

PLATELET COUNT AND PLATELET INDICES IN PREECLAMPSIA: A CROSS-SECTIONAL STUDY

Namrata Pritom Changmai¹, Rashmi Deori², Gautam Boro³, Sandeep Khakhlari⁴

¹Senior Resident, ²Associate Professor, ⁴Assistant Professor, Department of Pathology, Assam Medical College and Hospital, Dibrugarh, Assam, India.

³Assistant Professor, Department of Pathology, Dhubri Medical College and Hospital, Dhubri, Assam, India.

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Corresponding Author:
Dr. Sandeep Khakhlari,
Email: drsandeep.khakhlari@gmail.com

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Abstract

Introduction: Hypertension is a major risk factor of pregnancy leading to maternal and foetal morbidity, particularly in cases with preeclampsia and eclampsia. The pathophysiology of which is thought to be alteration in platelet fibrinolysis, coagulation and vascular endothelial function. **Aim:** To study the association of platelet count and platelet indices in women suffering from preeclampsia. **Materials and Methods:** At the Assam Medical College and Hospital in Dibrugarh, Assam, India, a hospital-based cross-sectional comparison research has been carried out for 1 year, beginning in July 2019 and ending in June 2020, taking 60 pregnant women suffering from preeclampsia and 60 healthy pregnant women. Platelet count, MPV along with PDW have been studied in these women and data analyzed. **Results:** Women who were diagnosed with preeclampsia had significantly lower mean platelet count compared to those who did not have the condition, while those who did exhibit statistically significant increases in MPV and PDW. Our research also revealed a negative connection between platelet count along with both PDW and MPV in individuals with preeclampsia. **Conclusion:** MPV (Mean platelet volume) as well as PDW (platelet distribution width) are the best prominent and validated indices, in particular represent platelet activation, and are therefore part of the data that can be detected by a complete blood count (CBC) test for a low cost, making them potentially useful markers for thromboembolic disease.

INTRODUCTION

One of the biggest and most interesting mysteries in obstetrics is how to treat hypertensive disorders of pregnancy (HDPs).^[1] Preeclampsia syndrome is the most severe form of hypertension, responsible for an estimated 50,000-60,000 fatalities annually globally, whether it occurs alone or is layered on top of chronic hypertension.^[2]

Preeclampsia is such a pregnancy specific multisystem condition characterized by high systemic vascular resistance, activated coagulation system, accelerated platelet aggregation, and malfunction of endothelial cells, all of which led to decreased organ perfusion.^[3]

Preeclampsia is predicted to be seven times more common in developing nations than in developed ones. Approximately 10% of maternal mortality in Africa and Asia are linked to HDPs.^[4] It has been estimated to be between 8 and 10 percent in India. Maternal and infant mortality are persistent problems for the health care systems of developing nations.^[5-9]

Inexpensive and easily observable, platelet indices are a portion of the information provided by a

complete blood count (CBC) test. The best verified and most notable of these are PDW and MPV, both of which show platelet activity, so may be effective indicators for thromboembolic disease.^[10,11]

Platelet indices such as PDW and MPV, and platelet count are therefore a useful tool for assessing coagulation activation and the risk of developing preeclampsia.^[11-13] The main aim of this study was to examine the relationship between the platelet indices along with platelet count in pregnant women without and with preeclampsia, to compare the MPV, platelet count, and PDW of these two groups, and to identify any differences between them.

MATERIALS AND METHODS

At the Assam Medical College and Hospital in Dibrugarh, Assam, India, a hospital-based cross-sectional comparison research has been conducted

over the course period of twelve months, from July 2019 to June 2020.

Data for the current study was collected from pregnant women of more than 20 weeks gestation admitted in the Antenatal ward and Emergency unit in the Department of Obstetrics and Gynaecology, Assam Medical College and Hospital, Dibrugarh during the study period. Two groups of women have been formed.

Group I: Pregnant women suffering from preeclampsia

Group II: Normotensive pregnant women

Selection Criteria for Cases

Inclusion Criteria

Group I: Normal-pressure pregnant women who have had their blood pressure $\geq 140/90$ mm Hg on two separate occasions spaced at least 4 hours apart and who have proteinuria (defined as a 24-hour urine collection of ≥ 300 mg of protein or a dipstick result of 1+) after 20 weeks of pregnancy and who have given their written consent to participate.

Group II: All pregnant women with normal blood pressure who are at least 20 weeks along and provide their informed permission.

