Rehospitalization Rate and Predictors of Rehospitalization in Heart Failure Patients in North Central Nigeria.

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Abstract

Heart failure (HF) is a major cause of morbidity and mortality worldwide. Despite the advancement in its treatment the rate of rehospitalization of patients after treatment for HF is still high around the world. Studies assessing rehospitalization rates of HF patients are few in Nigeria. The objective of the study was to determine the 180-day rehospitalization rate and predictors of rehospitalization in acute HF patients managed in our Centre. The study was a retrospective cohort study of 148 patients with acute HF.

The 180-day rehospitalization rate in our patients was 16.2%. The median time to rehospitalization was 61days. Serum urea (p=0.016), serum creatinine (p=0.033), admission eGFR < 60mls/min/1.73m^2 (p=0.007), LVEF (p=0.045) were associated with rehospitalization. eGFR < 60mls/min/1.73m^2 was an independent predictor of 180-day rehospitalization OR 5.4, (CI 1.701-7.690), p=0.014 suggesting 5 times greater likelihood of rehospitalization than patients with higher eGFR. The Kaplan-Meier survival curve for 180-day rehospitalization was plotted.

In conclusion, the 180-day rehospitalization rate among our patients varies from other reported rates in our environment. Acute HF patients with renal dysfunction have a high likelihood of medium term rehospitalization and hence constitute an at-risk group for targeted intervention during admission.

Key words: Heart failure, heart failure rehospitalization rate, predictors of rehospitalization

Introduction

Heart failure (HF) is a major cause of morbidity and mortality worldwide. It imposes considerable strain on patients through the burden of recurrent rehospitalizations. Advancement in treatment of HF over the years has resulted in the development of drugs which achieve rapid resolution of symptoms. All HF patients are at risk of rehospitalization.[1, 2] However, the rate of rehospitalization of patients after treatment for HF is still high around the world. Discharge from a HF hospitalization is followed by a readmission within 30 days in ≈24% of cases.[3] The propensity for HF patients to get an admission-readmission cycle has led to the description of the revolving door of admissions in HF patients.[3] It is therefore important to evaluate the rehospitalization rate and factors associated with rehospitalization in our centre which is located in a resource-limited setting in North central Nigeria.

The objective of the study was to determine the medium term 180-day rehospitalization rate of patients with acute heart failure with reduced ejection fraction (HFrEF) managed in our centre, identify factors predictive of rehospitalization and determine the survival curve for 180 days among our patients.

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Methods

Study setting: Our centre is a tertiary level healthcare centre with 500-beds in Ilorin the Kwara state capital which receives referrals from within the state and from other states in North central Nigeria. The town comprises a heterogeneous mix of several tribes and cultures, predominantly Yoruba.[4]

Study Design: The study was a retrospective cohort study of patients with acute HF with reduced ejection fraction (HFrEF) managed between June 1, 2016 to May 31, 2017. It was conducted using evaluation of data from the Cardiology unit's HF patient admission records in our HF registry. The patients were followed up for 180-days period to determine their re-hospitalization status.

Adult patients aged 15years and above admitted for acute HF with reduced ejection fraction were recruited. Patients enrolled into our registry were diagnosed with HF according to the European Society of Cardiology (ESC)[5] criteria and had echocardiographic confirmation of the diagnosis. Demographic variables and the presence of systemic hypertension (defined as sustained blood pressure of ≥140/90 mmHg or history of use of anti-

hypertensives), diabetes mellitus (DM) in the patients (defined as fasting blood sugar on at least two occasions >7mmol/l or HbA1C > 6.5%)[6] were collected.

The trans-thoracic echocardiography (Echo) studies were performed using an ALOKA 4000 SSD machine (ALOKA co. Ltd, Tokyo, 2008). The intra-observer concordance of echo measurements has been reported in an Echo laboratory with similar standards of training close to our centre.[7] Echo data was acquired following the recommendations by the American Society of Echocardiography (ASE) guidelines.[8] LVEF <50% was considered as evidence of LV systolic dysfunction.

Patients' Glomerular filtration rate was estimated using the Chronic Kidney Disease Epidemiology Collaboration (*CKD-EPI*) formula.[9, 10] The presence of renal dysfunction was defined as eGFR of less than 60ml/min/1.73m^2.[10]

Follow up: Each patients' records were examined over a one-year period post-hospitalization with particular attention paid to their rehospitalization episodes. The patients who were rehospitalized by 180 days post-discharge were identified.

