Comparative Study of Heart Failure by Gender at The Abidjan Cardiology Institute

Bamba-Kamagaté D[1], Daniogo MM[1], Kee MYC[2*], Koffi F[1], Soya E[1] and Anzouan-Kacou JB[3]

[1]Medical Service, Cardiology Institute of Abidjan, Abidjan, Côte d'Ivoire

[2]Service de Pharmacologie Clinique, Centre Hospitalier Universitaire de Bouaké, UFRSMB, Université Alassane Ouattara 01 BPV 18 Bouaké 01, Côte d'Ivoire

[3]Functional Investigation Service, Cardiology Institute of Abidjan, Abidjan, Côte d'Ivoire

*Corresponding author
KEE Mankoh Yves-Cédric, Abidjan Heart Institute, UFR-SM, Université Alassane Ouattara, 22 BP 318 Abidjan 22, Côte d'Ivoire.

ABSTRACT
Heart failure (HF) differs significantly between men and women in Africa, but data from Côte d'Ivoire are scarce. This retrospective study analyzed 1,211 patients hospitalized at the Institute of Cardiology of Abidjan (2015–2018). Men (61%) were older (56.2±15 vs. 52.7±19 years; p=0.003) and had higher rates of hypertension, diabetes, dyslipidemia, ischemic cardiomyopathy, and in-hospital mortality. Women exhibited higher heart rates, systolic blood pressure, and hypokalemia but had better in-hospital outcomes. Poor prognostic factors in men included advanced age, ischemic heart disease, and hyponatremia, while NYHA stage III-IV predicted worse outcomes in women. Ischemic cardiomyopathy was the leading cause in men, whereas dilated cardiomyopathy predominated in women. These findings highlight the need for gender-specific strategies to improve HF management in Côte d'Ivoire.

Introduction

Heart failure (HF) is one of the main causes of cardiovascular disease, often at an advanced stage. According to the European Society of Cardiology, 1 to 2% of Europeans are affected [1]. Its prevalence is tending to increase, not only because of the ageing of the population, but also because of improvements in the treatment of severe acute coronary events [2]. Its respective incidence of 4‰ and 3‰ in men and women aged 55 to 64 has risen to 50‰ and 85‰ in men and women aged 85 to 94 [3]. Also, gender is a non-modifiable risk factor. Classification of HF according to left ventricular ejection fraction (LVEF) has identified three types of HF. In the hospital setting, 50% of patients have reduced ejection fraction, and 50% have mildly reduced or preserved ejection fraction [1]. Patients with preserved EF would be more likely to be women. This suggests gender discrimination of the type of heart failure, on which severity and management strategy depend.

HF in men and women appears to be poorly described in sub-Saharan Africa [4,5]. We found no comparative analysis of HF by gender in Côte d'Ivoire. The aim of this study was to compare the characteristics of heart failure in women and men at the Institute of Cardiology of Abidjan (ICA), in order to identify the morphological profile and associated factors.

Methods

Our study took place in the Medicine Department of the Institute of Cardiology of Abidjan (ICA). It was a retrospective comparative study of patients hospitalized for heart failure. All patients over 18 years old, hospitalized between January 1st, 2015 and December 31, 2018 in the Medicine Department of the ICA and with complete records were selected and included. Patients with incomplete or untraceable medical records were excluded from the study. We divided the patients into two groups according to gender (male, female). Cases were identified in the medical department's hospitalization register. Records were retrieved from the ICA archives department for reading.

Data were collected from hospitalization medical files or records during the study period. Epidemiological, clinical, paraclinical including biological, therapeutic and outcome data were recorded consecutively for each in-patient. Data entry and analysis were

carried out using Epi-info version 7 software. Quantitative variables were expressed as mean ± standard deviation (m ± α) and qualitative variables as proportion (%). For comparison of means, we used the t-Student test and for proportions, the Chi2 test after checking the conditions of application. The significance threshold p ≤ 0.05 was chosen.

