Clinical Trajectories and Outcomes of Acute Heart Failure in Internal Medicine: A Real-World Single-Centre Study

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ABSTRACT

Purpose: To analyze the clinical characteristics and outcomes of patients with acute heart failure (AHF) admitted to an internal medicine department (IMD), with a focus on their trajectories, risk factors, and rehospitalisation/mortality rate.
Methods: This retrospective cohort study included 410 hospitalisations (280 patients; 28% readmissions) for AHF during 2023. Diagnosis was validated using the European Society of Cardiology age-specific NT-proBNP thresholds and echocardiographic criteria. Baseline clinical and laboratory data were analyzed, prognostic markers were identified, and a risk algorithm was developed.
Results: Mean patient age was 82 years (54% women). Most cases involved nonischemic etiology (80%) and HF with preserved ejection fraction (HFpEF, 69%). Frequent comorbidities included hypertension (85%), diabetes (45%), atrial fibrillation (44%), and multiple non-cardiac conditions. In-hospital mortality was 19.6%; 30-day readmission was 9.9%. Three clinical trajectories (index/first hospitalisation) were identified: single admission (n: 169), rehospitalisation (with/without death) (n: 73), and in-hospital death (n: 38). Prognostic markers included advanced age, elevated NT-proBNP, renal dysfunction, anemia, and non-cardiac cause of HF decompensation.
Conclusions: This elderly IMD-HF cohort, mainly female and multimorbid, showed high HFpEF prevalence and adverse outcomes. NT-proBNP, renal function, haemoglobin, and non-cardiac causes of HF decompensation were key prognostic indicators.

KEYWORDS

heart failure; hospitalization; rehospitalization; mortality; NT-proBNP

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INTRODUCTION

Heart failure (HF) remains one of the most pressing and complex challenges in modern cardiovascular medicine, with an estimated prevalence of 1–2% among the adult population in developed countries (1, 2). This condition not only imposes a substantial burden on healthcare systems but also significantly affects patients' quality of life and long-term prognosis. Within this spectrum, acute heart failure (AHF) stands out as a leading cause of hospital admissions among individuals aged 65 years and older – a population frequently characterized by the presence of multiple comorbidities and increased clinical vulnerability (3, 4).

In clinical practice, the setting of hospitalisation plays a pivotal role in shaping patient outcomes. Patients admitted to internal medicine departments (IMDs) tend to be older, exhibit greater frailty, and present with a higher burden of chronic illnesses compared to those managed in specialized cardiology units (5–7). These differences underscore the importance of tailoring therapeutic strategies and care pathways to the unique needs of this population.

This study presents a single-centre, retrospective descriptive analysis of patients admitted with AHF to an IMD. Our objectives are twofold: first, to characterize the baseline clinical conditions of these patients; and second, to delineate three distinct clinical trajectories emerging after the initial (index) hospitalization. Through this approach, we aim to contribute to a more nuanced understanding of AHF management in internal medicine settings and highlight potential avenues for improving care delivery in this high-risk group.

METHODS

OBJECTIVES

The primary objectives of this study were twofold. First, to describe the baseline demographic characteristics and clinical profiles of patients with acute AHF who were discharged from our IMD following decompensation, classified either as primary (cardiac-related cause of decompensation) or secondary (non-cardiac cause of decompensation). Second, to identify and describe three distinct clinical trajectories observed over the course of one year following the index (first) hospitalisation: (1) patients who experienced only a single hospitalization, (2) patients who underwent rehospitalisation, and (3) patients who died during their initial hospital stay

STUDY DESIGN AND ETHICAL ISSUES

This study is a retrospective, single-centre, observational analysis. Prior to its initiation, approval was obtained from the hospital's clinical research committee. All clinical data were handled in strict compliance with patient confidentiality protocols and ethical standards, in accordance with the principles outlined in the Declaration of Helsinki. Informed consent was waived in accordance with national legislation and institutional policies governing retrospective research.

CHARACTERIZATION OF THE URBAN AREA AND THE HEALTHCARE CENTER

The Hospital Municipal de Badalona (bsa.cat) is an adult university hospital located in Badalona, on the outskirts of Barcelona (Catalonia, Spain), approximately 11 km from the city center (calcularruta.com/barcelona-badalona.html). Badalona has a population of 219,786 inhabitants as of 2025, of whom about 162,000 are adults (≥18 years) (bdeex.com/es/naselenie/spain/Badalona).

The hospital offers a wide range of specialties, including cardiology and internal medicine. The IMD has a capacity of 50–70 inpatient beds and registered 2,168 hospitalizations in 2023 and 2,157 in 2024.

CATEGORIZATION OF PATIENTS

The study analyzed all patients discharged with AHF from our IMD during 2023 (January 1 to December 31), including both primary (cardiac-related) and secondary (non-cardiac-related) decompensation causes. Case selection involved reviewing all discharge summaries, encompassing both single hospitalizations and readmissions. All data was obtained from the hospital's clinical information system.