Data Analysis: Data analysis was with IBM SPSS version 23 (SPSS, Inc. Chicago Illinois). Continuous variables were expressed as mean ± SD or median and inter-quartile range]. Categorical variables were expressed as frequencies and proportions. The student's independent t-test was used to compare the means of continuous variables between two groups while Chi square was used to compare proportions. A p< 0.05 was judged to be statistically significant. Ethical approval was obtained from the Ethics and Research Committee of the UITH Ilorin.

Results

The study involved 148 patients who had complete follow-up data. The age range of the patients was 15-95years, the mean age of the patients was 56.55years ± 15.7, 65(43.9%) were females, 106 (71.6%) were employed, 25 (16.9%) were unemployed and 17(11.5%) were retired. Diabetes mellitus (DM) was present in 16 (10.8%) of them and 109 (73.6%) had a history of systemic hypertension. Majority of the patients were in NHYA classes II and III 36.5% and 17.6% respectively. The mean Echo dimensions were LVIDd - 5.75± 11cm, LVEF 39 ± 13.61%, LVFS 19.5±8.2%, 135 patients (91.2%) had LV diastolic dysfunction.

The other laboratory and echo parameters are shown in Table 1.

Twenty-four patients were rehospitalized within 180 days giving a 180-day rehospitalization rate of 16.2%. The median time to rehospitalization among these patients was 61days (IQR: 23-95). The outcome of rehospitalization was 6 deaths (25% mortality).

The factors that were significantly associated with 180-Day rehospitalization as shown in Table 2 were admission serum urea (p=0.016), serum creatinine (p=0.033), admission eGFR < 60mls/min/1.73m^2 (p=0.007), LVEF (p=0.045).

Table 1: Socio-Demographic, Clinical, Laboratory, and Echocardiographic Characteristics of patients in the Study

Variable (n=148)	Mean ±SD / n (%)
Age (years)	
Mean	56.55±15.7
Gender	
Female	65 (43.9)
Male	83 (56.1)
Employment status	
Employed	106 (71.6)
Marital status	
Married	110 (88.7)
Single/Divorced/Separated/Widowed	10 (8.1)
NYHA Status at first admission	
II	54 (36.5)
III	26 (17.6)
IV	68 (45.9)
Presence of Systemic Hypertension	
No	37 (26.4)
Yes	109 (73.6)
Presence of Diabetes mellitus	
No	132 (89.2)
Yes	16 (10.8)
Heart rate (bpm)	100.4±21.95
Echo LVIDd (cm)	5.75± 11
LVEF (%)	39 ± 13.61
LVFS (%)	19.5±8.2
LV Diastolic dysfunction	
Yes	135 (91.2)
No	13 (8.8)
Serum Hemoglobin (g/dL)	10.1 ± 1.2
Serum Sodium (mmol/L)	134.3± 5.2
Serum Potassium (mmol/L)	4.46 ±3.2
Serum Urea (mmol/L)	15.8 ± 4.2
Serum Creatinine (μmo l/L)	115.4 ± 76.2
eGFR (mls/min/1.73m^2)	73.8 ± 32.1
eGFR < 60mls/min/1.73m^2	53 (35.8%)

NYHA- New York Heart Association; LV – Left ventricular; LVIDd - Left Ventricular Internal Dimension in Diastole; LVEF- Left Ventricular Ejection Fraction; LVFS- Left Ventricular Fractional Shortening; eGFR – Estimated Glomerular Filtration Rate

A Kaplan-Meier survival curve for 180-day rehospitalization was plotted. Binary logistic regression analysis was also used to identify independent predictors of 180-day rehospitalization

