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Original Article

Effects of Preoperative Risk Factors on the Occurrence of Atrial Fibrillation Following Coronary Artery Bypass in Farshchian Cardiovascular Subspecialty Hospital

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ABSTRACT

Background: Atrial fibrillation (AF) is the most common cardiac dysrhythmia; it occurs following coronary artery bypass graft (CABG) surgery. The occurrence of this dysrhythmia causes hemodynamic disorders, prolongs the duration of hospitalization, and increases costs.

Methods: The present retrospective cohort study was conducted using the census method on 330 patients. Data were extracted from the records of patients undergoing CABG and were used to fill in the data collection form. The data were analyzed using the independent samples *t*-test and the χ^2 test in SPSS, version 21, at the alpha level of 0.05.

Results: The mean age of the patients was 61.76 ± 9.2 years, and 70.1% were male. The incidence of AF was significantly associated with mean age, the body mass index, creatinine, and the consumption of diuretic medications ($P < 0.05$). However, sex, paraclinical results (ie, sodium, potassium, and the ejection fraction), clinical history (ie, hypertension, hyperlipidemia, diabetes, smoking, a history of myocardial infarction, and anterior myocardial infarction), medications (ie, beta-blockers, calcium channel blockers, angiotensin receptor blockers, and statins), and the number of involved arteries did not affect the incidence of AF ($P > 0.05$).

Conclusions: Considering the prevalence and importance of AF, effective preoperative risk factors can be decreased or eliminated through interventions, thereby reducing the incidence of this cardiac dysrhythmia. ***(Iranian Heart Journal 2020; 21(3): 25-32)***

KEYWORDS: Atrial fibrillation, CABG, Preoperative risk factors, Postoperative AF.

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As a cardiac dysrhythmia and conduction disorder, atrial fibrillation (AF) is a common clinical problem (almost one-third of patients)[1] in post-coronary artery bypass graft surgery (CABG). [2-6] Due to improved patient care in the past decade, the mortality caused by the most common type of cardiac surgery (ie, CABG) has significantly decreased. Therefore, research focuses on the prevention of other postoperative complications in order to improve clinical outcomes. [7]

Because of population aging, [8] the need for CABG and the incidence of postoperative AF have increased by 22.5%. [2] AF occurs in 5% to 40% of post-CABG cases. [9,10] In patients undergoing noncardiac surgeries, including pulmonary surgeries, major abdominal surgeries, and esophageal and pharyngeal surgeries, the incidence of AF is reported to range between 18% and 74%. [6,7,11] In general, AF is an accidental and transient event. Nonetheless, experimental and clinical studies have shown that AF is a progressive disorder. [12] AF is defined as the irregular atrial activity and deterioration of its mechanical functioning. [13] Although this arrhythmia is often self-limiting, [3,14-16] it has such undesirable complications as hemodynamic disorders, the risk of heart failure, embolic and thromboembolic events, increased postoperative stroke, neurological and renal complications, use of inotropes, prolonged hospitalization, and increased treatment costs. [11,13,17-19] This disorder occurs 2 to 4 days following the operation, [10,13,20] with maximum occurrence on day 2. [13, 20]

Treatment costs, the duration of hospitalization, and other complications of AF can be reduced by antiarrhythmic drugs, timely prevention, and the identification of effective factors. [21] Numerous risk factors of AF have already been identified; they include advanced age, genetic predisposition, being male, ischemia, heart failure, a history of AF, reduced ejection fractions, enlarged left atria, ventricular surgery, chronic obstructive pulmonary disease, chronic kidney disease, hypertension, diabetes, stopping beta-blockers, and rheumatic heart disease. [7, 13, 14] The etiology and pathophysiology of AF are multifactorial and idiopathic. [7, 12, 22]

In the past, many risk factors for AF were studied; they include the following [10, 23]:

1- Postoperative factors such as advanced age, being male, genetics, a history of AF, congestive heart failure, chronic obstructive pulmonary disease, chronic kidney disease, diabetes mellitus, and hypertension

2- Intraoperative factors such as prolonged ventilation, atrial ischemia, hypokalemia, hypomagnesemia, conflicting evidence for aortic clamping, and the duration of bypass

The incidence of AF can be reduced by examining and identifying preoperative effective factors and interventions focused on the reduction or elimination of these factors. Thus, the present study aimed to identify and determine the preoperative risk factors affecting the incidence of AF following CABG.

