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A DIAGNOSTIC MARKER FOR ACUTE CORONARY SYNDROME USING MEAN PLATELET VOLUME (MPV): A COMPREHENSIVE STUDY

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ABSTRACT –

Background: Accurate diagnostic indicators are required for prompt intervention in cases of acute coronary syndrome (ACS), a global health concern. Mean Platelet Volume (MPV), sometimes disregarded in standard blood testing, has showed promise in assessing atherothrombosis risk and platelet function. In order to determine whether MPV may be used as a diagnostic tool in ACS, this study looked at how cardiac Troponin I levels related to MPV.

Methods: 96 patients were divided into two groups of 48 ACS cases and 48 non-ACS cases for an 18-month descriptive cross-sectional observational study. Statistical analyses were run to assess the connections between MPV and a number of other factors.

Results: Patients with ACS reported substantially higher MPV levels compared to those without ACS. Troponin I level had a positive association between them and MPV (p less than 0.0001), indicating that it could be a helpful prognostic marker. In ACS patients with ST-elevation and non-ST-elevation myocardial infarction, there were no discernible MPV changes ($p = 0.3$).

Conclusion: This study demonstrates a strong correlation between MPV and ACS. Combining MPV with established markers could improve ACS diagnoses because it is affordable and simple to measure. When MPV is incorporated into diagnostic protocols, there is a good opportunity for early ACS identification and intervention, which lowers the rates of morbidity and mortality that are related to it.

Keywords: Cardiovascular Disease, Mean Platelet Volume (MPV), Diagnostic Marker, Prognostic Factor, Acute Coronary Syndrome (ACS), Prompt detection

INTRODUCTION –

Acute Coronary Syndrome (ACS), which causes high rates of death and morbidity, poses a serious danger to global health (Thygesen et al., 2018). This condition results from atherosclerosis, involving plaque disruption and thrombosis, leading to the blockage of coronary arteries and resulting in clinical symptoms like Acute myocardial infarction (AMI) or unstable angina (UA) (Briggs, 2009). Despite being regularly measured in blood tests, Mean Platelet Volume (MPV) is often omitted from complete blood count reports due to a lack of standardization and limited evidence regarding its clinical importance (Klovaite et al., 2011, Yaghoubi et al., 2013).

Platelet activation and aggregation have long been recognized as contributing to the pathophysiology of coronary heart disease. After coronary plaques break, platelets are crucial in the formation of clots (Collet & Thiele, 2020). According to Omer et al. (2020), MPV is a simple and trustworthy biomarker of platelet size, indicating platelet function and atherothrombosis risk. Prior studies have shown that MPV may independently increase the risk of recurrent myocardial infarction, unlike known risk factors including hypertension, dyslipidemia, fibrinogen levels, white blood cell count, or plasma viscosity (Yilmaz et al., 2007). Increased risks of non-ST elevation myocardial infarction and issues resulting from lower blood flow to the heart in people with non-ST elevation ACS have been particularly associated to higher MPV (Sansanayudh et al., 2014).

Although earlier studies have focused on the connection between MPV and the chance of developing coronary artery disease (CAD), confirming MPV's significance in predicting outcomes in CAD patients (Dogan et al., 2012), the connection between MPV and acute coronary events is not well-explored. It is particularly difficult to determine a person's risk of having non-ST-elevation acute coronary syndrome (NSTE-ACS), which encompasses unstable angina and non-ST-elevation myocardial infarction (Dagenais et al., 2020).

Therefore, this study aimed to investigate MPV levels in patients with acute coronary syndrome. Its goal was to look into the correlation between cardiac Troponin I and MPV readings in hospitalized patients with a possible diagnosis of ACS. The research also attempted to evaluate MPV's performance as a diagnostic tool in the ACS diagnostic procedure.

MATERIALS AND METHODOLOGY –

This study was carried out using a descriptive cross-sectional observational methodology within the Medical Intensive Care Unit (MICU) of KIMS, KARAD institute. The research spanned 18 months, commencing in October 2020 and concluding in March 2022.

