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MEAN PLATELET VOLUME IN ACUTE CORONARY SYNDROME

Medicine

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ABSTRACT

BACKGROUND The present study was conducted to determine whether an association exists between mean platelet volume (MPV) and cardiac troponins in Acute Coronary Syndrome (ACS).

METHODS This hospital based cross-sectional study was conducted on 102 patients over a period of two years from August 2016 to August 2018 at MKCG Medical College Hospital, Berhampur, Odisha, India. Subjects were divided into 3 groups, myocardial infarction, unstable angina and controls. MPV was estimated. Statistical analysis was done using SPSS-25. p-value <0.05 was considered significant.

RESULTS MPV was higher among the MI group (11.5±1.36) compared to the unstable angina (8.09±0.57) and control group (7.7±0.48).

CONCLUSIONS MPV was significantly high in MI group compared to unstable angina (p=0.001) and control group(p=0.001), whereas the difference in mean MPV between the unstable angina group and controls was not statistically significant.

KEYWORDS

Mean platelet volume, Acute coronary syndrome, myocardial infarction, Unstable angina.

INTRODUCTION

Over the past decade, cardiovascular disease (CVD) has emerged as the single most important cause of death worldwide. In 2010, CVD caused an estimated 16 million deaths and led to 293 million disability-adjusted life-years (DALYs) lost—accounting for approximately 30% of all deaths and 11% of all DALYs lost that year. Like many high-income countries (HICs) during the past century, now low- and middle-income countries (LMICs) are seeing an alarming and accelerating increase in CVD rates.[1]

Cardiovascular diseases (CVDs) take the lives of 17.7 million people every year, accounting for 31% of all global deaths according to the WHO. By 2030, four fifths of all non communicable disease related mortality is projected to take place in developing countries. 17.7 million people die each year from CVDs, an estimated 31% of all deaths worldwide. More than 75%of CVD deaths occur in low-income and middle-income countries.[2]

Risk factors such as smoking, hypertension, diabetes, hypercholes terolemia, stress, age, male gender and obesity, significantly increase the chances of developing cardiovascular disease. However these explain only a small part part of the story and other relevant risk factors need to be identified for an accurate estimation of an individual's risk for myocardial infarction.[3]

Platelets play a quintessential role in the formation of atherosclerotic plaques and pathogenesis of vascular thrombosis. Large and hyperreactive platelets accelerate intracoronary thrombus formation, causing a cascade of clinical events such as acute coronary syndrome (ACS). An increase in platelet aggregation is associated with unstable angina and myocardial infarction and atherosclerotic plaque rupture starts the thrombogenic phenomenon in ACS, thus the activity of circulating platelets plays an important role for the progression of thrombus.[4]

Platelet size is determined at the level of the progenitor cell (i.e. megakaryocyte), and studies have reported that cytokines, such as Interleukin-3 or interleukin-6 influence megakaryocytic ploidy and can lead to the production of more reactive, larger platelets.

Large platelets, that contain more dense granules are metabolically and enzymatically more active than small platelets and they have a higher thrombotic potential. Thus, platelet volume has been proposed as an indirect marker of increased platelet reactivity.[5]

METHODS

The present study was conducted in the Department of General Medicine and Cardiology, MKCG Medical College Hospital, Berhampur, Odisha, India. It was a hospital based cross-sectional study done on 102 subjects. The study was carried out after obtaining approval from the Institutional Ethics Committee and after informed consent.

These patients were enrolled into three groups of 34 each, myocardial infarction (MI), unstable angina and controls on the basis of the criteria mentioned below. Clinical data was obtained from each case with respect to name, age, history, presence of co-morbidities like diabetes mellitus, hypertension, smoking, alcohol intake and drug history. These patients underwent 12 lead ECG. After systematic evaluation of eligible patients using the inclusion and exclusion criteria, 3 ml venous blood was collected in dipotassium EDTA tubes under aseptic precautions after obtaining informed consent and the MPV was measured within 1-2 hr of sample collection.

Sample for cTn I was collected at 6 hr and at 12 hours and levels were measured.

INCLUSION CRITERIA:-

ACS was diagnosed based on the presence of either of the criteria:

1) detection of rise in cardiac biomarker Trop I >0.01 for acute myocardial infarction.
2) For unstable angina where Trop I is < 0.01 , with at least one of the following four

a) typical symptoms of ischemia
b) ECG changes indicative of new ischemia
c) development of pathological Q wave in the ECG
d) Echocardiographic evidence of new regional wall motion abnormality. Non ACS group subjects were diagnosed based on atypical symptoms, no ECG evidence of ischemia, negative cTropI, no Echo evidence of RWMA, negative TMT if required and normal coronary angiogram in some patients.

3) Control group with no features of ischemic heart disease, hypertension, diabetes mellitus, anaemia, alcohol intake or smoking, matched for age and sex.

