

# Atrial fibrillation among the black population in a Ugandan tertiary hospital

Charles Lugero<sup>1,2</sup>  
Davis Kibirige<sup>3</sup>  
James Kayima<sup>1,2</sup>  
Charles Kizza Mondo<sup>2</sup>  
Jurgen Freers<sup>2</sup>

<sup>1</sup>Division of Adult Cardiology, Uganda Heart Institute, <sup>2</sup>Department of Medicine, Makerere University College of Health Sciences, Kampala, <sup>3</sup>Department of Medicine, Our Lady of Consolata Hospital, Kisubi, Uganda

**Background:** Atrial fibrillation (AF) is the most common type of sustained cardiac arrhythmia in adults, accounting for one-third of hospitalizations due to arrhythmia and related complications worldwide. Previously, rheumatic heart disease was documented as the commonest cause of AF in sub-Saharan Africa. However, due to the prevailing epidemiological transition in sub-Saharan Africa, the risk factors and ensuing complications of AF have changed and are on the increase.

**Methods:** This was a descriptive cross-sectional study involving 102 patients presenting with AF who were recruited from the cardiology unit of Mulago National Referral Hospital, Uganda, over 3 months. Sociodemographic, medical history, and clinical data were obtained.

**Results:** The mean age of study participants was  $52 \pm 21.3$  years with a female predominance (58 [56.9%]). The commonest coexisting medical conditions were hypertension in 42% and rheumatic heart disease in 32% of the patients. The commonest echocardiographic abnormality was chamber dilation, noted in 76.8% of all patients. Heart failure was the most frequent complication encountered (50%) followed by left ventricular diastolic dysfunction and acute thromboembolic stroke documented in 19.6% and 12.8% of the study participants, respectively. Of the enrolled patients, ten (9.8%) died within 3 days of admission.

**Conclusion:** AF tends to occur at a younger age in Ugandan patients. The commonest underlying medical conditions among these patients were hypertension and rheumatic heart disease. Hence, all patients with hypertension and rheumatic heart disease should be meticulously screened for AF.

**Keywords:** atrial fibrillation, clinical profile, complications, Uganda

## Introduction

In developed countries, atrial fibrillation (AF) is the most common sustained cardiac arrhythmia with an exponential increase with advancing age.<sup>1</sup> It is strongly associated with an increased risk of stroke, hospitalization, and mortality.<sup>2</sup> With the existing epidemiological transition from communicable to noncommunicable diseases, AF is a growing public health problem in sub-Saharan Africa (SSA).<sup>3</sup> Use of anticoagulants, accessibility and costs of monitoring, poor drug compliance, and nonadherence to existing treatment guidelines are key challenges in managing patients with AF in this region.<sup>4,5</sup>

Data derived from studies in SSA in comparison to those derived from the developed countries have revealed that majority of patients presenting with AF have very severe disease and are comparatively younger with a higher frequency of concomitant complications.<sup>6–10</sup>

Correspondence: Charles Lugero  
Department of Medicine, Makerere  
University College of Health Sciences,  
PO Box 7062, Kampala, Uganda  
Tel +256 414 541188  
Email charleslug@yahoo.com

In Uganda, there is no literature on the clinical profile, complications, and outcome of patients presenting with AF. This was the basis of performing this contemporary cross-sectional study to describe the clinical characteristics and complications of patients presenting with AF at the cardiology unit of Mulago National Referral and Teaching Hospital, Kampala, Uganda.

## Study methods

This was a descriptive cross-sectional study performed at the cardiology unit of Mulago National Referral and Teaching hospital in Kampala, the capital city of Uganda. This is the largest national referral hospital, teaching and health care research facility in Uganda with a 1,600 bed capacity.

