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Platelet Indices in Hypertensive Disorders of Pregnancy: A Prospective Study

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Abstract

Context: Platelet indices (platelet count, Mean Platelet Volume (MPV), platelet distribution width (PDW), plateletcrit) are widely used in understanding pathophysiology of vascular diseases. Pregnancy induced hypertension (PIH) is vascular disorder complicating most of the pregnancy.

Aims: The aim of the study is to evaluate platelet indices in PIH and compare with maternal and fetal outcomes.

Settings and Design: Prospective study.

Methods and Material: Study included 40 pregnant women with gestational hypertension(GH), 40 women with Preeclampsia (PE) and 80 normotensive pregnant women (NP).

Statistical Analysis Used: The data were processed on MS excel work sheet and analysis will be carried out using MedCalc Statistical Software version 12.7.8 (MedCalc Software bvba, Ostend, Belgium; http://www.medcalc.org; 2014). The intergroup analysis was carried out by ANOVA and post hoc analysis.

Results: Mean MPV and PDW were significantly increased whereas platelet count and plateletcrit were significantly decreased in GH and PE groups. Severe thrombocytopenia was observed in mild PE (11%), severe PE in (27%), HELLP syndrome (75%), Eclampsia (50%). IUGR was observed in 5.8% of PE, PPH in 8.8% of PE and 50% of Eclampsia, low birth weight was observed in 25% of PE and 50% of eclampsia, 6% IUD was observed in PE.

Conclusions: Platelet indices i.e. platelet count, MPV, PDW and plateletcrit are a simple, low cost, and rapid routine screening tests. We observed a significant relation between platelet indices and severity of PIH. It also showed that these could be used as markers for diagnosis, as well as for the severity of PIH.

Keywords: Platelet indices; MPV; PDW; Plateletcrit; Preeclampsia; Eclampsia.

Introduction

Pregnancy induced hypertension (PIH) is a global problem which complicates about 3–8% of pregnancies.[1,2] International society for the study of hypertension in pregnancy defined PIH as hypertension arising in pregnancy after 20 weeks of gestation includes gestational hypertension, preeclampsia, eclampsia and HELLP syndrome.[3]

Still the exact pathophysiology of PIH is not completely understood, though it is attributed by certain factors. PIH is considered as a multisystem disorder characterized by abnormal vascular response to placentation and is associated with increased systemic vascular resistance, enhanced platelet aggregation, activation of the coagulation system, and endothelial cell dysfunction which results in reduced organ perfusion.[4,5] Factors like deficient trophoblastic invasion of the maternal vascular bed with subsequent reduction of placental blood flow is attributed to it.[6]

The under perfusion of placenta initiates maternal endothelial dysfunction, and increased vascular permeability resulting in the activation of coagulation by the contact of platelets with the injured endothelium.[7,8] The activation of platelets increases the degranulation leading to decrease in platelet life span and increase in number of immature platelets in peripheral blood smears.[9,10] The indices used to measure platelet functions are platelet count (PC), mean platelet volume (MPV) and platelet distribution width (PDW) and Plateletcrit are altered. MPV and PDW depict the average size and variation in size of platelet, respectively.[11] PIH is associated with decrease in the platelet count and plateletcrit, increase in the MPV and PDW. Hence these are considered as valuable markers in of PIH.

Previous studies have stated the utility of different platelets indices as predictors of PIH.[12–14] But controversies exist. The aim of the study is to evaluate platelets indices in women with various types PIH and compare with maternal and fetal outcomes.

Materials and Methods

This is a prospective study carried out in a tertiary care hospital from November 2019 to February 2020. Pregnant women with gestational age above 32 weeks, attending the antenatal clinic for regular checkups in department of obstetrics were enrolled in this study. The study populations were divided into 3 groups, group 1 included 40 pregnant women diagnosed as having gestational hypertension (GH), group 2 included 40 women with Preeclampsia (PE) and group 3 included 80 normotensive pregnant women (NP).

The preeclampsia group was further stratified into mild PE (18), severe PE (16), HELLP syndrome (4), Eclampsia (2).

