

# Postoperative Atrial Fibrillation in Coronary Artery Bypass Grafting Herald Poor Outcome

Pulkit Malhotra, Shantanu Pande, Supaksh Mahindru, Ankit Thukral, Ankush Singh Kotwal, Rajan Prasad Gupta, Prabhat Tewari<sup>1</sup>, Surendra Kumar Agarwal

Departments of Cardiovascular and Thoracic Surgery and <sup>1</sup>Anaesthesiology, Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, Uttar Pradesh, India

## ABSTRACT

**Introduction:** Atrial fibrillation in postoperative period is common. Although the event of atrial fibrillation is associated with reduced cardiac output and its consequences and cerebrovascular events, its effect on outcome is not clearly documented. This study is done to evaluate the effect of atrial fibrillation on outcome of the operation.

**Materials and Methods:** This is a retrospective case-control study. A total of 263 patients received coronary artery bypass grafting during this period. The data for demographics, comorbidities, preoperative medications, operative details, and echocardiographic parameters of left ventricular functions were acquired. A total of 24 patients had atrial fibrillation (Group I), while 239 remained in normal sinus rhythm (Group II). The outcome is measured as combined of death and postoperative myocardial infarction (MI).

**Results:** The groups are comparable in demographic, preoperative medications, operative, and left ventricular parameters. Of the 24 (9.12%) patients who had postoperative atrial fibrillation, 11 were discharged on medical management. Nine patients reverted to sinus rhythm at discharge. Atrial fibrillation persisted in 8 patients 1 week after discharge and 3 patients after 1 month. The requirement of intraaortic balloon pump (IABP) was statistically significant in group I (5 in group I vs. 10 in group II,  $n = 0.001$ ). There were 4 deaths in group 1 and 7 in group 2 ( $P = 0.002$ ), however, the combined end point was achieved in 4 (16.6%) vs. 22 (9.2%), respectively,  $P = 0.1$ .

**Conclusion:** The appearance of atrial fibrillation heralds increased requirement of IABP, MI, and death in patients undergoing coronary artery bypass grafting.

**Keywords:** Atrial Fibrillation, outcome after postoperative atrial fibrillation, postoperative coronary artery bypass grafting

**Address for correspondence:** Dr. Shantanu Pande, Department of Cardiovascular and Thoracic Surgery, Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, Uttar Pradesh, India.

E-mail: shantanupande@hotmail.com

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## INTRODUCTION

Atrial fibrillation following cardiac surgery is an important factor affecting mortality in early postoperative care.<sup>[1]</sup> Though not common in preoperative period, its occurrence after coronary artery bypass grafting varies between 20% and 50% in various studies.<sup>[2,3]</sup> Indian data is scanty on this issue; however, a study quoted an incidence of 8% in

postoperative period.<sup>[4]</sup> Atrial fibrillation leads to reduction in cardiac output and puts the patient at the risk of embolic cerebrovascular event.<sup>[5]</sup> The incidence of atrial fibrillation increases with age and is observed increasingly common in patients with structural heart disease.<sup>[6]</sup> The incidence of atrial fibrillation is more among patient of valvular heart disease.<sup>[7]</sup> Framingham heart study has observed poor outcome in atrial fibrillation patients at long-term,

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especially in uncontrolled heart rate.<sup>[7]</sup> However, if the atrial fibrillation is controlled using available energy devices, the quality of life improves.<sup>[8]</sup> With this background knowledge and not an uncommon occurrence of atrial fibrillation following coronary artery bypass grafting (CABG), its effect on the immediate outcome is not clearly documented. In this study, we plan to observe the incidence of the postoperative occurrence of atrial fibrillation after CABG and its possible effect on the outcome of this sinister condition.

## MATERIALS AND METHODS

This study includes patients operated between January 2018 and April 2019. This is a retrospective case-control study. This study is approved by the institute ethics committee. During this period, a total of 263 patients underwent CABG. All these patients were enrolled in this study. Patients reporting atrial fibrillation after CABG were included in group 1 ( $n = 24$ ) and those who remained in normal sinus rhythm were designated group 2 ( $n = 239$ ). All the patients were operated using off-pump coronary artery bypass grafting technique.<sup>[9]</sup> They received total arterial revascularization using both internal mammary arteries.

Inclusion criteria include patients undergoing isolated coronary artery bypass grafting, age above 20 years, and normal sinus rhythm. Exclusion criteria include patients undergoing concomitant valve surgery, atrial fibrillation, acute myocardial infarction (MI), unstable angina, urgent surgery, or use of cardiopulmonary bypass to perform CABG.