METHODS

This retrospective cohort study was conducted in Farshchian Cardiovascular Subspecialty Hospital, Hamadan University of Medical Sciences, Iran. The research population comprised all patients undergoing CABG with health records between March 2015 and February 2016. Data were collected using the census method on all eligible patients.

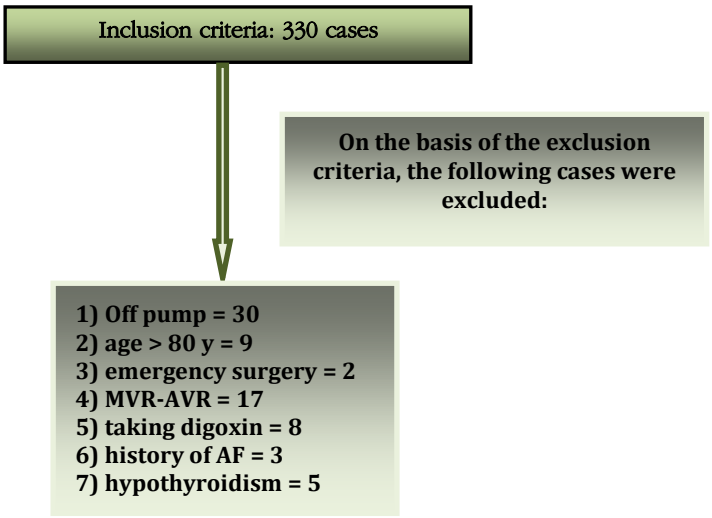
The inclusion criteria were access to health records and complete data. The exclusion criteria were simultaneous atrial surgery; a history of cardiac surgery; preoperative supraventricular dysrhythmias; taking antiarrhythmic drugs (except for beta-

blockers) during, before, or after the surgery; serious pulmonary problems (those who had pulmonary consultations by doctor's order and high pulmonary risk); chronic kidney disease; emergency operations; a history of ventricular aneurysm surgery; thyroid disorders; age over 80 years; and having off-pump bypass.

Eventually, 330 records were selected, and 69 were eliminated since they met the exclusion criteria (Fig. 1).

The data collection instrument had 2 sections: demographic information and clinical information. The demographic information comprised age, sex, weight, height, and the body mass index (BMI), while the clinical information encompassed data regarding the incidence of AF, paraclinical results, underlying diseases, and medication history. Each patient was assigned a special code based on the questionnaire. All data and characteristics were extracted from the records of in-patients. Ethical considerations were taken into account. As the study was retrospective, it was not possible to obtain informed consent from the patients. A letter of introduction was obtained from Hamadan University of Medical Sciences. Additionally, a permit was obtained from the director of the hospital in order to access patient records, and the researcher was introduced to the research units. The data in the patients' records were considered confidential and used only for the purposes of this research.

The collected data were analyzed using the independent samples *t*-test and the χ^2 test in SPSS, version 21, at the alpha level of 0.05.



Finally, after the examination of all the cases, 330 cases were selected and 69 were excluded due to having the exclusion criteria.

Figure 1: Patients excluded based on the exclusion criteria
MVR, Mitral valve replacement; AVR, Aortic valve replacement; AF, Atrial fibrillation

RESULTS

The results of the demographic information showed that the mean age of the patients was 61.76 ± 9.2 years. The majority of the patients were male (70.1%). Moreover, in 72% of the patients, 3 arteries were involved. The incidence of postoperative AF was observed in 32.6% of the patients in the intensive care unit.

The patients in the AF group had a higher mean age than did those in the non-AF group (P = 0.008). These patients also had a significantly lower BMI than did those in the non-AF group (P < 0.001). The mean creatinine level was significantly higher in the AF group than in the non-AF group (P = 0.001) (Table 1). Nevertheless, sex and the number of involved arteries did not affect the incidence of AF (P <0.05) (Table 2).

