ORIGINAL ARTICLE

Freedom from atrial fibrillation after cox maze III ablation during follow-up

Fariborz Akbarzadeh, Rezayat Parvizi[1], Naser Safaie[1], Mohammad-Mahdi Karbalaei, Bita Hazhir-Karzar[2], Babak Bagheri[3]

Departments of Cardiology, and [1]Cardiac Surgery, [2]Students' Research Committee, Medical Faculty, Tabriz University of Medical Sciences, Tabriz, [3]Department of Cardiology, Mazandaran University of Medical Sciences, Sari, Iran

ABSTRACT

Background: Nearly 60% of patients undergoing mitral valve (MV) operations are affected by atrial fibrillation (AF). Cox Maze III ablation is one of the effective ways for restoring sinus rhythm for patients undergoing open heart surgery. The aim of present study was to evaluate efficacy of Maze III ablation procedure for restoring sinus rhythm among patients who had underwent open heart surgery. **Materials and Methods:** During present descriptive-analytic prospective study 114 patients with chronic AF had undergone open heart surgery for their valvular or coronary artery diseases in Educational-Medical centres of Tabriz University of Medical Sciences (Tabriz, Iran) 2006-2012, were included in the study. For all patients Maze III ablation was done. Patients were evaluated by 12 lead electrocardiography (ECG) and 24 hours ambulatory ECG monitoring after 3-6 years (mean 4.8) of follow-up. **Result**: Patients' rhythm before Cox Maze III surgery was chronic AF in all patients. All patients were discharged from operating room with sinus rhythm. During intensive care unit (ICU) hospitalization, rhythm of 34 patients changed to AF and 80 patients had sinus rhythm. Sixteen patients had undergone electrical cardioversion for restoring sinus rhythm which was successful in 12 patients. Ninety-two patients had sinus rhythm when discharged from the hospital. After termination of follow-up, freedom from atrial fibrillation was 51%. Patients with AF during follow-up on surface ECG didn't have episodes of sinus rhythm in their ambulatory monitoring. One patient implanted cardiac pacemaker due to persistent sinus bradycardia. **Conclusion:** Based on the results of this study, Cox Maze III ablation procedure is an effective and safe way for restoring sinus rhythm among patients who are candidate for open heart surgery, while no significant complication was seen among patients.

Key words: Atrial fibrillation, mitral valve, maze ablation, open heart surgery

Address for correspondence:
Dr. Babak Bagheri,
Department of Cardiology,
Mazandaran University of Medical Sciences, Sari, Iran.
E-mail: dr.bab.bagheri@gmail.com

INTRODUCTION

Atrial fibrillation (AF) is a common arrhythmia in patients with heart disease, and is believed to increase the risk of stroke and death.[1] Nearly 0.4% of general population and 60% of patients undergoing mitral valve (MV) operations are affected by AF.[2] AF not only is extremely common, it is a progressive disorder that is often poorly controlled with anti-arrhythmic medications.[3-5] Furthermore AF often is accompanied with other cardiac diseases that compromise the patient's clinical outcome.[6] Restoration of sinus rhythm (SR) with atrioventricular resynchronization may be difficult in patients with chronic or permanent AF or other risk factors for AF.[7-12]

Access this article online

Quick Response Code:

Website: www.nigeriamedj.com

DOI: 10.4103/0300-1652.149173

The Maze procedure as an open-heart surgical approach, established by J. Cox Maze and associates has been proven to be effective in restoring SR and atrial contraction in patients with intermittent or chronic AF.[13-16] In patients with concomitant MV disease, SR can be restored in 80-90%. In patients with lone AF, 93% of the patients may be converted to SR without additional antiarrhythmic drug therapy. Atrial transport function, as demonstrated by doppler echocardiography (ECG), can be restored in 70-100% of these patients.[17,18]

During the past decade, the Maze III procedure has evolved into the gold standard of treatment for medically refractory AF.[19]

The Maze procedure for AF surgical treatment was performed to interrupt all macro-reentrant circuits that

might develop in the atria by creating a myriad of incisions across both atria placed so that the sinus node could ''direct'' the propagation of the sinus impulse throughout both atria.[20] The technique of Maze is based on a multiple wavelet theory, which proposes that different depolarizing wave-fronts circle the atria. Maze incisions should reduce the atrial mass below the critical reentry circuit size, so preventing AF.[17,21-23] The first Maze technique was the cut and sews method which developed to use radiofrequency energy to make ablation lines in left and right atrium for reducing the pump time and bleeding during open heart surgery. Multiple modifications were done and Maze III is the procedure of choice for surgical ablation of AF.

