ORIGINAL ARTICLE

Ischemic changes in lead aVR is associated with left ventricular thrombus or high-grade spontaneous echocontrast in patients with acute anterior myocardial infarction

Akut anteriyor miyokart enfarktüslü hastalarda aVR derivasyonundaki iskemik değişiklikler sol ventrikül trombüs veya yüksek dereceli spontan ekokontrast ile ilişkilidir

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ABSTRACT

Objective: The aim of this study was to investigate the relationship between ischemic changes in the lead aVR and left ventricular thrombus (LVT) or high-grade spontaneous echo contrast (SEC) in patients with acute anterior myocardial infarction (MI).

Methods: Quantitative T wave polarity in lead aVR (TPaVR) and ST segment deviation in the lead aVR (STaVR) measured from a surface electrocardiogram (ECG), as well as the absolute numerical values, were recorded. The ST/TPaVR ratio was obtained by dividing the larger absolute value by the smaller. The presence of LVT or high-grade SEC was recorded using echocardiograpy. The SYNTAX score (SS), clinical SS (cSS), and residual SS (rSS) were calculated from angiography results.

Results: A total of 34 patients with LVT or high-grade SEC were included in Group 1. Group 2 comprised 170 patients who did not have any LVT or high-grade SEC. The P wave duration, V2 ST-segment elevation, TPaVR, cSS, and ST/TPaVR ratio were significantly higher in Group 1. The ejection fraction (EF) and STaVR were significantly higher in Group 2. The EF (Odds ratio [OR]: 0.9, 95% confidence interval [CI]: 0.833–0.973; p=0.008), TPaVR (OR: 1.454, 95% CI: 1.074–1.967; p=0.015), and ST/TPaVR ratio (OR: 1.6, 95% CI: 1.307–1.959; p<0.001) were determined to be independent predictors for Group 1.

Conclusion: Ischemic changes in the lead aVR are closely associated with LVT or high-grade SEC in anterior MI patients.

ÖZET

Amaç: Biz bu çalışmada, akut anteriyor miyokart enfarktüslü (ME) hastalarda, yüzeyel elektrokardiyografide aVR derivasyonundaki iskemik değişiklikler ile sol ventrikül trombüsü (LVT) veya yüksek dereceli spontan ekokontrastı (SEK) arasındaki ilişkiyi araştırmayı amaçladık.

Yöntemler: Yüzeyel EKG'de aVR derivasyonunda T dalga polaritesi (TPaVR) ve ST segment sapması (STaVR) sayısal olarak ölçüldü ve mutlak değerleri hesaplandı. Büyük mutlak değerin, küçük olana bölünmesiyle ST/TPaVR oranı elde edildi. Ekokardiyografik görüntülerden LVT veya yüksek dereceli SEK varlığı kaydedildi. Syntax skoru (SS), klinik SS (cSS) ve rezidüel SS'leri (rSS) anjiyografik görüntülerden hesaplandı.

Bulgular: Otuz dört hastada LVT veya yüksek dereceli SEK mevcuttu ve Grup 1 olarak adlandırıldı. Yüz yetmiş hastada herhangi bir LVT ya da yüksek dereceli SEK yoktu ve bu hastalar Grup 2 olarak belirlendi. P dalgası süresi, V2 ST-segment yüksekliği, TPaVR, cSS ve ST/TPaVR oranı, Grup 1'de anlamlı olarak daha yüksek bulundu. EF ve STaVR, grup 2'de anlamlı olarak yüksek bulundu. EF (OO: 0.9, %95 GA: 0.833–0.973, p=0.008), TPaVR (OO: 1.454, %95 GA: 1.074–1.967, p=0.015) ve ST/TPaVR oranı (OO: 1.6, %95 GA: 1.307–1.959, p<0.001) grup 1 için bağımsız belirteç olarak tespit edildi.

Sonuç: Anteriyor ME'li hastalarda; yüzeyel EKG'de aVR derivasyonundaki iskemik değişiklikler, LVT veya yüksek dereceli SEK ile yakından ilişkilidir.

