

## ORIGINAL ARTICLE

# Prevalence and Outcomes of Left Ventricular Failure and Cardiomyopathy in a District Level Hospital

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## ABSTRACT

**Background:** The global prevalence and incidence of heart failure have been steadily rising, approaching epidemic levels, with a substantial impact on morbidity, mortality, and healthcare costs, and Bangladesh is experiencing a parallel rise in cardiovascular disease amid epidemiological transition. The purpose of the study is to determine the prevalence and clinical outcomes of left ventricular failure and cardiomyopathy in patients admitted to a tertiary care hospital. **Objectives:** The aim of the study was to determine the prevalence and clinical outcomes of left ventricular failure and cardiomyopathy in patients admitted to a tertiary care hospital. **Methods & Materials:** A retrospective study at the Department of Cardiology, Noakhali Medical College, Noakhali, Bangladesh (July 2024–June 2025) included 250 adults with left ventricular failure or cardiomyopathy, collecting demographics, clinical features, comorbidities, echocardiography, hospital stay, mortality, and complications; data were analyzed using SPSS v26 with descriptive statistics. **Results:** Among 250 patients (mean age 55.1 years; 70.4% male), left ventricular failure was most common (64.8%), dyspnoea was the predominant symptom (84%), and hypertension the leading comorbidity (52.8%). The mean LVEF was 38.9%, LV dilatation occurred in 52.8%, and the median hospital stay was 4 days. In-hospital mortality was 7.2%, with arrhythmias (10.4%), renal impairment (8.4%) and hyponatremia (15, 6.0%) being the major complications. **Conclusion:** Left ventricular failure and cardiomyopathy remain major causes of tertiary hospital admissions, presenting with typical heart failure features and comorbidities, and leading to measurable complications and mortality despite standard inpatient management.

**Keywords:** Prevalence, Outcomes, Left Ventricular Failure, Cardiomyopathy

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## INTRODUCTION

The global prevalence and incidence of heart failure have been steadily rising, approaching epidemic levels, as evidenced by the continuous increase in deaths attributable to heart failure and the escalating economic burden associated with its management [1]. According to the Global Burden of Disease Study 2019, approximately 64 million individuals were affected by heart failure worldwide in 2019, resulting in over 3 million deaths. Bangladesh is undergoing an epidemiological transition, with a decline in infectious diseases alongside increased life expectancy and widespread lifestyle changes, leading to a surge in non-communicable diseases [1]. Cardiovascular disorders have now become one of the leading causes of morbidity and mortality in the country. Heart failure, in particular, represents a significant and growing health challenge as the population ages. It is defined as a clinical syndrome in which the heart fails to adequately meet the circulatory demands of the body and is associated with substantial morbidity, mortality, and reduced quality of life [2]. Co-morbid conditions frequently coexist with heart failure, further increasing morbidity and mortality and exacerbating

the decline in quality of life [3]. Hospitalization rates are notably higher among patients with associated co-morbidities.

Heart failure arises as a complex clinical syndrome secondary to structural and/or functional abnormalities of the heart, either inherited or acquired, that impair the ability of the left ventricle to fill or eject blood effectively [1]. Cardiomyopathies are a heterogeneous group of myocardial diseases characterized by mechanical and/or electrical dysfunction, which may exhibit abnormal ventricular hypertrophy or dilatation and arise from a variety of causes, often with a genetic basis [4]. Dilated cardiomyopathy (DCM) represents a subgroup of myocardial disorders marked by ventricular dilatation and depressed contractility in the absence of abnormal loading conditions, such as significant hypertension or valvular heart disease, or ischemic heart disease sufficient to cause global systolic impairment [5,6]. Idiopathic dilated cardiomyopathy (IDC) is a primary myocardial disease of unknown origin, defined by left ventricular or biventricular dilatation and impaired myocardial contractility [7]. IDC is considerably more prevalent than other major forms of

cardiomyopathy, including hypertrophic, restrictive, and arrhythmogenic right ventricular cardiomyopathy.

