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Mean platelet volume and other platelet volume indices in patients with acute myocardial infarction: A case control study"

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Abstract: *Platelets play an important role in both initiation and propagation of acute coronary syndromes.*
Objective*: To evaluate the predictive value of platelet volume indices in patients of MI.*
Methods*: This hospital based case control comparative study was conducted between September 2013 to July 2014, evaluating the values of platelet indices of 60 patients of MI and 60 healthy control subjects. Blood sample was drawn from patients of acute myocardial infarction within 6 hrs of arrival before administration of any anticoagulant, in EDTA bulbs and samples were analyzed within 30 minutes of collection. Platelet indices was measured using an automated hematologic analyzer called SYSMEX 4000 I.*
Results*: Platelet indices (MPV, PDW, P-LCR) were raised in MI patients (11.97± 1.458 fl, 15.23 ± 3.503 fl and35.76± 8.210% respectively) as compared to controls (10.72±0.940 fl, 13.25 ± 2.526 fl and 31.40 ± 5.823 % respectively); whereas platelet count and PCT were low in MI pt. (231.25 ± 67.27 ×10^3/µl, 0.266 0 ±.0641% respectively) as compared to controls (276.38± 120.86×10^3/µl and 0.320 4±.0133% respectively).*
Conclusion: *Platelet indices (MPV, PDW, P-LCR, PCT) was found to be an important predictor of MI. They can be used as a simple, reliable, and economical method for predicting an impending acute coronary event.*
Key words*: Myocardial Infarction, Mean platelet volume, Platelet distribution width, platelet large cell ratio, plateletcrit.*

I. Introduction

Acute coronary syndrome (ACS) is becoming the leading cause of morbidity and mortality in developing countries like India. The spectrum of presentation is wide from unstable angina to acute myocardial infarction (1). Known major risk factors for coronary heart disease are age, family history, cigarette smoking, hypertension, elevated LDL cholesterol, and diabetes mellitus. Apart from that, endothelial dysfunction, lipoprotein-a, homocysteine, and C-reactive protein are now considered as new risk factors for coronary heart diseases (2, 3). Cardiovascular disease is mainly caused by atherosclerosis. Clinical complications occur when a plaque suddenly ruptures and platelets form a thrombus on the plaque and the coronary artery becomes occluded. Atherosclerotic plaque rupture is the cause of approximately 70% of myocardial infarctions (4).

Blood platelets play a pivotal role in cardiovascular disease, as aggregate formation of blood platelets in response to an unstable atherosclerotic plaque causes acute blockade of blood flow, causing ischemia and infarction (5). In addition to the role of platelets in arterial thrombosis, it is becoming clearer that platelets also play an important role in the progression of atherosclerosis. Atherosclerosis is an inflammatory process that is characterized by leukocyte infiltration and participation of other components of the (innate) immune response (5).

Platelets contain numerous cytokines, chemokines and growth factors in their granules and through interaction with leukocytes and endothelial cells platelets can promote inflammation and atherosclerosis (6). It has been described that inflamed endothelial cells have the ability to bind platelets and red blood cells, despite that the endothelial cell layer is intact (7, 8).

Platelets are heterogeneous in size, density, and activity (9). Alterations of these parameters may be associated with pulling the trigger of acute coronary syndrome and its spread (10).

Automated cell counters have made the platelet count (PC) and the platelet volume indices (PVI)—mean platelet volume (MPV), platelet distribution width (PDW), and platelet large cell ratio (P-LCR) plateletcrit (PCT)—routinely available in most clinical laboratories. However, there is scope to make better use of the platelet parameters generated. The MPV can reflect changes in either the level of platelet stimulation or the rate

of platelet production. Platelet activation is indirectly measured via MPV. Thus, our aim was to study MPV and other PVI in the spectrum of ischemic artery disease and to attempt a clinic-pathological correlation.

II. Methodology

This hospital based observational, Case Control type of analytic study was done from September 2013 to July 2014. 60 cases of MI and 60 healthy controls were included in the study done at SMS Medical College Jaipur. Sixty patients of acute myocardial infarction were be taken in study, Patients were be evaluated for mean platelet volume along with complete blood counts, renal function, liver function, lipid profile, CPK-MB etc.

Blood sample was drawn from patients of acute myocardial infarction within 6 hrs of arrival before administration of any anticoagulant, in EDTA bulbs and samples were analyzed within 30 minutes after collection by SYSMEX 4000 I analyzer. Similarly blood sample from normal healthy subjects selected on random basis from the same ward was collected and analyzed. Investigation was done in the Central laboratory and Advance hematology laboratory, SMS Hospital, jaipur. Platelet parameters obtained from patient with acute myocardial infarction were compared with controls. AMI was diagnosed on basis of symptom of ischemia, ECG changes indicative of new ischemia and elevated cardiac biomarkers. Patients taking anticoagulants or anti-platelet drugs, patients having myeloproliferative disorders, malignancies or patients not giving consent were excluded from study.

