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Characteristics of patients with acute heart failure in North Central Nigeria.

***Ogunmodede J.A.[1], Kolo P.M.[1], Bojuwoye M.O.[1], Dele-Ojo B.F.[2], Ogunmodede A.J.[3], Omotoso A.B.[1]**

ABSTRACT

Objectives: Heart failure (HF) is an important cause of hospital admission in Nigeria. HF is increasingly prevalent because the population is aging and HF epidemiology is changing. We aimed at profiling the socio-demographic, clinical and echocardiographic (Echo) characteristics of patients admitted for acute HF. This is one of the largest cohorts of HF patients profiled in Nigeria so far.

Methods: Cross sectional design. Socio-demographic, clinical and Echo data were collected from 455 patients admitted for AHF at University of Ilorin Teaching Hospital, North central, Nigeria.

Results: Mean age of patients was 58.9± 15.7years, (men were older than women, P= 0.006). 265(58.2%) were males, most patients were aged >60 years, 4.8% had pre-existing Type2 Diabetes mellitus. 53.2% of patients presented in New York Heart Association StagesIII and IV. Median duration of admission was 11days (IQR, 6-17), intrahospital mortality- 11.6%. Hypertension was the commonest aetiological factor (62.4%), followed by dilated cardiomyopathy 17.6%, rheumatic heart disease (6.6%), Peripartum cardiomyopathy (5.3%), and others.

Conclusion: AHF patients in our study are older than those in previous studies in Nigeria and sub-Saharan Africa. Hypertension is main driver of AHF, and patients largely present with clinically advanced disease necessitating stronger public health education about risk factors and early presentation.

Key words: Heart failure, Echocardiography, cardiovascular diseases, Nigeria

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Caractéristiques des patients atteints d'insuffisance cardiaque aiguë dans le centre-nord du Nigeria.

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Resume

Objectifs: L'insuffisance cardiaque (IC) est une cause importante d'hospitalisation au Nigeria. L'IC est de plus en plus répandue en raison du vieillissement de la population et de l'évolution de l'épidémiologie de l'IC. Nous avons cherché à profiler les caractéristiques sociodémographiques, cliniques et échocardiographiques (Echo) des patients admis pour IC aiguë. Il s'agit de l'une des plus grandes cohortes de patients atteints d'insuffisance cardiaque profilée au Nigeria à ce jour.

Méthodes: Conception en coupe transversale. Des données sociodémographiques, cliniques et d'écho ont été recueillies auprès de 455 patients admis pour AHF à l'hôpital universitaire d'Ilorin, centre-nord, Nigéria.

Résultants: L'âge moyen des patients était de 58,9 ± 15,7 ans (les hommes étaient plus âgés que les femmes, P = 0,006). 265 (58,2 %) étaient des hommes, la plupart des patients étaient âgés de plus de 60 ans, 4,8 % avaient un diabète sucré de type 2 préexistant. 53,2 % des patients se sont présentés aux stades III et IV de la New York Heart Association. La durée médiane d'admission était de 11 jours (IQR, 6-17), la mortalité intra-hospitalière - 11,6%. L'hypertension était le facteur étiologique le plus fréquent (62,4 %), suivie par la cardiomyopathie dilatée 17,6 %, les cardiopathies rhumatismales (6,6 %), la cardiomyopathie péripartum (5,3 %) et autres.

Conclusion: Les patients atteints d'AHF dans notre étude sont plus âgés que ceux des études précédentes au Nigeria et en Afrique subsaharienne. L'hypertension est le principal moteur de l'AHF et les patients présentent en grande partie une maladie cliniquement avancée nécessitant une éducation de santé publique plus approfondie sur les facteurs de risque et la présentation précoce.

Mots clés: Insuffisance cardiaque, echocardiographie, maladies cardiovasculaires, Nigéria

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INTRODUCTION

Cardiovascular diseases (CVDs) constitute the commonest cause of mortality worldwide. From a global perspective, Africa with over 1 billion inhabitants is disproportionately affected by CVDs and bears the highest burden of some CVD risk factors such as systemic hypertension (SH) by regional prevalence worldwide (1). At the start of the 21st century, the disease pattern in most parts of sub-Saharan Africa (SSA) was observed to be in the first stage of "epidemiological transition' described by Omran (2,3). With a shift from a predominance of communicable to a greater proportion of non-communicable diseases (NCDs). CVDs constitute the main driver of the NCD burden in SSA (4) and pose a continuing challenge to the relatively fragile health systems in most countries in the sub-region and contributing significantly to mortality and disability in the sub-region (5).

The temporal trends of Heart failure (HF) worldwide suggest that it will become increasingly important as the population ages. It has been reported to affect up to 10% of people aged >70 years of age (6) and the lifetime risk of developing the condition has been reported to be as high as 33% in men and 28% in women (7). HF is an important indication for hospital admission in Nigeria, and it accounts for up to 7.8% of total medical admissions and up to 44.9% of cardiovascular illnesses in some centres (8-10). The increasing life expectancy in Nigeria over the last 10 years (11) implies that subtle changes will occur to the epidemiology of HF. Hence the description of HF epidemiology has to be continuous in order to track the trends observed in earlier studies.

MATERIALS AND METHODS

Study Design and setting.

This is an observational study conducted at the University of Ilorin Teaching Hospital (UITH), Ilorin, Nigeria. UITH is the predominant tertiary health care facility in the city receiving referrals from private and government-owned health facilities in the city and from at least five neighbouring states spread across two geo-political zones- Osun, Oyo, Ekiti (Southwestern Nigeria), Kogi and Niger states (North central Nigeria).

