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Contemporary Profile of Acute Heart Failure in Southern Nigeria

Data From the Abeokuta Heart Failure Clinical Registry

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Ibadan and Abeokua, Nigeria; Johannesburg and Cape Town, South Africa; and Melbourne, Australia

Objectives The aim of this study was to determine the contemporary profile, clinical characteristics, and intrahospital outcomes of acute heart failure (AHF) in an African urban community.

Background There are limited data on the current burden and characteristics of AHF in Nigerian Africans.

Methods Comprehensive and detailed clinical and sociodemographic data were prospectively collected from 452 consecutive patients presenting with AHF to the only tertiary hospital in Abeokuta, Nigeria (population about 1 million) over a 2-year period.

Results The mean age was 56.6 ± 15.3 years (57.3 ± 13.4 years for men, 55.7 ± 17.1 years for women), and 204 patients (45.1%) were women. Overall, 415 subjects (91.8%) presented with de novo AHF. The most common risk factor for heart failure was hypertension (pre-existing in 64.3% of patients). Type 2 diabetes mellitus was present in 41 patients (10.0%). Hypertensive heart failure was the most common etiological cause of heart failure, responsible for 78.5% of cases. Dilated cardiomyopathy (7.5%), cor pulmonale (4.4%), pericardial disease (3.3%), rheumatic heart disease (2.4%), and ischemic heart disease were less common (0.4%) causes. The majority of subjects (71.2%) presented with left ventricular dysfunction (mean left ventricular ejection fraction 43.9 ± 9.0%), with valvular dysfunction and abnormal left ventricular geometry frequently documented. The mean duration of hospital stay was 11.4 ± 9.1 days, and intrahospital mortality was 3.8%.

Conclusions Compared with those in high-income countries, patients presenting with AHF in Abeokuta, Nigeria, are relatively younger and still of working age. It is also more common in men and associated with severe symptoms because of late presentation. Intrahospital mortality is similar to that in other parts of the world. (J Am Coll Cardiol HF 2014;2:250–9) © 2014 by the American College of Cardiology Foundation

Although recognized as a significant health problem in high-income countries (1,2), the syndrome of heart failure (HF), in both its acute (2) and chronic (2) forms, has emerged as an issue of global public health importance. It has been established that the burden of HF doubles with each passing decade after the age of 40 years, especially in industrialized countries, because of an aging population and the increasing burden of risk factors, including hypertension, diabetes mellitus, ischemic heart disease, and more recently, obesity (3). HF is estimated to affect about 15 million people worldwide (0.2% of the world population). Although there are robust estimates to describe the incidence, prevalence, and overall burden of HF in Europe (4–6) and North America (7,8), there is a paucity of data describing these aspects in other major populations around the globe. For example, HF in Africa (including Nigeria)

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appears to occur at a relatively younger age, afflicting individuals in the prime of life, and is mostly of non-ischemic origin. However, there are limited systematically collected and contemporary data to describe clinical characteristics, outcomes, and costs of HF for the continent (9,10).

As an extension of this, there are limited data derived from systematically and prospectively conducted studies of HF in Nigeria, the most populous region in sub-Saharan Africa. Previous studies in the 1960s, 1970s, and 1980s were mainly retrospective, and the various diagnoses were not confirmed by echocardiography (11–13). Moreover, there are even fewer data to describe acute clinical presentations of HF to match the clinical registry data derived from large cohorts in Europe and North America (14).

Considering the paucity of data on acute HF (AHF) in sub-Saharan Africa, we used data from the Abeokuta Heart Failure Clinical Registry to explore and determine the current etiology and characteristics of acute (both de novo and recurrent) presentations of the syndrome in southern Nigeria. The possible role of epidemiologic and demographic transitions

Abbreviations and Acronyms

AHF = acute heart failure
ECG = electrocardiography
HF = heart failure
LV = left ventricular
NYHA = New York Heart Association

