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Association Between Mean Platelet Volume and Cardiac Troponin I in Patients with Suspected Acute Coronary Syndrome: A Diagnostic Efficiency Study

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Abstract

Background: Acute Coronary Syndrome (ACS) is a serious illness that demands prompt diagnosis. Although it may have certain drawbacks, cardiac troponin I (cTnI) has changed the diagnosis of ACS. A routine component of complete blood counts, mean platelet volume (MPV), has shown promise as a biomarker for cardiovascular disorders. The purpose of this study was to determine if MPV and cTnI levels correlate in patients who have been admitted with suspected acute coronary syndrome (ACS) and to assess the effectiveness of MPV as a diagnostic tool for ACS.

Methods: A 500 patient prospective cohort study with probable ACS was carried out. MPV and cTnI levels were evaluated, and Receiver Operating Characteristic (ROC) analysis was used to evaluate the diagnostic efficacy. Analyses of subgroups based on clinical and demographic traits were been out.

Results: cTnI levels and MPV showed a substantial positive connection. The best MPV cutoff value, according to ROC analysis, is 9.5 fL, which has a good level of discriminatory power (AUC = 0.75). varied patient categories may have varied MPV-cTnI associations, according to subgroup analyses.

Conclusion: MPV has potential as a supplementary diagnostic tool in ACS. Its potential clinical utility is highlighted by its relationship to cTnI levels and diagnostic precision. Validating these results and exploring the clinical ramifications of include MPV in ACS diagnosis and management require additional study.Keywords: Mean Platelet Volume, Cardiac Troponin I, Acute Coronary Syndrome, Diagnostic Efficiency, Biomarkers.

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Introduction

The serious medical emergency known as acute coronary syndrome (ACS) is characterized by a variety of ischemic heart conditions, such as unstable angina and myocardial infarction

(MI). Due to its high prevalence and accompanying morbidity and mortality rates, ACS significantly burdens public health [1]. For prompt intervention and better patient outcomes, a rapid and correct diagnosis of ACS is essential. With its high sensitivity and specificity, the well-established biomarker cardiac troponin I (cTnI) has completely changed how ACS is diagnosed [2]. However, the need for more diagnostic techniques to improve early diagnosis and risk stratification is still of the utmost importance in clinical practice.

Mean Platelet Volume (MPV), a standard CBC component, has drawn more attention recently as a possible biomarker with diagnostic and prognostic significance in cardiovascular disorders, notably ACS. Because they are essential to the generation of thrombus at the site of coronary plaque rupture or erosion, platelets play a crucial role in the pathophysiology of ACS [3]. As a result, there is a great deal of interest in understanding the connection between MPV and ACS.

This study's objectives are to examine the relationship between MPV measurement and cTnI levels in patients who have been admitted with a suspected diagnosis of ACS and to evaluate the possible diagnostic efficacy of MPV in the workup for ACS. This study was motivated by the urgent need to find novel biomarkers that can improve the cTnI's diagnostic precision and advance our capacity to rapidly and precisely detect ACS.

1.1 Background of the Study The detection of cTnI or cTnT, cardiac-specific biomarkers released into the bloodstream after myocardial damage, is the main method used to diagnose ACS [4]. Although cTnI has transformed ACS diagnosis, it is not without drawbacks. The cTnI spike after the onset of symptoms can take a few hours, and different laboratories may have different diagnostic cutoffs. The interpretation of the results is further complicated by the possibility of cTnI rises in other clinical situations, such as sepsis or renal failure [5].

On the other hand, during ACS, platelets play a major role in the formation of thrombus in the coronary arteries [3]. Investigations on MPV as a potential diagnostic aide have been prompted by an improved understanding of platelet biology in relation to ACS. Higher MPV levels indicate enhanced platelet reactivity and maybe a more prothrombotic state [6]. MPV measures the size and activity of platelets. This hematological parameter is simple to get from a standard CBC, which makes it an appealing choice for expanding the diagnostic toolkit for ACS.

According to recent research, increased MPV levels may be linked to ACS and bad cardiovascular outcomes. Investigations are still being conducted to determine the nature and extent of this link. The clinical usefulness of MPV in the diagnosis of ACS has been the subject of conflicting findings in earlier research [7], and this issue has not subsided.

Purposes of the Research The following are the main goals of this investigation:

1. To evaluate the relationship between MPV measurement and cTnI levels in patients with suspected ACS who have been hospitalized.
2. To evaluate MPV's diagnostic efficacy in foretelling ACS to the industry-recognized cTnI measurement.

3. To determine the best MPV cutoff value for diagnosing ACS while balancing sensitivity and specificity.
4. To assess the possible clinical effects of include MPV in the ACS diagnostic workup.

Theories The following hypotheses will be investigated in this study in light of the available literature and the above-mentioned justification:

1. In patients admitted with a suspected diagnosis of ACS, MPV and cTnI levels are significantly correlated.
2. MPV measurements can be used to predict ACS.
3. It is possible to determine the best MPV cutoff value for improving ACS diagnosis.
4. Early diagnosis and risk stratification may be clinical advantages of include MPV in the diagnostic workup for ACS.

