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Factors associated with an increase in spatial and frontal QRS-T angles in patients with anterior myocardial infarction

Aim To determine existence of a relationship between any clinical, echocardiographic and coronarographic factors and increased spatial QRS-T (sQRS-T) angle and frontal QRS-T (fQRS-T) angle in patients with anterior myocardial infarction.

Material and methods This study included 137 patients aged 62 [53; 72] years with anterior acute myocardial infarction managed at the A. L. Myasnikov Institute of Clinical Cardiology. fQRS-T was calculated as the module of difference between the frontal plane QRS complex axis and the T wave axis. sQRS-T was calculated as a spatial angle between QRS and T integral vectors from a synthesized vectorcardiogram.

Results fQRS-T values for a group (median [25th; 75th percentile]) were 81 [37; 120] °; sQRS-T values were 114 [80; 141] °. The correlation coefficient between fQRS-T and sQRS-T values was 0.41 ($p<0.001$). fQRS-T weakly but statistically significantly correlated with patients' age ($r=0.28$; $p=0.001$), left ventricular ejection fraction (LV EF, $r= -0.22$; $p=0.01$), and glomerular filtration rate ($r= -0.32$; $p=0.0002$). sQRS-T weakly but statistically significantly correlated with left ventricular end-diastolic dimension ($r=0.24$; $p=0.0048$), LV EF ($r= -0.28$; $p=0.0009$), and the number of affected segments according to echocardiography data ($r=0.27$; $p=0.002$). fQRS-T values were significantly higher in the presence of concurrent arterial hypertension. sQRS-T values were significantly higher in the presence of a history of chronic heart failure. Both fQRS-T and sQRS-T values increased with increasing number of affected blood vessels and Killip class of acute heart failure.

Conclusion In patients after anterior acute myocardial infarction, increases in fQRS-T and sQRS-T are associated with more severe damage of the vasculature, decreased LV EF, and, thus, more severe clinical course of disease.

Keywords QRS-T angle; myocardial infarction; synthesized vectorcardiogram

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Introduction

Improving risk stratification techniques is important for determining the management tactics for patients with chronic coronary artery disease and acute coronary syndrome. Electrocardiogram, a low-cost and widely available method, may be promising. The prognostic electrocardiographic parameters of increasing interest include such indicators as spatial QRS-T angle (sQRS-T) and frontal QRS-T angle (fQRS-T), showing the spatial divergence of the ventricular depolarization and repolarization vectors [1]. Several studies showed that increased fQRS-T is an independent predictor of cardiovascular and all-cause mortality in the early [2, 3] and long-term [3–6] periods in patients with acute ST-elevation myocardial infarction (STEMI) and non-ST elevation myocardial infarction (NSTEMI).

It is not clear what factors affect the fQRS-T angle in patients with myocardial infarction (MI) and, thus, what interventions could improve the prognosis for patients with increased fQRS-T. When comparing fQRS-T with the findings of single-photon emission computed tomography in patients with a history of anterior MI, age and myocardial perfusion defect were the independent determinants of the fQRS-T increase [7]. No correlations between fQRS-T and myocardial perfusion defect were found in patients with inferior MI [8].

In patients with a history of MI, fQRS-T was negatively correlated with left ventricular ejection fraction (LVEF) with LVEF < 50% ($r=-0.5$; $p < 0.01$), but there was no such correlation in patients with LVEF > 50% [9].

The comparison of fQRS-T with magnetic resonance imaging data showed a correlation between fQRS-T and LVEF and infarction area in patients with STEMI [10]. Patients with STEMI [11] and NSTEMI [12] had a correlation between increased fQRS-T and the severity of coronary atherosclerosis (SYNTAX score≥23).

In our previous study, increased fQRS-T and sQRS-T were associated with more severe coronary artery disease, decreased LVEF, and, thus, a more severe clinical course in patients with acute inferior MI [13].

The objective of this study was to determine a correlation between any clinical, echocardiographic, and coronographic factors and increased sQRS-T and fQRS-T in patients with anterior MI.

Material and methods

The study design was retrospective. Medical records of patients with acute inferior MI treated in A. L. Myasnikov Institute of Clinical Cardiology in 2016–2017 were selected from a medical information system.

