

## FREQUENCY OF POST-OPERATIVE ATRIAL FIBRILLATION IN PATIENTS UNDERGOING CABG PROCEDURES

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### ABSTRACT

**Objective:** To determine the frequency of post-operative atrial fibrillation (POAF) in patients undergoing on-pump coronary artery bypass grafting (CABG).

**Study Design:** A descriptive cross-sectional study.

**Place and Duration of Study:** Adult Cardiac Surgery department, AFIC/NIHD, Rawalpindi, from Sep 2019 to Jan 2020.

**Methodology:** This study was conducted on 80 cardiac patients fulfilling the inclusion criteria among the patients underwent CABG surgery. They were observed during the hospital stay for the development of AF. Data was analyzed using SPSS-23 and  $p \leq 0.05$  was taken as statistically significant.

**Results:** In this study, 80 patients who underwent ON-PUMP CABG. The frequency of POAF calculated is 47 (58.75%). Majority of the patients who developed POAF presented with history of hypertension and diabetes mellitus i.e. 27.50% with male predominance i.e. 70% with the mean of variables, age =  $60.19 \pm 9.3$  years, body mass index =  $28.27 \pm 4.2$  kg/m<sup>2</sup>, CPB time =  $156 \pm 39.7$  min, aortic cross-clamp time =  $100 \pm 27.2$  min, ejection fraction v(EF) =  $47.2 \pm 10.7\%$ , heart rate =  $117.8 \pm 21$  beats per minute and serum lactate levels =  $3.7 \pm 1.54$  mmol/lit. Also mortality rate was seen relatively higher in patients with POAF i.e. 30 (38%) than in those having no POAF i.e. 50 (62%).

**Conclusion:** Frequency of POAF is moderately high with advanced age. Hypertension, obesity and BMI plays pivotal role in the development of POAF with prolong bypass time and Aortic Cross-clamp time. AF caused raised heart rate and serum lactate levels alongside compromised heart function, increased mortality and hospital stay.

**Keywords:** Atrial fibrillation, Cardiopulmonary bypass, Coronary artery bypass grafting, Hypertension.

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### INTRODUCTION

Coronary artery bypass grafting (CABG) is a type of open heart surgery which involves sewing of the graft vessels to the coronary arteries beyond the narrowing of blockage mainly caused by deposition of fatty material in the arterial wall or narrowing of the coronary arteries that restricts the blood flow to the myocardium resulting in myocardial ischemia<sup>1,2</sup>. Cardiac arrhythmias are one of the common postoperative complications seen in majority of patients undergoing cardiac surgery that is posing as a major life threat and a very common cause of increased duration of hospital stay and financial burden<sup>3</sup>. Both tachyarrhythmias and bradyarrhythmias can occur postoperatively out of which atrial fibrillation (AF) is the most common post-operative sustained heart rhythm disorder.

AF is characterized by irregular and rapid beating of heart due to disrupted electrical conduction system mainly in the left atrium which results in weaker contractions, slow and sluggish blood flow and myocardial blood flow is compromised<sup>4,5</sup>. The hallmark of AF is the absence of distinct *p*-waves and irregularly

irregular (i.e. totally irregular) ventricular rate and rhythm. The baseline (isoelectric line between QRS complexes) is characterized by either fibrillatory waves (f-waves) or just minute oscillations. These fibrillatory waves are small with varying morphology and high frequency (300-600 waves per minute). The normal heart rate is 60-100 beats per minute which in AF may reach 100-175 beats per minute<sup>6</sup>.

During early post-operative period atrial fibrillation has been reported in up to 5-40% patients who underwent coronary artery bypass grafting with the peak incidence between day zero and day four<sup>7</sup>. Incidence of POAF following thoracic surgery is between 10-30% while following non-cardiac, non-thoracic surgery ranges from 1-15%<sup>8</sup>.

Major predictors of POAF include age  $\geq 70$  years (age related atrial dilatation, hypertrophy, senile amyloidosis and fibrosis, preoperative stable angina, as well as low cardiac output syndrome following CABG. Several preoperative factors such as Older age, higher body mass index (BMI), and reduction in left ventricular ejection fraction<sup>6</sup>, direct cardiac stimulation from perioperative use of catecholamine, perioperative ischemia, increased sympathetic outflow from volume

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loss/anemia/pain may be associated with the occurrence of post-operative AF. Inflammatory mediators and leukocytosis after extracorporeal circulation contributes in rhythm alterations during post-operative period<sup>9</sup>. Metabolic alterations, such as hypo/hyperglycemia and electrolyte disturbances, may also contribute to post-operative AF. New onset of AF leads towards major complications such as stroke<sup>10,11</sup>.

