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The proportion of asymptomatic recurrence after catheter ablation of atrial fibrillation in patients with a pacemaker for sick sinus syndrome

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ABSTRACT

Background: Catheter ablation (CA) of paroxysmal atrial fibrillation (PAF) is an effective treatment. However, the frequency of asymptomatic AF recurrence after CA in patients with PAF and sick sinus syndrome (SSS) is not clear. The aim of this study was to elucidate the real AF recurrence after CA in patients with PAF and a pacemaker for SSS.

Methods and results: Fifty-one consecutive patients (mean age 66.6 ± 7.0 years, male 34) with PAF and SSS and pacemakers underwent CA. All patients were followed at 1, 3, 6, 9, and 12 months after the CA using a 12-lead ECG, Holter-ECG, and 1-month event recorder as a conventional follow-up. In addition, the pacemakers were interrogated every 12 months. During a 5-year follow-up after the final CA procedure, AF recurrences were observed in 7 patients (13.7%) with a conventional follow-up, including 1 (2.0%) asymptomatic patient. Pacemaker-interrogation revealed another 10 patients (19.6%) with asymptomatic AF recurrences. Ultimately, the conventional follow-up plus pacemaker-interrogation provided a higher incidence of AF recurrences ($P = 0.009$). Multiple CA procedures contributed to a significant increase in the AF-free survival rate at 5 years: 58.6% after a single CA and 86.0% after multiple CA procedures with a conventional follow-up, but which decreased to 40.6% and 60.9% with a conventional follow-up plus a pacemaker interrogation, respectively.

Conclusions: One-third of PAF patients with SSS and pacemakers recurred after multiple CA sessions. However, 65% of them were asymptomatic and difficult to be identified with conventional follow-up. Pacemaker interrogation significantly increased the detection rate of AF-recurrence.

1. Introduction

Catheter ablation (CA) of paroxysmal atrial fibrillation (PAF) is an effective treatment [1]. A rhythm follow-up after CA is mainly assessed by a 12-lead electrocardiogram (ECG), Holter-ECG, and event recorder [2,3] based on the patient's symptoms. However, several studies using a 7-day Holter [4] or tele-ECG [5] follow-up revealed a significant number of asymptomatic recurrences. Current pacing systems can automatically detect and record asymptomatic atrial tachyarrhythmias. Implanted dual-chamber devices are assumed to have a high appropriate detection rate of atrial high frequency episodes [6]. Little data were available in asymptomatic AF recurrences after CA in PAF patients who had received a pacemaker for the treatment of coexistent sick sinus syndrome (SSS) [7–9]. Thus, the aim of this study was to elucidate the real AF burden after CA in patients with PAF and a pacemaker for SSS.

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2. Methods

2.1. Study population

Among consecutive drug-refractory PAF patients who underwent catheter ablation, 51 patients (mean age 66.6 ± 7.0 years, male 34) with a pacemaker implantation for the treatment of SSS were included in this study. AF was defined as paroxysmal when it terminated spontaneously within 7 days [10]. All patients provided written, informed consent and our institutional review board approved the protocol.

2.2. Electrophysiological study

Antiarrhythmic drugs (AADs) were discontinued for >7 days (amiodarone was discontinued for >1 month) before the ablation; all patients were also effectively anticoagulated for >1 month. A 7-Fr, 20- or 14-pole, two-site mapping catheter (Irvine Biomedical, Irvine, CA, USA) was inserted through the right jugular vein and positioned in the coronary sinus for pacing, recording, and internal cardioversion.

