

Mean Platelet Volume as A Diagnostic Predictor in Myocardial Infarction

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Abstract

Background: Platelets play a pivotal role in both hemostasis and thrombosis. Mean platelet volume (MPV) is a measure of the average size of your platelets. Mean platelet volume (MPV) has been found to be an independent risk factor in western populations and also from Indian Data. **Aims:** To investigate whether there is association between Mean Platelet Volume (MPV) and Cardiac Troponins (C Tn I) in patients admitted with suspected case of Myocardial infarction. To Assess the potential efficiency of MPV in the diagnostic workup of Myocardial infarction. **Methodology:** 100 patients admitted in SDM Medical College and Hospital casualty and CCU of Narayana Hrudayala were included in this study after taking informed consent. **Results:** In our study, we found that only 5 % of patients has MPV Value more than 11.5 out of 100 patients, 20 % of patients has MPV value more than 10. It is observed that it MPV is higher in males with mean value of 9.27 compared to females which is 8.946. where as Troponin-I is higher in females with mean value 5.089 in comparison with males which is 5.303. **Conclusion:** Mean platelet volume (MPV) has been found to be an independent risk factor in western populations and also from Indian Data. Hence we thought it appropriate to look at this parameter in Indian patients with history of MI or CAD.

Keywords: Myocardial Infarction; Mean Platelet Volume; Troponin.

Introduction

Mean Platelet Volume: Mean platelet volume (MPV) is a measure of the average size of your platelets, a type of blood cell that helps prevent bleeding. MPV is particularly important in determining the cause of thrombocytopenia or thrombocytosis and it can be a useful diagnostic tool even if your platelet count is normal.

When an injury occurs, platelets aggregate to plug the wound and send hormone signals through the blood to attract protein clotting factors, which assist in repairing the injury.¹

Platelet count is measured as a part of the complete blood cell count (CBC) with automated blood cell counters along with in most analysers the mean platelet volume (MPV).

MPV is an analyzer-calculated measure of thrombocyte (platelet) size, determined directly from analysis of the platelet size-distribution curve.

The MPV normal range (expressed in femtoliters (fl)).

Myocardial infarction (MI) and coronary artery disease (CAD) is a significant cause for morbidity and mortality even in developing countries like India. Significant risk factors such as diabetes, hypertension, smoking, hypercholesterolemia and lifestyle have been already studied. (Fig. 1)

The term myocardial injury should be used when there is evidence of elevated cardiac troponin values (cTn) with at least one value above the 99th percentile upper reference limit (URL). The myocardial injury is considered acute if there is a rise and /or fall of cTn values. (Fig. 2)

The aim of the study is to investigate whether there is association between Mean Platelet Volume (MPV) and Cardiac Troponins (C Tn I) in patients admitted with suspected case of Myocardial infarction and To Assess the potential efficiency of MPV in the diagnostic workup of Myocardial infarction. (Fig. 4)



Materials and Methods

The present study will be carried out in the patients admitted to Emergency Department and Cardiac Care Unit attached to Department of General Medicine, Sdm College Of Medical Sciences And Hospital, Sattur, Dharwad.

Sample size : 100 patients admitted to Emergency Department and Cardiac Care Unit in SDM Hospital from November 2017 to November 2018 will be subjected for the study.

Study Design: An observational, descriptive, comparative study.

Inclusion criteria

ACS was diagnosed based on the presence of either of the criteria:

1. Detection of rise in cardiac biomarker Trop I > 0.01 for acute myocardial infarction.
2. For Unstable Angina where Trop I is < 0.01 , with atleast one of the following four:
 - a. Typical symptom of ischemia.
 - b. ECG changes indicative of new ischemia.
 - c. Development of pathological Q wave in the ECG.
 - D. Echocardiographic evidence of new regional wall motion abnormality.

Exclusion criteria

1. Patients with chest pain of > 6 hrs .
2. Critically ill patients (ACS associated with Renal Failure, Hepatic Failure, Myeloproliferative disorder or Malignancy).
3. Patients having any platelet disorder as Thrombocytopenia or Thrombocytosis.
4. Patients with any Clotting or Bleeding Disorder.
5. Patients with Antiplatelet Therapy.

Statistical analysis:

- Student t- test.
- Chi square test.

Collection of data (including sampling procedure, if any):

A pretested proforma meeting the objectives of the study is prepared. The cases for the study are

selected in accordance with the above mentioned inclusion and exclusion criteria.

The data is collected according to the proforma in terms of detailed history, clinical examination and the necessary investigations. The following investigations will be carried out.

