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ARTYKUŁ ORYGINALNY / *ORIGINAL ARTICLE*

The relationship between fragmented QRS complexes and SYNTAX and Gensini scores in patients with acute coronary syndrome

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Abstract

Background: Fragmented QRS (fQRS) complexes on 12-lead electrocardiography (ECG) have been reported to be predictors of cardiac events and all-cause mortality in coronary artery disease (CAD).

Aim: To investigate the relationship between fQRS complexes and SYNTAX and Gensini scores in patients with acute coronary syndrome (ACS).

Methods: A total of 302 patients (223 men and 79 women) with ACS (133 ST elevated myocardial infarction [STEMI], 107 non-STEMI [NSTEMI], and 62 unstable angina pectoris [USAP]) were evaluated retrospectively in this study. An fQRS pattern was found in 70 patients (fQRS group) but was not found in 232 patients (non-fQRS group). SYNTAX score > 22 and Gensini score > 20 were defined as high SYNTAX and Gensini scores. The relationship between the presence of fQRS on 12-lead ECG and SYNTAX and Gensini scores was assessed.

Results: SYNTAX score ($p < 0.001$), Gensini score ($p < 0.001$), NYHA class ($p < 0.001$), QRS duration ($p < 0.001$), number of disease vessels ($p = 0.003$), and high sensitive troponin T levels ($p = 0.026$) were significantly higher in the fQRS group. The number of fQRS leads (HR 5.79, 95% CI 2.78–12.06, $p < 0.001$, HR 3.41, 95% CI 1.32–8.78, $p = 0.016$, respectively) was found to be an independent predictor of high SYNTAX score and high Gensini score in multivariate analysis.

Conclusions: The number of fQRS leads on 12-lead ECG on admission is associated with the severity and complexity of CAD in patients with ACS.

Key words: fragmented QRS, Gensini score, SYNTAX score

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INTRODUCTION

Acute coronary syndrome (ACS) is a factor that has increased morbidity and mortality in socioeconomically developed countries in recent years, and it continues to be one of the leading causes of health care costs. Recently, one of the major issues cardiologists are addressing is risk stratification in patients with ACS to identify the severity and complexity of coronary artery disease (CAD). For this reason, a large number of scoring systems and laboratory parameters have been used in clinical practice. The most commonly used systems are the SYNTAX and Gensini scores. SYNTAX and Gensini scores are two major scoring systems predicting the prognosis and the need for revascularisation, in addition to their ability to determine the extent and severity of CAD [1, 2]. Although these scoring systems have a large number of advantages, they require an invasive method such as coronary angiography to perform the scoring. Therefore, those interested in cardiovascular medicine still need an easily accessible, cost effective, and noninvasive method to carry out risk stratification by determining the extent and severity of CAD in ACS patients.

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Fragmented QRS (fQRS) is defined as a new electrocardiographic (ECG) signal of ventricular conduction delay altered from myocardial fibrosis/scarring or ischaemic areas. The presence of fQRS on a 12-lead ECG is considered to increase the likelihood of poor outcome and at the same time predicts cardiac events and mortality in patients with CAD [3–7]. In this study, we evaluated the relationship between the presence of fQRS complexes and complexity of CAD assessed by SYNTAX and Gensini scores in patients with ACS.