The aim of present study to evaluate the efficacy of Cox Maze III ablation for restoring SR among patients who were candidate for valvular or coronary open heart surgery, was to evaluate the effectiveness of the midterm results of Maze procedure in restoring SR in patients who were candidate for valvular and coronary open heart surgery and AF.

MATERIALS AND METHODS

This study was conducted as a Descriptive Analytic prospective study between March 2006 and March 2012, 142 patients with AF underwent open-heart surgery and Maze III ablation for restoring SR in Educational-Medical centres of Tabriz University of Medical Sciences (Tabriz, Iran) were entered into study. One-hundred and fourteen patients were included in the study. The study protocol was approved by the Ethics Committee of Tabriz University of Medical Sciences, which was in compliance with Helsinki Declaration. Written, informed consent was taken by all patients before their inclusion into the study. Same surgery unit team from department of cardiac surgery of Tabriz University of Medical Sciences at the hospitals performed all operations. Before discharge, intravenous Amiodarone was started from intensive care unit (ICU) and changed to 400 mg orally and continued up to 6 months among patients with SR.

Basic Characteristics of patients in terms of age, sex, type of valvular heart disease, left ventricle ejection fraction (LVEF) and other information were extracted from patients' medical records. Patients invited to attend in clinic for further evaluation. Patients examined clinically and 12-lead ECG was obtained. Ambulatory 24 hours ECG recording was done for all patients. Failure was defined as symptomatic or asymptomatic AF, atrial flutter, and other atrial arrhythmias occurring during 24 hours of ECG.

A normal atrial rhythm less than 100 beats/min at rest was defined as normal SR. If AF occurred, the patient was categorised as having AF. All runs of three or more atrial beats were categorised as supraventricular tachyarrhythmias.

Data collection and statistical analysis were done by SPSS statistical software. Quantitative variables expressed as mean ± standard deviation (SD) and compared with Student's *t*-test between groups. Qualitative variables expressed as frequency and difference between groups was analyzed by Chi-square test. Significant difference was $P < 0.05$ in this study.

RESULTS

One-hundred forty-two patients who were candidate for surgical treatment of valve heart surgery and chronic AF underwent open heart surgery and Cox Maze III radiofrequency ablation for restoring SR. Four patients died during ICU hospitalisation due to bleeding problem and low output state. At the time of follow-up 24 patients were unavailable for study. During ICU stay rhythm of 42 patients relapsed to AF. Eighteen patients accepted to do electrical cardioversion which was successful in seven patients to convert the rhythm to sinus. At the discharge from hospital rhythm of 54 patients was sinus. Two patients' rhythm relapsed to AF during ward stay in hospital. Two patients implanted cardiac pacemaker due to persistent sinus bradycardia. These patients were available at the time of follow-up. Continuing of results is related to the patients who were available for follow-up.

One-hundred fourteen patients were available for study at the termination of follow-up. 24 patients were unavailable for follow up. Patients' mean age was 50.21 ± 7.82 and 37 patients (64.9%) were female. Baseline characteristics of patients are shown in Table 1.

Concomitant cardiac procedures and major problems were shown in Table 2.

Rhythm of patients before index surgery was chronic AF in all patients. All patients discharged from operating room with SR. During ICU hospitalisation, rhythm of 34 patients changed to AF and 80 patients had SR. Sixteen patients received electrical cardioversion for restoring SR which was successful in 12 patients. Rhythm of 92 patients was sinus at discharge from hospital. The mean hospital stay

Table 1: Baseline characteristics

Characteristics	Assessed Amount
LVEF, before (%)	49.19±6.3
LAD, mm	50.21±7.82
LVD, mm	53.3±8.1
Pulmonary hypertension ≥40 mmHg	90 (78.9)
Pure MR	2 (1.7)
Pure MS	16 (14)
MS-MR	96 (84)
AS	4 (3.5)
AR	8 (7)

LVEF – Left ventricular ejection fraction, LAD – Left atrium diameter, LVD – Left ventricle diameter, MR – Mitral regurgitation, MS – Mitral stenosis, AS – Aortic stenosis, AR – Aortic regurgitation; *Data was shown as mean ± Standard deviation and N (%) pattern

of patients was 17.2 ± 4.6 days and mean days of staying in ICU was 7.3 ± 3.5 days. ICU stay in patients with SR was 6.5 ± 1.5 days which was significantly lower than 8.2 ± 2.6 for patients with AF ($P < 0.001$). These numbers for hospital stay were 15.4 ± 2.6 and 19.1 ± 2.7 days respectively which was different statistically ($P < 0.001$).

