



High Prevalence and Clinical Burden of Atrial Fibrillation among Hypertensive Patients in Central Sudan: A Hospital-Based Cross-Sectional Study

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Abstract

Background: Atrial Fibrillation (AF), the most common sustained cardiac arrhythmia, significantly increases the risk of stroke, heart failure, and mortality. Hypertension (HTN) is a leading risk factor for AF, with hypertensive heart disease being the most common underlying disorder in AF patients. Despite the global rise in AF prevalence, data on its burden and correlates among hypertensive patients in Sudan remain limited. This study aimed to assess the burden and correlates of AF among hypertensive patients attending Al Mek Nimr University Hospital in 2024.

Materials and Methods: A descriptive cross-sectional study was conducted from July to December 2024, enrolling 133 hypertensive patients. Participants were selected using a consecutive sampling technique, with a sample size calculated at a 95% confidence level and a 5% margin of error, assuming an AF prevalence of 10%. Data were collected through structured questionnaires administered via direct interviews. The questionnaire included demographic information, hypertension history, clinical symptoms, comorbidities, and medication use. AF diagnosis was confirmed through ECG and/or medical records. Data were analyzed using SPSS version 25.0, with descriptive statistics, Chi-square tests, and t-tests used to assess associations.

Results: The prevalence of AF among hypertensive patients was 19.5%, with higher rates observed in older adults (37.5% in patients > 75 years) and women (23.2%). Common symptoms of AF included easy fatigue (65.4%) and palpitations (50.0%) ($P = 0.018$). Additionally, 46.2% of AF patients reported a history of stroke ($P = 0.002$), and 42.3% reported loss of independence in performing daily activities ($P = 0.039$), reflecting the significant burden of AF in this population. Comorbidities such as diabetes (34.6%) and obesity (26.9%) were present among AF patients but did not show statistically significant associations. Although 65.4% of AF patients were on anticoagulants, a notable proportion (34.6%) remained untreated, likely due to recent diagnosis, acute stroke presentation, or contraindications, highlighting a gap in thromboembolic risk management. Diuretics were more commonly used in AF patients (38.5%) compared to non-AF patients ($P = 0.003$), while the use of RAAS inhibitors (ACEIs and ARBs) was low (10.5% and 35.3%, respectively).

Conclusion: This study highlights the high burden of AF among hypertensive patients, especially in older individuals. The strong associations with stroke and functional decline underscore the need for systematic AF screening, optimized anticoagulation, and increased use of RAAS inhibitors in this high-risk population.

Keywords: Atrial Fibrillation; Hypertension; Prevalence; Sudan; Stroke Burden; Anticoagulation.

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INTRODUCTION

Atrial Fibrillation (AF) is the most common sustained cardiac arrhythmia in clinical practice, significantly elevating the risk of death, heart failure, hospitalization, and thromboembolic events, particularly stroke [1]. It represents a growing global health challenge, with a systematic review estimating that 33.5 million individuals were affected worldwide in 2010, a number projected to rise substantially [2]. Hypertension stands as the most prevalent and potent modifiable risk factor for AF. Longitudinal data indicate that hypertension increases AF risk by approximately 1.42-fold [3]. Given the high population prevalence of hypertension, hypertensive heart disease constitutes the primary underlying pathology in most AF patients [4]. Globally, hypertension affects around 32% of adults aged 30-79 years, with suboptimal control rates remaining a persistent issue [5]. The reported prevalence of AF among hypertensive populations varies significantly



across regions, influenced by demographics, detection methods, and healthcare contexts. A meta-analysis estimates a range of 5-15% [6]. European registries report figures around 8-10% [7], while studies from China suggest a lower prevalence of about 3.5% [8]. In Sudan and similar sub-Saharan African settings, cardiovascular diseases are a leading cause of morbidity and mortality. Hypertension is highly prevalent, yet data on its complications—including AF—are critically scarce. This gap is concerning, as AF in resource-limited settings often presents late, with a high burden of preventable complications like stroke, leading to significant disability and economic strain. This study therefore, aimed to assess the prevalence, identify associated correlates, and characterize the clinical burden of AF among hypertensive patients attending a major tertiary hospital in Central Sudan. The findings will provide essential evidence to inform targeted screening strategies, optimize management protocols, and guide public health planning to address this growing cardiovascular challenge in the region.