The Cardiology Unit of UITH where this study took place is manned by four experienced cardiologists assisted by postgraduate resident doctors and experienced nurses. Members of the Heart Failure Working Group include a cardiac surgeon, a cardiac rehabilitation therapist, Psychiatrists and Clinical psychotherapists. All the Echo examinations were usually carried out within 48 hours of admission, in accordance the unit's protocol.

Study population: All cases of acute heart failure (AHF), both de novo presentations and acute decompensation with pre-established diagnoses of HF and Echocardiographic ejection fraction less than 50% were recruited into the Ilorin Heart Failure Registry retrospectively using data from the Unit's admission register and patients' case notes between January 1, 2017 and December 31, 2019.

Patient enrollment and data collection: The Cardiology Unit's protocol for evaluating AHF patients includes detailed clinical documentation with the collection of the following data: demographic data, date of first diagnosis of HF (if not a de Novo presentation), and pre-admission history (previous HF-related admissions), symptoms, signs, self-reported cardiovascular risk factors, precipitating factors, and comorbidities.

Diagnosis of Heart Failure: A standardized diagnosis of HF was made using the Framingham criteria (12) as well as the guidelines of the European Society of Cardiology on the diagnosis and treatment of AHF (13). Clinical confirmation of HF was done by Echo and only patients with left ventricular (LV) Ejection Fraction (EF) <50% were recruited in to this study.

Both de novo presentation of AHF and acute presentation of typically decompensated HF were included in the registry. Cardiogenic shock was diagnosed when AHF was accompanied by low BP (SBP<90 mmHg) and oliguria (<0.5 mL/kg/h for at least 6 h) or low cardiac index (<2.2 L/min/m^2).

Clinical evaluation of the patients entailed among others, aetiology of HF, blood investigations, 12-lead ECG, Echo, medications, and intra-hospital mortality. Clinical evaluation usually entails documenting the New York Heart Association (NYHA) functional class, blood pressure (BP) measurements which are obtained according to standard guidelines using a mercury sphygmomanometer (Accoson®, Siemens UK, London, United Kingdom) and other cardiovascular and systemic examination. Anemia was defined as hemoglobin <10 g/dl. Glomerular filtration rate was estimated using the

CKD-epi formula (14). Chronic Renal dysfunction was defined as an estimated glomerular filtration rate <60 ml/min/1.73 m^2 for more than three months (15). All these information were obtained from the case notes of patients with retrospective data and phone calls made to those with incomplete data by trained research assistants. All data was entered into standardized case report forms.

Similar to the report by Ogah et al (16) clinical definitions were adopted as follows: Hypertensive HF was diagnosed in patients with a previous history of hypertension or sustained BP of ≥140/90 mmHg in the presence of symptoms of HF, and evidence of cardiac damage ECG and Echo that is causally related to hypertension and without alternative explanation, such as left ventricular hypertrophy, LV systolic and/or diastolic dysfunction (17). Pericardial Effusion was diagnosed when there is echo free space between the visceral and parietal pericardium. Valvular HF (mostly Rheumatic valvular heart failure in this cohort) was described when a patient had HF judged to be primarily from a disease of the valves manifesting with any or combinations of the following (18): i. Mitral stenosis: – presence of thickened and calcified mitral valve leaflets, loss of the classic M-shaped pattern of a normal mitral valve, diastolic dooming and restriction of the mitral valve leaflet motions. ii. Mitral Regurgitation: poor coaptation of the mitral valve leaflets in systole leading to valve regurgitation, thickened leaflets, dilated and hyperdynamic left ventricle iii. Aortic stenosis: Presence of calcified aortic valve, reduction in aortic cusp separation, highly echo reflective aortic valve leaflets iv. Aortic regurgitation: Poor coaptation of the cusps aortic in diastole, dilated left ventricles and fine fluttering, of the anterior mitral valve in diastole.

Dilated cardiomyopathy was diagnosed when there was dilated LV and any other heart chambers with normal or decreased wall thickness as well as impaired LV systolic function where the primary aetiology is not known and not thought to be due to hypertension (19) Hypertrophic cardiomyopathy was diagnosed according to recommendations by the European Society of Cardiology (ESC). (20) Peripartum cardiomyopathy was diagnosed if Echo revealed features of dilated cardiomyopathy (as already explained above) in the absence of a demonstrable cause or other structural heart disease, and if HF was identified for the first time within the last trimester of pregnancy or in the first five months post-partum (21). Ischaemic cardiomyopathy was diagnosed when HF was associated with a diagnosis of myocardial infarction (MI). The diagnosis of MI was based on typical dynamic ECG changes, serial cardiac enzyme Troponin I elevation and the presence of regional wall motion abnormalities (evidence of myocardial injury) on echo. Confirmation was done using coronary angiography where it was feasible for the patient. Cor-pulmonale was diagnosed when there was dilated and hypertrophied right ventricle (RV) with evidence of increased RV systolic pressure overload (diastolic flattening of the interventricular septum) or right heart failure in a patient with a known pulmonary parenchymal, airway or vascular disease, chest wall abnormality or disorder of central control of respiration. This excluded patients with right ventricular disease primarily of left ventricular origin or congenital heart disease.

ECG: A standard 12-lead resting electrocardiogram was recorded for each subject using a GE Mac 1200ECG Machine. All 12-lead resting electrocardiographic studies were performed by trained technicians and analyzed by a Consultant Cardiologist. ECG abnormalities were diagnosed on the basis of standard criteria (22).

