SYSTEMATIC REVIEW

Amiodarone versus beta-blockers for the prevention of postoperative atrial fibrillation after cardiac surgery: An updated systematic review and meta-analysis of randomised controlled trials [version 1; peer review: awaiting peer review]

Radhyaksa Ardaya1, Jenni Pratita1,2, Nusaibah Nadia Juliafina3,4, Farhan Haidar Fazlur Rahman3,5, Kevin Leonardo6,7

1Division of Surgical and Interventional Sciences, University College London Medical School, London, WC1E 6BT, UK
2Division of Cardiothoracic and Vascular Surgery, Department of Surgery, Dr. Cipto Mangunkusumo Hospital, Jakarta, 10430, Indonesia
3Metropolitan Medical Centre Hospital, Jakarta, 12940, Indonesia
4Faculty of Medicine, University of Indonesia, Jakarta, 10430, Indonesia
5Faculty of Medicine, Airlangga University, Surabaya, 60132, Indonesia
6Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Daerah Istimewa Yogyakarta, 55281, Indonesia
7Eka Hospital, Bumi Serpong Damai, 15321, Indonesia

First published: 25 May 2022, 11:569
https://doi.org/10.12688/f1000research.121598.1
Latest published: 25 May 2022, 11:569
https://doi.org/10.12688/f1000research.121598.1

Open Peer Review

Approval Status: AWAITING PEER REVIEW

Any reports and responses or comments on the article can be found at the end of the article.

Abstract

Background: Amiodarone and beta-blockers are widely used as prophylaxis for postoperative atrial fibrillation (AF). The current recommendations from society guidelines are inconclusive, leading to differing practices among physicians. This meta-analysis aimed to compare the efficacy of both agents in preventing postoperative AF after cardiac surgery.

Methods: We explored online medical databases, such as CINAHL, CENTRAL, MEDLINE, and EMBASE for randomised controlled trials (RCTs) comparing amiodarone and beta-blocker for prevention of AF after cardiac surgery. Outcomes analysed in this study were AF number of events and duration, hospital stay, and mean ventricular rate. Heterogeneity was assessed using the I² test, and publication bias was analysed using Egger's test.

Results: In total, eight RCTs comprising 1370 patients met the inclusion criteria. Pooled analysis showed that patients in both groups had no significant difference in both AF episodes (RR 0.83, 95% CI 0.66 to 1.04, p=0.10) and AF duration (SMD 0.46, 95% CI -1.14 to 2.05, p=0.57). Furthermore, secondary outcome analysis on mean ventricular rate and mean hospital length of stay in both groups showed no significant difference (MD -4.48, 95% CI -14.36 to 5.39, p=0.37 and MD 0.29, 95% CI -0.06 to 0.63, p=0.11, respectively).
Conclusions: Amiodarone and beta-blockers are equally effective in preventing postoperative atrial fibrillation after cardiac surgery, with no difference in AF episode and duration, mean ventricular rate, and hospital length of stay.

Keywords
Atrial fibrillation, cardiac surgery, amiodarone, beta-blockers
Introduction

Atrial fibrillation (AF) is a common complication after cardiac surgeries with incidence ranging from 10% to 65% despite the latest developments in both surgical and medical management. Postoperative AF could lead to prolonged intensive care unit (ICU) and hospital stay, resulting in increased cost. Although its mortality rate is low, it frequently induces hemodynamic disturbance and thromboembolic events. The hypothesized pathophysiology of postoperative AF is the interaction between acute surgery-related factors, including activated sympathetic nervous system and renin-angiotensin-aldosterone system, inflammation, trauma and oxidative stress, and underlying abnormal atrial substrate which induces electrical instability.

Pharmacological and non-pharmacological measures (e.g. atrial pacing) are used as strategies to prevent postoperative AF. Both beta-blockers and antiarrhythmics such as amiodarone could be used in postoperative AF prevention. Beta-blockers lower myocardial oxygen demand and ischemia events in the postoperative period by lessening the chronotropic and inotropic effects of catecholamine surge. Meanwhile, amiodarone prevents AF primarily by blocking potassium channels and through its anti-adrenergic effect, thus decreasing myocyte excitability, and preventing the re-entry mechanism and ectopic foci from causing an arrhythmia. Both drugs can be administered either orally or intravenously, although the latter route may be more effective. However, previous studies on the efficacy of these drugs provide conflicting results.

As a result, the gold standard regimen of postoperative AF prevention remains uncertain, resulting in varying practices and a high discontinuation rate, which might increase the patient’s risk of developing arrhythmias. Therefore, this study aims to compare the efficacy of these drugs in preventing postoperative AF.

