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Medicine

Association of Mean Platelet Volume with SGOT and CPKMB with Significant Coronary Artery Disease in Patient with Acute Coronary Syndromes

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Original Research Article

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Abstract: Coronary artery disease is major health problem. Various markers are being studied to diagnose significant coronary artery disease. We conducted this prospective observational study to find any association of mean platelet volume (MPV), SGOT and CPKMB with significant coronary artery disease.A total of 110 patients with acute coronary syndromes were included in the study. All patients underwent coronary angiogram and percutaneous intervention whenever indicated. Association of MPV, SGOT and CPK-MB was tested with presence of significant coronary disease. MPV was significantly higher in hypertensive & those who required coronary intervention (p value 0.014 &<0.001 respectively). Two or three vessel-involved-subjects were having significantly higher MPV than those with no or single major vessel involvement. (two vessel v/s normal or single vessel, MPV 10.66 +/-1.52 p value 0.03, three vessel v/s normal or single vessel, MPV 11.55+/-1.51 p value <0.001). Patients with LAD as the involved vessel had higher MPV values 10.55 +/-1.64, than those without LAD involvement 9.58+/-1.45 (p-value 0.03).Significant but weak negative correlation was observed between MPV & Left ventricular ejection fraction (LVEF) of heart (Pearson correlation -0.192, p 0.04). CPKMB and SGOT are sensitive for acute myocardial injury but not studied in association with significant coronary artery diseases. We observed that MPV was higher in patients with significant coronary disease, ≥2vessel disease and those with LAD involvement. MPV can be considered as a marker of significant coronary artery disease.

Keywords: Significant coronary artery disease, mean platelet volume (MPV), CPKMB, SGOT, LVEF.

INTRODUCTION

An acute coronary syndrome (ACS) manifests because of the rupture of an atherosclerotic plaque in the coronary artery. It manifests in any of the three different ways- ST-elevation myocardial infarction (STEMI), non-ST elevation myocardial infarction (NSTEMI), or unstable angina. Plaque rupture leads to formation of platelet-rich thrombus in the coronary arteries. Activated platelets bind to the circulating coagulation protein fibrinogen, through the integrin, glycoprotein IIb/IIIa receptors. The platelet–fibrinogen–platelet connection initiates the process of platelet aggregation and thus leads to coronary thrombus formation [1]. Mean platelet volume (MPV) is a measure of average size of the platelets, a surrogate for the granular content of the cell. Larger the cell, more likely it is to release the granular content when activated. MPV increases during acute myocardial infarction (AMI) and in the weeks after [2]. Previous studies have shown a significant association of MPV to cardiovascular events [3].

MPV is calculated by most of the automated equipment's performing blood cell count. So, it is an easy, reliable and inexpensive. If such an easily available marker is able to identify patients with significant coronary disease, this will be very useful in resource limited settings. We planned this study to look for an association of MPV with presence of significant coronary obstruction in patients presenting with ACS.

MATERIALS& METHODS

The Institutional ethics committee of B. J. Govt. Medical College and Sassoon General Hospital, Pune approved this study. In this single-center prospective cohort study, we included consecutive patients with ACS admitted to Sassoon General Hospital, Pune. A full clinical evaluation was performed; baseline investigations were performed including complete blood count, serum total cholesterol, triglycerides, serum creatinine, creatine phosphokinase muscle/brain (CPKMB), Serum Glutamic Oxaloacetic Transaminase (SGOT),

Electrocardiogram (ECG) and 2D Echocardiography. Coronary angiography and percutaneous coronary interventions were performed using standard protocols and guidelines.

Inclusion

All patients admitted with acute coronary syndrome and undergoing coronary angiography were included in the study.

Exclusion

Non-cardiac chest pain and patients with chronic kidney disease were excluded from study.

STATISTICAL ANALYSIS

Quantitative data was presented as means ± standard deviations (SD); Qualitative data was presented as frequencies. The Chi-square test with Yates' correction was used to compare categorical variables. The unpaired t-test was used to compare normally distributed continuous variables between groups. One-way analysis of variance (ANOVA) was used to compare continuous variables between groups. The relationship between MPV and clinical or laboratory variables was evaluated by Spearman's rank correlation coefficient. A value of two-tailed $P < 0.05$ was considered significant.

