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MPV as Prognostic Factor for Patients with Coronary Artery Diseases in Sudan

Wala Eldin Osman Elradi[1], Elharam Ibrahim Abdallah[2], Eman Elimam Diab[3], Omar Mahmoud Ahmed[4], Abdulrab Ahmed M. Alkhanjaf[5], Elhashimi Eltayb Hassan[6]

[1, 2]Department of Haematology & Immunohaematology (PhD), Faculty of Medical Laboratory Sciences, Alzaiem Alazhari University, Khartoum State, Sudan

[3, 4]Department of Haematology & Immunohaematology (M.Sc), Faculty of Medical Laboratory Sciences, Alzaiem Alazhari University, Khartoum State, Sudan

[5, 6]Department of Clinical Laboratory (PhD), Applied Medical Sciences College, Najran University, Najran, Saudi Arabia.

Abstract: ***Background: The main cause of Coronary Artery Disease (CAD) is a complication of atherosclerosis due to blockage of blood flow in the arteries of the heart. It has been observed that platelet activationand aggregation are critical processes in initiation of atherosclerotic lesions and formation of thrombosis inside coronary arteries. Objective: The aim of this study was to evaluate the platelet indices among patients with acute coronary syndrome (ACS). Method: A clinical based (Alshaab Hospital in Khartoum),case-control studywas conducted on 50 patients known as confirmed cases with acute coronary artery disease and 50 cases designated as healthy controls. On each blood sample drawn from each case (patients and control), the following platelet indices were measured using Mindary BC 3000: Platelets count, Mean platelets volume (MPV), platelets distribution width (PDW) and platelets Crit (PCT). Results: A statically significant difference in mean values of the measured platelet indices was found in the values of MPV only, that significantly raisedin patients with ACS compared to controls (9.18 ± 0.99) vs (7.59 ± 0.71) respectively, (p value < 0.001). The result showed the increased mean values PDW and PCT were statistical insignificance, (p value (0 .82) and (0.18) respectively. Furthermore, there was insignificant decrease in platelet count among patients when compared to control p value (0.205). Conclusions: In light of current results of this study, MPV could be used as a predictor for early detection of thrombosis in patients with ACS, These findings would encourage routine request of MPV as prognostic marker for early detection of coronary event.***

Keywords: MPV: Mean platelets volume, PDW: platelets distribution width, PCT: platelets Crit, ACS: Acute coronary syndrome, CVD: Cardiovascular diseases.

1. Introduction

Incidence of cardiovascular diseases has become increased and the occurrence of the disease increase morbidity and mortality rate. Large platelets are enzymatically and metabolically more active and have a higher potential thrombotic ability as compared with smaller platelets.[1]

Platelets indices specially MPV could be marker of thrombosis among patients with ACS ,so this indices could be easy tool for predicting coronary event ,also there is no Sudanese published data on this study.[1]

Mean platelet volume (MPV) is measurement of the average size of plateletsthat calculated by machines and included in blood tests as part of the complete blood count. MPV test results can be used to indicate platelet production in bone marrow or platelet destruction problems, since the average platelet size is larger when the body is producing large numbers of platelets.[1]

Higher MPV observed in myeloproliferative diseases, immunethrombocytopenic purpura (ITP), and Bernard–Soulier syndrome. It may related also to pre-eclampsia and recovery from transient hypoplasia.[2]In contrast low level of MPV may correlate with thrombocytopenia due to impaired production of megakaryocytes in the bone marrow, Also, low MPV value may correlate with abnormally small platelet size, symptoms sometimes related to spectrum referred to as Wiskott–Aldrich syndrome (WAS),[4]that caused by a genetic mutation of the gene of WAS.A Lavender-Top EDTA tube is used for sample for MPV testing. Platelet volumes range from 9.4–12.3 fL[5] (femtolitre), equivalent to spheres 2.65 to 2.9 µm in diameter.

