Predictors of Rehospitalization in Patients Admitted With Heart Failure in Abeokuta, Nigeria: Data From the Abeokuta Heart Failure Registry

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ABSTRACT

Objective: We sought, for the first time, to examine the rate and predictors of hospital readmission in patients discharged after an episode of heart failure (HF) in Nigeria.

Methods: This was a hospital-based, prospective, observational study that used the data from the Abeokuta HF Registry.

Results: Overall, 1.53% (95% confidence interval [CI] 0.58−4.02) and 12.2% (95% CI 8.88−16.8) of patients were re-hospitalized at least once within 30 days and 6 months, respectively (5.3% had multiple readmissions); the latter comprised 21/138 men (15.2%) and 11/124 (8.9%) women. A total of 11 (4.2%) died (all of whom had been rehospitalized). Worsening HF (24 cases, 75%) was the commonest reason for readmission. Among others, factors associated with rehospitalization included presence of mitral regurgitation (odds ratio [OR] 2.37, 95% CI 1.26−4.46), age ≥60 years (OR 2.04, 95% CI 0.96−3.29), presence of tricuspid regurgitation (OR 1.77, 95% CI 0.86−3.61), and presence of atrial fibrillation (OR 1.34, 95% CI 0.59−3.03). However, on an adjusted basis, only female sex (adjusted OR 0.33, 95% CI 0.14−0.79; $P = .014$ vs male) and body mass index <19 kg/m^2 (adjusted OR 3.74, 95% CI 1.15−12.16; $P = .028$ vs ≥ 19 kg/m^2) were independent correlates of readmission during 6 months' follow-up.

Conclusions: HF rehospitalization within 6 months' follow-up occurred in ∼12% of our cohort living an environment where HF etiology is predominately nonischemic and the HF population is relatively younger. Higher rates of readmission were noted in those with older age, lower body mass index, low literacy, lower serum sodium level, and presence of atrial fibrillation, renal dysfunction, and valvular dysfunction. (*J Cardiac Fail 2014;20:833−840*)

Key Words: Heart failure, rehospitalization, survival, outcome, predictors, Nigeria.

Heart failure (HF) affects >23 million people worldwide.[1] In the United States alone, ∼5.8 million people are affected and up to 2.4 million hospital admissions can be attributed to HF as primary or secondary diagnoses.[2] In Europe, >60% of the economic cost of HF is related to hospital admissions.[3] This is because HF is associated with high rates of recurrent hospitalizations and frequent clinic visits. HF in Nigeria and in most parts of sub-

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Saharan Africa commonly afflicts people in the prime of their lives, mostly of nonischemic origin, especially hypertensive heart disease and patients often present late with severe symptoms.[4–9]

Data from developed countries show that one-half of HF patients are rehospitalized within 6 months of discharge[10] and that 70% of these are due to worsening of previously diagnosed HF.[11] In a recent report, Jencks et al[12] showed that HF is the number 1 reason for readmission in the USA. Predictably, HF readmission is associated with higher mortality compared with the index admission. Whether similar patterns of readmission occur in patients affected by HF in sub-Saharan Africa and specifically West Africa is unknown.

We have previously reconfirmed via the Abeokuta HF Registry[4] that the risk factors and etiology of HF are not entirely the same in sub-Saharan Africa compared with other parts of the world.[5] The aim of the present study was for the first time, therefore, to identify predictors of rehospitalization in a Nigerian HF population with the use of the data from the Abeokuta HF Registry.

Methods

Study Design and Clinical Setting

As described previously,[4] this was a hospital-based, prospective, observational study in which all patients with clinical diagnosis of HF were recruited from January 1, 2009, to December 31, 2010. Patients were enrolled if they met the Framingham[13] as well as the European Society of Cardiology[14] criteria for the diagnoses of HF. The study was primarily conducted at the Federal Medical Centre (FMC), Abeokuta. The institution is the only tertiary health facility in the city.