Follow-up duration was 3-6 years, mean 4.8 years. At the time of final follow-up 58 patients (51%) patients had SR in surface ECG and their ambulatory monitoring showed no transient AF. Patients with AF during follow up on surface ECG didn't have episodes of SR in their ambulatory monitoring. No patient needed to implant pacemaker due to sinus node disease or atrioventricular block. The time of starting AF during follow up was not clear. No specific valvular disease was predictor of SR after Maze III ablation procedure. Table 3 shows effects of LVEF, left atrium (LA) size and LA reduction on SR after surgery.

DISCUSSION

In this study 114 patients underwent maze III ablation. After freedom from atrial arrhythmia follow-up was 51%. In present study follow-up indicated that 46 patients had SR (54.7%) and 2 patients had atrial tachycardia (2.3%).

Mean hospitalization and hospitalization in ICU were 17.24 ± 9.71 and 7.28 ± 4.43 days respectively; this duration varied in other studies. In study of Ballaux *et al*., hospitalization duration was 9 ± 4 days[24]; in study of Handa *et al*., 12.6 ± 6.4 days[25]; in study of Prasad *et al*., 9 days[26]; as it is shown hospitalization duration is more in present study which might be due to delay in patients recovery or patient's unawareness of appropriate home care.

Table 2: Concomitant cardiac procedures and major problems

Characteristics	Frequency, (%)
MV replacement	108 (97.4)
MV repair	4 (3.5)
AV replacement	12 (10.5)
TV replacement	2 (1.7)
LA reduction	52 (45.6)
Coronary artery bypass surgery	12 (10.5)

MV – mitral valve, AV – Aortic valve, TV – Tricuspid valve, LA – Left atrium

Table 3: Differences in baseline characteristics among patients with sinus rhythm and patients with atrial fibrillation

Characteristics	SR	AF	*P*
LVEF (%)	51.9±3.4	46.7±6.5	<0.001
LA size (mm)	45.2±2.8	54.4±3.63	<0.001
LA reduction (%)	61.5	38.5	0.09
Age years	48.2±5.81	51.4±6.63	<0.001
LVEDD (mm)	51.6±6.3	54.2±9.1	<0.001

SR – Sinus rhythm, AF – Atrial fibrillation, LVEDD – Left ventricle end-diastolic diameter; *Data was shown as mean ± standard deviation

A study with favourable outcome investigated the occurrence of new atrial arrhythmias, and sinus node dysfunction in patients who had undergone Maze III procedure. In this study during a mean follow-up of 4.0 ± 2.6 years total of 139 patients underwent the Maze III procedure for lone AF, and 64 patients had undergone the Maze III procedure and concomitant cardiac surgery. Freedom from supraventricular arrhythmias was 80% for the lone AF group and 64% for the concomitant AF group[24]; second group of this study was similar to the patients included in present study, but freedom from supraventricular arrhythmias were not similar to each other.

In a study which aimed to determine whether the maze III procedure provides additional advantages to patients with AF undergoing MV operations, It was concluded that freedoms from AF at 5 years were significantly higher in the MV replacement plus maze group (78%) and the MV repair plus maze group (81%) than in the MV replacement group[27]; this is more than what present study indicates.

In another study determining the time-related prevalence of AF and its risk factors after combined Cox maze and MV surgery, it was concluded that postoperative AF prevalence peaked at 36% at 2 weeks, decreasing to 21% at 5 years. Mean LVEF and LA size in this study were 62 ± 15% and 5.8 ± 1.2 cm respectively[28]; these values are less than present study's findings, but mean LVEF and LA size in our study were 49.19 ± 6.3 percent and 5.33 ± 0.81 cm respectively, so it can be concluded that patients' general condition was worse in our study; this might correlate to less freedoms from AF.

A study trying to examine results using bipolar radiofrequency in 130 patients undergoing a full Cox Maze procedure, a limited Cox Maze procedure, or pulmonary vein isolation alone, showed that after a 12-month follow-up, freedom from AF was about 85%[29]; which is much better than what achieved during this study.

