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Original Article

Value of adenosine test to reveal dormant conduction or adenosine-induced atrial fibrillation after pulmonary vein isolation

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ABSTRACT

Background: Recent studies investigating the implications of additional ablation guided by dormant pulmonary vein (PV) conduction testing using adenosine showed conflicting results, and the data about atrial fibrillation (AF) recurrence after trigger site elimination in adenosine-induced AF are still lacking.
Methods: Of 846 patients with paroxysmal AF (PAF) who underwent PV isolation (PVI), adenosine test after PVI was performed in 148 patients.
Results: PVI was successfully achieved in 846 patients. We excluded 58 patients due to loss to the follow-up. A higher rate of AF recurrence was found in the group without adenosine test (136/644, 21%) compared to the group with adenosine test (20/144, 13%, log-rank $P=0.047$). In multivariate analysis model for AF freedom during the follow-up period, the only significant clinical predictor of AF freedom was adenosine test (hazard ratio [HR] 1.97; 95% confidence interval [CI]: 1.2–3.23; $P=0.007$).

Among 148 patients with adenosine test, 114 (77%) patients showed neither dormant conductions nor AF-induced, 22 (15%) showed positive dormant conductions only, and 12 (8%) revealed adenosine-induced AF (6 of them also showed dormant conduction). After additional ablation in positive dormant conduction group and adenosine-induced AF group, AF recurrence was noted in 4/21 (19%) patients in positive dormant conduction group and 2/11 (18%) patients in adenosine-induced AF group, which was not different from that of patients in negative dormant conduction/ no AF-induced group (14/112, 12%, log-rank $P=0.67$).
Conclusions: Adenosine test after PVI to confirm the absence of dormant conduction and triggers initiating AF is beneficial to improve the outcomes after catheter ablation of PAF.

1. Introduction

Pulmonary vein (PV) isolation (PVI) is the mainstay strategy for atrial fibrillation (AF) ablation. However, recurrence rates of AF following PVI remain an important issue. One of the reasons for AF recurrence is PV reconnection, leading to arrhythmias recurrence [1–3]. Therefore, a significant number of patients may require repeated procedures [2].

Adenosine might identify reconnection of PV by unmasking dormant conduction; in addition, it has a potential to induce AF [4–8]. Recent studies investigating the implications of additional ablation guided by dormant PV conduction showed conflicting results. Some observational studies have suggested that elimination of dormant PV conduction may be associated with better outcomes in patients with paroxysmal AF (PAF) [6,9–11]. However, other studies did not show benefits of this technique during long-term follow-up [12–15]. It still remains to be determined whether dormant conduction-guided further ablation of PV leads to improved rates of durable PVI and long-term outcomes following catheter ablation of AF.

Moreover, there is still lack of data about AF recurrence after elimination of adenosine-induced AF triggers. Adenosine-induced AF may have different mechanism compared to adenosine-induced dormant conduction.

In this study, we assessed whether adenosine test performed to reveal dormant conduction or triggers is of value in achieving better outcomes after catheter ablation in patients with PAF.

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2. Material and methods

2.1. Study population

A total of 846 patients who underwent PAF ablation at Korea University Medical Center were retrospectively enrolled in this study between January 1, 2008 and October 31, 2014. Patients were included if they were > 18 years of age and were undergoing their first ablation procedure for PAF. Of them, 148 patients received adenosine test with 12–18 mg IV after PVI. We tested dormant conductions and/or trigger site of adenosine-induced AF, performed additional ablation to eliminate dormant conductions and trigger site of adenosine-induced AF, and assessed the recurrence rate of AF after 3 months of blanking period. Patients with a follow-up period less than 6 months were excluded.

2.2. Electrophysiology study and ablation procedures

The electrophysiology study was performed under intravenous sedation. Bipolar recordings were filtered at 30–500 Hz. Electroanatomic mapping was performed using either Ensite NavX (St. Jude Medical, ST Paul, MN, USA) or CARTO (Biosense Webster Inc., Diamond Bar, CA, USA) mapping systems.

