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The evaluation of of surface expression of platelet markers and left ventricle ejection fraction in patients with coronary artery disease

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ABSTRACT

Background and Aims: Surface expression of platelet markers enhanced during ischemic events and appear to play an important role in myocardial repair. Stromal cell-derived factor-1 (SDF-1) is one of these factors which its effects Mediated through CXCR4 and CXCR7 receptors. In our study we are going to determine the surface expressions of platelet markers and the changes of left ventricle ejection fraction in patients with coronary artery disease.

Materials and Methods: This descriptive cross-sectional study measured the superficial expression of platelet indices (SDF-1R, CXCR4, and CXCR7) and its association with the changes of the left ventricle ejection fraction in patients with coronary artery disease who have referred to Taleghani Hospital, Tehran in 2017-2018.

Results: Among all patients referred to Taleghani Hospital with symptoms of coronary artery disease, 57 patient had inclusion criteria. this study demonstrated that mean SDF1 and CXCR4 level were respectively 1.1 and 2.3 which there were significant difference between those with severe EF reduction comparing to the rest of the groups (respectively P<0.002 & P<0.004). The mean CXCR7 value of all patients was 3.5 (SD= 0.27) and showed a significant difference in patients with severe (6) and low (4.7) ejection fraction reductions compared to those with moderate (2.5) and normal (2.8) ejection fraction reductions (P<0.009).

Conclusion: Results from this study suggest that the level of surface expression of platelet markers (SDF-1, CXCR4, CXCR7) in patients with coronary artery disease who had severe LV dysfunction rise sharply compared to those with normal ejection fraction, and it can be, therefore, used as a factor to evaluate the level of damage caused by the coronary artery disease.

INTRODUCTION

This descriptive cross-sectional study measured the superficial expression of platelet indices (SDF–1R, CXCR4, CXCR7) and the left ventricle EF changes in patients with coronary heart disease who were referred to Taleghani Hospital during the years 2017-2018. Patients aged 18-60 years of age, who have referred to the hospital with symptoms of coronary heart disease and were admitted for angiography were included. The exclusion criteria were any history of revascularization, cancer and chemotherapy, platelet disorders and acute and chronic bleeding, and the consumption of medications with hematologic complication. Those who with history of receiving blood and platelet products during the last three months also were excluded as well. The consent forms were taken from the patients in case of a willingness to participate in this study. We get our ethical approval from shahid Beheshti University of medical sciences ethical center with ethical code 1398,12 .To measure the precise function of left ventricle and EF changes, Echocardiography were used after the angiography. In this

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regard, the EF > 55% was an indicator of normal function, EF 40-50% was a sign of mild LV dysfunction, EF 30-40% showed a modeate Lv dysfunction, and EF <30% suggested a severe reduction of left ventricle function [11].

The blood platelet indices count (SDF – 1R, CXCR4, CXCR7) was estimated by a 10 cc fasting blood sample that was taken from all patients, and the level of SDF – 1R, CXCR4, and CXCR7 factors was measured by flow cytometry analysis.

The collected data were analyzed by SPSS version 25, and the normality of the data was assessed by the Kolmogorov-Smirnov test. Normal distribution of the data for the ECG-based comparison of platelet factor, the AVONA test was used, and values below 0.05 were considered significant. Also, a post hoc analysis (in our study, Scheffe post hoc test) was used in order to investigate the association between subgroups. In this study, participants' information remained confidential, and participation was not compulsory. Written consent was taken from all participants, and the ethical regulations were based on the provision of the Helsinki convention and acquiesced from the ethical committee.

MATERIALS and METHODS

This descriptive cross-sectional study measured the superficial expression of platelet indices (SDF – 1R, CXCR4, CXCR7) and the left ventricle EF changes in patients with coronary heart disease who were referred to Taleghani Hospital during the years 2017-2018.. Patients aged 18-60 years of age, who have referred to the hospital with symptoms of coronary heart disease and were admitted for angiography were included. The exclusion criteria were any history of revascularization, cancer and chemotherapy, platelet disorders and acute and chronic bleeding, and the consumption of medications with hematologic complication. Those who with history of receiving blood and platelet products during the last three months also were excluded as well. The consent forms were taken from the patients in case of a willingness to participate in this study. We get our ethical approval from shahid Beheshti University of medical sciences ethical center with ethical code 1398,12 .To measure the precise function of left ventricle and EF changes, Echocardiography were used after the angiography. In this regard, the EF > 55% was an indicator of normal function, EF 40-50% was a sign of mild LV dysfunction, EF 30-40% showed a modeate Lv dysfunction, and EF <30% suggested a severe reduction of left ventricle function [11].

