ARTYKUŁ POGLĄDOWY / REVIEW PAPER
Otrzymano/Submitted: 20.11.2018 • Zaakceptowano/Accepted: 10.12.2018

Exacerbations of chronic heart failure requiring hospitalization, with the main focus on the elderly population – risk factors and prevention methods according to the review of the current literature

Zaostrzenia przewlekłej niewydolności serca wymagające hospitalizacji ze szczególnym uwzględnieniem populacji osób w podeszłym wieku – czynniki ryzyka i metody ich prewencji na podstawie przeglądu aktualnej literatury

Małgorzata Dobrowolska[1], Grzegorz Raczak[2], Paweł Miękus[1], Ludmiła Daniłowicz-Szymanowicz[2]

[1] Department of Cardiology, Saint Vincent de Paul Hospital, Gdynia, Poland
[2] II Department of Cardiology and Electrotherapy Medical University of Gdansk, Poland

Abstract

Exacerbation of chronic heart failure (HF) requiring rehospitalization is a major problem, especially in the elderly population. Additional risk factors, other than age and previous hospitalization, are: coronary heart disease, atrial fibrillation, decreased left ventricular ejection fraction, higher NYHA class, elevated natriuretic peptides and troponin levels, as well as coexisting diseases (mostly pulmonary diseases, diabetes mellitus, kidney failure), infections, anemia and hyponatremia. Accurate risk assessment of HF exacerbation, as well as fairly applied pharmacotherapy and organization of an adequate care of the patient after hospitalization, including programs of controlled physical training, may help reduce the risk of future exacerbations of HF, as well as the mortality of patients due to HF. *Geriatria 2018; 12: 204-212.*

Keywords: heart failure, hospitalization, risk factors, prevention, elderly patients

Streszczenie

Zaostrzenia HF wymagające ponownej hospitalizacje stanowią ogromny problem, zwłaszcza w grupie osób w wieku podeszłym. Dodatkowymi czynnikami ryzyka, poza wiekiem oraz poprzednią hospitalizacją, są: choroba niedokrwienna serca, migotanie przedsionków, upośledzona czynność skurczowa lewej komory serca i zaawansowana klasa wg NYHA oraz podwyższony poziom peptydów natriuretycznych i troponiny, jak również choroby współistniejące (przede wszystkich choroby płuc, cukrzyca, niewydolność nerek), a także infekcje, anemia i hiponatremia. Odpowiednia ocena ryzyka zaostrzenia HF u poszczególnych pacjentów, wraz z rzetelnym stosowaniem zaleconej farmakoterapii oraz organizacja odpowiedniej opieki chorego po wypisie ze szpitala, z uwzględnieniem programów kontrolowanych treningów fizycznych, może pomóc w zmniejszeniu ryzyka kolejnych zaostrzeń HF, jak również śmiertelności chorych z HF. *Geriatria 2018; 12: 204-212.*

Słowa kluczowe: niewydolność serca, hospitalizacja, czynniki ryzyka, prewencja pacjenci w podeszłym wieku

Introduction

Heart failure (HF) is a crucial clinical problem, being the main reason for hospitalization and mortality in Poland, especially in elderly patients (over 65 years old). Despite the improvement of treatment with application of evidence-based medicine and with improved access to electrotherapy and devices assisting heart function [1,2], the mortality rate due to HF is still rising [3]. It was found that 2 out of 3 patients, discharged from a hospital with HF, will be hospitalized again within 1 year, every third patient will be readmitted within the first 30 days of the discharge, and many of them even within the first week [4]. Moreover, many patients will need multiple admissions due to exacer-

bation of HF within a year after the first hospitalization [4].The rehospitalization of patients due to recurring exacerbations of HF is not only a major health issue for the patients, but also a financial burden for the healthcare system. Hence, an identification of the risk factors and an attempt to modify them are the crucial aspects of medicine. In many countries prevention of rehospitalization due to exacerbations of HF is considered a priority. Both incentives for having small numbers and financial punishments for high numbers of readmissions due to HF are being used throughout different healthcare systems [4].

The aim of the study is a systematic review of the current literature in order to identify the major risk factors for HF exacerbations leading to hospitalization and an assessment of preventive methods, focusing on the elderly population.

Discussion

Literature review identified studies published between 2012 and 2018, involving patients treated due to HF exacerbations in various countries. The review of the eligible studies was done, basing on the American and European guidelines, and mostly focusing on the possibility of accurate risk assessment of HF exacerbation, through the use of prognostic scales and implementing relevant clinical recommendations.

