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Original Research

Etiology, clinical features, comorbidities and mortality in patients with acute heart failure. Experience of a tertiary public hospital in Angola

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Abstract: This article aims to study the etiological and clinical profile of acute heart failure in Angola and to identify the predictors associated with in-hospital mortality. Methods: A descriptive, observational, cross-sectional study was carried out in a tertiary public hospital in Angola. Information on demographic and biological data was collected. The following variables were included: demographic, etiological, and clinical characteristics, cardiovascular risk factors, precipitating factors of cardiac decompensation, comorbidities, and complications. In the univariate analysis we evaluated absolute and relative frequency, in the bivariate analysis independent Mann-Whitney Test, T Student test, and Chi-Square, tests were used as appropriate. Results: The sample comprises 257 individuals, of which 114 (44.36%) are male. The mean age is 49.90 ± 15.95 years. Hospital mortality is 23%. Predictors of poor prognosis were male sex (56.67% vs 40.61%, $p = 0.037$), lower systolic, diastolic, and mean blood pressure ((mean = 115 mmHg vs 138 mmHg, $p < 0.001$; mean = 73 mmHg vs. 85 mmHg, $p < 0.001$ and mean = 87.55 mmHg vs 102.74 mmHg; $p < 0.001$, respectively), higher respiratory rate (mean = 26.48 vs 24.00, $p = 0.013$), New York Health Association (NYHA) Class IV (60.00% vs 35.03%, $p < 0.001$) and lower LVEF (mean = 34.90% vs 39.7%, $p = 0.013$) Infection as a precipitating cause of cardiac decompensation, a previous history of pulmonary TB and DCM were also associated with higher in-hospital mortality (61.66% vs 26.39%, $p < 0.001$; 33.33% vs 12.69 $p < 0.001$, and 45.00% vs 29.95%, $p = 0.031$; respectively). Conclusions: The results indicate that in Angola, heart failure affects young and middle-aged patients and is associated with high in-hospital mortality.

Keywords: Acute heart failure, Echocardiography, Angola

Introduction

Heart failure (HF) affects 64.3 million individuals worldwide of different age groups, sex, and race, with a prevalence of 1-4.3% of the adult population, demanding exorbitant annual expenses from health services for the care of these patients [1,2].

To date, there are no population-based studies evaluating the prevalence and incidence of HF in Sub-Saharan Africa (SSA) [1,3]. However, it is estimated that HF in SSA affects millions of people and that the 6-month mortality is 18% [3,4]. Several studies carried out in SSA at the hospital level have found that HF is a growing public health problem, constituting between 9.4% and 42.5% of

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hospital admissions and up to 30% of cardiology services admissions [5,6].

Studies in SSA have shown that patients with HF, when compared to developed countries, are younger, and the most frequent underlying causes are hypertensive heart disease, dilated cardiomyopathy, and valvular heart disease, with ischemic heart disease being uncommon [3-7]. In addition, a recent study showed that heart failure patients in Africa are more likely to be illiterate, have no health and drug insurance, and are more likely to be in New York Health Association (NYHA) functional class IV compared to those in Asia, the Middle East and South America [8]. A recent meta-analysis showed that the pharmacological treatment of chronic HF in ASS focuses on loop diuretics, angiotensin receptor blockers, angiotensin-converting enzyme inhibitors, and aldosterone antagonists. The use of β-blockers and digitalis, among African patients with HF, remains low [6]. In-hospital mortality varies between 3.8% [9] and 26.2% [10]. We can infer that in SSA, HF is a public health problem, consuming a lot of human and financial resources in the diagnostic and therapeutic approach of these patients.

In Angola, there are no published studies on HF. This study aims to describe the etiological and clinical profile of acute heart failure in patients admitted to a public tertiary hospital in Angola and to identify the predictors associated with in-hospital mortality.

1. Materials and Methods

1.1 Type and Place of Study

A descriptive, retrospective, observational and cross-sectional study was carried out on the clinical profile of patients hospitalized for acute heart failure (AHF) at Hospital Américo Boavida (HAB), Luanda, Angola - a tertiary-level public hospital.

1.2 Study population, case definition of heart failure, and outcomes

The target population consisted of all patients hospitalized for AHF (new or acutely decompensated) at the HAB in 2016. Based on data from the HAB's computer system (SIIGHOSP) and the hospital's cardiology service admissions book, initially, a list was made of all clinical files of patients hospitalized for AHF and registered with category I50 of the International Code of Diseases (ICD-10). Subsequently, clinical records of patients with subcategories I50.0, I50.1, and I50.9 were also reviewed and selected. Finally, each of the processes was carefully checked and evaluated. Only patients whose clinical information was compatible with the definitive diagnosis of HF according to the criteria of the 2021 European Society of Cardiology (ESC) guidelines for the diagnosis and treatment of heart failure were considered for inclusion in the study [11]. The echocardiography database of the cardiology department of the HAB was also consulted to verify the data on the left ventricular ejection fraction (LVEF) of patients whose files did not contain information on this variable. Patients were classified according to LVEF into HF with reduced LVEF (LVEFr < 40%), HF with intermediate LVEF (LVEF-40-49%), and IC with preserved LVEF (LVEF ≥ 50 %).

