

## A SYSTEMATIC REVIEW ON THE NEW FUROSEMIDE SUBCUTANEOUS INFUSER FOR THE TREATMENT OF HEART FAILURE

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**Abstract: Objective** to evaluate, through a systematic review, the favorable and unfavorable results of using the subcutaneous furosemide infuser in patients with heart failure (HF) **Methods:** An integrative review was carried out, using as criteria the search in the National Library of Medicine (PubMed) and Scientific Electronic Library Online (SciELO) databases using the descriptors (i) furosemide (ii) Heart failure, (iii) subcutaneous infuser, with the Boolean operator “AND”. Studies published from 2018 to 2023 were included.

**Results** The FDA has approved Furosix, a subcutaneous formulation of the loop diuretic furosemide administered through a single-use body infuser, for the treatment of congestion, its safety and efficacy for use have been demonstrated at a dose of 30 mg SC over 1 hour, therefore after 12.5mg/h in the next 4 hours and the bioavailability was 99.6% compared to intravenous furosemide with two separate doses of 40mg, according to studies the health costs associated with heart failure were significantly lower in the groups that used the furosix.

**Keywords:** Furosemide, subcutaneous infuser and heart failure.

## INTRODUCTION

Diuretics are currently the first-choice therapy for removing excess body fluid in order to control the signs and symptoms of heart failure, among them the most commonly used is furosemide, whether for the treatment of chronic heart failure and even acute heart failure, being applied intravenously (YAP et al., 2018).

Heart failure represents a large part of the world's comorbidities, defined as a functional or structural cardiac alteration that leads to an inability to meet tissue metabolic demands or to meet high filling pressures (ROBERT J et al., 2023).

In heart failure, the defect in ventricular

filling or ejection of blood leads to fatigue, dyspnea and fluid retention or edema, which gives rise to the classification of heart failure, where we can quantify the ejection fraction through the echocardiogram for its subsequent treatment, since this must be directed to the profile and class of each patient (SAMUEL et al., 2023).

Before delving deeper into the subject, we must keep in mind the relevance of the subject, since heart failure is the most common cause of hospitalization in the elderly over sixty years of age, its incidence and prevalence are increasing every year, with prevalence in African American individuals greater than 25% compared to white individuals (STEPHEN et al., 2021).

The Food and Drug Administration (FDA) in 2023 approved Furoscix a single-use subcutaneous infuser of furosemide, a loop diuretic for the treatment of heart failure with congestion due to volume overload in New York Heart Association classes III and IV (NYHA) later reported in this article (ANTHONY et al., 2022).

Oral and intravenous furosemide formulations are widely sold and used in the market due to their high effectiveness and low cost, which will be discussed in this article and compared to the current market, the subcutaneous infuser (MAXWELL et al., 2022).

## **INCIDENCE AND PREVALENCE**

The prevalence of heart failure in the United States reaches around 1% to 2% of the entire population, a considerably large number. EPIC study (GORRÍZ et al., 2021).

In Brazil, according to DATASUS, there are about two million patients being diagnosed with heart failure, totaling about 240,000 new cases per year, projections indicate that in 2025 Brazil will have the sixth oldest population in the world, which contributes to the increase in

these values and the need for further studies related to the subject (CHAN et al., 2020).

## **ETIOLOGY**

The etiologies that lead to heart failure are very varied, mainly systemic arterial hypertension (SAH), diabetes mellitus (DM), coronary artery disease (CAD), acute myocardial infarction (AMI), cardiomyopathies, left ventricular hypertrophy (LVH), pulmonary hypertension, lung color, valvulopathies, chronic renal failure, pericardial diseases, myocarditis, substance abuse and cardiotoxic chemotherapy (MARVIN A et al., 2021).

## **RISK FACTORS**

The most common risk factors associated with the onset of heart failure are substance abuse such as ethanol, sedentary lifestyle, obesity, poor medication adherence to antihypertensive drugs and smoking. Diabetes has also been pointed out as a pathology that causes heart failure due to its inflammatory and remodeling profile. coronary ischemia caused by AMI, hence the need to strengthen basic preventive measures (FELIPPO et al., 2019).

## **SIGNS AND SYMPTOMS**

Heart failure has a very rich clinical picture, with varied symptoms ranging from chest pain, exertional dyspnea in early heart failure, orthopnea, paroxysmal nocturnal dyspnea, hypotension, syncope, fatigue, confusion, palpitations, dizziness, cough, exercise intolerance, loss weight, with regard to physical examination, tachycardia, narrow pulse pressure, hypotension observed in severe heart failure, alternating pulse, cyanosis due to poor peripheral perfusion, diaphoresis, crackles on pulmonary auscultation, jugular venous distention, presence of S3, hepatosplenomegaly, positive hepatojugular reflux, ascites and symmetrical edema

(ROCIO et al., 2020).

