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Review Article

Managing Heart Failure for Patients with Preserved and Reduced EF to Improve Quality of Life

Sherin Mathew*, Terry L Oroszi

Department of Pharmacology and Toxicology, Wright State University, USA

***Corresponding author:** Sherin Mathew, Department of Pharmacology and Toxicology, Wright State University, USA

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Abstract

Heart failure is a long-term condition wherein the heart fails to pump blood as efficiently as it should [1]. Various factors cause this condition, one of the most common being hypertension [2]. As a result, blood gets backed up in the body, and pressure builds up in the lungs and the digestive system, causing chest pain and shortness of breath [3]. Ejection Fraction measures the efficiency and strength of the heart's performance. It determines how well the left ventricle, the heart's main pumping chamber, pumps blood and oxygen with each beat [4]. Heart failure with a low ejection fraction occurs when the left ventricular muscle does not pump as efficiently as normal [4]. An Ejection Fraction of less than 40% indicates that the heart is not pumping enough blood and may fail [4,5]. The most common cause of ejection fraction, being less than 45%, is a blockage or narrowing in one or more of the heart's four main arteries, which supply blood to the entire body [6]. Half of all heart failure patients have a reduced ejection fraction of 40% or below and are classified as heart failure with reduced ejection fraction. The other half may be grouped as heart failure with midrange ejection fraction (40–50%) or preserved ejection fraction (HFpEF), where the ejection fraction is greater than or equal to 50% [7].

Keywords: Heart Failure, Etiology, Reduced Ejection Fraction, Preserved Ejection fraction, Revascularization, CABG, Ventricular remodeling

Introduction

Over time, heart failure can damage the kidneys and other organs and lead to anemia, fluid retention, and fatigue, among other symptoms [8]. Several medications and procedures exist to help heart failure sufferers manage their symptoms and live longer healthier lives [9]. HFpEF is a rising problem in cardiac health, associated with getting older, being overweight, and having high blood pressure or even metabolic disorders [10]. Unfortunately, no available treatment is effective against this cardiac ailment [10]. It can be marked by an excessive amount of left ventricular pressure building up due to diastolic dysfunction, and there will be a hike in pressure can be observed both at rest and during exercise, ultimately can result in pulmonary hypertension [10]. Although the ejection fraction looks normal, people with HFpEF still experience mild deficiencies in systolic functioning and cannot take advantage of their systolic reserve capacity under stress. This results in a lesser degree of ejection fraction increase when compared to healthy subjects [10]. In this case, heart failure is due to left ventricular hypertrophy, or an enlargement of the left ventricle, which is often a result of the extra strain put on the heart by high blood pressure [11]. Heart failure with reduced ejection fraction is a complex, progressive medical condition associated with shortness of breath and impaired physical function. With its high mortality rate and risk of readmission, it has become one of the biggest public health challenges [12,13]. A person with high blood pressure will develop heart volume overload, leading to left ventricular hypertrophy. Thus, a person with high blood pressure and HFpEF will have signs and symptoms of both conditions [14].

One of the main challenges in treating heart failure with reduced ejection fraction is the highly individualized nature of the disease, in which age, comorbidities, and patient-specific factors can influence [15]. As a result, no single treatment approach is effective in all cases of heart failure with reduced ejection fraction. However, interventions such as exercise regimens and lifestyle modifications may help reduce heart failure symptoms with reduced ejection fraction [5]. Additionally, certain medications,

such as angiotensin-converting enzyme inhibitors and beta blockers, may help slow the disease's progression and improve the quality of life for patients suffering from heart failure with reduced ejection fraction [7]. Statins have been shown to reduce left ventricular hypertrophy and fibrosis under laboratory conditions. A small study indicated that taking statins could decrease the risk of death among patients with HFpEF [7]. It is now understood that the most significant predictor of long-term survival following a heart attack is the capability of the left ventricle. This function has conventionally been described regarding ejection fraction, yet it remains unclear if this metric holds much value in a post-heart attack context [6]. Hence, the relevance of discussing this topic is proven. A low ejection fraction may be caused by a lack of contractility from severe cardiac damage or ongoing ischemia and could also arise from the dilation of the left ventricle due to infarct expansion. Therefore, end-systolic volume (ESV) or end-diastolic volume (EDV) might provide better indicators of prognoses than an ejection fraction alone [6].