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Acute anterior myocardial infarction (MI) is one of the cardiac diseases that requires urgent medical and interventional therapy. If there is a delay in diagnosis and treatment, serious consequences, such as acute heart failure, cardiogenic shock, and death due to the decrease in left ventricle contractions may result.[1]

Abbreviations:

ASA	*Acetylsalicylic acid*
CAG	*Coronary angiography*
CI	*Confidence interval*
CICU	*Coronary intensive care unit*
cSS	*Clinical SYNTAX score*
ECG	*Electrocardiogram*
EF	*Ejection fraction*
IV	*Intravenous*
LAD	*Left anterior descending artery*
LV	*Left ventricle*
LVT	*Left ventricular thrombus*
MI	*Myocardial infarction*
NSTEMI	*Non- ST elevation myocardial infarction*
OR	*Odds ratio*
PCI	*Percutaneous coronary intervention*
ROC	*Receiver operating characteristic*
rSS	*Residual SYNTAX score*
SEC	*Spontaneous echo contrast*
SS	*SYNTAX score*
STaVR	*ST-segment deviation in lead aVR*
STEMI	*ST-segment elevation myocardial infarction*
TIMI	*Thrombolysis in Myocardial Infarction*
TpaVR	*T wave polarity in lead aVR*

Complication types have become markedly different in anterior MI patients since the application of primary percutaneous coronary intervention (PCI). The frequency has also diminished substantially. One of the most dramatically decreased complication is left ventricular thrombus (LVT), which is a poor prognostic marker. The frequency of LVT has declined from 46% to 2% in recent decades.[2–5] According to the existing studies, prolonged door-balloon time, trouble achieving Thrombolysis in Myocardial Infarction (TIMI) 2–3 flow, and a significantly decreased left ventricular ejection fraction (LVEF) are the primary prognostic factors for LVT development in patients with anterior MI.[4,6–8] However, LVT does not always occur in patients with these risk factors. High-grade spontaneous echo contrast (SEC) is another predisposing factor for LVT, and requires close follow-up for the possible LVT development.[9] In some patients, microvascular ischemia may persist even if left anterior descending artery (LAD) patency is fully achieved and therefore, these patients may be more likely to develop LVT.

The lead aVR is a neglected lead in electrocardiogram (ECG) analysis, but it provides unique and beneficial information.[10] According to the previous studies, changes in the lead aVR can reveal information on mortality and morbidity in ST-segment elevation myocardial infarction (STEMI), non-ST elevation myocardial infarction (NSTEMI), and heart failure.[11–13] The lead aVR reads the left ventricular (LV) apex from the opposite side. Ischemic changes in the lead aVR can provide information about the LV apex.[14] The authors of this study posited that the lead aVR may reveal ischemic changes in patients with LVT after acute anterior MI.

A search of the literature yielded no clear information about LVT and ischemic changes in the lead aVR in patients with anterior MI. The objective of this research was to investigate the relationship between ischemic changes observed in the lead aVR and LVT or high-grade SEC in patients with anterior MI.

METHODS

Patient population

The records of patients who were admitted to the coronary intensive care unit with ongoing chest pain between December 2015 and December 2017 were retrospectively examined. Diagnosis of anterior MI was made by the presence of ST-segment elevation of at least 2.5 mm in men aged <40 years or 2 mm in men aged ≥40 years, and at least 1.5 mm in women at leads V2–V3 and/or <1 mm observed at other leads in two adjacent chest leads.[1] Patients with known coronary artery disease, or end-stage renal or hepatic disease were excluded from the study. All of the patients enrolled in the study underwent primary PCI treatment and their demographic data were recorded. The study protocol was approved by the Cukurova University Medical School Ethics Committee (2018-April-76).

Evaluation of laboratory findings

Glucose, high-sensitive troponin T, creatinine kinase myocardial band, N terminal pro-brain natriuretic peptide, renal functions, lipid parameters, high-sensitive C reactive protein, uric acid, and complete blood count were recorded from routine blood tests taken on admission.