Epidemiology of HF and prognosis

Around twenty six million people worldwide suffer from HF, which makes it almost an epidemic. In the study, based on The Federal Health Monitoring System of Germany in the years 2000-2013,an increase in hospitalizations due to HF of 65,4% was observed and the number of days of hospitalization increased by 22,1% [5]. HF is a major cause of in-hospital mortality, accounting for its 9.3% [5]. The prognosis of patients after hospitalization due to HF is serious, because 6-month mortality reaches 20%, and annual – 30%, constantly progressing and becoming the most common cause of death. Although the highest risk occurs in the first months after discharge from the hospital, a previous hospitalization continues to give a 2-fold greater risk of death 2 years after admission as compared to the absence of hospitalization in a history of HF patients [6].

In the Polish POLKARD program evaluating patients with heart failure, the readmission rate within 6 months of hospitalization due to HF was as much as 50%. Special attention should be paid to the fact that HF is the most important cause of seniors' mortality. For example, the data of K. Ozierański et al. [7] show that in-hospital mortality due to exacerbation of HF was 1.9% in the group of patients aged 65-75, increasing to 4.2% in the group > 75 years of age; and annual mortality, respectively, 14.5% and 21.6%.

The most important risk factors for HF exacerbations requiring hospitalization and deaths

One of the largest analyses available in the literature, covering over 9 million patients with an average age of 74, lists the following predictors of HF exacerbation: hospitalization for HF as the most potent risk factor, as well as age, sex, body mass index, left ventricle ejection fraction (LVEF), New York Heart Association (NYHA) class of HF, natriuretic peptide level, co-morbidities such as hypertension, impaired renal function, diabetes, abnormal blood sodium and blood urea nitrogen [3]. In another study [8] assessing a typical population of geriatric patients (age 79 ± 12 years), hospitalized in the internal and cardiological department due to exacerbation of HF, it turned out that more than half of the patients (52%) did not follow the diet recommended before the hospitalization, and every third patient (30%) did not comply with the pharmacotherapy recommendations. Other factors accelerating exacerbation of HF were infections (29%), arrhythmias (25%), acute coronary syndromes (22%) and uncontrolled hypertension (15%), and 18% of patients were hospitalized with other causes (progression of kidney disease, anaemia iatrogenic factors 10%) [8].

The history of hospitalization due to exacerbation of HF is one of the strongest predictors of the next hospitalization [3]. For example, Ruigómez et al. [9] in a study of over 3500 patients report that during follow-up of 4.5 years, up to 32% of patients initially hospitalized for HF had repeated hospitalizations, 58.5% of whom died. Compared to patients with no history of prior hospital stays, in patients hospitalized at the initial stage of HF diagnosis, a double risk of re-readmission was observed (HR 2.14 [95% CI 1.88-2.44]).

Age is another known, strong risk factor for exacerbation and mortality due to HF. In the oldest persons (over 80 years old) with HF, a five-year survival is only 19% [10]. Interesting results are presented by Nutter et al. [3]. The authors analyzed in-hospital mortality in a

retrospective cohort study with an average age of 82.7 ± 8.2 and assessed that at the time of exacerbation of HF the mortality was as high as 28.8% [3]. In another analysis, the authors provide a strong correlation between the age of the patients and accompanying comorbidities, which significantly worsens the short-term mortality [6].

In the period between 2000 and 2013, 2/3 of patients diagnosed with HF were ≥ 75 years of age. Analyzing individual age groups, the largest number of hospitalizations caused by HF was observed in the group from 75 to 85 years old [5]. Data of the Institute for Management in Health Care indicate that in Poland seniors over 80 years account for 43.7% of patients hospitalized due to HF [11]. Age also affects the extension of the period of hospitalization. In the work of Opolski and colleagues in the group of 765 hospitalized Polish participants of the ESC HF Long Term registry from May 2011 to April 2013, the average length of hospitalization in Poland was 7 days [7].

Data from the literature prove that the worse prognosis concerns **the male gender**. For example, Scrutinio et al. reported that it was accompanied by a 45% higher death rate in follow-up of 180 days than compared to women [6]. Other authors [5] have similar results for the male sex.

Cardiological comorbidities

Ischemic coronary artery disease (CAD) significantly increases mortality in HF exacerbations. In the work of Scrutinio et al. [6] the most significant CAD effect was demonstrated in the first 6 months after admission to the hospital and was associated with an increased risk of death by 46%. It is known that acute coronary ischemia is a frequent reason for exacerbating HF and is associated with an increased risk of hospitalization and 90-day mortality. Post-mortem examinations showed that acute coronary syndromes, including unrecognized clinically acute myocardial infarction, are common in patients who died of HF and account for as much as 28% in Uretsky et al. [12].

