



A STUDY OF MEAN PLATELET VOLUME IN ST ELEVATION MYOCARDIAL INFARCTION AND ITS ASSOCIATION WITH SHORT-TERM OUTCOME

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ABSTRACT

BACKGROUND : Acute coronary syndromes (ACS) are an important cause of morbidity and mortality. Platelets play a crucial role in atherothrombosis, the major cause of most unstable coronary syndromes. Mean platelet volume (MPV), a measure of platelet size, is a potential surrogate marker of platelet reactivity. Larger platelets are metabolically and enzymatically more active and have greater prothrombotic potential when compared to smaller platelets. In patients presenting with ST elevation myocardial infarction (STEMI), we sought to assess whether MPV was associated with the short term clinical outcome.

AIMS AND OBJECTIVES - To assess the mean platelet volume in patients presenting with ST elevation myocardial infarction and to evaluate its relationship with short term outcome.

- To identify any association exists between mean platelet volume and other selected risk factors like age, sex, family history of coronary artery disease, smoking, systemic hypertension and diabetes mellitus.

MATERIALS AND METHODS: Blood samples for MPV estimation were obtained on hospital admission in 100 patients (74% men; age 55.5 ± 10.3 years) with STEMI, before thrombolysis. Social and clinical data was collected based on the proforma. Basic investigations were done and they were followed up for one month for the occurrence of complications like left ventricular (LV) dysfunction, cardiac failure, LV thrombus in echocardiography, recurrence of angina, occurrence of arrhythmias and death for a period of 30 days.

RESULTS: The STEMI patients who developed complications had a higher MPV when compared with those who did not develop complications (10.33 ± 0.54 fL, 57% vs 9.76 ± 0.51 fL, 43%; $p < 0.001$). Among the patients, 76% were males. The mean age of the sample studied was 55.5 ± 10.3 years. The prevalence of hypertension, diabetes mellitus and smoking was 26%, 32% and 41% respectively. Incidence of complications was higher among patients with risk factors like hypertension, diabetes mellitus, family history of coronary artery disease and smoking. In subgroup analysis, the mean MPV was significantly higher among patients with ejection fraction $< 50\%$, cardiac failure, arrhythmias and among those who died. MPV was also significantly higher among STEMI patients who smoked when compared with those who did not. There was no association between MPV and platelet count.

CONCLUSION: A higher MPV in patients with STEMI is associated with an increased incidence of post MI complications at a period of one month from admission. MPV is also higher among patients with risk factors like hypertension, diabetes mellitus, family history of coronary artery disease and smoking. Admission MPV may have a predictive role in addition to conventional risk factors for adverse outcome in patients with STEMI.

KEYWORDS : Mean Platelet volume, platelet size, activity, cardio vascular disease, prognosis, myocardial infarction, ST segment elevation MI, post MI complications, adverse outcome, diabetes, hypertension, smoking, cardiac failure, ejection fraction, thrombus.

INTRODUCTION

Acute coronary syndromes (ACS) are an important cause of morbidity and mortality, despite the developments in its diagnosis and treatment in recent years.

Acute coronary syndromes are a group of signs and symptoms that results from the formation of platelet rich coronary thrombus, usually after rupture of a plaque. The thrombus leads to partial or complete coronary artery occlusion, which causes varying degrees of myocardial ischemia and causes various clinical manifestations ranging from unstable angina (UA) to acute myocardial infarction (AMI).

Platelets play a crucial role in atherothrombosis, the major cause of most unstable coronary syndromes. Platelet activation at sites of vascular injury is central to the pathogenesis of occlusive arterial disease. Platelets contain, secrete and express a large number of chemical substances that are crucial mediators of inflammation, atherosclerosis and thrombosis. The established effectiveness of antiplatelet drugs to reduce cardiovascular thrombotic events has reinforced the major role of platelets in the atherothrombotic process.

Many studies have reported that measuring platelet activity can identify individuals who are at increased risk for cardiovascular events. However it is yet to be incorporated into routine clinical decision-making. Potential reasons include a shortage of adequate data about the optimal laboratory method of platelet testing, lack of consensus regarding a cut-off value for identifying increased risk, and the ambiguity about the interpretation and clinical utility of results. Moreover, many methods are not feasible economically or are laborious or require specialized equipment.