METHODS

Study population

A total of 385 consecutive patients who were diagnosed with ACS between January 2012 and November 2013 were evaluated retrospectively. New ECG changes without ST segment elevation, and/or positive cardiac biomarkers and symptoms of ischaemia explained non-ST elevated ACS (non-ST elevation myocardial infarction [NSTEMI] or unstable angina pectoris [USAP]). For a person to qualify as having an ST elevation myocardial infarction (STEMI) there should be > 30 min of continuous typical chest pain and ST-segment elevation ≥ 2 mm in two or more adjacent ECG leads within 12 h after onset of symptom or within 18 h if there was evidence of continuing ischaemia or haemodynamic instability. Patients excluded from the study were those with pre-excitation syndromes, complete or incomplete bundle-branch block pattern (BBBP), permanent atrial fibrillation, left ventricular hypertrophy (LVH) (according to the Sokolow-Lyon voltages criteria, > 35 mV on baseline ECG), ventricular paced rhythm (VPR), cardiomyopathy, myocarditis, a history of coronary artery bypass graft (CABG) surgery, impaired renal function (defined as a plasma creatinine value higher than 106.08 μmol/L or 1.2 mg/dL), and congenital heart disease. Eighty-three patients — 20 patients with incomplete right BBBP, 18 patients with history of CABG surgery, 15 patients with complete BBBP, 13 patients with permanent atrial fibrillation, eight patients with LVH, seven patients with impaired renal function, and two patients with VPR — were excluded from the final analysis. Consequently, in total 302 ACS patients were enrolled in the study. Demographic information, and risk factors of hypertension (HT), hyperlipidaemia, smoking, and diabetes mellitus (DM) of patients were acquired from the medical records. Patients whose baseline blood pressure exceeded 140/90 mm Hg or those who had been treated with antihypertensive drugs were diagnosed with HT. Patients with DM were defined as pre-diagnosed, and/or receiving antidiabetic medications, or newly diagnosed if fasting plasma glucose was ≥ 126 mg/dL or blood glucose was ≥ 200 mg/dL at any time. The Local Ethics Committee of our institution approved the study protocol.

Electrocardiography

Two blinded independent cardiologists examined the resting 12-lead ECG (filter range, 0.15–100 Hz; AC filter, 60 Hz, 25 mm/s, 10 mm/mV). The existence of an additional R′ or crochetage wave, notching in the lowest point of the S wave or fragmentation of the RS or QS complexes in two adjacent leads corresponding to a major coronary artery territory defined the fQRS pattern (Fig. 1) [8]. The fQRS pattern could develop in patients with absence or presence of Q waves. Pathologic Q wave was defined as any Q wave in lead V_2 or $V_3 \geq 0.02$ s or QS complex in leads V_2 and V_3 Q wave ≥ 0.03 s and ≥ 0.1 mV deep or QS complex in lead I, II, aVL, aVF, or V_4 to V_6 in any two leads of a contiguous lead grouping (I, aVL, and V_6; V_4 to V_6; and II, III, and aVF).

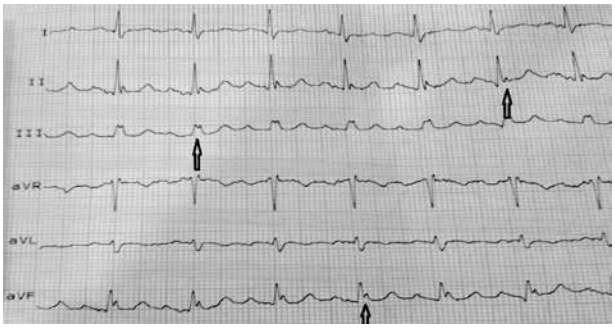

Figure 1. Development of fragmented QRS (arrows) in the inferior leads during acute coronary syndrome

Analysis of blood samples

The parameters analysed in fasting state within 24 h after admission were levels of plasma glucose, low-density lipoprotein cholesterol, and triglycerides. The haemogram parameters were determined and other biochemical measurements were made using standard biochemical techniques with a device from Beckman Coulter Ireland Inc., Mervue, Galway, Ireland. Roche TnThs assay was used to measure high sensitive troponin-T (hs-TnT). Normal reference values were obtained from a multicentre reference study, and the 99th percentile value was determined at 14 ng/L [9].

Echocardiography

The ejection fraction was measured by Simpson's method as advised by the American Society of Echocardiography [10], using the machine from GE, Vingmed Ultrasound AS, Horten, Norway with a 3.5-MHz transducer.

