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Study of relation between mean platelet volume and acute coronary syndrome.

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Abstract

Objective: To investigate whether there is an association between mean platelet volume measurement and cardiac troponin T in patients admitted with a suspected diagnosis of acute coronary syndrome. To assess the potential diagnostic efficiency of mean platelet volume in the diagnostic workup for acute coronary syndrome. **Material and Methods -** Our study was observational study which was performed on all Acute Coronary Syndrome patients seeking medical attention in ICU/wards and healthy individuals coming for routine health checkup at SriAurobindo medical college and Post Graduate Institute, Hospital, during the study period (December 2018 – may 2020) **Result** Average mean platelet volume was significantly higher in cases (9.46f L) as compared to healthy individuals (7.7f L).

Conclusion We concluded that MPV examination can be used as a marker for screening test of ACS such as standardized marker, i.e. troponin T, in line with the previous studies which showed that MPV increases in cases of ACS.

Keywords: ACS, MPV, AHA, WHF.

Introduction

Acute coronary syndrome (ACS) encompass a spectrum of unstable coronary artery disease including UNSTABLE ANGINA, NSTEMI and STEMI.¹

Despite remarkable progress in diagnosing patients with ACS, the identification of acute coronary syndrome is still challenging, and physicians continue to admit the overwhelming majority of patients, often over evaluating the possibility of (ACS) in patients with a low risk for ACS.¹

The International Federation of Clinical Biochemistry (IFCB), European Society of Cardiology (ESC), The American College of Cardiology (ACC), The American Heart Association (AHA) and The World Heart Federation (WHF) have issued the consensus guidelines on a universal definition of MI (myocardial infarction) and have recommend the cardiac troponin I and cardiac troponin T (cTnT) measurements as the preferred biochemical cardiac biomarkers for diagnosing ACS.² Diagnostic efficiency of cardiac troponins is limited within two to four hours of onset of symptoms.³ Therefore, other laboratory tests are needed to significantly reduce the delay in hospital admissions of patients with chest pain in the emergency department

which have the potential to significantly increase clinical and hospital revenues.⁴

According to the previous studies done on relation between MPV and ACS, it is suggested that raised mean platelet volume may be a risk factor as well as an important and reliable marker for diagnosing ACS in patients with chest pain. MPV (mean platelet volume) is a simple and dependable index of platelet size and it also correlates with the functional condition of platelets and can be measured easily by simple laboratory test.

Aims and Objectives

To investigate whether there is an association between mean platelet volume measurement and cardiac troponin T in patients admitted with a suspected diagnosis of acute coronary syndrome.

To assess the potential diagnostic efficiency of mean platelet volume in the diagnostic workup for acute coronary syndrome.

Material and Methods

It was an observational study with a sample size of 140 patients of acute coronary syndrome and 140 controls (total 280). All Acute Coronary Syndrome patients seeking medical attention in ICU/wards and healthy

individuals coming for routine health checkup at SriAurobindo medical college and Post Graduate Institute, Hospital.

Inclusion Criteria

- Patients presenting with complaints of chest pain
- changes in ECG
- Elevated cardiac biomarkers (troponin T)
- any patient with chest pain suggestive of unstable angina will be included in the study.
- All patients giving the written consent for participation in the study was included in this study.

Exclusion Criteria

- Patients not giving written consent
- Patient with thrombocytopenia
- Known cases of hereditary disorders of large platelets
- Patients on antiplatelet drugs
- Patients on anticoagulants
- Patients on medications that can reduce the platelet count (like hydroxyurea, antineoplastic agents)
- Patient with known liver disease
- Patient with known renal disease or malignancy.

