


Original Research Article

Correlation of mean platelet volume with angiographic severity of coronary artery disease in acute coronary syndrome patients at Gandhi hospital

Suneetha Karumuri^{1*}, Prem Kumar A², Dinakar Thatimatla³, Nitin Kabra⁴

¹Associate Professor, ^{2,3}DM Resident, ⁴Professor and Head
Department of Cardiology, Gandhi Hospital, Secunderabad, India

*Corresponding author email: drsuneethaleo@gmail.com

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Abstract

Background: Coronary artery disease is one of the major health problems worldwide and in India in particular. WHO has declared coronary artery disease as “Modern Epidemic”. Risk factors have traditionally been used to define the statistical likelihood of the development of clinical coronary disease in populations of asymptomatic patients. The study was being performed to evaluate relationship between mean platelet volume and angiographic severity of coronary artery disease in patients with acute coronary syndrome.

Materials and methods: A total of 200 adult patients with ACS or some electrocardiographic changes pointing to ischemia or who had stable angina pectoris and an indication for coronary angiography were evaluated. Relationship between MPV and extent and severity of CAD using Syntax and Gensini scores studied in comparison with other conventional risk factors.

Results: In this study there was positive correlation between MPV and SYNTAX and GENSINI score and association between Gensini score and Gender, alcohol was highly statistically significant (p 0.0001). There was statistically significant association between Gensini score and Gender (p 0.02), diabetes p 0.037, Body Mass Index (p 0.003), smoking (p 0.002). Significant association between Syntax score and BMI (p 0.003), smoking (p 0.03) was noted. Mean Platelet Volume and hypertension, diabetes was statistically significant (p 0.047). In this study mean MPV value for AAWMI (11.39+/-1.08), IWMI (10.44+/-0.97), PWMI (10.20+/-1.41), stable angina (10.44+/-0.36),

unstable angina (11.38±0.92) and comparison of mean MPV between all these groups is highly statistically significant (p 0.0001).

Conclusion: Present study demonstrated that MPV has significant correlation with Syntax and Gensini scores. Hypertension was the commonest risk factor followed by overweight. Males had higher Gensini scores when compared to females. Significant association between Syntax score and conventional risk factors like diabetes, smoking, and overweight was noted. Significant association between Gensini score and conventional risk factors like gender, diabetes, smoking, overweight was noted. Significant association between MPV, HTN, Diabetes mellitus, Smoking was noted. Comparison of mean MPV with AAMI, IWMI, PWMI and USA is highly statistically significant.

Key words

Mean platelet value, Acute coronary syndrome, Angiography, Coronary artery disease.

Introduction

Coronary artery diseases (CAD) cause more deaths, disability and incurs greater economic cost than any other illness in today's world [1]. Large increase in CAD is projected and it is likely to become the most common cause of death world wide by 2020 [2]. CAD is a leading cause of morbidity and mortality worldwide, and the incidence of CAD has been gradually increasing [3]. Cardiovascular diseases have been gaining importance in India recently because of increased incidence of the disease. It is the first among top 5 causes of deaths in Indian population (rural vs. urban, economically backward vs. developed states, men vs. women and at all stages vs. middle age) [4]. According to a WHO report, the current age standardized CVD mortality rates among males and females in India (per 100,000) are 363-443 and 181-281 respectively [5]. Atherosclerosis is a multifactorial disease involving several cardiovascular risk factors including dyslipidemia, high blood pressure, a high blood glucose level, and smoking. Platelets represent an important link between inflammation, thrombosis, and atherogenesis [6, 7]. Platelets play a vital role in thrombus formation and in the pathogenesis of atherosclerosis in patients with myocardial infarction. After rupture of atherosclerotic plaques, platelets get activated and prothrombotic events start predisposing to myocardial infarction.

Platelet volume is a marker of platelet activation and function, and is measured using mean platelet volume (MPV) [8-11]. Mean platelet volume (MPV) is a machine-calculated measurement of the average size of platelets found in blood and is typically included in blood tests as part of the CBC. Since the average platelet size is larger when the body is producing increased numbers of platelets, the MPV test results can be used to make inferences about platelet production in bone marrow or platelet destruction problems. The MPV is perhaps the most widely studied platelet activation parameter [12]. Changes in the volumetric parameters of platelets could have prophylactic or diagnostic significance in thrombotic and pre thrombotic events [13]. MPV is elevated in patients with acute coronary syndrome (ACS), and is used as an independent predictor of recurrent myocardial infarction (MI) and cardiac death [14]. Increased MPV values are considered to closely correlate with primarily acute coronary syndromes and cardiovascular diseases, as well as well-known risk factors such as hypertension (HTN), diabetes mellitus (DM), and hyperlipidemia (HL) [15]. The study was being performed to evaluate relationship between mean platelet volume and angiographic severity of coronary artery disease in patients with acute coronary syndrome.

