ORIGINAL ARTICLE

The prevalence and association of major ECG abnormalities with clinical characteristics and the outcomes of real-life heart failure patients — Heart Failure Registries of the European Society of Cardiology

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ABSTRACT

Background: Electrocardiogram (ECG) abnormalities increase the likelihood of heart failure (HF) but have low specificity and their occurrence is multifactorial.

Aim: This study aimed to investigate the prevalence and association of major ECG abnormalities with clinical characteristics and outcomes in a large cohort of real-life HF patients enrolled in HF Registries (Pilot and Long-Term) of the European Society of Cardiology.

Methods: Standard 12-lead ECG containing at least one of the following simple parameters was considered a major abnormality: abnormal rhythm; >100 bpm; QRS ≥120 ms; QTc ≥450 ms; pathological Q-wave; left ventricle hypertrophy; left bundle branch block. A Cox proportional hazards regression model was used to identify predictors of the primary (all-cause death) and secondary (all-cause death or hospitalization for worsening HF) endpoints.

Results: Patients with abnormal ECG (1222/1460; 83.7%) were older, more frequently were male and had HF with reduced ejection fraction, valvular heart disease, comorbidities, higher New York Heart Association class, or higher concentrations of natriuretic peptides as compared to those with normal ECG. In a one-year follow-up, the primary and secondary endpoints occurred more frequently in patients with abnormal ECG compared to normal ECG (13.8% vs 8.4%; $P = 0.021$ and 33.0% vs 24.7%; $P = 0.016$; respectively). Abnormal rhythm, tachycardia, QRS ≥120 ms, and QTc ≥450 ms were significant in univariable (both endpoints) analyses but only tachycardia remained an independent predictor of the primary endpoint.

Conclusions: HF patients with major ECG abnormalities were characterized by worse clinical status and one-year outcomes. Only tachycardia was an independent predictor of all-cause death.

Key words: tachycardia, electrocardiogram, QRS duration, left bundle branch block, heart rhythm

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INTRODUCTION

According to the heart failure (HF) guidelines of the European Society of Cardiology (ESC), an electrocardiogram (ECG) is the basic examination that should be performed routinely in patients with suspected or known HF [1]. ECG abnormalities increase the likelihood of HF (89% sensitivity) but have low specificity [1]. The presence of ECG abnormalities, especially in patients with HF, may depend on many

WHAT'S NEW?

Data from the heart failure registries of the European Society of Cardiology showed that major electrocardiogram (ECG) abnormalities (simple ECG parameters: abnormal rhythm; >100 bpm; QRS ≥120 ms; QTc ≥450 ms; pathological Q-wave; left ventricular hypertrophy; left bundle branch block) were present in the majority of real-life heart failure patients. What is more, these major ECG abnormalities were more common in patients with reduced left ventricular ejection fraction. Assessment of these simple major ECG abnormalities showed association with a worse general condition and one-year outcomes. Among others, tachycardia was the strongest predictor of all-cause death. Results of the ECG examination should not be overlooked as may provide important information in risk stratification.

factors (e.g. ischemia, HF etiology, electrolyte disturbances, pharmacotherapy) and is often observed. ECG abnormalities may be helpful in determining the HF etiology and making therapeutic decisions (e.g. anticoagulation in atrial fibrillation, pacing in bradycardia, cardiac resynchronization therapy [CRT] when QRS complex is prolonged). Several studies have also demonstrated that QRS duration or left bundle branch block (LBBB) can predict the risk of death in patients with chronic and decompensated HF [2–5]. Prolonged QTc (especially if genetically conditioned) may be associated with an increased risk of malignant ventricular arrhythmias, and ,in selected clinical situations, may be an indication for implantation of a cardioverter-defibrillator (ICD) [6]. The importance of ECG in clinical practice is undeniable, but particularly in the chronic setting of the disease, the results of this study are often overlooked. There is also insufficient data on the prevalence and role in risk stratification of major ECG abnormalities depending on the type of HF — HF with reduced (HFrEF), mid-range (HFmrEF) or preserved (HFpEF) ejection fraction.

