

Original Research Article

PREDICTORS OF POSTOPERATIVE ATRIAL FIBRILLATION AFTER ISOLATED CABG: A MULTICENTER OBSERVATIONAL COHORT

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ABSTRACT

Background: A common and potentially hazardous side effect after coronary artery bypass graft (CABG) surgery is postoperative atrial fibrillation (AF). Numerous factors have been proposed to raise the risk of post-operative AF following CABG. Estimating the percentage of patients who experience AF following off-pump CABG (OPCABG) and identifying potential predictors of AF following OPCABG were the goals.

Materials and Methods: A fixed sample size of 328 was chosen since the incidence of postoperative atrial fibrillation after CABG was 23%, according to a research by Arribas-Leal et al.

Results: The proportion of patients who developed post-operative atrial fibrillation was 56 (17.07%). The mean age was 61.38±10.24 years and there were 67 (20.42%) females and 261 (79.57%) males. While 32 developed AF on the third postoperative day, 19 developed it on the 2nd day, 03 developed AF on the first day and 02 developed it on the 4th post-operative day. Preoperative, postoperative, and demographic characteristics of the AF and non-AF groups were compared.

Conclusion: Our research revealed that after OPCABG, older age was an independent predictor of atrial fibrillation. The incidence of AF following OPCABG was linked to males, large atrial size, low ejection fraction, and prolonged hospital and intensive care unit stays.

Keywords: Predictor, Postoperative Atrial fibrillation, Intensive care units, Off pump CABG and Prognosis.

INTRODUCTION

One of the most frequent complications following coronary artery bypass graft surgery is postoperative atrial fibrillation. Depending on the arrhythmia's diagnosis, the patient's features, the type of operation, and the heart rhythm monitoring technique, the incidence of postoperative AF might range from 5% to over 40%.^[1] Postoperative AF is seen by some researchers as a benign, self-limiting arrhythmia. Although it rarely results in death, it can cause patient instability, lengthen hospital stays, and raise expenses. Persistent congestive heart failure, stroke, and perioperative myocardial infarction can all occasionally be caused by AF.^[2] Possible causes of atrial fibrillation after surgery include the use of cardiopulmonary bypass, the impact of cardioplegia, and myocardial ischemia.

Off-pump coronary artery bypass graft surgery on the beating heart without cardiopulmonary bypass has gained a lot of popularity in recent years. Nearly every surface of the beating heart can now be reached thanks to the quick advancement of OPCABG technology, particularly stabilizing devices. Although OPCABG has great short-term benefits, problems are not entirely absent. After heart surgery, the issue of AF in patients seems to be debatable.^[3] A survey of the literature reveals that there is a dearth of information from the Indian population that looks at the factors that influence the likelihood of atrial fibrillation in that community. This study's rationale was to investigate the traits that could indicate the occurrence of new-onset atrial fibrillation in patients receiving off-pump coronary artery bypass graft surgery at a single Indian medical facility.

MATERIALS AND METHODS

This prospective observational study was done in the department of cardiovascular and thoracic surgery, Heritage IMS Varanasi. The institutional review board and institutional research committee gave its approval. A fixed sample size of 328 was chosen since the incidence of postoperative atrial fibrillation after CABG was 23%, according to a research by Arribas-Leal et al.^[4] After gaining informed agreement, the study included all patients with single and multi-vessel disease who were having elective off-pump coronary artery bypass graft surgery throughout this time. The study did not include patients with chronic renal failure or recent ischemic attacks. Every off-pump coronary artery bypass graft patient had their preoperative and postoperative periods closely monitored for the occurrence of atrial fibrillation during seven days, and the information was recorded on a structured proforma. Atrial fibrillation was considered sustained in this study if it lasted longer than ten minutes, and only those cases were documented. Only the first occurrence was documented for analysis. Version 20.0 of the statistical program for the social sciences (SPSS) was used to conduct the statistical analysis. Frequencies, medians, means, or percentages were used to express descriptive data. A univariate analysis with a p value <0.05 was used to examine the relationship between intraoperative and postoperative factors and the incidence of AF.