Finally, patients were classified according to clinical outcomes, and were divided into two groups. Group I :patients who were discharged alive; Group II: patients who died during hospitalization. These patients died as a consequence of the complications of heart failure.

As presented in Figure 1, a total of 490 clinical records were evaluated, of which 257 (52.45%) were included in the study. A total of 233 patients (47.55%) were excluded, of which 190 (38.77%) had medical records with incomplete information about the study variables, 14 (2.86%) were aged < 18 years, and 29 patients (12.44%) who did not meet the diagnostic criteria for HF.

1.3 Study variables

The following variables were included: demographic and clinical characteristics, LVEF, cardiovascular risk factors, causes of heart failure, precipitating factors of cardiac decompensation, comorbidities, complications, and in-hospital mortality.

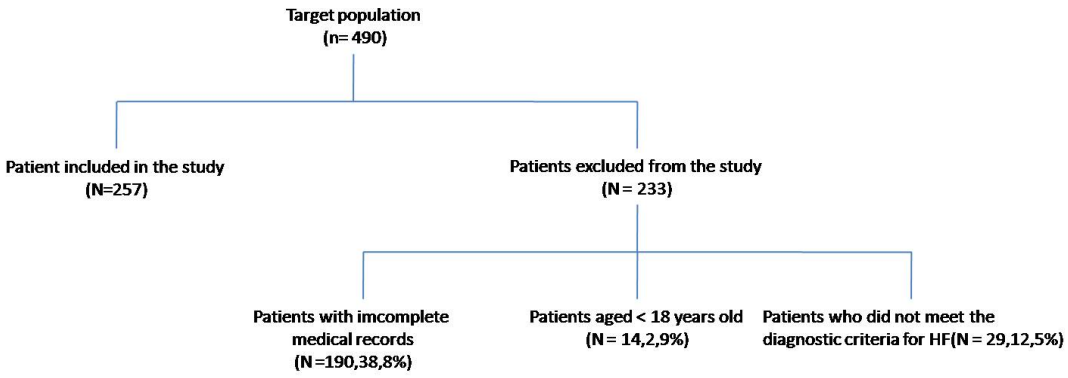

Figure 1 Recruitment, inclusion and exclusion of patients

1.4 Definition of etiology of heart failure

The etiology of heart failure was determined based on the following algorism: hypertensive heart disease (HHD) when the patient was a previous history of hypertension but no evidence of additional cardiovascular disease; ischemic heart disease (IHD), when the patient was previously diagnosed with IHD; valvular heart disease. (VHD), when there was moderate valvulopathy with no IHD; dilated cardiomyopathy (DCM), when there was no other known cardiac cause and had LVEF < 50%; and cor pulmonale, when right-sided heart failure without left ventricular dysfunction was present.

1.5 Inclusion and exclusion criteria

Patients aged 18 years or older admitted to the cardiology service of the HAB with a definitive diagnosis of HF, according to the ESC 2021 guidelines for the diagnosis and treatment of heart failure, were included in the study. Individuals with incomplete medical records were excluded from the study.

2. Statistical analysis

The data was analyzed according to outcomes. The normality of distribution was analyzed with the Kolmogorov-Smirnov test. Qualitative variables were expressed by absolute and relative frequencies and quantitative variables with mean ± standard deviation (SD). Statistical significance was set to $p < 0.05$. Independent Mann-Whitney Test, T Student test, and Chi-Square, tests were used as appropriate. Binomial logistic regression analysis was performed with the conditional Backward method, based on the Hosmer and Lemeshow test and on the Nagelkerke R^2 analysis, to predict variables of poor prognosis to AHF. The data was were analyzed using the SPSS version 27.0 for Windows (IBM-SPSS, Armonk, NY).

3. Results

Table 1 summarized the demographic, clinical, laboratory, and echocardiographic data in the entire population according to clinical outcomes.