Electrocardiographic evaluation

Admission and 48th-hour 12-lead surface ECGs of the patients were recorded (Cardiofax V model ECG-1550K; Nihon Kohden Corp., Tokyo, Japan) with a paper speed of 25 mm/second and 1 mv/10 mm standard calibration. Two independent cardiologists assessed the ECG recordings. ST segment elevation in the V1, V2, V5, and V6 were recorded from the ad-

mission ECGs. As ischemic changes in the lead aVR may have been masked due to ST segment elevation on the admission ECG, the 48th hour ECG was used for the calculation of QRS duration, P wave duration, PR interval, QT and QTc duration, T wave polarity in lead aVR (TPaVR) and ST segment deviation in lead aVR (STaVR) (Fig. 1a-c). The absolute value of TPaVR and STaVR was calculated. Then, a previously described ST/TPaVR ratio was obtained from the division of the larger absolute value by the smaller one.[15]

Echocardiographic evaluation

Transthoracic echocardiography was performed by 2 independent cardiologists (Epiq 7; Philips Healthcare Inc., Andover, MA, USA) a minimum of 48 hours after admission. The apical 2-chamber, parasternal long axis, and short axis views were evaluated in 3 consecutive cardiac cycles. The LVEF was determined using the biplane Simpson's method in the apical 2-chamber view. The LV endocardium was traced during end-diastole and end-systole. Both LV end-diastolic and end-systolic volumes were calculated. LVEF was acquired using both volume measurements. The LV systolic and diastolic diameters were measured using M-mode in parasternal long axis view. An echodense mass in the LV was accepted as a thrombus based on the agreement of 2 independent cardiologists and a radiologist (Fig. 2). SEC is characterized by dynamic smoke-like echoes within the LV cavity. A grading system for the intensity of SEC in the LV was defined as follows:

Grade 1. There is a minimal increase in echogenicity in the LV. It changes in cardiac cycles and fades with gain settings.

Grade 2. It has the same intensity as grade 1, but does not fade with gain settings.

Grade 3. It is more dense than grade 2 in the LV and fluctuates.

Grade 4. It is more dense in the LV than other chambers and demonstrates vortex-like movement.

Grade 3 or 4 SEC were accepted as high-grade. Two independent cardiologists confirmed the analysis of echocardiographic findings, and the interobserver agreement was 96%.

Interventional procedure

A 4000-unit heparin bolus and 300 mg acetylsalicylic acid (ASA) were administered to the patients at the

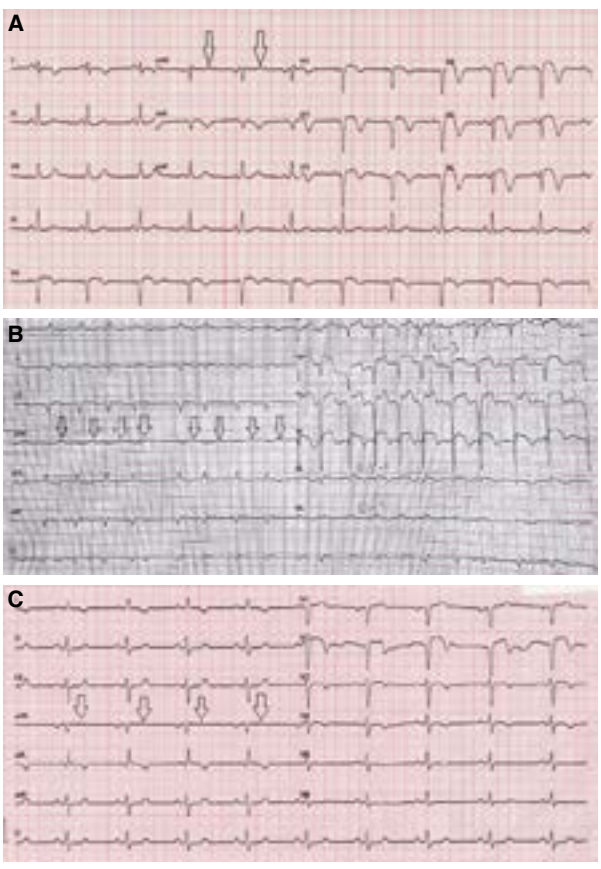

Figure 1. **(A)** Positive T wave in the lead aVR on a surface electrocardiogram (ECG) in a patient with left ventricular thrombus (LVT). **(B)** Positive T wave in the lead aVR on a surface ECG in a patient with high-grade spontaneous echo contrast (SEC). **(C)** Positive T wave in the lead aVR in a patient with LVT.