## CLASSIFICATION

To facilitate the management of patients with heart failure, classification is carried out according to functional class (NYHA), with class I patients without limitations in daily activities, class II patients who at rest do not have symptoms but with moderate physical activity have dyspnea, class III patients are comfortable at rest, but in daily activities such as getting dressed they have dyspnea and class IV patients have dyspnea even at rest (MANITO et al., 2020).

A second classification would be that of the American Heart Association (AHA), which classifies them in stage, stage A being that patient at high risk of heart failure, without structural heart disease and without evidence of cardiovascular disease, since stage B is considered pre heart failure since patients have structural heart disease and evidence of heart disease, but without signs or symptoms, stage C, on the other hand, is considered symptomatic heart failure with obvious cardiovascular and cardiovascular disease and the presence of signs and symptoms and finally the stage D, which are patients with advanced heart failure refractory to treatment (MANITO et al., 2020).

## DIAGNOSIS

The diagnosis is often made by clinical evaluation of the presence of signs and symptoms, evidence of edema and/or hypoperfusion, decreased functional capacity, associated with other factors such as a family history of heart disease, evidence of cardiac dysfunction on the echocardiogram that may show a reduction in the fraction of ejection, size of the cardiac chambers, or cardiac catheterization, electrocardiogram that shows the deviation of the cardiac axis to the left, increase in the duration of the QRS

complex, the evaluation involves the request of laboratory tests, among them the BNP and pro-BNP having as cutoff point for dyspnea of cardiac origin a BNP greater than 400 pg/ml and a pro-BNP greater than 450 pg/ml for patients under 50 years of age, with this cutoff point changing with increasing age (MONICA et al., 2020).

## TREATMENT

The treatment of heart failure varies between the patient with decompensated heart failure and the patient with chronic heart failure, that is, long-term heart failure, which requires a multimodal approach, starting with weight loss, exercise physical activity, restriction of sodium intake, fluids, if you are a smoker, you are advised to stop, to avoid licit and illicit drugs and drugs that aggravate heart failure such as non-steroidal anti-inflammatory drugs, phosphodiesterase inhibitors, tricyclic antidepressants, certain classes of antibiotics as well as several other medications (MIYOKO et al., 2020).

Pharmacological treatment, on the other hand, is based on the classification according to the ejection fraction presented, the main classes used are the renin-angiotensin-aldosterone system inhibitors, beta-blockers, mineralocorticoid antagonists, type 2 sodium-glucose co-transporter inhibitors (iSGLT2) and loop diuretics, with furosemide being the most used (DECCO et al., 2020).

## FUTURE PERSPECTIVES

Loop diuretics, which is the class of furosemide, act by decreasing sodium reabsorption in the thick ascending branch of the loop of Henle, that is, they increase sodium and water excretion, leading to relief of congestive symptoms, being more effective than thiazides., but they do not improve progression or decrease mortality (MEINE et al., 2020).

However, the FDA has approved *Furoscix*, a subcutaneous formulation of the loop diuretic furosemide administered through a single-use body infuser, for the treatment of congestion due to fluid overload in adults with chronic heart failure (HF) New York Class II-III Heart Association (NYHA). Furosemide (Lasix and generics) has been available for years in oral and IV formulations (LEI et al., 2020).

The safety and efficacy of use were demonstrated at a dose of 30mg SC over 1 hour, then 12.5mg/h over the next 4 hours and the bioavailability was 99.6% compared to intravenous furosemide with two doses of 40mg separately, and according to studies, health costs associated with heart failure were significantly lower in the groups that used furosix (SABRINA et al., 2018).

It is hoped that in the near future the cartridge-packed single-use subcutaneous furosemide in-body infuser may become a widely available reality in the near future, the device is programmed to deliver a total of 80 mg of furosemide after loading the cartridge into the infuser. the patient must place it on a device in a clean and dry area on both sides of the navel, press the button and start the infusion, activity must be limited during the infusion, the infuser in the body must be kept dry and must not being used near cell phones and the like, it costs US\$ 822.4 and is not a reality for many patients who need it, but what we hope is that it becomes more accessible (MARK et al., 2020).

best treatments on the market in recent times.

## CONCLUSION

As a conclusion of this article, we have that heart failure is a worldwide health problem, which reaches large proportions and which reduces the quality of life as well as increases the mortality of this class of patients. correct classification and optimal treatment, in order to increase the life expectancy of these patients as well as their quality of life, providing the

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