The aim of the study was to analyze the prevalence and association of easily measured major ECG abnormalities with clinical characteristics and outcomes in a large cohort of real-life HF patients enrolled in HF Registries (Pilot and Long-Term) of the ESC.

METHODS

Study design

The analysis is based on data from two HF Registries (the ESC-HF Pilot and the ESC-HF Long-Term) of the ESC. These registries were multicenter, prospective, observational surveys conducted in 136 (including 29 centers from Poland) and 211 European cardiology centers (including 35 centers from Poland), respectively. A detailed study design was previously published [7, 8]. In short, the registries enrolled participants in outpatient and inpatient setting with chronic, worsening, or new-onset HF meeting diagnostic criteria for HF aged ≥18 years. There were no other specific exclusion criteria. The study protocol was approved by local ethics committees. All participating patients were provided with detailed information and signed written consent. The electronic Case Report Form contained data on past medical history, clinical characteristics, test results, HF management, and one-year follow-up.

The current analysis concerns 2019 Polish patients. Full data on ECG recordings were available for 1611 patients, 1460 patients had available data on the primary endpoint and were included in the final analysis. The prevalence of the major ECG changes was analyzed on a standard resting 12-lead ECG. ECG containing at least one of the following parameters was considered a major abnormality: abnormal rhythm; tachycardia (>100 bpm); duration of QRS complex ≥120 ms; QTc interval ≥450 ms (Bazett correction); pathological Q-wave; left ventricle hypertrophy; LBBB. Patients were divided into two groups according to the presence of ECG abnormalities and compared with regard to baseline clinical characteristics, type of HF (HFrEF, HFmrEF, and HFpEF), and one-year outcomes. The type of HF was defined by the authors based on baseline LVEF measurement. The primary endpoint was all-cause death at one year. The secondary endpoint was a composite of all-cause death and hospitalization for HF worsening at one year (follow-up available for 1326 participants). The New York Heart Association (NYHA) functional class with regard to the presence of ECG changes at baseline and 12-month was also evaluated. Data regarding participants' status were collected via telephone follow-up from patients or their close relatives. If the contact was not possible, then the primary endpoint was ascertained from the data of the Polish National Health Fund.

Additionally, we sought to determine whether major ECG abnormalities were independent predictors of the primary and secondary endpoints in the study cohort.

Statistical analysis

The results were presented as median and quartiles for continuous variables and as frequencies and percentages for ordinal variables. Fisher's exact test was used for comparison of categorical variables and a Mann-Whitney U test for continuous and ordinal variables. Cox proportional hazards regression models were used to identify predictors of the primary and secondary endpoints. All variables found to be statistically significant in univariable analyses ($p < 0.05$) were included in multivariable analyses. Kaplan-Meier survival curves were plotted for both study endpoints. A *P*-value below 0.05 was considered significant for all tests. All tests were two-tailed. Statistical analyses were performed using SPSS software, version 22 (IBM SPSS Statistics 22, New York, NY, USA).

Table 1. Prevalence of major ECG abnormalities according to types of heart failure

Variable	% of the total cohort; number of patients	HFrEF (n = 806)	HFmrEF (n = 279)	HFpEF (n = 375)	*P*-value
Abnormal ECG	83.7%; 1222	88.7%; 715	83.9%; 234	72.8%; 273	0.14[a] 0.003[b] <0.001[c]
Not sinus rhythm on ECG	36%; 526	34.9%; 281	34.1%; 95	40%; 150	0.18[d]
Tachycardia	5.8%; 85	6%; 48	6.1%; 17	5.3%; 20	0.91[d]
Pathological Q-wave	28.5%; 416	33%; 266	33%; 92	15.5%; 58	1.00[a] <0.001[b] <0.001[c]
LVH	19.5%; 285	19.7%; 159	24.7%; 69	15.2%; 57	0.27[a] 0.009[b] 0.21[c]
LBBB	12.3%; 180	16.7%; 135	10.4%; 29	4.3%; 16	0.042[a] 0.01[b] <0.001[c]
QRS complex ≥120 ms	28.1%; 410	37.3%; 301	20.1%; 56	14.1%; 53	<0.001[a] 0.17[b] <0.001[c]
QTc interval ≥450 ms	44.4%; 648	50.5%; 407	35.1%; 98	38.1%; 143	<0.001[a] 1.00[b] <0.001[c]

