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Original Article / Özgün Araştırma

Relatıonshıp Between Epıcardıal Adıpose Tıssue And Syntax Score In Patıents Wıth Acute Coronary Syndrome

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Abstract

Objective: The aim of this study was to evaluate the relationship between epicardial adipose tissue (EAT) thickness and SYNTAX score in patients with acute coronary syndrome (ACS).

Methods: The study included 200 patients with ACS and 150 non-ACS. Systolic (EAT-S) and diastolic EAT (EAT-D) thickness was measured in each patient. EAT thickness and the relationship between EAT thickness and SYNTAX score were compared between the patient and control groups.

Results: Age, body mass index, and presence of hypertension and diabetes mellitus (DM) established a significant difference while smoking status and presence of hyperlipidemia caused no significant difference between the patient and non-ACS. Both EAT-S and EAT-D thickness established a significant difference between the two groups (5.57±1.15 vs. 4.47± 0.60, p<0.001; 3.18±0.81 vs. 2.71±1.90, p=0.014, respectively). EAT thickness established a significant correlation with SYNTAX score in the patient group (p<0.001; r=0.740).

Conclusion: EAT thickness was greater in the patient group and established a significant correlation with SYNTAX score. This situation offers us the opportunity to determine the severity of the disease with a non-invasive method before performing coronary angiography.

Keywords: Acute Coronary Syndrome, Echocardiography, Epicardial Adipose Tissue, Syntax Score

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Akut Koroner Sendrom Hastalarında Syntax Skoru İle Epikardiyal Yağ Doku Arasındaki İlişki

Öz

Amaç: Çalışmanın amacı akut koroner sendromlu (AKS) hastalarda epikardiyal yağ dokusu (EYD) kalınlığı ile Syntax Skoru arasındaki ilişkiyi değerlendirmektedir.

Yöntemler: Çalışmaya AKS geçiren 200 ve AKS geçirmemiş olan 150 hasta dahil edilmiştir. Her hasta için sistolik(S-EYD) ve diyastolik(D-EYD) EYD kalınlığı ölçülmüştür. EYD kalınlığı ve EYD ile Syntax Skoru arasındaki ilişki hastalar ve kontrol grupları arasında karşılaştırılmıştır.

Bulgular: Hastalar ve kontrol grubu karşılaştırıldığında yaş, vücut kitle indeksi, hipertansiyon ve diyabet varlığı anlamlı olarak farklı iken, tütün kullanımı ve hiperlipidemi varlığı açısından her iki grup arasında farklılık saptanmamıştır. Hem S-EYD hem de D-EYD kalınlığı her iki grup arasında farklı olarak bulunmuştur (5.57±1.15 vs. 4.47± 0.60, p<0.001; 3.18±0.81 vs. 2.71±1.90, p=0.014, sırasıyla). Hasta grubunda EYD kalınlığı Syntax Skoru ile önemli bir korelasyon göstermiştir (p<0.001; r=0.740).

Sonuç: EYD kalınlığı hasta grubunda daha fazla bulunmuş ve Syntax Skoru ile anlamlı bir korelasyon göstermiştir. Bu durum bize hastalara koroner anjiografi yapmadan önce hastalığını ciddiyetini, noninvaziv bir yöntemle belirleme fırsatı sunmaktadır.

Anahtar kelimeler: Akut Koroner Sendrom, Ekokardiyografi, Epikardiyal Yağ Doku, Syntax Skor.

INTRODUCTION

Cardiovascular diseases are common causes of death and morbidity worldwide[1, 2]. Large-scale epidemiological studies have reported several major risk factors for cardiovascular diseases. However, these risk factors alone are not sufficient to explain the development of cardiovascular diseases. In particular, almost half of the patients with acute coronary syndrome (ACS) are not detected with typical cardiovascular risk factors[3]. This situation has urged researchers to investigate novel risk factors to deepen our understanding of cardiovascular diseases and to help us perform risk assessment in a more sufficient way. One of the recently identified novel risk indicator is epicardial adipose tissue (EAT) thickness[4].

