A Study Of Platelet Indices And Angiographic Profile In Patients With Acute Coronary Syndrome

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Abstract: Background: ISCHEMIC HEART DISEASES continues to be a major public health problem becoming an increasingly important problem in developing countries constitutes around 12.8% of total deaths (7.2 million). Objectives: To evaluate the clinical course of ACS patient's admitted to KIMS HUBLI ICCU. Material & Methods: Patients admitting to ICCU KIMS, HUBLI diagnosed as Acute Coronary Syndrome. The study included 156 patients admitted to ICCU KIMS Hubli who diagnosed as ACUTE CORONORY SYNDROME. Results: There was significant difference in the platelet indices between the three groups. The platelet Indices - mean platelet volume, platelet distribution width and platicrit were significantly higher in STEMI and NSTEMI groups when compared to the USA group and severity of CAD more in patients who were having higher platelet indices. Conclusion: The platelet indices: mean platelet volume (MPV), platelet distribution width (PDW) and platecrit are significantly higher in STEMI and NSTEMI groups when compared to USA group. [Gouda G Natl J Integr Res Med, 2020; 12(1):01-06]

Key Words: Mean platelet volume(MPV);Platelet distribution width(PDW); Acute coronary syndrome (ACS); ST elevation MI(STEMI) ;Non ST elevation MI(NSTEMI)

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Introduction: Description of ischemic chest pain was formulated around the 1550 BC, when Egyptians reported a realistic description of heart ischemia in the Ebers Papyrus, "if thou examine a man for illness in his cardia" means if he has pain in his arms in his breast and in one side of his cardia…it is death threatening him." [1]

Cardiac catheterization paved the way for the development of coronary arteriography in 1958. [2] The development and refinement of the technique of open-heart surgery required close collaborations among surgeons, engineers, cardiologists, anaesthesiologist's, and haematologists.[3]

The field of invasive cardiology soon emerged, built on the pioneering work of Dotter and Judkins, although Andreas Grüntzig is considered the father of percutaneous interventional cardiology.[4] The initial technique of balloon angioplasty was followed by the insertion of bare metal stents, and today, drug-eluting stents are used to prevent coronary restenosis.[5]

In 1976, cardiologists were able to open acutely occluded coronary arteries by intracoronary infusion of the fibrinolysis agent streptokinase.[6]

Although communicable diseases continue to be a major cause of death, CVD has emerged as a significant health concern in these countries.[7] Coronary Artery Disease (CAD) is a well-known leading cause of mortality worldwide[8] and by the year 2020 will be first in the leading causes of disability.[9]

While the death rates have been declining for the past three decades in the West, these rates are rising in India. In the last three decades, the prevalence of CAD has increased from 1.1% to about 7.5% in the urban population and from 2.1% to 3.7% in the rural population.[10]

Regardless of improvement in primary prevention and treatment Acute Coronary Syndrome (ACS) remains the primary cause of death in the United States and most developed countries.[11] Almost 50% of all victims of MI die before they reach the hospital.[12]

Platelet Indices: Mean platelet volume (MPV) is a machine-calculated measurement of the average size of platelets found in blood. High MPV associates with a variety of established risk factors, cardio- and cerebrovascular disorders, and low-grade inflammatory conditions prone to arterial and venous thrombosis.

A typical range of platelet volumes is 8.1+/-0.6 fL (femtolitre), equivalent to spheres 2.65 to 2.9 µm in diameter.[13]

The PDW indicates the platelet distribution width measured at 20% relative height of the total height of the curve. An increased PDW is an indication for the anisocytosis of platelets. Standard PDW ranges 11.9+/- 1.8 (38-39). The platicrit indicates total percentage of platelet in along with other cell lineages measures 0.19+/- 0.1 %.[14]
There are potential confounding factors of MPV.

It has been shown that MPV values vary between different ethnicities furthermore; medications and illness also influence this value. For example, obesity, smoking, aging and diabetes increase MPV values, but aspirin, clopidogrel and inflammatory bowel disease decrease MPV values.[15]

Platelet activation plays a central role in the transformation of atherosclerotic cardiovascular disease (CVD) into its potentially major adverse clinical events, such as ischemic stroke and myocardial infarction (MI).

Increased platelet activation may also represent the net patho-physiological effects of a number of CVD risk factors, such as smoking and raised cholesterol, thus representing a broad marker of CVD risk.

Platelet activation leads to changes in platelet shape (increasingly spherical) with increased platelet swelling leading to an increase in platelet mass and volume. Traditional measures of platelet function/activation, such as the quantification of platelet derived metabolic parameters and the use of platelet aggregometry are technically difficult.