Moreover, as reported by Beohar et al. [13], the exhaustion of coronary autoregulation mechanisms may contribute to the reduction of coronary perfusion in acute HF and CAD, which particularly exposes the myocardium to lowering the perfusion pressure and/or increasing the oxygen demand. In a study involving 8772 patients with HF exacerbation, ST depression in ECG was associated primarily with increased 30-day mortality in patients with ischemic HF [14]. Data from the OPTIMIZE-HF registry, based on over 48 thousand people, show, however, that in patients with higher revascularization rates and a higher percentage of the use of evidence-based pharmacotherapy, a significant reduction in mortality risk was observed within 90 days in patients with ischemic HF [15].

Another important prognostic factor is the elevated level of **troponin** in patients hospitalized due to exacerbation of HF. Such condition reflects their myocardial injury or death of myocardium cells and it is associated with higher mortality [16]. Although there are many potential mechanisms to release troponin in exacerbating HF, coronary ischemia is suggested as the main cause [13].

Atrial fibrillation (AF), the most common arrhythmia in the adult population, affects about 40% of patients with HF (according to the data from the register of patients with HF ESC-HF Pilot comprising over 5000 patients) and is a known factor worsening the prognosis of patients with HF. For example, in Chang et al. [17], the presence of AF was considered an indicator of adverse cardiovascular events in patients with ICD (implantable cardioverter-defibrillators) implanted because of both the primary and secondary prevention. In addition, Joy PS et al. demonstrate the beneficial role of AF ablation in reduction of rehospitalization due to HF [18]. Namely, patients undergoing ablation who were discharged after exacerbation of HF and subjected to AF ablation had a lower recurrence rate and shorter duration of stay in the 90-day observation period (27.5 and 41.4%, respectively [$p < 0.0001$] and 5 58 and 6.60 days [$p = 0.031$]).

The staging of HF has an undeniable effect on the prognosis of patients. The most important parameters in this regard are the level of left ventricular ejection fraction (LVEF) and exercise capacity assessed according to the NYHA scale. It is known that the worse NYHA class is an independent risk factor for deaths [19]. In particular, NYHA III-IV is associated with higher in-hospital mortality and distant 10 years, as well as worse prognosis related to patients with lower LVEF [20]. Thus, mortality in the group of patients with HF with reduced ejection fraction (LVEF < 40%) and HF with preserved ejection fraction (≥ 50%) was 8.8% and 6.3%, respectively, where a patients with moderately reduced ejection fraction (LVEF 40-49%) intermediate values were shown (7.6%) [20].

Other co-morbidities

In patients with HF, additional non-cardiac diseases significantly worsen the prognosis, contribute to the increase in hospitalization and mortality [1]. This applies to a large extent to the elderly patients. Among the various additional diseases of the lungs, **COPD** is the most aggravating risk factor, as evidenced by the results of, inter alia, the Polish work of 2017 conducted by Cichocka-Radwan and Lelonek [11].

In addition, **infections of the upper and lower respiratory tract** significantly increase the risk of HF exacerbations [21]. Moreover, it has been observed that the prevention of pneumonia in patients with heart and lung disease can change the long-term prognosis [21].

There are studies showing a reduction in cardiovascular mortality after influenza vaccination in high--risk patients, and a link between influenza vaccination and reduced hospitalization [22]. It should be noted, however, that the pathogen that causes pneumonia can be identified only in 38% of cases, and only in 11% of cases it was caused by pathogens for which vaccination programs are present (in 6% of cases influenza and 5% Streptococcus pneumoniae) [21] . Therefore, the challenge will be to better identify pathogens in the future for more effective prophylaxis.

Looking beyond the issue of pneumonia, it should be noted that infection of every type, as the cause of HF exacerbation, turned out to be a predictor of short-term and long-term mortality (30 days and 1 year respectively) [23]. Patients with HF hospitalized for infectious reasons had higher mortality rates [23]. For example, Alon et al. postulated that the infection is also the cause of HF decompensation as well as the direct cause of mortality [24]. They suggested that hospitalization for pneumonia is an independent risk factor for cardiovascular events, and increases the risk of post-inflammatory changes [24].