Articles showing that epicardial adipose tissue (EAT) is a risk factor for coronary artery disease (CAD) are available in the literature[5-8]. Accordingly, measurement of EAT thickness is accepted as a noninvasive, sensitive, and repeatable method in the assessment of the risk of cardiovascular diseases[7]. As a metabolic active organ, EAT releases various proinflammatory and proatherogenic cytokines[8-12]. These cytokines have been shown to have a contributory effect on atherosclerosis and to have a strong relationship with coronary atherosclerosis[6,13]. On the other hand, the SYNTAX score used to score the severity of CAD is known as an independent marker of adverse cardiac events in patients treated with angiographic coronary intervention[14-16].

Literature reviews show that there is no article investigating the relationship between EAT and SYNTAX score. Therefore, the aim of this study was to evaluate the relationship between EAT and SYNTAX score by analyzing the correlation between EAT thickness and SYNTAX score in patients with ACS.

METHODS

The cross-sectional study included a group of 200 patients who presented to Van Yuzuncu Yil University Cardiology Department and Mus State Hospital due to ACS and a group of 150 healthy controls without ACS and coronary artery disease. The patient group included patients aged 18-75 years with no history of CAD. Patients with pregnancy, arrhythmia, kidney failure, chronic liver disease, familial

hypercholesterolemia, and malignancy were excluded.

Study protocol approval was given by the local ethics committee and was made in accordance with the Declaration of Helsinki. (Ethical approval received from Van Yuzuncu University Ethics Committee, Decision No. 08, Date 23/07/2015).

All the patients underwent electrocardiographic examination followed by physical examination and were interviewed about their medications. Subsequently, echocardiographic examination was performed to measure the mechanical myocardial function in each patient, which was performed from parasternal and apical windows with the patient in the left lateral decubitus position, using a 2-dimensional, M-mode, Doppler echocardiography device (Vivid E9) with an X5-1 transthoracic probe (Vivid 9 Pro, General Electric Medical Systems, Milwaukee, Wisconsin). Echocardiography was performed in accordance with the standard imaging techniques proposed by the European Association of Echocardiography (EAE). The thickness of the echolucent area neighbored by the right ventricular free wall at the end-diastole and end-systole was measured at an angle perpendicular to the aortic annulus. (Figure-1).

Figure 1: Images showing epicardial measurements

The diagnosis of ACS was made in the presence of two of the three criteria defined in the European Society of Cardiology (ESC) guidelines:

1. ischemia-type chest pain and/or sense of discomfort

2. changes in serial ECG recordings

3. characteristic elevation in serum cardiac biomarkers

Coronary angiographic examination was performed in each patient using Siemens Artis Zeego Angiography System at Yuzuncu Yil University and Mus State Hospital angiography laboratories. A coronary artery luminal narrowing of 50% or greater was accepted as significant stenosis.

For the calculation of the SYNTAX score, the coronary arteries were divided into 16 segments and scoring was made considering the stenosis of 50% and above for each segment. Scoring was made using the website http://www.syntaxscore.com/calculator/syntaxscore/frameset.htm.

Participants with a systolic blood pressure of more than 140 mmHg and a diastolic blood pressure of more than 90 mmHg and the patients using antihypertensive drugs were accepted as hypertensive; patients with a fasting low-density lipoproteins (LDL) level of more than 130 mg/dl and the patients receiving statin therapy were accepted as hypercholesterolemic; patients with a fasting triglyceride level of more than 150 mg/dl and the patients receiving antilipidemic drugs were accepted as hypertriglyceridemic; patients with a fasting glucose level of more than 126 mg/dl and the patients receiving treatment due to diabetes mellitus (DM) were accepted as diabetic patients. Smoking status was defined as current smoker and never smoker. Care was taken to achieve homogeneity between the patient and control groups with regards to the parameters affecting EAT thickness.

Statistical Analysis

Data were analyzed using SPSS 18.0 for Windows (SPSS Co., Chicago, IL, USA). Quantitative variables were expressed as mean

± standard deviation (SD) for data sets with normal distribution and as median (minimum, maximum) for data sets with nonnormal distribution. Categorical variables were expressed as percentages. Normal distribution of quantitative variables was analyzed using Kolmogorov-Smirnov test. Quantitative variables were evaluated using Student's t-test and Mann-Whitney U test as appropriate. Correlations between data sets were analyzed using Pearson's Correlation Coefficient or Spearman's rank correlation coefficient. Relationships between categorical variables were evaluated using chi-square test. A p value of <0.05 was considered significant.