Eligible patients presenting with AF to the cardiology unit, who were  $\geq 13$  years old, and had offered written informed consent or assent were consecutively recruited over a period of 3 months (April to June 2012) until the desired sample size was attained. Caregivers of patients  $< 16$  years old gave written consent and assent. Patients with atrial flutter and other rhythm disorders were excluded. AF was confirmed by a resting electrocardiography (ECG) done at the time of admission and interpreted by an experienced cardiologist.

The desired sample size of a minimum of 95 patients was obtained using the modified Kish Leslie (1965) formula:

$N = Z^2 pq / e^2$ , where  $N$  = required sample size,  $Z$  = standard normal value corresponding to the set level of confidence at 95% (1.96),  $P$  = estimated frequency of outcome factor in the population (the study used as a reference was by Karen Sliwa in South Africa where 56% of patients with AF had concomitant heart failure),<sup>8</sup>  $q = 1 - P$  (0.44), and  $e$  = precision (0.1).

After obtaining informed consent or assent, pretested questionnaires were used to collect the patients' information on the sociodemographic characteristics, presenting symptoms, presence and type of underlying heart diseases, thyroid status, history of excessive alcohol intake, and drug history (anti-arrhythmic and anticoagulation therapy). All participants had baseline anthropometric measurements of weight and height for the calculation of body mass index (BMI). Standard procedures for measuring blood pressure were also done on all patients after a 30-minute rest using a manual Dekamet Accoson MK3 mercury sphygmomanometer machine.

A two-dimensional Doppler transthoracic echocardiography (ECHO) was performed by an experienced cardiologist on all the patients with particular interest given to the left atrial size; left ventricular systolic and diastolic function; and the presence of valvular heart disease, hypertensive

heart disease, and myocardial infarction. On ECHO, measurements of the inter-ventricular septum (IVS) or left ventricular posterior (LVP) wall  $> 11$  mm were considered to signify presence of left ventricular hypertrophy (LVH).<sup>11</sup> Left ventricular function was defined as preserved when the left ventricular ejection fraction (LVEF) was  $\leq 35\%$  and depressed when  $LVEF < 35\%$ .

Diagnosis of hypertensive heart disease required the presence of at least one of the following conditions: 1) LVH on echocardiography (septum and posterior wall thickness  $11$  mm) and/or systolic or diastolic dysfunction or 2) signs of LVH on the 12-lead resting ECG using Sokolow–Lyon criteria and persistent elevation of blood pressure ( $\geq 140/90$  mmHg) despite antihypertensive drug therapy.<sup>11,12</sup>

Using the validated congestive heart failure-hypertension-age  $\geq 75$  years-diabetes-prior stroke/transient ischemic attack (CHADS2) score, stroke risk stratification was performed for all the enrolled patients.<sup>13</sup> This index measures stroke risk by assigning one point each for congestive heart failure, hypertension, age  $\geq 75$  years, and diabetes mellitus, with two points added for a history of stroke or transient ischemic attack. According to the American College of Cardiology, American Heart Association and the European Society of Cardiology guidelines, a CHADS2 score of  $\geq 2$  is considered as a marker of high risk of stroke and an indication for oral anticoagulation (OAC) therapy. A CHADS2 score of 1 is considered as a marker of moderate risk and an indication for OAC or cardiac aspirin.<sup>14</sup>

## Laboratory analysis

Blood was then drawn from all the participants to assess serum urea, creatinine, electrolytes, and thyroid function tests. The collected blood samples were centrifuged and the extracted plasma was stored at  $-20^\circ\text{C}$ . The analysis was done in the clinical chemistry laboratory of Mulago hospital by two experienced laboratory technicians using a fully automated COBAS® Integra 400 (Roche Diagnostics, Hoffman-La Roche Ltd., Basel, Switzerland) machine.

## Statistical analysis

All the data collected on the pretested data collection sheet were entered into Epidata and thereafter exported to Stata version 10 for statistical analysis. Patient characteristics were reported as frequency and percentage for categorical variables, mean and standard deviation (SD) for the normally distributed continuous variables, and median and interquartile range (IQR) for continuous variables that were not normally distributed. Chi-square tests or Fischer's exact test, where

appropriate, were used to compare the categorical variables. Only variables with a *P*-value of <0.05 were considered significant.

