**Editorial Review Article**

**Post operative atrial fibrillation - An update**

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URL: http://keralaheartjournal.in/ojs/index.php/KHJ/article/view/71

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**Abstract:**

Atrial fibrillation is the most common perioperative cardiac arrhythmia. Sympathetic overactivity, inflammatory state and oxidative stress are important contributors to the genesis of postoperative atrial fibrillation. Advancing age and mitral valve disease along with left atrial size are important parameters in noted in multivariate prediction model. Genetic predisposition has also been noted. Preventive strategies tried include beta blockers, statins, posterior pericardiotomy, carperitide infusion and thoracic epidural analgesia. Treatment options include rate and rhythm control along with anticoagulation if it persists more than 48 hours with high CHADS2 score. Some of the therapeutic modalities which have been found to be NOT useful in preventing post operative atrial fibrillation are dexamethasone, magnesium infusion and concomitant pulmonary vein isolation.

**Key words:**

Atrial fibrillation, cardiac surgery, predictors, prevention

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**Introduction**

Atrial fibrillation is the most common perioperative cardiac arrhythmia. Just as the prevalence of atrial fibrillation in the community increases with advancing age, incidence of postoperative atrial fibrillation (POAF) is higher in the elderly¹, whether it is in the setting of cardiac surgery or non cardiac surgery. POAF is more likely with cardiac than non cardiac surgery, with rates as high as 60% being reported². 31.4% incidence of POAF has been reported even in minimally invasive esophagectomy [3]. Among the cardiac surgeries, occurrence of POAF is more with valve surgery. Mitral valve disease and left atrial size have been shown to be good predictors of POAF in a multivariate analysis⁴. It is well known that POAF increases the risk of stroke and systemic embolism as well as perioperative mortality in addition to increased length of hospital stay and consequently the cost², ³, ⁵, ⁶. Higher risk of cardiovascular events in the first post operative year has been recorded after transient POAF even after non cardiac surgeries like radical cystectomy⁷.

Pathophysiological mechanisms of POAF

Several factors implicated in the genesis of POAF include sympathetic stimulation, cardiac remodelling due to the disease process, surgical trauma and oxidative stress as a consequence of ischemic cardioplegic arrest followed by reperfusion². Biomarkers of oxidative stress derived from fatty acids (isofurans and isoprostanes) measured at end of surgery were higher in those who developed POAF⁸.

Elevated C-Reactive Protein levels indicating inflammation has been shown to be a predictor of POAF in a meta-analysis which identified 925 patients with POAF in 15 case-control studies⁹.

Complete denervation of the heart as occurs in a cardiac transplant has a protective effect against POAF. Similar protective effects have also been noted in aortic transection for replacement of ascending aorta leading to autonomic denervation¹⁰.

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A left atrial driver maintaining atrial fibrillation in POAF has been suggested. Sadrpour SA et al¹³ recorded atrial electrograms from the epicardial surface of right atrium, left atrial portion of Bachmann’s bundle and posterior left atrium during sustained atrial fibrillation. Rapid regular atrial activation with constant morphology could be recorded from at least one left atrial site in the majority of those who had sustained atrial fibrillation.
Predictors of POAF

1. Obstructive sleep apnea
Obstructive sleep apnea (OSA) is a risk factor for POAF. Use of positive airway pressure therapy at home was associated with a lowering of POAF in those with OSA44.

2. Genetic factors
Genetic factors have been used in the prediction POAF. Single nucleotide polymorphisms in high-mobility group box protein 1 (HMGB1) was associated with susceptibility to POAF [15 Qu C 2015]. Sigurdsson MI et al noted genetic variants in 1q21 and 4q25 regions associated with POAF after coronary artery bypass surgery19.

3. CHA2DS2-VASc score
CHA2DS2-VASc scoring system used to predict the risk of ischemic stroke with atrial fibrillation can predict the risk of POAF as well. Kashani RG et al17 reported that the mean CHA2DS2-VASc score was 3.6 +/- 1.7 among those with POAF vs 2.8 +/- 1.7 in those without POAF (P < 0.0001). Those with high CHA2DS2-VASc score was found to have 5.21 times risk of developing POAF than low risk patients.

4. Renal dysfunction
Renal dysfunction (e-GFR less than 60 ml per 1.73 square meter of body surface area) associated with left ventricular diastolic dysfunction is an independent predictor of POAF after cardiac surgery20. It was noted that renal dysfunction can further risk stratify those with lower CHA2DS2-VASc score and a new R-CHA2DS2-VASc score has been suggested. In this study, those with CHA2DS2-VASc score of 0 or 1 could be stratified into two groups with different rates of POAF (3.1% vs. 68.8%, P < 0.001) using renal dysfunction as an additional parameter. Lim et al19 documented progressively higher rates of POAF with more severe renal dysfunction. While the overall incidence of POAF was 39% in their study, in those with e-GFR of 90 ml/min/1.73 m2 or more, it was only 29.5% and in those with e-GFR of 60 ml/min/1.73 m2 or less, it was 55.6%.

