



ATRIAL FIBRILLATION AND CORONARY BYPASS SURGERY – WHAT CAN BE RISK FACTORS FOR ITS' APPEARANCE?

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ABSTRACT

The main goal of our study was to evaluate possible perioperative risk factors for occurrence of atrial fibrillation in the postoperative period in patients after CABG operations. The study included 140 patients after CABG, divided into two groups – Group I - 64 patients with new onset of POAF and Group II - 76 patients without postoperative atrial fibrillation occurrence. In both groups possible risk factors for atrial fibrillation onset (preoperative and postoperative) were analyzed.

Results showed that we can predict new onset of atrial fibrillation after CABG if the following preoperative factors are present – low ejection fraction (less than 40%), LAd > 40mm, higher body mass index (BMI over 30), presence of COPD and older age. Important perioperative factors for onset of atrial fibrillation in our study were longer extracorporeal circulation, increased dose/number of inotropic drugs, blood transfusion and elevated WBC count postoperatively.

KEY WORDS: CABG, POAF, predicting factors

INTRODUCTION

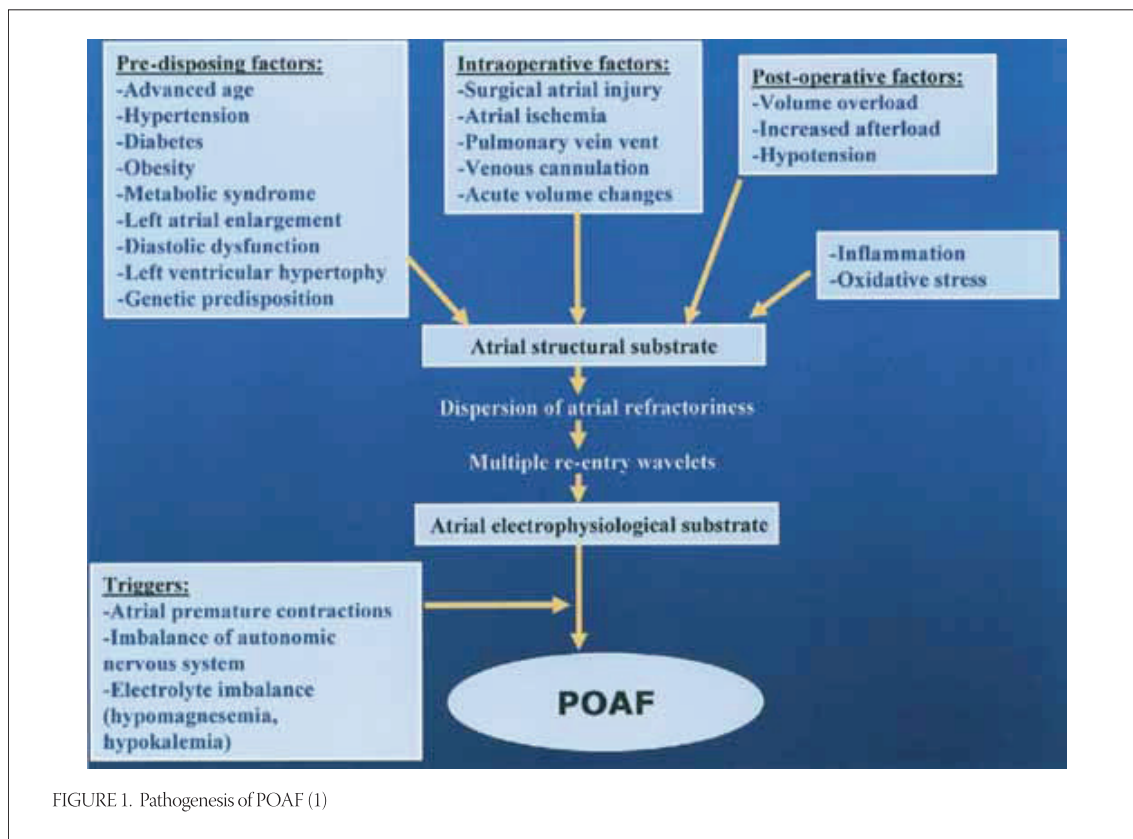
POAF is the most common complication after cardiac surgery. The incidence of POAF is approximately 30% after isolated CABG surgery, 40% after valve replacement or repair and increases to approximately 50% after combined procedures. As the incidence of POAF has increased continuously over the past decades, this is believed to be due to the aging of the population undergoing heart surgery. The pathophysiology of POAF after heart surgery is not precisely known, but mechanisms are thought to be multifactorial. Some causative mechanisms have been proposed that include pericardial inflammation, excessive production of catecholamines, autonomic imbalance during the post-operative period and interstitial mobilization of fluid with resulting changes in volume, pressure and neurohumoral environment as showed in Figure 1 (1).

