

REVIEW ARTICLE

# Predictors and outcomes of atrial fibrillation in hospitalized patients in Saudi Arabia: a systematic review

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## ABSTRACT

Atrial fibrillation (AF) is categorized as a supraventricular tachycardia that can lead to hemodynamic instability and even mortality, especially in hospitalized patients. The aim of this review was to identify the predictors and clinical outcomes of AF occurring during hospitalization either in medical or surgical patients in Saudi Arabia. PubMed database was searched thoroughly for the publication during the last 10 years from 2008 to 2018 for trials examining atrial fibrillation during the hospital stay for both medical and surgical patients in Saudi Arabia. A total of 126 trials were found. After refining research to include studies that were published in English and recruiting human subjects in the past 10 years, 38 papers were found. The trials were further filtered to include only the trials that provided full information on the cause of hospital admission, comorbidities, and outcomes measured. Only seven trials were matching the inclusion criteria. Higher mortality was linked to the in-hospital diagnosis of AF. Diabetes is a strong predictor for AF in hospitalized patients.

**Keywords:** Atrial fibrillation, hospitalization, diabetes, mortality, Saudi Arabia.

## Introduction

Atrial fibrillation (AF) is categorized as a supraventricular tachycardia where atrial activation becomes asymmetrical accompanied by worsened cardiac mechanical performance [1]. Although this type of arrhythmia is commonly self-limiting, it can lead to hemodynamic instability, in addition to being at risk factor for heart failure [2].

In hospitalized patients, AF can cause prolonged ICU and total hospital stay, increased costs, and can increase mortality [3]. Moreover, a major complication of AF is thromboembolism, mainly in the form of stroke, which can increase hospital mortality [4]. Therefore, numerous trials have proposed risk factors and outcomes of AF in hospitalized patients [5].

## Materials and Methods

This systemic review of the literature was done for the PubMed database in order to investigate the outcomes and predictors of AF occurring in hospitalized Saudi Arabian patients. Different terms were used while

reviewing the literature, including: “atrial fibrillation” and “Saudi Arabia”.

All the resulting titles and abstracts from this search were thoroughly revised. The second step was filtration of results. Only Original Research articles were included. All the articles investigated AF risk factors and outcomes in hospitalized patients in Saudi Arabia. Articles investigating AF in the outpatient setting were excluded. Additionally, all trials recorded the comorbidity and cause of admission to hospital. Trials published in the English language only were categorized as related articles which can be further assessed in the next stage.

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The next step was deciding the inclusion criteria to select the trials that will be included in the systematic review. Abstracts were reviewed manually to select the suitable abstracts to be included. The inclusion criteria were the presence of full information on the cause of hospital admission, comorbidities, in addition to outcomes measured. Furthermore, references of chosen studies were reviewed so as to identify any related articles. Finally, the needed data sets were gathered from the final record of the included articles and summarized.

## Results

A total of 126 articles were recovered by searching PubMed utilizing the combination of the two keywords “Atrial Fibrillation” and “Saudi Arabia”. Filters were then activated to include only trials done on human, in the duration of 2008–2018, on adult population and published in English language, only 38 articles appeared. After revising the abstracts based on the preset eligibility criteria, potential abstracts were selected. A total of seven articles were regarded as eligible to be included in the systematic review. These articles were published between 2008 and 2018, including a total of 20,911 Saudi patients with AF during hospitalization.

Five of the seven included trials were multicenter studies [6,7–9,10], where four of them were prospective trials [6–8,10] and the fifth one was retrospective [9]. Turning to the remaining two studies [11,12], one of them was retrospective [11] and the other one was a prospective observational study [12].

Out of 20,911 patients in the seven trials, three trials included 12,137 patients were admitted to the hospital due to heart failure, while two trials included 444 patients admitted for coronary artery bypass grafting. In a trial on 7,930 patients, the subjects were admitted with the acute coronary syndrome and final trial included 400 patients either admitted by heart failure, stroke, or acute coronary syndrome.

Moreover, the follow-up duration of patients varied between trials. Two trials followed patients only during hospital stay [11,12], three trials followed patients for 1 year [7,9,10], while one trial continued follow-up to 3 years [6].

Turning to AF outcome in hospitalized patients, only two trials [6,10] evaluated mortality as a primary outcome. It was concluded that mortality was higher in Saudi patients with AF during hospitalization on either short term as in-hospital mortality or long-term basis as in after discharge. Moreover, in the two studies including surgical patients with coronary artery bypass grafting [11,12], it was found that patients with postoperative AF during ICU stay had a higher risk of complication, including the risk of bleeding that may require reoperation and thrombosis.

