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The evaluation of platelets parameters in patients with acute coronary syndrome from single cardiac center in northeastern Iraq

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Abstract

Background and objectives: Platelets are an important link between inflammation and thrombosis and play a significant role in different stages of atherosclerotic plaque formation. This study aimed to define the correlation between variation in admission platelet parameters and acute coronary syndrome and to investigate the diagnostic accuracy of platelets parameters used. **Methods:** The study was performed at Sulaimani Cardiac Care Hospital and Sulaimani Public Health Lab. One hundred cases of diagnosed acute coronary syndrome; ST elevation myocardial infarction, non ST elevation myocardial infarction, and unstable angina were included and compared with 100 apparently healthy subjects. Participants were enrolled after taking a detailed history and complete blood count to assess the platelets parameters. **Results:** A significantly lower admission mean platelets count was found in patients (252x 10^9/l ± 81.3) than in control (291x10^9/l ± 67.6). The mean platelet volume, platelet distribution width and plateletcrit of the patients were all significantly higher. Furthermore, a significant correlation was detected between acute coronary syndrome with mean platelet volume and platelet distribution width. The risk of acute coronary syndrome rose up to approximately 9 times among patients with high mean platelet volume. Moreover, mean platelet volume showed a high sensitivity (88%) and specificity (89%) to detect patients with acute coronary syndrome, unlike plateletcrit and platelet distribution width that were of lesser sensitivity and specificity. **Conclusions:** Admission platelets parameters are readily available laboratory tests, and are of merit in identifying acute coronary syndrome patients.

Key words: Acute coronary syndrome, Mean platelet volume, Plateletcrit.

Introduction

Acute coronary syndrome (ACS): is a spectrum of disorders, including unstable Angina (UA), ST segment-elevation Myocardial Infection (STEMI), and Non ST-elevation Myocardial Infarction (NSTEMI). Coronary artery disease is mainly caused by atherosclerosis and its complications. Platelet activity has an important role in this process. Generalized platelets activation happens during acute coronary event, where increased platelets consumption at the site of atherosclerotic plaque rupture leads to the release of large platelets from bone marrow[1, 2]. It is well known that platelets size when estimated by MPV can be a marker for platelets function and is positively correlated with indications of platelets activity[3]. Consequently, larger and hyperactive platelets play a vital role in activation and progression of thrombosis. The automated hematology analyzers have made it possible to determine the platelets volume indices: mean platelet volume (MPV), platelet distribution width (PDW) and plateletcrit (PCT). Mean platelet volume is a measure of the average size of platelets, while PDW reflects the variation in the platelets size and PCT is the volume occupied by platelets in blood[4]. Recently, high MPV has been linked with myocardial damage in patients with ACS and correlated with poor prognosis[5]. The available cardiac markers to identify myocardial damage are not sufficiently sensitive at the early stage of ACS. Likewise, measuring platelets activity by any of the wide variety of methods remains a research tool that is not yet included in routine diagnosis[6, 7]. Therefore, using a multi diagnostic approach may be of benefit to diagnose ACS clinical manifestations[8]. Few studies had demonstrated the association between platelets size and ACS in Iraq and non

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from Kurdistan-Iraq. Hence, this study, the first from Kurdistan, aimed to define the correlation between admission platelets parameters and acute coronary syndrome, and to demonstrate the diagnostic accuracy of platelets indices in identifying ACS cases.

Materials and methods

This study was conducted between 1st of October-2015 to 1st of January-2016 at two centers: Sulaimani Cardiac Care Hospital, and Sulaimani Public Health Lab-hematology department. Two hundred participants were enrolled, including 100 healthy control subjects and another 100 cases of recently diagnosed acute coronary syndrome. Participants were included after a detailed clinical history. Patients presenting with acute chest discomfort accompanied by ECG changes and elevated cardiac biomarkers, and patients presenting with symptoms suggestive of unstable angina were included in the study. While Patients with history of bleeding disorders, malignancy, liver and renal diseases, preeclampsia, sepsis, recent blood transfusion (within 6 week), trauma or major operation, and patients on medications or have recent infection that can cause thrombocytopenia were excluded from study.

Three milliliters of venous blood sample were obtained from each participant upon admission to the hospital and before receiving any drug treatment by a sterile venipuncture using disposable syringes, and dispensed into EDTA K3 tubes, mixed gently, and delivered within 30 minutes of collection to hematology department-Sulaimani Public Health Lab for analysis. Platelets count and platelets indices were performed as part of full blood count by fully automated procedure using HORIBA ABX Micros 60 Hematology Analyzer (HORIBA ABX SAS-Japan).