Table 1 Sociodemographic and Clinical Profile of Study Cohort

	All (n = 452)	Men (n = 248)	Women (n = 204)	p Value
Age, yrs	56.6 ± 15.3	57.3 ± 13.4	55.7 ± 17.1	0.265
Yoruba tribe	415 (91.8%)	225 (90.7%)	190 (93.1%)	0.450
Other tribes	37 (8.2%)	23 (9.3%)	14 (6.9%)	0.448
Married	363 (80.3%)	221 (89.1%)		<0.001
No education	147 (32.5%)	63 (25.4%)	84 (41.2%)	0.006
Unemployed	13 (5.2%)	25 (12.3%)	38 (8.4%)	0.002
Urban residence	388 (74.8%)	185 (74.6%)	153 (75.0%)	0.922
Current smokers	15 (3.3%)	14 (5.6%)	1 (0.5%)	0.006
Never consumed alcohol	286 (63.3%)	100 (40.3%)	186 (91.2%)	<0.001
Known hypertension	293 (64.3%)	174 (70.2%)	119 (58.3%)	0.010
Known diabetes mellitus	45 (10.0%)	20 (8.1%)	25 (12.3%)	0.157
Asthma	9 (2.0%)	3 (1.2%)	6 (2.9%)	0.311
COPD	16 (3.5%)	12 (4.8%)	4 (2.0%)	0.127
Arthritis	64 (14.2%)	10 (4.0%)	35 (17.2%)	0.105
Family history of heart disease	14 (3.1%)	8 (3.2%)	6 (2.9%)	0.862
NYHA functional class (n = 308)				0.502
II	79 (17.5%)	47 (19.0%)	32 (15.7%)	
III	284 (62.8%)	150 (60.5%)	134 (65.8%)	
IV	89 (19.7%)	51 (20.4%)	38 (18.6%)	
BMI, kg/m^2	23.9 ± 5.7	24.0 ± 5.1%	23.7 ± 6.4%	0.470
Obesity	41 (9.1%)	21 (10.7%)	20 (12.4%)	0.428
Temperature, °C (n = 299)	36.4 ± 0.8	36.4 ± 0.7	36.4 ± 0.80	0.801
Respiratory rate, breaths/min (n = 395)	27.8 ± 6.3	27.9 ± 6.3	27.7 ± 6.2	0.706
Pulse rate, beats/min (n = 418)	96.6 ± 18.3	96.9 ± 17.9	96.3 ± 18.7	0.765
SBP, mm Hg (n = 424)	137.5 ± 31.8	138.7 ± 32.2	136.2 ± 31.4	0.416
DBP, mm Hg (n = 424)	87.3 ± 20.3	88.5 ± 21.0	85.9 ± 19.4	0.186
PCV (n = 381)	37.6 ± 7.0	37.9 ± 7.0	37.2 ± 7.1	0.372
WCC (n = 377)	7.13 ± 3.73	7.0 ± 3.8	7.27 ± 3.68	0.519
Lymphocytes, % (n = 303)	35.8 ± 12.8	35.3 ± 12.4	36.4 ± 13.2	0.452
Serum sodium, mmol/dl	135.2 ± 10.0	134.9 ± 10.2	135.6 ± 9.8	0.640
Serum potassium, mmol/dl	3.61 ± 0.74	3.63 ± 0.76	3.58 ± 0.72	0.661
Total cholesterol, mg/dl	171.0 ± 70.5	164.1 ± 72.2	188.6 ± 64.8	0.228
Urea, mg/dl	44.0 ± 39.6	48.3 ± 44.4	38.8 ± 32.1	0.037
Creatinine, mg/dl	1.45 ± 2.15	1.67 ± 2.56	1.19 ± 1.46	0.857
Glucose, mg/dl	112.8 ± 53.3	112.2 ± 46.6	113.4 ± 61.0	0.028
Duration of hospital admission, days	11.4 ± 9.1	10.8 ± 0.78	6.48 ± 0.52	0.608
Anemia (n = 382)	40 (10.5%)	18 (8.8%)	22 (12.4%)	0.169
Renal dysfunction (n = 366)	174 (47.5%)	97 (48.0%)	77 (47.0%)	0.461
HIV positive (n = 222)	2.7%	3.5%	1.9%	0.474

Values are mean ± SD or n (%).
BMI = body mass index; COPD = chronic obstructive pulmonary disease; DBP = diastolic blood pressure; HIV = human immunodeficiency virus; NYHA = New York Heart Association; PCV = packed cell volume; SBP = systolic blood pressure; WCC = white blood cell count.

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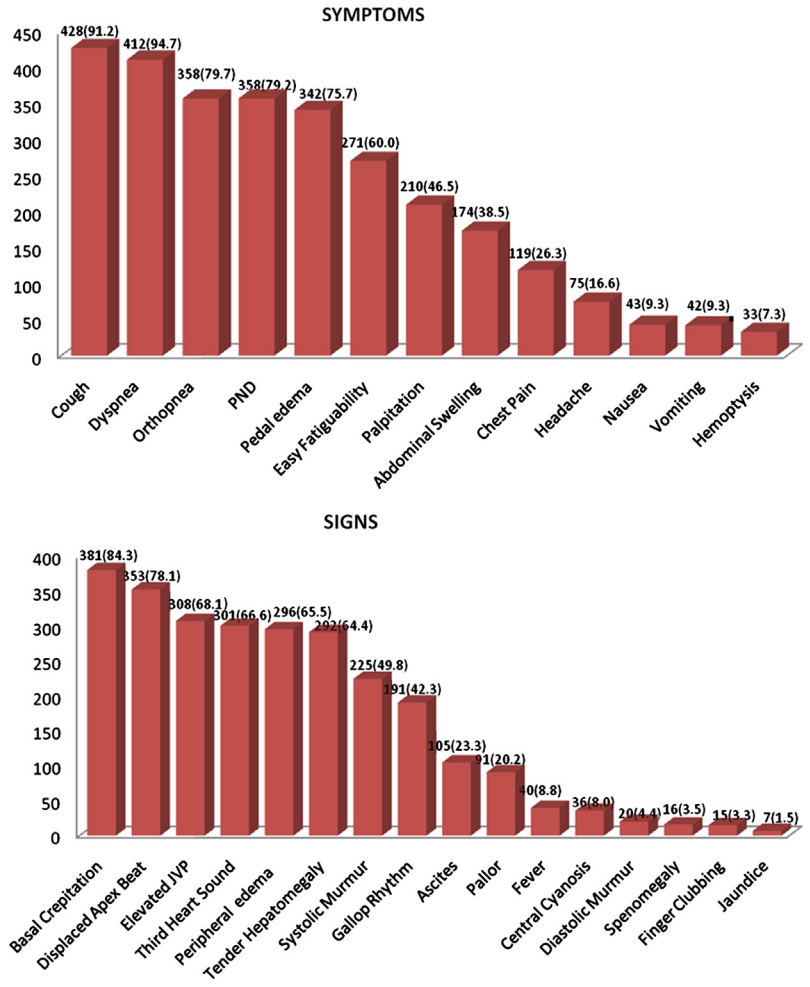

Figure 1 **Symptoms and Signs in the 452 Subjects With AHF**

AHF = acute heart failure; JVP = jugular venous pressure; PND = paroxysmal nocturnal dyspnea.

occurring in Nigeria in the profile of HF in the country was also assessed (15).

