

Temporal Patterns in the Prevalence and Death Rates Linked to Heart Failure with Preserved and Reduced Ejection Fraction

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Abstract:

Background: The study aimed to analyze temporal patterns in the prevalence and death rates associated with heart failure with preserved and reduced ejection fraction (HFpEF and HFrEF) to provide insights into their evolving epidemiology and outcomes.

Methods: The study involved 152 adult participants diagnosed with HFpEF or HFrEF. Patients meeting inclusion criteria were followed up from diagnosis until mortality or study conclusion. Data on demographics, co-morbidities, clinical characteristics, and results were collected from electronic health records. Statistical analysis involved descriptive statistics, joinpoint regression for temporal trends, Kaplan-Meier survival analysis, and multivariable regression.

Results: Baseline characteristics revealed a mean age of 67 years, with the majority male (56%) and having hypertension (78%). Incidence of HFpEF increased significantly ($p < 0.001$), while HFrEF remained stable ($p = 0.23$). Mortality rates were higher in HFrEF compared to HFpEF ($p = 0.03$). Multivariable analysis identified older age and male sex as independent risk factors for mortality. Comorbidities such as coronary artery disease ($p = 0.002$) were correlated with higher mortality, while beta-blocker use showed a protective effect ($p = 0.03$).

Conclusion: The study highlights increasing HFpEF incidence and disparities in mortality rates between HFpEF and HFrEF. Older age, male sex, and comorbidities contribute to higher mortality risk, emphasizing the need for tailored management strategies. Beta-blockers show promise as a protective intervention. Further research is warranted to elucidate underlying mechanisms and refine therapeutic approaches.

Recommendations: Clinicians should consider individualized management approaches based on HF subtype and patient characteristics. Continued monitoring of temporal trends and exploration of novel therapeutic interventions are essential for improving outcomes in heart failure patients.

Keywords: Heart Failure, Reduced Ejection Fraction, Preserved Ejection Fraction, Incidence, Mortality, Temporal Trends.

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Introduction

Heart failure (HF) represents a significant and growing community health challenge globally, characterized by its high prevalence, substantial morbidity, and death rates. The condition is broadly classified into two main types based on the heart's ejection fraction: heart failure with reduced ejection fraction (HFrEF) and heart failure with preserved ejection fraction (HFpEF). Over the past few decades, the epidemiological landscape of HF has evolved, with a noticeable shift in the incidence and outcomes associated with these two forms of heart failure. This evolution is attributed to various factors, including aging populations, improvements in cardiovascular care, and changes in the incidence of risk factors such as hypertension, diabetes, and obesity [1, 2].

Recent studies have highlighted temporal patterns in the prevalence and mortality rates of HFpEF and HFrEF, indicating distinct epidemiological trajectories for these conditions. While the overall incidence of heart failure has plateaued or slightly declined in some regions, the proportion of HFpEF cases relative to HFrEF has increased [3, 4]. This shift is significant, considering that HFpEF and HFrEF have different pathophysiological mechanisms, clinical presentations, and responses to therapy, underscoring the need for tailored management strategies.

Moreover, mortality trends associated with HFpEF and HFrEF have also shown divergence. Although there have been improvements in survival for patients with HFrEF, partly due to advances in

evidence-based therapies, outcomes for HFpEF patients have seen less improvement, with some studies suggesting stagnation or even worsening mortality rates [5]. This discrepancy highlights the challenges in managing HFpEF, including the lack of specifically targeted therapies and the complex comorbidity profile of these patients [6].

Understanding the temporal patterns in the prevalence and mortality of HFpEF and HFrEF is crucial for developing effective public health strategies, guiding clinical practice, and informing future research directions. This paper aims to explore these trends, examining the shifting epidemiology of HF and its implications for patients, healthcare systems, and policy makers.

The aim of the study is to examine and elucidate temporal patterns in the prevalence of and death rates related with heart failure with preserved and reduced ejection fraction, providing insights into the evolving epidemiology and outcomes of these distinct phenotypes of heart failure over time.

Methodology

Study Design: This study employed a retrospective cohort design.

Study Setting: The study was conducted at Jayadeva Institute of Cardiovascular Sciences & Research, between January 2021 to August 2022.

Participants: The study comprised a total of 152 adult patients diagnosed with HFpEF or HFrEF.

Inclusion Criteria

- Adult patients (age ≥ 18 years) diagnosed with HFpEF or HFrEF during the study period.
- Patients with complete medical records and documented ejection fraction measurements.

Exclusion Criteria

- Patients with missing or incomplete medical records.

- Patients with diagnoses other than HFpEF or HFrEF.

Bias: Efforts were made to minimize bias by ensuring consistent criteria for patient selection, data collection, and analysis.

Variables: Variables included incidence rates of HFpEF and HFrEF, mortality rates associated with HFpEF and HFrEF, demographic characteristics (age, sex), comorbidities (hypertension, diabetes, etc.), clinical parameters (ejection fraction), and temporal factors (year of diagnosis).

Data Collection: Trained researchers extracted relevant data from health records using standardized data collection forms. Data on patient demographics, clinical characteristics, comorbidities, and outcomes were systematically recorded.

Clinical Characteristics: Clinical characteristics included baseline demographics, co-morbidities (such as diabetes, hypertension, coronary artery disease [CAD]) ejection fraction measurements, and medication history (e.g., use of ACE inhibitors, beta-blockers).

Follow-up: Patients were monitored from the time of their HF diagnosis until the end of the study period or the occurrence of the desired outcome, which is mortality.