EXCLUSION CRITERIA:

1. Patients with musculoskeletal chest pain and with no ECG evidence of ischemic heart disease.
2. ACS associated with renal failure, hepatic failure, myeloproliferative disorder or malignancy.
3. Patients having any platelet disorder as thrombocytopenia or thrombocytosis, patients with any bleeding or clotting disorder and patients on antiplatelet therapy.
4. Patients with other thrombotic disorders like vasculitis, stroke.

STATISTICALANALYSIS

Statistical data analysis was done using SPSS-25. Quantitative data were summarized in the form of mean ±standard deviation. The difference in average MPV value among MI, unstable angina and

control group and its significance were evaluated using ANOVA test followed by post hoc analysis. A p-value<0.05 was considered statistically significant.

RESULTS

Majority of patients belong to the sixth decade of life (42.15%). Out of 102 cases in the study there were 54 males (53%) and 48 females (47%)(Figure 1).

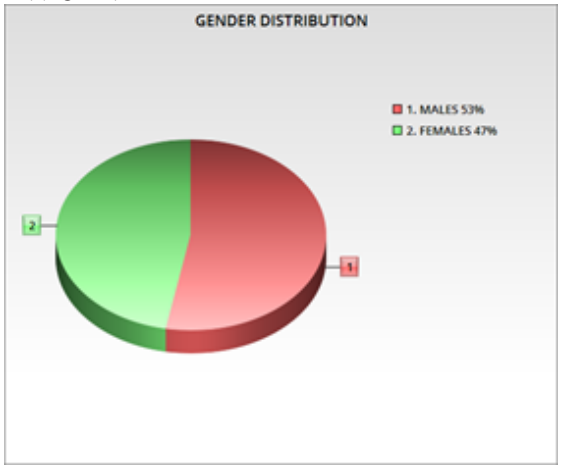

FIGURE 1: Gender Distribution Among Subjects

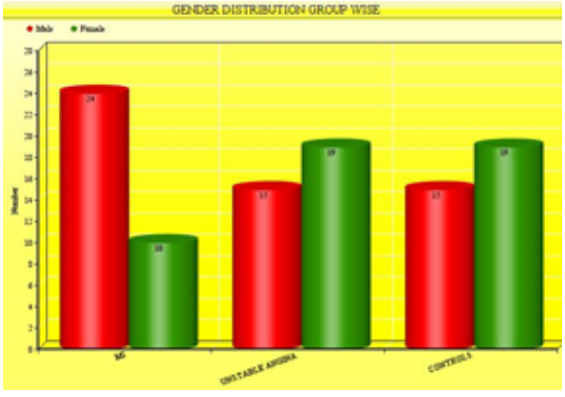

FIGURE 2 : Gender Distribution Among Various Groups

Between MI and unstable angina patients, the mean age was higher in the unstable angina group (57.26 vs 61.5 years) (Figure 3).

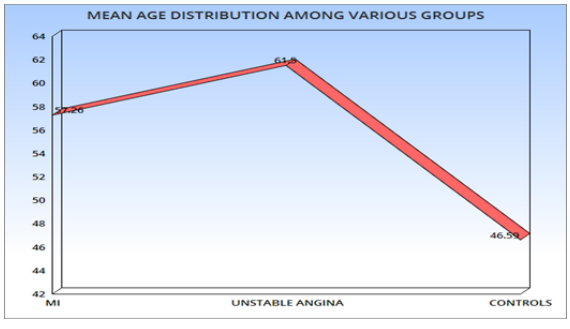

FIGURE 3: Mean Age Distribution Among Various Groups

The number of males in the MI group was 24(70.58%) and unstable angina group was 15(44%).

The total number of smokers were 23 (22%), with more smokers from the MI (41%) group(Table 1).

TABLE 1: Distribution Of Smokers Among The Groups

GROUPS	MI GROUP	UNSTABLE ANGINA	CONTROLS
SMOKERS	41%	26%	0

Alcohol consumption was observed among 12 patients (11.7%) with 8 from MI group and 4 from unstable angina group(Table 2).

TABLE 2: Distribution Of Alcoholics Among The Groups

GROUPS	MI GROUP	UNSTABLE ANGINA	CONTROLS
ALCOHOLICS	24%	12%	0

There were 23 diabetics (22.5%) of which 11 were MI group and 12 from unstable angina group(Table 3).

TABLE 3: Distribution Of Diabetes Mellitus Among The Groups

GROUPS	MI GROUP	UNSTABLE ANGINA	CONTROLS
DIABETES MELLITUS	31%	34%	0

Hypertension was seen among 26 patients (25.4%), with 12 from MI group and 14 from unstable angina group(Table 4).

TABLE 4: Distribution Of Hypertension Among The Groups

GROUPS	MI GROUP	UNSTABLE ANGINA	CONTROLS
HYPERTENSION	35%	41%	0

The mean platelet volume was highest in the MI group (11.5±1.36) compared to the unstable angina group (8.09±0.57) and the control group (7.7±0.48) and the findings were statistically significant (p=0.001)(Table 5).