Methods

Design and setting. This was a prospective, observational study conducted at the Federal Medical Centre, Idi-Aba, and Abeokuta, Nigeria. Abeokuta is the capital city of Ogun State, 1 of the 36 states that make up the Federal Republic of Nigeria. The Federal Medical Centre was established in 1993 by the federal government of Nigeria to cater to the health needs of the people of Ogun State and its environs in southwestern Nigeria. The center is the only tertiary hospital in the city, receiving referrals from all health facilities in the city, state, and neighboring states. The state has a population of about 3.2 million and a land area of about 16,409.26 km^2. The city itself has an estimated population of about 1 million inhabitants (16) The prevalence of human immunodeficiency virus antibodies in patients attending the hospital clinics in 2010 was 11.6% (16% in women and 7.3% in men) (17).

Health care costs in Abeokuta (and in fact in all parts of the country) are generally borne by patients through out-of-pocket payments. Health insurance in the country is still at a rudimentary stage. Only a very small segment of the population has access to this. However, strong family ties exist in the country whereby poor patients are assisted by their wealthy or well-to-do family members. This is in fact a considerable challenge to health care delivery in the city and the country in general.

A cardiologist (O.S.O.) covers the cardiac unit, assisted by postgraduate resident doctors and experienced nurses. Facilities for cardiac evaluation at the center include chest radiography, 12-lead electrocardiography (ECG), exercise ECG, Holter ECG, ambulatory blood pressure monitoring,

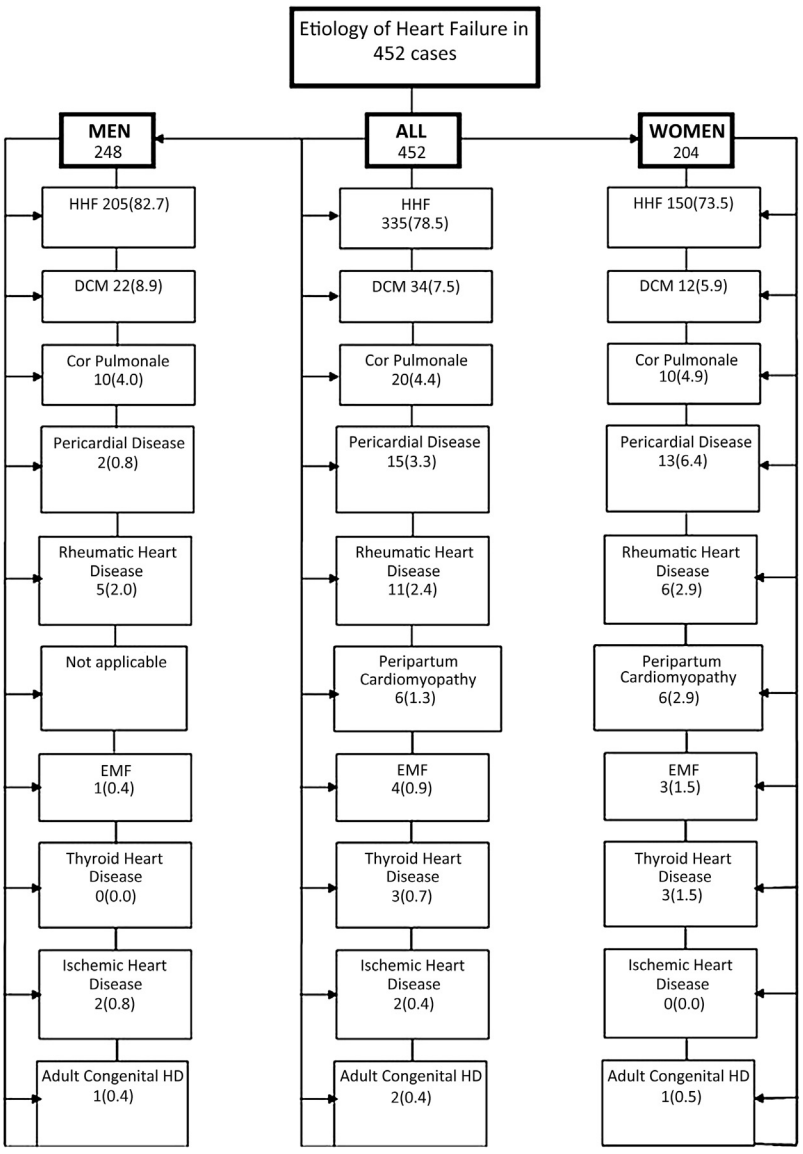

Figure 2 **Etiology of HF in the 452 Subjects**

DCM = dilated cardiomyopathy; EMF = endomyocardial fibrosis; HD = heart disease; HF = heart failure; HHF = hypertensive heart failure.

spirometry, and echocardiography. All electrocardiographic and echocardiographic examinations were carried out within 72 h of admission, as prescribed by the study protocol.