Echocardiography: Transthoracic echocardiography was performed using a commercially available echocardiography machine Sonoscape® SSI-8000 echocardiograph (Sonoscape Co. Ltd., Singapore). Two-dimensionally (2D) guided M-mode measurements were made according to the recommendations of the American Society of Echocardiography (23). The LV measurements taken included LV internal dimension at end-diastole (LVIDd) and end-systole (LVIDs), LV posterior wall thickness at end-diastole (PWTd) and end-systole (PWTs), and interventricular septal thickness at end-diastole (IVSd) and end-systole (IVSs). Left atrial diameter (LAD) was measured at end-systole from the trailing edge of the posterior aortic root to the leading edge of the posterior left atrial wall 923). Measurements were obtained in up to 3 cardiac cycles and averaged. LV mass was calculated using the formula of Devereux and Reichek LV mass = $0.8x\ (1.04x\ [(IVSd+LVID+PWTd)^3-LVID^3] + 0.6$ grams (23). LV geometry was defined according to standard criteria and described as normal geometry, LV concentric remodelling, eccentric LVH and concentric LVH (24).

LV systolic function was assessed by using the Teicholz formula (volume = $7D^3/(2.4+D)$ which had been programmed into the echo machine to determine the LV end-diastolic volume (LVEDV) and LV end-systolic volume (LVESV). The LV EF was thereafter determined using the formula EF = LVEDV – LVESV / LVEDV x 100% The LV Fractional shortening (FS) was determined by the formula: FS=LVIDd-LVIDs/ LVIDd x 100%. The transmitral and trans-tricuspid flow velocities were obtained with the Doppler sample volume placed just between the tips of the mitral and tricuspid valve leaflets respectively during ventricular diastole and standard measurements were obtained (25). Tricuspid annular plane systolic excursion (TAPSE) was measured in the apical four-chamber view by positioning the M-mode cursor at the angle of the lateral annulus tricuspid valve (TV) and measured as total displacement of the RV base from end-diastole to end-systole. All recordings of TAPSE obtained during held end-expiration. Patients who had moderate or severe tricuspid regurgitation in whom TAPSE will over-estimate the RV systolic function had only Right Ventricular Fractional Area Change (RVFAC) measured. This was obtained by tracing the RV end-diastolic area (RVEDA) and end-systolic area (RVESA) in the apical 4-chamber view using the formula (RVEDA - RVESA)/RVEDA × 100. RV Systolic dysfunction was defined as the presence of either TAPSE <16 mm or RVFAC <35% according to American Society of Echocardiography (ASE) guidelines (26).

Pulmonary artery systolic pressure (PASP) was estimated using continuous wave Doppler of the maximum velocity of the tricuspid regurgitant jet (V, from which the retrograde pressure gradient was calculated using the modified Bernoulli equation ($4\ V^2$). PASP was calculated by adding the pressure gradient to the estimated right atrial pressure (RAP) (26). RAP was estimated using the diameter and collapse of the inferior vena cava during spontaneous respiration, as described (27).

The intra-observer concordance correlation coefficient and measurement error for Echo in our environment have been measured in a nearby laboratory with similar training standards and have been reported (28).

Statistical analysis: The study data were by entered by experienced personnel into and analyzed using SPSS version 20.0 (SPSS, Inc., Chicago, Illinois). Normally distributed continuous variables were expressed as mean ± SD, skewed continuous variables were expressed as median and interquartile range (IQR) and ranges where necessary. Categorical variables were expressed as percentages. Chi-square test was used to compare proportions of categorical variables and Student t- test for comparing means of continuous variables. Comparison between the means ± standard deviation obtained in this study and those of other studies were done using Epicalc 2000® version 1.02, (Brixton Books). Two-sided p values <0.05 were considered significant.

Ethical Approval: Ethical approval was obtained from the Ethical Review Committee of the UITH. The study was carried out in accordance with international ethical principles as laid out in the Helsinki declaration (29).

RESULTS

Socio-demographic and clinical profile of the Cohort

The sociodemographic information of the study cohort and the comparison of these variables across gender are shown in Table 1. A total of 455 subjects were enrolled into the registry. There were 265 men (58.2%) and 190 women (41.8%). The mean age of all the subjects was 58.9± 15.7 years, range (15 – 104 years). The majority of subjects were >60 years of age (55.8%), the most represented age-group being 61-70 years, majority were married (80.4%) and of Yoruba ethnicity (91.4%). Women were more represented in the age groups within 21-40 years, while patients aged between 41 years and above were mostly men (Figure 1). There was a low prevalence of smoking (3.3%), and it was significantly more common in men than women. 4.8% of a sub-set of the cohort were diabetic and 435 subjects (95.6%) had de novo presentation of AHF. Majority (53.2%) of the subjects presented in++ NYHA Stages III and IV. Chronic renal failure (at least Chronic Kidney Disease stage 3-eGFR<60 ml/min/1.73 m2) was present in 35.9% of subjects who had complete renal function profile results.

Precipitating factors for acute HF

The commonest precipitating factor for HF in the cohort (n=238) was infections (predominantly respiratory tract infections) (41, 17.2%) followed by arrhythmias (40, 16.8%), poor drug compliance in 3.4% of patient and advanced pregnancy precipitated HF in 2 PPCM patients. No specific precipitant was identified in

147 (61.8%) patients and they were believed to have developed symptoms due to progression of disease. The occurrence of these precipitating factors was similar across both genders. Cardiogenic shock was present in 15 patients (3.3%) and this occurred significantly more frequently in men (P=0.023) (Table 1).

Intra-hospital outcomes

Table 1 also shows that the median overall length of hospital stay was 11days (IQR: 6-17days, range 2 to 45 days). Fifty-three patients (11.6%) died during admission. 94.3% of the patients who died were de novo cases. The mean ages of those who died and those who were discharged alive at were similar (59.9±18.1 vs 59.6±16.2 years, P=0.892).

12-lead Electrocardiogram, Echocardiography and aetiology of Heart Failure.

