Original Research Article

Association of mean platelet volume in patients with acute coronary syndrome: A Case control study

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Abstract

Background: Ischemic Heart Diseases are the leading cause of morbidity and mortality worldwide. In comparison with the people of European ancestry, CVD affects Indians at least a decade earlier and in their most productive midlife. Nearly two-thirds of the burden of NCD mortality in India is currently contributed by CVD-related conditions. Platelet hyper-reactivity and local platelet activation have been suggested to play a crucial role in acute coronary events (including ACS). **Objectives:** So this study was undertaken to determine the association of MPV in patients with ACS in relation to various types. **Methods:** This study is under taken among 70 ACS patients admitted and compared with 70 controls, after excluding the patients affected by diseases which are known to alter platelets structure and function. **Results:** The mean age of the patients among cases was found to be 64.8±10.8 years and 61.9±10.6 years among controls (p value– 0.11). On comparing, MPV was found to be 8.9±0.9 fL in control and was 12±1.4, 11.5±1.2, 10.3±0.8 fL among STEMI, NSTEMI and Unstable Angina patients respectively (p value<0.001). **Conclusion:** MPV is significantly higher in (ACS) cases compared to control group, among cases it was significantly high in STEMI, followed by NSTEMI and Unstable Angina. Platelet Indices help in anticipating severity (risk stratification) of CAD and also may help in diagnosis ACS patients, where myocardial injury markers are not available.

Keywords: Acute Coronary Syndrome; Coronary Artery Disease; Ischemic Heart Disease; Mean Platelet Volume; STEMI; NSTEMI; Unstable Angina.

Introduction

Non-Communicable Diseases (NCD) are the major challenges, which human beings are facing in present world. Among NCDs, Ischemic Heart Diseases (IHD) are the leading cause of morbidity and mortality worldwide. World being in transition phase from Communicable to non-Communicable disease era, developing countries are under major threat. Being second largest populated country, India holds a major population affected with ACS. In comparison with the people of European ancestry, CVD affects Indians at least a decade earlier and in their most productive midlife years[1,2].

Myocardial ischemia and infarction can result from various coronary disease processes, including vasospasm, increased myocardial demand in the setting of a fixed coronary lesion and erosion or rupture of vulnerable atherosclerotic plaque leading to acute thrombus formation and subsequent ischemia. All result in myocardial oxygen supply-demand mismatch and can precipitate ischemic symptoms, and all processes, when severe or prolonged, will lead to myocardial necrosis or infarction which are included under the ACS which comprises of Unstable Angina (UA), Non-ST segment Elevation Myocardial Infarction (NSTEMI) and ST segment Elevation Myocardial Infarction (STEMI).

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Platelet hyper-reactivity and local platelet activation have been suggested to play a crucial role in acute coronary events (including ACS)[3]. Platelet size has been shown to reflect platelet activity, that is- large platelets are metabolically and enzymatically more active than small platelets and produce more thromboxane A2[4,5]. Consequently, larger and hyperactive platelets play a pivotal role in accelerating the formation and propagation of intracoronary thrombus, leading to the occurrence of acute coronary events[6]. These observations have led to the hypothesis that "increase Mean Platelet Volume (MPV) may be a potentially useful predictor in cardiovascular risk stratification", [7] as it is an index of platelet size that correlates with platelet activation[8]. Many other investigators have demonstrated in small observational studies that, MPV is higher in patients with ACS compared to healthy controls, suggesting that they may be risk factors for the severity of Coronary Artery Disease (CAD). It is still not clear that, whether these parameter would be considered as risk factor / diagnostic predictors (biomarker) for CAD and also, in comparison to high prevalence not many studies has been done in Indian sub-continent. Hence, the study is undertaken to determine the association of MPVamong patients presenting with ACS. Hence this study was conducted to determine the association of Mean Platelet Volume (MPV) in patients with Acute Coronary Syndrome (ACS) compared to control group and to determine the differences in Mean Platelet Volume (MPV) among patients of Unstable Angina, Non-ST elevation Myocardial Infarction (NSTEMI) and ST-elevation Myocardial Infarction (STEMI).

