

Prevalence of heart rhythm disorders in patients with end-stage heart failure referred to qualification for heart transplantation

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INTRODUCTION

Heart failure (HF) affects 1%–2% of the adult population [1]. Notwithstanding substantial improvements in therapy, heart transplantation (HT) remains an accepted treatment option in end-stage HF [2, 3]. Heart rhythm disorders (HRD) are more common in patients with HF and worsen their prognosis [4, 5]. Assessment of HRD epidemiology in patients subjected to qualification for HT could allow for an improvement in targeted therapy. Thus, the aim of this study was a qualitative and quantitative analysis of HRD in patients with HF considered for HT.

METHODS

Retrospective clinical data of consecutive 169 patients with severe HF, who underwent the qualification procedure for HT, were analyzed. All patients were hospitalized from 2018 to 2019 in the 3rd Department of Cardiology, the Medical University of Silesia, the Silesian Center for Heart Diseases in Zabrze, Poland. Patients with end-stage, symptomatic HF despite optimal medical therapy were included in the study. Both scheduled and urgent patients were included in the analysis. The only exclusion criteria were the lack of maximal HF therapy in accordance with the current guidelines by the European Society of Cardiology. HT qualification was performed following the local protocol. Information about HRD was obtained during hospitalization from resting electrocardiography, Holter monitoring, and cardiac implantable devices (CIEDs) checks. Additional data were also obtained from previous medical history if avail-

able. The study was approved by the ethical committee of the Medical University of Silesia.

Statistical analysis

The qualitative variables were expressed as absolute number and percentage and were analyzed with the χ^2 test (where numbers were anticipated to be less than 5, Yates correction for continuity was implemented). The normal distribution of continuous variables was confirmed using the Kolmogorov-Smirnov test. Continuous variables were expressed as mean and standard deviation (SD). The significance of differences between mean values was tested with Student's t-test. A *P*-value of less than 0.05 was regarded as significant. Statistical analysis was performed using Statistica software version 13 (TIBCO Software Inc., Palo Alto, CA, US).

RESULTS

The mean standard deviation (SD) age of examined patients was 55 (10) years, and most of them were men (88.8%). Almost half of the patients (45.6%) were in class III of the New York Heart Association (NYHA). The ischemic etiology of HF was more frequent (52.1%). The mean (SD) left ventricular ejection fraction (LVEF) was 21 (8)%. Arterial hypertension and dyslipidemia were the most common comorbidities. Several patients (43.2%) had a history of myocardial infarction. More than half of the group had mitral regurgitation (52.1%). Most patients (94.1%) had CIED; many were implantable cardioverter-defibrillators (ICDs, 50.3%). In the analyzed group, ventricular arrhythmias were present in 40.8% of patients,

and most of them were ventricular tachycardia (VT) and fibrillation (VF). More than half of the group (52.1%) had a history of atrial flutter or fibrillation (AF). Ablation of any kind was performed in 17.2% of patients. All data are summarized in Table 1. Additional data from subgroups analysis are presented in the Supplementary material (Tables S1–S3).

DISCUSSION

Our registry shows the significant burden of patients with HRD. The most common arrhythmia was atrial fibrillation, which affects almost half of the analyzed group. Previous studies showed that such high prevalence was present in patients in class IV according to the NYHA [6]. In our study, patients in that class constituted only 11.8%. AF worsens the long-term prognosis of patients with HF and is associated with a higher number of hospitalizations and their longer duration [7]. The way in which AF affects HF is complex. The loss of synchronized atrial contraction and/or a persistently higher heart rate may provide negative ventricular remodeling [8]. The presence of AF leads to impairment in myocardial perfusion and perfusion reserve in a mechanism of microvascular coronary dysfunction [9]. Irregular pulse may not only worsen coronary flow, but it also affects other arteries and results in endothelial dysfunction [10]. There is evidence that rapid atrial rates are associated with increased inflammation, thrombin generation, and platelet activation [11]. Those processes may be partially reversed by sinus rhythm restoration [8]. Catheter ablation of AF in patients with HF reduces both mortality and HF-related hospitalization rates [4]. In the analyzed population, only 4.1% of patients with AF underwent such therapy. It seems that those patients should be more often considered for ablation.