Acute coronary syndrome result from acceleration of this chronic process characterized by rupture or fissuring of an unstable atherosclerotic plaque, accompanied by a cascade of platelet reactions resulting into thrombus formation.[16]

Platelets play a crucial role in pathogenesis of atherosclerotic complications, contributing to thrombus formation or apposition after plaque rupture.[17] After rupture of arteriosclerotic plaque in coronary arteries, platelets hyperactivity and local platelets activation have been suggested to play a causal role in prothrombotic events leading to MI.[18]

An increased platelet reactivity and shortened bleeding time are associated with increased platelet volume, therefore; platelet size has been considered to reflect platelet level of activity as the large platelets are more active than small platelets and they have a higher thrombotic potential due to high concentration of thromboxane A2.This study was conducted with the objective:

Materials & Methods: This prospective study was carried out in the department of General Medicine, Karnataka institute of medical sciences; Hubli. Patients admitting to ICCU KIMS, HUBLI diagnosed as Acute Coronary Syndrome.

Sample Size: The study included 156 patients admitted to ICCU KIMS Hubli who diagnosed as ACUTE CORONORY SYNDROME and met inclusion and exclusion criteria.

Inclusion Criteria: Patients with clinical manife stations, ECG and enzymatic changes suggestive of STEMI, Unstable angina and NSTEMI.

Exclusion Criteria: Patients with bleeding disorder ,Preeclampsia and sepsis. Known case of IHD/CVA on anti platelet and ethnic group like Bengali. Patients who are receiving drugs which can cause thrombocytopenia and inflammatory conditions like connective tissue disorders. Patients with infections known to cause thrombocytopenia.

Investigations: Complete haemogram (including MPV, PDW and Platicrit). RBS, Urea, Creatinine and cardiac biomarkers. Serum Electrolytes and lipid profile. Serum lipid profile. ECG. 2Decho. CAG.

Statistical Analysis: Data was entered into Microsoft excel data sheet and was analysed using SPSS 22 version software. ANOVA (Analysis of Variance) test was used. MS Excel and MS word was used to obtain various types of graphs such as bar diagram, Pie diagram.

P- value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

Result: In the study 156 subjects were included. Of them 15.4% were in the age group <40 years, 21.2% were in the age group 41 to 50 years, 32.1% were in the age group 51 to 60 years, 23.7% were in the age group 61 to 70 years and 7.7% were in the age group >70 years.

Study group including predominantly male (67.9%) patients as compared to female patients (32.10%). Table 1

Table 1: Profile Of Subjects In The Study

		Count	%
Age	<40 Years	24	15.4%
	41 to 50 years	33	21.2%
	51 to 60 years	50	32.1%
	61 to 70 years	37	23.7%
	>70 years	12	7.7%
Sex	Female	50	32.1%
	Male	106	67.9%
DM	Diabetic	52	33.3%
	Non diabetic	104	66.7%
HTN	No	106	67.9%
	Yes	50	32.1%
FH	CAD	5	3.2%
	DM	19	12.2%
	HTN	11	7.1%
	No	121	77.6%
Smoker	No	110	70.5%
	Yes	46	29.5%
Alcohol	No	118	75.6%
	Yes	38	24.4%
Tobacco	No	82	52.6%
	Yes	74	47.4%

In the study on ECG, 19.9% had unstable angina, 72.4% had STEMI, 7.7% had NSTEMI. 9% had ALWMI, 9.6% had ASWMI, 21.8% had AWMI, 31.4% had IWMI, 8.3% had NSTEMI and 19.9% had unstable angina. On CAG, 12.8% had normal CAG, 48.7% had SVD, 18.6% had DVD, 18.6% had TVD and 1.3% had Insignificant Coronary Artery Disease. Table 2

Table 2: ECG, CD AND CAG Findings Among Subjects

		Count	%
ECG	Unstable Angina	31	19.9%
	STEMI	113	72.4%
	NSTEMI	12	7.7%
DIAGNOSIS	ALWMI	14	9.0%
	ASWMI	15	9.6%
	AWMI	34	21.8%
	IWMI	49	31.4%
	NSTEMI	13	8.3%
	USA	31	19.9%
CAG	Normal	20	12.8%
	SVD	76	48.7%
	DVD	29	18.6%
	TVD	29	18.6%
	Insignificant Coronary Artery Disease	2	1.3%