The clinical manifestations of cardiomyopathy and heart failure at diagnosis vary widely among individuals; some patients may be asymptomatic, while others present with progressive refractory heart failure. Reported annual incidence rates, depending on the diagnostic criteria employed, range between 5 and 8 cases per 100,000 population [8-11]. In patients admitted to tertiary care hospitals, cardiomyopathy encompasses a spectrum of myocardial disorders that profoundly affect cardiac function and clinical outcomes [11]. It is a major cause of heart failure, arrhythmias, and sudden cardiac death [12,13]. Signs and symptoms associated with heart failure may not only arise directly from cardiac dysfunction but also result from abnormalities in distant organs, such as the kidneys or skeletal muscles, suggesting systemic processes, including neurohormonal activation, play a significant role. Critically ill patients are particularly susceptible to hemodynamic instability, which may progress to multi-organ dysfunction, often following a period of physiological deterioration. Hemodynamic monitoring guides medical interventions aimed at preventing or managing organ failure, thereby reducing morbidity and mortality. Left ventricular diastolic dysfunction (LVDD) is frequently under-recognized compared to systolic dysfunction (LVSD), though it may coexist with LVSD or occur in patients with preserved systolic function (Heart Failure with Preserved Ejection Fraction, HFpEF) [14]. LVDD is an independent predictor of increased mortality in intensive care settings and is associated with delayed weaning from mechanical ventilation [15-20].

Despite the growing recognition of heart failure and cardiomyopathy as major contributors to morbidity and mortality, there remains limited data on their prevalence, clinical characteristics, and in-hospital outcomes in the Bangladeshi population. Most existing studies focus on Western or industrialized countries, where ischemic heart disease predominates, while evidence from South Asian populations, where the spectrum of cardiomyopathy and associated comorbidities may differ, is scarce. Furthermore, variations in clinical presentation, echocardiographic findings, and hospital outcomes among patients admitted to tertiary care hospitals have not been thoroughly explored in this region. Understanding these patterns is essential for guiding clinical management, optimizing resource allocation, and improving patient outcomes in local healthcare settings. The purpose of the study is to determine the prevalence and clinical outcomes of left ventricular failure and cardiomyopathy in patients admitted to a tertiary care hospital.

## OBJECTIVES

To determine the prevalence and clinical outcomes of left ventricular failure and cardiomyopathy in patients admitted to a tertiary care hospital.

## METHODS & MATERIALS

This retrospective observational study was conducted at the Department of Cardiology, Noakhali Medical College, Noakhali, Bangladesh, from July 2024 to June 2025. A total of 250 patients diagnosed with left ventricular failure or cardiomyopathy were included, selected according to specific inclusion and exclusion criteria. Data were collected from electronic medical records to evaluate the prevalence, clinical characteristics, and in-hospital outcomes of these patients.

### Inclusion Criteria:

- Adult patients aged 18 years and above.
- Admitted with a primary or secondary diagnosis of left ventricular failure (LVF) or cardiomyopathy, including ischemic, dilated, hypertrophic, or other specified types.
- Availability of a complete echocardiogram report during the hospital admission.

### Exclusion Criteria:

- Patients with isolated right heart failure without left ventricular involvement.
- Patients with significant valvular heart disease as the primary cause of cardiac dysfunction.
- Patients with incomplete medical records regarding key clinical data, diagnosis, or hospital outcomes.

Demographic and clinical data, including age, sex, presenting symptoms, and comorbidities such as hypertension, diabetes mellitus, and ischemic heart disease, were systematically recorded. Echocardiographic assessment was performed to evaluate left ventricular ejection fraction (LVEF) and ventricular dilatation, providing insight into the structural and functional cardiac status. Hospital course variables, including length of stay, in-hospital mortality, and complications such as arrhythmias and renal impairment, were also documented. All data were entered into a standardized proforma and analyzed using IBM SPSS Statistics version 26.0. Continuous variables were expressed as mean  $\pm$  standard deviation (SD) and median where appropriate, while categorical variables were summarized as frequencies and percentages.

## RESULTS

Table I presents the demographic distribution of the 250 study participants. Most patients were aged 51–70 years (115, 46.0%), followed by 31–50 years (78, 31.2%), with a mean age of  $55.1 \pm 14.1$  years. Male patients predominated in the cohort (176, 70.4%), while females accounted for 74 (29.6%).