[a]*P*-value for HFrEF vs HFmrEF after Bonferroni correction; [b]*P*-value for HFmrEF vs HFpEF after Bonferroni correction; [c]*P*-value for HFrEF vs HFpEF after Bonferroni correction; [d]*P*-value for overall test

Abbreviations: ECG, electrocardiogram; HFmrEF, heart failure with mid-range ejection fraction; HFpEF, heart failure with preserved ejection fraction; HFrEF, heart failure with reduced ejection fraction; LBBB, left bundle branch block; LVH, left ventricular hypertrophy

RESULTS

Prevalence of ECG abnormalities

There were 1222 out of 1460 (83.7%) HF patients with major ECG abnormalities. The most frequent ECG abnormalities in the entire cohort were: prolonged QTc interval (44.4%) and abnormal heart rhythm (36.0%). Differences in the presence of major ECG abnormalities were observed across the HF types, with the most prevalent changes observed in HFrEF patients (Table 1).

Clinical characteristics

Patients with abnormal ECG were older (median, 67.2 vs 66 years; $P = 0.03$) and more often were male (68.1% vs 58.8%; $P = 0.007$) when compared with those with normal ECG. They were also more likely to have lower left ventricular ejection fraction (median, 35% vs 45%; $P < 0.001$), moderate or severe valvular heart disease, ischemic heart disease, a history of atrial fibrillation, and chronic kidney disease than the patients with normal ECG. The group with abnormal ECG findings also had a higher NYHA class, higher concentrations of natriuretic peptides and more frequently required treatment with diuretics, antiarrhythmic (amiodarone and digitalis) and anticoagulation than the patients with normal ECG. Detailed baseline clinical characteristics of both study groups are presented in Table 2.

Predictors of one-year outcomes

In a one-year follow-up the patients with abnormal ECG were more likely to reach the primary and secondary endpoints than those with normal ECG (13.8% vs 8.4%; $P = 0.021$ and 33% vs 24.7%; $P = 0.016$; respectively) (Table 2). The Kaplan-Meier curves for the primary and secondary endpoints for both subgroups are shown in Figure 1A, B, respectively.

Across the types of HF, HFrEF patients with abnormal ECG had worse one-year outcomes when compared with the HFmrEF and HFpEF groups (Table 3, Figure 1C, D).

In the total cohort, the presence of any ECG abnormality was a predictor of both the primary and secondary endpoints but only in the univariable analyses (Supplementary material, *Table S1*). The univariable analyses of specific ECG abnormalities revealed abnormal rhythm, tachycardia, QRS complex duration ≥120 ms, and QTc interval ≥450 ms (but not LBBB, pathological Q-wave, and left ventricular hypertrophy) to be predictors of both the primary and secondary endpoints (Supplementary material, *Table S1*). In the multivariable analysis, only tachycardia on ECG remained an independent predictor of the primary endpoint (hazard ratio 1.75; 95% CI, 1.06–2.87; $P = 0.03$) but not of the secondary endpoint (hazard ratio 1.33; 95% CI, 0.93–1.90; $P = 0.09$) (Table 4).

DISCUSSION

The results of this analysis provided important epidemiological data on the prevalence, associated patients' clinical characteristics, and relevance of basic ECG abnormalities in real-life HF patients. The study showed that ECG abnormalities were present in the majority of HF patients but were observed more frequently in HFrEF patients. What is more, these easily measured ECG parameters reflected patients in worse general condition, with multiple comorbidities, and were associated with poor one-year outcomes.

