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Diagnostic Importence of Platelet Indices in Patients with Acute Coronary Syndrome

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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.[2,3] Nearly two-thirds of the burden of NCD mortality in India is currently contributed by CVD-related conditions.[1] Platelet hyper-reactivity and local platelet activation have been suggested to play a crucial role in acute coronary events (including ACS).[4] So this study was undertaken to determine the association of MPV and PDW in patients with ACS in relation to various types.

Material and Methods: This study is under taken among 90 ACS patients admitted at Adichunchanagiri Hospital and Research Centre, B G Nagara and compared with 90 controls during the period of December-2017 to May-2019, 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 PDW was found to be 10 ± 0.7 fL in control and was 13.2±1.0, 12.6±0.8, 12.1±0.8 fL among STEMI, NSTEMI and UA patients respectively (p value<0.001) whereas 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: The platelet indices are 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 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. The NCD burden increased rapidly in India, with a proportional rise in burden attributable to CVD. Nearly two-thirds of the burden of NCD mortality in India is currently contributed by CVD-related conditions.[1] In comparison with the people of European ancestry, CVD affects Indians at least a decade earlier and in their most productive midlife years.[2,3]

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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).

Platelet hyper-reactivity and local platelet activation have been suggested to play a crucial role in acute coronary events.[4] Platelet size has been shown to reflect platelet activity. Large platelets are metabolically and enzymatically more active than small platelets and produce more thromboxane A2.[5,6] Consequently, larger and hyperactive platelets play a pivotal role in accelerating the formation and propagation of intracoronary thrombus, leading to the occurrence of acute thrombotic events."[7] These observations have led to the hypothesis that "increase Mean Platelet Volume (MPV) may be a potentially useful predictor in cardiovascular risk stratification",[8] as it is an index of platelet size that correlates with platelet activation.[9] Platelet Distribution Width (PDW) is a quantitative measure of platelet morphology (size variation). "An increased PDW indicates more variation of size (anisocytosis) which result from formation of pseudopodia and may be the predictor of platelet activation and turnover. PDW is more sensitive and specific than MPV in terms of platelet reactivity."[10]

MATERIAL & METHODS

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 was 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. This study was conducted on 70 cases and compared with 70 control group.

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.[11]
- The diagnosis of ST-Elevation Myocardial Infarction (STEMI) - satisfying Universal Definition.[11]

Blood was collected - "within 24 hours from admission and analyzed using blood samples with K3-EDTA that were analyzed after 1 hour of venipuncture to allow stabilization of platelet shape and within 2 hours to prevent EDTA-induced swelling, as it is time-dependent."

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

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MI11 or any patient with chest pain suggestive of Unstable Angina will be included in this study.

Patients with thrombocytopenia, known cases of hereditary disorders of platelets, patients on medications, which are known to alter platelets count/ morphology/ function, patients with known Congenital Heart Disease/ liver disease/renal disease/malignancy/thyroid disease and chronic inflammatory diseases were excluded from the study.

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). Significance is assessed at 5% level of significance. 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.

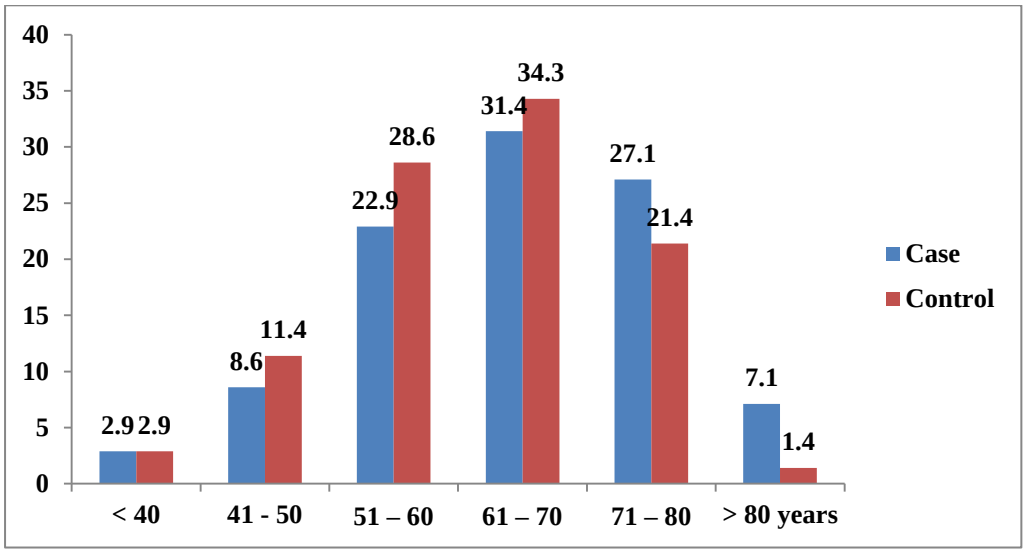

Figure 1: Age distribution in the both group of study participants

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. [Figure 1]

