Original Research Article

Clinical Correlation of Platelet Indices in Preeclamptic Patients without Hellp Syndrome

Afjalur Rahman[1], Rumen Chandra Boro[2], Hem Kanta Dev Sarma[3], Rajesh Das[4]

[1]Post Graduate Student, Department of Obstetrics and Gynaecology, Fakhruddin Ali Ahmed Medical College and Hospital, Barpeta, Assam, India.
[2]Associate Professor, Department of Obstetrics and Gynaecology, Fakhruddin Ali Ahmed Medical College and Hospital, Barpeta, Assam, India.
[3]Assistant Professor, Department of Obstetrics and Gynaecology, Fakhruddin Ali Ahmed Medical College and Hospital, Barpeta, Assam, India.
[4]Assistant Professor, Department of Obstetrics and Gynaecology, Fakhruddin Ali Ahmed Medical College and Hospital, Barpeta, Assam, India.

Abstract

Background: Although the pathogenesis of preeclampsia is poorly understood, there are studies which have shown that Platelets play a pivotal role. Platelet count has been shown to be a rapid procedure to estimate the severity of pregnancy-induced hypertension. Raised mean platelet volume (MPV) and platelet distribution width (PDW) have been shown to be correlated with severity of the disease, whenever there is decreased Platelet count. Hence, this study will be undertaken to see if there are associations between Platelet indices and severity of preeclampsia in cases without HELLP Syndrome.

Materials and Methods: A prospective case-control study was done in the Department of Obstetrics And Gynaecology, Fakhruddin Ali Ahmed Medical College and Hospital, Barpeta, on 106 women divided into two groups - Non-severe preeclampsia group (n=53) and Severe preeclampsia group (n=53). Platelet indices viz. Platelet Count, Mean Platelet Volume, Platelet Distribution Width, Plateletcrit and Platelet Large Cell Ratio were analyzed.

Results: Findings showed that there was a statistically significant decrease in Platelet Count (p<0.05) and an increase in Mean Platelet Volume (p<0.05) and Platelet Distribution Width (p<0.05) in mothers of severe-preeclampsia group. Furthermore, Platelet Count was significantly decreased (p<0.05) and Plateletcrit was significantly decreased (p<0.05) in severe preeclampsia mothers.

Conclusion: Platelet indices could be used as biomarkers for early diagnosis of severity of preeclampsia.

Keywords: Preeclampsia; Plateletindices;Platelet count; MPV; PDW.

Introduction

Hypertensive disorders form one of the fatal triad along with bleeding and infections that result in majority of the maternal morbidity and mortality associated to pregnancy. Hypertensive disorders complicate 5-10 % of all

pregnancies [1]. The vast majority of cases of pregnancy induced hypertension may be grouped into 5 clearly defined groups: Gestational hypertension, Preeclampsia, Eclampsia, preeclampsia superimposed on chronic hypertension and chronic hypertension .

Although the pathogenesis of preeclampsia is poorly understood, there are studies which have shown that Platelets play a pivotal role [2]. Platelet indices have lately been identified as therapeutically relevent indicators in the prediction; diagnosis and prognosis of numerous disorders, one of which is preeclampsia [3,4].

Platelet count has been shown to be a rapid procedure to estimate the severity of pregnancy-induced hypertension. Raised mean platelet volume (MPV) and platelet distribution width (PDW) have been shown to be correlated with severity of the disease, whenever there is decreased Platelet count.

