6 (15%)
Previous 2 LSCS	2 (4.65%)	1 (2.5%)
Foetal distress	15 (34.88%)	14 (35%)
Severe PE, with uncontrolled BP readings	4 (9.3%)	0 (0%)
Cephalopelvic disproportion	3 (6.98%)	6 (15%)
Prolonged labour	6 (13.95%)	4 (10%)
Placenta previa	1 (2.33%)	1 (2.5%)
Malpresentation	2 (4.65%)	4 (10%)
Maternal desire	4 (9.3%)	4 (10%)

[Table/Fig-7]: Comparison of indication for LSCS between study group.

BP (in mmHg)	n	%
140-149	6	9.09%
150-159	29	43.94%
160-169	24	36.36%
170-179	7	10.61%
180-190	0	0%

[Table/Fig-8]: Blood pressure in the preeclampsia patients.

DISCUSSION

India contributes to large number of maternal deaths occurring globally even with rapid economic progress in past two decades because of many factors like less female literacy rate and lesser access and use of reproductive health services [11]. The aim of this study was to compare PC, and platelet indices (MPV, PDW, between preeclamptic and normotensive pregnant women and assess their role in diagnosis and prediction of preeclampsia development. In the present study, adverse foetal outcomes were more in group A than group B. In group A, 40 babies born to preeclamptic mothers showed adverse outcomes. Twelve (30%) cases suffered IUGR. In group A, 39 cases and in group B, 26 cases showed maternal abnormalities and placental abruption and anaemia were the main abnormalities observed in both the groups.

The majority of the subjects were in the age group of 21-30 years in group A and 18-25 years in group B the present study. This finding was in comparison to a cross-sectional study by Gogoi P et al., where the mean age of the women with preeclampsia was 28.5±5.6 years compared with 27.8±5.5 years in the control group (p>0.05) [20]. In the present study majority 31 (47%) were primagravida in group A and 25 (38%) in group B. This finding was in contrary to a case-control study by Hassan HES et al., where 9 (22.5) out of 40 in group A (healthy patient) and 18 (40%) out of 45 in group B (preeclampsia) were primagravida [21]. Primiparous women have increased risk when compared with multiparous women because immune tolerance will be developed during first pregnancy which will be carried over to subsequent pregnancies. This is applicable only when the first pregnancy is free from preeclampsia. This finding was in similarity with a hospital based unmatched case control study by Grum T et al., where primigravida was found to be risk factor for preeclampsia on the multivariable analysis and the odds of developing preeclampsia were 2.68 times higher in women with primigravida comparing to the women with multigravida (AOR: 2.68 95% CI: 1.38, 5.22) [22].

This observation of low PC in women with preeclampsia was similar to that found in studies like study by Mohapatra S et al., Annam V et al., [23,24] The PCs were lower while the MPV, PDW and PLCR were increased in preeclampsia and eclampsia as compared to control group, Dogru HY et al., prenatal thrombocyte counts were separated into three groups as 150,000/mm^3 (Group 3), mean thrombocyte volumes of groups were calculated 10.11±0.72 fl, 18±0.48 fl, 7.82±0.53 fl, respectively [25], Chirag Buch A et al., In severe grade, the mean PC was on lower side than mild to moderate grade [26], however, it was not statistically significant. Though, platelet indices like MPV, PDW and PLCR are on higher side in severe grade of preeclampsia as compared to mild to moderate grade, it was also statistically insignificant and Freitas LG, et al., PDW was higher in preeclampsia comparing to normotensive pregnant (p=0.028) and to non pregnant women (p<0.001) [27]. MPV was higher in sPE comparing to normotensive pregnant and non pregnant women (p=0.05 and p<0.001, respectively. The main reason for decrease in PC in preeclampsia is endothelial cell activation and dysfunction which causes increased consumption of platelets.

