Al-Azhar International Medical Journal

Volume 4 | Issue 6 Article 37

2023

Section: Obstetrics and Gynecology

Comparative Study of Mean Platelet Volume in Preeclampsia versus Normal Pregnancy in 3rd Trimester

Fahd Abdel-aal Elomda
Department of Obstetrics and Gynecology, Faculty of Medicine for boys, Al-Azhar University, Cairo, Egypt.

Ahmed Mohammed Saeed
Department of Obstetrics and Gynecology, Faculty of Medicine for boys, Al-Azhar University, Cairo, Egypt.

Hany AbdElhakim AbdElrahman
Department of Obstetrics and Gynecology, Air force hospital, Cairo, Egypt.

Ahmed Tarek Ahmed Rashwan
Department of Obstetrics and Gynecology, Faculty of Medicine for boys, Al-Azhar University, Cairo, Egypt., ahmedtarekrashwan2@gmail.com

How to Cite This Article

Elomda, Fahd Abdel-aal; Saeed, Ahmed Mohammed; AbdElrahman, Hany AbdElhakim; and Rashwan, Ahmed Tarek Ahmed (2023) "Comparative Study of Mean Platelet Volume in Preeclampsia versus Normal Pregnancy in 3rd Trimester," *Al-Azhar International Medical Journal*: Vol. 4: Iss. 6, Article 37.
DOI: https://doi.org/10.58675/2682-339X.1854

ORIGINAL ARTICLE

Comparative Study of Mean Platelet Volume in Preeclampsia Versus Normal Pregnancy in 3rd Trimester

Fahd Abdel-aal Elomda [a], Ahmed Mohammed Saeed [a], Hany AbdElhakim AbdElrahman [b], Ahmed Tarek Ahmed Rashwan [a,*]

[a] Department of Obstetrics and Gynecology, Faculty of Medicine for Boys, Al-Azhar University, Egypt
[b] Department of Obstetrics and Gynecology, Air Force Hospital, Cairo, Egypt

Abstract

Background: **After twenty weeks of pregnancy, preeclampsia, a multisystem illness particular to pregnancy, develops and is characterised by hypertension and proteinuria with or without body edoema, resolving by 6−12 weeks postpartum in previous normotensive women.**

Aim and objectives: **Compare the mean platelet volume (MPV) in the third trimester of pregnancy between preeclamptic and healthy pregnant women to see if this parameter is indicative of preeclampsia.**

Subjects and methods: **This case control study was performed conducted at Al-Hussein Hospitals and Air Force General Hospital. The study included 80 pregnant women in their third trimester were selected to participate in the study, they were assigned to 2 group: 1st group: 100 pregnant women with preeclampsia, 2nd group: 100 pregnant women free of any medical disorders.**

Result: **There is statistically significant higher MPV value at the 31st, 34th and 37th gestational week of pregnancy in pregnant females with preeclampsia than control group.**

Conclusion: **MPV is a strong indicator of preeclampsia. MPV is frequently collected during a complete blood count, and its application to the diagnosis of preeclampsia in a clinical environment needs to be further studied.**

Keywords: Mean platelet, Postpartum, Preeclampsia, Risk pregnancy and third trimester

1. Introduction

Preeclampsia is a pregnancy-specific multisystem ailment that appears after 20 weeks of pregnancy and is defined by the development of hypertension and proteinuria with or without body edoema. In previously normotensive women, this condition resolves by six to twelve weeks postpartum.[1]

It affects 5%−10% of pregnancies and has a substantial impact on both the mother and the foetus in terms of morbidity and mortality.[2]

Preeclampsia's pathogenesis is still unknown, however recent theories have been put forth. The most widely recognised theory is that aberrant placentation causes placental ischemia.[3]

Preeclampsia is a syndrome that involves many organs, liver, kidney, placenta, brain, hematopoietic, and coagulation system: A good diagnostic test for preeclampsia would be especially useful in this setting.[4]

Despite the fact that the only effective treatment for preeclampsia is delivery because the pathologic changes caused by the condition are reversible once pregnancy has ended, researchers have been working toward the development of safe, dependable, and affordable screening tests for the prediction of preeclampsia for many decades in an effort to improve maternal and foetal outcomes.[5]

The platelet count, life span, and mean platelet volume (MPV) are all decreased in preeclampsia.[6]

