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A Comparative Analysis of Mean Platelet Volume and Other Platelet Indices in Patient of Acute Myocardial Infarction with Healthy Control-Prospective Study

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Abstract
Background: *Coronary artery disease caused by atherosclerosis and its complications. Platelets has important role in atherosclerosis and thrombus formation. Mean platelet volume is affected by inflammation and there is little data regarding its relation with coronary artery disease.*
Aims & Objective: *To study the mean platelet volume and other platelet indices in patient of acute myocardial infarction with healthy controls.*
Material and Methods: *This study was a comparative analysis done in the department of medicine at SMS medical college Rajasthan. 60 subjects with acute myocardial infarction diagnosed on the basis of symptoms, ECG changes and Troponin I/T was compared with 60 healthy individuals of same age and sex. MPV and other platelet indices done within 6 hours of symptoms before administration of anticoagulant. Inclusion and exclusion criteria was applied in both groups*
Results: *It was observed that cases has lower platelet count, higher MPV higher PDW higher P-LCR, low PCT levels as compared to healthy controls*
Conclusion: Measurement of MPV may be of some benefit in detecting those patients at higher risk for CAD
Keywords: *Acute myocardial infarction, MPV, coronary artery disease.*

Introduction

Acute coronary syndrome (ACS) is becoming the leading cause of morbidity and mortality in developing countries like India. The spectrum of presentation is wide from unstable angina to myocardial infarction[1]. International Federation of Clinical Biochemistry[1], the World Heart Federation[2], the American Heart Association, European Society of Cardiology and the American College of Cardiology have issued consensus guidelines for defining myocardial infarction. They have recommended cardiac Troponin I and cardiac Toponin T measurements as the preferred biomarkers for diagnosing ACS. Platelets play a crucial role in the pathogenesis of atherosclerosis and thrombosis formation after coronary plaque rupture. Platelets are small discoid cellular elements which heterogeneous with respect to sex, density, and age and metabolic function. Release of free arachiodonic acid from platelet activation leads to formation of prostaglandins such as thromboxane A2 and leukotrienes. These

prostaglandins and leukotrienes are potent vasoconstrictor and are platelet aggregating substances which can amplify the acute inflammatory response. Thus hyperactive and larger platelets play a important role in increasing the formation and prolongation of coronary thrombus formation which leads to acute thrombotic events[22]. These observation have led to the hypothesis that increased mean platelet volume MPV may be a potentially useful predictor in cardiovascular risk stratification[3]. MPV and other platelet indices correlates not only an increased risk of non STEMI, but also ischemic complications[4]. Also some studies have reported an association between high MPV and poor prognosis in IHD, but few studies to determine relation between IHD and other platelet indices such PDW, P-LCR and PCT.

Material and Method

It was hospital based case control comparative study done at SMS medical college and attached group of hospitals. Patient attending wards with acute myocardial infarction was taken as case.

Study period – from approval of plan to the desired no of patients achieved.

Sample size with detectable difference of 1±0.9, the sample size was calculated as 14 subjects in each group. But for study purpose taking all platelet volume indices in consideration the maximum sample size is calculated 60 subjects in each group.

Sampling technique- patients with acute myocardial infarction admitted in SMS medical College Jaipur

Ethical committee- permission given by ethical committee by SMS Medical College, Jaipur

Inclusion criteria

Cases- all patients with diagnosis of acute myocardial infarction (STEMI/NSTEMI)

1) Symptoms of ischemia
2) ECG changes indicative of new ischemia
3) Raised serum CPK-MB/ troponinT/I

Controls- normal healthy individuals

Exclusion criteria

1) Cases with hepatic or renal impairment
2) Where the blood sample either taken had micro-thrombi or a marked coagulant effect,
3) Patients taking anticoagulants or antiplatelets drugs
4) Lymphoproliferative disorders and malignancy
5) Patients not giving consent.