Exclusion Criteria

1. Pregnant women with history of

- Epilepsy
- Bleeding disorder
- Diabetes mellitus
- Drug intake impacting platelet count
- Hypertension
- Renal disease
- Severe anemia

2. Women not giving consent for participation

The Sysmex - XN - 550 has been used to do a complete blood count at the Advanced Hematology Service Laboratory under AMCH's Department of Pathology. PDW and MPV and Platelet count, have been determined using a six-part auto analyzer ability to run 44 parameters per sample.

Statistical Analysis

Percentages and mean \pm SD were the main ways in which the data were presented. Fisher's exact test, chi-square, along with t-test, have been utilized for finding out statistical significance, as well as p-value and correlation coefficient were computed. The data was also represented using diagrams. The statistical procedures have been performed utilizing SPSS, version 16.0. Whereas $P < 0.05$ indicates statistical significance.

RESULTS

In our study it was seen that in both Group I and II maximum number of cases belonged to the 21- 25 years age group (48.3% and 40% respectively). The mean age was almost equal in both the preeclampsia and normotensive group (24.5 ± 4.05 , 24 ± 4.03 years respectively). Majority of the pregnant women with preeclampsia were primiparae (55%).

The current investigation indicated that the preeclampsia group ($1.56 \pm 0.62 \times 10^9/L$) in comparison to the normotensive group ($2.42 \pm 0.89 \times 10^9/L$) had a significantly decreased mean platelet count and the difference has been found to be statistically significant ($p=0.000$).

The mean MPV, in women with preeclampsia was found to be 13.19 ± 1.32 fL which was significantly higher ($p=0.000$) than that of the women without preeclampsia (11.20 ± 0.86)fL. Also in our study, it was seen that majority of the cases of preeclampsia had MPV in the range $>10-14$ fl (70%), while 28.3% had MPV >14 fl and only 1.7% had MPV in the range 8-10 fl.

The mean PDW in women with preeclampsia was observed to be 18.10 ± 3.57 fL while it was observed to be 12.81 ± 1.22 fL in women without preeclampsia. A statistically significant ($p=0.0001$) difference was found in mean PDW between these two groups, most of the preeclampsia cases had a PDW value of >14 fL i.e. 91.7% whereas in the normotensive group majority (83.3%) had PDW value in the 9-14 fL range.

It was seen in our study that platelet count of preeclampsia patients showed a significant negative correlation with MPV and PDW.

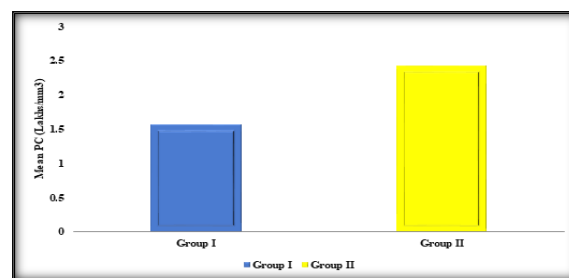


Figure 1: Bar Diagram Showing Comparison of Mean Platelet Count Between Preeclampsia and Normotensive Women

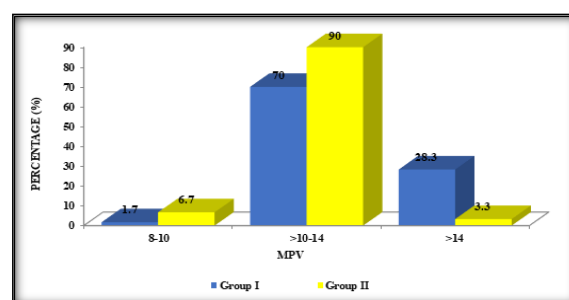


Figure 2: Bar Diagram Showing Distribution of MPV in Preeclampsia and Normotensive Women

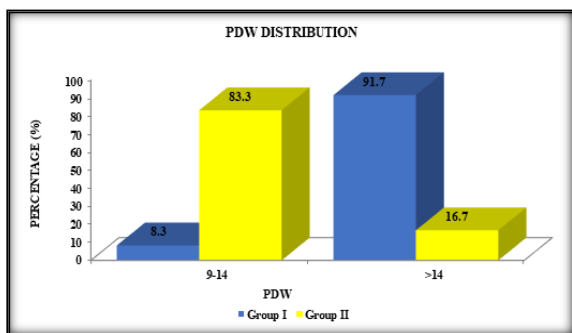


Figure 3: Bar Diagram Showing Distribution of PDW in Preeclampsia and Normotensive Women

