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Original Research Article.

Evaluation of Maternal Mean Platelet Volume for Prediction of Preeclampsia

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ABSTRACT

Introduction: The importance of MPV has been emphasized as an inflammatory marker in some diseases, one of them is preeclampsia. Till date there is no effective treatment of preeclampsia in addition to the termination of pregnancy. Therefore, a reliable predictor would play an important role in early prevention and intervention in preeclampsia.

Aim: The study aimed at measurement of MPV between 8-14 weeks of gestation and to look for correlation between MPV in pregnancy with hypertensive disorders & fetomaternal outcome.

Material & Methods: A descriptive type of observational study in the department of obstetrics and gynecology at a tertiary care hospital in western India was conducted between July 2017-June 2018 on pregnant women between 8-14 weeks of gestation after applying inclusion and exclusion criteria.

Results: The study group consists of 134 subjects from urban rural settings and different socioeconomic classes. The mean MPV in participants who developed preeclampsia was 11.37± 1.68fl compared to 10.55± 1.62fl who remained unaffected during study. (p >0.05), however this difference was not found statistically significant. Future studies with large no of patients will be required to understand the role of first trimester higher MPV as a predictor of preeclampsia.

Conclusion: In the present study we observed that MPV levels measured during 8-14 weeks of gestation were found higher in preeclamptic groups as compared to normotensive group, however not a significant predictor of preeclampsia. MPV measurement may contribute in the identification of at-risk women for preeclampsia and reducing adverse fetomaternal outcome.

Keywords: MPV, Preeclampsia.

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INTRODUCTION

Pre-eclampsia is a multisystem disorder of unknown aetiology and it remains a major cause of maternal morbidity and mortality.[1] Preeclampsia can lead to problems in the liver, kidneys, brain and the clotting system, risks for the baby include poor growth and prematurity.[2]

The pathophysiological events resulting in pre-eclampsia begins early in gestation and precede the onset of the clinical features.[3] Despite extensive research considerable controversy exists over the aetiology of pre-eclampsia. Although the cause of pre-eclampsia is unknown, the decidual portion of the spiral arteries do not undergo the normal pregnancy-induced remodelling that converts these vessels to high volume-low resistance conduits. This failure leads to vascular spasm, restricted blood flow, placental ischaemia and the release of toxic substances that enter the maternal circulation, resulting in multi-organ disease. These interwoven pathways of endocrine, paracrine and autocrine factors appear to result in a vicious cycle of endothelial cell dysfunction.[4] Management includes identification and referral of women at high risk, prompt diagnosis with prevention and treatment of complications and timely delivery (the only definitive cure).[5] Platelet indices have been recently used in the prediction, diagnosis and prognosis of many diseases being reported as

clinically useful biomarkers.[6] Platelets are anucleated cells with no DNA with diameter of 3-5 µm and volume of 4.5–11 fl. They are derived from their precursor mega karyocytes through endomitotic division in the bone marrow.[7]

Emerging evidence suggest that platelet indices can be used in the prediction, diagnosis and prognosis of many diseases like preeclampsia.[8] The platelet count and mean platelet volume (MPV) are measured during a routine automatic whole blood count and hence are commonly available parameters now a days. Mean platelet volume (MPV), which is a measure of platelet size, indicates the rate of platelet production and platelet activation.[9] Platelet activation begins early in pregnant women with risk for preeclampsia.[10] Several studies suggested that when platelets are activated they become larger in size which causes increased platelet indices such as MPV, PDW and PLCR[11], so elevated MPV can give an idea of platelet activation.[12]

Till date, there is no effective treatment for PE in addition to the termination of pregnancy.[13] Therefore, a reliable predictor would play an important role in early prevention and intervention in preeclampsia. In present study we will calculate mean platelet volume in first trimester to correlate with preeclampsia.

AIMS AND OBJECTIVES

1. To study MPV between 8-14 weeks of gestation.
2. To look for correlation, between MPV in pregnancy with hypertensive disorders.
3. To find out correlation, if any, between MPV and fetomaternal outcome.

MATERIALS AND METHODS

The present study was descriptive type of observational study and carried out in the department of obstetrics and gynaecology at SDMH Jaipur from

Inclusion Criteria

1. Singleton uncomplicated pregnancy.
2. Gestational age between 8 – 14 weeks.
3. Blood pressure reading – systolic less than 140 mm Hg & diastolic less than 90 mm Hg.
4. Willing to follow up & deliver at SDM Hospital.