These factors might alter the atrial refractoriness and slow atrial conduction. Multiple wavelet re-entry resulting from the dispersion of atrial refractoriness seems to be the electrophysiological mechanism of POAF. It is well known that neurohumoral activation increases susceptibility to POAF. Increased sympathetic and parasympathetic activation alter atrial refractoriness,

thus possibly contributing to the arrhythmia substrate. There is now an increasing body of evidence that inflammation plays an important role in the pathogenesis of POAF. Two recent studies have shown that inflammation can alter atrial conduction, facilitating re-entry and then predisposing to the development of POAF (2). Patients who develop POAF often experience other postoperative complications as well. Associations have been documented between POAF and postoperative myocardial infarction, congestive heart failure, ventricular arrhythmias, need for pacemaker, renal insufficiency, infection, pneumonia, increased need for inotropic support, prolonged ventilation, higher risk for perioperative stroke. Although POAF can be transient and generally self-limited, treatment is indicated for patients who remain symptomatic, are hemodynamically unstable and develop cardiac ischemia or heart failure. The available treatments (i.e. cardioversion, antiarrhythmic medication or pacing) all carry specific costs. POAF may be a persistent or recurrent problem for affected patients even after hospital discharge (3).

MATERIAL AND METHODS

All patients were operated in the Heart Centre Sarajevo, between January 2008 and May 2009, scheduled to



undergo first elective on-pump CABG. Patients were excluded if they had any surgery other than CABG, if sustained ventricular tachyarrhythmia or cardiogenic shock happened or if death occurred in operating room/intensive care. A form was completed for each patient including data related to perioperative (age, gender, smoking history, BMI, presence of diabetes mellitus, stable or unstable angina, prior myocardial infarction, COPD, hypertension, EF, LAd, intraoperative CPB time, aortic cross-clamp time) and postoperative (inotropic support, blood transfusion and WBC count) periods. The patients underwent on-pump CABG by standard surgical technique. Anaesthetic procedures and postoperative care went according to Heart Centre Sarajevo protocol for CABG operations with CPB.

RESULTS

A total of 140 patients operated in the Heart Centre Sarajevo during the period of January 2008 – May 2009 were included in the study. Patients were divided into two groups – with POAF 64 patients and a group without new onset of POAF with 74 patients. Preoperative patient characteristics are shown in Table 1. There were significant difference in older age, obese patients, patients with COPD, lower EF and LAd >40mm between groups.

Characteristics	POAF group (64)	No AF group (76)	P value
Age (mean year)	62,05	57,04	
<50years, n (%)	7 (10,9)	18 (23,7)	0,04
51-65 years, n (%)	30 (46,9)	39 (51,3)	0,6
>65 years, n (%)	27 (42,2)	19 (25)	0,03
Gender (male/female)	51/13	59/17	0,76/0,76
Smoking history, n (%)	32 (50)	34 (44,8)	0,13
BMI			
<20(underweight), n (%)	1 (1,6)	0	0,27
20-30 (normal), n (%)	46 (72)	44 (57,9)	0,08
30-40 (obese), n (%)	17 (26,4)	31 (40,8)	0,07
>40 (morbidly obese), n (%)	0	1 (1,3)	0,35
Diabetes mellitus, n (%)	18 (28,1)	25 (32,9)	0,54
Angina pectoris, n (%)			
Stable, n (%)	32 (50)	48 (63,1)	0,12
Unstable, n (%)	32 (50)	28 (36,8)	0,12
Prior myocardial infarction, n (%)			
COPB, n (%)	28 (43,7)	20 (26,3)	0,03
Hypertension, n (%)	45 (70,3)	53 (69,7)	0,94
EF<40%, n (%)	19 (29,7)	9 (11,8)	0,0085
LAd>40mm, n (%)	38 (59,3)	28 (36,8)	0,0077

TABLE 1. Preoperative clinical characteristics of the patients with new onset of POAF and those who did not develop POAF after CABG

Figure 2. presents number of patients with new onset of POAF due to day of onset. In our study 9 patients (14%) developed POAF on the 1st postoperative day, 14 patients (21,9%) on the 2nd postoperative day, while the largest number – 34 patients (53,2%) had POAF on the 3rd postoperative day and 7 patients (10,9%) POAF after the 3rd postoperative day.