Another important diagnosis affecting patients with HF is **diabetes**. Today, at least one-third of all patients admitted to hospital with HF suffer from diabetes [4]. Interesting is the fact that LVEF is preserved in about half of patients with HF, and vice versa from 30 to 40% of patients with HF with preserved LVEF have diabetes [25]. Diabetes and HF diabetics, in contrast to non-diabetic patients, are characterized by a higher rate of hospitalization, a higher hospitalization index, more frequent earlier visits to hospital emergency departments and rehospitalizations due to exacerbation of HF [25]. The same authors emphasize that patients with diabetes are more likely to return to the hospital shortly after discharge. In the PARADIGM-HF study the risk of rehospitalization due to exacerbation of HF increased almost twice as compared to non-diabetic patients [26]. Pre-diabetes has also been associated with an increased risk of hospitalization for heart failure [25,26]. In a well-known British prospective study in patients with diabetes (UKPDS), there was a 16% increase in the incidence of heart failure for each HbA1c increase by 1% ($p = 0.021$) [25]. Merlin C Thomas, et al. Further argue that the additional presence of diabetes related comorbidities, such as chronic kidney disease, more severe atherosclerotic vascular disease, also increases the risk of premature mortality in patients with heart failure [25]. In addition, factors that increase the risk of re-hospitalization include insufficient use of β-blockers, blockers of the renin-angiotensin-aldosterone system and mineralocorticoid receptor antagonists due to the increased risk of adverse drug reactions and limitations associated with greater coexistence of, among others, chronic kidney disease [25].

Chronic kidney disease (CKD) has a direct effect on cardiac function and its decompensation [23], and the mechanisms of these processes are multidirectional [23]. In the study of Berkovitch et al. CKD is a well-known risk factor of adverse prognosis in HF patients, increasing mortality, hospitalization and rehospitalization. In the analysis of MADIT II cohort, renal failure (HR 1.63) has been considered one of the strongest predictors of poor prognosis [19]. Scrutinio et al. [3] report that in their HF patients over 80 years of age, a reduction in GFR for every 5-unit below 60 ml/min/1.73 m^2, increased the risk of death by 12% [6].

Anemia is another known risk factor for HF [6]. It can be considered as a risk factor on its own as well as a marker of the presence of some comorbidities (including CKD, gastrointestinal bleeding, haematological abnormalities) that adversely affect the patient's prognosis. According to the current recommendations of both American and European Guidelines [1,2], iron deficiency is an important diagnostic and prognostic parameter, especially in patients with advanced HF (NYHA II and III).

It should be noted that patients with HF have an **increased risk of stroke** [17] and the occurrence of stroke in patients with HF contributes to the increase in morbidity and mortality in this group of patients [18]. Clinical dementia is an extremely important problem for elderly people, especially those with HF.

Deterioration of cognitive, executive functions, concentration, episodic memory, language, psychomotor speed and visual ability are typical for patients with HF [27] and as emphasized by Scherbakov et al. HF decompensation is often accompanied by delirium syndromes [27]. Moreover, HF significantly accelerates the occurrence of **cognitive impairment**, which is observed in 25 - up to 74% of patients with HF and is associated with premature death, loss of functional independence, worse compliance with medical recommendations and reduced quality of life [27,28]. Occurrence of delirium syndromes, which is significantly more frequent in older patients, is associated with higher mortality, lower self-care quality and prolonged hospitalization of patients with HF [1].

Laboratory prognostic factors in patients with HF

The most important laboratory parameters, both in the diagnosis, treatment monitoring and prognosis of patients with HF, include natriuretic peptides [1,2]. It is known that the screening of these parameters and the implementation of early therapy can prevent HF [2]. Patients with elevated N-terminal pro-brain natriuretic peptide (NT-proBNP) in serum have longer hospitalizations and higher costs for hospitalization for various reasons [29]. The AHA guidelines recommend the determination of, inter alia, BNP levels on admission to the hospital to predict mortality in patients with acute HF, as well as before the discharge to predict prognosis [2].

The prognosis of patients with HF significantly worsens with the reduction of serum sodium levels. Hyponatremia is mainly caused by dilution of blood. It is also associated with neuro-humoral hyperactivity in HF patients [30]. In the meta-analysis of Ouwerkerk et al., this risk factor, apart from the deterioration of renal function, was the strongest predictor of mortality due to HF [3]. Low serum sodium on admission due to exacerbation of HF, even if it is borderline low, may increase the risk of long-term mortality and / or re-hospitalization due to exacerbation of HF [30].

There are also ongoing studies on other prognostic indicators, such as for example the adhesion molecule of MCAM melanoma cells as a marker of endothelial damage [31] or copeptin [32]. Increased level of procalcitonin may serve as another indicator of worse prognosis in HF patients, being the most likely obvious precursor of infection [33].