## Ethical consideration

The study was approved by the Department of Internal Medicine, Makerere College of Health Sciences and Makerere University School of Medicine Research and Ethics Committee. All patients gave informed consent and assent prior to enrollment into the study.

## Results

### Sociodemographic, clinical, and laboratory characteristics of the patients

#### Sociodemographic characteristics of the study participants

Of the 102 patients enrolled, majority were females (58 [56.9%]). The overall mean age was 52±21.3 years and did not differ with sex. The youngest participant was 13 years and the oldest was 88 years old. Majority of the study participants were employed (52.9%) and had attained some level of education (85 [83.3%]) (Table 1).

#### Clinical features of the study participants

Majority of the participants presented with palpitations (86 [84%]) and dyspnea (70 [68.6%]). There was no difference in the presenting symptoms according to sex.

**Table 1** Sociodemographic characteristics of admitted patients presenting with AF

Characteristic	All, n (%)	Women (n=58), n (%)	Men (n=44), n (%)	Chi-square test P-value
Age median (IQR)	50 (36–68)	47 (36–67)	55 (34–70)	0.54
Education				
No education	17 (16.7)	11 (19)	6 (13.6)	0.327
Primary	23 (22.6)	16 (27.6)	7 (15.9)	
Secondary	18 (17.6)	10 (17.2)	8 (18.2)	
Post-secondary	44 (43.1)	21 (36.2)	23 (52.3)	
Occupation				
No employment	48 (47.1)	33 (56.9)	15 (34.1)	0.062
Self-employed	26 (25.5)	11 (19)	15 (34.1)	
Skilled employed	28 (27.4)	14 (24.1)	14 (31.8)	
Religion				
Muslim	21 (20.6)	9 (15.5)	12 (27.3)	0.332
Christian	79 (77.5)	48 (82.8)	31 (70.4)	
Other	2 (1.9)	1 (1.7)	1 (2.3)	
Residence				
Urban	47 (46.1)	27 (46.5)	20 (45.4)	0.912
Rural	55 (53.9)	31 (53.5)	24 (54.6)	

**Abbreviations:** IQR, interquartile range; AF, atrial fibrillation.

Approximately, 57% of the patients had a normal BMI, defined as 18.5–25 kg/m<sup>2</sup>. Obesity, overweight, and underweight were documented in 9.8%, 24.5%, and 8.8% of the participants, respectively.

#### Laboratory characteristics of the study participants

Thyroid dysfunction among the study participants was very infrequent. Overt and subclinical hyperthyroidism and hypothyroidism were both documented in 2.9% of the participants. There was no significant difference noted in regards to sex. Renal derangements were also uncommon in this study population. Only 31.7% and 37.6% of the participants had elevated serum creatinine and blood urea nitrogen (BUN) levels on assessment, respectively. Hypocalcemia (uncorrected for serum albumin levels) was very frequent, occurring in 51 (50.5%) participants (Table 2).

#### Underlying medical conditions associated with AF

The commonest underlying medical condition in the study participants was hypertension, documented in 43 (42.2%) participants. Rheumatic heart disease, diabetes mellitus, and congenital heart diseases were noted in 32.4%, 9.8%, and 5.9% of the study participants, respectively. A significant proportion of the participants (n=79 [77.4%]) had at least one cardiac condition combined. The documented combined cardiac