Table 1 Demographic, clinical, laboratory, and echocardiographic data in the entire population and according to clinical outcomes

Variable	Total (n 257)	GI - Alive (n 197)	GII - Deceased (n 60)	*p*-value
Age (years)	49.90 ± 15.95	49.20 ± 16.18	52.20 ± 15.08	.166
Male	114(44.36)	80(40.61)	34(56.67)	.037*#
Risk factors				.075#
History of AH	94(36.57)	78(35.59)	16(26.67)	.068#
History of DM	14(5.44)	13(6.60)	1(1.67)	0.140#
Smoking	6(2.33)	3(1.52)	3(5.00)	.118#
Alcoholic Habits	38(14.78)	25(12.69)	13(21.67)	.086#
Obesity	5(1.94)	4(2.03)	1(1.67)	.858#
Etiology				
HHD	86(33.46)	74(37.56)	12(20.00)	.012*#
Dilated CM	86(33.46)	59(29.95)	27(45.00)	.031*#
Cor pulmonale	22(8.56)	15(7.61)	7(11.66)	.305#
AF	20(7.78)	16(10.19)	4(6.66)	.713#
VHD	16(6.22)	10(5.07)	6(10.00)	.218
Peripartum CM	15(5.84)	14(7.10)	1(1.66)	.626#
Others	12(4.67)	9(4.57)	3(5.00)	.889#
HF Type				.446#
AHF de novo	165(64.20)	129(65.48)	36(60.00)	-
ADHF	92(35.79)	68(34.52)	24(40.00)	-
Class NYHA				
Class II	21(8.17)	16(8.12)	5(8.33)	.958#
Class III	131(50.97)	112(56.85)	19(31.66)	.001*#
Class IV	105(40.85)	69(35.03)	36(60.00)	.001*#
SBP mmHg	133 ± 33.68	138 ± 32.35	115 ± 31.94	<.001**&
DBP mmHg	83 ± 33.68	85 ± 14.76	73 ± 16.99	<.001**&
MAP mmHg	98.5 ± 21.90	102.7 ± 20.56	87.5 ± 21.70	<.001**&
HR bpm	102.4 ± 17.6	102 ± 17.60	105.0 ± 17.46	.191&
RR cpm	26.62 ± 6.32	24.0 ± 6.07	26.48 ± 6.73	.013*&
LVEF	38.57 ± 12.58	39.7 ± 13.36	34.90 ± 8.68	.021*&
LVFE				.001*#
HFpEF	45(17.50)	41(20.81)	4(6.67)	.011*#
HFiEF	39(15.17)	35(17.77)	4(6.67)	.035*#
HFrEF	173(67.31)	121(61.42)	52(86.67)	<.001**

ADHF - Acutely decompensated heart failure, AHF - Acute Heart failure, AH- Arterial hypertension, AF- Atrial fibrillation, CI - Confidence interval, CM - Cardiomyopathy, DM - Diabetes mellitus, DBP - Diastolic Blood Pressure, HHD - Hypertensive heart disease, HFpEF - Heart failure with preserved ejection fraction, HFiEF - Heart failure with an intermediate ejection fraction, HFrEF- Heart failure with reduced ejection fraction HR - Heart rate, LVEF - Left ventricular ejection fraction, MAP - Mean Blood Pressure. NYHA - New York Heart Association, OD - Odd ratio RR - Respiratory rate, SBP- Systolic Blood Pressure, VHD - Valvular heart disease, *$p < 0.05$ **$p < 0.01$ - Data are expressed as number (percentage) or mean ± standard deviation. & Mann-Whitney Test.# Chi-Square test

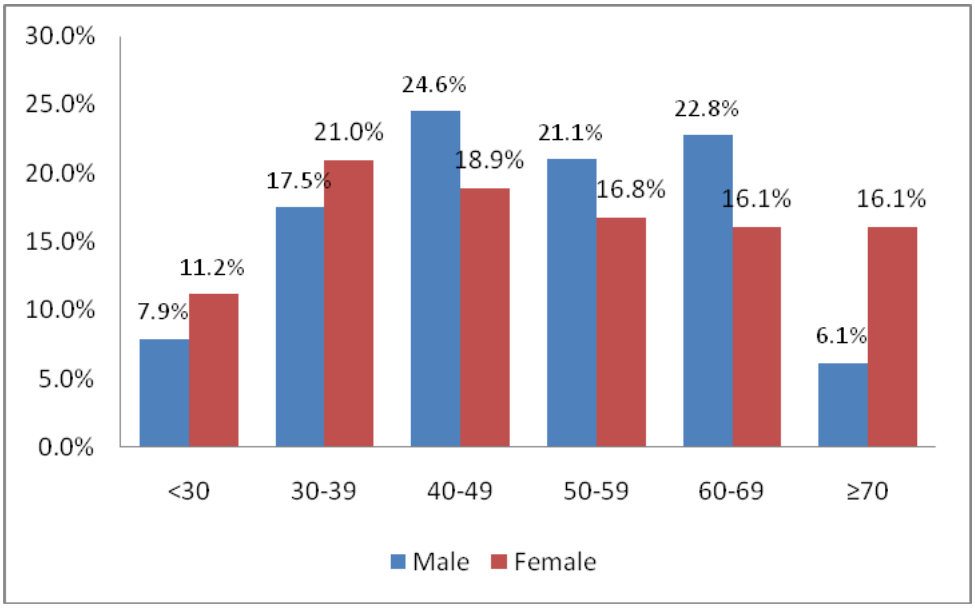

Figure 2 Population distribution according to age groups and gender

3.1 Clinical profile and risk factors

A total of 114 men (44.36%) and 143 women (55.64%) (mean age: 41,3 ± 11,8 years) were included. The distribution by age group and sex is represented in Figure 2. One hundred and ninety-seven patients were discharged alive, and 60 patients (23.34%) died during the hospital stay.