GH and PE were defined according to the International Society for the Study of Hypertension in Pregnancy (ISSHP).[3] GH is defined as denovo hypertension with systolic blood pressure (SBP) ≥140 mmHg and diastolic blood pressure (DBP) ≥90 mmHg after 20 weeks of gestation. PE is GH with proteinuria – 1+ on dipstick or ≥300 mg/day or Pr: Cr ratio as ≥3.0 mg/g. HELLP syndrome is hemolytic anemia, elevated liver enzymes, low platelets in pregnant women with PE. Eclampsia is presence of new onset of grandmal seizures in women with PE.[3]

Pregnant women with recurrent abortions, bad obstetric history, twins, pre-existing medical disorders – such as diabetes mellitus, essential hypertension, renal disorders, cardiovascular, thyroid disorders, and liver disease – were excluded from the study.

A written informed consent was obtained from women agreeing to participate in the study. The institutional ethics committee clearance was obtained. All the cases were followed until the delivery for maternal and fetal outcomes. Blood pressure (BP) was measured by oscillometric digital sphygmomanometer (HEM–780N3; Omron, Made in Japan). Two measurements were taken 4 h apart. ISSHP guidelines were followed to measure BP.

Based on the criteria described by the ISSHP guidelines, the PIH cases in our study were classified into five groups

- Gestational HTN
- Mild preeclampsia
- Severe preeclampsia
- Eclampsia
- Hemolysis, elevated liver enzyme levels, and low platelet levels (HELLP) syndrome.

Thrombocytopenia was classified as mild when platelet count was found to be 1–1.5 lakh/cumm, moderate at 50,000–1 lakh/cumm and severe with <50000/cumm.[15]

Maternal complications considered in the study were postpartum hemorrhage (PPH) abruption, preterm delivery and fetal complications low birth weight (LBW), Intra uterine death (IUD). Under strict aseptic conditions, 5 mL of blood sample was collected from all the participants by venous puncture, into properly labeled EDTA plain polystyrene tubes. The platelet indices that were studied are platelet counts (PC), mean platelet volume (MPV), platelet distribution width (PDW). The hematogram was performed on automated hematology analyzer (HORIBA-Yumizen H500, 6 Part Analyzer). In patients with very low platelet countperipheral smear was used to recheck the counts.

Statistical Analysis: The data were processed on MS excel work sheet and analysis will be carried out using MedCalc Statistical Software version 12.7.8 (MedCalc Software bvba, Ostend, Belgium; http://www.medcalc.org; 2014). The intergroup analysis was carried out by ANOVA and post hoc analysis. The association between various parameters in a group was evaluated using Pearson's correlation coefficient. A 2-tailed probability value of 0.05 was considered as statistically significant.

Results

The present study included 80 cases of Pregnancy induced hypertension (PIH), of which 40 were diagnosed with gestational hypertension (GH), 40 were Preeclampsia (PE) were cases and 80 normotensive pregnancy (NP) as controls.

The preeclampsia group is further stratified into mild PE (18), severe PE (16), HELLP syndrome (4) and Eclampsia (2).

The demographics, clinical and biochemical characteristics are described in Table 1.

There was no significant difference between the groups in age and gestational age. Systolic and diastolic pressure were increased in cases than controls and was statistically significant.

Table 2 represents the degree of thrombocytopenia in cases. 77.5% of GH had normal platelet count. In mild PE 11%, severe PE 27%, HELLP syndrome 75% and eclampsia 50% had severe thrombocytopenia

Table 3 describes the mean platelet count was significantly decreased in eclampsia (1.0±0.5 L/ cumm) when compared with other groups. PDW and MPV were significantly elevated in eclampsia (17.7 ±3.9, 11.1 ± 2.5 fl) when compared with normotensives (14.2± 4.8, 7.8±1.9 fl) respectively. The plateletcrit was significantly low in eclampsia (0.13± 0.06 %) when compared to normotensive (0.26±0.05 %). We observed that platelet indices correlated with severity of the disease. Platelet count and plateletcrit were negatively correlate and MPV and PDW were positively correlated with severity of the disease.

Table 4 represents maternal and fetal complications in cases. IUGR was observed in 5.8%

Table 1: Demographic, Clinical and Biochemical Characteristics in Study Population.