5. Brain natriuretic peptide
Brain natriuretic peptide (BNP) and N-terminal (NT)-proBNP levels in the immediate preoperative period was found to be predictive of POAF in a paper reviewing the best evidence from 5 reported studies20. Cut off value of 30 pg/ml has been mentioned as the significant level for BNP. Basic principles of management of atrial fibrillation is the same whether it is perioperative or otherwise. Rate control is the primary concern. Reversible factors like electrolyte imbalances should be looked for and corrected if present. In case POAF persists more than 48 hours, anticoagulation has to be considered if the CHADS2 score is 2 or more1. While initiating warfarin for POAF, potential bleeding risk has to be considered. Moreover, it has little effect on the early onset stroke after coronary artery bypass grafting (CABG) as it requires a few days to achieve a therapeutic level. All the same warfarin may prevent delayed strokes with persistent POAF after CABG21.

Potential strategies for prevention of POAF

1. Beta blockers
Beta blockers are often used perioperatively to prevent POAF. In fact non use of beta blockers have been associated with higher incidence of POAF22. A prospective randomized study involving 200 elective CABG patients compared metoprolol with nebivolol initiated four days prior to surgery23. They found that nebivolol was as effective as metoprolol in preventing POAF in CABG patients.

2. Statin therapy
Statin therapy is being considered as having a potential to reduce POAF. 40 mg of atorvastatin initiated at around 6 hours after coronary artery bypass surgery in a prospective randomized study of 60 patients24 showed a significantly lower incidence of POAF (16.7% vs 43.3%; p=0.049) in those receiving statin. Similar advantage in preventing POAF has been reported by Dehghani MR et al25 in patients undergoing isolated heart valve surgery. A collaborative meta-analysis of 11 randomized controlled trials using individual-participant data has confirmed that short term treatment with statins may reduce the risk of POAF26. Altogether there were 1105 participants in these 11 trials and POAF occurred in 36% of those not receiving statins and 19% of those who received statins (P < 0.00001).

3. Ranolazine
Ranolazine is a drug being touted for its anti-arhythmic potential in several studies. Ranolazine initiated preoperatively and continued post operatively for a week reduced the incidence of POAF (10.1 vs. 41.9%, p < 0.0001)27. But early symptomatic hypotension occurred more frequently in the ranolazine group (p=0.0004), though there was no difference in the length of intensive care stay or 30 day cardiovascular mortality. The study group of 205 patients consisted of CABG, valve surgery and combinations.

4. Perioperative carperitide infusion
In a randomized study involving 668 patients undergoing CABG, infusion of carperitide (human atrial natriuretic peptide) from the initiation of cardiopulmonary bypass reduced the incidence of POAF (12.2% vs 32.7%, P<0.0001)28. Altogether there were 1105 patients in these 11 trials and POAF occurred in 36% of those not receiving statins and 19% of those who received statins (P < 0.00001).

5. Thoracic epidural analgesia
Thoracic epidural analgesia has been shown to reduce the incidence of POAF in those undergoing extended lung surgeries, more so in those undergoing lobectomy9.

6. Posterior pericardiotomy
There has been conflicting data on the role of posterior pericardiotomy and POAF. Kongmalai P29 and colleagues reported that posterior pericardiotomy did not reduce the incidence of POAF. They noted an increased rate of perioperative myocardial infarction, left sided pleural effusion and pneumonia resulting in longer stay in the intensive care unit with posterior pericardiotomy. In contrast, Kaya M et al30 found that posterior pericardiotomy was effective in reducing POAF and reduces hospital stay.
Similar results were documented by Fawzy H\textsuperscript{30} and associates as well.

**Strategies found NOT useful in preventing POAF**

1. **Dexamethasone**

   DECS study\textsuperscript{31} evaluated the role of intra-operative dexamethasone in a large cohort of 4494 patients undergoing cardiac surgery and found that it had no protective effect on the occurrence of POAF. Similar negative results have been reported in a smaller study by Jacob KA and colleagues\textsuperscript{32}. Hence the used of dexamethasone for prevention of POAF is not recommended.

2. **Magnesium**

   Intravenous magensium is often used in the intensive care setting for its antiarrhythmic potential. In a randomized double blind placebo controlled trial of magnesium bolus in 389 patients undergoing cardiac surgery, it did not decrease the incidence of POAF\textsuperscript{33}.

3. **Pulmonary vein isolation**

   Adjuvant bilateral pulmonary vein ablation with radiofrequency energy was tried as a strategy to prevent POAF in 89 patients undergoing CABG and compared with a control group of 86 patients\textsuperscript{34}. The study showed that there was no benefit in terms of prevention of POAF and there was prolongation of the mean hospital stay in the ablation group.

**References**


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