Section: Pathology

Original Research Article

ASSESSMENT OF PLATELET ACTIVITY IN ANTENATAL PATIENTS WITH HYPERTENSIVE DISORDERS IN COASTAL TAMIL NADU

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Abstract

Background: Pregnancy-related hypertension affects 3-10% of pregnancies, with pre-eclampsia (PE) posing significant maternal and foetal risks. Platelet indices, such as MPV, PDW, PCT, and P-LCR, serve as markers of platelet activation and microvascular complications in PE. This study aimed to determine the platelet indices in antenatal mothers with hypertensive disorders. **Materials and Methods:** This cross-sectional observational study was conducted on 105 patients over 6 months at the Government Medical College and Hospital, Nagapattinam. CBC samples were collected from patients with eclampsia and preeclampsia, including platelet indices (MPV, PDW, PLT, P-LCR, and PCT). Blood was drawn from the antecubital vein and processed within two hours using SYSMEX XN-330, and peripheral smears were used to assess platelet morphology. Serum albumin creatinine ratio and spot urine proteinuria were analysed using ERBA XL 640 and MISSION U 500 analysers, respectively. **Result:** The platelet count ranged from 109000 to 461000, with a mean of 292570.29 ± 69195.24. The mean platelet volume (MPV) averaged 10.78 ± 1.05, and the mean platelet large cell ratio (P-LCR) was 28.56 ± 6.94%. The platelet crit (PCT) averaged 0.31 ± 0.07%, and the mean platelet distribution width (PDW) was 11.42 ± 1.73. Peripheral smears showed platelet clumping in 42.9%, clumping with giant platelets in 7.6%, giant platelets in 1.9%, and a normal smear in 47.6% of patients. **Conclusion:** This study highlights the significance of platelet indices (MPV, PDW, P-LCR, and PCT) in assessing platelet activity in hypertensive pregnancies. These markers aid in early detection and prognosis, enhancing timely management and maternal-foetal outcomes.

INTRODUCTION

Pregnancy-related hypertensive diseases account for 10-15% of maternal deaths, particularly in underdeveloped nations. Implicitly, these conditions represent 3–10% of all pregnancy-related problems, with erratic occurrences in different topographical and geographical regions. Pregnancy-related hypertension may be the initial indication of an underlying disease that has a substantial negative impact on the health of the mother, foetus, and newborn.[1] Early diagnosis and treatment of hypertension disorders can avert hypertensive crises and improve negative foetal outcomes, but it may not change the course and severity of the disease.

Pre-eclampsia (PE) is a complex illness characterised by the onset of hypertension and proteinuria following the 20th week of pregnancy.[2] From a clinical perspective, differentiating between moderate and severe pre-eclampsia (sPE) based on the severity of symptoms is important. This condition can worsen and lead to disseminated intravascular coagulation, HELLP syndrome (haemolysis, elevated liver enzyme, low platelets), or eclampsia, which is characterised by seizures as an indication of affection of the cerebral arteries.[2]

The cause of PE is uncertain, but it is linked to intrauterine foetal growth retardation and fibrin accumulation in the placental and renal microcirculation.[3,4] PE is a major cause of maternal and foetal mortality and affects 5-8% of pregnancies globally. Its frequency fluctuates depending on the

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population and ethnic group.[2] Platelet activation in this disease is confirmed by the increased expression of activation markers on the surface of platelets,[5,6] and increased plasma levels of activation indicators (β-thromboglobulin and platelet factor-4) in preeclamptic women. In addition, PE has been linked to decreased endothelial synthesis of nitric oxide and prostacyclin.[7-9] Platelet variation has been observed in pregnancy-induced hypertension (PIH) and is regarded as a hypercoagulable state. Platelet reactivity is elevated in pre-eclampsia and eclampsia alike, this is very well correlated with the number of vascular problems in PIH.[4]

The average platelet size and activity are measured using the mean platelet volume (MPV).[5] Platelet aggregation is indicated by size fluctuation, which is measured using the platelet distribution width (PDW). PDW and MPV are directly correlated with the large platelet cell ratio (P-LCR). MPV, or platelet volume, is a measurement of platelet function and activation.[8] Microvascular problems are associated with thrombotic activity and are indicated by MPV and platelet count.[6] Plateletcrit (PCT) is the volume that platelets occupy in the blood. The P-LCR measure of greater (>12 fl) circulating platelets in circulation. Early categorisation is crucial for the health of both the mother and child. Hence, the study is justifiable with the above parameters along with clinical significance. This study aimed to determine the platelet indices in antenatal mothers with hypertensive disorders.