Investigations Required:

Blood sample for :

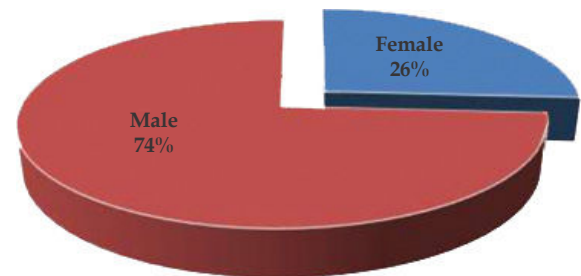
1. Trop I sample.
2. CKMB
3. BNP
4. 2 D ECHO
5. 12 Lead ECG.

Ethical clearance was obtained by the ethical committee of Shri Dharmasthala Manjunatheshwara College Of Medical Sciences and Hospital, Dharwad ref :SDMIEC:0349:2017

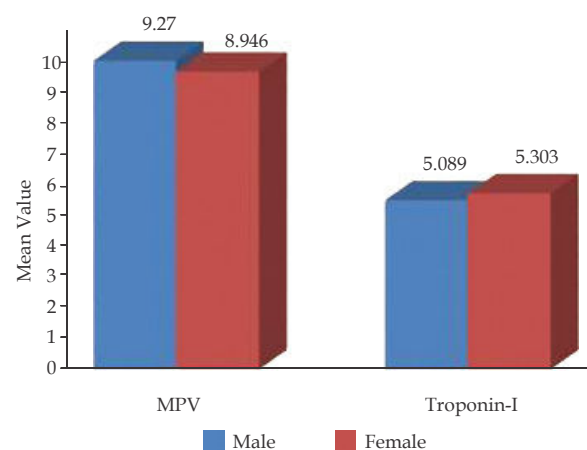
Results

100 patients admitted in SDM Medical College and Hospital casualty and CCU of Narayana Hrudayala were included in this study after taking informed consent.

In the study group Of 100 patients, 74 pateints were male and 26 were female. (Graph 1)



Graph 1: Gender Distribution.



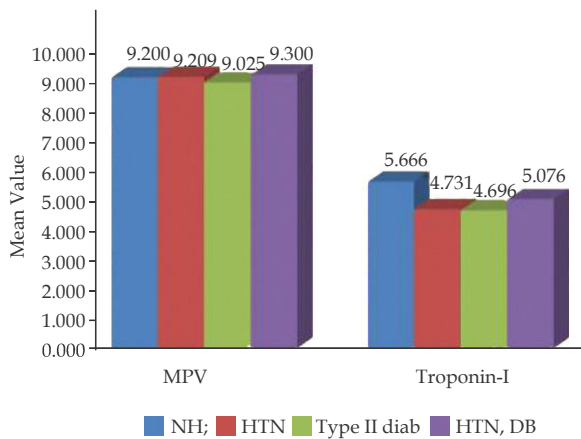
Graph 2: Comparison of MPV With Troponin-I Genderwise.

Table 1: Statistics.

Statistics	Age	MPV	TROPONIN -I	CK-MB	BNP	Creatinine	HB	TLC	Platelet Count	
N	100	100	100	100	100	100	100	100	100	
Mean	59.020	9.186	5.145	20.224	406.261	1.056	13.443	10592.900	2.911	
Median	60.000	8.800	2.075	10.850	177.000	.945	13.600	9600.000	2.895	
Std. Deviation	12.149	1.573	7.134	22.599	565.000	.625	2.391	3483.838	.957	
Range	54.000	7.200	29.950	79.000	3255.000	5.840	12.500	20330.000	4.460	
Minimum	30.000	6.600	.050	1.000	5.000	.400	6.300	4470.000	.630	
Maximum	84.000	13.800	30.000	80.000	3260.000	6.240	18.800	24800.000	5.090	
Percentiles	25	49.000	8.100	.153	3.613	50.125	.800	12.325	8100.000	2.243
	75	67.000	10.300	7.368	28.300	551.250	1.200	14.985	12845.000	3.573

From the above graph it is observed that MPV is higher in males with mean value of 9.27 compared to females which is 8.946. (Graph 2)

Where as Troponin-I is higher in females with mean value 5.089 in comparison with males which is 5.303.



Graph 3: Comparison of Mean MPV and Troponin -I, Comorbidity wise.