Study population. All cases of AHF, both de novo presentations and recurrent decompensation with pre-established diagnoses of HF, were consecutively recruited (with no refusals) into the registry between January 1, 2009, and December 2010. All subjects provided written and/or informed consent to participate in the study. Ethical approval was obtained from the ethics committee or ethics review board of the Federal Medical Centre. The study was carried out in accordance with international ethical principles (18).

Enrollment and data collection. Data from each subject were obtained using a uniform and standardized case report form. Detailed clinical documentation of newly diagnosed or newly presenting cases or pre-existing cases of HF was carried out. The following data were obtained: study identification number, demographic data, date of diagnosis of HF, and preadmission history (previous HF-related admissions). Others include New York Heart Association (NYHA) functional class, symptoms, signs, self-reported cardiovascular risk factors, etiology of HF, precipitating factors, comorbidities, blood investigations, 12-lead ECG, echocardiography, medications, and intra-hospital mortality.

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Table 2 Echocardiographic Variables of the Cohort in Men and Women

	All (n = 452)	Men (n = 248)	Women (n = 204)	p Value
Aortic root, cm	3.04 ± 0.50	3.22 ± 0.51	2.81 ± 0.39	<0.001
Left atrium, cm	4.80 ± 0.66	5.00 ± 1.43	4.54 ± 1.05	0.157
IVSTd	1.32 ± 0.37	1.38 ± 0.40	1.25 ± 0.36	0.001
PWTd, cm	1.17 ± 0.35	1.20 ± 0.36	1.12 ± 0.33	0.031
LVIDd, cm	5.48 ± 1.43	5.79 ± 1.44	5.11 ± 1.33	<0.001
LVIDs, cm	4.51 ± 1.40	4.82 ± 1.42	4.14 ± 1.29	<0.001
FS, cm	18.5 ± 9.0	17.6 ± 8.74	19.5 ± 9.12	0.039
EF, %	43.9 ± 9.0	42.1 ± 16.8	45.9 ± 17.1	0.037
LVM, %	320.7 ± 132.8	360.0 ± 141.8	272.4 ± 102.4	<0.001
LVMI, g	86.2 ± 37.0	92.8 ± 40.9	77.9 ± 26.6	<0.001
RWT, g/m$^{2.7}$	0.44 ± 0.15	0.43 ± 0.15	0.46 ± 0.15	0.189
E wave, m/s	0.82 ± 0.29	0.79 ± 0.28	0.86 ± 0.31	0.031
A wave, m/s	0.52 ± 0.15	0.49 ± 0.22	0.56 ± 0.28	0.017
E/A ratio	2.04 ± 0.40	2.10 ± 1.48	1.97 ± 1.28	0.460
IVRT, ms	145.0 ± 59.7	117.1 ± 35.9	110.6 ± 32.8	0.174
DT, ms	114.4 ± 34.7	142.6 ± 56.0	148.3 ± 64.4	0.397
LV geometry				
CH	38.3%	39.6%	36.8%	0.069
EH	45.4%	47.6%	42.8%	0.069
MR	77.9%	75.5%	80.7%	0.256
TR	69.7%	65.5%	74.7%	0.068
AR	8.2%	8.5%	7.8%	0.851
Systolic HF	66.4%	71.2%	60.6%	0.028
Spontaneous echocardiograms	6.8%	8.5%	4.8%	0.212
Intramural thrombi	0.8%	1.0%	0.6%	0.670

Values are mean ± SD or %.

A = left ventricular late filling velocity; AR = aortic regurgitation; CH = concentric hypertrophy; DT = deceleration time of E velocity; E = left ventricular early filling velocity; EH = eccentric hypertrophy; EF = ejection fraction; FS = fractional shortening; IVRT = isovolumic relaxation time; 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; MR = mitral regurgitation; PWTd = left ventricular posterior wall thickness in diastole; RWT = relative wall thickness; TR = tricuspid regurgitation.

Clinical evaluation. Blood pressure measurements were obtained according to standard guidelines using a mercury sphygmomanometer (Accuson, Siemens UK, London, United Kingdom). Body mass index was calculated as weight in kilograms divided by the square of height in meters. Values of 25.0 to 29.9 kg/m^2 and 30.0 kg/m^2 defined overweight and obesity, respectively. Anemia was defined as hemoglobin <10 g/dl. Glomerular filtration rate was estimated using the 4-variable Modification of Diet in Renal Disease formula (19). Renal dysfunction was defined as an estimated glomerular filtration rate <60 ml/min/1.73 m^2 (the same criteria used by Stewart et al. [20]).

Diagnosis of HF. A standardized diagnosis of HF was made using the Framingham criteria (21) as well as the guidelines of the European Society of Cardiology on the diagnosis and treatment of AHF (22) (Online Table 1). As such, both de novo presentation of AHF and recurrent presentation of typically decompensated HF (i.e., acute-on-chronic HF) were included in the registry.