**Table 2** Laboratory findings of the study participants

Laboratory investigations	All, n (%)	Women (n=58), N (%)	Men (n=44), N (%)	Chi-square test P-value
TSH				
Hyperthyroidism	3 (2.94)	3 (5.17)	0 (0.00)	0.227
Normal range	96 (94.12)	54 (93.10)	43 (98.45)	
Hypothyroidism	3 (2.94)	1 (1.72)	2 (4.55)	
BUN				
Low	7 (6.93)	4 (6.90)	3 (6.98)	0.266
Normal	56 (55.45)	36 (62.07)	20 (46.51)	
High	38 (37.62)	18 (31.03)	20 (46.51)	
Serum creatinine				
Low	2 (1.98)	1 (1.72)	1 (2.33)	0.807
Normal	67 (66.3)	40 (68.97)	27 (62.79)	
High	32 (31.7)	17 (29.3)	15 (34.88)	
Potassium				
Low	5 (4.95)	2 (3.45)	3 (6.98)	0.435
Normal	91 (90.1)	52 (89.66)	39 (90.7)	
High	5 (4.95)	4 (6.9)	1 (2.3)	
Calcium				
Low	51 (50.5)	31 (53.45)	20 (46.5)	0.507
Normal	49 (48.5)	26 (44.83)	23 (53.5)	
High	1 (1.0)	1 (1.72)	0 (00)	

**Abbreviations:** TSH, thyroid stimulating hormone; BUN, blood urea nitrogen.

**Table 3** Underlying medical conditions associated with atrial fibrillation

Underlying conditions	All, n (%)	Women (n=58), N (%)	Men (n=44), N (%)	Chi-square test P-value
MI				
Yes	10 (9.8)	4 (6.9)	6 (13.6)	0.257
No	92 (90.2)	54 (93.1)	38 (86.4)	
Congenital HD				
Yes	6 (5.9)	2 (3.4)	4 (9.1)	0.23
No	96 (94.1)	56 (96.6)	40 (90.9)	
RHD				
Yes	33 (32.4)	26 (44.8)	7 (15.9)	0.002*
No	69 (67.6)	32 (55.2)	37 (84.1)	
Diabetes mellitus				
Yes	10 (9.8)	4 (6.9)	6 (13.6)	0.257
No	92 (90.2)	54 (93.1)	38 (86.4)	
Heart diseases (MI/HT/CHD/RHD)				
Yes	79 (77.4)	50 (86.2)	29 (65.9)	0.015*
No	23 (22.6)	8 (13.8)	15 (34.1)	
History of alcohol				
Yes	16 (15.7)	6 (10.3)	10 (22.7)	0.089
No	86 (84.3)	52 (89.7)	34 (77.3)	
History of smoking				
Yes	4 (4.0)	0 (0.00)	4 (9.1)	0.019*
No	98 (96.0)	58 (100.0)	40 (90.9)	
Lung disease				
Yes	2 (2.0)	0 (0.00)	2 (4.6)	0.101
No	100 (98.0)	58 (100.00)	42 (95.4)	
Thyroid disease				
Yes	5 (4.9)	3 (5.2)	2 (4.6)	0.885
No	97 (95.1)	55 (94.8)	42 (95.4)	
Renal disease				
Yes	2 (2.0)	0 (0.00)	2 (4.6)	0.101
No	100 (98.0)	58 (100.0)	42 (95.4)	
Heart failure				
Yes	51 (50.0)	30 (51.7)	21 (47.7)	0.689
No	51 (50.0)	28 (48.3)	23 (52.3)	
Hypertension				
Yes	43 (42.2)	24 (41.4)	19 (43.2)	0.855
No	59 (57.8)	34 (58.6)	25 (56.8)	

Note: \*P-value is significant (<0.05).

Abbreviations: MI, myocardial infarction; HD, heart disease; RHD, rheumatic heart disease; CHD, congenital heart disease; HT, hypertension.

conditions included hypertensive heart disease, congenital heart diseases, myocardial infarction, and rheumatic heart disease, and they were more prevalent in females compared to males (86.2% vs 65.9%,  $P=0.015$ ) (Table 3).

