

PROGNOSTIC SIGNIFICANCE OF MEAN PLATELET VOLUME IN PATIENTS WITH ST ELEVATION MYOCARDIAL INFARCTION

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ABSTRACT

OBJECTIVE

To find the association between admission mean platelet volume in patients presenting with acute STEMI and mortality and to compare this index among diabetics and non-diabetics presenting with acute STEMI among patients admitted to Kanyakumari Government Medical College Hospital during the period January 2015 to December 2015.

METHODS

A cross sectional study was carried out among 100 patients admitted to the ICCU with Acute Myocardial Infarction who underwent thrombolysis. Information about their glycaemic status, TIMI score, KILLIP class, Mean platelet Volume was collected.

RESULTS

Mean Platelet Volume was higher in diabetics compared to non-diabetics (9.94 fl for diabetics and 9.06 fl for non-diabetics). Patients who presented with higher TIMI score and KILLIP class had higher MPV values. Mortality was also higher for patients who presented with higher mean platelet volumes. Mortality was also higher for diabetics compared to non-diabetics (38% for diabetics and 8% for non-diabetics).

CONCLUSION

Diabetic patients presenting with MI had higher Mean Platelet Volume than non-diabetics confirming the hypothesis that platelets are large and hyperactive in diabetics. Higher mean platelet volume was associated with higher inpatient and one-month mortality indicating that it can be used as a prognostic marker in acute coronary events.

KEYWORDS

Mean Platelet Volume, Myocardial Infarction.

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INTRODUCTION: Ischaemic heart disease is the most common cause of mortality and morbidity worldwide. Over three quarters of death and 85% of disability from cardiovascular disease occurs in developing countries. In addition to the dubious credit of having higher incidence of cardiovascular disease, the disease manifestation is also 10 years earlier in India than the rest of the world. The incidence of myocardial infarction in India is 64.37/1000 people among men aged between 29-69 years of age. In the recent years, India has seen a huge transition in its disease burden pattern; the load of communicable and non-communicable disease is expected to be reversed by 2020. India is on the verge of an epidemic of cardiovascular disease.

Platelets play an important role in pathogenesis of acute coronary syndromes. It has been shown that platelet size, measured as mean platelet volume (MPV), correlates with their reactivity. Mean platelet volume is positively associated with indicators of platelet activity including expression of glycoprotein Ib and glycoprotein IIb/IIIa receptors. Higher values of MPV characterise patients with myocardial infarction and unstable angina as compared to those with stable angina or noncardiac chest pain, and elevated MPV has been recognised as an independent risk factor for myocardial infarction. An elevated MPV is associated with poor clinical outcome among survivors of myocardial infarction.^(1,2,3)

Diabetes mellitus is a major global health problem worldwide. According to World Health Organisation, there were 34 million people suffering from diabetes worldwide in 2011. The increased platelet activity is emphasised to play a role in the vascular complications of this metabolic disorder. Platelet volume a marker of platelet function and activation is measured by Mean Platelet Volume by haematological analysers.⁽⁴⁾

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Many studies have separately evaluated the role of Mean Platelet Volume in diabetes and acute coronary syndromes. In this study, we tried to emphasise the central role of platelets in the pathogenesis of diabetes and coronary artery disease and its role in predicting long-term mortality and morbidity.

MATERIALS AND METHODS:

Study Population: This study was conducted among 100 patients diagnosed with STEMI admitted in ICCU within 12 hours of onset of symptoms at Kanyakumari Government Medical College Hospital.

Inclusion Criteria: Patients admitted with diagnosis of STEMI within 12 hours from the onset of symptoms.

Exclusion Criteria:

- Co-existing autoimmune diseases.
- Acute/chronic infectious/inflammatory diseases.
- Known malignant diseases.
- Use of glucocorticoids.
- Admission platelet count below 1 lakh & above 4.5 lakh/mm².

METHODOLOGY:

Study Population: Patients admitted with ST elevation MI admitted within 12 hours of the onset of symptoms were enrolled in the study.

No. of diabetics: 41.

No. of non-diabetics: 59.

Venous blood samples were collected immediately after admission prior to the administration of anti-platelet therapy in standardised EDTA tubes.

Samples were tested within 30 minutes of collection to minimise variations due to sample ageing.

Diabetes is defined as:

1. Pre-existing condition diagnosed before STEMI (patient on insulin, OHAs or diet control).
2. Newly diagnosed diabetics based on fasting plasma glucose levels >126 mg/dL. Fasting plasma glucose was taken into consideration after the third day to avoid stress hyperglycaemia.

STEMI was defined by: ST segment elevation consistent with MI of 2 mm in contiguous precordial leads and or ST segment elevation of 1 mm in two or more contiguous limb leads or new onset left bundle branch block.

