Research Article

STUDY OF CORRELATION OF PLATELET INDICES IN THE MANAGEMENT OF CORONARY ARTERY DISEASE

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ABSTRACT

Objectives: The current study aimed to assess whether platelet parameters are associated with the severity of coronary artery disease (CAD) and may be regarded as risk factors; therefore, this study was done to evaluate platelet parameters in patients with CAD.

Methods: This study was carried out in the Department of Medicine of Index Medical College, Hospital and Research Center. 60 CAD patients were enrolled in the study and were compared with 60 normal, healthy individuals of the same age. Those fulfilling inclusion and exclusion criteria were enrolled in the study, and the blood samples were analyzed for platelet indices firstly at the time of admission and then repeated following antiplatelet therapy.

Results: Significantly higher concentrations of mean platelet volume (p<0.001) and platelet distribution width (p<0.001) were found in cases before treatment when compared with the controls. A significantly lower value of total platelet count (p<0.001) was found in cases before treatment when compared with the controls.

Conclusion: Platelets have been associated with the development of cardiovascular diseases such as atherosclerosis and its severe outcomes such as acute myocardial infarction, unstable angina, and sudden cardiac death. The evaluation of platelet indices is considered an important factor in determining the functionality of platelets and is recognized as a promising risk indicator for atherothrombosis.

Keywords: Coronary artery disease, Platelet indices, Mean platelet volume, Platelet distribution width, Total platelet count.

INTRODUCTION

Coronary artery disease (CAD) is the most important cause of mortality and morbidity in developing countries. CAD risk factors include aging, lifestyle choices, and other concomitant illnesses. The risk of coronary atherosclerosis is further increased by obesity, mental stress, hypertension, smoking, diabetes mellitus, and high cholesterol. The etiology of cardiovascular diseases, such as atherosclerosis and its subsequent consequences, including unstable angina (UA), acute myocardial infarction (AMI), and sudden cardiac death, has been linked to platelets. Platelets, anucleate blood cells shed from mature megakaryocytes in the bone marrow, play a pivotal role in all stages of atherosclerosis, which is the pathological basis for CAD. Platelets are the first blood cells that arrive at the surface of the dysfunctional vessel wall, promoting leukocyte recruitment to the endothelium. Activated platelets secrete many adhesive and pro-inflammatory factors [1-4]. Platelet count (PLT) and responsiveness will vary in different states, such as AMI and Kawasaki disease [5,6]. The mean platelet volume (MPV) measures platelet size and reflects platelet activity. Previous studies showed that large platelets are metabolically and enzymatically more active than small platelets and produce more thromboxane A2 [7,8], inducing a greater risk of CAD [9,10]. Platelet indices are also associated with the prognosis of CAD patients [11]. It has been proposed that local platelet activation and platelet hyperreactivity are the causes of acute coronary events [12]. There is evidence that platelet size correlates with platelet activity. A group of platelet parameters that are analyzed as part of an automatic complete blood count are platelet count, MPV, and platelet distribution width (PDW) [13]. MPV and PDW measure platelet volume and variability in platelet size, respectively, and are accurate indicators of platelet activation [14,15]. Previous studies suggest that, besides well-known risk factors, platelet indices may represent additional risk factors for myocardial infarction [16]. Therefore, the current study is being conducted to evaluate the relationship between platelet indices and CAD in various categories.

METHODS

The present study was conducted in the Department of Internal Medicine of Index Medical College, Hospital and Research Center after obtaining IEC approval and written consent from the participants. The study group consisted of 60 individuals with CAD who were treated as cases, and 60 healthy individuals who were matched for age and dietary habits were treated as controls. The rights of the study participants, the need for the study, and the probable outcomes of the study were explained clearly to them.

Inclusion criteria
The study covered all individuals with an acute coronary syndrome diagnosis, including both diabetic and non-diabetic patients.