Five (4.9%) patients presented with “lone” AF (ie, no other diagnoses or evidence of underlying cardiac dysfunction). These were mostly males (64.7%) and were younger with a mean age of  $46.1 \pm 18.7$  years. In terms of ventricular response, over 86% of patients had uncontrolled AF (ventricular rate >90 beats per min [bpm]) and this was equally distributed between the males and females studied. Of the four patients with a heart rate <50 bpm, two had sick sinus syndrome.

## Echocardiographic findings of the study participants

An ECHO examination was done in all the participants. The commonest abnormality was chamber dilation (dilation of  $\geq 1$  chambers) documented in 76.8% of all patients. Preserved left ventricular systolic function and diastolic dysfunction were noted in 93 (91.2%) and 27 (26.5%) patients, respectively.

Other ECHO findings in the study participants were rheumatic heart disease in 35 (34.3%), mitral stenosis in 33 (32.3%), dilated cardiomyopathy in 14 (13.7%), ischemic heart disease in eleven (10.8%), and LVH in 35 (34.3%) patients.

Both rheumatic heart disease and mitral stenosis were more prevalent in female participants compared to male participants and this finding was statistically significant (48.3% vs 15.9%,  $P=0.001$  and 46.6% vs 13.6%,  $P<0.001$ , respectively) (Table 4).

## Complications attributable to AF

Heart failure was the commonest complications encountered among the study participants (51 [50%]). Acute thromboembolic stroke and left ventricular systolic and diastolic dysfunction were documented in 13 (12.8%), 7 (6.9%), and

**Table 4** Echocardiographic findings of the study participants

Echo diagnosis	All, n (%)	Women (n=58), N (%)	Men (n=44), N (%)	Chi-square test P-value
LVH				
Yes	35 (34.3)	21 (36.2)	14 (31.8)	0.644
No	67 (65.7)	37 (63.8)	30 (68.2)	
RHD				
Yes	35 (34.3)	28 (48.3)	7 (15.9)	0.001*
No	67 (65.7)	30 (51.7)	37 (84.1)	
MS				
Yes	33 (32.3)	27 (46.6)	6 (13.6)	<0.005*
No	69 (67.7)	31 (53.4)	38 (86.4)	
IHD				
Yes	11 (10.8)	5 (8.6)	6 (13.6)	0.419
No	91 (89.2)	53 (91.4)	38 (86.4)	
DCM				
Yes	14 (13.7)	6 (10.9)	8 (18.6)	0.280
No	84 (82.4)	49 (89.1)	35 (81.4)	
EF				
<35	7 (6.9)	4 (6.9)	3 (7.1)	0.962
$\geq 35$	93 (91.2)	54 (93.1)	39 (92.9)	
E/A				
<0.7	27 (26.5)	16 (27.6)	11 (25.0)	0.769
$\geq 0.7$	75 (73.5)	42 (72.4)	33 (75.0)	

Note: \*P-value is significant (<0.05).

Abbreviations: LVH, left ventricular hypertrophy; RHD, rheumatic heart disease; MS, mitral stenosis; IHD, ischemic heart disease; DCM, dilated cardiomyopathy; EF, ejection fraction; E/A, ratio of the early (E) to late (A) ventricular filling velocities on echocardiography.