RESULTS

Table 1 shows the clinical and demographic characteristics of the patients and the control group. Mean age was 62.21±12.29 years in the patient group and 60.22±5.81 in the non-ACS. Mean body mass index (BMI) was 23.56±3.07 years in the patient group as compared to 23.9±1.41 years in the control group. Hypertension was present in 85 (42%) of the ACS patients and 54 (36%) of the control subjects. DM type 2 was present in 91 (45%) of the ACS patients and 62 (41%) of the control subjects. The percentage of current smokers were similar in both groups (46% in both) (Table 1 and table 2).

Table I: The relationship of the groups with the EAT

	Patient group (n=200)	**non-ACS group (n=150)**	***p***
EAT-S (cm)	5.57±1.15	4.47± 0.60	<0.001
EAT-D (cm)	3.18±0.81	2.71±0.90	0.014
SYNTAX score	18.24±9.17		

SYNTAX: SYNergy between PCI with TAXUS and Cardiac Surgery, EAT-S: Systolic epicardial adipose tissue thickness, EAT-D: Diastolic epicardial adipose tissue thickness.

Table II: Basic characteristics of the groups

	Patient group (n=200)	**non-ACS group (n=150)**	***p***
Age (years)	62.21±12.29	60.22±5.81	0.123
BMI (kg/m²)	23.56±3.07	23.9±1.41	0.136
EAT-S (cm)	5.57±1.15	4.47± 0.60	<0.001
EAT-D (cm)	3.18±0.81	2.71±0.90	0.014
SYNTAX score	18.24±9.17		
HT	85 (42%)	54 (36%)	0.367
DM	91 (45%)	62 (41%)	0.540
Current smoker	93 (46%)	70 (46%)	0.976
HDL (mg/dl)	40.88±10.54	44.15±17.87	0.115
LDL (mg/dl)	114.72±39.85	119.40±32.87	0.356
Creatinine (mg/dl)	0.91±0.41	0.92±0.30	0.872

BMI: Body mass index, SYNTAX: SYNergy between PCI with TAXUS and Cardiac Surgery, LDL: Low-density cholesterol, HDL: High-density cholesterol, EAT-S: Systolic epicardial adipose tissue thickness, EAT-D: Diastolic epicardial adipose tissue thickness, HT: Hypertension, DM: Diabetes mellitus.

Systolic EAT (EAT-S) and diastolic EAT (EAT-D) were significantly higher in the patients with ACS compared to patients without ACS (5.57±1.15 vs. 4.47±0.60, p<0.001; 3.18±0.81 vs. 2.71±0.90, p=0.014, respectively) (Figure 2).

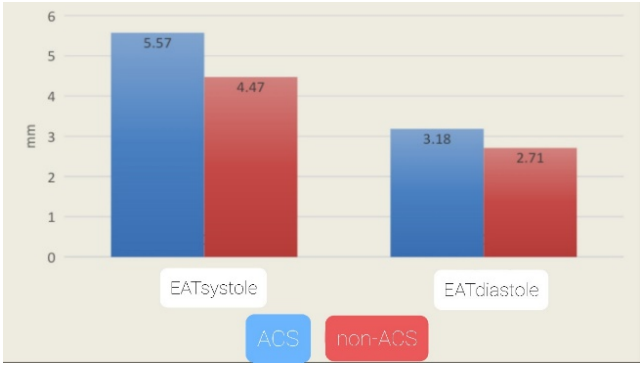

Figure 2: Comparison of systolic and diastolic EAT values in both groups

Pearson's Correlation Coefficient indicated a significant good positive correlation between the SYNTAX scores and EAT-S values in the

patient group (p<0.001; r=0.740). Meaningfully, as the SYNTAX score increased, the EAT-S value also increased (Figure 3).