The mean ECG heart rate was 101.4± 18.3bpm, this did not differ significantly across both genders. Arrhythmias were present in 26.9% of patients and various conduction defects were present in 39.7%. (Table 1)

Figure 2 shows the Echo confirmed aetiological factors for HF among the patients. Hypertensive heart disease was the commonest aetiological factor confirmed by Echo (62.4%), followed by DCM (17.6%), 30 cases of rheumatic heart disease (6.6%), 24 cases of peripartum cardiomyopathy (5.3%), 18 cases (4%) of cor pulmonale, seven cases (1.5%) of coronary artery disease, three cases of alcoholic cardiomyopathy (0.7%), three cases of thyrocardia (0.7%), there was one case of Hypertrophic cardiomyopathy (0.2%), one case of HIV-associated cardiomyopathy (0.2%), one each of intracardiac (right atrial) mass and acute pulmonary embolism.

Table 2 shows Echo findings of the cohort and their gender distribution. The LVIDd, LVIDs, LVM and aortic root diameter, were significantly higher in men than in women. However, women appeared to have a better systolic function with LV EF on the average 5% higher than men. In terms of LV geometry, 94.9% of the cohort had abnormal LV geometry (concentric remodeling was found in 1.7%, eccentric hypertrophy in 61% and concentric hypertrophy in 32.2%)

Serum electrolytes, Lipid profile and Haematologic indices of the Cohort

Table 3 shows the serum electrolyte profile of the cohort and its gender distribution. The male and female patients only differed significantly in their platelet count. Other parameters were similar across both genders.

Intra-hospital medications

While on admission, diuretics were prescribed in 89.4% of patients, Angiotensin Converting Enzyme (ACE) Inhibitors were used in 63.1%, Angiotensin Receptors Blockers (ARBs) in 64.3%, Spironolactone in 55.9%, Anti-platelet drugs (aspirin or clopidogrel) in 38.2%, Beta blockers were used in 30.9%, Digoxin in 22.2%, Amiodarone in 16.8 %, Anticoagulants (warfarin or enoxaparin) in16.7%, and Nitrates in 0.2%. (Table 4)

DISCUSSION

Compared to other recent studies done over the past decade in our country, our study highlights subtle changes in the epidemiological profile of patients with AHF. The mean age of our patients was significantly higher than that reported in recent studies profiling HF patients in Nigeria by Ogah et al (16) (t= 2.23, P=0.025). Putting our study in the context of earlier studies suggests an upward trend in the age of patients with AHF in our country compared with other studies done over the past decade and half. The mean age of our cohort is also significantly higher than that reported by Ojji et al, (30,31) Onwuchekwa et al (32), Laabes et al (33), Karaye and Sani (34) –all from Nigeria. The relatively high mean age of 57.6years observed among Familoni et al's smaller cohort is closer to findings among our cohort (35). However, Familoni et al studied only advanced HF patients (who had LVEF≤ 35%) who will expectedly be older having lived with the disease longer compared to our cohort made up mainly of de novo cases. Table 5 shows a comparison of our findings with those of other workers in similar studies in the country and SSA.

Comparisons with findings in AHF cohorts from other parts of Africa in older studies also suggest that our cohort is older (36-42). An instructive observation of the changing age of AHF patients is a comparison of our findings with that of the THESUS-HF study which was a large multi-centre study of AHF across 9 African countries (43). The significantly lower mean age of 52years of patients in that study no doubt reflects geographical and regional variations in the age of HF patients across SSA.

The mean age of our patients is also higher than that of the African sub-group of the

INTERnational Congestive Heart Failure (INTER-CHF) study, a large multi-centre study covering 108 centres in 16 countries of Africa, Asia, the Middle East and South America (44). Though it must be noted that the African cohort had the lowest age among the patients from the four regions studied. Our own patients are of similar age as Indonesian patients reported by Siswanto et al (45). Our patients are however significantly younger than patients from Japan (46), Europe and USA where the mean age of HF patients is as high as 72years (47,48). This may be related to the fact that risk factors for HF such as SH have an earlier age of onset and a greater propensity for causing target organ damage in blacks (49). Also the high cost of healthcare and low level of penetration of health insurance may also translate to inadequate treatment of these risk factors even when identified early. This difference in the age of HF patients is also a reflection of the level of risk factor awareness, strength of the health systems with respect to early risk factor detection, adequate risk factor management and presence of the guarantee of access to basic healthcare to mitigate the development of complications such as HF. These are available in the developed countries of Europe and the western hemisphere but largely unavailable in most parts of SSA where payment for treatment being out of pocket for most citizens frequently translates into poor access to care. Also, workers such as Ogah et al have reported very low levels of awareness of hypertension, with correspondingly low levels of treatment and BP control among various segments of the Nigerian populace (49). These will no doubt predispose to an earlier onset of complications such as HF among the populace. Considering also that the age group most represented among our patients was the 61-70year age group, it appears the age of developing HF is on the increase in our environment. The younger age of our cohort relative to that reported in some high-income countries is also related to a higher prevalence of HF aetiologies which principally affect the young such as peripartum cardiomyopathy and rheumatic valvular heart disease. These are uncommon in the western world and developed economies of Asia.

Our study showed that more men were affected than women in our environment. This is similar to findings in recent studies in Nigeria (10,30,32). Previous studies however report otherwise and this may be due to patient selection and reported better health seeking behaviour in women. This study shows that the main driver of HF among our cohort is SH. In our environment, SH was also found to be more prevalent in men in Nigeria in most studies reviewed Akinlua et al (50) and this may also explain the greater affectation of men by HF in our study. The preponderance of the male gender is also reflected in the INTER-CHF study and the overall percentage of male patients is similar to ours. However, there were more men in our study than in the African sub-group of the INTER-CHF cohort (44).