Patients are treated with 300 mg of aspirin & 300 mg of clopidogrel and subjected to thrombolysis with streptokinase. Successful thrombolysis is defined as ST segment resolution >50% of the original and or symptomatic relief of chest pain.

Admission time Random blood glucose was taken initially to screen diabetics and non-diabetics followed by fasting plasma glucose on day 4 once the patient stabilises. Since cardiac troponin assay was not available in our setting, CK-MB measured with a mass assay was carried out.

Echocardiogram was taken on the third day after thrombolysis to evaluate left ventricular systolic and diastolic

functions and other associated complication. Patients were followed up for a period of 1 month for mortality & morbidity. Repeat Echocardiogram is done after 1 month for the evaluation of patient's cardiac status.

Interested patients were subjected to Angiographic evaluation.

Data Entry and Analysis: Analysis was done using SPSS 16.0 software. Data were expressed in terms of percentages, mean values with standard deviation or median values. Differences between the groups were analysed using Mann-Whitney U test for median and chi square test for proportions. The association of each predictor variable with Mean Platelet Volume was assessed using Simple Linear Regression models. Results were said to be statistically significant if the p value was less than 0.05.

RESULTS: Baseline characteristics of the population is given in Table. 1. Most of the patients belonged to the age group of 50 to 70 years. There were 64 males and 36 females in the study. Among the total males presented, 39.06% were diabetic and among females 47.22% were diabetic. The mean HbA1c values were significantly higher in diabetics compared to non-diabetics. The average value of HbA1c value was 8.08 for diabetics and 5.83 for non-diabetics. The mean platelet volume was also significantly higher in non-diabetics (9.94 fl for diabetics and 9.06 fl for non-diabetics) (Fig: 1). The p value of the test was $p < 0.0001$ confirming the hypothesis that the platelets in diabetics are large and hyperactive. There was no significant variation in total CK-MB value among diabetics and non-diabetics with acute STEMI. The p value of the test is 0.05 making the correlation insignificant. Diabetics had higher mortality than non-diabetics. Both inpatient and mortality during 1-month followup was higher in diabetics. Among the 21 deaths, 16 were diabetics and 5 were non-diabetics (Fig: 3).

Higher TIMI score was associated with higher Mean platelet volume. With progressively increasing TIMI score, there is increase in MPV with the TIMI score of 9 having mean MPV of 10.15 fl (Fig: 2). There was also a positive correlation between patient's admission KILLIP class and mean MPV, with KILLIP class 4 having highest mean MPV, and diabetics presented with higher KILLIP on admission than non-diabetics (Table: 2). And higher TIMI score and KILLIP score was associated with higher mortality rate. ⁽⁵⁾

There is also positive correlation between mean platelet volume and mortality (Table: 3). However, correlation could not be reached for mortality among diabetics and non-diabetics with admission MPV value.

Characteristics	Number of Patients
Male	64
Female	36
Smokers	24
Alcoholics	4
Patients with prior CAD	15
Hypertensives	36
Infarct wall	Anterior wall- 60

Inferior wall – 35 Inf. wall, posterior wall & right Ventricle – 3 Ant. wall & inf. wall – 2
Table 1: Patient Characteristics

KILLIP	MPV	
	Mean	SD
Class 1	9.24	1.04
Class 2	9.59	0.93
Class 3	9.68	1.19
Class 4	10.65	0.07