MATERIALS AND METHODS

This cross-sectional observational study was conducted on 105 patients over 6 months at the Department of Pathology at Government Medical College and Hospital, Nagapattinam. The Institutional Ethics Committee approved the study before its initiation, and informed consent was obtained from all the patients.

Inclusion Criteria

Patients aged 21-40 years with systolic blood pressure ≥ 140 mmHg and diastolic ≥ 90 mmHg, all properly labelled blood samples from patients diagnosed with eclampsia or pre-eclampsia, serum albumin creatinine ratio, and more than 3+ proteinuria in urine spot samples were included.

Exclusion Criteria

Patients with unobtainable clinical data, improperly labelled or poorly preserved blood samples, those on antiplatelet drugs such as aspirin and clopidogrel, and those with previously diagnosed malignancy, gestational diabetes, cardiovascular disorders, renal or hepatic dysfunction were excluded.

Methods

All complete blood count (CBC) samples, including MPV, PDW, platelet count, platelet large cell ratio (P-LCR), and PCT, were collected from patients diagnosed with eclampsia or preeclampsia. The cutoff values for the platelet indices were derived by calculating the minimum values of these indices in PIH. All PIH and non-PIH subjects were interviewed according to a pre-prepared proforma and underwent complete clinical evaluation. Blood samples were collected in the morning to minimise diurnal variations.

Blood samples were drawn from the antecubital vein using a 5 ml syringe and immediately transferred into EDTA vacutainers and plain clot activator vacutainers for the respective analyses. Samples in EDTA vacutainers were processed within two hours of venepuncture using a 6-part differentiated haematology analyser (SYSMEX XN-330) for CBC analysis, including platelet indices. Platelet adhesion, aggregation, and morphology were assessed using peripheral blood smears. The serum albumin creatinine ratio was analysed using a fully automatic analyser (ERBA XL 640) within four hours of collection in clot activator vacutainers. Spot urine analysis for proteinuria was performed using urine strips with an automatic urine analyser (MISSION U 500). Data are presented as mean, standard deviation, frequency, and percentage.

RESULTS

The mean age of the patients was 29.87 ± 5.69 years. The platelet count ranged from 109000 to 461000, with a mean of 292570.29 ± 69195.24, indicating considerable patient variability. The MPV ranged from 8.7 to 13.3, with a mean of 10.78 ± 1.05. The P-LCR varied from 12.8% to 49.8%, with a mean value of 28.56 ± 6.94%. The PCT ranged between 0.11% and 0.46%, with a mean of 0.31 ± 0.07%, indicating the total platelet mass of the sample. The PDW ranged from 8.6 to 18.1, with a mean of 11.42 ± 1.73, representing platelet size variability and heterogeneity [Table 1].

Table 1: Platelet indices and their variability.

	Mean ± SD	Minimum- Maximum
Platelet count	292570.29 ± 69195.24	109000-461000
MPV	10.78 ± 1.05	8.7-13.3
P-LCR	28.56 ± 6.94	12.8-49.8
PCT	0.31 ± 0.07	0.11-0.46
PDW	11.42 ± 1.73	8.6-18.1

Peripheral smear examination revealed that platelet clumping was observed in 45 (42.9%) patients while clumping with giant platelets was noted in 8 (7.6%) patients. Giant platelets were observed in 2 (1.9%)

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patients, whereas a normal smear was observed in 50 (47.6%) patients [Table 2].

