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REVIEW ARTICLE

Understanding Hospitalization in Patients with Heart Failure

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Abstract

Heart failure is one of the most important and challenging public health problems of the 21st century and is associated with hard outcomes, such as death and hospitalization. New treatments for heart failure, despite the decrease in mortality, have not contributed to the decrease in hospitalization rates. Patients admitted with heart failure have a high event rate (> 50%) with a mortality rate between 10 and 15% and a rehospitalization rate within 6 months after discharge of 30 to 40%. Three major causes seem to directly affect the rehospitalization of patients with heart failure: comorbidities, congestion and target-organ lesion. The transition from inpatient to outpatient is a period of vulnerability, due to the progressive nature complexity of heart failure, with an impact on prognosis and which can extend for up to 6 months after hospital discharge. The physician has an important role in the actions that can minimize the risk of hospitalization for heart failure and the multidisciplinary approach, associated with the implementation of good practices supported by scientific evidence, can reduce the risk of hospitalization. The use of routines that have been proven to reduce hospitalization should be used in Brazilian hospitals. The objective of this review was to discuss the main causes of hospitalization, their impact on heart failure evolution and strategies that can be used to reduce it.

Introduction

Heart failure (HF) is one of the most important and challenging public health problems of the 21st century and is associated with hard outcomes, such as death and hospitalization.[1-3] HF is highly prevalent, resulting in decreased life expectancy and quality of life. The cost related to its treatment, especially regarding hospitalization, is quite high, regardless of the presentation characteristics, HF with Reduced Ejection Fraction (HFrEF), HF with ejection fraction in the middle range (40-49%)[4] and HF with Preserved Ejection fraction (HFpEF).[5]

In 2007, HF was responsible for 2.6% of hospitalizations and 6% of deaths recorded by the Unified Health System (SUS) in Brazil, consuming 3% of the total resources used to meet all admissions performed through system.[6] It is estimated that 26 million individuals have HF worldwide.[4]

The prevalence of HF is increasing worldwide, mainly due to the improvement in the care of ischemic disease and HF treatment with medications and devices, such as pacemakers and artificial ventricles, as well as the aging of the population, which leads to the increase in hospitalization costs for the health system.[7]

Many patients with heart failure are elderly and have multiple comorbidities, both cardiac and extracardiac, such as chronic kidney disease, depression, sleep apnea, arterial hypertension, atrial fibrillation, coronary artery disease, diabetes and chronic lung disease, which are accentuated with aging and can contribute to the increased risk of events such as hospital admissions and readmissions. The long-term prognosis is poor and half of the patients diagnosed with heart failure die within 5 years after the first hospitalization.[8] The survival rate at 5 years is lower than that observed in most cancer cases.[9,10]

The good response of individuals with HF to new forms of treatment does not contribute to the decrease in hospitalization rates related to the syndrome. Some recent publications suggest the opposite trend,

Keywords

Heart Failure / mortality; Hospitalization / trends; Comorbidity; Prognosis; Medication Adherence.

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in which a decrease in mortality and increase in hospitalizations was observed.[11] This apparent paradox between the use of new methods of treatment in heart failure and increased hospital admissions can be partly explained by the use of devices, such as artificial ventricles, resynchronizers and defibrillators in patients with HF. Another reason is related to the use of medications for HF, which increase survival at suboptimal doses. A recent study carried out in European countries showed that only 25 to 30% of patients in the real world receive the doses of beta-blockers recommended by the guidelines.[12]

The difficulty in reaching the maximum recommended doses of medications may be related to the fact that patients with HF are elderly with multiple comorbidities and, therefore, the prescribed medication may be poorly tolerated. Other reasons are related to polypharmacy, the complexity of prescription regimens to achieve the optimum dose and the fact that recently hospitalized HF patients are not adequately monitored by health professionals, especially in the first 30 days, when the risk of rehospitalization is very high.[13] Studies show that less than one third of patients hospitalized for HF was assessed by a cardiologist in the first 3 months after hospital discharge.[14]