Coronary angiography

Angiographic data of the patients were obtained from catheter laboratory records and were evaluated by using this data. Coronary angiography was performed on all patients by femoral approach using the standard Judkin's technique. A 6 F diagnostic catheter and iopromide as a contrast agent (Ultravist-370, Bayer Schering Pharma, Germany) was used in all subjects. A diameter of stenosis calculated as ≥ 50% with quantitative angiography was accepted as significant. SYNTAX

and Gensini scores were used to define the angiographic characteristics of the coronary atherosclerotic lesion [2, 11]. All angiographic variables related to SYNTAX score calculation were calculated by two of three experienced cardiologists, blinded to the study, on angiograms. If there was any controversy, the opinion of the third cardiologist was asked, and the last judgment was made with consensus. Occluded infarct-related arteries in patients with acute myocardial infarction were scored as occlusions with less than three months duration. Each coronary lesion with a diameter stenosis of at least 50%, in veins of at least 1.5 mm, should be scored. The online, most recently updated version was used for the calculation of the SYNTAX score (http://www.SYNTAXscore.com). The Gensini score is equal to the sum of all segment scores (each segment score equals segment weighting factor multiplied by a severity score), as previously described. Segment weighting factors are between 0.5 and 5.0. Severity scores reflecting the specific percentage luminal diameter reduction of the coronary artery segment are 32, 16, 8, 4, 2, and 1, respectively, for 100%, 99%, 90%, 75%, 50%, and 25%. SYNTAX score > 22 and Gensini score > 20 were defined as high SYNTAX and Gensini scores.

Statistical analysis

All statistical studies were carried out with the program SPPS (version 15.0, SPSS, Chicago, İllinois, USA). Quantitative variables were expressed as the mean value ± standard deviation or median (minimum–maximum), and qualitative variables were expressed as percentages (%). All measurements were evaluated with the Kolmogorov-Smirnov test. A comparison of parametric values between the two groups was performed using the Mann-Whitney U-test or student t test. Categorical variables were compared by the χ^2 test or Fisher's exact test. For determination of high SYNTAX (> 22) and high Gensini (> 20) scores, univariate and multivariate analysis were performed using Enter and Backward-Conditional logistic regression analysis, respectively. A p value < 0.05 was considered statistically significant.

RESULTS

A total of 302 patients (223 men and 79 women) were enrolled in this study. Of these, 133 patients were STEMI (66 anterior, 52 inferior, eight posterior, and seven lateral), 107 patients were NSTEMI, and 62 patients were USAP. An fQRS pattern was found in 70 patients (fQRS group) but was not found in 232 patients (non-fQRS group).

In the analysis of the study groups, the New York Heart Association (NYHA) class (p < 0.001), number of disease vessels (p = 0.003), SYNTAX score (p < 0.001), Gensini score (p < 0.001), QRS duration (p < 0.001), and hs-TnT levels (p = 0.026) were significantly higher in the fQRS group (Table 1).

In the subgroup analysis of the study patients according to the type of ACS, there were significant differences regarding mean age (p = 0.008), presence of Q wave (p = 0.001), SYNTAX score (p < 0.001), Gensini score (p < 0.001), and hs-TnT levels (p < 0.001) between the USAP, NSTEMI, and STEMI patients, respectively (Table 2). The presence of DM (p = 0.018), admission level of glucose (p = 0.003), and platelet count (p = 0.02) were significantly higher in STEMI patients compared to the USAP and NSTEMI patients, respectively. The presence of HT (p < 0.001), number of fQRS leads (p = 0.018), QRS duration (p = 0.005), and the rate of three-vessel disease (p = 0.005) were significantly lower, but the rate of previous myocardial infarction (p = 0.001) and the rate of one-vessel disease (p = 0.005) were significantly higher in USAP patients compared to the NSTEMI and STEMI patients, respectively. The family history of CAD was significantly lower (p = 0.004) in NSTEMI patients compared to the USAP and STEMI patients, respectively (Table 2).