It is observed that out of 100 patients, MPV is higher in patients with type 2 DM and HT with mean value of 9.300 followed by patients with HTN alone with mean value of 9.029, followed by patients with no comorbidities with mean value of 9.200 followed by type 2 DM which is 9.025. where as troponin -I was higher in patients with no comorbidities with mean value of 5.666, followed by patients with type 2 DM and HTN with mean value of 5.076, followed by HTN with mean value of 4.731, followed by type 2 DM with mean value of 4.696. (Graph 3) (Table 1)

Table 2: Gender.

Gender	Frequency	Percent
Female	26	26.0
Male	74	74.0
Total	100	100.0

Table 3: Complaints

Complaints	Frequency	Percent
Chest Pain	20	20.0
Chest Pain Associated with Sweating	1	1.0

Chest Pain Radiating To Neck	1	1.0
Chest Pain, Sweating	1	1.0
Chest Pain and Discomfort, Vomiting	1	1.0
Chest Pain, Dyspnea	4	4.0
Chest Pain, Dyspnea On Exertion	1	1.0
Chest Pain, Giddiness	6	5.0
Dyspnoea On Exertion	2	2.0
Breathlessness On Exertion	1	1.0
Breathlessness, Dry Cough	1	1.0
Breathlessness, Sweating	1	1.0
Chest Pain Radiating To Back	1	1.0
Chest Pain, Epigastric Discomfort	1	1.0
Chest Pain, Fatigue	1	1.0
Epigastric Discomfort	2	2.0
Epigastric Discomfort, Vomiting	1	1.0
Breathlessness On Exertion	1	1.0
Chest Discomfort, Vomiting, Dyspnoea	1	1.0
Chest Pain , Sweating, Giddiness	1	1.0
Chest Pain Associated With Sweating	3	3.0
Chest Pain Radiating To Back	2	2.0
Chest Pain Radiating To Back, Sweating	1	1.0
Chest Pain, Vomiting	1	1.0
Dyspnoea On Exertion, Chest Pain	2	2.0
Dyspnoea On Exertion, Giddiness	1	1.0
Retrosternal Chest Pain	1	1.0
Retrosternal Chest Pain, Dyspnea	2	2.0
Breathlessness, Dry Cough	1	1.0
Breathlessness, Giddiness	1	1.0
Chest Pain Radiating To Left Arm	4	4.0
Dyspnoea On Exertion, Dry Cough	1	1.0
Retrosternal Chest Pain, Breathlessness	1	1.0
Sudden Onset Breathlessness	1	1.0
Breathlessness On Exertion, Vomiting	1	1.0
Chest Pain Radiating To Back	1	1.0
Chest Pain Radiating To Back, Sweating	1	1.0
Chest Pain Radiating To Both Upper Arms	5	5.0
Chest Pain Radiating To Left Arm	8	8.0
Chest Pain Radiating To Left Upper Arm	1	1.0
Chest Pain Radiating To Right Arm	1	1.0
Chest Pain, Breathlessness	9	9.0
Chest Pain, Giddiness	2	2.0
Total	100	100.0

Table 4: Co-Morbidities.

Co-Morbidities	Frequency	Percent
Nil	38	38.0
Htn	23	23.0
Type 2 DM	19	19.0
Type 2 DM, COPD	1	1.0
Type 2 DM , HTN	18	18.0
Type 2 DM, HTN, Hypothyroidism	1	1.0
Total	100	100.0

Table 5: Type of MI.

Type of MI	Frequency	Percent
ACS	1	1.0
CAD	11	11.0
CAD-NSTEMI	1	1.0
IHD	13	13.0
ACS- NSTEMI	1	1.0
Inferior Wall	22	22.0
ACS	6	6.0
Anterior Wall	34	34.0
Antero- Lateral	3	3.0
Unstable Angina	1	1.0
CAD, Type 2 DM, HTN	1	1.0
Extensive Anterior Wall	2	2.0
Antero-Inferior Wall	1	1.0
Antero-Septal Wall	3	3.0
Total	100	100

Table 6: Diagnosis.