HF patients have a high risk for the development of a new condition: the post-hospitalization syndrome,[15] due to the association of the high complexity of care in intensive care units and the presence of multiple comorbidities, leading to the exposure to different homeostatic stressors during the hospitalization period.[16-19]

The relevance of the "rehospitalization" topic in the last decade involves two important points: first, the perception that reducing these rates would be a window of opportunity to decrease the waste of resources in the health system and, second, that the hospitalization causes additional damage to the heart and other organs. Hospitals in the United States with high rates of rehospitalization have started to be penalized, which led to a search for evidence-based strategies capable of improving the performance of these instituitions.[20]

Rehospitalization remains a challenge. New ways to care for HF patients at advanced stages, such as home care, long-term care hospitals and strategies involving palliative care, have started to be implemented in our country for this group of patients at advanced stages.

The integration of cardiologists, family doctors and multidisciplinary teams has been increasingly used in HF care, aiming to prolong life, improve patient functional capacity and reduce hospital length of stay. These results are considered effective markers of therapy in large HF studies.[21]

The present study aimed to discuss the main causes of hospitalization, its impact on HF evolution and strategies that can be used to reduce it.

Heart Failure and Hospitalization

The absolute number of cases of HF has increased due to the aging of the population, improved survival rates after myocardial infarction and modern HF treatment strategies[21] (Chart 1). Throughout life, patients with HF can have a sudden worsening of their symptoms, requiring emergency room care and hospital admission due to acute HF syndrome. These frequent decompensations lead to progressive deterioration of cardiac function and quality of life[22] (Figure 1).

Patients admitted for HF have a high event rate (> 50%), with a mortality rate between 10 and 15% and a rehospitalization rate within 6 months after discharge of 30 to 40%.[24]

The improvement of post-discharge outcomes for HF remains a major focus of the needs that are unmet in clinical practice. Better understanding of the mechanisms that worsen the prognosis of patients hospitalized for HF and have a direct impact on rehospitalization, can provide better care and then reduce hospital readmission rates.

The increasing prevalence of HF has direct consequences for hospitalizations, which is currently recognized as one of the most important results in cardiology. The worsening in HF symptoms results in hospitalization and is associated with a high mortality rate and post-discharge rehospitalization, being the most important parameter related to the cost of care for patients with HF.[25] The causes for hospitalization are difficult to assess, as they are influenced not only by clinical factors but also by social, cultural and economic factors.[21] The cardiologist, as a leader of the multidisciplinary team, develops a treatment plan focused on the clinical aspects of HF and the comorbidity approach. Patients with HF in primary care with a history of previous hospital admissions must be accompanied both by the family doctor and a cardiologist. This strategy improves medication adherence and decrease HF mortality[26] and it has been demonstrated, in a population study including 10,599 patients with HF, that patients treated by both a primary care doctor and a specialist within 30 days after

hospital discharge showed a lower rate of death at 1 year (7.2%), when compared to those who were treated only by a primary care doctor (10.4%; p < 0.001). When care is provided exclusively by a cardiologist, there is an increasing trend of mortality (hazard ratio - HR: 1.41 vs. Primary Care; 95% confidence interval - 95% CI: 0.98 to 2.03; p = 0.067). Patients who had shared care had higher rates of ejection fraction and noninvasive tests for detection of ischemia and cardiac catheterizations.[26]

Chart 1 – The heart failure (HF) scenario

1 in 5 adults aged > 40 years will have HF
1 in 5 patients with HF will die within 1 year
3 of the major risk factors for HF have been increasing – age, obesity and diabetes
HF is the main cause of hospitalization in Brazil (SUS) in individuals older than 60 years
The prevalence of HF in Europe and the United States will increase from the current 3% to 3.5% by 2030
The risk of sudden death in HF is 6 to 9 times higher when compared to the population without HF
There are 600,000 new cases of HF in Europe and 500,000 in the United States per year
There are 26 million individuals with HF worldwide
US$ 28 billion was the cost of the HF in 2010 in the United States, with a predicted cost of US$ 77.7 billion in the year 2030

SUS: Unified Health System (Sistema Único de Saúde)[23]. Adapted from: Lopez-Sendón J, Montoro N,[21] The changing landscape of heart failure outcomes. Medicographia; 2015;37:125-34.