Hence, this study was undertaken to see if there are associations between Platelet indices and severity of preeclampsia in cases without HELLP Syndrome

Materials and Methods

The study was conducted prospectively in the department of obstetrics and gynaecology Fakhruddin Ali Ahmed Medical College And Hospital, Barpeta, Assam, from 1st june 2021 to 31st may 2022 on 106 patients presenting with preeclampsia, non-severe preeclampsia (as per ACOG guidelines; BP ≥140/90mmhg at two intervals 4 hours apart with or without significant proteinuria) and severe preeclampsia (as per ACOG guidelines, BP ≥160/110mmhg, and proteinuria >5gm/24 hours)

Women with pre-existing medical disorders like hepatitis, nephropathy, and diabetes mellitus, on anticoagulant medications, or antiplatelet medication, with known platelet/haematological pathologies like Immune thrombocytopenic purpura (ITP), Thrombotic thrombocytopenic purpura (TTP), and aplastic anaemia, Women with hemolysis, elevated liver enzymes and low platelets (HELLP) syndrome, Acute fatty liver of pregnancy (AFLP), obstetric cholestasis (OC) were excluded from the study.

Results

The current study was conducted in 106 female study participants among whom majority were in the age group of 15 years to 24 years (66.04%) with non-severe Preeclampsia and in the age group of 15years to 24years (52.83%) with severe Preeclampsia. Table 1 showing Mean (SD) age of women in non-severe preeclampsia and severe pre-eclampsia was 22(5)and 24(6)years respectively.

Table 1: Age distribution of study participants

Row Levels	Non-Severe Preeclampsia		Severe Preeclampsia		Total	
	N	%	N	%	N	%
15-19	18	33.96%	12	22.64%	30	28.30%
20-24	17	32.08%	16	30.19%	33	31.13%
25-29	12	22.64%	10	18.87%	22	20.75%
30-34	6	11.32%	10	18.87%	16	15.09%
35-40		0.00%	5	9.43%	5	4.72%
Grand Total	53	100.00%	53	100.00%	106	100.00%

Mean (SD) period of gestation at detection of preeclampsia in weeks among the nonsevere preeclampsia and severe preeclampsia is 37(3)weeks and 36(3)weeks respectively. Mean period of gestation in severe pereclampsia was less than mean period of gestation in non-

Rahman *et al.*   **International Journal of Pharmaceutical and Clinical Research**

severe preeclampsa and is statistically not significant in our study(p<0.064).

Table 2 showing Mean SBP (SD) in mm of Hg between non-severe and severe preeclampsia was 149 (10) and 176(20) mm of Hg respectively. Mean DBP (SD) in mm of Hg between nonsevere and

severe preeclampsia is 95(5) and 112(9) respectively. There is a significant difference between the two studied groups with regards to blood pressure both systolic and diastolic which were found to be increased with severity of preeclampsia (P<0.001).

Table 2: Comparison of mean SBP and mean DBP with stages of preeclapmsia

BP	Non-Severe Preeclampsia		Severe Preeclampsia		Total		
	Mean	SD	Mean	SD	Mean	SD	P-value
Systolic BP	149	10	176	20	162	21	0.001
Diastolic BP	95	5	112	9	104	11	0.001

Table 3 showing Mean paltelet count (SD) in thousands per microlitre in patients with non-severe and severe preeclampsia was 224(46.3) and 188(57.6) respectively. Study findings revealed that there is a statistically significant decrease in platelet count (p<0.0001) between the two groups. Platelet count decreases with increasing severity of preeclampsia.

Table 3: Distribution of Platelet count in study participants

	Nonsevere Preeclampsia		Severe Preeclampsia		Total		
	Mean	SD	Mean	SD	Mean	SD	P-value
Platelet Count (PC)	224	46.3	188	57.6	193	51	0.0001

Table 4 showing mean Platelet Distribution Width (PDW) (SD) in femtolitre (fL) in patients with non-severe preeclampsia and severe preeclampsia is 12.3 (1.9) and 14.7 (2.3) respectively.

Study findings reveals that there is a statistically significant increase in PDW (p<0.0001) in mothers of severe preeclampsia group as compared to mothers of non-severe preeclampsia group.

