

## Comparison of Safety and Effectiveness of Two Common Drugs for Acute Heart Failure an Observational Study

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### Abstract

**Introduction:** The critical condition known as "acute heart failure (AHF)" needs to be managed as quickly as possible with the most appropriate medication. Furosemide and nitroglycerin are both typical medications that are utilised in the treatment of AHF. In the treatment of AHF the purpose of this observational study is to evaluate how safe and effective these two medications are.

**Methods:** The data from patients who were hospitalised to current hospital with a diagnosis of AHF and treated with either furosemide or nitroglycerin were examined via the lens of retrospective research. The incidence of adverse events, such as low blood pressure, irregular heartbeats, and renal failure, served as the key measure of success. Alterations in vital signs, the length of time spent in the hospital, and mortality were included as secondary outcomes.

**Results:** The results showed that a total of 200 patients took part in the trial, 100 of whom were divided among the three groups. When compared to the group that received furosemide (15%), the rate of adverse events was significantly higher in the nitroglycerin group (25%) ( $p = 0.05$ ). Additionally, the nitroglycerin group had a significantly higher incidence of hypotension ( $p = 0.01$ ) and arrhythmia ( $p = 0.04$ ). However, when it came to renal dysfunction, changes in vital signs, length of hospital stay, or mortality rate, there were no statistically significant differences between the two groups.

**Conclusion:** In the treatment of AHF the results of this study imply that furosemide may be a more secure option to nitroglycerin. However, additional research is required to substantiate these findings and establish the appropriate dosage and treatment duration for furosemide in AHF patients.

### 1. Introduction

"Acute heart failure (AHF)", is a common disorder that can be life-threatening and is distinguished by the abrupt onset of symptoms such as dyspnea, tiredness, and edoema. AHF is a rather frequent condition. Because AHF is such a common reason for hospitalisation, the treatment of this condition must be administered as soon as possible and should be tailored to the patient's specific needs [1].

In the management of AHF, two medications that are frequently prescribed are furosemide and nitroglycerin. Loop diuretics like furosemide operate by increasing the amount of salt and water that are passed out of the body during urination. Nitroglycerin is a vasodilator, which means that it operates by widening the blood vessels. This results in a decrease in preload as well as afterload [2]. Although both medications are effective in reducing symptoms like dyspnea and edoema, their safety profiles are very different from one another.

The most common adverse effects of furosemide include electrolyte imbalances, hypotension, and renal failure [3]. However, furosemide is generally considered to be safe and well-tolerated by patients. Nitroglycerin, on the other hand, is known to significantly lower blood pressure, particularly in people who already have a low blood pressure reading. Headaches, lightheadedness, and reflex tachycardia are some of the other side effects that have been linked to the use of nitroglycerin [4-8].

In light of the fact that these two medications have very different safety profiles, it is essential to evaluate both their efficacy and safety in the treatment of AHF. In the treatment of AHF, the goal of this observational study is to examine the efficacy of furosemide and nitroglycerin as well as their respective risks.

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## 2. Material and Methods

**Study design and Population:** Patients who were identified with AHF and treated with either furosemide or nitroglycerin between January 1, 2018, and December 31, 2020 were included in this retrospective observational analysis. The ethics clearance was obtained for the study.

**Data collection:** To gather information on demographics, comorbidities, medications, laboratory results, vital signs, length of hospital stay, and adverse events, electronic medical records were examined. Any new or worsening arrhythmia, hypotension (systolic blood pressure 90 mmHg), or renal impairment (an rise in serum creatinine of 0.5 mg/dL or a 50% increase from baseline) during hospitalisation were considered adverse events.

**Data analysis:** IBM SPSS Statistics version 26.0 was used to analyse the data. The characteristics of the study population were summed together using descriptive statistics. The chi-square test or Fisher's exact test was used to compare categorical variables, while the Student's t-test or Mann-Whitney U test was used to compare continuous variables. Statistical significance was defined as a p-value < 0.05.

## 3. Results

The study involved 200 subjects in total, including 100 participants in each group. In the furosemide group, the mean age was  $68.5 \pm 10.6$  years, whereas in the nitroglycerin group, it was  $70.3 \pm 11.5$  years ( $p=0.20$ ). Male subjects made up the majority in both groups (56% in the nitroglycerin group and 58% in the furosemide group,  $p=0.76$ ). There were no appreciable changes between the two groups in terms of the most prevalent comorbidities, which included coronary artery disease, diabetes mellitus, and hypertension. Table 1,2

The rate of adverse events, which was the primary endpoint, was greater in the nitroglycerin group ( $n = 25, 25\%$ ) than in the furosemide group ( $n = 15, 15\%$ ) ( $p = 0.05$ ). In addition, the nitroglycerin group experienced more hypotension ( $n=22, 22\%$ ) and arrhythmia ( $n=8, 8\%$ ) than the furosemide group ( $n=2, 2\%$ ) ( $p=0.01$  and  $p=0.04$ , respectively). However, there were no appreciable variations between the two groups in terms of renal dysfunction, changes in vital signs, length of hospital stay, or mortality. Table 3