Sometimes the blood pools inside the heart followed by formation of thrombi in the left atrial appendage which when leaves the heart and travels to the systemic circulation which causes thromboembolic occlusions of the arteries in the brain, limbs and other organs hence interrupting the blood supply of brain resulting in stroke. Risk of stroke is increased 4-6 times in an individual due to AF<sup>12</sup>. Furthermore, prolong myocardial ischemia as a result of AF is followed by congestive heart failure which increases morbidity. AF is increasing the duration of hospital stay and henceforth is a drain on hospital<sup>13</sup>.

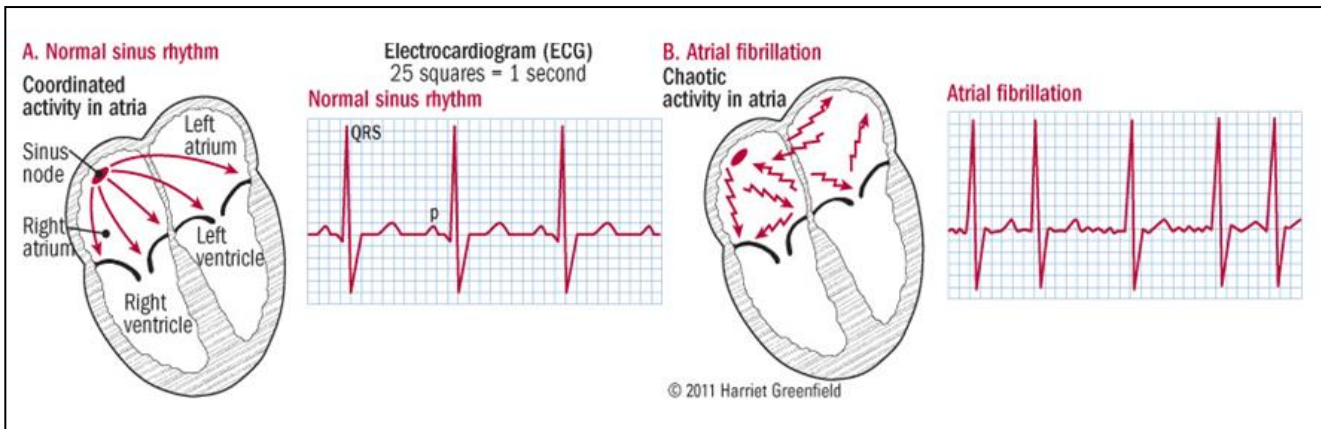
Intraoperative preventive measures include strategies to prevent shed mediastinal blood from pooling around the heart that might be considered in developing future paradigms for prevention of POAF. Prophylactic use of beta blockers and amiodarone is also quiet effective in prevention of this complication. Lifestyle management in patients with metabolic syndrome can play a major role in occurrence of such complications<sup>1</sup>.

as well in patients with unstable hemodynamics. In hemodynamically stable patients, heart rate maintenance therapy is recommended. During peri-operative period controlling heart rate at 90-115/min is advisable<sup>15,16</sup> (fig-1).

The purpose of conducting this study is to find out the frequency of post-operative atrial fibrillation in patients undergoing coronary artery bypass grafting (CABG) at Armed Forces Institute of Cardiology. It was made sure that the patients included in the study did not have any pre-existing rhythm problems and AF was induced solely by various intra and post-operative factors. The aim of this study is to investigate the major factors contributing to this life threatening complication on which sufficient amount of studies have been and are still being conducted at a very large scale in many countries yet in our country data is still scarce. This is a small scale study due to a limited time frame, but the results would hopefully help fulfill the literature gap in further policy making to minimize the risk factors of this major complication.