A standard 12-lead ECG is an essential diagnostic tool in clinical cardiology and crucial for the management of

Table 2. Baseline characteristics and one-year outcomes of patients with abnormal or normal ECG

Variable	Abnormal ECG (n = 1222)	Normal ECG (n = 238)	*P*-value
Baseline characteristics			
Age, years	67.2 (58.2–77.0)	66.0 (54.8–76.6)	0.04
Male	68.1%; 832	58.8%; 140	0.01
BMI, kg/m^2	27.8 (25.0–31.2); [1169]	27.8 (24.5–31.8); [227]	0.81
LVEF, %	35 (25–46)	45 (30–55.8)	<0.001
HFrEF	58.5%; 715	38.2%; 91	<0.001
HFmrEF	19.1%; 234	18.9%; 45	0.80
HFpEF	22.3%; 273	42.8%; 102	<0.001
Previous HF hospitalization	75.4%; 921	68.1%; 162	0.03
Coronary artery disease	56%; 684	42.4%; 101	<0.001
Prior PCI or CABG	34.2%; 417	26.1%; 62	0.01
Moderate or severe mitral regurgitation	49.7%; 572/[1150]	30.7%; 67/[218]	<0.001
Moderate or severe aortic stenosis	10.2%; 90/[882]	4.0%; 6/[151]	0.01
Hypertension	63.9%; 780	63.0%; 150	0.75
History of atrial fibrillation	46.5%; 568	21.1%; 50	<0.001
Peripheral artery disease	11.9%; 145	8.8%; 21	0.24
Diabetes	33.6%; 411	27.7%; 66	0.20
Chronic kidney disease	19.1%; 233	13.4%; 32	0.07
COPD	18.3%; 223	15.5%; 37	0.44
Prior stroke or TIA	12.0%; 146	10.1%; 24	0.73
CHA2DS2-VASc score	4 (3–5)	4 (2–5)	0.11
Current malignant disease	3.7%; 45	3.4%; 8	0.85
Current or former smoking	57.9%; 700	56.8%; 133	0.71
Alcohol usage	56.8%; 674	58.7 %; 135	0.59
Pacemaker	7.1%; 87	3.8%; 9	0.07
ICD	17.4%; 213	12.2%; 29	0.13
CRT	5.9%; 72	0.4%; 1	<0.001
Clinical status			
Heart rate, bpm	80 (70–96)	76 (68–88.2)	0.01
SBP, mm Hg	130 (110–140)	130 (120–150)	0.003
DBP, mm Hg	80 (70–83)	80 (70–90)	0.03
NYHA class	3 (2–3); [1218]	2 (2–3); [237]	<0.001
Anemia	32.4%; 298/[921]	34.6%; 56/[162]	0.29
Pleural effusion/congestion (X-ray)	39.2%; 360/[918]	27.0%; 47/[174]	0.003
Hemoglobin, g/dl	13.4 (11.9–14.4); [1140]	13.2 (11.1–14.4); [220]	0.31
Serum creatinine, mg/dl	1.1 (0.9–1.4); [1158]	1.0 (0.8–1.3); [214]	0.001
Serum sodium, mmol/l	139 (136–141); [1157]	139 (136–141); [220]	0.92
Serum potassium, mmol/l	4.4 (4.1–4.8); [1158]	4.4 (4.1–4.7); [220]	0.46
BNP, pg/ml	576 (203–1386.8); [163]	364 (155–643.5); [24]	0.01
NT-proBNP, pg/ml	3048 (1352–7024); [315]	1580 (419.5–4959.5); [55]	0.01
Pharmacotherapy			
ACE-I	75.4%; 921/[1221]	75.6%; 180	0.93
ARB	10.2%; 124/[1219]	15.1%; 36	0.02
β-blocker	89.1%; 1088/[1221]	86.6%; 206	0.42
Diuretic	83.3%; 1016/[1220]	77.3%; 184	0.08
MRA	67.3%; 821/[1221]	58.6%; 139	0.01
Statins	65.9%; 805/[1221]	60.5%; 144	0.21
Oral Anticoagulant	45.4%; 554/[1221]	26.2%; 62	<0.001
Antiplatelets	60.0%; 732/[1221]	65.5%; 156	0.11
Digitalis	25.1%; 306[1221]	16.0%; 38	<0.001
Amiodarone	9.7%; 118/[1221]	5.9%; 14	0.16
Other Antiarrhythmic	6.1%; 75/[1221]	3.4%; 8	0.09
One-year outcomes			
NYHA class I or II	68.2% 690/[1011]	81.0% 171/[211]	<0.001
NYHA class III or IV	31.8% 321/[1011]	19% 40/[211]	
Death	13.8%; 169	8.4%; 20	0.02
Death or rehospitalization	33%; 367/[1111]	24.7%; 53/[215]	0.02