Additionally, patients with AF during hospitalization had longer ICU and hospital stay and were at higher risk of postoperative shock. Finally, the four studies including

ischemic patients [8,10,12] proposed that patients with AF during their hospitalization were more vulnerable to undergo an intervention being classified as high-risk patients.

Furthermore, predictors of AF during hospitalization were also examined. It was revealed that patients with either previous history of stroke, hypertension, and heart failure with reduced ejection fraction were at higher risk to get AF during hospitalization. It was also observed among Saudi patients that those who get atrial fibrillation during their hospital admission were relatively young, with diabetes and rheumatic heart disease. In addition, it is recommended to use the rate control strategy in these patients. Further details on the included studies are discussed in Table 1.

## Discussion

The present work is a systematic review of literature in order to investigate the outcomes and predictors of AF occurring in hospitalized patients in Saudi Arabia. The review selected seven trials from the literature published during the last 10 years; between 2008 and 2018 to represent the Saudi Arabian population.

This review showed that in Saudi patients, AF during hospitalization was correlated to higher mortality rates either in medical or surgical patients. Moreover, AF was accompanied with prolonged hospital stay and higher rates of thrombotic and bleeding complication, especially in a surgical setting.

Turning to predictors of AF during hospitalization, it was revealed that young adults with diabetes or presence of the previous history of stroke, hypertension, or heart failure have risk factors for developing AF during hospital stay regardless of the cause of admission.

This systematic review included studies representing both medical and surgical patients. There were two trials, including patients who were admitted to hospital for coronary artery bypass grafting [11,12]. However, one of them was a retrospective analysis [11]. This retrospective analysis focused on detecting the preoperative risk factors that can lead to AF post-operatively and the outcome of this event in Saudi patients. Ismail et al. [11] reported that 35% of patients got post-operative AF and the incidence was directly related to patients' age. It is worth mentioning that the median age in this study was 65 years, so it was mainly targeting older adult patients. The same finding was supported in Elawady et al., as well [12].

Additionally, both studies concluded that diabetes and post-operative AF were highly related to each other [11,12]. Also, they considered echocardiographic parameters as predictors for the occurrence of AF, where enlarged left atrium, reduced left ventricular functions, and diastolic dysfunction were strong predictors for AF [11,12].

Elawady et al. additionally investigated post-surgical complications as outcomes for postoperative AF [12].

Table 1. Shows characteristics of the included trials.

Author(s)	Year	Study design	Number of subjects	Mean Age	Cause of hospital admission	Medical history considered	Follow-up after discharge	Outcome	Result
Ajlan et. al. [6]	2018	Multi-center prospective	2,593	61.4 ± 15.0	Heart failure	<ul style="list-style-type: none"> <li>Cerebrovascular accident/transient ischemic attack</li> <li>Chronic kidney disease</li> <li>Acute renal insufficiency</li> <li>Chronic lung disease</li> <li>Peripheral arterial disease</li> <li>Anemia</li> <li>Asthma</li> <li>Smoking</li> <li>Diabetes mellitus</li> <li>Alcohol consumption</li> <li>Family history of sudden cardiac death</li> <li>Family history of premature coronary artery disease</li> <li>Family history of cardiomyopathy</li> <li>Heart failure</li> <li>Ischemic heart disease</li> <li>Hypertension</li> <li>Dyslipidemia</li> <li>Thyroid disorder</li> <li>Cardiotoxic chemotherapy</li> <li>Cardiotoxic substances</li> </ul>	3 years	<ul style="list-style-type: none"> <li>Clinical features and outcomes of patients admitted with acute or chronic HF who got AF during hospitalization</li> </ul>	<ul style="list-style-type: none"> <li>17.8% of patients had AF.</li> <li>Patients with AF were more likely to be males and older, have a history of ventricular arrhythmia or cerebrovascular accident.</li> <li>Less likely to have diabetes or coronary artery disease.</li> <li>The 1-, 2-, and 3-year mortality rates were significantly higher in patients with AF.</li> </ul>
Ismail et. al. [11]	2017	Retrospective	252	Median age of 65 years	Under-going on pump Coronary artery bypass grafting	<ul style="list-style-type: none"> <li>Hypertension</li> <li>Diabetes mellitus</li> <li>Smoking</li> <li>Dyslipidemia</li> <li>Peripheral vascular disease</li> <li>Old myocardial infarction</li> <li>Hemodialysis</li> <li>Chronic obstructive pulmonary disease</li> <li>Old cerebrovascular disease</li> </ul>	Only during a hospital stay	<ul style="list-style-type: none"> <li>Risk factors as predictors for postoperative AF.</li> <li>Identify the perioperative predictive predictors of AF in patients who underwent coronary artery bypass grafting.</li> </ul>	<ul style="list-style-type: none"> <li>Postoperative data revealed that patients who developed postoperative AF had more bleeding requiring re-opening for exploration.</li> <li>Postoperative shock was also higher in the postoperative AF group (13.1%) patients in comparison to no AF group (0.6%) patients with a <math>p</math>-value <math>&lt; 0.001</math>.</li> <li>The ICU stay, ventilation time, and in-hospital stay was statistically longer in the AF group than the other group.</li> </ul>