ECG. A standard 12-lead resting electrocardiogram was recorded for each subject using a Schiller electrocardiograph (Schiller AG, Baar, Switzerland). All 12-lead resting electrocardiographic studies were performed by trained nurses or technicians and analyzed by a reviewer who was blinded to the clinical data of the patients. The Minnesota code classification (23) system was used in sorting out the various abnormalities. Electrocardiographic abnormalities were diagnosed on the basis of standard criteria (24).

Echocardiography. An Aloka SSD-4000 echocardiograph (Aloka Co. Ltd., Tokyo, Japan) was used to assess all patients. Two-dimensionally guided M-mode measurements were made according to the recommendations of the American Society of Echocardiography (25). Left ventricular (LV) internal dimension, posterior wall thickness, and interventricular septal thickness were measured at end-diastole and end-systole. When optimal M-mode imaging could not be obtained, 2-dimensional linear measurements were obtained according to American Society of Echocardiography criteria (25). Left atrial end-systolic diameter was obtained from the trailing edge of the posterior aortic–anterior left atrial complex. Measurements were obtained in up to 3 cardiac cycles according to American Society of Echocardiography convention (25). One experienced cardiologist (O.S.O.) performed all echocardiographic studies. The intraobserver concordance correlation

coefficient and measurement error for our laboratory have been reported (26). LV mass was calculated using the formula of Devereux and Reichek (27) LV geometry was defined according to standard criteria (28).

Left atrial dimension and area were measured using standard methods (29,30).

Transmitral flow velocities were obtained with the Doppler sample volume placed just beyond the tip of mitral valve leaflets, and standard measurements were obtained (31). Tissue Doppler imaging was applied only to identify true pseudonormal filling pattern.

Statistical analysis. Data were entered into EpiData software (EpiData Association, Odense, Denmark) by experienced personnel and analyzed using SPSS version 11.0 (SPSS, Inc., Chicago, Illinois). Descriptive statistical analysis for baseline data was performed on continuous variables using means, standard deviations, ranges, and medians as appropriate. Categorical variables are expressed as percentages. McNemar and chi-square tests (for categorical variables) and Student *t* tests or analysis of variance (for continuous variables) were used for comparisons as appropriate. Two-sided p values <0.05 were considered significant.

Results

Cohort profile. Table 1 summarizes the demographic information, history, and risk profile of the study cohort. A total of 452 subjects were recruited into the registry. This constituted 9.4% of the total number of medical admissions during the period. There were 248 men (54.9%) and 204 women (45.1%). The mean age of the cohort was 56.4 ± 15.2 years. The majority of subjects were >45 years of age and married, whereas 67.5% had at least a primary school education. More than two-thirds also lived in urban communities. Few subjects (3.3%) were current cigarette smokers, and smoking was more commonly reported in men than in women (5.6% and 0.5%, respectively), with a similarly low level reporting positive family histories of heart disease. More than one-half the cohort was being actively treated for hypertension. The overall prevalence of diabetes mellitus was 10.0%. Of note, 415 subjects (91.8%) had de novo presentation of AHF. About 90% of the subjects were in NYHA functional class II or III 1 month before evaluation, 27% were either overweight or obese, 21.7% had moderate to severe renal dysfunction (estimated glomerular filtration rate <60 ml/min/1.73 m^2), and 10.5% were anemic. Presenting symptoms and signs are summarized in Figure 1.

Precipitating factors for acute HF. The common precipitating factors for HF in the cohort included infections, especially chest infection (n = 284 [62.8%]); uncontrolled hypertension (n = 200 [44.2%]); and arrhythmias, especially atrial fibrillation (n = 123 [27.3%]). Less common precipitants included anemia (n = 33 [7.3%]), excessive physical activity (n = 25 [5.5%]), and electrolyte imbalance (e.g., hyponatremia, hypokalemia; n = 10 [2.2%]). Of note, there was only 1 case of acute myocardial infarction (0.2%).

12-lead ECG. A majority of subjects presented with abnormal results on 12-lead ECG. Axis deviations (most commonly left axis deviation) were determined in 76.1% of patients. Atrial enlargement or abnormalities were recorded in 69.7% of electrocardiograms. ECG-defined LV hypertrophy was observed in 82.8% of patients, of whom 38.5% had electrocardiographic LV hypertrophy with strain pattern, 13.1% had right ventricular hypertrophy, and 28.7% had arrhythmias; atrial fibrillation was also present in 52 subjects (11.5%).

Echocardiography and etiology of HF. Figure 2 shows the etiological risk factors for HF in the cohort. Hypertensive heart disease, dilated cardiomyopathy, cor pulmonale (right heart disease), pericardial disease, and rheumatic heart disease were the common risk factors for HF in the cohort, constituting 78.5%, 7.5%, 4.4%, 3.3%, and 2.4% of cases, respectively. Pericardial diseases and right HF were more common in women, whereas hypertensive HF and dilated cardiomyopathy were more common in men. Other causes of HF in the cohort included peripartum cardiomyopathy (1.3%), endomyocardial fibrosis (0.9%), thyroid heart disease (0.7%), ischemic heart disease (0.4%), and adult congenital heart disease (0.4%). The echocardiographic features of the subjects according to sex are shown in Table 2. Aortic root diameter, LV septal wall thickness in diastole, posterior wall thickness, indexes of LV systolic function, and LV mass were significantly higher in men than in women. Men also had a significantly higher frequency of systolic HF than women (71.2% vs. 60.6%, p = 0.028). Online Table 2 shows the echocardiographic characteristics of the cohort according to the etiological risk factors for HF.

