

Epidemiological Profile and Cardiovascular Risk Factors of Heart Failure with Reduced Ejection Fraction: A Two-Year Retrospective Study at a Military Hospital in Marrakech, Morocco

ABSTRACT

Background: Heart failure with reduced ejection fraction (HFrEF) represents a growing global public health burden, particularly in low- and middle-income countries where cardiovascular risk factors are prevalent and undercontrolled. Data from North Africa and Morocco remain scarce.

Objectives: To describe the epidemiological profile and cardiovascular risk factor distribution of HFrEF patients hospitalized at a military tertiary center in Marrakech, Morocco.

Methods: Retrospective descriptive study conducted between December 2021 and December 2023, including 173 adult patients hospitalized for HFrEF (LVEF \leq 40%) at the Cardiology Department of Avicenne Military Hospital. Data were extracted from medical records and analyzed using Microsoft Excel 2019.

Results: The mean age was 67.9 ± 8.7 years (range 38–92), with a strong male predominance (80%). The most prevalent cardiovascular risk factors were sedentary lifestyle (85%), smoking (53%), type 2 diabetes (45%), hypertension (33%), and dyslipidemia (33%). Associated comorbidities included anemia (45%), renal failure (36%), and prior ischemic cardiomyopathy (41.6%). These findings align broadly with international registries while highlighting specificities of the North African context.

Conclusion: HFrEF in Morocco predominantly affects elderly males with multiple modifiable cardiovascular risk factors. This profile underscores the urgent need for comprehensive primary prevention strategies and improved management of hypertension, diabetes, and smoking in the region.

Keywords: Heart failure, reduced ejection fraction, cardiovascular risk factors, epidemiology, Morocco, North Africa, HFrEF

1. Introduction

Heart failure (HF) is one of the leading causes of cardiovascular morbidity and mortality worldwide, affecting an estimated 64.3 million individuals globally [1]. Among its phenotypes, heart failure with reduced ejection fraction (HFrEF), defined by a left ventricular ejection fraction (LVEF) \leq 40%, accounts for approximately 50% of all HF cases and carries a particularly poor prognosis [2,3]. HFrEF is characterized by significant neurohormonal activation, progressive ventricular remodeling, and a high risk of hospitalization and sudden cardiac death [4].

The epidemiology of HFrEF is shaped by the prevalence and severity of its major risk factors:

ischemic heart disease, hypertension, diabetes mellitus, dyslipidemia, and tobacco use [5]. In developed countries, ischemic cardiomyopathy dominates as the primary etiology, while in sub-Saharan Africa and parts of the Middle East and North Africa (MENA) region, hypertensive cardiomyopathy and idiopathic dilated cardiomyopathy are more prevalent [6]. However, the epidemiological transition in countries such as Morocco—characterized by increasing urbanization, sedentary lifestyles, and adoption of Western dietary patterns—has led to a rising burden of metabolic risk factors, including type 2 diabetes and obesity [7].

Despite the clinical significance of HFrEF, large-scale epidemiological data from North Africa and Morocco remain limited. Most available evidence comes from international registries such as the ESC-HF-LT in Europe [8], the ASIAN-HF study [9], and the INTER-CHF registry [10], which collectively highlight significant regional variations in HFrEF prevalence, etiology, and outcomes. Local registry data are essential to inform context-specific prevention and treatment strategies.

The present study aims to describe the epidemiological profile, cardiovascular risk factor distribution, and comorbidity burden of HFrEF patients hospitalized at the Avicenne Military Hospital in Marrakech, Morocco, over a two-year period, and to compare these findings with published international data.

2. Materials and Methods

2.1 Study Design and Population

This was a retrospective descriptive study conducted at the Department of Cardiology, Avicenne Military Hospital, Marrakech, Morocco, over a 24-month period from December 2021 to December 2023. All patients aged ≥ 18 years with a confirmed discharge diagnosis of HFrEF (LVEF $\leq 40\%$ on transthoracic echocardiography) were eligible for inclusion. Patients presenting with cardiogenic shock at admission, HF with mid-range or preserved ejection fraction, or incomplete medical records were excluded. A total of 173 patients met the inclusion criteria.