Patients admitted to the MICU under the Department of Medicine formed the participant pool. Those fulfilling specific criteria related to chest pain indicative of Acute Coronary Syndrome (ACS) and included were those with high Troponin I level or Electrocardiogram (ECG) abnormalities. Patients under anticoagulant or antiplatelet therapy, individuals with bleeding disorders, preeclampsia, sepsis, or those who recently underwent blood transfusion were excepted from the study.

Participants who met the requirements for inclusion went through a thorough registration procedure and provided baseline information on sociodemographic variables, clinical observations, and other pertinent investigations. Up until discharge, each patient's progress

was monitored. The gathered information was then examined to determine the significance the use of mean platelet volume as a marker for those with acute coronary syndrome.

The study included individuals who had been admitted to the hospital with chest pain that would indicate ACS and obvious ECG changes. The research excluded those who were on anticoagulant or antiplatelet medication, had bleeding problems, preeclampsia, sepsis, or had recently received a blood transfusion.

Patients satisfying the inclusion criteria underwent a structured history-taking session, delving into demographic details such as age, gender, educational background, and residence. Specifics about their presenting symptoms were also recorded. Furthermore, each patient underwent a focused clinical examination, vital signs were documented, and a baseline 12-lead ECG was conducted.

Measurement of Mean Platelet Volume (MPV):

Before beginning any therapy, blood samples were taken from patients who had just been admitted to the hospital. Two millilitres of blood were drawn into ethylenediaminetetraacetic acid tubes through antecubital venous access. Within a 4-hour window, these samples were analysed utilizing a hemogram device, specifically the Melet Schloesing (MS-9), employing the Coulter principle to measure both MPV and platelet count.

The patients chosen as the sample group for this study had to meet the predetermined inclusion criteria. The research originally intended to recruit a minimum of 24 participants. Due to time restrictions, all patients who met the study's eligibility requirements during the allocated period were still enrolled. As a consequence, 48 individuals with acute coronary syndrome (ACS) and 48 patients without ACS were included in the research. The Institute Ethical Committee gave its ethical approval before the project got started. All participants signed or left their thumbprints on written documents requesting their written, informed consent in either Marathi or Hindi. A comprehensive examination and the use of a standardized questionnaire for interviews and examinations were required for data gathering.

Microsoft Excel 2010 was used to arrange the data that had been gathered. The terms mean, median, mean + SD, and standard deviation were employed to convey quantitative data. Quantitative information was displayed as percentages or proportions. The statistical study made use of OpenEpi version 2.3 and SPSS version 21. Quantitative data were analysed using the student t-test, and the Chi-square test was employed to assess the applicability of qualitative data.

RESULTS -

Acute Coronary Syndrome was diagnosed in 48 individuals (Group I) and was not present in 48 patients (Group II) in this comparative observational analysis. Patients under the age of 45 were represented in both groups, however most of Group I's patients were above the age of 60. In both groups, males outnumbered women, with more hypertension patients in Group I. Similar numbers of people in both groups had diabetes. Obesity was widespread, especially in Group I. Both groups included non-smokers, although the smoking prevalence was greater. Some patients showed signs of dyslipidemia, and Group I patients were more likely to drink moderate amounts of alcohol.

The results of the laboratory investigation showed that Group I and Group II could clearly be distinguished from one another. The mean values of important indices, such as Mean Platelet

Volume (MPV), Platelet Distribution Width (PDW), Plateletcrit (PCT), CPK MB, and Troponin I, were higher in Group I than in Group II. These variances suggest substantial disparities in a few blood indicators, suggesting probable differences in the two groups' health as depicted in table 1.

Table 1 lists the research population's laboratory parameters.

