 DOI: 10.5958/2394-6792.2016.00110.1

Correlation of platelet volume indices in coronary artery disease and control groups

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Abstract

Background: Coronary artery disease (CAD) stems as a consequence of atherosclerotic plaque with associated platelet rich coronary thrombus formation. Larger platelets are metabolically more active and have a greater thrombogenic potential compared to smaller platelets.

Aims: The present study was designed to evaluate the platelet volume indices in coronary artery disease patients with documented angiogram abnormalities and to correlate the significance in comparison to normal controls.

Materials and Methods: This was a comparative study of 128 subjects; 51 patients of CAD with angiogram evidence of single vessel, double vessel and triple vessel disease and 77 controls. Blood samples were collected in standardised EDTA tubes and analysed using a five part analyser Sysmex XS-800-I. The controls were healthy voluntary blood donors and were compared with CAD patients admitted for angiography.

Results: Patients with abnormal angiogram findings had a higher MPV and PDW than the normal controls. MPV showed a statistically significant correlation between CAD and control groups with a P value of 0.001.

Conclusion: Platelet volume indices, specifically Mean platelet volume can be of benefit in detecting coronary artery disease patients who may probably show abnormality in angiogram findings.

Keywords: Coronary artery disease, mean platelet volume, platelet distribution width, Thrombus, Angiogram.

Introduction

Coronary artery disease is a serious and common life threatening illness with considerable mortality and morbidity. Platelet activity determines the initiation of atherosclerotic events and platelet size which is measured as mean platelet volume (MPV) is a marker of platelet function and associated with platelet activity.[1] Larger platelets are enzymatically and metabolically more active with greater thrombogenic potential. Platelet indices have been used for assessing many haematological disorders but not extensively for cardiovascular diseases. Platelet indices correlate with functional activity of platelets and can be an emerging risk factor for atherothrombosis.[2] Many studies have highlighted the correlation of high MPV with stable angina, unstable angina and acute myocardial infarction.[3,4] Some studies found a negative correlation of MPV with coronary artery disease patients and necessitated further evaluations.[5] Hence the present study was done to evaluate the most significantly correlated platelet index MPV with angiogram proved coronary artery disease patients and compare them with normal controls.

Materials and Methods

This is a tertiary hospital based prospective case control study to assess the correlation of platelet indices in spectrum of angiogram proved coronary artery disease patients with respect to normal controls.

The study was approved by the local ethics committee and carried out obtaining written informed consent.

The study was conducted in a span of 6 months and patients who came with chest pain and referred to cardiology clinic and categorised as stable coronary artery disease were taken. All these patients underwent coronary angiogram and those who showed significant single vessel, double vessel and triple vessel disease were taken up for the study and their initial CBC parameters on admission was analysed.

Inclusion criteria: Patients more than 20 years of age with chest pain and angiogram proven CAD including Single vessel, Double vessel and Triple vessel diseases.

Exclusion criteria: Patients with past history of major haematological disorders, trauma or major surgical history and acute myocardial infarction were excluded from the study.

The controls were normal healthy donors who came to blood bank and were matched for age according to the study.

A total of 77 controls were taken and 51 patients of CAD who showed abnormal angiogram findings were taken for analysis. Out of the 51 CAD patients, 25 were Single vessel disease, 13 were Double vessel disease and 13 were Triple vessel disease.

Venous samples from the subjects were taken and collected in EDTA tubes. Samples were analysed within 1 to 2 hours using Sysmex XS 800i.

Values were expressed as mean+/- standard deviation and data were analysed using SPSS statistics software version 23. ANOVA and Chi-square tests performed and Pearsons correlation coefficient was used for evaluating correlation of MPV values between CAD patients and age matched controls.

Results

During the 6 months of study, 128 individuals (20 females, 108 males) were investigated and the results were analysed. We included 51 patients of CAD (25 Single vessel, 13 Double vessel and 13 Triple vessel disease) and 77 age-matched controls.