Materials and methods

All patients referred to the Department of Cardiology at Gandhi Medical College and Hospital, Secunderabad. 200 consecutive patients

aged more than 18 years with Acute Coronary Syndrome were selected and screened to determine if they met the study criteria.

The sample size was calculated depending on the previous study⁴ and the case load in the hospital with a power of 80% to detect a difference at the 95% confidence interval considering a Type I error (α) of 5% and Type II error (β) of 20% and power of the study, the sample size will be 200.

Inclusion criteria

- 200 consecutive patients aged more than 18 years with Acute Coronary Syndrome presenting to department of Cardiology, Gandhi Medical College and Hospital, Secunderabad.

Exclusion criteria

- Critically ill patients (patients with renal failure, hepatic failure, myeloproliferative disorder or malignancy).
- Patients having any platelet disorder as thrombocytopenia or thrombocytosis, patients with any bleeding or clotting disorder.
- Patients with cardiomyopathy, history of congenital heart disease, heart failure, valvular heart diseases, and pregnancy and patients on anti-inflammatory drugs.

Procedure

In 200 adult patients with chest pain suggestive of acute coronary syndrome, underwent a full clinical evaluation. A detailed history and clinical profile of patient included in proforma for etiological purpose and thorough evaluation including following investigations like: ECG, RBS, FBS, PPBS spectrophotometric determination using hexokinase, Cardiac enzymes TroponinI by enzyme linked immunofluorescent assay, CK MB-Enzyme Immunoassay for the Quantitative Determination of Creatine Kinase (CKMB) in serum, Serum Creatinine, Blood Urea - spectrophotometric determination by jaffes reaction. Blood sampling

was done for Mean platelet volume. MPV measured within 1-2 hours of sample collection using SYSMEX 4000 I analyzer. The blood was collected by venepuncture into a tube containing ethylenediaminetetraacetic acid.

Selective coronary angiography performed by the femoral approach using the Judkins technique or the right radial approach and SIEMENS AXIOM ARTIS angiographic system. Multiple views were obtained, with visualization of the left anterior descending (LAD) and left circumflex coronary artery in at least four projections, and the right coronary artery in at least two projections. Angiographic evaluations were done by two experienced cardiologists, who were blinded to the study. The extent and severity of CAD were assessed by the Gensini score and Syntax score.

The Gensini score was calculated by multiplying the severity coefficient, which was assigned to each coronary stenosis according to the degree of luminal narrowing (reductions of 25%, 50%, 75%, 90%, 99%, and complete occlusion were given Gensini scores of 1, 2, 4, 8, 16, and 32, respectively), by the coefficient identified based on the functional importance of the myocardial area supplied by that segment: the left main coronary artery, 5; the proximal segment of the left anterior descending coronary artery, 2.5; the mid segment of the left anterior descending coronary artery, 1.5; the apical segment of the left anterior descending coronary artery, 1; the first diagonal branch, 1; the second diagonal branch, 0.5; the proximal segment of the circumflex artery, 2.5 (if right coronary artery dominance exist 3.5); the distal segment of the circumflex artery, 1 (if dominant, 2); the obtuse marginal branch, 1; the posterolateral branch, 0.5; the proximal segment of the right coronary artery, 1; the mid segment of the right coronary artery, 1; the distal segment of the right coronary artery, 1; and the posterior descending artery, 1.

SYNTAX score 105 was used to estimate the extent and severity of the CAD through the assessment of the number of angiographically

detected coronary lesions, their functional effects, locations, and complexity. The following variables were taken into consideration for SYNTAX score estimates: coronary dominance, location at bifurcation, trifurcation, or ostial lesions, tortuosity, calcifications, the content of the thrombus, presence of diffuse disease, and elongated lesions. This tool provided guidance on the appropriate revascularization technique to be used. SYNTAX scores were calculated to estimate the extent and severity of the CAD. Narrowing of coronary arteries greater than 50% in a vessel with a diameter exceeding 1.5 mm was considered a significant lesion. SYNTAX scores were calculated and the prognostic value of the SYNTAX score in relation to cardiovascular events, which were defined as low-risk (SYNTAX score 0–22), intermediate-risk (SYNTAX score 23–32) and high-risk (SYNTAX score > 32) was determined.