Hypertension was the most frequent risk factor (36.57%), followed by alcoholism and diabetes mellitus (DM). In turn, only 2.33% were smokers. On the other hand, more than a third (38.9%) of patients had no known cardiovascular risk factors. It should be noted that 64.20% of the cases had de novo AHF as a form of clinical presentation, and 91.82% of the individuals were in NYHA classes III and IV.

3.2 AHF precipitating factors, comorbidities, and complications.

Table 2 summarized the precipitating factors, comorbidities, and complications in the entire population according to clinical outcomes. The precipitating factors included therapeutic noncompliance (TI) (36.57%), followed by infections (34.63%) (predominantly, respiratory infections). Less common precipitating factors included hypertensive crisis (8.56%), cardiac arrhythmia (7.78%), and anemia (7.00%).

Hypertension (19.84%) was the most common comorbidity followed by pulmonary tuberculosis (PTB) (17.50%), community-acquired pneumonia (CAP) (11.67%), and chronic kidney disease (8.17%). HIV-AIDS was found in 2.33% of cases.

The most frequent complications during hospitalization were acute renal failure, acute pulmonary edema, and arterial hypotension in 12.84%, 7.00%, and 7.00% of the cases, respectively. Fatal complications such as irreversible cardiorespiratory arrest and cardiogenic shock occurred in 5.45% and 5.05% of patients.

3.3 Echocardiography and causes of AHF

The etiological factors of AHF in the population studied show that hypertensive heart disease (HHD) and dilated cardiomyopathy (DCM) were the two main etiologies of HF in 33.46% each, followed by cor pulmonale, atrial fibrillation, and valve heart disease (VHD) in 8.56%, 7.78 % and 6.22% of cases, respectively. Other causes of HF in our population include peripartum cardiomyopathy (PPCM) (5.84%), pericardial disease (2.33%), infective endocarditis, ischemic heart disease (IHD), and high-output HF in 0.78% each. Echocardiographic data showed that the mean LVEF was 38.7 ± 12.8. Patients had HF with reduced LVEF (HFrEF), HF with intermediate LVEF (HFpEF), and HF with preserved LVEF (HFpHF) in 67.31%, 15.17%, and 17.50% of the cases, respectively.

Table 2 Precipitating factors, comorbidities, and complications in entire population and according to clinical outcomes

Variable	Total (n 257)	GI - Alive (n 197)	GII - Deceased (n 60)	*p*-value
Precipitating factors				
Therapeutic noncompliance	94(36.57)	81(41.11)	13(21.66)	0.006**#
Infection	89(34.63)	52(26.39)	37(61.66)	<.001***#
Arrhythmia	20(7.78)	15(7.61)	5(8.33)	.855#
Anemia	18(7.00)	16(8.12)	2(3.33)	.203#
Hypertensive crisis	22(8.56)	20(10.15)	2(3.33)	.098#
Pregnancy	14(5.44)	13(6.59)	1(1.66)	.140#
Comorbidades				
Arterial hypertension	51(19.84)	46(23.35)	5(8.33)	.010*#
Pulmonary tuberculosis	45(17.50)	25(12.69)	20(33.33)	<.001**#
CAP	30(11.67)	20(10.15)	10(16.66)	.168#
Diabetes mellitus	18(7.00)	16(8.12)	2(3.33)	.203#
Chronic kidney disease	21(8.17)	13(6.59)	8(13.33)	.095#
Atrial fibrillation	13(5.05)	11(5.58)	2(2.33)	.486#
Valvular heart disease	11(4.28)	9(4.56)	2(2.33)	.683#
Chronic liver disease	4(1.56)	2(1.01)	2(2.33)	.204#
HIV-AIDS	3(1.16)	1(0.50)	2(2.33)	.074#
HIV-AIDS + PTB	3(1.16)	3(1.52)	0(0.0)	-
Bronchial Asthma	7(2.72)	7(3.55)	0(0.0)	-
Complications				
Acute renal failure	33(12.84)	24(12.18)	9(15.00)	.567#
Arterial hypotension	18(7.00)	11(5.58)	7(11.66)	.106#
Acute pulmonary edema	18(7.00)	16(8.12)	2(3.33)	.203#
Pulmonary hypertension	14(5.45)	13(6.59)	1(1.66)	.151#
Stroke	14(5.45)	5(2.53)	2(3.33)	.743#
Hypotension and CS	31(12.06)	11(5.58)	20(33.33)	<.0001***
Any complications	118(45.91)	69(35.02)	49(81.66)	<.0001***
Cardio-respiratory arrest	14(5.44)	0(0.0)	14(23.33)	-
Cardiogenic Shock	13(5.06)	0(0.0)	13(21.66)	-
PT	1(0.39)	0(0.0)	1(1.66)	-