Diagnosis	Frequency	Percent
ACS- NSTEMI	1	1.0
Anterior Wall MI	1	1.0
Anterior Wall MI	11	11.0
Anterior Wall MI, Cardiogenic Shock	1	1.0
Antero-Inferior Wall MI	1	1.0
Antero-Septal Wall MI	1	1.0
Antero-Septal Wall MI, Type 2 DM	2	2.0
Extensive Anterior Wall MI	1	1.0
Extensive Anterior Wall MI, Type 2 DM, HTN	1	1.0
Ischaemic Heart Disease	1	1.0
Unstable Angina	1	1.0
Coronary Artery Disease	1	1.0
Coronary Artery Disease, HTN	1	1.0
Ischaemic Heart Disease , Type 2 DM	1	1.0
Acute Antero-Lateral Wall MI	1	1.0
Acute Coronary Syndrome	2	2.0
Acute Coronary Syndrome, HTN	1	1.0
Acute Coronary Syndrome, Type 2 DM	2	2.0
Acute Coronary Syndrome, HTN	1	1.0
Anterior Wall MI,Pulmonaty Edema	1	1.0
Anteriorwall MI, HTN	11	11.0
Anteriorwall MI, Type 2 DM	7	7.0

Anteriorwall MI, Type 2 DM, HTN	2	2.0
Antero- Lateral MI, Type 2 DM	1	1.0
CAD, Type 2 DM, HTN	1	1.0
Coronary Artery Disease	3	3.0
Inferior Wall MI	11	11.0
Inferior Wall MI, HTN	5	5.0
Inferior Wall MI, Type 2 DM	1	1.0
Acute Coronary Syndrome, Type 2 DM, HTN	2	2.0
Anterolateral MI,Cardiogenic Shock	1	1.0
Coronary Artery Disease- Nstemi	1	1.0
Coronary Artery Disease, HTN, Type 2 DM	1	1.0
Coronary Artery Disease, Type 2 DM	1	1.0
Ischaemic Heart Disease	1	1.0
Ischaemic Heart Disease , Type 2 DM	4	4.0
Inferior Wall MI ,CCF,Pulmonary Edema	1	1.0
Ischaemic Heart Disease , Type 2 DM,HTN	9	9.0
Coronary Artery Disease, Atrial Fibrillation	1	1.0
Coronary Artery Disease, Type 2 DM, HTN	2	2.0
Total	100	100

Table 7: VS Gender.

vs Gender	Gender	N	Mean	Std. Deviation	t
MPV	Male	74	9.270	1.593	.903 p=0.369 ns
	Female	26	8.946	1.517	
Troponin -I	Male	74	5.089	6.909	.131 p=0.896 ns
	Female	26	5.303	7.882	
CK-MB	Male	74	20.909	22.992	.509 p=0.612 ns
	Female	26	18.277	21.758	
BNP	Male	74	408.600	599.774	.069 p=0.945 ns
	Female	26	399.604	462.233	
Creatinine	Male	74	1.125	.668	1.904 p=0.06 ns
	Female	26	857	436	
HB	Male	74	13.846	2.424	2.952 p=0.004 hs
	Female	26	12.296	1.906	
TLC	Male	74	10456.081	3545.244	.661 p=0.51 ns
	Female	26	10982.308	3339.030	
Platelet Count	Male	74	2.816	.970	1.696 p=0.093 ns
	Female	26	3.183	.882	

Table 8: Ver. Comorbidity.

Ver. Comorbidity	N	Mean	Std. Deviation	F	p	
MPV	Nil;	38	9.2000	1.74325		
	HTN	23	9.2087	1.43777		
	Type II DIAB	20	9.0250	1.21995		
	HTN,DB	19	9.3000	1.79320		
HB	Nil;	38	13.5861	2.52834		
	HTN	23	13.2174	2.05042		
	Type II diab	20	13.7650	1.67623		
	HTN,DB	19	13.0916	3.13904		
TLC	Nil;	38	11248.16	4058.764		
	HTN	23	10393.04	3358.427		
	Type II diab	20	10556.50	3356.606		
	HTN,DB	19	9562.63	2265.892		
Platelet Count	Nil;	38	2.6732	.91721		
	HTN	23	2.6904	.89020		
	Type II diab	20	3.3395	.87443		
	HTN,DB	19	3.2042	1.02947		

Table 9: VS Comorbidities.

VS Comorbidities	N	Mean	Std. Deviation	H	p	
Troponin -I	Nil;	38	5.6658	6.96942		
	HTN	23	4.7309	6.89226		
	Type II diab	20	4.6960	7.94031		
	HTN,DB	19	5.0758	7.37905		
CK-MB	Nil;	38	23.5853	23.94715		
	HTN	23	14.1261	17.74839		
	Type II diab	20	21.3500	26.84704		
	HTN,DB	19	19.7000	20.27957		
BNP	Nil;	38	351.4676	460.44093		
	HTN	23	354.2000	407.20837		
	Type II diab	20	509.0450	632.91834		
	HTN,DB	19	470.6737	817.63099		
Creatinine	Nil;	38	1.1503	.90966		
	HTN	23	.9330	.24522		
	Type II diab	20	.9460	.32176		
	HTN,DB	19	1.1300	.45889		

Table 10: Correlations.