The study included patients with a 12-lead digital electrocardiogram (ECG) recorded before discharge from the hospital, echocardiogram, and coronary angiography (CAG) data stored in the medical information system.

Patients with paced ventricular rhythm and complete left bundle branch block were excluded.

The study included 137 patients: 107 (78%) male and 30 (22%) female patients, the median age and interquartile range were 62 [53; 72] years.

The severity of acute heart failure (AHF) in the acute period of MI was assessed using the Killip classification.

Glomerular filtration rate (GFR) was calculated using the MDRD (Modification of Diet in Renal Disease) formula. Chronic kidney disease (CKD) was classified following the guideline [14].

Electrocardiogram

Digital 12-lead ECGs were acquired and processed using a PC-based Easy ECG device (Ates Medica, Russian Federation). ECG records made in the sub-acute period (day 9 of MI [7; 11]) before discharge from the hospital were analyzed.

The fQRS-T angle was calculated as an absolute difference between the QRS and T axes in the frontal plane. If fQRS-T was > 180°, it was brought to a minimum by subtracting from 360°. The sQRS-T was calculated as the spatial angle between the QRS and T integral vectors calculated using a synthesized vectorcardiogram.

Echocardiogram

Transthoracic echocardiogram was performed on a Vivid 9 (GE, USA) ultrasound device following the recommendations for cardiac chamber assessment in adults. The B-mode biplane method of disks (modified Simpson's rule) was used to measure LVEF. Local myocardial contractility disorders were evaluated using a 16 segment LV model.

Coronary angiography

Coronary angiography (CAG) was performed on an Allura Xper FD 10 angiographic complex (Philips, Netherlands) via radial access. Narrowing of the left coronary artery by more than 50% and other large epicardial coronary arteries and their first-order branches by more than 70% was estimated as significant stenosis.

On the day of hospital admission, all patients signed the consent for the diagnosis and treatment procedures, including ECG and the procession of personal data, and signed the informed consent for medical interventions. Moreover, patients signed the informed consent before CAG for this particular examination. Each patient underwent only the procedures indicated given their diagnosis.

Statistical analysis

The statistical analysis of data was performed using MedCalc version 12.7.8 (MedCalc Software BVBA, Belgium). Continuous variables are presented as the medians and interquartile ranges [25th percentile; 75th percentile], and categorical variables are expressed as the absolute numbers and percentages (%). The Mann – Whitney test was used to estimate the differences between two independent quantitative variables, and the chi-square method was used for qualitative variables; the two-tailed Fischer's exact test was used to analyze fourfold tables with the expected event value less than 10. Spearman's rank correlation analysis was applied to determine the correlation between variables. The differences were statistically significant at $p < 0.05$.

Results

Characteristics of the subjects are presented in Table 1.

The fQRS-T angle values in the group were 81 [37; 120] °; fQRS-T in female patients was significantly higher than in male patients (105 [49;137] ° versus 70 [35;114] °, p=0.047).

The sQRS-T angle values in the group were 114 [80; 141] °. There were no significant differences in sQRS-T between female and male patients, but there was a trend to higher values in male patients than in female patients (117 [86;143] ° versus 98 [74;126] °, p=0.12). The correlation coefficient between fQRS-T and sQRS-T was 0.41 ($p < 0.001$).

There were weak but significant correlations between fQRS-T and patient's age (r=0.28; p=0.001), LVEF (r=– 0.22; p=0.01), and GFR (r=–0.32; p=0.0002). There were also weak but significant correlations between sQRS-T and left ventricular end-diastolic dimension (LVEDD; r=0.24; p=0.0048), LVEF (r=0.28; p=0.0009), and the number of segments involved according to echocardiogram (r=0.27; p=0.002).

The fQRS-T values were significantly higher in concomitant arterial hypertension than without arterial hypertension (91 [42;131] ° versus 38 [21;97] °, p=0.004), and with decreased GFR (< 90 mL/min/1.73 m^2) than with GFR≥90 mL/min/1.73 m^2 (100 [52;133] ° versus 49 [27;92] °, p=0.0001). There was a trend to higher fQRS-T values in chronic heart failure (CHF), post-infarction cardiosclerosis (PICS), dyskinesis zones in echocardiographam, and left coronary artery involvement compared to the absence of such conditions. However, the differences were not statistically significant.