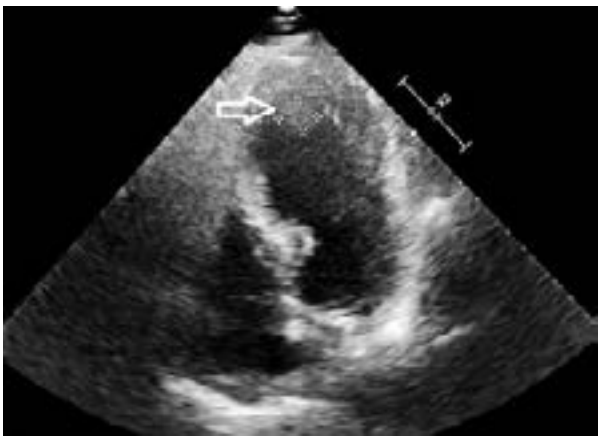

Figure 2. Left ventricular thrombus in a patient with acute anterior myocardial infarction.

time of diagnosis. Subsequently, either 180 mg ticagrelor or 600 mg clopidogrel were given, and patients were redirected to the coronary angiography (CAG) laboratory. Coronary angiograms were performed using the Judkins technique with femoral or radial arterial access. The culprit lesion in left anterior descending (LAD) artery was pre-dilated, and an appropriately sized stent was implanted. Thrombolysis In Myocardial Infarction (TIMI)-3 flow was achieved in all patients. A tirofiban (loading dose: intravenous [IV] 25 mcg/kg was loaded within 5 minutes, infusion after loading 0.15 mcg/kg/minute IV for up to 18 hours) or abciximab (0.25 mg/kg IV bolus over at least 1 minute and 0.125 mcg/kg/minute IV continuous infusion for 12 hours) infusion was administered to patients with a high thrombotic burden. Two interventional cardiologists evaluated the CAG images individually. A SYNTAX score (SS) was calculated using the vessels with a diameter greater than 1.5 mm and stenosis of more than 50% based on the CAG images (http://www.syntaxscore.com). After that, a clinical SS (cSS) was calculated using the SS and some clinical and laboratory findings. A residual SS (rSS) was calculated for patients with incomplete revascularization. The quantity of contrast medium and the door-to-balloon time were also recorded for all of the patients.

In-hospital follow-up

After the interventional treatment, all of the patients were followed up in the coronary intensive care unit (CICU). Ticagrelor 90 mg 2 times a day plus 100 mg ASA daily or clopidogrel 75 mg plus 100 mg ASA daily was continued as dual antiplatelet therapy. The patients were monitored for at least 48 hours in the CICU and then sent to the cardiology service. Anticoagulant treatment (warfarin) was administered to patients with LV thrombus or high-grade SEC, and the patients were discharged with medical therapy.

Statistical analyses

The data were analyzed using IBM SPSS Statistics for Windows, Version 20.0 (IBM Corp., Armonk, NY, USA). The variables were divided into categorical and continuous groups. Categorical variables were expressed as frequencies and percentages and were analyzed using a chi-square test. Continuous variables were expressed as the mean±SD. The Kolmogorov-Smirnov test was used to determine normal distribution. Normally distributed variables were analyzed with an independent samples t-test. Non-normally distributed variables were analyzed with the Mann-Whitney U-test. Binominal logistics regression analyses were performed with the significant variables ($p<0.05$). Independent predictors for LVT or high-grade SEC were determined. Receiver operating characteristic (ROC) analysis was applied to these predictors ($p<0.05$). Cut-off levels were determined using ROC analysis. Of these, 3 cut-off levels were selected for these predictors and the sensitivity and specificity were calculated. A p value of <0.05 was considered to be statistically significant.