**METHODOLOGY**

It is a descriptive cross sectional study, has been carried out at Armed Forces Institute of Cardiology/ National Institute Heart Diseases, Rawalpindi, from September 2019 to January 2020. Adult cardiac patients (n=80) having age 40-80 years regardless of gender with no previous history of arrhythmias, neurological or thyroid problems undergoing ON-pump CABG had



**Figure-1: Normal sinus rhythm and irregular fibrillatory waves on an electrocardiograph.**

Postoperative AF can be treated by rhythm control, heart rate control, and therapeutic management by the use of beta blockers (esmolol, metoprolol, or popranolol) calcium-channel antagonists and amiodarone therapy. Drugs can target to achieve rate control or rhythm control<sup>14</sup>. Antithrombotic therapy is effec-

been included in this study. Non-probability convenient sampling was used and data has been analysed through SPSS-23 by keeping *p*-value  $\leq 0.05$  as statistical significant. Demographical variables including age, weight height, intraoperative variables including CPB time and aortic cross-clamp time and post-operative

left ventricular ejection fraction (LVEF), ECG changes, CPB time, cross-clamp time, post-op lactate levels and post-operative heart rate had been monitored. Institutional consent was taken from department of Cardiac Perfusion, Armed Forces Institute of Cardiology, Rawalpindi. Data was intended to keep confidential and strictly for academic purpose. Prior to data collection, consent was taken from institutional ethics review board (IERB. Patients were given specific identification number (MI) to maintain anonymity (fig-2).

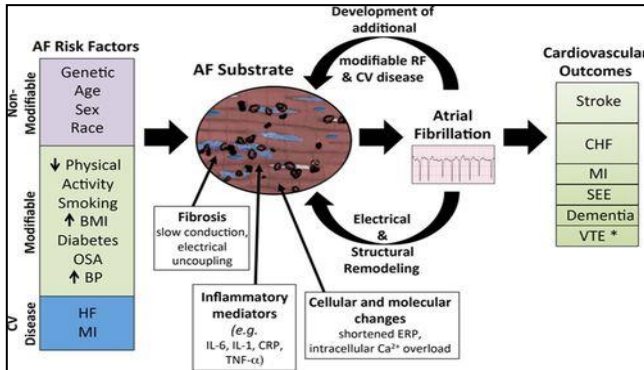


Figure-2: Major risk factors of atrial fibrillation.

**RESULTS**

Out of 80 patients 56 (70%) were males while rest were females, mean age of patients who developed post-operative atrial fibrillation i.e. (n=47), has been reported as 60.19 ± 9.3 years with a mean height of 164.21 ± 9.8 cm and their mean weight is 76 ± 12.24 kg. The mean body mass index of patients with POAF is 28.27 ± 4.2kg/m<sup>2</sup> whereas those without POAF have a BMI of 25.3 ± 5.1 kg/m<sup>2</sup> (table-I).

Table-I: Mean and standard deviation of demographical pre-operative variables.

Demographic variables	Mean ± SD
Age	60.19 ± 9.3
Height	164.21 ± 9.8
Weight	76 ± 12.24
BMI (with POAF)	28.27 ± 4.2
BMI (without POAF)	25.3 ± 5.1

Out of 47 patients who developed POAF, 8 (10%) presented with a history of smoking, 21 (26.5%) with hypertension, 4 (5%) with diabetes, 12 (15%) were both smokers and hypertensive, 3 (3.75%) were smokers and diabetic, 22 (27.50%) were hypertensive and diabetic, 6 presented with a history of smoking, hypertension and diabetes (7.5%) and 4 (5%) presented with none of them prior to the surgery (fig-3).

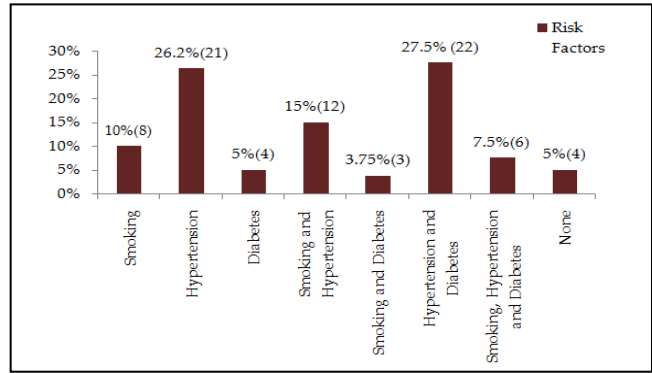


Figure-3: History of smoking, hypertension and diabetes.

The mean CPB time in patients with POAF was 156 ± 39.7 min whereas in those without POAF was reported 106 ± 30.4 min. Similarly the mean Aortic Cross-clamp time in patients who developed POAF was 100 ± 27.2 min and in those without POAF was calculated as 67 ± 22 min (table-II).

The mean EF of patients after CABG with POAF is reported as 47.20 ± 10.7%, meanlactate levels after POAF are 3.7 ± 1.54 mmol/lit and the mean heart rate of the patients is 117.8 ± 21.04 bpm. Out of a total 80 patients, 47 (58.7%) individuals presented with atrial fibrillation. This shows that there is a moderate incidence of AF. The mortality rate in patients who underwent POAF out of a total 80 patients is relatively

Table-II: Mean and standard deviation of intra-operative variables.