Abeokuta is the capital city of Ogun state in southwestern Nigeria (1 of the 36 states that make up the Federal Republic of Nigeria). The entire state has an estimated population of 3.2 inhabitants based on the 2006 national population census, out of which a million are living in Abeokuta.[15]

As in other parts of the country, the state operates 3 tiers or levels of health care: primary (health posts, health centers), secondary (cottage, general, or state hospitals), and tertiary (federal medical centers and university teaching hospitals). Primary health care is constitutionally under the jurisdiction of the local government. The remaining 2 are under the state and federal governments, respectively. A significant proportion of health care delivery is carried out by private health institutions and mission hospitals.

The costs of health care in the city and in most parts of the country are generally borne by the patients through out-of-pocket expenses. Social health insurance coverage is low in the city and in most parts of the country. On the other hand, strong family bonding exists in the city, where more affluent individuals assist their poorer family members.

Referrals were received from private as well as public primary and secondary health care facilities within the city of Abeokuta who were informed of the existence and importance of the registry. Patients aged ≥18 years were enrolled, each of them gave written informed consent, and the institution's Ethics Review Board approved the study. The study was carried out according to international laid-out guidelines as enshrined in the Declaration of Helsinki.[16]

Clinical Evaluation

A standard case report form was used in data collection. Baseline clinical and demographic variables, such as age, sex, contact addresses, telephone numbers of patients and their relations, marital status, occupation, educational background, and history of cardiovascular risk factors, such as hypertension, family history, cigarette smoking, etc, were collected. Also collected were the signs and symptoms, clinical diagnoses, comorbidities, medications, result of investigation, date of discharge, and in-hospital outcome.

Blood pressure was recorded according to a standard guideline[17] with the use of a mercury sphygmomanometer (Accosson, London). Systolic and diastolic blood pressures were measured at Korotkoff sound phases I and V, respectively. An average of 3 readings were taken after 5 minutes of rest. Patients were weighed without shoes and in light clothing on a standard beam balance. An anthropometric plane was used for height measurement with patients not putting on shoes or headgear.

Body mass index (BMI) was calculated with the use of the formula: BMI = weight (kg)/[height (m)]^2. BMIs of 24−29.9 kg/m^2 and ≥30 kg/m^2 defined overweight and obesity, respectively. Anemia was defined as hematocrit of <10 g/dL. Glomerular filtration rate was estimated (eGFR) with the use of the 4-variable Modification of Diet in Renal Disease (MDRD) formula.[18] Renal dysfunction was defined as eGFR of <60 mL min^{-1} 1.73 m^{-2} (same criteria used by Stewart et al[5]). Twelve-lead electrocardiographic tracing was obtained with the use of a Schiller electrocardiograph, and the reports were analyzed by the authors blinded to the clinical history of the patients. M-Mode, 2-dimensinal, and Doppler echocardiography were performed with the use of an Aloka 4000 SSD machine (Aloka, Tokyo, Japan) according to standard criteria.[19]

The criteria used for diagnoses of the different etiologies have been previously reported.[4]

Follow-Up

The patients were followed for a period of 6 months. Information on readmission was assessed through hospital case record, telephone contact of patients or their relatives (cell phone coverage in Nigeria is quite extensive and reliable), telephone calls to their private doctors (when necessary), and occasional home visits by research assistants.

Follow-up was done at 1 and 6 months after the index admission. Information collected during follow-up included, among other things, patients' well-being (subject's feeling about his or her general health, which was graded from markedly improved to markedly worse), medications, and information on rehospitalization. At the end of 6 months, 233 out of the 262 patients were known to be alive, 18 were lost to follow-up, and 11 were known to have died (all during hospital readmission). Thirty-two patients were readmitted at least once, 13 patients twice, and one was readmitted thrice within 6 months.

Data Management and Statistical Analysis

Data management was done with the use of Epidata data management software (Epidata Association, Odense, Denmark). Data analysis was with the use of IBM SPSS version 20 (SPSS,

Chicago, Illinois) and Stata version 11 (Stata Corp, College Station, Texas) statistical software.