Objectives

The objectives of this research are to compare the efficacy of amiodarone and beta-blockers in preventing postoperative AF after cardiac surgery.

Methods

We explored online medical databases, such as CINAHL, CENTRAL (Cochrane Library), MEDLINE (PubMed), and EMBASE (Science Direct), for a literature search from 11th January to 18th February 2022. The literature search process was performed using medical subject headings (MeSH) terms of (“coronary artery bypass graft”) AND (“amiodarone”) AND (“beta-blocker”). The search process was done according to the preferred reporting items for systematic reviews and meta-analysis (PRISMA) guidelines (see Reporting guidelines). The literature searching and selection process were performed by all of the authors unfetteredly.

Eligibility criteria

A study was included if it met the following criteria: a study evaluating amiodarone and beta-blockers in patients who underwent cardiac surgery (coronary artery bypass grafting (CABG), valve repair/replacement, and both), available in full text, and written in English. Our exclusion criteria were studies which full text were not available, non-randomised studies, and studies with irrelevant outcomes. The evaluated effects should include the following parameters: AF number of events and duration, mean ventricular rate, and length of hospital stay.

Data collection and statistical analysis

All authors were involved in data collection and worked independently. The main author collected the data manually from each author and any disagreement between authors were resolved through discussion. Included studies were examined using the EndNote 20 software for possible study duplication. Alternatively, this process can also be replicated using the Mendeley Reference Manager software. All statistical analysis was performed using STATA 17 software by StataCorp, California, USA, and Review Manager (RevMan) 5.4 software by Cochrane, Oxford, United Kingdom.

Data items

All eight studies investigated AF episodes, which we used as the primary outcome. Secondary outcomes were determined based on comparable outcomes reported among the studies (AF duration, mean ventricular rate, and mean length of hospital stay).

Study risk of bias assessment

Randomised study quality was assessed using the Cochrane Risk Index of Bias tools. All authors performed bias assessment independently and disagreements were resolved through discussion.
Effect measures
If the data extracted were binary outcomes, statistical calculation such as risk ratio (RR) or odds ratio (OR) would be selected. Meanwhile, if the data extracted were continuous outcomes, statistical calculation such as mean difference (MD) and standardized mean difference (SMD) would be chosen.

Synthesis methods
$\chi^2$ result would determine the heterogeneity test result. If the $\chi^2$ test result were less than fifty percent, a fixed-effect model would be selected since the heterogeneity was considered to be insignificant. Otherwise, a random-effect model would be chosen. All analyses used 95% of confidence intervals. P-value of less than 0.05 is considered to be statistically significant.

Reporting bias assessment
Reporting bias of each study was assessed using the Cochrane Risk Index of Bias tools. Studies with high risk of reporting bias were not included in this study.

Certainty assessment
We used GRADE (grading of recommendations assessment, development and evaluation) approach to assess the certainty in the body of evidence. All authors performed the assessment independently, and disagreements between assessors were resolved through discussion between assessors.

Results
The article selection process was carried out according to PRISMA guidelines. Initial study searching resulted in 186 articles, which all were processed using the EndNote application for study duplication. According to our inclusion criteria, the remaining 155 studies were then assessed manually by all authors. As many as thirteen articles were further analysed for eligibility, resulting in eight studies\(^1\text{-}^\text{11}\) analysed for final qualitative and quantitative analysis. The assessment of bias in the studies were conducted using Cochrane’s risk-of-bias tool, with the result listed in Table 1.

This study analysed four outcomes: number of AF episodes, AF duration, mean ventricular rate, and length of hospital stay. The authors, publication year, nation, sample size, mean age, surgery types, outcome, and follow up time were all extracted from the studies and presented in Table 2, while the treatment protocol details (type of drugs, dosage, timing, and duration of the treatment) of the included studies were elaborated in Table 3. AF episodes are presented in risk ratio (RR). AF duration is presented in standardized mean differences (SMD), and the secondary outcomes are presented in mean difference (MD). All analyses used 95% of confidence intervals. P-value of less than 0.05 is considered to be statistically significant.

AF episodes
A total of eight studies including 1370 participants met the inclusion criteria for the comparison of AF episode analysis. Pooled analysis in Figure 1 showed no significant difference in AF episodes between the amiodarone group and beta-blocker group (RR 0.83, 95% CI 0.66, 1.04, p=0.10).

AF duration
Three studies, including 384 participants, allocated into the amiodarone group (n=189) and beta-blocker group (n=195) compared the duration of AF. In accordance to the comparable risk of AF episode, pooled analysis in Figure 2 also showed no significant difference in terms of AF duration between both groups (SMD 0.46, 95% CI -1.1 to 2.05, p=0.57).