RESULTS

Among the 204 patients included in the study, there were 34 patients (mean age: 56.9±9.9 years) with LVT or high-grade SEC and were defined as Group 1. Twenty of those patients had LVT (9.8%) and 14 patients (6.8%) had high-grade SEC. There were 170 patients (mean age: 57.4±12.2 years) who did not have LV thrombus or high-grade SEC and these patients constituted Group 2. In the comparison of demographic findings, smoking frequency was significantly higher in Group 2 ($p=0.038$). Other variables were similar (Table 1). A comparison of the ECG, echocardiographic and angiographic findings revealed that the P wave duration ($p=0.014$), V2 ST-segment elevation ($p=0.038$), TPaVR ($p<0.001$), and ST/TPaVR ratio ($p<0.001$) were significantly higher in Group 1. The EF ($p=0.002$) and STaVR ($p=0.026$) were significantly higher in Group 2. The cSS was significantly higher in Group 1, other findings were similar (Table 2). Binominal logistic regression analysis was performed with the significantly different variables ($p<0.05$). The EF (Odds ratio [OR]:0.9, 95% confidence interval [CI]:0.833–0.973; $p=0.008$), TPaVR (OR:1.454, 95% CI:1.074–1.967; $p=0.015$) and the ST/TPaVR ratio (OR:1.6, 95% CI:1.307–1.959; $p<0.001$) were determined to be independent predictors for the presence of LVT or high-grade SEC (Table 3). ROC analyses were performed with independent predictor variables. The sensitivity and specificity levels were determined according to the cut-off levels for EF (area under the curve [AUC]: 0.635; $p=0.016$; Fig. 3), TPaVR (AUC: 0.765; $p<0.001$; Fig. 4), and ST/TPaVR ratio (AUC: 0.809; $p<0.001$; Fig. 5) (Table 4).

Table 1. Comparison of demographic and laboratory findings

	Group 1 (n=34)	Group 2 (n=170)	*p*
Age (years)	56.9±9.9	57.4±12.2	0.807
Male gender, n, (%)	29 (85.3)	148 (87.1)	0.782
Systolic blood pressure (mm Hg)	123.1±13.2	121.3±19.5	0.671
Diastolic blood pressure (mm Hg)	78.1±10.1	77.7±10.1	0.848
Pulse (beats/minute)	89.5±16.5	82.0±13.5	0.009
Body mass index (kg/m^2)	28.8±4.4	27.9±3.6	0.403
Smoking, n (%)	10 (29.4)	83 (48.8)	0.038
Diabetes mellitus, n (%)	13 (38.2)	65 (38.2)	1.000
Hypertension, n (%)	9 (26.5)	57 (33.5)	0.422
Hyperlipidemia, n (%)	6 (17.6)	18 (10.6)	0.244
Glucose (mg/dL)	187.2±82.7	200.6±115.9	0.523
White blood cells (uL)	11.6±1.6	12.1±3.0	0.198
Hemoglobin (%)	13.7±2.4	13.7±1.7	0.885
Blood urea nitrogen (mg/dL)	43.6 0± 29.6	39.3±18.3	0.438
Creatinin (mg/dL)	1.0±0.3	0.9±0.2	0.257
Sodium (mmol/L)	135.6±2.4	136.2±3.2	0.213
Potassium (mmol/L)	4.5±0.6	4.2±0.5	0.090
Total cholesterol (mg/dL)	195.3±40.2	181.5±39.1	0.087
Low-density lipoprotein (mg/dL)	130.6±33.0	118.3±30.1	0.086
High-density lipoprotein (mg/dL)	38.8±9.4	38.2±7.8	0.738
Triglyceride (mg/dL)	138.7±69.2	142.3±55.7	0.726
High-sensitive C-reactive protein (mg/L)	5.4±7.2	2.7±4.5	0.135
Uric acid (mg/dL)	5.2±1.4	5.7±1.5	0.123
N-terminal brain natiuretic peptide (pg/mL)	2324±3117	3622±4616	0.052
High-sensitive troponin T	31.4±58.6	22.3±26.8	0.381

Group 1 = Patients with left ventricular thrombus or high-grade SEC, Group 2 = Patients without left ventricular thrombus or high-grade SEC. Categorical variables were compared using Pearson's chi square test, continuity correction chi square, or Fisher's exact test, as appropriate, and an independent samples t-test and the Mann-Whitney U test were used to compare continuous variables.