HEART FAILURE DIAGNOSIS

A total of 567 hospitalizations were reviewed, from which 410 confirmed discharges with a diagnosis of AHF were identified. Diagnostic validation required a positive clinical assessment, jointly conducted by specialists in internal medicine and cardiology. In addition, measurement of left ventricular ejection fraction (LVEF) was mandatory, and baseline N-terminal pro B-type natriuretic peptide (NT-proBNP) levels had to meet the age-specific diagnostic thresholds established by the European Society of Cardiology for AHF (see Figure 1).

COLLECTED INFORMATION

A total of 280 patients accounted for 410 hospitalizations, including readmissions, allowing for baseline demographic analysis. Data collected included sex, age, body mass index (BMI), HF etiology (ischemic or non-ischemic), LVEF, HF phenotype, and heart rhythm categorized as sinus rhythm, atrial fibrillation (AF), or pacemaker-dependent rhythm. Data was also collected on comorbidities including hypertension, diabetes mellitus, chronic obstructive pulmonary disease (COPD), sleep apnea syndrome, active cancer, hypothyroidism, stroke, and chronic kidney disease (CKD). To recognize each condition, the use of specific treatments was verified. Stroke was only included if the patient had previous hospitalization for this condition. Pre-existing CKD required an estimated glomerular filtration rate ≤30 mL/min/1.73 m² during a stable phase for inclusion. This analysis also incorporated admission values of blood pressure, NT-proBNP, haemoglobin, creatinine, and eGFR, along with differentiation of HF cause of decompensation (cardiac and non-cardiac)