Variables	Group I	Group II	p Value
	Average ± SD	Average ± SD	
Hb in gm%	**11.2 ± 1.5**	**11.1 ± 1.2**	**NS**
MPV in fl	**10.9 ± 1.7**	**8.9 ± 0.8**	**<0.0001**
Platelet count in 109/l	**269.3 ± 30.8**	**281.5 ± 25.9**	**NS**
Platelet distribution width in fl	**13 ± 1.5**	**11.13 ± 1.5**	**<0.0001**
Plateletcrit in %	**0.5 ± 0.2**	**0.3 ± 0.2**	**<0.0001**
CPK MB	**5.6 ± 1.7**	**4.9 ± 0.8**	**0.01**
Troponin I	**1.4 ± 0.8**	**0.9 ± 0.4**	**<0.0001**
Serum creatinine in mg/dL	**0.8 ± 0.4**	**0.8 ± 0.3**	**NS**
eGFR (mL/min/1.73m2)	**74.6 ± 11.2**	**78.8 ± 11.02**	**NS**
LVEF in %	**61.4 ± 8.6**	**65.6 ± 11.7**	**NS**

NS – Not significant, Hb – Haemoglobin

For patients diagnosed with Acute Coronary Syndrome (ACS), males displayed an average haemoglobin level of 10.8, MPV of 9.9, platelet count of 266.9, PDW of 10.3, PCT of 0.3, CKMB of 5.1, troponin I of 1.2, serum creatinine of 1, estimated Glomerular Filtration Rate (eGFR) of 76.3, and Left Ventricular Ejection Fraction (LVEF) of 61.6. In female ACS patients, the mean haemoglobin was 11.2, MPV was 10.4, platelet count was 270.2, PDW was 10.7, PCT was 0.2, CKMB was 5.6, troponin I was 1.4, serum creatinine was 0.8, eGFR was 74.4, and LVEF was 58.2 as depicted in table 2.

Table 2: Laboratory parameters of patients with ACS

Variables	Male	Female	p Value
	Average ± SD	Average ± SD	
Hb in gm%	**9.6 ± 1.6**	**10.1 ± 1.3**	**NS**
MPV in fl	**9.8 ± 1.6**	**9.9 ± 1.7**	**NS**
Platelet count in 109/l	**267.3 ± 31.8**	**271.4 ± 27.4**	**NS**
Platelet distribution width in fl	**11.4 ± 2.1**	**11.7 ± 1.7**	**NS**

Plateletcrit in %	**0.4 ± 0.2**	**0.5 ± 0.2**	**<0.0001**
CPK MB	**5.2 ± 1.4**	**5.5 ± 1.4**	**NS**
Troponin I	**1.3 ± 0.9**	**1.6 ± 0.7**	**NS**
Serum creatinine in mg/dL	**0.8 ± 0.4**	**0.8 ± 0.5**	**0.02**
eGFR (mL/min/1.73m2)	**75.8 ± 10.4**	**79.5 ± 10.8**	**NS**
LVEF in %	**61.8 ± 8.7**	**59.9 ± 8.8**	**NS**

NS – Not significant, Hb – Haemoglobin

In non-ACS cases, males exhibited an average haemoglobin level of 9.7, MPV of 8.9, platelet count of 282.1, PDW of 10.3, PCT of 0.2, CKMB of 4.8, troponin I of 0.8, serum creatinine of 0.9, eGFR of 77.5, and LVEF of 73.6. Females without ACS had mean haemoglobin levels of 10.2, MPV of 8.7, platelet count of 275.9, PDW of 9.6, PCT of 0.2, CKMB of 4.3, troponin I of 0.8, serum creatinine of 0.8, and LVEF of 76.2 as shown in table 3.

Table 3: Laboratory investigation of patients without ACS

Variables	**Male**	**Female**	**p Value**
	Average ± SD	**Average ± SD**	
Hemoglobin in gm%	**9.7 ± 1.2**	**10.5 ± 1.2**	**NS**
MPV in fl	**9.1 ± 0.8**	**8.9 ± 0.8**	**NS**
Platelet count in 109/l	**279.1 ± 29.5**	**274.4 ± 27.8**	**NS**
Platelet distribution width in fl	**10.8 ± 1.6**	**9.9 ± 1.1**	**NS**
Plateletcrit in %	**0.3 ± 0.2**	**0.3 ± 0.2**	**NS**
CPK MB	**4.9 ± 0.8**	**4.4 ± 0.9**	**NS**
Troponin I	**0.9 ± 0.4**	**0.9 ± 0.5**	**NS**
Serum creatinine in mg/dL	**0.9 ± 0.3**	**0.9 ± 0.3**	**0.02**
eGFR (mL/min/1.73m2)	**77.7 ± 10.7**	**76.4 ± 10.9**	**NS**
LVEF in %	**74.5 ± 11.3**	**76.5 ± 11.5**	**NS**

NS – Not significant, Hb – Haemoglobin

The Mean Platelet Volume (MPV) of ST-elevation myocardial infarction (STEMI) and non-ST-elevation myocardial infarction (NSTEMI) in ACS patients did not show any statistically significant connection, with a p-value of 0.3 indicating no discernible difference in MPV between STEMI and NSTEMI cases.