AIDS Acquired immunodeficiency syndrome , CS - Cardiogenic shock, HIV – Human immunodeficiency virus, CI - Confidence interval, CAP - Community-acquired pneumonia, CPA - Cardio-respiratory arrest, NA - Not applicable. PT - Pulmonary tromboembolism, PTB - Pulmonary tuberculosis. *$p < 0.05$, **$p < 0.001$, ***$p < 0.0001$ Data are expressed as number (percentage) or mean ± standard deviation.# Chi-Square test

3.4 In-hospital mortality.

In the present study, in-hospital mortality was 23.34%. In the bivariate analysis, in-hospital mortality was associated with the male sex (56.67% vs 40.61%, $p = 0.037$), lower systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean blood pressure (MBP) (mean = 115 mmHg vs 138 mmHg, $p < 0.001$ and mean = 73 mmHg vs 85 mmHg, $p < 0.001$, mean = 87.55 mmHg vs 102.74 mmHg, $p < 0.001$, respectively), higher respiratory rate (mean = 26.48 vs 24.00, $p = 0.013$), NYHA Class IV (60.00% vs 35.03%, $p = 0.001$) and lower LVEF (mean = 34.90% vs 39.7%, $p = 0.021$). Infection as a precipitating cause of cardiac decompensation and a previous history of PTB and DCM were also associated with higher in-hospital mortality (61.66% vs 26.39%, $p < 0.001$; 33.33% vs 12.69; $p < 0.001$, and 45.00% vs 29.95%, $p = 0.031$, respectively).

A Binomial logistic regression was performed to ascertain the effects of NYHA class IV, DCM, SBP, DBP, MBP and LVEF on the likelihood that participants have AHF (Table 3). The logistic regression model was statistically significant, $\chi^2(4) = 29.293$, $p < 0.0001$. The model explained 18.6% (Nagelkerke R^2) of the variance in AHF and correctly classified 78.2% of cases. Patients with NYHA functional class IV were 2.26 times more likely to exhibit AHF (OR = 2.265; $p = 0.017$; 95% CI = 1.15-4.43). Interestingly,increasing MPB was associated with a reduction in the likelihood of exhibiting AHF in this cohort (OR = 0.964; $p < 0.001$; 95% CI = 0.947-0.982). Continuous variables DCM, SBP, DBP, and LVEF were not predictors of AHF in this model ($p > 0.05$).

Table 3 Multivariate analysis to estimate the effect of predictive variables of poor prognosis for AHF.

Clinical variables	*B*	Wald	*p*-value*	OR	95% Confidenceinterval	
					Lower	Highest
NYHA class IV	0.818	5.700	0.017	2.265	1.158	4.432
DCM	-0.255	0.422	0.506	0.755	0.366	1.643
SBP	0.000	0.000	0.998	1.000	0.666	1.504
DBP	-0.009	0.033	0.857	0.991	0.894	1.097
MBP	-0.036	14.867	<0.001	0.964	0.947	0.982
LVEF	-0.020	1.545	0.214	0.981	0.951	1.011

Dependent variable: Acute heart failure (AHF). B: Unstandardized Regression Coefficient. **p*-value referring to the Multiple Linear Regression analysis by the Backward: Conditional method (5º step). Significant values in bold when $p < 0.05$.

4. Discussion

The main results of this study suggest that AHF in Angola predominantly afflicts young and middle-aged individuals in the prime of life and most of whom have *de novo* AHF. Late clinical presentation is common, with more than 90% presenting in NYHA classes III and IV. About two-thirds of our population had HF with reduced LVEF, with HHD and DCM being the two most common etiologies. In contrast, IHD is relatively uncommon. Therapeutic noncompliance and infections are the most common precipitating factors of cardiac decompensation. Arterial hypertension and PTB are the most common comorbidities. The in-hospital mortality rate is high, around 23%.