In a different study the long-term outcome of patients with ischemic heart disease who underwent the Cox Maze procedure were examined, although operative mortality in this series was 2% and 19% of patients required postoperative pacemakers, at last follow-up (mean of 5.7 ± 3.3 years), 98% of patients were free of AF[30]; although in present study no one passed away and two patients implanted postoperative pacemakers, in comparison to this study included patients who had ischemic heart disease, which can explain better results in our study.

As a new method in a study, Cox Maze III lesion set with argon-powered cryoenergy (CryoMaze procedure) on all patients with AF presenting for cardiac operations, then long-term clinical results and heart rhythm status were

investigated. It was shown that overall freedom from AF more than 3 years after operation was 60%. Among patients with preoperative intermittent AF, 85% were in normal SR, and 47% with continuous AF were in normal SR[31]; freedom from AF in mentioned study is more than what present study shows.

Also in another new method using Saline-Irrigated Cooled-tip Radiofrequency Ablation it was concluded that after 3, 6 and 12 months, the respective cumulative frequencies of AF were 25%, 15% and 12.8% respectively[19]; which indicates a better outcome in this method.

Examining the long-term outcome of patients who underwent this procedure either as a lone operation or as a concomitant procedure has shown that at a follow-up of 5.4 ± 2.9 years, 96.6% of all patients were free of AF. Of all patients (198 patients) who underwent a Cox Maze III procedure; 112 were lone operations, and 86 were concomitant procedures.[26] It might be thought that high freedom from supraventricular arrhythmias percentage might be caused by lone operation patients' dominancy but there was no statistically significant difference between the lone operation and parallel procedure groups (95.9% vs 97.5%).

Recently, there have been more new limited methods suggested for the treatment of AF. There also have been a number of centres that have been designated to perform only ablations on the left atrium. Success rates from these methods have been reported between 46% and 94% at different follow-up.[13,32-36]

Some characteristics may be effective in remaining SR among patients undergoing Maze III ablation. In our study LVEF was higher, LA diameter and Left Ventricular End Diastolic Diameter (LVEDD) were smaller and age was lower in patients who remained in SR during follow-up. The results of our study were along with the other studies which recorded the association of larger LA dimension, high age of patients and high LV mass as predictor of AF after surgery.[12]

CONCLUSION

This study indicates that the favourable maze III results of abolishment of AF and other atrial arrhythmias in patients with concurrent cardiac surgery persist for a long time after surgery. So according to present study a policy of offering a curative Cox maze III procedure to patients with AF undergoing open cardiac surgery can be supported.

One of the major strengths of this study was using 24-hour ambulatory ECG monitoring, which reduced the frequency of false negative cases, in other words this method managed to detect abnormalities while asymptomatic periods of arrhythmia existed. This can also explain why arrhythmia free patients were less in present study, because most of mentioned studies used less accurate (than 24-hour 12-lead ECG monitoring) methods to detect arrhythmias. Unfortunately, the logistics of continuously monitoring patients for years is not possible. If patients were indeed in intermittent AF, one would have expected a lower incidence of arrhythmia free patients.