DISCUSSION

Some essential findings were detected in our study: T-wave positivity in aVR, a greater ST/TPaVR ratio, and a lower EF were closely associated with LVT or high-grade SEC. We also calculated the sensitivity and specificity of the TPaVR and ST/TPaVR ratio for LVT or high-grade SEC. If the TPaVR is greater than or equal to 1.8 mV, LVT or high-grade SEC can be predicted with 92% sensitivity and 86% specificity. If the ST/TPaVR ratio is greater than or equal to 3.25, LVT or grades 3–4 SEC can be predicted with 88% sensitivity and 77% specificity.

The lead aVR is usually neglected in 12-lead ECG analysis.[10] Bipolar leads, such as I, II, and III, are preferred because they point out a location. The lead aVR sees the basal right ventricle and septum. Therefore, it can give information about pathologies of these locations. The lead aVR vector is directed from the LV apex to the basal section of the heart. It may supply some information about reciprocal changes if there is ischemia or infarction in the LV. The apex is the thinnest part of LV. It is also the most sensitive area for ischemia.[14]

All of the study patients had acute total occlusion in the LAD. Therefore, all of the LV, including the

Table 2. Comparison of electrocardiographic, echocardiographic, and angiographic findings

	Group 1 (n=34)	Group 2 (n=170)	*p*
Transthoracic echocardiography time, n (days)	3.9±1.3	3.7±1.4	0.286
Ejection fraction (%)	37.6±8.1	43.1±7.2	0.002
Left ventricular diastolic diameter (mm)	37.7±18.7	46.1±6.6	0.071
Left ventricular systolic diameter (mm)	27.9±16.8	34.9±4.8	0.144
QRS duration (ms)	93.9±19.9	92.8±19.2	0.762
P wave duration	104.5±10.1	98.0±14.4	0.014
PR interval (ms)	151.3±21.9	143.3 ±15.9	0.050
QT interval (ms)	374.7±48.8	376.3±44.3	0.845
QTc interval (ms)	436.3±26.2	436.5±38.2	0.985
V1 ST-segment elevation (mm)	1.1±0.7	1.1±0.8	0.939
V2 ST-segment elevation (mm)	3.4±1.1	2.9±1.9	0.038
V5 ST-segment elevation (mm)	2.0±0.9	1.8±1.6	0.279
V6 ST-segment elevation (mm)	1.4±1.0	1.0±1.2	0.130
ST-segment deviation in the lead aVR (mm)	0.5±0.3	0.6±0.4	0.026
T wave polarity in the lead aVR (mV)	0.6±1.3	-0.8±1.6	<0.001
ST/TPaVR ratio	6.3±3.5	3.2±2.4	<0.001
Syntax score, n	18.3±5.4	16.4±7.4	0.082
Clinical Syntax score, n	35.3±16.0	30.1±12.2	0.032
Residual Syntax score, n	2.9±2.6	3.9±7.1	0.240
Door-balloon time (hours)	32.3±5.1	33.4±11.7	0.835
Contrast volume (mL)	159.7±50.2	141.5±48.3	0.059
Abciximab or tirofiban infusion, n (%)	5 (22.7)	23 (18.9)	0.719

Categorical variables were compared using Pearson's chi square test, continuity correction chi square, or Fisher's exact test, as appropriate, and an independent samples t-test and the Mann-Whitney U test were used to compare continuous variables.

Table 3. Independent predictors for left ventricular thrombus or grade 3–4 spontaneous echo contrast

	Odds ratio	95% Confidence interval	*p*
Smoking	1.591	0.524–4.832	0.412
Ejection fraction	0.9	0.833–0.973	0.008
P wave duration	1.05	0.997–1.105	0.066
V2 ST-segment elevation	0.971	0.745–1.264	0.825
ST-segment deviation in the lead aVR	0.566	0.098–3.284	0.526
T wave polarity in the lead aVR	1.454	1.074–1.967	0.015
ST/T wave polarity in the lead aVR ratio	1.6	1.307–1.959	<0.001
Clinical Syntax score	1.007	0.950–1.067	0.823

apex, may have damage from this occlusion. All of our patients had a reduced EF (≤45%). The probability of LVT formation was increased because blood flow had slowed in the contraction of defect areas. However, LVT was not observed in every patient with a severely reduced EF. LVEF represents visible contractility. All of our patients were revascularized, but we thought that there might still be ongoing ischemia in the microvascular circulation in patients with LVT or high-grade SEC. LVT frequently occurs in the LV