Results

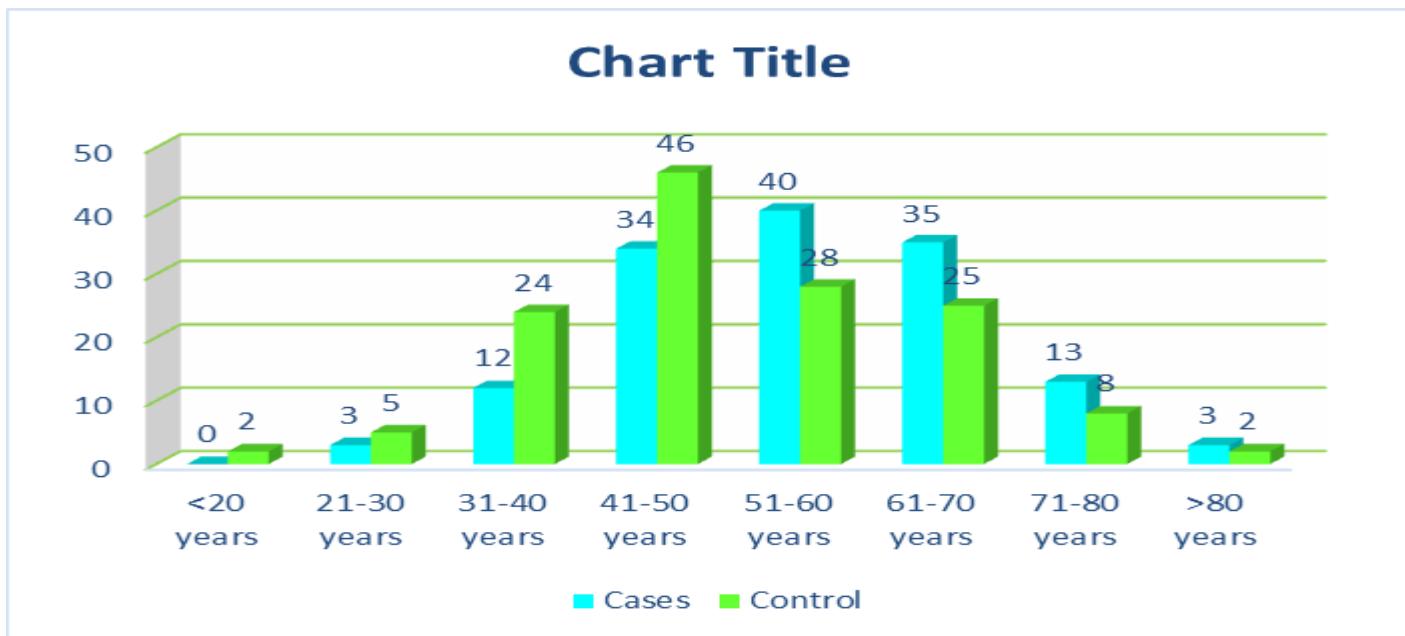
Table 1: age wise distribution of ACS cases and controls

Age Group	Cases	Control	Total
<20 years	0	2 (1.4%)	2 (0.7%)
21-30 years	3 (2.1%)	5 (3.6%)	8 (2.9%)
31-40 years	12 (8.6%)	24 (17.1%)	36 (12.9%)
41-50 years	34 (24.3%)	46 (32.9%)	80 (28.6%)
51-60 years	40 (28.6%)	28 (20%)	68 (24.3%)
61-70 years	35 (25.0%)	25 (17.9%)	60 (21.4%)

71-80 years	13 (9.3%)	8 (5.7%)	21 (7.5%)
>80 years	3 (2.1%)	2 (1.4%)	5 (1.8%)
Total	140 (100%)	140 (100%)	280 (100%)

P value- 0.061

Graph 1: age wise distribution of ACS cases and controls



The above table and graph show age distribution of Acute coronary syndrome patients and their controls. Maximum number of cases were seen in age group 51-60 years followed by 61-70 years followed by 41-50

years and their percentage were 28.6%, 25% and 24% respectively.