Atrial fibrillation outcomes in hospitalized patients

Author(s)	Year	Study design	Number of subjects	Mean Age	Cause of hospital admission	Medical history considered	Follow-up after discharge	Outcome	Result
Panduranga et. al. [7]	2016	Multicenter, prospective, observational	4,539	59 ± 15 years	Acute heart failure	<ul style="list-style-type: none"> <li>Hypertension</li> <li>Diabetes mellitus</li> <li>Coronary artery disease</li> <li>Hyperlipidemia</li> <li>Smoking</li> <li>Khat</li> <li>Chronic kidney disease/dialysis</li> <li>Valvular heart disease</li> <li>Atrial fibrillation</li> <li>Stroke/Transient ischemic attack</li> <li>Peripheral vascular disease</li> <li>Alcohol</li> </ul>	At 3 months and 1 year	<ul style="list-style-type: none"> <li>Compare clinical characteristics, management, and outcomes</li> </ul>	<ul style="list-style-type: none"> <li>Prevalence of AF was 12%.</li> <li>AF is more common in patients with heart failure with reduced ejection fraction.</li> <li>A total of 5.8% and 1.4% of the patients had PCI and CABG, respectively, where AF was due to ischemia.</li> </ul>
Hersi et. al. [8]	2015	Multicenter, observational cross-sectional	400	61.7 + 15.9	Congestive heart failure, acute coronary syndrome, and stroke.	<ul style="list-style-type: none"> <li>Diabetes mellitus</li> <li>Dyslipidemia</li> <li>Overweight or obesity</li> <li>Smoking</li> <li>Heart failure</li> <li>Rheumatic heart disease</li> <li>Coronary artery disease</li> </ul>	8 months	<ul style="list-style-type: none"> <li>Provide clinical data and outcomes on patients hospitalized with AF.</li> </ul>	<ul style="list-style-type: none"> <li>AF patients are relatively young and have higher rates of diabetes and rheumatic heart disease.</li> <li>Rate control is the main strategy currently used for managing AF.</li> </ul>
Khafaji et. al. [9]	2015	Multicenter, retrospective study of prospectively collected data	5,005	66.5 ± 13	Heart failure with prior stroke history	<ul style="list-style-type: none"> <li>Previous cerebrovascular history</li> <li>Heart failure</li> <li>Previous admission ≤ 6 months</li> <li>Known systolic LV dysfunction</li> <li>Known coronary artery disease</li> <li>Valvular heart disease</li> <li>Peripheral vascular disease</li> <li>Atrial fibrillation</li> <li>Current smoking</li> <li>Type 1 diabetes</li> <li>Type 2 diabetes</li> <li>Known hypertension</li> <li>Known hyperlipidemia</li> <li>Chronic kidney disease/dialysis</li> <li>Sleep apnea requiring therapy</li> <li>Family history of cardiomyopathy/heart failure</li> <li>Khat</li> <li>Alcohol</li> <li>Peripartum (at present)</li> <li>Radiation chemotherapy</li> <li>Thyroid disease</li> <li>Asthma/chronic obstructive pulmonary disease</li> </ul>	1 year	<ul style="list-style-type: none"> <li>Report the prevalence, clinical characteristics, and precipitating factors, the management and outcome of patients with prior stroke hospitalized with acute heart failure and got AF during hospitalization.</li> </ul>	<ul style="list-style-type: none"> <li>Patients with stroke were more likely to be admitted with AF when compared with patients without stroke.</li> <li>Patients with AF were more likely to be older and to have diabetes mellitus, hypertension, hyperlipidemia, chronic kidney disease, ischemic heart disease, peripheral arterial disease, and left ventricular dysfunction.</li> <li>AF or left ventricular (LV) dysfunction are potential sources of embolization.</li> </ul>

