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ORIGINAL ARTICLE

Clinical Characteristics, Management, and Six-Month Outcomes after Discharge of Patients Admitted for Acute Heart Failure in Ibadan, Nigeria

Caractéristiques Cliniques, Prise en Charge et Résultats à Six Mois Après la Sortie des Patients Admis Pour une Insuffisance Cardiaque Aiguë à Ibadan, au Nigeria

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ABSTRACT

BACKGROUND: The burden of acute heart failure (AHF) is on the increase globally however, there are few studies on AHF in Nigeria and among black populations.

OBJECTIVE: This study described the clinical profile, conventional management and six-months outcome after discharge of patients admitted for acute heart failure at the University College Hospital, Ibadan, Nigeria.

METHODS: The study was a prospective study of 160 consecutive AHF patients. Socio-demographic details, clinical history, basic laboratory parameters electrocardiographic and echocardiographic parameters were assessed. They were followed-up for six-months after discharge to ascertain death or readmission.

RESULTS: The mean ± standard deviation (SD) age of all the patients was 58.0 ±15.1 years. Those aged 60 years and above constituted about half of the participants. Males comprised 59.3% and hypertension was the most common risk factor (77.5%). One hundred and thirty-four subjects (83.8%) were in New York Heart Association functional classes III or IV. The most common AHF type was heart failure with reduced ejection fraction and mostly presented de novo. The median duration of admission was 11 days while intrahospital mortality and mortality at 6 months after discharge were 6.3% and 25.6% respectively.

CONCLUSION: This study provided a real-world data of AHF at UCH, Ibadan, Nigeria. It showed AHF was predominantly associated with hypertension. There was high mortality among these AHF subjects. There is a need for more strategy in our environment for preventing AHF and its adverse outcomes. **WAJM 2023; 40(1): 30–44.**

Keywords: Heart failure, Acute Heart failure, Nigeria, Hypertension, Cardiovascular disease.

RÉSUMÉ

CONTEXTE: Le fardeau de l'insuffisance cardiaque aiguë (ICA) est en augmentation dans le monde entier ; cependant, il existe peu d'études sur l'ICA au Nigeria et parmi les populations noires.

OBJECTIF: Cette étude décrit le profil clinique, la prise en charge conventionnelle et le résultat six mois après la sortie des patients admis pour une insuffisance cardiaque aiguë à l'University College Hospital, Ibadan, Nigeria.

MÉTHODES: L'étude était une étude prospective de 160 patients consécutifs souffrant d'insuffisance cardiaque aiguë. Les détails sociodémographiques, l'histoire clinique, les paramètres de laboratoire de base, les paramètres électrocardiographiques et échocardiographiques ont été évalués. Ils ont été suivis pendant six mois après leur sortie de l'hôpital pour vérifier le décès ou la réadmission.

RÉSULTATS: L'âge moyen ± écart-type (ET) de tous les patients était de 58,0 ±15,1 ans. Les personnes âgées de 60 ans et plus constituaient environ la moitié des participants. Les hommes représentaient 59,3 % et l'hypertension était le facteur de risque le plus fréquent (77,5 %). Cent trente-quatre sujets (83,8 %) appartenaient aux classes fonctionnelles III ou IV de la New York Heart Association. Le type d'AHF le plus fréquent était l'insuffisance cardiaque avec fraction d'éjection réduite et se présentait le plus souvent de novo. La durée d'admission était de 11 jours tandis que la mortalité intrahospitalière et la mortalité à 6 mois après la sortie étaient respectivement de 6,3% et 25,6%.

CONCLUSION: Cette étude a fourni des données réelles de l'AHF à l'UCH, Ibadan, Nigeria. Elle a montré que l'AHF était principalement associée à l'hypertension. Il y avait une mortalité élevée parmi ces sujets AHF. Il y a un besoin de plus de stratégie dans notre environnement pour prévenir l'AHF et ses résultats défavorables. **WAJM 2023; 40(1): 30–44.**

Mots-clés: Insuffisance cardiaque. Insuffisance cardiaque aiguë, Nigeria, Hypertension, Maladie cardiovasculaire.

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Abbreviations: ACEI, Angiotensin-Converting Enzyme Inhibitors; **ACS,** Acute Coronary Syndrome; **ADCHF,** Acute Decompensation of Chronic Heart Failure; **ADHERE,** Acute Decompensated Heart Failure National Registry; **AF,** Atrial Fibrillation; **Afl,** Atrial flutter; **AHF,** Acute Heart Failure; **ANOVA,** One-Way Analysis of Variance; **AO,** Aortic Root Diameter; **AOR,** Adjusted Odd Ratio; **ARB,** Angiotensin II Receptor Blockers; **AVO,** Aortic Valve Opening; **BAE,** Bi-Atrial Enlargement; **BMI,** Body Mass Index; **BNP,** B-Type Natriuretic Peptide; **BSA,** Body Surface Area; **CKD,** Chronic Kidney Disease; **CONSENSUS,** 1 study Cooperative North Scandinavian Enalapril Survival Study; **COPD,** Chronic Obstructive Pulmonary Disease; **CSF,** Case Study Form; **DAMA,** Discharged Against Medical Advice; **DBP,** Diastolic Blood Pressure; **DT,** Deceleration Time; **E/A,** Early to Late Diastolic Trans-Mitral Flow Velocity; **ECG,** Electrocardiography; **EDV**, End-diastolic volume; **EF,** Ejection Fraction; **ESV,** End-systolic Volume; **Euro-HF,** European Heart Failure Survey; **FBC+diff,** Full Blood Count and Differential; **GLI,** Glycaemic Liability Index; **HbA1c,** Haemoglobin A1c; **HcB,** Health Care Budget; **HF,** Heart Failure; **HHD,** Hypertensive Heart Disease; **HTN,** Hypertension; **IHD**, Ischaemic Heart Disease; **IN-HF,** Italian Network on Heart Failure; **IQR,** Inter-Quartile Range; **IVRT,** Iso-volumic Relaxation Time; **IVST,** Interventricular Septal Thickness; **JVP,** Jugular Venous Pressure; **LBBB,** Left Bundle Branch Block; **LMIC,** Low and Middle-income Countries; **LOS,** Length of Hospital Stay; **LV,** Left Ventricular; **LVDD,** Left Ventricular Diastolic Dimension; **LVEDD,** Left Ventricular End Diastolic Dimension; **LVEF,** Left Ventricular Ejection Fraction; **LVH,** Left Ventricular Hypertrophy; **MACEs,** Major Adverse Cardiovascular Events; **NH,** Non-Hispanic; **NT-pro BNP,** N-Terminal Pro-B-Type Natriuretic Peptide; **NYHA,** New York Heart Association; **OHAs,** Oral Hypoglyceamic Agent; **OR,** Odd Ratio; **PCV,** Packed Cell Volume; **PND,** Paroxysmal nocturnal dyspnea; **PSVC,** Premature Supraventricular Contraction; **PVC,** Premature Ventricular Contraction; **QTC,** Corrected QT Interval; **RBBB,** Right Bundle Branch Block; **RVH,** Right Ventricular Hypertrophy; **RWT,** Relative Wall Thickness; **SBP,** Systolic Blood Pressure; **SD,** Standard Deviation; **SSA,** Sub-Saharan Africa; **TAPSE,** Tricuspid Annulus Plane Systolic Excursion; **THESUS-HF,** The Sub-Saharan Africa Survey of Heart Failure; **TWMG,** Time-weighted Mean Glucose; **UCH,** University College Hospital; **UTI,** Urinary Tract Infection; **VEF**, Ventricular Ejection Fraction; **VHD,** Valvular Heart Disease; **WBC,** White Blood Count.