Pharmacotheraphy used according to current guidelines

There is undeniable evidence that adherence to appropriate regular pharmacotherapy by HF patients significantly improves prognosis, reducing, among other things, the risk of HF exacerbations requiring hospitalization [1]. Drugs that improve prognosis include beta-blockers, ACEI, aldosterone antagonists, ivabradine reduces the risk of relapse of hospitalization in patients with sinus rhythm, while digoxin and furosemide contribute to the reduction of symptoms [1].

The ESC guidelines state that a new substance composed of a representative of ARB (valsartan) and a nephrilysin inhibitor (sakubitril) has been shown to be superior to ACEI (enalapril) in reducing the risk of death and hospitalization due to HF. In diabetes, empagliflozin treatment should be considered for patients with type 2 diabetes to prevent or delay the onset of HF and prolong life, because this drug reduces mortality by 30% in such patients [1]. Data from both the Polish register POLKARD [34] and European (the Spanish register) [35] prove that doctors follow the recommendations of the guidelines. Data from Opolski et al. [34] regarding HF therapy in primary care in Poland in 2018 based on a nationwide cross-sectional study, shows that the majority of patients were treated with drug classes according to the guidelines: the percentage of patients treated with β-blocker alone was 88% and 71% ACEI. Ten years earlier, these percentages were 68% and 57%, respectively [34].

Unfortunately, despite appropriate recommendations by doctors, prognosis in patients with HF is worsened by the following factors: non-compliance with medical recommendations, low awareness of symptoms, depression, low socio-economic status, recent changes in the treatment of HF [36]. Patients who were hospitalized with a longer delay caused by the patient had a more severe clinical condition classified by the NYHA scale, which was associated with a worse prognosis [36]. In these patients, Jia-Rong Wu et al. [36] showed that the mean delay time from the awareness of symptoms to seeking treatment was 16 days (in the control group 3 days) and the average length of stay in the hospital was 7 days (median in control group 4 days). In the study of Johansson et al., [37] patients with symptoms of depression had an almost 1.5 times higher risk of death than patients without depression, and a delay in treatment greater than 3 days, after adjusting the clinical variables of both groups. Scrutinio et al. [6]

show in their work that patients who did not comply with medical recommendations had a worse prognosis.

The role of ICDs in the treatment of HF

An important breakthrough in cardiology was the use of implantable cardioverter defibrillators (ICDs) in the primary prevention of sudden cardiac death, including those with resynchronizing function, which resulted in a radical reduction in mortality in patients with HF [1]. The age of patients qualified for this type of treatment is not a contraindication, however, in the group of older HF patients the benefits of ICD in primary prevention of cardiac arrest are not so obvious [19]. The large US registry from 2004-2009, based on over 23000 patients aged ≥ 66 years, shows that ICD implantation had a smaller impact on the overall mortality of patients in this group, compared to previous studies [38]. The coexistence of diabetes, CKD and higher NYHA class are additional independent risk factors of death in elderly patients, leading to a relatively smaller percentage of sudden cardiac deaths in this population and, consequently, a lower benefit of implanted ICD [19].

Prognosis the risk of HF exacerbations using scoring systems

Precise prediction of prognosis may be beneficial in patients with HF. In an attempt to identify patients with the highest risk of rehospitalisation and focus on specific interventions, simple tools to assess the risk of CHF decompensation were sought. Patients with worse prognosis may benefit more from aggressive treatment and closer monitoring [3]. For example, it is known that diastolic blood pressure, as well as the products [systolic blood pressure × heart rate] and [diastolic blood pressure] may be useful in the risk stratification of a subsequent exacerbation of heart failure [39]. Furthermore, the diastolic blood pressure may predict short-term mortality in patients with HF [39]. In the study by Kowalczys et al. [39] it turned out that the higher value of the product [systolic blood pressure x heart rate] and [diastolic blood pressure × heart rate] correlated negatively with the risk of exacerbating HF in the 6-month observation period. Similarly, patients with a higher product [diastolic blood pressure x heart rate] were characterized by a lower risk of HF decompensation in both 3 and 6 months [39].