The analysis of the patients' clinical and medication history revealed that clinical history (ie, hypertension, hyperlipidemia, diabetes, smoking, and myocardial infarction) did not affect the incidence of AF (P > 0.05). Furthermore, only diuretic medications were associated with the incidence of AF (P < 0.050) (Table 3).

Table 1: Patients' demographic and paraclinical characteristics

Variable	Mean±SD	Number	Incidence of Atrial Fibrillation	Type of Test: Independent Samples *t*-Test
Age	9.9 ± 62.95	85	Yes	P = 0.008
	8.7 ±60.70	176	No	
Body mass index	± 23.33	83	Yes	P < 0.001
	4.9 ± 25.70	171	No	
Sodium	5.1 ± 140.89	85	Yes	P = 0.5950
	3.6 ± 140.60	176	No	
Potassium	0.56 ± 4.01	85	Yes	P = 0.791
	0.464 ±	176	No	
Creatinine	0.36 ± 1.20	85	Yes	P = 0.0001
	0.22 ± 1.03	176	No	
Ejection fraction	± 844.8	85	Yes	P = 0.257
	6.4 ± 45.9	167	No	

Table 2: Patients' sex and number of involved arteries

Variable	Incidence of Atrial Fibrillation		Type of Test: χ^2 Test
	Absent	Present	
Female	59	19	x^2 = 3.4 P = 0.065
Male	117	66	
One artery	2	0	x^2 = 4.45 P = 0.216
Two arteries	24	19	
Three arteries	129	59	
Four arteries	21	7	

Table 3: Patients' clinical and medication history

Type of Test: χ^2 Test	Incidence of Atrial Fibrillation		Variable	
	Absent	Present		
$x^2 = 0.367$ *P* = 0.454	94	42	Yes	History of hypertension
	82	43	No	
$x^2 = 0.021$ *P* = 0.884	77	38	Yes	History of hyperlipidemia
	99	47	No	
$x^2 = 2.03$ *P* = 0.154	61	22	Yes	History of diabetes
	115	63	No	
$x^2 = 1.47$ *P* = 0.225	55	33	Yes	History of smoking
	121	52	No	
$x^2 = 1.84$ *P* = 0.175	22	16	Yes	History of myocardial infarction
	154	69	No	
$x^2 = 1.44$ *P* = 0.23	8	7	Yes	History of anterior myocardial infarction
	168	78	No	
$x^2 = 1.67$ *P* = 0.195	114	48	Yes	Beta-blockers
	62	37	No	
$x^2 = 0.485$ *P* = 0.486	77	38	Yes	Calcium channel blockers
	99	47	No	
$x^2 = 0.869$ *P* = 0.351	6	5	Yes	Angiotensin receptor blockers
	170	80	No	
$x^2 = 1.49$ *P* = 0.222	125	54	Yes	Statins
	51	31	No	
$x^2 = 4.65$ *P* = 0.031	8	10	Yes	Diuretics
	168	75	No	

DISCUSSION

In the present study, we sought to determine the effects of preoperative risk factors on the occurrence of AF following CABG in Farshchian Cardiovascular Subspecialty Hospital. Based on studies reporting the importance of AF, the incidence of this cardiac dysrhythmia and relevant factors must not be neglected. Pillarisetti et al [24] (2013) stated that postoperative AF should not be considered a benign complication and left untreated. Rather, these patients must be monitored. More recent surgical techniques can be used in order to reduce the incidence of AF. Canale et al [17] (2014) examined AF following robotic cardiac surgery and indicated that the incidence of AF was generally low in this type of surgery compared with conventional heart surgery.