RESULTS

Three hundred and twenty-eight individuals were consecutively enrolled for this study from among the 748 patients who had off-pump coronary artery bypass grafts performed at this institution during the study period. The proportion of patients who developed post-operative atrial fibrillation was 56 (17.07%). The mean age was 61.38 ± 10.24 years and there were 67 (20.42%) females and 261 (79.58%) males. While 32 developed AF on the third postoperative day, 19 developed it on the 2nd day, 03 developed AF on the first day and 02 developed it on the 4th post-operative day. Preoperative, postoperative, and demographic characteristics of the AF and non-AF groups were compared. The pre-operative continuous variables are summarized in [Figure 1]. The AF and non-AF groups differed statistically significantly in terms of age, ejection fraction, left atrial size, intensive care unit (ICU)

stay, and overall hospital stay, according to the results of an independent t test.

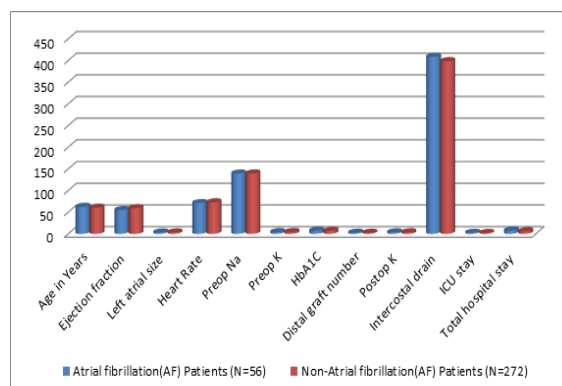


Figure 1: Show the mean level of Pre-operative and post-operative continuous variables.

The relationship between category variables and AF is summarized in [Figure 2]. When there were more than two groups, the Mann Whitney U test and the chi square test were used to assess binary variables.

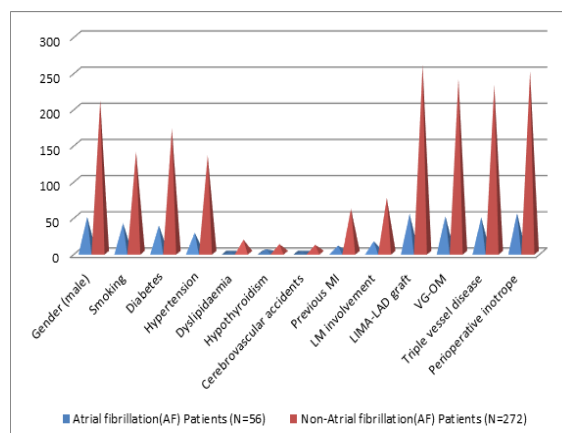


Figure 2: Show the Preoperative categorical variables.

[Figure 1 and 2] demonstrate a substantial correlation between perioperative inotrope use, smoking, left atrial size, age, gender, and ejection fraction in patients developing AF. By controlling for additional independent variables that might also be connected to AF, multivariate analysis was used to assess the associations between the onset of postoperative AF and its risk factors. A logistic regression model was used for the multivariate analysis, and the findings showed that the combined risk of postoperative AF was 4.6% for predictors such as age, gender, ejection fraction, left atrial size, smoking, and perioperative inotrope use ($F(7,241) = 2.72, p = 0.012$).

Table 1: Results of multivariate analysis for prediction of independent risk factors.

Regression weights	B coefficient	R2	P value
Age >60 years	0.092	0.044	0.032
Gender (male)	0.076	0.060	0.121
LA size >4	0.068	0.076	0.234
Ejection fraction <40	0.006	0.108	0.824
Smoking	0.068	0.052	0.146
Perioperative inotrope	0.152	0.078	0.052