Accepted 20 December 2022.
Available online 22 January 2024

* Corresponding author at: Department of Obstetrics and Gynecology, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt. Fax: 01064518090.
E-mail address: ahmedtarekrashwan2@gmail.com (A.T. Ahmed Rashwan).

https://doi.org/10.58675/2682-339X.1854

Regarding variations in platelet number and volume during a healthy pregnancy and preeclampsia, contradictory findings have been published. Preeclamptics and controls did not differ in their platelet counts or MPV values, according to some researchers, whereas preeclamptics showed lower platelet counts and greater MPV, which some researchers attributed to preeclampsia's increased platelet consumption.[7] This study studies the MPV in preeclamptic and healthy pregnant women throughout the third trimester of pregnancy to see if this parameter has a predictive relevance in determining the presence of preeclampsia.

2. Patients and methods

2.1. Study design

An Al-Hussein Hospitals and Sayed Galah Hospitals prospective case control study.

2.2. Participation

200 pregnant women in their third trimester diagnosed with preclampsia (from 31 weeks gestation to completed 37 weeks gestation) were selected to participate in the study, they were assigned to 2 group: 1st group: 100 pregnant women with preeclampsia. 2nd group: 100 pregnant women free of any medical disorders.

A written consent was taken from all the patients to participate in the study. Also, an approval of the study was obtained from Al-Azhar University academic and ethical committee.

2.3. Inclusion criteria

Age between 18 and 40 years old and gestational age from 31 weeks gestation to completed 37 weeks gestation.

2.4. Exclusion criteria

Women with other medical disorders (e.g. Diabetes mellitus, heart disease, atherosclerosis, systemic lupus erythematosus), rhesus isoimmunization (Coombs positive), other causes of thrombocytopenia as ITP – TTP – HUS – SLE and premature rupture of membrane.

2.5. Sampling method

Both the study group and the control group had a single 2.5 ml sample of venous blood taken by vein puncture and put into commercially available EDTA solutions (Ethylene Diamine Tetraacetic Acid). Additionally, urinary dipsticks were used to collect urine samples in order to test for proteinuria, which was detected when the urine contained +1 or 300 mg of protein every 24 h.

2.6. Hematological analysis

Blood samples were obtained in EDTA tubes and well mixed to prevent clumping and clotting in order to evaluate haematological parameters. Blood samples were evaluated in a haematology auto analyzer within 2 h of blood collection (Sysmex the automated haematology analyzer SF-300, developed by Sysmex Corporation, Japan).

2.7. Statistical analysis

In addition to the mean and standard deviation, frequencies (the number of occurrences) and percentages were sometimes employed to statistically describe the data (SD). To compare numerical variables between the study groups, the student's t-test was employed. Using a Chi square (2) test analysis, categorical data were compared. The acceptable cut off value for the examined diagnostic indicators was established using receiver operator characteristic (ROC) analysis. *P* values of 0.05 or less were used to determine statistical significance. All statistical computations were performed using Microsoft Windows and SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 23.

2.8. Ethical considerations

The AL-Azhar University Faculty of Medicine's Obstructs and Gynecology Department's Ethical Committee will review the study protocol before approving it. Following an explanation of the study's objectives and methods, each participant will be asked for their informed verbal and written consent. At all stages of the study, confidentiality and personal privacy will be observed.

3. Results

Table 1.

There is no statistically significant important difference between pregnant females with preeclampsia and control group as regard the age, BMI and gravity (Fig. 1).

There is statistically significant higher frequency of proteinuria at the 31st, 34th and 37th gestational week of pregnancy in pregnant females with preeclampsia than control group (Table 2).

Table 1. Comparison between preeclampsia and control groups regarding the age, BMI and gravity.

	Preeclampsia group No. = 100	Control group No. = 100	t/x^2	*P* value
Maternal Age (years)				
Mean±SD	28.175±4.909	28.100±4.584	0.2101[b]	0.834
Range	23–34	22–34		
Gravidity				
Primigravida	28 (28%)	36 (36%)	1.471[a]	0.225
Multigravida	72 (72%)	64 (64%)		
BMI				
Mean±SD	28.275±1.3585	28.300±1.505	−0.198[b]	0.843
Range	26–31	26–31		

P-value >0.05: Non significant (NS); *P*-value <0.05: Significant (S); *P*-value< 0.01: highly significant (HS).
[a] Chi-square test.
[b] Independent student *t*-test.