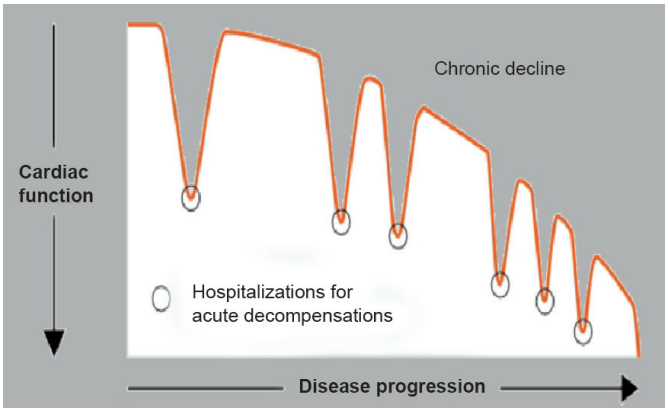

Figure 1 – *Heart failure as a progressive disease with deterioration of cardiac function and quality of life. Adapted from Gheorghiade M, et al. Pathophysiologic Targets in the Early Phase of Acute Heart Failure Syndromes. Am J Cardiol; 2005;96:11G-17G*

Main Factors Influencing Results After Hospital Discharge

The first hospitalization can be a consequence of an acute event by myocarditis, coronary heart disease, cardiac arrhythmia or acute valvular disease and may also occur due to the decompensation of a chronic HF picture due to infection, non-adherence to pharmacological and non-pharmacological treatment, use of medications such as nonsteroidal anti-inflammatory medications, among others.

Outpatients with stable chronic HF have an annual rate of hospitalization of around 31.9%. This rate increases to 43.9% in patients who were hospitalized for acute HF.[27] Longitudinal prospective studies show similar results when comparing stable patients with those hospitalized for HF, but hospitalization is associated with increased risk of death and its effect on prognosis is similar to that described in patients with acute coronary syndrome.[28]

Three major causes seem to directly affect the rehospitalization of patients with HF: comorbidities, congestion and target-organ lesions.[28]

Cardiovascular and non-cardiovascular comorbidities play an important role in post-discharge events in patients with HF. Cardiovascular comorbidities that may result in rehospitalization are myocardial ischemia, arrhythmias (such as atrial fibrillation) and uncontrolled hypertension. All of them can potentially be treated at the first hospitalization.[28]

Non-cardiovascular comorbidities are also important in the rehospitalization process and it has been observed that, after the first hospitalization due to HF, 65% of patients are readmitted for another cause rather than decompensated HF. Therefore, most rehospitalization have another cause other than HF.[19]

A study showed that diabetes, chronic kidney disease and anemia are independent factors associated with higher mortality and/or rehospitalization rates. Other non-cardiovascular comorbidities, such as infections and chronic lung disease can also be causes of rehospitalization.[29]

In the analysis of the Cardiovascular Health Study of risk factors for all hospitalization causes among elderly patients with a new diagnosis of HF, three conditions (decreased muscle strength, reduced gait speed and depression) were considered independent risk factors for hospitalization after a HF diagnosis, even when considering other social, demographic and clinical factors.[30]

Other factors related to patient characteristics, such as non-adherence to treatment, food abuse, drugs, alcohol, family and social support and access to health care, directly affect rehospitalization.[28]