INTRODUCTION

Heart failure (HF) is the final pathway of all cardiac diseases and constitutes a significant public health problem and an enormous impediment to sustainable human development globally.[1] It affects as much as 64 million people globally and is expected to rise in the coming years due to the increasing incidence and prevalence of cardiovascular diseases and its risk factors, as well as improving life expectancy.[2–7]

Furthermore, HF among Africans tends to be more prevalent in younger and economic productive population compared to Europeans and North Americans thereby negatively affecting economic productivity.[8] AHF constitute a significant part of the total cost of HF,[7] therefore the burden and outcome of acute heart failure(AHF) have enormous implications, and it constitutes a severe burden at the individual, family and societal levels.[8]

In addition, despite the increase in therapies and prevention capacity for HF, mortality and morbidity are still high and associated with poor quality of life.[9] The mortality and morbidity burden tend to increase as the disease progress and this burden is high in low and middle income countries(LMIC).[10]

There are also disparities in the available literature on HF between high income countries (HIC) and low and LMIC with the AHF syndrome better studied in the former.[10–12] While many studies have been done in developed countries which have provided remarkable insight into AHF, there are few 'real world' studies in Nigeria and sub Saharan Africa (SSA) that have examined clinical characteristics, rehospitalization as well as mortality and morbidity associated in patients with AHF.[13–17] Also, acute heart failure among blacks, compared with Caucasian, is less studied.

It is therefore imperative to have more studies in the African black population of AHF patients in order to have better understanding of their clinical, demographic, electrographic and echocardiographic features and outcomes.

This study described the clinical profile, conventional management and six months' post-discharge outcome of patients with acute heart failure at the University College Hospital, Ibadan, Nigeria.

SUBJECTS, MATERIALS AND METHODS

Study Location

The study was carried out at the Cardiology Unit of the Department of Medicine, University College Hospital (UCH), Ibadan, an 850-bed federal tertiary health facility that serves the population in Oyo State and other states of Nigeria. The hospital was established by the act of parliament in November 1952.

Study Design

The study was a prospective observational study.

Study Population

Consecutive acute heart failure (AHF) patients admitted into the cardiology unit of the Department of Medicine, University College Hospital, Ibadan were recruited. The recruitment was between 7th June 2018 and 7th January 2019 (7 months).

Sample Size Determination

A minimum sample size was calculated using the Leslie Kish formula.[18] The proportion of 13% was used for this study since intra hospital case-fatality rate and mortality after discharge range among those with AHF ranges from 3.8–7.3% in a study by Ogah *et al.*[19] A 10% increase was included to take into account attrition due to loss to follow up. The final sample size used was 160.

Inclusion Criteria

Participants who were 18 years and above with de novo HF or acute decompensated chronic HF, irrespective of the primary cause were included in the study.

Exclusion Criteria

Participants who were pregnant and seropositive (HIV-1 and HIV-2) were excluded.

Enrolment and Data Collection

Each participant was interviewed with an interviewer administered questionnaire on the ward with privacy ensured.

Interview and assessment sessions were done for about 40 minutes per patient. Phone numbers and addresses of participants and their next-of-kin were collected to aid follow up. The interviewer read questions from the questionnaires to the participants, and their answers were recorded. Basic demographic data and clinical history were collected. The assessment of cigarette smoking was done and recorded as ever, never, and current smoking and alcohol use was similarly done. The precipitants of AHF episodes were also recorded.

There were four interviews during assessment: during recruitment and one month, 3 months and 6 months' post-discharge. The interview at recruitment were in person for all cases while an attempt was made for in-person assessment for all follow-up sessions. When the patient could not meet follow up a schedule or refused, a phone interview was conducted. The interview was to determine readmission, presence of event or complications. Verbal autopsy was done for death, not in the facility of study, and the investigator did not have access to the records.

Clinical Evaluation

Cardiovascular risks were assessed. Hypertension was defined as a cut-off blood pressure of >140/90 mm Hg based on the mean of three measurements taken at least five minutes apart, a history of hypertension, or use of antihypertensive drugs prior to recruitment. Systolic and diastolic blood pressures were taken at Korotkoff phases 1 and 5, respectively, and recorded to the nearest 2 mmHg.

Diabetes mellitus (DM) was defined as a use of drugs for diabetes, history of diabetes or a fasting blood glucose concentration greater than 126mg/dL or random blood sugar >200mg/dL with classical symptoms of DM at first encounter. Obesity was determined using cut off body mass index (BMI) of greater than 30 kg/m^2.

Family history of hypertension or heart failure was defined as self-reported hypertension or heart failure in a participant's father, mother, sibling, or second-degree relative.

The types of medications used by the patients were identified and the use

by each patient was recorded as types and either yes or no for each type.

Physical assessments such as weight and height were measured on the ward. Weight was measured with minimal dressing and recorded to the nearest kilograms while the patient was minimally dressed using calibrated weighing scale while height was measured in metre using stadiometer without headgear or cap. Body mass index (BMI) was calculated using the weight of the patient to the square root of height. Body surface area was calculated using Mosteller formula ("[weight(cm)] X [height(cm)]/3600).[20] General physical and cardiac examinations were also conducted, and relevant information were noted in the case reporting form (CRF). Body mass index (BMI) was calculated using the formula weight (kg)/height^2 (m) and stratified into <18.5 kg/m^2,18.6–24.9kg/m^2, 25–29.9 kg/m^2, and ≥30.0 kg/m^2.

Diagnosis of Acute AHF

The subjects were diagnosed with HF based on the Framingham criteria which is presence of two major or one major and two minor criteria.[21] Acute heart failure cases were classified as de novo AHF or acute decompensated chronic HF. The participants had echocardiographic study to exclude differentials. The degree of LV systolic dysfunction was classified using EF into reduced EF (<40%), mid-range ejection fraction (40-49%) and preserved ejection fraction (≥50%).[22,23]

Definition of AHF Terms

a) De novo AHF (New-onset AHF) is meant to be AHF in patients with no prior history of HF
b) Acute decompensated chronic HF is worsening HF features in a known HF patient.

Procedures

Biochemistry and Haematological Assessment

About 20ml of venous blood was collected from the superficial vein of the convenient upper limb of each patient, using aseptic procedure, for full blood count and differential (FBC + diff), clinical chemistry (serum creatinine, urea, sodium, chloride, potassium, urinalysis, fasting blood glucose, fasting lipid profile) and virology (HIV). Fasting blood glucose and fasting lipid samples were collected after 8–10hours of overnight fasting.

Blood samples were collected in the appropriate sample bottles. Samples for FBC, electrolyte and urea, FBG were placed in ethylenediaminetetraacetic acid (EDTA) bottle, plain and sodium citrate bottles respectively. The samples were transported immediately to the laboratory for analysis.

Serum creatinine level was used to determine the eGFR with the Cockcroft-Gault formula.[24]

1. Electrocardiography

A standard 12-lead electrocardiography studies was done for the participants using a commercially available CONTEC® Workstation Model, CONTEC EC8000G, ECG machine (Made in China) at a speed of 25mm/s and 1mV/cm calibration while they were supine and at rest using standard procedure.[25] Various parameters such as PR intervals, QRS duration and axis, rate, rhythm, conduction abnormalities, types of arrhythmias, and QT intervals were assessed. The definitions of the ECG parameters are based on standard ECG definitions.[25]

Echocardiography

Two dimensional (2-D) and two dimensional(2-D) directed M-mode transthoracic echocardiography were done for the participants based on the American Society of Echocardiography guidelines.[26] The participants had the echocardiographic procedure within 72 hours of admission in the partial left lateral decubitus position using a Toshiba Xario (Toshiba Medical Systems Corp) with a 3.5 MHz transducer. Various echocardiographic parameters were obtained.

Follow up Details

Participants were followed-up for 6 months for major adverse cardiovascular events (MACEs) such as hospitalization for HF, cardiovascular events and cardiac deaths. They were assessed at one, three and six months in the clinic. Those lost to follow up were noted. The composite all-cause mortality for HF during 6 months of follow up after discharge from hospital were noted. Death was further classified into the cardiovascular causes and non-cardiovascular causes. The ECG, echocardiographic, haematologic and biochemistry studies conducted for the patients at baseline were not repeated at follow up.

