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An Evaluation of Platelet Indices in Newly Diagnosed Cases of Acute Myocardial Infarction

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ABSTRACT

Acute myocardial infarction (AMI) is characterized by prothrombotic phenotype associated with endothelial dysfunction, an increase in platelet activation and systemic inflammation. Platelet aggregation and activation are crucial in the formation of thrombi and acceleration of atherosclerosis, associated with unstable angina, sudden cardiac death is brought on by an acute myocardial infarction. **Objective:** To evaluate the platelet-indices in newly diagnosed cases of acute myocardial infarction. **Methods:** This cross-sectional study was conducted during November 2022 to December 2023 in Pathology Department of Sheikh Zayed Medical College/Hospital Rahim Yar Khan. Samples were collected from the patients of AMI admitted to Emergency Ward and from healthy controls as well. Complete Blood Count (CBC) with platelet indices, platelet count, Mean Platelet Volume (MPV), Platelet Crit (PCT) and Platelet Distribution Width (PDW) were investigated on five-part automated hematology analyzer BT-PRO 2300. Analysis of the data was done by using SPSS version 20.0. **Results:** Total 140 patients were divided into a healthy control group (70) and newly diagnosed cases of acute myocardial infarction (70). Among diagnosed cases of AMI 46 (65.7%) had ST-elevation myocardial infarction (STEMI) and 24 cases (34.2%) got non-ST-elevation myocardial infarction (NSTEMI). It was found that AMI patients had lower platelet counts and PCT with higher MPV and PDW. **Conclusions:** It was concluded that the platelet indices (PDW, and PCT, MPV) are significant predictors of myocardial infarction. They might be applied as an easy, reliable, and economical way to anticipate an impending acute coronary event.

INTRODUCTION

Acute Myocardial Infarction (AMI) is the major cause of deaths in developed and developing countries [1]. Myocardial infarctions occur when a thrombus abruptly blocks the coronary artery. The World Health Organization estimates that in developed nations, cardiovascular illnesses account for one in three deaths (31% of all deaths) [2]. AMI impairs coronary artery blood flow and partially or completely obstructs the coronary artery is a sign of coronary artery disease (CAD) in an emergency situation [3]. ST-elevation myocardial infarction (STEMI) and non-ST-elevation myocardial infarction (NSTEMI) refers to potentially fatal conditions that arise when the blood supply to the heart is compromised due to the destabilization of an atherosclerotic plaque. This change prevents the heart muscle from working properly and may possibly be fatal [4]. The signs of an acute myocardial infarction (AMI) include shortness of breath, tachycardia, vertigo, fainting and sudden development of mediastinal chest pain or pressure, which typically radiates to the left arm and neck, cardiac arrest or newly developed congestive heart failure [5]. Platelets play a vital role in atherothrombosis, the substantial cause of unstable coronary syndromes [6]. Platelets secrete and express large number of essential mediators of coagulation, thrombosis, inflammation and atherosclerosis [7]. Mean platelet volume (MPV) is a potential marker of platelet reactivity [8]. MPV estimation is routinely available in the inpatient and outpatient setting at a minimum cost. MPV

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elevation is associated with other markers of platelet's activity, together with increased platelet aggregation, increase in thromboxane synthesis, β-thromboglobulin release, and overexpression of adhesion molecules [9]. Risk of acute myocardial infarction (AMI) rises with age, irrespective of gender. According to the French ONACI registry, the prevalence of acute myocardial infarction is approximately 1% in the 45–65 age range and rises to approximately 4% in the 75–84 age group [10]. The ratio of men to women among people suffering in Pakistan is 1.02:1. In both the male and female population, the prevalence of coronary artery disease (CAD) is 1.3%. There is 1.2% prevalence in people under 50 years and a 2.03% prevalence in people over 60 years [11]. The main methods for evaluating the Acute Myocardial Infarction (AMI) include Electrocardiogram (ECG), Blood Tests, Chest x-ray (CXR), Echocardiography (ECHO), stress tests and cardiac catheterization. Atrial fibrillation, acute cardiac syndrome, congestive cardiac failure, cardiogenic shock, rupture of the ventricular free wall, pericardial effusion, aneurysm development and mural thrombi are the main consequences of coronary artery disease [12]. Platelet volume indices (MPV and PDW) are included in complete blood count (CBC). Elevated mean platelet volume (MPV) suggests thrombosis or hypercoagulability of the platelet. The active platelet release is reflected in platelet distribution width (PDW) as a variation in size of platelets [13].

Therefore, the current study was carried out to assess the platelet volume indices and platelet count in newly diagnosed patients of Acute Myocardial Infarction (AMI).