**Table 5** Complications of patients with AF admitted at Mulago Hospital medical wards

Complication	Total, n (%)	Women n (%)	Men n (%)	Chi-square test P-value
Rehospitalization	41 (40.2)	21 (36.2)	20 (45.5)	0.3459
Stroke				
Yes	13 (12.8)	7 (12.1)	6 (13.6)	0.814
No	89 (87.2)	51 (87.9)	38 (86.4)	
Heart failure				
Yes	51 (50.0)	30 (51.7)	21 (47.7)	0.689
No	51 (50.0)	28 (48.3)	23 (52.3)	
Poor quality of life				
Grade 1	1 (0.99)	1 (1.72)	0 (0.00)	0.093
Grade 2	19 (18.81)	10 (17.24)	9 (20.93)	
Grade 3	41 (40.59)	29 (50.00)	12 (27.91)	
Grade 4	40 (39.60)	18 (31.03)	22 (51.16)	
LV dysfunction Based on EF				
Yes	7 (7.0)	4 (6.9)	3 (7.1)	0.962
No	93 (93.0)	54 (93.1)	39 (92.9)	
LV dysfunction Based on E/A ratio				
Yes	20 (19.6)	12 (21.1)	8 (19.1)	0.806
No	79 (79.8)	45 (78.9)	34 (80.9)	
LV dysfunction (combined EF and E/A)				
Yes	20 (19.6)	12 (21.1)	8 (19.1)	0.806
No	79 (79.8)	45 (78.9)	34 (80.9)	
Death				
Yes	10 (9.8)	5 (8.6)	5 (11.4)	0.645
No	92 (90.2)	53 (91.4)	39 (88.6)	

**Abbreviations:** AF, atrial fibrillation; LV, left ventricular; EF, ejection fraction; E/A, ratio of the early (E) to late (A) ventricular filling velocities on echocardiography.

20 (19.6%) patients, respectively. Forty one (40.2%) patients had a history of readmission due to AF. Of the enrolled patients, ten (9.8%) died within 3 days following admission (Table 5).

## Stroke risk stratification

We used the recently validated CHADS2 score to stratify patients for stroke risk. Out of 102 participants, the majority had moderate risk (58 [56.9%]). High stroke risk was noted in 18 (17.7%) patients while 26 (25.5%) had a low risk. A secondary analysis of the 13 patients who had stroke, using the CHADS2 stroke risk stratification, showed that ten (76.9%) patients had a high stroke risk while three (23.1%) had a moderate risk.

## Discussion

To our knowledge, this is the first study to describe the clinical profile and complications of patients presenting with AF in Uganda, a country with a rising burden of cardiovascular diseases.

In regards to the mean age of the study participants, the findings of our descriptive survey were similar to what was noted in studies done in Cote d'Ivoire, South Africa, and India.<sup>7,8,15</sup> The mean age of the study participants was comparable to what was documented in the above studies (52±21.3 years), reflecting a younger patient population with AF in SSA. Studies from Cameroon and Kenya documented a higher mean age of 65.8±13 years and 67.8±17.1 years, respectively.<sup>9,10</sup>

A female predominance was noted in our study (56.9%) similar to studies performed in South Africa (61%), Cameroon (56.4%), and India (55.5%).<sup>8,9,15</sup> Studies from Cote d'Ivoire and Kenya had more males presenting with AF (56% and 52%, respectively).<sup>7,10</sup> This female predominance in our study could probably be explained by the sex-based differences in underlying etiologies of AF in our study. Rheumatic heart disease and mitral stenosis were more prevalent among female patients.

## Clinical presentations of the study participants

Palpitations, dyspnea, and chest pain were the most prominent symptoms reported, occurring in 84.3%, 68.6%, and 49% of the patients, respectively. A high frequency of symptoms related to a rapid heart rate, ie palpitations, syncope, dizziness, and fatigue (32%), was reported in the study participants in Kenya.<sup>10</sup> Among the 158 (92%) patients with AF who reported with symptoms of heart failure in the study done in Cameroon, dyspnea was the most prevalent occurring in 72.1% of the patients.<sup>9</sup> Other symptoms were palpitations in 46.5% and malaise in 20.9% of the patients. Dyspnea was also the commonest reported symptom in the study done in Cote d'Ivoire.<sup>7</sup>

The most prominent documented clinical signs in the study participants (50%) were congruent with heart failure. This noted high frequency of heart failure is similar to what was documented in Cote d'Ivoire (62.6%), South Africa (56%), and Cameroon (49.4%).<sup>7-9</sup> Studies from Kenya and People's Republic of China on patients presenting with AF reported relatively low frequency of heart failure of 38% and 33.1%, respectively.<sup>10,16</sup>