Radiofrequency ablation was performed using an open irrigated-tip catheter guided by a circular mapping catheter. Ablation lesions were delivered at power settings between 25 W and 30 W for 20–40 s using a power-controlled mode. Circumferential-antral ablation was performed around the left and right PVs. Power settings were generally kept at 25 W when ablating in the posterior left atrium (LA) near the esophagus and lesion duration was limited to 20 s. After completion of the circumferential-antral ablation lesion set, a circular mapping catheter was placed sequentially into each of the ipsilateral PVs to assess for electrical isolation. Ablation of the carinal region was performed at the physician's discretion as needed to achieve complete PVI. The endpoint of ablation was complete PVI as defined by entrance and exit block.

2.3. Adenosine injection test protocol

Adenosine was infused following electrical isolation of each PV. Adenosine test was started from 12 mg. The end-point of protocol was inducible atrioventricular block, sinus arrest, or sinus bradycardia. If a 12-mg dose failed to induce atrioventricular block, sinus arrest, or sinus bradycardia, the operator repeated the adenosine injection in the same pulmonary vein with increased adenosine doses titrated up to 18 mg. In our study, none of patients failed to show atrioventricular block or sinus arrest or sinus bradycardia with 18 mg of adenosine. Isopreterenol was not used during adenosine test.

The local site of the earliest dormant conduction was evaluated with a circular mapping catheter placed in the PVs, while the trigger site of AF was evaluated with multi-electrode catheters positioned in the LA, right atrium, coronary sinus, and superior vena cava. We performed additional ablation in cases of dormant conduction or trigger site of adenosine-induced AF. Repeated testing with adenosine was performed and if dormant conduction or AF induction was still present, repeated ablation and adenosine testing were performed until dormant conduction or adenosine-induced AF was no longer present. At the end of procedure, all PV's were re-interrogated, and isoproterenol infusion at a rate of 10–20 μL/min was used to detect any residual non-PV trigger. Additional ablation was performed if any trigger was found during isoproterenol infusion.

2.4. Follow-up schedule

All patients' ECG and Holter data during follow-up at 3 months, 6 months, and 12 months or whenever patients visited were collected. Additional long-term (> 1 month) event recording was performed if symptoms were reported. Recurrence of AF was defined as documented any atrial tachycardia (AT) or AF lasting > 30 s on Holter or one-month event recorder ECG and recorded after a three-month blanking period. Anticoagulants and antiarrhythmic

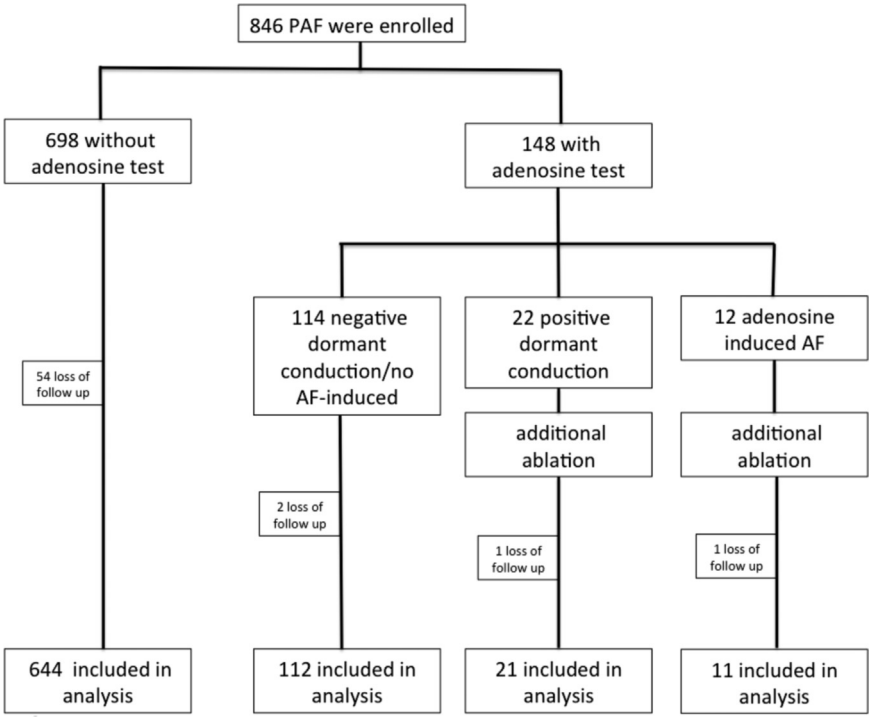

Fig. 1. Study design.

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