Univariate and multivariate analyses were made for high SYNTAX score. Age, fQRS, number of fQRS leads, gender, HT, STEMI, USAP, and hs-TnT were found to be associated with high SYNTAX score. The number of fQRS leads (HR 5.79, 95% CI 2.78–12.06, p < 0.001), gender (HR 0.41, 95% CI 0.19–0.78, p = 0.021), STEMI (HR 2.68, 95% CI 1.31–5.48, p = 0.007), and hs-TnT (HR 6.49, 95% CI 2.51–16.75, p < 0.001) were found to be independent predictors of high SYNTAX score in multivariate analyses (Table 3).

Similarly, univariate and multivariate analyses were made for high Gensini score. Age, fQRS, number of fQRS leads, DM, STEMI, USAP, and hs-TnT were found to be associated with high Gensini score. Age (HR 1.03, 95% CI 1.00–1.05, p = 0.016), number of fQRS leads (HR 3.41, 95% CI 1.32–8.78, p = 0.011), DM (HR 2.36, 95% CI 1.17––4.47, p = 0.016), and USAP (HR 0.29, 95% CI 0.12–0.68, p = 0.004) were found to be independent predictors of high Gensini score in multivariate analyses (Table 4). The relationship between number of fQRS leads and SYNTAX and Gensini scores in patients with ACS are shown in Figure 2 and Figure 3.

DISCUSSION

Our study results demonstrate that the number of fQRS leads on 12-lead ECG on admission is associated with the severity and complexity of CAD in patients with ACS. To our knowledge, this is the first study to evaluate an association between the presence of fQRS complexes and prediction of severity and complexity of CAD by assessing SYNTAX and Gensini scores.

As objective methods, SYNTAX and Gensini scores can evaluate CAD severity, and it has been demonstrated that they are related to short- and long-term cardiovascular risk and appropriate revascularisation [1, 2, 12]. Both of these scoring systems show coronary anatomy, artery morphology, and severity of stenosis in atherosclerotic lesions [13].

Although different conclusions have been reached in earlier studies about the use of Gensini score in patients with

Table 1. The baseline characteristics and laboratory findings of study patients

Variable	fQRS group (n = 70)	Non-fQRS group (n = 232)	P
Gender, male	55 (78.6%)	168 (72.4%)	0.304
Age [years]	65 (34–89)	63 (19–88)	0.106
Heart rate [bpm]	73 (52–155)	75 (48–132)	0.914
BMI [kg/m^2]	22.8 (19.4–37.6)	23.1 (18.4–37.6)	0.734
Hypertension	33 (47.1%)	103 (44.4%)	0.686
Hyperlipidaemia	33 (47.1%)	98 (42.2%)	0.468
Diabetes mellitus	25 (35.7%)	91 (39.2%)	0.597
Smoking	24 (34.3%)	74 (31.9%)	0.708
History of CAD	16 (22.9%)	70 (30.2%)	0.235
Ejection fraction [%]	45 (30–70)	50 (30–70)	0.841
NYHA class:			< 0.001
1	21 (30%)	156 (67.2%)	
2	37 (52.9%)	65 (28%)	
3	8 (11.4%)	8 (3.4%)	
4	4 (5.7%)	3 (1.3%)	
QRS duration [ms]	94.3 ± 7.8	85.3 ± 9.8	< 0.001
Previous MI	9 (12.9%)	34 (14.7%)	0.706
Q wave	11 (15.7%)	34 (14.7%)	0.827
Number of DV:			0.003
1	20 (28.6%)	119 (51.3%)	
2	36 (51.4%)	85 (36.6%)	
3	14 (20%)	28 (12.1%)	
Culprit lesion:			0.121
LAD	36 (51.4%)	95 (40.9%)	
Cx	18 (25.7%)	66 (28.4%)	
RCA	16 (22.8%)	71 (30.7%)	
SYNTAX score	19 (3–37.5)	11 (0–30.5)	< 0.001
Gensini score	74.5 (3–168)	36 (2–164)	< 0.001
Type of ACS:			0.962
STEMI	31 (44.3%)	102 (43.9%)	
NSTEMI	31 (44.3%)	76 (32.8%)	
USAP	8 (11.4%)	54 (23.3%)	
Glucose [mg/dL]	133 (75–443)	124 (42–374)	0.276
BUN [mg/dL]	11 (5–21)	11 (5–21)	0.881
Creatinine [mg/dL]	0.75 (0.47–1.2)	0.76 (0.46–1.2)	0.164
LDL [mg/dL]	125.4 ± 40.1	123.5 ± 34.8	0.701
Triglyceride [mg/dL]	132 (56–362)	122 (42–374)	0.336
WBC [10^3/mm^3]	9.9 (5.6–22)	10 (4.9–32.4)	0.743
Haemoglobin [g/dL]	13.4 (9–17.4)	13.6 (8.6–19)	0.120
Platelet [10^3/mm^3]	231 (144–501)	232 (96–644)	0.800
Hs–TnT [ng/L]	256.9 (3–6102)	143.3 (3–6000)	0.026