Congestion is considered the leading cause of hospitalization for HFrEF and HFpEF and plays an important role as a cause of rehospitalization and as a death marker after hospital discharge.[28,31,32]

The slow resolution of congestion signs and symptoms during the first days of hospitalization for HF is associated with adverse outcomes and its more severe presentation form, represented by a worsening in HF during hospitalization. This event is an independent predictor of increased mortality.[32] The assessment of clinical signs of congestion, such as pulmonary rales, jugular venous pressure, peripheral edema and weight gain, is important at the time of hospital discharge and the first days after leaving the hospital. Clinical signs, however, are less effective than hemodynamic worsening markers to rule out congestion. Serum levels of natriuretic peptides can identify persistent congestion, even in the presence of an apparent improvement in the clinical picture.[28,32]

Studies have shown that congestion markers, such as weight gain and poor response to diuretics, are associated with rehospitalization and short-term outcomes, but not with long-term mortality.[33,34]

The risk of death after hospitalization for HF remains increased between 12 to 18 months after the event.[35] These data indicate that persistent target-organ lesions, such as heart, lungs, kidneys, liver and brain, are associated with hospitalization. Additionally, other markers related to organ lesions and/or loss of function are associated with hard outcomes after hospitalization for HF.[28]

The association between chronic kidney disease and worsening of outcomes in patients with HF has been well established.[36] Recently, the role of liver dysfunction has been demonstrated. The increased pressure in the inferior vena cava caused by congestion is transmitted to the liver, leading to cholestasis and death of hepatocytes, with an increase in serum transaminases. This fact has been associated with worse prognosis, including mortality from all causes.[37] (Figure 2)

Vulnerable Phase of Heart Failure

The vulnerable phase of HF is characteristic of patients with acute heart failure and is defined as the period during which microenvironmental changes in lifestyle, after an episode of decompensated HF, can cause an increased risk for adverse cardiovascular events, such as death and rehospitalization from HF. Patients who overcome this phase uneventfully can remain stable for a long period.[38]

The vulnerable phase of HF, which occurs in each episode of acute HF, can be divided into three sub-phases: very early stage, early stage and late stage – having a variable impact for each individual[38] (Figure 3).

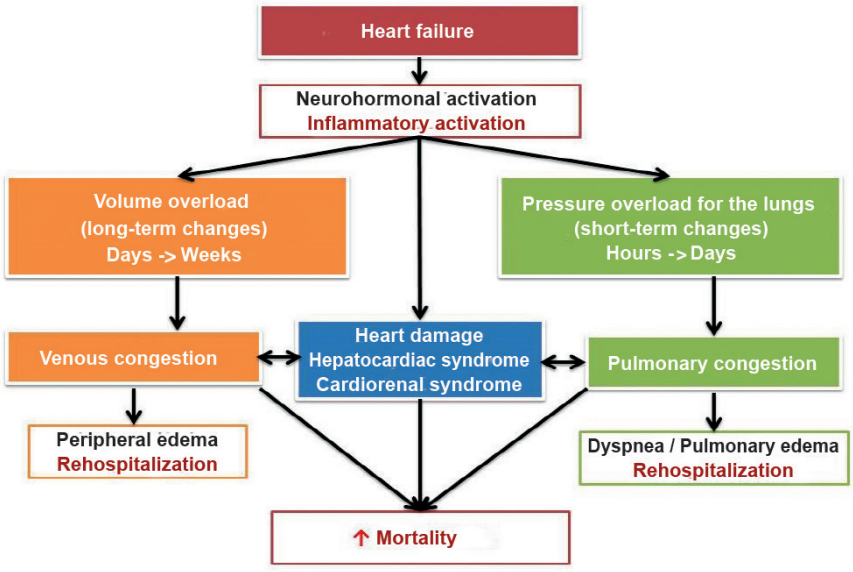

Figure 2 – *Mechanisms of increased risk of death and rehospitalization in patients hospitalized for HF. Adapted from Medicographia; 2015;37:139-43.*

