Cardiology and Cardiovascular Research
2025, Vol. 9, No. 4, pp. 159–166
https://doi.org/10.11648/j.ccr.20250904.17

Research Article

Evolution of Heart Failure with Reduced Ejection Fraction in a Cardiology Clinic in Cotonou

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Abstract

Introduction: Heart failure, the final stage of most heart diseases, is responsible for high mortality. The aim of this work was to study the evolutionary profile of heart failure with reduced ejection fraction (HFrEF) among patients followed at the University Cardiology Clinic of Cotonou. Material and Method: This was a descriptive, observational, longitudinal and analytical study conducted from January 2021 to June 2022. It included by exhaustive sampling patients who presented with HFrEF. Inclusion was made during post-hospitalization follow-up. The variables studied were clinical presentation, CHARLSON score summarizing the burden of comorbidities, mortality rate and number of re-hospitalizations. Results: A total of one hundred and thirteen (113) patients were included in the study. Mean age was 53.2 ±17.3 years, with a sex ratio of 1.75. Dyspnea was stage III in 59.5% of patients and stage IV in 8.1%. The CHARLSON score was greater than or equal to 3 in 12.4% of cases. The re-hospitalization rate was 18.6%, and the one-year mortality rate was 33.6%. Factors associated with death included advanced age, left ventricular ejection fraction below 30% and a CHARLSON score greater than or equal to 3. Conclusion: HFrEF is a severe pathology associated with a poor prognosis. These findings underscore the critical need for early and aggressive management strategies, with the rigorous control of associated comorbidities.

Keywords

Heart Failure, Mortality, Re-hospitalization

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Received: 9 October 2025; **Accepted:** 31 October 2025; **Published:** 9 December 2025

1. Introduction

Cardiac Heart failure (HF) affects around 26 million people worldwide and represents a major public health challenge. [1, 2]. It is exacerbated by an ageing population, and its prognosis is clouded by the risk of death, re-hospitalization and comorbidities [3]. It is often associated with coronary heart disease in Western countries [4] and with arterial hypertension (AH) in the black African population, particularly in Benin [5].

In Benin, studies have shown a mortality rate of 21.3% at 12 months after hospitalization [5]. Despite improvements in drug treatment and the contribution of cardiac rehabilitation, the rate of re-hospitalization remains high in the first year after hospitalization (47.9%) according to ASSOGBA *et al* [5]. The aim of this study was to update data on the evolutionary profile of patients hospitalized for heart failure with reduced ejection fraction at the University Cardiology Clinic of the CNHU-HKM in Cotonou.

2. Materials and Methods

This was a descriptive, observational, longitudinal and analytical study conducted from January 1, 2021 to June 30, 2022 at the University Cardiology Clinic of the National Teaching Hospital Hubert Koutoukou Maga (CNHU-HKM) in Cotonou. It included, by exhaustive sampling, patients who had presented with HFrEF and whose left ventricular ejection fraction was less than 50%. Inclusion was made during post-hospitalization follow-up.

The dependent variables were the occurrence or non-occurrence of re-hospitalization for heart failure or death. Other variables collected were sociodemographics, cardiovascular risk factors, underlying heart disease, previous history, comorbidities and clinical signs on admission. Hypertension was defined as blood pressure greater than or equal to 140/90 mmHg or normal in subjects on antihypertensive medication. Diabetic subjects were defined as those with fasting blood glucose levels greater than or equal to 1.26 g/L, or random blood glucose levels greater than or equal to 2 g/L, or normal blood glucose levels on antidiabetic medication. Obesity was defined as a body mass index greater than or equal to 30 kg/m ². Impaired renal function was defined as a low glomerular filtration rate of less than 60 ml/minute/1.73 m ²according to the simplified MDRD formula (Modification of Diet in Renal Disease) [6]. Hypertensive heart disease was defined as the presence of long-standing arterial hypertension associated with left ventricular hypertrophy and/or diastolic dysfunction on echocardiography, in the absence of other causes of myocardial remodeling [7]. Ischaemic heart disease was defined as a documented history of coronary artery disease, previous myocardial infarction, or coronary revascularization, or evidence of myocardial ischemia on imaging or electrocardiography [8]. The CHARLSON score (Appendix I) was used to assess the importance and severity of comorbidities that could influence mortality risk. This score takes into account 19 conditions, and a certain number of points are attributed to the presence of each condition [9]. A score of 3 or more is associated with a poor 10-year survival rate. Therapeutic compliance was studied using the GIRERD questionnaire (Appendix II), which uses 6 questions to ask patients about their medication intake. For each negative response, one point is awarded. Compliance was judged good for a score between 0 and 2. Poor compliance was defined as a score greater than or equal to 3 [10].