This study had obtained the favourable opinion of the ethics committee and the authorization of the medical scientific Direction of the ICA. We did not require patient consent since this is a retrospective study based on medical records. Nevertheless, each patient's medical data were transmitted only to the principal investigator or any person authorized by him/her, under conditions guaranteeing confidentiality.

Results
Descriptive Study
During the study period, 1,211 patients with heart failure were registered out of 4,562 admissions to the ICA medicine department, representing a frequency of 26.5% of admissions to the department. Two patients were excluded due to insufficient data.

The mean age of patients was 54.8 ± 16.8 years (extremes: 18 and 94). Patients were over 50 in 22.4% of cases. The majority lived in Abidjan (77.6%). Most patients (89%) had no health insurance. Men accounted for 60.9% (n=736) and women for 38.1% (n=473), with hospital prevalence of 16.1% and 10.4% respectively.

Analytical Study
Socio-demographic data showed that men were statistically older than women (56.2±15 years vs. 52.7±19 years;p=0.003), had more health insurance than women(8.1% vs. 3.4%;p=0.04). Compared with women, men were more likely to be aged > 55 years, to have hypertension, diabetes and dyslipidemia (p<0.05; Table 1). There was no gender difference in obesity.

Clinically, men had statistically more previous hospitalizations for HF (p=0.02) than women (Table1).

Table 1: Comparison of epidemiological parameters of heart failure by gender

Parameters	Male (n=736)	Female (n=473)	OR [CI95%]	p
Socio-demographic				
Age (year)	56,2±15	52,7±19		0,003
Place of residence				
Abidjan	510 (69,3)	326 (68,9)	0,5 [2-5,1]	0,3
Outside Abidjan	152 (20,7)	89 (18,8)	0,4 [0,13-1,2]	0,11
Health insurance				
Yes	8,1	3,4	2[1-4]	0,04
No	36,7	52,3	0,7[0,4-1,1]	0,12
Cardiovascular Risk Factors				
Age (year)				
Men (> 55)	53,9	-		0,0
Women (> 60)	-	37,4		
Arterial hypertension	379 (51,5)	230 (48,6)	1,1 [0,8-1,5]	0,04
Diabetes	146 (19,8)	65 (13,7)	1,6[1,1-2,2]	0,01
Smoking	114 (15,5)	20 (4,2)	1,1[0,8-1,6]	0,52
Dyslipidemia	69 (9,4)	19 (4,0)	2,5[1,5-4,3]	0,005
Obesity	70 (9,5)	43 (9,1)	1,1[0,7-1,6]	0,76
Sedentary lifestyle	53 (7,2)	44 (9,3)	0,8[0,5-1,2]	0,2

OR: Odds ratio, **CI:** Confidence Interval

Anaemia was the most frequent precipitating factor in men, with statistical significance (28.8% vs. 23.3%; p=0.0003). Systolic blood pressure (SBP) was significantly higher in women (p=0.005), associated with frequent tachycardia (p=0.00). Rhythm disorders (32.3% vs. 26.6%; p=0.03), ischemic heart disease (15.8% vs. 9.7%, p=0.001) and hypokalaemia were more common in men, with a statistically significant difference (p=0.02; Tables 2and 3). Although the mean NT-Pro BNP was higher in women, it was not statistically significant (10038.4±8052.5pg/ml vs. 8827.4±8339.6pg/ml; p=0.5). Hypokalaemia was statistically significant in men (Table 3).

In terms of therapeutics, furosemide, ACE inhibitors/ARBIIs and beta-blockers were prescribed more frequently in men, with no statistically significant difference. Aspirin (p=0.001) and statins (p=0.007) were statistically significantly more widely used in men than in women (Table 3).