2.3. CA technique

The strategy of an extensive pulmonary vein isolation (EPVI) has been previously described [11]. Briefly, after a transseptal puncture, pulmonary venography and contrast esophagography were performed to determine the anatomical relationships of the PV ostia, left atrium (LA), and esophagus. An activated clotting time of 250–350 s was maintained with a continuous infusion of heparin during the procedure. Two circular mapping catheters were placed in the superior and inferior pulmonary veins (PVs), and the left and right ipsilateral PVs were circumferentially and extensively ablated under fluoroscopic and electrophysiological guidance. Radiofrequency current applications were delivered with an 8-mm tip ablation catheter (Japan Lifeline, Tokyo, Japan) in the temperature control mode, with a target temperature of 55 °C (maximum power, 35 W on the LA posterior wall; 40 W at the anterior aspect of the PVs), and the esophageal temperature was measured during the application [11]. The endpoint was the elimination or any dissociation of the PV potentials. After completing the EPVI, adenosine triphosphate (20–40 mg) was injected to unmask any dormant conduction, and that was disconnected [12]. Thereafter, a cavotricuspid isthmus (CTI) line was created with a bidirectional conduction block endpoint [13]. Isoproterenol (5–20 μg/min) was intravenously injected before completing the procedure. If sustained or non-sustained AF was reproducibly initiated from non-PV foci, they were focally ablated [14]. When non-PV foci were located in the superior vena cava (SVC), the SVC was electrically isolated [15,16]. If spontaneous AF did not occur, rapid atrial pacing was performed to induce AF. After an episode of pacing-induced AF was sustained, internal cardioversion was attempted to convert the AF to sinus rhythm (SR). If post pacing spontaneous AF was seen, then the source of the initiation was ablated. Linear ablation (left atrial roof and/or bottom and/or mitral isthmus lines) was performed only when AF from an undetermined origin or macroreentrant atrial tachycardia spontaneously occurred, with an endpoint of a bidirectional conduction block [17,18]. In case atrioventricular nodal reentrant tachycardia or atrioventricular reentrant tachycardia was induced, they were also treated. On completion of the procedure, the endpoints of the EPVI, SVC isolation, and linear ablation were re-confirmed. In the re-do session, PVs were re-isolated when they were reconnected. Isoproterenol (5–20 μg/min) was intravenously injected and non-PV foci were targeted. Linear ablation lines were added with an endpoint of bidirectional conduction block only when AF from an undetermined origin or macroreentrant atrial tachycardia occurred.

2.4. Follow-up

AADs were not prescribed after the procedure. All patients were followed up at 1, 3, 6, 9, and 12 months after the CA conventionally using a 12-lead ECG, Holter-ECG, and 1-month event recorder (in patients with symptoms). Atrial tachyarrhythmias lasting longer than 30s after the blanking period of 2 months were defined as an AF recurrence (Conventional follow-up). After the procedure, the patients' devices were programmed to their original settings with one exception: in all patients, mode switching was programmed to occur at an atrial sensed rate of >170 bpm, and the pacemaker was interrogated every 12 months unless they did not have any symptomatic episodes. A Sudden increase in the heart rate of >170 bpm lasting longer than 30s detected by the device was generally determined as a recurrence. We excluded any inappropriate high rate episodes by manual interpretation of the documented electrocardiograms.

2.5. Statistical analysis

The data were expressed as means±standard deviations (continuous variables) or frequencies and percentages (categorical variables). To compare the 2 groups, a Chi-square analysis or Fisher's exact test were used for categorical variables. A Cox-proportional hazard model was used to assess the association of the baseline variables with the endpoint of AF recurrence. Survival curves were calculated using the Kaplan-Meier method. *P*-values of <0.05 were considered statistically significant.

3. Results

3.1. Patient characteristics and clinical outcomes

The baseline characteristics of the 51 patients are shown in Table 1. The patients were predominantly male (n = 34, 66.7%) with an age of 66.6 ± 7.0 years. The mean duration of an AF history was 82.4 ± 63.9 months. Forty (78.4%) patients were highly symptomatic on the baseline evaluation. Acute success was achieved in all patients without any complications. Immediately after the ablation, all permanent pacemakers (PPMs) were interrogated and the integrity and function of the leads were checked. The PPM was determined to have a normal function in all patients post-ablation. No device-related complications occurred in the patients as a result

Table 1
Baseline characteristics (N = 51).

Patient age, years	66.6 ± 7.0
Gender, male (%)	34 (66.7)
Duration of an AF history, months	82.4 ± 63.9
SHD, n (%)	5 (9.8)
Symptomatic (%)	40 (78.4)
Hypertension, n (%)	25 (49.0)
Diabetes, n (%)	14 (27.4)
CHF, n (%)	7 (13.7)
Stroke, n (%)	4(7.8)
$CHADS_2$ score	1.1 ± 1.0
Echocardiography	
LAD, mm	39.7 ± 5.4
LVEF, %	63.6 ± 8.7

Data are presented as the n (%) or mean ± SD.
AF; atrial fibrillation, CHF; congestive heart failure, LAD; left atrial dimension at end-systole, LVEF; left ventricular ejection fraction, SHD; structural heart disease.

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