In order to stratify the risk of HF exacerbations, scoring systems such as the LACE index (L-length of stay, A-Acute, C-Co-morbidities, E-Emergency Department) and LACE +index are also useful (additionally including age, sex, hospital referential status, stationary outpatient care, number of elective admissions and those in the acute mode in the previous year, number of admissions in emergency departments in the last 6 months and length of hospitalization) [4]. The risk of early mortality in 3 days after admission to hospital is assessed by the EAHFE-3D index , including oxygen saturation (Sat O_2) < 90%, hyponatremia (< 135 mmol/l), use of inotropic or vasoconstrictor drugs, use of non-invasive ventilation, systolic pressure blood <110 mmH), NYHA class III-IV. There are also other scoring systems for estimating the risk of HF exacerbations, such as the SeatleHeartFailure Model SHFM (including 30 parameters), Meta-analysis Global Group in Chronic HF MAGGIC (including 13 parameters) and HF Survival Score HFSS. However, these scales seem quite complicated, so they are not widely used in clinical practice. To stratify the risks associated with HF rehospitalisation with special emphasis on patients with diabetes, many risk assessment models have been proposed: HOSPITAL scale, 8Ps risk scale, DERRI tool to assess the risk of re-hospitalization in diabetic patients [8] and there was also proposed a HF rehospitalisation risk online calculator (CORE) (http://www.readmissionscore.org/heart_failure.php) [25]. Currently, however, the clinical value of HF risk predictors remains limited, as available scales seem to be too complicated to use in everyday practice, and their use does not translate into clinical practice.

Prevention of exacerbations of HF

There is ample evidence of the possibility of slowing or preventing the onset of symptomatic HF through interventions focused on modifying HF risk factors or treating asymptomatic left ventricular dysfunction. Treatment of the diseases underlying HF leads to improved prognosis. The results of many clinical studies have shown that good control of hypertension delays the development of clinically overt HF, and in some of them it has been shown to prolong life [3].

The aim of avoiding rehospitalization due to HF is a proper treatment after the discharge with an appropriate lifestyle and rehabilitation program. Unfortunately, almost half of hospitalizations are not related to specific cardiac causes [4], thus increasing the difficulty in analyzing risk predictions. Many episodes of HF exacerbations are related to the social

environment, poor care provided by the patients' families and an inappropriate program of post-hospital care [36]. In addition, state care funds and private insurance companies are constantly striving to reduce costs, which may lead to improperly shortened hospital stay [3]. Moreover, there is no approved program that focuses on the appropriate risk algorithm, based on the prognostic factors of HF exacerbation. This necessary matter should become one of the most important goals to be pursued in the management strategy of patients with HF. The authors of predictive models of rehospitalization suggest that non-medical factors may play a greater impact than previously thought on the risk of hospitalization due to exacerbation of HF, and additional identification of patients inadequately responding to the currently used therapy, which may lead to further development of targeted therapies and ultimately to a more effective therapy of patients with HF [3].

The proper care of the patient right after discharge from the hospital is of great importance in reducing the risk of relapse of HF exacerbations. In hospitals where the possibility of an early re-assessment of the patient by the doctor after discharge from the hospital was organized, a reduction in the number of re-admissions in the 30-day period was observed [40]. In addition, in hospitals where an outpatient follow-up visit was planned at the end of hospitalization, a smaller number of re-hospitalizations were recorded compared to hospitals without a similar plan [1]. According to the ESC recommendations [1], the patient should be included in the HF care program; before discharge, a detailed plan for a future assessment should be determined and discussed with the attending physician. Exercise training and rehabilitation of patients with HF may also be of utmost importance. The results of the latest Cochrane review on exercise training covered a total of 4740 patients with HF, observing a trend towards the reduction of mortality in exercise groups in studies with more than 1-year follow-up [1]. It showed that in comparison to the control group, exercise training reduced the total number of hospitalizations and hospitalizations due to HF and improved quality of life.

In order to achieve better cooperation directly with the patient, both in the field of complex pharmacotherapy and self-care, it is worth considering the support of a multidisciplinary team dealing with HF treatment, as well as cooperation with specialist support teams in the field of dementia. It is also worth taking care of cooperation with family members and other people involved in the care of the patient [1].

Conclusions

HF exacerbations requiring re-hospitalization are a huge problem, especially in the elderly population. Additional risk factors, other than age and previous hospitalization, are identified as: ischemic heart disease, atrial fibrillation, impaired left ventricular systolic function and advanced NYHA class as well as elevated natriuretic peptides and troponins levels. Other established risk factors include comorbidities (primarily lung diseases, diabetes, renal failure), along with infections, anemia and hyponatremia.

Appropriate assessment of HF exacerbation risk in individual patients, in conjunction with the accurate use of prescribed pharmacotherapy and the appropriate organization of post discharge care after discharge from the hospital, including controlled physical training programs, may help reduce the risk of further HF exacerbations and the mortality in patients with HF.