2.2 Data Collection and Variables

Data were extracted from standardized hospital records using a pre-designed data collection form. Demographic variables included age, sex, and occupational status. Cardiovascular risk factors assessed included smoking (active or past), type 2 diabetes mellitus (T2DM), arterial hypertension (AHT), dyslipidemia, obesity (BMI ≥ 30 kg/m²), sedentary lifestyle, and family history of coronary artery disease. Comorbidities recorded included anemia (hemoglobin < 12 g/dL in women, < 13 g/dL in men), chronic kidney disease (CKD), chronic obstructive pulmonary disease (COPD), obstructive sleep apnea syndrome (OSAS), prior ischemic cardiomyopathy (CMI), valvular heart disease, rhythm disorders, and malignancy.

2.3 Statistical Analysis

Data were entered and analyzed using Microsoft Excel 2019. Quantitative variables were expressed as means \pm standard deviations with ranges. Qualitative variables were expressed as absolute frequencies and percentages. Ethical confidentiality standards were maintained throughout the study.

3. Results

3.1 Age and Sex Distribution

The study population comprised 173 patients. The mean age was 67.9 ± 8.7 years (range: 38–92 years). The majority of patients (79%) were aged between 60 and 79 years: 52% in the 60–69 age group and 27% in the 70–79 age group. Only 0.5% were under 40 years of age. Male sex predominated markedly, accounting for 138 patients (80%), versus 35 women (20%), yielding a sex ratio of 4:1.

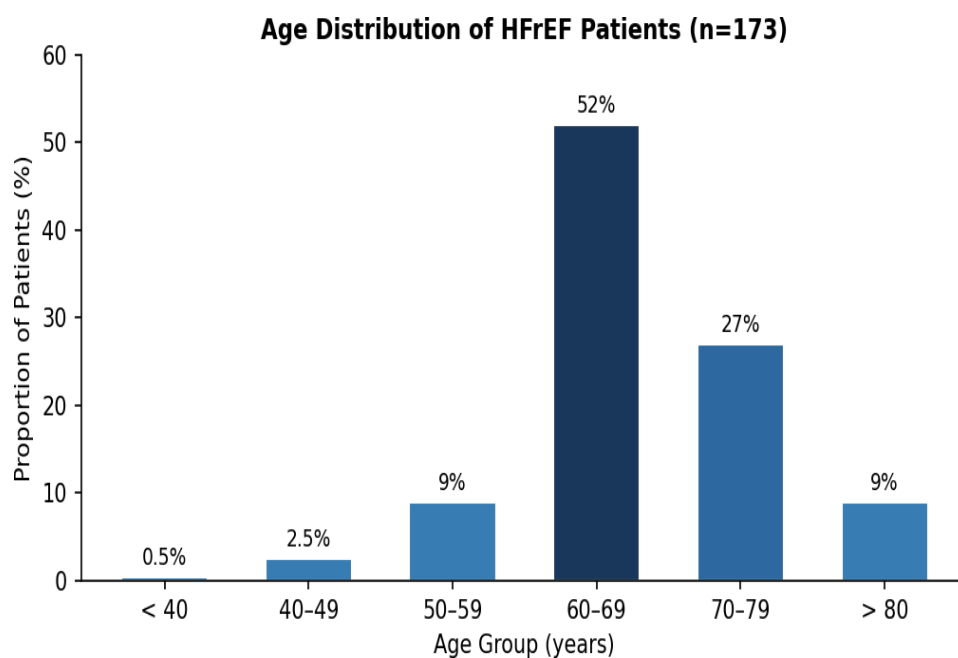


Figure 1. Age distribution of HFReEF patients (n = 173). The 60–69 year group accounts for the largest proportion (52%).

3.2 Cardiovascular Risk Factors

Table 1 summarizes the distribution of modifiable cardiovascular risk factors. Sedentary lifestyle was the most prevalent (85%), followed by smoking (53%), T2DM (45%), AHT (33%), and dyslipidemia (33%). Obesity was found in 8% of patients, and no patient had a documented family history of coronary artery disease.