Continuous variables are presented as medians and interquartile ranges (IQR);
Available cases count in the respective variable are presented in square brackets.
Abbreviations: ACE-I, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; BMI, body mass index; BNP, brain natriuretic peptide; bpm, beats per minute; CABG, coronary artery bypass grafting; CHA2DS2VASc score, congestive heart failure, hypertension, age >75 years, diabetes mellitus, history of stroke or thromboembolism, vascular disease, age 65 to 74 years, female sex; COPD, chronic obstructive pulmonary disease; CRT, cardiac resynchronization therapy; DBP, diastolic blood pressure; HF, heart failure; ICD, implantable cardioverter-defibrillator; LVEF, left ventricular ejection fraction; MRA, mineralocorticoid receptor antagonist; NT-proBNP, N-terminal pro-brain natriuretic peptide; NYHA, New York Heart Association; PCI, percutaneous coronary intervention; SBP, systolic blood pressure; TIA, transient ischemic attack. Other — see Table 1

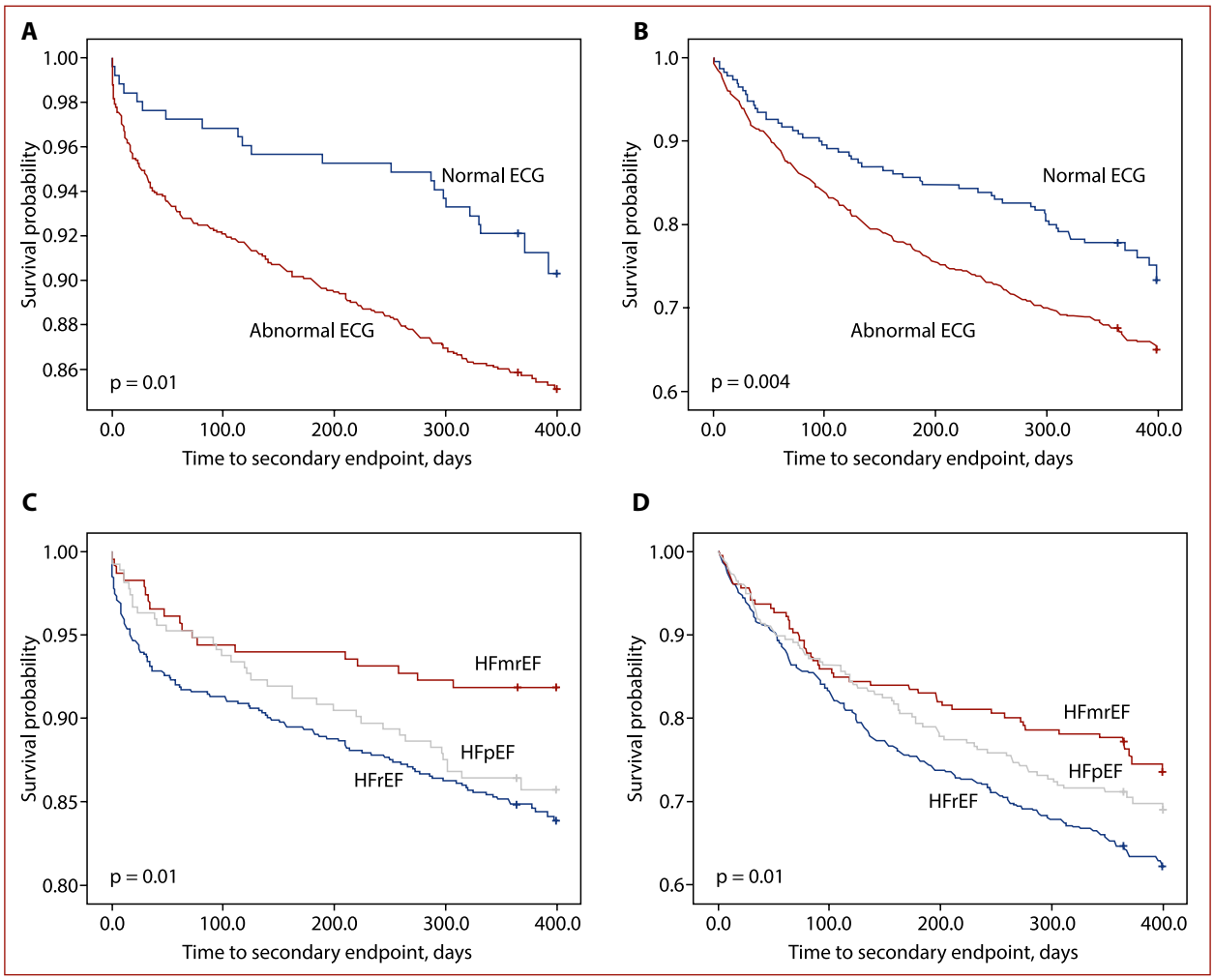

Figure 1. A. Kaplan-Meier curves for the primary endpoint of patients with abnormal or normal ECG. **B**. Kaplan-Meier curves for the secondary endpoint of patients with abnormal or normal ECG. **C**. Kaplan-Meier curves for the primary endpoint of patients with abnormal ECG regarding to the type of heart failure. **D**. Kaplan-Meier curves for the secondary endpoint of patients with abnormal ECG regarding to the type of heart failure