Ethical Considerations

The study approval with assigned number UI/EC/18/0004 was sought and obtained from the Ethical Review Committee of UCH/UI Ibadan. The questionnaires used for the study were kept secure, and the data generated were also kept secured from third parties.

The study ensured each participant gave informed written consent before recruitment into the study. Participants were given the privilege to withdraw at any stage of the study.

Data Management and Statistical Analysis

Data was entered into the CRF and subsequently entered into a secured electronic database. The statistical analysis was done using International Business Machines (IBM) Corporation Statistical Product and Service Solutions (SPSS) for Windows version 23.0 (Armonk, NY: IBM Corp).

The broad group of explanatory variables included sociodemographic, lifestyle, co-morbidities and risk factors, clinical symptoms at admission, clinical sign, vital signs at admission, anthropometry, laboratory results, ECG and echocardiographic results, precipitants of AHF, medications on admission & post-discharge, and outcome.

The data were subjected to the normality test. Normally distributed continuous variables were summarised as means, & standard deviations and were compared with one-way analysis of variance (ANOVA). Those that were not normally distributed were summarised as median & interquartile range and compared with the Mann-Whitney U test. Categorical variables were expressed as frequencies and percentages while they were compared with Pearson chi-square test.

For all tests, two-sided *p*-value <0.05 were considered to be significant.

RESULTS

Socio-demographic Characteristics, Risk Factor Profile and Co-morbidities of the Participants

Demographic data at baseline admission are shown in Table 1 and flow chart of 160 participants recruited into the study are in Figure 1. The mean ± standard deviation (SD) age of all the patients was 58.0 ± 15.1 years, (male mean ±SD age, 58.7±14.8 years versus(vs) female mean± SD age, 57.1±15.6 years; *p*-value = 0.525). The range was 18–90 years. Majority of the participants were males, 95 (59.3%).

About half of the participants were aged 60 years and above, with males (50.5%) compared to females (43.1%) (*p*=0.421). About four out of five participants were married with male preponderance (92.6% vs 76.9%, *p*- = 0.0009) (Table 1).

Most of the participants paid out of pocket for their care and there was no difference across the gender (*p* =0.407) (Table 1).

The most common comorbidities were hypertension (77.5%), kidney disease (34.4%), and diabetes mellitus (18.1%) (Table 1). Behavioural cardiovascular risk factors such as smoking and drinking of alcohol were not common, however those who were identified to have engaged in them, did so for long duration. (Table 1).

Symptoms, Physical Signs and New York Heart Association (NYHA) Functional Class among the Participants

The most common presenting complaints were reduced exercise tolerance, fatigue & tiredness, difficulty to recover after exercise(increased time to recovery after exercise) and dyspnoea with the following frequencies 88.1%, 83.8%, 83.8% and 83.1% respectively (Figure 2). Dyspnoea, palpitation and headache were noted more in female subjects compared to males (*p*=0.010, *p*=0.0009, and *p*=0.033 respectively).

The commonest physical findings at baseline evaluation were tachypnoea, ascites, laterally displaced apical impulse and the presence of third heart sound (98.8%, 90.0% and 73.8%, respectively) (Figure 3). About 80% were in NYHA class III/IV.

Baseline Anthropometry, Vital Signs, Haematological and Biochemical Results of the Participants

The anthropometric measures and vital signs at admission were largely similar across gender (Table 2). Majority were either overweight (63.1%) or obese (10.0%).

The laboratory findings are presented in Table 2. However, the bio-humoral variables with statistical significance across the gender were platelet count, serum urea and creatinine respectively (*p*-value = 0.008, *p*-value = 0.043 and *p*-value = 0.001 respectively).

Electrocardiographic & Echocardiographic findings of the Study Subjects

i. ***Electrocardiography***

Table 3 showed the electrocardiographic findings of the study subjects. About two out of every five had arrhythmias. The mean of parameters such as QT interval and QRS duration were higher in males compared to female.

ii. ***Echocardiography***

Echocardiographic parameters were similar across the gender except for aortic root diameter, which is higher in males than females, 2.99 ± 0.56 cm vs 2.77 ± 0.38 cm respectively; *p*-value 0.006 (Table 4). Left ventricular systolic dysfunction was predominant among the study population;120 (75.0%) (Table 4). The commonest valvular abnormalities were mitral incompetence (84.4%) and tricuspid incompetence (78.1%) respectively (Table 4). Similarly, aortic incompetence was commoner in males (23.2%) compared to females (9.2%), 0.023 (Table 4).

Majority of participants were de novo AHF compared to acute decompensated CHF (ADCHF) (75.6% versus 24.4%, *p*=0.350). The mean ± SD EF among de novo AHF and ADCHF were 38.6±12.9% and 39.1±16.6%, *p*-value = 0.830 respectively.

Fifty-one (67.1%), 10(13.2%) and 15(19.2%) belong to reduced, mid-range and preserved ejection AHF categories respectively. The proportion of above 60 years among de novo HF vs ADCHF were 59(36.9%) vs 17(10.6%) respectively (*p*=0.929). The mean± SD among those with depressed EF, mid-range EF and preserved EF were 32.4 ±7.4%, 43.1±2.6% and 64.1±11.2 *p*=0.830 respectively.

Aetiological Risk Factors and Precipitants for AHF among Participants

Most common cause of AHF was hypertensive heart disease, 131 (84.2%). Dilated cardiomyopathy and rheumatic heart disease were found in 25 (16.3%) and 10 (6.3%) respectively (Table 5).

Precipitants of AHF were infection (51.3%), arrhythmias (25.0%), poor medication adherence (18.1%) (Table 5). The least common precipitant of AHF among participants were physical stress/ emotional excesses (0.6%) and fluid overload (0.1%).

Medications usage among the 160 AHF Participants

Majority of the patients, 156(97.5%) were on loop diuretic at the time of recruitment, while 93.1% and 83.8% of the participants were on spironolactone and ACE inhibitors respectively. (Table 6). The usage of medications was similar without statistical significance across gender.

Outcome

i. ***In-hospital Outcome***

The median length of stay (LOS) was 11 (0-11) days (Table 7). Majority stayed for more than a week on admission 116(72.5%). Only 3(1.9%) were discharged against medical advice (DAMA) during the baseline admission. Ten subjects (6.3%) died during baseline hospital admission with no significant differences between males and females (*p*-value=0.271) (Table 7 and Figure 1). Most deaths were after 8 days of stay for both gender while there is similar pattern of death during admission between gender, hazard ratio (HR) (95% confidence interval (CI)), *p*-value; 1.51(0.86, 2.62), 0.151.

Table 1: Sociodemographic Characteristics, Risk Factor Profile and Burden of Co-Morbidities of the 160 Participants