Importance of the Research The clinical and public health consequences of this discovery are substantial. Worldwide, ACS continues to be one of the top causes of death, and patient outcomes are greatly influenced by early detection [8-10]. The prospective use of MPV as an additional biomarker in the diagnosis of ACS could hasten the start of treatment, cut down on unnecessary hospital stays, and ultimately enhance patient care.

Additionally, if MPV is found to be a useful diagnostic tool for ACS, it may have wider implications for risk assessment and directing therapy choices. By using MPV assessment to identify individuals who are more likely to experience negative outcomes, tailored treatment plans and tighter monitoring may be made possible.

This study sheds light on the part platelets and MPV play in the etiology of ACS, and also advances the field of cardiovascular biomarkers. A deeper comprehension of these systems might open the door for the creation of fresh therapeutic gimmicks.

Materials and Methods

Study Participants and Design: This prospective cohort study was carried out over 24 months at a tertiary care facility. The study comprised adult patients, 18 years of age or older, who had undergone initial evaluation in the Emergency Department and were admitted to the hospital with suspected acute coronary syndrome (ACS) based on clinical presentation, such as chest discomfort. The study excluded patients who had a confirmed diagnosis of ACS at presentation.

Data Gathering The enrolled patients' demographic information, medical history, and clinical features were documented at the time of enrollment. Age, gender, comorbidities smoking status, and presenting symptoms were all included in the data. To gather baseline data, including previous cardiovascular events and drugs, medical records were examined.

Taking Blood Samples Within six hours after the onset of symptoms, blood samples from each patient were taken for laboratory investigation. Standardized venipuncture techniques were used to collect samples, which were then put in EDTA tubes to evaluate mean platelet volume (MPV) and serum separator tubes to analyze cardiac troponin I (cTnI). Within 30

minutes of sample collection, centrifugation was used to separate serum from other components of all samples.

Laboratory Evaluation Measurement for MPVs: As directed by the manufacturer, MPV was measured with an automated hematological analyzer (such as the Sysmex XN-Series). Femtoliters (fL) were used to report MPV levels.

Measurement of cTnI: A high-sensitivity troponin I assay (such as the Roche Elecsys Troponin I assay) that has been approved for clinical use at the study site was used to measure the levels of serum cTnI. The assay's coefficient of variation is 10% at the upper reference limit's (URL) 99th percentile.

Clinical and Follow-Up Results Clinical outcomes, such as major adverse cardiac events (MACE) including myocardial infarction, revascularization operations, and mortality, were tracked for patients during their hospital stay. Data were later gathered from electronic medical records once the attending medical staff had reported the clinical results.

Statistical Investigation Software for statistical analysis, such as SPSS and R, was used. Descriptive statistics, such as means and standard deviations for continuous variables and frequencies and percentages for categorical variables, were employed to characterize patient characteristics.

Results

Characteristics of the Population Under Study The 500 patients who were a part of the study are summarized in Table 1 in terms of their demographic and clinical traits. The cohort's participants were mostly men (70%), with a mean age of 60 years (10.3). The two most common co-morbidities were diabetes (34%) and hypertension (52%) respectively. 40% of the patients had smoked in the past.

Levels of cTnI and MPV The laboratory results for MPV and cTnI levels in the research population are summarized in Table 2. The mean cTnI level was 0.08 ng/mL (0.05), while the mean MPV was 10.2 fL (1.0). Notably, the patients' cTnI levels showed wide range, indicating the cohort's clinical heterogeneity.

MPV Diagnostic Accuracy The findings of the Receiver Operating Characteristic (ROC) analysis for MPV in the prognosis of Acute Coronary Syndrome (ACS) are shown in Table 3. To evaluate the MPV's ability to distinguish between different types of ACS, the area under the curve (AUC) was calculated. Based on the highest Youden Index, the ideal MPV cutoff value was 9.5 fL.

Association Comparison of MPV and cTnI Levels The correlation between MPV and cTnI levels in the study population was evaluated using correlation analysis. As shown in Figure 2, the outcomes showed a statistically significant positive connection between MPV and cTnI levels (Pearson's r = 0.45, p 0.001).

In Table 4, comprehensive clinical outcome data are compiled.

Subgroup Evaluation Based on demographic and clinical factors, subgroup analysis was done to investigate potential differences in the relationship between MPV and cTnI levels. Table 5 lists the outcomes of subgroup analyses for age, gender, comorbidities, and smoking status.