DISCUSSION -

Group I has more members than Group II., individuals in both research groups were over 60 in the majority. Both groups were dominated by men. In Group I, smoking and dyslipidemia were more common, while hypertension, diabetes, obesity, and smoking were also common ailments. Both groups used alcohol seldom, but Group II had a greater proportion of abstainers.

A variety of measures among them are Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), Plateletcrit (PCT), CPK MB, and Troponin I., indicated significant differences between Groups I and II in laboratory testing, with Group I exhibiting higher mean values than Group II. Particularly, the MPV average for Group I was 10.1, whereas that for Group II was 8.8. In comparison to Group II (0.8), Group I had greater troponin I levels (1.3).

When comparing Mean Platelet Volume (MPV) between ST-elevation myocardial infarction (STEMI) and non-ST-elevation myocardial infarction (NSTEMI) patients in the ACS group, there was no statistically significant link detected. This is in line with other studies that focused on the higher MPV in ACS patients, highlighting its potential diagnostic value. Mean Platelet Volume (MPV) and Troponin I were shown to positively correlate, with those who had increased MPV also testing positive for troponin I. This significant correlation supports MPV's potential diagnostic utility. Different outcomes from other studies have shown the complexity of these connections in the setting of acute coronary syndrome.

There were no statistically significant correlations between hypertension and any of the laboratory markers in the D Aryanto et al. investigation. This result is in contrast to our investigation, which found a clear and significant relationship between these measures and hypertension. D Aryanto et al. reported a specificity of 71% and a sensitivity of 92%, respectively, reflecting the test's accuracy in detecting genuine positive cases and true negative instances, respectively (Aryanto et al., 2018).

A 100% positive predictive value was shown in different study by Abubakar et al., which means that when the test produced positive findings, it correctly indicated the existence of Acute Coronary Syndrome (ACS) (Abubakar & Pineda, 2016). 100% specificity means that all genuine negative instances were accurately recognized by the test. However, the sensitivity was only 43.6%, indicating that a sizable fraction of instances were overlooked by the test, as seen by the low sensitivity value. Susmitha MS et al. discovered a significant difference in Mean Platelet Volume (MPV) between ACS patients and the control groups with a p-value of 0.025. This shows a statistically significant difference, indicating that MPV levels in ACS patients are definitely different from those in the control group (Susmitha M S et al., 2021).

An 82.53% negative predictive value was reported by Pal R et al. This indicates that in about 82.53% of cases when the test returned negative findings, the existence of ACS was correctly ruled out (Pal, 2014). Increased MPV is independently connected to a higher risk of plaque rupture, claims a study by Wang et al. According to this research, elevated levels of MPV might operate as a separate risk factor for plaque rupture, a crucial development in cardiovascular problems (Wang et al., 2019). Overall, these investigations give important light on the diagnostic capability of several indicators in recognizing and comprehending acute coronary syndrome, highlighting both their advantages and disadvantages in clinical practice.

CONCLUSION -

Acute Coronary Syndrome (ACS) and Mean Platelet Volume (MPV) are significantly correlated, according to this study. MPV, known for its simplicity and cost-effectiveness, can be employed alongside other cardiac biomarkers to predict potential adverse events in Atherosclerotic Cardiovascular Disease (ASCVD). We propose that when used in conjunction with ECG and other biochemical markers like CPKMB and Troponin, MPV emerges as a vital diagnostic factor for identifying Acute Coronary Syndrome. Consequently, integrating MPV into diagnostic protocols could improve the screening process for ACS, providing a valuable tool for early detection and intervention in cardiovascular events.

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