Data collection

A Performa sheet was prepared to get information on age, sex, etc. An informed consent was taken from all cases and controls. A complete history which included symptoms was taken. Relevant past history, family history, and treatment history was taken,

Each patient thoroughly examined with special emphasis on any particular system if it were involved in the disease process. Blood sample was taken within 6 hr of symptoms before administration of any anticoagulant. The following investigation were done in all patients and controls

- Complete blood count
- Liver function test
- Renal function test
- Random blood sugar
- Lipid profile
- ECG
- Troponin T/I

Statistical Analysis

All data was done on PRIMER and SPSS version 20 statistical software. Quantitative data were summarized in form of mean and Standard deviation and the difference in means were analyzed in using student t test. The difference in proportion was analyzed using CHI SQUARE test. The level of significance for all statistical analysis would be kept at <0.05. Receiver operator characteristic (ROC) curve analysis was performed to determine the optimal cut off value of significant variables.

Results

Table 1 Age wise distribution of the groups

Age	N	Mean	Std. Deviation	Minimum	Maximum	P value LS
Controls	60	56.58	9.608	30	70	0.977NS
Cases	60	56.53	9.140	38	80	
Total	120	56.56	9.338	30	80	

Mean age of 60 cases in our study was 56.53 year and the mean age of controls was 56.58 year without any significant difference. The range of age in cases was 38-80 year and in control was 30-70 year. Mean age of cases in our study was similar to study by Pervin, Ferdousy et al and Alireza Yaghoubi, Zahra Golmohammadi et al where it was 55.05 and 62.7 years. [5, 6]

Table 2 Sex wise distribution of the groups

	Controls (N=60)		Cases (N=60)		Total (N=120)	
	No	%	No	%	No	%
F	16	26.67	16	26.67	32	26.67
M	44	73.33	44	77.33	88	73.33
Total	60	100	60	100	120	100

Chi Square= 0.043 with 1 degree of freedom; P = 0.836 NS.

In present study there was 16 female (26.67%) in both case and control and 44(73.33%) male in both case and control. This is similar to study by Alireza Yaghoubi, Zahra Golmohammadi et al where male constitute 77.61% of study population [7]and study by Vitthal khode, Jayaraj Sindhur et al also shows 86.71% male[25].

Table 3 Comparison of platelet indices in groups (i)

	Platelet Count			Mean MPV			Mean PDW		
	Case	Controls	Total	Case	Controls	Total	Case	Controls	Total
N	60	60	120	60	60	120	60	60	120
Mean	276.38	231.25	53.82	1072	11.97	11.35	13.25	15.23	14.24
SD	120.86	67.24	99.99	0.94	1.458	1.374	2.526	3.503	3.199
Mini.	112	108	108	9	8	8	9	9	9
Max	788	459	788	13	14	14	2	27	27
P Values LS	0.0135			<0.0015					

Table 3 Comparison of platelet indices in groups (ii)

	Mean PLCR			Mean PCT		
N	Case	Controls	Total	Case	Controls	Total
Mean	60	60	60	60	60	20
SD	31.4	35.75	33.58	0.32	0.266	0.293
Mini.	5.823	8.21	7.418	0.133	0.064	0.107
Max	20	13	13	0.13	0.13	0.13
P Values LS	44	55	55	0.84	0.49	0.84
	<0.0015			<0.0055		

Mean platelet count in cases (231.25±67.27) was found lower as compared to controls (276.38±120) with p value of <0.0135. This finding is similar to study done by Alizeza Yaghoubi, Zahara[7] and Ridvan Mercan, Cengizz Demir et al [8]. Controls have higher platelet as compared to cases in both unstable angina and AMI.

Similarly MPV is higher in cases (11.97±1.458) as compared to control (10.72±0.940). Difference was significant with p value <0.001, these are comparable with study done by Alireza et al [7], Abdulla s. Assiri et al [9]. This shows that MPV is an indicator of inflammation, atherogenesis and thrombosis.