III. Statistical Analysis

Data thus collected was entered in MS excel sheet and the data was analyzed using PRIMER and SPSS version 20 Statistical software. Quantitative data were summarized in form of mean and S.D. (Standard Deviation) and the difference in means was analyzed by using student's t test i.e. for the comparison of the age and hematological parameters of the patient and the control groups while qualitative data were summarized in form of proportions. The difference in proportion was analyzed using CHI SQUARE test. The level of significance for all statistical analysis was kept at $p < 0.05$. Receiver operating characteristic (ROC) curve analysis was performed to determine the optimal cut off values of significant variables.

IV. Results

Age range in our study was 30-80 years. Mean age of 60 cases was 56.53± 9.14 years and of controls was 56.58± 9.608 years. There were Sixteen female in both case and control group and forty four male in both case and control group. No Significant difference was observed in age and sex distribution of the case and control group.

Mean platelet count was found lower in cases (231.25 ± 67.27) as compared to controls (276.38± 120.86). This difference was statistically significant (p value = 0.0135). Mean platelet volume was significantly higher among cases (11.97± 1.458) as compared to controls (10.7 ±0.940); P value =0.001. In ROC curve of MPV the area under curve (AUC) was found to be 0.762 (95% confidence interval) statically significantly P value <0.005. The best cut off value for MPV for predicting MI was 11.65 fl (Sensitivity 66.7% and specificity and 53.33 %).

Platelet Distribution Width (PDW) was high in cases (15.23± 3.503) as compared to controls (13.25±2.526). This Difference was statistically significant; p value=0.001 (<0.05). In ROC curve of PDW the AUC was found to be 0.687 (95% confidence interval), statically significantly P value <0.05. The best cut off value for PDW for predicting MI was 13.45 fl (Sensitivity 73.3% and specificity and 63.33 %).

Platelet Large Cell Ratio was high in cases (35.76 ±8.210) as compared to controls (31.40 ±5.823). This Difference was statistically significant (p value= 0.001). In ROC curve of P-LCR the AUC was found to be 0.686 (95% CI) , statistically significantly P value <0.05.The best cut off value for P-LCR for predicting MI was 38.5 unit (Sensitivity 50% and specificity and 68.3 %).

Plateletcrit was low in cases (0.266 0 ±.0641) as compared to controls (0.320 4±.0133). Difference was statically significant p value - 0.005 (<0.05). In ROC curve of PCT AUC was found to be 0.368 , statically significantly P value <0.05 The best cut off value for PCT for predicting MI was 0.175 unit (Sensitivity 65% and specificity and 13.3 %).

V. Discussion & Conclusion

Many studies show increase MPV in patient of ACS compared to controls like Georg Slavka et al (11), Abdullah S. Assiri et al(12) and RandheerPal et al(13).

In this study along with MPV other PVI (MPV, PDW, and P-LCR) were also raised in patients who had suffered an acute coronary event compared with controls, which was similar to study done by Killol Nathubhai et al(14) and by M M Khandekar et al(15) in which MPV , PDW ,P-LCR were increased in MI and UA group compared to stable coronary disease patients.

PLT count was low in cases as compared to control group and was statistically significant which was similar to study by Rıdvan Mercan et al (16). In this study PCT was the only PVI that was found low in cases compare to control group. Study done by Vitthal Khode et al (17) also found no significant difference in PCT between cases and control group whereas another study done by Jasmin H Jasani et al (18) found PCT was significantly raised in patients with AMI and UA compare to normal healthy controls .Low PCT in present study was probably because of low platelet count in case group as compared to control.

Though MPV is widely studied in ACS, but the role of PDW, PCT specifically in patients with CAD and acute coronary events is yet to be explored. Similarly, the P-LCR parameter is generated by only a few machines, with the Sysmex analyzer being one of them. It is not often quoted in the literature, probably because it is a relatively new PVI parameter.

Some studies have suggested that the increased MPV contributes to the prethrombotic state in acute ischemic syndromes and that larger platelets may play a specific role in infarction. Because larger platelets are haemostatically more active, the presence of larger platelets is probably a risk factor for developing coronary thrombosis and MI. Patients with larger platelets can easily be identified during routine haematological analysis because PVI are generated as a byproduct of automated blood counts. Thus, in conclusion, PVI may provide an important, simple, effortless, and cost effective tool, for predicting an impending acute coronary event.

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Table 1

SN	PARAMETER	CASES	CONTROLS	P-VALUE
1	AGE	56.53±9.14	56.58±9.608	0.977
2	SEX RATIO M:F	77.33 : 26.67	77.33 : 26.67	0.836
3	PLT COUNT IN $\mu\times10^3$	231.25 ± 67.24	276.38± 120.86	0.13
4	MPV (fl)	11.97± 1.458	10.72±0.940	0.001
5	PDW(fl)	15.23 ± 3.503	13.25 ± 2.526	0.001
6	P-LCR (%)	35.76± 8.210	31.40 ± 5.823	0.001
7	PCT (%)	0.266 0 ±.0641	0.320 4±.0133	0.005