Continuous data are expressed as mean ± SD and 95% confidence interval (CI) or median ± interquartile range [IQR] where necessary. Categoric variables are expressed as proportions. The patients were divided into 2 groups (group 1, those not rehospitalized; and group 2, those rehospitalized). They were compared accordingly. Univariate regression analysis was used to identify factors associated with rehospitalization. A forest plot was constructed for the result of the univariate analysis. Multiple logistic regression analysis was used to determine the independent predictors of readmission. The criteria for inclusion in the multiple logistic regression analysis was a P value of $<.15$ in the univariate analysis. $P < .05$ was judged to be statistically significant.

Results

Sociodemographic Characteristics

Two hundred sixty-two patients, comprising 138 men (53%) and 124 (47%) women, who survived admission for de novo HF were followed for 6 months. Table 1 compares the sociodemographic and clinical profiles of the cohort according to 6-month readmission status. The group readmitted were significantly older (mean age 61.7 ± 14.0 vs 56.1 ± 15.4; $P = .026$). Except for body mass index (BMI) and serum sodium, which were significantly higher in the readmitted group (P values .029 and .039, respectively), all other parameters were similar between the 2 groups (Table 2).

The overall mean length of hospital stay was 10.5 ± 6.1 days (range 2−61 days, median 9 days). Eleven (12.2%) of the 90 patients who were admitted for ≤7 days (short stay) compared with 21 (12.2%) of the 172 patients who had length of hospital admission >7 days were rehospitalized.

Readmission Rates

The readmission rates at 30 and 180 days were 1.53% (95% CI 0.58%−4.02%) and 12.2% (95% CI 8.88% −16.8%), respectively. Figure 1 is a Kaplan-Meier survival curve for readmission in our cohort.

Reasons for 6-Month Readmission

Twenty-four (75%) of the 32 patients were admitted because of worsening HF. Three were due to arrhythmias (atrial fibrillation) and one each was due to pneumonia, lower gastrointestinal bleeding, renal failure, angioedema, and severe hypertension.

Clinical Correlates of Readmission

Those readmitted were older, more likely to be men and nonsmokers, and less likely to take alcohol (59.4% vs 61.7%) and had lower frequency of diabetes mellitus (DM; 9.4% vs 13.5%). They also tended to have more severe symptoms and signs of HF, such as orthopnea (87.5% vs 81.2%) and paroxysmal nocturnal dyspnea (93.8% vs 84.2%). Virtually all of the readmitted cases were in New York Heart Association functional class III or IV (100% vs 91.4%). They also had lower BMI (22.0 vs 24.3 kg/m^2; Table 1). Total white cell count, lymphocyte count, serum sodium, total cholesterol, and blood sugar were also higher in the readmitted group. Serum potassium, creatinine, and packed cell volume levels were lower in rehospitalized patients. The frequency of atrial fibrillation was also higher in the readmitted group (18.8% vs 11.7%).

Echocardiography

Accordingly to echocardiographic findings, the left atrial diameter and left atrial area left ventricular diameter in systole were significantly higher in the readmitted group compared with the others. Left ventricular ejection fraction (LVEF) was lower, with 76.7% in the rehospitalized group recording an LVEF of <50% compared with 62.6% for the others. Significantly, the rehospitalized group also had higher rates of valvular dysfunction (Table 2). In terms of prescribed pharmacotherapy the 2 groups were similar, with the notable exception of more digoxin prescribed in those rehospitalized (84.4% vs 67%; $P = .046$).

Predictors of Rehospitalization

According to univariate analysis (Table 3), low BMI (odds ratio [OR] 2.95, 95% CI 1.16−7.47; $P = .018$), low literacy (<6 years of formal education), serum sodium <130 mmol/L (OR 4.11, 95% CI 1.58−10.75; $P = .002$), and presence of mitral regurgitation (OR 4.64, 95% CI 0.1.06−20.29; $P = .026$) were significantly associated with higher risk of rehospitalization. Factors associated with lower risk of rehospitalization included female sex, history of smoking, presence of DM, higher random blood sugar, and higher packed cell volume. On an adjusted basis (Fig. 2), only female sex (adjusted OR 0.33, 95% CI 0.14−0.79; $P = .014$ vs male) and BMI <19 kg/m^2 (adjusted OR 3.74, 95% CI 1.15−12.16; $P = .028$ vs ≥19 kg/m^2) were independent correlates of readmission during 6 months' follow-up.