Values of sQRS-T were significantly greater with a history of CHF than without CHF (138 [93;148] ° versus 110 [78;136] °, p=0.04). There was a trend to higher sQRS-T values in diabetes mellitus, PICS, and left coronary artery involvement compared to the absence of such conditions, though the differences were not statistically significant.

There was a trend to lower values of fQRS-T and sQRS-T in spontaneous reperfusion, but the differences were not statistically significant.

There were no statistically significant differences between fQRS-T and sQRS-T in patients with the involvement of proximal or middle segments of left anterior descending artery (LAD). The values of fQRS-T and sQRS-T increased with more vessels involved and a higher Killip class of AHF (see Table 2). Characteristics of patients with fQRS-T and sQRS-T above and below the 75th percentile are provided in Table 3.

The comparison of patients with fQRS-T and sQRS-T values above and below the median showed than patients with fQRS-T≥81° were older than those with fQRS-T <81° (65 [56; 80] years versus 60 [49; 66] years, p=0.003); had multivessel disease more often (35 (51%) cases and 13 (19%) cases, respectively, p=0.0003), and also had lower GFR (79 [67; 91] mL/min/1.73 m^2 versus 94 [80; 101] mL/min/1.73 m^2, p=0.0001). Patients with sQRS-T ≥114° were more likely to have multivessel disease than those with sQRS-T <114° (31 (44%) versus 17 (25%), p=0.03), higher LVEDD (54 [51; 58] mm and 53 [51; 55] mm, respectively, p=0.03), more segments involved (4 [4; 6] versus 4 [2; 5], p=0.02) and lower LVEF (45 [42; 50] % versus 50 [42; 60] %, p=0.03).

Table 1. Characteristics of the included patients

Parameter		Value
Time to hospitalization, hours*		3 [2; 7]
AHF class (Killip)	I, n (%)	99 (72)
	II, n (%)	21 (15)
	III, n (%)	17 (13)
AH, n (%)		106 (77)
CHF, n (%)		18 (13)
DM, n (%)		26 (19)
PICS, n (%)		23 (17)
Obesity, n (%)		9 (6.6)
Early post-infarction angina, n (%)		8 (5.8)
Right bundle branch block, n (%)		12 (8.8)
LVEDD, mm		53 [51; 57]
IVST, mm		11 [10; 11.5]
LVPWT, mm		10 [10; 11]
LVEF, %		47 [42; 55]
Number of involved segments (echo)		4 [2; 5]
Presence of dyskinesis zones, n (%)		18 (13)
Number of vessels involved	1, n (%)	56 (41)
	2, n (%)	33 (24)
	> 2, n (%)	48 (35)
Infarct – related artery	LAD (proximal segment), n (%)	78 (57)
	LAD (middle segment), n (%)	53 (38.7)
	DA, n (%)	5 (3.6)
	LCX, n (%)	1 (0.7)
Left main coronary artery disease, n (%)		18 (13)
Spontaneous reperfusion, n (%)		9 (6.6)
GFR, mL/min/1,73m^2		87 [72;99]
CKD	Stage II, n (%)	59 (43)
	Stage III, n (%)	14 (10)
	Stage IV, n (%)	3 (2)

* corresponds to the time from the onset of ACS symptoms to the hospitalization, AHF, acute heart failure; AH, arterial hypertension, CHF, chronic heart failure: DM, diabetes mellitus; PICS, post-infarction cardiosclerosis; CKD, chronic kidney disease; LVEDD, left ventricular end-diastolic dimension, IVST, interventricular septal thickness; LVPWT, left ventricular posterior wall thickness; LVEF, left ventricular ejection fraction; LAD, left anterior descending artery; DA, diagonal artery; LCX, left circumflex artery; GFR, glomerular filtration rate,

Case studies

1. Patient with high fQRS-T and sQRS-T

Figure 1 shows an ECG of a 37-year-old patient recorded on day 8 after acute anterior MI (dated 20/02/2017).