Table 2: Factors Associated with 180-Day Rehospitalization

Variable	Not Rehospitalized (n=124)	Rehospitalized (n=24)	*p* value
Age	55.66 ± 15.6	61.2 ± 15.2	0.115
Gender:			
Female	57	8	0.254
Male	67	16	
Serum Hemoglobin	10.2 ± 1.8	9.8 ± 1.1	0.124
Serum Sodium (mmol/L)	133.9 ± 4.8	135.5 ± 6.4	0.222
Serum Potassium (mmol/L)	4.32 ± 1.95	5.0 ± 6.1	0.376
Serum Urea (mmol/L)	7.2 ± 7.37	18.1 ± 38.02	**0.016***
Serum Creatinine (µmol/L)	97.0 ± 24.56	120.7 ±84.81	**0.033***
eGFR (mls/min/1.73m^2)	81.4 ± 20.7	71.8 ± 34.3	0.122
eGFR<60mls/min/1.73m^2			
Yes	32	2	**0.007***
No	43	18	
Heart rate (bpm)	97.1± 21.1	100.72 ± 21.1	0.682
LVIDd(mm)	57.3 ± 11.9	58.8 ± 3.3	0.403
LVEF (%)	40.4± 13.9	32.2±9.94	**0.045***
LVFS (%)	20.4±8.4	15.53±5.4	0.051
LV Diastolic dysfunction			
Present	62	13	0.709
Absent	48	25	

LVIDd- Left Ventricular Internal Dimension in Diastole; LVEF-Left Ventricular Ejection Fraction; LVFS- Left Ventricular Fractional Shortening; eGFR – Estimated Glomerular Filtration Rate

Table 3: Predictors of 180-Day Rehospitalization

Variable	B	OR	*p* value	95% CI	
				Lower	Upper
Serum Urea (mmol/L)	-0.037	0.964	0.277	0.903	1.030
Serum Creatinine (µmol/L)	-0.006	0.994	0.200	0.984	1.003
eGFR <60mls/min/1.73m^2					
Yes	-1.902	5.400	**0.014***	1.701	7.690
No [REF]					
LVEF (%)	-0.054	0.947	0.052	0.896	1.000

B: Regression coefficient, OR- Odds Ratio, CI- Confidence Interval, LVEF- Left Ventricular Ejection Fraction, eGFR – Estimated Glomerular Filtration Rate

among the patients. The dichotomized outcomes were defined as "not rehospitalized within 180 days" and "rehospitalized within 180 days". On logistic regression analysis (Table 3), the presence of eGFR less than <60mls/min/1.73m^2 was a significant independent predictor of 180-day rehospitalization among the patients (OR=5.4, p=0.014), suggesting that a patient who had eGFR<60mls/min/1.73m^2 were 5.4 times

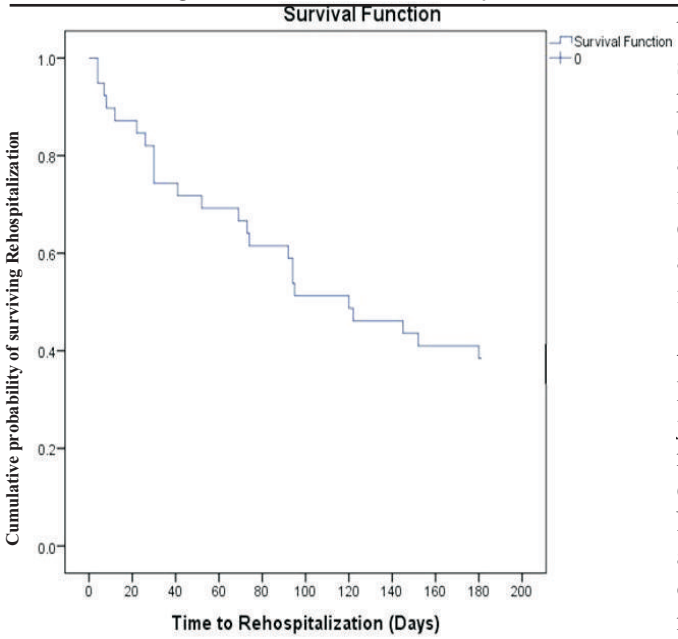

Figure 1: Kaplan-Meier Survival curve for 180-Day Rehospitalization

more likely to be rehospitalized within 180 days compared to those who had eGFR higher than that.

Discussion

HF is a chronic condition which portends a great deal of implication for the patient's well being for the patient both in the immediate, medium and long-term.[11] The long term implication of having HF was shown by Kingery et al in Tanzania who compared one-year post-discharge mortality rates among HF patients with those of patients with other medical ailments. They found that mortality was higher among HF patients.[12] Maggioni et al's study of a European cohort showed that 44% of HF patients were rehospitalized within 1 year of discharge.[13] A study of rehospitalization tendencies of HF patients is thus very important for better planning of long-term care of the patients based on appropriate and accurate identification of at-risk individuals This will form the basis of promoting individualised care of the patients.