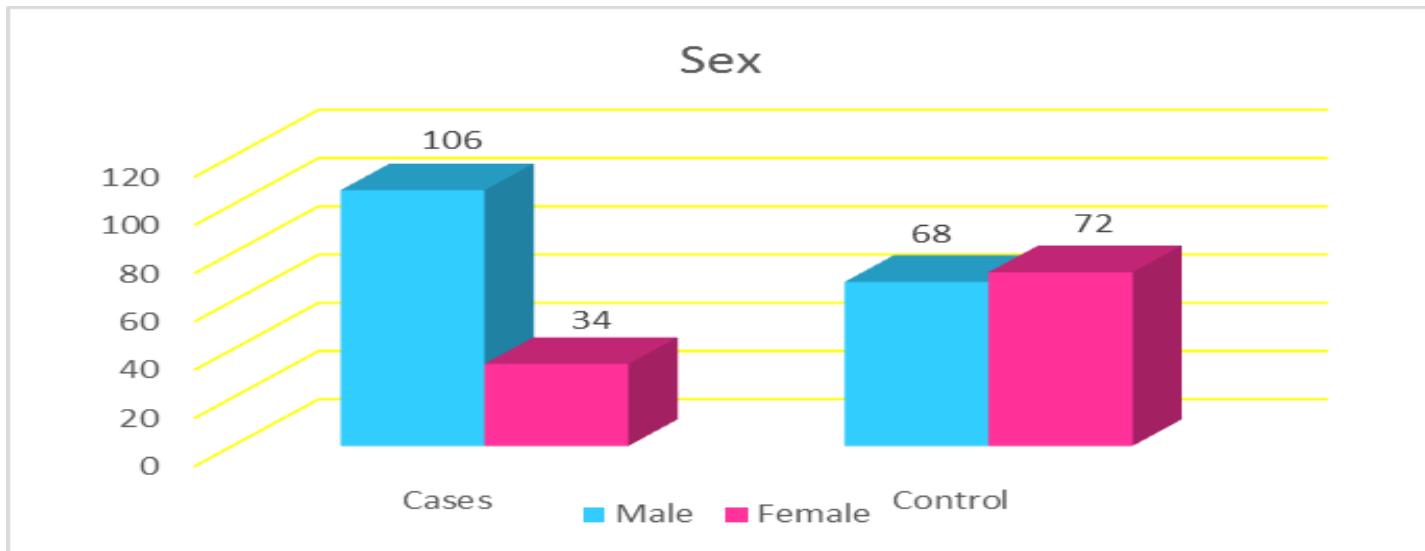
Minimum number of cases were seen in age group 21-30 years, >80 years and 31-40 years and their percentage were 2.1%, 8.6% and 2.1% respectively.

Table 2: gender wise distribution of study population

	Cases	Control	Total
Male	106 (75.7)	68 (48.6)	174 (62.1)
Female	34 (24.3)	72 (51.4)	106 (37.9)
Total	140 (100)	140 (100)	280 (100)

P value- <0.001

Graph 2: gender wise distribution of study population



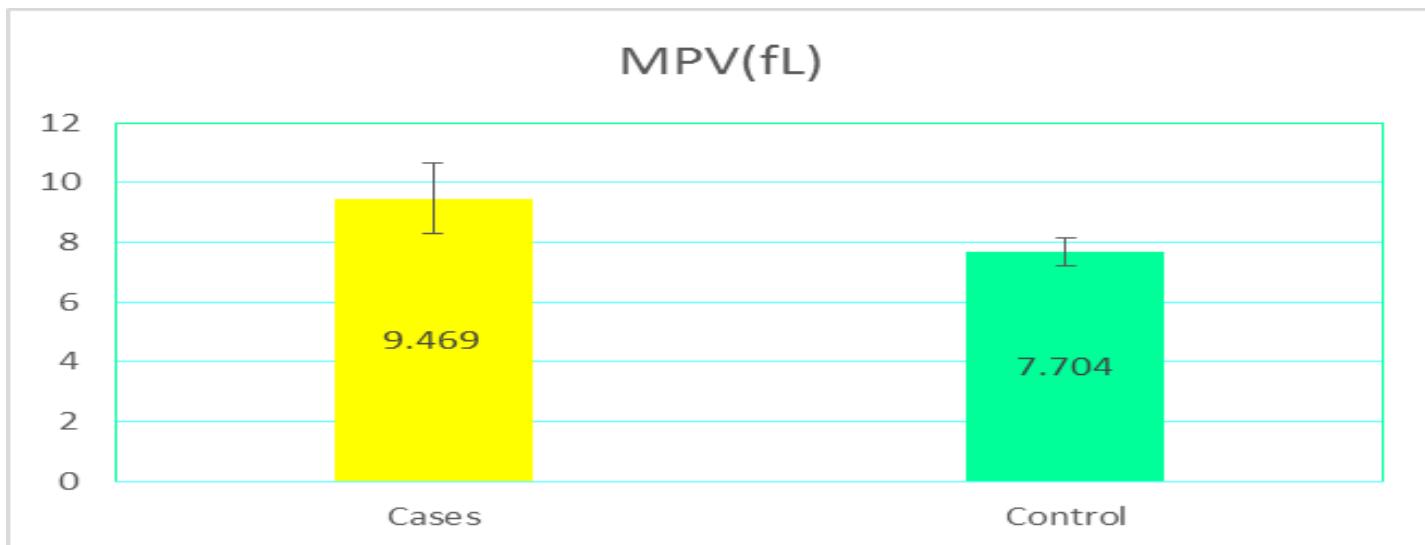
The above table and graph shows gender wise distribution of cases of ACS and their controls.

