The Effect of Diabetes on the Relation of Epicardial Fat Thickness to the Severity of Coronary Artery Disease in St Elevation Myocardial Infarction Patients

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Abstract: Background: there is a strong relation linking epicardial fat depth and harshness of coronary artery illness. The impact of diabetes on severity of coronary artery disease (CAD) is well identified. The potential effect of diabetes on the association among EFT and severity of CAD in ST elevation myocardial infarction was not fully investigated. **Patients and Methods:** The study included 52 patients with STEMI (mean age: 56.3±6.4 years). Patients were divided into two groups depending on the presence of diabetes (diabetic and non-diabetic group). EFT was determined on the right ventricle of persons having the left lateral decubitus position via transthoracic echocardiography. GENSINI score was applied to identify the harshness of CAD. **Results:** Diabetic subjects exhibited significantly higher ($p < 0.05$) EFT values in comparison with non-diabetics. EFT is in parallel related with diabetes and GENSINI score in all subjects ($p < 0.05$, for all). The relationship between EFT and GENSINI score was stronger in diabetic patients in comparison with non-diabetics ($r = 0.6618$; $p< 0.001$vs. $r = 0.330$; $p = 0.04$). **Conclusion:** In diabetic and non-diabetic individualsn suffering from STEMI, epicardial fat thickness is linked with GENSINI score. This association is stronger in diabetic patients than non-diabetic.

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Key words: Epicardial fat thickness, Diabetes, STEMI, Gensini score.

1. Introduction:

Diabetes is a very important independent risk factor for the development of coronary artery disease(1). Not only diabetes play an important role in inducing atherosclerosis, but also many different dynamic factors associated to diabetes and considered as predisposing factors for inducing of both acute myocardial infarction and post-infarction complications (2). Epicardial fat tissue (EFT) is visceral adipose active tissue that arises during the embryonic stage from visceral layer and play a role in supplying the heart and surrounding tissues with required energy, in addition, EFT secrets adiponectin and leptin hormones and considered as a local store for pro-inflammatory cytokines which is linked to hypertension, obesity, coronary artery disease and insulin resistance (3). Therefore, determination of the volume of EFT may play a task in the stratification of the cardio-metabolic risk and as a marker for starting of therapy. One of the methods for decreasing the EFT thickness through weight loss and giving anti-inflammatory agents. For the reason that coronary arterial supply both epicardial and myocardial tissues with blood it is practical to assume that enhanced local vascularization may recommence epicardial fat to its physiological role(4). In our study, we search for the effect of diabetes in the relationship between epicardial fat quantity and severity of coronary artery illness by Gensini score in myocardial infarction individuals.

2. Patients and Methods:

Patients included in our study were 52 patients (27 males and 25 females) with mean age (54.3±6.7 years) admitted to the catheterization lab at Zagazig University between February 2018 and August 2018. They were diagnosed as **acute myocardial infarction** (any patient with typical chest pain, a positive troponin-I level {defined in our clinical laboratory as >0.01 ng/ml} with or without ST segment changes on 12-lead electrocardiogram.). Patients, who had coronary lesions with a diameter stenosis of ≥ 50%, in vessels of size ≥ 1.5 mm, were included. Patients also underwent transthoracic echocardiography before the coronary angiography.

We exclude all patients with a history of coronary artery disease, heart failure (EF < 50), hepatic or renal failure, active or chronic inflammatory or autoimmune diseases, severe arrhythmia and patients with poor image quality in the echocardiographic examination.

After assessment of detailed medical history and a complete physical examination, the baseline characteristics including age, sex, hypertension, T2DM, smoking status, family history of CAD, Waist circumference (was measured down to the 0.1 cm unit

at the mid-point between the lower rib margin and the iliac crest)(5), and previousmedications were recorded for all patients.

Venous blood samples were collected from all participants to measurecomplete blood picture, Serum creatinine with an auto-analyser and Highly-sensitive cardiac troponin I (hs-cTnI).

Transthoracic echocardiography:

Echocardiographic evaluation was done using the commercially available equipment, the digital ultrasound system (GE) Vivid S6 with a 2- to 3-MHz transducer.