Statistical tests have shown a significant correlation between age and the BMI as 2 demographic characteristics and the incidence of AF after open-heart surgery. Pilatis et al [9] also showed the significant correlation between age and the noted disorder. Moreover, Pilatis et al [9] (2013) and Prakasarao et al [25] (2016) examined the effects of the preoperative consumption of metoprolol on the early incidence of AF in patients undergoing CABG and reported similar results. Moreover, van Oosten et al [26] (2014) reported the significant effect of the BMI. However, the results were not significant in terms of sex, which is consistent with the results reported by Akintoye et al, [1] (2018) who examined the effective factors in AF and other complications of cardiac surgery, and Golmohammadi and EsmaeeliJavid, [3] (2010) who investigated the risk factors of AF.

The association between the incidence of AF after open-heart surgery and patients' clinical history (ie, diabetes, hypertension, hyperlipidemia, smoking, and myocardial infarction) was not significant. These results are consistent with the results of the following

studies. Gorczyca et al [22] (2017) attempted to determine the predictive factors for AF following CABG and found no correlation between AF and diabetes, hypertension, or hyperlipidemia. In the study by Prakasarao et al [25] (2016), the correlation between diabetes and hypertension on the one hand and AF on the other was not significant. In addition, Bockeria et al [21] (2016) examined the effects of treatment with statins on the prevention of early-onset AF after CABG and found no correlation between AF and a history of diabetes. Mariscalco et al [4] (2014) reported no correlation between a history of cardiac infarction and AF. Ismail et al [13] (2017) investigated the factors affecting AF after CABG and found no significant correlation between AF and a history of smoking.

Nevertheless, a significant correlation between AF and a history of hypertension and smoking was reported by Akintoye et al [1] (2018). This difference in results may be due to the numerous sampling centers [28] and the manifold increase in the number of samples in the noted study. [1] Mariscalco et al [4] (2014) introduced a predictive tool for the risk of AF after cardiac surgery and reported a significant correlation between AF and diabetes and hypertension. Almassi et al [27] (2011) explored the effects and prediction of AF and reported a significant association between AF and a history of hypertension. This difference in results may be due to the large sample size and difference in the statistical population of various studies.

The results of the present study on the correlation between paraclinical results (ie, creatinine, sodium, potassium, and the ejection fraction) and the incidence of AF after open-heart surgery showed a significant association only in the case of creatinine ($P < 0.05$). Mihos et al [23] (2013) studied the prevalence of AF after minimally invasive surgery by comparison with sternotomy and reported no significant association between the ejection fraction and the incidence of AF. Concerning creatinine, the results of the present study are consistent with those of Radmehr et al, [28] (2011) who found a significant correlation between creatinine and the incidence of AF ($P < 0.05$). Exploring the association between increased serum creatinine levels before and after surgery, Radmehr and colleagues showed that the noted factor increased early mortality and postoperative complications. Melduni et al [12] (2015) studied the etiology of early-onset AF and observed a significant difference between their 2 groups with and without the incidence of AF in terms of creatinine. Nevertheless, Ismail et al [13] (2017) reported significant results for potassium and the ejection fraction, which is inconsistent with the present study.

Between different medications, the only significant correlation with AF belonged to diuretic medications, while the consumption of beta-blockers, calcium channel blockers, angiotensin receptor blockers, and statins was not significantly correlated with postoperative AF. Cossu et al [29] (2012), Mariscalco et al [4] (2014), and Ismail et al [13] (2017) corroborated the results of the present study and reported no significant correlation between AF and any beta-blocker, calcium channel blocker, angiotensin receptor blocker, diuretic, or statin. However, Patti et al [19] (2015) examined the preoperative consumption of statins and the risk of AF and concluded that the short-term use of statins before surgery might decrease the risk of postoperative AF in patients undergoing cardiac surgery. Prakasarao et al [9] (2016) reported the significant effect of metoprolol. The researcher did not find any study reporting a correlation between AF and the consumption of diuretics.

The effects of the paraclinical results and medication history of patients differ across

studies because of the difference in patients' clinical conditions, predispositions, and unique reactions. Therefore, similar results cannot be expected if the same interventions and conditions exist for different patients.

CONCLUSIONS

Considering the prevalence and importance of AF, effective preoperative risk factors can be decreased through interventions, thereby reducing the incidence of this cardiac Arrhythmia.

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