Discussion

This represents one of the first reports from the city of Abeokuta, Nigeria, to prospectively determine medium-term outcomes in adults who survive a de novo hospitalization for HF. Our sample represents a unique population of HF patients from the southwestern region of Nigeria.

As in other parts of Africa[5,6] and in contrast to reports from high-income countries,[20,21] this was a relatively young cohort with HF of predominantly nonischemic causes. With full follow-up in the majority of cases, we found a low rate of 6-month mortality (4.2%), as well as relatively low rates of rehospitalization (predominantly recurrent HF) at 30 days (1.53%) and 6 months (12.2%). In this Nigerian population and HF cohort, there were a number of characteristics that appeared to modulate the risk of rehospitalization. Higher rates of rehospitalization

Table 1. Baseline Sociodemographic and Clinical Profile of the Subjects

Variable	All (n = 262)	Rehospitalized (n = 32)	The Rest (n = 230)	*P* Value
Sociodemography				
Male sex, n (%)	138 (52.7)	21 (65.6)	117 (50.9)	.133
Age, y	56.1 ± 15.4	61.7 ± 14.0	55.3 ± 15.5	.026
Single marital status, n (%)	45 (21.5)	5 (17.9)	40 (22.1)	.735
Urban residence, n (%)	201 (76.7)	21 (65.6)	180 (78.3)	.122
CV risk factors/comorbidities, n (%)				
Never smoked	214 (81.7)	26 (81.2)	188 (81.7)	.800
Current alcohol user	161 (61.5)	19 (59.4)	142 (61.7)	.305
Diabetes mellitus	34 (13.0)	3 (9.4)	31 (13.5)	.779
Hypertension	213 (81.3)	27 (84.4)	181 (80.9)	.810
Atrial fibrillation	33 (12.6)	6 (18.8)	27 (11.7)	.263
COPD	19 (7.3)	4 (12.5)	15 (6.5)	.265
Arthritis	67 (25.6)	12 (37.5)	55 (23.9)	.128
Family history of heart disease	23 (8.8)	4 (12.5)	19 (8.3)	.500
Symptoms and signs, n (%)				
Cough	232 (88.5)	27 (84.4)	205 (89.1)	.385
Dyspnea	253 (97.3)	30 (93.8)	223 (97.8)	.388
Orthopnea	214 (82.0)	28 (87.5)	186 (81.2)	.470
Paroxysmal nocturnal dyspnea	222 (85.4)	30 (93.8)	192 (84.2)	.189
Leg edema	209 (80.1)	26 (81.2)	183 (79.9)	.859
Basal crepitation	218 (83.2)	29 (90.6)	189 (82.2)	.315
Elevated jugular venous pressure	209 (79.8)	28 (87.5)	181 (78.7)	.348
Third heart sound	189 (72.1)	24 (75.0)	165 (71.7)	.834
Systolic murmur	123 (46.9)	15 (46.9)	108 (47.0)	.993
Hepatomegaly	186 (71.0)	23 (71.9)	163 (70.9)	.907
Ascites	59 (22.5)	8 (25.0)	51 (22.2)	.821
NYHA III or IV on admission	242 (92.4)	32 (100)	210 (91.4)	.325
Body mass index, kg/m^2	24.0 ± 5.2	22.0 ± 4.2	24.3 ± 5.3	.029
Temperature, °C	36.4 ± 0.8	36.2 ± 0.5	36.4 ± 0.9	.186
Respiratory rate, per min	28.7 ± 6.6	29.7 ± 8.8	28.5 ± 6.3	.335
Pulse rate, beats/min	96.3 ± 18.0	96.1 ± 18.1	96.4 ± 18.0	.942
Systolic blood pressure, mm Hg	136.2 ± 29.7	87.8 ± 21.8	134.0 ± 18.3	.678
Diastolic blood pressure, mm Hg	87.6 ± 18.8	87.8 ± 21.8	87.5 ± 18.3	.935
Pulse pressure, mm Hg	48.7 ± 18.3	50.5 ± 16.0	48.5 ± 18.6	.568
Packed cell volume, %	37.1 ± 7.3	37.6 ± 6.8	37.1 ± 7.3	.719
White cell count	7.5 ± 3.7	7.6 ± 3.9	7.6 ± 3.9	.194
Lymphocytes, %	35.6 ± 12.8	35.1 ± 11.4	35.6 ± 13.0	.833
Serum sodium, mmol/L*	136.0 ± 6.5	133.4 ± 6.2	136.5 ± 6.5	.039
Serum potassium, mmol/L	3.65 ± 0.8	4.0 ± 0.9	3.6 ± 0.7	.102
Total cholesterol, mg/dL	166.0 ± 80.4	139.4 ± 49.7	169.5 ± 83.4	.437
Blood glucose, mg/dL	115.9 ± 55.9	116.8 ± 65.2	116.0 ± 54.5	.990
Blood urea, mg/dL†	43.7 ± 4.1	56.2 ± 8.4	42.0 ± 3.1	.105
Blood creatinine, mg/dL†	1.50 ± 0.11	1.36 ± 0.15	1.53 ± 0.16	.683
QRS duration, ms	109.7 ± 29.5	100.3 ± 21.0	112.2 ± 31.1	.220
QT interval, ms	358.9 ± 37.6	355.3 ± 37.1	359.8 ± 38.1	.716
QTc, ms	453.3 ± 35.8	449.9 ± 30.4	454.1 ± 37.3	.720
Etiology of heart failure, n (%)				.866
Hypertensive heart disease	199 (76.0)	24 (75.0)	175 (76.1)	
Dilated cardiomyopathy	22 (8.4)	2 (6.2)	20 (8.7)	
Right heart failure	15 (5.7)	3 (9.4)	12 (5.2)	
Pericardial diseases	8 (3.1)	2 (6.2)	6 (2.6)	
Rheumatic heart disease	7 (2.7)	0 (0.0)	7 (3.0)	
Other	11 (4.2)	1 (3.1)	10 (4.3)	