Diagnosis: coronary artery disease, inferior MI, angioplasty with stenting of LAD and right coronary artery dated 14/08/2016. Restenosis in the previously implanted stent in LAD, angioplasty with stenting of the LAD dated 09/10/2016. STEMI, LAD angioplasty dated 10.11.2016. MI and LAD angioplasty dated December 2016. Anterior STEMI, LAD angioplasty at the level of the previously implanted stent dated 20.02.2017. Acute heart failure Killip class II;

CAG: LAD, the previously implanted stent in the middle segment, is occluded (thrombosis). 90% ostial

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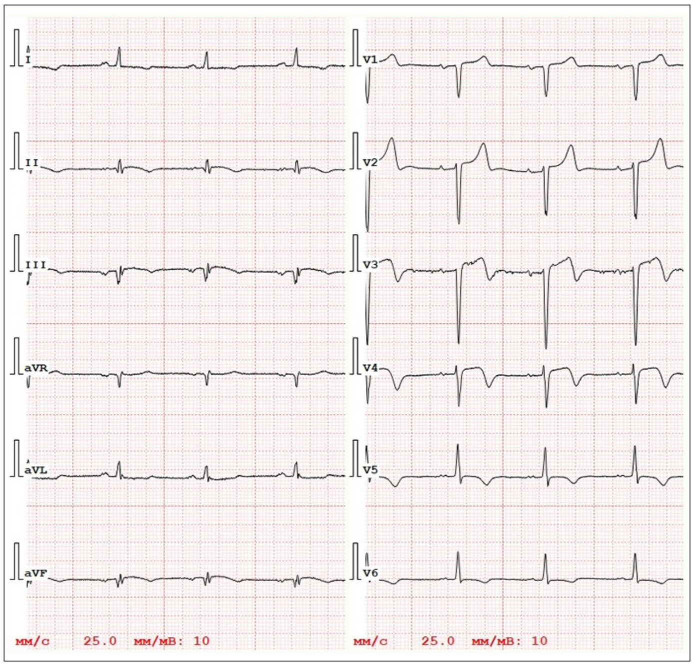
Table 2. fQRS-T and sQRS-T depending on the number of vessels involved and the Killip class of AHF

Parameter		fQRS-T	p	sQRS-T	p
Number of vessels involved	1	48 [28; 100]°	0.005	98 [68; 134]°	0.01
	>1	97 [51; 130]°		122 [90; 146]°	
	1–2	62 [31; 110]°	0.004	102 [74; 135]°	0.01
	>2	104 [60; 135]°		125 [102; 147]°	
AHF class (Killip)	I	66 [30; 120]°	0.03	110 [74; 135]°	0.025
	II–III	94 [64; 132]°		132 [90; 156]°	
	I–II	69 [35; 120]°	0.04	110 [78; 137]°	0.07
	III	98 [79; 138]°		139 [97; 158]°	

AHF, acute heart failure: fQRS-T, frontal QRS-T angle; sQRS-T, spatial QRS-T angle.

Figure 1. ECG of a 37-year-old patient on day 8 after the onset of acute anterior MI. fQRS-T 160°, sQRS-T 174°



stenosis of the diagonal artery. 30% middle stenosis of the left circumflex artery. 30% proximal stenosis of the right coronary artery.

Echocardiogram: LVEDD 6.1 cm; LVEF 45%. Hypoakinesis of the apical and middle interventricular septum, and anterior anteroseptal regions. GFR 117 mL/min/ 1.73 m².

2. Patient with relatively low fQRS-T and sQRS-T

Figure 2 shows an ECG of a 40-year-old patient recorded on day 12 after acute MI.

Diagnosis: coronary artery disease. Anterior MI, angioplasty with stenting of LAD dated 05/06/2016. Acute heart failure Killip class I.

CAG: LAD, middle occlusion (thrombosis). Left circumflex artery: several 30% stenotic lesions. 60% middle stenosis of the right coronary artery.