Exclusion Criteria

1. Multiple pregnancy.
2. Molar pregnancy.
3. Chronic diseases (chronic hypertension, diabetes mellitus, severe anaemia, Grade 3 & Grade 4 heart disease, renal disease).
4. Patients who had bad obstetrics history.
5. Patients with intrauterine fetal death.
6. Patients suffering from any platelet disorder.
7. H/O hypertensive disorder in previous pregnancy.

After Detailed history and consent, Obstetrics and general examination was done. Patients were explained about nature and purpose of study including cost of investigations. After obtaining their written informed consent they were enrolled in the present study. Venous blood samples were taken from antecubital vein under aseptic precautions. Mean platelet volume (MPV) is a machine calculated measurement of the average size of platelets found in blood and is typically included in blood tests as part of the CBC. MPV is calculated by dividing the platelet crit (PCT) by the total number of platelets. Reference range of Mean Platelet Volume.[14]

Non pregnant Adult: 6.4 -11fl
First Trimester: 7.7-10.3 fl
Second Trimester: 7.8-10.2 fl
Third Trimester: 8.2-10.4

Outcome:

1) Maternal
   - Antenatal Preeclampsia, eclampsia and its complications.
   - Mode of delivery
2) Foetal
   - Postnatal condition & complication
   - IUGR/Birth weight
   - Prematurity
   - APGAR Score
   - NICU admission
   - NICU days

OBSERVATION AND RESULTS

Majority of study subjects nearly 62 % were in age group >25 years. There is no significant difference of mean age between normotensive and preeclamptic patients (P Value = 0.103). There is no significant difference of gestational age at the time of enrollment between normotensive and preeclamptic patients. (P Value = 0.786l). MPV in preeclamptic female was 11.37 while in normotensive female it was 10.55, however this difference was not found statistically significant (P =0.146). Mean gestational age at the time of delivery in normotensive female was 38.23 week while in preeclamptic female it was 37.35 week. Statistically significant difference of gestational age at the time of delivery was found between normotensive and preeclamptic patients (P Value 0.019). Mean birth weight in normotensive pregnant female was 2.92 kg while in preeclamptic mother it was 2.57 kg only. When statistically compared mean birth weight of preeclamptic mother was found significantly lower than normotensives. (P =0.003)

ROC curve showed that AUC of 0.635 for MPV which was able to detect 55.6% of true positive cases of preeclampsia (sensitivity) & 77.6 % of normotensives (specificity) when cut off value of MPV>11.4 was used, however this AUC was not found statistically significant in present study.

Sensitivity & specificity of criterion value 11.4 FL was 55.56 % & 77.60 % respectively.

Table 1: Distribution of study group according to age

Age (Years)	No.	%
≤25	51	38.06
>25	83	61.94
Total	134	100.00

Table 2: Comparison between both groups according to age

Age (Years)	Normotensive		Preeclampsia		Total	
	No.	%	No.	%	No.	%
≤25	46	90.20	5	9.80	51	100.00
>25	79	95.18	4	4.82	83	100.00
Total	125	93.28	9	6.72	134	100.00

Chi-square = 0.583 with 1 degree of freedom; P = 0.445

Table 3: The characteristics of the 2 groups

Parameters	Group	N	Mean	SD	Median	'p' Value*
Age	Normotensive	125	26.56	2.73	27	0.103
	Preeclampsia	9	25.00	3.04	25	
Gestational Age at Time of Enrollment	Normotensive	125	11.17	2.01	11.71	0.786
	Preeclampsia	9	10.98	2.25	11.14	
MPV	Normotensive	125	10.55	1.62	10.4	0.146
	Preeclampsia	9	11.37	1.68	11.5	
Gestational age at Delivery	Normotensive	125	38.23	1.04	38	0.019
	Preeclampsia	9	37.35	1.54	37.57	
Birth Weight	Normotensive	125	2.92	0.33	2.92	0.003
	Preeclampsia	9	2.57	0.35	2.4	

*Unpaired 't' test

Table 4: ROC curve

Area under the ROC curve (AUC)	0.635
Standard Error	0.102
95% Confidence interval	0.548 to 0.717
z statistic	1.329
Significance level P (Area=0.5)	0.1839

Table 5: Sensitivity, specificity for different cut off points of MPV during the first trimester of pregnancy