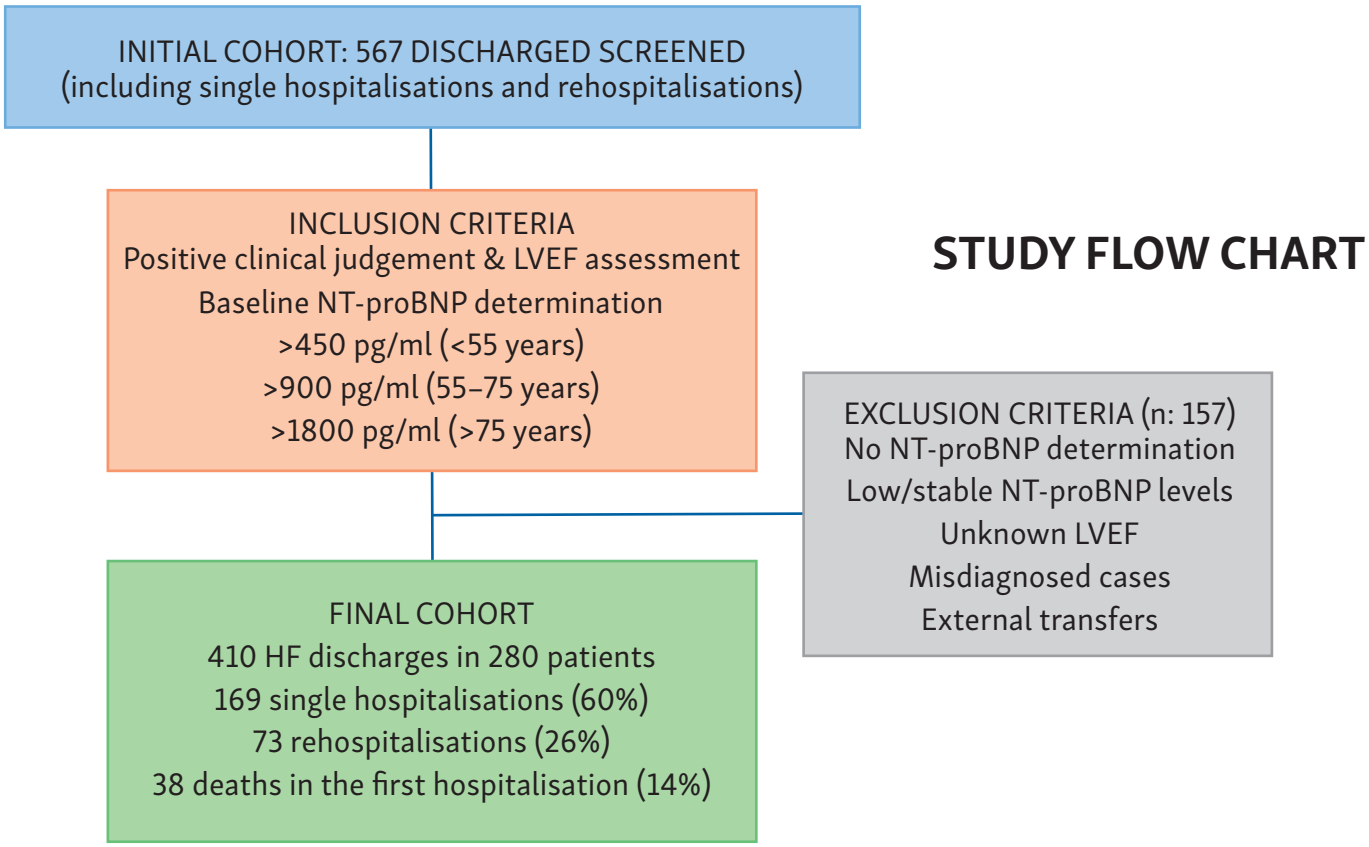


Fig. 1 Study flow chart.
A total of 567 hospitalizations were initially classified as heart failure (HF). After applying clinical criteria, assessing left ventricular ejection fraction (LVEF), and measuring peptide levels in accordance with European Society of Cardiology guidelines, 410 hospitalizations were confirmed as HF, corresponding to 280 individual patients (including readmissions).

STATISTICAL ANALYSIS

All categorical variables are presented as absolute numbers (n) and percentages (%), while continuous variables are expressed as mean ± standard deviation (SD) and range. NT-proBNP values, due to their significant skewness and dispersion, are reported as median and interquartile range (IQR, 25–75%). To compare qualitative data between groups, the Chi-square test (Pearson's χ^2) was used for categorical variables. For continuous variables, the Kruskal-Wallis test was applied to non-normally distributed data (screwed variables), while the ANOVA and Student's t-test were used for normally distributed variables.

Odds ratios (OR) with 95% confidence intervals (95% CI) were calculated, and all statistical tests were two-sided, considering a p-value <0.05 as statistically significant. All statistical analyses were performed using Microsoft Excel 2021®. Multivariate analysis was not performed.

FOLLOW-UP AND CENSORING

Index hospitalisation was defined as the first admission for acute HF during the study period. For in-hospital mortality, time zero was the admission date, and patients were followed until discharge. For post-discharge outcomes, time zero was set at the discharge date. Patients were followed until administrative censoring on July 31, 2024. Readmissions within 30 and 100 days were assessed among patients who were alive at discharge and measured over fixed windows of 30 and 100 days from the discharge date. Mortality at 1-, 3-, and 6-months post-discharge was evaluated using fixed windows of 30, 90, and 180 days, or corresponding calendar months. Survivors without events were right censored on July 31, 2024.

RESULTS

BASELINE DEMOGRAPHICS

During 2023, our IMD recorded 410 AHF hospitalisations involving 280 patients (Table 1). The cause of HF decompensation was determined by identifying the initial or most significant contributing factor in its development, while acknowledging that overlapping or multifactorial mechanisms could not be excluded.

Our population was elderly (mean age 82), predominantly female (54%), and typically overweight (mean BMI 28.1). Women were generally older than men (84 vs 79 years) with nearly triple the proportion of nonagenarians (29% vs 10%). This cohort showed high prevalence of hypertension (85%), DM (45%), and AF (44%), with relatively low coronary artery disease (CAD) incidence (20%). This LVEF profile corresponded with predominantly (69%) HF with preserved ejection fraction (HFpEF) versus a minority of patients (20%) exhibiting HF with reduced ejection fraction (HFrEF). Men had higher CAD rates (25% vs. 16%), lower mean LVEF (50.2% vs.56.5%), and more HFrEF (30% vs 12%) (Table 2).

Tab. 1 Precipitating causes of heart failure (n: 410 hospitalizations).

Acute heart failure: precipitating factors	n (%)
Respiratory infection /insufficiency[1]	176 (43)
Worsening renal function[2]	49 (12)
Atrial fibrillation (new onset and worsening)[3]	38 (9)
Natural evolution (valvular disease/ amyloidosis)[4]	28 (7)
Sepsis[5]	27 (6)
Urinary infection[6]	19 (5)
Non-compliance[7]	17 (4)
Acute coronary syndrome	14 (3.3)
Anaemia (gastrointestinal bleeding)	11 (3)
Bradyarrhythmia[8]	8 (2)
Hip fractures	7 (1.7)
Ascitic decompensation	5 (1.3)
Stroke	5 (1.3)
Pulmonary embolism	3 (0.7)
Other	3 (0.7)

1: includes respiratory infections of viral or bacterial etiology (sepsis not included), respiratory insufficiencies partial pressure of oxygen <60 mmHg with no proven infectious origin and overlapped cases. 2: Marked increase in serum creatinine compared to basal level (conditioning issue). 3: includes new onset of atrial fibrillation cases and the exacerbation of previously known atrial fibrillation ones. 4: includes cases of acute heart failure without a documented trigger for decompensation, occurring in the context of advanced valvular disease (predominantly severe degenerative aortic stenosis) and prosthetic valve dysfunctions or, the detection of transthyretin (TTR) amyloidosis. 5: from any origin. 6: bacterial etiology (sepsis not included). 7: includes alcoholism, abandonment of treatment, low awareness of illness and social isolation. 8: requiring permanent pacemaker placement. Categorical variables are expressed as absolute number and percentage.

