

# Atrial fibrillation among adult Saudi patients with chronic heart failure: Tertiary center experience

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## ABSTRACT

**Objective:** To estimate the rate of atrial fibrillation (AF) among adult patients with chronic heart failure (HF) from Saudi Arabia, and to identify the clinical and the demographic characteristics.

**Methods:** This study was performed using all medical records of patients registered in Prince Sultan Cardiac Center in Qassim, Saudi Arabia, and diagnosed with HF during the period from January 1, 2010 to June 30, 2014. The review process included patients diagnosed with chronic HF who were registered for follow-up during the study period. The rate of AF was calculated, and the associated risk factors were determined.

**Results:** The rate of AF among chronic HF ( $n = 70$ ) patients was 14.9%. The rate of AF was higher among males (15.7%) than females (12.5%). In both genders, the rate of AF rose with advancing age, and in each age stratum, it was higher in males than females. The rate of AF was higher if chronic HF was associated with chronic diseases, such as diabetes mellitus (DM, 14.3%), hypertension (HTN, 20%), and none of the patients had a history of chronic kidney disease.

**Conclusion:** The rate of AF with chronic HF is high among Saudi Arabia patients. It is higher among male patients and HTN and DM patients.

**Keywords:** Heart failure, atrial fibrillation, Saudi Arabia, adult

## Introduction

Atrial fibrillation (AF) is a supraventricular tachyarrhythmia characterized by uncoordinated atrial activation leading to ineffective atrial contraction. AF represents an important clinical problem with related to significant health and social issues. It can be complex and challenging for clinicians to manage. It can also lead to frequent hospitalizations, hemodynamic abnormalities, and thromboembolic events resulting in significant morbidity and mortality and impact negatively on the patients' quality of life.<sup>[1,2]</sup>

The number of AF patients has been increasing worldwide. A study from New Zealand in 1999 reported 10.4% as the prevalence of AF admissions.<sup>[3]</sup> The prevalence of AF increases with aging. The Feinberg analysis, which is based on other four epidemiological studies, indicated that the prevalence of AF was increased with age by 2.3% and 5.9% in the population aged >40 years and >65 years, respectively.<sup>[4]</sup> The further increase in the prevalence and the incidence of AF with the aging of the population are predicted in the future.<sup>[5]</sup>

AF has many etiologies, and it may develop in the presence of many controllable and non-controllable risk factors. Chronic

diseases such as certain heart diseases, hypertension (HTN), diabetes mellitus (DM), and hyperthyroidism are considered as controllable risk factors. Congenital heart diseases, aging, and family history are considered as non-controllable risk factors. At present, the prevalence of both chronic HF and AF is increasing since these two conditions share common risk factors.<sup>[6,7]</sup> As a risk factor, heart failure (HF) comes at the second place after HTN. A study of electrical ALternans in Patients with HF (ALPHA) shows the AF prevalence exceeds 20% in HF patients thus demonstrates an association between AF and chronic HF.<sup>[8]</sup>

The studies about the magnitude of the AF problem among the Saudi Arabia population are lacking. Therefore, this study aims to (1) estimate the rate of AF among chronic HF patients and (2) identify the associated risk factors, clinical characteristics, and the demographic risk factors.

## Materials and Methods

The single-center retrospective study was performed using hospital-based data from the heart function clinic at prince sultan cardiac center in Qassim (PSCCQ), Saudi Arabia. This center was selected since it is the only specialized and

referral center that deals with cardiac problems in the region. The medical records of all the patients who were diagnosed with chronic HF between January 01, 2010 and December 31, 2014 (=74 files) were reviewed. Ethical approval was obtained from the Institutional Review Board at PSCCQ research center. Participants' confidentiality of information was assured by excluding names and identifiers in the data extraction sheets. Information from records was used for research purpose only.

The registered medical records of the patients included which fulfilled the following characteristics: (1) The availability of demographic factors (age, nationality, residence, gender, and body mass index) and accordingly patients were grouped into three categories normal 18.5–24.9 Kg/m<sup>2</sup>, overweight 25–29.9 Kg/m<sup>2</sup>, and obese 30 Kg/m<sup>2</sup>, or greater). (2) The etiology of HF and patients risk profile, including DM, HTN, and chronic kidney disease (CKD) depending on the medication use. (3) Saudi Arabia nationals, adult (ages 18–65 years), having at least one etiology for HF development. The HF stages were classified according to New York Heart Association (NYHA) class. The records of 70 Saudi patients' were selected after excluding who dissatisfy the inclusion criteria. Three files were excluded because of non-availability of required data and one pediatric patient.