Abbreviations: see Table 1 and 2

Table 3. One-year outcomes of patients with abnormal or normal electrocardiogram regarding to the type pf heart failure

Type of HF	Abnormal ECG	Normal ECG	*P*-value
NYHA class			
HFrEF	3 (2–4); n = 719	2 (2–3); n = 91	<0.001
HFmrEF	3 (2–3); n = 234	3 (2–3); n = 45	<0.001
HFpEF	3 (2–3); n = 273	3 (2–3); n = 102	0.20
Death			
HFrEF	15.6%; 112/715	6.5%; 6/91	0.01
HFmrEF	8.1%; 19/234	6.6%; 3/45	1.00
HFpEF	13.9%; 38/273	10.7%; 11/102	0.49
Death or rehospitalization			
HFrEF	36.9%; 239/648	29.6%; 24/81	0.22
HFmrEF	24.8%; 51/206	26.8%; 11/41	0.84
HFpEF	30%; 77/257	19.4%; 18/93	0.06

Abbreviations: see Table 1 and 2

patients with most cardiovascular conditions, including patients with HF. The advantages of ECG are simplicity of implementation, non-invasive nature, low cost, and wide availability. ECG is routinely performed in most HF patients, but frequently not enough attention is paid to its results. A normal ECG is infrequently observed in patients with suspected HF but it has a low specificity [9]. Analysis of EuroHeart Failure survey data showed that ECG

Table 4. Multivariable analysis of predictors of the primary and secondary endpoints in heart failure patients at one-year