Tab. 2 Characteristics of the study population.

Item	All patients	Female	Male	*p*
Demography				
n	280 (100%)	152 (54%)	128 (46%)	
Age: years± SD (range)	83 (41–99)	85 (46–99)	79 (41–96)	**<0.001**
BMI: Kg/m^2± SD (range)	28.4 ± 5.6 (16–49.1)	28.4 ± 5.8 (16–49.1)	28.5 ± 5.3 (17.6–44.1)	0.948
Age distribution: n (%)				
≤59 years	10 (4%)	2 (1%)	8 (6%)	
60–69 years	18 (6%)	8 (5%)	10 (8%)	
70–79 years	65 (23%)	31 (20%)	34 (27%)	
80–89 years	130 (46%)	68 (45%)	62 (48%)	
≥90 years	57 (20%)	43 (28%)	14 (11%)	
Etiology n (%)				
CAD	55 (20%)	22 (14%)	33 (26%)	**0.019**
Non-CAD	225 (80%)	130 (86%)	95 (74%)	
Cardiac rhythm n (%)				
SR	134 (48%)	73 (48%)	61 (48%)	0.951
AF	119 (43%)	67 (44%)	52 (41%)	0.561
Pacemaker	27 (9%)	12 (8%)	15 (11%)	0.289
LVEF: % ± SD (range)	53.7 ± 12.3 (19–76)	56.8 ± 10.2 (20–76)	50.0 ± 13.5 (19–76)	
HFrEF: n (%)	57 (20%)	17 (11%)	40 (31%)	**<0.001**
HFmrEF: n (%)	30 (11%)	13 (9%)	17 (13%)	0.211
HFpEF: n (%)	193 (69%)	122 (80%)	71 (55%)	**<0.001**

BMI (body mass index); SD (standard deviation); CAD (coronary artery disease); SR (sinus rhythm); AF (atrial fibrillation); LVEF (left ventricular ejection fraction); HFrEF (heart failure with reduced ejection fraction); HFmrEF (heart failure with mildly reduced rejection fraction); HFpEF (heart failure with preserved ejection fraction). All categorical variables are expressed as absolute number and percentage and all continuous variables are expressed as mean ± SD, (range). Significant p values (between genders) are in bold (continuous variables required Student's t-test and categorical variable Pearson's χ^2 test).

Nearly half (49%) of patients had three or more non-cardiac comorbidities and men showed higher rates of chronic respiratory diseases (58% vs 35%) and sleep disorders (24% vs 14%), while hypothyroidism was more common in women (16% vs 6%). (Table 3). The distribution of HF phenotypes demonstrated a clear predominance of HFpEF, which accounted for 193 out of 280 cases. This group showed a notable female majority (64%). Beyond sex, HFpEF was significantly associated with older age, higher body mass index (BMI), and a greater prevalence of AF (48% vs. 30% in HFrEF). As anticipated, patients with HFrEF exhibited markedly lower LVEF and a higher prevalence of CAD (Table 4).

Tab. 3 Main non-cardiac comorbidities of the studied population.

Comorbidity	All patients	Female	Male	*p*
Hypertension	242 (86%)	133 (88%)	109 (85%)	0.572
DM	130 (46%)	63 (41%)	67 (52%)	0.069
COPD	127 (45%)	53 (35%)	74 (58%)	**0.001**
SAS	52 (19%)	21 (14%)	31 (24%)	**0.028**
Stroke	50 (18%)	30 (20%)	20 (16%)	0.368
CKD	42 (15%)	22 (14%)	20 (16%)	0.789
Hypothyroidism	33 (12%)	25 (16%)	8 (6%)	**0.006**
Active cancer	19 (7%)	7 (5%)	12 (9%)	0.125
≥3 comorbidities	136 (49%)	68 (45%)	68 (53%)	0.163

DM (diabetes mellitus); COPD (chronic obstructive pulmonary disease), SAS (sleep apnea syndrome), CKD (chronic kidney disease). Categorical variables are expressed as absolute number and percentage, and significant p values (between genders) are in **bold** (Pearson's χ^2).

Tab. 4 Clinical profile of heart failure phenotypes of the studied population.