**Table – I: Demographic Characteristics of the Study Population (n = 250)**

Characteristics	Frequency (n)	Percentage (%)
Age (years)	18–30	4.8
	31–50	31.2
	51–70	46.0
	>70	18.0
	Mean $\pm$ SD	55.1 $\pm$ 14.1
Sex	Male	70.4
	Female	29.6

Table II summarizes the primary diagnosis, presenting symptoms, and comorbidities of the participants. Left ventricular failure was the most common primary diagnosis (162, 64.8%), followed by ischemic cardiomyopathy (76, 30.4%) and other cardiomyopathies (12, 4.8%). Dyspnoea was the predominant presenting symptom (210, 84.0%), followed by fatigue (165, 66.0%), peripheral edema (90, 36.0%), and palpitations (60, 24.0%). Hypertension was the most prevalent comorbidity (132, 52.8%), followed by diabetes mellitus (88, 35.2%) and ischemic heart disease (77, 30.8%).

**Table – II: Prevalence, Clinical Features, and Comorbidities of Study Participants (n = 250)**

Category	Number of Patients	Percentage (%)
Primary Diagnosis	Left Ventricular Failure (LVF)	162
	Ischemic Cardiomyopathy	76
	Other Cardiomyopathy	12
Presenting Symptoms	Dyspnoea	210
	Fatigue	165
	Peripheral edema	90
	Palpitations	60
Comorbidities	Hypertension	132
	Diabetes mellitus	88
	Ischemic heart disease	77

Table – III describes the echocardiographic profile and hospitalization details. The mean left ventricular ejection fraction (LVEF) was  $38.9 \pm 11.5\%$ , with lower values in ischemic cardiomyopathy ( $35.4 \pm 7.8\%$ ) compared to other cardiomyopathies ( $42.6 \pm 9.2\%$ ). Left ventricular dilatation was present in 132 patients (52.8%). The mean hospital stay was  $6.23 \pm 7.12$  days, with a median of 4 days.

**Table III: Echocardiographic Parameters and Hospital Stay of the Study Population (n = 250)**

Parameter	Value
Left Ventricular Ejection Fraction (LVEF, %)	$38.9 \pm 11.5$
LVEF in Ischemic Cardiomyopathy	$35.4 \pm 7.8$
LVEF in Other Cardiomyopathy	$42.6 \pm 9.2$
Left Ventricular Dilatation	132 (52.8%)
Length of Hospital Stay (days)	$6.23 \pm 7.12$ (Median: 4)

Table IV presents the in-hospital mortality and complications. Overall, in-hospital mortality was 7.2% (18 patients), with similar rates in the left ventricular failure subgroup (12, 7.4%) and cardiomyopathy subgroup (6, 7.1%). Among complications, arrhythmias were most common (26, 10.4%), followed by renal impairment (21, 8.4%) and hyponatremia (15, 6.0%).

**Table – IV: In-Hospital Mortality and Complications of the Study Participants (n = 250)**

Parameter	Number	Percentage (%)
Mortality	In-hospital mortality	18
	Mortality in LVF group	12
	Mortality in cardiomyopathy	6
Complications	Renal Impairment	21
	Arrhythmias	26
	Hyponatremia	15

## DISCUSSION

Left ventricular failure and cardiomyopathy are prevalent cardiovascular conditions that contribute substantially to morbidity and mortality, particularly in aging populations. Left ventricular ejection fraction (LVEF) and ventricular dilatation serve as key markers of cardiac structural and functional compromise, reflecting the severity of disease and predicting clinical outcomes. The findings of this study demonstrate that left ventricular failure was the most common primary diagnosis, with ischemic cardiomyopathy and other cardiomyopathies also contributing significantly. Patients frequently presented with dyspnoea, fatigue, peripheral edema, and palpitations, while comorbidities such as hypertension, diabetes mellitus, and ischemic heart disease were common. Echocardiographic assessment revealed reduced LVEF and ventricular dilatation in a substantial proportion of patients, and in-hospital outcomes included complications such as arrhythmias and renal impairment, with an overall mortality rate of 7.2%. These results highlight

the clinical significance of early recognition and comprehensive evaluation of left ventricular failure and cardiomyopathy in tertiary care settings to optimize patient management and improve outcomes.

The demographic profile of the present study indicates that left ventricular failure and cardiomyopathy predominantly affect middle-aged to older adults, with 46.0% of patients aged 51–70 years and a mean age of  $55.1 \pm 14.1$  years. These findings align with previous reports, as Rahman et al. observed that 60% of heart failure patients were aged 51–70 years, while Wahiduzzaman et al. and Shah et al. documented mean ages of  $55.18 \pm 12.42$  years and  $57.8 \pm 15.14$  years, respectively, confirming that heart failure is most common among older adults in tertiary care settings [21–23]. The study also revealed a clear male predominance (70.4%), consistent with the observations of Rahman et al., Wahiduzzaman et al., and Shah et al., all of whom reported higher hospitalization rates among men compared to women [21–23]. Overall, the age

and sex distribution in this cohort reflects a consistent demographic trend for patients presenting with left ventricular dysfunction.