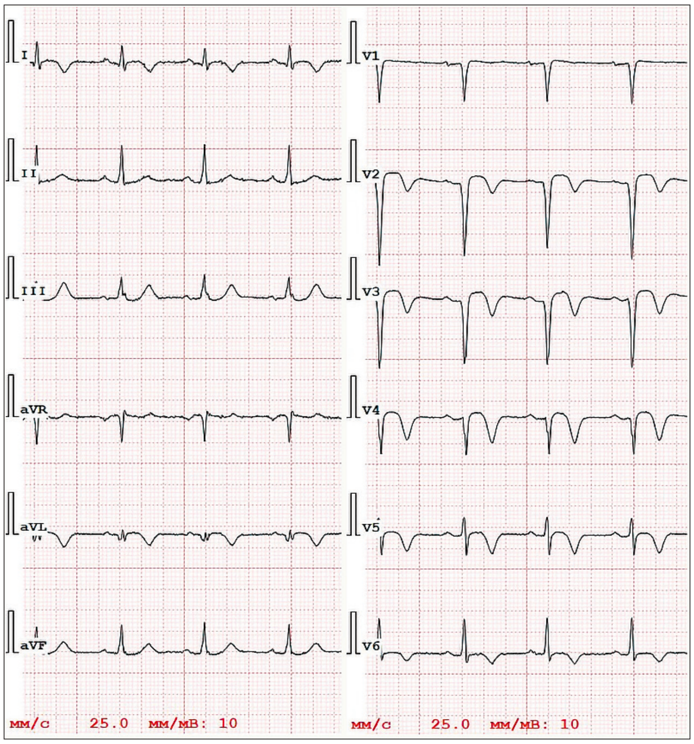
Echocardiogram: LVEDD 5.1 cm, LVEF 50%. Hypokinesis of the apical segments of all walls, the middle segment of the septum and the anterior wall.

Stress echocardiogram: Negative test for latent coronary artery disease. GFR 100 mL/min/1.73 m².

3. Patient with right bundle branch block and increased fQRS-T and sQRS-T

Figure 3 shows an ECG of a 70-year-old patient recorded on day 9 after acute MI.

Figure 2. ECG of a 40-year-old patient on day 12 after the onset of acute MI. fQRS-T 38°, sQRS-T 90°



Diagnosis: coronary artery disease. Anterior MI, LAD angioplasty, and stenting 13/03/2016. Acute heart failure Killip class III; Arterial hypertension grade 3, risk 4. CKD, stage 3. Right bundle branch block. Chronic bronchitis.

CAG: LAD ostium is occluded. 80% distal stenosis of the right coronary artery.

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Figure 3. ECG of a 70-year-old patient on day 9 after the onset of acute MI. fQRS-T 119°, sQRS-T 147°