Item	Total	HFpEF	HFmrEF	HFrEF	*P*
N = 100%	280	193	30	57	
Female: n (%)	152 (54)	124 (64)	12 (40)	16 (28)	**<0.001**
Male: n (%)	128 (46)	69 (36)	18 (60)	41 (72)	
Age: years	83 (41–99)	83 (46–99)	81 (53–96)	77 (41–98)	**0.020**
BMI: Kg/m2	28.4 ± 5.5 (16–49.1)	28.7± 5.2 (17–49.1)	28.3 ± 5.8 (19–42.3)	26.8 ± 5.8 (16–44.1)	**0.001**
CAD: n (%)	55 (20)	26 (14)	11 (37)	18 (32)	**0.005**
Non-CAD: n (%)	225 (80)	167 (86)	19 (63)	39 (68)	
LVEF: %	53.7 ±12.3 (19–76)	61.2 ±5.0 (50–76)	45.6 ±3.0 (41–49)	32.6 ± 5.7 (19–40)	<0.001
SR: n (%)	134 (48)	84 (43)	16 (53)	34 (60)	0.083
AF: n (%)	119 (43)	92 (48)	10 (33)	17 (30)	**0.032**
Pacemaker: n (%)	27 (9)	17 (9)	4 (14)	6 (10)	0.714
Single Hosp: n (%)	169 (60)	117 (61)	14 (47)	38 (67)	0.192
Rehosp: n (%)	73 (26)	52 (27)	11 (36)	10 (17)	0.137
Death: n (%)	38 (14)	24 (12)	5 (17)	9 (16)	0.706

BMI (body mass index); SD (standard deviation); CAD (coronary artery disease); SR (sinus rhythm); AF (atrial fibrillation); LVEF (left ventricular ejection fraction); HFrEF (heart failure with reduced ejection fraction); HFmrEF (heart failure with mildly reduced rejection fraction); HFpEF (heart failure with preserved ejection fraction). Hosp (hospitalization). Rehosp (rehospitalizations). Death (at first hospitalization) All categorical variables are expressed as absolute number and percentage and all continuous variables are expressed as mean ± SD, (range). Significant p values – between HF phenotypes are in **bold** (Anova for continuous variables / Pearson's χ^2 for categorical variables).

INDEX HOSPITALISATION: PATIENT PROFILES & CLINICAL TRAJECTORIES

Taking the first annual hospitalization for HF as the index episode, three distinct clinical trajectories were identified (Table 5): single admission (n: 169), rehospitalizations with possible deaths (n: 73), and death during initial hospitalization (n: 38). Across these groups, worsening outcomes correlated with increased age (81, 84, 86 years; p: 0.0018), higher NT-proBNP levels (8,264, 10,084, 17,001 pg/ml; p <0.001), reduced kidney function (eGFR: 50.9, 45.3, 38.9 mL/min/1.73m^2; p <0.001) and lower haemoglobin values (11.9, 11.3, 11.2 g/dl; p = 0.044). In addition, a progressively higher proportion of non-cardiac causes of AHF decompensation was observed across the three groups (63%, 75%, and 84%; p: 0.013), suggesting that AHF cases attributable to non-cardiac factors carry a worse prognosis than those precipitated by a clearly identifiable cardiac cause (e.g., arrhythmia, ACS).

Tab. 5 Patient profiles and trajectories according to index hospitalization.

Items	All patients	Single hospitalization	Rehospitalizations	Death First hospitalization	*p*
Total: n (%)	280 (100)	169 (60)	73 (26)	38 (14)	
Gender					
Female: n (%)	152 (54)	97 (57)	33 (45)	22 (58)	0.195
Male: n (%)	128 (46)	72 (43)	40 (55)	16 (42)	
Clinical findings					
Age (years)	83 (41–99)	81 (41–99)	84 (55–98)	86 (69–96)	**0.001**
BMI	28.4 ± 5.5 (16–49.1)	28.5 ± 5.9 (17.3–49.1)	28.2 ± 5.1 (16.0–40.0)	28.3 ± 4.6 (20.1–42.3)	0.885
SBP	135.3 ± 26.9 (60–230)	136.6 ± 27.0 (65–230)	134.3 ± 27.1 (60–195)	131.2 ± 26.4 (70–200)	0.498
DBP	76.3 ± 14.4 (30–115)	77.4 ± 14.2 (40–110)	75.3 ± 14.9 (30–115)	73.3 ± 14.0 (40–100)	0.222
Cr	1.52 ± 1.0 (0.42–6.63)	1.40 ± 0.9 (0.42–6.24)	1.55 ± 0.8 (0.47–5.09)	2.01 ± 1.5 (0.48–6.63)	**0.002**
eGFR	47.8 ± 21.9 (15–90)	50.9 ± 21.8 (15–90)	45.3 ± 20.8 (15–90)	38.9 ± 22.2 (15–90)	**0.004**
Hb (gr/dl)	11.6 ± 2.2 (3.5–17.3)	11.9 ± 2.3 (4.8–17.3)	11.3 ± 2.2 (3.5–16.4)	11.2 ± 2.0 (7.0–16.5)	**0.044**
NT (proBNP)	9938 (8841–11035)	8264 (6981–9547)	10084 (8083–12085)	17101 (13623–20579)	**<0.001**
Etiology: n (%)					
CAD:	55 (20)	33 (20)	19 (26)	4 (8)	0.074
Non-CAD	225 (80)	136 (80)	54 (74)	35 (92)	
Cardiac rhythm: n (%)					
SR	134 (48)	90 (53)	25 (34)	19 (50)	**0.023**
AF	119 (43)	68 (40)	38 (52)	13 (34)	0.126
Pacemaker	27 (9)	11 (7)	10 (14)	6 (16)	0.085
LVEF: %	53.7 ± 12.3 (19–76)	53.4 ± 12.9 (20–72)	54.8 ± 11.3 (19–76)	53.1 ± 11.4 (34–76)	
HF Phenotype: n(%)					
HFrEF	57 (20)	38 (22)	10 (14)	9 (24)	0.257
HFmrEF	30 (11)	14 (8)	11 (15)	5 (13)	0.257
HFpEF	193 (69)	117 (69)	52 (71)	24 (63)	0.679
AHF trigger n(%)					
Cardiac	87 (31)	63 (37)	18 (25)	6 (16)	**0.013**
Non-cardiac	193 (69)	106 (63)	55 (75)	32 (84)	