Platelet indices like MPV and PDW are simple parameters and could be used as markers for the early prediction or diagnosis of thrombus formation and disease related, those parameters are increase during platelet activation. MPV is calculated parameters by automatic machine from the average size of platelets incirculation.PDW is an indication for the anisocytosis of platelets, whilePCT is an effective tool for screening and detection of platelet quantitative abnormalities.[6]

Cardiovascular disease (CVD) is a type of diseases that involve the heart or blood vessels. Cardiovascular disease includes coronary artery disease (CAD) such as myocardial infarction (heart attack) and angina.[7] Other CVDs include heart failure, stroke, hypertensive heart disease, cardiomyopathy, heart arrhythmia, rheumatic heart disease, congenital heart diseases, aortic aneurysms, valvular heart disease, carditis, peripheral artery disease, thromboembolic disease, and venousthrombosis.[8, 7] The underlying mechanisms vary depending on the disease in question. Coronary artery disease, stroke, and peripheral artery disease involve atherosclerosis. That may cause by increase blood pressure, lack of exercise, smoking, diabetes, obesity, poor diet, high blood cholesterol and excessive alcohol

consumption among others. Increased in blood pressure results in 13% of CVD deaths, while smoking results in 9%, diabetes 6%, lack of exercise 6% and obesity 5%. Rheumatic heart disease may result from untreated strep throat.[7]

Worldwide 90% of CVD is preventable [9] by improvement of risk factors through: exercise, healthy eating, avoidance of tobacco smoking and avoidance or limitation of alcohol intake. Riskfactorstreatment, such as increase in blood pressure, fats and diabetes is also beneficial.[9]Antibiotics treatment for people with strep throat can decrease the risk of rheumatic heart disease.[10]The efficacyof aspirin in healthy people is of unclear benefit. [11,12]

Cardiovascular diseases are the leading cause of death worldwide. This is true in all places of the world except Africa.[7]Together they resulted in 17.3 million deaths (31.5%) in 2013 up from 12.3 million (25.8%) in 1990.[8]Deaths, at a given age, from CVD are more common and have been increasing in much of the developing world, while rates have decrease in most of the developed world since the 1970s.[12,13] Coronary artery disease and stroke account for 80% of CVD deaths in males and 75% of CVD deaths in females.[7]Most cardiovascular disease affects older adult people. In the United States 11% of individual between 20 and 40 have CVD, while 37% between 40 and 60, 71% of people between 60 and 80, and 85% of people over 80 have CVD[14].So the aimof this study was to determinethe role of platelets indices among patients with acute coronary syndrome in Khartoum state.

2. Materials and methods

This was Cross-sectional, case - control study conductedin Alshaab hospital in Khartoum stateduring the period from June 2019 to February 2020, among a total of 100 persons (50 cases with ACS and 50apparently healthy individual as controls).The age of the patients ranged between 38-77 years from both genders. While the age of the control group ranging between 38 -70 years from both gender. Patients with renal or liver disease or with history of platelets disorders were excluded from the study. There was full commitment precaution sample taken, privacy and confidentiality. A total of 2.5 ml of blood Transferred into EDTA evacuated anticoagulant container and the container inverted three times for mixing the blood. Then the containers were labeled and complete blood count (CBC) was investigated using automated analyzer (Mindary BC3000). Quality control of the analyzer involves measuring materials with known, stable characteristics and frequent intervals.Data had been analyzed by SPSS version 21 to obtain Mean, SD and p value. Independent t-test and Persons correlation coefficients were used; significance levels were set at ($P < 0.05$)

3. Result

The current study has enrolled 100 subjects (cases and control) were selected according to inclusion criteria.

MPV levels were significantly higher among patients with ACS compared to controls, P. value = 0.000.

In contrast; the result showed insignificantly increased in PDW and PCT p value (0.823), (0.189) respectively. Also there was insignificantly decreasedin platelet count among the test group when compared to control group, p value (0.205). Table (1)

Regarding comparison between males and females, the results show that there were insignificant differences between males and females for all platelets parameters Table (2).Also our results reveal that there were no correlations between age of patients and Platelets, MPV, PDW and PCT in test group Table (3).