The statistical analysis performed using Statistical Package for the Social Science (SPSS) software version 23 to identify descriptive analysis. T-test and ANOVA were used to find association between variables. Statistical significance of the calculated correlation coefficient was estimated using the binary regression test. The Receiver Operator Characteristic (ROC) analysis included calculation of the area under the curve (AUC) was used to measure the diagnostic accuracy (sensitivity and specificity) of a test where the values from 0.5 to 0.7 represented low accuracy; values from 0.7 to 0.9 represented tests that are useful for some purposes; and values greater than 0.9 represented tests with high diagnostic accuracy. P-value ≤ 0.05 were regarded as statistically significant. The work was approved by the ethics committee of Kurdistan Higher Council of Medical Specialties.

Results

This cross sectional study participant included 200 persons, 100 apparently healthy individuals as the control group and 100 patients with acute coronary syndrome (ACS), further divided into three groups: (1) forty-four cases of ST elevation myocardial infarction STEMI, (2) Thirty-four cases of non ST elevation myocardial infarction (NSTEMI) (3) Twenty-two cases of unstable angina. The age of the patients enrolled ranged from 37-67 years with a mean of (53.4 ± 6.7) year and the age of the control group ranged from 39-64 years, with a mean of (52.9 ± 6.4) year. Regarding the sex distribution of the patients, 57% were males and 43% were females, in the control group 54% were males and 46% were females.

The platelet counts in ACS patients ranged between (130-550x10^9/l), with a mean value of (252x 10^9/l ± 81.3), which is significantly lower than the value in control group (291x10^9/l ± 67.6), having a range of (149-432x10^9/l), p-value 0.009, Table (1).

Regarding the platelets indices; mean platelet volume (MPV); in ACS patients; readings ranged between (5.0-11.5 fl) with a mean value of (9.55 fl ± 0.9) which is significantly higher than the mean MPV of control group (7.59fl ± 0.8), with a range of (6.10-9.90 fl), and a p-value = 0.0005. The plateletcrit (PCT) range in the patients was (0.10-0.34%), with a mean of (0.19% ± 0.1), which is similarly significantly higher than in control group (0.18% ± 0.1) with a range of (0.08-0.30), p-value= 0.024. Likewise, the mean value of platelet distribution width (PDW) in patients group (13.93% ± 2.6), is significantly higher in comparison with the control group mean value (13.88 ± 2.1) p-value = 0.036, Table (1).

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Table (1): The platelets parameters among participants.

Platelets parameters	Control (No.=100)	ACS patients (No.100)	p-value
Platelets count ($x10^9$/l)			
Range	149-432	130-550	
Mean	291	252	0.009
SD	67.9	81.3	
MPV (fl)			
Range	6.1-9.90	5-11.50	
Mean	7.59	9.55	0.0005
SD	0.8	0.9	
PCT (%)			
Range	0.08-0.30	0.10-0.34	
Mean	0.18	0.19	0.024
SD	0.1	0.1	
PDW			
Range	7.30-17.4	9.0-23.0	
Mean	13.88	13.93	0.036
SD	2.1	2.6	

There was statistically significant difference in the mean MPV in each subgroup of patients with ACS namely; STEMI, Non-STEMI and UA in comparison to values reported in the control, with mean MPV in NSTEMI being the highest among others (9.77fl +0.83), p-value of (0.0001), (0.0002) and (0.0007)] respectively, Table (2).

Table (2): The platelets parameters among acute coronary syndrome subgroups.

Platelets indices	Control No.=100)	(STEMI) (No.44)	(NSTEMI) (No.34)	patients (UA) (No.22)
MPV (fl)				
Range	6.1-9.90	8.40-11.50	5-11.50	8.10-10.9
Mean	7.59	9.33	9.77	9.68
SD	0.8	1.16	0.83	0.74
P value		0.0001	0.0002	0.0007
PCT(%)				
Range	0.08-0.30	0.11-0.31	0.10-0.34	0.12-0.23
Mean	0.18	0.17	0.20	0.23
SD	0.05	0.05	0.05	0.04
P value		0.24	0.007	0.0001
PDW(%)				
Range	7.30-17.4	10.20-21.40	9-23	10.1-16
Mean	13.88	12.75	14.31	12.29
SD	2.06	2.48	2.99	2.06
P value		0.005	0.36	0.001

This study reported a statistically significant correlation between ACS and MPV and PDW, p-value of 0.000 and 0.013 respectively, and it is worthy to note that the risk of ACS raises up to approximately 9 times among patients with higher MPV than normal [OR =8.98, (CI 4.91-16.42)]. While, on the other hand, platelet count and PCT didn't correlated significantly with acute coronary disease, p-value= 0.07 and 0.2 respectively, Table (3).