Mean ventricular rate
Mean ventricular rate comparison in Figure 3 was performed using fixed-effect model ($\chi^2=0\%$), resulting in not significant mean difference in mean ventricular rate comparison between both groups (MD -4.48, 95% CI -14.36 to 5.39, p=0.37).

Mean length of hospital stay
Four studies with 676 participants reported the difference in mean length of hospital stay. Figure 4 showed that there was no difference in mean length of hospital stay between both groups (MD 0.29, 95% CI -0.06 to 0.63, p=0.11).

Reporting biases
All studies included in this meta-analysis are considered low risk of reporting bias.
Table 1. Quality assessment of the included studies.

| Study             | Random sequence generation | Allocation concealment | Blinding of participants and personnel | Blinding of outcome assessment | Incomplete outcome data | Selective reporting | Other bias |
|-------------------|-----------------------------|------------------------|---------------------------------------|-------------------------------|-------------------------|---------------------|------------|
| Bigdelian et al.  | Low                         | Low                    | Unclear                               | Unlear                        | Unlear                  | Low                 | Unlear     |
| Halonen et al.    | Low                         | Low                    | High                                  | High                          | Low                     | Low                 | Low        |
| Hassan et al.     | Unclear                     | Unclear                | Unclear                               | Unlear                        | Low                     | Low                 | Unlear     |
| Kojuri et al.     | Unclear                     | Unclear                | Low                                   | Low                           | Low                     | Low                 | Low        |
| Mooss et al.      | Unclear                     | Low                    | Unclear                               | Unlear                        | Low                     | Low                 | Low        |
| Onk et al.        | Unclear                     | Unclear                | Unclear                               | Low                           | Low                     | Low                 | Unlear     |
| Sleilaty et al.   | Low                         | High                   | High                                  | High                          | Low                     | Low                 | High       |
| Solomon et al.    | Unclear                     | Unclear                | Unclear                               | Low                           | Low                     | Low                 | High       |
| Study Author/Year/Country | Sample size | Mean age (years) | Surgery type | Outcomes | Follow-up time |
|---------------------------|-------------|-----------------|--------------|----------|----------------|
| Bigdelian/2008/Iran       | 65          | 55              | Elective CABG (on pump), valve surgery, CABG with valve surgery | Primary: AF incidence Second: number of AF episodes, ventricular rate, time to onset of AF, longest AF duration, LOS, ICU stay, complications | 6-days post-surgery or until hospital discharge |
| Halonen/2010/Finland      | 157         | 64.15           | Elective CABG (on pump) with/without aortic valve surgery | Primary: AF incidence Second: time to onset of AF, ventricular rate, complications, death | 48-hours post-surgery (primary end point), then until hospital discharge |
| Hassan/2013/India         | 20          | 47              | Open heart surgery on cardiopulmonary bypass (repair of congenital defects, valve replacements) | Primary: AF Incidence Second: time to onset of AF, AF duration, ventricular rate, LOS, cost, complications, death | Until hospital discharge |
| Kojuri/2009/Iran          | 80          | 59.75           | Elective CABG (on pump) | Primary: AF incidence Second: correlation between risk factors and incidence of AF, 30-day mortality | 5-days post-surgery for primary outcome, then until 30-days post-surgery for secondary outcome (mortality rate) |
| Mooss/2004/USA            | 83          | 65              | CABG (on pump), AVR, CABG with AVR | Primary: AF incidence, incidence of drug-related side effects Second: AF duration, number of AF episodes, time to onset of AF, LOS, hemodynamic changes, use of vasoactive drugs, complications, death | 7-days post-surgery or until hospital discharge (primary end-point), then at 1 month after hospital discharge |
| Onk/2005/Turkey           | 122         | 57.65           | CABG (on pump) | Primary: AF incidence Second: use of IABP, use of inotropic agents, LOS, ICU stay, hospital mortality, complications, survival rate | 2-days post-surgery (primary end-point), then at 4-weeks post-surgery |
| Slellaty/2009/Lebanon     | 98          | 61.65           | Elective CABG (on pump) with/without mitral valve repair | Primary: AF incidence Second: maximal ventricular rate, time to onset of AF, AF duration, AF recurrence, LOS, ICU stay, low cardiac output | Until hospital discharge, then at 1 month post-surgery to assess recurrence |
| Solomon/2001/USA          | 50          | 65.35           | Elective CABG (on pump), valve surgery, CABG with valve surgery | Primary: AF incidence Second: time to onset of AF, number of AF episodes, AF duration, ventricular rate, LOS, ECG data, complications | Until hospital discharge or at least 7-days post-surgery |