Table 2: Comparison of clinical parameters of heart failure patients by gender

Clinical parameters	Male (n=736)	Female (n=473)	OR [IC95%]	p
Hospitalization history for HF	304(41,3)	145(30,6)	1,5 [1,2-2]	0,02
Hemodynamic constants				
Systolic blood pressure≥140mmHg	172,3±4,6	173,8±27,3		0,005
Diastolic blood pressure≥90mmHg	106,4±15,3	112,1±54,2		0,07
Heart rate≥100 bpm	97,3±20,7	106,1±32,9		0,00
Breathing rate≥20cpm	32,8±11,5	33,1±9		0,07
Type of HF				
Left	322(43,8)	236(49,9)	1,5 [0,6-3,4]	0,35
Right	31(4,2)	16(3,4)	2,1 [0,8-5,8]	0,14
Global	372 (50,5)	211(44,6)	1,9 [0,8-4,4]	-
Acute lungedema	14(1,9)	12(2,5)	0,8 [0,2-2,8]	0,7
Cardiogenic shock	4(0,5)	4(0,8)	0,7 [0,1-3,8]	0,7

Risk factors				
Anaemia	212(28,8)	110(23,3)	2,2 [1,5-3,1]	0,0003
Infectious syndrome	172(23,4)	98(20,7)	1,1 [0,8-1,5]	0,28
Therapeutic non-compliance	175(23,8)	88(18,6)	2 [0,7-5,5]	0,17
Rhythm disorder	85(11,5)	39(8,2)	1,7 [0,6-4,9]	0,32
Myocardial ischemia	66(9)	32(6,8)	1,5 [1-2,4]	0,08
Worsening renal function	34 (4,6)	12(2,5)	2,3 [0,8-6,9]	0,13
Speed deviation	28(3,8)	14(3)	1,6 [0,5-4,9]	0,41
Pulmonary embolism	20(2,7)	18(3,8)	0,66 [0,2-2,2]	0,5

CI: Confidence Interval, **HF:** Heart failure, **OR:** Odds ratio.

Table 3: comparison of radiological and biological parameters by gender in heart failure patients

Paraclinical parameters	Male (n=736)	Female (n=473)	OR [IC95%]	p
Chest X-ray				
CTI normal	165(22,4)	2(18,4)		0,8
Cardiomegaly (CTI>0.50)	571(77,6)	386(81,6)		0,2
Electrocardiogram				
Sinus rhythm	(491)66,7	(299)63,2	1,2[0,8 - 1,7]	0,36
Rhythm disorders	(238)32,3	(126)26,6	1,8[1,0 - 3,2]	0,03
Conduction disorders	(209)28,3	(127)26,8	1,1[0,8 - 1,4]	0,6
Echocardiography				
Ejection Fraction (EF)	0,6±3,6	0,8±4,4		0,1
≥ 50%	(143)19,4	(99)20,9		0,8
[40–50%]	(124)16,8	(77)16,3		0,7
< 40%	(398)54,1	(276)58,4		0,1
Underlying heart disease				
Dilated cardiomyopathy	384(52,2)	236(49,9)	1,1[0,8 - 1,5]	0,53
Hypertensive cardiomyopathy	103(14)	61(12,9)	1,2[0,8 - 1,7]	0,3
Ischemic cardiomyopathy	116(15,8)	46(9,7)	1,2[1,3 - 2,8]	0,001
Valvulopathy	114(15,5)	66(13,9)	1,2[0,8 - 1,7]	0,2
Pulmonary hypertension	149(20,2)	90(19)	1,2[0,5 - 2,7]	0,6
Pericarditis	31(4,2)	24(5,1)		0,09
Hyponatremia (mEq/L)	78±62,9	69,5±64,6		0,6