The data is collected using hospital information services and patients' case records from a archive. The immediate, at discharge, and one-month follow-up paper 12 lead ECG is used to diagnose and record atrial fibrillation. Echocardiography of preoperative and one-month postoperative period is recorded for left ventricular size, function, and status of mitral valve competence. Intensive care unit data is accessed for collection of information like 24 h blood drainage output, transfusion of blood and blood products, requirement of intraaortic balloon pump (IABP), collection of investigation data, etc.

Primary endpoint of the study is mortality, perioperative MI, and combined end point of both of them. The secondary endpoint is the use of IABP. Universal definition of MI based on creatinine kinase (CK MB) in post CABG patient is used for diagnosis.<sup>[10]</sup> IABP was inserted when the patients presented with low cardiac output with the requirement of adrenaline dose of more than 0.05  $\mu\text{g}/\text{kg}/\text{min}$ . Low cardiac

output was diagnosed clinically. Patients developing atrial fibrillation during operation were reverted to normal sinus rhythm with electric cardioversion using internal paddles. Development of atrial fibrillation in intensive care unit was treated with injection amiodarone with loading of 300 mg in 30 min followed by continuous infusion to achieve a total dose of 1 g. The patients were then discharged on oral medication of 200 mg once daily for a period of 6 weeks.

Power of study is calculated by the prevalence of the atrial fibrillation in this study (9.12%) and the difference in the combined endpoint achieved in each group (25% in group 1 vs. 11.2% I group 2,  $P = 0.10$ ). To achieve a power of 80%, the study must have 127 patients of postoperative atrial fibrillation (group 1) and similar number of propensity-matched patients in group 2. Hence, this study fails to achieve the required power of 80%. The power of study for patients in this study is calculated *post hoc* on the basis of combined end point is 39.7% and for mortality is 74.9%.

## Statistics

Two groups are unequal in numbers; hence, a non-parametric test is chosen to compare two groups. Mann-Whitney U test is applied. The variables are expressed as median and minimum and maximum values. Pearson's correlation is done between variables whenever required. Chi-square test is used to compare two nominal variables. SPSS version 17 for windows (SPSS, Inc. Chicago, IL, USA) is used for statistical analysis.

## RESULTS

Patients in both the groups have similar demographics. Similarly, the risk factors that may trigger atrial fibrillation are not significantly different. Echocardiographic parameters defining left ventricular size and function are also not different in two groups [Table 1]. There was no correlation between the occurrence of atrial fibrillation and left ventricular ejection fraction, serum potassium, serum creatinine, ventilation time, and duration of operation. However, total blood loss postoperatively was positively correlated to occurrence of atrial fibrillation ( $r = 0.19$ ,  $P = 0.001$ ). All relevant intraoperative and postoperative factors are similar in two groups [Table 2]. The outcomes in the study are mentioned in Table 3. Overall mortality in the study is 4.18% with 16.6% in group 1 and 2.9% in group 2. However, there was no perioperative MI in group 1. The use of IABP was significantly higher in group 1. Intraoperative atrial fibrillation was witnessed in 11 patients and all were reverted back to normal sinus rhythm using DC shock before shifting the patient back

**Table 1: Risk factors and preoperative variables**

Variable	Group 1 n=24	Group 2 n=239	P
Age in years	59.5 (40-70)	59 (23-81)	0.58
Male (n)	19	189	0.54
Female (n)	5	50	
BMI	23.4 (17.4-31.6)	24.8 (17.6-40.7)	0.34
NYHA Class			0.12
1	2	7	
2	12	135	
3	10	97	
Diabetes Mellitus (%)	8 (33.3)	91 (38.1)	0.80
Hypertension (%)	10 (41.7)	104 (43.5)	0.94
Tobacco Consumption (%)	6 (25%)	52 (21.8)	0.59
Preoperative $\beta$ blocker (%)	19 (79.2)	221 (92.5)	0.57
Preoperative statin (%)	17 (70.8)	179 (74.9)	0.82
LDH (IU/dl)	280 (120-963)	179 (29-707)	0.04
LVESD in mm	26 (20-40)	28 (24-50)	0.35
LVEDD in mm	46 (36-86)	46 (23-63)	0.31
LVEF (%)	50 (25-60)	55 (20-60)	0.07
LVEF <35%	3	21	0.67
LA size in mm	38.1 (30-50)	32 (28-50)	0.69
RVSP in mm Hg	46 (33-68)	37 (22-53)	0.21