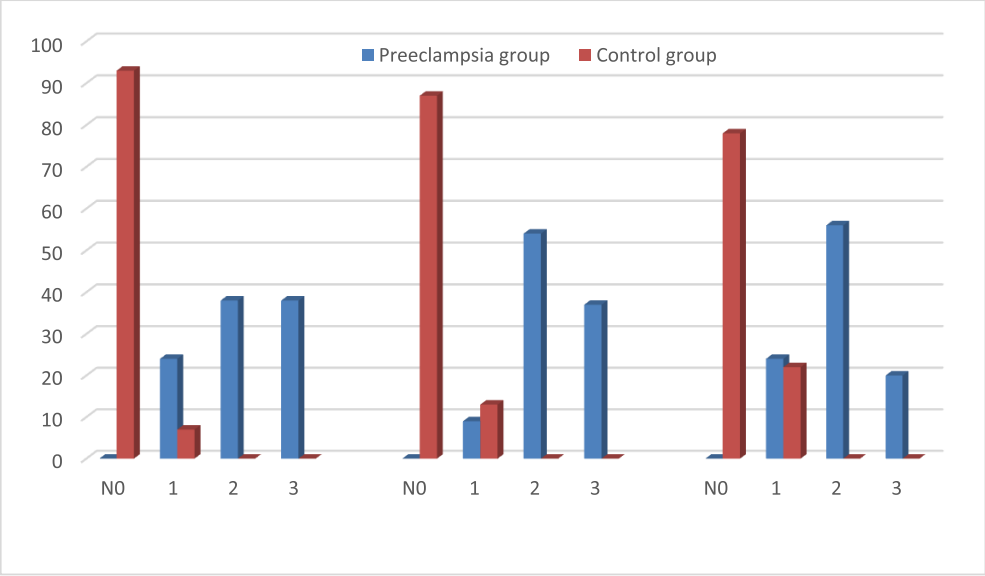

Fig. 1. Comparison between preeclampsia and control groups regarding the presence of proteinuria.

Table 2. The severity of preeclampsia and the frequency preeclampsia related complications.

	No. = 100
severity of preeclampsia	
Moderate	34 (34%)
Severe	66 (66%)
preeclampsia related complications	
Eclampsia	29 (29%)
HELP syndrome	9 (9%)
Fetal IUGR	38 (39%)

Among our studied pregnant females with precelamsia; 65% of them have severe preeclampsia (systolic blood pressure ≥160 mmHg and/or diastolic blood pressure ≥110 mmHg). The most frequent preeclampsia related complications was fetal IUGR in 39% followed by eclampsia in 29% and lastly HELP syndrome in 9% (Table 3).

There is statistically significant lower platelet count at the 31st, 34th and 37th gestational week of pregnancy in pregnant females with preeclampsia than control group (Table 4).

There is statistically significant higher MPV value at the 31st, 34th and 37th gestational week of pregnancy in pregnant females with preeclampsia than control group (Table 5).

There is statistically significant higher PDW value at the 31st, 34th and 37th gestational week of pregnancy in pregnant females with preeclampsia than control group (Fig. 2).

There is statistically significant lower platelet count at the 34th and 37th gestational week of pregnancy in females with severe preeclampsia than those with moderate preeclampsia (Fig. 3).

There is statistically significant lower MPV value at the 31st, 34th and 37th gestational week of pregnancy in females with severe preeclampsia than those with moderate preeclampsia (Table 6).

There is statistically significant higher platelet count at the 31st and 34th gestational week of

Table 3. Comparison between preeclampsia and control groups regarding the platelet count.

Platelets ($x10^3/mm^3$)	Preeclampsia group No. = 100	Control group No. = 100	t	*P* value
at 31st gestational week				
Mean±SD	213.77±8.951	258.50±9.184	−34.757[a]	**<0.0001**
at 34th gestational week				
Mean±SD	209.27±31.447	245.20±10.667	−11.104[a]	**<0.0001**
at 37th gestational week				
Mean±SD	208.450±36.286	244.200±7.881	−10.151[a]	**<0.0001**

P-value >0.05: Non significant (NS); *P*-value <0.05: Significant (S); *P*-value< 0.01: highly significant (HS).
[a] Independent student *t*-test.

Table 4. Comparison between preeclampsia and control groups regarding the mean platelet volume values.