Material and method

This is a case control study on patients presenting with Acute Coronary Syndrome (ACS) to Department of General Medicine,

Adichunchanagiri Institute of Medical Sciences, B.G.Nagara in 18 months interval. Data for the study will be collected by detailed history taking, patient evaluation, clinical examination and investigations of patients presenting with Acute Coronary Syndrome (ACS) in a structured format after taking informed consent. The study was approved by Institutional Ethics Committee

Defining terms

- "Non-ST Elevation Unstable Angina is based largely on the clinical presentation. Typically, chest discomfort is severe and has at least one of three features:

(1) sudden onset of symptoms at rest (or with minimal exertion) that last at least 10 minutes unless treated promptly;
(2) severe pain, pressure, or discomfort in the chest; and
(3) an accelerating pattern of angina that develops more frequently, with greater severity, or that awakens the patient from sleep.

- The diagnosis of Non ST Elevation Myocardial Infarction (NSTEMI) is established if a patient with above clinical features develops evidence of myocardial necrosis, as reflected in abnormally elevated levels of biomarkers of cardiac necrosis / satisfying Universal Definition[9].
- The diagnosis of ST-Elevation Myocardial Infarction (STEMI) - satisfying Universal Definition[9,10].

With appropriate formula, minimum case needed was found to be 68 and minimum controls of 68 (minimum total sample size = 136)[11,12]. Since this is time bound hospital based case control study, considering above calculation and also previous year records of incidence of Acute Coronary Syndrome (ACS) in this study was conducted on 70 cases and compared with 70 control group.

Any patient with age more than 18 years, presenting with complaints of chest pain with changes in ECG and with elevated cardiac biomarkers/ satisfying Universal Definition of MI [9] or any patient with chest pain suggestive of Unstable Angina will be included in this study.Any patient with thrombocytopenia, known cases of hereditary disorders of platelets, medications which are known to alter platelets count/ morphology/ function, known Congenital Heart Disease / liver disease/ renal disease / malignancy/ thyroid disease, Known case of chronic inflammatory diseases were excluded from the study[13][49].

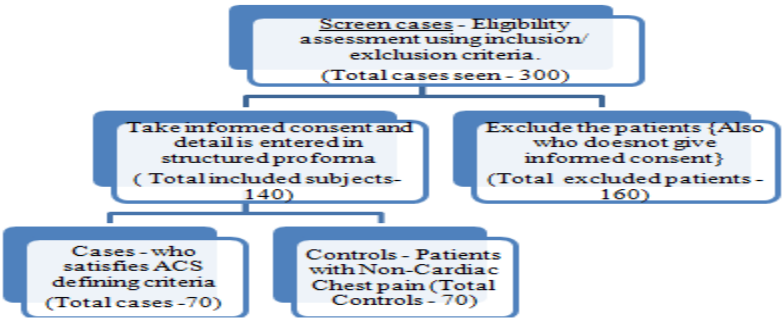

Fig 1: SOP followed for cases and controls

Statistical analysis

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean ± SD (Min-Max) and results on categorical measurements are presented in Number (percentage). Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters. Analysis of variance (ANOVA) has been used to find the significance of study parameters between three or more groups of patients. P-value (level of significance) is based on ANOVA test and Standard Deviation.

Results

This study is conducted among 70 cases after excluding the patients who had diseases which were intended to affect the platelet indices (as per exclusion criteria) and compared with 70 controls.

Table 1: Age distribution in the both group of study participants.

Age category in years	Case (N=70)		Control (N=70)		p value#
	n	%	n	%	
< 40	2	2.9	2	2.9	0.56
41 - 50	6	8.6	8	11.4	
51 – 60	16	22.9	20	28.6	
61 – 70	22	31.4	24	34.3	
71 – 80	19	27.1	15	21.4	
> 80	5	7.1	1	1.4	

Note: p value based on chi-square test

The mean age of the patients among cases was found to be 64.8±10.8 years and 61.9±10.6 years among controls (p value – 0.11). Age wise result of the ACS cases was found to be 2 (2.9%), 6 (8.6%), 16 (22.9%), 22 (31.4%), 19 (27.1%) and 5 (7.1%) among less than 40, 41-50, 51-60, 61-70, 71-80, >80 years respectively. In control group it was found that 2 (2.9%), 8 (11.4%), 20 (28.6%), 24 (34.3%), 15 (21.4%) and 1 (1.4%) in less than 40, 41-50, 51-60, 61-70, 71-80, >80 years respectively.(Table1)

Table 2: Gender distribution in the both group of study participants.