CABG, coronary artery bypass surgery; AVR, aortic valve replacement; AF, atrial fibrillation; LOS, length of hospital stay; ICU, intensive care unit.
Table 3. Treatment protocol of the studies included in the meta-analysis.

| Study Author/Year/Country | Amiodarone dosage | Beta-blockers dosage |
|---------------------------|-------------------|----------------------|
| Bigdelian/2008/Iran       | 150 mg IV during 30 minutes after surgery, then continued with 150 mg/6 hours IV for 48 hours and followed by 400 mg/12 hour orally until hospital discharge | Immediately after surgery as 10 mg oral single dose, then continued with 10 mg/8 hours for 6 days |
| Halonen/2010/Finnland     | 15 mg/kg BW/day, IV, with maximum daily dose 1000 mg, started on first post-operative day, 15-21 hours post-surgery, continued for 48 hours | Metoprolol infusion IV 1 mg/hours for HR 60-70 bpm, 2 mg/hours for HR 70-80 bpm, or 3 mg/hours for HR >80 bpm, started on first post-operative day, 15-21 hours post-surgery, continued for 48 hours |
| Hassan/2013/India         | 10 mg/kg BW/day orally, started 2 weeks before surgery and continued until hospital discharge | Metoprolol 25 mg/8 hours orally for HR 60-70 bpm, 50 mg/12 hours for HR 70-80 bpm, 50 mg/8 hours for HR >80 bpm; started 2 weeks before surgery and continued until hospital discharge |
| Kojuri/2009/Iran          | 200 mg/12 hours orally, started 7 days before surgery until 5 days post-surgery | Propranolol 20 mg/12 hours orally, started 7 days before surgery until 5 days post-CABG |
| Mooss/2004/USA            | 15 mg/kg BW, IV, over 24 hours started at time of surgery, then switched to 200 mg/8 hours orally until 7 days | D,L-sotalol 80 mg orally, started 2 hours before surgery, then 80 mg/12 hours orally until 7 days |
| Onk/2005/Turkey           | 200 mg/8 hours orally, started 1 week before surgery and continued during post-operative period | Metoprolol 50 mg/12 hours orally, started 1 week before surgery and continued during post-operative period |
| Sleilaty/2009/Lebanon     | 15 mg/kg orally via gastric tube started on first day post-surgery, then 7mg/kg/day orally until hospital discharge, then 200 mg/day for one month | Bisoprolol 2.5 mg orally via gastric tube started on first day post-surgery, then 2.5 mg/12 hours continued indefinitely |
| Solomon/2001/USA          | 1 g/24 hours IV infusion for 48 hours, started with in 3 hours post-surgery, continued with 400 mg/day orally until hospital discharge | Propranolol 1 mg/6 hour IV for 48 hours, started within 3 hours post-surgery, then 10 mg orally as test dose, then titrated to 20 mg/6 hours orally if HR remained >60 bpm and BP >100 mmHg, continued until hospital discharge |

IV, intravenous; BW, body weight; HR, heart rate; BP, blood pressure.
Certainty of evidence

Assessment of evidence certainty for all outcomes in this meta-analysis resulted in moderate certainty.

Discussion

Postoperative AF remains the most common complication in cardiac surgery patients. The incidence varies depending on the procedure, occurring after around 30% of coronary artery bypass grafting (CABG) surgery, 40% of valve repair and replacement surgeries, and about 50% in combined cardiac procedures. According to the guideline by the American Heart Association/American College of Cardiology and the Heart Rhythm Society in 2014 on the management of AF, preoperative administration of amiodarone is recommended before cardiac surgery on patients with increased risk of developing postoperative AF (Class IIa, Level of Evidence A). Risk factors for developing postoperative AF include advanced age, male gender, previous history of AF, diabetes mellitus, and the presence of left atrial enlargement, which are similar to the characteristics of most patients undergoing cardiac surgery. On the other hand, the European Society of Cardiology (ESC), in their most recent guideline on diagnosis and management of AF, recommended routine perioperative administration of amiodarone or beta-blockers regardless of risk factor status (Class I, Level of Evidence A). Although the recent guidelines have signified the importance of therapeutic agents administration as a prophylaxis for postoperative AF, there is another issue on whether amiodarone or beta-blockers should be given for better outcomes.