Table 2: MPV and KILLIP class

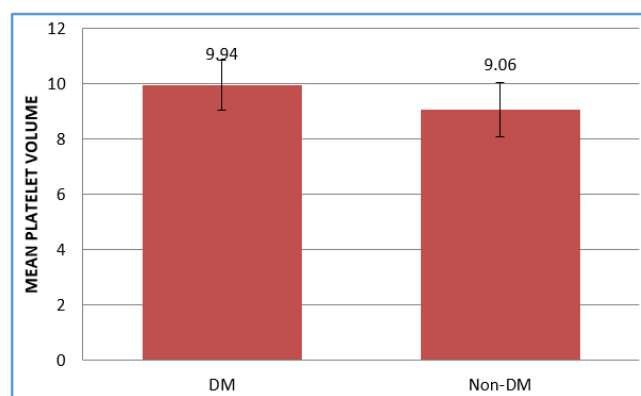


Fig. 1: MPV among Diabetics and Non-diabetics

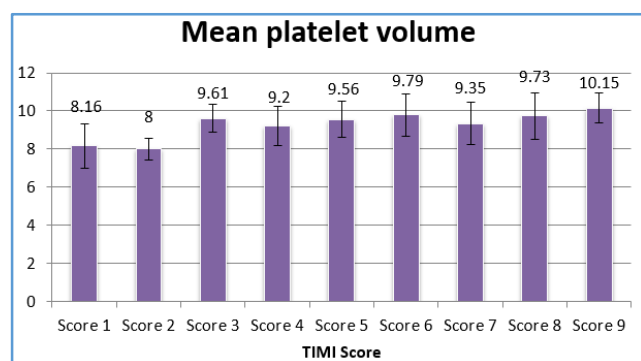


Fig. 2: Mean Platelet Volume and TIMI Score

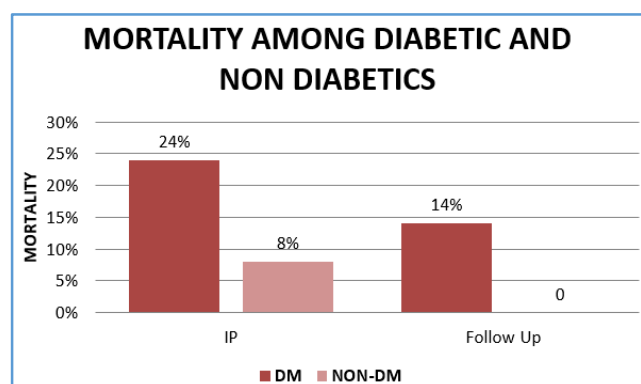


Fig. 3: Mortality among Diabetics and Non-diabetics

DISCUSSION: In 100 patients with acute MI, 36% were females and 64% were males. The number of diabetics were 42 and non-diabetics were 58. Among diabetics 59.52%

were males and 40.47% were females. Among the total males presented, 39.06% were diabetic and among the total females presented, 47.22% were diabetic. Higher incidence of MI was noted in the age group of 51 to 60 years with overall clustering of cases seen above the age group of 50 years.

Among the patients presented, diabetics had higher HbA1c values compared to non-diabetics. The mean HbA1c was 8.08 for diabetics and 5.83 for non-diabetics. Diabetics also presented with higher mean platelet volume. The average MPV for diabetics was 9.94 fl and for non-diabetics was 9.06 fl.

According to a study conducted by Dr. Thomas Alex Kodiatte et al, Departments of Pathology and Medicine, Sri Devaraj Urs Medical College, Tamaka, Kolar, India showed that in diabetic patients the MPV was significantly higher than that seen in non-diabetics (p value < 0.0001). Among the diabetic subjects, a positive Pearson correlation was seen between MPV and HbA1c.⁽²⁾

This finding is confirmed in our study with high statistical significance. There is a positive correlation between admission MPV and HbA1c value (r = 0.34; p value < 0.0001).

A correlation could not be reached between admission CK-MB values among diabetics and non-diabetics. CK-MB mass assay is not a highly specific test for myocardial ischaemia and its sensitivity and specificity is less compared to cardiac troponins. The p value was >0.05.

In our study, Mean platelet volume positively correlated with mortality indices like TIMI score and Killip class (Fig: 3). In our study, TIMI score had a positive correlation with MPV in Pearson correlation test (r = 0.189 and p value = 0.059), and KILLIP score had a strong correlation with MPV in Pearson correlation test (r = 0.238 and p value = 0.017).

Individual risk factors like systemic hypertension, prior CAD was not analysed separately as they were statistically evaluated via the TIMI score which predicts 14-day mortality in patients presenting with acute MI.⁶

Comparing the correlation between admission MPV and overall mortality (both in-hospital and one-month mortality taken together), our study showed a correlation between the two variables. According to Kendall Tau’s test, by which the above parameters were analysed it showed a correlation coefficient value of 0.065 and a p value of 0.433 (Table: 3). Then comparing mortality among diabetics and non-diabetics, the mortality was higher in diabetics than non-diabetics with a p value of < 0.0001. Both inpatient and 1-month followup mortality was significantly higher in diabetics.

KILLIP score and TIMI score independently had strong correlation with mortality, with higher admission scores having higher mortality.

In our study, we could not arrive at a statistically significant correlation between MPV value among diabetics and mortality in comparison with MPV values among non-diabetics and mortality. This drawback would have been due to the limited sample size of our present study.

CONCLUSION:

- Mean Platelet Volume was higher in diabetics than non-diabetics.
- Mean platelet Volume has positive correlation with overall mortality; mortality rate higher with higher MPV values.
- Mean Platelet Volume correlated with admission haemodynamic status which is assessed by KILLIP class and TIMI score.
- Mean platelet volume had significant correlation with HbA1c values.
- Mean Platelet Volume can be used as a predictor of longterm cardiovascular mortality.

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