Conflict of interest
None

Adres do korespondencji:
Małgorzata Dobrowolska
Department of Cardiology
Saint Vincent de Paul Hospital
1, Wójta Radkego St. 81-348 Gdynia
☎ (+48 58) 726 08 81
m.d.k.dobrowolska@domax.com

References

1. Ponikowski P, Voors AA, Ankeret SD, et al. 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. Kardiol Pol. 2016;74(10):1037-147.
2. Yancy CW, Jessup M, et al. 2017 ACC/AHA/HFSA Focused Update of the 2013 ACCF/AHA Guideline for the Management of Heart Failure. J Am Coll Cardiol 2017;70(6,8):776-803.
3. Ouwerkerk W, Voors AA, Zwinderman AH. Factors influencing the predictive power of models for predicting mortality and/or heart failure hospitalization in patients with heart failure. JACC Heart Fail. 2014;2(5):429-36.
4. Thomas MC, et al. Perspective Review: Type 2 Diabetes and Readmission for Heart Failure. Clin Med Insights: Cardiol. 2018;12:1-7.
5. Christ M, Strock S, Dorr M, et al. Heart Failure epidemiology 2000-2013 insights from the German Federal Health Monitoring System Eur J Heart Fail. 2016;18:1009- 18.
6. Scrutinio D, Passantino A, Guida P, et al. Prognostic impact of comorbidities in hospitalized patients with acute exacerbation of chronic heart failure Eur J Intern Med. 2016;34:63-7.
7. Ozierański K, Balsam P, Tymińska A, et al. Heart failure in elderly patients: differences in clinical characteristics and predictors of 1-year outcome in the Polish ESC-HF Long-Term Registry. J Am Coll Cardiol. 2008;52:13-6.
8. Diaz A, Ciocchini C, Esperatti M, et al. Precipitating factors leading to decompensation of chronic heart failure in the elderly patient in South-American community hospital. J Geriatr Cardiol. 2011;8:12-4.
9. Ruigómez A, Michel A, Martín-Pérez M, et al. Heart failure hospitalization: An important prognostic factor for heart failure readmission and mortality. Int J Cardiol. 2016;220:855-61.
10. Mahjoub H, Rusinaru D, Soulière V, et al. Long-term survival in patients older than 80 years hospitalised for heart failure. A 5-year prospective study. Eur J Heart Fail. 2008;10(1):78-84.
11. Cichocka-Radwan A, Lelonek M. Annual prognostic factors in chronic heart failure in patients over 80 years old. Kardiol Pol. 2017;75(2):164-73.
12. Uretsky BF, Thygesen K, Armstrong PW, et al. Acute coronary findings at autopsy in heart failure patients with sudden death: results from the assessment of treatment with lisinopril and survival (ATLAS) trial. Circulation. 2000;102(6):611-6.
13. Beohar N, Erdogan AK, Lee DC, et al. Acute heart failure syndromes and coronary perfusion. J Am Coll Cardiol. 2008;52(1):13-6.
14. Greig D, Austin PC, Zhou, et al. L Ischemic electrocardiographic abnormalities and prognosis in decompensated heart failure. Circ Heart Fail. 2014;7:986-9.
15. Flaherty JD, Rossi JS, Fonarow GC, et al. Influence of coronary angiography on the utilization of therapies in patients with acute heart failure syndromes: findings from Organized Program to Initiate Lifesaving Treatment in Hospitalized Patients with Heart Failure OPTIMIZE-HF). Am Heart J. 2009;157:1018-25.
16. Peacock WF, De Marco T, Fonarow GC, et al. Cardiac troponin and outcome in acute heart failure. N Engl J Med. 2008;358:2117-26.
17. Chang IC, Agamawi YM, Austin E, et al. Usefulness of Atrial Fibrillation as a Marker for Adverse Cardiovascular Outcomes in Both Primary and Secondary Prevention in Patients with Implantable Cardioverter-Defibrillators. Am J Cardiol. 2016;118(10):1497-502.
18. Joy PS, Gopinathannair R, Olshansky B, et al. Effect of Ablation for Atrial Fibrillation on Heart Failure Readmission Rates. Am J Cardiol. 2017;120 9):1572-7.
19. Khoo CY, Allen JC, Chia SY, et al. Mortality outcome and predictive risk factors for death in patients with heart failure and reduced ejection fraction who declined implantable cardioverter defibrillator implantation in Singapore. J Arrhythm. 2018;34(5):536-40.
20. Chioncel O, Lainscak M, Seferovic PM, et al. Epidemiology and one-year outcomes in patients with chronic heart failure and preserved, mid-range and reduced ejection fraction: an analysis of the ESC Heart Failure Long-Term Registry. Eur J Heart Fail. 2017;19(12):1574-85.
21. Bornheimer R, Shea KM, Sato R, et al. Risk of exacerbation following pneumonia in adults with heart failure or chronic obstructive pulmonary disease. PLoS ONE. 2017;12(10):e0184877.
22. Grijalva CG, Zhu Y, Williams DJ, et al. Association between hospitalization with community-acquired laboratory-confirmed influenza pneumonia and prior receipt of influenza vaccination. JAMA. 2015;314(14):1488-97.
23. Berkovitch A, Maor E, Sabbag A, et al. Precipitating Factors for Acute Heart Failure Hospitalization and Long-Term Survival. Medicine (Baltimore). 2015;94(52):e2330.
24. Alon D, Stein GY, Korenfeld R, et al. Predictors and outcomes of infection-related hospital admissions of heart failure patients. PloS One. 2013;8:e72476.
25. Takeda N, Sakata Y, Mano T, et al. Competing risks of heart failure with preserved ejection fraction in diabetic patients. Eur J Heart Fail. 2011;13:664-9.
26. Kristensen SL, Preiss D, Jhund PS, et al. Risk related to pre-diabetes mellitus and diabetes mellitus in heart failure with reduced ejection fraction: insights from prospective comparison of ARNI with ACEI to determine impact on global mortality and morbidity in heart failure trial. Circ Heart Fail. 2016;9:e002560.
27. Scherbakov N, Doehner W. Heart-brain Interactions in Heart Failure. Card Fail Rev. 2018;4(2):87-91.
28. Bouabdallaoui N, Ducharme A. Setting Up a Heart Failure Program in 2018: Moving Towards New Paradigm(s). Curr Heart Fail Rep. 2018;15(6):357-67.