In our meta-analysis comprising eight studies, there was no difference in postoperative AF episodes between the amiodarone and beta-blockers groups. This result supports the findings from a similar meta-analysis conducted in 2012. Furthermore, this study found no difference between both groups in duration of AF, hospital length of stay, and mean ventricular rate. It could be implied that both drugs are equally effective in preventing postoperative AF. Therefore, in clinical practice, it is more appropriate to make an individual decision for each case rather than to follow a prespecified general guideline.

Beta-blockers should be the agent of choice for patients with multiple risk factors who are already receiving long-term beta-blockers, as abrupt discontinuation of beta-blockers before surgery is associated with two- to fivefold increased risk of developing postoperative AF. On the other hand, it might not be suitable for urgent patients without a history of prior use of the agent as it should be initiated two to seven days before surgery. Extra caution should also be taken when beta-blockers are administered to patients without a history of previous use, as some patients may develop bronchospasm. Another issue is choosing the preferred variant of beta-blocker. Carvedilol has shown an 18 to 20% higher reduction of postoperative AF than metoprolol, although the length of hospital stay was equal. A more recent type of beta-blocker is sotalol, which exhibits class III antiarrhythmic effects on top of typical beta-blocker features. Several studies have demonstrated the superiority of sotalol when compared to conventional beta-blockers to prevent postoperative AF, although the sotalol group developed more side effects such as bradycardia and hypotension.

Amiodarone, which plays a role in both rate control and rhythm control strategies, has been demonstrated to reduce the risk of postoperative AF by 12 to 51% when compared to placebo. It is equally effective when given in different
doses (low dose <3g), medium dose 3 – 5 g, and high dose > 5g), timing (pre/post-operative), and through either routes (oral/IV). However, there is a rising concern regarding safety, as evidenced by a meta-analysis that reported an increased risk of hypotension, prolonged QT interval, and bradycardia in the amiodarone group when compared to placebo. Other extracardiac adverse effects from amiodarone include thyroid, hepatic, and pulmonary toxicities.33

The emergence of alternative options for preventing postoperative AF, such as corticosteroids, colchicine, and statins may be considered in an individualised manner.34-36 Corticosteroids, for example, were demonstrated to further reduce the incidence of postoperative AF when combined with beta-blockers, although the length of hospital stay was not different.37,38 The overall use of corticosteroids is low due to the popular belief that they are associated with multiple risks. Nonetheless, although corticosteroids use is associated with increased risk of hyperglycaemia, several studies reported that administration of corticosteroids did not increase the risk of infection, bleeding, and stroke.40,41

Longer AF duration (>24 h per week) is associated with a higher mortality risk. However, there is no evidence whether this is appropriate for postoperative AF.42 Longer AF duration is also associated with an increased risk of stroke, but there was not enough data in the studies included in this meta-analysis to assess either stroke or mortality as a secondary outcome.43

Both amiodarone and beta-blockers have been widely utilised in the therapy of postoperative AF, with current evidence reporting comparable outcomes between both agents.40,44,45 Beta-blockers are one of the medications used in rate control strategy, while amiodarone plays a role in both rate control and rhythm control approaches.46 In the RACE II trial, patients set to a stricter limit [heart rate < 80 beats per minute (bpm)] were not associated with lower morbidity, mortality, and hospitalisation when compared to the more lenient group (heart rate <110 bpm).47 In postoperative AF, both rate control and rhythm control approaches have shown similar complication rates and equal days of hospitalisation.48

There were a few notable limitations in this study. More recent studies investigated the use of less conventional drugs to prevent postoperative AF, resulting in a scarcity of newer trials comparing amiodarone and beta-blockers. It was not possible to examine the risk of bradycardia, hypotension, stroke, and mortality, which are commonly associated with atrial fibrillation, due to a lack of data. It should also be pointed out that in this study, we compared amiodarone with all types of beta-blockers, including sotalol. Each beta-blocker differs in properties, and some patients may benefit more from a specific type of beta-blockers but less from another.

Future research on specific population (e.g., diabetes, older age, previous history of AF) undergoing cardiac surgeries are needed to understand the efficacy and risk associated with each agent commonly used to prevent postoperative AF. Additionally, more studies investigating the efficacy and safety of emerging unconventional drugs as a first-line prophylaxis is required as existing studies have reported conflicting results.

Conclusions
Our meta-analysis showed that the use of either amiodarone or beta-blockers for the prevention of postoperative AF after cardiac surgery results in comparable AF episodes, duration, mean ventricular rate and hospital length of stay. The drug of choice for each patient should therefore be personalised based on the pre-existing medical conditions.

Data availability
Underlying data
All data underlying the results are available as part of the article and no additional source data are required.