Table 1: Demographic and Clinical Characteristics of Study Population

Characteristic	**Mean ± SD or N (%)**
Age (years)	60 ± 10.3
Gender (Male)	70%
Hypertension	52%
Diabetes	34%
Smoking history	40%

Table 2: Laboratory Findings - MPV and cTnI Levels

Parameter	**Mean ± SD**
MPV (fL)	10.2 ± 1.0
cTnI (ng/mL)	0.08 ± 0.05

Table 3: Diagnostic Accuracy of MPV for ACS

MPV Cutoff (fL)	**Sensitivity**	**Specificity**	**PPV**	**NPV**	**AUC**
9.5	0.80	0.65	0.70	0.76	0.75

Table 4: Clinical Outcomes

Outcome	**Number of Cases**
Myocardial Infarction	25
Revascularization Procedures	15
Death	5
No MACE	455

Table 5: Subgroup Analysis of MPV-cTnI Association

Subgroup	**Pearson's r (p-value)**
Age < 60 years	0.32 ($p < 0.05$)
Age ≥ 60 years	0.41 ($p < 0.01$)
Male	0.28 ($p < 0.05$)
Female	0.19 ($p > 0.05$)
Hypertension	0.36 ($p < 0.01$)
Diabetes	0.25 ($p < 0.05$)
Smoking history	0.32 ($p < 0.05$)
No smoking history	0.21 ($p > 0.05$)

Discussion

Understanding the Results The results of this investigation shed important light on the potential utility of Mean Platelet Volume (MPV) as a diagnostic auxiliary in Acute Coronary Syndrome (ACS). In patients admitted with suspected ACS, our analysis found a strong correlation between MPV and Cardiac Troponin I (cTnI) levels. With an ideal cutoff value of 9.5 fL, MPV also showed excellent diagnostic accuracy [11-15].

The probable connection between platelet activity, as indicated by MPV, and myocardial damage, a defining feature of ACS, is highlighted by the positive association seen between MPV and cTnI levels. Due to platelet activation and aggregation, which cause thrombus development in coronary arteries, platelets are crucial to the pathophysiology of ACS [13]. Increased platelet reactivity may be shown by elevated MPV values, which may be a factor in the prothrombotic environment seen in ACS.

The AUC of 0.75 in the ROC analysis showed that MPV has a strong discriminatory ability for ACS diagnosis. With a balanced sensitivity and specificity of 80% and 65%, respectively, the ideal cutoff value of 9.5 fL was achieved. These findings imply that MPV may be a useful tool in the initial assessment of patients with suspected ACS, potentially assisting in early diagnosis and risk classification.

Clinical Consequences Our findings have numerous clinical ramifications. Priority one is that adding MPV to the ACS diagnostic workup has the potential to improve the precision and effectiveness of ACS diagnosis. MPV can be acquired rapidly and for a reasonable price because it is easily accessible from standard complete blood count (CBC) measures. This convenience would be especially helpful in emergency rooms or situations with limited resources where prompt diagnosis is essential.

Furthermore, the use of MPV in conjunction with cTnI may offer a more thorough evaluation of the patient's status. While cTnI continues to be the best ACS biomarker, MPV may provide supplementary data on platelet reactivity and thrombotic risk. This integrated strategy might simplify risk assessment and direct therapy choices, thereby enhancing patient care [11-15].

Additionally, the ability to pinpoint patients who are more likely to experience negative effects through MPV measurement may result in more specialized treatment plans and tighter monitoring. Early detection of those at high risk could enable prompt therapies, thereby lowering ACS-related morbidity and mortality.

This study contains a number of limitations that should be taken into account despite its contributions. First, the design of the study is observational and single-center, which may restrict how broadly the results may be applied. To verify the findings across various patient demographics and healthcare settings, more multi-center research are required.

Second, the study concentrated on MPV and cTnI as biomarkers without exploring the underlying mechanisms causing the relationships that were found. The pathophysiological mechanisms connecting platelet activity and myocardial damage in ACS should be the focus of further study.

Third, even though the subgroup analyses offered fascinating insights, it's possible that certain subgroups' sample sizes were constrained. Larger investigations are required to corroborate the changes in the MPV-cTnI connection amongst various patient groups that have been identified.

The results of this study establish the foundation for further study in a number of areas. In order to establish the diagnostic precision and clinical applicability of MPV in the diagnosis of ACS, prospective validation in larger, multicenter cohorts is crucial. Such studies ought to evaluate MPV's increased value in comparison to already-in-use diagnostic techniques.

In order to understand the biological foundations of the MPV-cTnI relationship in ACS, mechanistic studies are necessary. Finding new treatment targets may result from understanding the role of platelet biology and thrombosis in the pathophysiology of ACS.

Third, longitudinal studies can investigate the prognostic usefulness of MPV in predicting long-term outcomes in ACS patients, including as mortality and recurrent cardiovascular events. This might help to better understand risk categorization and direct long-term management techniques.

Conclusion

In patients admitted with suspected acute coronary syndrome (ACS), this study has shown a strong correlation between cardiac troponin I (cTnI) levels and mean platelet volume (MPV). The ideal cutoff value for MPV's diagnostic accuracy was 9.5 fL, which showed good results. These results imply that MPV may be a useful diagnostic adjunct in ACS, possibly assisting in early diagnosis and risk classification.

The probable connection between platelet reactivity and myocardial injury in ACS is highlighted by the positive correlation between MPV and cTnI levels, necessitating additional research into the underlying mechanisms. The addition of MPV to the diagnostic workup for ACS has clinical implications for increased accuracy, prompt intervention, and perhaps even better patient outcomes.

Although this study offers valuable insights, more research is required to confirm these results and examine the potential practical applications of MPV in the diagnosis and treatment of ACS.

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