Variables	All (n=160)	Male (n=95)	Female (n=65)	*p*-value
Age (mean ± SD) years	58.0±15.1	58.7±14.8	57.1±15.6	0.525
Age (Range) years	18-90	18-86	23-90	
Aged 60 years n (%)	76(47.5)	48 (50.5)	28 (43.1)	0.421
Marital Status n (%)				0.009**
Single	6(3.8)	4(4.2)	2(3.1)	
Married	138(86.3)	88(92.6)	50(76.9)	
Divorced	1(0.6)	0	1(1.5)	
Separated	5(3.1)	2(2.1)	3(4.6)	
Widowed	10(6.3)	1(1.1)	9(13.8)	
Educational Level n (%)				0.128
None	15(9.4)	5(5.3)	10(15.4)	
Primary	32(20.0)	18(18.9)	14(21.5)	
Secondary	65(40.6)	42(44.2)	23(35.4)	
Tertiary	45(28.1)	27(28.4)	18(27.7)	
Postgraduate	3(1.9)	3(3.2)	0	
Employment Status n (%)				0.132
Unemployed	73(45.6)	47 (49.5)	40 (61.5)	
Employed	87(54.4)	48 (50.5)	25 (38.5)	
Estimated monthly income n (%)				0.126
≤₦100.000	146(93.1)	84(88.4)	62(95.4)	
>₦100 000	14(6.9)	11(11.6)	3(4.6)	
Source of funding for care n (%)				1.000
Out of Pocket	159(99.4)	94(98.9)	65(100.0)	
Health insurance alone	0	0	0	
Both1(0.6)	1(1.1))	0		
Comorbidities n (%)				
Hypertension	124(77.5)	74 (77.9)	50 (76.9)	0.855
Kidney disease	55(34.4)	36 (37.9)	19 (29.2)	0.310
Diabetes mellitus	29(18.1)	17 (17.9)	12 (18.5)	0.927
Obesity	16(10.0)	6(6.3)	10(15.4)	0.060
COPD	8(5.0)	6 (6.3)	2 (3.1)	0.474
Asthma	3(1.9)	2(2.1)	1(1.5)	1.000
Arthritis	3(5.1)	1 (1.1)	4 (6.2)	0.159
Family history of hypertension n (%)	16(10.0)	7 (7.4)	9 (3.8)	0.192
Family history of heart failure n (%)	1(0.6)	1 (1.1)	0	1.000
History of atrial fibrillation n (%)	17(10.7)	8(8.4)	7(10.8)	0.617
History of Stroke n (%)	2(1.3)	1(1.1)	1(1.5)	1.000
History of thyroid disease n (%)	1(0.6)	1(1.1)	0	1.000
Smoking n (%)				<0.0001**
Never	139(86.9)	74 (77.9)	65 (46.8)	
Previous	18(11.3)	18 (18.9)	0 (0.0)	
Current	3(1.9)	3 (3.2)	0 (0.0)	
Duration of smoking (median± IQR) years (n=21)	11.0±3.0	11(7.0-15)	–	–
Alcohol intake n (%)				<0.0001**
Never	108(67.5)	51 (53.7)	57 (87.7)	
Previous	41(25.6)	35 (36.8)	6 (9.2)	
Current	11(6.9)	9 (9.5)	2 (3.1)	
Duration of alcohol intake (median ± IQR) years (n=52)	15(10–20)	15(10–20)	15(11–19)	0.432

**Significant *p*-value <0.05. SD, *Standard Deviation;* COPD, *Chronic Obstructive Pulmonary Disease;* IQR, *Interquartile Range.*

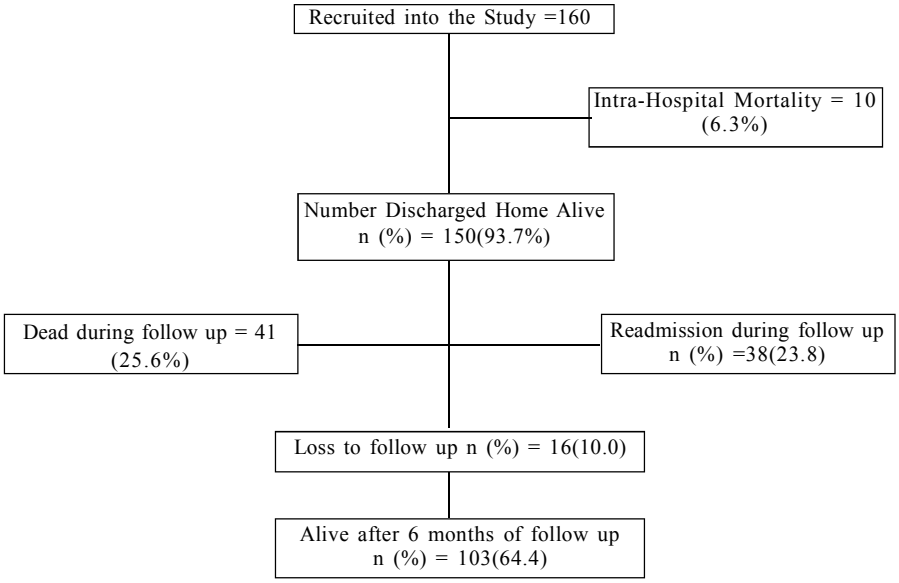

Fig. 1: Flow Chart of Participant during the Study.

ii. ***Outcome 6 months after discharge from \|Hospital***

The survivors that were followed up during 6 months' post-discharge were 150(93.8%) with 16(10.0%) of the total study population lost to follow up. Thirty-one patients died during the follow up period making a total of 41(25.6%) of the total study population that died during the study period.

DISCUSSION

This is a hospital-based study of AHF that identified and characterised AHF patients at the UCH, Ibadan. It also determined the average duration of intra-hospital admission, intrahospital and six months' outcome (mortality, readmission/ rehospitalisation and composite

Table 2: Biophysical Profile and Laboratory Results of the 160 Participants

Variables	All (n=160)	Male (n=95)	Female (n=65)	*p*-value
Weight median (IQR) Kg	69.8 (62.78–76.82)	69.8(64.8–74.8)	69.8(61.8–78.2)	0.213
Height median (IQR) metre	1.63 (1.36–1.90)	1.62(1.05–2.19)	1.62(1.39–1.85)	0.001**
BMI median (IQR) Kg/m^2	26.5(24.66–28.44)	26.5(8.3–44.7)	26.5(24.0–29.0)	0.919
BMI category n (%)				0.063
<18.5kg/m^2	5(3.1)	1(1.1)	4(6.2)	
18.5–24.9kg/m^2	38(23.8)	24(25.3)	14(21.5)	
25–29.9kg/m^2	101(63.1)	64(67.4)	37(56.9)	
≥30Kg/m^2	16(10.0)	6(6.3)	10(15.4)	
Pulse median (IQR) cycles/min	90.0(70.0–110.0)	90(70.0–110.0)	88.0(62.0–114.0)	0.623
Respiratory rate median (IQR) beats/min	28.0(20.0–36.0)	28.0(20.0–36.0)	28.0(20.0–36.0)	0.775
SBP median (IQR) mmHg	110.0(80.0–140.0)	110.0(80.0–140.0)	110(80.0–140.0)	0.625
DBP median (IQR) mmHg	80.0(51.5–108.5)	80.0(49.0)–111.0)	80.0(54.5–105.5	0.959
Heart rate mean± SD beats/min	97.9± 16.3	96.2±15.4	100.5±17.5	0.102
Tachycardia n (%)	52(32.5)	30(57.7)	22(42.3)	0.764
Pulse pressure median (IQR) mmHg	38.5(22.5–54.5)	38.0(23.0–53.0)	40.0(20.0-40.0)	0.325
Body surface area (mean ± SD) m^2	1.74 ± 0.12	1.76 ± 0.12	1.71 ± 0.13	0.050
PCV mean± SD	40.1 ± 6.3	41.1±4.9	38.6 ± 6.5	0.710
WBC median (IQR) /10mm3	7.5(4.2–10.8)	7.6(4.5-11.7)	7.2(2.5–11.9)	0.828
Platelet median (IQR) /mm3	220.5(121.7–319.3)	209.0(125.0–289.3)	226.0(92.0–360.0)	0.008**
Sodium (median ± IQR)	137.0(130.0–144.0)	137.0(132.0–142.0)	137.0(127.5–146.5)	0.813
Potassium (median ± IQR)	3.8(3.8–4.0)	3.9(3.3–4.5)	3.8(2.9–4.75)	0.136
Urea median (IQR) mg/dl	45.4(8.6–82.2)	49.0(14.0–84.0)	40.0(0–40.0)	0.043**
Creatinine median (IQR) mg/dl	1.30(0.5–2.1)	1.5(0.7–2.3)	1.1(0.55–1.8)	0.001**
eGFR median (IQR) mL/min/1.73 m2	53.1(19.9–86.3)	52.0(23.9–70.1)	56.8(11.4–102.2)	0.782
Total cholesterol mean± SD mg/dl	153.6 ± 30.6	152.4 ± 27.1	155.4 ± 35.3	0.550
LDL mean ± SD mg/dl	94.4 ± 24.9	94.1 ± 20.8	94.1 ± 30.8	0.857
HDL mean ± SD mg/dl	40.4 ± 15.1	40.5 ± 18.0	40.2 ± 9.3	0.878
Triglyceride mean ±SD mg/dl	99.0 ± 28.7	98.4 ± 27.6	99.9 ± 30.5	0.744

