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Maintenance of sinus rhythm after electrical cardioversion for recurrent atrial fibrillation following mitral valve surgery with or without associated radiofrequency ablation

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ABSTRACT

Background: This study reports the outcomes of patients who underwent electrical cardioversion for atrial fibrillation recurrence following mitral valve surgery and associated radiofrequency ablation compared to those who did not undergo concomitant atrial fibrillation ablation.
Methods: The population consisted of 116 patients with persistent/long-standing persistent AF who underwent mitral valve surgery with (Group A, n = 54) or without (Group B, n = 62) associated radiofrequency ablation between January 2007 and January 2011 at three institutions and who subsequently underwent cardioversion for persistent atrial fibrillation within 12 months of their initial procedure.
Results: The mean follow-up duration was 30.7 ± 9.4 months. Of the 104 patients with acute restoration of SR 42 (40.3%) had AF recurrence. The average time to recurrence after cardioversion was 7.3 ± 4.2 days. Recurrence was significantly lower in patients undergoing ablation surgery (21.4%) than in those undergoing no ablation surgery (78.6%, $p < 0.001$). Non-performed ablation procedure ($p < 0.001$), time from surgery ≥88 days and left atrial dimensions ≥45.5 mm before cardioversion (both, $p = 0.005$) were multivariable predictors of atrial fibrillation recurrence. In Group B the use of amiodarone was inversely correlated with recurrence of AF ($p < 0.001$). This correlation was not significant ($r = -0.02$, $p = 0.85$) in Group A.
Conclusions: Electrical cardioversion for recurrent AF showed better results and stable recovery of sinus rhythm in patients undergoing concomitant surgical ablation during mitral valve surgery. This might be attributable to substrate modification caused by surgical lesions. Amiodarone improved the ECV-success rate only in patients with no associate ablation. Further larger randomized studies are necessary to confirm our findings.

1. Introduction

Since its introduction in 1989 by Cox and colleagues [1], the surgical treatment of atrial fibrillation (AF) has experienced a new dawn during the past few years [2]. Technological innovations have helped to simplify the original Maze technique replacing the surgical incisions with transmural ablation lines created by various energy sources [3].

In patients with mitral valve disease preoperative AF is present in 30–50% and it is associated with less favorable short- and long-term outcomes. It has been demonstrated that surgical correction of the underlying cardiac abnormality usually will not abolish AF that has been present for 6 months or more [4,5]. In contrast, the Maze procedure associated to mitral valve surgery is reported to have several clinical benefits [6–8] and to restore stable sinus rhythm with a success rate ranging from 74% to 83% [9,10].

Electrical cardioversion (ECV) is commonly recommended for patients with recurrent AF following an initial ablation procedure. Nonetheless, although the long-term effect of ECV might be promising under these circumstances, it has been reported that >80% of patients who undergo ECV for persistent AF or atrial flutter after catheter ablation have recurrence [11] and little is known about the benefit of ECV, with or without additional pharmacological pre-treatment, after unsuccessful ablation surgery.

Therefore, the purpose of this study is to report early and mid-term outcomes of patients who underwent ECV for AF recurrence following

Abbreviations: ECV, electrical cardioversion; AF, atrial fibrillation.

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mitral valve surgery and associated radiofrequency (RF) ablation compared to those who did not undergo concomitant AF ablation. We also examined multiple pre-procedural and peri-procedural variables to determine predictors of AF recurrence after cardioversion.

2. Methods

2.1. Patient population

Ethical Committee approval was waived due to the retrospective analysis of the study according to National laws regulating observational retrospective studies (Italian law nr. 11960, released on 13/07/2004; Dutch law). However, written informed consent was obtained from all the patients prior to the surgical procedure.

The patient population consisted of 116 patients with persistent and long-standing persistent AF who survived mitral valve surgery with (Group A, n = 54) or without (Group B, n = 62) associated radiofrequency AF ablation between January 2007 and January 2011 at three institutions (Careggi Hospital, Florence, Italy; University Hospital, Catanzaro, Italy; University Hospital, Maastricht, the Netherlands) and who subsequently underwent ECV for persistent AF within 12 months of their initial procedure. During this interval a total of 317 patients with mitral disease and AF underwent cardiac surgery at these institutions and, among them, 115 (36.2%) had concomitant ablation surgery.