RESULTS

110 patients (77 males) with mean age of 54.6 years were included. Table 1 shows MPV was significantly higher in hypertensive than Normotensive patients (MPV 10.59+/-1.53, 9.81+/-1.69 respectively p value 0.014). Presence of diabetes, history of ischemic heart condition did not have an association with MPV, nor did smoking habit nor gender. Subjects requiring percutaneous intervention had higher MPV than medically managed subjects (MPV 10.88+/-1.48, 9.26+/-1.39 respectively p value <0.001).

Table-1: Patients multiple variables were studied in relation with MPV by applying unpaired t test (P value significant if < 0.05)

Variables (No. of subjects)	MPV Mean	p value
Diabetes Present (36)	10.6194	0.131
Diabetes Absent (74)	10.0718	
Hypertension Present (62)	10.5919	0.014
Hypertension Absent (48)	9.8106	
Males (77)	10.3208	0.706
Females (33)	10.0882	
IDH Present (9)	10.5556	0.457
IDH Absent (101)	10.2239	
Smokers (10)	10.4100	0.752
Nonsmokers (100)	10.2351	
Medical management	9.2630	0.001
Coronary interventions	10.8851	

On application of one way ANOVA test, there was no significant difference between MPV of normal vessel angiogram with single vessel involved angiogram and also between two vessel involved with three major vessel involved subjects, but normal and single vessel involved subjects were having significantly lower mean MPV than those having two & three vessels involved in angiography.

In figure 1 Box and Whisker plot shows that MPV increased as number of affected vessel increases from zero to three. LVEF was significantly lower in double or triple vessels involved subjects than the single vessel involved subjects. No statistical significant difference was observed in CPKMB level and vessels involvement status on coronary angiography.

Left anterior descending (LAD) involved subjects were having mean MPV 10.55 +/-1.64, which was significantly higher than non-LAD subjects mean MPV 9.58+/-1.45 (p-value 0.03). LVEF in subjects with LAD involvement was significantly lower mean LVEF than subjects without LAD involvement [44.48+/-8.87 and 49.55+/-7.98% respectively; (p-value 0.04)]. While there was no significant difference in BMI, SGOT, CPKMB, Cholesterol, triglycerides, and serum creatinine values in these two groups of subjects by LAD involvement status.

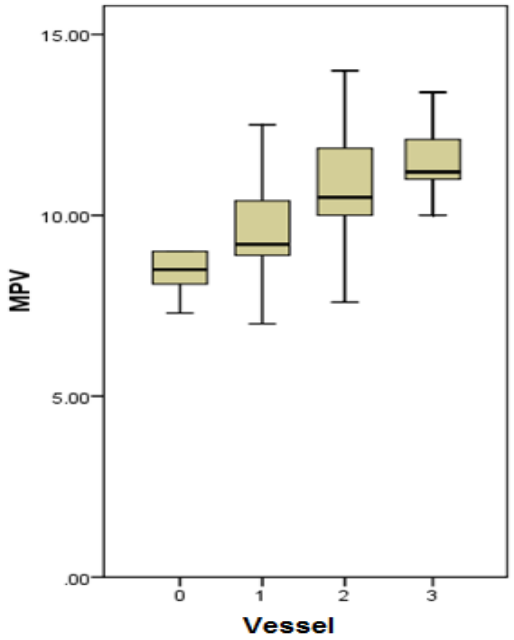

Fig-1: Box and Whisker plot showing distribution mean platelet volume in accordance with vessels Affected

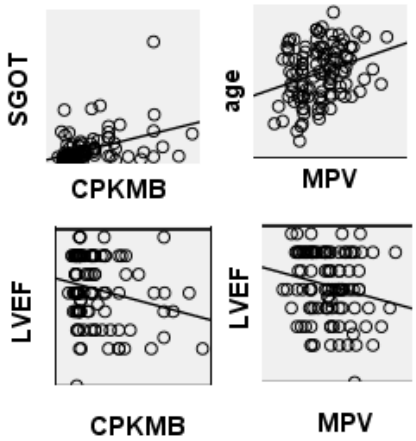

Fig-2: Line Diagram showed Pearson's positive correlation of MPV with Age and CPKMB with SGOT and negative Correlation of MPV with LVEF and LVEF with CPKMB

As reflected in figure 2 weak positive correlation was observed between age with MPV (Pearson correlation 0.289, p=0.002) that means as age advances MPV increases and SGOT with CPKMB (Pearson correlation 0.430, p-value <0.001) this suggest that SGOT and CPKMB follow same direction in ACS. And Weak but negative correlation was observed between LVEF with CPKMB (Pearson correlation=0.222, p=0.02) and MPV (Pearson correlation– 0.192, p-values 0.044). Which indicate that as CPKMB and MPV increase Left ventricular ejection fraction decreases.