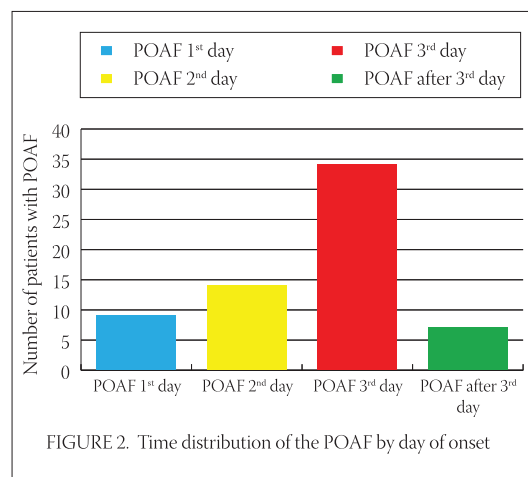


FIGURE 2. Time distribution of the POAF by day of onset

Table 2. shows the connection between the CPB time and onset of POAF. The longer the CPB time, the higher onset of POAF is. The appearance of POAF is also caused by longer aortic cross-clamp time.

Characteristics	POAF group (64)	Non POAF group (76)	P value
CPB time (min/max min)	38 / 221	40 / 145	0,005
CPB time – mean time min	88,9	75,2	
Aortic cross-clamp time (min/max min)	19 / 87	12 / 78	0,002
Aortic cross-clamp mean time min	45,2	37,4	

TABLE 2. Intraoperative clinical characteristics of the patients with new onset of POAF and those who did not develop POAF after CABG.

Table 3. shows significant connection between the onset of POAF and higher inotropic support postoperatively, usage of blood transfusion and higher count of postoperative WBC.

Characteristics	POAF group (64)	No AF group (76)	P value
High inotropic support, n(%)	22 (34,3)	8 (10,5)	0,0006
Blood transfusion, n(%)	27 (42,2)	19 (25)	0,03
Postoperative WBC count	16,3±6,5	15±4,2	0,048

TABLE 3. Postoperative clinical characteristics of the patients with new onset of POAF and those who did not develop POAF after CABG

DISCUSSION

POAF is the most common complication occurring after cardiac surgery. Despite advances in CPB, cardioplegic arrest and surgical techniques, its incidence has paradoxically increased in recent years as the result of surgical patients being older and with more severe illnesses. Many preoperative and postoperative factors have been suggested to increase the incidence of POAF after conventional CABG, however, little is known about intraoperative mechanisms through which the incidence of POAF could be reduced (4). The most consistent predictor for the development of POAF is advanced age. In a recent study investigating the effect of age on the incidence of POAF Mathew et al. have documented that for every decade there is a 75% increase in the odds of developing POAF and concluded that, on the basis of age alone, anyone older than 70 years is considered to be at high risk for developing POAF (5). In addition to older age, many other risk factors for the development of POAF have been identified, including a previous history of atrial fibrillation, male gender, decreased left-ventricular ejection fraction, left atrial enlargement, valvular heart surgery, chronic obstructive pulmonary disease, chronic renal failure, diabetes mellitus and rheumatic heart disease (6). A recent study reported that obesity was a powerful risk factor for the occurrence of POAF after iso-

lated CABG surgery in patients older than 50 years. However, in the younger population this association was not observed. Obesity is related to unfavourable changes in pulmonary function and can explain prolonged ventilation. It also presents technical challenges to the cardiac surgeon. Poor operative exposure of the heart, operating at depth within the chest, poor internal mammary artery exposure during harvest, problems with harvesting the long saphenous vein and obtaining good lower-limb wound closure are several of the challenges posed by obese patients (7). Patients undergoing cardiac surgery with excessive body mass index are likely to have other comorbid factors including the five obesity-related illnesses: type II diabetes mellitus, hypertension, hyperlipidemia, stroke and coronary artery diseases. These illnesses account for approximately 85% of the increased health problems and economic burden of obesity (8). Cardiac surgery is associated with an elevated postoperative WBC count that represents a common marker of inflammation. A more pronounced increase in postoperative WBC count independently predicts development of POAF (9). It is also known that red blood cell transfusion modulates inflammation by increasing plasma levels of inflammatory markers. Intensive care unit red blood cell transfusion is associated with increased occurrence of POAF after cardiac surgery (10).

CONCLUSION

The cause of POAF after cardiac surgery is not completely understood, and its' prevention remains suboptimal. Our study showed that some factors for POAF onset can be predicted and some can be even changed in order to decrease incidence of POAF.

List of Abbreviations

CABG	-	coronary artery bypass grafting
POAF	-	postoperative atrial fibrillation
BMI	-	body mass index
COPD	-	chronical opstructive pulmonary disease
WBC	-	white blood cells
CPB	-	cardio-pulmonary bypass
EF	-	ejection fraction
LAd	-	left atrial diameter

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