NYHA: New York Heart Association, LDH: Lactate Dehydrogenase level, LVESD: Left Ventricular End-Systolic Dimension, LVEDD: Left Ventricular End-Diastolic Dimension, LVEF: Left Ventricular Ejection Fraction, LA: Left Atrium, RVSP: Right Ventricular Systolic Pressure

**Table 2: Operative and intensive care data**

Variable	Group 1 n=24	Group 2 n=239	P
Number of grafts	3 (1-4)	3 (1-5)	0.78
Blood transfusion (n)	1.5 (0-6)	1 (0-10)	0.13
Blood drain 24 h (ml)	935 (150-1570)	880 (164-1460)	0.58
Hypertension (%)	14.5 (13-41)	16 (5-648)	0.98
ICU stay (h)	72 (52-96)	56 (50-62)	0.15

ICU: Intensive Care Unit

**Table 3: Outcome variable**

Variable	Group 1 n=24	Group 2 n=239	P
POMI (n)	0	15	0.26
Mortality (n)	4	7	0.002
Combined end point (n)	4	22	0.10
IABP (n)	5	10	0.001

POMI: Perioperative Myocardial Infarction, IABP: Intraaortic Balloon Pump

to intensive care unit. Atrial fibrillation occurring in postoperative period was treated medically with infusion of amiodarone ( $n = 24$ ). All patients had control of heart rate with many reverting to sinus rhythm. At discharge, 11 patients of a total of 24 remained in atrial fibrillation. At 1 week, 8 remained in atrial fibrillation and at 1 month, it reduced to 3 patients who remained in atrial fibrillation.

Follow-up echocardiography was available at 1 month for all the discharged patients. Left ventricular end-systolic dimension is 28 mm (23–45) in group 1 vs. 28 mm (25–48) in group 2,  $P = 0.63$ . The Left ventricular end-diastolic dimension is 46 mm (22–55) in group 1 vs. 45 mm (20–65) in group 2,  $P = 0.55$ . Left ventricular ejection fraction is 45% (32–50) in group 1 and 45% (26–60) in group 2,  $P = 0.96$ . The left atrial size is 32 mm (28–53) in group 1 vs.

32 mm (26–50) in group 2,  $P = 0.47$ . During clinical follow-up of 6 months, all the patients are alive.

## DISCUSSION

This study has a small number of patients who experience atrial fibrillation after coronary artery bypass grafting ( $n = 24$ , 9.12%). Intraoperative atrial fibrillation was witnessed in 11 patients and was reverted using DC shock during the procedure. All the patients reverted to normal sinus rhythm before shifting to intensive care unit. At the time of discharge, 11 patients remained in atrial fibrillation though with controlled heart rate and 3 patients continued to be in atrial fibrillation at 1 month. There are not many studies that follow the patient of atrial fibrillation as to what happens to their rhythm.<sup>[11]</sup> In past, the occurrence of atrial fibrillation was considered benign and self-limiting, but it has been proven beyond doubt that such postoperative events increase mortality.<sup>[12,13]</sup> The sinister effect of atrial fibrillation is due to loss of the atrial kick and subsequent loss of cardiac output.<sup>[14]</sup> The incidence in our study is very low as compared to the lone Indian study by Dave *et al.*, considering the patients' characteristics are similar.<sup>[4]</sup> This difference may be due to the use of off-pump technique as compared to on cardiopulmonary bypass as in Dave *et al.* study. One reason is inflammatory response which is mostly similar in two techniques but few pathways are more pronounced with use of cardiopulmonary bypass.<sup>[15]</sup> Moreover, Bohatch *et al.* have shown increased incidence of atrial fibrillation when cardiopulmonary bypass is used to perform surgical revascularization.<sup>[16]</sup> Our patients did not require endarterectomy, which is associated with higher occurrence of atrial fibrillation in early postoperative period.<sup>[17]</sup>

Inflammation is an important factor that triggers atrial fibrillation after an operation. Weymann *et al.* in their study on inflammation have supported that C reactive protein is an important factor in causation of atrial fibrillation.<sup>[18]</sup> Though we did not study the inflammatory parameters, lactate dehydrogenase levels were higher in patients experiencing atrial fibrillation in this study. Inflammatory response has been suppressed by higher dose of statins.<sup>[19]</sup> This may be one of the reasons that patients in this study experienced a lower incidence of atrial fibrillation. In our study, more than 70% of patients were receiving beta-blockers at the time of surgery; hence, the incidence of atrial fibrillation may have been lower as suggested by many studies.<sup>[20,21]</sup>