Correlations		Troponin -I
MPV	R	.059
	p	.560
	N	100

Table 11: Correlations.

Correlations		CK-MB	BNP	Creatinine	HB	TLC	Platelet Count
MPV	R	.074	.038	.207	.131	.215	-.137
	p	.461	.709	.039	.195	.032	.174
	N	100	100	100	100	100	100

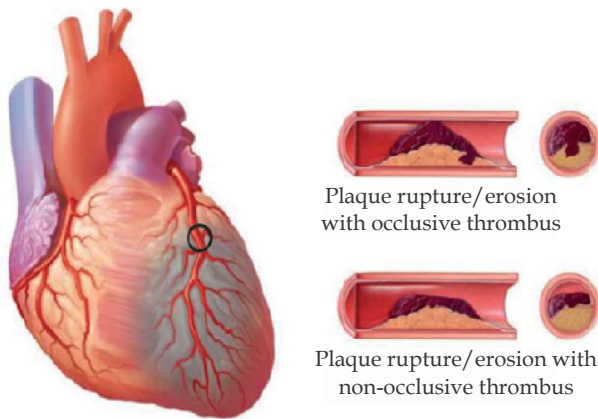


Fig. 1 : Myocardial Infraction Type 1.

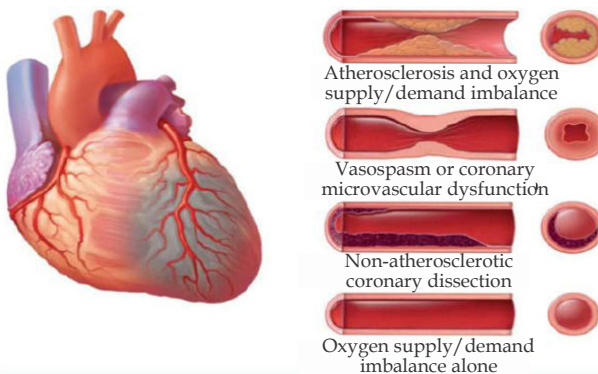


Fig. 2: Myocardial Infraction Type 2.

Discussion

Platelets play a pivotal role in both hemostasis and thrombosis. Mean platelet volume (MPV) is a measure of the average size of your platelets.

In this study we want to investigate whether there is association between Mean Platelet Volume (MPV) and Cardiac Troponins (C Tn I) in patients admitted with suspected case of Myocardial infarction. To Assess the potential efficiency of MPV in the diagnostic workup of Myocardial infarction. (Fig. 3)

Out of 100 patients with MI, 74 pateints were male and 25 were female, 20 patients were presented with chest pain alone, 9 patients were presented with breathlessness, 8 patients presented with pain radiating to left arm, 6 patients with dyspnoea on exertion, 6 patients with chest pain with giddiness. (Table 2)

It is observed that it MPV is higher in males with mean value of 9.27 compared to females which is 8.946.where as Troponin-I is higher in females with mean value 5.089 in comparison with females which is 5.303.

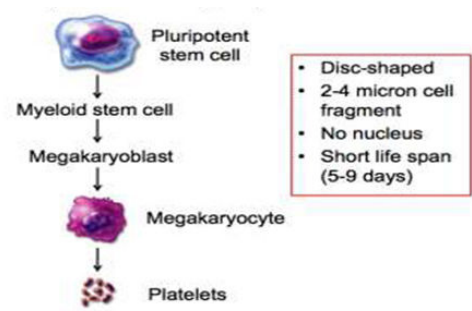


Fig. 3: Platelet (Thrombocyte) Production.

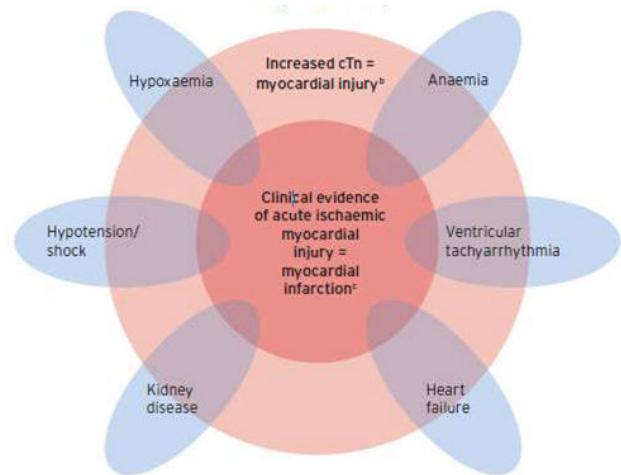


Fig. 4: No myocardial injury.