Out of 140 cases 75.7% were males and 24.3% were females.

Table 3: mean platelet volume in cases and controls

	Group	N	Mean	Std. Deviation	P value
MPV(fL)	Cases	140	9.469	1.1916	<0.001
	Control	140	7.704	.4673	

Graph 3: mean platelet volume in cases and controls



The above table and graph shows average mean platelet volume in ACS cases and controls

In control group 48.6% were males and 51.4% were females.

P value was statistically significant <0.001 .

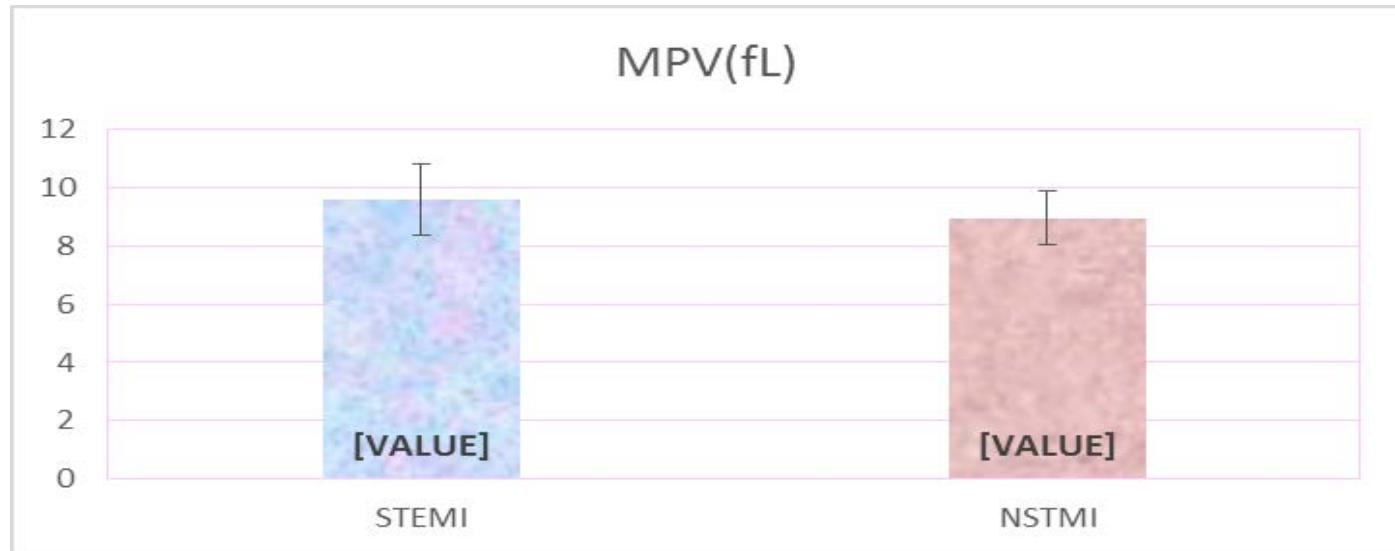
Average mean platelet volume in ACS cases was 9.46 fL and average mean platelet volume in controls was 7.70 fL.

