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ARRHYTHMIAS FOLLOWING CARDIAC SURGERY IN THE INSTITUTE OF CARDIOVASCULAR DISEASES OF TÂRGU-MUREȘ

Medicine

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ABSTRACT

Introduction: Cardiac arrhythmias are the most common complication in cardiac surgery and play a major role in postoperative mortality and morbidity. New-onset of atrial fibrillation is the most common arrhythmic complication after coronary artery bypass graft surgery and it may result in haemodynamic compromise, thrombotic events, anxiety, and thus a prolonged hospitalization.

Materials and methods: A prospective study was performed in the Institute of Cardiovascular Diseases and Transplantation of Tirgu Mures, Romania. We collected data between January and June 2017. For statistical analysis T-test and Fisher-test (GraphPad Prism 6.0 software, GraphPad Software, Inc, La Jolla, CA 92037 USA) were used. Significance level was set at $p<0.005$.

Results: In the arrhythmic group, the mean age was higher than in the control group. The ejection fraction was lower in the arrhytmic group. In the arrhytmic group more cases needed higher doses of inotropic drugs than in the control group. The arrhytmic group presented statistically significant hemodynamic and renal postoperative complications.

Discussion: Cardiac dilatation, myocardial atrophy, decrease of conduction tissue and atrial fibrosis caused by aging may be responsible for the increased risk of atrial fibrillation after CABG. Echography findings that suggested the increased risk of atrial fibrillation in the postoperative period was the enlarged atrium. The blood supply to the right atrium, the sinoatrialnode and the atrioventricular node is mainly conveyed via the right coronary artery, thus the stenosis of the right coronary artery may be a predictor. The statistically significant hemodynamic and renal postoperative complications in our study are among the most common postoperative complications described in the literature.

Conclusions: Postoperative atrial fibrillation is more frequent in the elderly patients (above 60 years) with increased left atrium. Other disturbances that predispose to this arrhythmia are: hypoxia and metabolic acidosis.

KEYWORDS

Introduction

Post-operative arrhythmias are frequent complications in patients undergoing cardiac surgery. Causing a significant increase in post-operative morbidity and mortality, arrhythmias are likewise to be present in normal subject.[1] Still they can cause hemodynamic instability in the recovery period after a cardiac surgery.[2, 3]

New-onset postoperative atrial fibrillation (POAF) is a common arrhythmic complication after first-time surgical myocardial revascularization.[4 ,5] Various studies reported an incidence between 11-40%.[6,7]

POAF can cause haemodynamic compromise, acute kidney injuries, long term thromboembolic events along prolonged hospitalization, increased in-hospital and long-time mortality in comparative studies presenting results from patients in sinus rhythm after cardiac surgery.[8,9 ,10 ,11]
It may be related to clinical and perioperative factors.[12]

Among a multitude of studies, in 2004, Mathew si colab. confirmed that age over 70 years is associated with an increased risk of AF.[7,13 ,14]

By all of other factors, left atrial enlargement, diastolic dysfunction and left ventricular hypertrophy are considered factors in POAF occurrence. [15]

Cardiopulmonary by-pass time (CBP), atrial and venous cannulation, myocardial ischemia, volume and electrolyte imbalances, hypotension, are implied also be a cause for the increased number of POAF.[13-15]

The hyperadrenergic condition following surgical stress and inotropic drugs also contributes to postoperative atrial fibrillation. [16]

AF may be prevented by having focused mainly on anti-arrhythmic medication: digitalis, beta-blockers, calcium channel blockers and amiodarone. The aims of treatment for post-operative AF are control of the ventricular response, prevention of cardioembolic events and restoring normal sinus rhythm [17].

Material and methods

The present retrospective study used the medical records database from Cardiac Surgery Clinic, Institute of Cardiovascular Diseases and Transplantation, Tirgu Mures, Romania. Secondary to obtaining the ethical committee approval, we studied all patients files that underwent heart surgery between January to June 2017. In conformity to the declaration of Helsinki standards all study investigations were conducted accordingly.

Patients data were included based on the following criteria: unrestricted access to patient's medical records, existence of clinical, imagistic data, laboratory results and perioperative ICU data.

Exclusion criteria consisted of previous cardiac surgery, chronic kidney disease (CKD), thyroid disorders, history of supraventricular arrhythmia. A number of 90 consecutive patients undergoing first-time cardiac surgery were included.

Our statistical analysis did not include the number of deaths subjects during the procedures neither the 24 hours after surgery death subjects. We followed the presence of newly emerged AF based on gender, age, surgery type (isolated CABG +/- valve replacement), preoperative comorbidities, surgery time, echocardiographic parameters (ejection fraction-EF and left atrium size-LAS), post-surgical organ dysfunctions (neurologic, respiratory, renal, gastro-intestinal injuries) and laboratory results (electrolytes, complete blood count, creatinine and Astrup parameters – pH, SaO2), cardio-pulmonary by-pass and total ischemic times. Acute renal injury was defined using the Ejection fraction (modified Simpson's rule) and left atrial size were assessed by 2D echocardiography. Classic cut-off values were set at 45% for EF and 45mm for LAS.[18]

For the statistical analysis we used T-test and Fisher's-test (statistical significance $p<0.05$), using GraphPad Prism 6.0 software, GraphPad Software, Inc, La Jolla, CA 92037 USA.

Results

All patients (66 male, 24 female) were divided into two groups. Patients presenting arrhythmia (38/90 patients - 42.20%) - the arrhythmic group was compared with a control group (52/90pts - 57.70%) patients without AF.

