Clinical Investigations

Surgical Ablation of Atrial Fibrillation in Patients With Congestive Heart Failure

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ABSTRACT

Background: Congestive heart failure (CHF) and atrial fibrillation (AF), both of which cause morbidity and mortality, are mutually promoting diseases. We aimed to evaluate surgical AF ablation in CHF.

Methods and Results: Among 212 patients (age 69 ± 8.8 years, 87% with persistent AF) undergoing concomitant left atrial (LA) ablation, 79 (37.3%) presented CHF (n = 62 with a left ventricular ejection fraction [LVEF] 0.31−0.45, n = 17 with an LVEF ≤ 0.30). Patients with CHF were similar to controls regarding AF duration (61 ± 65.1 months vs. 54 ± 67.2 months, not significant [NS]), LA diameter (49 ± 7.5 mm vs. 50 ± 9.2 mm, NS), and heart rate (78 ± 18.4 min^{-1} vs. 81 ± 21.3 min^{-1}, NS), but they required more circulatory support (17.7% vs. 1.5%, $P < .001$) and a longer intensive care unit stay (6 ± 9.5 days vs. 4 ± 10.5 days, $P = .032$). At follow-up after 13 ± 7.3 months, 42 patients (66%) with CHF and 81 controls (74%, NS) were in sinus rhythm (SR) (55% and 64% without antiarrhythmic drugs, respectively, NS). Univariate and logistic regression analysis revealed that AF duration and LA diameter predicted rhythm outcome but not CHF. In patients with an LVEF of 0.30 or less, SR conversion significantly improved LVEF, New York Heart Association class, and Minnesota Living with Heart Failure score. Kaplan-Meier estimates suggested superior survival of patients with stable SR (100% vs. 73%, log-rank $P < .05$).

Conclusions: If patients presenting with CHF and AF require cardiac surgery, concomitant AF ablation should be considered, especially if left ventricular function is severely impaired. (*J Cardiac Fail 2007;13:509−516*)

Key Words: Cardiac surgery, concomitant ablation, rhythm control.

Despite significant advances in therapeutic interventions, congestive heart failure (CHF), the most important complication of almost all forms of heart disease, remains a leading cause of morbidity and mortality.[1,2] Atrial fibrillation (AF), per se a major health problem because of its risk of stroke and premature death, is frequently associated with CHF.[3−6] The prevalence of AF increases as the severity of CHF increases.[6] Whereas AF occurs in approximately 10% of patients with CHF in New York Heart Association (NYHA) functional class II, AF occurs in approximately 50% of patients with CHF in NYHA functional class IV.

From a pathophysiologic point of view, however, the relationship of both disease entities is characterized by a mutual advancement.[6] CHF promotes AF because the hemodynamic load and specific neuroendocrine stimulation provoke alterations in atrial electrophysiologic characteristics. AF begets CHF because the loss of atrial contraction and irregular ventricular response reduce cardiac output and tachycardia may induce cardiomyopathy. Clinical data suggest that patients with CHF accompanied by AF have a poor prognosis. Mortality (all cause, sudden death, and pump failure) and morbidity (hospitalization) in patients with CHF and AF are significantly increased.[7−9]

Because the respective incidence of CHF and AF increases with age,[5,6] and the age of patients requiring cardiac surgery is continuously increasing,[10] a growing number of patients undergoing heart surgery are affected. During the

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past decade, surgical AF treatment, initially introduced as the Maze procedure,[11] has become a less complex operation.[12–14] By using different technologies for tissue ablation and focusing the lesion pattern on the left atrium (LA), promising results have been reported.[13–16] In this study we evaluated outcome after concomitant surgical AF ablation in patients with CHF.

Methods

Patients

Between March 2002 and February 2006, a total of 212 patients (56.1% were male, age 69 ± 8.8 years) scheduled for cardiac surgery underwent concomitant AF ablation. According to established definitions,[17] the majority of patients presented with persistent AF (n = 185, 87.3%), and 27 patients had paroxysmal AF. Of all the patients, 79 (37.3%) exhibited CHF, defined as NYHA class III or higher and left ventricular ejection fraction (LVEF) of 0.45 or less, determined by ventriculography or echocardiography. Patients with CHF were further stratified according to preoperative LVEF; 62 patients had moderate left ventricular (LV) impairment (LVEF 0.31–0.45), and 17 patients had severe LV dysfunction (LVEF ≤ 0.30). Preoperative, perioperative, and follow-up data were prospectively entered into an institutional database. Informed consent regarding the operation and data acquisition was obtained from all patients. For assessment of perioperative risk, the logistic EuroSCORE was determined.[18]

Surgical Procedures and Perioperative Treatment

The detailed procedures of the study population are listed in Table 1. The authors H. G., S. D., S. B., P. D., and W. K. performed 109, 17, 42, 23, and 21 operations, respectively. For all procedures, standard normothermic cardiopulmonary bypass and warm antegrade blood cardioplegia were used. All patients underwent endocardial ablation of the LA as described in detail previously.[16] Microwave (Flex 4, Guidant Corporation, Santa Clara, Calif) or radiofrequency (Cardioblate, Medtronic Incorporation, Minneapolis, Minn) energy was applied depending on the device availability or the surgeon's discretion. The lesion pattern is depicted in Figure 1. The LA appendage was oversewn only if thrombi were inside (n = 4). The transesophageal echocardiography probe was removed during ablation to avoid esophageal injury.