	NP	GH	PE	HELLP	Eclampsia	P value
Age (yrs.)	24.34± 4.3	22.6 ± 2.45	21.6± 2.09	22.95 ± 2.93	23.92± 2.82	0.34
GA(wks.)	33.23±3.9	36.26± 4.34	34.33± 2.38	33.32 ± 2.59	34.23 ± 3.4	0.08
SBP (mm/Hg)	118.2±8.4	125 .6± 7.3	139.4 ± 2.3	147.8± 9.7	148.22± 8.3	< 0.001*
DBP (mm/Hg)	72.4±7.9	85.2 ± 7.6	92.3± 8.4	98.68 ± 8.6	101.58± 11.67	<0.001*

GA- Gestational age * Significant.

Table 2: Platelet counts in hypertensive disorders of pregnancy..

Hypertensive disorder of Pregnancy	Thrombocytopenia			
	Mild	Moderate	Severe	Normal
GH (40)	9 (22.5%)	0	0	31(77.5%)
Mild PE (18)	8 (44%)	6 (33%)	2(11%)	2 (11%)
Severe PE (16)	4 (22%)	7 (38%)	5 (27%)	0
HELLP syndrome (4)	0	1 (25%)	3 (75%)	0
Eclampsia (2)	0	1 (50%)	1(50%)	0
Total (80)	26(28%)	15 (19%)	11 (13%)	33 (41%)

Table 3: Mean and SD of platelet indices in Normotensives and Preeclampsia.

	NP (80)	GH(40)	Mild PE (18)	Severe PE (16)	HELLP (4)	Eclampsia(2)	P value
Platelet count (L)	2.7±0.93	2.3±0.76	1.9± 0.9	1.34± 0.82	1.2 ± 0.62	1.0 ± 0.5	<0.001*
PDW (fl)	14.2± 4.8	14.9 ± 3.2	15.3± 4.8	16.4 ± 3.5	17.2 ± 4.2	17.7 ±3.9	<0.001*
MPV (fl)	7.8±1.9	8.1 ±1.6	8.5± 1.7	9.8 ± 2.1	11.2 ± 3.1	11.1 ± 2.5	<0.001*
Pct.(%)	0.26±0.05	0.22 ± 0.06	0.2± 0.02	0.18± 0.04	0.15 ± 0.05	0.13± 0.06	0.02*

Pct. – Plateletcrit * significant

Table 4: Maternal and fetal outcomes with severity of PIH.

PIH	Maternal complications	Fetal complications
GH (40)	nil	nil
Mild PE (18)	IUGR (2)	
Severe PE (16)	Abruption (2)	LBW (4)
	PPH (3)	IUD (1)
	IUGR (6)	
Eclampsia (2)	PPH (1)	IUD (1)
Total (80)	14	6

of PE, PPH in 8.8% of PE and 50% of Eclampsia, low birth weight was observed in 25% of PE and 50% of eclampsia, 6% IUD was observed in PE.

Discussion

In our study we observed a decrease in platelet counts and plateletcrit with an increase MPV and PDW. Our study goes along with the studies done by Muneer etal, Ruchika etal, Habbas et al.[12,16,17]

Thrombocytopenia is found in approximately 6% of pregnancies and most common cause in pregnancy is pregnancy induced hypertension (PIH). A study done by Fay et al and Shah AR et al indicated that there is possibility of platelet hyperdestruction, hemodilution and platelet trapping during pregnancy could be the reason for decreasedplatelet.[18,19]

In our study we classified PIH according to Hypertensive Disorders of Pregnancy ISSHP recommendations. The disparities in results with other studies could be attributed to the various systems of classification in grouping PIH. In a study gestational HTN was excluded and mild and severe PIH were clubbed. Wolde et al's method to categorize cases with PIH based on the National High BP Education Working Group (2000) into the five mentioned groups which is related to our study.[20]

In our study we observed a decrease in platelet counts which were related to the severity of PIH. 28.5% of pregnant women with preeclampsia (PE), 50% with eclampsia (E) and 75% with HELLP syndrome had severe grade of thrombocytopenia. This is in accordance with the studies done by Meshram etal who observed 29.1% of PE and 44.4% of Eclampsia had low platelet counts. Veena etal in their study stated that the thrombocytopenia is due to peripheral consumption, endothelial damage and reduced lifespan of platelets.[22]

In our study we observed 14% of low birth weight (LBW) in women with severe PE and 50% in woman with eclampsia. Sibai et al showed that pregnancies complicated by severe preeclampsia have 12% of infants with LBW.[23] In our study incidence of IUGR was 21% which is comparable with the studies done by Meshram et al who had 19.14%.[21]

The incidence of PPH in severe PE was 14% in present study. The incidence rate is higher than those observed by Meshram et al (8.5%).[21] These differences could be attributed to the variations to the treatment strategies.

