Mayagüez Medical Center
Family Medicine Residency Program
Title: "A Medication Comparison Study in the Length of Hospital Stay on Patients with Heart Failure with Reduced Ejection Fraction"

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INTRODUCTION

Heart failure (HF) is a structural or functional cardiac disorder that impairs the ability of the ventricle to eject blood. HF is a progressive cardiac condition associated with high morbidity, mortality, and significant healthcare costs. Despite advancements in treatment, hospitalization rates for HF remain substantial. Healthcare reimbursement models, such as the Diagnosis-Related Group/Prospective Payment System (DRG/PPS) in the United States, influence hospital length of stay (LOS) by structuring payments based on diagnoses, procedures, and duration of hospitalization. The United States typically has shorter hospital LOS for HF, averaging around five days.

Heart failure with reduced ejection fraction (HFrEF) is defined as an ejection fraction of 40% or less. The goal of pharmacologic therapy for HFrEF is to improve symptoms, slow or reverse deterioration in myocardial function, and reduce mortality. For patients with HFrEF with a New York Heart Association class II to III symptom profile, combination therapy is recommended, incorporating one agent from each of the following classes: renin-angiotensin-aldosterone system antagonist (preferably an angiotensin receptor-neprilysin inhibitor [ARNI]), beta-blocker, mineralocorticoid receptor antagonist (MRA), and sodium-glucose co-transporter 2 (SGLT2) inhibitor. A Dutch registry of 10,910 HF patients demonstrated high utilization of evidence-based therapies, particularly among younger individuals. However, elderly patients were more likely to receive diuretics alone, with suboptimal dosing of renin-angiotensin system (RAS) inhibitors and beta-blockers.

When a patient is hospitalized, rapid symptomatic management is undertaken. A key factor in HF pathophysiology is extracellular fluid volume expansion, which leads to increased intracardiac filling pressures and subsequent congestion. Symptoms such as edema, dyspnea, and orthopnea are commonly managed with diuretics. Clinical guidelines strongly recommend using loop diuretics to alleviate congestion, with MRAs serving as adjunctive therapy in symptomatic HFrEF patients. MRAs contribute to diuresis and counteract the aldosterone escape observed with neurohormonal activation in HF. Although MRAs have demonstrated disease-modifying benefits, their usage remains suboptimal. Early initiation of MRAs may reduce the risk of hypokalemia caused by loop and thiazide diuretics, potentially optimizing HF management by decreasing LOS and reducing healthcare costs.

Given the impact of loop diuretics and MRAs on HF management and hospital outcomes, this study aims to compare the LOS between HFrEF patients treated with loop diuretics, MRAs, or both. We also aim to assess the incidence of adverse events associated with each medication type.

METHOD

This study is a retrospective cohort study utilizing medical record data from Mayagüez Medical Center. A total of 334 patient records with a diagnosis of heart failure with reduced ejection fraction (HFrEF) were reviewed with dates of admission from January 8, 2024, through September 30, 2024.

The study aimed to compare the LOS among HFrEF patients who were treated with loop diuretics, MRAs, both, or neither therapies. Additionally, the incidence of adverse events associated with each medication type and their impact on LOS were assessed.

From the 334 records reviewed, 200 adult patients met the inclusion criteria. Eligibility criteria required admission with a diagnosis of HFrEF confirmed by a documented echocardiogram. Additionally, patients must have received guided medical therapy for the diagnosis of heart failure during hospitalization.

To evaluate the statistical differences and effects, a Kruskal-Wallis analysis was used to assess differences between the medians and ranges of the four groups (only loop diuretics given, only MRAs given, both medications or none). Statistical significance was determined using p-values < 0.05.

RESULTS

Study sample size: 200 patients

- Female: 53
- Male: 147

Age Range: 21 to 97 years
- Median age: 71 years

The mean minimum ejection fraction recorded was 18.9%
The mean maximum ejection fraction recorded was 27.0%
(Range = 19%, 40%, SD = 7.2).

Although the study classified patients as having reduced ejection fraction, the hospital categorized the condition as systolic heart failure. Nevertheless, all patients met the requirement of an echocardiogram-confirmed ejection fraction of 40% or less.