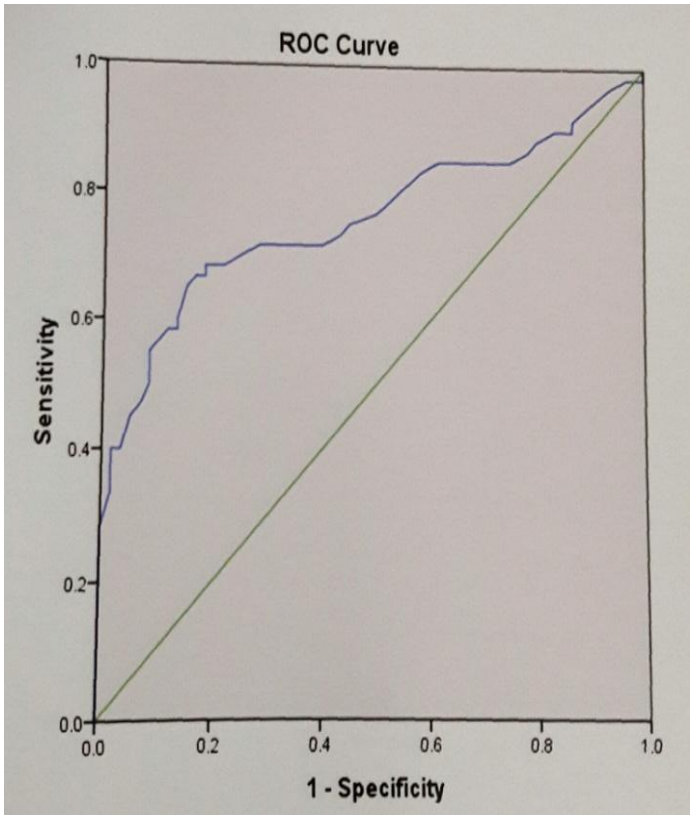
Mean PDW was 15.23 fl in cases and 13.25 fl in controls. PDW is higher in cases as compared to controls. This is similar to study done by Jasmine H Jasani, Madhur Modi et al [24]. Where PDW mean was 16.75fl as compared to controls 10.70 fl.

In comparison of P-LCR mean in cases was 35.76% and 31.40% in controls which similar to study done by Khurana et al [23].The best cutoff for P-LCR in ROC for predicting MI was 38.5 units with sensitivity of 50% and specificity of 68.3%.

Mean plateletcrit (PCT) was found lower in cases (0.266±0.0641) as compared to controls (0.320±0.0133). The ROC curve of PCT was 0.368 i.e. curve is significantly different from 0.5 since p value <0.05. The best cut off value for PCT for predicting MI was 0.175 units with sensitivity of 65% and specificity of 13.3 with SE 0.053.

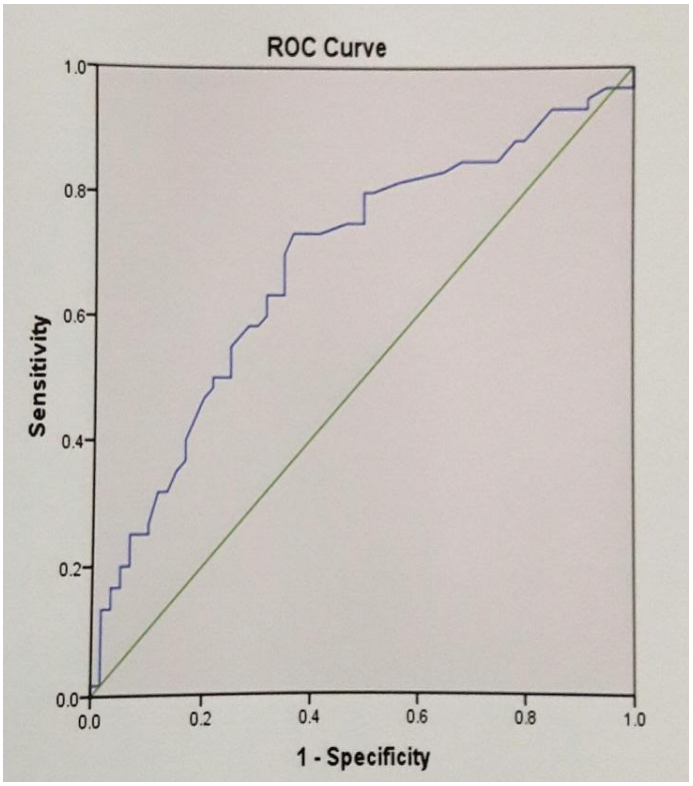
Table 4 ROC curve for detecting the optimal cut off value for platelets indices