Among all participants (73.33% male patients and 26.66% female

patients) the mean age was 60.33 years; still no statistically significance (p>0.05), in the arrhythmic group mean age was higher compared to the control group.

The arrhythmic group presented a reduced ejection fraction, not statistically significant (p>0.05) compared to the control group. When analysing the echocardiographic data, statistically significant (p<0.05) difference between the left atrium size was estimated within the two groups. (Table 1).

Table Echocardiographic findings

Variables	Arrhythmic group	Control group	p value
LVEF (mean)	51.53%	53.67%	0.3935
LA size (mean)	47.50 mm	43.05 mm	0.0538

LVEF-left ventricular ejection fraction; LA- left atrium.

Within the two groups Na+, K+ and SaO2 daily levels were computed. For arterial blood oxygen saturation, a statistically significant (p=0.0001) difference was estimated. When determining the difference between the electrolytes levels, for K+ there was a statistically significant (p=0.0014) disparity. The creatinine and white blood cell levels within the arrhythmic group were higher, with a statistically significant (p=0.005) value for the creatinine level. For the haematocrit, haemoglobin and pH, lower levels were documented among the arrhythmic group patients, yet not statistically significant (p>0.05). (Table 2).

Table 2 Paraclinical parameters - mean values

Variables mean values	Arrhythmic group	Control group	p value
Na+ (mEq/L)	141.8	141.6	0.6397
K+ (mEq/L)	4.021	3.819	0.0014
SaO2%	97.72	98.89	0.0001
Creatinine (mg/dl)	1.54	1.081	0.0050
WBC (/mm3)	11790	9986	0.0633
Hematocrit (%)	29.68	30.22	0.4247
Hemoglobin (mmol/L)	9.4	9.7	0.1664
pH	7.37	7.39	0.0732

Na+ - sodium plasma level, K+ - Potassium plasma level, WBC – white blood cells, SaO2 - arterial oxygen saturation.

The arrhythmic group presented statistically significant (p=0.0063) hemodynamic and renal postoperative complications (Table 3).

Table 3 Postoperative complications

Postoperative complication	Arrhytmic group (n=38)	Control group (n=52)	p value
Neurologic	0	0	1
Respiratory	2	6	0.4594
Renal	6	0	**0.0044**
Gastrointestinal	6	2	0.0660
Hemodynamic	20/18	6/46	**0.0063**
Death	2	0	0.1755

n=number of cases;

DISCUSSION

Atrial fibrillation is one of the most common postoperative complications in cardiac surgery, prevalence depending on the type of surgery, population profile, detection methods. Its incidence after elective coronaro-aortic bypass graft surgery varies in a very wide range, but also from region to region (19).

Postoperative atrial fibrillation may be asymptomatic,but symptoms include palpitations, breathlessness, chest pain, sweating, and hypotension (19).

The postoperative arrhytmia episodes are diagnosed by continous monitoring and the use of 12 lead electrocardiogram. Episodes occur within the first 6 days following cardiac surgery (19).

In our study, we found atrial fibrillation mostly in eldery men, as age is an independent risk factor (20, 21, 22). Cardiac dilatation, myocardial atrophy, decrease of conduction tissue and atrial fibrosis caused by aging may be responsable for the increased risk of atrial fibrillation after CABG. The difference between genders may be explained by the sex differences in ion-channel expressionand hormonal effects on autonomic tone (20).

Echography findings that suggested the increased risk of atrial fibrillation in the postoperative period was the enlarged atrium. Many studies described the enlarged atrium as potent and independent predictor of atrial fibrillation in the post-operative period (19, 21).

In our study, the ejection fraction was lower in the arrhytmic group, but not statistically significant, however, it is mentioned in the literature as a predicting factor (22).

Although we did not find statistically significant changes amongs the comorbidities, such as hemodynamic disturbances, respiratory-, renal-, gastrointestinal disturbances and diabetes mellitus, the literature mentions some comorbidities as predictive factor for atrial fibrillation. In hypertension there is increased fibrosis and dispersion of atrial refractoriness. The blood supply to the right atrium, the sinoatrialnode and the atrioventricular node is mainly conveyed via the right coronary artery, thus the stenosis of the right coronary artery may be a predictor.Chronic obstructive lung disease patients frequently have premature atrial contractions, which may trigger the initiation of atrial fibrillation (20, 22).

In terms of laboratory parameters, we found higher Na, K levels, but these were not significant statistically. We found increased leucocyte levels in our patients with postoperative atrial fibrillation. The inflammatoryprocesses initiated by ECC might alter intraatrialconduction and other electrophysiological properties of the atria, leading to postoperative AF (23).

The statistically significant hemodynamic and renal postoperative complications in our study are among the most common postoperative complications described in the literature: myocardial infarction, persistent congestive heart failure, respiratory failure, various infectious complications, renal failure, severe hypotension and shock, multisystemic failure, andcardiopulmonary arrest (19). Postoperative pneumonia and mechanical ventilation longer than 24 hours have been shown to be independent postoperative predictors of AF, as well as atrial pacing, and need of postoperative inotropic agents (19).

Conclusions

We can tell that based on our study, postoperative atrial fibrillation is more frequent in the eldery (above 60 years) with increased left atrium. Other disturbances that predispose to this arrythmia are : hipoxia and metabolic acidosis. However, we must not forget the increased number of leucocytes due to the systemic inflammatory response, anemia and the need of high level of inotropic drugs, but in these cases the changes were not statistically significant.

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