LV wall thickness was higher in the hypertensive HF group, whereas LV dilation was found to be greatest in the dilated cardiomyopathy group, which also had the highest frequency of LV systolic dysfunction.

In terms of LV geometry, 93.5% of the cohort had abnormal LV geometry (concentric remodeling in 9.7%, concentric hypertrophy in 38.3%, and eccentric hypertrophy in 45.4%).

Intrahospital medications. On admission, 431 (95.4%), 419 (92.7%), 383 (84.7%), and 338 (74.7%) patients were placed on diuretic agents, angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, and digitalis, respectively. Calcium-channel blockers, centrally acting antihypertensive agents beta-blockers, anticoagulant agents (heparin), and hypoglycemic agents were prescribed for 78 (17.3%), 54 (12.0%), 42 (9.4%), 292 (64.7%), and 30 (6.7%) subjects, respectively.

At discharge, 448 patients (99.1%) were prescribed angiotensin-converting enzyme inhibitors, 398 (88.1%) loop diuretic agents, 327 (72.3%) digoxin, 121 (26.8%) long-acting calcium-channel blockers, 65 (14.4%) combined hydralazine and isosorbide dinitrate, and 41 (9.1%) beta-blockers. Ancillary medications used during the

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Table 3 Comparison of the Present Study With Other HF Studies in Sub-Saharan Africa and Other Parts of the World

Study/First Author (Ref. #), Country	n	Women (%)	Mean Age (yrs)	Smoking (%)	Hypertension (%)	Diabetes (%)	Obesity (%)	Cholesterol (mg/dl)
Present study, Nigeria	452	45.1	56.6	3.3	64.3	10.0	10.7	164.1
Stewart et al. (20), South Africa	844	57.0	55.0	48.0	55.0	10.0	34.0	162.4
THESUS-HF (40)	1,006	50.7	52.0	9.8	55.5	11.1	16.3	157.6
Laabes et al. (36), Nigeria	102	68.6	44.8	5.9	44.1	6.9	25.5	NR
Ojji et al. (35), Nigeria	315	49.1	50.6	NR	NR	NR	NR	NR
Oyoo and Ogola (33), Kenya	91	51.6		NR	NR	NR	NR	NR
Kingue et al. (41), Cameroon	167	40.7	57.0	NR	NR	NR	NR	NR
Soliman and Juma (48), Malawi	3,908	39.9	58.9	NR	NR	NR	NR	NR
Habte et al. (49), Ethiopia	781	47.6	43.5	NR	NR	NR	NR	NR
Amoah and Kallen (50), Ghana	572	NR	42.0	NR	NR	NR	NR	NR
Onwuchekwa and Asekomeh (37), Nigeria	423	42.8	54.0	NR	NR	NR	NR	NR
Kuule et al. (34), Uganda	157	66.2	45.0	NR	NR	NR	NR	NR
Ogah et al. (51), Nigeria	1,441	48.4	54.0	NR	NR	NR	NR	NR
Tantchou et al. (42), Cameroon	462	42.9	42.5	NR	NR	NR	NR	NR
Karaye and Sani (38), Nigeria	79	44.3	46.9	NR	NR	NR	NR	NR
EHFS II (44)	3,580	38.7	69.9	NR	62.5	32.8	NR	NR
ADHERE (7), United States	105,388	52.0	72.4	NR	73	44.0	NR	NR
OPTIMIZE-HF (52), United States	48,612	52.0	73.0	NR	NR	NR	NR	NR
ADHERE (53), Indonesia	1,687	64.5	60.0	74.0	54.8	31.2	NR	NR
JCARE-CARD (45), Japan	2,675	40.3	71.0	37.7	52.9	29.9	NR	24.8

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course of admission were aspirin in 197 (43.6%), centrally acting antihypertensive agents in 79 (17.5%), hypoglycemic agents in 49 (10.8%), thiazide diuretic agents in 32 (7.1%), and amiodarone in 10 (2.2%).

Intrahospital outcomes. Seventeen subjects died during the course of admission. Causes of death were pump failure (n = 7), sudden death possibly due to arrhythmia (n = 5), pulmonary embolism (n = 3), and stroke (n = 2). All intrahospital deaths occurred in patients with de novo HF, mostly in women. Those who died were younger (mean age 48.2 vs. 56.8 years, p = 0.025). The majority (n = 9) had either hypertension (52.9%) or dilated cardiomyopathy (29.4%) and were more likely to present with systolic dysfunction (n = 5) and/or in NYHA functional class III or IV (n = 15).

The mean overall length of hospital stay was 10.8 ± 6.1 days (range 2 to 61 days; median 9 days).

International comparisons. Table 3 shows a comparison of our findings with those of other workers in sub-Saharan Africa and other parts of the world.

