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Original Research Article

Association of mean platelet volume and acute coronary syndrome

Hasim Ahamed, Renoy A. Henry*, Rema Pai

Department of Internal Medicine, Amrita Institute of Medical Sciences, Amrita Vishwa Vidyapeetam University, Kochi, Kerala, India

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***Correspondence:**
Dr. Renoy A. Henry,
E-mail: drrenoy@gmail.com

ABSTRACT

Background: Acute coronary syndrome (ACS) is a set of signs and symptoms due to rupture of a plaque and are a consequence of platelet rich coronary thrombus formation. Larger platelets are haemostatically more active and and hence carry risk for developing coronary thrombosis leading to ACS. Platelet parameters especially mean platelet volume (MPV) could be used as an important and reliable marker in early detection of ACS when the patients come to emergency department with chest pain. The primary objective is to study the association between mean platelet volume and acute coronary syndrome. The secondary objectives are to analyse if there is a statistically significant difference in mean platelet volume between Non-ST elevation (NSTEMI) and ST-elevation Myocardial Infarction (STEMI) and between double vessel disease (DVD) and triple vessel disease (TVD).
Methods: A total of 260 patients were included in the study depending on the inclusion and exclusion criteria. After dividing the patients with chest pain into control (Non-cardiac chest pain) and study group (ACS) which contained 130 each, venous blood was drawn and taken to haematology laboratory for analysis of MPV within 2 hrs. The statistical analysis used were mean, median, test of significance in difference (t-test) and chi-square test.
Results: Mean platelet volume (MPV) was found to be higher among ACS patients (9.4868±0.85270) as compared to control (7.430±0.72172) and it was significant with a P value <0.05. It was also noticed that MPV was higher among patients with STEMI when compared to NSTEMI, 10.32±0.77932 and 9.22±0.52743 and it was statistically significant (P<0.05). Similarly, MPV between patients with triple and double vessel disease were compared and the mean MPV of 10.04±0.88738 of TVD was greater than the mean MPV of 9.22±0.67438 in DVD and was statistically significant (P<0.05).
Conclusions: In this study the MPV was higher in patients with ACS than those in control group. The study also showed that there was significant difference in MPV values between people with STEMI and NSTEMI and between people with DVD and TVD. Hence it might be useful as an additional cost efficient test in conjunction with other markers in the early prediction of ACS in the emergency room. Larger platelets are haemostatically more active and hence carry risk for developing coronary thrombosis leading to ACS. Patients with increased MPV could be easily identified during routine haematological analysis and hence could play an important role in early detection of acute coronary syndrome (ACS).

Keywords: Chest pain, Double vessel disease, Mean platelet volume, Triple vessel disease

INTRODUCTION

Acute coronary syndrome (ACS) consists of a spectrum of diseases ranging from unstable angina to transmural myocardial infarction. It is a set of signs and symptoms due to rupture of a plaque and are a consequence of platelet rich coronary thrombus formation. Platelets have a major role in the pathogenesis of acute coronary

syndrome (ACS), where plaque rupture is followed by platelet activation and thrombus formation. Platelet activation is the key step of pathogenesis of acute coronary syndrome.

Activated platelets are larger in size, which can be measured by mean platelet volume (MPV).[1] Larger platelets are more adhesive and tend to aggregate more as they have more dense granules. They are metabolically and enzymatically more active than small platelets and produce more thromboxane A2. Increased platelet volume will increase the tendency for coronary thrombus formation in ACS patients. The activated platelet is the major biological risk factor for pathogenesis of ACS, so inhibition of this process could play an important role in prevention of ACS.

The diagnostic criteria of ACS are clinical presentation, biochemical markers of acute ischemic injury, and electrocardiographic findings.[2] The present cardiac markers are not sufficiently sensitive at an early stage of ACS. Hence an early and reliable marker is needed for accurate diagnosis of ACS when patients attend the emergency department.[3,4]

Platelet parameters especially MPV could be an important and reliable marker in early detection of ACS when other markers are not available. Though there have been quite a few studies which have demonstrated an association between stroke and platelet size, only a few studies have looked at the association between platelet size and ACS.[5] Among them, there has been discrepancy regarding the sample size, methodology used and the result. There are only a couple of documented studies in India comparing the association of increased mean platelet volume with ACS. Hence an attempt has been made to study the relationship if any between mean platelet volume and ACS in a tertiary care centre in Kerala, India.

Primary objectives of the study were To study the correlation between mean platelet volume and acute coronary syndrome and secondary objectives were to analyse if there is a statistically significant difference in mean platelet volume between Non-ST elevation and ST-elevation MI, and between double vessel disease and triple vessel disease.

METHODS

The study was a prospective study where all patients who came to emergency department of Amrita Institute of Medical Sciences with chest pain were segregated into chest pain due to non-cardiac and Acute coronary syndrome after initial evaluation. Initial evaluation involved clinical history and examination, Electrocardiography, Complete blood count, Troponin I levels and 2-Dimensional echocardiography.

Based on these tests they were grouped in two groups, case and control. Patients belonging to ACS spectrum were the case group and the others were included in the control group. A total of 302 patients were involved in the study of which 42 were excluded due to meeting of exclusion criteria. 260 patients were finally included in the study, out of which 130 were cases and 130 were put in the control group.

Inclusion criteria

Any patient presenting with complaints of chest pain with changes in ECG and with elevated cardiac biomarkers or any patient with chest pain suggestive of unstable angina was included in this study.

Exclusion criteria

Any patient with thrombocytopenia, known cases of hereditary disorders of large platelets, patients on medications that can reduce the platelet count: hydroxyurea, antineoplastic agents, and inhibitors of the platelet integrin αIIbβ3, patients with known liver disease, renal disease or malignancy and patients on anticoagulants were excluded from the study.