COPD, chronic obstructive pulmonary disease; NYHA, New York Heart Association functional class.

were observed in those with older age, lower BMI, low literacy, lower serum sodium level, presence of atrial fibrillation, renal dysfunction, and valvular dysfunction. Conversely, female sex, being single, history of DM, and lower packed cell volume were associated with lower rates of rehospitalization. Given the size of the cohort and relatively low number of rehospitalized patients, it was difficult to determine independent predictors of such an event. However, further analyses did show that on an adjusted basis, women were two-thirds less likely to be readmitted compared with men, and those with a low BMI were almost 4 times more likely to be readmitted than their heavier, potentially more nourished, counterparts.

The readmission rate of 12% in the present study is generally lower than the rates reported from North America and Europe. In a study by Krumholz et al,[22] it was reported that ~50% of HF patients were readmitted within 6 months after the initial admission. Ross et al[23] showed from Medicare data that all-cause readmission ranged from 22.9% to 23.3% from 2004 to 2006 in the United States. However,

Table 2. Echocardiographic Profile of the Subjects

Variable	All Subjects (n = 262)	Readmitted (n = 32)	The Rest (n = 230)	*P* Value
Left atrial diameter, cm	4.62 (1.0)	4.8 (0.7)	4.60 (1.0)	<.001
Left atrial area, cm^2	26.9 (8.4)	27.1 (8.0)	26.8 (8.5)	.006
Septal wall thickness in diastole, cm	1.31 (0.69)	1.72 (0.67)	1.26 (0.37)	.050
Posterior wall thickness in diastole, cm	1.20 (0.82)	1.21 (0.21)	1.20 (0.87)	.803
LV internal diameter in diastole, cm	5.63 (3.01)	5.68 (0.88)	5.63 (0.61)	.490
LV internal diameter in systole, cm	4.45 (1.57)	4.74 (0.93)	4.41 (0.64)	.004
Fractional shortening, %	19.2 (11.0)	17.3 (10.4)	19.6 (11.2)	.099
Ejection fraction, %	39.7 (18.5)	36.8 (18.1)	40.1 (18.6)	.020
Mitral E-wave velocity, m/s	0.81 (0.29)	0.87 (0.32)	0.80 (0.30)	.880
Mitral A-wave velocity, m/s	0.53 (0.26)	0.53 (0.25)	0.53 (0.26)	.905
E/A ratio	1.94 (1.35)	1.96 (1.20)	1.93 (1.37)	.088
Systolic dysfunction, n (%) (n = 236)	152 (64.4)	23 (76.7)	129 (62.6)	.156
Mitral regurgitation, n (%) (n = 219)	165 (75.8)	25 (92.6)	140 (72.9)	.056
Tricuspid regurgitation, n (%) (n = 219)	152 (69.4)	23 (85.2)	129 (67.2)	.232