Increased MPV was observed in CAD Group compared to the control group. The mean MPV value was 9.32 fl with standard deviation of 1.083 in the CAD group compared to 8.67 with standard deviation of 0.79 in the control group. [Fig. 1, 2, 3, 4]

MPV levels were significantly higher in CAD group compared to control group (P=0.001) by ANOVA and nonparametric tests in comparison to the Platelet distribution width (PDW) (P=0.350) which was not raised significantly. [Fig. 5]

On analysing the MPV and PDW values among different angiogram groups (Control [n=77], Single vessel disease [n=25], Double vessel disease [n=13] and Triple vessel disease [n=13]) using ANOVA, difference in MPV values was statistically significant among the groups with a p value of 0.001; whereas the PDW values were not statistically significant (P=0.87). The MPV value was found to be little lower in triple vessel disease in comparison with single vessel and double vessel disease.

Using the independent samples Kruskal Wallis test, MPV was found to be statistically significant with a p value of 0.007; whereas the PDW values were not statistically significant (P=0.401). [Fig. 6 and 7]

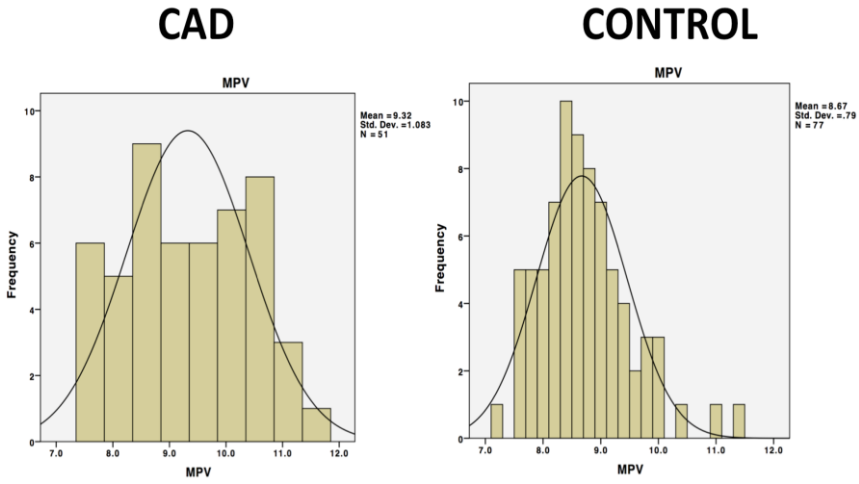


Fig. 1: Mean platelet volume (MPV) in CAD patients in comparison to age matched controls