Mean PDW was 13.87 ± 2.90, mean MPV was 11.27 ± 2.40, Mean Platelet crit was 0.30 ± 0.16. Table 3

Table 3: Mean And SD Of Various Laboratory Parameters Measured In The Study

	Mean	SD
RBS	138.40	63.39
Urea	28.60	16.46
Creatinine	0.98	0.30
TCH	207.72	63.47
TGS	154.49	56.61
HDLC	50.59	21.60
LDLC	85.12	30.07
HB	12.77	2.84
TC	9659.67	3839.64
TP	2.41	1.01
PDW	13.87	2.90
MPV	11.27	2.40
Platelet Crit	0.30	0.16
Ejection Fraction	48.86	8.71

In our there was significant difference in mean PDW, MPV and Platelet crit with respect to Type of coronary syndrome that is indices are higher in STEMI and NSTEMI as compared to USA and it was statistically significant. Table 4

PDW: NSTEMI>STEMI>USA
MPV: STEMI>NSTEMI>USA
Plateletcrit: STEMI=NSTEMI>USA

Table 4: Platelet Indices Correlation With Respect To Diagnosis Of Acute Coronary Syndrome

	Acute Coronary Syndrome						P value
	Unstable Angina		NSTEMI		STEMI		
	Mean	SD	Mean	SD	Mean	SD	
PDW	12.4	3.5	14.8	2.6	14.2	2.8	0.005*
MPV	10.2	2.1	11.5	2.5	11.6	1.3	0.016*

Platelet Crit	0.2	0.1	0.3	0.2	0.3	0.2	0.002*

PDW: TVD>SVD>DVD
MPV: TVD>SVD>DVD
Plateletcrit: TVD=SVD=DVD

In the study there was significant difference in mean PDW and MPV with respect to CAG findings and it was statistically significant. Platicrit values are not statically significant. Table 5

Table 5: Platelet Indices Correlation With Respect To Vessels Affected As Detected By CAG

	CAG										P value
	Normal		SVD		DVD		TVD		ICAD		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
PDW	11.7	1.4	14.0	2.8	13.8	2.9	15.3	3.1	11.8	1.5	<0.001*
MPV	10.0	1.3	11.5	3.0	11.0	1.1	11.9	2.0	9.8	0.1	0.032*
Platelet Crit	0.2	0.1	0.3	0.2	0.3	0.1	0.3	0.2	0.2	0.1	0.035*

Discussion: Most important risk factor for coronary artery disease was tobacco chewing followed by DM, HTN, and smoking and alcohol risk was found to be more in people who had habits of both alcohol and smoking.

Many studies were done to find the co relation between platelet indices and acute coronary syndrome especially MPV as they have potential diagnostic and prognostic value. There is considerable data suggestive of higher MPV in patients with STEMI and NSTEMI than in patients with USA as well as in patients with risk factors for atherosclerosis than in patients with no risk factors.

Platelet Indices In Acute Coronary Syndrome:
Platelet indices – MPV, PDW and Platicrit were assessed by auto analyser. In our study included a total of 50 females (32.1%) and 106 males (67.8%), majority of the cases were in the group of 51-60 years among them 113 cases of STEMI, 31 cases of USA and 12 cases of NSTEMI and it was compared with study done by Jasmin et al[19] which was included of 180 patients 60 patients with stable angina, 60 with acute coronary syndrome and 60 with non-cardiac chest pain.

Our study patients with STEMI having the mean values of MPV, PDW and PCT of 11.6fl, 14.2% and 0.3% respectively and in study[19] it was 11.2fL, 17.85% and 0.34% respectively in both studies results were statistically significant.

In our study patients with unstable angina having mean MPV, PDW and platicrit values of 10.2fl, 12.4% and 0.2% respectively and in another study [19] were 10.31fL, 16.75% and 0.36% respectively which both of were statistically significant. Our study showed mean platelet volume in the STEMI ,NSTEMI and USA groups 11.6fl and 11.5 fl and 10.2fl respectively compared to martin et al done study where MPV values were 10.09fl in STEMI and 9.72fl in non-cardiac chest pain both studies were statistically significant.

Our study showed mean platelet volume in the STEMI ,NSTEMI and USA groups 11.6fl and 11.5 fl and 10.2fl respectively compared Smyth et al showed that MPV in STEMI was 8.54fl and 8.1fl in non-cardiac chest pain both studies were statistically significant.

Our study showed mean platelet volume in the STEMI ,NSTEMI and USA groups 11.6fl and 11.5 fl and 10.2fl respectively compared with another study[20] showed that mean MPV of 9.40fl in STEMI and 8.2fl in NSTEMI both were statistically significant.