MPV (fl)	Preeclampsia group No. = 100	Control group No. = 100	t	*P* value
at 31st gestational week				
Mean±SD	7.495±0.307	7.060±0.418	8.608[a]	**<0.0001**
at 34th gestational week				
Mean±SD	7.782±0.408	7.350±0.268	9.064[a]	**<0.0001**
at 37th gestational week				
Mean±SD	8.447±0.667	7.510±0.199	13.887[a]	**<0.0001**

P-value >0.05: Non significant (NS); *P*-value <0.05: Significant (S); *P*-value< 0.01: highly significant (HS).
[a] Independent student *t*-test.

Table 5. Comparison between preeclampsia and control groups regarding the mean platelet distribution width values.

PDW (fl)	Preeclampsia group No. = 100	Control group No. = 100	t	*P* value
at 31st gestational week				
Mean±SD	15.372±1.211	11.427±1.218	23.316[a]	**<0.0001**
at 34th gestational week				
Mean±SD	16.260±1.451	11.747±1.419	22.587[a]	**<0.0001**
at 37th gestational week				
Mean±SD	16.502±1.467	12.502±1.333	20.691[a]	**<0.0001**

P-value >0.05: Non significant (NS); *P*-value <0.05: Significant (S); *P*-value< 0.01: highly significant (HS).
[a] Independent student *t*-test.

pregnancy in non-complicated than complicated preeclampsia cases (Table 7).

There is statistically significant higher MPV value at the 34th and 37th gestational week of pregnancy in complicated than non-complicated preeclampsia cases.

4. Discussion

MPV has been found to be higher in preeclampsia. Even though MPV values rise throughout a healthy pregnancy, preeclampsia causes them to become even higher before returning to normal after delivery. Therefore, it has been hypothesised that a rise in MPV and a decrease in platelet count are related to the disease's severity. During a full blood count assay, It is common practise to report MPV, an accurate and cost-effective indicator of the usual volume of circulating platelets. Recent studies have shown that it can be used to predict a variety of major illnesses, including coronary artery disease, stroke, and thromboembolic events.

In the third trimester, 200 pregnant women participated in this case-control study, they were assigned to 2 groups 1st group: 100 pregnant women with preeclampsia 2nd group: 100 pregnant women free of any medical disorders. There is no statistically significant important difference between pregnant females with preeclampsia and control group as regard the age, gravity and BMI.

Our findings corroborated the findings of Oun et al. investigation, .'s[8] which found no statistically significant differences in age between the preeclampsia and control groups. According to the results of the current study, pregnant women with preeclampsia had a statistically significantly greater frequency of proteinuria at the 31st, 34th, and 37th gestational weeks of pregnancy than the control group. Pregnant women with preeclampsia have statistically significantly higher systolic and diastolic blood pressure at weeks 31, 34, and 37 of pregnancy than the control group.

According to our findings, El Sheikha et al. study.'s from [9] found a significant difference in the

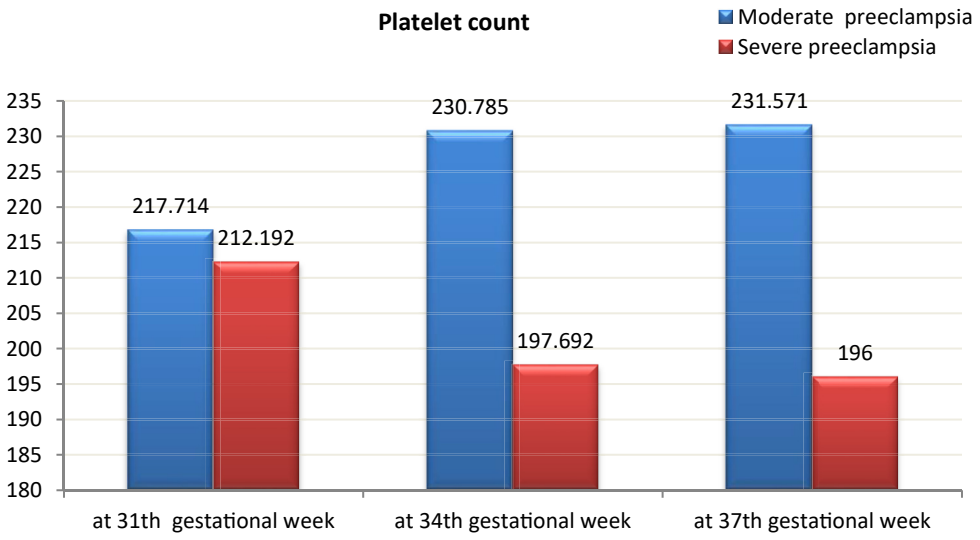

Fig. 2. Platelet count in relation to the severity of preeclampsia.