consistent with other data from sub-Saharan Africa,[5,6] this was a relatively young cohort with HF of predominantly nonischemic causes. In other parts of the world, hospital readmission risk increases with age. Patients aged ≥65 years are far more likely to experience recurrent hospitalization. A 4-fold increase in 30-day readmission rate was reported for elderly populations who were ≥80 years. Blackledge et al[24] and Koitabachi et al[25] observed a 24% increase per 10-year age increment in the annual readmission rate. The reported impact of sex on readmission rates in those with HF is inconsistent. Whereas some authors reported higher rates in women,[26] others reported higher rates in men, similar to our finding.[27,28]

Arrhythmias, especially atrial fibrillation (AF), are common in HF and adversely affect hemodynamics in patients. Several studies have shown that this rhythm disorder is associated with higher risk of readmission in individuals with HF regardless of ejection fraction or rhythm control.[29,30] Recent findings from Africa suggest that AF occurs in 4.6% of cardiac cases (estimated 5.6 out of 100,000 cases/y)[31] The mean age of occurrence is 57.2 ± 18.8 years in Africa compared with 70.1 ± 13.4 years in North America.[32] Common risk factors include hypertension, HF, and valvular heart disease.[31–34] Our finding of higher risk of readmission in patients with poor left ventricular function is similar to the findings of many workers.[35,36] However, some recent reports indicate similar risk in HF with preserved ejection fraction.[37,38] Our study also confirmed earlier reports that presence of valvular dysfunction is associated with a 4-fold higher risk of HF-related readmission.[39]

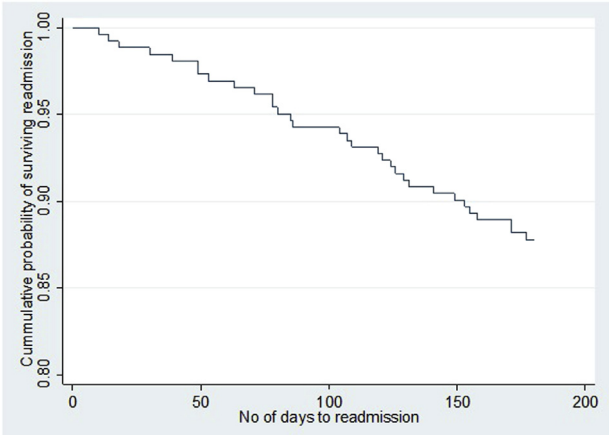

Fig. 1. Kaplan-Meier survival curve for readmission.

Some plausible reasons for the lower rate of readmission in our cohort compared with data from developed countries may be related to the younger age of our patients as well as the fact that the majority of the patients had hypertensive HF and other forms of nonischemic HF. Several studies have documented higher readmission rates with ischemic etiology.[24] Our patients also stayed longer on the ward (mean length of hospital stay was 9 days compared with 4 days in the USA) before discharge. This could have afforded them the opportunity of better stabilization. The fact that the study was carried out in a cardiology unit/tertiary care institution may account for our finding and may not reflect the situation in the general Nigerian population. The higher rate of readmission in lean patients may be related to cardiac cachexia and severe HF. It may also support the concept of obesity paradox in HF. Hyponatremia has been linked to frequent ventricular ectopics and sudden death. Hyponatremia in HF is due to activation of the renin-angiotensin-aldosterone axis and decreased sodium and water delivery to the collecting ducts of the nephron, coupled with resistance to the action of natriuretic peptides. Hyponatremia in HF is also linked to increased vasopressin levels in HF as a result of an increase in number of aquaporin water channels in the collecting duct of the kidney.[40] We also observed that the rehospitalized group had a higher frequency of osteoarthritis. This may be related to age. It may also be due to concurrent use of nonsteroidal antiinflammatory drugs, which can worsen their HF.