Data extraction sheet was used for data collection, including the demographic data, data related to the frequency of follow-up, risk profile, etiology and NYHA class of HF, history of medical intervention, and the report for registering the occurrence of AF. Data collectors were trained about the study objectives and the study procedure. Data collection sheet for each patient was extracted by one of the members of the research team and revised by another team member. Furthermore, data extraction sheets were validated by experts in the Heart Function Clinic and piloted to meet the research criteria.

The SPSS software for Windows (SPSS, version 22, Chicago, IL) was used for statistical analysis. The rate of AF among HF patients was calculated. Description of the study population was analyzed according to demographic risk profile and cardiac clinical characteristics. Cross-tabulation and significance analysis about AF rate were also produced. Chi-square and Fisher's exact tests were used. Data presented as mean±standard deviation and a  $P < 0.05$  was considered as statistically significant.

## Results

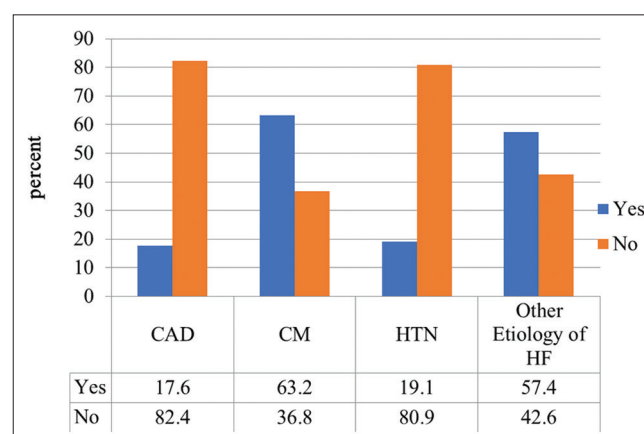
### Demographic and etiologic factors associated with HF development

The demographic and clinical characteristics of the study population are presented in Table 1.

The etiologies behind the chronic HF in the patients are divided clinically into HTN, CM, coronary artery disease

(CAD), and others, including congenital heart diseases and VHD. Among all HF patients, cardiomyopathy (CM) patients have the highest rate 63.2% of HF. Different HF etiologies are presented in Figure 1.

Analysis of study population found that most elderly patients were presented with CM (39.4%), HTN (36.4%), and CAD (27.3%). On the other hand, other etiology, including congenital heart diseases and VHD were 21.2% among elderly. Regarding the gender, the most common cause of HF among males was CM (55.8%). However, HTN was accounted for 23.1% and CAD for 21.2% of HF and other etiologies were causing HF in 17.3% of male patients. With smoking habit,



**Figure 1:** Distribution of patients by etiology of HF, M patients has the highest percentage (63.2%) as an etiology for HF. The HTN and CAD patients were presented with HF by 19.1% and 17.6%, respectively. HF: Heart failure, CAD: Coronary artery disease, CM: Cardiomyopathy, HTN: Hypertension

**Table 1:** Demographic and clinical characteristics of HF patients

Characteristics	Mean±SD
Age (years)	44.7±12.9
Duration of follow-up (years)	1.3±1.0
Number of hospital admissions	2.1±1.6
Number of ER admissions	1.8±1.7
BMI (kg/m <sup>2</sup> )	29.6±5.8
Ejection fraction (%)	27.7±12.6
Characteristics	n (%)
Male	54 (77.1)
Female	16 (22.9)
Smoker	8 (11.8)
DM	43 (63.2)
HTN	32 (47.0)
CKD	12 (17.6)
Beta-blockers users	58 (86.6)
ACEI ARBs users	62 (92.5)
Diuretics users	63 (94.0)

ER: Emergency room, BMI: Body mass index, DM: Diabetes mellitus, HTN: Hypertension, CKD: Chronic kidney disease, ACEI: Angiotensin-converting enzyme inhibitors, ARBs: Angiotensin receptor blockers

half of the smokers were presented with CM. Approximately, 1/4 of the smoker patients (25%) were presented with HTN.

### Rate of AF among HF patients

During the study period (~4 years), 10 cases had developed AF according to the electrocardiography findings; the prevalent cases were 14.9%. Investigation of general practitioner files identified another 57 patients with other arrhythmias, e.g., left bundle branch block and atrial flutter. The rate of AF varied markedly on the basis of the underlying diagnosis. The rate of AF was 16.3% and 16.7% in patients with HF caused by CM and HTN, respectively.