TABLE 5: Comparison Of Mean Platelet Values Among The Three Groups

VARIABLE(SD)	MI	UNSTABLE ANGINA	CONTROLS
Mean of MPV(fL) ± SD	11.5±1.36	8.09±0.57	7.7±0.48

Oneway ANOVA test

TABLE 6 : MPV

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for		Minimum	Maximum
					Lower Bound	Upper Bound		
1	34	11.471	1.4192	0.2434	10.975	11.966	9.0	14.0
2	34	8.059	0.6001	0.1029	7.849	8.268	7.0	9.0
3	34	7.782	0.4783	0.0820	7.615	7.949	7.0	9.0
Total	102	9.104	1.9214	0.1902	8.727	9.481	7.0	14.0

ANOVA

TABLE 7: MPV

	Sum of Squares	df	Mean Square	F	P-value.
Between Groups	286.956	2	143.478	165.354	0.001
Within Groups	85.902	99	0.868		
Total	372.858	101			

The difference in Mean MPV across three groups is statistically significant.

TABLE 7: POST HOC TESTS FOR PAIRWISE COMPARISON

Dependent Variable: MPV

LSD

(I) group. MUAC	(J) group. MUAC	Mean Difference (I-J)	Std. Error	P-value	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	3.4118*	0.2259	0.000	2.963	3.860
	3	3.6882*	0.2259	0.000	3.240	4.137
2	1	-3.4118*	0.2259	0.000	-3.860	-2.963
	3	0.2765	0.2259	0.224	-0.172	0.725
3	1	-3.6882*	0.2259	0.000	-4.137	-3.240
	2	-0.2765	0.2259	0.224	-0.725	0.172

MPV was significantly high in MI group compared to unstable angina (p=0.001) group and control (p=0.001) group, whereas the difference in mean MPV between the unstable angina group and control group was not statistically significant.

DISCUSSION

The mean age of patients in our study was 55.12±8.86. The majority of patients belonged to the 6th decade (42.15%). In our study, the number of males was 54(53%) and the number of females was 48(47%). The number of males with acute coronary syndrome was 39(57%) and females was 29(43%). The Framingham study showed that women have a lower incidence of coronary artery disease than men until the age of 75 years.[6,7,8]

Smoking is an important risk factor for all CVD. Smokers have approximately 2 fold higher risk of cardiovascular diseases compared to non smokers. Prevalence of smoking is increasing in women in some populations and is a risk factor for coronary heart disease.[9] The prevalence of smoking in our study was 22.54% with more smokers in the MI group (41.17%) compared to unstable angina group (26.4%).

Moderate alcohol consumption is known to be protective against coronary heart disease, however a study of acute MI patients revealed that alcohol consumption in South Asians was not protective against CHD. Further studies have shown that regular and moderate alcohol intake is associated with low risk of IHD and heavy or binge drinking was associated with high risk of IHD.[10,11].

Alcohol consumption was observed only among 11.5% patients in our study. Exact amount of alcohol intake was not available, so we could not stratify the patients into moderate or heavy alcohol intake groups.

Those with diabetes have 2-4 fold higher risk of developing coronary disease than people without diabetes. The age and sex adjusted mortality risk in diabetic patients without preexisting coronary artery disease has been found to be equal to that of non diabetic individuals with prior MI.[12,13,14]

Our study had 22.54% diabetics.

Hypertension was seen in 40(39.21%) patients of which, 17(42.5%) were males and (57.5%) were females.

The mean platelet volume was compared among the three groups. MPV was significantly high patients with MI compared to the unstable angina and control group in this study.

This is in agreement with results of similar studies done in the past.[15,16] In a study by Klovaite J et al. done on a sample size of 39,531 participants show the association between increasing MPV and risk of MI.[17] In these studies increased MPV was found to be associated with coronary artery disease, acute MI, congestive heart failure and in hypertensive patients it is associated with evidence of target organ damage and cerebrovascular disease.[18,19] Studies indicates that platelets and their interaction with the coronary arterial wall are of pathogenic importance in atherosclerosis and its complications. After erosion or rupture of atherosclerotic plaques in coronary arteries, platelet activation plays a crucial role in the prothrombotic events leading to MI. Increased platelet reactivity are associated with increased platelet volume.[20] Larger platelets contain more granules and are metabolically and enzymatically more active than small platelets and have high thrombotic potential.

Pizulli et al. suggested that because platelets stay in the circulation for 7-11 days, they might be detected days before symptoms appear. Similarly, Martin et al. have shown a correlation between higher MPV and recurrence or death after the first MI in their prospective study.[21]

CONCLUSION

From the above discussion it is concluded that, MPV was significantly raised among patients with myocardial infarction (MI) compared to the unstable angina and control group.

MPV is easily available and is relatively inexpensive and hence is a useful tool along with other investigations to screen patients with suspected acute coronary syndrome.

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