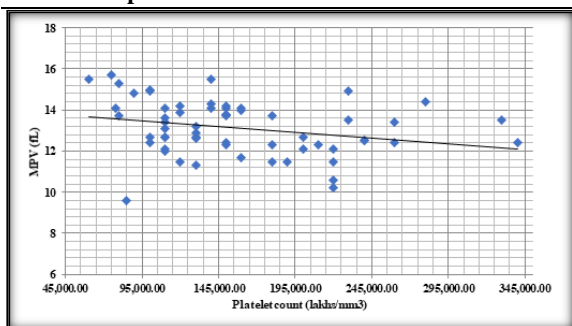


Figure 4: Scatter Diagram Showing Correlation of Platelet Count with MPV

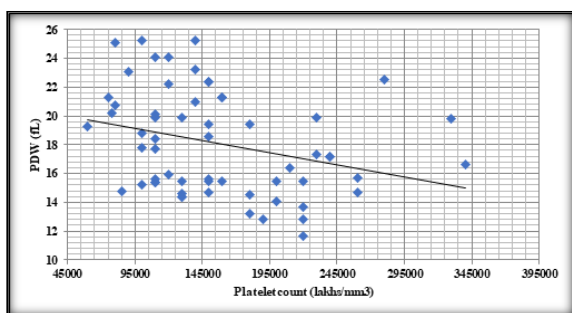


Figure 5: Scatter Diagram Showing Correlation of Platelet Count with PDW

DISCUSSION

In the present study mean age was observed to be 24.5 ± 4.05 years in both the preeclampsia and normotensive group, which is comparable to the findings of Rabia et al.^[14] (23.45 ± 3.23 years), Annam et al.^[15] (24.3 years), however Onisai et al.^[16] in their research work found 29.8 years mean age.

Among the 60 cases of preeclampsia, 50% had thrombocytopenia (18.3% cases having platelet count 50,000 to 1,00,000/cumm and 31.7% cases between 1.0 to 1.5 lakhs/cumm). The other 50% all had platelet counts more than 1.5 lakhs/cumm. Out of the 60 normotensive pregnant women, 21.7% had thrombocytopenia (5% having platelet count 50000 to 1.0 lakhs/ cumm and 16.7% between 1.0 to 1.5 lakhs/cumm) and the rest 78.3% were having normal platelet count. These findings were comparable to those of Mohapatra et al.^[17] who reported 13 cases of preeclampsia (43.3%) as having platelet count in the range 1-1.5 lakhs/mm³ and 5 cases (16.7%) as having platelet count < 1 lakh/mm³. Compared to

normotensive women, whose mean platelet count has been found to be $(2.42 \pm 0.89$ lakhs/mm³) and mean platelet count in preeclamptic women was 1.56 ± 0.62 lakhs/mm³, a difference, which is statistically significant ($p=0.000$). All of these results match those found by Vijaya C et al.^[19], Annam et al.^[15], Vrunda et al.^[18], as well as Sultana R et al.^[7] Researchers Monteiro G et al.^[21] used historical data from an Indian population to find that pregnant women with hypertension after the 20th week of pregnancy had substantially lower mean platelet counts compared to controls. Platelet count, according to their research, is also a predictor of the severity of pregnancy induced hypertension. In this research work, it has been seen that majority of cases had MPV in the range >10-14 fl (70%), while 28.3% had MPV >14 fl and only 1.7% had MPV in the range 8-10 fl. Similarly, majority of the normotensive women had MPV in the range >10-14fl (90%), 6.7% had MPV in the range 8-10fl while only 3.3% had an MPV of > 14fl. According to Rabia et al.^[14], the mean MPV for patients with preeclampsia was between 8 and 10 fL, and it ranged from 10 to 12 fL in 23% of cases.

The MPV in the preeclampsia group was found to be 13.19 ± 1.32 fl and in the normotensive group was found to be 11.20 ± 0.86 fl. The statistical significance of this difference in mean MPV between these two groups has been shown to be quite high ($p=0.000$).