## Coexisting medical conditions or risk factors

Hypertension in our study was the most prevalent coexisting medical condition, noted in 43 (42%) study participants. This is consistent with findings from majority of the recent studies on AF in developing countries that have also documented hypertension as the most prevalent coexisting medical



condition. This is in contrast to the past notion that rheumatic heart disease is the commonest.<sup>7,9,10,16–19</sup>

However, rheumatic heart disease was noted to be the commonest coexisting medical condition in a similar study done in North India, reported in 61.3% of the patients.<sup>15</sup> Only 14.6% of the patients were documented to have hypertension with 10.2% having hypertensive heart disease on ECHO. With the exception of heart failure in the study from South Africa, a significant proportion of patients with AF had rheumatic heart disease (21%) compared to those with hypertensive heart disease (19%).<sup>8</sup>

Other coexisting medical conditions reported among the study participants in our study were rheumatic heart failure (32%), diabetes mellitus, and myocardial infarction (both in 9.8% of the patients). Lung disease of any form and pre-existing thyroid dysfunction were very infrequent, reported in only 2% and 4.9% of the patients, respectively.

Thyroid dysfunction has been noted to be very uncommon among patients with AF in most studies done in developing countries. Studies reported from Kenya, People's Republic of China, Pakistan, and Brazil have reported prevalence of 3.7%, 2.5%, 7.5%, and 14.3%, respectively.<sup>10,16,20,21</sup>

It is worth noting that coronary artery disease is also very infrequent among African patients presenting with AF. Prevalence of 6.5%, 6.4%, 19%, and 6.6% have been documented in studies done in South Africa, Cameroon, Kenya, and Ethiopia, respectively.<sup>8–10,19</sup> The probable explanations are lower mean total cholesterol or low-density lipoprotein cholesterol concentrations and lower frequencies of smoking among the African patients compared to their contemporaries in developed countries. We did not assess lipid profiles in our study. Only 3.9% of the study participants gave a history of smoking and all were male.

The intimate relationship between hypertension and AF has been extensively described in medical literature. Long standing uncontrolled hypertension is often associated with left ventricular diastolic and systolic dysfunction. This subsequently results in increased left atrial pressure and left atrial enlargement. The latter is a precursor of AF. Hypertension is also associated with renin–angiotensin–aldosterone system activation which increases oxidative stress and inflammation. This collectively augments atrial fibrosis and cellular hypertrophy increasing the risk of AF.<sup>22</sup>

## Complications attributed to AF

Regarding complications associated with AF, heart failure of any form (50%) and recurrent hospital admissions (40.2%) were the most prevalent. Thromboembolic stroke

was noted in 13 (12.8%) patients. Stroke risk stratification of these patients using the CHADS score revealed that majority (10 [76.9%]) had a high stroke risk. This high frequency of thromboembolic stroke was similar to what was documented in the Cameroonian (17.4%), Chinese (17.5%), and Ethiopian (15.4%) studies.<sup>9,16,19</sup> This magnitude of stroke among patients with AF is outstandingly higher than what has been documented in the developed countries. In one prospective study reported from Geneva, Switzerland, stroke was prevalent in only 2.6% of the patients.<sup>23</sup> This disparity could be explained by the probable suboptimal use of oral anticoagulant therapy among patients with AF in the developing countries.<sup>5,16,24</sup> This calls for policies and guidelines aimed at improving treatment of AF in these countries.

In our study, ten (9.8%) patients with AF died within 3 days of admission. Although no postmortem examinations were done, we presume the causes of death were of cardiovascular nature because all the patients who died had severe heart failure (New York Heart Failure class III and IV). Another probable documented cause of death was severe hypostatic pneumonia.