ACS — acute coronary syndrome; BMI — body mass index; BUN — blood urea nitrogen; CAD — coronary artery disease; DV — disease vessel; fQRS — fragmented QRS; Cx — circumflex artery; Hs–TnT — high sensitive troponin T; LAD — left anterior descending artery; LDL — low-density lipoprotein; MI — myocardial infarction; NSTEMI — non-ST elevated myocardial infarction; RCA — right coronary artery; STEMI — ST elevated myocardial infarction; USAP — unstable angina pectoris; WBC — white blood cell

Table 2. The baseline characteristics and laboratory findings in subgroups of acute coronary syndrome

Variable	USAP (n = 62)	NSTEMI (n = 107)	STEMI (n = 133)	P
Gender, male	46 (74.2)	78 (72.9)	99 (74.4)	0.962
Age [years]	58 (33–80)	68 (19–88)	63 (29–89)	0.008
Heart rate [bpm]	72 (51–98)	73 (51–132)	76 (48–155)	0.200
BMI [kg/m^2]	23.1 (18.3–37.5)	22.7 (18.7–37.5)	22.9 (18.3–37.2)	0.496
Hypertension	11 (17.7%)	61 (57%)	64 (48.1%)	< 0.001
Hyperlipidaemia	26 (41.9%)	54 (50.5%)	51 (38.3%)	0.164
Diabetes mellitus	19 (30.6%)	34 (31.8%)	63 (47.4%)	0.018
Smoking	16 (25.8%)	38 (35.5%)	44 (33.1%)	0.421
History of CAD	21 (33.9%)	18 (16.8%)	47 (35.3%)	0.004
Ejection fraction [%]	50 (30–70)	50 (30–70)	45 (30–70)	0.313
NYHA class:				0.353
1	39 (62.9%)	69 (64.5%)	69 (51.9%)	
2	21 (33.9%)	30 (28%)	51 (38.3%)	
3	2 (3.2%)	5 (4.7%)	9 (6.8%)	
4	0 (0%)	3 (2.8%)	4 (3%)	
Presence of fQRS	8 (12.9%)	31 (29%)	31 (23.3%)	0.058
Number of fQRS leads	0.4 ± 0.9	1.0 ± 1.5	0.9 ± 1.6	0.018
QRS duration [ms]	84.2 ± 9.6	89.5 ± 11.6	87.2 ± 8.7	0.005
Previous MI	18 (29%)	14 (13.1%)	11 (8.3%)	0.001
Q wave	18 (29%)	15 (14%)	12 (9%)	0.001
Number of DV:				0.005
1	38 (61.3%)	52 (48.6%)	49 (36.8%)	
2	21 (33.9%)	43 (40.2%)	57 (42.9%)	
3	3 (4.8%)	12 (11.2%)	27 (20.3%)	
Culprit lesion:				< 0.001
LAD	25 (19.1%)	40 (30.5%)	66 (50.4%)	
Cx	24 (28.9%)	45 (54.2%)	14 (16.9%)	
RCA	13 (14.8%)	22 (25%)	53 (60.2%)	
SYNTAX score	7 (0–31)	14 (2–37.5)	16.5 (2–32.5)	< 0.001
Gensini score	14.5 (2–162)	40 (2–140)	48 (2–168)	< 0.001
Glucose [mg/dL]	118 (78–454)	118 (80–449)	138 (73–415)	0.003
BUN [mg/dL]	11 (5–21)	12 (5–21)	11 (5–21)	0.535
Creatinine [mg/dL]	0.76 (0.46–1.2)	0.75 (0.47–1.2)	0.82 (0.47–1.2)	0.256
LDL [mg/dL]	127 ± 34.9	126.5 ± 36.9	120.4 ± 35.8	0.321
Triglyceride [mg/dL]	116 (42–374)	125 (57–367)	125 (54–362)	0.356
WBC [10^3/mm^3]	10.3 (5.1–25.4)	9.9 (4.9–22)	9.8 (5–32.4)	0.453
Haemoglobin [g/dL]	13.9 (9.1–17.8)	13.6 (8.6–19)	13.4 (8.8–17.8)	0.345
Platelet [10^3/mm^3]	226 (96–400)	210 (121–644)	245 (96–501)	0.02
Hs–TnT [ng/L]	18.2 (3–88)	162 (6.3–6102)	245 (3–6000)	< 0.001

