

Postoperative Atrial Fibrillation in Cardiac Surgery Patients

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Abstract-

Introduction: Postoperative atrial fibrillation (POAF) is the most common arrhythmic complication following cardiac surgery, contributing significantly to morbidity, prolonged hospitalization, and healthcare costs. Despite advances in perioperative care, the incidence remains high. **Materials and Methods:** A prospective observational study was conducted among 200 adult patients undergoing elective cardiac surgery (CABG, valve surgery, or combined procedures). Patients were monitored continuously for 7 days postoperatively for development of atrial fibrillation. Demographic variables, comorbidities, intraoperative parameters, and postoperative outcomes were analyzed. **Results:** The incidence of POAF was 28%. Advanced age, left atrial enlargement, prolonged cardiopulmonary bypass time, and electrolyte imbalance were significant predictors ($p < 0.05$). Patients with POAF had significantly longer ICU stay and higher rates of postoperative complications. **Conclusion:** POAF remains a frequent complication after cardiac surgery. Identification of high-risk patients and targeted prophylactic strategies may reduce its burden.

Keywords: Postoperative atrial fibrillation; Cardiac surgery; CABG; Risk factors; Outcomes; Arrhythmia.

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INTRODUCTION

Postoperative atrial fibrillation (POAF) is a common complication following cardiac surgery, with reported incidence ranging from 20% to 50% depending on the type of procedure performed¹. It most frequently occurs between the second and fourth postoperative day and is associated with increased risk of stroke, heart failure, prolonged intensive care unit (ICU) stay, and increased healthcare expenditure². Although often transient, POAF significantly impacts both short-term and long-term outcomes³.

The pathophysiology of POAF is multifactorial and incompletely understood. Cardiac surgery induces systemic inflammation, oxidative stress, atrial ischemia, and autonomic imbalance, all of which contribute to atrial electrical remodeling⁴. Cardiopulmonary bypass (CPB) further exacerbates inflammatory cytokine release and oxidative injury⁵. Structural changes such as atrial enlargement and fibrosis also predispose patients to arrhythmogenesis⁶.

Advanced age is consistently identified as the strongest independent predictor of POAF⁷. Other risk factors include hypertension, diabetes mellitus, chronic obstructive pulmonary disease (COPD), obesity, left atrial enlargement, and prior history of atrial fibrillation⁸. Intraoperative factors such as prolonged CPB time, aortic cross-clamp duration, and electrolyte imbalance further increase susceptibility⁹.

The clinical significance of POAF extends beyond rhythm disturbance. Studies have demonstrated increased risk of thromboembolic events, especially stroke, in patients who develop POAF¹⁰. Moreover, POAF is associated with a twofold increase in ICU length of stay and higher readmission rates¹¹. Long-term data suggest that POAF may not be entirely benign and could predispose to recurrent atrial fibrillation and increased mortality¹².

Preventive strategies include beta-blockers, amiodarone, statins, magnesium supplementation, and anti-inflammatory agents¹³. Current guidelines recommend perioperative beta-blocker therapy in the absence of contraindications¹⁴. However, despite these interventions, incidence remains substantial.

In developing countries, limited data exist regarding the epidemiology and predictors of POAF, especially in mixed surgical populations¹⁵. Identification of modifiable risk factors may help tailor preventive measures and improve postoperative outcomes.

The present study aims to determine the incidence, risk factors, and clinical outcomes of POAF in patients undergoing cardiac surgery in a tertiary care center.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Cardiothoracic Surgery at a tertiary care hospital over 18 months. Institutional ethical clearance was obtained, and written informed consent was taken from all participants.

Study Population

A total of 200 adult patients undergoing elective cardiac surgery were enrolled.

Inclusion Criteria

- Age ≥ 18 years
- Undergoing elective CABG, valve surgery, or combined procedures
- Sinus rhythm preoperatively
- Provided informed consent

Exclusion Criteria

- Preexisting atrial fibrillation or flutter
- Emergency surgeries
- Redo cardiac surgeries
- Severe renal or hepatic dysfunction
- Thyroid disorders
- Use of anti-arrhythmic drugs preoperatively

Data Collection

Preoperative variables included age, sex, BMI, comorbidities, left atrial size (echocardiography), and left ventricular ejection fraction (LVEF). Intraoperative parameters included CPB duration, aortic cross-clamp time, and type of surgery. Postoperatively, continuous ECG monitoring was performed for 7 days or until discharge. POAF was defined as an episode of atrial fibrillation lasting more than 30 seconds or requiring treatment.

