

Frequency of Atrial Fibrillation after Coronary Artery Bypass Grafting in an Asian Tertiary Care Hospital

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Authors' contributions

This work was carried out in collaboration among all authors. Author IAK designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors AK and BM managed the analyses of the study and literature searches. Author WM managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Post-surgical atrial fibrillation is a common arrhythmic complication of coronary artery bypass surgery. However, mostly it is thought to be a benign and self-limiting problem, but it has also been observed that it is a serious complication and can raise the number of complications after bypass surgery.

Aims: To assess the frequency of atrial fibrillation after coronary artery bypass grafting

Study Design: Cross-sectional study

Place and Duration of Study: Department of Cardiology, Punjab Institute of Cardiology (PIC), Lahore, between February 2018 and August 2018.

Methodology: 145 patients who fulfilled the selection criteria were enrolled in the study. The type of CABG (on-pump or off-pump) was noted from the medical record. Then patients were evaluated

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by an ECG monitor. If P waves were absent, with disorganized electrical activity in their place, and irregular R-R intervals due to irregular conduction of impulses to the ventricles and heart rate >100bpm, then atrial fibrillation was labeled.

Results: The mean age of patients was 53.08±8.80 years. There were 84(57.9%) males and 61(42.1%) were females. There were 61(42.1%) patients with 2 vessels involved while among 84(57.9%) patients triple vessels were involved. There were 86(59.3%) with On-pump CABG and 59(40.7%) with off-Pump CABG. There were 71(49%) patients with follow-up atrial fibrillation and 74(51%) have no followed up atrial fibrillation. There was no significant association between atrial fibrillation and age group as the p-value was not significant.

Conclusion: CABG is associated with a higher frequency of atrial fibrillation after CABG as in our study the frequency was 49%.

Keywords: Atrial fibrillation; coronary artery bypass grafting; surgical procedure; on-pump; off-pump.

1. INTRODUCTION

Coronary artery bypass surgery or grafting (CABG) is the surgery that is performed to reestablish the blood circulation back to the normal position for a clogged coronary artery. The normal coronary artery circulated the blood to and from the cardiac muscles itself first, but not via the main circulatory system [1]. There are 2 main methods. In one method, the left internal thoracic artery can be distracted to the left anterior descending branch of a left coronary artery. While in other methods, the great saphenous vein is detached from the leg; one end is attached to the aorta or its major subdivisions, and another end is attached to obstructed artery instantaneously after obstruction to reestablish the blood flow [2].

Several complications are associated with CABG, both in the short term and in the long term; they are associated with CABG and may result in severe outcomes [3]. Atrial fibrillation is the abnormal heart rhythm that is characterized by quick and asymmetrical beatings [4]. Mostly, it initiates for a very short period of abnormal beating which may remain for a longer duration and probably may remain constant with passing time [5]. Many times it is asymptomatic. Infrequently, there may be few heart trembles, loss of consciousness, dizziness, dyspnea, or pain or pressure in the chest. Atrial fibrillation may be a risk factor for heart failure, dementia, or intravascular events [6,7].

The rationale of this study is to assess the frequency of atrial fibrillation after CABG. Atrial fibrillation is common in patients of CABG. But the literature showed variable evidence regarding the occurrence of atrial fibrillation after CABG. Moreover, not much work has been done in the literature as well as there is no data available. So

to get local evidence, we want to conduct this study on whether the occurrence of atrial fibrillation is high or low. So that patients can be managed or have some preventive strategies to prevent atrial fibrillation and its complications. Moreover, the patients with atrial fibrillation can be screened regularly after CABG and if minor changes develop, patients can be managed on an early basis and prevented from hazardous consequences.

2. OBJECTIVE

To assess the frequency of atrial fibrillation after coronary artery bypass grafting.

3. MATERIALS AND METHODS

Study Design: Cross-sectional study.

Setting: Department of Cardiology, Punjab Institute of Cardiology, Lahore.

Study Duration: Six months, between February 2018 and August 2018.