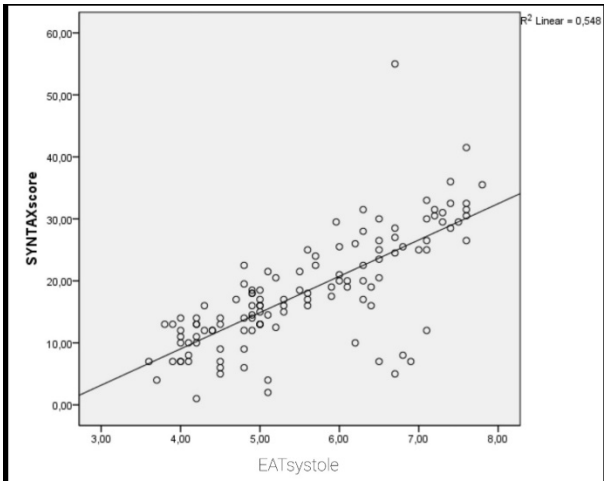

Figure 3: Scatter plot showing the relationship between the SYNTAX scores and EAT-S values in the patient group

Similarly, a significant good positive correlation was between the SYNTAX scores and the EAT-D values in the patient group (p<0.001; r=0.646). As the SYNTAX score increased, the EAT-D value also increased (Figure 4).

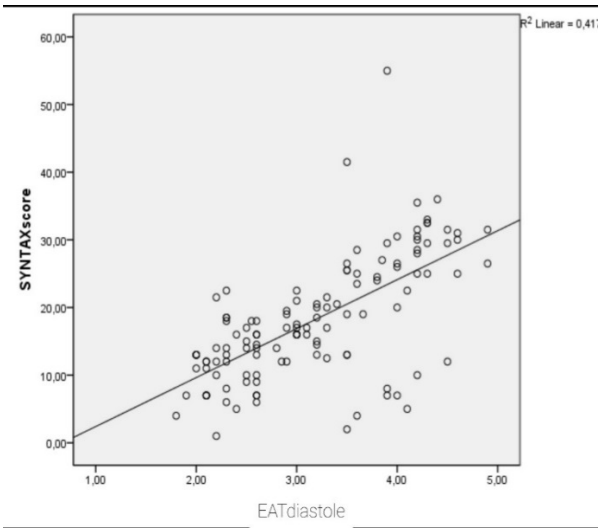

Figure 4: Scatter plot showing the relationship between the SYNTAX scores and EAT-D values in the patient group

A weak insignificant correlation was found between age and EAT-S, EAT-D (p=0.629, r=0.04; p=0.877, r=0.01, respectively). Similarly, a moderate significant positive correlation was found between BMI and EAT-S, EAT-D (p=0.001, r=0.343; p=0.001, r=0.329, respectively).

Mean EAT-S and EAT-D values were 5.07±1.24 and 2.98±1.13 in current smokers as opposed to 5.00±1.20 and 2.87±0.80 in non-smokers, respectively. However, no significant difference was found in the EAT-S and EAT-D values between current and non-smokers (p=0.670, 0,575, respectively). On the other hand, mean EAT-S value was 5.31±1.02 in hypertensive patients as opposed to 4.87±1.12 in non-hypertensive patients and a significant difference was found between the two groups (p=0.003). Similarly, mean EAT-D value was 3.18±0.78 in hypertensive patients as opposed to 2.69±1.82 in non-hypertensive patients and a significant difference was found between the two groups (p=0.012).

Mean EAT-S value was 5.53±1.09 in patients with DM as opposed to 5.53±1.09 in patients without DM and a significant difference was found between the two groups (p=0.001). Similarly, mean EAT-D value was 3.32±0.81 in patients with DM as opposed to 2.71±1.65 in patients without DM and a significant difference was found between the two groups (p=0.003). However, no regression analysis was performed for the distinction between the patient and non-ACS groups since the distribution of DM and hypertensive patients was similar in both groups.

