

Comparison of Circumferential Pulmonary Vein Isolation and Antiarrhythmic Drug Therapy in Patients with Atrial Fibrillation

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ABSTRACT

Introduction: The aim of this study was to evaluate quality of life after circumferential pulmonary vein isolation (CPVI) compared with antiarrhythmic drug therapy (ADT) in treating atrial fibrillation (AF). CPVI is now a common therapy in AF, but few studies have focused on the effect of CPVI on quality of life.

Methods: A total of 123 AF patients were followed prospectively. Quality of life was evaluated comparing CPVI with ADT as a second-line treatment for patients with AF. The Medical Outcomes Study Short Form (SF)-36 health surveys were conducted to establish a

baseline score before initiation and again at 6 months after the intervention.

Results: Mean follow-up duration was 12.7 ± 4.3 months. Of 123 patients enrolled, 66 were randomized to receive CPVI and 57 to ADT alone. At the 6-month follow-up, 13 (22.8%) patients in the ADT group and 41 (62.1%) patients in the CPVI group had no recurrence of AF. The SF-36 scales were significantly higher in the CPVI than in the ADT group, as were the physical component summary scores (269.3 ± 58.6 vs. 234.9 ± 66.9) and mental component summary scores (273.6 ± 69.4 vs. 234.1 ± 44.7). Quality of life was significantly higher in the CPVI group (except for body pain).

Conclusion: In patients with AF, CPVI has superiority over ADT with regards to the maintenance of sinus rhythm and improvements in quality of life.

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INTRODUCTION

Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia. The prevalence

has been increasing with the aging population and the growing number of individuals who survive with chronic cardiovascular diseases. AF increases the risk of stroke and other embolic events, and has been associated with diminished functional status and heart failure symptoms of diastolic dysfunction with the development of dilated cardiomyopathy. It considerably impairs the patients' quality of life (QoL). The technique of circumferential pulmonary vein isolation (CPVI) has undergone rapid evolution and has emerged as an important strategy in the treatment of patients with AF, although its effect on QoL has not been fully characterized. The aim of the present study was to evaluate effect on QoL score in patients with AF after treatment with CPVI compared with antiarrhythmic drug therapy (ADT).

MATERIALS AND METHODS

Patients

The study included 123 patients with AF, randomized to CPVI ($n = 66$) or ADT alone ($n = 57$). All patients were followed-up for 6 months after the intervention.

QoL Assessment

QoL was assessed using the Medical Outcomes Study Short Form-36 (SF-36) health survey questionnaire [1]. The SF-36 assesses eight specific QoL domains. It contains items to assess physical health (general health perception, physical functioning, role limitations due to physical problems, and bodily pain) and mental health (social functioning, role limitations due to emotional problems, mental health, and vitality). The total score from the

eight scales can range from 0 to 100, with higher scores representing better functioning and QoL than lower scores.

CPVI

The right internal jugular vein or subclavian vein was punctured while patients were under local anesthesia (lidocaine). An electrode catheter was introduced into the coronary sinus to record left atrial electrical activity and pacing. The intra-atrial septum was punctured under X-ray guidance projected into a SWARTZ L1 and R0 expansion scabbard along the sheath pipe into the ablation catheter infused with a cold saline catheter (St. Jude, USA) and LASSO catheter (St. Jude, USA). Under X-ray guidance and the EnSite3000 noncontact mapping system, three-dimensional (3D) electro-anatomic maps were constructed. The left and right pulmonary veins were encircled, with additional lines in the posterior left atrium or roof and along the mitral isthmus for those who had atrial flutter. Contiguous applications of radiofrequency energy were delivered at a target temperature of 50–60°C and a maximal power output of 40–50 W. The endpoint of ablation was an 80% reduction in the amplitude of the electrogram or a total of 40 s of energy application. Additional ablation was performed in the outer pulmonary veins, where the local electrogram amplitude exceeded 0.2 mV. If AF was still present at the end of circumferential pulmonary vein ablation, either amiodarone or transthoracic cardioversion was used to restore sinus rhythm.

