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Original Research Article

PREVALENCE AND RISK PREDICTORS OF POST OPERATIVE ATRIAL FIBRILLATION AFTER HEART SURGERY UNDER CPB

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Abstract: *The current analysis was designed to assess the prevalence and risk predictors of atrial fibrillation after heart surgery performed under cardiopulmonary bypass (CPB). A descriptive observational study was conducted in the Cardiology Department of Faisalabad Cardiology Hospital, Faisalabad. A total of 150 patients older than 18 years old undergoing CABG and valvular surgery performed by cardiopulmonary bypass were included in the study. The association of POAF and risk factors, including age, LVEF<40%, history of diabetes, myocardial infarction, beta-blocker therapy, COPD, aortic cross-clamp time, CPB time, inotropic, and ventilation support, was evaluated. The patients with no history of beta blockers showed less risk of developing AF (OR: 0.153); hence the use of beta-blockers is significantly associated with AF. Similarly, patients with LVEF less than 40% and inotropic support for 30 minutes also had less odds of AF (0.174, 0.127); hence these variables are also significantly associated with AF. A history of myocardial infarction increased the risk of AF to 6.27 times. Using a ventilator for> 24 hours increased the incidence of AF to 12.28 times. LVEF <40%, inotropic and ventilation support, myocardial infarction, and CPB time preoperatively are strong predictors of POAF after cardiac surgery.*

Keywords: Cardiac surgery, postoperative atrial fibrillation, atrial fibrillation, cardiopulmonary bypass

Introduction

Atrial fibrillation is a common condition that occurs postoperatively after cardiac surgery in 10-65% of patients (Cole et al., 2020; Mansour and Ghaleb, 2017). This arrhythmia worsens the postoperative complications in patients like thromboembolic events, renal failure, stroke, and heart failure, which increase the hospital stay, treatment costs, and increase chances of readmission (Eikelboom et al., 2021). A decline in cognitive functions and delirium are also included in its postoperative complications. AF is usually caused by heart muscle ischemia and inadequate atrial cardioplegia (Yamashita et al., 2019). Postoperative atrial fibrillation mainly presents two to four days after surgery, is short-lived primarily, and does not require treatment. However, POAF doubles the one-month mortality rate and significantly increases morbidity and hospital stay (Gudbjartsson et al., 2020). Various therapies and surgical techniques have been proposed to prevent POAF, like administering oral beta-blockers after surgery, but none are significantly effective. More than half of the patients (80%) convert to sinus rhythm after 24 hours, and 98% of patients convert to SR 6 weeks after initial detection. This study assessed the prevalence and risk predictors of atrial fibrillation after heart surgery performed under CPB.

Methodology

A descriptive observational study was conducted in the Cardiology Department of Faisalabad Cardiology Hospital, Faisalabad. A total of 150 patients older than 18 years old undergoing CABG and valvular surgery performed by cardiopulmonary bypass were included in the study. The study did not have patients with chronic atrial fibrillation and undergoing surgeries except for coronary artery bypass graft and valve replacement. The evaluation of preoperative predictors of POAF, including age older than 60 years, LVEF less than 40%, history of diabetes, myocardial infarction, beta-blocker therapy, and COPD, was conducted. The surgery type and time for cross clamping the aorta is less than 60 minutes, and the cardiopulmonary bypass time is less than 100 minutes. Inotropic support for less than 30 minutes and the use of a ventilator for less than 24 hours after surgery was also evaluated. AF was co-evaluated with the risk factors and was detected on lead II of

cardioscope to determine the outcome. The rate of in-hospital mortality and hospital stay was also noted. All the data were analyzed by IBM SPSS version 13. Logistic regression analysis was done to evaluate the relationship of AF with risk factors.