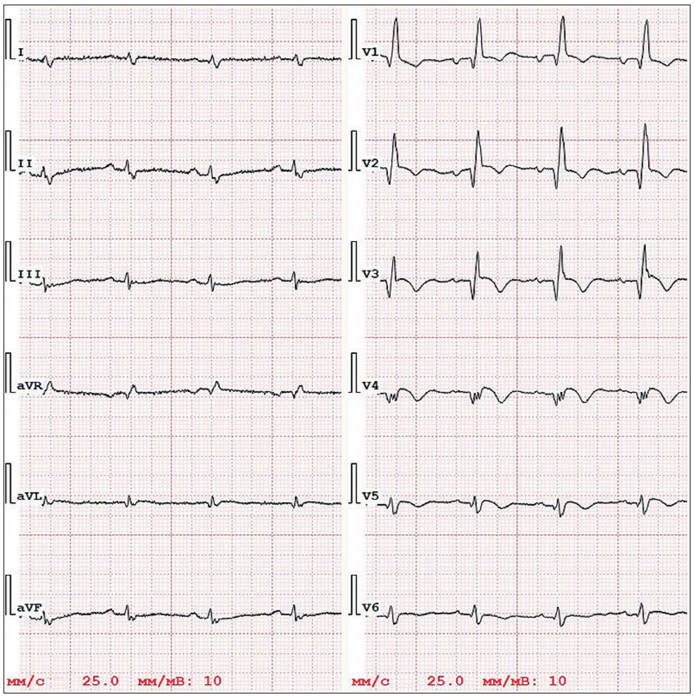
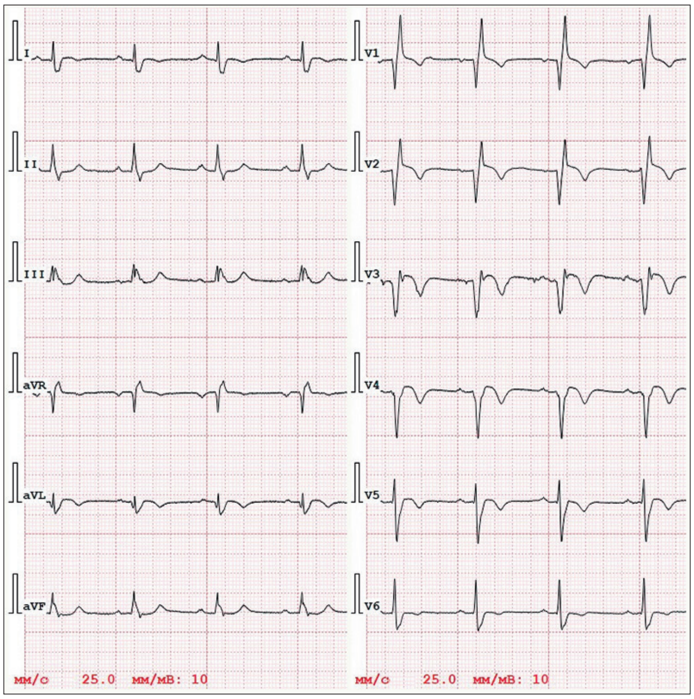


Figure 4. ECG of a 45-year-old patient on day 6 after the onset of acute MI. fQRS-T 31°, sQRS-T 29°



Echocardiogram: LVEDD 5.0 cm; LVEF 42%. Akinesis of the apical and middle segments of the anterior, anteroseptal walls of the left ventricle developing to the apical, partially middle segments of the lateral wall, the apical segment of the inferior wall. Signs of increased pulmonary artery pressure.

GFR 50 mL/min/1.73 m^2.

4. Patient with right bundle branch block and low fQRS-T and sQRS-T

Figure 4 shows an ECG of a 45-year-old patient recorded on day 6 after acute MI.

Diagnosis: coronary artery disease. Anterior MI, angioplasty with stenting of LAD dated 16/06/2016. Right bundle branch block. Acute heart failure Killip class I. Chronic bronchitis.

CAG: LAD, proximal occlusion.

Echocardiogram: LVEDD 4.6 cm; LVEF 52%. Hypoakinesis of the apical and middle segments of the interventricular septum and the anteroseptal wall of the left ventricle. GFR 106 mL/min/1.73 m^2.

Discussion

The improvement of the high cardiovascular risk tactic is currently of increasing relevance for the reduction of cardiovascular mortality [15].

According to the current clinical guidelines [16], routine risk stratification using any of numerous available adverse outcome risk scores (GRACE, TIMI, DYNAMIC TIMI, CADILLAC, PAAMI, Zwolle) is not recommended for patients with STEMI due to a lack of effective treatment approaches based on the stratification results. The individual risk of adverse outcomes is determined by the patient's age, localization and extent of MI, the severity of coronary artery disease, timeliness and completeness of reperfusion, complications, and the presence of renal dysfunction and diabetes mellitus.

Increased fQRS-T in patients with acute MI is an independent predictor of cardiovascular and all-cause death in the early [2, 3] and long-term [3–6] periods of MI. However, the factors affecting fQRS-T in patients with MI are not known.

A better understanding of the pathogenesis of abnormalities in the prognostically significant parameters in patients with MI (especially accurate quantitative indicators that can be evaluated over time) could potentially allow using such parameters not only as additional indications for specific therapies but also to assess the efficacy of treatment.

