Original Article

Relationship Between the Pulmonary Artery Pressure and the Occurrence of Atrial Fibrillation After Coronary Artery Bypass Graft Surgery

Somayeh Beikmohammadi[1], MD; Hamid Reza Sanati[2], MD; Mohammad Mehdi Peighambari*[2], MD; Mohammad Mostafa Ansari-Ramandi[1], MD; Mehrdad Azimi[1], MD; Ali Zahedmehr[2], MD; Ata Firouzi[2], MD; Reza Kiani[2], MD; Farshad Shakerian[2], MD; Omid Shafe[2], MD

ABSTRACT

Background: Atrial fibrillation (AF) is one of the most common complications after cardiac surgeries. The incidence of postoperative AF has risen continuously over the past decades. AF is associated with lengthened hospital stays and risk of stroke. We sought to study the relationship between the pulmonary artery pressure (PAP) and the occurrence of AF after coronary artery bypass graft surgery (CABG).

Methods: This prospective observational study was designed to assess the relationship between the PAP and the occurrence of post-CABG AF. Patients with chronic and paroxysmal AF before surgery were excluded. All the patients had complete evaluation via echocardiography, ECG, and laboratory testing. The patients were monitored for 3 days after surgery, and any tachycardia monitored as AF was noted. The study population was divided into 2 groups: with postoperative AF and without AF.

Results: We selected 232 patients, 106 with AF and 126 with sinus rhythm. The results confirmed that the occurrence rate of AF after CABG was higher in the older patients ($P \leq 0.001$). Both univariate and multivariate analyses showed a significant relationship between a higher occurrence rate of post-CABG AF and a higher PAP (mean value = 26.5 vs 20 mm Hg) in the patients ($P \leq 0.001$ and $P = 0.01$, respectively).

Conclusions: Although age has been the most important predictor for the occurrence of AF after CABG in the past and present studies, there are many other variables affecting its occurrence. Among the variables evaluated in this study, a higher PAP was a significant predictor for a higher occurrence rate of AF following CABG. ***(Iranian Heart Journal 2017; 17(4): 17-20)***

Keywords: Pulmonary artery pressure● Atrial fibrillation● Coronary artery bypass graft surgery

[1] Rajaie Cardiovascular, Medical, and Research Center, Iran University of Medical Sciences, Tehran, IR. Iran.
[2] Cardiovascular Intervention Research Center, Rajaie Cardiovascular, Medical, and Research Center, Iran University of Medical Sciences, Tehran, IR. Iran.

***Corresponding Author:** Mohammad Mehdi Peighambari, MD; Rajaie Cardiovascular, Medical, and Research Center, Iran University of Medical Sciences, Tehran, IR. Iran.
E-mail: mehdipei@gmail.com **Tel:** 02123922128

Received: May 30, 2016 **Accepted:** August 14, 2016

Atrial fibrillation (AF) occurs in about 20%–40% of patients after coronary artery bypass graft surgery (CABG). [1-2] It is one of the most common complications after cardiac surgeries. The incidence of postoperative AF has increased continuously over the past decades, possibly due to the aging of the population undergoing cardiac surgeries. [3]

Postoperative AF usually occurs within 2–4 days after the procedure. Although generally well tolerated, AF can also be life-threatening—especially in the elderly and patients suffering from left ventricular dysfunction. [4] It is also associated with an increased risk of thromboembolic events and stroke [7] and ventricular dysrhythmias, as well as lengthened hospital stays and resultant extra costs.

Several studies seeking to predict the factors that affect the occurrence of AF after CABG have shown a consistent association between increasing age and the risk of AF after CABG. [1, 2, 6] Left atrial enlargement has also been identified as an independent factor for the high occurrence rate of AF following CABG. [8] On the other hand, there have been a few studies that have shown no relationship between left atrial enlargement and the risk of post-CABG AF. [2,9,10] In the previous studies, the pulmonary artery pressure (PAP) has not been studied as a factor affecting the occurrence of AF post CABG.

The present study was designed to evaluate the relationship between the PAP and the occurrence of AF following CABG. Perioperative data and variables were also analyzed to assess which patients were at a higher risk for developing post-CABG AF.

METHODS

This prospective observational study, conducted from March 2013 until March 2016, sought to assess the relationship between the PAP and the occurrence of post-CABG AF. Patients with chronic AF before surgery or a history of paroxysmal AF were excluded from the study. Patients were monitored continuously and examined during the 1st 3 postoperative days in the intensive care unit for having any form of tachycardia compatible with AF and were selected randomly and divided into 2 groups: with AF and without AF. Rate control for the patients was done using beta-blockers or calcium-channel blockers and if resistant, intravenous amiodarone was used. Before and after surgery, all the patients had complete paraclinical workup for electrolyte disturbances, renal function tests, thyroid function tests, lipid profile, and echocardiographic evaluation of left ventricular function, PAP, diastolic function, and left atrial dimension.

Paraclinical Evaluation

Echocardiography was done for all the patients with a Vivid 7 ultrasound system by a single operator. Laboratory testing and sample analysis were conducted using the same laboratory kits.

