

Original Article

Amiodarone in the Management of Cardiac Arrhythmia Following Open Heart Surgery

Nazmul Hosain¹, Md Rajibul Islam², Muhammad Abdul Quaium Chowdhury¹,
 Mohammad Fazle Maruf¹, Ahsan Uddin Mahmud¹, Minhazur Rahman Chowdhury³,
 Maruf Hasan Alam Arnob¹, Fahmida Hoque⁴

¹Department of Cardiac Surgery, Chittagong Medical College & Hospital, Chattagram, ²Department of Cardiology, Chittagong Medical College Hospital, Chattagram, ³Department of Cardiac Anesthesia, Chittagong Medical College Hospital, Chattagram, ⁴Chittagong Eye Infirmary, Chattagram,

Abstract

Key words:
 Arrhythmia,
 Cardiopulmonary
 bypass,
 Amiodarone.

Background: Postoperative cardiac arrhythmias may present as life threatening complications like- cerebrovascular strokes, thrombo-embolic manifestations, inadequate ventricular filling and compromised hemodynamic stability. Amiodarone is an effective drug for various postoperative arrhythmias. Objective of this study is to evaluate the efficacy of Amiodarone in controlling postoperative arrhythmia in our settings at the department of cardiac surgery.

Methods: This retrospective observational study involved random selection of 20 patients, who developed potentially life-threatening arrhythmia following cardiac surgical procedures under cardiopulmonary bypass (CPB) at Chittagong Medical College Hospital (CMCH) between January 2018 and December 2020. Amiodarone was used in controlling postoperative cardiac arrhythmia by loading 1000 mg in first 24 hours, followed by 800 mg orally in daily divided doses.

Results: Among 20 patients under study, five had valvular replacement, three had ASD closure, one VSD closure, one patient had excision of LA myxoma and in ten patients had undergone CABG. The Mean \pm SD of the age of the patients was 50.2 ± 14.7 years. Eleven patients (55%) were female. Atrial fibrillation with rapid ventricular rate occurred in 15 patients, supraventricular tachycardia in two and ventricular tachycardia three patients. Targets were achieved in all 20 of these patients. Among them 13 (65%) reverted to sinus rhythm, in other 7 AF persisted but ventricular rates became below 100/m with hemodynamic stability. The Mean \pm SD of the time required for target achievement was 8.9 ± 7.4 hours. There was no perioperative death in these patients.

Conclusion: Amiodarone is an effective medication in combating both atrial and ventricular arrhythmia following cardiac surgery employing cardiopulmonary bypass.

(*Cardiovasc j* 2021; 14(1): 20-23)

Introduction:

Postoperative cardiac arrhythmias are among the most dangerous complications following cardiac surgery employing cardiopulmonary bypass (CPB). Arrhythmias may present as life threatening complications following cardiac operations. Atrial fibrillation is the most common form of arrhythmia following cardiac surgery. These rhythm aberrations are usually benign, but might turn into life threatening situations. Atrial fibrillation (AF)

may be associated with dangerous potential of leading to cerebrovascular strokes, thrombo-embolic manifestations involving end organs, inadequate ventricular filling and conversion to other deadly arrhythmias.¹ This may also compromise the delicate hemodynamic stability during immediate aftermath of cardiac operations. Ventricular arrhythmias in general are more dangerous and may cause serious consequences and death.

Address of Correspondence: Dr. Nazmul Hosain, Department of Cardiac Surgery, Chittagong Medical College & Hospital, Chattagram, Bangladesh. Email: heartsurgeon007@gmail.com.

© 2020 authors; licensed and published by International Society of Cardiovascular Ultrasound, Bangladesh Chapter and Bangladesh Society of Geriatric Cardiology. This is an Open Access article distributed under the terms of the CC BY NC 4.0 (<https://creativecommons.org/licenses/by-nc/4.0>)