Table 2: Peripheral smear findings

	Number of patients (%)
Clumping	45 (42.9%)
Clumping with giant platelets	8 (7.6%)
Giant platelets	2 (1.9%)
Normal smear	50 (47.6%)

DISCUSSION

Hypertensive disorders of pregnancy, including gestational hypertension, preeclampsia, and eclampsia, are associated with significant alterations in platelet indices, reflecting underlying endothelial dysfunction, platelet activation, and increased thrombotic risk. The mean platelet count in our study was 292,570.29 ± 69,195.24, showing significant changes among patients. A decrease in platelet count has been widely reported in hypertensive pregnancies, particularly in preeclampsia. Previous studies have shown an inverse relationship between platelet count and blood pressure, such as Singh et al. reported that patients with higher blood pressure had lower platelet counts, a finding consistent with our study.[10]

Damani found that pregnant women with PIH had lower platelet counts (217,050 ± 50,780.7) than normotensive controls (384,480 ± 235,500), indicating endothelial dysfunction. Endothelial injury increases platelet activation and consumption, which is worsened by inflammation and oxidative stress.[11] Moreover, AlSheeha et al. identified a platelet count of 248 × 10^3/µL as a diagnostic marker for pre-eclampsia, with a sensitivity and specificity that suggest clinical utility.[12] This aligns with our findings, emphasising the importance of platelet monitoring in high-risk pregnancies.

We found that the markers of platelet activation, including MPV, P-LCR, and PDW, were higher in our study population, indicating increased platelet turnover and reactivity. The MPV was 10.78 ± 1.05, which is higher than the typical values observed in normotensive pregnancies. Elevated MPV suggests more significant and more reactive platelets, a feature commonly seen in conditions with increased platelet activation and consumption, such as pre-eclampsia. Prior research has shown conflicting results regarding the MPV in hypertensive pregnancies, such as Gogoi et al. found significantly higher MPV in preeclamptic women compared to normotensive controls (9.45 ± 1.19 vs. 9.02 ± 1.1).[13] However, AlSheeha et al. reported no significant differences in MPV and PDW between preeclamptic and normotensive women, suggesting that MPV alone may not be a definitive marker and should be interpreted in conjunction with other indices.[12]

In our study, P-LCR and PDW, which reflect the proportion of larger platelets and variation in platelet size, respectively, were also increased. P-LCR (28.56 ± 6.94%) and PDW (11.42 ± 1.73) suggest increased platelet counts, a compensatory reaction to platelet depletion in the hypercoagulable condition of preeclampsia. These findings are in agreement with Martina et al., who reported significantly higher PLCR and PDW in pregnant women compared to non-pregnant women.[14]

We found that peripheral smear examination provided further insights into platelet morphology. Platelet clumping was observed in 42.9% of patients, and 7.6% had clumping with giant platelets. The presence of giant platelets (1.9% of cases) suggests ongoing platelet activation and destruction, findings that correlate with the severity of preeclampsia. Gupta et al. demonstrated that decreased platelet count in severe pre-eclampsia was significant compared to mild pre-eclampsia, further supporting our observations.[15]

Saini et al. found that platelet count showed high sensitivity (82%) but moderate specificity (54%) for predicting PIH. Additionally, MPV had a sensitivity of 54% and specificity of 82%, suggesting its potential role in risk stratification. However, the platelet count/MPV ratio demonstrated better predictive ability, with a specificity of 100% for pre-eclampsia without severe symptoms, supporting its clinical value.[16] Further, Alisi et al. demonstrated significant alterations in haematological parameters, including a decrease in platelet count and platelet count/MPV ratio, along with increased PDW and PLCR in pre-eclampsia.[17]

We suggest that platelet indices are valuable markers for predicting hypertensive complications during pregnancy. These findings highlight the complex interplay between platelet indices and disease progression, demonstrating the need for routine platelet monitoring in hypertensive pregnancies.

CONCLUSION

Our study highlights the significant role of platelet indices in assessing platelet activity in antenatal patients with hypertensive disorders. The findings demonstrate that platelet parameters, such as MPV, PDW, P-LCR, and PCT, are altered in PIH. Peripheral smear examination further revealed platelet clumping and the presence of giant platelets, indicating increased platelet reactivity in pre-eclampsia and eclampsia. These alterations in platelet indices serve as potential markers of platelet activation and could aid in the early identification and prognostic evaluation of hypertensive disorders during pregnancy. Routine assessment of platelet parameters may play a crucial role in the timely

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intervention and management of these patients, thereby improving maternal and foetal outcomes.

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