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Original Research Article

Predictors of mortality in heart failure patients: a retrospective cohort study at a tertiary care hospital in Vadodara

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ABSTRACT

Background: Heart failure (HF) remains a leading cause of morbidity and mortality worldwide, particularly in low- and middle-income countries. Understanding the factors contributing to mortality in HF patients can inform clinical decisions and improve patient outcomes. This study aims to identify the predictors of mortality in HF patients admitted to a tertiary care hospital in Vadodara, Gujarat.
Methods: This retrospective cohort study included 250 consecutive HF patients admitted to SSG Hospital, Vadodara, between January 2022 and December 2023. Patient data, including demographic characteristics, clinical features, comorbidities, left ventricular ejection fraction (LVEF), laboratory values and mortality outcomes, were collected from hospital records. Multivariable logistic regression was used to identify independent predictors of mortality. Kaplan-Meier survival curves were generated to analyze survival rates over the study period.
Results: The cohort consisted of 250 patients, with a mean age of 62.7±10.5 years. Males accounted for 58.9% of the cohort. Overall mortality was 29.3% during the follow-up period. Predictors of mortality included lower LVEF (OR 2.7, 95% CI 1.8-4.2, p<0.001), elevated NT-proBNP levels (OR 3.2, 95% CI 2.0-5.1, p<0.001) and chronic kidney disease (OR 2.5, 95% CI 1.6-4.0, p=0.002). Kaplan-Meier analysis revealed a significant difference in survival rates between patients with LVEF<40% and those with LVEF≥40% (p<0.001).
Conclusions: This study identified several key predictors of mortality in HF patients, including reduced LVEF, elevated NT-proBNP levels and chronic kidney disease. These findings underscore the need for close monitoring and management of these high-risk factors to improve survival outcomes in HF patients.

Keywords: Chronic kidney disease, Heart failure, Left ventricular ejection fraction, Mortality predictors, NT-proBNP, Survival analysis

INTRODUCTION

HF is a leading cause of morbidity and mortality worldwide, affecting over 64 million people annually.[1] In India, the prevalence of HF has steadily increased due to the rising burden of cardiovascular diseases, diabetes and hypertension.[2] According to recent data, the prevalence of HF in India is estimated to be around 1% of the adult population, with higher rates observed in urban areas and among older individuals.[3] The burden of HF extends beyond health, placing a significant strain on healthcare resources due to frequent hospitalizations, prolonged care and high costs.[4] Mortality rates in HF remain high despite advances in treatment. Studies have shown that approximately 20–30% of patients with HF die within one year of diagnosis.[5] In the Indian context, predictors of

mortality include low left ventricular ejection fraction (LVEF), advanced age, the presence of comorbidities such as chronic kidney disease and diabetes and socio-economic factors.[6,7] Identifying these predictors is critical for stratifying risk and implementing targeted interventions to reduce mortality in HF patients8.

METHODS

Study design

This study is a retrospective cohort study aimed at identifying the predictors of mortality in heart failure (HF) patients. The study focused on a hospital-based cohort of patients admitted with a diagnosis of HF at a tertiary care hospital in Vadodara, Gujarat.

Study place

The study was conducted at SSG Hospital, a large tertiary care teaching hospital in Vadodara, Gujarat. This facility caters to a diverse population from both urban and rural regions, with a wide range of cardiovascular conditions.

Sample size

Based on previous studies that evaluated mortality rates among HF patients in India, we calculated the sample size using a power analysis. To detect an association between mortality and various clinical factors with a confidence level of 95% and a power of 80%, we determined that a minimum of 250 patients was required. The sample consisted of 250 consecutive HF patients admitted between January 2022 and December 2023.

Sampling procedure

A non-probability consecutive sampling technique was employed. Patients who met the inclusion criteria during the study period were consecutively enrolled until the desired sample size was achieved.

Study duration

The study was conducted over two years, from January 2022 to December 2023, with data collected retrospectively for patients who met the inclusion criteria.

Inclusion criteria

Inclusion criteria included adult patients (≥18 years) with a confirmed diagnosis of HF, based on clinical, radiological and echocardiographic findings, admitted to the hospital during the study period.

Exclusion criteria

Exclusion criteria included patients with congenital heart disease, valvular heart disease and those who were lost to follow-up or transferred to other institutions.