The highest rate of AF (18.8%) was in elderly group patients [Table 2]. Furthermore, there was the gender-based distribution of AF since male patients exhibit a higher rate (15.7%) than female patients (12.5%). Out of total obese patients (n = 23), only 4 patients developed AF. One-fourth of smoker patients developed AF [Table 2].

### Distribution of AF by class of HF

The population was classified according to NYHA class into 4 Classes: 28.8%, 40.9%, 27.3%, and 3.0% in Class I, Class II, Class III, and IV, respectively. The prevalence of AF was increased with increasing the NYHA class. The prevalence of AF increases from NYHA Class I HF (15.8%) to Class IV HF (~50%).

### Risk of AF among patients with chronic diseases

Chronic diseases are one of the risk factors for developing AF and affect the rate of AF and worsen the cardiac functions. Chronic diseases were present in the total HF patients as 63.2% DM, 47.1% HTN, and 17.6% with CKD. The rate of AF was 14.3 % in patients with a history of DM and 20% among HTN patients [Table 3].

### Prognosis of AF

A complication of HF includes stroke in 11.8% patients. The AF rate among patients with stroke is shown in Figure 2.

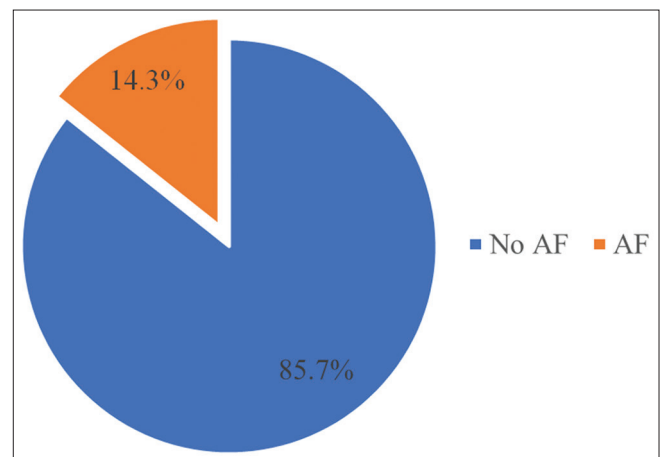
### Discussion

The relationship between the AF and its underlying causes may be explained by different mechanisms according to various theories such as re-entry (circus movement), branching theory (chain reaction), and ectopic focus (related to ischemia).<sup>[9]</sup> In heart diseases, there is a decrease in conduction velocity, which allows enough time for the sinoatrial node (SAN) to recover from the refractory period that causes re-entering of impulse result in a new excitation wave.<sup>[10]</sup> That explained the high rate of AF in HF patients. In 2000, Hokkaido *et al.* reported the prevalence of AF 14% among 19,825 patients.<sup>[11]</sup> The percentage determined in our study (14.9%) is similar to studies mentioned above.

**Table 2:** Distribution of AF patients regarding the demographic factors

Demographic factors and its classification	ECG (%)		P
	AF	Non AF	
Age (years)			
≤30 (n=13)	2 (15.4)	11 (84.6)	0.65**
31-49 (n=21)	2 (9.5)	19 (90.5)	
≥50 (n=32)	6 (18.8)	26 (81.3)	
Gender			
Male (n=51)	8 (15.7)	43 (84.3)	1.000*
Female (n=16)	2 (12.5)	14 (87.5)	
BMI			
Normal weight (n=13)	3 (23.1)	10 (76.9)	0.448**
Overweight (n=24)	2 (8.3)	22 (91.7)	
Obese (n=23)	4 (17.4)	19 (82.6)	
Smoking			
Non-smoker (n=51)	7 (13.7)	44 (86.3)	0.71**
Ex-smoker (n=7)	1 (14.3)	6 (85.7)	
Smoker (n=8)	2 (25.0)	6 (75.0)	

ECG: Electrocardiography, AF: Atrial fibrillation, BMI: Body mass index, \*Fisher's exact test was used, \*\*Chi-square test was used



**Figure 2:** AF prevalence among patients having stroke. The prevalence of AF in patients who developed stroke was 14.3%, AF: Atrial fibrillation