Pathophysiology of Heart Failure

Cardiac failure can result from either systolic or diastolic dysfunction or both [16]. The etiological factors behind heart failure can be attributed to myocardial cell damage and decreased functional cells [17]. The three main culprits of this condition are ischemic heart disease, hypertension, and diabetes, doubling the risk of developing heart failure compared to those with normal blood pressure [17, 7].

Excessive alcohol consumption, exposure to toxic drugs, valvular disease, and prolonged arrhythmias can all cause heart failure. However, these are much less common when compared to the primary three factors [17].

Physiological processes in Heart failure with preserved ejection fraction (HFpEF) can be explained as a condition that happens more and more in people when they get older, or for those who are obese, those who have diabetes, and those who have high blood pressure. One of the other main characteristics of heart failure with preserved ejection fraction is the reduced ability or capacity for physical activity [18]. In any such case, the left ventricular filling pressure gets affected, resulting in pressure overload [10]. This extra pressure can lead to other consequences, such as secondary pulmonary hypertension [10]. In addition, this has become the most common type of heart failure, and its rate of occurrence compared to heart failure with reduced ejection fraction is still hiking [29].

Heart failure with reduced ejection fraction is when the left ventricle of the heart cannot pump adequate blood to the rest of the body [18]. This results in symptoms such as shortness of breath and fatigue caused by weakened, ineffective, or decreased heart pumping [5]. Based on epidemiological research, around half of heart failure (HF) patients have either normal or preserved ejection fraction [5]. Therefore, heart failure patients are classified into two groups:

1) Those with reduced or decreased ejection fraction, known as systolic failure [5].

2) Those with a preserved ejection fraction are usually referred to as diastolic failure [5].

Signs and Symptoms

As the heart weakens, patients experience shortness of breath due to lung buildup and swelling of their extremities and stomach area from their blood not circulating correctly [20]. Other symptoms such as nausea, lack of appetite, exercise intolerance, heart palpitations, rapid or irregular heartbeat, chest discomfort, weakness, and dizziness also become apparent [20]. Patients may also experience clammy or sweaty skin. Often cardiac disorders may have signs such as swelling or edema, abnormal heart rhythm, abnormal lung sounds, and symptoms like dyspnea, fatigue, and inability to perform physical functions [21]. The signs and symptoms associated with reduced ejection fraction are almost the same as in any heart disease; sometimes, it may be asymptomatic. Similarly, heart failure with preserved ejection fraction presents similar signs and symptoms [20].

Risk Factors

The elderly population is more prone to develop cardiovascular disease when compared to the younger generation [22]. Risk factors associated with any chronic heart disease, including the reduced ejection fraction and preserved ejection fraction, apart from aging, are hypertension, obesity, diabetes, high cholesterol, sedentary lifestyle [10]. Hypertension is a major factor causing diastolic heart failure or HFpEF. Although, many patients with systolic heart failure or heart failure with reduced ejection fraction may have a history of hypertension. The most common etiology of heart failure with reduced ejection fraction is ischemic heart disease, found to be a contributor in more than 60% of diagnoses. Patients with heart problems caused by lack of blood flow to the left ventricle have a much higher mortality rate than those with non-ischemic conditions [23]. Patients with diastolic heart failure may have coronary artery disease [23,22]. As a preventive measure, the same risk factors should be modified in both cases [22]. Also, sodium intake and other dietary features may influence the risk of heart failure in obese individuals and those over a certain age [24] .Above all, social or behavioral factors can harm heart health, such as smoking and drinking too much alcohol [25]. These social or behavioral factors can be considered as modifiable risk factors [25].