The statistical analysis used were mean, median, test of significance in difference(t-test) and chi-square test.

RESULTS

A total of 302 patients were involved in the study of which 42 were excluded since they met one or more of the exclusion criteria. After obtaining the sample size for analysis equal number of patients were allotted in control group.

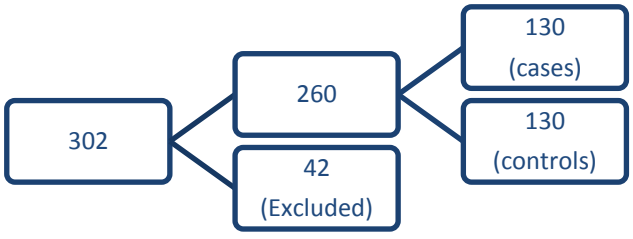

Figure 1: Distribution of patients.

The primary aim was to see the correlation of MPV in ACS. There was significant ($P<0.05$) difference in MPV values between case group and control group. The obtained mean value of MPV of 9.4868±0.85270 in case group was greater than the mean value of MPV of 7.430±0.72172 in control group and it is statistically significant.

One secondary aim was to look for a significant difference in MPV values between people with STEMI and NSTEMI. The obtained mean value of MPV in STEMI is 10.32±0.77932 which is greater than the mean value of MPV in NSTEMI which is 9.22±0.52743 and it was statistically significant (P<0.05).

The other secondary aim was to look for significant difference in MPV values between people with DVD and TVD. The obtained mean value of MPV of 10.04± 0.88738 of TVD was greater than the mean value of MPV of 9.22±0.67438 in DVD and was statistically significant (P<0.05).

Table 1: The general characteristics of the study group.

Characteristics	Case	Control
Sex		
Male	94 (72.3%)	101 (77.7%)
Female	36 (27.7%)	29 (22.3%)
Age		
<30	0	5 (3.8%)
31-60	38 (29.2%)	73 (56.2%)
61-90	92 (70.8%)	52 (40%)
Diabetes	33 (25.4%)	57 (43.8%)
Systemic hypertension	51 (39.2%)	30 (23.1%)
Dyslipidemia	53 (40.8%)	37 (28.5%)
Smoking	39 (30%)	31 (23.8 %)
Ethanol	20 (15.4 %)	22 (16.2 %)

Table 2: Difference in the MPV value in case and control group.

	Group	n	Mean	Std. Deviation	t
MPV	Case	130	9.4868	0.85270	20.95
	Control	130	7.4300	0.72172	(P<0.05)

Table 3: Difference in the MPV value in STEMI and NSTEMI groups.

	Diagnosis	n	Mean	Std. Deviation	t
MPV	STEMI	39	10.3282	0.77932	9.16 (P<0.05)
	NSTEMI	81	9.2210	0.52743	

Table 4: Difference in the MPV value in DVD and TVD groups.

	Diagnosis	n	Mean	Std. Deviation	t
MPV	DVD	69	9.2188	0.67438	5.63 (P<0.05)
	TVD	46	10.0478	0.88738	

DISCUSSION

A study done to find out the association with MPV and ACS by Randheer et al evaluated 215 patients and results showed that Mean platelet volume (MPV) was found to be higher among ACS patients as compared to non-ACS, 11.44±1.23 vs 9.91±1.27 fl (p-value<0.001).[6] In another study done by Pervin et al, MPV was significantly higher in patients with ACS compared to non-ACS which is in concordance with our results.[7] Results of other studies done by A Mathur et al and AS Assiri et al are also in favour of our study.[8,9] This study also tried to compare the MPV values between people with STEMI and NSTEMI (case group) which was one of the secondary aims. The obtained mean value of MPV in STEMI is 10.32±0.77932 which was greater than the mean value of MPV in NSTEMI which was 9.22±0.52743 and It was statistically significant (P<0.05).

There are 2 studies comparing the MPV of STEMI and NSTEMI. One was conducted by Rifat et al and the study showed that the difference in mean platelet volume was statistically significant in STEMI and NSTEMI patients, which was 8.7±1 and 7.9±0.7 fl (p<0.01) respectively, which was in concordance with this study.[10] The 2nd study was conducted by Sermin et al and the results were also not in discordance with the results obtained in this study. The MPV values for STEMI patients when

compared to the NSTEMI patients were slightly higher, but statistically not significant.[11]

The difference in MPV in people having double vessel and triple vessel disease in this study group was considered based on the Coronary Angiography report. The obtained mean value of MPV of 10.04±0.88738 of TVD is greater than the mean value of MPV of 9.22±0.67438 in DVD and was statistically significant (P<0.05). There are no previous studies showing such a comparison. More vessel involvement means more will be the inflammation thereby leading to more number of activated platelets resulting in an increase in MPV and this probably explains the above obtained results.

Limitation

A selection bias might have creeped in with patients with non-cardiac chest pain (atypical symptoms) who might have unstable angina in the absence of electrocardiography changes and cardiac troponin positivity.

CONCLUSION

In this study the MPV was higher in patients with ACS than those in control group. The study also showed that there was significant difference in MPV values between people with STEMI and NSTEMI and between people with DVD and TVD. Hence it might be useful as an additional cost efficient test in conjunction with other markers in the early prediction of ACS in the emergency room. Larger platelets are haemostatically more active and hence carry risk for developing coronary thrombosis leading to ACS. Patients with increased MPV could be easily identified during routine haematological analysis. It could play an important role in early detection of acute coronary syndrome (ACS) and be beneficial for early differentiation of DVD and TVD. Nonetheless, conflicting results of other studies make this issue controversial, which warrants performing of more comprehensive studies in future.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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