REFERENCES

1. Fuster V, Ryden LE, Asinger RW, Cannom DS, Crijns HJ, Frye RL. ACC/AHA/ESC guidelines for the management of patients with atrial fibrillation: Executive summary. Circulation 2001;104:2118-50.
2. Guden M, Akpinar B, Sanisoglu I, Sagbas E, Bayindir O. Intraoperative saline-irrigated radiofrequency modified maze procedure for atrial fibrillation. Ann Thorac Surg 2002;74:S1301-6.
3. Kay GN. Catheter ablation of atrial fibrillation: Challenges and promise. Am J Cardiol 2000;86:25-7K.
4. Weimar T, Bailey MS, Watanabe Y, Marin D, Maniar HS, Schuessler RB, *et al*. The Cox-maze IV procedure for lone atrial fibrillation: A single center experience in 100 consecutive patients. J Interv Card Electrophysiol 2011;31:47-54.
5. Naghavi-Behzad M, Alizadeh M, Azami S, Foroughifar S, Ghasempour-Dabbaghi K, Karzad N, *et al*. Risk factors of congenital heart diseases: A case-control study in Northwest Iran. J Cardiovasc Thorac Res 2013;5:5-9.
6. Parvizi R, Akbarzadeh F. Surgical radiofrequency MAZE III ablation for treatment of atrial fibrillation during open heart surgery. J Tehran Heart Center 2006;1:23-7.
7. Khargi K, Deneke T, Haardt H, Lemke B, Grewe P, Müller KM, *et al*. Saline-irrigated, cooled-tip radiofrequency ablation is an effective technique to perform the Maze procedure. Ann Thorac Surg 2001;72:S1090-5.
8. Wann LS, Curtis AB, January CT, Ellenbogen KA, Lowe JE, Estes NM, *et al*. 2011 ACCF/AHA/HRS Focused Update on the Management of Patients With Atrial Fibrillation (Updating the 2006 Guideline) A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2011;57:223-42.
9. Cappato R, Calkins H, Chen SA, Davies W, Iesaka Y, Kalman J, *et al*. Updated worldwide survey on the methods, efficacy, and safety of catheter ablation for human atrial fibrillation. Circulation 2010;3:32-8.
10. Olesen JB, Lip GY, Hansen ML, Hansen PR, Tolstrup JS, Lindhardsen J, *et al*. Validation of risk stratification schemes for predicting stroke and thromboembolism in patients with atrial fibrillation: Nationwide cohort study. BMJ 2011;342:d124.
11. Aliasgarzadeh A, Ghojazadeh M, Haji-Hoseini R, Mehanfar F, Piri R, Naghavi-Behzad M, *et al*. Age related secretary pattern of growth hormone, insulin-like growth factor-I & insulin-like growth factor binding protein-3 in postmenopausal women. Indian J Med Res 2014;139:598-602.
12. Akbarzadeh F, Shadravan S, Ghorbanian M, Piri R, Naghavi-Behzad M. Double left anterior descending coronary artery originating from left main coronary stem and right coronary artery. J Cardiovasc Thorac Res 2013;5:73-5.
13. Deneke T, Khargi K, Grewe PH, von Dryander S, Kuschkowiz F, Lawo T, *et al*. Left atrial versus bi-atrial maze operation using intraoperatively cooled-tip radiofrequency ablation in patients undergoing open-heart surgery: Safety and efficacy. J Am Coll Cardiol 2002;39:1644-50.