The impact of current smoking status on HF readmission is inconsistent. Similarly to our finding, the ‘‘smoker’s paradox’’ has been demonstrated by other workers, reporting a 23% lower risk of 90-day rehospitalization risk in current cigarette smokers.[41] It has been postulated that current smoking has a preconditioning-like effect on HF patients, allowing a better outcome during acute decompensation.

Table 3. Univariate Correlates of Readmission in the 262 De Novo Heart Failure Subjects

Variable	OR	95% CI	*P* Value
Age >60 y	2.04	0.96−4.29	.058
Female sex	0.54	0.25−1.18	.117
Body mass index <19 kg/m^2	2.95	1.16−7.47	.018
No education	1.47	0.62−3.46	.376
Not married	0.73	0.30−1.75	.481
History of smoking	1.06	0.41−2.74	.907
Alcohol use	1.10	0.52−2.35	.796
History of diabetes mellitus	0.66	0.19−2.31	.518
Serum sodium <130 mmol/L	4.11	1.58−10.75	.002
Random blood glucose >140 mm Hg	0.67	0.22−2.02	.459
Packed cell volume ≤30%	0.53	0.15−1.85	.313
Serum creatinine >2 mg/dL	1.20	0.43−3.39	.729
Presence of atrial fibrillation	1.74	0.65−4.59	.263
Ejection fraction <35%	1.36	0.61−3.04	.459
Presence of mitral regurgitation	4.64	1.06−20.29	.026
Presence of tricuspid regurgitation	2.81	0.93−8.45	.057

OR, odds ratio; CI, confidence interval.

Furthermore, sudden or recent cessation of smoking during hospitalization allows for more rapid stabilization and compensation among patients who were smoking up until the time of HF hospitalization. The paradox could also be explained by the beneficial or lower dimethyl arginine (ADMA, a potential nitric oxide synthase inhibitor) profile that has been documented in smokers by some authors.[42,43] ADMA is increased in HF patients and is associated with the severity of HF as well as predicts adverse outcomes.[44]

Presence of DM or high blood glucose is an established predictor of readmission in HF patient.[45−48] This is due to the role of hyperglycemia and insulin resistance in the development of diabetic heart disease partly as a result of inefficient myocardial fuel metabolism.[49] Hyperglycemia could also induce shifts in the fluid and electrolytes that may affect the outcome of HF patients. In the present study we observed that DM patients were less likely to be readmitted. This could be a statistical chance finding. It could also be due to the higher prevalence of HF with preserved ejection fraction in DM patients. These are generally less likely to be readmitted compared with those with reduced ejection fraction.

The implication of our finding is that simple sociodemographic and laboratory variables, especially BMI, age, serum sodium, and presence of atrial fibrillation and valvular dysfunction, could be used to predict patients