29. Kitagawa T, Oda N, Mizukawa M, et al. Hospitalization and medical cost of patients with elevated serum N-terminal pro-brain natriuretic peptide levels. PLoS One. 2018;13(1):e0190979.
30. Hiki M, Kasai T, Yatsu S, et al. Relationship Between Serum Sodium Level within the Low-Normal Range on Admission and Long-Term Clinical Outcomes in Patients with Acute Decompensated Heart Failure. Int Heart J. 2018;59(5):1052-8.
31. Banach J, Grochowska M, Gackowska L. Melanoma cell adhesion molecule as an emerging biomarker with prognostic significance in systolic heart failure. Biomark. Med. 2016;10(7):733-42.
32. Winther JA, Brynildsen J, Høiseth AD, et al. Prognostic and diagnostic significance of copeptin in acute exacerbation of chronic obstructive pulmonary disease and acute heart failure: data from the ACE 2 study. Respir Res. 2017;18(1):184.
33. Banach J, Wołowiec Ł, Rogowicz D, et al. Procalcitonin (PCT) Predicts Worse Outcome in Patients with Chronic Heart Failure with Reduced Ejection Fraction (HFrEF). Dis Markers. 2018;(28)18:9542784.
34. Wizner B, Fedyk-Łukasik M, Opolski G, et al. Chronic heart failure management in primary healthcare in Poland: Results of a nationwide cross-sectional study. Eur J Gen Pract. 2018;24(1):1-8.
35. Trullŕs JC, Manzano L, Formiga F, et al. Heart Failure with Recovered Ejection Fraction in a Cohort of Elderly Patients with Chronic Heart Failure. Cardiology. 2016;135(3):196-201.
36. Wu JR, Lee KS, Dekker RD, et al. Prehospital delay , precipitants of admission ,and lengh of stay in patients with exacerbation of heart failure. Am J Crit Care. 2017;26(1):62-9.
37. Johansson P, van der Wal M, van Veldhuisen DJ. Association between prehospital delay and subsequent clinical course in patients with/hospitalized for heart failure. J Card Fail. 2012;18(3):202-7.
38. Chen CY, Stevenson LW, Stewart GC, et al. Real world effectiveness of primary implantable cardioverter defibrillators implanted during hospital admissions for exacerbation of heart failure or other acute co-morbidities: cohort study of older patients with heart failure. BMJ. 2015;351:h3529.
39. Kowalczys A, Bohdan M, Gruchała M, et al. Prognostic value of daytime heart rate, blood pressure, their products and quotients in chronic heart failure. Cardiol J. 2017; DOI: 10.5603/CJ.a2017.0130.
40. McAliste FA, Youngson E, Kaul P, et al. Early Follow-Up After a Heart Failure Exacerbation. Circ Heart Fail. 2016;9:e003194.