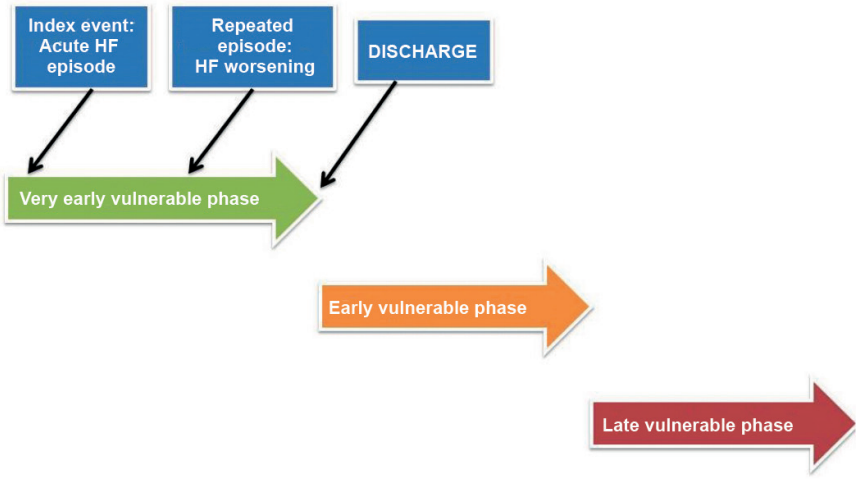

Figure 3 – *The vulnerable phase of heart failure. Adapted from Medicographia; 2015;37:144-7.*

Very-early vulnerable stage of heart failure

The very early vulnerable stage begins with an acute episode of HF and extends until a few days after hospital discharge. After the initial stabilization period of an acute episode, approximately 15% of patients may experience an in-hospital worsening of HF, which is associated with the risk of adverse events.[39]

This phase is more often observed in patients who are discharged before full congestion improvement, which usually occurs between 4-5 days of hospitalization, or

who are affected by comorbidities, target-organ lesions and post-hospitalization syndrome.[15] The pressure exerted by the public health system, encouraging early hospital discharges, leads doctors to use higher doses of diuretics within shorter periods of time to achieve congestion improvement.[38] High doses of diuretics can quickly relieve congestion, but increase the cost of renal function worsening, and many patients could remain relatively congested at the time of hospital discharge. Kidney and liver dysfunction may determine the prognosis of these patients at the very early vulnerable stage.[37] The presence of anemia at admission also contributes to a worse outcome, if not correctly managed at this phase.[38]

Continuous-use drugs that modify the evolution of HF are not easy to be started within a short period of hospital stay, and patients may experience an increased risk of rehospitalization or death after discharge, simply because the correct therapy was not provided. These patients require a follow-up carried out by a multidisciplinary team at short time intervals. Guidelines recommend phone contact within 3 days and a medical consultation within two weeks after discharge.[9]

Early vulnerable stage of heart failure

The early vulnerable phase starts after hospital discharge of the patient with an acute HF episode. The hospital length of stay was adequate for congestion improvement; however, problems related to HF as well as to other comorbidities may be present because they have been aggravated by hospitalization. During the hospital-to-home transition, HF specialist nurses, nutritionists, physical therapists and pharmacists should be involved in the process of educating the HF patient for self-care, including the rehabilitation process and the medication reconciliation in the outpatient setting. These factors (medication management, dietary counseling and cardiac rehabilitation) are important determinants of vulnerability after acute HF[38]. This vulnerability phase is also related to the attitudes of patients, family members and caregivers, i.e., incorporation of the lifestyle changes required after hospital discharge.