P value was statistically significant (P value <0.001)

Table 4: mean platelet volume in stemi and nstemi

	STEMI NSTMI	N	Mean	Std. Deviation	P value
MPV(fL)	STEMI	114	9.587	1.2203	0.014
	NSTMI	26	8.954	0.9087	

Graph 4: mean platelet volume in stemi and nstemi



The above table and graph shows average mean platelet volume in STEMI and NSTEMI

Average mean platelet volume in patients having STEMI was 9.58 fL .

Average mean platelet volume in patients having NSTEMI was 8.95 fL

P value was statistically significant (P value 0.014)

Table 5: correlation between mpv and lvef

Correlation Coefficient	MPV(fL)	
	Coefficient	P value
LVEF	- 0.656	<0.001

The above table shows correlation between mean platelet volume and LVEF. There was a negative correlation between MPV and LVEF and correlation

The above table shows correlation between mean platelet volume and trop T.

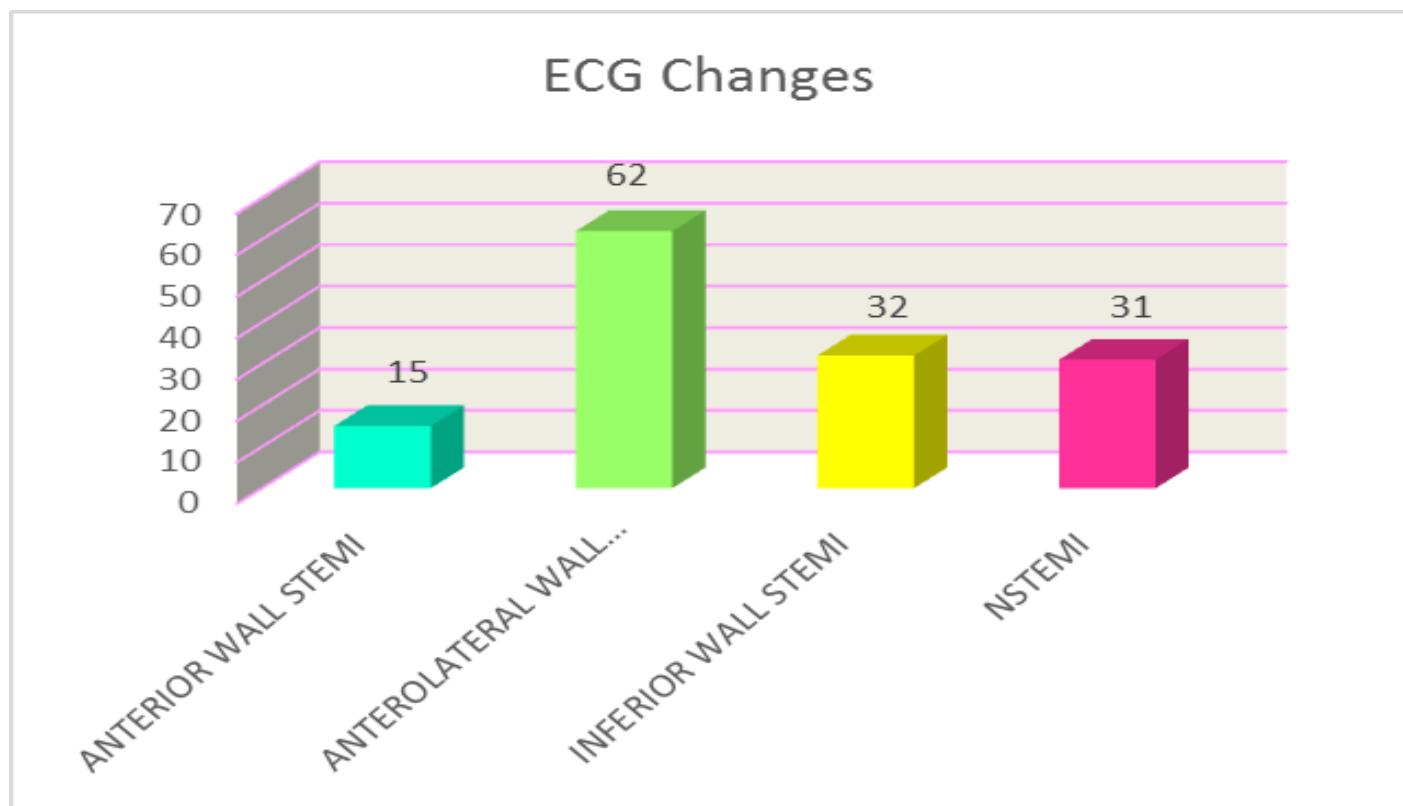
There was a positive correlation between MPV and troponin T and Correlation coefficient of MPV and trop T was 0.696 with statistically significant P value (<0.001).