Platelet activation causes morphological changes of platelets. These changes include changes to spherical shape and pseudopodia formation. Platelets with increased number and size of pseudopodia differ in size thus increasing PDW. There was a significant difference statistically in clinical parameters like PC, PDW (fl) between the study groups in the current study. This finding of increased PDW in women having preeclampsia was reported in studies by Mohapatra S et al., (2.38 lacs/mm^3±0.33 in control group, 2.23 lacs/mm^3±0.19 in mild PIH, 1.82 lacs/mm^3±0.45 in preeclampsia and 1.21 lacs/mm^3±0.49 in eclampsia) [23], Chirag Buch A, et al., In severe grade, the mean PC was on lower side than mild to moderate grade, however, it was not statistically significant [26]. Though, platelet indices like MPV, PDW and PLCR are on higher side in severe grade of preeclampsia as compared to mild to moderate grade, it was also statistically insignificant and Freitas LG et al., platelet activation causes endothelial dysfunction and increased platelet consumption during low grade intravascular coagulation [27]. This results in release of younger platelets by bone marrow which increases MPV because of their larger size [28].

The increase in MPV associated with preeclampsia is reported in study by Chirag Buch A et al., and in another study by Gioia S et al., a study by Özdemirci Ş, et al., [26,29,30]. Another study Kanat-Pektas M et al., concluded that when MPV of 10.1 or more and PAPP-A MoM (pregnancy associated plasma protein) of 0.33 or less are conjoined as a threshold, the pregnancies can be prediced with high sensitivity and specificity that they are at risk of developing preeclampsia [31]. Another two studies by Yang SW et al., and Bellos I et al., also reported MPV as a good predictor for preeclampsia [32,33].

Out of 66 participants in group A, the mode of delivery was vaginal for 34.8% participants and LSCS for 65.1% participants. Out of 66 participants in group B, the mode of delivery was vaginal for 39.3% participants and LSCS for 60.6% participants. In a systematic review by Amorim MMR et al., through Cochrane database system concluded that there is no evidence from randomised controlled trials to inform decisions regarding planned caesarean section versus vaginal birth for severe preeclampsia [34].

On comparing the neonatal outcomes, it was found that IUGR was noted in 30% in preeclampsia group as against 23% in group B normal group. This finding was supported in a study by Odegard RA et al., which concluded that severe and early onset preeclampsia were associated with significant foetal growth restriction [35]. Foetal distress was also noted to be in a greater number of participants with preeclampsia.

There was not much difference in percentage of neonates shifted to NICU after birth in two groups in the study. Twenty eight (42.42%) in group A and 25 (37.88%) in group B were admitted to NICU.

The novelty in this study is the simultaneous use of a combination of PC and MCV and PWD as markers for prediction of preeclampsia.

These simple and relatively inexpensive markers can be used for close prenatal monitoring, help earlier recognition of preeclampsia in high risk cases and thus allow appropriate anti-hypertensive therapy. Further insight into the pathophysiological role of platelets in preeclampsia may facilitate a targeted strategy for preeclampsia prevention.

Limitation(s)

The main limitation was small sample size and generalisation of results requires support of evidence from similar large studies.

CONCLUSION(S)

This study concluded that there is decrease in PC and increase in the platelet indices like MPV, PDW in preeclampsia group compared to normotensive group and the difference in laboratory findings of platelet indices was significant among the groups. Platelet indices can be used as a prognostic tool, for prediction of preeclampsia and help in improving the feto-maternal outcome. Further multicenter studies with large numbers of patients and prolonged follow-up are required in this population to confirm these findings.