Smoking

We measured smoking in terms of pack years. The pack-year is a unit for measuring the amount a person has smoked over a long period of time. It is calculated by multiplying the number of packs of cigarettes smoked per day by the number of years the person has smoked.

Diabetes mellitus

Known diabetics on treatment

Newly detected diabetes mellitus.

- Symptoms of diabetes mellitus with random blood glucose >200 mg/dl (11.1 mmol/L)
- Fasting plasma glucose > 126 mg/dl (7.0 mmol/L)
- 2 hr plasma glucose > 200 mg/dl (11.1 mmol/L) during OGTT (75-g)
- HbA1C > 6.5%

Hypertension

Patients having elevated blood pressure show accelerated atherogenesis and an increased incidence of coronary artery disease.

- Known hypertensives on treatment

- Newly detected hypertension according to JNC VIII criteria.

Obesity

Patients were classified as overweight and obese based on body mass index

BMI = Weight (kg)/height (m²). The currently recommended cut-offs of BMI recommended by World Health Organization include:

- 18.5 - 24.9 kg/m² - Normal
- 25.0 - 29.9 kg/m² - Overweight
- >30 kg/m² -Obesity

Dyslipidemia

According to NCEP-ATP III guidelines, patients were considered to have dyslipidemia when.

1. Total cholesterol > 200 mg/dl.
2. HDL < 40 mg/dl.
3. LDL >100mg/dl.

Statistical analysis

Data was collected by using a structure proforma. Data entered in MS excel sheet and analyzed by using SPSS 19.0 version IBM USA. MS Word and Excel had been used to generate graphs, tables etc. Descriptive statistics of each variable was presented in terms of Mean, standard deviation, standard error of mean. Qualitative data was expressed in terms of proportions. Quantitative data was expressed in terms of Mean and Standard deviation. Correlation between two quantitative variables was assessed by using Pearson's correlation coefficient test (r). Association between two qualitative variables was tested by using chi square and Fischer's exact test. A p value of <0.05 was considered as statistically significant whereas a p value <0.001 was considered as highly significant.

Results

The mean age of the study population was observed as (57.60 +/-11.46) with a minimum age of 28 years and a maximum age of 88 years. The mean MPV value of the study population was (11.09 +/- 1.12) with minimum MPV value of 8.60 and maximum MPV value of 13.70. The mean BMI of the study population

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(25.72+/-2.23) with minimum BMI value of 20 and maximum BMI value of 33. The mean SYNTAX score of the study population was (18.5 +/-12.32) with minimum SYNTAX score of 2 and maximum SYNTAX score of 42. The mean GENSINI score of study population was (36.33+/-27.44) with minimum GENSINI score of 2 and maximum GENSINI score of 112 (Table – 1 to 4).

Table – 1: Distribution of sample according to coronary angiogram.

Distribution according to Coronary angiogram

Coronary angiogram	Frequency	Percent
Double vessel disease	64	32.0
Single vessel disease (LAD)	46	23.0
Single vessel disease (RCA)	41	20.5
Triple vessel disease	49	24.5
Total	200	100.0

Table – 2: Correlation of MPV with SYNTAX and GENSINI score.

Correlation of MPV with SYNTAX and GENSINI score

Mean Platelet Volume [fl]	Syntax score	Gensini score
Pearson Correlation	.512**	.414**
p	.0001	.0001
Inference	Positive correlation	Positive correlation

Table – 3: Comparison of MPV between all groups.

Comparison of Mean Platelet Volume between all groups together

	N	Mean	Std. Deviation	F	p	Inference
Anterior wall MI	126	11.39	1.08	9.26	0.0001 (<0.001)	Highly significant
Inferior wall MI	55	10.44	.97			
Posterior wall MI	2	10.20	1.41			
Stable angina	5	10.44	.36			
Unstable angina	12	11.38	.92			
Total	200	11.09	1.12			

Table – 4: Descriptive statistics.

Descriptive statistics

	N	Mean	Std. Deviation	Std. Error	Range	Minimum	Maximum
Age	200	57.60	11.46	.81	60	28	88
MPV[fl]	200	11.09	1.12	.08	5.10	8.60	13.70
Syntax score	200	18.5	12.3	1.10	40	2	42
Gensini score	200	36.33	27.44	1.94	107.0	2.0	109.0
BMI	200	25.72	2.33	.16	13	20	33

Table – 5: Association between GENSINI score and alcohol.