Within the same individual, platelets vary in size and density. Mean platelet volume (MPV), a measure of platelet size, is a potential surrogate marker of platelet reactivity. Although the most precise methodology for measuring MPV has not been established, it is widely available in the inpatient and outpatient setting at a comparatively lower cost. Many studies have demonstrated the greater prothrombotic potential of larger platelets which are metabolically and enzymatically more active. Also it has been shown that elevated MPV is associated with other indicators of platelet activity like increased platelet aggregation, increased TxA₂ synthesis and β -thromboglobulin release, and increased expression of adhesion molecules.

Furthermore, higher MPV is observed in patients with diabetes mellitus, hypertension, hypercholesterolemia, smoking, and obesity, which are all proven to increase the risk of cardiovascular disease.

Some investigations have demonstrated the correlation between elevated MPV and ACS and also the association between increased MPV and percutaneous coronary intervention outcomes, including mortality and stent restenosis. Hence the hypothesis considered for the present study is "Platelet volume is not associated with post myocardial infarction short-term outcome". The proposed study will also help to confirm or refute the published reports on platelet volume in myocardial infarction.

MATERIALS AND METHODS

SETTING:

Department of Medicine and Intensive Coronary Care Unit, Govt. Rajaji Hospital and Madurai Medical College, Madurai.

INCLUSION CRITERIA:

Patients who had a history suggestive of acute myocardial infarction

and whose ECG showed ST segment elevation of >1 mm in two contiguous limb leads or ≥1 mm in two contiguous chest leads.

EXCLUSION CRITERIA:

1. Patients not having typical ECG changes.
2. Presence of septicemia.
3. Known case of hematologic disorders.
4. Presence of blood loss.
5. Presence of hyperthyroidism or other endocrine disorders.
6. Presence of chronic liver disease.
7. Presence of chronic obstructive pulmonary disease.
8. Presence of chronic renal failure.
9. Past history of cerebrovascular accident.
10. Know case of malignancy.
11. Known case of myeloproliferative disorders.

AIMS AND OBJECTIVES

- To assess the mean platelet volume in patients presenting with ST elevation myocardial infarction and to evaluate its relationship with short term outcome.

- To identify any association exists between mean platelet volume and other selected risk factors like age, sex, family history of coronary artery disease, smoking, systemic hypertension and diabetes mellitus.

PARTICIPANTS:

100 patients presenting with STEMI in Department of Medicine or Cardiology.

STATISTICAL METHODS:

The data collected during the study was formulated into a master chart in Microsoft office excel and statistical analysis was done with help of computer using statistical software package SPSS V.17 for windows. Using this software, frequencies, range, mean, standard deviation and 'p' were calculated through student 't' test, one way ANOVA, pearson correlation and chi square test . P value of < 0.05 was taken as significant.

RESULTS:

This study was conducted in the patients who were admitted in the Department of Medicine and Intensive Coronary Care Unit, Govt. Rajaji Hospital, Madurai. The ECG diagnosis of myocardial infarction was made based on the criteria given by Thygesen et al (2007). After applying exclusion criteria, 100 patients were selected for the study.

Among the 100 patients studied, 74 patients were male and 26 patients were female (3:1). STEMI was commoner among males, similar to observations made by Kyto et al (2014) and Barbara et al (2000). 62.2 % (n = 46) of the males and 42.3% (n = 11) of the females had complications. Our study did not show any significant relation between MPV and gender.

In our study, the ages of the patients ranged from 38 to 88 years. The mean age was 55.5 ± 10.3 years. The maximum number (n = 64) of patients fell in the age group of 41-60 years. 51.6 % (n = 33) of patients in this age group had complications. 66.7 % (n=18) of the patients in the age group of 61-80 years had complications which was the highest proportion among all age groups. In our study the relationship between age and MPV was not significant.

Of the 100 patients, 36 patients had a positive family history of CAD among which 80.5% (n = 29) had complications. Only 43.75% (n = 28) of patients without positive family history had complications. In our study there was no significant relationship between family history of CAD and MPV.