Our study showed mean platelet volume in the STEMI ,NSTEMI and USA groups 11.6fl and 11.5 fl and 10.2fl respectively compared with another study [21] showed that mean MPV value of 10.43fl in STEMI and 9.2fl in control cases both studies were statistically significant.

Our study constituted 156 patients, divided into three groups – 113 patients in STEMI, 12 NSTEMI and 31 in USA group compared to with another study [22] study where they have included 862 patients among them 192 cases were STEMI, 421 cases were USA,249 cases were Non ACS and and 184 cases were control. In our study, the mean values of MPV and PDW in STEMI patients were

11.6fl and 14.2% respectively and in with another study [22] mean MPV and PDW values were 9.15 FL and11.35 % respectively both study results were statistically significant.

Our study constituted 156 patients, divided into three groups – 113 patients in STEMI, 12 NSTEMI and 31 in USA group compared to shivprasad et al[23] study included total 120 patients among them 60 cases were ACS(STEMI/NSTEMI) and other 60 cases were non ACS patients. Our study patients with STEMI having the mean MPV, PDW and PCT values of 11.6fl, 14.2% and 0.3% respectively and in Shivaprasad et al study[23] patients with ACS(STEMI/NSTEMI) having mean MPV,PDW and PLT values of 11.56fl, 17.34% and 0.221% respectively and both were statistically significant.

Our study patients with USA having the mean MPV, PDW and PCT values of 10.2fl, 12.4% and 0.2% respectively and in shivaprasad et al[23] study patients with USA having mean MPV,PDW and PLT values of 10.5fl, 15% and 0.114% respectively and both were statistically significant.

In our study constituted of 156 patients, divided into three groups – 113 patients in STEMI, 12 NSTEMI and 31 in USA group included a total of 50 females (32.1%) and 106 males (67.8%), compared to with another study [24] study included total 364 patients among them 173 cases of STEMI and 191 cases of control.

In our study mean MPV and PDW values in STEMI patients were 11.6fl and 14.2% respectively compared to with another study [24] study it was 10.2±2.8 and 17.8% respectively both were statistically significant.

In our study mean MPV and PDW values in USA patients were 10.2% and 12.4% respectively and in with another study [24] study it was 8.5±0.9 and 16.3% respectively in control group both studies were statistically significant ($p<0.05$).

Our study showed Platicrit values of 0.3% in STEMI ,0.3% in NSTEMI groups and 0.2% in USA group and it is statistically significant was compared to Jasmin et al[19] study in that platicrit values were 0.36+-0.13% in STEMI , 0.34+-0.12% in NSTEMI and 0.24+_0.007% in USA which was also statistically significant.

Platelet Indices In Relation To Severity Of CAD: In the study there was significant difference in mean PDW and MPV with respect to CAG findings, PDW: TVD>SVD>DVD, MPV: TVD>SVD>DVD but platicrit values are not significantly associated with severity of CAD Plateletcrit: TVD=SVD=DVD.

In our study MPV in SVD, DVD and TVD was 11.5fl, 11fl and 11.9fl respectively compared to Ahmad and Roney et al[25] studies the mean MPV in TVD patients was 10.04±0.88738 fl and 9.22±0.67438 in DVD both were statistically significant ($P<0.05$). In our study mean PDW in SVD, DVD and TVD were 14%, 13.8% and 15.3% respectively and its statistically significant. In our study mean platicrit values in SVD, DVD and TVD were 0.3% which were not statistically significant.

It was concluded that the MPV was higher in patients with ACS than those in control group.

The study also showed that there was significant difference in MPV values between people with STEMI and NSTEMI and between people with DVD and TVD. Hence it might be useful as an additional cost efficient test in conjunction with other markers in the early prediction of ACS in the emergency room.

Larger platelets are haemostatic ally more active and hence carry risk for developing coronary thrombosis leading to ACS. Patients with increased MPV could be easily identified during routine haematological analysis.

Conclusion: The platelet indices: mean platelet volume (MPV), platelet distribution width (PDW) and platecrit are significantly higher in STEMI and NSTEMI groups when compared to USA group. There was statistical difference in the mean platelet volume, platelet distribution width and platicrit between the STEMI and NSTEMI group.

The present study and several other studies show that platelet volume indices vary between patients with coronary artery disease that is mean platelet indices values significantly more in TVD compared to DVD and SVD and these could be of some help to detect patients who are at risk for future cardiovascular events and they could be benefited with early aggressive anti platelets therapy.

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