Left ventricular failure was the most common primary diagnosis in this study (64.8%), followed by ischemic cardiomyopathy (30.4%). Dyspnoea (84.0%), fatigue (66.0%), and peripheral edema (36.0%) were the predominant presenting symptoms. Hypertension (52.8%), diabetes mellitus (35.2%), and ischemic heart disease (30.8%) were the most prevalent comorbidities. These findings are supported by previous studies: Kabiruzzaman et al. reported ischemic heart disease as the leading etiology among heart failure inpatients, with nearly half of patients also hypertensive and a substantial proportion diabetic [24]. Similarly, Alam et al. found ischemic cardiomyopathy to be the most frequent cause of heart failure, with almost half of the cohort hypertensive and a significant portion affected by ischemic heart disease [25]. Shah et al. also documented a high burden of ischemic pathology accompanied by hypertension and diabetes [23]. Collectively, these studies reinforce that ischemic pathology, often with coexisting hypertension and diabetes, remains the predominant cause of heart failure and cardiomyopathy in tertiary care settings, typically presenting with classic symptoms of congestive cardiac dysfunction.

The mean left ventricular ejection fraction (LVEF) of the study population was  $38.9 \pm 11.5\%$ , with lower values among ischemic cardiomyopathy patients ( $35.4 \pm 7.8\%$ ) compared to other cardiomyopathy types ( $42.6 \pm 9.2\%$ ). Left ventricular dilatation was observed in more than half of the participants (132; 52.8%). The mean hospital stay was  $6.23 \pm 7.12$  days, with a median of 4 days. These echocardiographic and hospitalization findings are consistent with prior studies. Momenuzzaman et al. reported a median baseline LVEF of 35% (IQR 30–40%) in 454 heart failure patients in Dhaka, closely matching the present cohort, and noted that nearly 40% of patients experienced LVEF recovery over time, highlighting the dynamic nature of ventricular remodeling [26]. Kumar et al., in a long-term prospective registry of 500 non-ischemic HFrEF patients, found that 27.4% achieved significant LVEF improvement, with lower recovery rates among patients with more dilated ventricles, supporting the clinical relevance of the 52.8% left ventricular dilatation observed in this study [27]. These data underscore that reduced LVEF and ventricular dilatation are common and are important predictors of hospitalization outcomes and potential functional recovery.

The overall in-hospital mortality in this study was 7.2%, with similar rates in the left ventricular failure (7.4%) and cardiomyopathy (7.1%) subgroups. Arrhythmias were the most frequent complication (26 patients; 10.4%), followed by renal impairment (21 patients; 8.4%) and hyponatremia (15, 6.0%). These outcomes are comparable to prior reports in similar clinical settings. Beri et al. documented an in-hospital mortality of 8.8% among heart failure patients, with arrhythmias as the most common complication (24.4%) and renal impairment in 13.4% of cases, reflecting a similar pattern in tertiary or resource-limited settings [28]. Likewise, Ide et al., in the large-scale JROAD-HF registry, reported an in-hospital mortality of 7.7%, closely matching the 7.2% observed here [29]. Overall, these results suggest that while most patients survive hospitalization, a substantial proportion experience cardiovascular or renal complications, highlighting the need for careful monitoring and timely management of

arrhythmias and renal impairment in patients with left ventricular failure and cardiomyopathy.

## LIMITATIONS OF THE STUDY

This study had several limitations:

- Findings may not be generalizable due to the specific population studied.
- The study's limited geographic scope may introduce sample bias, potentially affecting the broader applicability of the findings.

## CONCLUSION

This study shows that left ventricular failure and cardiomyopathy are significant contributors to hospital admissions in tertiary care, predominantly affecting middle-aged and older adults with a higher proportion of male patients. Most presented with classical heart failure symptoms, particularly dyspnoea, and commonly had comorbidities such as hypertension and diabetes. Echocardiography revealed reduced cardiac function in many patients, often accompanied by ventricular dilatation and a moderate hospital stay. Mortality and complications, including arrhythmias, renal impairment and hyponatremia, were notable but within expected clinical ranges, emphasizing the need for early recognition, comprehensive inpatient management, and continued optimization of care for this population.