Results

The average age of patients was 45.6±12.2. POAF was detected in 61 patients (40.7%). The relationship between AF and predicted risk factors is shown in Table I-III. The patients with no history of beta blockers showed less risk of developing AF (OR: 0.153); hence the use of beta-blockers is significantly associated with AF. Similarly, patients with LVEF less than 40% and inotropic support for 30 minutes also had less odds of AF (0.174, 0.127); hence these variables are also significantly associated with AF. On the other hand, a history of myocardial infarction increased the risk of AF to 6.27 times. Using a ventilator for> 24 hours increased the incidence of AF to 12.28 times. Tables IV and V show the timeline of AF diagnosis and its relationship with mortality and hospital stay.

Table I: Risk factors of AF

Risk factor	N (%)
Younger than 60 years	46 (30.7)
LVEF less than 40%	46 (30.7)
Use of beta blockers	127 (84.7)
COPD	4 (2.7)
Diabetes mellitus	70 (47.3)
Myocardial infarction	90 (60)
Valve surgery	65 (43.3)
CABG	85 (56.7)
Aortic cross-clamp time of more than 60 minutes	45 (30)
CPB more than 100 minutes	50 (33.3)
On ventilator for more than 24 hours	15 (10)
Inotropic support of more than 6 hours	42 (28)

Table II: Incidence of POAF

Risk factor	N (%)	Incidence of POAF	No POAF cases in case of risk factor
Younger than 60 years	46	9	19.56
LVEF less than 40%	46	14	19.7
Use of beta blockers	127	42	33.1
COPD	4	0	0
Diabetes mellitus	70	42	50.6
Myocardial infarction	90	38	50.7
Valve surgery	65	28	43.1
CABG	85	33	38.8
Aortic cross-clamp time of more than 60 minutes	45	30	66.7
CPB more than 100 minutes	50	30	60
On ventilator for more than 24 hours	15	5	33.3
Inotropic support of more than 6 hours	42	19	45.2

Table III: Relationship between postoperative POAF and risk factors

Risk factor		Incidence of POAF n(%)	Odds ratio (95% CI)	Adjusted Odds ratio	P
Age	<60	6 (13)	0.43 (0.16-1.12)	1	0.628

	>60	27 (26)		0.68 (0.14-3.26)	
Beta-blockers	Yes	24 (18.9)	0.36 (0.14-0.94)	1	0.004
	No	9 (39.1)		0.15 (0.04-0.54)	
LVEF<40%	Yes	11 (15.1)	0.44 (0.20-0.997)	1	0.044
	No	22 (28.6)		0.17 (0.03-0.95)	
MI	Yes	19 (26)	1.58 (0.73-3.46)	1	0.04
	No	14 (18.2)		6.27 (1.08-36.26)	
Diabetes	Yes	18 (21.7)	0.96 (0.44-2.09)	1	0.66
	No	15 (22.4)		0.77 (0.24-2.47)	
CABG	Yes	15 (17.9)	0.58 (0.27-1.26)	1	0.980
	No	18 (27.3)		1.02 (0.18-5.81)	
Valvular surgeries	Yes	18 (27.3)	1.73 (0.79-3.76)	1	0.980
	No	15 (17.9)		1.02 (0.18-5.81)	
CPB time	Yes	18 (27.3)	1.73 (0.79-3.76)	1	0.980
	No	15 (17.9)		1.02 (0.18-5.81)	
Aortic cross-clamp time	Yes	21 (46.7)	0.15 (0.06-0.34)	1	0.999
	No	12 (11.4)		0 (0-0)	
Inotropic support	Yes	9 (20.9)	0.92 (0.39-2.17)	1	0.007
	No	24 (22.4)		0.13 (0.03-0.58)	
Ventilator support	Yes	5 (35.7)	2.14 (0.67-6.90)	1	0.023
	No	28 (20.6)		12.28 (1.42-106.08)	
COPD	Yes	1 (3)	0.88 (0.095-8.18)	1	0.0819
	No	4 (3.4)		0.58 (0.005)-64.20)	

Table IV: Detection of POAF

Diagnosis of POAF	**Yes**	**No**
During surgery	22 (14.7)	126 (84)
1st day after surgery	26 (17.3)	122 (81.3)
2nd day after surgery	41 (27.3)	107 (71.3)
3rd day after surgery	31 (20.7)	116 (77.3)