Hypokalemia (mEq/L)	1,7 ± 0,9	1,9 ± 1		0,02
Hypouraemia (g/L)	0,1	0,1		0,4
Hypocreatinemia (mg/L)	1,4±0,7	1,6±1,2		0,8
Hypoglycaemia(g/L)	0,6±0,1	0,7±0,2		0,4
Low Nt-Pro BNP (pg/mL)	0,8±0,9	0,8±0,9		0,9
Hypernatremia (mEq/L)	151,2±6,8	147± 0,1		0,6
Hyperkalemia (mEq/L)	5,6±0,5	5,7±0,7		0,9
Hyperemia (g/L)	2,1 ± 8,3	2 ± 10,2		0,9
Hypercreatininemia (mg/L)	31,1 ± 39,1	31,8±34,4		0,08
Hypergycaemia (g/L)	1,8±0,7	1,9±0,7		0,08
High Nt-Pro BNP (pg/mL)	8827, 4±8339, 6	10038, 4±8052, 5		0,5

CI: Confidence Interval, **CTI:** Cardiothoracic index, **OR:** Odds ratio.

Calcium antagonists were statistically significantly more widely used in women than in men (p=0.04).

Outcome was statistically more favourable in women (p=0.02) than in men. Complications were significantly more frequent in men (p=0.02) than in women, as were in-hospital deaths (p=0.02; Table 4). Statistically significant, poor prognostic factors (advanced age, ischemic heart disease and hyponatremia) were more common in men than in women (Table 4).

Table 4: Comparison of therapeutic and outcome parameters by gender in heart failure patients

Parameters	Male (n=736)	Female (n=473)	OR [IC95%]	p
Diuretics				
Furosemide	701(95,2)	449(94,9)		0,7
MRAs	253(34,4)	176(37,2)		0,7
Beta-blockers	417 (56,7)	259(54,8)		0,9
ACE inhibitors / ARB IIs	562 (76,4)	340(71,9)		0,08
Other				
Calcium channel blockers	47(6,4)	48(10,1)		0,04
Anticoagulants	334(45,4)	221(46,7)		0,7
Aspirin	188(25,5)	86(18,2)		0,001
Statins	135(18.3)	59(12,5)		0,007
Nitro derivatives	138(18,8)	105(22,2)		0,6
Outcome				
Favourable	676(91,8)	452(95,6)	0,5[0,3 - 0,9]	0,02

Complications	51(6,9)	18(3,8)		
Death	49 (6,7)	17(3,6)	1,9[1,1 - 3,4]	0,02

ACE: Angiotensin converting enzyme, **ARB IIs:** Angiotensin 2 Receptor blockers, **CI:** Confidence Interval, MRAs Mineralocorticoid Receptor Antagonists, **OR:** Odds ratio.

Discussion

In this study, the prevalence of HF was 26.5%. This hospital prevalence varies from 9.4% to 42.5% according to Ogah et al. in sub-Saharan Africa [6]. In the West, the prevalence of HF is less than 2% in the general population [7]. Moreover, it increases with age, from around 1% before the age of 55 to over 10% at 70 and over [8]. Indeed, the average age of HF patients in Europe is 70, and prevalence is 9 times higher at 65 [9]. This difference in prevalence between continents could be explained by the study method and the variation in sample size of the populations studied. Furthermore, better management of underlying heart disease in developed countries could also contribute to a reduced frequency of HF. In our study assessing the characteristics of HF according to gender, we found that HF could occur after middle age (fifty). However, this mean age would be 4 years higher in men than in women (56.2±15 years vs. 52.7±19 years; p=0.003). This finding is confirmed by studies carried out by Ogah in 9 countries in sub-Saharan Africa (54±16.9 years vs. 50.7±19.5 years; p=0.0045) and Okeahialam in Nigeria (53.8±12.6 vs. 44.6±14.6 years) [4-5]. In fact, Okeahialam et al. in Nigeria noted that between 50 and 70, HF tended to be more frequent in men than in women [5]. On the other hand, in the West, gender inversion was noted beyond the age of 70. Studies by Galvao et al. (74.5 vs. 70.1 years; p<0.0001) and Lenzen et al. (74.7 vs. 68.3 years, p<0.001) showed that those diagnosed were older and more likely to be women [10,11]. Indeed, women would have a tendency to develop HF at a later age than men [12]. Nevertheless, the male predominance of our study was not found in studies from Nigeria, Tanzania, and Spain. In these studies, women accounted for the majority in 60.7%, 51%, and 56% of cases, respectively [5,13,14]. Female susceptibility appears to exist below the age of 50, probably due to unidentified or hormonal risk factors [5]. Therefore, gender-related genetic susceptibility should also be explored in depth.