Gender	Case (N=70)		Control (N=70)		p value#
	n	%	n	%	
Female	26	37.1	29	41.4	0.60
Male	44	62.9	41	58.6	

Note: p value based on chi-square test

Among 70 patients, 26 were female (37.1%) and 44 were male (62.9 %) compared with 29 females (41.4%) and 41 males (51.6%) in control groups (p value 0.6). (Table2)

Table 3: Comparison of MPV (fL) between cases and controls.

Diagnosis	MPV (fL)		p value#
	Mean	SD	
STEMI (n=35)	12	1.4	<0.001*
NSTEMI (n=18)	11.5	1.2	
Unstable angina (n=17)	10.3	0.8	
Controls (n=70)	8.9	0.9	

Note: p value based on ANOVA test, SD-Standard deviation, *statistically significant (p<0.05)

On comparing MPV of patients with controls, it was found to be 8.9 ± 0.9 fL in control group and was 12 ± 1.4 fL, 11.5 ±1.2 fL, 10.3 ±0.8 fL among STEMI, NSTEMI and Unstable Angina patients respectively (p value <0.001). (Table 3)

Discussion

Being one of the most common cause of morbidity and mortality, one has to understand the pathophysiology of IHD completely. Platelets and their activity play an important role in initiation of atherosclerotic lesions and coronary thrombus formation potentially leading to ACS.

The mean age of the patients among cases was found to be 64.8±10.8 years and 61.9±10.6 years among controls (p value – 0.11). Much of the patients were of the age group 61-70 years (31.4%), followed by 71-80 years (27.1%) and least number of them were of less than 40 years age group (2.9%). Chahare V W et al conducted a study at Roy Research Center, Kolkata, West Bengal, India where mean age for male and female was 59.9 years and 64.0 years respectively. Also 46% patients was aged between 60-80 years and 8% were of less than 40 years[12]. ACS was found to be more common among male (62.9%) compared with females (37.1%) with p- value 0.6 in present study. Iyengar S S et al in Indian Heart journal conducted a study – 'Premature coronary artery disease in India: coronary artery disease in the young (CADY) registry' in 2016 among 997 patients, in which 714 were men (72%)[13].On comparing MPV of patients with controls, it was found to be 8.9 ± 0.9 fL in control group and was 12 ± 1.4 fL, 11.5 ±1.2 fL, 10.3 ±0.8 fL among STEMI, NSTEMI and Unstable Angina patients respectively (p value <0.001). In a study conducted by, Manchanda J et al showed that, MPV (fL) is 8.14±0.67 in controls, 9.67±0.84, 9.54 ±0.76 and 8.53±0.54 fL in STEMI, NSTEMI and Unstable Angina patients respectively[14]. Hasim Ahamed et al conducted a prospective study explained that, MPV was found to be higher among ACS patients (9.48±0.85) as compared to control (7.43±0.72). It was also noticed that MPV was higher among patients with STEMI when compared to NSTEMI, (10.32±0.78 and 9.22±0.53 respectively) and it was statistically significant (P<0.05)[15]. Patil K S et al showed that, MPV was statistically significantly (P<0.05) higher in STEMI (10.48±1.42) and NSTEMI groups (9.73±1.15) compared to NCCP group (8.0±1.28). [16] Randheer Pal et al in a hospital based observed that, MPV was found to be higher among ACS patients as compared to non ACS patients (11.44±1.23 vs 9.91±1.27 fL , p-value<0.001).The results of MPV are similar to studies done by Patil K S et al and Randheer Pal et al in their studies

Conclusion

Majority of the cases of acute coronary syndrome were in the group of 61-70 years. ACS is also more commonly in male as compared to females. Mean platelet volume (MPV) is significantly higher in (ACS) cases, as compared to control group and also it is significantly high in STEMI, followed by NSTEMI and comparatively less UA group among ACS patients.

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Declarations

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