Atrial Fibrillation is the commonest persistent cardiac arrhythmia. In general, AF is defined as an episode with irregular RR-intervals without a traceable p-wave, during at least 10 seconds.² De novo atrial fibrillation is the most common perioperative arrhythmia and its reported incidence ranges from 0.4% to 26% in patients undergoing non-cardiac non-thoracic surgery. The magnitude of risk depends only on the definition of atrial fibrillation but also on type of surgery, use of antiarrhythmic medications and follow up time. The incidence may vary according to patient characteristics like age, presence of structural heart disease and other co-morbidities, as well as the type of surgery performed.³ Following cardiac surgery, the reported incidences vary from 10 to 60% depending on the type of surgery, with higher incidences in valve surgery compared to coronary artery bypass surgery.⁴ Postoperative Cardiac arrhythmias hence are potentially life-threatening complication that may cause postoperative prolonged ICU and hospital stay, may increase hospitalization cost and in hospital mortality. Long term mortality is also higher in patients, who develop post-operative cardiac arrhythmia. Electrical defibrillation is the method of choice for emergency correction of deadly arrhythmias. However, it has various limitations of application on conscious patients. Various pharmacological tools are employed to combat these dreadful rhythm abnormalities. Common drugs used in the management of postoperative arrhythmia include digoxin, beta blockers, amiodarone, nifedipine, verapamil, adenosine, sotalol, bretylium, magnesium etc.

It has become clear from multiple meta-analyses, reviews, and large cohort studies, that the perioperative use of β -blocking agents reduces the incidence of atrial fibrillation after cardiac surgery.⁵ Furthermore, it is evident that the perioperative use of β -blockers reduces mortality. Sotalol has a greater efficacy in preventing Postoperative atrial fibrillation (POAF) than standard β -blockers,⁶ but not used in immediate postoperative settings due to more unfavorable adverse event profile. Bi-atrial pacing significantly reduces the incidence of POAF,⁶ although it has been reported to be difficult to apply. Some studies demonstrated even pro-arrhythmic side effects and also unintentional diaphragmatic or left ventricular

pacing are common.

Amiodarone is an effective drug for both atrial and ventricular postoperative arrhythmias.^{7,8} It may work against ventricular tachycardia (VT), ventricular fibrillation (VF), wide complex tachycardia, as well as atrial fibrillation and paroxysmal supraventricular tachycardia. Objective of this study is to evaluate the efficacy of amiodarone in controlling postoperative arrhythmia following cardiac operations utilizing cardiopulmonary bypass in our settings in Department of cardiac surgery of Chittagong Medical College Hospital.

Study Methods:

This retrospective observational study involved random selection of 20 patients, who developed potentially life-threatening arrhythmia following cardiac surgical procedures under cardiopulmonary bypass (CPB) at Chittagong Medical College Hospital (CMCH) between January 2018 and December 2020. Information was gathered from patients' files, OT and ICU records. Earlier either digoxin or amiodarone was used for controlling postoperative cardiac arrhythmia following open heart surgical procedures. At CMCH standard protocol is intravenous loading 1000 mg of amiodarone in 24 hours. Initial 150 mg is infused in 10 minutes. Then 450 mg more is loaded in 6 hours and the remaining 400 mg in next 18 hours. After that either infusion rate of 0.5 mg/min (720 mg/24 hours) or 800 mg orally in divided doses is given to the patients. The therapeutic target was set at either reversion to sinus rhythm or correction of ventricular tachyarrhythmic events or reduction of heart rate below 100 with hemodynamic stability, if AF is not corrected.

Results:

Before 2019, our protocol was to administer digoxin to combat atrial fibrillation. From 2018, we changed our protocol with starting amiodarone for any serious type of ventricular and atrial tachyarrhythmias. 20 patients were selected by random sampling, who underwent cardiac surgery under cardiopulmonary bypass in the department of Cardiac Surgery, Chattogram Medical College Hospital between January 2018 and December 2020, and received amiodarone to combat dangerous or potentially life-threatening postoperative arrhythmia. These include

supraventricular tachycardia, ventricular tachycardia and atrial fibrillation with rapid ventricular rates jeopardizing hemodynamic stability. These 20 patients received amiodarone according to our new protocol. Three of these patients had mitral valve replacement, two patient had aortic valve replacement, three patients had pericardial patch closure of ASD, one patient had ventricular septal defect, one patient had excision of LA myxoma and in ten patients had undergone CABG. The Mean \pm SD of the age of the patients was 50.2 ± 14.7 years. ASD patients were the youngest, whereas IHD patients were the oldest. Eleven patients (55%) were female. In this study, seven patients had previous Myocardial Infarction. No significant clinical history was found in the ASD and myxoma patients, but all valve replacement patients had previous history of rheumatic heart disease. All of the cases were elective. Comorbidity of previous stroke, chronic obstructive pulmonary disease and renal insufficiency were not noted in any patient. Four patients were current smokers. Atrial fibrillation with rapid ventricular rate occurred in 14 patients, supraventricular tachycardia in two patients and episodes of ventricular tachycardia occurred in three patients in the study group.