4.1 Clinical profile and risk factors

The relatively young age found in our cohort is in agreement with the vast majority of studies carried out in SSA [4,10,12-21] (Table 3), it contrasts, however with the situation in European countries, North America, and Japan, where HF is essentially a problem of the elderly (mean age at presentation 72 years) [22]. As highlighted by several authors, the younger patients with AHF in ASS may be related to the etiology of HF. Rheumatic heart diseases and cardiomyopathies are essentially problems of youth and middle-aged individuals. Furthermore, hypertension is known to occur early in Africans and African Americans, with greater adverse consequences [4,5,22,23]

The higher rate of HF in women found in the present study is consistent with that found in about half of the studies conducted in SSA [4,10,12,13,15,16,19-21,24-32] (Table 3). Reported sex differences in different SSA regions may be related to patient selection, the burden of cardiovascular risk factors, and regional etiologic variations. In populations with predominant rheumatic heart disease and cardiomyopathy (especially PPCM), HF rates tend to be higher in females than males [3,6,8,9]. These aspects were confirmed in our cohort.

The risk factors found in the present study are in line with those described in the vast majority of studies on SSA, with hypertension being the main risk factor followed by alcohol habits and DM [4,9,17,20,31,33]. It should be noted that the prevalence of smoking in our population (1.55%) is similar to that reported in Nigeria (3.3%), [9] and Tanzania (3.5%) [10] but is significantly lower than that reported in other countries in SSA [4,13,17,34]. The prevalence of smoking habits found in our cohort is in line with the population-based study carried out by Pedro et al. (2017), on smoking habits and nicotine dependence in the province of Bengo, Angola, where the authors found a current smoking prevalence of 6.1% [35].

Other aspects of our population (predominance of *de novo* AHF and late and severe clinical presentations) are similar to those reported by other authors [9,12,14,15,17,19,20,23]. The late and severe presentation of the patient suggests a possible delay in the diagnosis of HF which is often made and/or confirmed only in tertiary centers. On the other hand, one study carried out in Angola showed that among hypertensive patients only 21.6% (95% CI: 17.0% to 26.9%) knew their condition. Furthermore, only 13.9% (95% CI: 5.9% to 29.1%) of the subjects being aware of their hypertensive condition were under pharmacological treatment, of which only 36.4% were under control. [36]. These factors contribute to the poor evolution of hypertension, culminating in hypertensive heart disease and later HF.

4.2 Precipitating factors and comorbidities

In the present study, therapeutic noncompliance (36.57%) and infections (34.63) are the main precipitating factors. These findings are in line with a study conducted in Ethiopia, in which community-acquired pneumonia (47.5%) and treatment discontinuation (22.5%) were the main factors associated with decompensation [33]. This finding was corroborated in a study conducted in Uganda where the authors also reported that among previously hospitalized patients, non-adherence to HF medication (31.7%) was the main precipitating factor for cardiac decompensation [19].

The comorbidities found in our population reveal an interesting aspect, which was the high prevalence of a previous history of PTB, which was not found by other authors. This may be associated with the high prevalence of PTB in Angola, which in 2015 was estimated at 243.6 per 100,000 inhabitants [37]. Contrary to what Pallangyo et al. (2017), reported in Tanzania, the prevalence of renal dysfunction found by us is similar to that found in other studies carried out in SSA [17,20,38]. In turn, the prevalence of HIV/AIDS found in the present study is significantly lower than that reported in Botswana [17], Zambia [16], and Uganda [13] but is very similar to that reported in Nigeria [9], Congo Brazzaville [27] Gabon [24] and Tanzania [20]. The most likely explanation for this fact lies in the low prevalence of HIV in our population. In Angola, according to the results of the Multiple Indicators and Health Survey 2015-2016, the prevalence of HIV in the population aged 15-49 years is 2% [39], while in Botswana the prevalence of HIV-AIDS was around 24.4% in 2012 [17].

4.3 Echocardiography and causes of HF

The etiological pattern in the present study is consistent with findings in Nigeria [40], Tanzania [20,28], and Cameroon [26], in Congo Brazzaville [27] and Côte d'Ivoire [14] where HHD and DCM are the two most frequent causes of HF. In contrast, in Zambia [16], Rwanda [41], and the Democratic Republic of Congo (DRC) [29] DCM is the most common cause of HF. While, in Kenya [32], Burkina Faso [34], and Ethiopia [12] VHD is the leading cause of HF. It should be noted that VHD in our cohort was the fifth cause of AHF and IHD was very rare (<1%) (Table 4).