DISCUSSION

This multi-center study has a high volume. The incidence of AF following CABG has been continuously reported to range from 8 to 49% during the past 20 years. A higher risk of hemodynamic impairment, extended hospital stays, and cerebral thrombosis can result from AF.^[4] 17.07% of the participants in this study experienced AF, with the highest incidence occurring on the third and second postoperative days. This is in line with a research by Lewicki et al. that found that the incidence of arrhythmia peaked on the second and third postoperative days, with 18.3% of OPCABG and 19.3% of OPCABG patients developing AF.^[5] Arribas-Leal et al. reported a 23% incidence of AF with on-pump CABG, while Perrier et al. reported a 21% incidence.^[4,6] This indicates that the incidence of AF in individuals receiving on-pump versus off-pump CABG does not differ significantly. A meta-analysis, however, revealed that the OPCABG group experienced a substantial decrease in AF.^[7] Postoperative AF has a complex etiology. Previous research has linked the etiology of atrial fibrillation (AF) to age-related degenerative change, the perioperative inflammatory response, and abnormalities in the electrophysiology of atrial cells.^[3] Reentry resulting from dispersion of atrial refractoriness is thought to be the electrophysiologic cause of postoperative AF. A depolarizing wavefront that contacts both refractory and excitable myocardium becomes fractured when adjacent atrial sections have different or non-uniform refractoriness. As a result, the wavefront can return and activate the myocardium, which was previously refractory but is now repolarized. This causes the wavefront to propagate continuously, or reenter. There is now no satisfactory explanation for why some individuals who undergo the identical surgical procedures get postoperative AF while others maintain sinus rhythm.^[2] According to Omer et al., myocardial ischemia itself triggers the inflammatory cascade and may play a role in the development of POAF. Both on-pump and off-pump CABG also activate the inflammatory cascade.^[8] Patients with a sinus rhythm had a statistically significant ($p=0.04$) mean age of 60.34 ± 7.46 years, while those who developed AF had a mean age of 62.42 ± 8.21 years. This was analogous to study by Lewicki et al in which the mean age of those who acquired AF was 60.8 ± 8.9 years as compared to 62.6 ± 10.2 years in those who did not get AF, however it was not statistically significant.^[5] According to Shah et al., the mean age of people with AF was 67 ± 3.24 years, while the mean age of people without AF was 59.9 ± 3.62 years. These differences were statistically significant.^[9] Age over 60 was found to be a major predictor of AF in participants receiving OPCABG in this trial. According to Ismail et al., the incidence of post-operative AF was 7% in patients under 60, 18% in those between 60 and 70, and up to 42% in

those beyond 70.^[10] Age has been identified as an independent predictor of atrial fibrillation (AF) for a number of reasons, including the existence of comorbidities and degenerative changes in the atrium.^[11,12] The probability of getting AF was found to be 1.16 (1.05-1.30) greater for men, with 89.28% of AF cases occurring in men. On performing multivariate analysis, though. It was disregarded as an AF predictor. Lewicki et al. discovered that the percentage of females who acquired AF was higher than that of males, however Perrier et al. claimed that female sex was not a predictor of postoperative AF.^[5,6] According to a research by Ismail et al., males made up 69% of patients who got AF and 61.9% of those who did not, however this difference was not statistically significant.^[10] Stewart et al. discovered that AF was related to both gender and age, which is consistent with this study.^[14] Compared to the non-AF group, 73.21% of patients who developed AF smoked, with a significant p value of 0.026 and an OR of 1.31 (95% CI 1.08-1.62). Nicotine may cause pro-arrhythmic atrial fibrosis, which increases vulnerability to catecholamines, making smoking a significant modifiable risk factor for cardiovascular disorders.^[15] Univariate analysis revealed a correlation between AF and left atrial size and ejection fraction. However, ejection fraction <40 and left atrial size >4 were not identified as independent predictors in this study using multivariate analysis. Ismail et al. discovered that a higher prevalence of post-operative AF was linked to left atrial size, atrial volume, decreased left ventricular function, and a high post-operative heart rate.^[10] Assuming that dysfunctional left atrium was separate from atrial remodeling, Levya et al. discovered no association between left atrial size and AF.^[16] Although both ICU stay and overall hospital stay were linked to AF, they were not included in this study as independent predictors of AF. The average length of stay was 7.64 ± 2.86 days, with an ICU stay of 2.48 ± 0.27 days. Velioglu et al. discovered that AF patients' periods of hospital and intensive care unit stays were statistically significantly longer than those of non-AF patients.^[17] Longer hospital and intensive care unit stays are observed to be caused by the worsening of hemodynamic condition brought on by AF, its complications, and its treatment.

CONCLUSION

These results imply that among patients who had OPCABG, age was an independent predictor of the onset of AF. Male gender, big atrial size, poor ejection fraction, and prolonged ICU and hospital stays were also linked to post-operative AF. To support the immediate and long-term results for patients who develop AF after surgery, more

research with a bigger sample size and longer postoperative followup is necessary.

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