The dominance of Hypertensive Heart Failure among our cohort is similar to observations made in other Nigerian studies and reflected in the larger THESUS- HF study (43) As noted in other studies on the continent, the prevalence of Ischemic Heart Disease (IHD) among our patients is also low, though our cohort features a far lower prevalence than that reported by Karaye and Familoni working in Northern and Southwestern Nigeria respectively (34,35). This is at variance with reports in Europe where IHD is the main driver of HF (47). Even though Kolo et al earlier reported increasing prevalence of myocardial infarction cases seen at our centre it is still not a significant cause of AHF (51). Peripartum cardiomyopathy is relatively uncommon among our patients. This is similar to observations by Ogah et al (16) and Ojji et al (30) who have reported from centres in South western and Northern Nigeria respectively. It is however more common in North western Nigeria where Karaye and Sani reported a far higher prevalence (34).

Majority of the patients in this cohort presented with advanced disease. However higher proportions of patients with advanced disease were reported by Ogah et al (16) in Southwestern Nigeria while Ojji et al (30) had just over a third of their patients presenting in the late stages. The African sub-group of the INTER-CHF study also recorded this trend. Conversely most patients from the Middle East, Asia and South America presented in the early clinical stages of the disease (44). Factors responsible for presentation in advanced stages of disease will include socio-economic factors and the organisation of the health system and the presence of clear referral pathways. These affect patients' ability to access care early before deterioration of their illness. The availability of health insurance is also key to early presentation. In the INTER-CHF study, the lowest access to health insurance (28%) was recorded among the African participants and they recorded the highest proportion of patients presenting with

clinically advanced disease.

The relatively older age of our patients can also explain the higher intra-hospital mortality rate among them compared to other studies locally and internationally (Table 5). As well, the large proportion of individuals with advanced disease at presentation could also influence intra-hospital outcome. The Japanese and American cohorts compared in this study also featured large proportions of patients with advanced disease, but the difference between their outcome and ours may relate to different dynamics of intra-hospital care, different dynamics of other factors that influence patients' disease outcome such as funding of healthcare, availability of health insurance and availability of advanced modalities of investigation and treatment in our different settings.

The duration of admission of hospitalized HF patients in Nigeria appear to be similar. Our findings are similar to observations by Ogah et al (16) and slightly lower than Karaye and Sani. (34) Elsewhere on the continent, Damasceno reported a lower mean length of stay (43) and the length of admission we reported is slightly higher than elsewhere in Europe and Asia (45,47) The length of stay is invariably dependent on factors such as the severity of disease and quality of care.

The prevalence of arrhythmias in our study is similar to findings by Ojji et al (30) and higher than what was reported the THESUS-HF researchers (43) and Makubi et al in Tanzania. (40) Arrhythmias can serve as both aetiological factors and precipitants of AHF. One of the mechanisms of this is that arrhythmias especially tachyarrhythmias impair diastolic filling and reduce cardiac output. Arrhythmias also worsen pre-existing heart disease by impairing coronary perfusion (which takes place predominantly during diastole) and worsening myocardial ischemia.

The presence of renal dysfunction signaled eGFR<60mls/min/1.73m^2 among our cohort was lower than observations by Ogah et al (16) higher than reports from elsewhere in the country (34) on the continent (37,43). It is also higher than reports from studies Japan, Europe and USA (46-48). However, several of these studies used absolute cut-off values of 177umol/L of serum creatinine to define renal dysfunction/Chronic kidney disease (CKD) rather than eGFR. It has been reported that more than 50% of hospitalized HF patients develop some degree of renal impairment, and moderate to severe impairment has been reported in up to 30–35% of cases.(52) Impaired renal function has been shown to predict unfavorable outcomes in HF patients (53)

A comparison of the therapy of HF in among our cohort brings to fore the relatively low utilization of beta blockers (BBs) in our environment. The use of beta blockers among 31% of our patients however suggests an increased use of BBs compared to findings in previous studies in centres near us (30,43) It is however lower than 42% reported in Tanzania about the same time as these earlier studies (40). While Beta blockers are not indicated in all HF patients, some physicians may be reluctant to start BB therapy for HF patients especially during early stages of decompensation when there is fluid congestion. The use of Sacubitril/Valsartan combination in hospitalised AHF patients is one of the novel treatment strategies that has to be introduced into our practice. With evidence from the PIONEER-HF trial, the high cost of the drug will however pose a challenge to its use among our patients (54). The development of local HF guidelines in our country based on available evidence will no doubt improve clinician compliance with evidence-based treatment strategies.

Study limitations and strengths: Our study being a hospital-based study based in a tertiary care centre may under-represent the heart failure population by missing out those managed in private hospitals and primary care facilities. However, the centrality of our hospital to the delivery of specialized care in the state and region means that it is representative of the profile of HF patients in our environment. Our study is strong on sample size. The retrospective design may also be limited by the occurrence of missing data from patient's records. To our knowledge, this is one of the largest single cohorts of AHF patients studied in Nigeria over the past fifteen years.

CONCLUSION

As the burden of risk factors for HF increase, it is expected that its contribution to man's disease burden will progressively increase. This indicates the importance of continuous observation of the disease's trends and patterns to track incident changes that will influence medical intervention. Our study suggests at least one such change indicating that the age of onset of AHF in Nigeria is increasing, and the burden of the disease is less on people in the most productive phase of life unlike previous reports. It is still commoner in men and intra-hospital mortality

among our cohort is higher than that in other parts of the country. SH remains the commonest aetiology and the large proportion of patients with advanced disease indicates the need for more public health education efforts among the populace targeted at risk factor prevention, early detection and management.