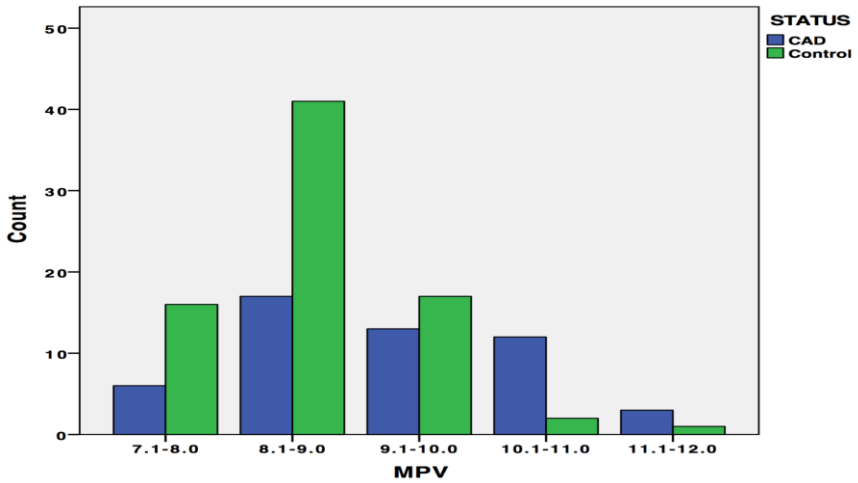


Fig. 2: Frequency of Mean platelet volume (MPV) in CAD and Control groups

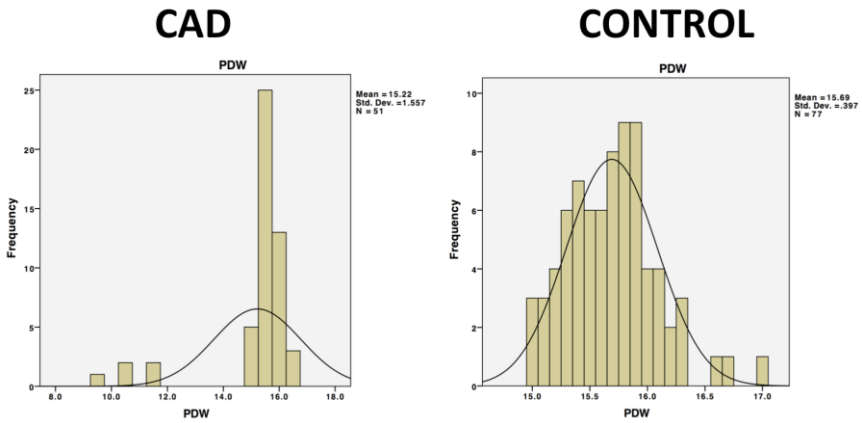


Fig. 3: Platelet Distribution Width (PDW) in CAD patients in comparison to age matched controls

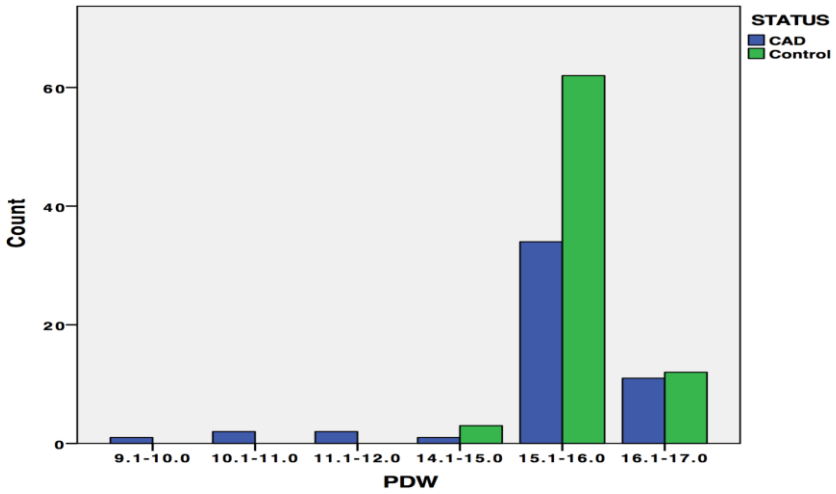


Fig. 4: Frequency of Platelet distribution width (PDW) in CAD and Control groups

Nonparametric Tests

Hypothesis Test Summary

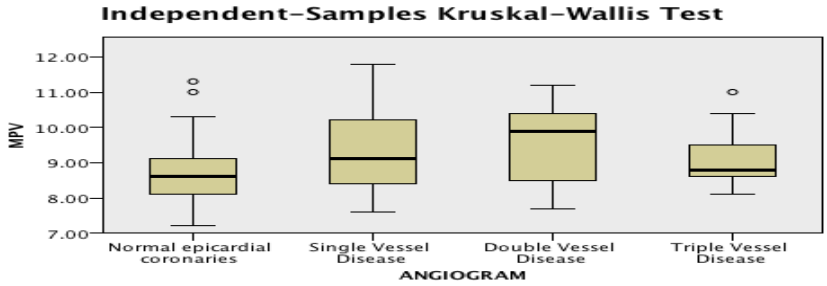
	Null Hypothesis	Test	Sig.	Decision
1	The distribution of MPV is the same across categories of STATUS.	Independent-Samples Mann-Whitney U Test	.001	Reject the null hypothesis.
2	The distribution of PDW is the same across categories of STATUS.	Independent-Samples Mann-Whitney U Test	.350	Retain the null hypothesis.

Fig. 5: There is a statistically significant difference in the MPV values between CAD and Control groups with a P value of 0.001

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The medians of MPV are the same across categories of ANGIOGRAM.	Independent-Samples Median Test	.019	Reject the null hypothesis.
2	The distribution of MPV is the same across categories of ANGIOGRAM.	Independent-Samples Kruskal-Wallis Test	.007	Reject the null hypothesis.
3	The medians of PDW are the same across categories of ANGIOGRAM.	Independent-Samples Median Test	.186	Retain the null hypothesis.
4	The distribution of PDW is the same across categories of ANGIOGRAM.	Independent-Samples Kruskal-Wallis Test	.401	Retain the null hypothesis.