REFERENCES

[1] Reddy SG, Rajendra Prasad CSB. Significance of platelet indices as severity marker in nonthrombocytopenic preeclampsia cases. J Lab Physicians. 2019;11(3):186-91.
[2] Pankiewicz K, Szczerba E, Maciejewski T FA. Non-obstetric complications in pre-eclampsia. Prz Menopauzalny. 2019;18(2):99-109.
[3] AlSheeha MA, Alaboudi RS, Alghasham MA, Iqbal J Al. Platelet count and platelet indices in women with pre-eclampsia. Vasc Heal Risk Manag. 2016;12:477-80.
[4] Nooh AM, Abdeldayem HM. Changes in platelet indices during pregnancy as potential markers for prediction of pre-eclampsia development. Open J Obstet Gynecol. 2015;5(12):703-12.
[5] Budak YU, Polat M HK. The use of platelet indices, plateletcrit, mean platelet volume and platelet distribution width in emergency non-traumatic abdominal surgery: A systematic review. Biochem Med. 2016;26(2):178-93.
[6] Lopez E, Bermejo N, Berna-Erro A, Alonso N, Salido GM, Redondo PC, et al. Relationship between calcium mobilization and platelet α- and δ-granule secretion. A role for TRPC6 in thrombin-evoked δ-granule exocytosis. Arch Biochem Biophys. 2015;585:75-81.
[7] Tesfay F, Negash M, Alemu J, Yahya M, Teklu G, Yibrah M, et al. Role of platelet parameters in early detection and prediction of severity of pre-eclampsia: A comparative cross-sectional study at Ayder comprehensive specialized and Mekelle general hospitals, Mekelle, Tigray, Ethiopia. PLoS One. 2019;14(11):e0225536.
[8] Fondjo LA, Boamah VE, Fierti A, Gyesi D OE. Knowledge of pre-eclampsia and its associated factors among pregnant women: A possible link to reduce related adverse outcomes. BMC Pregnancy Childbirth. 2019;19(1):456.
[9] Shennan A, Duhig K, Vandermolen B. Recent advances in the diagnosis and management of pre-eclampsia. F1000Research. 2018;7.
[10] Portelli M, Baron B. Clinical presentation of pre-eclampsia and the diagnostic value of proteins and their methylation products as biomarkers in pregnant women with pre-eclampsia and their newborns. J Pregnancy. 2018;2018:2632637.
[11] Petla LT, Chikkala R, Ratnakar KS, Kodati V, Sritharan V. Biomarkers for the management of pre-eclampsia in pregnant women. Indian J Med Res. 2013;138:60-67.
[12] Joshi Kale Vrundra, Sapre Shaila. Lowered platelet count: A prognostic index in preeclampsia. J Obstet Gynaecol Ind. 2004;54(3):235-36.
[13] Singh A, Varma R. Role of Platelet Distribution Width (PDW) and plateletcrit in the assessment of nonthrombocytopenic pre-eclampsia and eclampsia. J Obstet Gynecol India. 2018;68(4):289-93.
[14] Dadhich S, Agrawal S, Soni M, Choudhary R, Jain R, Sharma S, et al. Predictive value of platelet indices in development of pre-eclampsia. J SAFOG. 2012;4(1):17-21.
[15] WHO. Who recommendations for prevention and treatment of pre-eclampsia and eclampsia Implications and Actions [Internet]. World Health Organisation. 2013 [cited 2021 Mar 28]. Available from: https://apps.who.int/iris/bitstream/handle/10665/119627/WHO_RHR_14.17_eng.pdf;sequence=1.
[16] ACOG Practice Bulletin No. 202 Summary: Gestational Hypertension and Pre-eclampsia. Obs Gynecol. 2019;133(1):1.
[17] Whelton PK, Carey RM, Aronow WS, Casey DE, Collins KJ, Dennison Himmelfarb C, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Pr. J Am Coll Cardiol. 2018;71(19):e127-248.
[18] Mondal BR, Paul D, Sultana T, Rahman Q, Ahmed S, Fatema K, et al. Assessment of platelet count and platelet indices in pre-eclampsia and eclampsia. Am J Innovat Res Appl Sci. 2015;1(3):80-84.
[19] BDSS Corp. Released 2020. coGuide Statistics software, Version 1.0, India: BDSS corp.