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**Conflicts of interest:** There are no conflicts of interest.

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

## REFERENCES

- Ministry of Health and Family Welfare, Government of the People's Republic of Bangladesh. Strategic plan for surveillance and prevention of noncommunicable diseases in Bangladesh 2007–2010. Dhaka: Ministry of Health and Family Welfare; 2007.
- McMurray JJ, Adamopoulos S, Anker SD, Auricchio A, Böhm M, Dickstein K, Falk V, Filippatos G, Fonseca C, Gomez-Sanchez MA, Jaarsma T. Corrigendum to: ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure 2012 [Eur Heart J 2012; 33: 1787–1847, doi: 10.1093/eurheartj/ehs104. European Heart Journal. 2013 Jan 7;34(2):158-.
- Braunstein JB, Anderson GF, Gerstenblith G, Weller W, Niefeld M, Herbert R, Wu AW. Noncardiac comorbidity increases preventable hospitalizations and mortality among Medicare beneficiaries with chronic heart failure. *Journal of the American College of Cardiology*. 2003 Oct 1;42(7):1226-33.
- Maron BJ, Towbin JA, Thiene G, Antzelevitch C, Corrado D, Arnett D, Moss AJ, Seidman CE, Young JB. Contemporary definitions and classification of the cardiomyopathies: an American Heart Association scientific statement from the council on clinical cardiology, heart failure and transplantation committee; quality of care and outcomes research and functional genomics and translational biology interdisciplinary working groups; and council on epidemiology and prevention. *Circulation*. 2006 Apr 11;113(14):1807-16.
- Kaur H, Khetarpal R, Aggarwal S. Dilated cardiomyopathy: an anaesthetic challenge. *Journal of Clinical and Diagnostic Research: JCDR*. 2013 Jun 1;7(6):1174.
- Richardson P. Report of the 1995 World Health Organization/International Society and Federation of Cardiology Task Force on the definition and classification of cardiomyopathies. *Circulation*. 1996; 93:841-2.
- Report of the WHO/ISFC task force on the definition and classification of cardiomyopathies. *Br Heart J*. 1980;44(6):672–3.

