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Platelet Volume Indices in Patients with Acute Coronary Syndrome

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Authors' contributions

This work was carried out in collaboration among all authors. Author EP designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors SS, SP and AS managed the analyses of the study. Author PR managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Background & Aims: Acute coronary syndrome is one of the leading causes of morbidity and mortality in the world and platelet hyperactivity with local platelet activation plays a crucial role in its genesis. As there is discrepancy regarding the significance of deranged platelet parameters, we aimed to study the role of platelet volume indices in the spectrum of coronary artery syndrome and to correlate them clinically.
Study Design: The study was conducted by collecting the data of patients with Myocardial infarction from the Cardiac care unit registry along with their clinical history and investigations. Stable coronary artery cases were collected from the Catheterization Lab and compared with Age and Sex matched controls. All CBCs of the above groups were processed by a 5-part counter and the data generated was transferred to a master chart for statistical analysis.
Place and Duration of study: The study was conducted in the Central Laboratory & Department of Pathology at D.Y. Patil Hospital, Navi Mumbai, India in collaboration with the Cardiac Care Unit and Catheterisation Lab of the hospital for a period of two years.

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Methods: A total of 122 cases were studied and grouped into 5 groups according to presentation and the platelet volume indices of these were compared with 38 matched controls and statistically analysed.

Results: Mean Platelet Volume and Platelet Distribution Width of patients with ST elevation Myocardial Infarction (STEMI) and Non ST elevation Myocardial Infarction(NSTEMI) were increased marginally in number when compared to Stable Coronary Artery Disease(SCAD) and Control group, however this was not statistically significant. Platelet Large Cell Ratio (PLCR) was significantly raised in STEMI cases only (P = 0.09), so it may prove to be a better marker for the disease (P = 0.09). Platelet counts in various groups when compared with controls gave inconsistent results i.e SCAD vs Control significantly decreased (*P* = 0.07) and STEMI vs Control significantly increased (*P* = 0.01).

Conclusion: The platelet volume indices in suspected acute coronary syndrome cases showed various changes, but present data failed to be diagnostically significant. However this data may later help to characterise further relationship between Acute coronary syndrome and platelet function in subsequent studies.

Keywords: Acute coronary syndrome; platelet indices; coronary artery disease.

1. INTRODUCTION

With changing lifestyle and increased awareness, coronary artery disease and myocardial infarction cases are on the rise in urban Indians. Acute coronary syndrome (ACS) can have variety of clinical manifestations and encompass ST-segment elevation myocardial infarction (STEMI), unstable angina (UA), non-ST segment elevation myocardial infarction (NSTEMI) as well as stable coronary artery disease (SCAD) [1]. These pose diagnostic dilemmas and need extensive investigations as they have therapeutic and prognostic significance.

Larger platelets, as indicated by automated cell counters in the form of raised mean platelet volume (MPV), platelet distribution width (PDW) and platelet large cell ratio (PLCR) are found to be metabolically and enzymatically more active than smaller platelets by producing increased thromboxane A2 [2,3]. Platelet activity and local platelet activation have been suggested to play a causal role in acute coronary thrombotic events, as indicated in various studies [4,5].

The present study was undertaken to study the role of platelet indices of acute coronary syndrome, especially in countries like India, where there is shortage of resources for extensive diagnostic tests and risk stratification of these patients.

2. MATERIALS AND METHODS

This study was done at a tertiary care postgraduate teaching hospital over a duration of two years. All the patients admitted in cardiac care unit with diagnosis of coronary artery syndrome based on history, ECG and / or cardiac enzymes were included in the study. Patients who were already on anticoagulation or antiplatelet drugs or with history of blood or platelet transfusion and patients with systemic/liver/renal diseases, myeloproliferative, myelodysplastic diseases along with malignant conditions were excluded from the study.

All patients in the study were divided into 4 groups and controls were included in 5th group.

Hence the 5 groups were:

Group 1: Patients with ST segment elevation myocardial infarction (STEMI).
Group 2: Patients with non-ST segment elevation myocardial infarction (NSTEMI).
Group 3: Patients with stable coronary artery disease (SCAD).
Group 4: Patients with unstable angina (UA).
Group 5: Age and sex matched controls.

Data of patients in study group (Group 1-4) was collected from case records of cardiac care unit and Catheterization Lab. Complete blood count (CBC) findings of study and control groups with emphasis on platelet indices was collected from five-part automated blood cell counter (Mindray BC-5300 and Mindray BC-5600 Auto hematology Analyzer) done for diagnostic or therapeutic purposes. The data was then transferred to master chart and statistically analyzed.