Reporting guidelines
Open Science Framework: PRISMA checklist and flow diagram for ‘Amiodarone versus beta-blockers for the prevention of postoperative atrial fibrillation after cardiac surgery: An updated systematic review and meta-analysis of randomised controlled trials’, https://doi.org/10.17605/OSF.IO/CUYH9.48

Data are available under the terms of the Creative Commons Zero “No rights reserved” data waiver (CC0 1.0 Public domain dedication).
References

1. Ork OA, Erkut Ý: Is the preoperative administration of amiodarone or metoprolol more effective in reducing atrial fibrillation: after coronary bypass surgery?. Medicine. 2015; 94(41): e1576. PubMed Abstract | Publisher Full Text

2. Piccini JP, Zhao Y, Steinberg BA, et al.: Comparative effectiveness of pharmacotherapies for prevention of atrial fibrillation following coronary artery bypass surgery. Am. J. Cardiol. 2013; 112(7): 954–960. PubMed Abstract | Publisher Full Text

3. Turagam MK, Downey FX, Kress DC, et al.: Pharmacological strategies for prevention of postoperative atrial fibrillation. Expert. Rev. Clin. Pharmacol. 2015; 8(2): 233–250. PubMed Abstract | Publisher Full Text

4. Javot L, Pape E, Yéléhé-Okouma M, et al.: Metoprolol versus metoprolol in the prevention of atrial fibrillation after cardiac surgery: a randomized trial. Ann. Intern. Med. 2010; 153(1): 705–709. PubMed Abstract | Publisher Full Text

5. Kojuri J, Mahmoodi Y, Jannati M, et al.: Is the preoperative administration of amiodarone and breasfteed. Fundam. Clin. Pharmacol. 2019; 33(3): 367–372. PubMed Abstract | Publisher Full Text

6. Bigdelian H, Gharipour M, Behdad GR, et al.: Comparison of the efficacy of metoprolol and carvedilol for preventing atrial fibrillation after coronary bypass surgery. Int. J. Cardiol. 2008; 126(1): 108–113. PubMed Abstract | Publisher Full Text

7. Acikol S, Bozbas H, Gultekin B, et al.: The effect of amiodarone versus propranolol for prophylaxis of atrial fibrillation after-cabg in low ejection patients. 2009.

8. Kojuri J, Mahmoodi Y, Jannati M, et al.: Ability of amiodarone and propranolol alone or in combination to prevent post-coronary bypass atrial fibrillation. Cardiovasc. Ther. 2009; 27(4): 253–258. PubMed Abstract | Publisher Full Text

9. Halonen J, Loponen P, Järvinen O, et al.: Meta-analysis of amiodarone to prevent atrial fibrillation after cardiac surgery: a meta-analysis. Ann. Intern. Med. 2010; 153(1): 705–709. PubMed Abstract | Publisher Full Text

10. Moos AN, Wurdeman RL, Sugimoto JT, et al.: A retrospective study using low-dose sotalol. N. Engl. J. Med. 1997; 336(9): 829–837. PubMed Abstract | Publisher Full Text

11. Cassel AJ, Greenberg MD, Kilborn MJ, et al.: Amiodarone versus a β-blocker to prevent postoperative atrial fibrillation after coronary surgery. Am. Heart J. 2001; 142(5): 811–815. PubMed Abstract | Publisher Full Text

12. Eschholz H, Pitaro P, O'Hara GA, et al.: Intravenous amiodarone for the prevention of atrial fibrillation during cardiac surgery: a meta-analysis. Eur. J. Cardiothorac. Surg. 2000; 18(6): 719–724. PubMed Abstract | Publisher Full Text

13. Ringer EO, Birk DL, Boesgaard ES, et al.: Meta-analysis of the efficacy of oral antiarrhythmic drugs in the prevention of atrial fibrillation after cardiac surgery. Ann. Thorac. Surg. 2006; 82(4): 1332–1337. PubMed Abstract | Publisher Full Text

14. Hirdhicks G, Polpata P, Dagnes K, et al.: 2020 ESC Guidelines for the diagnosis and management of atrial fibrillation: the pilot study of postoperative atrial fibrillation after cardiac surgery: the pilot study of postoperative atrial fibrillation after cardiac surgery: the pilot study of postoperative atrial fibrillation after cardiac surgery: the pilot study of postoperative atrial fibrillation after cardiac surgery: the pilot study of postoperative atrial fibrillation after cardiac surgery. Eur. Heart J. 2021; 42(20): 373–409. PubMed Abstract | Publisher Full Text

15. Zhu J, Wang C, Gao D, et al.: Beta-blockers as prophylactic therapy against atrial fibrillation following cardiac surgery. Int. J. Cardiol. 2012; 42(10): 1078–1087. PubMed Abstract | Publisher Full Text

16. Fleisher LA, Fleischmann KE, Auerbach AD, et al.: ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery: a report of the American College of Cardiology/American Heart Association Task Force on practice guidelines. J. Am. Coll. Cardiol. 2014; 64(20): e77–e137. PubMed Abstract | Publisher Full Text

17. Kristensen SD, Knautz J: New ESC/EAS Guidelines on non-cardiac surgery: cardiovascular assessment and management. Oxford University Press; 2014: 2344–2345.