DISCUSSION

Cardiovascular diseases have recently become epidemic around the world, which are mostly caused by atherosclerosis accompanied by thrombosis[17,18]. Some of the patients presenting to emergency service due to a chest pain are diagnosed with ACS, which is a clinical emergency caused by total or subtotal blockage of the coronary artery by thrombus, accompanied by the rupture of an atherosclerotic plaque in coronary arteries[3]. In patients with CAD, the treatment strategy is highly variable and several scoring systems

have been developed for the determination of a treatment strategy. Of these scoring systems, the SYNTAX score is the most commonly used system[14]. In our study, we aimed to investigate whether there is a relationship between EAT and SYNTAX scores in patients with ACS and to determine the difference in EAT thickness between patients who applied with ACS and the control group. In addition, we also aimed to investigate the value of EAT as an effective imaging technique in the prediction of ACS. Similar to the study by Sacks HS et al.[19] we also found that an EAT-S value of 3 mm or more in our patients with ACS was associated with the development of CAD. In a similar study, Djaberi et al.[20] also measured EAT and the progression of coronary atherosclerosis using multiple detector computed tomography (MDCT) and reported that EAT established a significant correlation with the of atherosclerosis. Additionally, Alexopoulos et al.[21] also investigated the relationship between EAT and atherosclerotic plaque detected in coronary arteries via cardiac CT angiography and reported that the EAT volume was higher in non-calcified plaques and obstructive lesions. This finding suggests that the EAT volume is higher mostly in unstable plaques. This assumption has also been confirmed by the study conducted by Ahn et al.[5], which, unlike others, measured the EAT thickness in patients with CAD by echocardiography. In this study, high EAT thickness was found in patients with ACS. In addition, epicardiac fat plays an important role in the pathology of coronary atherosclerosis beyond its contribution to visceral fat due to its close relationship with anatomical relationships. EAT, coronary artery creates an environment surrounded by inflammatory signals from the outside to the inside[22]. The physical contact of EAT to direct adventitia and coronary arteries shows that it also has an effect on angiogenesis[23,24]. During the thickening of the EAT, it remains hypoxic, macrophages and T lymphocytes invade the EAT, creating a pathological change[25]. This inflammation creates a predisposition for atherosclerosis formation[26]. In this case, it would not be wrong to say that the increase in EAT potentially contributes to the development of coronary atherosclerosis as a result of the secretion of proinflammatory cytokines[7,22,27]. In line with all these studies, our study also revealed that there is a relationship between EAT and ACS.

DM is an independent risk factor for CAD. The role of DM in increasing the risk of atherosclerosis is mainly due to its effect on hyperlipidemia[28,29]. Similar to the study by Zihang Wang et al.[30], our study also shows that EAT is increased in patients with DM Type 2. However, although the role of DM in the development of CAD has been documented in numerous studies, more studies are needed to explain the impact of DM on new risk factors.

Although the exact effect of EAT in the development of hypertension remains unclear, increased EAT has been shown to be associated with artery stiffness in the studies evaluating healthy individuals and patients with CAD risk factors[24,25]. Moreover, the effect of EAT on the cardiovascular system in hypertensive patients has been investigated from various perspectives. Şengul et al.[31], for instance, evaluated the effect of EAT thickness on blood pressure pattern and reported that increased EAT thickness was associated with hypertension. Similarly, in our study, we found that EAT thickness increased significantly in hypertensive patients.

Shemirani et al.[32] found a significant relationship between smoking and EAT thickness. However, Ahn et al.[5] and Yorgun et al.[33] found no significant relationship between smoking and EAT thickness. In our study, we also found no significant relationship between smoking and EAT thickness.

Visceral obesity is another major risk factor for CAD which has been shown to be more useful than total body fat in the prediction of CAD. Moreover, increased visceral fat has been shown to be associated with accelerated atherosclerosis[34]. In our study, we also found a correlation between BMI and increased EAT thickness.

Literature reviews indicate that the role of EAT in the etiopathogenesis of ACS remains unclear and thus further clinical studies as well as biochemical and genetic studies are needed. This study found a relationship between EAT thickness and ACS type via SYNTAX score.

In conclusion, EAT was measured thicker in the ACS. We observed progressively thicker in the patient group and in patients with multivessel disease and a significant relationship was found between EAT thickness and SYNTAX score in ACS. İn this case, shows us that we can determine the degree of disease of ACS patients by looking at EAT before angiography. Thus, it will allow us to be prepared before angiography. However, more studies with larger patient series are needed to substantiate this relationship.

Ethical Committee Approval: Study protocol approval was given by the local ethics committee and was made in accordance with the Declaration of Helsinki. (Ethical approval received from Van Yuzuncu University Ethics Committee, Decision No. 08, Date 23/07/2015).

Declaration of Conflicting Interests: The authors declare that they have no conflict of interest.

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