3. RESULTS AND DISCUSSION

A total of 160 subjects were included in this study, out of which 122 were patients (cases)

Table 1. Platelet volume indices in various groups with significant comparisons

PVI (Units)	CAD	Unstable Angina	STEMI	NSTEMI	Controls	Significant comparisons
MPV (fL)	8.75± 0.96	9.12± 1.14	8.89 ±0.94	8.75 ± 1.24	8.5± 0.93	None
Platelet count (x 10^9/L)	241.0± 71.22	247.83± 73.34	268.24 ± 76.79	269.81 ± 69.79	246.63± 54.13	CAD vs Control (decreased) *P* = 0.07 STEMI vs Control (increased) *P* = 0.01
PDW (fL)	15.98±0.33	15.96± 0.42	15.95 ± 0.38	15.90 ± 0.38	15.62± 1.51	None
PLCR (%)	26.60±8.90	30.32± 8.94	28.92 ± 7.94	26.22 ± 8.039	29.04± 8.90	STEMI vs Controls (increased) *P* = 0.09 [1]

PVI - Platelet volume indices, CAD - Coronary artery disease, STEMI - ST elevation Myocardial infarction, NSTEMI -Non ST elevation Myocardial infarction, MPV - Mean platelet volume, fL - Femtolitres, L – Litres, PDW - Platelet distribution width, PLCR - Platelet large cell ratio, % - Percent

and 38 were healthy controls. Out of total 122 cases, there were 24 cases of stable coronary artery disease (19.67%), 21 cases of non-ST segment elevation myocardial infarction cases (17.21%), 42 cases were of ST segment elevation myocardial infarction (34.43%) and 35 cases of unstable angina (28.69%) in our study.

Mean age (in years) of cases in each disease cohort was as follows: Stable coronary artery disease- 60.17 ± 11.51, Non-ST segment elevation myocardial infarction cases- 54.86 ± 9.66, ST segment elevation myocardial infarction- 52.5 ± 13.97, Unstable angina- 55.23 ± 10.8. Our findings were consistent with other studies by Ridwan, Assiri, Pipliwal and Dehghani et al. in which the expected incidence of Ischemic Heart Disease was in the 5th and 6th decades [6,7,8,9].

Males were more than twice likely to have coronary artery disease compared to females in our study, 85 were (69.67%) males and 37 were females (30.33%) with a male to female ratio of 2.3:1. Other studies similarly indicate that cardiac disease is twice as prevalent in males than females, reportedly due to the protective effects of female hormones and relatively lower stress levels in females [6,7,8].

3.1 Platelet Count

In the present study, platelet counts in different study groups when correlated with control group gave inconsistent results. Group 1 (STEMI) showed significantly increased platelet count (P =0.1) while no significant variation was seen in group 2 (NSTEMI) and group 4 (unstable angina) patients. Group 3 (stable coronary artery disease) patients showed a significant decrease on comparison with controls (P = 0.07). Other studies have also reported discrepancies regarding the utility of platelet counts in diagnosis of acute coronary syndrome [4,5,7,9]. However, this is in contrast to study by Ridwan et al and Gargi et al. which showed significant decrease in the platelet counts of acute myocardial infarction patients (includes STEMI and NSTEMI) and unstable angina group with no change in other groups [6,10].

3.2 Mean Platelet Volume (Mpv)

When mean platelet volume of group 1 (STEMI), group 2 (NSTEMI) and group 3 (stable CAD) and group 4 (unstable angina) were compared, they showed no change as compared to controls (group 5); therefore, MPV is not a good indicator of disease. In contrast to our study, Ridwan et al showed significant increase in the p value of MPV in different groups compared with controls [6]. Similar elevated MPV was also found in a study by Dehghani et al. Gargi et al. and Bharihoke et al. [9,10,11] This disparity in our study could be due to smaller size of study-group or due to other regional and cultural factors. However, Halbmeyer et al. also showed that MPV failed to show significant difference compared to controls [12].

3.3 Platelet Distribution Width and Platelet Larger Cell Ratio (PDWAnd PLCR)

PDW showed mildly significant variation which was not significant. PLCR was significantly increased in the STEMI group (P = 0.09). This is in concordance with the study by Pipliwal et al. but in disagreement with Ridwan et al. who found no significant variation of PDW and PLCR in myocardial infarction patients when compared to controls [8,6]. Our experience with PDW mirrored Ridwan et al. [6] The role of PDW in assessing ischemic heart disease has not been extensively studied, similarly PLCR is a relatively new parameter given by latest five part and other higher versions of hematology analyzers and not subjected to detailed analysis as an indicator of CAD. In a study by Dehghani et al. they found only PDW and PLCR increased significantly in unstable angina patients, but not other parameters [9].

However, our study was limited by small sample size and lack of comparison with follow-up repeat sample for complete blood count. Large case control study is recommended to validate our results.

4. CONCLUSION

Even though there are contradicting views, the present study highlighted that platelet count and its volume indices cannot be taken as indicators for predicting the course of disease in patients with acute coronary syndrome. But they provide valuable insight in understanding the pathological processes leading to the disease.

Further, large population-based case-control studies, follow-up and validation of results are recommended to know the exact role of platelet parameters in cases of acute coronary syndrome.

CONSENT

All authors declare that 'written informed consent was obtained from the patient (or other approved parties) for publication of this case report and accompanying images.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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