The mean platelet volume (MPV) was significantly a higher in PIH and was related to the severity of the disease. Dadhich et al stated that the MPV values increased with the duration of gestation, as well as the severity of the disease.[24] Dundar et al. found a significant increase in the MPV weeks before the diagnosis of preeclampsia.[25] It was suggested that the MPV can be used as a valuable marker in the diagnosis and prediction as well as in the prognosis of the disease. However, AlSheeha et al. and Altinbas et al. have reported no significant difference between the normal healthy pregnant females and preeclampsia patients.[26,27]

The platelet distribution width (PDW) showed a significant increase in PIH and the values were also higher in women with more severe elevations of blood pressure. Our values correlated with the values reported by Giles et al.[28] Similar findings were presented in other studies.[29,30] whereas no significant difference was observed in few studies.[26] Nitesh etal in their study stated that the increase in markers of platelet indices can be due an active turnover of platelet production in the bone marrow and peripheral consumption.[31]

A significant decrease in plateletcrit was observed in our study which goes along with the studies done by Karateke et al. and Freitas et al.[32,33] A decrease in the Plateletcrit indicates a decrease in platelet utilization and activation of platelets count which indicates continuous activation and utilization of platelets.

Conclusion

Platelet indices i.e. platelet count, MPV,PDW and plateletcrit are a simple, low cost, and rapid routine screening tests. In our study we observe a decrease in platelet count and plateletcrit with increase in MPV and PDW. We also observed a significant relation between platelet indices and severity of PIH. It also showed that these could be used as markers for diagnosis, as well as for the severity of PIH. The categorization of PIH also provided for better understanding of the disease process. Further studies focusing on serial estimation of platelet indices throughout the pregnancy can be used to assess the severity of PIH. Identifying platelet indices as early markers can aid in early intervention in women with PIH.

