Original Article

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Mean Platelet Volume (MPV), Mean Platelet Count, and Red Blood Cell Distribution Width (RDW) in Acute Coronary Syndrome (ACS)

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ABSTRACT

Background: Red blood cell distribution width (RDW) reflects anisocytosis, which is the variability in erythrocyte size. This parameter is commonly used in the differential diagnosis of various types of anemia Mean platelet volume (MPV) demonstrates platelet size and serves as an indirect marker of platelet activation. Both RDW and MPV have been proposed as potential markers for cardiovascular disease severity and prognosis. **Aim**: To evaluate the role of RDW, MPV, and the MPV/PLT ratio as supporting indicators in the diagnosis and severity assessment of acute coronary syndrome (ACS). **Methods**: This cross-sectional hospital-based study included 104 patients diagnosed with ACS (ST-elevation myocardial infarction, non-ST elevation myocardial infarction, unstable angina) admitted to the coronary care unit between October and December 2023. A control group of 181 healthy individuals was used to establish reference values. Data analysis was conducted using IBM SPSS. **Results**: Platelet count, MPV, and the MPV/PLT ratio were significantly associated with ACS. However, RDW showed no association with ACS in this study. **Conclusions**: This study evaluated the role of hematological parameters in acute coronary syndrome. To the best of our knowledge, this is the first study in Basrah demonstrating that the PLT count, MPV, and MPV /PLT ratio are significantly associated with ACS. In this study, RDW was not related to ACS. Given that a complete blood count (CBC) is a simple, cost-effective, and widely available test, we propose that these hematological indices may serve as supportive tools in the risk assessment of ACS patients.

Keywords: Acute coronary syndrome, platelet count, mean platelet volume, red cell distribution width, MPV/PLT ratio.

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INTRODUCTION

Acute Coronary Syndrome (ACS) represent a widespread group of life-threatening coronary events associated with high morbidity and mortality. They include ST-elevation myocardial infarction (STEMI), non-ST elevation myocardial infarction (NSTEMI), and unstable angina. ACS is a manifestation of coronary heart disease (CHD), typically resulting from the rupture of an atherosclerotic plaque.[1] Common risk factors include smoking, hypertension, diabetes, hyperlipidemia, male sex, physical inactivity, family history, obesity, and poor

nutritional practices. Consequently approximately one-third of global mortality rates are attributed to these risk factors.[2] Several forms of CHD may be asymptomatic, but many studies report that ACS as to always being symptomatic.[3-5] Mean platelet volume (MPV) serves as an indirect marker of platelet activation, while red blood cell distribution width (RDW) reflects the variation in erythrocyte size, conventionally referred to as anisocytosis.[6,7] MPV and RDW are routinely measured as part of a complete blood count (CBC), a widely available laboratory test that yields results within a few hours. Although these parameters have shown potential roles in cardiovascular risk assessment, it is important to note that they are not specific to ACS.[8] Elevated levels of MPV and RDW may also be observed in several conditions, including systemic inflammation, infections, and malignancies. Therefore, these hematological indices should be interpreted in the context of the patient's clinical picture. A growing body of evidence suggests that MPV and RDW may be useful biomarkers in the diagnosis and prognosis of ACS. Several studies have concluded that patients with ACS tend to exhibit higher MPV and RDW levels than non-ACS patients. Additionally, patients with ACS who have higher MPV and RDW levels are at increased risk for adverse outcomes, including death, myocardial infarction, and stroke.[9] The mechanisms by which MPV and RDW are associated with ACS are not fully understood. However, it is thought that these parameters may reflect the underlying inflammatory processes that result in platelet activation, which is directly involved in the development of ACS.[10] Given the potential role of MPV and RDW in assessing the severity of coronary disease, there is a growing interest in using these indices for the diagnosis and prognosis of this condition. However, more research is needed to validate the role of these parameters in ACS and to determine the best way to utilize them in clinical practice. Recent studies have shown that hematological parameters can effectively predict long-term mortality and re-infarction rates in ACS. However, the role of these parameters in predicting short-term mortality has not been studied extensively.[11] This study aims to evaluate the values of MPV and RDW as risk factors/markers in acute coronary syndromes.