METHODS

This cross-sectional study was conducted at in pathology department of Sheikh Zayed Medical College/Hospital, Rahim Yar Khan, after getting approval from the Institutional Review Board (IRB) wide reference number 487/IRB/SZMC/SZH dated 10/08/2022. A sample size of 70 was calculated with expected difference of 8 between PDW of MI and control group and 99 % of confidence interval, 1 % of margin of error. This calculated sample size of 70 was doubled to 140 for better precision [14]. Convenient sampling technique was used. For patients' group subjects with Acute Myocardial Infarction (AMI) were included in the study while controls were normal population. Subjects with any other coronary illness was excluded from the study. Blood samples from newly diagnosed patients of Acute Myocardial Infarction (AMI) and the healthy individuals (control) were drawn and processed on fully automated 5-part hematology analyzer BT-Pro 2300. Platelet indices, (platelet count, PCT, PDW and MPV were measured. Data were analyzed using SPSS version 20.0 with by applying descriptive statistics. ANOVA test was applied to compare three groups. Mean and standard deviation was used to present quantitative data while qualitative data were presented percentages and frequencies.

RESULTS

Total 140 patients were selected and divided into (02) groups, 70 newly diagnosed cases of acute myocardial infarction of which 46 cases (65.7%) were having ST-elevation (MI) and 24 cases (34.2%) got non-ST-elevation (MI), the 70 healthy individuals were taken as the control group (table 1).

Table 1: Group Wise Distribution of the Study Subjects

Baseline Characteristics	Frequency (%)
Controls	70 (100 %)
NSTEMI	24 (34.2%)
STEMI	46 (65.7%)

Table 2 shows that the mean age along with SD of the patients amongst study subjects diagnosed as STEMI was (55.87 ± 12.6), NSTEMI (59.75 ± 8.6) and (52.61 ± 5.8) among controls (with p-value 0.003). MPV of STEMI patients was found to be (9.054 ± 0.6), NSTEMI (9.058 ± 0.6) and (7.941 ± 0.6) in control group (with P-value 0.000). PDW was found to be (16.8 ± 1.5), (16.6 ± 2.5) and (15.9 ± 1.4) amongst STEMI, NSTEMI and controls (with P-value 0.029). PCT value (0.174 ± 0.05), was observed (0.172 ± 0.06) and (0.207 ± 0.05) among STEMI, NSTEMI and control group (with P-value 0.002) and platelet count was (215.85 x109/L ± 73.5), (209.75 x109/L ± 62.0) and (259.50 x109/L ± 67.3) amongst STEMI, NSTEMI and controls with (0.001 P-value).

Table 2: Comparison of Age, MPV, PDW, PCT and Platelets in STEMI, NSTEMI and Healthy Control Group

Variables	STEMI	NSTEMI	CONTROLS	p-value
	Mean ± SD	Mean ± SD	Mean ± SD	
Age	55.87 ± 12.680	59.75 ± 8.614	52.61 ± 5.834	0.003
MPV	9.054 ± 0.632	9.058 ± 0.646	7.941 ± 0.692	0.000
PDW	16.817 ± 1.569	16.679 ± 2.521	15.989 ± 1.477	0.029
PCT	0.174 ± 0.055	0.173 ± 0.062	0.208 ± 0.0512	0.002
Platelet Count (x10^9 /L)	215.85 ± 73.506	209.75 ± 62.055	259.50 ± 67.37	0.001

Figure1 shows that there were 10 males and 14 females in NSTEMI, 33 males and 13 females in STEMI and 57 males and 13 females in control group.

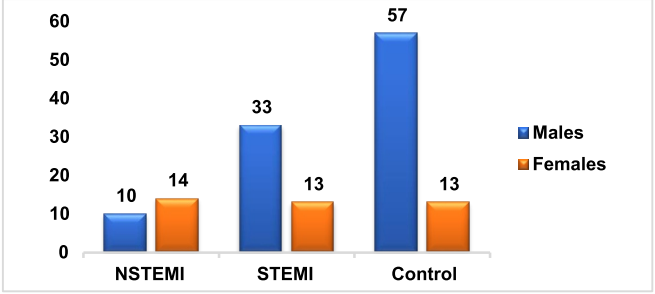

Figure 1: Gender Wise Distribution of the Study Subjects

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Mean age was found to be 54.91, mean value of MPV was 8.499, mean value of PDW was 16.379, mean value of PCT was 0.19071 and mean platelet count observed was 236.63 as shown in figure 2.

