

Does isolation of the left atrial posterior wall improve clinical outcomes after radiofrequency catheter ablation for persistent atrial fibrillation? A prospective randomized clinical trial



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ABSTRACT

Introduction: Although posterior wall of left atrium (LA) is known to be arrhythmogenic focus, little is known about the effect of posterior wall isolation (PWI) in patients who undergo radiofrequency catheter ablation (RFCA) for persistent atrial fibrillation (PeAF).

Methods: We randomly assigned 120 consecutive PeAF patients to additional PWI [PWI (+), n = 60] or control [PWI (–), n = 60] groups. In all patients, linear ablation was performed after circumferential pulmonary vein isolation (PVI). Linear lesions included roof, anterior perimitral, and cavotricuspid isthmus lines with conduction block. In PWI (+) group, posterior inferior linear lesion was also conducted. Creatine kinase-MB (CK-MB) and troponin-T levels were measured 1 day after RFCA. LA emptying fraction (LAEF) was assessed before and 12 months after RFCA.

Results: A total of 120 subjects were followed for 12 months after RFCA. There were no significant differences between two groups in baseline demographics and LA volume (LAV). The levels of CK-MB and troponin-T and procedure time were not significantly different between the groups. AF termination during RFCA was more frequently observed in PWI (+) than control ($P = 0.035$). During follow-up period, recurrence occurred in 10 (16.7%) patients in PWI (+) and 22 (36.7%) in control ($P = 0.02$). The change in LAEF was not significantly different between the groups. On multivariate analysis, smaller LAV and additional PWI were independently associated with procedure outcome.

Conclusions: PWI in addition to PVI plus linear lesions was an efficient strategy without deterioration of LA pump function in patients who underwent RFCA for PeAF.

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Abbreviations: AF, atrial fibrillation; LA, left atrium; LAEF, left atrial emptying fraction; LAV, left atrial volume; MSCT, multi-slice computed tomography; PeAF, persistent atrial fibrillation; PV, pulmonary vein; PVI, pulmonary vein isolation; PWI, posterior wall isolation; RFCA, radiofrequency catheter ablation; TTE, transthoracic echocardiography; TEE, transesophageal echocardiography.

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1. Introduction

Radiofrequency catheter ablation (RFCA) for atrial fibrillation (AF) aims to prevent AF by either eliminating the trigger that initiates AF or by modifying the arrhythmogenic substrates. Although the efficacy of pulmonary vein isolation (PVI) in paroxysmal AF is well established, PVI alone may not be sufficient in cases with persistent AF (PeAF). In previous studies, additional left atrial (LA) linear lesion formation following PVI has been shown to improve the clinical outcome of RFCA for AF [1–5]. The posterior wall of the LA is known to be one of the non-pulmonary vein (PV) foci and it has been proposed that surgical isolation of posterior wall of the LA combined with all PVs might cure chronic AF with a high success rate [6]. However, there are no data about the effect of posterior wall isolation (PWI) of the LA on AF

recurrence after RFCA for PeAF. The aims of the present study were to determine whether additional PWI after PVI and linear lesions in the LA can improve clinical outcome after RFCA for PeAF, and to assess whether additional PWI affects LA transport function during a long-term follow-up period.

2. Methods

2.1. Study subjects

From January 2011 to August 2012, patients who underwent RFCA of PeAF were prospectively enrolled and randomly assigned to two groups: without PWI and with PWI. PeAF was defined according to the most recent guidelines of the Heart Rhythm Society and the European Cardiac Arrhythmia Society [7]. Exclusion criteria were the presence of visible LA thrombi on transesophageal echocardiography (TEE), previous AF ablation or cardiac surgery, cardiomyopathy, more than mild valvular disease, congenital heart disease, aortic aneurysm or dissection, and any acute or chronic inflammatory disease. Anti-arrhythmic drugs except for amiodarone were discontinued at least five half-lives before the procedure. Amiodarone was discontinued at least 8 weeks earlier. All patients were on continuous warfarin therapy with a target international normalized ratio (INR) of 2 to 3.

2.2. Study protocol

This study was designed as a prospective randomized clinical trial, and the study protocol was approved by the Institutional Review Boards of Korea University Guro Hospital. The authors of this manuscript have certified that they comply with the Principles of Ethical Publishing in the International Journal of Cardiology. Proper informed consent was obtained from all participants. All enrolled patients with PeAF were randomly assigned to either RFCA without PWI [PWI (–) group] or RFCA with PWI [PWI (+) group] according to an optimum assignment procedure with computer-generated random numbers. RFCA for AF was performed by a single operator who had experience of more than 700 independent cases of AF ablation. All patients underwent successful PVI and LA linear ablation on both the roof and anterior wall of the LA (Fig. 1A and B). Patients in the PWI (+) group underwent additional posterior inferior linear ablation (Fig. 1C). Cavotricuspid isthmus

(CTI) block was conducted after LA ablation in all patients. Acute procedural success was defined as AF termination. Even though AF terminated during ablation, continued ablation was conducted until the lesion set as protocol has been completed. If AF persisted after the completion of the stepwise ablation procedure, internal direct current (DC) cardioversion (5 to 20 J, biphasic shocks with R-wave synchronization, anodal decapolar catheter in the free wall of the right atrium to the cathodal duodecapolar catheter inside of the coronary sinus) was performed to restore sinus rhythm (SR).