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Author(s)	Year	Study design	Number of subjects	Mean Age	Cause of hospital admission	Medical history considered	Follow-up after discharge	Outcome	Result
Elawady et. al. [12]	2014	Prospective, observational study	192	58.62 ± 10.02	Coronary artery bypass graft surgery	<ul style="list-style-type: none"> <li>Hypertension</li> <li>Diabetes mellitus</li> <li>Dyslipidemia</li> <li>Smoker</li> <li>Old myocardial infarction</li> </ul>	Only during a hospital stay	<ul style="list-style-type: none"> <li>Clinical predictors and outcomes of postoperative AF</li> </ul>	<ul style="list-style-type: none"> <li>Older hypertensive patients are at higher risk of developing postoperative AF.</li> <li>Had significantly longer intensive care unit and hospital stays.</li> <li>with a larger left atrial size.</li> </ul>
Hersi et. al. [10]	2012	Multicenter, prospective study	7,930	56.8 ± 12.5	Acute coronary syndrome	<ul style="list-style-type: none"> <li>Congestive heart failure</li> <li>Significant valvular disease</li> <li>Chronic renal failure</li> <li>Smoking</li> <li>Diabetes mellitus</li> <li>Hypertension</li> <li>Hyperlipidemia</li> <li>Premature coronary artery disease</li> </ul>	1 year	<ul style="list-style-type: none"> <li>Incidence of AF in patients with acute coronary syndrome</li> <li>The associated in-hospital, 30-day, and 1-year adverse outcomes</li> </ul>	<ul style="list-style-type: none"> <li>Incidence of AF was 2.7%.</li> <li>Significantly more patients with AF had Killip class IV and NSTEMI as admission diagnosis.</li> <li>A larger proportion of NSTEMI patients (3.9%) had AF than did patients with UA (2.7%) or STEMI (2.0%; <i>p</i> value = 0.0002).</li> <li>Patients with AF were significantly more likely to have in-hospital stroke, CHF, or cardiogenic shock.</li> <li>Patients with AF had significantly higher rates of in-hospital, 30-day, and 1-year mortality.</li> </ul>

CAD, coronary artery disease.



This was explained through higher bleeding rate (9.5%) requiring reoperation and a higher incidence of cardiogenic shock (13.1%) compared to non-atrial fibrillation peers, in addition to prolonged ICU stay. He also included surgical patients but using a prospective observational study design [12]. The study found that males were more diagnosed for atrial fibrillation compared to females though the difference was non-significant.

The present review also included medical patients, as well as surgical patients. Five trials were included with medical patients admitted to the hospital and diagnosed with in-hospital AF. The five trials agreed on increased mortality on both short and long terms in patients getting AF during hospitalization [6,7–9].

Indications for admission were variable and included acute coronary syndromes, heart failure, and heart failure with previous stroke history. Hersi et al. [8] included three of them in a multicenter study. In contrast to surgical patients and data from European countries [13], Hersi et al. correlated AF to younger age groups, especially with diabetes which represented 48% of patients getting AF in the study [8]. It is important to state that patients in this study were not recruited consequently which may predispose the findings to the risk of biases [8].

Another multicenter study done by Ajlan et al. [6] was a large study recruiting 2,593 heart failure Saudi patients. The study showed that patients with heart failure were at a higher risk to get AF, where patients with heart failure and AF represented 78%. Moreover, these patients were at a higher risk of adverse events and poor outcomes, including mortality [6]. However, the study recommended further investigations to compare the outcomes of AF occurring in hospitalized patients with heart failure with reduced ejection fraction versus patients having heart failure with preserved ejection fraction.

Finally, to the author's knowledge, this is the first systematic review to show the figures for AF outcomes and predictors in different populations of hospitalized patients in Saudi Arabia. Though it is highly recommended to undergo further prospective studies to include more patients, especially those admitted with non-cardiac reasons.

## Conclusion

In Saudi Arabia, AF during hospitalization is highly linked to increased mortality rates in varying populations, including both medical and surgical patients. AF can also lead to a prolonged hospital stay and higher rates of complication, especially in surgical patients. Additionally, younger diabetic patients, in addition to the presence of hypertension, previous history of stroke, or heart failure have risk factors for in-hospital diagnosis of AF.

## List of Abbreviations

AF Atrial fibrillation  
CAD Coronary artery disease

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Not applicable.

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## Declaration of conflicting interests

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