Table 4: Comparison of PDW with stages of preeclampsia

	NonSevere Preeclampsia		Severe Preeclampsia		Total		
	Mean	SD	Mean	SD	Mean	SD	P-value
Platelet Distribution Width (PDW)	12.3	1.9	14.7	2.3	13.7	3.4	0.0001

Table 5 showing mean of Mean Platelet Volume (SD) in femtolitre (fL) in patients with non-severe and severe preeclampsia is 10.6 (1.8) and 13.7 (1.9) respectively. Study findings revealed that there was a statistically significant increase in MPV (p<0.0001) in mothers of severe preeclampsia group as compared to mothers of non-severe preeclampsia group.

Table 5: Comparison of MPV with stages of preeclampsia

	Non-Severe Preeclampsia		Severe Preeclampsia		Total		
	Mean	SD	Mean	SD	Mean	SD	P-value
Mean Platelet Volume (MPV)	10.6	1.8	13.7	1.9	11.6	1.8	0.0001

Table 6 showing mean Platelet Large Cell Ratio (SD) in percentage among patients with non-severe and severe preeclampsia is 30.1 (7.4) and 37.5 (8.7) respectively. Study findings

revealed that there was a statistically significant increase in P-LCR (p<0.0001) in mothers of severe preeclampsia group as compared to mothers of non-severe preeclampsia group.

Table 6: Comparison of P-LCR with stages of preeclampsia

	Non-Severe Preeclampsia		Severe Preeclampsia		Total		
	Mean	SD	Mean	SD	Mean	SD	P-value
Platelet Large Cell Ratio (P-LCR)	30.1	7.4	37.5	8.7	35.3	7.6	0.0001

Plateletcrit (SD) in percentage among patients with non-severe and severe preeclampsia is 0.22 (0.06) and 0.21 (0.07) respectively. Study findings revealed that there is a statistically significant decrease in plateletcrit (p<0.0001) in mothers of severe preeclampsia group as compared to mothers of non-severe preeclampsia group. Platelet count to MPV ratio in patients with non-severe and severe preeclampsia is 13.68 and 10.67 respectively. Study findings revealed that there is a statistically significant decrease in platelet count to MPV ratio (p<0.001) in mothers of severe preeclampsia group as compared to mothers of non-severe preeclampsia group.

Discussion

In developing countries like India, pregnancy-induced hypertension has been a major source of maternal and perinatal morbidity and mortality. As a result, an effort was undertaken in the current research to understand the relationship between the platelet indices viz. platelet count, Mean Platelet Volume (MPV), Platelet Distribution Width(PDW), Plateletcrit(PCT) and Platelet Large cEll Ratio(P-LCR) in patients with preeclampsia and attempted to evaluate whether these parameters could be used as markers in early diagnosis of preeclampsia.

In the present study it is found that mean paltelet count (SD) in thousands per microlitre in patients with non-severe and severe preeclampsia was 224(46.3) and 188(57.6) respectively. This study findings revealed that there is a statistically significant decrease in platelet count (p<0.0001) between the two groups i.e. Platelet count decreases with increasing severity of preeclampsia. The study conducted by Tesfay F. [5] found that mean±SD platelet counts were 226.42±56.52x109/L and 185.28±60.22x109/L,in patients with mild preeclampsia and severe preeclampsia, respectively. Lowering of platelet count with increasing severity of pregnancy induced hypertension is consistent with Srivastava, Jambhulkar (2001) [6], Joshi et al (2004) [7], J. Davies et al (2007) [8], and Ellora Devi et al (2012) [9].

This study findings revealed that there is a statistically significant increase in PDW (p<0.0001) in mothers of severe preeclampsia group as compared to mothers of non-severe preeclampsia group which is similar to the study conducted by Karateke A et al [10]. which showed PDW was significantly higher in patients with severe preeclampsia copared to patients with mild preeclampsia. Similar studies conducted by Singh A et al [11]. and Thalor N et al [12]., and Yang SW et al [13]., and Dadhich S et al [14]., found that the mean PDW showed a significant increase with increasing severity of disease which is similar with our study.