MATERIALS AND METHODS

This is a cross-sectional hospital-based study involving patients entering coronary care unit. We evaluated 104 acute coronary syndrome cases from October 2023 to December 2023. Cases included ST-elevation myocardial infarction (STEMI), non-ST elevation myocardial infarction (NSTEMI), and unstable angina. The study was approved by the Scientific Committee for Research in the College of Health and Medical Techniques at Al-Maaqal University and the esteemed management of the Basrah Oil Specialist Cardiac Center. Venous blood samples were obtained within 30 minutes of admission in an EDTA tube to measure hematological indices and in a gel tube to measure biochemical markers. Additionally, lipid profiles, blood urea nitrogen, and creatinine (Cr) levels were measured. A control group of 181 healthy individuals was selected to establish reference values for the parameters. The data were analyzed using IBM SPSS (version 26). Patients with a history of smoking, blood transfusions, and antiplatelet therapy were excluded from this study. All participants provided informed consent to be enrolled in the study.

RESULTS

A total of 104 patients diagnosed with ACS and 181 apparently healthy individuals were included in this study. Baseline clinicodemographic characteristics are presented in Table 1. The majority of the patients were male (69.2%), in which more than three-quarters suffering from ST-elevation myocardial infarction (77.9%). Percutaneous coronary intervention (PCI) was performed in 69.2% of patients. The in-hospital mortality rate was 5.8%.

Table 1: Clinico-demographic characteristics of patients

Characteristic		Number	%
Gender	Male	72	69.2
	Female	32	30.8
Clinical Condition*	STEMI	81	77.9
	NSTEMI	17	16.3
	Unstable Angina	6	5.8
Status of Patient	Alive, PCI Done	72	69.2
	Alive, PCI Not Done	26	25.0
	Died	6	5.8

*ST-elevation myocardial infarction (STEMI), non-ST elevation myocardial infarction (NSTEMI), percutaneous coronary intervention (PCI)

Table 2 compares the parameters between ACS patients and healthy controls. While RDW showed no significant difference, PLT, MPV, and the MPV/PLT ratio were significantly higher in the ACS group.

Table 3 shows the comparison of hematological variables by gender. Platelet count was significantly higher in females, while the MPV/PLT ratio was higher in males.

Table 2: Comparison of the study parameters between ACS Patients and controls

Sample		MPV	RDW	PLT	MPV/PLT
Normal N= 181	Mean	8.8	13.1	231.0	0.039
Patient N= 104	Mean	10.1	13.2	259.6	0.042
P Value		0.000	0.838	0.000	0.049

Table 3: Hematological variables among gender

Gender		PLT	MPV	RDW	MPV/PLT
Male N= 72	Mean	246.8	10.0	13.2	0.045
Female N= 32	Mean	288.5	10.2	13.1	0.037
Total N= 104	Mean	259.6	10.1	13.2	.042
P Value		0.007	0.511	0.748	0.039

Figure 1 shows PLT distribution in ACS patients and Controls. Median values are comparable; however, the ACS group exhibits greater variability and several high outliers, indicating elevated platelet counts in some ACS patients. Figure 2 demonstrates higher MPV values in ACS patients compared to controls, with minimal overlap in distributions

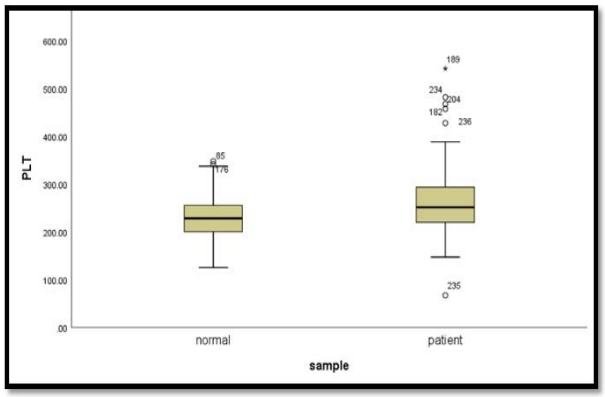

Figure 1: Distribution of PLT among ACS patients and controls.