***Significant p-value <0.05; Kg, Kilogramme; IQR, Interquartile Range; SBP, Systolic Blood Pressure; DBP, Diastolic Blood Pressure; BMI, Body Mass Index; PCV, Packed Cell Volume; WBC, White Blood Cells; IQR, Interquartile Range; SD, Standard Deviation; eGFR, Estimated Glomerular Filtration Rate; LDL, Low-density Lipoproteins Cholesterol; HDL, High-density Lipoprotein Cholesterol.*

Table 3: Electrocardiographic Profile of the Participants

Variables	All (n=160)	Male (n=95)	Female (n=65)	*p*-value
Heart rate mean ±SD/min	97.9 ± 16.3	96.2 ± 15.4	100.5 ± 17.5	0.102
Sinus rhythm n (%)	98(61.3)	58 (59.2)	40 (40.8)	0.951
Normal ECG axis n (%)	110(68)	55(57.9)	55(84.6)	<0.0001**
Atrial fibrillation n (%)	23(14.4)	12 (12.6)	11 (16.9)	0.447
Atrial flutter n (%)	4(2.5)	4 (4.2)	0 (0.0)	0.147
Premature ventricular contractions (PVCs) n (%)	28(17.5)	17 (17.9)	11 (16.9)	0.874
Premature supraventricular contractions n (%)	2(1.3)	0 (0.0)	1(1.5)	0.406
Atrial Chamber Enlargement n (%)				0.358
Left	24(15.0)	13 (13.7)	11 (16.9)	
Right	15(9.4)	11 (11.6)	4 (6.2)	
Bi-atrial	6(3.8)	5 (5.3)	1 (1.5)	
None	115(71.9)	45 (69.4)	35 (75.4)	
Ventricular Chamber Hypertrophy				
Left ventricular hypertrophy (LVH) n (%)	48(30.0)	28 (29.5)	20 (30.8)	0.883
Left ventricular hypertrophy (LVH) with strain n (%)	37(23.1)	23 (24.2)	14 (21.5)	0.381
Right ventricular hypertrophy (LVH) n (%)	13(8.1)	6 (6.3)	7 (10.8)	0.849
Right ventricular hypertrophy (LVH) with strain n (%)	8(5.0)	6 (6.3)	2 (3.1)	0.474
Conduction Abnormalities n (%)	22(13.8)	10(10.5)	12(18.5)	0.152
First degree AV block n (%)	9(5.6)	5 (5.3)	4 (6.2)	1.000
Second degree AV block	3(1.9)	0 (0.0)	3 (4.6)	0.065
Complete heart block	0	0		
Right bundle branch block (RBBB) n (%)	3(1.9)	3 (3.2)	0 (0.0)	0.272
Left bundle branch block (LBBB) n (%)	6(3.8)	2 (2.1)	4 (6.2)	0.225
Intermediate interventricular block n (%)	1(0.6)	0 (0.0)	1 (1.5)	0.406
Presence of infarction	2(1.3)	2 (2.1)	0 (0.0)	0.515
QT interval mean± SD ms	369.7 ± 71.5	368.7 ± 67.0	371.5 ± 98.6	0.038**
QT_c interval mean± SD ms	415.6 ± 65.3	434.5 ± 64.7	402.7 ± 64.7	0.835
QRS mean± SD ms	112.7 ± 39.7	120.5 ± 55.8	101.9 ±23.3	0.031**

***Significant p-value <0.05; SD, Standard Deviation; QTc, Corrected QT; ECG, Electrocardiographic; AV, Atrioventricular; MS, Milliseconds.*

endpoints) of AHF patients at the UCH, Ibadan.

Clinical Profile, Socio-demographic Characteristics and Laboratory findings

The mean age of 58 years from our study was similar to previous studies in this environment.[27–30] While the mean age of this study population was a bit higher compared to some results from an Asian study, and other studies in Africa, it is lower compared to results from American and European studies.[31,32] The Acute Decompensated Heart Failure National Registry (ADHERE), European Heart Failure Registry(Euro-HF) and Organized Programme to Initiate Lifesaving Treatment in Hospitalised Patients with Heart Failure(OPTIMIZE-HF) studies reported mean age of 75,71 and 73 years among their study participants respectively.[33–35]

There are varied findings regarding gender distribution in the various AHF studies. Although this study found a higher burden of AHF among males than females like some studies.[27,36–39] This is contrary to other studies that found female preponderance.[31,33,35,40,41] The higher male proportion of HF in this study is likely due to the higher burden of cardiovascular risks in men.

The most typical comorbidity was hypertension, followed by diabetes mellitus, and this is similar to previous studies across race and national economic development level.[32,36,42,43] Although, only one out of every ten AHF episode recruited were precipitated by uncontrolled hypertension. A similar pattern and burden were found in the previous studies.[36,44–46] This brings to the fore the need for more effective hypertension prevention and control in this environment.

The most typical clinical presentation reported by the subjects were congestion and fluid retention (dyspnoea, orthopnoea, PND and leg swelling). Congestion has been reported as a usual finding in AHF and it is most typical cause of admission and readmission among HF patients. [36,47] The significant differences between male and female at presentation were dyspnoea, palpitation and headache where female reported higher frequency. Further studies would be required to unravel the explanations for these differences.

Tachycardia was reported in about a third of participants with a high resting heart rate of 97.9±16.3/minutes, which is in tandem with other studies.[36,37,44] This high heart rate burden has been previously demonstrated in many acute heart failure studies.[19,32,37,45,48,49] It is not unusual to have higher heart rate burden in AHF compared to chronic heart failure.[50]