coefficient of MPV and LVEF was (- 0.656) with statistically significant P value (<0.001).

Table 6 : ECG changes in acute coronary syndrome

		Group		Total
		Cases	Control	
ECG	ANTERIOR WALL STEMI	15 (10.7)	0	15 (5.4)
	ANTEROLATERAL WALL STEMI	62 (44.2)	0	62 (22.2)
	INFERIOR WALL STEMI	32 (22.8)	0	32 (11.5)
	NSTEMI	31 (22.1)	0	31 (11.1)
	WNL	0	140 (100)	140 (50)
Total		140 (100)	140 (100)	280 (100)

Graph 5: ECG changes in acute coronary syndrome

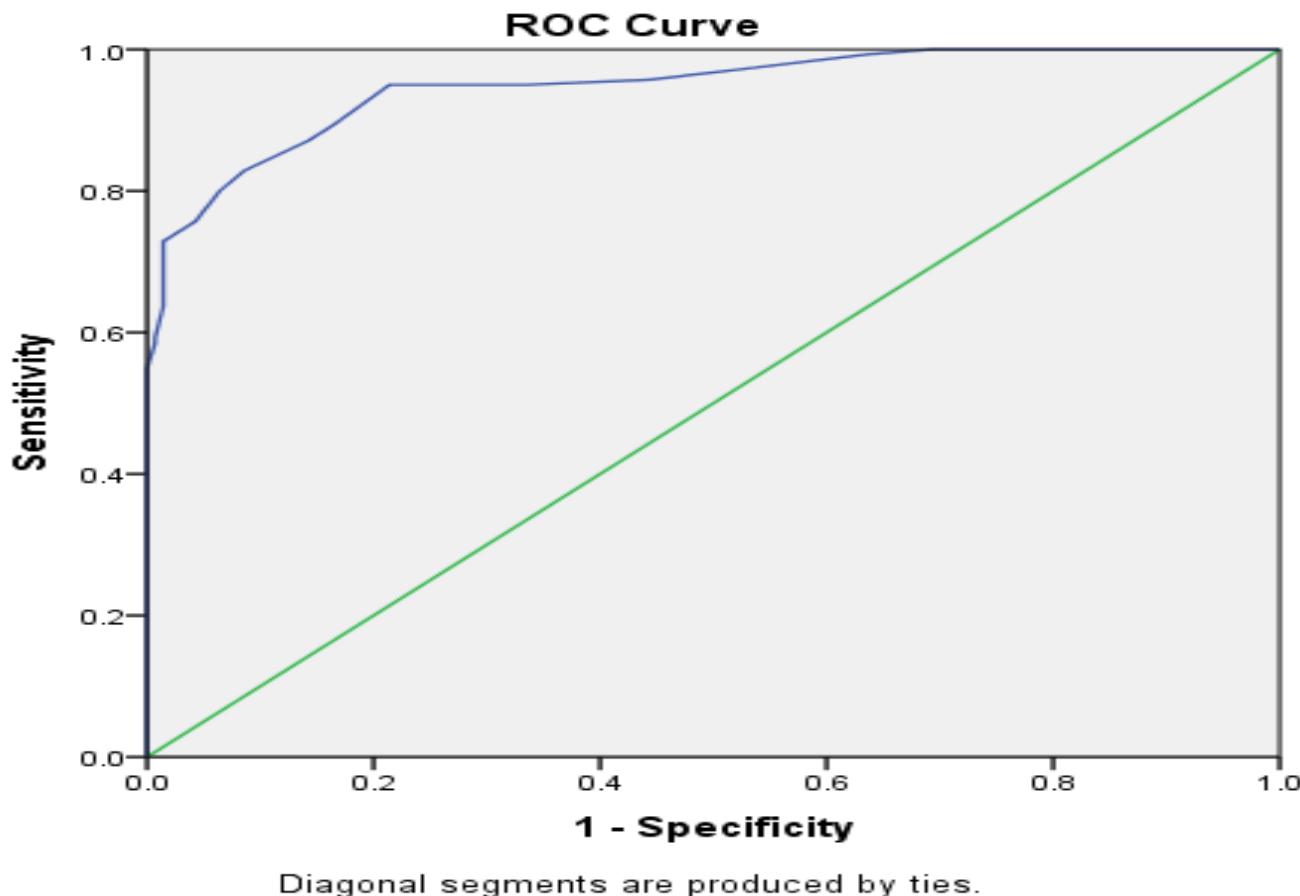


Above table and graphs shows various ECG changes in ACS, out of 140 patients of ACS 44.2% patients had anterolateral wall STEMI

22.8% patients had inferior wall STEMI, 15% patients had anterior wall STEMI and 22.1% patients had NSTEMI.

All 140 controls had normal ECG.

Graph 6 sensitivity and specificity of mean platelet volume in diagnosing ACS.



ROC CURVE OF MPV

Table 7: AUC of mean platelet volume

Area under the curve	Std. Error ^a	P value	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
0.947	0.012	<0.001	0.923	0.971

At the cutoff point- 8.05

Table 8: MPV with various parameters

Sensitivity	95.00%	89.97% to 97.97%
Specificity	78.57%	70.84% to 85.05%
Positive Likelihood Ratio	4.43	3.22 to 6.10
Negative Likelihood Ratio	0.06	0.03 to 0.13
Disease prevalence (*)	50.00%	43.99% to 56.01%
Positive Predictive Value (*)	81.60%	76.31% to 85.92%
Negative Predictive Value (*)	94.02%	88.36% to 97.02%
Accuracy (*)	86.79%	82.25% to 90.52%

The result of analysis using ROC curve it was found that the area under curve (AUC) was 0.947 (95%CI: 0.923-0.971) with P value <0.001.

Sensitivity of MPV in diagnosing ACS was 95% and specificity was 78.57%

Positive predictive value of MPV in ACS was 81.6%

Negative predictive value of MPV in ACS was 94.02%

Accuracy was 86.79%