Table 4. Left ventricular thrombus or grade 3-4 spontaneous echo contrast determination according to cut-off levels for ejection fraction, T wave polarity in lead aVR, and ratio

	Cut-off value (≥)	Sensitivity (%)	Specificity (%)
EF (%)	36	70	38
	41	53	53
	47	30	92
TPaVR (mv)	-0.8	46	88
	0	74	62
	1.8	92	86
ST/TPaVR ratio (n)	2.75	88	55
	3.25	88	77
	4.25	58	79

EF: Ejection fraction; STaVR: ST segment deviation in the lead aVR; TPaVR: T wave polarity in the lead aVR.

apex. Since the lead aVR sees the LV apex directly from the opposite side, T-wave positivity in the lead aVR or an increased ST/TPaVR ratio may reflect continued microvascular ischemia in the LV. LV contractile function is reduced in an anterior MI as a result of myocardial stunning. The EF may increase slightly in these patients after patency is fully achieved. We thought that microvascular ischemia may persist in patients with T-wave positivity observed at the lead

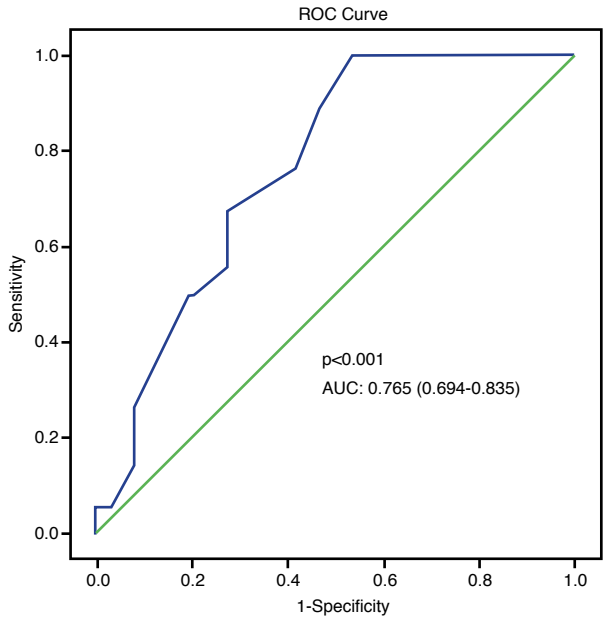

Figure 4. Receiver operating characteristic analysis to determine the predictive value of T wave polarity in the lead aVR for left ventricular thrombus and high-grade spontaneous echo contrast.

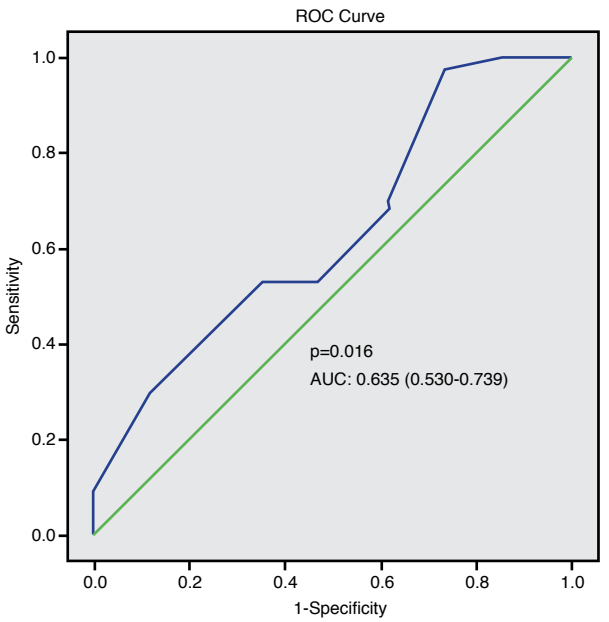

Figure 3. Receiver operating characteristic analysis to determine the predictive value of ejection fraction for left ventricular thrombus and high-grade spontaneous echo contrast.