Statistical Analysis

The data of the patients were recorded in questionnaires. The collected data were then analyzed using SPSS. The χ^2 test and the Student *t*-test were used to determine the relationship between the different factors and the occurrence of AF after CABG. The differences between the 2 groups were considered significant if they had a *P* value < 0.05. The univariate factors with a significant difference were fed into a multivariate logistic regression analysis to assess their independent correlation with AF.

RESULTS

The demographic and paraclinical data of the patients in the 2 groups are summarized in Table 1.

The study population consisted of 232 patients, 106 of whom had AF and 126 sinus

rhythm. Only 2 patients underwent off-pump CABG. None of the patients had CABG done in an emergent condition. The 232 patients comprised 46 female and 186 male individuals. There was no significant difference in the occurrence of AF between the male and female genders. Our results also demonstrated no significant difference concerning the ejection fraction and left atrial dimension between the 2 groups. Further, we found no significant difference as regards the renal and thyroid function tests between the 2 study groups. The 2 groups also did not significantly differ *vis-à-vis* their electrolytes and lipid profile. Also not significantly different between the groups was the prevalence of diabetes mellitus and hypertension.

The patients who were older (mean age = 65 vs 60 y) had a significantly higher occurrence rate of AF ($P \leq 0.001$).

Both univariate and multivariate analyses revealed a significant relationship between a higher occurrence rate of AF following CABG and a higher PAP (mean value = 26.5 vs 20 mm Hg) in the patients ($P \leq 0.001$ and $P = 0.01$, respectively).

Table 1. Demographic and paraclinical data of the patients studied by univariate analysis

	Mean Value and Range in the AF Patients	Mean Value and Range in the Non-AF Patients	*P*
Age (y)	65 (58.75-70)	60 (53.75-65)	<0.001
Weight (kg)	75 (70-82.75)	74 (65-80)	0.063
Hemoglobin (g/dL)	13.5 (12.4-14.55)	13.5 (12.375-14.9)	0.711
Hematocrit (%)	38.95 (36.275-42)	39.75 (36-43)	0.394
White blood cells (/mL)	7700 (6500-9000)	7300 (6000-8800)	0.176
Platelets (x10^9/L)	215 (179.75-258.5)	214.5 (181.5-265)	0.803
C reactive protein (mg/L)	27.7 (24.75-40.25)	30 (20-40)	0.908
Blood urea nitrogen (mg/dL)	18 (13-22)	18 (14-20.25)	0.632
Creatinine (mg/dL)	0.85 (0.7-1)	0.9 (0.8-1)	0.631
Low-density lipoprotein (mg/dL)	79 (61-96)	77.5 (60.75-104.25)	0.975
High-density lipoprotein (mg/dL)	36.5 (33-43)	37.5 (35-45)	0.086
Triglyceride (mg/dL)	116.5 (77.75-162.5)	116 (80-154.5)	0.942
Thyroid-stimulating hormone (µIU/mL)	1.1 (0.675-1.8)	1.2 (0.6-2)	0.259
Uric acid (mg/dL)	5.2 (4.4-6.625)	5 (4-6.05)	0.366
Bilirubin (mg/dl)	0.8 (0.475-6.625)	0.7 (0.475-1.2)	0.843
Troponin (ng/ml)	0.01 (0-0.01)	0.01 (0.01-0.01)	0.849
Ejection fraction (%)	45 (35-55)	45 (33.75-50)	0.053
Pulmonary artery pressure (mm Hg)	26.5 (20-35)	20 (15-30)	<0.001
Left atrial diameter (cm)	3.4 (3.1-3.8)	3.4 (3.1-3.7)	0.493
Sodium (mEq/L)	140 (137-143)	141.5 (138.75-144)	0.042
Potassium (mEq/L)	4.2 (4-4.5)	4.25 (4-4.5)	0.569
Magnesium (mEq/L)	2	2	0.056

AF, Atrial fibrillation

DISCUSSION

The present study confirmed the higher occurrence rate of AF after CABG in older patients. It also showed that patients who had a higher PAP were at an increased risk for developing AF after CABG.

Similar to other studies, [8, 9] the present study confirmed that aging is allied to a higher occurrence rate of post-CABG AF. The fibrosis and dilatation of the atria have been shown to increase with age, [11] causing consequent slowing in the conduction of the atrial muscle fibers, which may be a possible cause for the increase in the occurrence of AF. [12]

In the present study, both univariate and multivariate analyses exhibited a significant relationship between a higher PAP and the occurrence of AF after CABG. Although the clear mechanism is not known, patients with a higher PAP also have more diastolic dysfunction, which may be a contributing factor for the occurrence of AF.

There was no protective role for the preoperative administration of beta-blockers in our study, which was similar to the results of a study done by Golmohammadi and Javid [13] in 2008.

Several findings in our study chime in with the studies done before. Nonetheless, the differences seen in the results of the stated studies may be due to the different operative procedures. The other aspects that may lead to these discrepancies include differences in patient characteristics and demographics surveyed, sample size, number of risk factors in the multivariate model, and monitoring techniques.

ACKNOWLEDGEMENTS

None.

Financial Disclosure: No conflicts of interest or financial interests are declared.

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