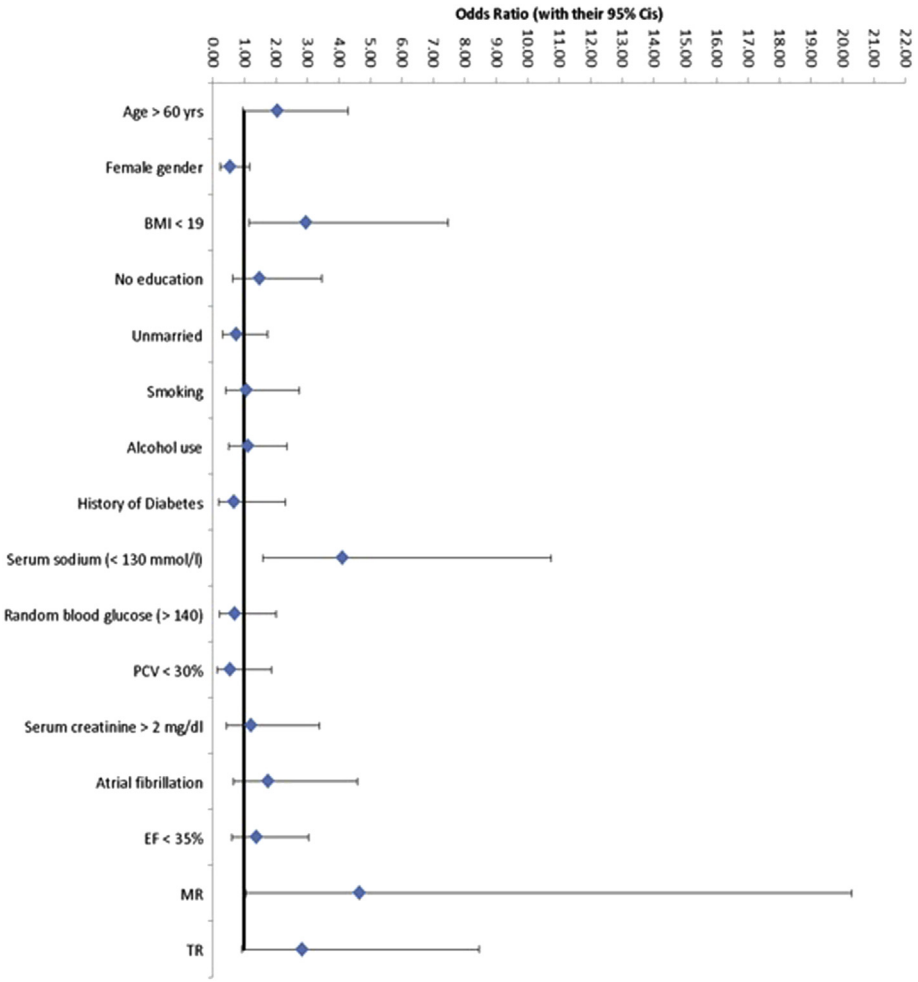

Fig. 2. Univariate variables associated with readmission represented with forest plot. Adjusted odds ratio [OR] for women = 0.33 (95% confidence interval [CI] 0.14−0.79), Adjusted OR for BMI = 3.74 (95% CI 1.15−12.16).

who are at risk of rehospitalization in our environment. It may be worthwhile to look at the impact of nutritional rehabilitation in our HF patients.

The process of care, access to health care, low literacy, poverty, and cultural practices may also affect the timing of presentation of patients to health care facilities as well as adherence to clinic attendance and drug therapy. Because of ignorance coupled with poverty or lack of access to health care, patients in developing countries such as in Africa often present late to the hospital, and when they do, catastrophic spending for care of chronic conditions such as HF is often a major challenge. This consequently affects adherence.

Cultural practices as well as superstitious beliefs also affect health-seeking behavior in Africa. Patients often visit hospitals as a last option (after trying other alternatives, including native or traditional medicine). For chronic conditions such as HF, they often move from one center to the other seeking a permanent cure. This also affects compliance.

It will be worthwhile to explore the impact of these factors in future outcome studies on HF or other chronic noncommunicable diseases in our environment.

Study Limitations

As noted in a previous report,[50] research is often problematic and challenging in a resource-poor environment, and there are a number of limitations that require comment. The first of these is the sample size and fewer events, which did not allow for the development of models of risk prediction for the population. A larger and multicenter study is therefore advocated to provide this information.

Heart rate variability and newer echocardiographic parameters, such as tissue Doppler imaging, were not assessed. We also did not assess the impact of quality of life and psychosocial factors.

Finally, because our sample is limited to Abeokuta (in the southwestern part of the country), our findings cannot be generalized to other parts of Nigeria.

Conclusion

HF rehospitalization within 6 months' follow-up occurred in ~12% of patients in our cohort living in an environment where HF etiology is predominately nonischemic. Higher rates of readmission were noted in those with older age, lower BMI, low literacy, lower serum sodium level, and presence of atrial fibrillation, renal dysfunction, and valvular dysfunction.

Disclosures

None.

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