Among the rehospitalization cases, 30% occur in the first 2 months after discharge and are preceded by cardiovascular events, which can be prevented by the multidisciplinary team actions.[40] Simple processes, although effective, such as adequate use of medication, can reduce the rehospitalization rates, since for 50% of patients with HFrEF, medications are not prescribed according to the recommendations in the guidelines.[41]

HF rehospitalization rates in young adults and the elderly are similar, suggesting that the risk of rehospitalization is present regardless of age.[42]

Viral and bacterial infections are important causes of HF decompensation at this stage and can be prevented by vacination.[43]

The transition from inpatient to outpatient can be very difficult in vulnerable period due to the complexity of the HF progressive nature. Multiple comorbidities, continuous use of polypharmacy and patients' difficulty to perceive the severity of their problem are important factors in determining the risk of vulnerability in the post-discharge stage.[38]

Late vulnerable stage of heart failure

The late vulnerable phase, which extends up to 6 months after discharge, is related to the reactivation of the renin–angiotensin–aldosterone system (RAAS) and hemodynamic alterations occur prior to systemic congestion. Regardless of the medical practice habits in different areas of the world, the prognosis of patients for different continents is similar in that phase.[38]

The worst prognosis at this stage could be prevented by optimizing treatment adherence. Adherence to medication and social support improves the survival free of cardiac events in patients with HF.[44]

After the late phase, adverse events decrease over time and then reach a plateau, which can be sustained for several months. During the plateau, the optimization of disease-modifying measures, including the use of devices, is the main target for hospitalization control.[38]

HF vulnerability phases can last approximately 6 months after an acute HF episode and is determinant of prognosis. To prevent the occurrence of outcomes, patients should be discharged at least 24 to 48 hours after hemodynamic stabilization, while euvolemic, with optimized oral medication and stable function of vital organs, especially the kidneys and the liver.[38]

Measures to Reduce Rehospitalization

Optimized heart failure treatment

The in-hospital care of patients with HF should be considered as a continuum, with consecutive phases

(immediate, intermediate and pre-discharge phases), each consisting of different treatment goals[45,46]

The immediate phase begins at admission and aims at clinical stabilization (peripheral oxygenation, ventilation support and adequate perfusion), symptom improvement (especially dyspnea), reduction of target-organ lesions (myocardium, kidneys and liver), reduction of the risk of early complications and reduced length of stay in the intensive care unit.[45]

With the clinical picture stabilization and symptom improvement, the patient is transferred to the ward, where the next phases (intermediate and pre-discharge) are initiated. This period is the beginning of the hospital-to-home transition.

The process involves the use of a multidisciplinary team and the recommendations should consider a moment of better responsiveness of patients and their families for the implementation of a long-term care plan. In this phase, the following objectives should be prioritized:[45] maintaining patient stabilization with treatment optimization; initiating and titrating the medication doses that modify the disease; identifying the underlying etiology of HF and associated comorbidities; minimizing hospital stressors; careful assessment for use of devices in appropriate patients; optimization of hemodynamics (euvolemia); stratification of pre-hospital admission risk in order to identify vulnerable and high-risk patients; involvement of the patient, their families and caregivers in a program of HF education and care; and cardiac rehabilitation program.

Promotion of self-care

The promotion of self-care is defined as encouraging a process of naturalistic decision-making that patients use in selecting behaviors that maintain physiological stability and response to symptoms once they occur. It can be a great ally for physicians who care for patients with HF.[47]

A systematic review of randomized trials on multidisciplinary care programs of patients with HF showed that the increase in patient self-care activities effectively reduced hospitalization for HF (Hazard Ratio - RR = 0.66; 95% confidence interval - 95%CI = 0.52- 0.83), and hospitalization for all causes (RR = 0.73, 95%CI: 0.57 to 0.93), but with no effect on mortality (RR = 1.14, 95%CI: 0.67 to 1.94).[48]

Another systematic review of randomized studies, which specifically focused on self-care interventions (six studies with 857 patients), showed that self-care activities reduced rehospitalization for HF (Odds ratio - OR = 0.44; 95%CI = 0,27- 0.71; p = 0.001) and hospitalization for all causes (OR = 0.59; 95% CI = .44-.80; p = 0.001), without a significant effect, however, on mortality (OR = 0.93, 95%CI: 0.57-1.51; p = 0.76).[49] In this review, the patients maintained the primary role in caring for their health condition, which included educational sessions or an educational software offering information on signs and symptoms of HF, the importance of daily weight control, dietary restrictions and the importance of medication adherence.