This study follows from our previous work on fQRS-T and sQRS-T abnormalities in patients with a history of inferior MI [13]. Our data showed that patients with anterior MI had significantly higher fQRS-T and sQRS-T than those with inferior MI (81 [37; 120] ° and 105 [49;137] ° versus 54 [18; 80] ° and 80 [53; 110] °, respectively). These data are consistent with the findings by Kurisu et al. (fQRS-T in patients with a history of anterior and inferior MI was 82°±49° and 27±22°, respectively) [8]. It should be noted that according to echocardiographic data, our patients with anterior MI

Table 3. Characteristics of patients with fQRS-T and sQRS-T above and below the 75th percentile

Parameter		fQRS-T, >120° n=34	fQRS-T, ≤120° n=103	p	sQRS-T, >141° n=34	sQRS-T, ≤141° n=103	p
Male, n (%)		23 (68)	84 (82)	0.14	28 (82)	79 (75)	0.65
Age, years		64 [57;80]	62 [50;72]	0.048	64 [57;81]	62 [52;71]	0.05
AH, n (%)		31 (91)	75 (73)	0.032	29 (85)	77 (75)	0.29
CHF, n (%)		7 (21)	11 (11)	0.15	8 (24)	10 (10)	0.07
DM, n (%)		7 (21)	19 (18)	0.80	10 (29)	16 (16)	0.08
PICS, n (%)		6 (18)	17 (17)	0.91	7 (20)	16 (16)	0.67
Obesity, n (%)		2 (6)	7 (7)	0.83	3 (9)	6 (6)	0.69
Time to hospitalization, hours		3 [2; 6]	3 [2;7]	0.89	3 [2; 5]	4 [2; 8]	0.41
IRA	LAD (proximal segment), n (%)	17 (50)	61 (60)	0.53	20 (59)	58 (56)	0.95
	LAD (middle segment), n (%)	16 (47)	37 (36)		13 (38)	40 (40)	
	Other, n (%)	1 (3)	4 (4)		1 (3)	4 (4)	
SR, n (%)		1 (3)	8 (8)	0.45	1 (3)	8(8)	0.45
LCA involvement, n (%)		5 (15)	13 (13)	0.77	8 (24)	10 (10)	0.07
Killip class	I, n (%)	24 (70)	75 (73)	0.89	19 (56)	80 (78)	0.03
	II, n (%)	5 (15)	16 (15)		7 (21)	14 (14)	
	III, n (%)	5 (15)	12 (12)		8 (23)	9 (8)	
Number of vessels involved	1, n (%)	10 (29)	46 (45)	0.1	8 (23.5)	48 (47)	0.02
	2, n (%)	7 (21)	26 (25)		8 (23.5)	25 (24)	
	>2, n (%)	17 (50)	31 (30)		18 (53)	30 (29)	
EPIA, n (%)		2 (6)	6(6)	1.00	2(6)	6(6)	1.00
LVEDD, mm		53 [51; 57]	53 [51; 56]	0.61	56 [52; 59]	53 [51; 55]	0.007
IVST, mm		11 [10.8; 13]	10.5 [10; 11]	0.004	10.3 [10; 11.4]	11 [10; 11.5]	0.51
LVPWT, mm		10 [10; 11.2]	10 [9.8; 11]	0.11	10 [10; 11]	10 [10; 11]	0.81
LVEF, %		47 [42; 50]	47 [42; 56]	0.68	44 [41; 47]	49 [42;57]	0.004
Number of involved segments (echo)		4 [3; 6]	4[2; 5]	0.71	5 [4; 6]	4 [2; 5]	0.016
Dyskinesis, n (%)		5 (15)	13 (13)	0.98	7 (20)	11 (11)	0.23
RBBB, n (%)		2 (6)	10 (10)	0.73	2 (6)	10 (10)	0.73
GFR, mL/min/1.73m2		80 [69; 88]	90 [73; 101]	0.016	77 [47; 96]	89 [76; 101]	0.008
GFR, mL/min/1.73m^2	>90, n (%)	8 (23)	53 (51)	0.018	12 (35)	49 (47.5)	0.002
	60–89, n (%)	20 (59)	39 (38)		12 (35)	47 (45.5)	
	<60, n (%)	6 (18)	11 (11)		10 (30)	7 (7)	