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RESULTS

A total of 57 patients who have referred to Taleghani Hospital with coronary artery disease symptoms were included in this study. All participants underwent echocardiography; 33 patients were in normal group and 10 patients have mild LV systolic dysfunction , 7 patients were diagnosed with moderate LV systolic dysfunction, and 7 patients were categorized as having severe LV function reduction.

Table 1 presents the mean values of SDF-1R, CXCR4, and CXCR7 in the groups. The mean SDF-1R value in all patients was 1.11, and there was only a significant difference in patients with severe EF reduction comparing to the rest of the people ($p < 0.002$).

The mean level of CXCR4 in all patients was 2.3, which showed only a significant difference between patients with severe reduction in ejection fraction (3.2) compared to other groups (moderate LV systolic dysfunction (2.1) and Mild Dysfunction (2.3) and patients with normal LV Function (2/2)) ($P = 0.004$).

The mean measure of CXCR7 among all patients was 3.5, and it had significant differences in groups of severe (6) and low (4.7) EF reductions compared to patients with moderate LV systolic dysfunction (2.5) and normal LV fuction (2.8) EF reductions ($P<0.009$), as illustrated in table 1.

Table 1. Patients' distribution based on the platelet indices count and EF reduction (LV= Left ventricle, SD= Standard deviation)

Platelet Marker	LV systolic function	Mean	SD
SDF1	Normal	1.07	0.24
	Mild Dysfunction	1.00	0.22
	Moderate Dysfunction	1.07	0.08
	Sever Dysfunction	1.5	0.51
	Total	1.11	0.3
CXCR4	Normal	2.21	0.47
	Mild Dysfunction	2.29	0.7
	Moderate Dysfunction	2.14	0.55
	Sever Dysfunction	3.16	1.06
	Total	2.33	0.68
CXCR7	Normal	2.85	0.13
	Mild Dysfunction	4.68	0.44
	Moderate Dysfunction	2.49	0.05
	Sever Dysfunction	6.04	0.38
	Total	3.52	0.27

DISCUSSION

This study suggest that the surface expressions of platelet markers (SDF-1, CXCR4, CXCR7) was increased in patients with coronary artery disease and severe left ventricle dysfunction compared to patients with normal EF and, therefore, can be used as an indicator to evaluate the level of damage caused by the coronary artery disease.

The expression of stromal cell-derived factor-1 (SDF-1) on the outer surface of platelets in ischemia plays an essential role in the myocardial damage recovery, leading to the migration of progenitor cells from the bone marrow to the site of injury. The CXCR4 and CXCR7 factors mediate the effect of SDF-1 and increase after injury or severe ischemia. Our results were in agreement with the 2017 study of Kiani and colleagues [12], who have suggested that any damages to the heart tissue lead to the inflammatory chemical secretion of SDF – 1, and subsequently, the increase of CXCR7 and CXCR4 expression in blood cells. In another study by Mayorga and colleagues in 2018 [13], the mesenchymal stem cells (MSC) isolated from the green fluorescent proteins (GFP) were induced to increase the expression of SDF-1 expression. In this study, the administration of MSC significantly improved the EF in control and diabetic rats 21 days after acute myocardial infarction, an outcome that was in line with our findings.

Based on a 2014 study by Rath and colleagues, the clinical potential of the CXCR7 platelet expression level is an influential factor in mediating the beneficial role of SDF-1 on improving performance in patients with acute coronary disease. Surprisingly, in our study the rate of CXCR7 in the group with mild LV systolic dysfunction was more than that of patients with moderate left ventricle dysfunction, which can be partly explained by the small study population in our study; therefore, inadequate power for statistical analyses. However, Schiller and colleagues [14] have neither reported a significant correlation with platelet expression level of CXCR4 and CXCR7 after assessing serum SDF-1 levels among 160 patients with coronary heart disease, as a result, further investigation of this factor will be recommended in future studies. Another limitation of our study is to conduct this study with small sample size from a single health center; therefore, broader multi-central studies with larger sample sizes might be required for the adaptation of the results to the general population.

CONCLUSION

In conclusion, based on the results of this study, it can be said that the level of surface expression of platelet markers (SDF-1, CXCR4, CXCR7) in patients with coronary artery disease who had severe left ventricle ejection fraction reduction rise sharply compared to those with normal ejection fraction, therefore, these platelet markers can be used as an index for the assessment of myocardial damage and left ventricular severe EF reduction.

CONFLICT OF INTERESTS

Authors declare that they have no conflict of interest.

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