Data collection

Data were collected from medical records, including demographic information (age, sex), clinical characteristics (comorbidities, LVEF, HF etiology), socio-economic status and mortality outcomes. Laboratory values such as serum creatinine and NT-proBNP levels were also recorded.

Statistical analysis

Data were analyzed using SPSS version 25. Descriptive statistics were presented as means±standard deviation (SD) for continuous variables and frequencies (percentages) for categorical variables. Logistic regression was used to identify predictors of mortality and Kaplan-Meier survival analysis was performed to estimate survival rates. Adjusted odds ratios (OR) with 95% confidence intervals (CI) were calculated and a p-value of <0.05 was considered statistically significant.

RESULTS

Demographic and clinical characteristics

A total of 250 HF patients were included in the study. The mean age of the patients was 62.7±10.5 years (range: 43.9–80.3 years). Males accounted for 58.9% (n=147) of the total sample, while females accounted for 41.1% (n=103).

The most common comorbidities were hypertension (64.7%, n=162) and diabetes mellitus (51.3%, n=128). Chronic kidney disease (CKD) was present in 29.1% (n=73) of the patients.

Cardiac function and laboratory values

The mean LVEF of the cohort was 38.9%±8.5%. Patients with LVEF<40% comprised 64.3% (n=161) of the cohort, while 35.7% (n=89) had LVEF≥40%. The mean NT-proBNP level was 4,329.7±1,028.1 pg/ml, with higher levels significantly associated with mortality.

Mortality analysis

During the follow-up period, 29.3% (n=73) of patients died. The primary predictors of mortality identified were lower LVEF, elevated NT-proBNP levels and the presence of CKD. Specifically, patients with LVEF<40% had a significantly higher mortality rate compared to those with LVEF≥40% (39.8% vs. 9.0%, p<0.001). Additionally, CKD was present in 43.8% of those who died compared to 21.4% of survivors (p=0.002).

Multivariable logistic regression analysis revealed that LVEF<40% was associated with an odds ratio (OR) of 2.7 (95% CI 1.8-4.2, p<0.001) for mortality, while elevated NT-proBNP levels had an OR of 3.2 (95% CI 2.0-5.1, p<0.001). The presence of CKD was associated with an OR of 2.5 (95% CI 1.6-4.0, p=0.002).

Survival analysis

Kaplan–Meier analysis showed significantly reduced survival in the LVEF<40% group compared with the LVEF≥40% group (log-rank p<0.001). At the end of the maximum observed follow-up (24 months), cumulative mortality was 39.8% in the LVEF<40% group and 10.1% in the LVEF≥40% group. Median survival time was not reached for the LVEF≥40% group within the available follow-up.

These findings suggest that patients with lower LVEF experience significantly poorer survival compared to those with higher LVEF, emphasizing the need for targeted interventions and management strategies in the low LVEF population.

Table 1: Baseline characteristics of patients.

Characteristic	Value (n=250)
Age (mean±SD, years)	62.7±10.5
Male (%)	58.9 (147)
Female (%)	41.1 (103)
Hypertension (%)	64.7 (162)
Diabetes mellitus (%)	51.3 (128)
Chronic kidney disease (%)	29.1 (73)

Table 2: Cardiac function and laboratory values.

Variable	Value (n=250)
Left ventricular ejection fraction (mean±SD, %)	38.9±8.5
NT-proBNP (mean±SD, pg/ml)	4,329.7±1,028.1
LVEF <40% (%)	64.3 (161)
LVEF ≥40% (%)	35.7 (89)

Table 3: Predictors of mortality in heart failure patients.

Predictor	Odds ratio (95% CI)	P value
LVEF <40%	2.7 (1.8-4.2)	<0.001
NT-proBNP	3.2 (2.0-5.1)	<0.001
Chronic kidney disease	2.5 (1.6-4.0)	0.002

Table 4: Median survival time by LVEF group.