The mean age of patients in this study is similar to that reported in heart failure studies in Nigeria and on the African continent by Ogah et al in Abeokuta South west Nigeria[14], Akpa and Iheji in Port Harcourt South south Nigeria[11], Kingery et al in Tanzania[12] and the THESUS-HF researchers who studied 1006 African patients.[15] It is in tandem with the observed difference in the epidemiology of HF involvement in sub-saharan Africa compared to more economically developed societies such as the US where HF is rather a disease of the elderly, with a mean age of 72 years (median age, 66-70 years)[16], Sweden where it is 72 years[17] and China where the median age is 71 years.[18] This is probably because of stronger risk factor detection systems and stronger health systems that provide effective primary prevention strategies. It is also pertinent that major causes of HF in sub-saharan Africa are non-ischemic and include diseases such as systemic hypertension, idiopathic dilated cardiomyopathy, HIV-related cardiomyopathy and rheumatic heart disease and these are commoner among younger people and middle-aged individuals.[19,20]

Relatively few studies have reported medium term rehospitalization rates of HF patients in Nigeria. Hence the importance of this study as a piece of the jigsaw in obtaining a full picture of HF rehospitalization in Nigeria. Comparisons of HF epidemiology reported from different centres in Nigeria show that the pattern of HF aetiology varies across the different geographical zones.[21, 22] Hence outcome variables such as rehospitalization frequency may also vary. The 180-day re-hospitalization rates in HF patients in our study is similar to 12% reported by Ogah et al[14] but far lower than that reported by Akpa and Iheji.[11] Re-hospitalization rates as high as 25% to 50% have been reported in HF patients in the US.[3, 23] The lower 180-day rehospitalization rate in patients managed in our environment may be related to the predominantly non-ischemic nature of the aetiology of HF in our patients. Blackledge et al[24] suggested that HF was associated with a poorer survival in patients with ischemic heart disease. This may be due to a higher likelihood of having more co-morbidities among such individuals. Our HF patients being much younger than patients from the Western populations may also be able to withstand the rigour of the illness better and have fewer co-morbidities such as DM, cancers which are known predictors of re-hospitalization among patients with HF.[14,15,24]

The effect of renal dysfunction in predicting 180-day HF rehospitalization was also found in our study. Patients with eGFR <60mls/min/1.73m^2 were more than five times as likely as those who did not to be re-hospitalized. This is similar to findings in Nigerian patients by Akpa et al[11], Tanzanian patients by Kingery et al[12], a diverse cohort of African patients by Sliwa et al[15], in Japanese patients by Tsutsui et al[25] and American patients by Adams et al.[16] The causal relationship between renal dysfunction and HF is bi-directional - renal dysfunction can predispose to HF and HF can lead to worsening renal function. Heart failure can precipitate renal dysfunction through several mechanisms. These include chronic renal hypoperfusion, venous congestion and intra-abdominal hypertension.[26] Renal dysfunction in HF not only predicts re-hospitalization but has also been found to be associated with prolonged hospital stay during admissions.[27] Patients with renal dysfunction at admission therefore form an at-risk group in whom

targeted interventions should be commenced early to improve outcome and reduce the risk of rehospitalization.

The retrospective nature of this cohort study meant that subject selection was affected by incompleteness of patient records. Also, the influence of other patient characteristics in predicting re-hospitalization as reported in other studies in this environment may not have been obvious because of the sample size in this study.

However, this study is strong on the fact that it is one of the first reports of its kind from North central Nigeria. Also, the variation of its findings with earlier findings in studies from other parts of the country suggests the fact that medium–term outcomes of HF patients is not the same in every part of Nigeria. The evaluation of how socio-economic disparities and other peculiarities of the different geographical segments of our country influence HF patient's re-hospitalization rate will be a good focus for further research. Our study however contributes to the painting of a complete picture of HF rehospitalization in our country.

Conclusion

In conclusion, the 180-day rehospitalization rates among our HF patients varies from what is reported from other centres in our environment where the aetiology of HF is mainly non-ischemic. The main predictor of rehospitalization among our patients is the presence of renal dysfunction. In the resource-constrained setting where we practice HF treatment strategies have to give consideration to early identification of this high-risk group in order to reduce rehospitalization in HF patients.

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