Radiofrequency ablation of atrial fibrillation in patients with mitral or aortic mechanical prosthetic valves: A feasibility, safety, and efficacy study

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BACKGROUND Patients with prosthetic valves have a high prevalence of atrial fibrillation (AF). We report a multicenter experience of performing pulmonary vein antral isolation (PVAI) in this challenging, high-risk cohort of patients.

OBJECTIVE The purpose of this study was to assess the feasibility, safety, and efficacy of radiofrequency (RF) ablation for sinus rhythm restoration in AF patients with mitral or aortic mechanical prosthetic valves.

METHODS A total of 50 patients with prosthetic valves (group I) who underwent RF ablation for AF between January 1, 2007, and April 30, 2009, were identified prospectively at four tertiary care centers. A matched group of 50 patients (group II) acted as controls.

RESULTS Total procedural time (199.4 ± 49 minutes vs 166.6 ± 27.5 minutes, $P < .001$) and fluoroscopy time (60 ± 17 minutes vs 53.8 ± 6.8 minutes, $P < .01$) were prolonged, with a higher incidence of atrial flutter at 3 months in group I (18% vs 6%, $P = .1$) compared to group II. At 12 months, 80% of patients in the valve group were in sinus rhythm after an average of 1.3 procedures, and 82% of controls were in sinus rhythm after an average 1.2 procedures ($P = .9$). There was a trend toward a higher nonfatal complication rate in the valve group than in the control group (8% vs 4%, $P = .1$).

CONCLUSION In patients with prosthetic valves, RF ablation for AF is feasible, safe, and efficacious, with a trend toward a higher nonfatal complication rate and an increased rate of postablation atrial flutter.

KEYWORDS Atrial fibrillation; Prosthetic valve; Radiofrequency ablation

ABBREVIATIONS **AF** = atrial fibrillation; **CFAE** = complex fractionated atrial electrogram; **INR** = international normalized ratio; **PV** = pulmonary vein; **PVAI** = pulmonary vein antral isolation; **RF** = radiofrequency; **SVC** = superior vena cava

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Introduction

Atrial fibrillation (AF) is frequently associated with patients who have rheumatic or nonrheumatic valve disease.[1] Restoration of sinus rhythm by surgical ablation in patients with AF undergoing valve surgery was previously shown to be beneficial.[2] However, a significant proportion of patients undergoing mitral valve surgery develop *de novo* AF during subsequent years.[3]

Patients with advanced valvular heart disease often experience lower success rates with pharmacologic rhythm control strategies, resulting in a tendency to preferentially treat these patients with rate control approaches.[4] Over the last decade, catheter ablation has evolved into a very effective treatment modality for AF. Pulmonary vein antral isolation (PVAI) currently is an established treatment for restoration of sinus rhythm in patients with AF.[5–7] However, access to the left atrium and subsequent catheter manipulation for PVAI often are challenging. Cases of prosthetic valve dysfunction secondary to trauma from ablation cath-

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eter[8] and entrapment of mapping catheters in the native valve apparatus requiring cardiac surgery have been reported.[9–11] The complexity of procedures in this cohort is twofold, with issues related to (1) the direct proximity of the catheters being manipulated to the prosthetic valve and (2) anticoagulation. Patients who may experience a substantial benefit from PVAI often are not considered for these complex procedures because of the fear of possible fatal and nonfatal complications. Patients with prosthetic valves have a higher incidence of biatrial tissue remodeling, fibrosis, and dilation that facilitate the development of new-onset AF.[12] If untreated, AF can result in significant morbidity in this group of patients. A previous small single-center study of this cohort of patients undergoing ablation for AF suggests a higher incidence of postprocedural atrial arrhythmias, perioperative complications, and longer fluoroscopic times compared to controls.[13] Here we report a multi-institutional experience of performing PVAI in this challenging, high-risk, and yet most benefited cohort of patients.

Methods

Patients from four large high-volume AF ablation centers in the United States were enrolled between January 2007 and April 2009 from a prospective AF database from all participating institutions. Consecutive patients with either a prosthetic mitral or aortic valve were included in group I (n = 50). Age- and gender-matched controls (without prosthetic valves) undergoing AF ablation during the same period formed group II (n = 50). Not all institutions contributed equally. The distribution was 20/15/7/8 patients from each of the four participating institutions. Patients with prior endocardial or epicardial AF ablation were excluded from the study.