In the study sample of 100 patients, 26 patients had systemic hypertension. The prevalence of systemic hypertension was similar to that observed by Gupta et al (2001). Among the hypertensives 84.62% (n = 22) had complications and 47.30% (n = 35) of non hypertensives had complications. The hypertensives had a higher MPV than the non hypertensives, but the difference was not significant. Various studies have reported a significantly higher MPV in people with hypertension.

In our study group, 32 patients were diabetic among which 62.5% (n = 20) had complications. 54.41% (n = 37) of non-diabetics had complications. Although the mean MPV was higher among diabetics, the relationship was not significant. Papanas et al (2004) had

concluded that MPV was higher among people with type 2 diabetes mellitus.

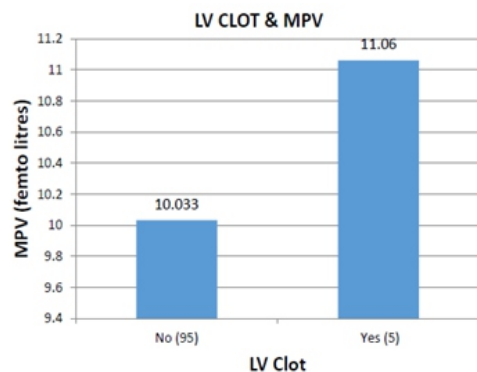
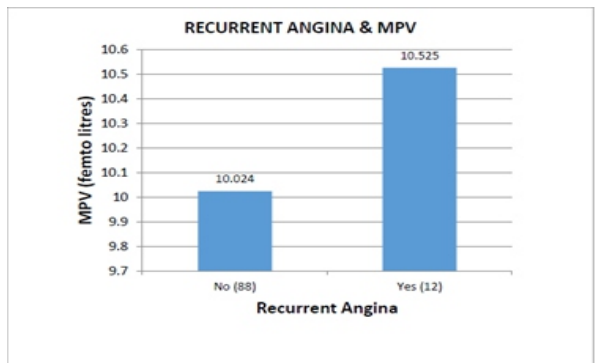
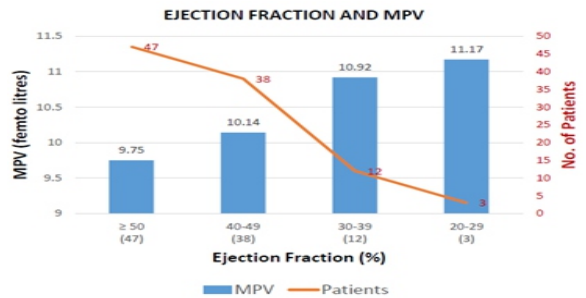
Among the study group, 41 patients were smokers of which 68.3% (n = 28) had complications. 49.15% (n = 29) of non-smokers had complications. The mean MPV was significantly higher among smokers. Kazuomi et al (1992) and Varol et al (2013) had observed a higher mean MPV among smokers. Kazuomi et al also observed a decrease in mean MPV after cessation of smoking.

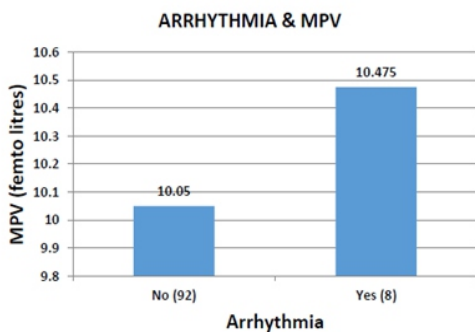
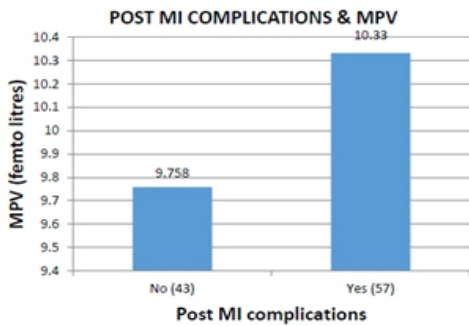
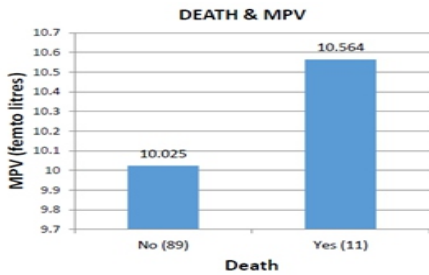
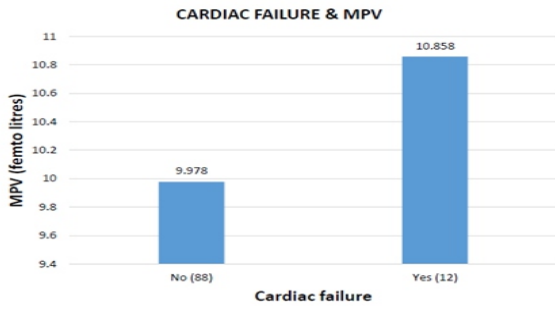
A number of previous studies have shown that higher MPV is observed in patients with diabetes mellitus, hypertension and smoking. This may indicate that there is a common mechanism by which these factors increase the risk of cardiovascular disease.