Standard parasternal long-axis and short-axis views from two-dimensional images were done for measurement of EFT on the free wall of the right ventricle while patients will be in left lateral decubitus position.

M-mode, 2- dimensional and Doppler echocardiographic assessment was performed for all patients.

Assessment of the EFT

EFT obtained by echocardiography is generally determined as (the relatively echo-lucent space between the outer wall of the myocardium and the visceral layer of pericardium; and is measured perpendicularly on the free wall of the right ventricle at end-systole in three cardiac cycles, the average value of three cardiac cycles from each echocardiographic view was determined).

Angiographic assessment of severity of coronary artery disease by Gensini Score

Coronary angiography was performed by Judkins technique without nitroglycerin using 6-French right and left heart catheters. **()** Coronary lesions leading to a diameter stenosis of ≥ 50% in vessels of ≥ 1.5 mm were scored separately. Angiogram was analyzed by two interventional cardiologists who were blinded to clinical status and laboratory measurements. After obtaining images by standard approaches, each angiogram was interpreted by two independent cardiologists. **( )** The severity of coronary artery lesions will be scored using a modified Gensini scoring system.

Statistical Analysis

Data were coded and entered using R language (R-studio Version 0.99.484 – © 2009-2015) for data analysis. Data are expressed as mean value ± standard deviation and percentage. Differences in frequency of characteristics were assessed by independent sample student's t-test for continuous variables. While Chi-square statistics used for discrete variables. A two-tailed P-value, 0.05 was considered statistically significant (6)

3. Results:

The present work reported that the average EFT values of diabetes 6.7 ± 1.3 mm, whereas in non-diabetic group averaged 5.4 ± 1.4 mm. While the mean GENSINI score values of diabetes and non-diabetes groups were 30.18 ± 16.09 mm and 20.75 ± 13.95 mm, respectively. (Table 1)

EFT is associated with GENSINI score in all patients (r =0.53, P = <0.01), in non-diabetic group (r = 0.33, P= 0.04) and diabetic group (r= 0.66, P=0.01).

Table (1): Comparison of various variables between the two groups

variables	Diabetic group	Non-diabetic group	P value
SPB (mmHg)	138 ± 17.88	126.67 ± 14.14	0.26
DPB (mmHg)	88 ± 8.37	82.22 ± 9.17	0.27
Waist circumference (cm)	108.67± 11.08	101.04 ± 12.76	0.07
LAD (mm)	35.25 ± 3.16	36.36 ± 5.22	0.38
LVID (mm)	53.35 ± 6.38	54.71 ± 8.23	0.53
EF%	57.7 ± 9.52	56.39 ± 9.32	0.63
Epicardial fat thickness (mm)	6.72 ± 1.36	5.36 ± 1.42	0.001
Gensini score	30.18 ± 16.09	20.75 ± 13.95	0.04
Hemoglobin gm/dl	12.81 ± 1.44	13.48 ± 1.27	0.15
WBCs (x10^3/µl)	8.4 ± 2.98	9.76 ± 2.58	0.16
Troponin	8.63 ± 3.35	3.99 ± 2.60	0.26
Creatinine (mg/dl)	0.967 ± 0.3	0.98 ± 0.27	0.93
Age (years)	53.32 ± 6.87	55 ± 6.62	0.41
Gender	6 (30 %)	20 (71.5 %)	0.01
Smoking	5 (25%)	13 (46.5 %)	0.06
HTN	15 (25%)	14 (50 %)	0.06

Table (2): Correlations between Epicardial fat thickness and different variables in all groups:

Variables	R value	P value
Gensini Score	0.5390906	0.00007707
Creatinine	0.1769714	0.3871
Troponin	-0.6780229	0.09412
EF%	-0.06990567	0.6899
LVID	0.04198239	0.8108
LAD	0.4751717	0.005991
Age	-0.01094413	0.9518
Hg	-0.07357301	0.73
WBCs	-0.39	0.06
Waist circumference	0.14	0.43

Table (3): Correlation of Gensini Score with epicardial fat thickness in non-Diabetic patients:

Variable	R-value	P-value	
Gensini Score	0.3303559	0.044	Poor correlation

Table (4): Correlation of Gensini Score with epicardial fat thickness in Diabetic patients:

Variable	r-value	P-value	
Gensini Score	0.6618399	0.00148	Moderate correlation

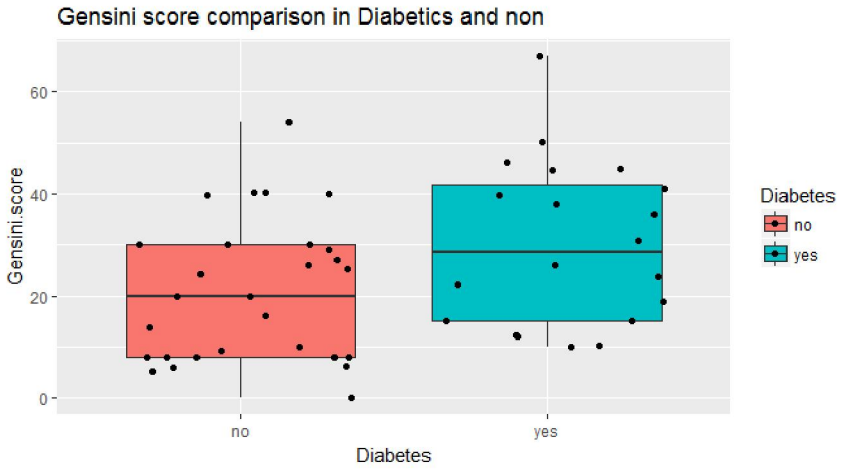

Figure (1): scatter plot diagram shows the comparison between our groups in Gensini score: the difference is statistically significant.

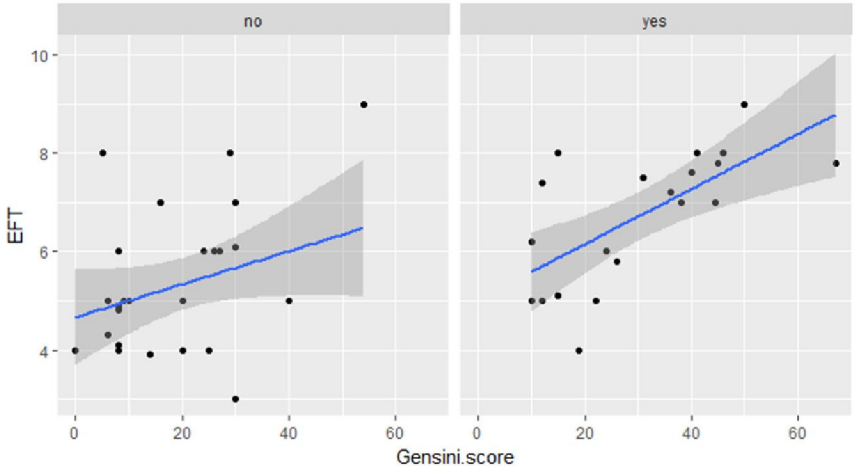

Figure (2): scatter plot with line diagrams shows the correlation between EFT and Gensini score in diabetics and non-diabetic groups. (No= Non-diabetic group), (yes=Diabetic group**)**