Sample Size: n = 145 cases was estimated by using 95% confidence level, 6% margin of error, and anticipated population percentage of atrial fibrillation i.e. 16% after CABG.

Sampling Technique: Non Probability, consecutive Sampling.

3.1 Sample Selection

Patients of age 40-65 years of either gender underwent CABG for patients having coronary artery disease under general anesthesia were enrolled. Patients who had rheumatic heart disease or rheumatic valvular replacement, diastolic dysfunction, already diagnosed with

atrial fibrillation, and taking treatment were excluded.

3.2 Data Collection Procedure

Their demographic information (name, age, gender, history of diabetes (BSR>186mg/dl), and several arteries involved with average diameter of ≥ 2.5 mm) was also noted. The type of CABG (on-pump or off-pump) was noted from the medical record. Then patients were evaluated by an ECG monitor for 5 days. If P waves were absent, with disorganized electrical activity in their place, and irregular R-R intervals due to irregular conduction of impulses to the ventricles and heart rate>100bpm, then atrial fibrillation was labeled. All this information was recorded on proforma.

3.3 Data Analysis

The collected data were analysed in SPSS v. 21. Quantitative variables e.g. age was presented in form of mean \pm S.D. Qualitative variables e.g. gender, h/o diabetes, number of arteries involved, type of CABG, and atrial fibrillation were presented in form of frequency and percentage.

4. RESULTS

The mean age of the patients was 53.08 \pm 8.80 years. There were 84(57.9%) patients who were male and 61(42.1%) were females. There were 61(42.1%) patients with 2 vessels involved while among 84(57.9%) patients triple vessels were involved. In this study, 70(48.3%) patients had diabetes, 90(62.1%) had hypertension, 48(33.1%) had left ventricular dysfunction and 107 (73.8%) were taking beta-blockers. There were 86(59.3%) with On-pump CABG and 59(40.7%) with off-Pump CABG (Table 1).

Table 1. Demographics of patients

n	145
Age (years)	53.08 \pm 8.80
Gender	8.803
Male	84 (58%)
Female	64 (42%)
Number of arteries involved	
2 Vessel	61 (42.1%)
3 Vessel	84 (57.9%)
Risk factors	
Diabetes	70 (48.3%)
Hypertension	90 (62.1%)
Left ventricular dysfunction	48 (33.1%)
Taking β -blockers before CABG	107 (73.8%)
Type of CABG	
Off-pump	59 (40.7%)
On-pump	86 (59.3%)

There were 71(49%) patients with follow-up atrial fibrillation and 74(51%) have no followed up atrial fibrillation (Fig 1).

There was no significant association between atrial fibrillation and age group as the p-value was not significant (p-value=0.86). There was a significant association between follow-up atrial fibrillation and gender as the p-value was significant (p-value=0.002). There was a significant association between follow-up atrial fibrillation and the number of arteries involved as the p-value was significant (p-value=0.039). There was no significant association between follow-up atrial fibrillation and diabetes as the p-value was not significant (p-value=0.36). There was no significant association between follow-up atrial fibrillation and type of CABG as the p-value was significant (p-value=0.29) (Table 2).