All patients were seen or contacted at specific intervals after discharge, i.e. at 2 weeks (T0), then at 1 month (T1), 3 months (T2), 6 months (T3), 9 months (T4) and finally at 12 months (T5). At this time, the notion of re-hospitalization or not for heart failure or death was sought.

Data were collected by examining consultation or hospitalization records, filling in questionnaires, interviewing patients directly and then making follow-up telephone calls. Data were entered and analyzed using Epi info version 3 software. Excel was used to organize the data into tables and graphs. After entry, data consistency and any data entry errors were noted and corrected. Categorical variables were expressed as percentages, and quantitative variables as mean with standard deviation in the case of normal distribution, and with median and interquartile range in the opposite case. A significance level of 5% was used for the comparisons.

3. Results

During the study period, a total of 517 patients were admitted to the department, 325 of whom had heart failure. Of these, 301 had reduced LVEF, i.e. a hospital prevalence of 58.2%, but 113 were included in the study because of a lack of important data. The mean age of the patients was 53.6 ± 17.3 years. Male patients accounted for the majority, with 63.7% of the sample, i.e. a sex ratio of 1.75. At the time of inclusion, 12.4% of patients had already been hospitalized for heart failure. The main cardiovascular risk factors were hypertension (48.7%), obesity (18.6%) and diabetes (10.6%). The Charlson score was zero in 66.4% of cases, between 1 and 2 in 21.2% and greater than or equal to 3 in 12.4%. Comorbidities were mainly renal failure (15%), atrial fibrillation (8.8%), hyponatremia (32.7%) and hypokalemia (14.1%).

At the beginning of treatment, 59.5% of subjects were in NYHA stage III, 32.4% in stage II and 8.1% in stage IV. Table 1 shows the distribution of the sample according to underlying heart disease.

Table 1. *Distribution of 113 patients with heart failure according to underlying heart disease, Cotonou (Benin).*

	Number	Percentage (%)
Ischemic cardiomyopathy	45	39,8
Hypertensive cardiomyopathy	51	45,1
Valvulopathy	06	05,3
Peripartum cardiomyopathy	14	12,4
Dilated cardiomyopathy	09	07,9
Hypertrophic cardiomyopathy	03	02,6
Congenital heart disease	02	01,8
Chronic pulmonary heart disease	01	0,9

Left ventricular systolic function was below 30% in 38% of cases, between 30 and 39% in 37.2% and between 40 and 49% in 24.8%. Treatment was represented by diuretics (99.1%), angiotensin-converting enzyme (ACEi) inhibitors (67.3%) or angiotensin II receptor blockers (4.4%), beta-blockers (41.1%), spironolactone (38.9%) and dobutamine (6.2%). Therapeutic compliance was judged to be good in 54.9% of cases and poor in 45.1%.

During follow-up, 21 patients were re-hospitalized at least once for heart failure, an overall frequency of 18.6%. The frequency of re-hospitalization by follow-up period is shown in Figure 1.