Fig. 6: MPV between Angiogram groups statistically significant with P value of 0.019 (Independent samples Median test) and 0.007 (Independent samples Kruskal-Wallis test)



Total N	128
Test Statistic	12.260
Degrees of Freedom	3
Asymptotic Sig. (2-sided test)	.007

Fig. 7: MPV values among the different angiogram groups

Table 1: MPV and PDW in CAD patients and in control groups

Parameters	MPV		PDW	
	CAD	Control	CAD	Control
Mean	9.324	8.67	15.218	15.691
N	51	77	51	77
Std. Deviation	1.0825	0.7897	1.5574	0.3968
Minimum	7.6	7.2	9.5	15
Maximum	11.8	11.3	16.7	17
Range	4.2	4.1	7.2	2
Std. Error of Mean	0.1516	0.09	0.2181	0.0452
Variance	1.172	0.624	2.425	0.157

Table 2: MPV and PDW in Single vessel disease (SVD), Double vessel disease (DVD), Triple vessel disease (TVD) patients and in control groups

Parameters	MPV				PDW			
	SVD	DVD	TVD	Control	SVD	DVD	TVD	Control
Mean	9.31	9.55	9.13	8.67	15.18	15.35	15.16	15.691
N	25	13	13	77	25	13	13	77
Std. Deviation	1.154	1.155	0.889	0.7897	1.697	1.549	1.385	0.3968
Minimum	7.6	7.7	8.1	7.2	9.5	10.4	10.6	15

Maximum	11.8	11.2	11	11.3	16.7	16.6	15.9	17
Range	4.2	3.5	2.9	4.1	7.2	6.2	5.3	2
Std. Error of Mean	0.231	0.320	0.247	0.09	0.339	0.430	0.384	0.0452
Variance	1.331	1.334	0.791	0.624	2.88	2.399	1.919	0.157

Discussion

Platelets have a very important role in the development of coronary artery thrombosis and in other common cardiovascular diseases such as stroke, peripheral vascular diseases and so on.[1] Activated platelets are larger in size and have a higher thrombotic potential. Larger platelets have a greater mass and they are metabolically and enzymatically more active than smaller platelets, since they have larger granules and adhesion receptors with a greater thrombotic potential.[6] Thus MPV as a measurement of mean size of the platelets correlated positively with platelet function.[7] Platelet distribution width measures the extent of variability of the size of platelets. High PDW values suggest increased production of larger reticulated platelets. Elevated platelet indices are known to be a risk factor for coronary artery disease and/or myocardial infarction.[8]

In the present study, there is a statistically significant increase in the MPV values in CAD group compared to Control group with a P value of 0.001.On analysing the MPV and PDW values among different angiogram groups (Control, Single vessel disease, Double vessel disease and Triple vessel disease), difference in MPV values was statistically significant among the groups with a p value of 0.001. This correlated with other studies in the literature. Abass AE et al reported that Sudanese patients with acute coronary syndrome (ACS) had significantly higher MPV values than patients without ACS.[7]

Chu SGet al concluded that MPV is higher in patients presenting with an acute myocardial infarction (AMI) and in patients who develop restenosis following coronary angioplasty. Increased MPV is also associated with higher mortality following myocardial infarction.[2]

One study pointed that patients with acute coronary syndrome had higher platelet volume indices and lower platelet counts compared with those with stable angina and the normal population.[9]

In contrast, Islamoglu Y et al found that MPV levels are not related to coronary collateral circulation.[10]

In the present study, PDW does not show a statistically significant difference among the CAD and control groups.

This data suggests that increased mean platelet volume contribute to a prethrombotic state in coronary artery disease patients and that larger platelets may be significant risk factor playing a role in the development of coronary artery disease.

The limitations of the present study is to be analysed on more larger sets of single vessel, double vessel and triple vessel diseases in order to arrive at a more conclusive evidence.

Conclusion

In the present study we observed high MPV in CAD groups in comparison to control group. This correlates with the other studies which showed increased MPV in unstable angina and myocardial infarction. Thus in conclusion, MPV may provide an important cost effective tool to predict an impending coronary artery disease.

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