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Authors' contributions:

Ogunmodede JA (FWACP)- Was involved in conception and design, capture of echo data, analysis and interpretation of data, drafting the manuscript and revising it critically for important intellectual content and final approval of the version to be published and final approval of the version to be published.

Kolo PM, (FMCP) - Was involved in the conception and design of the study, capture of echo data and revising the manuscript critically for important intellectual content and final approval of the version to be published.

Bojuwoye MO (FMCP) – Was involved in the conception and design, or acquisition of data, or analysis and interpretation of data, drafting the manuscript and revising it critically for important intellectual content; and final approval of the version to be published.

Dele-Ojo BF (FMCP) - Was involved in the conception and design of the study, revising the manuscript critically for important intellectual content and final approval of the version to be published.

Ogunmodede AJ (FMCPsych)- Was involved in the conception and design, data analysis, revising the manuscript critically for important intellectual content and final approval of the version to be published

Omotoso ABO (FWACP)- conception and design, revising the manuscript critically for important intellectual content and final approval of the version to be published.

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Table 1: Sociodemographic, clinical and electrocardiographic profile of the Study cohort

Variable	All	Male	Female	P value
Gender, n (%)	455	265 (58.2)	190 (41.8)	
Age (years)	59.7 ± 16.4	61.6 ± 14.4	56.97 ± 18.7	**0.006***
Duration of Admission (days)	11 (6-17) #	11 (6-17)	11 (6-16)	0.754
Body Surface Area (Kg/m^2)	1.76± 0.24	1.8 ± 0.2	1.7 ± 0.2	**<0.001***
Employment status, n (%)				
Unemployed	115 (25.3)	73 (63.5)	42(36.5)	0.296
Employed	340 (74.7)	197 (57.9)	143 (42.1)	
Marital status				
Married	229 (80.4)	137 (92.6)	92 (80)	**0.001***
De novo Heart failure				
Yes	435 (95.6)	251 (57.7)	184 (42.3)	0.275
No	20 (4.4)	14 (70.0)	6 (30.0)	
Systolic Blood Pressure (mmHg)	121.2 ± 26.3	119.9 ± 22.6	123.1 ±31.1	0.551
Diastolic Blood Pressure (mmHg)	78.9 ± 19.9	78.9 ± 20.8	79 ±18.8	0.989
NYHA functional Class at admission (n=248)				
NYHA II	116 (46.8)	67 (57.8)	49 (42.2)	0.611
NYHA III & IV	132 (53.2)	72 (54.5)	60 (45.5)	
Current Cigarette smoker	18 (3.96)	17 (6.4)	1 (0.53)	**0.001***
Consumes Alcohol	25 (20.7)	25 (100.0)	0 (0.0)	**<0.001***
Cardiogenic shock Present, n (%)	15 (3.3)	13 (86.7)	2 (13.3)	**0.023***
Intrahospital Mortality, n (%)				
Died	53 (11.6)	32 (12.1)	21 (11.1)	0.738
Discharged	402 (88.4)	233 (87.9)	169 (88.9)	
Duration of Admission (days)	11 (6-17)#	11 (6-17)	11 (6-16)	0.754
ECG Heart Rate (bpm)	101.4 ± 18.3	99.5 ±17	103.5 ±19.7	0.188
Arrhythmia present (n=271)	73 (26.9)	45 (61.6)	28 (38.4)	0.649
Conduction defect on ECG, n (%)	31 (11.4)	25 (80.6)	6 (19.4)	**0.008***

Table 2: Echocardiographic variables of the Cohort in men and women

Variable	All (n=455)	Male (265)	Female (190)	P value
LAD (mm)	47.2 ± 8.6	48.1 ± 8.1	46.1 ± 9.3	0.187
IVSTD (mm)	12.6 ± 3.8	13.1 ± 3.7	11.9 ± 3.8	0.100
LVIDd (mm)	59.2 ± 10.8	61.3 ± 10.3	55.8 ± 10.8	**<0.001***
LVIDs (mm)	47.1 ± 11.8	49.2 ± 11.1	43.9 ± 12.1	**0.018***
LVEF (mm)	37.7 ± 12.3	35.8 ± 12.1	40.7 ± 12.1	**0.002***
FS (mm)	18.8 ± 7.2	17.8 ± 7.2	20.3 ± 7.0	**0.009***
PWTd (mm)	11.2 ± 3.4	11.5 ± 3.5	10.9 ± 3.2	0.388
LVM (gram)	364.3 ± 138.8	399.9 ± 126.2	311.1 ± 140.8	**0.001***
LVMI (gram/m^2)	203.9 ± 70.7	214.2 ± 61.5	188.2 ± 81.3	0.096
RWT	0.4 ± 0.2	0.4 ± 0.2	0.4 ± 0.2	0.859
RVDd (mm)	31.6 ± 8.6	32.0 ± 8.3	30.9 ± 9.1	0.584
TAPSE (mm)	16.1 ± 5.1	15.2 ± 17.4	4.9 ± 5.2	0.128
RVFAC (%)	16.8 ± 7.7	17.7 ± 7.2	15.5 ± 8.4	0.391
PASP (mmHg)	55.8 ± 19.3	54.7 ± 20.5	57.4 ± 18.2	0.699
Aortic root Dimension (mm)	31.5 ± 5.2	33.5 ± 4.8	28.5 ± 4.2	**<0.001***
Mitral E/A ratio	2.3 ± 1.4	2.4 ± 1.3	2.2 ± 1.5	0.499
Mitral DT (milliseconds)	138.1 ± 81.9	131.0 ± 91.2	155.1 ± 54.3	0.444