Sensitivity value of MPV was 95% which suggest that MPV may be a marker of ACS, the specificity obtained from this study was 78.57%.

Specificity indicates that MPV's ability to determine the subjects that did not suffer ACS which was only 78.57%

Discussion

In our study, we included a total number of 140 cases of acute coronary syndrome and 140 controls.

This study was conducted under the department of Medicine, Sri Aurobindo Medical College and Post Graduate Institute, Indore during the period of December 2018 to May 2020.

The purpose of this study was to investigate whether there is an association between mean platelet volume measurement and cardiac troponin T in patients admitted with a suspected diagnosis of acute coronary syndrome and to assess the potential diagnostic efficiency of mean platelet volume in the diagnostic workup for acute coronary syndrome. In our study Maximum number of cases were seen in age group 51-60 years followed by 61-70 years followed by 41-50 years and their percentage were 28.6%, 25% and 24% respectively. Minimum number of cases were seen in age group 21-30 years, >80 years and 31-40 years and their percentage were 2.1%, 8.6% and 2.1% respectively. Similar to a study done by Hemant S. Joshi et al⁶ in their study the maximum number of cases

of ACS were in age group 50-69 years (55.9%) which was also similar to a study done by PS Singh et al⁷ in their study maximum number of cases of ACS were in the age group 51 to 60 (32%) – the cases were predominately male (75%). In our study Out of 140 cases 75.7% were males and 24.3% were females. which was similar to a study done by Gautam A.G et al⁸ in their study, patients of ACS were predominately male (73.1%) and 26.9% were female. Which was similar to a study done by Chandrasekhar Dilip et al⁹ in their study they found that 74% patients of ACS were male and 26% were females.