Therefore, the levels of MPV were found to be higher in both the preeclamptic and normotensive women in parallel to other studies. As our institute is situated in North-East India, where congenital macrothrombocytopenia is quite prevalent which is evidenced by the findings in various studies conducted on macrothrombocytopenia. A significant frequency of asymptomatic constitutional macrothrombocytopenia was discovered by Naina et al.^[23] in the eastern and north-eastern area of India. This high rate of prevalence of macrothrombocytopenia could be attributed as one of the probable reasons behind the increased values of MPV in North-East Indian population. In spite of this, it can be seen very clearly that the MPV is much greater in preeclamptic women in comparison to the normotensive pregnant controls, which is in agreement with the results of the several studies that were described before.

In our study, 91.7% of the women with preeclampsia had PDW >14 fl while only 8.3% had a PDW value in the range 9-14fl. Majority of the normotensive women (83.3%) had PDW value in the range 9-14 fl and only 16.7% had PDW >14fl. Outcomes were similar to those reported by Rabia et al.^[14], that PDW values more than or equal to 14 accounted for 86% of preeclampsia along with 87.5 % of eclampsia, with PDW values between 9 and 14 accounting for 14% and 12.5%, respectively. In 92% of the controls, PDW has been found to be in the range of 9-14.

Our research showed that the mean PDW in preeclamptic women was 18.10 ± 3.57 fl whereas in normotensive women it was 12.81 ± 1.22 fl, a difference that has been statistically significant

($p=0.000$). In their research on the role of platelet indices in PIH, Annam et al.^[15] found that preeclampsia patients had a PDW of 15.51 ± 2.67 fl, compared to 11.07 fl in healthy pregnant women. The PDW in the normotensive control group varied from 9 to 12.8 fl, while in moderate and severe preeclampsia patients, the PDW ranged from 13.6 to 17.2 fl and 14.1 to 20.1 fl, respectively, as reported by Meghana P et al.²⁰. An increased PDW may be explained by a higher rate of platelet turnover, that would lend credence to the theory that a shorter platelet survival period leads to a higher rate of platelet destruction.^[15] Platelet distribution width changes may also indicate that preeclampsia related endothelial dysfunction causes the body to produce younger and bigger platelets to make up for the declining platelet count.^[25] In this study, platelet count of preeclamptic patients presented a significant negative relation with MPV and PDW which means that as platelet count increases or decreases, MPV and PDW also decreases or increases and is statistically significant. Platelet count correlated negatively with PDW and PLCR, but not with MPV, as reported in research by Tesfay et al.^[22] in people with preeclampsia. Similarly, Dhakre et al.^[24] discovered a correlation between severity of preeclampsia and platelet indices and they drew the conclusion that thrombocytopenia and severity of PIH are closely associated.

CONCLUSION

One of the most prevalent obstetric disorders, hypertension in pregnancy is linked with high risk of maternal and infant death. Numerous changes in haematological parameters occur in these women, which has a major effect on the outcome of the pregnancy. Maternal along with fetal morbidity and mortality may be reduced via early diagnosis of these illnesses so that treatment can begin as soon as possible. According to the findings of this investigation, preeclamptic individuals exhibit significant abnormalities in both haematological and biochemical parameters. This study shows that changes in platelet count, MPV and PDW are strongly associated with preeclampsia and provide an indication towards worsening of preeclampsia status of the patient. As a result, monitoring these patients using platelet count as well as platelet indices may be done in a straight forward and economical manner.