	Area	SD	Asymptotic Sig	Asymptotic 95% Confidence Interval	
				Lower bound	Upper bound
1 MPV	0.762	0.45	0.000	0.673	0.851
2 PDW	0.687	0.049	0.000	0.591	0.783
3 P –LCR	0.686	0.050	0.000	0.584	0.784
4 PCT	0.368	0.053	0.013	0.264	0.472



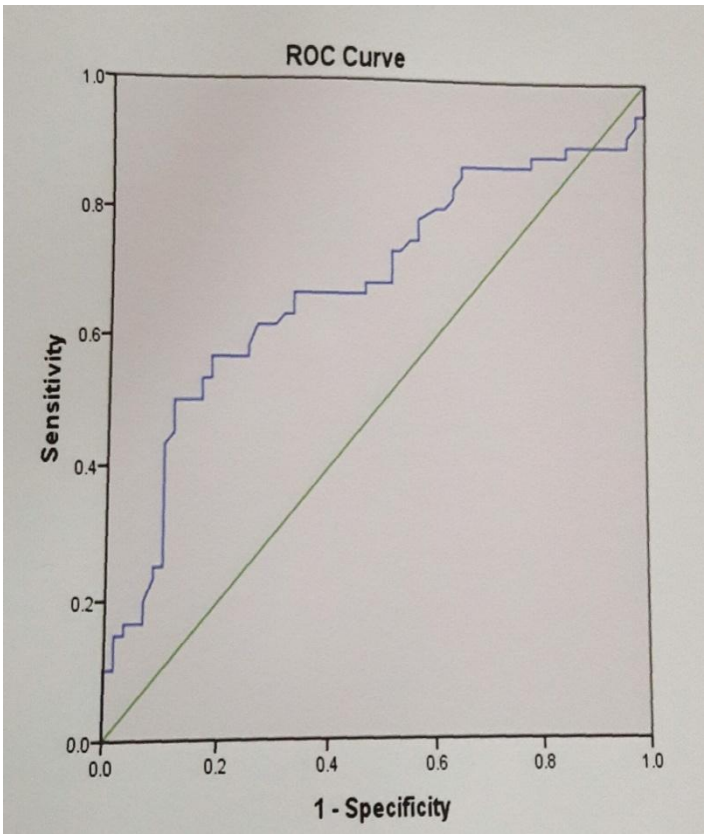
ROC for MPV shows that best cut off value for MPV for predicting MI was 11.65fl. (Sensitivity 66.7% and specificity of 53.33% with SE of 0.05)