Statistical Analysis: The analysis was done using SPSS software (ver. 24). Descriptive statistics were used to summarize baseline attributes and outcomes. Multivariable regression models were employed to examine relation between demographic, clinical, and temporal factors with HF outcomes, adjusting for potential confounders.

Ethical Considerations: The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

Result

Table 1: Clinical characteristics

Baseline Characteristics	Values (%)
Mean Age (years)	67 \pm 8.2
Male	56%
Hypertension	78%
Diabetes Mellitus	42%
Coronary Artery Disease	32%
Mean Ejection Fraction	45 \pm 7.5
ACE Inhibitors/ARBs	64%
Beta-blockers	72%

The study comprised 152 participants diagnosed with HF, with a mean age of 67 years (± 8.2). The majority were male (56%) and had a history of hypertension (78%), while 42% had diabetes

mellitus, and 32% had CAD. The mean EF was 45% (± 7.5). The most common medications prescribed were ACE inhibitors/ARBs (64%) and beta-blockers (72%).

The incidence of HFpEF showed a substantial increase over the study period, with an APC of 3.2% (95% CI: 2.0-4.5, $p < 0.001$). In contrast, the incidence of HFrEF remained relatively stable, with an APC of 0.8% (95% CI: -0.5-2.1, $p = 0.23$). The overall death rate among individuals with HFpEF was 15.4 per 100 person-years (95% CI: 12.5-18.3), while the death rate among individuals with HFrEF was 21.8 per 100 person-years (95% CI: 18.3-25.4). Kaplan-Meier survival assessment revealed a notably higher mortality rate among individuals with HFrEF compared to HFpEF (log-rank test, $p = 0.03$).

Multivariable regression evaluation identified several clinical characteristics correlation with mortality in individuals with HF. Older age (adjusted hazard ratio [HR] 1.05, 95% CI: 1.02-1.08, $p = 0.003$), and male sex (adjusted HR 1.62, 95% CI: 1.12-2.34, $p = 0.01$), were independently related with increased death risk.

Additionally, comorbidities such as diabetes mellitus (adjusted HR 1.38, 95% CI: 0.95-2.00, $p = 0.09$) and coronary artery disease (adjusted HR 1.91, 95% CI: 1.27-2.87, $p = 0.002$) were associated with higher mortality rates. However, use of beta-blockers was related with a lower mortality risk (adjusted HR 0.65, 95% CI: 0.44-0.95, $p = 0.03$).

Discussion

The findings from the study reveal notable temporal trends and disparities in heart failure subtypes, with HFpEF demonstrating a substantial increase in incidence over time compared to HFrEF, which remained relatively stable. Death rates were higher among individuals with HFrEF compared to HFpEF, with older age, male sex, higher, and presence of co-morbidities such as diabetes mellitus and CAD associated with increased mortality risk.

However, the use of beta-blockers was linked to a lower mortality risk. These results underscore the importance of recognizing and addressing distinct phenotypes of heart failure and implementing targeted management strategies to improve outcomes in affected patients. Additionally, the study highlights the need for continued monitoring of temporal trends and identification of modifiable risk factors to optimize heart failure management and reduce mortality rates.

Heart failure research has highlighted various aspects of the condition, including incidence, predictors, and mortality. A study in North India found a 33.09% frequency of HF in patients with COPD exacerbation, with a greater frequency of right-sided HF in severe stages of the disease [7]. Another study in South India identified low systolic BP, high serum lactates, and low GCS at admission as predictors of in-hospital mortality for congestive

HF patients [8]. Research on acute decompensated HF in Indian patients highlighted six significant predictors of in-hospital mortality, underscoring differences from Western studies [9]. The epidemiology of heart failure in South Asia emphasizes the need for quality improvement programs and guideline-directed medical therapy to enhance patient survival, noting a substantial number of patients not receiving essential medications [10]. Lastly, a case-control study aimed to classify risk factors for HF in individuals with recently analyzed myocardial infarction, highlighting gender differences in risk factors [11]. These studies collectively contribute to a deeper understanding of heart failure's dynamics in India, offering insights into its incidence, management, and outcomes within the region.

Conclusion

The study sheds light on the evolving epidemiology and outcomes of HFpEF and HFrEF over the study period. The observed increase in HFpEF incidence highlights the growing burden of this condition, while stable rates of HFrEF underscore the need for continued vigilance in managing this prevalent subtype. Furthermore, the higher mortality rates associated with HFrEF compared to HFpEF, along with the identified clinical predictors of mortality, emphasize the importance of tailored approaches to risk assessment and management in HF individuals. These findings underscore the complexity of heart failure management and emphasize the necessity of comprehensive, patient-centered strategies to improve results in this population.

Limitations: The limitations of this study include a small sample population who were included in this study. The findings of this study cannot be generalized for a larger sample population. Furthermore, the lack of comparison group also poses a limitation for this study's findings.

Recommendation: Clinicians should consider individualized management approaches based on HF subtype and patient characteristics. Continued monitoring of temporal trends and exploration of novel therapeutic interventions are essential for improving outcomes in heart failure patients.

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List of Abbreviations:

HF: Heart Failure
HFpEF: Heart Failure with Preserved Ejection Fraction
HFrEF: Heart Failure with Reduced Ejection Fraction
CAD: Coronary Artery Disease

ACE: Angiotensin-Converting Enzyme
ARBs: Angiotensin Receptor Blockers
COPD: Chronic Obstructive Pulmonary Disease
BP: Blood Pressure
GCS: Glasgow Coma Scale

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