Variable	Primary endpoint (n = 189)			Secondary endpoint (n = 420)		
	HR	95% CI	*P*-value	HR	95% CI	*P*-value
Age	1.03	1.02–1.05	<0.001	1.01	0.99–1.02	0.20
Male	–	–	–	0.77	0.62–0.96	0.03
BMI	0.98	0.95-1.01	0.21	–	–	–
NYHA (class III or IV vs I or II)	1.91	1.50–2.43	<0.001	2.02	1.52–2.68	<0.001
CKD	1.66	1.19–2.34	0.003	1.40	1.11–1.76	0.005
COPD	1.25	0.88–1.78	0.22	1.20	0.95–1.52	0.11
Diabetes	1.37	0.98–1.93	0.07	1.26	1.03–1.55	0.04
AF history	0.88	0.59–1.31	0.53	–	–	–
HGB	0.97	0.89–1.05	0.46	0.96	0.91–1.01	0.09
Serum sodium	0.92	0.90–0.94	<0.001	0.96	0.94–0.98	<0.001
SBP	1.00	0.99–1.01	0.92	0.996	0.99–1.0001	0.05
B-blocker	0.47	0.31–0.70	0.001	0.70	0.52–0.93	0.01
ARB	0.52	0.26–1.02	0.06	–	–	–
ACE-I	0.72	0.49–1.06	0.1	0.76	0.61–0.95	0.02
Abnormal rhythm	1.08	0.72–1.63	0.70	0.98	0.80–1.22	0.88
Tachycardia (>100 bpm)	1.84	1.12–3.03	0.02	1.41	0.98–2.01	0.06
QRS ≥120 ms	1.34	0.94–1.91	0.11	1.21	0.97–1.51	0.10
QTc interval ≥450 ms	1.13	0.81–1.59	0.46	1.14	0.92–1.41	0.22
Digitalis	–	–	–	1.03	0.82–1.30	0.80
Amiodarone	1.66	1.06–2.62	0.03	1.19	0.87–1.62	0.29
Statins	0.76	0.54–1.08	0.12	–	–	–
HF type						
HFmrEF (reference)	1.00	1.00–1.00	1.00	1.00	1.00–1.00	1.00
HFrEF	2.04	1.21–3.44	0.01	1.27	0.95–1.71	0.10
HFpEF	1.42	0.82–2.46	0.22	0.86	0.61–1.20	0.36

Abbreviations: ACE-I, angiotensin converting enzyme inhibitor; AF, atrial fibrillation; ARB, angiotensin receptor blocker; BMI, body mass index; bpm, beats per minute; CI, confidence interval; CKD, chronic kidney disease; HGB, hemoglobin; HR, hazard ratio; SBP, systolic blood pressure. Other — see Table 1 and 2

abnormalities (including ventricular rate, PR, QRS and QTc intervals, left ventriclar hypertrophy, pathological Q-wave, ST-T-wave abnormalities, and interventricular conduction abnormalities) were observed in more than 98% of HF patients [9]. In our study, we focused on the predefined major ECG parameters, which can be assumed as being in line with the previous observations.

All of the ECG abnormalities (except abnormal heart rhythm and tachycardia) were more prevalent in HFrEF patients when compared with patients with HFmrEF and HFpEF. Although it is known that heart rhythm abnormalities (especially atrial fibrillation) are frequently present in patients with HFpEF [1, 10], the presence of ECG abnormalities was more commonly associated with a history of advanced heart valve disease, atrial fibrillation, chronic kidney disease, signs of HF decompensation (higher natriuretic peptides, pleural effusion, higher NYHA class) and use of diuretics and anticoagulants.