This study showed that hypertension, diabetes, and dyslipidaemia were cardiovascular risk factors significantly more common in men. Our findings were consistent with those of Ogah concerning hypertension (60% vs. 51%; p=0.004) [4]. Conversely, Okeahialam observed that hypertension was the main cardiovascular disease among Nigerian women, probably linked to dietary habits [5]. Additionally, Lawson et al. noted that diabetes was the most common cardiovascular risk factor in men compared to women (28% vs. 25%; p<0.0001). This would explain the high prevalence of ischemic heart disease, which is associated with diabetes in men. Moreover, they also showed that arterial hypertension (67% vs. 62%) and dyslipidaemia (4.8% vs. 4.3%) were more frequent in women than in men [14].

In contrast, the study by Franke et al. in Germany and the Euro Heart Survey (EHS-HF) reported a predominance of hypertension and diabetes in women [11,15]. These seemingly contradictory results underscore the difficulty of predicting risk factor characteristics by gender. One could speculate that the presence of these cardiovascular risk factors in women may be explained by the onset of heart disease at a later age, when women's cardiovascular risk is higher [14]. The risk of hospitalization was 1.5 times higher in men with heart failure than in women in this study. Similarly, frequent previous hospitalizations for heart failure were also observed in men rather than women in Guadeloupe (57.5% vs. 56.8%) [14]. However, a Canadian study showed a higher incidence of re-hospitalization in women (rate 98%, CI 95% 86-110) compared to men (rate 91%, CI 95% 82-101). The reason proposed was the type of heart failure: women were more likely to have preserved EF, while men were more likely to have impaired EF. Therapies for heart failure with preserved EF were aimed solely at alleviating symptoms, leading to hospital admission, whereas heart failure with altered EF had more conclusive treatments to reduce re-hospitalization [16]. Indeed, women are more likely to develop heart failure with preserved EF, as reported in our study (20.9% vs. 19.4%) [14]. In line with this, Masoudi et al. in the United States noted that HF with preserved EF was almost 2 times more frequent in women than in men (43% vs. 23%; p<0.001) [17]. Martinez et al. found that 60.5% of women and 42.5% of men had HF with preserved EF [18]. Furthermore, studies have reported that patients with altered EF heart failure are more likely to be male. For instance, in Côte d'Ivoire, Bamba-Kamagate's comparative analysis of heart failure with reduced EF and preserved EF showed that men (59.1%) were more likely to have heart failure with reduced EF [19]. Similarly, Hidehiro et al. in Japan found that 81.1% of men had heart failure with reduced EF (p=0.039) [20]. An important parameter that could explain female hospitalizations would be hypertensive relapse. Although hypertension was not the most significant cardiovascular risk factor among the women in our study, they exhibited significantly higher systolic blood pressure than men (173.8±27.3 mmHg vs. 172.3±4.6 mmHg; p=0.005), as well as elevated diastolic blood pressure and tachycardia. This finding is confirmed by the UK study conducted by Lawson et al. (140.3±22.3 mmHg vs. 135.9±20.9 mmHg; p<0.0001) and by the ADHERE study (148.0 mmHg vs. 139.4 mmHg; p=0.0001) [10,14].