METHODS

Study Design, Setting, and Duration

A hospital-based, descriptive cross-sectional study was conducted at Al Mek Nimr University Hospital in Shendi, Sudan, from July to December 2024.

Study Population and Sampling

The study included hypertensive patients aged 18 years and above. Exclusion criteria were: refusal to participate, AF diagnosis before hypertension, and valvular or congenital heart disease. Consecutive sampling was used. The sample size was calculated as 139 using the formula for a single proportion (95% CI, 5% margin of error, 10% expected prevalence). A total of 133 participants were enrolled.

Data Collection and Study Variables

Data were collected through face-to-face interviews using a structured questionnaire, in addition to a comprehensive review of participants' medical records. The collected variables encompassed sociodemographic

characteristics (age, sex, and educational level), detailed clinical history including duration of hypertension, symptoms suggestive of atrial fibrillation (such as palpitations, fatigue, dyspnea, and chest pain), prior history of stroke, and previous hospitalizations. Information regarding comorbid conditions was also obtained, including diabetes mellitus, obesity (defined as body mass index > 30 kg/m²), ischemic heart disease, chronic kidney disease, thyroid disorders, and smoking status. Furthermore, data on current medications were documented, particularly antihypertensive therapies (calcium channel blockers, angiotensin receptor blockers, angiotensin-converting enzyme inhibitors, beta-blockers, and diuretics) as well as anticoagulant use. The primary study outcome was the diagnosis of atrial fibrillation, which was confirmed by a standard 12-lead Electrocardiogram (ECG) or documented evidence in the medical record.

Data Analysis

Data were analyzed using SPSS v25.0. Descriptive statistics were presented as frequencies (percentages) or mean ± SD. Bivariate analysis used Chi-square tests (or Fisher's exact test) for categorical variables and independent t-tests for continuous variables. A *p*-value < 0.05 was considered statistically significant.

RESULTS

A total of 133 hypertensive patients were enrolled in this study, with a mean age of 64.2 ± 11.5 years. Females constituted 61.7% of the cohort. The majority of participants (73.7%) were aged 56 years or older, and nearly three-quarters (73.6%) had primary education or less. The baseline sociodemographic characteristics of the study population (Table 1).

The overall prevalence of atrial fibrillation among hypertensive patients was 19.5% (26/133). The prevalence increased progressively with age, reaching its highest level among patients older than 75 years (37.5%). Although AF was more common in women than in men (23.2% vs. 13.7%), this difference was not statistically significant (*P* = 0.261). The distribution of AF according to age and sex (Table 2).

Patients with AF experienced a higher symptom burden and greater functional impairment compared to those without AF. Easy fatigue and palpitations were the most frequently reported symptoms. A history of stroke and loss of independence were significantly more common among AF patients. A detailed comparison of symptoms and clinical burden between AF and non-AF patients (Table 3).

Several cardiometabolic comorbidities were common in this cohort, particularly diabetes mellitus and obesity. However, none of the assessed comorbid conditions showed a statistically significant association with AF status. The distribution of comorbidities according to AF status (Table 4).

Patterns of antihypertensive and antithrombotic medication use differed between AF and non-AF patients. Calcium channel blockers were the most frequently prescribed drugs overall, while diuretics and anticoagulants were used significantly more often in AF patients. Detailed medication uses by AF status (Table 5).