Biomarker monitoring

Scientific evidence suggests that serial measurements of plasma natriuretic peptides (Brain Natriuretic Peptide - BNP and N-terminal portion of prohormone natriuretic peptide type B - NT-proBNP) can promote a significant improvement in reducing hospitalizations for HF. A recent meta-analysis, which included 14 studies with 3,004 patients with HF, assessed whether the use of BNP to guide treatment would reduce the risk of rehospitalization for HF. The study found a decreased risk of rehospitalization for HF (RR = 0.79; 95% CI = 0.63 to 0.98; p = 0.03), but had no effect on the risk of death (RR 0.94, 95 % = 0.81 to 1.08; p = 0.39) or on rehospitalization for all causes (RR = 0.97, 95% CI 0.89 to 1.07; p = 0.56). The study also observed that alterations in BNP values can have significant effects on clinical outcomes of patients with HF. Therapy guided by BNP was not associated with an increased risk of adverse effects.[50]

Although the use of the BNP strategy has beneficial effects with decreased mortality in patients younger than 75 years, it was not effective in patients older than 75 years, which represents most of the patients with HF.[13]

Recently, the European Guideline on HF recommended the use of natriuretic peptides as a new strategy to optimize the treatment of patients with chronic HF.[4]

Telemedicine

Telemedicine is a generic term, which encompasses different situations of patient control, using telemonitoring and a structured telephone support system. Thus, it is a type of remote monitoring of markers, such as weight, heart rate, blood pressure, pulse oximetry,

electrocardiogram and also the pulmonary arterial pressure through sophisticated implantable devices.[13]

A meta-analysis evaluated 9,805 patients to demonstrate the effectiveness of telemonitoring and a structured telephone support system in patients with HF. The study showed that telemonitoring reduced all-cause mortality (RR = 0.66, 95% CI 0.54 to 0.81; p < 0.0001), and the structured telephone support system showed similar results, although non-significant (RR = 0.88, 95% CI 0.76 to 1.01; p = 0.08). Both telemonitoring (RR = 0.79; 95% CI = 0.67 to 0.94; p = 0.008) and telephone support (RR = 0.77, 95%CI: 0.68 to 0.87; p < 0.0001) reduced HF-related hospitalizations. Both procedures improved the quality of life and functional class; reduced costs; and were well accepted by patients, with improvement in medical prescription adherence and self-care. Telemonitoring and a structured telephone support system are effective interventions to improve outcomes in patients with HF.[51]

The use of an implanted device in the pulmonary artery of patients with advanced HF was recently approved by the Food and Drug Administration (FDA) and has shown to reduce morbidity and mortality in HF.[52]

Conclusions

The cardiologist has an important role in determining actions that can minimize the risk of hospitalization for heart failure. In different scenarios, we observed that hospitalization for heart failure is a major public health concern. The multidisciplinary approach associated with the implementation of good practices based on scientific evidence can reduce the risk of hospitalization. The application of these routines, which have shown to reduce hospitalization, should be carried out in Brazilian hospitals.

Author contributions

Conception and design of the research: Mesquita ET, Jorge AJL. Writing of the manuscript: Mesquita ET, Jorge AJL, Rabelo LM, Souza Jr. CV. Critical revision of the manuscript for intellectual content: Mesquita ET, Jorge AJL, Rabelo LM, Souza Jr. CV.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

This study is not associated with any thesis or dissertation work.

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