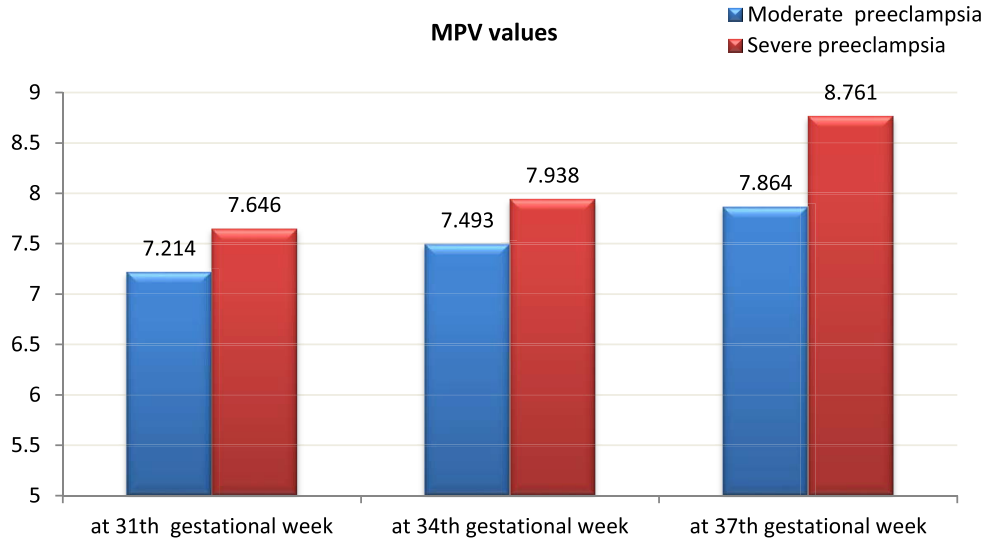

Fig. 3. MPV value in relation to the severity of preeclampsia.

two analysed groups' systolic and diastolic blood pressures, which rose in correlation with the development of preeclampsia (*P* 0.001). The study by Ajah et al.,[10] which found that eclampsia and pre-eclampsia with severe characteristics were more common than usual in 136 and 104 cases,

Table 6. Comparison between complicated and non-complicated preeclampsia cases regarding the platelet count.

Platelets (x10^3/mm^3)	Complicated preeclampsia No. = 28	Non-complicated preeclampsia No. = 72	t	*P* value
at 31st gestational week				
Mean±SD	210.77±7.461	215.00±9.277	−2.326[a]	**0.024**
at 34th gestational week				
Mean±SD	198.727±8.753	213.275±35.914	−3.138[a]	**0.002**
at 37th gestational week				
Mean±SD	202.725±38.869	210.724±38.869	−1.532[a]	0.130

P-value >0.05: Non significant (NS); *P*-value <0.05: Significant (S); *P*-value< 0.01: highly significant (HS).
[a] Independent student *t*-test.

Table 7. Comparison between complicated and non-complicated preeclampsia cases regarding the mean platelet volume values.

MPV (fl)	Complicated preeclampsia No. = 28	Non-complicated preeclampsia No. = 72	t	*P* value
at 31st gestational week				
Mean±SD	7.527±0.265	7.482±0.326	0.281[a]	0.779
at 34th gestational week				
Mean±SD	8.163±0.480	7.637±0.266	5.504[a]	**<0.0001**
at 37th gestational week				
Mean±SD	9.209±0.485	8.159±0.472	9.845[a]	**<0.0001**

P-value >0.05: Non significant (NS); *P*-value <0.05: Significant (S); *P*-value< 0.01: highly significant (HS).
[a] Independent student *t*-test.

respectively, validated our findings. Preterm birth, caesarean section, low birth weight kids, maternal and perinatal mortality were more frequently linked to it. Additionally, the study by Umezuluike et al. discovered that 28 (46.7%) of the kids were born preterm, and 24 (40.0%) suffered birth asphyxia. Among preeclamptic participants, 24 (40.0%) had eclampsia, 17 (28.3%) had Abruptio placentae, 25 (41.7%) were being treated in the intensive care unit, and 2 (3.3%) died, and 35 (58.3%) were admitted to the NIC. Of the patients with normotension, two (3.3%) experienced abruptio placentae as a result of trauma. The ICU provided treatment for one of the two ladies who had Abruptio placentae before she was discharged.