One ASD patient, two mitral valve replacement patients and one CABG patient had history of pre-operative atrial fibrillation. Cardiac arrhythmias developed at immediate post-operatively in five patients, on 1st POD in two patients, on 2nd POD in seven patients, at 3rd POD in four patients and beyond 3rd POD in two patients. All patients were successfully treated with amiodaron. Target achievements were set by reversion to sinus rhythm, correction of ventricular tachyarrhythmic events or reduction of heart rate below 100 with hemodynamic stability. These targets were attached in all 20 of these patients. Among them 13 (65%) reverted to sinus rhythm. The Mean \pm SD of the time required for target achievement was 8.9 ± 7.4 hours. The longest time to achieve the goal was 42 hours in an MVR case hours and shortest time was 2 hours in an ASD case. Only three patients required more than 12 hours to be stable.

Discussion:

Postoperative cardiac arrhythmia is a major concern following cardiac surgery. Postoperative

atrial fibrillation is a common, expensive and potentially morbid complication following cardiac surgery. Patients who develop POAF in USA incur on average \$10 000 to \$20 000 in additional hospital treatment costs, 12 to 24 hours of prolonged ICU time, and an additional 2 to 5 days in the hospital. In Bangladesh, there is no study regarding the expenses POAF. It has been identified as an independent predictor of numerous adverse outcomes, including a 2 to 4-fold increased risk of stroke, reoperation for bleeding, infection, renal or respiratory failure, cardiac arrest, cerebral complications, need for permanent pacemaker placement, and a 2-fold increase in all-cause 30-day and 6-month mortality.⁹

Amiodarone with its class III anti-arrhythmic effects is a strong arrhythmia preventive drug in the acute post-operative setting. Prophylactic amiodarone, with or without concomitant use of β -blockers also has a positive effect on duration of hospital stay, postoperative stroke, and postoperative ventricular tachyarrhythmia.¹⁰ In our study, there was also positive response to amiodarone in all 20 cases.

Amiodarone increases the refractory period of atrial and ventricular muscle as well as the atrioventricular node. It has mild beta blocker and calcium channel blocker activity in addition to its class III anti-arrhythmic activity. It has been effective in acute as well as chronic AF. Cardiac toxicity from amiodarone is uncommon.¹¹ The incidence of amiodarone-induced ventricular arrhythmia is low even in the presence of structural heart disease. It has no negative inotropic effect, is a powerful afterload-reducing agent, and has coronary vasodilatory effects.^{12,13}

In our study targets were attached in all 20 of these patients. Among them 13 (65%) reverted to sinus rhythm. In a similar study conversion to sinus rhythm was achieved in 55 (61%) of 90 patients with supraventricular arrhythmias.⁵ POAF may occur in around 35% of cardiac surgery cases on average and has a peak incidence on postoperative day 2.¹⁰ In our study most of the patients (35%) also developed AF on 2nd POD.

Another most common complication occurs after patient has undergone cardiopulmonary by-pass (CPB), is ventricular tachycardia. It is caused by

abnormal automaticity or triggered activity in ischemic tissue or by reentry within scarred ventricular tissue. Patient may complain of palpitation or symptoms of low cardiac output, e.g.: dizziness, dyspnea or syncope. ECG shows tachycardia and broad abnormal QRS complexes with the rate more than 120/min.

Prompt action to restore sinus rhythm is required and should usually be followed by prophylactic therapy. Synchronized DC cardioversion is the treatment of choice if systolic BP is less than 90 mm of Hg. If arrhythmia is well tolerated intravenous amiodarone given as a bolus followed by continuous infusion, then oral dose is given for prophylaxis.

Conclusion:

Amiodarone is an effective medication in combating arrhythmia following cardiac surgery employing cardiopulmonary bypass. It is safe and effective against both atrial and ventricular arrhythmias. In our settings we started using amiodarone in any dangerous or potentially life-threatening arrhythmia developed following cardiac operations. All our patients responded well to this therapy and either reversion to sinus rhythm or satisfactory control of the arrhythmia was achieved.