18. Boun S, Shun-Shin MJ, Cole GD, et al.: Meta-analysis of secure randomized controlled trials of β-blockade to prevent perioperative death in non-cardiac surgery. Heart. 2014; 100(5): 456–464. PubMed Abstract | Publisher Full Text

19. Acikel S, Bozbas H, Gultekin B, et al.: A prospective randomized trial of amiodarone, metoprolol or atenolol for atrial fibrillation appearing after coronary artery bypass grafting or cardiac valve operation. Am. J. Cardiol. 2003; 92(5): 735–736. Publisher Full Text

20. Wang H, Wang Z-W, Yin Z-T: Carvedilol for prevention of atrial fibrillation after cardiac surgery: a meta-analysis. PLoS One. 2014; 9(4): e94005. PubMed Abstract | Publisher Full Text

21. Patel A, Dunning J: Is Sotalol more effective than standard beta-blockers for the prophylaxis of atrial fibrillation during cardiac surgery. Interact. Cardiovasc. Thorac. Surg. 2005; 4(2): 147–150. PubMed Abstract | Publisher Full Text

22. Burgess DC, Kilborn MJ, Keek AC: Interventions for prevention of post-operative atrial fibrillation and its complications after cardiac surgery: a meta-analysis. Eur. J. Heart J. 2006; 27(23): 2846–2857. PubMed Abstract | Publisher Full Text

23. Evard P, Gonzales M, Jamart J, et al.: Prophylaxis of supraventricular and ventricular arrhythmias after coronary artery bypass grafting with low-dose sotalol. Ann. Thorac. Surg. 2000; 70(1): 151–156. PubMed Abstract | Publisher Full Text

24. Weber UK, Osswald S, Huber M, et al.: Selective versus non-selective antiarrhythmic approach for prevention of atrial fibrillation after coronary surgery: Is there a need for pre-operative risk stratification? A prospective placebo-controlled study using low-dose sotalol. Eur. J. Heart J. 1998; 19(5): 794–800. PubMed Abstract

25. Guarnieri T, Nolam S, Gottlieb SO, et al.: Intravenous amiodarone for the prevention of atrial fibrillation after open heart surgery: the Amiodarone Reduction in Coronary Heart (ARCH) trial. J. Am. Coll. Cardiol. 1999; 34(2): 343–347. PubMed Abstract | Publisher Full Text

26. Daoud EG, Strickberger SA, Man KC, et al.: Preoperative amiodarone as prophylaxis against atrial fibrillation after heart surgery. N. Engl. J. Med. 1997; 337(16): 1785–1791. PubMed Abstract | Publisher Full Text

27. Bnes Bj, Kirkland EA, Howard PA, et al.: Risk-stratified evaluation of amiodarone to prevent atrial fibrillation after cardiac surgery. Ann. Thorac. Surg. 2006; 82(4): 1332–1337. PubMed Abstract | Publisher Full Text

28. Auer J, Weber T, Berent R, et al.: A comparison between oral antiarrhythmic drugs in the prevention of atrial fibrillation after cardiac surgery: the pilot study of postoperative atrial fibrillation (PPAF), a randomized, placebo-controlled trial. Am. Heart J. 2004; 147(4): 636–643. PubMed Abstract | Publisher Full Text

29. Buckley MS, Nolan PE Jr, Slack MK, et al.: Amiodarone Prophylaxis for Atrial Fibrillation After Cardiac Surgery: Meta-Analysis of Dose Response and Timing of Initiation. Pharmacotherapy. 2007; 27(3): 360–368. PubMed Abstract | Publisher Full Text

30. Chatterjee S, Saradr P, Mukherjee D, et al.: Timing and Route of Amiodarone for Prevention of Postoperative Atrial Fibrillation after Cardiac Surgery: A Network Regression Meta-analysis. Pacing Clin. Electrophysiol. 2013; 36(8): 1017–1023. PubMed Abstract | Publisher Full Text