Abbreviations as in Table 1

STEMI, recently, in their study, Zencirci et al. [14] showed that the Gensini score plays an important role in inadequate resolution of ST segment in patients with STEMI undergoing primary percutaneous coronary intervention (PCI) [14]. On the other hand, SYNTAX score was defined initially for stable or unstable angina but then myocardial infarction SYNTAX score was defined for patients with STEMI treated with primary PCI in large-scale studies, and it was shown to be convenient and

Table 3. Univariate and multivariate analysis for high SYNTAX score

Variable	Univariate		Multivariate*	
	β (95% CI)	P	β (95% CI)	P
Age	1.02 (0.99–1.05)	0.062		
Fragmented QRS	4.24 (2.20–8.15)	< 0.001		
NOL ≥ 2	4.61 (2.40–8.87)	< 0.001	5.79 (2.78–12.06)	< 0.001
Gender, female	1.76 (0.91–3.41)	0.092	0.41 (0.19–0.78)	0.021
Diabetes mellitus	0.71 (0.36–1.38)	0.321		
Hypertension	2.76 (1.44–5.31)	0.002		
Creatinine	0.67 (0.14–3.07)	0.608		
Previous MI	0.51 (0.17–1.51)	0.229		
STEMI	0.38 (0.20–0.73)	0.004	2.68 (1.31–5.48)	0.007
NSTEMI	0.65 (0.32–1.30)	0.228		
USAP	0.31 (0.10–0.91)	0.034		
Hs–TnT ≥ 100 ng/L	6.36 (2.61–15.52)	< 0.001	6.49 (2.51–16.75)	< 0.001

*Analysis of Backward-Stepwise regression; CI — confidence interval; Hs–TnT — high sensitive troponin T; NOL — number of fragmented QRS leads; MI — myocardial infarction; NSTEMI — non-ST elevated myocardial infarction; STEMI — ST elevated myocardial infarction; USAP — unstable angina pectoris

Table 4. Univariate and multivariate analysis for high Gensini score

Variable	Univariate		Multivariate*	
	β (95% CI)	P	β (95% CI)	P
Age	1.04 (1.01–1.06)	< 0.001	1.03 (1.00–1.05)	0.016
Fragmented QRS	4.24 (1.75–10.26)	0.001		
NOL ≥ 2	4.33 (1.79–10.48)	0.001	3.41 (1.32–8.78)	0.011
Gender, female	1.46 (0.77–2.77)	0.24		
Diabetes mellitus	2.69 (1.45–4.97)	0.002	2.36 (1.17–4.47)	0.016
Hypertension	1.50 (0.87–2.58)	0.142		
Creatinine	0.43 (0.13–1.40)	0.166		
Previous MI	1.11 (0.50–2.45)	0.788		
STEMI	3.99 (2.10–7.57)	< 0.001		
NSTEMI	1.55 (0.86–2.81)	0.144		
USAP	0.12 (0.06–0.22)	< 0.001	0.29 (0.12–0.68)	0.004
Hs–TnT ≥ 100 ng/L	3.80 (2.14–6.75)	< 0.001		

*Analysis of Backward-Stepwise regression; abbreviations as in Table 3

useful [15]. Attempts have been made to handle problems such as identification of responsible lesion and residual lesion after treatment with myocardial infarction SYNTAX score [16].