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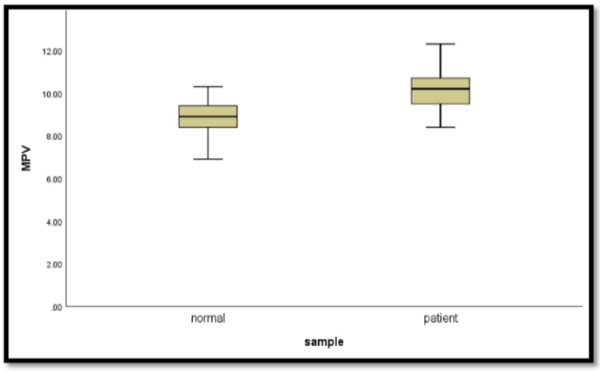

Figure 2: Comparison of MPV among ACS patients and controls

DISCUSSION

Coronary artery disease is a leading cause of morbidity and mortality in both developed and underdeveloped countries. Several endogenous and exogenous risk factors are known to increase the risk of acute coronary syndrome.[12] Troponin is a well-studied cardiac marker used in the diagnosis of ACS. However, identifying additional predictive markers is essential for improving patient risk stratification. Larger and hyperactive platelets contribute to intracoronary thrombus formation, potentially accelerating the onset of ACS. Platelet function plays a key role in the pathophysiology of cardiovascular disease.[13,14] Mean platelet volume is an indicator of platelet size and serves as an indirect marker of platelet activity. In the general population, a higher MPV value is associated with an increased occurrence of myocardial infarction (MI).[15] Additionally, MPV is considered a useful prognostic marker of cardiovascular risk.[16] The key finding of this study is a strong association between MPV, PLT, and the MPV/PLT ratio in ACS patients compared to the control group. This may indicate enhanced platelet activation in the context of coronary events. Several studies have shown that elevated RDW is linked to multiple cardiovascular conditions, including coronary artery disease, heart failure, stroke, atrial fibrillation, and venous thromboembolism.[17-20] Inflammation is a direct contributor to anisocytosis by promoting the release of immature red blood cells into the peripheral circulation.[21] Additionally, a study by Cavusoglu et al. found that RDW is associated with cardiovascular mortality.[22] However, in our study, no significant association was found between RDW and ACS. The MPV/PLT ratio is a biomarker used as a prognostic indicator of ACS. The MPV/PLT ratio may reflect the factors involved in the pathogenesis of ACS more accurately than MPV and platelet count separately. Our

study demonstrated that the MPV/PLT ratio was significantly elevated in ACS patients and showed a positive correlation with disease severity. Supporting this, a previous study reported that a high MPV/PLT ratio was an indicator of increased platelet activation and aggregation, which was evident in STEMI patients.[23] Moreover, Azab, et al. showed that the MPV/PLT ratio was a predictive factor for mortality in NSTEMI patients.[24]

CONCLUSIONS

This study evaluated the role of hematological parameters in acute coronary syndrome. To the best of our knowledge, this is the first study in Basrah demonstrating that the PLT count, MPV, and the MPV/PLT ratio is significantly associated with ACS. In this study, RDW was not related to ACS. Given that a complete blood count (CBC) is a simple, cost-effective, and widely available test, we propose that these hematological indices may serve as supportive tools in the risk assessment of ACS patients.

Limitations:

Our study was limited by the small sample size, which may affect the generalizability of our findings. Additionally, this is a single-center study, which may result in selection bias. Potential confounding factors were not fully controlled, which may influence hematological indices. We recommend larger, multicentric studies to validate these results across a broader population.

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