Discussion

This is the first detailed, comprehensive, and prospective study of AHF in Abeokuta and in southern Nigeria. Our data show that acute presentation of HF (predominantly de novo) constitutes just fewer than 10% of all medical admissions in the city. In general, cardiologic conditions are responsible for just under 1 in 5 emergency medical admissions in Abeokuta, second only to infections and infestations, which account for almost 1 in 2 cases (32). These data suggest that AHF in Abeokuta predominantly afflicts young and middle-age individuals in the prime of life, most of whom present with de novo AHF. Clinically late presentation is common, with more than 80% presenting in NYHA functional class III or IV. More than two-thirds of our cohort had systolic HF, with hypertensive heart disease the most common risk factor for HF overall (almost 4 in 5 cases). Alternatively, ischemic heart disease is relatively uncommon. Infections and uncontrolled hypertension are the most common precipitating factors, with comorbidities and secondary valvular dysfunction also common. We also noted low use of disease-modifying drugs such as beta-blockers and combined hydralazine and isosorbide. The intrahospital mortality rate was relatively low at just under 4%.

Contrary to the situation in advanced countries of Europe and North America, and in Japan, where HF is essentially a problem of the elderly (with a mean age at presentation of 72 years), ours was a relatively young cohort. Our finding of a lower rate of HF in women is consistent with many previous reports. Alternatively, there have been reports (notably from South Africa and the East African countries of Kenya and Uganda) of more women than men presenting with HF (20,33,34). Other aspects of this cohort (including precipitating factors, a predominance of de novo cases, and late, severe presentations) are similar to equivalent African reports. The etiological pattern in our cohort is also consistent with findings in other parts of Nigeria, where hypertensive HF contributes to 52.7% to 62.6% of cases of HF (35–38).

In a recent systematic review, we showed that the pooled prevalence of hypertension increased from 8.6% (confidence interval: 13.7% to 16.3%) in the only study during the period

Table 3 Continued

Anemia (%)	CKD (%)	NYHA Class (III and IV) (%)	Mean EF (%)	HHF (%)	DCM (%)	VHDX (%)	RHF (%)	IHD (%)	LOS (days)	Mortality (%)
8.8	48.0	82.5	42.0	78.5	7.5	2.4	4.4	0.4	11.0	3.8
10.0	25.0	34.0	45	33.3	35.3	7.9	14.3	7.9	NR	NR
15.2	7.7	34.6	39.5	45.4	18.8	14.3	NR	7.7	7.0	4.2
NR	NR	93.1	NR	44.1	21.6	22.5	NR	1.0	NR	NR
NR	NR	NR	NR	62.6	13.8	7.4	1.8	NR	NR	NR
NR	NR	37.4	NR	13.2	25.2	32.0	NR	2.2	NR	NR
NR	NR	NR	NR	54.5	26.3	24.6	NR	2.4	NR	NR
NR	NR	NR	NR	24.0	19.0	34.0	NR	0.08	NR	NR
NR	NR	NR	NR	24.2	20.2	32.8	3.8	12.0	NR	NR
NR	NR	NR	NR	21.3	16.6	20.1	NR	10.0	NR	NR
NR	NR	NR	NR	56.3	12.3	4.3	2.1	0.2	NR	NR
64.3	NR	96.8	NR	25.1	27.3	28.2	NR	1.9	NR	NR
NR	NR	NR	NR	56.7	3.0	3.7	1.6	0.6	NR	NR
NR	NR	51.0	NR	15.0	32.0	35.0	8.0	NR	13.0	9.2
NR	NR	NR	NR	57.0	24.0	12.7	2.5	7.6	NR	NR
14.7	16.8	NR	38.0	11.4	19.3		3.2	53.6	9.0	6.7
NR	30.0	76.0	34.4						4.3	4.0
NR	NR	NR	39.0							3.8
NR	NR	NR	37.9	54.8	NR	NR	NR	23.3	7.1	6.7
20.8	11.7	87.5	42.2	24.6	21.9	15.7	NR	32.0	NR	NR

ADHERE = Acute Decompensated Heart Failure National Registry; CKD = chronic kidney disease; DCM = dilated cardiomyopathy; EHFS II = EuroHeart Failure Survey II; EF = ejection fraction; HHF = hypertensive heart failure; HF = heart failure; IHD = ischemic heart disease; JCARE-CARD = Japanese Cardiac Registry of Heart Failure in Cardiology; LOS = length of stay in hospital; NR = not reported; NYHA = New York Heart Association; OPTIMIZE-HF = Organized Program to Initiate Lifesaving Treatment in Hospitalized Patients With Heart Failure; RHF = right heart failure; THESUS-HF = Sub-Saharan Africa Survey of Heart Failure; VHDX = valvular heart disease.

from 1970 to 1979 to 22.5% (confidence interval: 21.8% to 23.2%) from 2000 to 2011. Awareness, treatment, and control of hypertension were generally low (14.2% to 30%, 18.6% to 21%, and 9%, respectively), with an attendant high burden of hypertension-related complications (39).

Hypertension is also the predominant etiological factor for HF in adjacent Cameroon (40). Alternatively, in East Africa (Kenya, Uganda) as well as the horn of Africa (34), cardiomyopathy is more common.