SBP (systolic blood pressure) mmHG; DBP (diastolic blood pressure) mmHG; BMI (body mass index) Kg/m2; Cr (creatinine) mg/dl, eGFR (estimated glomerular filtration rate) mL/min/1.73 m2; NT-proBNP (N-terminal pro-brain type natriuretic peptide) pg/ml; CAD (coronary artery disease); SR (sinus rhythm); AF (atrial fibrillation); SD (standard deviation); LVEF (left ventricular ejection fraction); HFrEF (heart failure with reduced ejection fraction); HFmrEF (heart failure with mildly reduced ejection fraction); HFpEF (heart failure with preserved ejection fraction).

MORTALITY AND REHOSPITALIZATION RATE

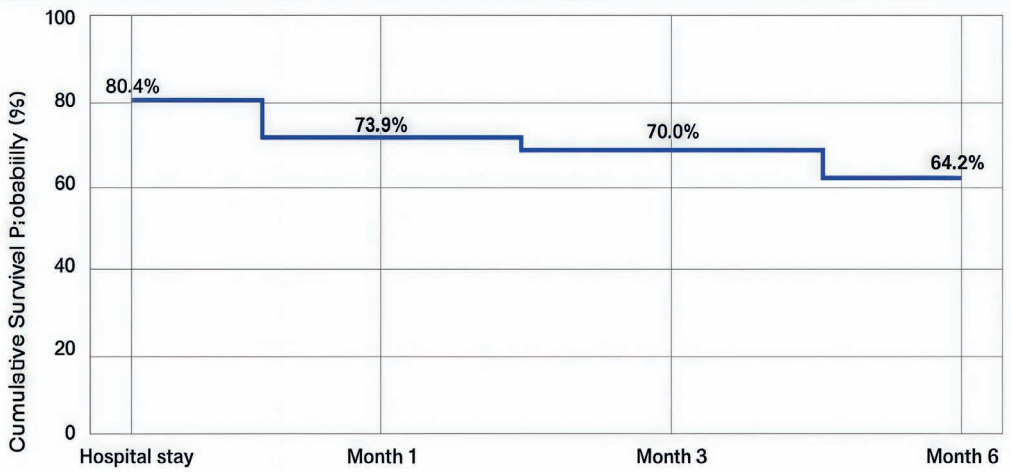
During the study period (2023), all-cause mortality was 19.6% (n: 55) all through hospitalization. Cumulative mortality rose to 26% (n: 73) at 3 months and 30% (n: 84) at 6 months after discharge, considering the last recorded event. Deaths were documented across all settings, including private residences, nursing homes for retired/older people, convalescence facilities, and during subsequent hospitalizations in 2024. These findings emphasize a pronounced early mortality burden that not only persists but progressively intensifies within this elderly cohort (Figure 2).

In our study, 410 hospitalizations were recorded among 280 patients, of which 113 (28%) represented rehospitalizations. The readmission rate was 9.9% within the first 30 days, rising to 22.7% by 100 days. Sequentially, 69 patients experienced a first readmission (second hospitalization), 27 patients a second readmission (third hospitalization), 13 patients a third readmission (fourth hospitalization), and 4 patients a fourth readmission (fifth hospitalization)

DISCUSSION

As was previously described, our cohort of AHF patients was elderly (mean age 82), predominantly female (54%), with high rates of hypertension (85%), DM (45%), and AF (44%), and a notably reduced presence of CAD (20%) and HFrEF (20%). These findings align with other European cohorts of patients with decompensated HF managed in IMDs including the RICA (9) and RICA-2 registries (10), the PRECIC study (11), the SMIT study (12), the ATHENA study (13), as well as the series reported by Davidge et al. (6), De

Matteis et al. (8), Chuda et al. (14), and Bazmpani et al. (15) (Table 6). In contrast, the large and broadly representative ESC-HF-LT registry (n: 4,449) included a younger cohort (mean age 69 years) with higher proportions of men (63%), CAD (53%), and HFrEF (67%), underscoring the age-related shift in heart failure phenotype (16).