Pharmacological Management

Drug Therapy

Several different types of drugs are often used to treat heart failure. They are categorized based on how they improve health and manage symptoms. Cardiac glycosides, beta-adrenergic blocking agents, angiotensin-converting enzyme inhibitors, and angiotensin receptor blockers (ARBs) are the four main drug classes used to treat heart failure [26]. Examples of cardiac glycosides include

Digoxin and Digitoxin [26]. HFpEF manifests differently in every patient and is connected to various underlying causes, extra-cardiac manifestations, and cardiac abnormalities. Regardless of the individualized nature of HFpEF, the standard course of treatment has been based on an approach that works best for chronic heart failure with reduced ejection fraction [27]. When looking at iron deficiency, providing iron intravenously (IV) rather than orally can improve quality of life and lessen symptoms in patients with heart failure with reduced ejection fraction, as measured by transferrin saturation levels [7].

In managing patients with suspected HFpEF, it is crucial to identify causes that may be treated, such as factors contributing to risk, comorbid illnesses, and specific cardiac conditions. Unfortunately, no therapies exist that improve survival in these cases; treatment focuses on relieving symptoms, improving quality of life, controlling fluid retention, and modulating risk factors and any related illnesses. If a patient is not following the prescribed diet, taking their medication, and making the necessary lifestyle changes for heart failure, it can lead to further complications, including worsening the condition or issues with treatment, which shows the importance of patient compliance [28].

Phenotype Specific Treatment

Remodeling refers to the compensatory changes in the heart after a heart attack. It is known as maladaptive remodeling because some of the changes that take place do not have a good effect on the heart. This remodeling is often seen in patients with myocardial infarction or heart attack [27]. The heart shrinks and becomes abnormally shaped. It is not the same as a normal, healthy heart, stronger and more resilient than before it was injured [27]. The ventricular surgical reconstruction technique is designed to reverse the maladaptive morphologic changes of post-infarction ventricular remodeling by restoring left ventricular volume and a more normal elliptical shape to the left ventricle, thereby reducing myocardial wall stress and improving ventricular function. The surgical ventricular reconstruction technique has been added to coronary artery bypass graft (CABG) surgery, especially for patients at risk for recurrent myocardial infarction. Adding surgical ventricular remodeling to CABG surgery reduces the left ventricular end-diastolic volume compared to CABG alone [23]. However, this structural alteration does not relate to a significant improvement in symptoms or exercise tolerance or a reduction in the death or hospitalization rate due to cardiac problems. The study concluded that adding ventricular surgical reconstruction to CABG is not beneficial in reducing morbidity or mortality [27,23].

Direct Cardiac Shockwave Therapy

The buildup of plaque on the inside of the arteries that causes the blockage of blood flow to the heart is atherosclerosis [23]. Doctors have found a way to regenerate these affected sections through shockwave therapy. This well-established regenerative tool uses controlled shockwaves to deliver unique chemical signals to stimulate the body's natural healing processes. Shockwave therapy works by creating new blood vessels in ischemic myocardium [19, 29]. One such chemical signal is vascular endothelial growth factor, a signaling protein that directs the body to create new blood vessels and prevent others from breaking down. These new blood vessels form due to angiogenesis (forming new blood vessels controlled by chemical signals in the body). Through the induction of angiogenesis and the reduction of fibrotic scar tissue, shockwave therapy has helped regenerate ischemic myocardium [19,29]. Even though a conventional medical treatment and cardiovascular revascularization with CABG is considered the go-to for addressing chronic cardiovascular issues, there are times when this procedure may not be helpful due to its high costs or maybe health limitations [29]. The novel regenerative technique known as cardiac shockwave therapy may provide a solution at these moments.

Reducing mortality is the primary goal of heart attack treatment, as it benefits the patient and the nation. In light of the above, the researchers believe that shockwave therapy can be a suitable alternative for patients who cannot undergo coronary artery bypass graft surgery [27,29]. A study on the use of shockwave therapy for ischemic heart disease patients concluded that it was a safe and effective treatment, especially for those suffering from angina pectoris, chest pain or discomfort, which is often considered a sign in increasing the risk of myocardial infarction or perhaps a symptom for coronary artery disease [29].