Among the group studied, 5 patients had a history of previous MI of which 60% (n = 3) had complications. 10 patients were on aspirin and their mean MPV was not significantly different from the others. Pizulli et al (1998) had stated that aspirin had no effect on platelet volume.

The mean platelet count of the study population was 2.53 ± 0.68 lakhs/mm³. Platelet count did not vary significantly between those with complications and those without complications. There was no significant relationship between platelet count and MPV.

The complications of myocardial infarction that were observed in this study were depressed ejection fraction, presence of LV thrombus, recurrent angina, cardiac failure, arrhythmias and death. The most common common complication was a depressed ejection fraction which was seen in 60% of the patients studied.





CONCLUSION:

This study was done to assess the mean platelet volume in patients presenting with ST elevation myocardial infarction and to evaluate its relationship with short term outcome and other selected risk factors like age, sex, family history of coronary artery disease, smoking, systemic hypertension and diabetes mellitus.

This study was conducted in 100 patients after applying the inclusion and exclusion criteria and were evaluated after institutional ethical clearance with an informed consent.

Among the 100 patients studied, there were 74 males and 26 females. Among them, 62.2 % of the males and 42.3% of the females had

complications. The more frequency of complications in males may be due to additional risk factors in them like smoking. The age of the sample varied from 38 to 88 years. The mean age of the sample was 55.53 ± 10.32 years. The mean age of those who survived without complications did not differ significantly from those who had complications.

The prevalence of hypertension, diabetes mellitus and smoking was 26%, 32% and 41% respectively. 36% had a positive family history of CAD, 5% had a history of previous MI and 10% were already on aspirin. The incidence of complications was higher among patients with either hypertension or diabetes mellitus or smoking or a family history of CAD. 48% of the patients had anterior wall MI, 9% had anterolateral MI and 43% had inferior wall MI, including associated right ventricular or posterior ventricular MI. The incidence of complications was highest among the patients with anterolateral MI.

The mean platelet count of the patients without complications was 2.43 ± 0.69 lakhs/mm³ and that of the patients with complications was 2.55 ± 0.67 lakhs/mm³. The difference was not statistically significant.

The MPV of the patients with and without complications ranged from 9.4 to 11.3 fL and 8.6 to 10.8 fL respectively. The mean MPV was significantly higher among MI patients with complications. The mean MPV was significantly higher among patients with cardiac failure, arrhythmias and among those who died. MPV was higher among patients with ejection fraction < 50%. MPV in patients with MI was found to be independent of age, gender, hypertension, diabetes mellitus and family history of CAD. The mean MPV in patients with MI was significantly higher among smokers. Aspirin was not found to have any significant association with MPV.

From the present study, it is concluded that a higher MPV in patients with STEMI is associated with increased incidence of post MI complications. MPV is independent of risk factors like age, sex, family history of coronary artery disease, systemic hypertension and diabetes mellitus. Measurement of MPV is simple, inexpensive, easy to interpret, and widely available. MPV has a definite role in prognosticating patients following STEMI and can serve as an add-on to scoring systems which predict post MI mortality. Further large scale studies are required to assess variation in MPV among different races and to arrive at a cut-off value for predicting cardiovascular risk.

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