Follow-Up and Study Objectives

All patients were systematically followed up for 6 months after the intervention, with the following parametric data obtained: 12-lead

electrocardiography (ECG), echocardiography, and 24-h Holter recording at baseline and 1, 3, and 6 months. Additional 12-lead ECG or a Holter measurement was encouraged when patients experienced palpitations. QoL was assessed using the SF-36 survey at baseline and again at 6 months after the intervention. Episodes were qualified as AF, if they lasted at least 3 min and were documented by ECG/Holter or reported by the patient as AF, even in the absence of ECG confirmation.

Statistical Analysis

Analysis was carried out using SAS 16.0 statistical software package. Continuous variables were summarized by mean \pm standard deviation or the median and interquartile range (25th and 75th percentiles), and were compared using *t*-tests or Wilcoxon rank sum test. Categorical variables were represented by frequencies and percentages, and were compared using χ^2 tests. Differences were considered significant at $P < 0.05$.

RESULTS

Clinical Characteristics

Clinical characteristics of 123 enrolled patients are shown in Table 1. Sixty-six patients

underwent CPVI (45 males and 21 females with the mean age of 61.5 ± 10.1 years). Fifty-seven patients received ADT (35 males and 22 females with the mean age of 60.9 ± 13.7 years). The baseline characteristics were comparable, with no significant differences between two groups (e.g., age, gender, paroxysmal AF or persistent AF, coronary artery disease, hypertension, and valvular heart disease; Tables 1, 2).

QoL at Baseline and at Follow-up

A total of 123 patients were prospectively followed up for 6 months. At the 6-month follow-up 13 (22.8%) patients in the ADT group and 41 (62.1%) patients in the CPVI group had no recurrence of AF. At baseline, there were no significant differences in QoL between the ADT and CPVI groups. Table 3 shows the changes in QoL from baseline to the 6-month follow-up assessment for the SF-36 scales pertaining to physical and mental health in the CPVI group. For all scales the observation was statistically significant different in the CPVI group at baseline vs. 6 months (Table 3). For seven of eight scales (except for body pain), the observation was statistically significant at baseline vs. 6 months in the CPVI group. The 6-month physical component summary (PCS) and mental component summary (MCS) scores

Table 1 Baseline patient characteristics between circumferential pulmonary vein isolation (CPVI) and antiarrhythmic drug therapy (ADT) group

Group	Age (years)	Total AF duration (years)	Echocardiography			Mean rate
			LA (mm)	LV (mm)	EF	
CPVI ($n = 66$)	61.5 ± 10.1	6.2 ± 5.6	39.2 ± 5.6	46.4 ± 4.9	58.5 ± 7.4	75.9 ± 19.3
ADT ($n = 57$)	60.9 ± 13.7	4.6 ± 6.2	39.1 ± 5.9	47.5 ± 6.4	58.1 ± 6.2	74.1 ± 20.1
<i>t</i> -value	0.27	1.51	0.12	1.04	0.36	0.51
<i>P</i> -value	0.79	0.14	0.91	0.91	0.30	0.61

AF atrial fibrillation, EF ejection fraction, LA left arterial, LV left ventricular

Table 2 Baseline patient characteristics between circumferential pulmonary vein isolation (CPVI) and antiarrhythmic drug therapy (ADT) group

	Male, <i>n</i> (%)	Hypertension, <i>n</i> (%)	Diabetes mellitus, <i>n</i> (%)	Stroke, <i>n</i> (%)	Type of AF		Underlying disease		
					Paroxysmal, <i>n</i> (%)	Persistent, <i>n</i> (%)	CHD, <i>n</i> (%)	HC, <i>n</i> (%)	VHD, <i>n</i> (%)
CPVI	45 (68.1)	27 (40.9)	8 (12.1)	5 (7.6)	60 (90.9)	6 (9.1)	21 (37.5)	3 (4.5)	3 (4.5)
ADT	35 (61.4)	20 (35.1)	13 (22.8)	6 (10.5)	50 (87.7)	7 (12.3)	28 (49.1)	4 (7.0)	2 (3.5)
χ^2 -value	0.62	0.44	0.47	0.33	0.33		4.84		
<i>P</i> -value	0.43	0.51	0.12	0.57	0.57		0.39		

AF atrial fibrillation, CHD coronary heart disease, HC hypertensive cardiopathy, VHD valvular heart disease