El Sheikha et al.[9]'s study also showed that pre-eclampsia-affected moms and their foetuses both experience issues. There were seven cases of IUGR, three cases of eclampsia, one case of HELLP syndrome, and one case of IUFD.

The present study showed that there is statistically significant lower platelet count at the 31st, 34th and 37th gestational week of pregnancy in pregnant females with preeclampsia than control group. There is statistically significant higher MPV value at the 31st, 34th and 37th gestational week of pregnancy in pregnant females with preeclampsia than control group. There is statistically significant higher PDW value at the 31st, 34th and 37th gestational week of pregnancy in pregnant females with preeclampsia than control group.

Our results were in agreement with study of **Oun *et al.*,**[8] as they reported that there was highly statistically significant important difference between groups according to platelet count.

Similarly, of **El Sheikha *et al.*,**[9] found that pre-eclampsia patients and healthy controls had different mean values SD for haemoglobin (12.17 1.15 Vs. 12.87 1.26) and for red blood cells (RBCs) (4.04 0.633 Vs. 4.1 0.318) (106/L), the platelet count, and the white blood cells (WBCs) (240.794 81.53 Vs. 270.204), respectively. These findings were consistent with recent research studies conducted by Yavuzcan et al.[11] that identified a substantial decrease in platelet count and an increase in MPV in hypertensive disorders. Also, **Iqbal & Sharma,**[12] revealed that the subject group's mean platelet count (131.493762.05999) was substantially greater than the control group's (324.9683230.78764). *P* value is less than 0.05. When contrasting the mean platelet volume of the patients with the controls. It was discovered that the mean platelet volumes of the patients and control group were, respectively, 7.14382.62068 and 7.89763.08140.

The current study showed that there is statistically significant lower platelet count at the 34th and 37th gestational week of pregnancy in females with severe preeclampsia than those with moderate pre-eclampsia. There is statistically significant lower MPV value at the 31st, 34th and 37th gestational week of pregnancy in females with severe pre-eclampsia than those with moderate preeclampsia. There is statistically significant lower PDW value at the 31st, 34th and 37th gestational week of pregnancy in females with severe preeclampsia than those with moderate preeclampsia.

Whereas, in the study of **Dogru *et al.*,**[13] They claimed that the MPV values in the group of people with severe preeclampsia were found to be considerably higher than those in the control group (*P* 0.05). Our hands in the study, there is statistically significant higher platelet count at the 31st and 34th gestational week of pregnancy in non-complicated than complicated preeclampsia cases. There is statistically significant higher MPV value at the 34th and 37th gestational week of pregnancy in complicated than non-complicated preeclampsia cases. There is statistically significant higher PDW value at the 31st, 34th and 37th gestational week of pregnancy in complicated than non-complicated pre-eclampsia cases.

Our results were in line with study of **Umezuluike *et al.*,**[14] as they found that PCT was strongly associated with preterm birth in preeclamptic women.

This suggests that individuals in this study who had higher PCT had lower odds of having a baby too soon. According to this study, newborns of pre-eclamptic mothers who had rising P-LCR had an increased likelihood of being admitted to the NICU. None of the measurements were related to prenatal or infant asphyxia, though. Poor platelet indices in the maternal circulation, such as PCT and P-LCR, can be assumed to have a detrimental effect on perinatal outcomes.

Other investigations conducted by Agarwal et al.,[15] Kamel Ammar et al.,[16] and others also identified these negative effects related to PCT and P-LCR. The similarities may be explained by the pathogenesis of preeclampsia, in which immature platelets are released into circulation from the bone marrow in an effort to reduce increased loss of platelets.

Our results were supported by study of **Oun *et al.*,**[8] as they reported that positive correlation and significant between MPV with age, diastolic and platelet count through GA 31 wks, GA 34 wks and GA 37 wks. No correlation and significant between MPV with other studied parameters in control group.