Figure 1: Distribution by Sex

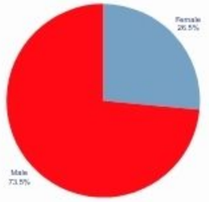
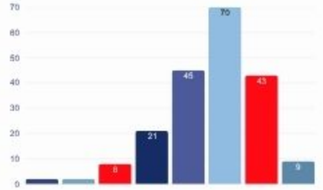


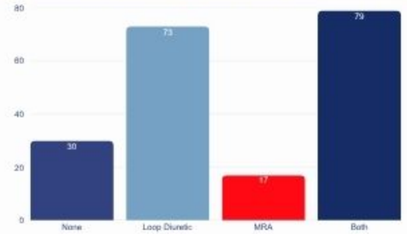
Figure 2: Distribution by Age (years)



Mean Age = 70.7 years;
Median = 71.0; Range = 21, 97; SD = 12.8

The groups included 73 patients who received only loop diuretics, 17 patients who received only spironolactone (MRA), 79 patients who received both medications, and 30 patients who did not receive either treatment (Figure 3).

Figure 3: Distribution by use of Loop Diuretic or MRA



The mean of hospital length of stay (LOS) for the full cohort was 7.0 days (Range = 1.0–55.0; SD = 6.8).

Due to outliers with prolonged LOS exceeding 30 days, the median LOS of 5.0 days was a better measure of central tendency. When performing the Kruskal-Wallis test to compare LOS among the different treatment groups, no statistically significant difference was found (p = 0.883) (Table 1).

Potential confounders influencing medical therapy selection included impaired renal function and hyperkalemia. The prevalence of impaired renal function was 131 patients (65.5%), while 39 patients (19.5%) had or developed hyperkalemia.

Patient disposition at discharge was also assessed. Discharge options included home, leaving against medical advice, hospice, home health services, or death. A total of 80.5% of the population was discharged home, while the fatality rate for the cohort was 9.0% (18 patients).

When taken as an isolated variable, the use of loop diuretics had a tendency for reduced lethality (Relative Risk = 0.50), though it was not statistically significant.

However, MRA use, when taken as an isolated variable, was associated with a statistically significant reduction in mortality (Relative Risk = 0.33). When comparing patient fatality rates, those who received no medications had a mortality rate of 16.7%, and those receiving either MRA or loop diuretics had a mortality rate of 10%. Patients receiving both treatments had the lowest fatality rate at 3.8%. Chi-square for trend analysis showed a statistically significant difference (p = 0.025) (Table 2).

TABLE #1: MEDIAN LOS (DAYS) BY TREATMENT GROUPS

No diuretic	Loop Diuretic	MRA	Both	p*
5.0	6.0	6.0	6.0	0.883

*Kruskall-Wallis Test

TABLE #2: FATALITY RATES BY TREATMENT GROUPS

No diuretic	Loop Diuretic	Both	p*
5/30 (16.7%)	9/90 (10.%)	3/79 (3.8%)	0.025

*X^2 for Trend

CONCLUSION

Understanding medication impact on LOS can assist in developing treatment strategies, with the goal of optimizing hospital resource use and improving patient outcomes overall.

Identifying any potential increase in adverse events may help clinicians balance the benefits and risks of each therapy approach.

Insights gained from medication comparisons can guide physicians in selecting treatments that minimize hospital length of stay, which could reduce healthcare costs and improve patient experiences.

Understanding adverse event profiles will allow for improved patient safety protocols and well-informed clinical decision-making.

The underuse of MRAs in HFrEF highlights the need for strategies to improve adherence to GDMT and optimize HF treatment.

The combination of loop diuretics and MRAs demonstrated a significant reduction in fatality rates among HFrEF patients, despite no observed difference in LOS between treatment groups. MRA use showed a reduction in lethality (relative risk of 0.33). Fatality rates were highest among patients receiving no medication (16.7%), intermediate among those receiving one medication (10.0%), and lowest among those receiving both treatments
The mean LOS was 7.0 days and no statistically significant difference in LOS among the groups

These findings highlight the importance of guideline-directed combination therapy in improving survival outcomes.

LIMITATIONS

This study is limited by its retrospective design, single-center setting, and relatively small sample size. Also, unmeasured confounding factors may affect the generalizability of the results. Some examples of these are: comorbidities, medications, socio-economic status, and cultural factors.

Furthermore, multicenter, prospective studies with larger cohorts would be necessary to validate these findings and optimize HF therapy /management.

Retrospective design limits causal inference; and potential biases from incomplete records.

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IRB PROTOCOL NO: 2410222067