Receiver operating characteristics (ROC) for MPV



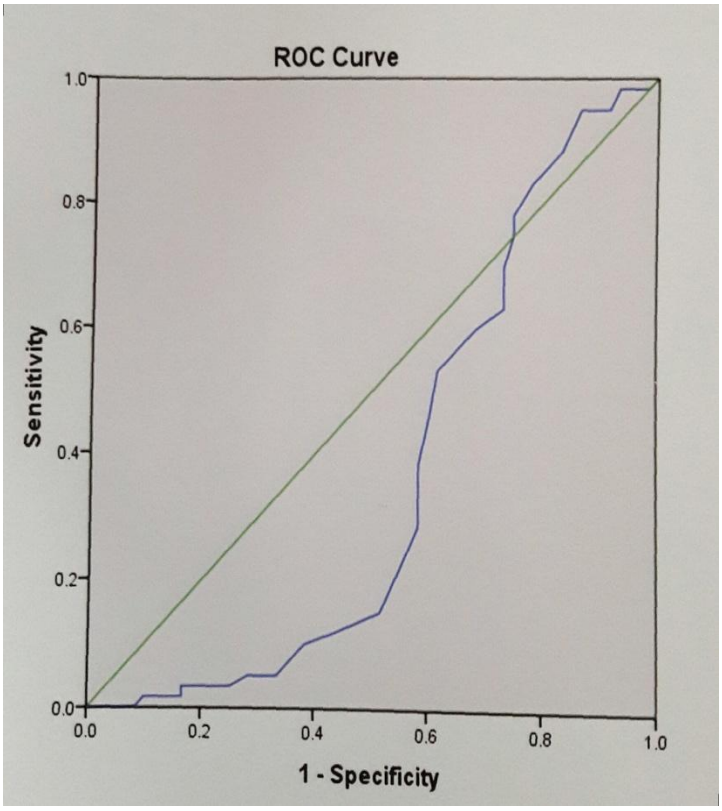
The ROC curve of PDW for predicting AMI was 13.45fl (sensitivity 73.3% and specificity 63.33%)

Receiver operating characteristics (ROC) for PDW



The ROC curve for P-LCR showed that cut off value for predicting MI was 38.5 units. (Sensitivity 50% and specificity 68.3%)

Receiver operating characteristics (ROC) for P-LCR



The Roc curve for PCT, predicting AMI was 0.175 units (sensitivity 65% and specificity 13.3%)

Receiver operating characteristics (ROC) for PCT

Discussion

Our study shows that higher level of mean platelet volume (MPV) as compared to healthy age and sex matched controls. Similarly other platelets indices such as platelet distribution width (PDW), platelet large cell ratio (P-LCR) was high and plateletcrit was low.

Platelet play important role in coronary syndromes, central to all occlusive arterial disease is the activation of platelets at sites of vascular injury via pathologically exaggerated and deregulated version of the protective mechanism involved in haemostasis. Platelets secrete large number substances that are crucial in inflammation thrombosis and atherosclerosis. There are many methods of measuring platelet activity that identify individuals with increased risk of cardiovascular events.

Mean platelet volume is used to measure platelet size, is a potential marker of platelet reactivity and it correlates with platelet aggregation leading thrombus formation and has important role in coronary artery disease. Larger platelets are metabolically and enzymatically more active. Whereas other platelet indices such PDW reflects a deregulation in thrombopoiesis leading to multiple abnormalities of platelet reactivity and change in platelet membrane and adenine content [10-12]. Increased inflammatory cytokines influence megakaryocytopoiesis. Multi factorial complex interactions between platelets, endothelial cells and leukocytes further stimulates thrombosis and can add up in coronary artery diseases, also there is increased platelet activation during acute coronary syndromes [13]. Platelets indices might be helpful in risk stratification or improvement of risk prediction if combining it with other risk factors in risk prediction models similarly other platelets indices can be used for risk stratification, the cut off values of platelet indices is the most useful in predicting cardiovascular events in clinical practice along with other risk factors.

Three cohort studies, mortality following an AMI was reported that 3184 patients with AMI, those with elevated platelet indices significantly higher risk of death than those with normal platelet indices.[14-16]. The risk of restenosis following higher with patients has higher MPV [17-23].

Conclusion

However it is difficult to standardize the blood collection and processing and handling procedure for multicentre laboratory testing. The major goal of present study emphasized the relationship between platelet indices and coronary artery diseases, a simple inexpensive and widely available marker of platelet activity. Platelet indices was found to be elevated in patients with MI compared with controls subjects and platelet count, PCT was low in MI patients as compared to controls. So, we conclude that platelet indices is a simple and reliable method found to be a independent predictor of myocardial infarction.

Limitation – It is difficult to find out whether the relation between platelet size and cardiovascular risk is discrete or continuous using MPV. Furthermore, the time between collection of blood samples and measurement of MPV, although mostly standardized within each study, differed significantly between studies. Since it is case control study we have not followed patients for various parameters.

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