Table (3): Correlation between acute coronary syndrome and platelet parameters

Platelets parameters	p-value	O.R.	95% C.I.	
			Lower	Upper
MPV	0.000	8.98	4.91	16.42
PCT	0.20	0.00	0.00	29.13
PDW	0.013	0.79	0.66	0.95
Platelets count	0.07	0.99	0.99	1.00

Furthermore, Receiver Operating Characteristic (ROC) curve analysis demonstrated that MPV is of high diagnostic accuracy in identifying ACS patients [AUC=0.94, sensitivity 88% and specificity 89%], while in contrast to PCT and PDW, which both showed a lesser diagnostic accuracy [AUC= 0.59 and 0.34 respectively], Table (4).

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Table (4): Diagnostic accuracy of platelets indices.

Platelets indices	AUC	Cut-off	Sensitivity (%)	Specificity (%)	95% C. I. Lower Bound	95% C. I. Upper Bound
MPV	0.94	8.45	88	89	0.91	0.98
PCT	0.59	0.19	56	56	0.51	0.67
PDW	0.34	13.05	38	35	0.27	0.42

Discussion

This study has demonstrated significant differences in the mean platelets parameters (platelets count, MPV, PCT and PDW) in patients admitted with ACS in comparison to normal control group, Table 1. It's clear that the mean platelets count were significantly lower, in contrast to the mean MPV, PCT and PDW which were all significantly higher in comparison to the control group values, p-value = 0.009, p-value= 0.0005, p-value =0.024 and p-value = 0.036 respectively. Interestingly, the mean MPV in each of the three subgroups of ACS (S TEMI, Non-STEMI and UA), were all significantly higher in comparison to control MPV mean value. The explanation of the above findings would be the contribution of platelets to the prothrombotic state in ACS; a hypothesis that has been suggested by previous studies as well[8-14].

Likewise, the study investigated the correlation of platelets parameters and ACS in patients upon admission to Sulaimani Heart Center with chest pain, and we detected a significantly positive correlation of high MPV and PDW (as both reflecting the platelets volume) with ACS in comparison to normal people, p-value =0.000 and p-value =0.01 respectively, while no correlation of significance reported with PCT, p-value= 0.2, Table 3. These findings were shared by previous studies as well[12, 15, 16]. Moreover, high MPV in patients presenting with acute chest pain would have an increased risk of approximately 9 times to have an underlying acute thrombotic event compared to those with normal MPV (OR =8.98, C.I.= 4.91-16.42). Martin et al [16] had demonstrated that increased MPV was considered as an independent risk factor of recurrent MI. Moreover, previous published data, declared that increased MPV can be identified as a marker of increased morbidity and mortality in patients with ACS, even among survivors, particularly STEMI, that formed 44% of our patients enrolled [17-19]. In addition, some investigators had correlated high MPV with the complexity and severity of coronary artery diseases according to the Gensini and SYNTAX scores and revealed a positive correlation between MPV and Gensini score [20, 21]. While, on the other hand, no significant association was reported with the PCT and platelets count, p-value= 0.202 and p-value= 0.068 respectively. The above results agreed with previously published data[8].

Furthermore, we applied the receiver operator characteristic (ROC) area to validity of platelets indices to distinguish ACS chest pain from chest pain of non-cardiac origin, and we reported an AUC for MPV=0.94, (sensitivity 88% and specificity 89%). Limited numbers of studies documented the diagnostic accuracy of MPV in patients with ACS, and they reported a variable range of accuracy, with AUC ranging from 0.56-1 [6, 8, 12, 22]. Al-Obaeidi et al.[12] reported AUC for MPV value = 1, supporting our proposition that MPV is of a high diagnostic accuracy in identifying ACS. Shah et al[23] had also confirmed the reproducibility of MPV.

Our main limitation is that we didn't measure troponin level and platelets aggregation in the enrolled ACS cases, and hence, comparing the above parameters with the platelets indices in the detection of ACS.

Conclusions

This study declared that platelets parameters including; platelets count, MPV, PDW and PCT are useful and laboratory tests, and are of advantage in identifying ACS patients. Furthermore, an elevated MPV is of high diagnostic accuracy for the benefit of detection of ACS patients.

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