Risk Factor	n	%
Sedentary lifestyle	147	85%
Smoking	91	53%
Type 2 Diabetes Mellitus	78	45%
Hypertension	58	33%
Dyslipidemia	57	33%
Obesity (BMI ≥ 30)	14	8%
Family history of CAD	0	0%

Table 1: Distribution of modifiable cardiovascular risk factors in the study population.

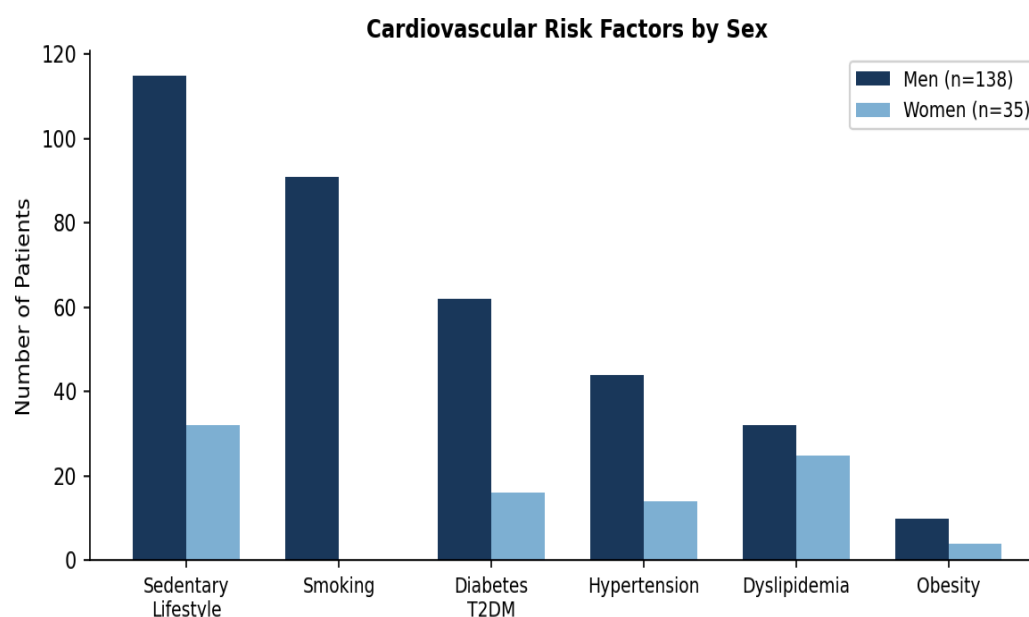


Figure 2. Distribution of modifiable cardiovascular risk factors stratified by sex.

3.3 Comorbidities

The most frequent comorbidities were anemia (45%), prior ischemic cardiomyopathy (41.6%), renal failure (36%), valvular heart disease (18%), and rhythm disorders (6.3%). COPD and OSAS were present in 4% and 3% of patients, respectively.

4. Discussion

Our study provides a detailed epidemiological characterization of HFrEF in a military hospital setting in Morocco. The mean age of 67.9 years is consistent with data from the ESC-HF-LT registry (mean 66 years) [8] and the INTER-CHF study [10], suggesting that HFrEF predominantly affects the elderly in both Western and MENA populations. However, the striking male predominance observed in our cohort (80%) is notably higher than in European registries (approximately 60–65% male) [8,11], possibly reflecting the military nature of the study population and known sex disparities in risk factor exposure in this region.

The high prevalence of smoking (53%) in our cohort is alarming and aligns with reports from the WHO documenting high tobacco use rates in North Africa [12]. Similarly, the 45% prevalence of T2DM is substantially higher than in European cohorts (~30%) [8], reflecting the epidemiological transition in Morocco and the burden of metabolic syndrome in this population. Sedentary lifestyle, affecting 85% of patients, is particularly concerning; physical inactivity is an independent risk factor for both HF incidence and worse outcomes [13].

