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ATRIAL FIBRILLATION AFTER CARDIAC SURGERY UNDER CARDIOPULMONARY BYPASS: INCIDENCE, RISK FACTORS.

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ABSTRACT

Background and Aims: Atrial fibrillation is a common, but potentially preventable, complication following coronary artery bypass graft (CABG) surgery, and vulvular heart disease surgeries for Mitral stenosis/mitral regurgitation/ aortic stenosis/ aortic regurgitation/ tricuspid regurgitation and Ebstein anomaly. The occurrence is more common when double valve replacement are there or valve replacement plus CABG is combined.

Methods: A total of 120 adult patients undergoing coronary artery bypass graft (CABG) surgery and valvular surgeries were included in the present study. They were evaluated with respect to preoperative risk factors and postoperative factors. Outcome measure was POAF after cardiac surgery under CPB. Postoperative intensive care unit and hospital stay and mortality were also studied.

Results: Non-use of β blockers preoperatively was associated with lower odds of developing atrial fibrillation (OR 0.142) and the association is significant (*P* value: 0.002). Patients with LVEF >/=50% had lower odds of developing atrial fibrillation [OR 0.164; 95% confidence interval (CI) 0.029-0.852] and the association is significant (*P* = 0.03).

Multivariate analysis showing association of postoperative atrial fibrillation with risk factors. The odds of having AF were 5.17 times higher among those with prior MI (*P* = 0.03). Also the odds of having AF were 11.03 times higher in those in whom ventilator support was present for more than 24 h (*P* = 0.034).

Conclusion: The incidence of POAF after cardiac surgery was 42.5%. Preoperative LVEF <0.5, prior MI, CPB time >100 min and extended ventilation for >24 h were significantly associated with POAF.

KEYWORDS : CABG, cardiopulmonary bypass, postoperative atrial fibrillation, valvular surgery.

INTRODUCTION

A number of advances in anesthetic and surgical techniques have reduced risk in patients undergoing cardiac surgery. However, postoperative atrial fibrillation remains common, with an incidence that is consistently reported to range between 27% and 40%, with little change over the past 2 decades. Previous reports have suggested that atrial fibrillation is associated with an increased incidence of congestive heart failure (CHF), renal insufficiency, and stroke, which prolong hospitalization and increase rates of rehospitalization after discharge.

This is associated with increased rate of postoperative complications such as congestive heart failure, renal insufficiency, thromboembolic events and stroke, which prolong the length of hospital stay, increase rates of rehospitalisation and the overall cost of hospitalisation.[1-5] The intraoperative and postoperative periods are potentially stressful for the heart with extremes in response affecting reperfusion, inflammation, hemostasis, and excitotoxicity. Most previous studies of postoperative atrial fibrillation have primarily focused on chronic disease and risk factors prior to surgery. In addition, many studies are based on single-institution data, which limits generalizability.

METHODS

After obtaining approval from the Ethics Committee, we included 120 adult patients undergoing coronary artery bypass graft (CABG) and valvular surgery using cardiopulmonary bypass (CPB) over a period of 1 year.

Data were collected prospectively from cardiovascular surgery operation theatre and intensive care unit (ICU) for this observational descriptive study. Patients with chronic AF and those undergoing cardiac surgeries other than CABG and valve replacement were excluded. Since no similar studies were conducted in the past in this institute, the sample size was calculated based on the cardiac surgical workload of the hospital.

The predictors of POAF which were studied include preoperative parameters such as age >60 years, left ventricular ejection fraction (LVEF) <40%, prior diabetes (fasting plasma glucose level 126 mg/dL or random plasma glucose greater than 200 mg/dLor patient on chronic antidiabetic treatment), prior myocardial infarction (MI), chronic obstructive pulmonary disease and use of beta blocker therapy. Intraoperative parameters included were type of surgery (valvular or CABG), aortic cross clamp time >60 min and CPB time >100 min.

Duration of postoperative inotropic support >30 min and postoperative ventilatory support >24 h were also considered. The outcome was POAF which was documented from detection of AF on the lead II of cardioscope and was correlated with the risk factors. The length of hospital stay and mortality were also studied.

A binomial logistic regression was performed to predict the association of multiple risk factors contributing to AF. Both unadjusted and adjusted odds ratios are reported. IBM SPSS Statistics V.21

RESULTS

The mean age of the patients was 51.4 years with a standard deviation of 8.25 years. The incidence of POAF in the study group was 42.5%.

Non-use of β blockers preoperatively was associated with lower odds of developing atrial fibrillation (OR 0.142) and the association is significant (*P* value: 0.002). Patients with LVEF >/=50% had lower odds of developing atrial fibrillation [OR 0.164; 95% confidence interval (CI) 0.029-0.852] and the association is significant (*P* = 0.03).

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DISCUSSION

Atrial fibrillation is considered the commonest arrhythmia after cardiac surgery. It has an impact on the clinical situation, hemodynamic stability, thromboembolic events, the hospital stay as well as a direct impact on hospital cost. AF is a main contributing factor for increasing postoperative morbidity and mortality.