Anaemia was the most frequent trigger in men (28.8% vs. 23.3%; p=0.0003). This could be explained by the findings of Abassade et al., who noted an increase in the prevalence of anaemia with advancing age and renal failure [21]. This factor should be actively sought in male HF patients prior to initiating any treatment, in order to avoid therapeutic failure and reduce the risk of therapeutic non-compliance, a phenomenon frequently observed in men in this study. Such non-adherence would likely be linked to the increased cost of treatment for low-income patients without health insurance. Apart from the aforementioned triggers, we found no association with infectious syndrome in our countries, despite infections being predominant, nor with rhythm disorders. However, studies by Ghaliet al. (13% vs. 5%; p<0.001), Adams et al. (12% vs. 5%; p=0.012), and Dries et al. (86% vs. 14%) [22-24] identified a male predominance in rhythm disorders. This finding suggests that men would be more likely than women to suffer from rhythm disorders, a trend linked to ischemic heart disease, which is more frequent in men, as observed in our study, and is associated with multiple hospitalizations. Despite these differences in

cardiovascular risk factors and triggers for decompensated heart failure in men and women, the clinical picture of decompensated heart failure was comparable. Generally, this involved global or left-sided decompensation of HF with impaired ejection fraction (54.1% vs. 58.4%; p=0.1), often complicated by acute lung oedema and cardiogenic shock. The severity of this clinical picture underscores the need for appropriate and individualized management. Furosemide, ACE inhibitors or ARB IIs, beta-blockers, and MRAs were widely used in both sexes, with no statistically significant difference. This aligns with current clinical practice and complies with established recommendations for the management of HF [7]. However, Houde et al. in Canada noted a statistically significant increase in the prescription of diuretics, ACE inhibitors or ARB IIs, and beta-blockers in men [25]. According to the authors, this difference could be explained by the type of HF, as ACE inhibitors or ARB IIs, beta-blockers, and diuretics are first-line treatments for heart failure with reduced EF, which was more frequent in men (86% vs. 61%; p<0.001). Conversely, women had a higher mean EF (37±16% vs. 29±12%; p=0.001), which necessitated calcium channel blockers (p=0.04). Galvao et al. also reported frequent use of calcium-channel blockers in women compared with men (28% vs. 20%; p<0.0001) [10]. This use of calcium antagonists in our study could be explained by the higher systolic blood pressure observed in women but also by their efficacy in black patients [26]. Paradoxically, women with a high thrombogenic risk over the age of fifty received fewer antiplatelet agents and lipid-lowering drugs than men. Specifically, aspirin (p=0.001) and statins (p=0.007) were more widely used in men. These results are consistent with findings from the CIBIS II study, which reported that aspirin was significantly more prescribed in men than in women (43% vs. 37%; p=0.02) [27]. Similarly, the Franke study in Germany identified similar trends for statins (43.6% vs. 36.6%; p<0.01) but no significant difference for aspirin use (29% vs. 28.3%; p=ns) [15]. The use of aspirin and statins may be linked to the higher prevalence of ischemic heart disease in men, a condition that is more frequent among men than women. Despite the similarity of management, the in-hospital evolution was significantly more favourable in women than in men (95.6% vs. 91.8%; p=0.02), with a low in-hospital death rate (3.6% vs. 6.7%; p=0.02) and fewer complications (3.8% vs. 6.9%; p=0.02). This finding underscores the severity of the clinical picture of heart failure in older men, who exhibit relevant cardiovascular risk factors and triggers. The association between female gender and better survival outcomes appears to be stronger in the presence of a non-ischemic aetiology of heart failure [28]. As noted by Adams et al., women demonstrated better survival rates than men because their heart failure was primarily linked to non-ischemic causes. The relative risk of death for men compared with women was 2.36 [19]. Moreover, in men, diabetes and ischemic heart disease were identified as aggravating factors in our series. Macdonald et al. in Scotland highlighted a higher risk of death in heart failure patients with coexisting diabetes [29]. On the other hand, the low in-hospital mortality rate could be linked to the higher systolic blood pressure observed in women [30].

