Platelet Indices in the Spectrum of Ischemic Heart Disease

Devi Subbarayan	Preethi Ravi
Assistant professor, Pathology Department, Chettinad Health City, Kelambakkam, Tamilnadu, 603103.	Third year medical student, Chettinad Health City, Kelambakkam, Tamilnadu, 603103.

ABSTRACT Background- Ischemic heart disease (IHD) is a leading cause of death in urban area of today's world. Platelet plays an important role in pathogenesis of atherosclerosis. The mean platelet volume (MPV), measure of platelet size is a potential marker of platelets reactivity. Studieshave stated that an increase MPV associated with myocardial damage. The current study is undertaken to evaluate the platelet parameters and an attempt to predict cardiovascular events in Indian population. Materials and methods: A case-control study involving 30 coronary artery disease (CAD), 31 acute coronary syndrome cases (ACS) and 32 controls. Platelet parameters which include platelet count (PC), MPV, platelet distribution width (PDW) were determined in all groups, compared and statistically analysed. Results: Significant increase in mean values for MPV, PDW are increased in cases compared to the controls. Among the cases these parameters are significantly increased in ACS cases compared to stable CAD cases. Results: our results showed that these simple parameters can be used in routine practice to predict the impending adverse cardiac events.

Introduction:

Coronary artery disease (CAD) accounts for around 3 million deaths per year in India. India has 29.8 million symptomatic patients with CAD, 19.3 million diabetes and 118 million hypertensive individuals who are at the risk of developing metabolic syndrome, in turn increasing the risk for CAD.[1]The known risk factors that leading to the development of coronary artery disease includes diabetes mellitus, hypertension, dyslipidemia, tobacco use and family history of coronary artery disease. All these factors increase the risk CAD by increasing the risk of development of atherosclerosis. Activation of platelets after rupture of atherosclerotic plaque results in platelet rich thrombus. The thrombus leads to partial or complete occlusion of vessels resulting in myocardial ischemia and other clinical manifestation ranging from unstable angina (UA) to acute myocardial infarction (AMI). Platelet expresses constituents that play a vital role in coagulation, inflammation thrombosis and atherosclerosis. Larger platelets have greater thrombotic potential. Studies have shown that mean platelet volume (MPV), the most commonly used measurement of platelet size is a potential marker of platelets reactivity including increased platelet aggregation, thromboxane synthesis and increased expression of adhesion molecule.[2,3] Some studies have stated that there is an increase MPV associated with myocardial damage in acute coronary syndrome (ACS) and has been found to be predictive of unfavorable whereas some got a negative results based on the same.[4] Moreover MPV higher MPV has been observed in diabetes, hypertension, hypercholesterolemia, smoking and obesity, thus suggesting a common mechanism by which these factors may increase the cardiovascular disease.[5-9] The present study was undertaken to evaluate the platelet parameters and an attempt to predict cardiovascular events in Indian population.

Materials and methods:

A case control study was conducted in Chettinad Hospitals and Research Institute, Kelambakkam, Tamilnadu, India involving 30 CAD cases, 31 ACS cases and 32 age and sex matched controls. ACS cases were diagnosed based on history, characteristic of electrocardiographic changes and increased cardiac enzymes. We also included stable coronary artery disease (SCAD) admitted for coronary angiography or a coronary artery bypass procedure. Controls had no history of heart disease and normal electrocardiogram. Smokers, obese and diabetic patients were excluded from control subjects. Subjects with severe renal or hepatic impairment, with sepsis or any chronic inflammatory disorders and with myeloproliferative neoplasm or other malignancies were excluded. Pregnant women, patients with thyroid dysfunction or on oral anticoagulant therapy were also excluded.

In patients with ACS, 3 ml of venous blood was collected within 4-6 hours of admission into the casualty in K_2EDTA vacutainers. Similarly venous blood from CAD were collected on the day of admission and analyzed. Blood from controls were taken from the outpatient department when they come for routine health checkup. All the samples were analyzed within 8 hours of collection using Coulter LH780 automated hematology analyzer which computed the value of platelet count (PLC), MPV, platelet distribution width (PDW).

The collected data were statistically analyzed using Statistical Package for Social Science (SPSS) software. The mean and standard deviation (SD) was calculated for age and platelet indices for all the three groups separately. One way analysis of variance (ANOVA) was used for statistical analysis and 'p' value 0.05 or less was taken as significant.

Results:

Summary statistics is given in table 1.

Table 1.Comparison of platelet parameters among the groups

	Group						One way ANOVA	
	Coronary Artery Disease (CAD) (n =30)		Acute coronary syndrome (ACS) (n = 31)		Controls (n = 32)			
	Mean	SD	Mean	SD	Mean	SD	F Value	Sig.
Age	58.93	7.71	58.19	14.21	53.34	10.12	2.379	.098

PLATE-LET COUNT	291.27	52.39	275.68	76.81	189.12	58.25	23.638	.000
MPV	8.20	.27	8.69	.64	7.89	.51	15.656	.000
PDW	16.33	.21	16.67	.48	14.98	.41	169.891	.000

With the above mentioned inclusion and exclusion criteria 61 cases were enrolled in the study with age and sex matched 32 controls. Out of the 61 cases, 31 had ACS and 30 of them were CAD cases. The mean age of patients with ACS was 58.19. The mean age of patients with CAD was 58.93 and controls averaged 53.34. There was no significant age difference among the three groups.