Time Point	At Risk	Interval Deaths	Survival Probability	Cumulative Survival Probability
In-Hospitat	280	55	0.8036	0.8036
Month 1	225	18	0.9200	0.7393
Month 3	207	11	0.9469	0.6997
Month 6	196	18	0.9184	0.6424
Month 6	198	16	0.9184	0.6424

Fig. 2 Life curve for acute heart failure cohort.
Kaplan-Meier survival curve for patients discharged after acute AHF hospitalization, using actuarial estimates at 1, 3, and 6 months. Cumulative survival probabilities were 73.9% at 1 month, 70% at 3 months, and 64.2% at 6 months. Patients were followed until July 31, 2024, with right-censoring applied to those who survived beyond each interval. At Risk: Number of patients alive at the start of each interval. Interval Deaths: Number of deaths occurring during that interval. Survival Probability: Likelihood of surviving that specific interval. Cumulative Survival Probability: Overall chance of surviving from baseline to the end of that interval. So, by 6 months, the estimated survival probability is 64.2%, meaning roughly two-thirds of the cohort survived that long.

Tab. 6 Characteristics of acute heart failure patients admitted to internal medicine departments.

Item	**HMB**	**RICA** (9)	**RICA-2** (10)	**PRECIC Study** (11)	**SMIT Study** (12)	**ATHENA study** (13)	**Chuda et al** (14)	**De Matteis et al** (8)	**Davidge et al** (6)	**Bazmpani, et al** (15)
Country	Spain	Spain & Portugal	Spain & Portugal	Portugal	Italy	Italy	Poland	Italy	Sweden	Greece
N	280	5,644	1,000	429	770	276	75	6,930	5,029	137
Age	82	81	83	79	82	83	81	81	79	81
Women (%)	54	53	51	62	55	53	61	51	45	51
CAD (%)	20	26	24	34	31	30	39	48	46	44
Non-CAD (%)	80	74	76	66	69	70	61	52	54	56
AF (%)	43	53	68	52	47	47	48	45	58	72
LVEF	53	55	57		44	45	42			
HFrEF (%)	20	28	34	30	28	35	44			35
HFpEF (%)	69	61	52	70	40	47	56			52
DM (%)	46	46	50	48	36	37	44	30	26	47
Hypertension (%)	86	86	88	87	73	79	72	53	75	70

Acute heart failure patients admitted to internal medicine departments consistently exhibit (albeit with some variations), elevated mean age, female predominance and higher prevalence of hypertension, DM, and AF with comparatively lower rates of coronary artery disease (CAD) and (HFrEF).
HMB (Hospital Municipal de Badalona). DM (diabetes mellitus), AF (atrial fibrillation), CAD (coronary artery disease), LVEF (left ventricular ejection fraction) HFrEF (heart failure with reduced ejection fraction), HFpEF (heart failure with preserved ejection fraction). Blank boxes: data not available.

Returning to our cohort, we observed an all-cause in-hospital mortality rate of 19.6%, a figure substantially higher than those reported in major multicenter studies, including the KaRen study (2.4%) (17), OPTIMISE-HF (3.8%) (18), the ADHERE registry (4.0%) (19), the SMIT study (5.9%) (12), the PRECIC study (7.9%) (11), and the JROADHF registry (7.7%) (20). Despite these differences, our findings are consistent with single-center studies of older, comorbid populations, which have reported comparable in-hospital mortality rates: 20% in Lodz (14), 12.7% in Prague (21), 12% in Vellore (22), and 19% in Florence (geriatric ATHENA cohort) (13).

Focusing in rehospitalisations, these represent a critical inflection point in the HF trajectory, with the greatest vulnerability occurring within 30–90 days after discharge (5, 6, 23–25). In our cohort, readmissions were frequent, accounting for 28% of the total 410 hospitalisations, with 30-day and 100-day readmission rates of 9.9% and 22.7%, respectively. Figures from other series demonstrate notable variation: 30-day readmission rates of 24.8% in New York, USA (25) and 23.8% in Adelaide, Australia (7), while in Halmstad, Sweden, a 100-day rate of 33% was reported (6). Moreover, Sager et al. (Lund, Sweden) reported 30-day mortality and readmission rates of 40% and 24% with continuous furosemide infusion compared with 20% and 40% using bolus injection. In a real-world study, Wideqvist et al. (Gothenburg, Sweden) observed 30-day and 90-day readmission rates of 11.4% and 21% in patients with AHF (26). Taken together, these variations in both mortality and rehospitalisation rates underscore important differences across healthcare systems, discharge planning practices, patient demographics, and comorbidity burden.