Association between Gensini score and alcohol

Alcohol	Gensini score						Total	Fischer's exact test	p	Inference
	0 – 24		25-53		≥ 54					
	No	%	No	%	No	%				
Present	27	30.3	35	63.6	30	53.6	92	16.96	0.0001 (<0.001)	Highly significant
Absent	62	69.7	20	36.4	26	46.4	108			
Total	89	100.0	55	100.0	56	100.0	200			

Discussion

In the present study, the mean age of the study population observed as (57.60 +/- 11.46) with a minimum age of 28 years and a maximum age of 88 years, highest number of patients 31.5 % were in age group between 51-60 years and least number 7.5% were in <40 years of age. In this study, population males constituted around 69% and females constituted 31%. The mean BMI of the study population (25.72+/-2.23) with minimum BMI value of 20 and maximum BMI value of 33, in this study 37% were of normal weight, 59% were overweight and 4% are obese.

Hypertension was the common risk factor seen in 67% of patients followed by overweight which was seen in 59% of study group. Diabetes

mellitus was observed in 46% of patients. 48.5% of the study group was smokers and 51.5% were non-smokers. 54% of the study group was chronic alcoholics and dyslipidemia was present in 42%.

The mean Gensini score of study population was (36.33+/-27.44) with minimum Gensini score of 2 and maximum Gensini score of 112. 44.5% of patients had Gensini score between 0-24, 27.5% had Gensini score between 25 and 53, 28% had Gensini score more than 54. The mean Syntax score of the study population is (18.5 +/-12.3) with minimum Syntax score of 2 and maximum Syntax score of 42. 67% of patients had Syntax score between 0-22, and 10% had Syntax score

between 23 and 33 and 23% of patients have Syntax values more than 33.

Association between Syntax and age was not statistically significant (p 0.72) and association between gensini score and age was also not statistically significant (p 0.4). Association between Syntax score and gender was not statistically significant (p 0.25) whereas association between Gensini score and gender was statistically significant (p 0.02). Gensini scores were higher among males when compared to females and was statistically significant which is similar in other studies.

The association between MPV, age, gender, alcohol and dyslipidemia was not statistically significant whereas association between MPV and hypertension was statistically significant (p 0.047) and results were comparable to other studies. There was no statistical significance between hypertension and Syntax and Gensini scores, with syntax and hypertension (p 0.71) with gensini score and hypertension (p 0.18) which were comparable to other studies.

The association between Syntax and Gensini scores and diabetes was statistically significant, with syntax score and DM (p 0.04) and gensini score and DM (p 0.03) similar results were shown in other studies. The association between Syntax and Gensini scores and BMI was statistically significant, with syntax score and BMI (p 0.003) and gensini score and BMI (p 0.003). Association between Syntax and dyslipidemia was not statistically significant with a p value of 0.08.

The association between Gensini score and dyslipidemia was not statistically significant (p 0.56). Association between Syntax score and alcohol was not statistically significant (p 0.18). Association between Gensini score and alcohol was highly statistically significant (p 0.001). The mean MPV value of our study population was (11.09 +/-1.12) with minimum MPV value of 8.60 and maximum MPV value of 13.70. In our study 35% of patients had normal MPV and 65%

of patients had high MPV values. There was positive correlation between MPV and SYNTAX and GENSINI score and it was highly statistically significant (p 0.0001). With this study we observed a positive correlation between MPV and Gensini and SYNTAX scores. Therefore, this simple hematology test can be used in determining cardiovascular disease burden besides other risk factors during routine clinical practice.

Conclusion

MPV has significant correlation with Syntax and Gensini scores. Hypertension was the commonest risk factor followed by overweight. Males had higher Gensini scores when compared to females. Significant association between Syntax score and conventional risk factors like Diabetes, Smoking, Overweight was noted. Significant association between Gensini score and conventional risk factors like Gender, Diabetes, Smoking, Overweight was noted. Significant association between MPV, HTN, Diabetes mellitus, Smoking was noted. Comparison of mean MPV with AWM, IWMI, PWMI and USA is highly statistically significant.

Limitations

However, limitations in this study are small group of patients, study conducted at a tertiary care center in south India hence results cannot be generalized to all population, usage of coronary angiography for determining total atherosclerotic burden tends to underestimate plaques that show positive remodeling and the SYNTAX score which has high inter and intra observer variability used to estimate severity of this study.

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