Despite advances in techniques of surgery, CPB, and cardioplegic arrest, the occurence of post cardiac surgeries AF has significantly increased. This happened because of patients, tend to be older and iller, with a great frailty index, and this high-risk subgroup is more liable for complications. It is also of note that, the use of telemetry (continuous ECG monitoring) has improved its early detection. Abundant studies were implemented to identify the predictors of atrial fibrillation for the creation of an atrial fibrillation risk score. [5-6]

Proposed mechanisms such as pericardial inflammation, autonomic imbalance during the postoperative period, excessive production of catecholamines and a fluid shift with resultant changes in volume and pressure are all contributory to the development of POAF.[7],[8]

The danger of AF is related to the rapid heart rate, irregular rhythm, loss of atrial kick and risk of atrial thrombosis. These can be treated by electrical or pharmacological conversion from AF to sinus rhythm followed by antiarrhythmic medication to maintain sinus rhythm. Alternatively, rate control and anticoagulation without conversion to sinus rhythm can be used.[9]

Advanced age has been the most consistent predictor of POAF.[10] In a study done by Mathew *et al*.,[4] it was found that every 10-year increase in age is associated with a 75% increase in the odds of developing AF. Thus, on the basis of age alone, anyone older than 70 years is considered to be at high risk for developing AF.

Mueller *et al*.[8] studiedAF and minimally invasive CABG and found that diabetes was strongly associated with development of POAF. Since our study had a mixed population with a large number of valvular surgical patients who were younger, we did not find a significant correlation between the two.

In studies by Zaman *et al*. and Yi-Ting Tsai *et al*., there was a significantly lower incidence of POAF in patients on β-blockers.[9],[10] Sympathetic activation or an exaggerated response to adrenergic stimulation may be an important trigger for POAF.[11,12] Therefore, β-blockers, by antagonising the sympathetic activity, serve to protect against it. In our study there was a definite association between those patients not taking β-blockers and the development of atrial fibrillation (OR -0.142).

It was seen from our study that patients who underwent cardiac surgery with prolonged aortic cross clamp time (>60 min) and CPB time(>100 min) had higher incidence of POAF (P < 0.001). Helgadottir *et al*. and Hashemzadeh *et al*. also noted similar findings.[13],[14] CPB is associated with an ischemia-reperfusion injury inducing a complex inflammatory response, the analogous of which have been reported in patients with AF. These range from the presence of inflammatory infiltrates in atrial biopsies to increased concentrations of C-reactive protein which form the substrate for generation of ectopic activity.[15],[16]

When extended ventilation was needed in the postoperative period, in our patients, it was associated with increased incidence of POAF. Aranki *et al*. in their study have documented these findings.[5] Causative agents may be hypoxia, hypovolemia, sepsis and electrolyte imbalances.[17] In our study, patients with AF had a longer median stay in the ICU >3 days in comparison to patients in sinus rhythm who got discharged on the third day. This may be related to the need for stabilisation of hemodynamic status, correction of hypoxia, need for ventilatory support or a combination of all. Other authors like Creswell *et al*. and Aranki *et al*. have found similar association.[8],[3] The increase in the cost of hospitalisation makes it imperative to design strategies to prevent the occurrence of AF, to treat it effectively once it develops and to initiate prophylactic anticoagulation protocols for prevention of embolic strokes. AF increased the median postoperative hospital stay from 7 days in patients in sinus rhythm to >7 days in those who developed POAF. Although we did not analyze the actual hospital costs per patient, it is clear that an increase in hospital stay will significantly drive up the cost of hospitalisation. Above all, there was an increased mortality also because of POAF than mortality because of other cause (4% vs 1.33%). Almassi *et al*. found the incidence of POAF to be 29.6% and the in-hospital mortality was 6% after surgery, for patient with POAF when compared with 3% for patients with no POAF (P < 0.002).[10]

Most of these patients would revert to sinus rhythm within 6 weeks, and electrical cardioversion could be done on an outpatient basis for the few patients who do not revert despite pharmacological treatment.[17] Such an approach would result in a considerable reduction in length of stay in hospital and significant cost reduction.

Limitations to our study include its observational design. Thus, the effects of medications are likely to be overestimated and confounded by treatment bias wherein patients with greater comorbidities may be less likely to receive -blockers or NSAIDs. However, the described associations of atrial fibrillation with drug therapy were independent of postoperative markers of illness severity such as CHF, MI, and inotropic therapy. Second, episodes of atrial fibrillation may have been missed because of the lack of continuous electrocardiographic monitoring, although the recorded incidence of atrial fibrillation is comparable with other published reports. Third, systematic electrolyte concentrations were not obtained.

Another limitations of our study were that both CABG and valve surgeries were included. In addition, the sample size was not calculated and arbitrarily chosen on the basis of our workload. The cost burden on those patients could also not be calculated.

CONCLUSION

The peak incidence of POAF after cardiac surgery was on the second postoperative day with the incidence being 40.7% in our study. A low preoperative EF (<0.4%), prior MI, CPB time >100 min and extended ventilation for >24 h showed a significant association with POAF. It also increased hospital stay and mortality in study subjects.

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