The co-occurrence of anemia (45%) is well-documented in HFrEF and is associated with worse functional status, increased hospitalization rates, and higher mortality [14]. Iron deficiency anemia, in particular, has emerged as a therapeutic target, with ferric carboxymaltose demonstrating improvements in exercise capacity and quality of life [15]. Renal failure (36%) further complicates management, as it limits use of renin-angiotensin-aldosterone system inhibitors and increases the risk of cardiorenal syndrome [16].

These findings support the hypothesis that effective HFrEF prevention in Morocco and similar settings must begin with aggressive management of traditional risk factors—particularly smoking cessation programs, improved glycemic control, antihypertensive treatment optimization, and promotion of physical activity at the population level.

5. Conclusion

HFrEF at the Avicenne Military Hospital predominantly affects elderly men with multiple modifiable cardiovascular risk factors, particularly sedentary lifestyle, smoking, and diabetes Mellitus. These results underscore the importance of primary and secondary cardiovascular prevention programs tailored to the Moroccan context. Future prospective multicenter studies are needed to generate nationally representative data to guide evidence-based policy.

References

1. McDonagh TA, Metra M, Adamo M, et al. 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. *Eur Heart J*. 2021;42(36):3599–3726.
2. Savarese G, Lund LH. Global public health burden of heart failure. *Card Fail Rev*. 2017;3(1):7–11.
3. Ponikowski P, Anker SD, AlHabib KF, et al. Heart failure: preventing disease and death worldwide. *ESC Heart Fail*. 2014;1(1):4–25.
4. Pfeffer MA, Shah AM, Borlaug BA. Heart failure with preserved ejection fraction in perspective. *Circ Res*. 2019;124(11):1598–1617.
5. Roger VL. Epidemiology of heart failure. *Circ Res*. 2021;128(10):1421–1434.
6. Dokainish H, Teo K, Zhu J, et al. Global mortality variations in patients with heart failure: results from the International Congestive Heart Failure (INTER-CHF) prospective cohort study. *Lancet Global Health*. 2017;5(7):e665–e672.
7. Boutayeb A, Boutayeb S. The burden of noncommunicable diseases in developing countries. *Int J Equity Health*. 2005;4(1):2.
8. Crespo-Leiro MG, Anker SD, Maggioni AP, et al. European Society of Cardiology Heart Failure Long-Term Registry (ESC-HF-LT). *Eur J Heart Fail*. 2016;18(6):613–625.
9. Lam CS, Teng TK, Tay WT, et al. Regional and ethnic differences among patients with heart failure in Asia: the Asian sudden cardiac death in heart failure registry. *Eur Heart J*. 2016;37(40):3141–3153.
10. Dokainish H, Teo K, Zhu J, et al. Heart failure in low- and middle-income countries: background, rationale, and design of the INTERNATIONAL Congestive Heart Failure Study (INTER-CHF). *Am Heart J*. 2015;170(4):627–634.
11. Maggioni AP, Dahlström U, Filippatos G, et al. EURObservational Research Programme: the Heart Failure Pilot Survey. *Eur J Heart Fail*. 2010;12(10):1076–1084.
12. WHO. Global Adult Tobacco Survey: Morocco Country Report. Geneva: World Health Organization; 2022.
13. Piepoli MF, Hoes AW, Agewall S, et al. 2016 European Guidelines on cardiovascular disease prevention in clinical practice. *Eur Heart J*. 2016;37(29):2315–2381.
14. Groenveld HF, Januzzi JL, Damman K, et al. Anemia and mortality in heart failure patients. *J Am Coll Cardiol*. 2008;52(10):818–827.
15. Ponikowski P, Kirwan BA, Anker SD, et al. Ferric carboxymaltose for iron deficiency at discharge after acute heart failure: a multicentre, double-blind, randomized, controlled trial. *Lancet*. 2020;396(10266):1895–1904.
16. Damman K, Valente MA, Voors AA, et al. Renal impairment, worsening renal function, and outcome in patients with heart failure: an updated meta-analysis. *Eur Heart J*. 2014;35(7):455–469.