Coronary Artery Bypass Graft Surgery – Revascularization

Coronary artery bypass graft (CABG) surgery is used to treat coronary artery disease and dramatically increases the chances of survival for patients [30]. Studies have concluded that myocardial revascularization, achieved through CABG, can improve patient's quality of life and survival with chronic heart disease [23]. Before cardiac surgery, measuring the ejection fraction is a major part of assessing the patient's risk for the procedure [14]. Coronary artery disease occurs when arteries that supply blood to the heart become clogged or narrowed by substances called plaque, restricting blood flow. The condition is serious and may cause chest pain, heart attacks, and even death in severe cases. This procedure involves taking a healthy blood vessel from another part of the body, usually the leg, chest, or arm, and using it to bypass a blocked or narrowed artery [30]. Veins are most commonly used because they are naturally flexible and durable. A vein is taken from elsewhere in the patient's body and connected to the artery on either side of the blockage, allowing blood to flow freely around it. In other words, coronary artery bypass surgery creates an alternate route for blood to flow around the blockage and reach the heart muscle [30]. A history of heart failure is considered a major risk factor for short-term and long-term complications after coronary artery bypass graft surgery, even if the person had an average ejection fraction before the procedure. Individuals with an ejection fraction lower than normal more than doubled the chances of mortality after CABG [23,14]. Scientific research has indicated that healthy heart muscle in the left ventricle is a good predictor of whether or not individuals experiencing coronary heart failure will benefit from CABG [12]. There are controversies for the same. Some research

suggests that those who undergo bypass surgery can expect an excellent quality of life and a ten-year survival rate (Dunning et al., 2008). Although a ten-year survival rate after bypass grafting is expected, patients who are alcoholics and chain smokers must stop those unhealthy habits in order to prevent further negative impacts that could adversely affect their life expectancy or worsen their condition [31].

It has not been scientifically proven that age can impact a person's lifespan, but research suggests that age is not necessarily associated with reduced quality of life if the individual is in good health and not engaging in unhealthy habits [31]. This is especially true if the person has no pre-existing conditions that could potentially influence their overall well-being [31]. CABG can be life-saving and positively affect patients with heart failure and reduced ejection fraction in all the standard categories of death, including sudden, pump failure, and myocardial infarction-related death [23]. However, it has certain risks and complications. One of the most common complications is graft failure, where the grafts fail to heal correctly and must be removed, requiring the procedure to be repeated [30]. Apart from the risk and complications associated with CABG, there are limitations too, that will limit the patients with heart failure and reduced or preserved ejection fraction to undergo surgery [29].

Discussion

Non- pharmacological Management

Non-pharmacological therapy has long been recognized as an important part of treatment for patients with heart failure, particularly if the ejection fraction is relatively low. This therapy involves a wide range of interventions, including lifestyle changes, diet modifications, cardiac rehabilitation programs, and stress reduction techniques [5]. The non-pharmacological approach is used as a complement to medications intended to treat heart failure. One of the primary goals of non-pharmacological therapy is to improve the quality of life for patients with heart failure by helping them to manage their condition more effectively. It addresses symptoms like fatigue, shortness of breath, and chest pain and improves patients' overall physical and emotional well-being. In addition to medications, providing non-pharmacological interventions for heart failure patients is essential. Such measures can help slow the progression of the disease and delay the need for pharmaceutical treatment since classically recognized modifiable risk factors for ischemic heart disease and other atherosclerotic conditions are smoking, unbalanced diet, physical inactivity, unhealthy plasma lipid levels, high blood pressure, and being overweight or obese [25]. There is also evidence to suggest that non-pharmacological therapy can positively affect survival time [25].

Treatment without medication is often enough for those with mild to moderate heart failure to treat their symptoms and decrease impairment. However, more severe heart failure typically requires medical intervention, and the successful management of these issues can be achieved by logical behavior changes along with these interventions. This way can increase the quality of the outcome [25]. Non-pharmacological therapy is also vital in treating heart failure in children and adolescents, although pharmacological therapy is the mainstay of treatment in this population. Clinical trials with random participants have examined the effectiveness of lifestyle interventions as a non-pharmacological approach on diverse groups, such as healthy individuals and patients from general practice. It was determined that these interventions resulted in a moderate but worthy decrease in blood pressure, total cholesterol, body weight, and coronary risk score. Also, observed results have shown a considerable decrease in fatal and non-fatal myocardial infarctions and unexplained deaths among those exposed to the intervention compared to those operating under normal circumstances [25].