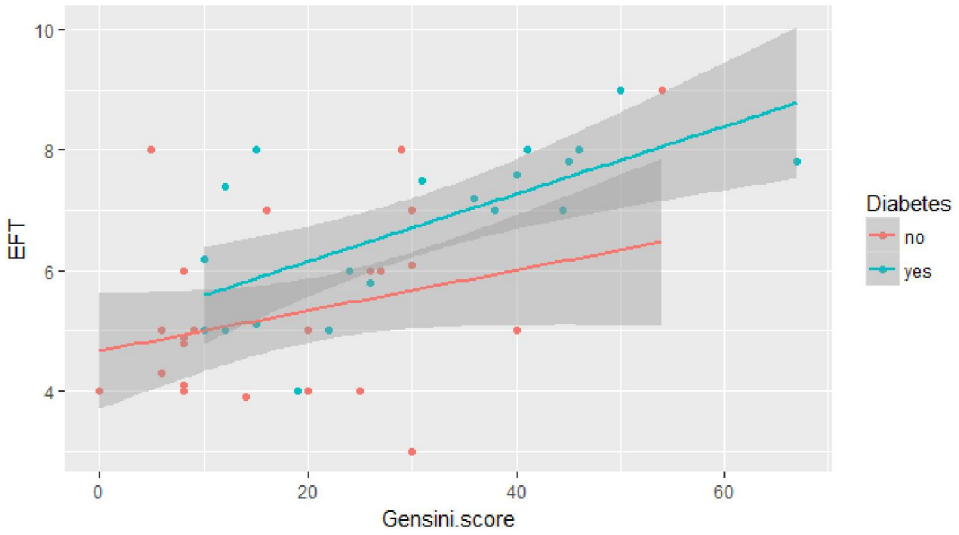

Figure (3): scatter plot with line diagram shows the correlation between EFT and Gensini score in diabetics and non-diabetic groups: the statistically significant positive correlation between EFT and Gensini score in the two groups.

4. Discussion:

In our study we found high association between diabetes and Gensini score in myocardial infarction patients with significant correlation (p value <0.05).

This was consistent with saleem et al. (7)**.** Their research was aimed to discover the involvement between glycosylated haemoglobin (HbA1C) concentration and the harshness of coronary artery illness on 110 patients suffering from acute myocardial infarction. They found that there was a significant correlation (p=0.003) between DM and Gensini score.

Also, Lekakis et al. (8)who studied the impacts of diabetes as customary vascular risk factors on the atherosclerotic changes in the femoral and carotid arteries, on the extent and severity of coronary artery disease (CAD) confirmed this result. They found that diabetes mellitus can be an independent predictor of the extent and severity of CAD.

We found a highly significant positive correlation between EFT and Gensini score (P value= 0.00007707) in all our MI patients.

Our study is strongly in agreement with Eroglu et al.(9)who found a positive relationship between echocardiographic EAT quantity and sternness of coronary artery illness by (Gensini score) in 150 subjects. The authors also reported that an easily and non-invasive EAT, which is determined by transthoracic echocardiography, can be used as marker for the prediction of CAD as a traditional risk factors.

Also, Jeong et al(10)found that epicardial fat thickness was extensively associated with the sternness of CAD in patients with known coronary artery disease. These studies were confirmed byShemirani and MeysamKhoshavi. (11)

(12)Ahn et al measured EAT thickness in 527 patients undergoing their first coronary angiography. The study revealed that the thickness of EAT were low in individuals complaining from atypical chest pain or stable angina than that in unstable angina. These results suggest that the echocardiographic size of EAT may offer supplementary data for evaluating CAD risk and predicting the degree and action of CAD.

On the other hand, our study does not agree with Chaowalit et al(13)study which concluded that the amount of subepicardial adipose tissue thickness was not associated with the severity of CAD.

Their study was done on older patients (68 ± 13 years) which can make difference in results. Also there are differences in techniques used in measuring echocardiographic EFT; it was measured at end-diastole and severity of coronary artery disease was assessed by CAGE score while in our study EFT was measured at end-systole and danger of coronary artery disorder was evaluated by Gensini score.

In our study, we found positive correlation between EFT and severity of coronary artery disease by Gensini score in non-diabetic group (P value =0.08599) with more significant correlation in the diabetic group (P value =0.00148).

Sade et al. (14) indicated that EAT volume by cardiac multi-slice computed tomography is augmented in T2DM subjects and is liked with unfavorable compartments of coronary atherosclerosis and metabolic syndrome. The intimate anatomical connection among coronary arteries and EAT, shared with other data demonstrating that EAT which

participating in the pathogenesis of diabetic coronary atherosclerosis is a biologically active adipokine-secreting tissue.

Conclusion

The thickness of epicardial fat tissue may be connected with the severity of CAD in non-diabetic both and diabetic ST elevation myocardial infarction subjects. Though, there is a contact association among the severity of CAD and EFT in diabetic individuals.

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