There was a significant increase in mean PC in both CAD and ACS cases compared to controls. Though the PC is decreased in ACS cases compared to CAD cases, it was not statistically significant. There was a gradual increase in mean MPV among the groups. There was a significant increase in MPV in ACS cases (8.69±.64) compared to CAD cases (8.20±.27) and controls (7.89±.51). There was a significant increase in PDW in cases compared to the controls (14.98±.41). Between the cases PDW was significantly increased in ACS cases (16.67±.48) compared to CAD cases (16.33±.21). There was no significant difference in platelet parameters between sexes among the three groups (Table 2 & 3).

Table 2.Comparison of platelet parameters between the sexes

	Group					
	CAD Cases		ACS Cases		Controls	
	Male (n =23)	Female (n =7)	Male (n =24)	Female (n =7)	Male (n=16)	Female (n=16)
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age	59.65	7.28	56.57	9.18	56.46	12.70	64.14	18.36	56.00	9.56	50.69	10.25
PLATELET COUNT	290.22	56.81	294.71	37.60	279.54	78.43	262.43	75.20	190.56	66.06	187.69	51.42
MPV	8.18	.29	8.24	.22	8.76	.63	8.46	.68	7.84	.56	7.94	.47
PDW	16.35	.21	16.24	.21	16.70	.53	16.59	.22	14.97	.41	14.99	.42

Table 3. Independent Samples Test

Group		t-test for Equality of Means	
		t	Sig. (2-tailed)
CAD Cases	Age	0.924	0.363
	PLATELET COUNT	-0.196	0.846
	MPV	-0.508	0.615
	PDW	1.206	0.238
ACS Cases	Age	-1.272	0.213
	PLATELET COUNT	0.512	0.612
	MPV	1.115	0.274
	PDW	0.548	0.588
Controls	Age	1.516	0.140
	PLATELET COUNT	0.137	0.892
	MPV	-0.580	0.566
	PDW	-0.170	0.866

Discussion:

Coronary artery disease is the leading cause of death globally. Platelets play a vital role in the development of atherothrombosis. Following atherosclerotic plaque rupture platelets get activated. The platelet activity and function can be best assessed by platelet volume indicators like MPV and PDW rather than PC. Several studies have demonstrated that an elevated MPV has been associated with increased vascular ischemic events and also have been found to be associated with increased mortality and morbidity, recurrent MI.[2] Hence; platelet volume parameters are simple and reliable biomarker to predict coronary events.

Several studies have shown variable association of PC with CAD. Khandekar et al[10] study did not find any significant difference in PC between the groups. Pizzuli et al[11] showed significant decrease in PC count in UA cases compared to stable CAD cases; Chu et al[2] have reported increase in MPV in AMI, UA cases compared to non-cardiac chest pain. Their review and Unal et al[12] study found elevated MPV is associated with increased mortality following MI and occurrence of restenosis following coronary artery intervention. Some studies have shown increased MPV in UA patients compared to MI cases. In this research we did not study separately UA cases and AMI cases.

Few studies have shown there are ethnic differences in platelet indices.[3, 13] The cut off value for MPV in Indian population is still not known. Large cohort of studies are required to establish the mean cut off value for platelet indices in Indian population. Moreover there is time dependent elevation of platelet volume indices in EDTA anticoagulant sample. EDTA causes swelling of platelets which can spuriously elevate the MPV values. Previous studies have not mentioned the time between blood collection and onset of acute coronary event except Khode et al[3] study which evaluated within 4 hours of onset of chest pain.

We observed step wise significant increase in PDW among controls, CAD and ACS cases which is in agreement with Khode et al[3]& Kandhekar et al[10] study. Our study showed significant increase in MPV and PDW among ACS cases compared to CAD cases. There was no significant sex difference in platelet volume indices among the three groups which is in accordance with previous studies.[3, 14-5]

There are few limitations in our study. The size of the sample was less. To establish mean cut off value large cohort of patients will be required for more meaningful analysis. We could not correlate MPV with cardiac enzymes, so it could have been more meaningful in predicting the coronary events. It has been shown there are ethnic differences in MPV. The mean MPV value for Indian population is not established. Based on our limited study we cannot establish MPV cut off to predict cardiovascular events though we found statistically significant increase in platelet volume indices in ACS cases compared to CAD cases.

In conclusion, our limited study results suggest MPV and PDW are increased in patients with ACS compared to stable CAD cases; these parameters could be a risk factor for ACS and MI. Though the PC was decreased slightly in ACS cases compared to the stable CAD cases, it was not statistically significant in the present study. Hence, PC alone cannot be used as a reliable marker for predicting coronary events. However large cohort of series is required to establish cut off value in Indian patients. So these simple parameters can be used in routine clinical practice for predicting ACS.

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