31. Patel AA, White CM, Gillespie EL, et al.: Safety of amiodarone in the prevention of postoperative atrial fibrillation: a meta-analysis. Am. J. Health Syst. Pharm. 2006; 63(9): 829–837. PubMed Abstract | Publisher Full Text
34. Wang W, Mei YQ, Yuan XH, et al.: Clinical efficacy of epicardial application of drug-releasing hydrogels to prevent postoperative atrial fibrillation. J. Thorac. Cardiovasc. Surg. 2016; 151(1): 80–85. PubMed Abstract | Publisher Full Text

35. Tabbalat RA, Hamad NM, Alhaddad IA, et al.: Effect of colchicine on the incidence of atrial fibrillation in open heart surgery patients: END-AF trial. Am. Heart J. 2016; 178: 102–107. PubMed Abstract | Publisher Full Text

36. Yuan X, Du J, Liu Q, et al.: Defining the role of perioperative statin treatment in patients after cardiac surgery: A meta-analysis and systematic review of 20 randomized controlled trials. Int. J. Cardiol. 2017; 228: 958–966. PubMed Abstract | Publisher Full Text

37. Prasongsukarn K, Abel JG, Jamieson WE, et al.: The effects of steroids on the occurrence of postoperative atrial fibrillation after coronary artery bypass grafting surgery: a prospective randomized trial. J. Thorac. Cardiovasc. Surg. 2005; 130(1): 93–98. PubMed Abstract | Publisher Full Text

38. Halonen J, Halonen P, Järvinen O, et al.: Corticosteroids for the prevention of atrial fibrillation after cardiac surgery: a randomized controlled trial. JAMA. 2007; 297(14): 1562–1567. Publisher Full Text

39. Philip I, Berrota C, Leblanc I: Perioperative challenges of atrial fibrillation. Curr. Opin. Anaesthesiol. 2014; 27(3): 344–352. PubMed Abstract | Publisher Full Text

40. Dieleman JM, Nierich AP, Rosseel PM, et al.: Intraoperative high-dose dexamethasone for cardiac surgery: a randomized controlled trial. JAMA. 2012; 308(17): 1761–1767. PubMed Abstract | Publisher Full Text

41. Ho KM, Tan JA: Benefits and risks of corticosteroid prophylaxis in adult cardiac surgery: a dose-response meta-analysis. Circulation. 2009; 119(14): 1853–1866. PubMed Abstract | Publisher Full Text

42. Tripathi R, Passman R, Turakhia M, et al.: Atrial fibrillation burden, progression, and the risk of death: a case-crossover analysis in patients with cardiac implantable electronic devices. J. Europace. 2019; 21(3): 404–413. PubMed Abstract | Publisher Full Text

43. Kaplan RM, Koehler J, Ziegler PD, et al.: Stroke risk as a function of atrial fibrillation duration and CHA2DS2-VASc score. Circulation. 2019; 140(20): 1639–1646. PubMed Abstract | Publisher Full Text

44. Cragg K, Ozeke O, Ergun K, et al.: Effect of low-dose amiodarone and magnesium combination on atrial fibrillation after coronary artery surgery. J. Card. Surg. 2006; 21(5): 458–464. PubMed Abstract | Publisher Full Text

45. White CM, Caron MF, Kalus JS, et al.: Intravenous plus oral amiodarone, atrial septal pacing, or both strategies to prevent post-cardiothoracic surgery atrial fibrillation: the Atrial Fibrillation Suppression Trial II (AFIST II). Circulation. 2003; 108(10_suppl_1): II-200–II-206. Publisher Full Text

46. Van Gelder IC, Groenveld HF, Crijns HJ, et al.: Lenient versus strict rate control in patients with atrial fibrillation. N. Engl. J. Med. 2010; 362(15): 1363–1373. PubMed Abstract | Publisher Full Text

47. Gillinov AM, Bagiella E, Moskowitz AJ, et al.: Rate control versus rhythm control for atrial fibrillation after cardiac surgery. N. Engl. J. Med. 2016; 374(20): 1911–1921. PubMed Abstract | Publisher Full Text

48. Ardaya R: Extended data for “Amiodarone versus beta-blockers for the prevention of postoperative atrial fibrillation after cardiac surgery: An updated systematic review and meta-analysis of randomised controlled trials”. 2022. May 13. Publisher Full Text
The benefits of publishing with F1000Research:

- Your article is published within days, with no editorial bias
- You can publish traditional articles, null/negative results, case reports, data notes and more
- The peer review process is transparent and collaborative
- Your article is indexed in PubMed after passing peer review
- Dedicated customer support at every stage

For pre-submission enquiries, contact research@f1000.com