Generally, two-thirds of patients with HF have systolic dysfunction. This is in keeping with the findings of our study and other workers (Table 3). Consistent with the findings of the EuroHeart Failure Survey II and the Heart of Soweto Study, valvular dysfunction was also common. The use of angiotensin-converting enzyme inhibitors and spironolactone is quite comparable with findings in advanced countries. However, this was not the case with beta-blockers and combined hydralazine and isosorbide. This observation presents an opportunity for improvement in the care of patients with HF in Abeokuta in particular and Nigeria in general. Previously reported intrahospital mortality rates from sub-Saharan Africa are generally higher than in our cohort; ranging from 4.3% to 9.2% (33,40–42) compared with 3.8% to 6.7% (7,43–45) in high-income countries. The mean length of hospital stay (11 days) was longer than that reported in the Sub-Saharan Africa Survey of Heart Failure (7 days) (40) but shorter than a cohort from Cameroon (13 days) (42). These are all longer than is the lengths of stay reported in high-income countries (4 to 7 days) (7).

The younger age at presentation of patients with HF in our cohort and in many parts of Africa may be related to the etiology of HF. Rheumatic heart disease and cardiomyopathies are essentially problems of youth and middle age. Also, hypertension is known to occur early in Africans and African Americans, with greater adverse consequences. The sex differences reported from different regions of sub-Saharan Africa may be related to patient selection, sex differences in the burden of cardiovascular risk factors, and regional variations. In areas with a predominance of rheumatic heart disease and cardiomyopathy (especially peripartum cardiomyopathy), HF rates tend to be higher in women than in men. Health care–seeking behaviors may also play an important role. It is more likely that the breadwinner is taken to the hospital in Africa, especially where there is no health insurance coverage for the entire family. Some of the possible reasons for underuse of standard medications for HF in our cohort may include poor awareness of these therapies for HF in the city, high costs, and the late presentation and severity of HF in our subjects. Many physicians are still not comfortable commencing beta-blockers or combined hydralazine and isosorbide in severely ill patients with HF, and this presents an opportunity for improved management and outcomes in Abeokuta and wider Nigeria. In the EuroHF Registry, "the best survival was seen in hypertensive HF, as almost all the patients were discharged alive" (7). The fact that patients with hypertension represented the bulk of our cohort may explain, therefore, the lower intrahospital

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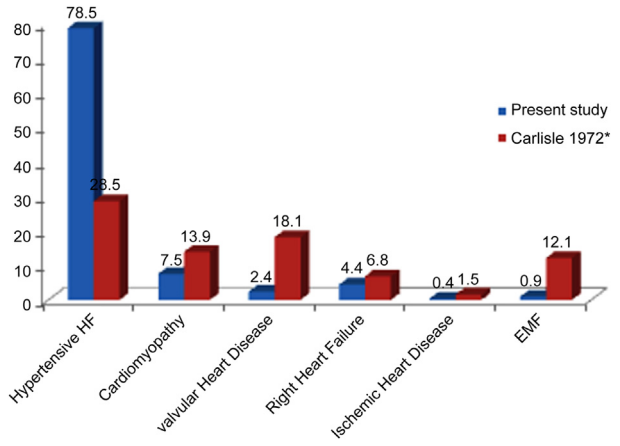

Figure 3 **Comparison of Etiology of HF in the Present Study With a Similar Study in Southern Nigeria From the 1970s**

*Carlisle R, Ogunlesi TO. Prospective study of adult cases presenting at the Cardiac Unit, University College Hospital, Ibadan 1968 and 1969. Afr J Med Sci 1972;3:13–25. EMF = endomyocardial fibrosis; HF = heart failure.

mortality rate. Our data also afford us the opportunity to compare our findings with those of a similar study in the region of the country reported 41 years ago. It does appear that hypertension now plays an increasingly predominant role in driving heart disease in southern Nigeria. Rheumatic heart disease appears to be less prominent. Endomyocardial fibrosis is almost disappearing from the scene, whereas pulmonary heart disease is emerging as a prominent risk factor (Fig. 3).

Study limitations. This was a cross-sectional study, with all the inherent limitations of this method. Because this was a tertiary cohort, those with milder forms of HF were likely to have been underrepresented. To overcome this likelihood, all local health facilities were contacted before study commencement requesting referral of all HF cases to our clinic (the only center with cardiologic services, including echocardiography). Cases of ischemic heart disease may also have been underrepresented because of an increased likelihood of sudden out-of-hospital death and the lack of coronary angiography (all documented cases were investigated with coronary angiography elsewhere). We also did not collect data on the duration of hypertension before the onset of HF. Finally, we did not assess for nutritional deficiencies and malnutrition as possible factors for the earlier development of HF in this population, although in a related study in the country, Olubodun (46) reported that patients with HF were more likely to be thiamine deficient, hypoalbuminemic, and anemic.

Conclusions

These data suggest that AHF in Abeokuta, Nigeria, predominantly affects younger individuals of working age. Overall, HF is more common in men and is associated with severe symptoms because of late presentation. Severe LV systolic dysfunction and abnormal LV remodeling pattern are also common. Intrahospital mortality was similar to findings in many parts of the world. Hypertension has become the most common (and indeed preventable) antecedent in the region. Because hypertension has been projected to rise by 89% in countries of sub-Saharan Africa (47), especially Nigeria, which is the most populous country in the region (compared with a projected 24% increase in high-income countries) between 2000 and 2025, efforts should be made in the area of primordial and primary prevention as well as health promotion to combat this emerging epidemic.

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Key Words: acute heart failure ▪ clinical registry ▪ health outcomes ▪ Nigeria.

APPENDIX

For supplemental tables, please see the online version of this article.