A high mortality rate in patients with AF has also been revealed in the Cameroonian study compared to low rates in European countries (<4%), Switzerland (2.6%), and France (ALPHA study in France [1.8%]).<sup>9,23,25</sup> This signifies that AF in African patients is more severe and is associated with more adverse outcomes. This high rate of mortality in Africa could also be explained by the suboptimal use of oral anticoagulant therapy due to economic reasons, difficulties in performing international normalized ratio (INR) to assess adequate anticoagulation, and presence of uncontrolled hypertension, a documented relative contraindication. Other factors that could explain the higher rate of mortality are the higher prevalence of rheumatic heart disease and increased severity of comorbidities like uncontrolled hypertension.

In a study done in Cameroon, out of 88 patients who were followed up for a mean period of 318±124 days, 26 (29.5%) died. This proportion was higher than what was registered in our study, probably because of our shorter period of assessment for mortality (3 days vs 318±124 days). A low rate of use of oral anticoagulant therapy was noted in the study from Cameroon. Only three (11.5%) of the 26 patients who died were on oral anticoagulant therapy.<sup>9</sup>

In the Kenyan study, despite 64.7% of patients having a CHADS score ≥2, 21.2% of these patients did not receive any form of anticoagulant therapy.<sup>10</sup> We however noted a moderately good prescription rate of oral anticoagulant therapy in our study. Approximately, 53% of patients with at least

one stroke risk factor received therapy. These rates of use of the recommended therapy are, nevertheless, still lower than what is reported from studies from some developed countries (88% in Switzerland).<sup>23</sup>

Combined left ventricular diastolic and systolic dysfunction was also frequent in the study participants, noted in 20 (19.6%) cases. Diastolic and systolic dysfunction in isolation occurred in 19.6% and 6.9% of the patients, respectively. Similar studies from South Africa, Cameroon, and People's Republic of China have reported a higher proportion of patients with systolic dysfunction (22.7%, 30%, and 35% respectively) compared to our study.<sup>8,9,16</sup>

## Study limitations

This cross-sectional study was designed to assess the clinical characteristics and complications of patients with AF with out a follow-up component; hence, we were unable to classify AF into paroxysmal, persistent, and permanent AF.

It was difficult to verify the precise cause of death because no autopsy studies were done; therefore, causes of death were determined based only on clinical grounds. Due to economic constraints, we did not perform neuroimaging to document the type of stroke and infarct size.

Because Mulago hospital is the only national referral hospital in Uganda where a full-scale cardiology approach is practiced, a selection bias was certainly present because only very sick patients are referred to a cardiologist. This study, hence, excluded those suffering from milder forms of cardiovascular disease or asymptomatic AF in the community as well as noncardiac cases in the hospital. This is particularly relevant when interpreting the estimated rate of case presentations.

We used the CHADS score which is less sensitive compared to the congestive heart failure-hypertension-age  $\geq 75$  years-diabetes mellitus-prior stroke or transient ischemic attack-vascular disease-age of 65–74 years and sex category (CHADS2VASC) score for the lower risk group.

## Conclusion

In this study, we have demonstrated that the clinical presentation of Ugandan patients with AF is more common, severe (more prevalent advanced congestive heart failure, palpitations, recurrent hospital admissions, and incidence of thromboembolic stroke), and occurs at a younger age than in developed countries. It also illustrates the rising prevalence of noncommunicable diseases like hypertension as the commonest risk factor of AF with an already existing high prevalence of rheumatic heart disease, hence a dual

epidemic. AF in Ugandan patients is a predictive factor for both severe stroke and early mortality.

## Recommendations

A meticulous cardiac evaluation for AF should be executed especially in patients with hypertension, rheumatic heart disease, and diabetes mellitus in Uganda. Local guidelines on management of AF should be developed to improve the outcome in patients with AF and reduce adverse outcomes.

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## Author contributions

All authors contributed toward data analysis, drafting and critically revising the paper and agree to be accountable for all aspects of the work.

## Disclosure

The authors report no conflicts of interest in this work.

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