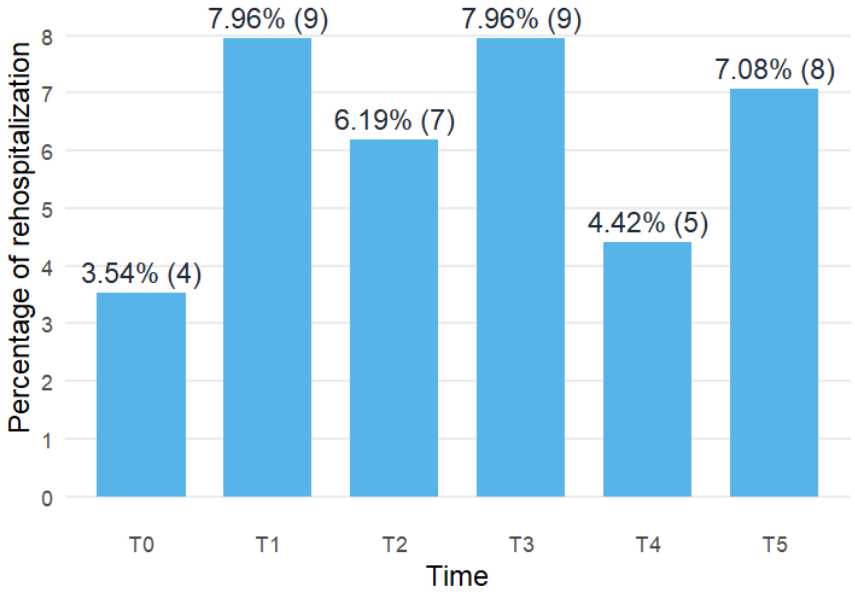

Figure 1. *Distribution of 113 heart failure patients according to frequency of re-hospitalization by follow-up period, Cotonou, Benin (T0: inclusion, T1: 1 month, T2: 3 months, T3: 6 months, T4: 9 months, T5: 12 months).*

The Kaplan–Meier survival curve illustrates the progressive occurrence of deaths during the one-year follow-up period (2021–2023) among patients with heart failure with reduced ejection fraction. A relative stability in survival was observed during the first months, followed by a gradual decrease after approximately 180 days. The decline became more pronounced beyond 260 days, reflecting an increase in the number of deaths toward the end of the follow-up. At 365 days, the estimated survival probability was around 70%. This trend indicates a progressive mortality over time, suggesting a worsening long-term vital prognosis within the studied population.

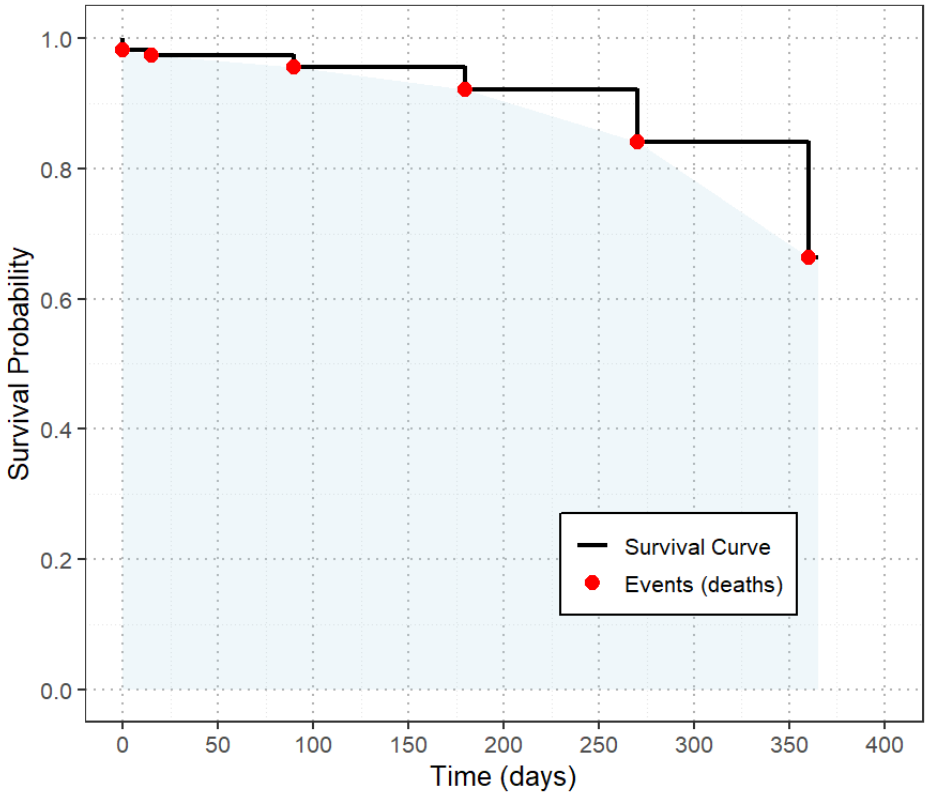

Figure 2. *Kaplan–Meier estimate of the survival curve of HFrEF patients followed at the CUC over a 12-month period.*

Average age (p=0.003) and a Charlson score greater than or equal to 3 (p=0.04) were significantly associated with re-hospitalization (Table 2).