AH, arterial hypertension; CHF, chronic heart failure; DM, diabetes mellitus; PICS, post-infarction cardiosclerosis; IRA, infarct-related artery; LAD, left anterior descending artery; SR, spontaneous reperfusion; LCA, left coronary artery; EPIA, early post-infarction angina; LVEDD, left ventricular end-diastolic dimension; IVST, interventricular septal thickness, LVPWT, left ventricular posterior wall thickness, LVEF, left ventricular ejection fraction; RBBB, right bundle branch block; GFR, glomerular filtration rate; fQRS-T, frontal QRS-T angle; sQRS-T, spatial QRS-T angle.

had more segments involved, higher LVEDD and lower LVEF than those with inferior MI. Patients with anterior and inferior MI had weak but significant correlations of fQRS-T with the age of patients and LVEF and of sQRS-T with LVEF and the number of segments involved according to echocardiography. However, the correlation coefficient between fQRS-T and sQRS-T was 0.35–0.40 in patients with inferior and anterior MI, i.e., these indicators were rather complementary than substitutable.

The found correlations of fQRS-T with LVEF and multivessel disease are consistent with the findings of other researchers who also noted the relation of increased fQRS-T with LVEF [2, 6, 10], the presence of multivessel coronary artery disease [4], and high SYNTAX scores [11, 12].

Not much is still known about the correlation between fQRS-T and GFR. Patients with CHF and preserved LVEF [17] and patients with suspected acute decompensated CHF [18] more often had a history of CKD if fQRS-T was increased. Increased fQRS-T was associated with higher left ventricular end-diastolic volume in patients with severe CKD [19]. Decreased fQRS-T in patients with terminal CKD after kidney transplant concurred with decreased left ventricular end-diastolic volume 3 months after the surgery and increased LVEF a year after the surgery [20]. The correlation between fQRS-T and GFR

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seems to be of complex, multifaceted nature, but we could not find publications that would analyze this problem in detail.

As case studies demonstrated, fQRS-T and sQRS-T do not always correlate with the impression of MI extent resulting from the analysis of traditional signs, such as the presence of abnormal Q and QS waves, ST segment displacement, and T wave abnormalities. The same applies to patients with the right bundle branch block.

It is not yet clear what threshold values of sQRS-T and fQRS-T should be considered optimal. In a foreign population study, the values of 75th and 95th percentiles (which are usually used as the upper normal limits) were 31° and 63° for fQRS-T and 83° and 114° for sQRS-T, respectively [21]. There are no published data on the distribution of these indicators in the Russian population. Depending on different approaches to the threshold determination and different objectives of various clinical trials, the upper limit of fQRS-T ranged from 42° (upper tercile in patients with suspected NSTEMI) [5] to 104° (upper tercile in patients with acute coronary syndrome) [3], and increased fQRS-T was correlated with higher two-year mortality in both trials. The threshold limit of 90° is mostly used to study the correlation of fQRS-T with mortality and cardiovascular complications in patients with different CVDs [1].

In our study, a quarter of patients with inferior MI and about a half of patients with anterior MI had fQRS-T > 80° and sQRS-T > 110°. In patients with anterior MI, there was a correlation of fQRS-T with age, multivessel disease, and GFR and of sQRS-T with multivessel disease, LVEDD, and LVEF at relatively low threshold levels (fQRS-T >81° and sQRS-T >114°, i.e., above the median) and higher threshold levels (fQRS-T >120° and sQRS-T >141°, i.e., higher the 75th percentile). It seems that the development of optimal threshold levels for these parameters requires further research in more representative groups of patients with MI and at the population level.

Our small pilot study had several limitations. It was retrospective, did not assess changes in sQRS-T and fQRS-T in patients with acute MI, and only simple and commonly used parameters were compared. Nevertheless, the found correlations between these electrocardiographic parameters and other adverse prognostic signs in patients with MI can provide incentives for further research.

Conclusion

Patients with anterior and inferior myocardial infarction had weak but significant correlations of fQRS-T with the age of patients and LVEF and of sQRS-T with LVEF and the number of segments involved according to echocardiography.

Correlations of fQRS-T with age, multivessel disease and GFR and of sQRS-T with multivessel disease, LVEDD and LVEF were observed in patients with anterior myocardial infarction at both relatively low and high threshold levels.

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