Exclusion criteria
Patients with HIV, DKA, hemoglobinopathies, splenomegaly (liver cirrhosis), individuals undergoing chemotherapy, and those who refused to provide consent were not allowed to participate in the study.

We measured the platelet index in a 2 ml blood sample collected in EDTA tubes by venipuncture. These blood samples were analyzed within 2 h of venipuncture by an automatic blood counter (a Sysmex XE-2100) for a complete blood count analysis. The Institutional Ethics Committee granted ethical approval. The statistical packages for social science (SPSS) software, version 20, was used to compute and analyze

all of the data. The data are shown as mean±SD. $p<0.05$ is considered significant and $p<0.001$ is considered highly significant.

RESULTS

It is evident from Table 1 that sixty cases in total were examined in three categories. UA was diagnosed in 08 patients. 19 patients were under non-ST elevation myocardial infarction (NSTEMI), and 33 patients were under ST-elevation myocardial infarction (STEMI). Within the case group, 14 patients were female and 46 were male. 60 subjects were age- and sex-matched controls.

From Table 2, it is evident that in this study, the mean age (SD) of the CAD patients was 62.05 (10.52), and the healthy control was 51.56 (8.087). Maximum cases were under the age group of 60–69 years. UA was more common in people 50–59 years old, while NSTEMI and STEMI were more common in people 60–69 years old.

It is evident from Table 3 that the mean values of MPV and PDW were found to be higher in cases before treatment when compared with the controls. A significantly lower value of total platelet count (TPC) was found in cases before treatment when compared with the controls.

Table 4 shows that mean MPV and mean PDW were highest in STEMI; followed by NSTEMI and UA. The mean TPC was minimum in STEMI, followed by NSTEMI and UA.

Table 1: Distribution of cases according to gender

S. No.	Gender	UA	NSTEMI	STEMI	Total
1	Female	0	5	9	14
2	Male	8	14	24	46
3	Total	8	19	33	60

UA: Unstable angina, NSTEMI: non-ST elevation myocardial Infarction, STEMI: ST-elevation myocardial infarction

Table 2: Distribution of cases according to age

S. No.	Age category	UA	NSTEMI	STEMI	Total
1	<40 years	0	0	0	0
2	40–49 years	1	6	2	9
3	50–59 years	4	3	7	14
4	60–69 years	3	6	13	22
5	>70 years	0	4	11	15
6	Total	8	19	33	60

UA: Unstable angina, NSTEMI: non-ST elevation myocardial infarction, STEMI: ST-elevation myocardial infarction

Table 3: Comparison of platelet indices between cases and control

S. No.	Comparison of platelet indices	Control Mean±SD	Cases Before t/t, Mean±SD	p
1	MPV (fl)	9.89±0.99	11.114±0.89	<0.001
2	PDW (%)	11.03±0.78	12.44±1.41	<0.001
3	TPC (×10³/cum m)	287.73±54.36	268.154±45.07	<0.0338

MPV: Mean platelet volume, TPC: Total platelet count, PDW: Platelet distribution width

DISCUSSION

Platelets have a huge role in the etiology of CAD and ischemic heart disease [17]. Abnormal platelet function is considered the main risk factor for major coronary events, with increased activations as the main reason [18]. Furthermore, the site of coronary atherosclerotic plaque is critical since increased platelet consumption causes the freeing of large platelets from the marrow. In addition, the increase in the size of platelets causes an increase in susceptibility to reinfarctions [19]. For this reason, the size of platelets after discharge plays a vital role in assessing the probability of developing more severe CVD problems. Platelet volume is essential in deciding platelet production and mobility. In addition, the platelet volume after angioplasty is considered essential since it can be a marker of restenosis [20]. According to studies, patients' platelet counts and sizes should always be checked because they are independent variables linked to a higher mortality rate [21]. Therefore, routine measurement is crucial, especially for patients with a history of heart conditions. The wide range of platelet sizes results in significant variability that impacts platelet functioning. The bigger platelets are more active than the small platelets [22]. They also have the most prothrombotic properties since they have high levels of BTG, thromboxane, and increased procoagulant. The reactive platelets are often large, with adhesion in the receptors and granules.