[20] Gogoi P, Sinha P, Gupta B, Firmal P, Rajaram S. Neutrophil-to-lymphocyte ratio and platelet indices in pre-eclampsia. Int J Gynecol Obstet. 2019;144(1):16-20.
[21] Hassan HES, Azzam H, Othman M, Hassan M, Selim T. Soluble E-selectin, platelet count and mean platelet volume as biomarkers for pre-eclampsia. Pregnancy Hypertens. 2019;17:01-04.
[22] Grum T, Seifu A, Abay M, Angesom T, Tsegay L. Determinants of pre-eclampsia/eclampsia among women attending delivery Services in Selected Public Hospitals of Addis Ababa, Ethiopia: A case control study. BMC Pregnancy Childbirth. 2017;17(1):01-07.
[23] Mohapatra S, Pradhan BB, Satpathy UK, Mohanty A, Pattnaik JR. Platelet estimation: Its prognostic value in pregnancy induced hypertension. Indian J Physiol Pharmacol. 2007;51(2):160-64.
[24] Annam V, Srinivasa K, Yatnatti SK, Res SD. Evaluation of platelet indices and platelet counts and their significance in pre-eclampsia and eclampsia. Int J Biol Med Res. 2011;2(1):425-28.
[25] Doğru HY, Yücel N, Pelit FÇ BG. The importance and evaluation of mean platelet volume on the severity of pre-eclampsia. Perinat J. 2011;19(3):108-13.
[26] Chirag Buch A, Ajinath Patil A, Shriram Agrawal N, Mukesh Karia K, Kaur M, Patro N. Evaluation of platelet count and platelet indices and their significance in preeclampsia. Sch. J App Med Sci. 2018;6(4):1598-1602.
[27] Freitas LG, Alpoim PN, Komatsuzaki F, Carvalho M das G, Dusse LMS. Pre-eclampsia: Are platelet count and indices useful for its prognostic? Hematology. 2013;18(6):360-64.
[28] Chen X ST. Maternal biomarkers of endothelial dysfunction and preterm delivery. PLoS One. 2014;9(1):e85716.
[29] Gioia S, Piazze J, Anceschi MM, Cerekja A, Alberini A, Giancotti A, et al. Mean platelet volume: Association with adverse neonatal outcome. Platelets. 2007;18(4):284-88.
[30] Özdemirci Ş, Başer E, Kasapoğlu T, Karahanoğlu E, Kahyaoglu I, Yalvaç S, et al. Predictivity of mean platelet volume in severe pre-eclamptic women. Hypertens Pregnancy. 2016;35(4):474-82.
[31] Kanat-Pektas M, Yesildager U, Tuncer N, Arioz DT, Nadirgil-Koken G, Yilmazer M. Could mean platelet volume in late first trimester of pregnancy predict intrauterine growth restriction and pre-eclampsia? J Obstet Gynaecol Res. 2014;40(7):1840-45.
[32] Yang SW, Cho SH, Kwon HS, Sohn IS, Hwang HS. Significance of the platelet distribution width as a severity marker for the development of pre-eclampsia. Eur J Obstet Gynecol Reprod Biol. 2014;175(1):107-11.
[33] Bellos I, Fitrou G, Pergialiotis V, Papantoniou N, Daskalakis G. Mean platelet volume values in pre-eclampsia: A systematic review and meta-analysis. Pregnancy Hypertension. 2018;13:174-80.
[34] Amorim MMR, Souza ASR, Katz L. Planned caesarean section versus planned vaginal birth for severe pre-eclampsia. Cochrane Database Syst Rev. 2017;2017(10):CD009430.
[35] Ødegård RA, Vatten LJ, Nilsen ST, Salvesen KÅ AR. Pre-eclampsia and fetal growth. Obstet Gynecol. 2000;96(6):950-55.

PARTICULARS OF CONTRIBUTORS:
1. Postgraduate Student, Department of Obstetrics and Gynaecology, Sri Devaraj URS Medical College, Kolar, Karnataka, India.
2. Professor, Department of Obstetrics and Gynaecology, Sri Devaraj URS Medical College, Kolar, Karnataka, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. E Gomathy,
Professor, Department of Obstetrics and Gynaecology, Sri Devaraj URS Medical College, Kolar-563101, Karnataka, India.
E-mail: egomathy5@gmail.com

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