References

1. Redman Christopher W, Sargent Ian L. Latest advances in understanding preeclampsia. Science. 2005;308(5728):1592–15.
2. Walker JJ. Pre-eclampsia. Lancet (London, England). 2000;356(9237):1260–1265.
3. Mark A. Brown, Laura A. Magee, Louise C. Kenny, S. Ananth Karumanchi, Fergus P. Recom etal. Hypertensive Disorders of Pregnancy: ISSHP Classification, Diagnosis, and Management Recommendations for International Practice. Hypertension. 2018; 72:24–43.
4. Burton GJ, Woods AW, Jauniaux E, Kingdom JCP. Rheological and physiological consequences of conversion of the maternal spiral arteries for uteroplacental blood flow during human pregnancy. Placenta.2009;30(6):473–482.
5. Burton GJ, Charnock-Jones DS, Jauniaux E. Regulation of vascular growth and function in the human placenta. Reproduction. 2009; 138(6):895–902.
6. Rupakala BM, Gupta R, ShettyVH, Sailakshmi MPA. Thrombocytopenia in hypertensive disorders of pregnancy. Int J Reprod Contraception Obstet Gynecol 2018; 7:848–54.
7. Maynard SE, Karumanchi SA. Angiogenic factors and preeclampsia. Semin Nephrol. 2011;31(1):33–46.
8. Juan P, Stefano G, Antonella S, Albana C. Platelets in pregnancy. J Prenat Med. 2011;5(4):90–92.
9. Nirmala T, Vani BR, Murthy Srinivasa V, et al. Study of platelet indices in pregnancy induced hypertension. Indian J Pathol Oncol. 2015;2(1):25–30.
10. Sameer MA, Meshram DP, Deshpande SA, et al. Role of platelet count as important prognostic marker in pregnancy induced hypertension. J Dent Med Sci (IOSR-JDMS). 2014;13(4):39–43.
11. Abha Singh, Ruchi Varma. Role of Platelet Distribution Width (PDW) and plateletcrit in the assessment of nonthrombocytopenic preeclampsia and eclampsia. The Journal of Obstetrics and Gynecology of India (July–August 2018) 68(4):289–293.
12. Muneera A, AlSheeha, Rafi S Alaboudi, Mohammad A, Alghasham, Javed Iqbal, Ishag Adam. Platelet count and platelet indices in women withpreeclampsia. Vascular Health and Risk Management 2016:12 477–480.
13. Nitesh Thalor, Kanika Singh, Mukta Pujani,Varsha Chauhan, Charu Agarwal, Rashmi Ahuja. Acorrelation between platelet indices and Preeclampsia. hematol transfus cell ther. 2 0 1 9;41(2): 129–133.
14. Habas E, Rayani A, Ganterie R. thrombocytopenia in hypertensive disease of pregnancy. The Journal of Obstetrics and Gynecology of India (March–April 2013) 68(4):289–293.
15. George JN, Woolf SH, Raskob GE, Wasser JS, Aledort, LM, Ballem PJ et al. Idiopathic thrombocytopenic purpura: A practice guideline developed by explicit methods for the American society of haematology. Blood. 1996;88:3–10.
16. Dhakre R, Nandmer GK, SapkalR. Correlation of platelet indices with severity of preeclampsia:a prospective study from central India. Int J Reprod Contracept Obstet Gynecol 2018;7:1416–20.
17. Eman Abdel-Moneim Alkholy, Elsayed Ali Farag, Mohammed Atef Behery[3] and Mervat Mohammed Ibrahim. The significance of platelet count, mean platelet volume and platelet width distribution in preeclampsia. AAMJ, Vol. 11, N. 1, January, 2013 200–05.
18. Fay RA, Hughes AO, Farron NT. Platelets inpregnancy: Hyper destruction in pregnancy. Obstet Gynecol. 1983;61:238.
19. Shah AR, Chaudhari SN, Shah MH. Role of plateletparameters in diagnosing various clinical conditions.Natl J Med Res. 2013; 3:162–5.
20. Wolde Z, Segni H, Woldie M. Hypertensive disorders of pregnancy in Jimma University specialized hospital. Ethiop J Health Sci. 2011; 21:147–54.
21. Meshram DP, Chavan YH, Kadam PN, Panchal MG, Ramteke DJ. Maternal and foetal outcomes in pregnancy induced hypertension: A hospital based study. Int J Pharm Sci Invention. 2014; 3:23–6.
22. Veena HC, Manjunatha S, Itagi V, Taklikar RH, Patil RS. The hemostatic mechanisms in PIH. Indian J Appl Basic Med Sci. 2015; 17:40–4.
23. Sibai BM, Spinnato JA, Watson DL, Hill GA, Anderson GD. Pregnancy outcome in 303 cases with severe preeclampsia. Obstet Gynecol. 1984 Sep;64(3):319–25.
24. Dadhich S, Agarwal S, Soni M, Choudhary R, Jain R, Sharma S, et al. Predictive value of platelet indices in development of preeclampsia. J SAFOG DVD. 2012; 4:17–21.
25. Dundar O, Yoruk P, Tutuncu L, Erikci AA, Muhcu M, Ergur AR, Atya V, Mungen E. Longitudinal study of platelet size changes in gestation and predictive power of elevated MPV indevelopment of pre-eclampsia. Prenat Diagn.2008;28(11):1052–6.
26. Sheeha MA, Alaboudi RS, Alghasham MA, Iqbal J, Adam I. Platelet count and platelet indices in women with preeclampsia. Vasc Health Risk Manag. 2016; 12:477–80.
27. Altinbas S, Burak ZT. Increased MPV Is Not a Significant Predictor for Preeclampsia During Pregnancy. J Clin Lab Anal. 2012;26(5):403–6.

28. Giles C. The platelet counts and mean platelet volume. Br J Haematol. 1981;48(4):31–7.
29. Sultana R, Karim SM, Atia F, Ferdousi S, Ahmed S. Platelet count in preeclampsia. J Dhaka National Med Coll Hos.2012;18(2):24–6.
30. Karateke A, Kurt RK, Baloglu A. Relation of platelet distributionwidth (PDW) and plateletcrit (PCT) topreeclampsia. Ginekol Pol. 2015; 86:372–5.
31. Freitas GL, Alpo PN, Komatsuzaki F, Carvalho MG, DusseLM. Preeclampsia: are platelet count and indices useful for itsprognostic? Hematology. 2013;18(6):360–4.