Table 4 Etiology of acute heart failure in SSA

Autor, Year of publication	Country	Sample N	Females %	Age M ± SD	Etiology HHD	DCM	VHD	IHD	CP	PPCM	Others
Damasceno,2012 [4]	SSA	1006	50.8	52.3 ± 18.3	45.4	18.8	14.2	7.7	-	7.7	6.2
Ogah, 2014 [9]	Nigeria	452	45.1	56.6 ± 15.3	78.5	7.5	2.4	0.4	4.4	1.3	5.5
Kingery, 2017 [10]	Tanzania	145	55.86	52	42.8	19.3	16.6	6.2	7.6	-	7.5
Abebe, 2016 [12]	Ethiopia	311	69.77	53.6 ± 16.9	16.1	12.5	40.8	15.8	4.5	-	10.3
Adouti, 2020 [14]	Ivory Coast	302	38.41	55.5 ± 16.9	40.4	21.9	11.6	7.9	3.0	-	15.2
Ojji, 2009 [18]	Nigeria	340	49.12	50.6 ± 15.3	62.6	14.7	11.5	-	1.8	3.2	6.2
Okello, 2014 [19]	Uganda	274	69.71	-	9.1	31.4	13.9	5.5	-	-	40.1
Pallangyo, 2017 [20]	Tanzania	455	56.48	46.4 ± 18.9	40.1	27.0	23.2	0.0	-	-	9.7
Tigabe, 2021 [21]	Ethiopia	226	59.3	51.2 ± 19.0	4.4	13.7	28.3	27.0	17.7	-	8.9
Lemogoum, 201 [23]	Cameroon	142	41.55	-	40.1	-	2.8	21.8	-	-	35.3
Bonsu, 2017 [25]	Ghana	1488	54.44	60.3 ± 14.2	42.8	9.0	18.1	2,7	2,1	15,4	30.1
Boombhi, 2017 [26]	Cameroon	148	57.43	61.46	30.2	28.2	11.9	6.3	8.7	3.8	10.9
Ikama, 2015 [27]	C. Brazaville	272	52.21	56.9 ± 16.5	39.0	31.6	8.8	5.5	0.0	-	15.1
Makubi, 2014 [28]	Tanzania	427	51.52	55 ± 17	45.0	28.9	12.0	6.6	-	-	7.5
Malamba-Lez, 2018 [29]	DRC	231	53.25	56 ± 17	4.3	47.6	14.3	3.9	12.1	8.2	9.6
Tirfe, 2020 [33]	Ethiopia	169	54.44	37.8 ± 17.8	10.1	8.3	48.5	10.1	8.3	-	14.7
Mandi, 2020 [34]	Burkina Faso	298	49.66	58.56 ± 18.54	50.3	19.8	6.7	4.4	-	10.7	8.1
Onwuchekwa, 2009 [38]	Nigeria	423	42.79	54.4 ± 17.3	56.3	7.3	4.3	0.2	2.1	-	29.8
Kwan, 2013 [41]	Rwanda	192	69.79	-	8.0	54.0	25.0	-	-	-	13.0
Karaye, 2021[42]	SSA	1294	48.84	-	35.0	14.1	9.5	20.0	-	0.3	21.1
Tantchou Tchoumi, 2011[46]	Cameroon	462	42.86	42.5 ± 18.0	15.0	30.5	35.0	0.96	8.0	-	10.5
Pio, 2014 [47]	Togo	297	46.46	52.2 ± 16.7	43.1	5.9	11.8	19.2	2.7	11.8	5.5
Present series, 2022	Angola	257	55.64	49.90 ± 15.95	33.46	33.46	6.22	0.78	8.56	5.84	11.68

CP - Cor pulmonale, DCM - dilated cardiomyopathy, HHD - hypertensive heart disease, IHD - Ischemic heart disease, M - Median, PPCM - Peripartum cardiomyopathy, SD - Standard deviation, VHD - Valvular heart disease.

In turn, in the THESUS-HF registry carried out in 9 SSA countries, heart failure was most commonly due to arterial hypertension (45%), followed by DCM (19%) and rheumatic heart disease (14%), while the IHD accounted for less than 8% [4]. In contrast, the INTER-CHF Africa study that included inpatients (48.6%) and outpatients revealed that hypertension was the main cause of HF in 35% of cases, IHD ranked second, followed by idiopathic dilated DCM in 20% and 14.1% of cases, respectively [42].Although increasing, the low prevalence of IHD in SSA has been explained by the difference in the prevalence of several cardiovascular factors. The lipid profile of individuals on ASS is typically low, reflecting their lifestyle that includes a high level of physical activity and a low-fat diet, which contributes to low rates of atherosclerosis. In SSA, the overall prevalence of hypercholesterolemia and diabetes mellitus is less than 35% and 4%, respectively [43].In addition, the low life expectancy often reported in African countries reduces the number of the elderly population, which is more prone to ischemic heart disease due to atherogenic vascular phenomena typical of senility [44].