In our study it was found that MPV was significantly higher in cases of ACS (9.469fL) as compared controls which was (7.704fL) with statistically significant P value (P value <0.001) which was similar to a study done by Satish Basanagouda Biradar et al¹⁰ in their study they observed that MPV in cases of ACS was (9.2fL) which was significantly higher than the controls (8.6fL)(P value 0.000) also similar to a study done by Neelam Bharihoke et al¹¹ in their they found that MPV was higher in ACS cases (9.30f L) as compared to controls (7.71f L) with statistically significant P value <0.0001.

In our study it was found that Average mean platelet volume in patients having STEMI was 9.58 fL. And Average mean platelet volume in patients having NSTEMI was 8.95 fL and the difference was statistically significant with P value 0.014. similar to a study done by Hasim Ahamed et al¹² in which patients with higher mean platelet volume suffered from STEMI than comparatively lower MPV which associated with NSTEMI, 10.32 ± 0.77932 and 9.22 ± 0.52743 and it was statistically significant ($P < 0.05$). also similar to a study done by Kruthika SPatil¹³ in their study found that mean platelet volume (MPV) in cases of STEMI

(10.48f L) was significantly higher than MPV in cases of NSTEMI (9.73f L) with statistically significant (P value 0.000).

In our study there was a negative correlation between MPV and LVEF and correlation coefficient of MPV and LVEF was (- 0.656) with statistically significant P value (<0.001). which was similar to a study done by Z. ACAR, M.T. AGAC et al¹⁴ in which they observed a negative relation between admission MPV and subsequent LVEF. There was a significant difference in mean platelet volume (MPV) on admission between the groups (LVEF<50% and LVEF>50% 9.5 ± 1 vs 8.8 ± 0.7 fL p = 0.001). also similar to a study done by Huseyin U Yazici et al¹⁵ it was seen that mean platelet volume was significantly higher in patients with reduced LVEF as compared to the patients with preserved LVEF (p=0.02).

In our study out of 140 patients of ACS 44.2% patients had anterolateral wall STEMI 22.8% patients had inferior wall STEMI, 15% patients had anterior wall STEMI and 22.1% patients had NSTEMI. In a study done by Vikas Agrawal et al¹⁶ they found that About 65% of patients in this study had STEMI and 35% patients had NSTEMI similar to a study done by Vinod Kumar Balakrishnan et al¹⁷ in their study found that out 125 patients of ACS 73.6% patients had STEMI, 10.4 % patients had NSTEMI and 10% patients had unstable angina.

In our study the result of analysis using ROC curve it was found that the area under curve (AUC) was 0.947 (95%CI: 0.923-0.971) with P value <0.001.

- Sensitivity of MPV in diagnosing ACS was 95% and specificity was 78.57%
- Positive predictive value of MPV in ACS was 81.6%

- Negative predictive value of MPV in ACS was 94.02%
- Accuracy was 86.79% which was similar to a study done by D Aryanto et al¹⁸ in which it was found that the sensitivity of mean platelet volume was 92% suggesting that MPV may be a marker of ACS and the specificity value obtained in this study was 71%
- Positive predictive value was 95%
- Negative predictive value was 58%
- With confidence interval of 95% which was similar to a study done by RANDHEER PAL et al¹⁹ found that sensitivity of MPV in diagnosing ACS was 89.42% and Specificity of mean platelet volume was 46.84%
- Positive Predictive Value: 61.18%
- Negative Predictive Value: 82.53%
- Confidence interval was 95%

Conclusion

We concluded that MPV examination can be used as a marker for screening test of ACS such as standardized marker, i.e. troponin T, in line with the previous studies which showed that MPV increases in cases of ACS.

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