Sixteen patients refused ECV or did not undergo cardioversion because of contraindication. Patients with paroxysmal AF, those who underwent prior cardiac surgery or catheter ablation and those with postoperative residual/recurrent moderate mitral or tricuspid regurgitation were excluded from this study. Atrial fibrillation was defined according to the Heart Rhythm Society/European Heart Rhythm Association/European Cardiac Arrhythmia Society [12]. Clinical characteristics are shown in Table 1. Baseline data were comparable in the two Groups.

2.2. Surgical technique

Indication to surgical ablation was given following the recent European Society of Cardiology Guidelines [13]. However, the final decision to perform or not perform a surgical ablation was at the attending surgeon's discretion. All operations were carried out on cardiopulmonary bypass with cardiac arrest being achieved with antegrade blood cardioplegia. The mitral valve surgery was performed through a standard left atriotomy and different techniques of mitral repair were accomplished according to the underlying

Table 1
Baseline characteristics and surgical data (n = 116).

	Group A Ablation group (n = 54)	Group B No ablation group (n = 62)	p
Age	69.9 ± 8.6	68.2 ± 8.9	NS
Sex (male/female)	28/26 (51.8/48.2)	31/31 (50/50)	NS
Body mass index (kg/m^2)	26.0 ± 3.1	26.7 ± 2.8	NS
Co-morbidities			
Hypertension	20 (37.1)	21 (33.9)	NS
Diabetes	14 (25.9)	15 (24.1)	NS
Cerebrovascular disease	6 (11.1)	6 (9.6)	NS
Chronic obstructive pulmonary disease	4 (7.4)	3 (4.8)	NS
Congestive heart failure	3 (5.5)	5 (8.0)	NS
Renal failure	1 (1.9)	2 (3.2)	NS
Atrial fibrillation type			
Persistent	32 (59.3)	36 (58.1)	NS
Long-standing persistent	22 (40.7)	26 (41.9)	
Atrial fibrillation duration before surgery (months)	33 [27–44]	28 [21–37]	NS
New York Heart Association Functional Class	3 [2–3]	3 [2–3]	NS
II	12 (22.2)	21 (33.9)	
III	30 (55.6)	27 (43.6)	
IV	12 (22.2)	14 (22.5)	
EuroScore	5.3 [4.0–6.2]	6.0 [5.0–7.0]	NS
Mitral valve pathology			
Rheumatic	9 (16.7)	11 (17.7)	NS
Degenerative	26 (48.2)	31 (50.1)	
Ischemic	14 (25.9)	14 (22.5)	
Functional	4 (7.4)	5 (8.1)	
Other	1 (1.9)	1(1.6)	
Mitral lesion			
Stenosis	1 (1.9)	2 (3.2)	NS
Insufficiency	49 (90.7)	58 (93.6)	
Mixed	4 (7.4)	2 (3.2)	
Coronary artery disease	16 (29.6)	16 (25.8)	NS
Aortic valve disease	7 (12.9)	12 (19.3)	NS
Tricuspid valve disease	16 (29.6)	18 (29.0)	NS
Left atrial size (mm)	52.3 ± 9.0	55.1 ± 11.5	NS
Left ventricular ejection fraction (%)	56.0 ± 11.6	58.5 ± 11.9	NS
End systolic diameter (mm)	31.4 ± 3.3	30.5 ± 2.2	NS
End diastolic diameter (mm)	52.3 ± 4.3	51.8 ± 4.0	NS
Mitral valve surgery			
Repair	42 (77.8)	46 (74.2)	NS
Replacement			
Bioprosthesis	8 (14.8)	11 (17.7)	
Mechanical	4 (7.4)	5 (8.1)	
Coronary artery bypass grafting	16 (29.6)	14 (22.5)	NS
Anastomoses (n)	2.0 [2–3]	2.5 [2–3]	
Aortic valve replacement			
Bioprosthesis	6 (11.1)	6 (9.6)	NS
Mechanical	1 (1.9)	4 (6.4)	
Tricuspid valve repair	14 (25.9)	16 (25.8)	NS
Right atrial lesions	3 (5.5)	–	
Left atrial appendage exclusion/ligation	52 (96.2)	–	
Ganglia ablation	11 (20.4)	–	
Cardiopulmonary bypass time (min)	170 ± 40	160 ± 34	NS
Aortic cross clamp time (min).	144 ± 29	129 ± 20	NS

Values are expressed as mean ± standard deviation (normally distributed data), median [Interquartile range] (non-normally distributed data) or n (%). Abbreviations: NS: not significant.