A standard resting 12-lead ECG may reveal signs of inherited disorders but also suggests underlying structural heart disease, electrolyte disturbances and may reflect patients at higher risk of poor prognosis. In our study, the presence of at least one of the major ECG abnormalities and associated worse general condition at baseline translated into a worse prognosis in a one-year observation (higher rate of all-cause death, death, or HF hospitalization and higher NYHA class than in the patients without such ECG abnormalities). Among all tested major ECG abnormalities only tachycardia (defined as >100 bpm) was an independent predictor of the primary endpoint but not the secondary endpoint. Important to note is that patients in the abnormal ECG group had significantly higher resting heart rates, despite the more frequent use of antiarrhythmic drugs (amiodarone, digitalis) and a high rate of β-blocker (89.2%) administration. A higher resting heart rate in HF patients was proven to be associated with higher long-term mortality [11, 12], particularly when above 110 bpm and with concomitant atrial fibrillation [13, 14].

It can be concluded that none of the other typical ECG parameters except tachycardia independently influenced the prognosis of patients with HF, regardless of the type of HF. However, it should also be emphasized that the presence of ECG abnormalities was a marker of patients in a worse clinical condition and with a worse one-year prognosis.

In our study, QTc prolongation was the most frequent abnormality (44.4% and 50.5% of the whole cohort and HFrEF patients, respectively) but it was not an independent predictor of worse outcomes. Similarly, it was previously presented that QTc interval was frequently prolonged in HF patients (70% of patients had QTc ≥440 ms) but it was not associated with increased long-term mortality [15].

There is evidence that both patients with reduced or mildly reduced left ventricular ejection fraction (35%–50%) and with LBBB are at higher risk of death and HF hospital-

izations [16–18], and in selected cases, CRT might be particularly beneficial [1]. Similarly, QRS complex prolongation due to right ventricular pacing was shown to be associated with an increase in HF hospitalization [19]. In our study, LBBB was observed in 12.3% of the total cohort but it was not a predictor of a worse prognosis. It is worth noting that CRT was implanted in 5.8% of patients with the ECG abnormalities and nobody in the normal ECG group. It should also be highlighted that there are no standardized LBBB criteria, hence the clinical trials and registries used various and divergent definitions of LBBB. As a consequence, this translates into different observed rates of LBBB occurrence and associated prognosis [20].

Despite years of investigations, knowledge on the risk stratification for sudden cardiac death (SCD) in patients with HF is incomplete. The primary prevention of SCD is based only on left ventricular ejection fraction, which translates into difficulty in choosing patients who will benefit from ICD implantation, particularly among patients with nonischemic HF. Several ECG parameters alone or in combination were shown to have prognostic relevance (e.g. LBBB, prolonged QRS complex, prolonged QTc interval) [6, 21]. However, despite certain clinical scenarios (CRT implantation, ICD implantation in secondary SCD prevention) they are used infrequently in risk stratification, particularly in patients with chronic HF, or at high risk of HF decompensation. Therefore, further research on better risk stratification in HF, including the risk of HF decompensation and mortality in different HF subgroups, is particularly warranted and is currently ongoing [22–24]. This might be an important strategy in guiding the HF therapy to reduce risk via further intensification of pharmacological treatment or closer monitoring [25].

Limitations

The inclusion of real-life patients followed by cardiologists is an important advantage of ESCHF Pilot and ESCHFLT registries, but drawbacks include the partial incompleteness of the data and the observational design. What is more, only the predefined ECG data in the Case Report Forms designed by the coordinators of the registries were available for analysis. The registries were not primarily focused on the ECG analysis, hence measurement errors are possible. There were no predefined definitions of the ECG parameters, including LBBB, pathological Q-wave, and left ventricular hypertrophy.

CONCLUSIONS

Results from a large real-world HF database of patients followed by cardiologists showed that ECG abnormalities were present in the majority of HF patients but more frequently in HFrEF patients. The patients with ECG abnormalities were characterized by a worse general condition and poor one-year outcomes when compared with thos without any abnormal ECG findings. Among other ECG abnormalities, only tachycardia was an independent predictor of all-cause mortality.

Supplementary material

Supplementary material is available at https://journals.viamedica.pl/kardiologia_polska.

Article information

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