Study findings revealed that there was a statistically significant increase in MPV (p<0.0001) in mothers of severe preeclampsia group as compared to mothers of non-severe preeclampsia group which is similar to the study conducted by Karateke A et al [11], which showed MPV was significantly higher in patients with severe preeclampsia copared to patients

with mild preeclampsia. Similar studies conducted by Singh A et al [11]. and Thalor N et al [12], and Yang SW et al [13]., and Dadhich S et al [14]., found that the MPV showed a significant increase with increasing severity of disease which is similar with our study

This study findings revealed that there is a statistically significant increase in P-LCR (p<0.0001) in mothers of severe preeclampsia group as compared to mothers of non-severe preeclampsia group which is similar to the studies conducted by Sitotaw C et al [15]. and kamel Ammar WA et al [16]. and Mondal B et al [17]. which also showed that P-LCR increases significantly with increase severity of pereclampsia.

This study findings revealed that there is a statistically significant decrease in plateletcrit (p<0.0001) in mothers of severe preeclampsia group as compared to mothers of non-severe preeclampsia group which is similar to the studies conducted by Yücel B et al [18]. and Mohapatra K et al [19]. and Singh A et al [11]. and Karateke A et al. and Thalor N et al [12]. This study findings revealed that there is a statistically significant decrease in platelet count to MPV ratio (p<0.001) in mothers of severe preeclampsia group as compared to mothers of non-severe preeclampsia group which is similar to the study conducted by Doğan K et al [20]. and AlSheeha MA et al [21]. and Abdel Razik M et al [22].

Conclusion

Simple and common tests, such as the complete blood count (CBC), are very useful in detecting platelet indices in preeclamptic patients and its detection early in the course of the disease and planning early management can prevent any unexpected poor outcome to both mother and fetus. Platelet indices viz. Platelet count, Mean Platelet Volume (MPV), Platelet Distribution Width(PDW), Plateletcrit(PCT) and Platelet Large Cell Ratio(P-LCR) are found to be useful in detecting the risk of Preeclampsia in patients due to increased platelet destruction and turnover in the disease. . Changes in these parameters may be associated with changes in blood pressure, allowing for early prediction of individuals who are likely to acquire a progressing severe form of the disease and appropriate therapies to prevent further course of the disease. Preeclampsia progresses, platelet count and plateletcrit decreases while MPV, PDW, and P-LCR increases, and that these changes are more pronounced in severe preeclamptic mothers than in non-severe preeclamptic mothers. Thus, calculation of platelet indices seems to be a reliable, quick, simple, and cost-effective tool for early detection of severity of preeclampsia.

References

1. Payne B, Hanson C, Sharma S, Magee L, Dadelszen V, Stones P, et al. Epidemiology of the hypertensive disorders of pregnancy. Pregnancy Hypertension. 2016;57(3):63–74.
2. Golebiewska EM, Poole AW. Platelet secretion: From haemostasis to wound healing and beyond. Blood Rev. 2015; 29(3):153–62.
3. Vinodhini R and Lavanya K, evaluation of platelet count as a prognostic index in eclampsia andpre-eclampsia. J of Dental and Med Sci. 2014;2(10):447-452
4. Costantine MM, Sibai B, Bombard AT, Sarno M, West H, Haas DM, et al. Performance of a multianalyte "rule-out" assay in pregnant individuals with suspected preeclampsia. Hypertension. 2022;79(7):1515–24.
5. Tesfay F. Prediction of Preeclampsia during Pregnancy Using Platelet Parameters at Ayder Comprehensive Specialized and Mekelle General Hospitals in Mekelle, Tigray, Ethiopia (Doctoral dissertation, Addis Ababa University).

6. Jambhulkar S, Shrikhande A, Shrivastava R, Deshmukh K. Coagulation profile in pregnancy induced hypertension. Indian Journal of Hematology & blood transfusion, 2001 Mar; 19(1):3-5.