Willem Einthoven invented the first practical ECG, and it is still the most important diagnostic method for many diseases in cardiology. Recently, fQRS was defined by unexpected deviations in QRS morphology. The specific cause of this fractionation on surface ECG and the determinants of this phenomenon are not fully known. Numerous studies have demonstrated that fQRS is associated with increased morbidity and mortality and is also a predictor of adverse cardiac events in patients with ACS [17–19], idiopathic dilated cardiomyopathy (CMP) [20], and decompensated heart failure [21]. Theoretically, fQRS is generally agreed to be derived from regional myocardial fibrosis/scar and ischaemia, which cause heterogeneous myocardial electrical activation [22–24]. Fragmented QRS has been shown to be associated with myocardial fibrosis in patients with ischaemic or non-ischaemic left ventricular dysfunction [25]. Pietrasik and Zaręba [26] demonstrated the sensitivity of fQRS in detecting myocardial scars, and asserted that the presence of fQRS could be used for the prediction of cardiac events. In a former study, Peters et al. [27] showed that fQRS was a diagnostic sign of arrhythmogenic right ventricular dysplasia or CMP, which is associated with

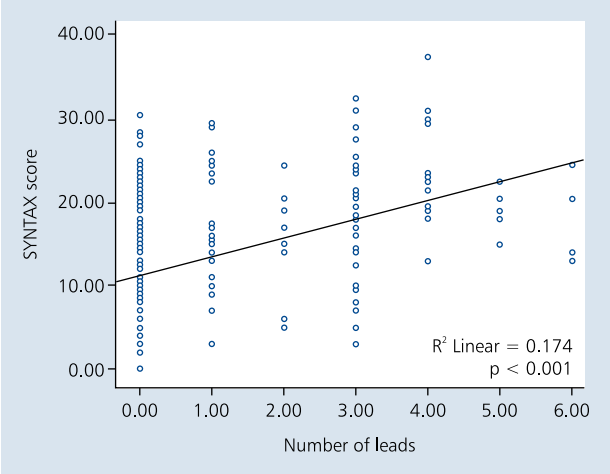

Figure 2. Relationship between number of fragmented QRS leads and SYNTAX score in acute coronary syndrome patients

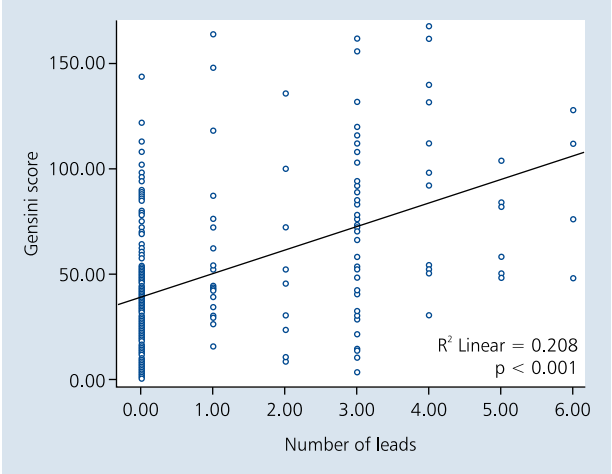

Figure 3. Relationship between number of fragmented QRS leads and Gensini score in acute coronary syndrome patients

right ventricular scarring. These results show that the fQRS complex is an easily evaluated, noninvasive ECG parameter and is associated with cardiac fibrosis.