Conclusion

This study demonstrated that men with heart failure were older than 50 years, hypertensive, diabetic, and dyslipidemic. They were more prone to re-hospitalization triggered by anaemia and therapeutic non-compliance. Furthermore, heart failure in men was significantly associated with rhythm disorders, ischemic heart disease, and hypokalaemia. Conversely, female heart failure was characterized by elevated systolic blood pressure and tachycardia on admission, with standard heart failure treatment prescribed. Despite having similar treatment protocols, men exhibited worse outcomes, with more complications and a higher death rate. A prospective cohort study of heart failure patients would further validate these observations in Côte d'Ivoire and Sub-Saharan Africa.

References

1. McDonagh TA, Metra M, Adamo M, Gardner RS, Baumbach A, et al. ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. Eur Heart J. 2021. 42: 3599-3726.

2. Benjamin EJ, Blaha MJ, Chiuve SE, Cushman M, Das RS, et al. Heart Disease and Stroke Statistics-2017 Update: A Report from the American Heart Association. Circulation. 2017. 135: e146-e603.

3. Delahaye F, De Gevigney. Epidemiology of heart failure. Ann Cardiol Angéiol. 2001. 50: 6-11.

4. Ogah OS, Davison BA, Sliwa K, Mayosi BM, Damasceno A, et al. Gender differences in clinical characteristics and outcome of acute heart failure in sub-Saharan Africa: results of the THESUS-HF study. Clin Res Cardiol. 2015. 104: 481-490.

5. Okeahialam BN, Muoneme SA. Influence of gender on heart failure among hospitalized Nigerian patients. Afr J Med Med Sci. 2015. 44: 151-155.

6. Ogah OS, Adebiyi A, Sliwa K. Heart Failure in Sub-Saharan Africa. Top Heart Fail Manag. 2019. 61-99.

7. Van Riet EE, Hoes AW, Wagenaar KP, Limburg A, Landman MA, et al. Epidemiology of heart failure: the prevalence of heart failure and ventricular dysfunction in older adults over time. A systematic review. Eur J Heart Fail. 2016. 18: 242-252.

8. Lesyuk W, Kriza C, Kolominsky-Rabas P. Cost-of-illness studies in heart failure: a systematic review 2004-2016. BMC Cardiovasc Disord. 2018. 18: 74.

9. Galvao M, Kalman J, DeMarco T, Fonarow GC, Galvin C, et al. Gender differences in in-hospital management and outcomes in patients with decompensated heart failure: analysis from the Acute Decompensated Heart Failure National Registry (ADHERE). J Cardiac Fail. 2016. 12: 100-107.

10. Lenzen MJ, Rosengren A, op Reimer WJMS, Follath F, Boersma E, et al. Management of patients with heart failure in clinical practice: differences between men and women. Heart. 2008. 94: e10.

11. Masoudi FA, Havranek EP, Smith G, Fish RH, Steiner JF, et al. Gender, age, and heart failure with preserved left ventricular systolic function. J Am Coll Cardiol. 2003. 41: 217-223.

12. Makubi A, Hage C, Lwakatare J, Kisenge P, Makani J, et al. Contemporary aetiology, clinical characteristics and prognosis of adults with heart failure observed in a tertiary hospital in Tanzania: the prospective Tanzania Heart Failure (TaHeF) study. Heart. 2014. 100: 1235-1241.

13. Llorens P, Escoda R, Miró O, Herrero-Puente P, Martín-Sánchez FJ, et al. Characteristics and clinical course of

patients with acute heart failure and the therapeutic measures applied in Spanish emergency departments: based on the EAHFE registry (Epidemiology of Acute Heart Failure in Emergency Departments. Emergencias. 2015. 27: 11-22.

14. Lawson CA, Zaccardi F, Squire I, Okhai H, Davies M, et al. Risk Factors for Heart Failure: 20-Year Population-Based Trends by Sex, Socioeconomic Status, and Ethnicity. Circ Heart Fail. 2020. 13: 1-12.

15. Franke J, Lindmark A, Hochadel M, Zugck C, Koerner E, et al. Gender aspects inclinical presentation and prognostication of chronic heart failure according to NT-proBNP and the Heart Failure Survival Score. Clin Res Cardiol. 2015. 104: 334-341.