Most of the subjects in this study were on loop diuretics (97.5%), ACE

Table 4: Echocardiographic Parameters of Participants

Variables	All (n=160)	Male (n=95)	Female (n=65)	*p*-value
Aortic valve opening (mean ± SD) cm	2.01 ± 0.38	2.05 ± 0.41	1.95 ± 0.31	0.117
Aortic root diameter (mean ± SD) cm	2.92 ±0.57	2.99 ±0.56	2.77 ± 0.38	0.006**
Left atrial diameter (mean ± SD) cm	4.47 ±7.28	4.52 0.75	4.39 0.69	0.269
IVST(d) mean ± SD cm	1.06 ± 0.25	1.02± 0.22	1.03 ± 0.27	0.757
IVST(d) mean ± SD cm	1.16 ±0.28	1.17± 0.28	1.14 ± 0.28	0.536
LVPWT(d) mean ± SD cm	1.07 ± 0.27	1.02 0.22	1.03 0.27	0.677
LVPWT(s) mean ± SD cm	1.32 ± 0.33	1.17 0.28	1.14 0.28	0.710
LVID(d) mean ± SD cm	5.87 ± 1.07	5.89 1.13	5.69 1.00	0.255
LVID(s) mean ± SD cm	4.68 ± 1.16	4.73 1.13	4.61 1.20	0.493
Pulsed Wave Doppler Study of Trans-mitral Inflow				
Mitral E wave velocity (mean ± SD) m/s	0.95 ± 0.33	0.95 ± 0.37	0.95 ± 0.29	0.999
Mitral A wave velocity (mean ± SD) m/s	0.57 ± 0.47	0.57 ± 0.57	0.57 ± 0.28	0.989
E/A wave ratio median (IQR)	1.67(0.80,2.54)	1.67(0.66,1.68)	1.67(0.50,2.64)	0.723
DT of Mitral E mean ± SD ms	202.8 ± 112.9	200.4 ± 112.0	221.2 ± 114.0	0.253
IVRT (mean ± SD) (ms)	122.7± 31.1	121.3 ± 30.6	124.8 ± 30.0	0.480
LV Filling Pattern n (%)				0.476
Normal	102(63.8)	62(65.3)	40(61.5)	
Impaired relaxation	23(14.4)	14(14.7)	9(13.5)	
Pseudo normalization	5(3.1)	1(1.1)	4(6.2)	
Restrictive pattern				
Reversible	4(2.5)	2(2.1)	2(3.1)	
Fixed	26(16.3)	16(16.8)	10(15.4)	
LV Geometry n (%)				0.859
Normal geometry	19(11.9)	13(13.7)	6(9.2)	
Concentric remodeling	10(6.3)	6(6.3)	4(6.2)	
Concentric geometry	109(68.1)	63(66.3)	46(70.8)	
Eccentric geometry	22(13.8)	13(13.7)	9(13.8)	
EDV (mean ± SD) ml	187.1±71.4	192.8±65.4	178.7±79.1	0.221
ESV (mean ± SD) ml	116.0± 51.6	119.7±45.1	110.6±60.1	0.274
Fractional shortening (mean ± SD)	19.8± 8.7	19.0±7.6	20.8±10.1	0.199
Ejection fraction (EF) (mean ± SD)	38.7± 13.8	37.6±12.1	40.4±15.9	0.203
EF Category n (%)				0.393
Reduced EF(≤40%)	114(71.3)	69 (72.6)	45 (69.2)	
Mid-range EF(41–49%)	21(13.1)	14 (14.2)	7 (10.8)	
Preserved EF(≥50%)	25(15.6)	12 (12.6)	13 (20.0)	
Relative wall thickness (RWT) mean ± SD cm	0.37±0.10)	0.40±0.28	0.40±0.15	0.832
TAPSE mean ± SD cm	1.63± 0.46	1.67±0.43	1.58±0.50	0.231
LV mass (mean ± SD) g	258.0± 84.5	260.5±75.3	254.2±96.8	0.646
LV mass indexed to BSA (mean ± SD) g	149.1±50.8	148.9±45.5	149.5±58.1	0.939
LV mass indexed to height$^{2.7}$ (mean ± SD) g	70.0±25.7	67.8±20.9	73.1±31.3	0.205
Valvular abnormalities n (%)				
Mitral incompetence	135(84.4)	80 (84.2)	55 (84.6)	0.945
Tricuspid incompetence	125(78.1)	74 (77.9)	64 (78.5)	0.932
Aortic incompetence	28(17.5)	22 (23.2)	6 (9.2)	0.023**
Pulmonary incompetence	12(7.5)	8 (8.4)	4 (6.2)	0.763
Aortic stenosis	4(2.5)	3 (3.2)	1 (1.5)	0.647
Mitral stenosis	1(0.6)	0 (0.0)	1 (1.5)	0.406
Tricuspid stenosis	0	0	0	
Pulmonary stenosis	0	0	0	
Presence of wall motion abnormality n (%)	48(30.0)	30 (31.6)	18 (27.7)	0.598
Pericardium pericardial effusion n (%)	84(52.5)	50 (52.6)	34 (52.3)	0.932
Size of pericardial effusion n (%)				0.579
Nil	84(52.5)	50 (52.6)	34 (52.3)	
Negligible	59(36.9)	35 (35.8)	24 (36.9)	
Less than 1cm	8(5.0)	5 (5.3)	3 (4.6)	
Between 1–2cm	4(2.5)	1 (1.1)	3 (4.6)	
More than 2cm	5(3.1)	4 (4.2)	1(1.5)	
Spontaneous echo contrast n (%)	9(5.6)	5 (5.3)	4 (6.2)	1.000
Intra-cardiac clots n (%)	2(1.3)	0 (0.0)	2 (3.1)	0.164

***Significant p-value <0.05; SD, Standard Deviation; IVST(d), Interventricular Septal Thickness(diastole); IVST(s), Interventricular Septal Thickness(systole); LVPWT(d), Left Ventricular Posterior Wall Thickness(diastole); LVPWT(s), Left Ventricular Posterior Wall Thickness(systole); LVID (d), Left Ventricular Internal Diameter-diastole; LVID (s), Left Ventricular Internal Diameter-systole; IQR, Interquartile Range; EDV, End Diastolic Volume; ESV, End Diastolic Volume; EF, Ejection Fraction; LV, Left Ventricular; DT, Deceleration Time; IVRT, Isovolumetric Relaxation Time; TAPSE, Tricuspid Annulus Plane Systolic Excursion; RV, Right Ventricular.*

Table 5: Aetiological Risk Factors of AHF, Classification of AHF, Frequency of Previous Admission and Precipitants of AHF among the Participants

Variables	All (n=160)	Male (n=95)	Female (n=65)	*p*-value
Diagnosis of Heart Failure				
Hypertensive heart disease	131(81.9)	80 (84.2)	51 (78.5)	0.354
Dilated cardiomyopathy	26(16.3)	20(21.1)	6(9.2)	0.047**
Rheumatic heart disease	10(6.3)	4 (4.2)	6 (9.2)	0.319
Non-rheumatic valvular heart disease	7(4.4)	3(3.2)	4(6.2)	0.443
Ischaemic heart disease	5(3.1)	3 (3.2)	2 (3.1)	1.000
Thyrotoxic heart disease	3(1.9)	1 (1.1)	2 (3.1)	0.567
Cor pulmonale	3(1.9)	2 (2.1)	1 (1.5)	1.000
Endomyocardial fibrosis	1(0.6)	0 (0.0)	1 (1.5)	0.406
Congenital heart disease	1(0.6)	1 (1.1)	0 (0.0)	1.000
Previous Heart Failure Admission (12 months prior to recruitment) n (%)			0.534	
0	122(78.3)	75 (70.1)	47 (60.9)	
1	31(19.4)	16 (23.9)	15 (32.6)	
2	5(3.1)	3 (4.5)	2 (4.3)	
≥3	1(0.6)	1 (1.1)	1 (2.2)	
Type of Acute Heart Failure n (%)				0.350
Acute decompensated CHF	38(23.8)	20(21.1)	18(27.7)	
De novo HF	122(70.3)	75(78.9)	47(72.3)	
Type of Heart Failure based on EF n (%)				0.350
Reduced EF(≤40%)	114(71.3)	69(72.6)	45(69.2)	
Mid-range EF(41–49%)	21(13.1)	14(14.7)	7(10.8)	
Preserved EF(≥50%)	25(15.6)	12(12.6)	13(20.0)	
Precipitant Factors of Heart Failure n (%)				
Infections (UTI, Chest, etc.)	82(51.3)	45 (47.4)	37 (56.9)	0.235
Arrhythmias	40(25.0)	24 (25.3)	16 (24.6)	0.926
Poor medication adherence	29(18.1)	18 (18.9)	11 (16.9)	0.744
Electrolyte imbalance	21(13.1)	12 (12.6)	9 (13.8)	0.823
Uncontrolled hypertension	17(10.6)	9 (9.5)	8 (12.3)	0.568
Myocardial infarction	5(3.1)	4 (4.2)	1 (1.5)	0.649
Pulmonary embolism	5(3.1)	3 (3.2)	2 (3.1)	1.000
Alcoholic intoxication	4(2.5)	4(4.2)	0	0.147
Thyrotoxicosis	2(1.3)	1 (1.1)	1 (1.5)	1.000
Fluid overload	1(0.6)	0 (0.0)	1 (1.5)	0.406
Physical stress/emotional excesses	1(0.6)	0 (0.0)	1 (1.5)	0.406

***Significant p-value <0.05 AHF, Acute Heart Failure; EF, Ejection Fraction; CHF, Chronic Heart Failure; UTI, Urinary Tract Infection; ACEi, Angiotensin-Converting Enzyme Inhibitors; ARB, Angiotensin II Receptor Blockers.*

inhibitors (83.8%) and mineralocorticoid antagonist (MRA) (93.1%) at baseline hospital admission. The rate of use of anti-failure medications was sustained at discharge. There was a marked improvement between baseline and post-discharge in the usage of beta-blockers from 56.3% to 79.4% with implication on the likelihood of improved heart rate control. This improvement in intra-hospital and post-discharge utility of evidence-based anti-HF therapies has been previously documented.[32,44,46,51]

This high utility of these medications, whether intrahospital or at discharge is comparable to another study.[38] Landmark studies such as ADHERE, Euro-HF, and OPTIMIZED-HF recorded lower utility.[52] This can be explained by a time-lapse of these findings, which is averagely more than 15 years since those studies were done.[52] The figures from this study are more favourable than previous studies which can be explained by increasing adoption of professional guidelines across health institutions.[46,53] This may however not give insight into actual usage since medication adherence during and after admission was not assessed. Also, optimal dosage utilisation, according to professional guidelines, was not assessed.