An area under the curve of MPV with cut off value 9.0 fL was higher than SGOT>40U/L and CPKMB>24U/L (0.805 v/s 0.645 v/s 0.655, respectively), which clearly suggest that MPV is better in differentiating critical coronary disease from non-critical stenosis than SGOT & CPKMB (figure 3). Multiple logistic regressions show that MPV was independently associated with significant coronary artery diseases than SGOT or CPK MB (P value <0.001, 0.324, 0.175 respectively.)

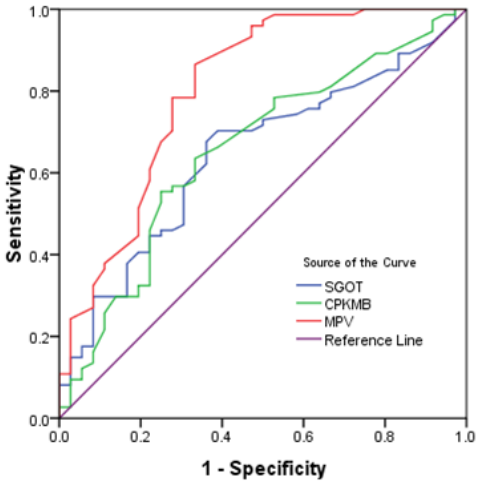

Fig-3: Receiver operating characteristic (ROC) curve reflected the area under curve of MPV, SGOT, and CPKMB

DISCUSSION

We did a prospective cohort study which included 110 patients with acute coronary syndrome (ACS). We found that MPV was significantly higher in patients with significant coronary disease than those without. There were 77 (70%) males and 33 (30%) females with mean age of 54.6 years which was similar to a study of 1206 patients with myocardial infarction having 934 men (77.4%) and 272 women (22.6%) with mean age of the study population was 56 years[4]. MPV was found to be greater in hypertensive while it was also highest in patients with at least four comorbid conditions [5]. There was a moderate positive correlation between MPV and the total number of comorbidities[5]. But in our study only the presence of hypertension showed significant correlation with MPV.

Increased MPV has been noted in subjects with cardiovascular risk factors, such as smoking, diabetes, obesity, hypertension, and hyperlipidemia [3]. Among the diabetics, platelet indices (MPV, PDW, and P-LCR) were higher in those with complications as compared to those not having any complications, which was statistically not significant. [6] Similar observation was made in our study. MPV of patients having two and three vessel disease were compared, the mean MPV of TVD was greater than the mean MPV of in DVD and was statistically significant.[7]In our study MPV in single or normal vessel diseases was low as compared to MPV in double and triple vessel diseases which was statistically significant (single and normal vessel (p value 0.779) v/s double and triple vessel diseases (p value 0.033 &<0.001) [7]. In addition, LAD involvement was associated with higher MPV than non-LAD (p value 0.003).MPV was significantly lower in the patient with left ventricular ejection fraction (LVEF) ≥40% compare with those of 40% [8]. Similarly, negative correlation was observed in our study.

Dehghani et al compared the different platelet indices to signify their importance in acute coronary events[9]. Of which MPV had a higher AUC as compared to AUC of platelet distribution width (PDW) and platelet large cell ratio (P-LCR). When the sensitivity and specificity of MPV compared with PDW and P-LCR, MPV has more sensitivity and specificity [9]. In our study, we compared AUC of MPV with SGOT and CPKMB. AUC of MPV (0.805) was higher than SGOT (0.645) & CPKMB (0.655).To study the Importance of MPV as independent risk factor for significant coronary diseases in one study they had compared the MPV with other variables like TIMI and GRACE score. Non-significant difference AUC was found between MPV and the GRACE or TIMI score [10, 11].

Combined results from 16 cross-sectional studies involving 2809 patients investigating the association of MPV and AMI indicated that MPV was significantly higher in those with AMI than those not having AMI [3]. In the present study, we show that MPV is associated with presence of significant coronary disease and is also negatively correlated with LVEF.

The limitations of our study include, single center study and non-inclusion of patients who did not undergo coronary imaging. We also did not study mortality as a parameter.

CONCLUSION

Patients with significant coronary disease had higher MPV values than those without. MPV is a better parameter to differentiate significant coronary artery disease than SGOT or CPK-MB. Further studies are required to assess the association of MPV with morbidity & mortality.

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