Another effective non-pharmacological intervention for the symptoms and prevention of heart failure is cardiac rehabilitation. Cardiac rehabilitation is a program designed to promote exercise, maximize cardiac function and improve quality of life. Cardiac rehabilitation can be performed in an outpatient setting, but it is more commonly done in an inpatient rehabilitation facility [32]. For non-pharmacological therapy to be effective, however, the ejection fraction must remain above 20%. This is because many treatment methods, such as lifestyle changes and cardiac rehabilitation programs, are ineffective if the heart cannot pump sufficiently [32].

Overall goal of non-pharmacological therapy is to improve the quality of life for patients with heart failure, as it provides a valuable and effective way to do this. As long as they have a relatively high ejection fraction, patients can work with their healthcare providers to develop a customized treatment plan to meet their needs best. In most cases, this will include treatment with pharmacological therapy. This type of therapy aims to improve the symptoms associated with heart failure and slow the progression of the disease. It is suggested to make behavioral changes in daily routine, such as smoking cessation and limiting alcohol intake, as well as engaging in healthy eating habits and exercising regularly, to enhance the outcomes of pharmaceutical therapies [33,31, 25]. A small study of 13 participants showed that a DASH diet limited in salt improved diastolic function, arterial stiffness, and ventricular–arterial coupling after three weeks [7, 24]. The DASH improved both ventricular diastolic function's relaxation and stiffness measures. The energy available for diastolic filling seemed lower, yet stroke volume stayed constant, which suggests increased diastolic filling efficiency [24]. Studies on animal models indicate that limiting dietary sodium consumption can provide relief by improving cardiac muscle and vascular stiffness and functioning. It was hypothesized that adhering to the Dietary Approaches to Stop Hypertension diet in combination with Sodium Restrictive Diet (DASH/SRD) would enhance left ventricular diastolic function, arterial elastance, and the connection between heart and artery in hypertensive HFPEF patients [24]. Other healthy food options include eating a fair amount of vegetables, fruits, legumes, whole grains, and nuts, staples of a vegetarian diet, has been linked to reduced chances of cardiovascular disease [33]. Adherence to

the prescribed course of treatment, including the other dietary and lifestyle modifications, is essential for achieving a 100 percent success rate when treating the disease [28].

Conclusion

In conclusion, HFpEF and heart failure with reduced ejection fraction are the most common syndromes in heart failure [12]. It accounts for 50% of all heart failure cases [27]. Patients with HFpEF can be asymptomatic or experience shortness of breath, fatigue, or edema. They may also be diagnosed with hypertension, diabetes, or atrial fibrillation. As the trigger for heart failure, these conditions play a crucial role in developing HFpEF. Unfortunately, current treatment strategies for HFpEF are not disease-specific. They, therefore, do not focus on the mechanism of action but rather on symptoms through diuretics and ACE inhibitors to address fluid retention and reduce blood pressure [26]. As a result, patients with HFpEF often have to take multiple medications to control their symptoms effectively. The growing understanding of the phenotypic diversity in HFpEF suggests that personalized therapeutic strategies may be valuable in treating this syndrome. Personalized therapeutic strategies encompass non-pharmacological therapy that can help manage and improve quality of life [31]. Lifestyle changes such as diet control and exercise can reduce weight, while stress management can help reduce or eliminate stress. Lifestyle changes effectively reduce weight and improve quality of life, along with pharmacological therapy to improve cardiac function, symptoms, and exercise tolerance in patients with heart failure with preserved ejection fraction [33,5,25]. Unlike patients with systolic dysfunction, patients with HFpEF can live relatively everyday lives for many years with proper treatment. However, confusion and controversies continue regarding the definitions, pathophysiology, prognosis, and management of diastolic and systolic heart failure [22]. In general, HFpEF and heart failure with reduced ejection fraction share similar clinical characteristics, but that does not mean the same thing causes them or should be treated the same way [21]. Patient compliance with pharmacological or non-pharmacological management treatment is crucial for a successful outcome [34,35] Manifestations like signs, symptoms, exercise intolerance, hemodynamics, and outcomes in both can be similar or identical, yet this alone cannot justify combined treatment options [36,37]. Instead, the point of separating diseases should be tried to determine what causes them and what could potentially fix them [21].

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