Considering 70 ACS patients, 35 had STEMI (50%), 18 had NSTEMI (25.7%) and 17 patients were diagnosed to have Unstable Angina (24.3%)

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Table 1: Comparison of Platelet Indices (fL) between cases and controls

Diagnosis	PDW (fL) p value-<0.001*		MPV (fL) p value-<0.001*		PLCR (%) p value-<0.001*		Plateletcrit (%) p value-<0.001*	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
STEMI (n=35)	13.2	1.0	12	1.4	33.1	5.1	0.32	0.05
NSTEMI (n=18)	12.6	0.8	11.5	1.2	32	4.8	0.28	0.06
Unstable angina (n=17)	12.1	0.8	10.3	0.8	25.9	2.1	0.23	0.04
Controls (n=70)	10	0.7	8.9	0.9	21.1	2.9	0.19	0.05

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

On comparing PDW of patients with controls, it was found to be 10 ± 0.7 fL in control group and was 13.2 ± 1.0 fL, 12.6 ±0.8 fL, 12.1 ±0.8 fL among STEMI, NSTEMI and Unstable Angina patients respectively (p value <0.001). MPV 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). Plateletcrit was found to be 0.19 ± 0.05 % in control group and was 0.32 ± 0.05%, 0.28 ± 0.06 %, 0.23 ±0.04 % among STEMI, NSTEMI and Untable Angina patients respectively (p value <0.001). PLCR was found to be 21.1 ± 2.9 % in control group and was 33.1 ± 5.1 %, 32 ± 4.8 %, 25.9 ± 2.1 % among STEMI, NSTEMI and Unstable Angina patients respectively (p value <0.001). [Table 1]

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.

A larger platelet volume is associated with enhanced platelet reactivity.[12] Automated cell counters are routinely available in many clinical laboratories and can be used to determine platelet count and the platelet volume indices - MPV, PDW, PCT and PLCR. MPV can also act as an independent predictor of impaired angiographic reperfusion and 6-month mortality among patients with STEMI treated with primary percutaneous coronary intervention (pPCI).[12,13]

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.[14]

On comparing PDW of patients with controls, it was found to be 10 ± 0.7 fL in control group and was 13.2 ± 1.0 fL, 12.6 ±0.8 fL, 12.1 ±0.8 fL among STEMI, NSTEMI and Unstable Angina patients respectively (p value <0.001). That is, PDW is more in ACS patients (cases), compared to controls (non-ACS). Among ACS patients, PDW is highest in STEMI, followed by NSTEMI and comparatively less in Unstable Angina. In a study conducted by, Manchanda J et al–"The study of platelet indices in acute coronary syndromes" showed that,

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PDW (fL) is 12.23 ±3.13 in controls, 13.66 ±3.55, 13.24 ±3.46 and 13.41 ±4.02 in STEMI, NSTEMI and Unstable Angina patients' respectively.[15]
MPV 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.15 Plateletcrit (PCT) was found to be 0.19± 0.05% in control group and was 0.32 ± 0.05%, 0.28 ± 0.06 %, 0.23 ±0.04 % among STEMI, NSTEMI and Unstable Angina patients respectively (p value <0.001). Jasani J et al, in their study "Evaluation of platelet count and platelet indices in patients with coronary artery disease found that PCT was 0.34% and 0.36% in MI and UA respectively compared to normal healthy control where it was 0.24% and is comparable with this study.[16] PLCR was found to be 21.1 ± 2.9 % in control group and was 33.1 ± 5.1 %, 32 ± 4.8 %, 25.9 ± 2.1 % among STEMI, NSTEMI and Unstable Angina patients respectively (p value <0.001). Manchanda J et al, in his study explained that, PLCR (%) is 18.12 ±3.54 in controls, 22.09±3.70, 22.36 ±4.95 and 18.57 ±3.70 in STEMI, NSTEMI and Unstable Angina patients respectively.15 Khandekar M M et al, published in his study that, PLCR (%) is 29.3±7.4 and 29.8 ±7.2 in STEMI and Unstable Angina respectively in comparison to control group (20.6±6.14 %).[17]

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. The platelet indices: platelet distribution width (PDW), mean platelet volume (MPV), platelet large cell ratio (PLCR) and plateletcrit are significantly higher in (ACS) cases, as compared to control group. Platelet indices were also significantly high in STEMI, followed by NSTEMI and comparatively less UA group among ACS patients. This study also concludes that single and cost effective, platelet indices help in anticipating severity (risk stratification) of coronary artery disease and also help in diagnosis ACS patients, where myocardial injury markers are not available.

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