7. Joshi et al Platelet estimation: its prognostic value in pregnancy induced hypertension. Indian J Physiol Pharmacol. 2004; 51 (2): 160–164.

8. J.Davies, Fernando, Hallworth; Hemostatic Function in Healthy Pregnant and pre- eclamptic women: An assessment using the platelet function analyser (PFA-100) and thromboelastography; International Anesthesia Research Society. February 2007;104(2).

9. Dr Ellora Devi; Combination of Platelet & Uric Acid Estimation Can Predict Severity of Pih Better; Int J Pharm Bio Sci. 2012 July; 3(3): (B) 1039 – 1045.

10. Karateke A, Kurt RK, Baloğlu A. Relation of platelet distribution width (PDW) and platelet crit (PCT) to preeclampsia. Ginekologia polska. 2015;86(5).

11. Singh A, Varma R. Role of platelet distribution width (PDW) and plateletcrit in the assessment of nonthrombocytopenic preeclampsia and eclampsia. The Journal of Obstetrics and Gynecology of India. 2018 Aug;68(4):289-93.

12. Thalor N, Singh K, Pujani M, Chauhan V, Agarwal C, Ahuja R. A correlation between platelet indices and preeclampsia. Hematology, transfusion and cell therapy. 2019 Jun 10;41:129-33.

13. Yang SW, Cho SH, Kwon HS, Sohn IS, Hwang HS. Significance of the platelet distribution width as a severity marker for the development of preeclampsia. European Journal of Obstetrics & Gynecology and Reproductive Biology. 2014 Apr 1;17 5:107-11.

14. Dadhich S, Agrawal S, Soni M, Choudhary R, Jain R, Sharma S, Saini SL. Predictive value of platelet indices in development of preeclampsia. J SAFOG. 2012 Jan;4(1):17-21.

15. Sitotaw C, Asrie F, Melku M. Evaluation of platelet and white cell parameters among pregnant women with Preeclampsia in Gondar, Northwest Ethiopia: A comparative cross-sectional study. Pregnancy hypertension. 2018 Jul 1; 13:242-7.

16. kamel Ammar WA, Abd El MA, Hei MA, Mohamed MI. Evaluation of platelet indices and their significance in Preeclampsia. Nature and Science. 2014;12(3):147-53.

17. Mondal B, Paul DL, Sultana T, Rahman Q, Ahmed S, Fatema K, Khan WA, Banu B, Ahmed MU, Ahmed10 AN. Assessment of platelet count and platelet indices in preeclampsia and eclampsia. Am J Innov Res Appl Sci. 2015;1(3):80-4.

18. Yücel B, Ustun B. Neutrophil to lymphocyte ratio, platelet to lymphocyte ratio, mean platelet volume, red cell distribution width and plateletcrit in preeclampsia. Pregnancy Hypertension: An International Journal of Women's Cardiovascular Health. 2017 Jan 1; 7:29-32.

19. Mohapatra K, Mohanty P, Sultana NN. Role of platelet distribution width and plateletcrit in assessment of nonthrombocytopenic preeclampsia and eclampsia in a tertiary care hospital of Odisha: an observational study. International Journal of Reproduction, Contraception, Obstetrics and Gynecology. 2020 May 1;9(5):1996-2004.

20. Doğan K, Guraslan H, Senturk MB, Helvacioglu C, İdil S, Ekin M. Can platelet count and platelet indices predict the risk and the prognosis of preeclampsia? Hypertension in pregnancy. 2015 Oct 2;34(4):434-42.

21. AlSheeha MA, Alaboudi RS, Alghasham MA, Iqbal J, Adam I.

Platelet count and platelet indices in women with preeclampsia. Vascular health and risk management. 2016; 12:477.

22. Abdel Razik M, Mostafa A, Taha S, Salah A. Combined Doppler ultrasound and platelet indices for prediction of preeclampsia in high-risk pregnancies. The Journal of Maternal-Fetal & Neonatal Medicine. 2019 Dec 17;32(24):4128-32.