A - Left ventricular late filling velocity; LVH- Left ventricular hypertrophy; DT - deceleration time of E velocity; E –left ventricular early filling velocity; EF - ejection fraction; FS - fractional shortening; IVSTd - interventricular septal wall thickness in diastole; LVIDd - left ventricular internal diameter in diastole; LVIDs - left ventricular internal diameter in systole; LVM - left ventricular mass; LVMI - left ventricular mass index; PWTd - left ventricular posterior wall thickness in diastole; RWT- relative wall thickness

Table 3: Laboratory Investigation results of the Cohort

Variables	All	Male	Female	P value
Serum Sodium (µmol/L)	134.74 ± 6.04	134.6± 6.02	134.9 ± 6.1	0.681
Serum Potassium (µmol/L)	3.8 ± 0.79	3.81 ± 0.84	3.79 ±0.7	0.832
Serum Urea (mmol/L)	7.26 ± 5.02	7.83±5.1	6.47 ±4.9	0.058
Serum Creatinine (µmol/L)	117.8 ± 64.4	120.6 ± 52. 8	113.8 ± 78.4	0.465
Serum eGFR (mls/min / 1.73m^2)	72.9 ± 28.3	75.5 ± 28.2	69.3 ±28.2	0.133
Hemoglobin (g/dL)	13.46 ± 1.98	13.7 ±1.99	13.2 ±1.96	0.187
Serum Calcium (mmol/L)	1.95 ± 0.51	1.91 ±0.52	2.00 ± 0.49	0.627
Serum Phosphate (mmol/L)	1.94 ± 1.13	1.93 ± 1.28	1.97 ±0.87	0.932
White Blood Cell count (x10^9/L)	9.3 ± 10.5	9.9 ±9.8	8.48 ± 11.46	0.515
Platelet Count (x10^9/L)	190 ± 95.3	172.0 ± 85.7	217.6 ± 103.8	**0.029***
Total Cholesterol (mmol/L)	4.1 ± 1.2	4.2 ± 1.25	3.97 ± 1.1	0.478
HDL- Cholesterol (mmol/L)	0.94 ± 0.44	0.96 ± 0.44	0.92 ±0.44	0.744
LDL – Cholesterol (mmol/L)	2.7 ± 1.03	2.7 ±1.07	2.69 ± 1.0	0.983
Triglyceride (mmol/L)	1.03 ± 0.62	1.09 ±0,75	0.98 ± 0.41	0.495

eGFR- Estimated Glomerular filtration rate, HDL- High Density Lipoprotein, LDL- Low Density Lipoprotein

Table 4 : Profile of Drug Use Among the Patients

Drug/Drug category	Frequency (%)
Angiotensin Converting Enzyme Inhibitor	287(63.1)
Angiotensin Receptor Blocker	293 (64.3)
Diuretic (Frusemide/Torsemide)	408 (89.4)
Beta blockers	141 (30.9)
Spironolactone	254 (55.9)
Digoxin	101 (22.2)
Others :	
Anti-platelet drug (Aspirin or Clopidogrel)	96 (38.2)
Amiodarone	76 (16.8)
Anticoagulant (warfarin or enoxaparin)	76(16.7)
Isosorbide dinitrate	1 (0.2)

Table 5: Comparison of the current study with similar studies done locally and elsewhere

	Author (Year) (Ref. Number), Country	N	Mean age ±SD (yrs)	Men (%)	DM (%)	NYHA class (III&IV)	Mean EF (%)	DOA (days)	Mortality (%)	HHF (%)	DCM (%)	PPCM (%)	VHDX (%)	IHD (%)
1	Present study Ogunmodede et al (2021)	455	58.9± 15.7	58.2	4.8	53.2	37.7	11	11.6	62.4	17.6	5.3	6.6	1.5
2	Ogah et al (2014), (28) Nigeria	452	56.6 ±15.3	54.9	10	82.5	42.0	11	3.8	78.5	7.5	1.3	2.4	0.4
3	Makubi et al (2014) (40) Tanzania	427	55±17	49	12	79	41	NR	NR	45	28		12	9
4	Damasceno et al (2012) Thesus HF (43)	1006	52.3±18.3	49.3	11.1	34.6	39.5	7.0	4.2	45.4	18.8	7.7	14.3	7.7
5	Tantchou et al. (2011) (36), Cameroon	462	42.5±18	57.1	NR	51.0	NR	13	9.2	15.0	32.0	NR	35.0	NR
6	Onwuchekwa and Asekomeh (2009) (32), Nigeria	423	54.4 ±17.3	57.2	NR	NR	NR	NR	4.3	56.3	12.3	0	4.3	0.2
7	Ojji et al (2009) (31), Nigeria	315	50.6 ±15.29	50.9	NR	NR	NR	NR	NR	62.6	13.8	3.2	7.4	NR
8	Kuule et al. (2009) (39) Uganda	157	45.0	33.8	NR	96.8	NR	NR	NR	25.1	27.3	NR	28.2	1.9
9	Stewart et al. (2008) (37) South Africa	844	55±16	43	10.0	34.0	45	NR	NR	33.3	35.3	NR	7.9	7.9
11	Karaye and Sani (2008) (34), Nigeria	79	46.9±17.9	55.7	NR	NR	43.7	13.0	NR	57.0	24.0	13.9	12.7	7.6
12	Familoni et al (2007) (35), Nigeria	82	57.6 ± 15.9	67.1	NR	NR	22.3	NR	67.1	43.4	28	NR	9.8	8.5
13	Amoa and Kallen (2000) (41), Ghana	572	42 ± 0.9	NR	NR	NR	NR	NR	NR	21.3	16.6	NR	20.1	10.0
14	Oyoo and Ogola (1999) (42), Kenya	91	NR	48.4	NR	37.4	NR	NR	NR	13.2	25.2	NR	32.0	2.2