Limitations:

This is a single center study. The number of patients under study was small. There was no comparison of safety and efficacy of Amiodarone with that of other drugs.

Conflict of Interest - None.

References:

1. Prystowsky E. Management of atrial fibrillation: therapeutic options and clinical decisions. *Am J Cardiol.* 2000; 85(10):3-11. DOI:10.1016/s0002-9149(00)00908-5
2. Konings K, Kirchhof C, Smeets J, Wellens H, Penn O, Allessie M. High-density mapping of electrically induced atrial fibrillation in humans. *Circulation.* 1994; 89(4):1665-1680. DOI:10.1161/01.cir.89.4.1665
3. Joshi K, Tiru M, Chin T, Fox M, Stefan M. Postoperative atrial fibrillation in patients undergoing non-cardiac non-thoracic surgery: A practical approach for the hospitalist. *Hosp Pract.* 2015; 43(4): 235-244. DOI:10.1080/21548331.2015.1096181
4. Echahidi N, Pibarot P, O'Hara G, Mathieu P. Mechanisms, Prevention, and Treatment of Atrial Fibrillation After Cardiac Surgery. *J Am Coll Cardiol.* 2008; 51(8): 793-801. DOI: 10.1016/j.jacc.2007.10.043
5. Installe E, Schoevaerdt J, Gadisseux P, Charles S, Tremouroux J. Intravenous amiodarone in the treatment of various arrhythmias following cardiac operations. *J Thorac Cardiovasc Surg.* 1981; 81(2): 302-308. DOI:10.1016/s0022-5223(19)37640-8
6. Crystal E, Connolly S, Sleik K, Ginger T, Yusuf S. Interventions on Prevention of Postoperative Atrial Fibrillation in Patients Undergoing Heart Surgery. *Circulation.* 2002; 106(1): 75-80. DOI: 10.1161/01.cir.0000021113.44111.3e
7. Giri S, White C, Dunn A et al. Oral amiodarone for prevention of atrial fibrillation after open heart surgery, the Atrial Fibrillation Suppression Trial (AFIST): a randomised placebo-controlled trial. *The Lancet.* 2001; 357(9259): 830-836. DOI:10.1016/s0140-6736(00)04196-9
8. Singh B, Collett J, Chew C. New perspectives in the pharmacologic therapy of cardiac arrhythmias. *Prog Cardiovasc Dis.* 1980; 22(4): 243-301. DOI:10.1016/0033-0620(80)90011-0
9. Hohnloser S, Meinertz T, Dambacher T et al. Electrocardiographic and antiarrhythmic effects of intravenous amiodarone: Results of a prospective, placebo-controlled study. *Am Heart J.* 1991; 121(1): 89-95. DOI:10.1016/0002-8703(91)90960-p
10. Greenberg J, Lancaster T, Schuessler R, Melby S. Postoperative atrial fibrillation following cardiac surgery: a persistent complication. *European Journal of Cardio-Thoracic Surgery.* 2017; 52(4): 665-672. DOI:10.1093/ejcts/ezx039
11. ESC clinical guideline on management of atrial fibrillation Camm AJ, Kirchhof P, Lip GYH, Task Force for the Management of Atrial Fibrillation of the European Society of Cardiology (2010) Guidelines for the management of atrial fibrillation. *Eur Heart J* 31: 2369-429. *British Journal of Cardiac Nursing.* 2011; 6(5): 240-242. DOI: 10.12968/bjca.2011.6.5.240
12. Incomplete Conflicts of Interest Disclosures in: Fish Oil and Postoperative Atrial Fibrillation: The Omega-3 Fatty Acids for Prevention of Post-operative Atrial Fibrillation (OPERA) Randomized Trial. *JAMA.* 2013; 309(9): 876. DOI:10.1001/jama.2013.537
13. Hohnloser S, Meinertz T, Dambacher T et al. Electrocardiographic and antiarrhythmic effects of intravenous amiodarone: Results of a prospective, placebo-controlled study. *Am Heart J.* 1991; 121(1): 89-95. DOI:10.1016/0002-8703(91)90960-p