DISCUSSION

This study reveals a high burden of AF (19.5%) among hypertensive patients in Central Sudan, exceeding rates from many international studies [9,10]. The strikingly high AF prevalence in our cohort may be attributed to multiple factors characteristic of our setting. These include likely delayed diagnosis of hypertension, suboptimal blood pressure control due to medication non-adherence or affordability issues, and a high burden of untreated comorbidities. The hospital-based design, capturing more severe cases, may also contribute to this elevated figure compared to community-based studies. The age-dependent increase in AF prevalence, peaking at 37.5% in those > 75 years, aligns with global

Table 1: Baseline Sociodemographic Characteristics (N = 133).

Characteristic	Category	No	%
Age Group	18-40 years	7	5.3
	41-55 years	28	21.1
	56-65 years	34	25.6
	66-75 years	40	30.1
	> 75 years	24	18.0
Sex	Male	51	38.3
	Female	82	61.7
Education	Illiterate	49	36.8
	Primary	49	36.8
	Secondary	27	20.3
	University	8	6.0



Table 2: Prevalence of Atrial Fibrillation According to Age Group and Sex.

Characteristic	AF Present n (%)	AF Absent n (%)	Total	P-value
Age Group				
18-40 years	1 (14.3)	6 (85.7)	7	0.144
41-55 years	4 (14.3)	24 (85.7)	28	
56-65 years	4 (11.8)	30 (88.2)	34	
66-75 years	8 (20.0)	32 (80.0)	40	
> 75 years	9 (37.5)	15 (62.5)	24	
Sex				
Male	7 (13.7)	44 (86.3)	51	0.261
Female	19 (23.2)	63 (76.8)	82	
Total	26 (19.5)	107 (80.5)	133	

Table 3: Distribution of Symptoms and Clinical Burden According to Atrial Fibrillation Status.

Symptom/Burden	AF Patients	Non-AF Patients	P-value
Symptoms			
Palpitations	13 (50.0)	27 (25.2)	0.018
Easy Fatigue	17 (65.4)	50 (46.7)	0.096
Dyspnea	11 (42.3)	34 (31.8)	0.317
Chest Pain	6 (23.1)	25 (23.4)	0.976
Clinical Burden			
History of Stroke	12 (46.2)	19 (17.8)	0.002
Loss of Independence	11 (42.3)	24 (22.4)	0.039
≥3 Hospitalizations/year	7 (26.9)	14 (13.1)	0.078

Table 4: Distribution of Comorbidities by AF Status.

Comorbidity	AF Patients	Non-AF Patients	P-value
Diabetes Mellitus	9 (34.6)	41 (38.3)	0.730
Obesity (BMI ≥30)	7 (26.9)	32 (29.9)	0.766
Ischemic Heart Disease	6 (23.1)	18 (16.8)	0.465
Chronic Kidney Disease	3 (11.5)	21 (19.6)	0.341

Table 5: Antihypertensive and Anticoagulant Medication Use According to Atrial Fibrillation Status.

Medication Class	All Patients	AF Patients	Non-AF Patients	P-value
Antihypertensives				
CCBs	88 (66.2)	16 (61.5)	72 (67.3)	0.577
ARBs	47 (35.3)	9 (34.6)	38 (35.5)	0.933
ACEIs	14 (10.5)	3 (11.5)	11 (10.3)	0.849
Beta-blockers	33 (24.8)	9 (34.6)	24 (22.4)	0.210
Diuretics	23 (17.3)	10 (38.5)	13 (12.1)	0.003
Antithrombotics				
Any Anticoagulant	22 (16.5)	17 (65.4)	5 (4.7)	< 0.001



patterns of atrial aging and fibrosis [11]. The higher prevalence in women (23.2%) contrasts with some older studies but aligns with contemporary understanding of women's longer lifespan and the potentiated effect of hypertension on AF risk in women [12-16].