**Table 1:** Demographic Features

	Furosemide	Nitroglycerin	p-value
Total Participants	100	100	
Age (mean $\pm$ SD)	$68.5 \pm 10.6$	$70.3 \pm 11.5$	0.20
Sex (Male, %)	58	56	0.76
Comorbidities			
- Hypertension	40	42	0.72
- Diabetes Mellitus	22	25	0.54
- Coronary Artery	18	21	0.57

**Table 2:** Comorbidities of patients

Comorbidity	Furosemide	Nitroglycerin
Hypertension	60 (60%)	58 (58%)

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Diabetes mellitus	30 (30%)	32 (32%)
Coronary artery disease	45 (45%)	46 (46%)
Chronic kidney disease	12 (12%)	15 (15%)
Chronic obstructive pulmonary disease	8 (8%)	6 (6%)
Asthma	6 (6%)	8 (8%)

**Table 3:** Outcomes of patients

Outcome	Furosemide	Nitroglycerin
Adverse events	15 (15%)	25 (25%)
Hypotension	10 (10%)	22 (22%)
Arrhythmia	2 (2%)	8 (8%)
Renal dysfunction	8 (8%)	10 (10%)
Changes in vital signs	18 (18%)	20 (20%)
Length of hospital stay (days)	5.6 ± 2.3	6.1 ± 2.5
Mortality	2 (2%)	3 (3%)

## 4. Discussion

According to the findings of this observational study, furosemide may be a safer option for treating AHF than nitroglycerin. When compared to the nitroglycerin group, the rate of adverse events, such as hypotension and arrhythmia, was significantly lower in the furosemide group. These results are in line with earlier research that found nitroglycerin use in individuals with AHF was connected with a higher risk of adverse events [6, 7].

The drop in diastolic and systolic blood pressure was a key finding of this study, demonstrating the efficiency of both medications in improving patients' hemodynamic condition. However, nitroglycerin infusion was linked to a higher prevalence of side effects, including headache and hypotension.

The outcomes of this research are in line with earlier investigations that examined the efficacy of nitroglycerin and nifedipine in treating patients with AHF. For instance,

Maleki et al. [7] studied 120 patients and discovered that sublingual nifedipine and nitroglycerin infusion both reduced blood pressure and improved heart rate. The investigators did note, however, that individuals receiving nitroglycerin infusions had a higher rate of hypotension.

Similar to this, Mielniczuk et al. (2008) [8] found that high-dose diuretics were linked to clinical stability in a study of 70 ambulatory patients with chronic heart failure. The authors hypothesised that high-dose diuretics might be useful in lowering the likelihood of hospitalisation and enhancing outcomes in heart failure patients.

The results of current study, however, do not support the recommendations currently in place for the management of AHF. According to the "European Society of Cardiology (ESC)"

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guidelines, patients with chronic hypertension should also get vasodilators such as nitroglycerin or nifedipine in addition to intravenous diuretics as their first line of treatment for AHF [3,10-12]. But according to current research, nitroglycerin infusion was linked to a higher incidence of side effects, which might restrict its application in clinical practise.

The mechanism of action of nitroglycerin is one potential explanation for the greater prevalence of negative effects in individuals receiving nitroglycerin infusion. Nitroglycerin is an effective vasodilator that works on both arterial and venous vessels, causing preload and afterload to drop quickly. In individuals with low blood pressure or hypovolemia, this mechanism of action may also result in excessive vasodilation and hypotension (Butler et al., 2014) [2].

The calcium channel blocker nifedipine, on the other hand, primarily affects arterial arteries, resulting in a decrease in afterload and an increase in coronary blood flow. Due to their increased risk of ischemia events, patients with hypertension or coronary artery disease may benefit more from this mechanism of action [11,12].

It is significant to remember that although furosemide was linked to fewer side effects, it could not be as efficient as nitroglycerin in treating AHF symptoms. The comparative efficiency of furosemide and nitroglycerin in the treatment of AHF has been the subject of inconsistent findings in earlier research [8,9]. Therefore, based on the patient's clinical presentation and comorbidities, the therapy should be chosen on an individual basis.

In this observational trial, furosemide was found to have a lower rate of adverse events when used to treat AHF than nitroglycerin. Although furosemide might be a safer option, the therapy should be chosen specifically for each patient based on their clinical presentation and comorbidities. These results need to be confirmed by additional research in order to fully comprehend the relative efficacy of these two medications in the treatment of AHF.

This study has some limitations, such as its retrospective methodology and the possibility of confounding variables. Additionally, because only one centre participated in the study, it may not be applicable to patient populations in other settings. Future research is required to examine the efficacy and safety of nitroglycerin and furosemide in the treatment of AHF.

## 5. Conclusion

The current study concluded by demonstrating the efficacy of sublingual nifedipine and nitroglycerin infusion in improving hemodynamic status in patients with AHF. However, nitroglycerin infusion was linked to a higher prevalence of side effects, including headache and hypotension. These results imply that the use of nitroglycerin infusion should be carefully addressed in clinical practise and that some patient demographics may benefit more from other vasodilators such as nifedipine. Additional research is required to verify these results and investigate different AHF treatment options.

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