REFERENCES

1. Roberts JM, Cooper DW (2001). Pathogenesis and genetics of preeclampsia. *The Lancet* Volume 357, Issue 9249, Pages 53–56.
2. World Health Organization. The world health report: 2005: make every mother and child count. Geneva: WHO; 2005. USA; McGraw Hill Education; 2018.
3. Ananth CV, Keyes KM, Wapner RJ. Preeclampsia rates in the United States, 1980-2010: age-period-cohort analysis. *BMJ*. 2013;347:564.
4. WHO recommendations for prevention and treatment of preeclampsia and eclampsia. 2011.
5. Krishna Menon M. K. and Palaniappan B. Hypertensive disorders of pregnancy. In MudlairMenon (Ed.). *Clinical Obstetrics*. 9th edn. Orient Longman Madras, 1994; 133-159.
6. Yang SW, Cho SH, Kwon HS. Significance of the platelet distribution width as a severity marker for the development of preeclampsia. *Eu J Obstet Gynecol Reprod Biol*. 2014; 175: 107-11.
7. Sultana R, Fazlul Karim SM, Atia F, Ferdousi S, Ahmed S (2012). Platelet Count In Preeclampsia. *J Dhaka National Med. Coll. Hos*. 18 (02): 24-26.
8. Schroeder BM, American College of Obstetricians and Gynecologists. ACOG practice bulletin in diagnosing and managing preeclampsia and eclampsia. American College of Obstetricians and Gynecologists. *Am Fam Physician* 2002;66:330-1.
9. ACOG Committee on Obstetric Practice. ACOG practice bulletin. Diagnosis and management of preeclampsia and eclampsia. Number 33, January 2002. American College of Obstetricians and Gynecologists. *Int J Gynecol Obstet* 2002;77:67-75.
10. Xu RL, Zheng ZJ, Ma YJ, Hu YP, Zhuang SH (2013). Platelet volume indices have low diagnostic efficiency for predicting bone marrow failure in thrombocytopenic patients. *Exp Ther Med*. 1, 209-214.
11. Osselaer JC, Jamart J, Scheiff JM. Platelet distribution width for differential diagnosis of thrombocytosis. *Clin Chem* 1997;43:1072-6.
12. Briggs C, Harrison P, Machin SJ. Continuing developments with the automated platelet count. *Int J Lab Hematol* 2007;29:77-91.
13. Dundar O, Yoruk P, Tutuncu L, et al. Longitudinal study of platelet size changes in gestation and predictive power of elevated MPV in development of preeclampsia. *Prenatal Diag*. 2008;28:1052-6.
14. Rabia Parveen Siddiqui, Kajal Chandrakar, Ruchi Varma, Shruti Shrivastava. "Study on Platelet Indices in Pregnancy Induced Hypertension". *Journal of Evidence based Medicine and Healthcare*; Volume 2, Issue 44, November 02, 2015; Page: 8035-8040, DOI: 10.18410/jebmh/2015/1079.
15. Annam V, Srinivasa K, Yatnatti SK, Suresh DR. Evaluation of platelet indices and platelet counts and their significance in preeclampsia and eclampsia. *Int J Biol Med Res*. 2011;2(1):425-428.
16. Onisai M, Vladareaner AM, Bumbea H, Clorascu M, Pop C, Andrei C, et al. A study of haematological picture and of platelet function in preeclampsia-report of a series of cases. *J of Clin Med* 2009; 4: 326-27.
17. Mohapatra S, Pradhan BB, Satpathy UK, Mohanty A, Pattnaik JR. Platelet estimation: Its prognostic value in pregnancy induced hypertension. *Ind J Physiol Pharmacol* 2007;51(2):160-164.
18. Vrunda JK, Saila S. Lowered Platelet Count: A prognostic index in pregnancy induced hypertension. *J Obstet Gynaecol Ind*. 2004;54(3):235-236.
19. Vijaya C, Lekha M.B, Archana Shetty, Geethamani V. "Evaluation of Platelet Counts and Platelet Indices and their Significant Role in Pre-eclampsia and Eclampsia." *Journal of Evolution of Medical and Dental Sciences* 2014; vol.3, Issue 12, March 24; Page: 3216-3219.
20. Meghana P and Bharathi M. Platelet Count And Platelet Indices In Hypertensive Disorders Of Pregnancy. *International Journal of Recent Scientific Research* Vol. 9, Issue, 2(K), pp. 24571-24573, February, 2018.
21. Monteiro G, Subbalakshmi NK, Pai SR. Relevance of [10] measurement of hematological parameters in subjects with pregnancy induced hypertension. *Nitte Univ J Health Sci*. 2014;4(1):15-20.
22. Tesfay F, Negash M, Alemu J, Yahya M, Teklu G, Yibrah M, et al. (2019) Role of platelet parameters in early detection and prediction of severity of preeclampsia: A comparative cross-sectional study at Ayder comprehensive specialized and Mekelle general hospitals, Mekelle, Tigray, Ethiopia. *PLoS ONE* 14(11): e0225.
23. Naina H, Nair S, Daniel D, et al. Asymptomatic constitutional macro thrombocytopenia among West Bengal blood donors. *Am J Med*. 2002; 112(9):742-743.
24. Dhakre R, Nandmer GK, Sapkal R. Correlation of platelet indices with severity of preeclampsia: a prospective study from central India. *Int J Reprod Contracept Obstet Gynecol* 2018;7:1416-20.
25. Precious N, Alisi C, Buseri I, Chinwe A. Some blood cell changes and alteration in renal and hepatic function in pre-eclampsia. *Int Blood Res Rev*. 2014;2(3):132-39.