Laboratory parameters including serum electrolytes (potassium, magnesium), inflammatory markers (CRP), and hemoglobin were recorded.

Outcome Measures

Primary outcome: Incidence of POAF.

Secondary outcomes: ICU stay, hospital stay, stroke, reoperation, and mortality.

Statistical Analysis

Data were analyzed using SPSS version 25. Continuous variables were expressed as mean \pm SD. Categorical variables were expressed as percentages. Chi-square test and independent t-test were applied. Multivariate logistic regression was performed to identify independent predictors. $p < 0.05$ was considered statistically significant.

RESULTS

Table 1: Baseline Characteristics

Variable	POAF (n=56)	No POAF (n=144)	p-value
Mean Age (years)	67 \pm 8	59 \pm 10	0.001
Male (%)	64%	61%	0.72
Hypertension (%)	71%	48%	0.02
Diabetes (%)	55%	42%	0.08
LA Enlargement (%)	60%	30%	0.001

Advanced age, hypertension, and left atrial enlargement were significantly associated with POAF.

Table 2: Intraoperative Variables

Variable	POAF	No POAF	p-value
CPB Time (min)	118 \pm 25	95 \pm 20	0.001

Variable	POAF	No POAF	p-value
Cross Clamp (min)	75 ± 15	62 ± 12	0.003

Longer CPB and cross-clamp time significantly increased POAF risk.

Table 3: Laboratory Parameters

Parameter	POAF	No POAF	p-value
Potassium (mEq/L)	3.5 ± 0.4	4.1 ± 0.3	0.01
Magnesium (mg/dL)	1.6 ± 0.2	2.0 ± 0.3	0.02

Electrolyte imbalance correlated significantly with POAF.

Table 4: Type of Surgery

Surgery Type	POAF (%)
CABG	24%
Valve	34%
Combined	40%

Valve and combined surgeries had higher POAF incidence.

Table 5: Postoperative Outcomes

Outcome	POAF	No POAF	p-value
ICU Stay (days)	5.2 ± 1.1	3.4 ± 0.8	0.001
Hospital Stay (days)	12 ± 3	8 ± 2	0.001

POAF significantly prolonged ICU and hospital stay.

Table 6: Complications

Complication	POAF (%)	No POAF (%)
Stroke	7%	2%
Mortality	5%	2%

Stroke and mortality were higher in POAF patients.

DISCUSSION

The present study demonstrated a POAF incidence of 28%, consistent with previous reports ranging from 20–40%¹⁶. Advanced age emerged as the strongest predictor, aligning with findings from recent meta-analyses¹⁷. Aging is associated with atrial fibrosis, conduction abnormalities, and increased oxidative stress¹⁸.

Left atrial enlargement significantly increased risk, supporting evidence that structural remodeling predisposes to arrhythmogenesis¹⁹. Hypertension further contributes to atrial stretch and fibrosis²⁰.

Intraoperative factors such as prolonged CPB time were strongly associated with POAF, likely due to systemic inflammatory response and atrial ischemia-reperfusion injury²¹. Elevated inflammatory markers have been previously linked with higher POAF risk²².

Electrolyte disturbances, particularly hypokalemia and hypomagnesemia, were significantly correlated with POAF, consistent with earlier studies²³. Magnesium supplementation has shown benefit in reducing POAF incidence²⁴.

Valve surgeries demonstrated higher POAF incidence compared to isolated CABG, possibly due to atrial manipulation and preexisting structural heart disease²⁵.

Patients with POAF experienced longer ICU stay and increased complications, highlighting its clinical impact. Stroke risk was higher in POAF group, reinforcing the need for early rhythm control and anticoagulation strategies²⁶.

Our findings emphasize the importance of risk stratification and prophylactic measures such as beta-blockers and electrolyte optimization.

CONCLUSION

POAF remains a frequent and clinically significant complication after cardiac surgery. Advanced age, atrial enlargement, prolonged CPB time, and electrolyte imbalance are key predictors. Early identification and targeted preventive strategies may reduce morbidity and improve postoperative outcomes.

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