Loop diuretics appeared to have generally a higher utility of usage compared to other anti-failure medications. However, there is a source of concern in utility level of anticoagulation due to one out every four subjects who did not get any form of anticoagulant at admission. Low usage was noted in RO-AHFS studies done in Romania.[54] Generally, medical venous thromboembolism prevention particularly using low-molecular-weight-heparin is

Table 6: Medications usage during admission in the 160 AHF Participants and Post-Discharge Medications in 150 Participants

Variables	All (n=160)	Male (n=95)	Female (n=65)	*p*-value
In-Hospital Medications				
Loop diuretics	156 (97.50)	92 (96.8)	64 (98.5)	0.647
Aldactone inhibitors	149 (93.1)	88 (92.6)	61 (93.8)	1.000
ACEi/ARB	138 (86.3)	83 (87.4)	55 (84.6)	0.619
Anticoagulant agents	126 (78.8)	71(74.7)	55(84.6)	0.558
Beta-blocker	90 (56.3)	49 (51.6)	41 (63.1)	0.194
Digoxin	34 (21.3)	17 (17.9)	17 (26.2)	0.240
CCBs (Amlodipine)	21 (31.1)	13 (13.7)	8 (12.3)	0.800
Amiodarone	10 (6.3)	6 (6.3)	4 (6.2)	1.000
Aspirin	7 (4.4)	4(4.2)	3 (4.6)	1.000
Anti-glycaemic agent	5 (3.1)	3 (3.2)	2 (3.1)	1.000
Thiazide	3 (1.9)	2 (2.1)	1 (1.5)	1.000
Centrally acting	1 (0.6)	1 (1.1)	0 (0.0)	1.000
Post-discharge Medications	n=150	n=91	n=59	
ACEI/ARB	150(93.5)	90 (94.7)	60 (92.3)	0.529
Aldactone inhibitors	149(93.1)	88 (92.6)	61 (93.8)	1.000
Loop diuretics	148(92.5)	88 (92.6)	60 (92.3)	1.000
Beta-blockers	127(79.4)	72 (75.8)	55 (84.6)	0.175
Digoxin	30(13.3)	19 (20.0)	11 (16.9)	0.624
Anticoagulants	20(12.5)	12 (12.6)	8 (12.3)	0.951
Statins	8(5.0)	4 (4.2)	4 (6.2)	0.716
Aspirin	7(4.4)	5 (5.3)	2 (3.1)	0.702
Nitrate	7(4.4)	6 (6.3)	1 (1.5)	0.242
Others	1(0.6)	0 (0.0)	1 (1.5)	0.406

***Significant p-value <0.05; LMWH, Low Molecular Weight Heparin; ACEi, Angiotensin-converting Enzyme Inhibitor; ARB, Angiotensin II Receptor Blockers; CCBs, Calcium Channel Blockers; Anticoagulant Agent; (LMWH, Warfarin, Traditional Heparin) Anti-glycaemic Agent (Insulin and Oral Hypoglycaemic Agent).*

Table 7: Outcome of Subjects after Admission and 6 Months Follow-up

Variables	All (n=160)	Male (n=95)	Female (n=65)	*p*-value
Length of stay (LOS) days median (IQR)	11(0–11)	11(1,21)	11(0,22)	0.632
Intra-hospital mortality	10(6.3)	4(4.2)	6(9.2)	0.271
Intra hospital stay				0.169
0–7 days	44(27.5)	23 (24.2)	21 (32.3)	
8–14 days	58(36.3)	40 (42.1)	18 (27.7)	
>14 days	58(36.3)	32 (33.7)	26 (40.0)	
All readmission at 6 months n (%)	38(23.8)	25(26.3)	13(34.2)	0.641
Readmission for AHF n (%)	27(71.0)	18(75.0)	9(64.3)	0.179
Readmission for non-HF causes n (%)	11(29.0)	6(12.5)	5(14.3)	1.000
Frequency of readmission n (%)				0.788
Nil	105(65.6)	62(65.3)	43(66.1)	
1	33(20.6)	21(22.1)	12(18.5)	
2	4(2.5)	2(2.1)	2(3.1)	
≥3	1(0.6)	1(1.1)	0	
All-cause mortality after 6 months	41(25.6)	28(29.5)	13(20.0)	0.223
Composite end-point n (%)	56(35.0)	43(45.3)	13(20.0)	0.001**
Cardiac death n (%)	4(2.5)	2(2.1)	2(3.1)	1.000
Cardiovascular events n (%)	1(0.6)	0	1(1.5)	0.406

***Significant p-value <0.05; Composite End-point-intrahospital Death; Post -Discharge Death and Re-admission.*

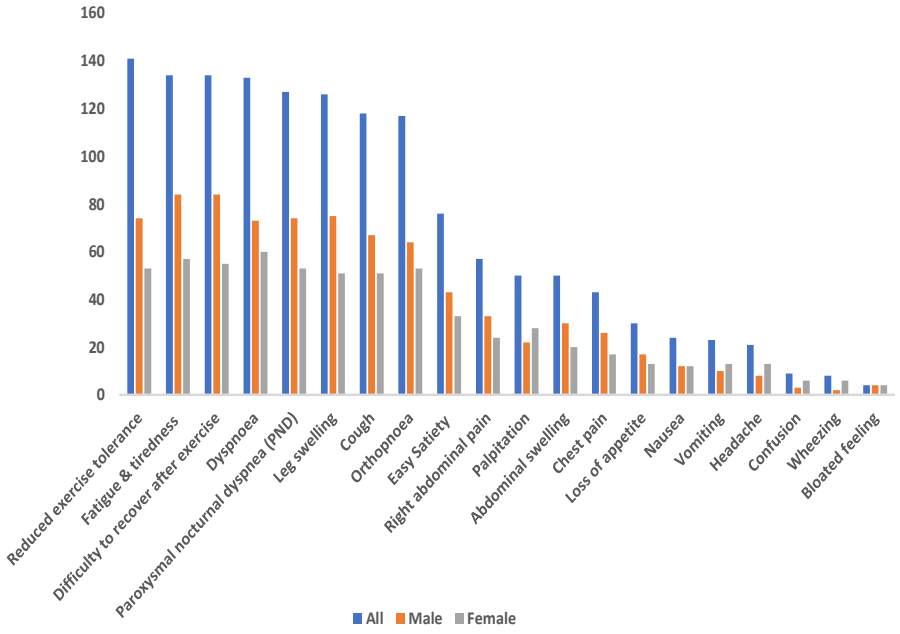

Fig. 2: Heart Failure Symptoms and Frequencies of Previous AHF Admissions among the 160 AHF Participants