Table 2. *Distribution of re-hospitalizations for heart failure according to mean age, Charlson score, therapeutic compliance and left ventricular ejection fraction (Cotonou, n=113).*

		Re-hospitalization	No rehospitalization	Total	p-value
Mean age (years)		60,1 ± 5,1	49,9 ± 4,1	-	0,003
Sex	Male	27	45	72	0,37
	Female	12	29	41	
Charlson score	≥3	8	6	14	0,04
	<3	26	73	99	
Good compliance	No	16	35	51	0,66
	Yes	23	39	62	
LVEF < 30%	Yes	17	26	43	0,66
	No	22	48	70	

LVEF: left ventricular ejection fraction.

The 12-month mortality rate was 33.6% (38 patients). Death was significantly associated with higher mean age (p=0.01), a left ventricular ejection fraction below 30% (p=0.009), a Charlson score greater than or equal to 3 (p=0.02) and hypokalemia (p=0,002) (Table 3).

Table 3. *Distribution of heart failure deaths according to mean age, Charlson score, therapeutic compliance, left ventricular ejection fraction and metabolic disorders (Cotonou, n=113).*

		Deaths	No deaths	Total	p-value
Mean age (years)		60,5 ± 8,0	49,8 ± 4,1	-	0,01
Sex	Male	22	50	72	0,51
	Female	15	26	41	
Charlson score	≥ 3	9	5	14	0,02
	< 3	29	70	99	
Good compliance	No	24	27	51	0,011
	Yes	14	48	62	
LVEF < 30%	Yes	22	23	45	0,009
	No	16	52	68	
Hypokalemia	Yes	11	05	16	0,002
	No	27	70	97	

LVEF: left ventricular ejection fraction.

4. Discussion

The study has a number of strengths which enhance its quality. It is based on longitudinal sampling, offering a more complete view of the evolution of the population. This enabled us to demonstrate a sinusoidal dynamic in re-hospitalization. In addition, the study collected a wide range of data, enabling in-depth analysis of the factors associated with unfavorable outcomes. In addition, regular telephone follow-up of patients provided up-to-date data on their state of health. However, it is important to note certain limitations of the study. The representativeness of the sample may be challenged. Indeed, because of the size of the sample it may be difficult to generalize the results to the entire population suffering from HFrEF. Finally, the absence of coronary angiography data is also a limitation of this study.

According to the present study, heart failure with reduced ejection fraction accounted for 58.2% of total admissions. In Benin, HOUNTONDJI J *et al* reported a hospital prevalence of 25% and in 2016, LAWANI P *et al* noted a prevalence of 25.8% for HFrEF [11, 12]. In 2018, SONOU *et al* observed a prevalence amounting to 47.1% [13]. It is clear that the prevalence has increased progressively over the years. The high prevalence observed in our study is undoubtedly linked to the fact that this cardiology clinic the largest university cardiology center of the country.

The mean age of the participants in our study was 57.6 ± 17.3 years. These values are close to the 52.2 ± 16.7 years reported by MACHIHUDE *et al* [14] and the 56.2 ± 16.5 years recorded by CODJO *et al* [15]. Studies carried out in Parakou also showed comparable results [16]. OUEDRAOGO *et al* in Burkina Faso in 2018 also found similar statistics, with an average age of 54.5 ± 20.9 years [17].

The predominance was male, representing 63.7% of the sample, with a sex ratio of 1.75, similar to the results of GAHOU *et al* [10]. Reverse trends were reported by KODINGAR *et al* in Cotonou in 2016 (68.4% female) [16] and OUEDRAOGO *et al* in Burkina Faso in 2018 (55.9% female) [17].

It should be noted that treatment was not optimal because any patient were treated with sodium-glucose co-transporter inhibitor type 2 (SGLT2i) and sacubitril/valsartan combination. Financial affordability was the main reason.

Underlying heart disease was dominated by hypertensive cardiomyopathy (45.1%), ischemic cardiomyopathy (39.8%) and peripartum cardiomyopathy (12.4%). A similar study carried out in Porto-Novo, Benin, in 2016 [18] reported the same hypertensive predominance (41.8%) and a low rate of ischemic cardiomyopathy (4.48%). SANI *et al* also found the same predominance in certain South-Saharan African countries [19]. On the other hand, GNABA *et al* at the Abidjan Heart Institute found no peripartum cardiomyopathy and a high prevalence of ischemic cardiomyopathy (26%), explained by the availability of coronary angiography, which has increased the diagnostic performance of this condition. [20].