In the study of **El Sheikha *et al.*,**[9] WBCs, protinurea, edoema, age, and mean platelet volume are all strongly positively correlated with both systolic and diastolic blood pressure (P 0.05). Additionally, it has a strong negative connection (P 0, 05) with the following variables: birth weight, delivery gestational age, haemoglobin level, and RBC count. Although there was no connection between MPV and platelet count that was significant ($r = -0.176$ and $P = 0.082$).

4.1. Conclusion

A key biomarker of preeclampsia is mean platelet volume. In comparison to other routinely examined laboratory indications, such as platelet count, it has a stronger link with this sickness. Oftentimes, MPV is taken with a complete blood count, and its application to the diagnosis of preeclampsia in a clinical environment needs to be further studied (Fig. 2).

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article.

Sources of funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflicts of interest

The authors declared that there were no conflicts of interest.

References

1. Sibai BM, Caritis S, Hauth J. What we have learned about Preeclampsia. *Semin Perinatol*. 2003;27:239–246.
2. Cunningham FG, Gant NE, Leveno KJ. Hypertensive disorders in pregnancy. In: Gary Cunningham F, Leveno Kenneth J, Bloom Steven L, Dashe Jodi S, Hoffman Barbara L, Casey Brian M, eds. *Williams Obstetrics*. Twenty-second ed. New York: Mcgraw-Hill; 2005:1230–1231; vol. 15.
3. Lam C, Lim KH, Karumanchi SA. Circulating angiogenic factors in pathogenesis and prediction of preeclampsia. *Hypertension*. 2005;46:1077–1085.
4. Anderson GD, Sibai BM. Hypertension in pregnancy. In: Gabbe S, Niebyl J, Simpson J, eds. *Obstetrics Normal and Problem Pregnancies*. New York, NY: Churchill Livingstone; 1996.
5. Caughy AB, Stotland NE, Washington E. Maternal ethnicity, Paternal ethnicity, Parental ethnic discordance : predictors of preeclampsia. *Obstet Gynecol*. 2005;16:106–156.
6. Nadar S, Lip GY. Platelet activation in the hypertensive disorders of pregnancy. *Expet Opin Invest Drugs*. 2004;13:523–529.
7. Jaremo P, Lindahl TL, Lennmarken C. The use of platelet density and volume measurements to estimate the severity of preeclampsia. *Eur J Clin Invest*. 2000;30:1113–1118.
8. Oun IA, Ahmed AK, Khedr M, Ragab MAA. Comparative study of mean platelet volume in preeclampsia versus normal pregnancy in 3rd trimester. *Egypt J Hospital Med*. 2019;76:3204–3210.
9. El Sheikha KZ, Sedek AMAH, Asem AAA, NazmyAmer SEDM. Comparative study of mean platelet volume in pre-eclampsia versus normal pregnancy in third trimester. *JMSCR*. 2016;7:610–620.
10. Ajah, Ozonu NC, Ezeonu PO, Lawani LO, Obuna JA, Onwe EO. The feto-maternal outcome of pre-eclampsia with severe features and eclampsia in Abakaliki, South-East Nigeria. *J Clin Diagn Res*. 2016;10:18–21.
11. Yavuzcan A, Caglar M, Ustun Y. Mean platelet volume, neutrophillymphocyte ratio and platelet-lymphocyte ratio in severe preeclampsia. *Ginekol Pol*. 2014;85:197–203.
12. Iqbal S, Sharma A. Platelet count and MPV in women with PIH in their third trimester. *Int J Reproduct Contracep Obstet Gynecol*. 2019;8:44–50.
13. Dogru HY, Yucel N, Pelit FC, Bolat G. The importance and evaluation of mean platelet volume on the severity of pre-eclampsia. *Perinatal J*. 2011;19:108–113.
14. Umezuluike BS, Anikwe CC, Nnachi OC, Iwe BC, Ifemelumma CC, Dimejesi IB. Correlation of platelet parameters with adverse maternal and neonatal outcomes in severe preeclampsia: a case-control study. *Heliyon*. 2021;7:e08484.
15. Agarwal Ajmani SN, Prakash M. Mean platelet volume among platelet indices is a better severity marker in pre-eclampsia. *J Obstet Gynaecol India*. 2018;8:21–25.
16. Ammar K, El MA, Hei MA, Mohamed MI. Evaluation of platelet indices and their significance in pre-eclampsia. *Nat Sci*. 2014;12:147–153.