Table 1: Statistics and mean differences of Platelets count, MPV, PDW and PCT among case and control groups

Study groups		Mean± Std. Deviation	Minimum-Maximum	P value
Platelets	Case	261.84±124.51	44-612	0.205
	Control	288.96±84.25	169-533	
MPV	Case	9.18 ± 0.99	7.00-11.70	
	Control	7.59 ± 0.71	6.10-8.80	<0.001
PDW	Case	15.32±1.03	11.60-16.70	0.823
	Control	15.27 ±1.02	11.50-15.20	
PCT	Case	0.28± 0.30	0.05-2.20	0.189
	Control	0.22 ± 0.07	0.122- 0.43	

- T-test was used to calculate P value
- P value less than 0.05 considered significant

Table 2: Statistics and mean differences of Plts, MPV, PDW and PCT among gender in test groups

Test groups		Mean± Std. Deviation	Minimum-Maximum	p. value
Platelets	Male	246.58±125.77	112-612	0.273
	Female	286.74±121.60	44-560	
MPV	Male	9.28 ± 0.85	7.40-11.70	0.330
	Female	9.00 ±1.18	7.00-11.40	
PDW	Male	15.35 ±1.04	11.60-16.70	0.758
	Female	15.26±1.04	11.60-16.50	
PCT	Male	0.24± 0.12	0.109- 0.53	0.231
	Female	0.34 ± 0.46	0.050-2.20	

T-test was used to calculate P value
P value less than 0.05 considered significant

Table 3: Correlations of age with Platelets, MPV, PDW and PCT in test group

		Platelets	MPV	PDW	PCT
Age (Year)	R value	-0.018	0.012	0.002	0.007
	P value	0.903	0.932	0.988	0.960

P value less than 0.05 considered significant

3. Discussion

Generally activation of platelet occurs before an acute coronary event. Atherosclerotic plaque of the coronarywill leads to increase in platelet consumption that causes release of large platelets from the bone marrow. The fact that persistent of the increase of platelets even after discharge of patients from hospital supports the view that platelet volume is chronically larger in the infract group[15, 16]. This suggests that MPV and other indices could bemarker of the degree of damage that occur, and so can predict early occurrence of myocardial infarction.

MPV levels were significantly higher among patients with ACS compared to controls,thisresult is similar to study done by Lippi et al. reported that Italian patients with ACS has significantly higher MPV values(p value<.001) than patients without ACS (2009).[16]

Another similar result in a study done by ChuH, etal (2011) in China showed that there was significantly increased in MPVin ACS group and this study also was agreed with this results. [17]

Also this study was agreed with Indian study by MM Khander, et al (2006); they found that mean platelet volume were significantly high, p value (<001) among patients with AMI and UA compared to control group, but their study found significant increase in PDW, p value (<001).[18] Which was opposite to this study which report increase in PDW but statistically insignificant and that may be due to genetic variations or low sample size that we used. Also Randheer Pal, et al(2014) from India found: MPV was higher in patients with acute coronary syndrome when compared to non ACS patients (p value <.001). [19]

A study was done by, vitthalkhode, et al in India report that there was significant increase in MPV (mean 9.65, SD.9, p value 0.018), but insignificant increased in platelet count and PCT in AMI group compared to control group (2012). [20]All of resultsare similar to this study except the point of platelet count which was slightly lower than control in our study and slightly higher than control in their study but both of them had insignificant values; may relate to the variability of platelets count during activation.Also the insignificant variation of other parameters may confirm that, those parameters are less sensitive than MPV in prediction of thrombus formation.

4. Conclusion

MPV as a simple, easy and economic laboratory measurement we suggest that it might be useful in conjunction with other conventional biochemical cardiac markers in early predication of the risk of ACS in patients admitted to the emergency department, so must be used as routine investigation and prognosis of patients with coronary artery diseases .

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