The re-hospitalization rate is similar to the 18.5% found by SOSSOU *et al* [21], i.e. 18.5%. GNABA *et al* [20] in their study of heart failure reported 28% re-hospitalization for heart failure. These high figures reflect the severity of the condition, as do the mortality rate of 33.6% reported in this study. Older

age is logically linked to higher mortality, since it is associated with more comorbidities. The fact that a high Charlson score ≥ 3 is associated with mortality confirms this trend. In the literature, it is known that there is a linear association between left ventricular ejection fraction and mortality in heart failure. Indeed, the lower the systolic function, the greater the risk of death [22, 23]. Non-adherence to therapy can lead to exacerbations of symptoms and deterioration of the clinical picture, potentially resulting in hospitalization or death.

5. Conclusion

This study carried out at the University Cardiology Clinic in Benin, provided an overview of the evolution of HFrEF over a 12-month period, focusing on the symptomatic evolution of patients. The study results underline the severity of HFrEF, with a mortality rate of 33.6% at one year. Factors associated with an unfavorable evolution include advanced age, poor therapeutic compliance, and the presence of comorbidities. Appropriate management of comorbidities and closer patient support through therapeutic education in particular, and cardiac rehabilitation in general, will contribute effectively to improving the prognosis of the condition.

Abbreviations

ACEi	Angiotensin-Converting Enzyme Inhibitors
AH	Arterial Hypertension
CNHU-HKM	National Teaching Hospital Hubert Koutoukou Maga
HF	Heart Failure
HFrFE	Heart Failure with Reduced Ejection Fraction
LEVF	Left Ventricular Ejection Fraction
MDRD	Modification of Diet in Renal Disease
NYHA	New York Heart Association
SGLT2i	Sodium-Glucose Cotransporter-2 Inhibitors

Author Contributions

Djidjoho Joël Arnaud Sonou: Conceptualization, Methodology, Writing – original draft, Writing – review & editing
Baudouin Tchaniga: Conceptualization, Data curation, Investigation, Methodology
Baudouin Tiomon: Writing – review & editing
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Elodie Tondji: Writing – review & editing
Murielle Hounkponou: Writing – review & editing
Léopold Houénontondji Codjo: Conceptualization, Methodology

Funding

This work is not supported by any external funding.

Data Availability Statement

The data is available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

Appendix

Appendix I: CHARLSON Comorbidity Score

Table 4. CHARLSON Comorbidity score.

Comorbidity index	
Determining concomitant pathologies	Yes
Myocardial infarction	1
Congestive heart failure	1
Cerebrovascular disease	1
Dementia	1
Chronic lung disease	1
Joint problems (rheumatism)	1
Ulcer disease	1
Hepatopathy of minor importance	1
Diabetes	1
Hemiplegia	2
Moderate to severe renal impairment	2
Diabetes with target organ damage	2
Tumors	2

Comorbidity index	
Leukemia	2
Lymphoma	2
Moderate to severe liver disease	3
Metastases	6
AIDS	6
Total score	0 à37

Appendix II: GIRERD Questionnaire

Self-questionnaire to assess compliance, i.e. whether treatment is taken regularly as prescribed.

1) Did you forget to take your medication this morning? yes no
2) Since your last consultation, have you run out of medication? yes no
3) Have you ever been late taking your medication? yes no
4) Have you ever not taken your medication because your memory fails you on certain days? yes no
5) Have you ever stopped taking your medication because some days you feel it is doing you more harm than good? yes no
6) Do you think you have too many pills to take? yes no

Interpreting the results:

0: good compliance

1-2: minimal compliance problems

≥ 3: poor compliance.

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Biography

Djidjoho Joël Arnaud Sonou is a cardiology lecturer at the Faculty of Health Sciences of the University of Abomey-Calavi, with the rank of Associate Professor. His areas of interest are cardiac eletrophysiology, cardiac pacing, cardiac physiology, hypertensiology and women's cardiovascular health. Dr Sonou is the current president of the Beninese Society of Cardiology. He has authored and co-authored several research articles related to his areas of interest.

Research Field

Djidjoho Joël Arnaud Sonou: Cardiac rhythm and conduction disorders, Cardiac pacing and implantable defibrillators, heart failure, acute coronary syndrome, high blood pressure.