14. Weimar T, Schena S, Bailey MS, Maniar HS, Schuessler RB, Cox JL, *et al*. The cox-maze procedure for lone atrial fibrillation: A single-center experience over 2 decades. Circ Arrhythm Electrophysiol 2012;5:8-14.
15. Hanke T, Charitos E, Stierle U, Graf B, Baldewig M, Sievers H. The surgical Cox Maze III procedure for the treatment of atrial fibrillation: Results from continuously monitored patients. Thorac Cardiovasc Surg 2012;61:OP188.
16. Shams-Vahdati S, Vand-Rajavpour Z, Paknezhad SP, Piri R, Moghaddasi-Ghezeljeh E, Mirabolfathi S, *et al*. Cost-effectiveness of cardiac biomarkers as screening test in acute chest pain. J Cardiovasc Thorac Res 2014;6:29-33.
17. Deneke T, Khargi K, Grewe PH, Laczkovics A, von Dryander S, Lawo T, *et al*. Efficacy of an additional MAZE procedure using cooled-tip radiofrequency ablation in patients with chronic atrial fibrillation and mitral valve disease. Eur Heart J 2002;23:558-66.
18. Izumoto H, Kawazoe K, Eishi K, Kamata J. Medium-term results after modified Cox/Maze procedure combined with other cardiac surgery. Eur J Cardiol Surg 2000;17:25-2.
19. Abreu Filho AC, Lisboa AF, Dallan A, Sobreira Spina G, Grinberg M, Scanavacca M, *et al*. Effectiveness of the maze procedure using cooled-tip radiofrequency ablation in patients with permanent atrial fibrillation and rheumatic mitral valve disease. Circulation 2005;112:I20-5.
20. Damiano RJ Jr. Alternative energy sources for atrial ablation: Judging the new technology. Ann Thorac Surg 2003;75:329-30.
21. Wi JH, Min HK, Kang DK, Jun HJ, Hwang YH, Kim DK, *et al*. Cox-Maze III procedure with valvular surgery in an autopneumonectomized patient. J Cardiothorac Surg 2012;7:116.
22. Henry L, Ad N. Performance of the Cox Maze procedure—a large surgical ablation center's experience. Ann Cardiothorac Surg 2014;3:62-9.
23. Stulak JM, Dearani JA, Sundt TM 3rd, Daly RC, Schaff HV. Ablation of atrial fibrillation: Comparison of catheter-based techniques and the Cox-Maze III operation. Ann Thorac Surg 2011;91:1882-8.
24. Ballaux PK, Geuzebroek GS, van Hemel NM, Kelder JC, Dossche KM, Ernst JM, *et al*. Freedom from atrial arrhythmias after classic maze III surgery: A 10-year experience. J Thorac Cardiovasc Surg 2006;132:1433-40.
25. Handa N, Schaff HV, Morris JJ, Anderson BJ, Kopecky SL, Enriquez-Sarano M. Outcome of valve repair and the Cox maze procedure for mitral regurgitation and associated atrial fibrillation. J Thorac Cardiovasc Surg 1999;118:628-35.
26. Prasad SM, Maniar HS, Camillo CJ, Schuessler RB, Boineau JP, Sundt TM 3rd, *et al*. The Cox maze III procedure for atrial fibrillation: Long-term efficacy in patients undergoing lone versus concomitant procedures. J Thorac Cardiovasc Surg 2003;126:1822-8.
27. Bando K, Kobayashi J, Kosakai Y, Hirata M, Sasako Y, Nakatani S, *et al*. Impact of Cox maze procedure on outcome in patients with atrial fibrillation and mitral valve disease. J Thorac Cardiovasc Surg 2002;124:575-83.
28. Gillinov AM, Sirak J, Blackstone EH, McCarthy PM, Rajeswaran J, Pettersson G, *et al*. The Cox maze procedure in mitral valve disease: Predictors of recurrent atrial fibrillation. J Thorac Cardiovasc Surg 2005;130:1653-60.
29. Melby SJ, Zierer A, Bailey MS, Cox JL, Lawton JS, Munfakh N, *et al*. A new era in the surgical treatment of atrial fibrillation: The impact of ablation technology and lesion set on procedural efficacy. Ann Surg 2006;244:583-92.
30. Damiano RJ Jr, Gaynor SL, Bailey M, Prasad S, Cox JL, Boineau JP, *et al*. The long-term outcome of patients with coronary disease and atrial fibrillation undergoing the Cox maze procedure. J Thorac Cardiovasc Surg 2003;126:2016-21.
31. Gammie JS, Didolkar P, Krowsoski LS, Santos MJ, Toran AJ, Young CA, *et al*. Intermediate-term outcomes of surgical atrial fibrillation correction with the CryoMaze procedure. Ann Thorac Surg 2009;87:1452-8.
32. Doukas G, Samani NJ, Alexiou C, Oc M, Chin DT, Stafford PG, *et al*. Left atrial radiofrequency ablation during mitral valve surgery for continuous atrial fibrillation: A randomized controlled trial. JAMA 2005;294:2323-9.
33. Kottkamp H, Hindricks G, Autschbach R, Krauss B, Strasser B, Schirdewahn P, *et al*. Specific linear left atrial lesions in atrial fibrillation: Intraoperative radiofrequency ablation using minimally invasive surgical techniques. J Am Coll Cardiol 2002;40:475-80.
34. Benussi S, Nascimbene S, Agricola E, Calori G, Calvi S, Caldarola A, *et al*. Surgical ablation of atrial fibrillation using the epicardial radiofrequency approach: Mid-term results and risk analysis. Ann Thorac Surg 2002;74:1050-6.
35. Jabbari H, Bakhshian F, Alizadeh M, Alikhah H, Naghavi-Behzad M. Lecture-based Versus Problem-Based Learning Methods in Public Health Course for Medical Students. Res Dev 2012;1:31-5.
36. Abdollahi M, Foruzan-nia K, Behjati M, Bagheri B, Khanbabayi-Gol M, Dareshiri S, *et al*. The effect of preoperative intravenous paracetamol administration on postoperative fever in pediatrics cardiac surgery. Niger Med J 2014;55:379-83.

How to cite this article: kbarzadeh F, Parvizi R, Safaie N, Karbalaei M, Hazhir-Karzar B, Bagheri B. Freedom from atrial fibrillation after cox maze III ablation during follow-up. Niger Med J 2015;56:59-63.

Source of Support: Nil, **Conflict of Interest:** None declared.