AF ablation procedure in the study and control groups

All patients in group I had a therapeutic international normalized ratio (INR). Group I patients undergoing ablation had a mean INR of 2.8 (range 2.5–3.2) versus a mean INR of 2.2 (range 1.7–3.0) for group II patients. Additional heparin was given to maintain the activated clotting time >400 seconds during the procedure. None of the patients in the study or control group underwent ablation by remote magnetic or robotic navigation system. All patients underwent manual catheter manipulation. PVAI using a double transseptal approach has been described in detail elsewhere (Figure 1).[14,15] In brief, intracardiac echocardiogram was used to monitor while obtaining transseptal access and to define the pulmonary vein (PV) anatomy. We routinely used either an SL0 or SL1 sheath. A circular mapping catheter (Lasso, Biosense Webster, Diamond Bar, CA, USA) was used for mapping, and a 3.5-mm open irrigated-tip catheter (ThermoCool, Biosense Webster) was used to ablate the antrum of the PVs and to achieve electrical isolation of the PVs. Radiofrequency energy output was titrated to a maximum of 45 W along the anterior segments and to 35 W while ablating the posterior segments.

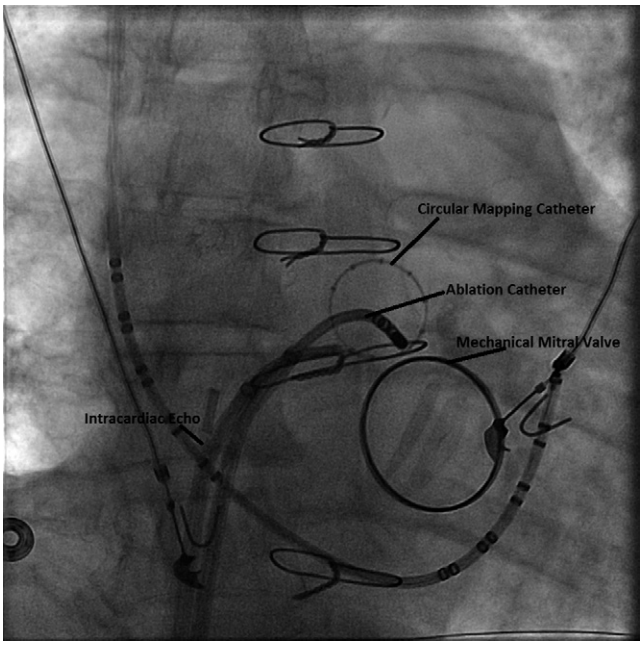

Figure 1 Fluoroscopic image of the heart showing transseptal sheath, circular mapping catheter, ablation catheter in the left atrium, and St. Jude mechanical prosthetic valve.

The three-dimensional geometry of the left atrium was reconstructed using the CARTO (Biosense Webster) or NavX mapping system (St. Jude Medical, Minneapolis, MN, USA) (Figure 2). The procedural endpoint for this ablation strategy was local elimination of all PV potentials along the antra or inside the veins (entry and exit block). The antrum included the entire posterior wall and extended anteriorly to the right PVs along the left septum. Further ablation of the superior vena cava along the right atrium–superior vena cava junction was performed if mapping revealed double potentials around this region and when high-output (30 mA) pacing did not capture the phrenic nerve. The procedure was performed in the patients' presenting rhythm, and direct cardioversion was performed at the end of the procedure if necessary. Only PVAI was performed in patients with paroxysmal AF, whereas in patients with persistent AF additional substrate modification involving complex fractionated atrial electrogram (CFAE) identified by either the mapping catheter or the three-dimensional map also was performed. CFAE along the posterior wall, left atrial septum, roof, coronary sinus, and crista terminalis were mapped and ablated. Any spontaneous intraatrial tachycardia that occurred during ablation was mapped and ablated. Some of these patients required roof lines and left inferior PV–mitral isthmus lines to ablate residual left atrial tachycardias after PVAI and CFAE ablation. We did not perform routine linear ablation. Linear ablation was performed only when an intraatrial reentrant tachycardia occurred that required a specific linear lesion set based on the activation map or in cases with extensive fractionation. Antral isolation included an equivalent of a roof line. In addition, isoproterenol 20 mcg/min was administered for 15