	Variables	Mean ± SD
Intra-Operative Variables	CPB Time in patients with POAF (minutes)	156 ± 39.7
	CPB Time in patients without POAF (minutes)	106 ± 30.4
	Cross-clamp time in patients with POAF (minutes)	100 ± 27.2
	Cross-clamp time in patients without POAF (minutes)	67 ± 22
Post-operative Variables	Ejection Fraction (%)	47.20 ± 10.7
	Lactate Levels (mmol/lit)	3.7 ± 1.54
	Heart Rate (bpm)	117.8 ± 21.04

Table-III: Frequency of atrial fibrillation and associated mortality.

Frequency of AF n (%)	AF	47 (58.75%)
	No-AF	33 (41.25%)
Frequency of Mortality, n (%)	AF	30 (38%)
	No-AF	15 (19%)

n=80; AF=Atrial Fibrillation

higher i.e. 30 (38%), than the patients without POAF in which 15 (19%) mortality is reported (table-III).

**DISCUSSION**

POAF is a major complication following cardiac surgery causing morbidity and mortality. Major risk factors affecting its frequency during the pre, intra and postoperative phase were monitored and results were generated which helped in finding their association with AF.

The results are in agreement with the study<sup>12</sup>, showing male gender (65%) and pre-op history of hypertension as a major risk factor of POAF (40%) which in our study was 26.25%. Also old aged patients with male predominance (70%), were more prone to POAF with a mean age of  $70 \pm 20$  SD whereas mean age calculated in our study was very close to it i.e.  $60.19 \pm 10$  SD.

A study<sup>15</sup>, showed the frequency of POAF in patients to be 25.8%. Majority of the patients with PoAF presented with a preoperative history of hypertension (68.1%), diabetes mellitus, smoking and obesity with a mean BMI of  $27.04 \pm 4.85$  kg/m<sup>2</sup>. Compared to this, the frequency of POAF in this study was found to be relatively higher i.e. 58.75% with afore-mentioned co morbidities as major.

In<sup>1</sup>, post-op mean EF was  $55 \pm 14\%$ , pretty much in accordance with our post-operative mean EF  $47.2 \pm 10.7$  SD. The mean CPB time in PoAF patients was  $87 \pm 36$  min and in patients without POAF was  $100 \pm 31$  min while in POAF patients of our study it was higher ( $156 \pm 39.7$  min) and lower in patients without POAF ( $106 \pm 30.4$  min). The mean aortic cross-clamp time in the study<sup>1</sup>, was  $53 \pm 43$  min and  $59 \pm 36$  min in patients with POAF and without POAF respectively. However our results has mean aortic cross-clamp time in POAF patients relatively higher ( $100 \pm 27.2$  min), in without POAF patients was  $67 \pm 22$  min. Another study<sup>17</sup>, had discussed about the raised serum lactate levels in postoperative cardiac surgery and its association with tissue hypoxia and other non-hypoxic metabolic disorders which could directly or indirectly be associated with early mortality. Lactate levels in the range of 2-4 mmol/lit are an indicator of hyperlactemia which can be detrimental. If raised to 4 mmol/lit and above, results in lactic acidosis. A study<sup>18</sup>, showed that 19.4% patients with POAF had lactate levels  $\geq 4$  mmol/lit and only 5.3% reported with serum lactate levels  $< 4$  mmol/lit of which mean value of  $3.7 \pm 5.4$  SD was found in our study.

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### CONCLUSION

The frequency of AF in patients undergoing On-pump CABG is moderately high i.e. 58.75% with an overall male predominance i.e. 70% and hypertension, diabetes and high BMI as most common co morbidities associated with post-op AF and its frequency increases with age. Prolong CPB and Aortic Cross-clamp time leads towards PoAF alongside raised lactate levels with high mortality rate. Preventive measures such as pre-op anti-thrombin therapy are advised, vitamin-D deficiency should be corrected preoperatively by vitamin-D supplementations<sup>19</sup>. Lifestyle modifications especially in hypertensive and diabetic patients could bear beneficial results in reducing its incidence.

### RECOMMENDATION

This was a single-centric study and adding up to this limitation was a very limited time-frame. Henceforth this study can further be explored in future by planning a multi-centric population based study in future with increased sample size which would generate more generalizable results.

### CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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## Post-Operative Atrial Fibrillation

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