Ventricular arrhythmias represent a wide range of HRD. Their incidence rises with the severity of HF. Along with HF progression, they are the most common cause of sudden cardiac death (SCD) in this population [1]. In the analyzed group, 39.6% of patients had at least one episode of VT or VF. Some patients (4.1%) met the criteria for an electric storm (ES) and underwent catheter ablation. ES is associated with high mortality [12]. The most common CIED in the presented group was ICD, which was implanted in more than half of the patients (50.3%). Modern HF pharmacotherapy is considered to have been a cause of substantial reduction in SCD rates in recent years. Despite that, ICD implantation in selected patients is still an essential part of HF therapy. In the analyzed population, ICD or cardiac resynchronization devices (CRT-D) were implanted in 93.5% of the patients. CRT-D in appropriate patients reduces morbidity and mortality, and improves cardiac function [13]. In the studied population, it is worth noting the high percentage of patients with CRT-D (43.2%). It is more than twice as high as within the general HF population from the same center [14]. HRD, especially AF, may lead to loss of adequate biventricular pacing and, in consequence, exacerbation of HF. An intensive clinical follow-up is crucial to

Table 1. Clinical, electrophysiology characteristics and heart rhythm disorders and ablation procedures of patients with end-stage heart failure who underwent qualification procedure for heart transplantation in 2018–2019

Variable	N = 169
Clinical characteristics	
Mean age, years, mean (SD)	55 (10)
Male gender, n (%)	150 (88.8)
NYHA class, n (%)	
I	7 (4.1)
II	65 (38.5)
III	77 (45.6)
IV	20 (11.8)
HF etiology, n (%)	
Ischemic	88 (52.1)
Nonischemic	81 (47.9)
Mean LVEF, %, mean (SD)	21 (8)
Chronic kidney disease, n (%)	61 (36.1)
Diabetes, n (%)	53 (31.4)
Dyslipidemia, n (%)	113 (66.9)
Arterial hypertension, n (%)	88 (52.1)
Peripheral artery disease, n (%)	25 (14.8)
Chronic obstructive pulmonary disease, n (%)	10 (5.9)
Active smoking, n (%)	122 (72.2)
Stroke, n (%)	17 (10.1)
Transient ischemic attack, n (%)	6 (3.6)
Coronary artery disease, n (%)	99 (58.6)
Myocardial infarction, n (%)	73 (43.2)
ST-elevation myocardial infarction	58 (34.3)
Non-ST elevation myocardial infarction	26 (15.4)
Percutaneous coronary intervention, n (%)	78 (39.8)
Coronary artery by-pass graft, n (%)	26 (15.4)
Valvular heart disease (moderate or severe), n (%)	103 (60.9)
Mitral regurgitation	88 (52.1)
Mitral stenosis	2 (1.2)
Tricuspid regurgitation	62 (36.7)
Aortic stenosis	13 (7.7)
Aortic regurgitation	11 (6.5)
Mean VO ₂ max, l/min, mean (SD)	15.8 (5.1)
Electrophysiology characteristics	
Cardiac implantable electric device, n (%)	159 (94.1)
PM	1 (0.6)
ICD	85 (50.3)
CRT-D	73 (43.2)
AVB, n (%)	13 (7.7)
I°	1 (0.6)
II°	4 (2.4)
III°	8 (4.1)
SND, n (%)	1 (0.6)
Heart rhythm disorders and ablation procedures	
Ventricular arrhythmias, n (%)	69 (40.8)
VT/VF	67 (39.6)
ES	7 (4.1)
Other	5 (3)
Atrial fibrillation, n (%)	84 (49.7)
Paroxysmal	43 (25.4)
Sustained	41 (24.3)
Atrial flutter, n (%)	19 (11.2)
Other SVT, n (%)	7 (4.1)
Ablation, n (%)	29 (17.2)
PVI	7 (4.1)
AVN	8 (4.7)
CTI	5 (3)
VT	7 (4.1)
Other	2 (1.2)

Abbreviations: AVB, atrioventricular block; AVN, atrioventricular node; CRT-D, cardiac resynchronization therapy defibrillator; CTI, cavotricuspid isthmus; ES, electric storm; ICD, implantable cardioverter-defibrillator; LVEF, left ventricular ejection fraction; NYHA, New York Heart Association; PM, pacemaker; PVI, pulmonary vein isolation; SND, sinus node dysfunction; SVT, supraventricular tachycardia; VF, ventricular fibrillation; VT, ventricular tachycardia

avoid HF decompensations in this population [1]. Remote monitoring care of patients with HF and CIEDs improves their prognosis [15].

Sinus node disease and atrioventricular block may result in life-threatening bradycardia or asystole. In the presented population, those conditions were reported in 7.7% of patients. This number could be underestimated due to the high rate of other CIED implantations. Presumably, some patients could have indications for a prior upgrade to CRT-D due to a significant proportion of right ventricular pacing.

The main limitation of this study is its retrospective character. Further analysis of the long-term prognosis of patients with HRD who underwent HT would be essential.

Supplementary material

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

Article information

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Conflict of interest: MT received fees from Abbott, Biotronik, Boston Scientific. Other authors declare no conflict of interest.

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