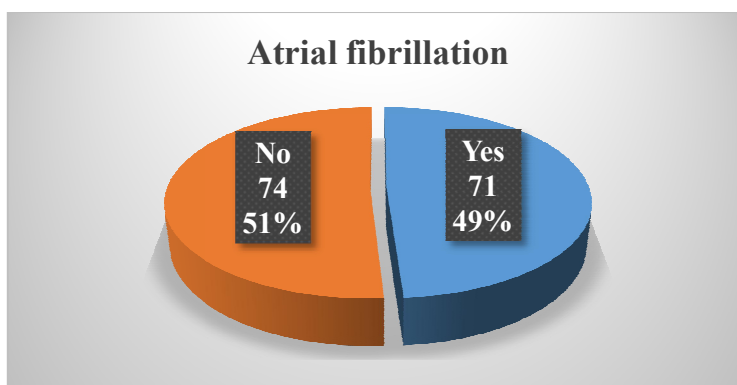


Fig. 1. Frequency of atrial fibrillation

Table 2. Follow up atrial fibrillation in relation to the age of the patients

Age (years)	Atrial fibrillation		P-value
	Yes (n=71)	No(n=74)	
36-45	18(25.4%)	17(23.0%)	0.86
46-55	21(29.6%)	25(33.8%)	
56-65	32(45.1%)	32(43.2%)	
Gender			
Male	32(45.1%)	52(70.3%)	0.002
Female	39(54.9%)	22(29.7%)	
Arteries Involved			
Double Vessel	36(50.7%)	25(33.8%)	0.039
Triple Vessel	35(49.3%)	49(66.2%)	
Diabetes			
Yes	37(52.1%)	33(44.6%)	0.365
No	34(47.9%)	41(55.4%)	
Hypertension			
Yes	39(54.9%)	51(68.9%)	0.083
No	32(45.1%)	23(31.1%)	
Left ventricular dysfunction			
Yes	21(29.6%)	27(36.5%)	0.377
No	50(70.4%)	47(63.5%)	
Taking β -blocker before CABG			
Yes	50(70.4%)	57(77.0%)	0.366
No	21(29.6%)	17(23.0%)	
Type of CABG			
On-Pump	39(54.9%)	47(63.5%)	0.290
Off-Pump	32(45.1%)	27(36.5%)	

5. DISCUSSION

Though the complications of post-surgical atrial fibrillation are well known, it is still unclear whether the atrial fibrillation that develops after surgery is related to the higher rate of mortality. In previous studies, the rate of post-surgical atrial fibrillation was not seemed to have an impact on the short or long-term consequences [8,9]. With more than 90% of patients reverting to sinus rhythm at six to eight weeks after surgery, tachyarrhythmia itself was short-lived [9]. In few previous studies, postoperative atrial fibrillation was found to be associated with the two- to four-fold higher risk of stroke within thirty days of surgery [10]. Stamou et al., [11] found that there is a significantly higher in-hospital mortality rate (3%) in patients who developed atrial fibrillation after minimally invasive surgery as compared to those who did not develop atrial fibrillation (1%). However, Loubani et al., found 50% persistent atrial fibrillation at the time of discharge and 83 patients had postoperative atrial fibrillation. This lack of information is mystified by the fact that the immediate cause and way of mortality in such patients is still not known [12].

The precise mechanism of atrial fibrillation is still not known but different pathophysiological

factors are anticipated to play an important role in the development of atrial fibrillation after CABG: stress-related overdrive of sympathetic nervous system or heightened vagal tone [13-16], perioperative ischemia, atrial incision, the release of inflammatory mediators due to cardiopulmonary bypass [17,18], postoperative inflammation that makes myocardium susceptible to abnormal electrical activity [19,20] and age-related changes resulting in atrial dilatation.

As stated by Villreal et al., the rate of post-surgical atrial fibrillation was observed as 16%, which was significantly less than in previous studies. This low rate may be accredited to, in any case, the exclusion of patients with valvular heart diseases and patients having atrial fibrillation before surgery [21]. Magee et al., showed that about 21.5% of patients developed atrial fibrillation after bypass surgery [22]. While Zaman et al., showed that around 28.2% of patients developed atrial fibrillation after bypass surgery [23].

The most commonly encountered cardiac arrhythmia is atrial fibrillation. More than 2.7 to 6.1 million people in the United States are affected by it. Atrial fibrillation is highly dependent on age, affecting 4% of people over

60 years of age and 8% of people over 80 years of age. About 25% of people aged 40 and older will experience atrial fibrillation throughout their lifetime [24,25]. In all age groups, the frequency of atrial fibrillation is substantially greater in males than in females, although this effect may be mediated by the difference in mean height between males and females. In white people, atrial fibrillation tends to be more prevalent than in black people with black people having less than half the age-adjusted risk of experiencing atrial fibrillation [26,27].