The profound clinical burden is starkly highlighted by our findings: 46.2% of AF patients had a history of stroke, and 42.3% reported loss of independence. The finding that 46.2% of AF patients had prior stroke suggests that many likely presented with stroke as their first manifestation of AF, highlighting the critical need for proactive screening. These figures substantially exceed those in developed settings and underscore AF's devastating impact in resource-limited contexts where rehabilitation services are scarce. The significant association between AF and stroke ($P = 0.002$) reinforces the critical importance of effective stroke prevention strategies. Our medication analysis reveals critical gaps. The high diuretic use in AF patients (38.5% vs 12.1%, $P = 0.003$) likely reflects disease severity markers (heart failure, resistant hypertension) rather than causation. More concerning is the relatively low utilization of renin-angiotensin-aldosterone system (RAAS) inhibitors (both ACE inhibitors and ARBs), representing missed opportunities for upstream prevention of atrial fibrillation, as supported by multiple meta-analyses [17-20]. This practice gap may stem from cost, availability, or knowledge barriers requiring targeted intervention. While 65.4% of AF patients were on anticoagulants, suggesting reasonable clinician awareness, the remaining 34.6% untreated represents a vulnerable population. Contextual factors including recent diagnosis, stroke presentation (contraindication), and bleeding concerns likely contribute. Systematic implementation of CHA₂DS₂-VASc scoring and careful net benefit assessment could optimize management [21].

The lack of significant associations between AF and traditional comorbidities (diabetes, obesity, etc.) likely reflects limited statistical power rather than true absence of a relationship. Larger studies are needed to clarify these associations in our population. Strengths of this study include its focus on an under-researched population, the use of confirmed ECG-based diagnosis for AF, and the comprehensive assessment of clinical burden. However, several limitations must be acknowledged. The cross-sectional design precludes causal inference. The hospital-based sampling method may introduce selection bias, potentially overestimating prevalence by including sicker patients. The modest sample size, particularly of the AF subgroup ($n = 26$), limited the statistical power to detect significant associations for some correlates. Finally, as a single-center study, generalizability to other Sudanese or African settings may be limited.

CONCLUSION

This study demonstrates a markedly elevated prevalence of atrial fibrillation among hypertensive patients in Central Sudan, substantially exceeding many international reports. The exceptionally high stroke burden among AF patients reflects delayed diagnosis and inadequate primary prevention strategies. The exceptionally high rates of stroke and functional dependence among patients with AF highlight the devastating consequences of delayed detection and suboptimal preventive care in this setting. Despite the availability of effective therapies, important gaps remain in the use of RAAS inhibitors and anticoagulation. These findings underscore the urgent need for systematic AF screening, improved hypertension management, and optimized stroke prevention strategies to reduce AF-related morbidity and disability in resource-limited settings.

RECOMMENDATIONS

Given the high prevalence of Atrial Fibrillation (AF) and its strong association with stroke among hypertensive patients, routine AF screening—particularly for individuals aged ≥ 65 years—should be integrated into standard hypertension care. Opportunistic pulse assessment and periodic ECG evaluation are recommended for early

detection. Blood pressure management should adhere to guideline-based therapy, with greater emphasis on RAAS inhibitors for patients at increased risk of AF. Stroke prevention strategies should include systematic use of validated risk stratification tools, such as the CHA₂DS₂-VASc score, to guide anticoagulation decisions. Furthermore, strengthening healthcare provider training, enhancing public awareness of AF symptoms and blood pressure control, and conducting larger multi-center studies—including the establishment of a national AF registry in Sudan—are essential to improve long-term monitoring, management, and outcomes.

CONSENT

Written informed consent was obtained from all participants.

ETHICAL CONSIDERATIONS

Ethical approval was obtained from the Sudan Medical Specialization Board. Institutional permission was granted by the Director of Al Mek Nimr University Hospital. Written informed consent was obtained from all participants before inclusion. The study adhered to the Declaration of Helsinki principles.

COMPETING INTERESTS

The authors have declared that no competing interests exist.

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