In the present study, two-thirds of the patients had HFrEF (LVEF <40%). This fact may be related to the high prevalence of DMC and PPMC found in our cohort (39.30%). In a study carried out by us in this same hospital that included 1.431 patients with DMC, Morais et al. (2020), reported a mean LVEF of 25.0% [45]. On the same path is the study carried out in the DRC where DMC and PPMC were found in 55.8% of the cases, the mean LVEF was 29.0% [29]. On the other hand, it is important to emphasize that classification in HFrEF and HFpEF over time has been based on different LVEF cut-off points. Preserved HFpEF can be defined as EF > 40%, [16], EF > 45%, [17,28], EF ≥ 50% [12,14,21,25,33,46] or EF ≥ 55% [19,31,47], thus limiting the comparison between studies. However, in SSA, the vast majority of studies revealed a higher proportion of patients with HFrEF (57.6-87.2%) than HFpEF [14,17,23,28,31,34], as observed in our cohort.

4.4 In-hospital mortality

The in-hospital mortality rate found in the present study (23%) is in line with the in-hospital mortality rate reported in the vast majority of studies in SSA [10,13,16,19,20,23,26,27,29,30,33] where in-hospital mortality varies between 17.0% and 26.2%; but it is higher than that reported in European countries, where it varies between 3.8% and 14.3% [48] and in some studies carried out in SSA, where it varies between 3.8% and 14.1% [4,9,12,14,15,17,21,31,38,46].

The predictors of poor prognosis that we found (NYHA functional class IV, SBP; lower DBP, MAP, reduced LVEF, and DCM) were very similar to those described in ASS [16,19,23,30]. In a study in Zambia, where in-hospital mortality was 24.1%, independent prognostic predictors of mortality included: LVEF < 40 percent, NYHA class IV, serum urea above 15mmol/L, and Hb below 12g/dL [16]. In a study in Cameroon, the in-hospital mortality rate was 20.4%, the factors significantly associated with poor prognosis were: SBP < 90mmHg, increased serum creatinine; LVEF < 20%, hospital use of dobutamine for the treatment of cardiogenic shock, pleural effusion and prothrombin time < 50%. In the multivariate analysis, the predictors independently associated with poor prognosis were SBP < 90 mmHg; increase in serum creatinine (by 1 mg/L); LVEF < 20%; use of dobutamine as therapy for cardiogenic shock and pleural effusion [23]. In the same vein in the study in southwestern Ethiopia, the mortality rate was 21.29% and the predictors of poor prognosis were the presence of complications, cardiogenic shock, and LVEF ≤ 30% [30]. Finally, the poor prognosis of lower SBP found in our population is consistent with findings from patient registered in developed countries [49].

In our study, the male gender was associated with higher in-hospital mortality, corroborating the findings reported in Cameroon [31]. Although not statistically significant, this trend was also observed in the THESUS study [4].

Finally, infection was the main precipitating factor of cardiac decompensation and was associated with high in-hospital mortality, an important finding of this study. In a study in Tanzania, concomitant infection was an independent predictor of longer hospital stays. In this study, the authors also found hypotension and reduced LVEF to be independent predictors of in-hospital mortality [19].

However, only NYHA functional class IV was an independent predictor of in-hospital mortality in our cohort.

The great variation in in-hospital mortality observed in the different studies carried out in SSA is certainly related to constraints versus facilities in the access, management, and correct treatment of these patients, available in each country.

Limitation of the study. Several limitations in the present study should be noted: a) Failure to assess the therapy instituted during hospitalization and at discharge, as well as the length of stay; b) clinical, electrocardiographic, radiological, and laboratory parameters of the patient were not evaluated; c) be a single-center study.

5. Conclusions

This is the first study performed to date on the etiological and clinical profile of acute heart failure and to identify the predictors associated with in-hospital mortality in Angola. The study suggests that heart failure affects young and middle-aged patients, with hypertensive heart disease and dilated cardiomyopathy being the most common causes. The disease is associated with high in-hospital mortality. Male sex, NYHA class IV, hypotension/cardiogenic shock, reduced LVEF and DCM are associated with higher in-hospital mortality, but only NYHA functional class IV was an independent predictor of in-hospital mortality in our cohort. A multicenter study is needed to better characterize the scope of HF in our population.

Author Contribution

Conceptualization: H.M. and M.A.A.G.; Data collection. A.A.; Formal Analysis: H.M.; Methodology: M.A.A.G. and A.A.; Writing-Original draft: H.M.; Writing-review & editing: H.M., I.L. and M.A.A.G.; Approval of the final manuscript: H.M. A.A. I.L. and M.A.A.G.; Supervision: H.M. and M.A.A.G.

Informed Consent Statement

The use of the database was authorized by the Management

of HAB. Anonymity and total confidentiality were guaranteed regarding the identity and information collected from the patients whose clinical processes were studied, following all the norms of research in human beings according to the Declaration of Helsinki.

Disclosure

There are no financial conflicts of interest to disclose.

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