These data also explain why the number of fQRS leads was significantly higher in ACS patients with high SYNTAX and Gensini scores in our study, and support the hypothesis that fragmentation is due to fibrosis/scar or ischaemia secondary to the extent and severity of CAD on a chronic basis rather than acute ischemic events. On the other hand, hs-TnT was significantly higher in ACS patients with fQRS, but in multivariate analysis of the entire study population the number of fQRS leads has been shown to be an independent variable for predicting high SYNTAX score and also high Gensini score.

Limitations of the study

There are four significant limitations in our study. First, this was a retrospective study, based on a relatively small group of patients, and the study cohort was predominantly male. Second, our results do not apply to patients with wide QRS complexes because the patients with complete or incomplete BBBP and patients with VPR were excluded. Third, fQRS on a 12-lead ECG requires an optimal low-pass filter setting (100 Hz or 150 Hz). Fragmentation may be missed with a filter setting of 40 Hz or 60 Hz. Fourth, we did not investigate the effect of drug therapy on fQRS, especially the effects of beta-blockers and renin–angiotensin system blockers.

CONCLUSIONS

The present study indicates that the fQRS number on 12-lead ECG on admission is associated with severity and complexity of CAD in patients with ACS. Moreover, the fQRS might be useful to identify high-risk patients.

Conflict of interest: *none declared*

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Zależność między fragmentacją zespołów QRS a wynikami w skali SYNTAX i skali Gensiniego u chorych z ostrym zespołem wieńcowym

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Streszczenie

Wstęp: Jak wskazują doniesienia, fragmentacja zespołów QRS (fQRS) w 12-odprowadzeniowym elektrokardiogramie (EKG) jest czynnikiem predykcyjnym zdarzeń sercowych i zgonu z jakiejkolwiek przyczyny u pacjentów z chorobą wieńcową (CAD).

Cel: Celem badania była ocena zależności między fQRS a punktacją w skali SYNTAX i skali Gensiniego u chorych z ostrym zespołem wieńcowym (ACS).

Metody: Do badania włączono retrospektywnie 302 chorych (223 mężczyzn i 79 kobiet) z ACS [133 przypadków zawału serca z uniesieniem docinka ST (STEMI), 107 przypadków zawału serca bez uniesienia odcinka ST (NSTEMI) i 62 przypadki niestabilnej dławicy piersiowej (USAP)]. Cechy fQRS stwierdzono u 70 chorych (grupa fQRS), a u 232 osób nie występowały pofragmentowane zespoły QRS (grupa nie-fQRS). Jako wysoką punktację definiowano wynik w skali SYNTAX wynoszący > 22 i wynik w skali Gensiniego wynoszący > 20. Oceniono zależności między obecnością fQRS w 12-odprowadzeniowym EKG a punktacją w skali SYNTAX i skali Gensiniego.

Wyniki: Punktacja w skali SYNTAX ($p < 0,001$), punktacja w skali Gensiniego ($p < 0,001$), klasa wg NYHA ($p < 0,001$), czas trwania zespołu QRS ($p < 0,001$), liczba zmienionych chorobowo naczyń ($p = 0,003$) i stężenie troponiny T oznaczanej metodą wysokoczułą ($p = 0,026$) były istotnie większe w grupie fQRS. W analizie wieloczynnikowej wykazano, że liczba odprowadzeń, w których występowały pofragmentowane zespoły QRS (odpowiednio HR 5,79; 95% CI 2,78–12,06; $p < 0,001$; HR 3,41; 95% CI 1,32–8,78; $p = 0,016$) była niezależnym czynnikiem predykcyjnym wysokiej punktacji w skali SYNTAX i skali Gensiniego.

Wnioski: Liczba odprowadzeń, w których występują pofragmentowane zespoły QRS w 12-odprowadzeniowym EKG wykonanym przy przyjęciu do szpitala, wiąże się ze stopniem ciężkości i złożonością CAD u chorych z ACS.

Słowa kluczowe: fragmentacja zespołów QRS, skala Gensiniego, skala SYNTAX

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