Out of 100 patients, 38 patients have no comorbid illness, 23 patients have hypertension, 19 patients have type 2 diabetes mellitus, 18 patients have type 2 diabetes mellitus and hypertension, 1 patient has type 2 diabetes mellitus, hypertension, hypothyroidism. (Table 4)

It is observed that out of 100 patients, MPV is higher in patients with type 2 DM and HTN with mean value of 9.300 followed by patients with HTN alone with mean value of 9.029, followed by patients with no comorbidities with mean value of 9.200 followed bt type 2 DM which is 9.025.

Where as troponin -I was higher in patients with no comorbidities with mean value of 5.666, followed by patients with type 2 DM and HTN with mean value of 5.076, followed by HTN with mean value of 4.731, followed by type 2 DM with mean value of 4.696.

Out of 100 patients , it is observed that 34 patients have anterior wall MI, 22 patients has inferior wall MI, 13 patients has ischaemic heart disease, 11 patients has coronary heart disease, 6 patients has acute coronary syndrome, 3 patients has anteroseptal , 3 patients has anterolateral MI, 2 patients has extensive anterior wall MI. (Table 5)

It is observed that platelet count is higher in females with mean value of 3.183 compared to males which is 2.816. On the other hand creatinine was higher in males with mean value of 1.125 compared to females which is 0.857.

It is observed that CK-MB is higher in males with mean value of 20.909, standard deviation of 22.992, compared to females which is 18.277 with standard deviation of 21.758. On the other hand it is observed that hemoglobin is higher in males with mean value of 13.846, standard deviation 2.424 when compared to females which is 12.296 with standard deviation of 1.906.

It is observed that mean platelet count is higher in patients with type 2 DM with mean value of 3.340 followed by type 2 DM and HTN with mean value of 3.204, followed by HTN alone with 2.690 followed by patients with no comorbidities. On the other hand creatinine was found to be higher in patients with no comorbidities followed by patients with type 2 DM and HTN with mean value of 1.130, followed by HTN alone with mean value of 0.933.

It is observed that mean BNP is higher in patients with type 2 DM with mean value of 509.045, followed by HTN and type 2 DM with mean value of 470.6737, followed by HTN alone with mean value of 354.2, followed by no comorbidities. (Table 6,9)

Conclusion

Myocardial infarction (MI) and coronary artery disease (CAD) is a significant cause for morbidity and mortality even in developing countries like India. Significant risk factors such as diabetes, hypertension, smoking, hypercholesterolemia and lifestyle have been already studied.

Mean platelet volume (MPV) has been found to be an independent risk factor in western populations and also from Indian Data. Hence we thought it appropriate to look at this parameter in Indian patients with history of MI or CAD.

100 patients admitted in SDM Medical College and Hospital casualty and CCU of Narayana Hrudayala were included in this study after taking informed consent.

In our study, we found that only 5% of patients has MPV Value more than 11.5 out of 100 patients, 20% of patients has MPV value more than 10.

It is observed that MPV is higher in males with mean value of 9.27 compared to females which is 8.946. Where as Troponin-I is higher in females

with mean value 5.089 in comparison with females which is 5.303. (Table 7)

Out of 100 patients, MPV is higher in patients with type 2 DM and HTN with mean value of 9.300 followed by patients with HTN alone with mean value of 9.029, followed by patients with no comorbidities with mean value of 9.200 followed by type 2 DM which is 9.025. (Table 8)

From earlier studies such as by Endler et al., we see that higher cut-off such as 11.6 have been used and this has been shown to be an independent risk factor. However in our observation we find that a very small number of patients had MPV values more than 11.

Khandekar et al., where 210 Indian patients were studied. They concluded that larger platelets are haemostatically more active and are a risk factor for developing coronary thrombosis, leading to myocardial infarction. Patients with larger platelets can easily be identified during routine haematological analysis and could possibly benefit from preventive treatment.

Kilicli et al. have studied 200 patients in Turkey and also noted that high MPV is an independent risk factor for coronary atherosclerosis and MI.

We however do not seem to agree with these studies and suggest that a larger cohort of patients be studied in India, and only then give significance to platelet indices.

Acknowledgement: NIL

Conflict of Interest: NIL

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