The majority of HF cases in the present study are reported in the elderly patients because of the increasing occurrence of various chronic and cardiovascular diseases with aging which contribute to HF and eventually AF. Aging leads to artery rigidity, causing an increase in blood pressure and heart load resulting in atrial dilatation with high liability to fibrillate.<sup>[12]</sup> All of these aging processes lead to raise the rate of AF in elderly patients as presented in this study. Our finding that the prevalence of AF increases with aging is in agreement with another study.<sup>[13]</sup>

Obesity, a controllable risk factor, is increasing worldwide.<sup>[14]</sup> It is associated with different heart diseases such as HF and

**Table 3:** History of Chronic Diseases in HF Patients

Chronic diseases	History	ECG (%)		P Value
		AF (n=10)	Non AF (n=56)	
DM	NON - DM (n=24)	4 (16.7)	20 (83.3)	1.000*
	DM (n=42)	6 (14.3)	36 (85.7)	
HTN	NON - HTN (n=36)	4 (11.1)	32 (88.9)	0.49*
	HTN (n=30)	6 (20)	24 (80)	
CKD	NON - CKD (n=55)	10 (18.2)	45 (81.8)	0.19*
	CKD (n=11)	0 (0.0)	11 (100.0)	

ECG: Electrocardiography, AF: Atrial fibrillation, DM: Diabetes Mellitus, HTN: Hypertension, CKD: Chronic kidney disease. \* Fisher's exact test was used

arrhythmia<sup>[15]</sup> and leads to AF. In addition, the AF in obese individuals may cause dilatation of the left atrium.<sup>[16]</sup> Population-based studies suggest that there was 49% increased the risk of AF development among obese individuals.<sup>[17]</sup> However, our study shows that normal weight patients develop AF more than obese patients, unexpectedly. Our findings are in contrast to other studies may be due to the small sample size.

Smoking is usually associated with the development of atherosclerotic changes.<sup>[18]</sup> The association between cigarette smoking and the risk of AF was examined in 5,668 subjects, and AF was identified in 371 cases.<sup>[19]</sup> In our study, the rate of AF is 25% with smoking, which was insignificant in comparison to non-smokers.

The associated chronic diseases (HTN, CKD, and DM) are considered as a risk factor that raises the prevalence of AF. HTN is concomitant with atrial changes (widening of the left atrium and reducing conduction speed).<sup>[20]</sup> Therefore, HTN is considered one of the most prevalent causes of AF.<sup>[21]</sup> In this study, the development of AF was more within HTN patients. Unexpectedly, CKD was not associated with AF development, since none of the patients had CKD.

The CM was the leading cause of HF in most of the patients, and the rate of AF was higher in HF patients due to CM. AF can develop with CAD through hyper excited ectopic foci, which can initiate impulses other than normal SAN impulses.<sup>[9]</sup> Chart review of our data report suggests that CAD was leading to HF in 17.6% of the samples with 8.3% AF rates among them. This finding is similar to a study performed on 63,589 patients, which has 12.5% prevalence of AF in CAD patients.<sup>[22]</sup>

AF can cause severe complications as ischemic stroke due to stasis of blood in left atrium that can lead to a cardiac embolus in brain vessels<sup>[23]</sup> which negatively impact patients' lives. In the Framingham study, the proportion of stroke associated with AF was 14.7%.<sup>[24]</sup> In this study, 14.3% of AF cases were complicated with stroke.

This study is based on data derived from Heart Function Clinic at PSCCQ, a newly established clinic, and it was expected to have less number of registered files and missing data. This reflects the small number of subjects included and is

the limitation to our study. The small sample size limited the application of advanced statistical analysis. Since it is a single center data, it is hard for our study to be generalized across the country and required further multi-centers study.

## Conclusion

This epidemiological study concludes that the rate of AF depends on the age and gender of the patients, among patients with clinically diagnosed HF with regular follow-up to the Heart Function Clinic at PSCCQ. This study also found that the rate of AF among Saudi Arabia patients with chronic HF was 14.9%. The rate was higher if there were coexisting demographic and clinical risk factors such as elderly (advancing age), male gender, smoking, and HTN. It is difficult to determine the pre-existing comorbidities that contributed to AF development by this kind of study.

The lower rate of AF in younger patients without other risk factors suggests that the screening of the whole population is not necessary, but targeted screening of older subjects with risk factors to optimize stroke prevention is more beneficial. However, it remains uncertain that how frequent the screening should be performed because this study focuses only on the point prevalence of AF.

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