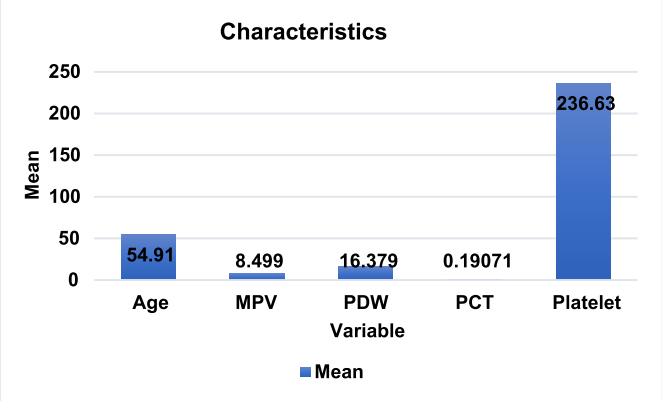

Figure 2: Overall Characteristics of Age, MPV, PDW, PCT and Platelets

DISCUSSION

Platelets have a critical role in formation of thrombus subsequent to the rupture of an atherosclerotic plaque, which results in myocardial infarction [15]. Following CBC, the platelet volume indices with mean platelet volume (MPV), platelet distribution width (PDW) and plateletcrit (PCT) can be used to quickly determine the size and reactivity of the platelets. In the present investigation, we identified the relationship between MPV, PDW and PCT with myocardial infarction (MI). In present study (140 cases) were studied comprising of STEMI (46 cases), NSTEMI (24 cases) and control group (70 cases). In this research, the mean age among STEMI patients was found (55.87 ± 12.6) years, NSTEMI (59.75 ± 8.6) years and (52.61 ± 5.8) years among healthy controls (p-value 0.003). A study conducted in Egypt by Hassan et al., reported the mean age of the diagnosed cases was (58.71 ± 13.42) years and that of control group was (57.41 ± 12.15) years [16]. In current study, patients with myocardial infarction (MI) had higher MPV (9.054 ± 0.6), (9.058 ± 0.6) in STEMI and NSTEMI counter to the control group (7.941 ± 0.6). PDW was also higher (16.8 ± 1.5), (16.6 ± 2.5) in STEMI and NSTEMI than control (15.9 ± 1.4). While patients with myocardial infarction had lower PCT (0.174 ± 0.05), (0.172 ± 0.06) in STEMI and NSTEMI than control (0.207 ± 0.05) and lower platelet count (215.85 x109/L ± 73.5), (209.75 x109/L ± 62.0) in STEMI and NSTEMI as compared to control (259.50 x109/L ± 67.3). A study conducted in Egypt selected 75 subjects including cases and controls groups, MPV (10.21 ± 1.15) and PDW (18.02 ± 1.49) were also higher in MI group than control group MPV(9.50 ± 1.33), PDW(10.14 ± 2.13) [17]. Another study from India including 65 cases with MI and control group reported that MPV (8.2 fL) and PDW (16.9%) were raised in MI group than control group with MPV (6.8 fl) and PDW (14.9 %) and platelet count was higher in control group (274×109 /L) than MI group (203×109/L) similar to our study [18]. A recent study in India was performed on 70 cases, and the results were compared to 70 controls. PDW was found to be (10 ± 0.7) in control group and was (13.2 ± 1.0), (12.6 ± 0.8) among STEMI and NSTEMI patients (with p value <0.001). MPV was observed to be (8.9 ± 0.9) in the controls and (12 ± 1.4), (11.5 ± 1.2) in the STEMI and NSTEMI patient groups (with p value <0.001). PCT was (0.19 ± 0.05) in control group and was (0.32 ± 0.05), (0.28 ± 0.06) in STEMI and NSTEMI patients respectively (with p value <0.001). This study revealed that MI patients had greater MPV and PDW levels than the control group similar to our study while contrary to our study PCT was higher in conrols than cases [19]. A study conducted in India on 60 cases of MI and 60 healthy controls reported that mean age of of the controls was (56.58 ± 9.608) years, while the cases were (56.53 ± 9.14) years. The mean platelet volume (MPV) of the cases was substantially higher (11.97 ± 1.458) than that of controls (10.7 ± 0.940). Additionally it was discovered that platelet distribution width was higher in cases (15.23 ± 3.503) than controls (13.25 ± 2.526). In comparison to controls plateletcrit (PCT) was lower in cases (0.266 ± .0641) than controls (0.320 ± .0133). Moreover, it was shown that the mean platelet count in patients (231.25 ± 67.27) was lower than in controls (276.38 ± 120.86). Similar to our study, it was demonstrated that showed that AMI group had higher MPV and PDW than the control group and that the AMI patients had had lower PCT and platelet counts [20].

CONCLUSIONS

Current study deduced that the patients with acute myocardial infarction (MI) have higher MPV and PDW in STEMI and NSTEMI patients and the patients diagnosed with myocardial infarction (MI) bears lower PCT and platelet count in STEMI and NSTEMI. Current study results reveal that increased platelet volume indices contribute to the pre-thrombotic state in acute myocardial infarction (AMI) and that larger platelets play a specific role in infarction and are hemostatically more active.

Authors Contribution

Conceptualization: MBG
Methodology: FY, SA, FH
Formal Analysis: MBG, FS, BB
Writing-review and editing: MBG, FS, BB, SA, ZH

All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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