Table 1. Surgical Procedures

	Overall (n = 212) % (n)	No CHF (n = 133) % (n)	CHF (n = 79) % (n)
MVP/R	39.2 (83)	42.8 (57)	32.9 (26)
Isolated	22.6 (48)	27.1 (36)	15.2 (12)
+CABG	11.3 (24)	9.8 (13)	13.9 (11)
+TVP/R (+CABG)	4.2 (9)	4.5 (6)	3.8 (3)
+Congenital	1.0 (2)	1.6 (2)	–
AVR	32.1 (68)	31.6 (42)	32.9 (26)
Isolated	18.9 (40)	20.3 (27)	16.4 (13)
+CABG	3.8 (8)	3.0 (4)	5.1 (4)
+MVP/R (+CABG, +TVP/R, +AAR)	9.4 (20)	8.2 (11)	11.4 (9)
CABG	27.8 (59)	24.1 (32)	34.2 (27)
Isolated	27.4 (58)	24.1 (32)	32.9 (26)
+Aneurysmectomy	0.5 (1)	–	1.3 (1)
Other procedures	1.0 (2)	1.6 (2)	–
Microwave ablation	51.9 (110)	52.6 (70)	50.6 (40)
Radiofrequency ablation	48.1 (102)	47.4 (63)	49.4 (39)
LA reduction plasty	1.4 (3)	1.5 (2)	1.3 (1)
Re-do surgery	7.1 (15)	6.0 (8)	8.9 (7)

CHF, congestive heart failure; MVP/R, mitral valve plasty/replacement; CABG, coronary artery bypass grafting; TVP/R, tricuspid valve plasty/replacement; AVR, aortic valve replacement; AAR, ascending aortic replacement; LA, left atrial.

All patients were anticoagulated with heparin followed by phenprocoumon with a target international normalized ratio of 2.0 to 3.0. After 3 months and stable sinus or atrial-driven pacemaker rhythm in Holter electrocardiogram and mechanical atrial function in echocardiogram, anticoagulation was ceased. Patients with mechanical valve substitutes were prescribed phenprocoumon permanently (international normalized ratio of 2.5–3.5 for aortic valve prostheses and 3.0–4.0 for mitral valve prostheses). Direct current shock cardioversion of early recurrent AF was performed if the patient was symptomatic or hemodynamically compromised. Perioperatively, either preoperative beta-blocker treatment was continued or antiarrhythmic treatment with class III antiarrhythmic drugs (sotalol or amiodarone) was initiated. The decision was left to the discretion of the surgeon. After discharge, the patient's general physician or cardiologist managed the anticoagulation and antiarrhythmic therapy.

Follow-Up

Prospective follow-up was performed at 3, 6, and 12 months and annually thereafter. Patients were interviewed and underwent clinical examination, electrocardiography, and transthoracic echocardiography. In 9 patients (4.2%) who were unable to visit the clinic, interviewing was done by telephone and echocardiographic data were obtained from the referring cardiologist. Ablation was considered successful if sinus rhythm (SR) was maintained with

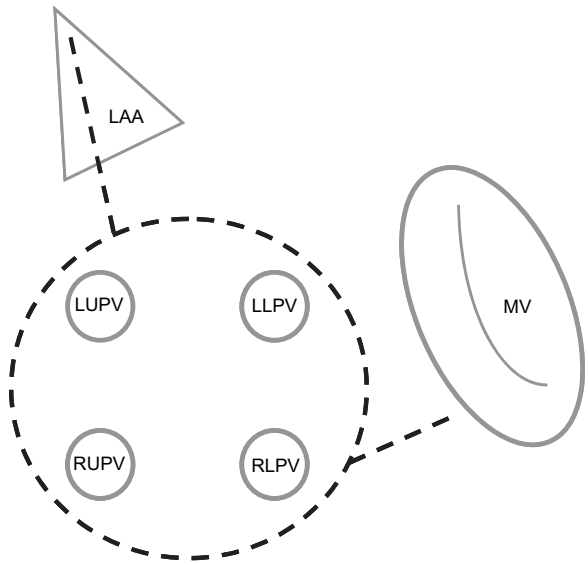

Fig. 1. Lesion pattern of LA endocardial ablation. The lesion pattern consisted of (I) LA posterior wall ablation isolating all pulmonary vein ostia, (II) a line into the LA appendage, and (III) a line to the mitral valve annulus (P3). LAA, left atrial appendage; MV, mitral valve; LUPV, left upper pulmonary vein; LLPV, left lower pulmonary vein; RUPV, right upper pulmonary vein; RLPV, right lower pulmonary vein.