Criterion	Sensitivity	Specificity
>11.4	55.56	77.60

Table 6: Distribution of Study Participants According to Fetal outcome

Fetal Outcome	Normotensive		Preeclampsia		Total	
	No.	%	No.	%	No.	%
Birth asphyxia	1	0.80	0	0.00	1	0.75
MAS	1	0.80	2	22.22	3	2.24
NEC	0	0.00	1	11.11	1	0.75
Pathological jaundice	3	2.40	3	33.33	6	4.48
RDS	0	0.00	1	11.11	1	0.75
TTNB	2	1.60	1	11.11	3	2.24
Normal	118	94.40	1	11.11	119	88.81
Total	125	100.00	9	100.00	134	100.00

Chi-square = 72.951 with 6 degrees of freedom; P <0.001

Table 7: Distribution of Study Participants According to maternal outcome

Maternal Outcome	Normotensive		Preeclampsia		Total	
	No.	%	No.	%	No.	%
APH	1	0.80	1	11.11	2	1.49
HELLP	0	0.00	1	11.11	1	0.75
PPH	1	0.80	4	44.44	5	3.73
Septicaemia	1	0.80	1	11.11	2	1.49
Normal	122	97.60	2	22.22	124	92.54
Total	125	100.00	9	100.00	134	100.00

Chi-square = 73.863 with 4 degrees of freedom; P <0.001

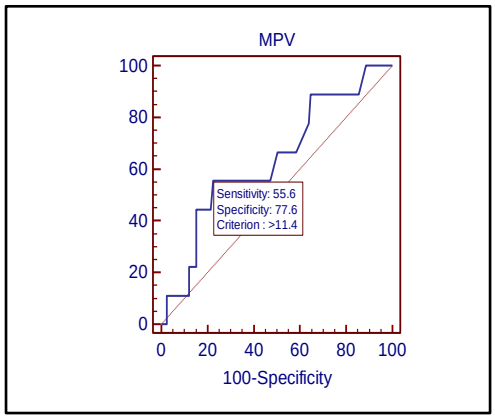

Fig 1: ROC curve

DISCUSSION

Present study was conducted to evaluate the MPV between 8-14 weeks period of gestation and to look for its correlation with preeclampsia. Total of 150 subjects were recruited in present study, 16 (10.6%) subjects were lost to follow-up. Finally, 134 subjects remained in the study for analysis. Majority of subjects were of age >25 years (61.94%). The mean age of participants who developed preeclampsia was 25 ± 3.04 years while participants who remained unaffected was 26.56 ± 2.73 years. There was no statistically significant difference found between mean age of normotensive & preeclampsia group in our study. In present study, 7(77.78%) neonates of participants who developed preeclampsia were admitted in ICU, whereas 4 (3.20 %) neonates in normotensive participants. In present study, 8 (88.88%) neonates in preeclampsia group developed complications of which maximum i.e 3 (33.33%) developed pathological jaundice followed by 2 (22.22%) developed MAS followed by 1 (11.11%) each develop RDS, TTN & NEC. In present study, 7 (77.77%) preeclamptic participants developed maternal complications of which one each (11.11%) of participants developed preeclampsia faced APH, septicaemia & HELLP syndrome & 4(44.44%) preeclamptic participants develop PPH, while in normotensive group 1(0.80%) each of participants faced APH, PPH and septicaemia respectively. In present study, mean level of MPV in participants developed preeclampsia was 11.37 ± 1.68 fl, while in normotensive group it was 10.55 ± 1.62 fl (P value = 0.146). In present study MPV in preeclampsia group was higher than normotensive group. In present study however difference was not statistically significant. Our hospital is a private hospital, here maximum patients are booked patients who are otherwise on regular antenatal checkup and treatment, so viewing major complications is less. From our perspective, these conflicting results might be explained, by differences in research design, small sample sizes, incomplete adjustment for confounders, and differences in study populations. Another point of concern is with the sampling time. Future studies are required to explore the underlying mechanisms of this discrepancy. Overall, these results support the need for a well-designed study.

CONCLUSION

In the present study we observed that MPV levels measured during 8-14 weeks of gestation were found higher in preeclamptic group as compared to normotensive group, however not a significant predictor of preeclampsia. This finding is useful because maternal mean platelet volume can be easily measured in all clinical laboratories as a part of complete blood count and could serve as a cost-effective method for identifying pregnant women at risk for developing preeclampsia. These can be used as "predictive tool" for obstetrician for early identification and expert management of preeclampsia. Then close monitoring of maternal and fetal status of identified cases can be done in tertiary care centre like our institution resulting in reduction of maternal-fetal morbidity and mortality. MPV measurement may contribute in the identification of at-risk women for preeclampsia. The quick, simple and cost-effective nature of this test would facilitate it's clinical use.

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