Few studies have shown a reduction of atrial fibrillation with beta-blocker prophylaxis to 7%–8% in postoperative

period in patients undergoing coronary artery bypass grafting, which is the case in our study.<sup>[22]</sup> Similarly, a retrospective analysis from a large sample of patients from a surgical database reported a reduction in postoperative mortality from 3.4% to 2.8% with the use of preoperative beta-blockers.<sup>[23]</sup> The benefit in prevention of postoperative atrial fibrillation was achieved by prophylactic usage of either of the class drugs, metoprolol, carvedilol, timolol, or atenolol.<sup>[24-27]</sup> Halonen *et al.* reported a further improvement in reducing the postoperative atrial fibrillation if metoprolol was used intravenously as compared to oral route.<sup>[28]</sup> Although a study by Maniar *et al.* could not report any advantage with intravenous esmolol over oral usage of metoprolol, they reported a concern of higher incidence of hemodynamic compromise with the use of esmolol.<sup>[29]</sup> A study has reported better results in controlling postoperative atrial fibrillation with carvedilol when its prophylactic use was compared to metoprolol.<sup>[30]</sup> Prophylactic use of amiodarone has also shown to reduce postoperative atrial fibrillation significantly.<sup>[31]</sup> However, a trial failed to replicate these results when the control group was already receiving beta-blockers, calcium channel blockers, or digoxin.<sup>[32]</sup> A large meta-analysis by Bagshaw *et al.* suggested that prophylactic use of amiodarone is effective in reducing the incidence of postoperative atrial fibrillation in patient undergoing cardiac surgery.<sup>[33]</sup> However, both metoprolol and amiodarone were found to be equally effective in controlling postoperative atrial fibrillation when they were administered prophylactically.<sup>[34]</sup>

Patients in our study were also different as compared to western studies. The major differences that could have affected the appearance of atrial fibrillation are lack of obesity and younger age at the time of procedure. Obesity can be one of the trigger factors for the appearance of atrial fibrillation as suggested by Wang *et al.*<sup>[35]</sup> It is also suggested that increased oxidative stress and or lipoapoptosis increases the chances of atrial fibrillation by causing structural changes in atria.<sup>[36,37]</sup> Increased size of left atrium is also one of the contributing factors for atrial fibrillation that is missing in our study patients.<sup>[38]</sup> Age is relatively younger than western studies; the incidence of coronary artery disease in younger patients is witnessed in India.<sup>[39]</sup> Old age remains the strongest risk factor for onset of atrial fibrillation. Mathew *et al.* suggested that increase in age in excess of 70 years increases the incidence of atrial fibrillation.<sup>[40]</sup>

Our study also highlighted a higher mortality rate in patients who developed atrial fibrillation. Similar facts have been validated by other studies, with even higher rate of mortality even after 1 and 3 years of follow-up.<sup>[41]</sup> Villareal *et al.* also witness an increased incidence of mortality in their series

associated with atrial fibrillation after coronary artery bypass grafting.<sup>[42]</sup> Though other studies also report an increased early mortality rate,<sup>[43,44]</sup> this was not observed in studies done by Kalavrouziotis *et al.* and Rubin *et al.*<sup>[12,45]</sup> However, a large study with a 5-year follow-up recently reported that risk-adjusted outcome at 5 years was similar after coronary artery bypass grafting independent of appearance of atrial fibrillation.<sup>[46]</sup>

### Limitation of the study

This study has a small number of patients experiencing new onset atrial fibrillation after coronary artery bypass grafting. This may give us a trend but reliability of the data can only be achieved with an appropriate power of study. A larger study and possibly a multicenter study are required to effectively cover all the aspects of atrial fibrillation after coronary artery bypass grafting.

### CONCLUSION

This study reports a lower incidence (9.12%) of atrial fibrillation after coronary artery bypass grafting. However, in patients who develop atrial fibrillation, there was a significantly higher incidence of application of IABP in postoperative period. The mortality rates were also significantly higher in this group of patients.

### Ethical approval statement

Ethical approval was waived by the local Ethics Committee of the institute in view of the retrospective nature of the study and all the procedures being performed were part of the routine care.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

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