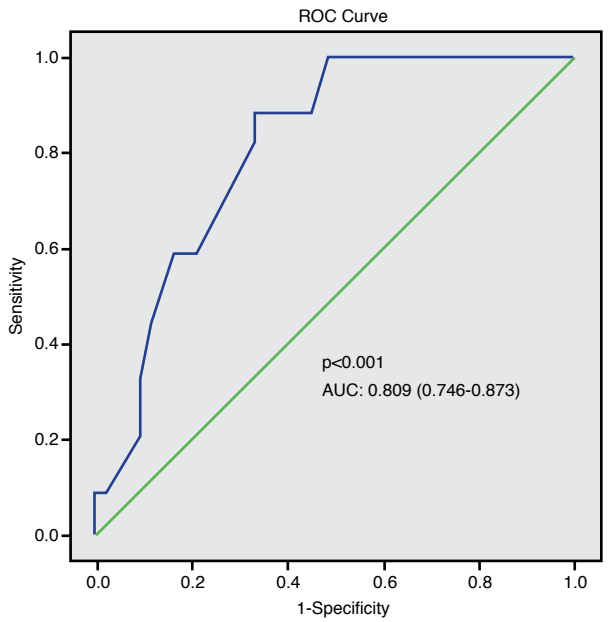

Figure 5. Receiver operating characteristic analysis to determine the predictive value of the ST segment deviation/T wave polarity in the lead aVR ratio for left ventricular thrombus and high-grade spontaneous echo contrast.

aVR and a persistently low EF. Therefore, T-wave positivity in the lead aVR might be a more sensitive measure than EF to detect ongoing microvascular ischemia in the myocardium and that these parameters might be closely associated with the formation of LVT or high-grade SEC.

With the extensive application of primary PCI and early interventional treatments, the frequency of LVT in STEMI patients has been markedly reduced.[7,16] A lower EF and apex-involved anterior MI has been reported to be related to LVT. LVT is more frequent (4–16%) in anterior MI patients than in NSTEMI patients.[5,8,17] Systolic dysfunction, a lower EF, late reperfusion, and a low TIMI flow score were reported as independent predictors for LVT. Our study results revealed an LVT frequency of 9.8%, which was consistent with some other studies. The EF was significantly lower in patients with LVT or high-grade SEC, and it was demonstrated to be an independent predictor in multivariate analysis. There was no difference between the door-to-balloon time, or abciximab and tirofiban treatments between the groups. We did not have the exact time of symptom onset; however, we think that patients with LVT or high-grade SEC might have a longer symptom-onset-to-balloon time.

Choi et al.[18] have reported that grade 2–3 diastolic dysfunction and a ratio of mitral annular E and e' velocities were closely related to LVT in anterior MI patients. We did not use any diastolic parameters in our study. In a study conducted by Gökdeniz et al.,[19] when 19.5 was used as the cut-off value for the SS, it predicted LVT with 84.3% sensitivity. We calculated the SS, cSS, and rSS values in this study. In the univariate analysis, only the cSS was significantly higher in patients with LVT and high-grade SEC. However, it was not an independent predictor in the logistic regression analysis. Gökdeniz et al.[19] found that both groups had a markedly high SS. Our mean SS value of LVT and high-grade SEC patients was similar to that of their patients without LVT and high-grade SEC. If our patients had a high SS value, maybe we would observe similar results. Additionally, when 1.8 mV or greater was used as the cut-off value for TPaVR, it predicted LVT or high-grade SEC with 92% sensitivity.

Limitations

This was a retrospective study, and the patient population was highly selected. We did not use additional imaging methods to confirm the LVT diagnosis. All of our patients had a recent MI. Therefore, we did not use any other stress test to confirm microvascular ischemia. There is a need for larger, prospective studies to further examine the role of the lead aVR in this patient group.

Conclusion

T-wave positivity and ischemic changes in the lead aVR should be closely monitored for the possibility of LVT formation or high-grade SEC in anterior MI patients. Early and more frequent echocardiographic evaluation may be required for these patients.

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Anahtar sözcükler: aVR derivasyonu; sol ventrikül trombüs; miyokart enfarktüsü.