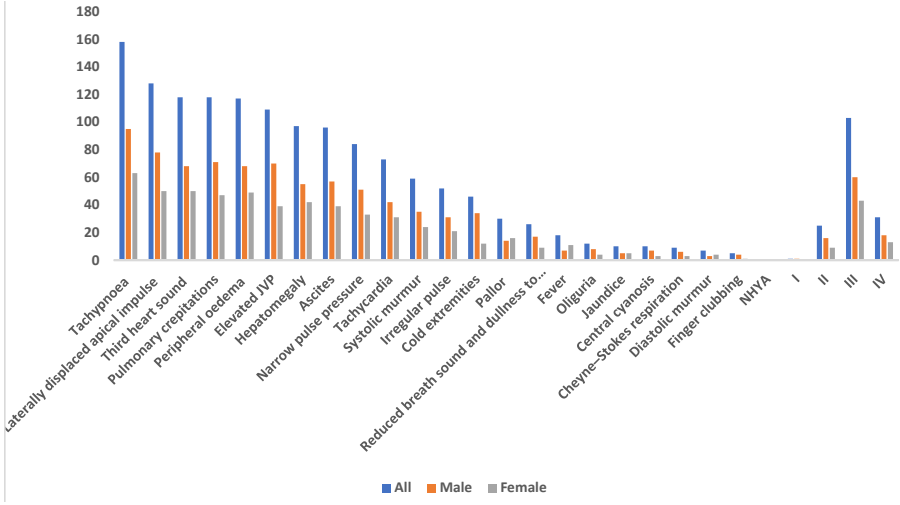

Fig. 3: Physical Signs and New York Heart Association (NYHA) Functional Class of the Participants.

expensive, and the constraint of availability may not be usual among this predominantly fee-paying AHF population.[55,56]

The key precipitants of AHF were infections, and arrhythmias, and poor medication adherence, while fluid overload, physical stress & emotional excesses played a minimal role. This pattern is similar to what was reported in the article reporting Abeokuta Heart Failure Clinical Registry data with infections and arrhythmias playing a leading role.[43] There was also very little difference across gender statistically. The higher role of poor medication adherence in this population might be attributable to out-of-pocket payment by majority of the participants for care during the study period, unlike low rate of medication non-adherence that was reported in high-income countries, with widespread health insurance scheme, 5.8% in ESC heart failure Long term Registry.[46] Similar figure to our study was gotten in Gulf AHFS registry(19%).[38,44]

Electrocardiographic and Echo-cardiographic Abnormalities in AHF Patients

Cardiac arrhythmias are common in HF.[57] Only 14.4% had atrial fibrillation which is similar to results from the AHF studies in Middle East countries and locally and higher than reported in THESUS–HF study (7.7%).[32,43,44] However, contrastingly, the rate of atrial fibrillation in this study and other local study figures are lower than figures from European and North American countries. The RO-AHFS registry recorded higher value of 44%,[54] ADHERE (31%),[34] and OPTIMIZED- HF(32%)[52] Although this study's figure is slightly higher than an Ethiopian study(27.5%) result, which is also an African population like this study.[58]

Electrocardiography left ventricular hypertrophy (LVH) was observed in one out of every three participants in this study. This is lower than (38.5%) Abeokuta AHF study but similar to results from Gulf AHF registry result of 30%, Oman AHF registry 25.7%.[36,54] The high proportion of LVH may be due to a high burden of hypertension in this study population, and this has implication on the metabolism of the heart and noted for a great implication on HF outcome.[59] This study however did not demonstrate it prognostic significance.

Heart failure with reduced ejection fraction was the most common with similar frequencies in both males and females. Study populations with similar age profile have similar <40% EF profile[44] except the Ethiopian study where EF <40% was 31.8%.[52,58] Those with HF with preserved EF were 40% in ADHERE, 54% in Euro-HF and 49% in OPTIMIZE HF studies.[52]

LV systolic dysfunction was found in more than three quarter (71.3%) of the subjects in this study, while both right and left ventricular dysfunction were noted in 30%. The mean EF was similar between de novo AHF and ADCHF. However, other studies have reported significant differences between these two AHF types.[44,45] This maybe attributable to racial and aetiological difference profiles.

About four out of five of the subjects had an echocardiographic

diagnosis of hypertensive heart disease (HHD) (81.9%) while ischaemic heart disease (IHD) was 3.1%. This reflected a previous finding of the predominant role of HHD among the Nigerian and African HF populations compared to IHD.[32,43,60] Compared to North American, European and Asian populations, IHD as an aetiology of HF generally, it is the least implicated.[52]

Duration of Intra-hospital Admission, Intrahospital and Six months' Outcome ofAHF

Death during hospital admission was 6.3% in this study compared to 5.7% in EHFS HF,7.1% in Indonesia ADHERE and 6.5% in GULF AHF Registry.[34,36,61] In contrast, the figure from this study is lower than from a tertiary hospital in Botswana(30.8%) which examined 193 subjects over 180 days too.[62] The higher figure from the Botswana study may be due to HIV positive patients who constitute 33.9% of the study sample. Similarly, this study's intrahospital mortality was lower than the IN-HF study, which reported 13%, an environment with a better health system development and universal health insurance notwithstanding.[50] The disparity can be explained by a large proportion of IHD in the study sample. It is similar to data from the Abeokuta AHF Registry of 4.2%.[19] Overall, this study excluded HIV positive population and had a low burden of IHD.

The median length of stay (LOS) of 11 days was in tandem with previous studies.[43,62] It is, however, higher than what is obtainable in high medium income countries. The median LOS in ADHERE was four days, Euro HF was eight days and OPTIMISED- HF was four days.[52] The availability of universal health insurance with in-built quality control mechanism may explain this disparity. Also, the influence of out-of-pocket payment may explain such finding in this study population.

More of the death during hospital admission for AHF in this study was after more than a week of admission, which suggests the disease's severity. Four out of five of the participants were in NYHA class of II/IV. This is in contrast to 6 months' post-discharge where more of the death was early post-discharge.

Among the total study sample, about one of five participants had readmission at least once during the six months follow up period. The re-admission was mainly due to acute decompensation and the proportion was lower compared to Euro HF and OPTIMIZED- HF, which can be partly explained by a lower mortality rate from these studies. Also, the availability of universal health insurance possibly eases readmission of AHF in those countries.

This study highlighted the composite endpoint among the study population, which was enormous (35.0%) with males more affected than females. This finding has a great implication on the burden of care of AHF in term of cost of care and adverse socioeconomic outcome. Reduced EF AHF's high burden is a possible explanation for the high burden of all composite events.[63] The burden is worse among males compared to females.

There is an urgent need for a cardiovascular prevention programme to address hypertension, which is mostly preventable but the most common aetiology of HF in this study, like many other studies via extensive awareness programme and intervention. There is a need for early detection and intervention in preventing and control of hypertension. Longer follow-up studies on outcome in this setting would need to be done to provide further insight into the patients' prognostic outcome. The role of other biomarkers, particularly cardiac biomarkers such as cystatin, natriuretic peptides and troponin, among others, would need to be ascertained considering the poor contribution of ECG and echocardiography to prognosis determination in AHF.

More studies would be needed in a primary and secondary care setting to determine the burden of AHF and the difference in predictors of outcome due to standard of care. This is because of the slight subnational differences and differences arising possibly from hospital types and practice type. Strategies should be developed to reduce the length of hospital stay, readmission and mortality among AHF, which is still high, particularly post-discharge.

There is a need to have more insight into the potential role of clinical profile in guiding management. Acute heart failure is a heterogeneous group, and there would be a need to study the various sub-groups further concerning burden and prognosis. Finally, effort should be made to reduce loss to follow up cases among AHF patients.

The study was limited by the following factors**.** First, this is a single tertiary centre study and therefore may not reflect findings in primary and secondary facilities in the same area. Even though the facility is a large tertiary centre in an urban area, it may not have adequately captured the patient's population in rural areas. This would impair the generalizability of the finding. Secondly, it is a survey and may have introduced bias in recruitment in the study. Thirdly, the study may be affected by unmeasured confounders which may be socioeconomic, patient preference, centre implementation of the standard of care, and even post-hospital care although in this study efforts were made to explore a broad group of socio-demographic, bio-humoral/laboratory, electrocardiographic, echocardiographic and therapeutic variables. Also, variables such as medical adherences were assessed without using validated tools. Finally, BNP testing was not included in the HF diagnosis and follow up.

CONCLUSION

This study provided the prospective real-world data of AHF from Ibadan. The insight from this report would help guide and improve HF management and its outcome in Nigeria and among the black population in general. Overall, the mortality burden reported is high but, similar to many other studies. Overall, the study provided an understanding of the factors contributing to HF admissions in a population in South-Western, Nigeria.

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Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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