8. Williams DG, Olsen EG. Prevalence of overt dilated cardiomyopathy in two regions of England. *Heart*. 1985 Aug 1;54(2):153-5.
9. Gillum RF. Idiopathic cardiomyopathy in the United States, 1970–1982. *American heart journal*. 1986 Apr 1;111(4):752-5.
10. Codd MB, Sugrue DD, Gersh BJ, Melton 3rd LJ. Epidemiology of idiopathic dilated and hypertrophic cardiomyopathy. A population-based study in Olmsted County, Minnesota, 1975-1984. *Circulation*. 1989 Sep;80(3):564-72.
11. Bagger JP, Baandrup U, Rasmussen K, Møller M, Vesterlund T. Cardiomyopathy in western Denmark. *Heart*. 1984 Sep 1;52(3):327-31.
12. Kuriachan VP, Sumner GL, Mitchell LB. Sudden cardiac death. *Current problems in cardiology*. 2015 Apr 1;40(4):133-200.
13. Ciarambino T, Menna G, Sansone G, Giordano M. Cardiomyopathies: an overview. *International journal of molecular sciences*. 2021 Jul 19;22(14):7722.
14. Huygh J, Peeters Y, Bernards J, Malbrain ML. Hemodynamic monitoring in the critically ill: an overview of current cardiac output monitoring methods. *F1000Research*. 2016 Dec 16;5: F1000-acuity.
15. Gonzalez C, Begot E, Dalmay F, Pichon N, Francois B, Fedou AL, Chapellas C, Galy A, Mancía C, Daix T, Vignon P. Prognostic impact of left ventricular diastolic function in patients with septic shock. *Annals of Intensive Care*. 2016 Apr 21;6(1):36.
16. Landesberg G, Gilon D, Meroz Y, Georgieva M, Levin PD, Goodman S, Avidan A, Beeri R, Weissman C, Jaffe AS, Sprung CL. Diastolic dysfunction and mortality in severe sepsis and septic shock. *European heart journal*. 2012 Apr 1;33(7):895-903.
17. Papanikolaou J, Makris D, Saranteas T, Karakitsos D, Zintzaras E, Karabinis A, Kostopanagiotou G, Zakynthinos E. New insights into weaning from mechanical ventilation: left ventricular diastolic dysfunction is a key player. *Intensive care medicine*. 2011 Dec;37(12):1976-85.
18. Moschietto S, Doyen D, Grech L, Dellamonica J, Hyvernats H, Bernardin G. Transthoracic echocardiography with Doppler tissue imaging predicts weaning failure from mechanical ventilation: evolution of the left ventricle relaxation rate during a spontaneous breathing trial is the key factor in weaning outcome. *Critical care*. 2012 May 14;16(3): R81.
19. Amarja H, Bhuvana K, Sriram S. Prospective observational study on evaluation of cardiac dysfunction induced during the weaning process. *Indian Journal of Critical Care Medicine: Peer-reviewed, Official Publication of Indian Society of Critical Care Medicine*. 2019 Jan;23(1):15.
20. Sanfilippo F, Di Falco D, Noto A, Santonocito C, Morelli A, Bignami E, Scolletta S, Vieillard-Baron A, Astuto M. Association of weaning failure from mechanical ventilation with transthoracic echocardiography parameters: a systematic review and meta-analysis. *British Journal of Anaesthesia*. 2021 Jan 1;126(1):319-30.
21. Rahman MT, Ahmed R, Alam R, Hossain MA, Hossain MS, Hossain MA, Goni MN, Rahman MS, Hoque MF, Sarker M. Assessment of Heart Failure Patients in a Tertiary Care Hospital: A Retrospective Study. *Bangladesh Heart Journal*. 2023 Jul 8;38(1):63-9.
22. Wahiduzzaman M, Lita AI, Kumar DU, Dhar R. Association of Heart Failure Admission with Age, Sex, Risk Factors and Co-Morbidities in Tertiary Care Hospital in Bangladesh. *Saudi J Med*. 2024;9(2):55-60.
23. Shah UA, Rashid A, Mufti SA, Khan S, Qazi ZM, Masoom I, Khuja ZA, Bukhari I, Kakroo SA, Rather H. Clinical profile, treatment patterns and one-year outcome of heart failure patients admitted in tertiary care hospital of North India. *J Family Med Prim Care*. 2024 Aug;13(8):3225-3230.
24. Kabiruzzaman M, Malik FN, Ahmed N, Badiuzzaman M, Choudhury SR, Haque T, Rahman H, Ahmed MN, Banik D, Khan MA, Dutta AK. Burden of heart failure patients in a tertiary level cardiac hospital. *Journal of Bangladesh College of Physicians and Surgeons*. 2010;28(1):24-9.
25. Alam N, Majumder AA. Study on Heart Failure Patients Admitted in National Institute of Cardiovascular Diseases. *Cardiovascular Journal*. 2021 Apr 15;13(2):172-6.
26. Momenuzzaman NAM, Haque MA, Nahar S, Shama A, Habibi H, Mostafa MG. Functional and Quality of Life Outcomes in Heart Failure Patients at a Specialized Heart Failure Clinic in Dhaka, Bangladesh. *Cureus*. 2025 Jun 4;17(6): e85325.
27. Kumar S, Negi PC, Asotra S, Kumar J, Merwah R, Sharma R, Kumar R, Bhardwaj V, Thakur PS. Incidence and determinants of left ventricular ejection fraction (LVEF) recovery in heart failure with reduced ejection fraction (HFrEF) of non-ischemic aetiology; a hospital-based prospective longitudinal registry study. *Indian Heart J*. 2025 May-Jun;77(3):188-192.
28. Beri B, Fanta K, Bekele F, Bedada W. Management, clinical outcomes, and its predictors among heart failure patients admitted to tertiary care hospitals in Ethiopia: prospective observational study. *BMC Cardiovasc Disord*. 2023 Jan 6;23(1):4.
29. Ide T, Kaku H, Matsushima S, Tohyama T, Enzan N, Funakoshi K, Sumita Y, Nakai M, Nishimura K, Miyamoto Y, Tsuchihashi-Makaya M. Clinical characteristics and outcomes of hospitalized patients with heart failure from the large-scale Japanese Registry of Acute Decompensated Heart Failure (JROADHF). *Circulation Journal*. 2021 Aug 25;85(9):1438-50.