The current study showed increased PI among UA and STEMI compared to controls. The MPV and PWD levels were higher among patients with CAD when compared with controls. Similarly, MPV and PWD levels were significantly higher in STEMI patients as compared to NSTEMI and UA, and they appear in decreasing order, respectively. When PI was compared between UA and NSTEMI, there was no significant difference. There are more male patients, i.e., 46 (76.6%), with acute coronary syndrome in our study than female patients, i.e., 14 (23.4%) (Table 1). The results of the present study are in accordance with the work of Iqbal *et al.* [23], Joaquín Alonso *et al.* [24], Chandrasekhar *et al.* [25], and Judith *et al.* [26]. In our study, the mean age of the study group was 62.05 years majority, i.e., 36.66% of patients with ACS were in the 60- to 69-year-old age group, with the maximum (21.66%) belonging to the STEMI study group (Table 2). The results of the present study were consistent with the work of Iqbal *et al.* [23].

In the present study, MPV and mean PDW were found to be higher among CAD patients as compared to controls ($p<0.001$); however, the means of both groups are still within the normal range (Table 3). The results of the present study are in accordance with the study of Pal *et al.* [27], Sansanayudh *et al.* [28], Eswaran *et al.* [29], and Patil *et al.* [30]. Our study was similar to the study of Khandekar *et al.* [31], where they reported that MPV and PDW were significantly raised in patients with AMI and UA when compared with the control group and suggested that the increased MPV contributes to the prethrombotic state in acute ischemic syndromes and that bigger platelets may play a specific role in infarction. Because bigger platelets are hemostatically more active, the presence of bigger platelets is probably a risk factor for developing coronary thrombosis and MI.

In our study, the mean values of MPV and PDW were increased in patients with the STEMI study group as compared with NSTEMI, followed by the UA study group (Table 4). Similarly, the Manchanda *et al.* [32] study concludes that platelet indices, especially MPV and PDW, are raised in patients who have suffered STEMI and NSTEMI as compared to patients diagnosed with UA. Patil *et al.* [33] also found that

Table 4: Comparison of platelet indices in CAD patients

S. No.	Comparison of platelet indices	UA	NSTEMI	STEMI	F value	p
1	MPV (fl)	10.77±0.688	10.87±0.95	11.68±1.04	5.542	<0.001
2	PDW (%)	11.55±1.79	11.91±1.0	12.77±1.60	3.420	<0.039
3	TPC (×10³/cum m)	288.7188±47. 95	263.375±43. 76	252.3684±43. 50	3.989	<0.023

CAD: Coronary artery disease, TPC: Total platelet count, UA: Unstable angina, NSTEMI: non-ST-elevation myocardial Infarction, STEMI: ST-elevation myocardial infarction

the platelet indices, mean platelet volume, and PDW were significantly higher in the STEMI and NSTEMI groups when compared to the NCCP group.

The results of our study are consistent with the findings of Adel *et al.* [34], which proved that platelet index was directly associated with the severity of ischemic heart disease and CAD. In another study by Akin *et al.* [35] and Bekler *et al.* [36], it was evident that the PDW was associated with an increased syntax score.

CONCLUSION

From the present study, it can be concluded that platelets play a critical role in the pathogenesis of atherosclerotic complications, contributing to thrombus formation or apposition after plaque rupture. Platelet volume indices (PVI) are a useful means of identifying bigger platelets, which are hemostatically more active and are a risk factor for developing coronary thrombosis, leading to myocardial infarction. Patients with bigger platelets can easily be identified during routine hematological analysis and could benefit from preventive treatment. Therefore, PVI is an important, simple, effortless, and cost-effective tool that must be used more extensively to predict impending acute events.

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CONFLICTS OF INTEREST

There are no conflicts of interest.

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