In all enrolled subjects, transthoracic echocardiography (TTE) with Doppler study was performed immediately before and 1 year after RFCA. We analyzed LA volume (LAV) and LA emptying fraction (LAEF) by conventional geometric methods. Multi-slice computed tomography (MSCT) was also performed immediately before RFCA in all patients. We also assessed LAV and LAEF by a 3-dimensional analysis method using MSCT data. Immediately before RFCA, blood samples were drawn from a peripheral vein for analysis of high sensitivity C-reactive protein (hs-CRP) and B-type natriuretic peptide (BNP) levels. We also analyzed hs-CRP, BNP, cardiac enzymes including cardiac troponin T, creatine kinase-MB (CK-MB), and myoglobin from the peripheral venous blood 1 day after RFCA.

2.3. Transthoracic echocardiography

All examinations were performed using a commercially available Vivid 7™ (GE Medical Systems, Vingmed, Horten, Norway) ultrasound system. All recorded echocardiograms were collected and analyzed using an offline computer analysis station (Echopac™ 6.3.4; GE Medical Systems).

Measurements were taken from three consecutive cardiac cycles and averaged. The maximal LAV (LAV_{max}) and minimal LAV (LAV_{min}) was measured using the modified Simpson's method by manually tracing the endocardial border in the apical 4- and 2-chamber views over the cardiac cycle after zooming in on the LA. LAEF was calculated using the following formula:

$$LAEF = 100 \times (LAV_{max} - LAV_{min}) / LAV_{max}$$

Each echocardiographic parameter was determined according to the recommendations of the American Society of Echocardiography [8].

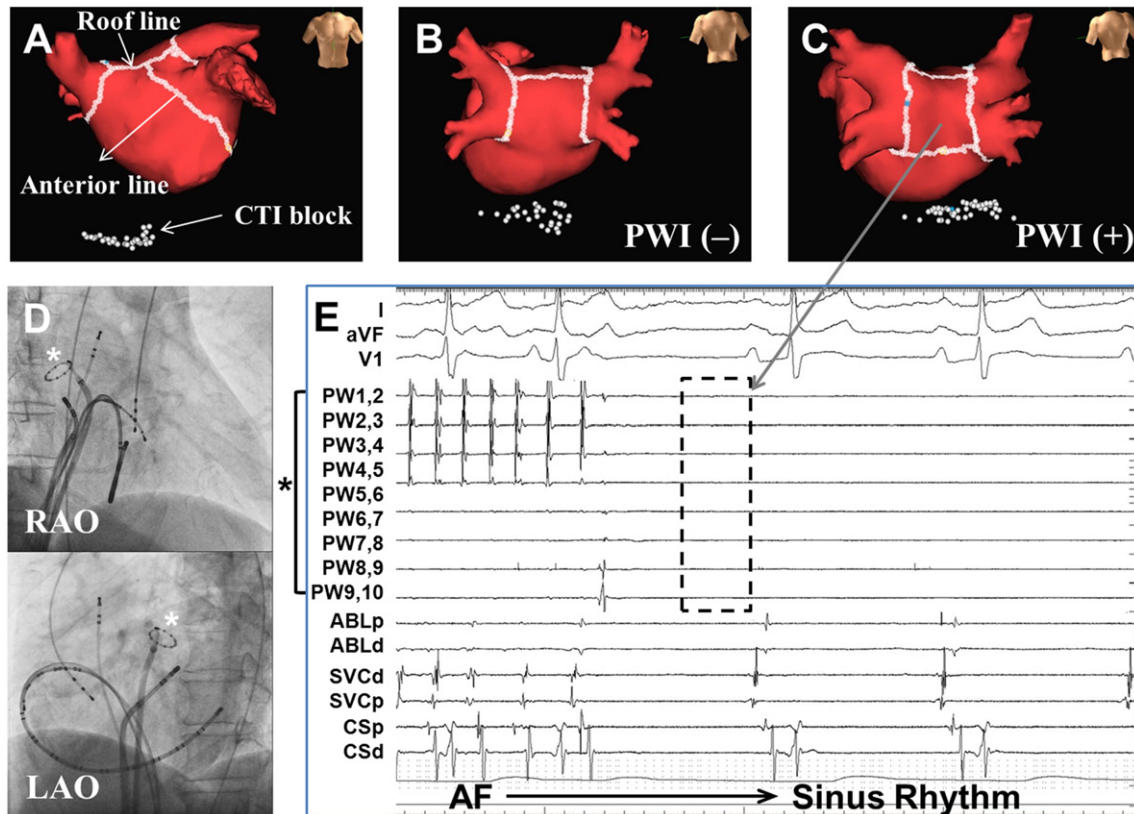


Fig. 1. A, B: Common ablation lesion set in both groups showing pulmonary vein isolation, roof line, anterior line, and cavo-tricuspid isthmus (CTI) ablation. C: Posterior–anterior view, showing additional posterior wall isolation (PWI). D: Representative fluoroscopic images of the PWI procedure. The asterisk (*) indicates a decapolar circular catheter located in the posterior wall of the left atrium during the AF ablation procedure. E: A representative electrogram showing termination of atrial fibrillation (AF) during PWI. With complete formation of the additional line of the LA posterior wall, no potentials were recorded in the decapolar circular catheter (dotted box). ABL = ablation, AF = atrial fibrillation, CS = coronary sinus, LAO = left anterior oblique view, PW = posterior wall, RAO = right anterior oblique view, SVC = superior vena cava.

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