As it was observed, three clinical trajectories emerged from the index hospitalization: (1) single admission, (2) rehospitalization – with some subsequent deaths, and (3) death during the initial stay. Across these groups, greater clinical severity was consistently associated with older age, renal dysfunction, and elevated NT-proBNP levels. Overall, the severity indicators identified in our cohort are in line with prior reports. For instance, De Matteis et al. demonstrated a 2.5-fold increase in in-hospital mortality among AHF patients aged ≥85 years (8). Similarly, the PRECIC study identified advanced age (≥80 years) as a significant predictor of one-year mortality (p: 0.001) (11), while the JROADHF registry confirmed age as an independent predictor of in-hospital mortality (p<0.001) (20). In addition, the ESC-HF-LT registry reported age as a key determinant of annual all-cause mortality in HF patients, with risk increasing per 5-year increment (p<0.0001) (16). Finally, Al-Omary et al. found advancing age (per 10-year increment; p<0.001) to be a univariate predictor – among other factors – of annual AHF readmissions (27)

In the context of renal dysfunction, Chuda et al. reported that AHF patients with CKD or more than three comorbidities (among other factors) had a higher risk of rehospitalisation (p<0.05) (14). Davidge et al. similarly observed a significantly increased admission rate among patients with severely impaired renal function (eGFR <30 ml/min; p: 0.005) (6). In addition, Wideqvist et al. and Al-Omary et al. found that readmitted patients had higher rates of CKD (p: 0.001 and p: 0.082, respectively) (26, 27). For its part, the ESC-HF-LT registry also identified renal dysfunction as a strong predictor of all-cause mortality in HF patients (p<0.001) (16).

Lastly, baseline NT-proBNP levels at index hospitalization emerged as a risk factor in our cohort for both mortality and rehospitalisation, consistent with prior well-established evidence (1–3). Udani et al. stratified 21,445 AHF patients into admission quartiles (<1,669; 1,670–4,274; 4,275–10,499; >10,500 pg/ml), showing progressively higher in-hospital mortality (0.9%, 1.4%, 2.5%, 4.7%; all p<0.005) and increased 60-day readmission in the highest quartile (p: 0.013 vs. group 1; p: 0.014 vs. group 2), persisting at 90 days only against group 1 (p: 0.021) (28). Sager et al. reported 30-day mortality of 20% in elderly AHF patients with mean NT-proBNP 9,640 pg/ml versus 40% with 15,901 pg/ml (25). The BIOSTAT-CHF program (n: 2,516) identified NT-proBNP >4,000 pg/ml as a major mortality predictor, alongside age >70 years, elevated blood urea nitrogen, and low hemoglobin (29). Similarly, Huang et al. found that AHF patients who died had significantly higher NT-proBNP than survivors (15,942 vs. 6,013 pg/ml; p<0.001), with risk rising from a cut-off of 8,100 pg/ml (30).

Therefore, our series aligns with published data on baseline characteristics of AHF patients hospitalised in IMDs. Moreover, our findings reaffirm the established association between adverse prognosis and advanced age, comorbidities, renal dysfunction, and elevated baseline NT-proBNP levels.

LIMITATIONS

The present study has several limitations that warrant consideration. First, the retrospective design of our analysis is inherently subject to multiple biases. Second, the single-centre nature of this series introduces an additional bias. Third, there is a low representation of younger patients, individuals with CAD or heart HFrEF, as the study was conducted in an IMD (not in a cardiology one).

CONCLUSIONS

This study offers a real-world snapshot of AHF patients admitted to an urban IMD. The cohort was predominantly elderly and female, with multiple cardiac and non-cardiac comorbidities, a low prevalence of CAD and HFrEF, and high rates of rehospitalization and in-hospital mortality. In addition, clinical data from index hospitalizations – including age, renal dysfunction, haemoglobin, NT-proBNP levels, and the proportion of non-cardiac versus cardiac AHF causes – were identified as severity markers.

In conclusion, highlighting experiences like ours underscores the challenges of this clinical scenario, while offering valuable lessons and supporting strategies to improve care for a highly vulnerable population.

AUTHOR CONTRIBUTIONS, FUNDINGS AND CONFLICT OF INTEREST

All authors have contributed significantly to the manuscript, meeting the criteria for authorship and approving its final version. EK was responsible for study design, data analysis and article writing. SMC, JTM, ASI, DCG, FPA and LZ were responsible for screening articles, data collection and clinical performance GTW, EMA and CCP were responsible for theoretical guidance and decision-making in case of disagreement and AFC was responsible for the statistical analysis.

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