16. Sun LY, Tu JV, Coutinho T, Turek M, Rubens FD, et al. Sex differences in outcomes of heart failure in an ambulatory, population-based cohort from 2009 to 2013. Canadian Medical Association Journal. 2018. 190: E848-E854.

17. Masoudi FA, Havranek EP, Smith G, Fish RH, Steiner JF, et al. Gender, age, and heart failure with preserved left ventricular systolic function. J Am Coll Cardiol. 2003. 41: 217-223.

18. Martinez-Brana L, Mateo-Mosquera L, Bermudez-Ramos M, Valcarcel Garcia Mde L, Fernandez Hernandez L, et al. Clinical characteristics and prognosis of heart failure in elderly patients. Rev Port Cardiol. 2015. 34: 457-463.

19. Bamba-Kamagaté D, Koffi F, N'Cho-Mottoh MP, Ehouman E, Djamen NCM, et al. Comparative analysis of impaired and preserved heart failure at the Abidjan Heart Institute. Cardiol Trop. 2021. 163: 9-19.

20. Hidehiro K, Shinya S, Junji Y, Oikama Y, Sagara K, et al. Clinical characteristics and long-term clinical outcomes of Japanese Heart Failure patients with preserved versus reduced left ventricular ejection fraction. J Cardiol. 2013. 62: 102-109.

21. Abassade P, Rabenirina F, Garcon P, Antakly Y, Cador R. Anemia in heart failure. Ann Cardiol Angéiol. 2009. 289-292.

22. Ghali JK, Krause-Steinrauf HJ, Adams JrKF, Khan SS, Rosenberg YD, et al. Gender differences in advanced heart failure: insights from the BEST study. J Am Coll Cardiol. 2003. 42.

23. Adams KFJr, Dunlap SH, Sueta CA, Clark SW, Patterson JF, et al. Relation between gender, etiology and survival in patients with symptomatic heart failure. J Am Coll Cardiol. 996. 28: 1781-1788.

24. Dries DL, Exner DV, Gersh BJ, Domanski MJ, Waclawiw MA, et al. Atrial fibrillation is associated with an increased risk for mortality and heart failure progression in patients with asymptomatic and symptomatic left ventricular systolic dysfunction: a retrospective analysis of the SOLVD trials. J Am Coll Cardiol. 1998.32: 695-703.

25. Houde S, Feldman DE, Pilote L, Beck EJ, Giannetti N, et al. Are there sex-related differences in specialized, multidisciplinary congestive heart failure clinics. Can J Cardiol. 2007. 23: 451-455.

26. James PA, Oparil S, Carter BL, Cushman WC, Dennison-Himmelfarb C, et al. Evidence-Based Guideline for the Management of High Blood Pressure in Adults Report From the Panel Members Appointed to the Eighth Joint National Committee (JNC 8). JAMA. 2014. 311: 507-520.

27. Simon T, Mary-Krause M, Funck-Brentano C, Jaillon P. Sex differences in the prognosis of congestive heart failure: results from the Cardiac Insufficiency Bisoprolol Study (CIBIS II). Circulation. 2001. 103: 375-380.

28. Biykem B, Khalaf S. Heart Failure in Women. Methodist Debakey Cardiovasc J. 2017. 13: 216-223.

29. MacDonald MR, Jhund PS, Petrie MC, Lewsey JD, Hawkins NM, et al. Discordant short-and long-term outcomes associated with diabetes in patients with heart failure: importance of age and sex: a population study of 5.1 million people in Scotland. Circ Heart Fail. 2008. 1: 234-241.

30. Mihai G, Abraham WT, Albert NM, Greenberg BH, O'Connor CM, et al. Systolic Blood Pressure at Admission, Clinical Characteristics, and Outcomes in Patients Hospitalized With Acute Heart Failure. JAMA. 2006. 296: 2217-2226.