Table 3 The mean changes from baseline to 6-months for the SF-36 scales

	CPVI		<i>P</i>	ADT		<i>P</i>
	Baseline Mean \pm SD	6-months Mean \pm SD		Baseline Mean \pm SD	6-months Mean \pm SD	
PF	67.1 \pm 17.9	76.0 \pm 17.5	0.005	62.1 \pm 26.3	65.1 \pm 20.4	0.494
RP	46.9 \pm 17.6	58.0 \pm 22.9	0.002	42.5 \pm 20.6	48.9 \pm 26.9	0.174
BP	58.6 \pm 24.0	69.3 \pm 21.2	0.007	60.6 \pm 20.3	66.8 \pm 22.2	0.120
GH	48.2 \pm 20.7	66.0 \pm 19.9	<0.001	42.9 \pm 25.5	52.2 \pm 26.8	0.023
VT	60.9 \pm 16.5	70.8 \pm 20.3	0.003	57.4 \pm 17.5	62.8 \pm 13.2	0.062
SF	56.4 \pm 21.1	70.1 \pm 24.3	0.001	53.3 \pm 17.3	60.5 \pm 17.7	0.030
MH	60.8 \pm 15.9	72.4 \pm 16.4	<0.001	60.1 \pm 11.2	62.3 \pm 12.2	0.324
RE	50.0 \pm 25.0	60.4 \pm 26.1	0.021	42.7 \pm 25.8	48.4 \pm 27.4	0.255
PCS	220.8 \pm 54.6	269.3 \pm 58.6	<0.001	208.2 \pm 64.9	234.9 \pm 66.9	0.033
MCS	228.1 \pm 54.3	273.6 \pm 69.4	<0.001	213.5 \pm 44.5	234.1 \pm 44.7	0.015

ADT antiarrhythmic drug therapy, BP bodily pain, CPVI circumferential pulmonary vein isolation, GH general health perception, MCS mental component summary, MH mental health, PCS physical component summary, PF physical functioning, RE role limitations due to emotional problems, RP role limitations due to physical problems, VT vitality, SF social functioning

were increased significantly in the CPVI group to 269.3 ± 58.6 and 273.6 ± 69.4 , respectively (within-group $P < 0.001$ for both; Table 3). In the ADT group, the PCS and MCS scores also increased at 6 months to 234.9 ± 66.9 and 234.1 ± 44.7 , respectively (within-group $P < 0.05$ for both; Table 3). However, at 6 months, SF-36 scales were significantly higher in the

CPVI group than in the ADT group, as were the PCS scores (269.3 ± 58.6 vs. 234.9 ± 66.9 ; $P < 0.05$) and MCS scores (273.6 ± 69.4 vs. 234.1 ± 44.7 ; $P < 0.001$; Table 4).

Patients in the CPVI group were further evaluated based on whether they had AF recurrence. Among patients who had no AF recurrence, the difference in all eight SF-36 scale

Table 4 The mean changes of each group for the SF-36 scales

	CPVI Mean \pm SD	ADT Mean \pm SD	P value
PF	76.0 \pm 17.5	65.1 \pm 20.4	0.002
RP	58.0 \pm 22.9	48.9 \pm 26.9	0.041
BP	69.3 \pm 21.2	66.8 \pm 22.2	0.528
GH	66.0 \pm 19.9	52.2 \pm 26.8	0.007
VT	70.8 \pm 20.3	62.8 \pm 13.2	0.010
SF	70.1 \pm 24.3	60.5 \pm 17.7	0.013
MH	72.4 \pm 16.4	62.3 \pm 12.2	<0.001
RE	60.4 \pm 26.1	48.4 \pm 27.4	0.015
PCS	269.3 \pm 58.6	234.9 \pm 66.9	0.003
MCS	273.6 \pm 69.4	234.1 \pm 44.7	<0.001

ADT antiarrhythmic drug therapy, *BP* bodily pain, *CPVI* circumferential pulmonary vein isolation, *GH* general health perception, *MCS* mental component summary, *MH* mental health, *PCS* physical component summary, *PF* physical functioning, *RE* role limitations due to emotional problems, *RP* role limitations due to physical problems, *VT* vitality, *SF* social functioning

measurements was statistically significant between the baseline and 6-month evaluations. Whereas the difference in all eight SF-36 scale measurements in patients with AF recurrence was statistically insignificant, except for the role limitations due to emotional problems.