Table V: Relationship between POAF and hospital stay and mortality

	Postoperative atrial fibrillation		**Probability**
	Yes	**No**	
Increase in length of hospital stay			<0.01
Yes	47 (31.3)	9 (6)	
No	12 (8)	79 (52.6)	
Rate of mortality			0.098
Yes	6 (4)	2 (1.3)	
No	54 (36)	87 (58)	

Discussion

We explored the relationship between POAF and its possible risk factors. It was found that AF was mainly detected in the first three days after the surgery, with most patients being diagnosed on the second day. The same results were reported by Gjerakaroska et al. (Gjerakaroska-Radovikj et al., 2020) and Goulden et al. (Goulden et al., 2022).

Associated factors such as autonomic imbalance before surgery, increase in catecholamines, pericardial inflammation, and changes in volume and pressure due to fluid shift contribute to POAF (Chang et al., 2019; Douketis et al., 2019).

AF is primarily common in elder patients, old age being the most common predictor. Ronsoni et al. (Ronsoni et al., 2019) reported that the risk of AF increased by 75% with every 10-year increase in age, with older patients being at higher risk of AF. But in our study, the incidence of POAF was higher in younger patients undergoing valvular surgery; therefore, the incidence of POAF was higher in younger patients.

Our results showed that myocardial infarction was significantly associated with POAF than diabetes. Omar et al. (Omar et al., 2021) also concluded that a history of myocardial infarction increased the risk of POAF after heart surgery. Ellam et al. (Ellam et al., 2020) Showed that diabetes was a strong predictor of POAF in patients undergoing invasive CABG. Since our study included fewer participants undergoing CABG, we did not find diabetes as a predictor of POAF.

Studies by El-Essawi et al. (El-Essawi et al., 2022) and Yi-Ting et al. (Tsai et al., 2015) reported a low prevalence of POAF in patients with a history of bet blocker use. In contrast to this, we observed that the

incidence of POAF was more in patients with no prior history of beta blockers

LVEF <40% was also a strong predictor of POAF. Similarly, CABG and valvular surgery also contribute to the risk of POAF. Although the occurrence of POAF was more in valve surgery patients, there was a significant difference between the occurrence of POAF in both patients. Almassi et al. reported a 27.5% incidence of POAF after CABG, 48.8% after MVR, and 32.9% after AVR (Almassi et al., 1997). The significant change can be due to structural and pathological abnormalities.

The patients with higher cross-clamp time and CPB time also had an increased occurrence of POAF. Similar results were noted in Helgadottir et al. (Helgadottir et al., 2012) and Hashemzadeh et al. (Hashemzadeh et al., 2013). In addition, AF had a high incidence in patients with >30 minutes of inotropic support than those who needed it for less than 30 minutes after CPB, although this difference was insignificant. Hashemzadeh et al. (Hashemzadeh et al., 2013) also noted that > 30 minutes of inotropic support was a significant risk factor for POAF. Similar to Arnaki et al (Aranki et al., 1996), ventilation support was also significantly associated with POAF.

Patients with AF also had a more extended hospital stay due to ventilation support, unstable hemodynamics, and correction of hypoxia. The same observations were reported by Aranki et al. (Aranki et al., 1996). The mortality rate was also higher in AF patients (4%) compared to other patients (1%). In Almassi et al. (Almassi et al., 1997), the mortality rate in POAF patients was 6% compared to 3% in other patients. Our study had some limitations. The sample size was just calculated depending on the number of patients in the hospital. Secondly, both valve surgery and CABG were selected. Lastly, we did not estimate the hospital costs for POAF patients.

Conclusion

LVEF <40%, inotropic and ventilation support, myocardial infarction, and CPB time preoperatively are strong predictors of POAF after cardiac surgery.

Conflict of interest

The authors declared absence of conflict of interest.

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