CKD - chronic kidney disease; DCM - dilated cardiomyopathy; DM – Diabetes mellitus; EF -ejection fraction; HHF - hypertensive heart failure; HF -heart failure; IHD - Ischemic heart disease; DOA - Duration of Admission in hospital; NR - not reported; NYHA – PPCM- Peripartum Cardiomyopathy; n- Sample size; New York Heart Association; THESUS-HF - Sub-Saharan Africa Survey of Heart Failure; VHDX - Valvular heart disease

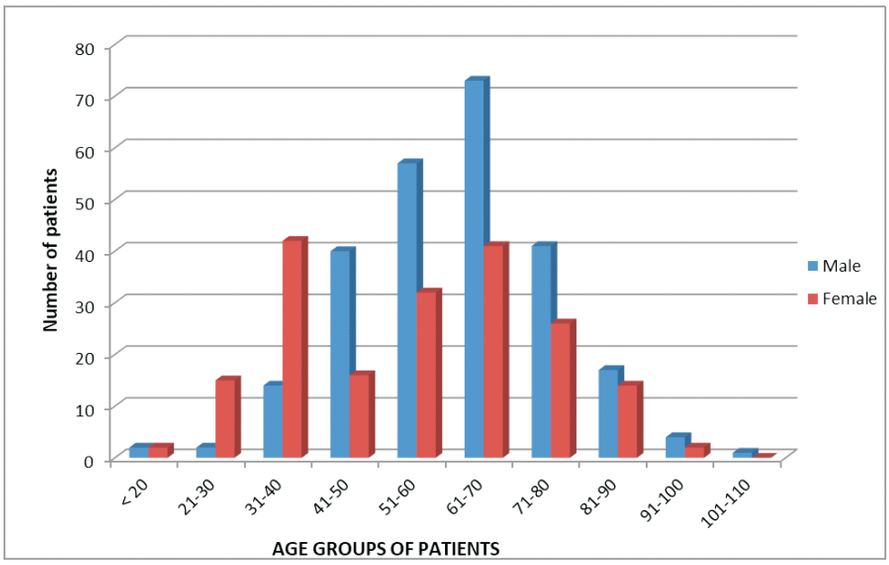

Figure 1: Gender distribution of Patients across different age groups

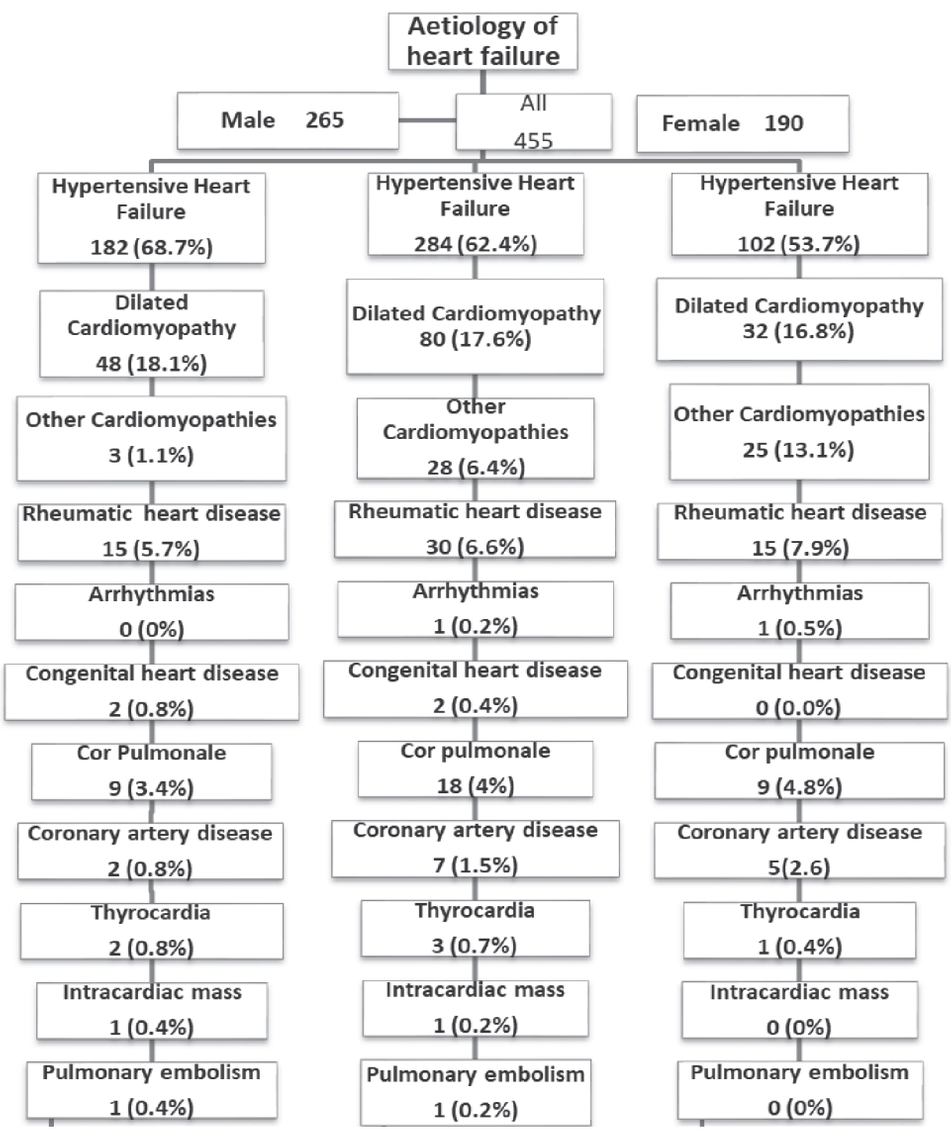

Figure 2: Echocardiography confirmed aetiology of Heart failure among the study patients