The condition occurs in the absence of comorbidity in 10-15 percent of cases of atrial fibrillation. However other cardiovascular disorders, including hypertension; heart failure; diabetes-related heart disease; ischemic heart disease; and valvular, dilated, hypertrophic, restrictive, and congenital cardiomyopathies, are frequently associated with atrial fibrillation. Reduced kidney function and the involvement of albuminuria are closely correlated with atrial fibrillation in the Atherosclerosis Risk in Communities Research [28].

The frequency of atrial fibrillation after CABG is known to be as high as 31.9 percent, according to Cresswell, and it is increased in elderly patient cohorts. Recently, Chauhan et al. reported a lower incidence of postoperative atrial fibrillation in patients with minimally invasive direct CABG compared to those with regular CABG [29]. Knowing that the incidence of postoperative atrial fibrillation in our population was 34.4% before any matching (all patients across the past 10 years) and that the incidence in our minimally invasive direct CABG cohort was 23.6%, the incidence differed by 31%, according to Cohan [30]. In our study, the frequency of atrial fibrillation was 49% which was comparatively high as compared to the studies discussed above.

According to the Framingham report, the overall incidence rate of atrial fibrillation in all populations was 1.7 percent, according to Siebert et al., It is age-dependent to a large extent, reaching a range of 2 to 4 percent among individuals over 70 years old. The prevalence in the population of patients with ischemic heart disease is 4.8% among women and 6.2% among men, depending on the nature of the disease. Whereas the most common age group in our sample was 56-65 years, the prevalence was 45.1 percent and 45.1 percent among males, while it was 54.9 percent among females. The

range of occurrence of postoperative atrial fibrillation, cited in the literature, varies greatly, from 5 percent to over 40 percent. The outcomes of various investigations can depend on the application [31].

Postoperative atrial fibrillation was until recently, known as a benign complication. However, a systematic meta-analysis examination found that this arrhythmia is correlated with higher short- and long-term mortality rates. Patients who experienced postoperative atrial fibrillation have a higher incidence of postoperative complications such as stoking, pneumonia, respiratory failure, and prolonged hospitalization [32]. In our study highest frequency of atrial fibrillation was seen in patients in the elderly age group i.e. 36-45 years: 25.4%, 46-55 years: 29.6% & 56-65 years: 45.1%.

In several studies, advanced age is found to be a significant risk factor for developing post-surgical atrial fibrillation in cardiac surgery [33,34]. El Chami et al., also identified predictive preoperative and postoperative atrial fibrillation characteristics and CABG stated that age was the most significant isolated predictor of postoperative atrial fibrillation (OR=1,059/year, 95 percent confidence interval - 95 percent CI:1,055-1,063) [35]. Post-surgical atrial fibrillation has inconsistently been correlated with the male gender. This discrepancy can be explained by sex variations in ion-channel expression and hormonal impacts on autonomic tone [36]. Similar findings were reported by Folla and Farouk [37,38]. However, in this study, a significant difference was seen for atrial fibrillation among male and female patients (45.1% vs. 54.9%) but among female patients frequency of atrial fibrillation was higher than that of male patients which are contradicting to the findings of Folla and Farouk.

Post-surgical atrial fibrillation is a great burden for the healthcare system. It increases the use of intensive care units and also increases the stay of a patient in the hospital. Numerous modalities that may range from conservative medical methods to invasive bi-atrial pacing can be valuable to predict the development of atrial fibrillation after surgery. Several studies are done to discover the actors that lead to post-surgical atrial fibrillation. Developing a useful and simple atrial fibrillation scoring system, which can help to predict the post-surgical atrial fibrillation, can be appropriate, and further research is mandatory to determine the interpretation of

these criteria and utilize them to use the available protocols for the prevention and treatment of atrial fibrillation.

6. CONCLUSION

CABG is associated with a higher frequency of atrial fibrillation after CABG as in our study the frequency was 49%. Now we have got the evidence for the local population. Now we can plan and implement some preventive or management protocols to prevent atrial fibrillation and its complications.

CONSENT

Informed consent was obtained from patients.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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