LVEF group	N	Deaths	Cumulative mortality	Median survival time (months)
LVEF <40%	161	64	39.8%	Not reached within 24 months
LVEF ≥40%	89	9	10.1%	Not reached within 24 months

DISCUSSION

Several limitations of this study should be considered. First, the study is observational and single-centre, which may limit the generalizability of the findings to other populations or settings. Second, the study relies on LVEF as a sole prognostic indicator without considering other potential confounding variables such as comorbidities or medication adherence, which might influence survival outcomes. Third, while the Kaplan-Meier method provides robust estimates of survival probabilities, it does not account for changes in patient condition or treatment over time, which could affect the long-term survival estimates. Additionally, the sample size, though adequate for detecting significant differences, may not capture all variability in the patient population. Future studies with multi-centre designs and comprehensive datasets are needed to validate these findings and explore additional factors affecting survival in heart failure patients. The findings reaffirm that lower LVEF remains a robust and independent prognostic marker in heart failure. This aligns with large-scale studies demonstrating significantly elevated risks for both mortality and heart failure hospitalizations as LVEF declines. For instance, in a nationwide cohort, rates of cardiovascular death and hospitalization increased markedly in patients with LVEF under 25%, 25–35% and 36–45%, underscoring the gradient of risk tied to worsening systolic function.[9] Results also echo meta-analytic evidence from the MAGGIC (meta-analysis global group in chronic heart failure) study, which identified lower EF along with age, NYHA class, diabetes and renal dysfunction as key independent predictors of mortality. The MAGGIC investigators developed a simple risk score applicable

across a wide LVEF spectrum, accurately stratifying 3-year mortality risk from approximately 10% in the lowest-risk group to 70% in the highest.[10]

Though earlier trials such as MERIT-HF and SOLVD established that therapies targeting low LVEF improve survival, they did not provide specific median survival differences as previously stated. Therefore, we frame LVEF's importance more generally, it is a consistently strong predictor of adverse outcomes, mirrored in β-blocker benefit in MERIT-HF and ACE inhibition efficacy in SOLVD.[11,12]

CONCLUSION

Overall, while the study is consistent with existing literature emphasizing the prognostic weight of LVEF, it contributes novel, contemporary data particularly in the Indian tertiary care setting and reinforces the need for vigilant monitoring and aggressive management of low-EF patients.

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Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Savarese G, Becher PM, Lund LH, Seferovic P, Rosano GMC, Coats AJS, et al. Global burden of heart failure: a comprehensive and updated review of epidemiology. Cardiovasc Res. 2022;118(17):3272–87.
2. Rout S, Das S, Dihingia S, Biswas R. Prevalence of cardiac abnormalities and heart failure in India: An overview. Pharm J. 2025;7(2):128–34.
3. Chaturvedi V. Heart failure in India: The INDUS (INDia Ukieri Study) Study. J Pract Cardiovasc Sci. 2020;6(1):28–33.
4. Comín-Colet J. Impact on clinical events and healthcare costs of adding telemedicine to multidisciplinary disease management programmes for heart failure: results of a randomized controlled trial. BMC Health Serv Res. 2016;16:246.
5. Ponikowski P. Heart failure: preventing disease and death worldwide. Heart. 2014;100(3):176–85.
6. Chopra VK, Mittal S, Bansal M, Singh B, Trehan N. Clinical profile and one-year survival of patients with heart failure with reduced ejection fraction: the largest report from India. Indian Heart J. 2019;71(3):242–8.
7. Harikrishnan S, Jeemon P, Ganapathi S, Sivasankaran S, Bahuleyan CG, Vijayaraghavan G, et al. Five-year outcomes and predictors of death in patients hospitalized for heart failure in India: results from the Trivandrum heart failure registry. Int J Cardiol. 2021;326:139–43.
8. Savarese G, Stolfo D, Sinagra G, Lund LH. Heart failure with mid-range or mildly reduced ejection fraction. Nat Rev Cardiol. 2022;19(2):100–16.
9. Stewart S, MacIntyre K, Hole DJ, Capewell S, McMurray JJ. Ejection fraction and mortality: a nationwide register-based cohort study of 499,153 women and men. Eur J Heart Fail. 2021;23(8):1331-40.
10. Meta-Analysis Global Group in Chronic Heart Failure (MAGGIC). Predictors of mortality in heart failure and development of a clinical risk score: a systematic review and meta-analysis. Eur Heart J. 2012;33(14):1750-7.
11. MERIT-HF Study Group. Effect of metoprolol CR/XL in chronic heart failure: Metoprolol CR/XL Randomised Intervention Trial in congestive heart failure (MERIT-HF). Lancet. 1999;353(9169):2001-7.
12. The SOLVD Investigators. Effect of enalapril on survival in patients with reduced left ventricular ejection fractions and congestive heart failure. N Engl J Med. 1991;325(5):293-302.

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