DISCUSSION

AF is the most common chronic arrhythmia associated with an adverse prognosis. It is an independent risk factor for stroke, resulting in an approximate three- to fivefold excess risk [2]. Furthermore, the risks attributable to most stroke risk factors decline with advancing age [2]. AF causes disabling symptoms such as fatigue, dyspnea, and palpitations. As a result, the patient's QoL may be drastically reduced. The study showed that AF was associated with a 1.5–1.9-fold increased risk of mortality and was an independent predictor of mortality with stroke [3]. At present, more attention is

focused on the research and treatment of AF in order to improve the QoL of patients with this disorder.

This study demonstrated that the SF-36 scales were significantly higher in patients treated with CPVI compared to ADT for all physical and mental health assessments except for body pain. The results of the present study indicate that compared with ADT, CPVI is more likely to maintain sinus rhythm, reduce dyspnea, palpitations, and stroke, and improve the QoL of AF patients.

In two previous trials, radiofrequency catheter ablation appeared superior to ADT treatment in improving symptoms and QoL [3, 4], which concurs with the present study. The results of a multicenter trial comparing catheter ablation with ADT in patients with symptomatic, paroxysmal AF refractory to one or more drugs showed the clear superiority of ablation on rhythm-related endpoints [5]. A different multicenter clinical trial that

evaluated symptoms and QoL comparing catheter ablation with ADT as a second-line treatment for patients with paroxysmal AF concluded that ablation is superior to ADT at improving symptoms and QoL [6].

The results from a recent study by Wokhlu et al. [7] which enrolled 323 patients, showed that 72% of patients achieved AF elimination off ADT, 15% achieved AF control on ADT, and 13% had recurrent AF after 2 years of follow-up. The PCS and MCS scores also showed a noteworthy increase. The results of several trials have shown that radiofrequency catheter ablation is superior to ADT at maintaining sinus rhythm, primarily as a second-line treatment [8–11]. In the present study, after a mean follow-up of 12.7 ± 4.3 months, 22.8% and 62.1% of the ADT group and CPVI group, respectively, had no recurrence of AF. At 6 month, the PCS and MCS scores increased considerably in both the CPVI group and the ADT group. CPVI has a higher success rate and, thus, results in an elevated QoL.

The results of the Atrial Fibrillation Follow-up Investigation of Rhythm Management (AFFIRM) study [12] showed that there were no differences in survival or event rates in patients with AF randomized either to ventricular rate control or heart rhythm control. The QoL scores were comparable between the rate control and rhythm control interventions. In addition, QoL was similar with sinus rhythm versus AF control. Attempts to improve QoL by restoring sinus rhythm were usually unsuccessful [12]. A multicenter trial demonstrated that a routine strategy of heart rhythm control such as metoprolol or amiodarone does not reduce the rate of death from cardiovascular causes, as compared with a rate-control strategy [13]. In previous studies, the restoration and maintenance of sinus rhythm were often attempted with electrical cardioversion and

ADT. However, the favorable outcome acquired by restoring the sinus rhythm was counteracted by the increased risk of adverse effects from ADT. In this study, patients in the CPVI group were sorted into two groups based on AF recurrence: no AF recurrence group and AF recurrence group. In the no AF recurrence group, there was a significant difference in all eight SF-36 scales, but there was no statistically significant difference in the recurrence AF group, except for role limitations due to emotional problems. AF impaired QoL and was related to increased frequency and duration of disease and disease indexes. The present results show that restoration and maintenance of sinus rhythm can improve the QoL.

The effect of ADT on the QoL of patients with AF is still controversial [8, 12, 13]. A study by Dorian et al. [14] has suggested that QoL improvements were not significantly different among the groups randomized to amiodarone, sotalol, or propafenone, and this was especially true for patients in whom treatment prevented AF recurrence. The study found that general health perception, social functioning, and physical and mental health summary measures of the SF-36 scales improved significantly from baseline to 6 months. Thus, indicating the lack of superiority of ADT over ablation in patients with AF with regard to maintenance of sinus rhythm and improvement in QoL.

In summary, CPVI is superior to ADT in patients with AF regarding the maintenance of sinus rhythm and improvement in QoL, especially in patients in whom CPVI was successful.

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Dr. Xu is the guarantor for this article, and takes responsibility for the integrity of the work as a whole.

Conflict of interest. The authors have no conflicts of interest.

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