

The results of persistent atrial fibrillation with radiofrequency energy after a six-month follow-up

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Summary

Objective: To evaluate the efficacy and safety of the radiofrequency ablation of persistent atrial fibrillation (AF) after a 6-month follow-up. **Subject and method:** A prospective study of 40 patients with persistent AF who underwent catheter ablation using a three-dimensional (3D) system at the Vietnam Heart Institute, Bach Mai Hospital. **Result:** The mean age of patients was 54.25 ± 12.54 . The procedure time was 256.25 ± 48.61 minus, the irradiation time was 29.55 ± 14.29 minus, and the number of ablation points was 132.77 ± 53.79 points. The ablation time was 64.10 ± 24.76 minus, and the number of cardioversion shocks was 1.17 ± 1.1 times. No severe complications occurred during and after the procedure, and there and 2D echocardiography before the procedure and during the follow-up period. The success rates of maintaining sinus rhythm (SR) after 6 months, isolating the pulmonary vein alone, and the additional ablation group were 60.7%, 55%, and 75%, respectively. The successfully maintained SR group had no other AF symptoms [European Heart Rhythm Association (EHRA) class I], and patients with AF recurrence showed symptoms (EHRA class IIb). **Conclusion:** AF radiofrequency ablation is a new method with a success rate of 60.7% after a 6-month follow-up. Patients with successful ablation showed symptom improvement. The ablation procedure is safe, with a low rate of severe complications.

Keywords: Persistent atrial fibrillation, ablation, electrophysiology, 3D mapping system.

1. Background

Atrial fibrillation (AF) is a arrhythmia in which irregular heartbeats result in symptoms such as palpitations, chest pain, shock, fainting, slurred, and risk of blood clot formation. Moreover, it is responsible for systemic embolism, which makes AF one of the diseases that attract the interest of researchers worldwide to find treatments. The interventional strategy for AF ablation is based on the complete isolation of the electrical connections between the pulmonary veins and the left atrium [1]. This strategy shows high effectiveness when applied to patients with paroxysmal AF. For patients

with persistent AF, ablation for sinus cardioversion has a slightly lower success rate. As research has been conducted for such interventions and clinical achievements have been recorded internationally, this treatment remains popular in Vietnam. Hence, this study aims to evaluate the effectiveness of persistent AF with radiofrequency energy after a 6-month follow-up.

2. Subject and method

Study design: A prospective intervention study with follow-up using an appropriate sample size.

Study contents: 40 patients with persistent AF underwent ablation using a three-dimensional (3D) mapping system (EnSite Precision) at the Vietnam National Heart Institute, Bach Mai Hospital, from October 2017 to November 2021.

Received: 10 October 2022, **Accepted:** 29 December 2022

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Inclusion criteria: Persistent AF: Record on a 12-lead ECG, maintaining for > 7 days. Symptomatic patients despite using medical treatment and accepting AF ablation. No severe stenosis or valvular regurgitation valvular indicative of intervention or operation. No ischemic heart disease indicative of revascularization.

Exclusion criteria: Thrombus in the heart chamber. Elderly patients (≥ 80 years). Heart failure with reduced ejection fraction (EF < 45%). Basedow’s disease.

Study protocol: All patients underwent clinical evaluation of symptoms, medical history, blood test, echocardiography, MSCT for left atrium and pulmonary veins. All patients underwent pulmonary vein isolations (PVI) and cardioversion to sinus rhythm. Any arrhythmias such as premature atrial complexes, atrial flutter or atrial tachycardia were noted. Peak to peak map were used to define low voltage zone in left atrial (cut off 0.2 - 0.5mv). Ablation were performed if any arrhythmias or low voltage zone appeared.

Completed PVI criteria: No EGM recorded in pulmonary veins (PV s) after ablation. Bi directional electrical block confirmed by pacing in left atrial and in PVs (pulse amplitude 10V, pulse width 1.0ms).

Complications record and follow up: Patients received blood tests, cardiac echoes, and a 24-hour Holter electrocardiogram (ECG) the day after ablation and 1, 3, and 6 months after discharge. Success was defined as no AF > 30 seconds on 24-hour Holter ECG.

Statistical analysis: Data were processed on a computer with IBM SPSS 21.0 software. The t-test was

used to compare two mean values, and the chi-square test (χ^2) was used to compare two percentages, $p < 0.05$ was considered statistically significant.

3. Result

3.1. Persistent AF ablation strategy

Forty patients with persistent AF underwent ablation in our study. Their mean age was 54.25 ± 12.54 years. All patients had completed pulmonary vein isolation. Ten patients had ablation lesions beyond PVs, such as premature atrial complexes, typical or atypical atrial flutter, low-voltage zone, and rotor. All lesions beyond PVs were performed after PVI confirmation. The proportion of other lesions is shown in Figure 1.

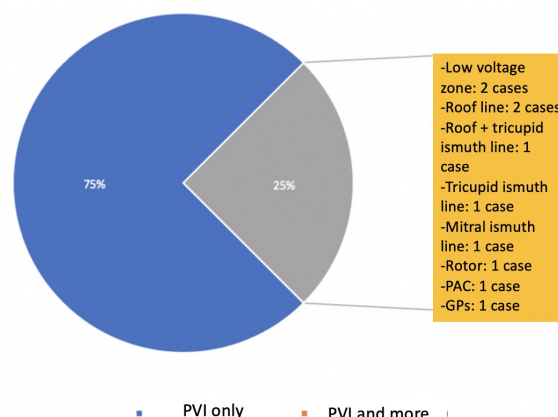


Figure 1. Ablation strategy in our study.

Rolf et al defined the left atrial low-voltage zone as < 0.5mV while mapping sinus rhythm (SR) [2]. Linear ablation was performed for patients who recorded typical or atypical atrial flutter. PAC will be ablated if shown after cardioversion.

Table 1. Ablation time, number of lesions, procedure time, and cardioversion times

	Procedure time (min)	Fluoroscopy time (min)	Number of lesions (points)	Ablation time (min)	Cardioversion (times)
< 60 years (n = 24) ¹	250.42 ± 47.59	31.79 ± 14.84	126.5 ± 50.2	62.54 ± 22.63	1.17 ± 0.96
≥ 60 years (n = 16) ²	265.0 ± 50.33	26.19 ± 13.15	142.19 ± 59.18	66.45 ± 28.26	1.19 ± 1.33
p ^{1,2}	0.375	0.471	0.33	0.42	0.96
PVI-only ³ (n = 30)	258.67 ± 49.81	27.5 ± 13.49	119.9 ± 38.55	60.42 ± 20.59	1.43 ± 1.13

	Procedure time (min)	Fluoroscopy time (min)	Number of lesions (points)	Ablation time (min)	Cardioversion (times)
PVI and more ⁴ (n = 10)	249.0 ± 46.54	35.70 ± 15.54	171.4 ± 74.43	75.14 ± 33.29	0.4 ± 0.52
p ^{3,4}	0.593	0.117	0.061	0.214	0.009
Overall	256.25 ± 48.61	29.55 ± 14.29	132.77 ± 53.79	64.10 ± 24.76	1.17 ± 1.1

The mean procedure time for persistent AF ablation was 256.25 ± 48.61 minus. There were no significant differences between the two groups (< 60 and ≥ 60 years). The numbers of cardioversion shocks in the PVI and more group were lower than those in the PVI-only group (p=0.009).

3.2. Effectiveness of the persistent AF ablation

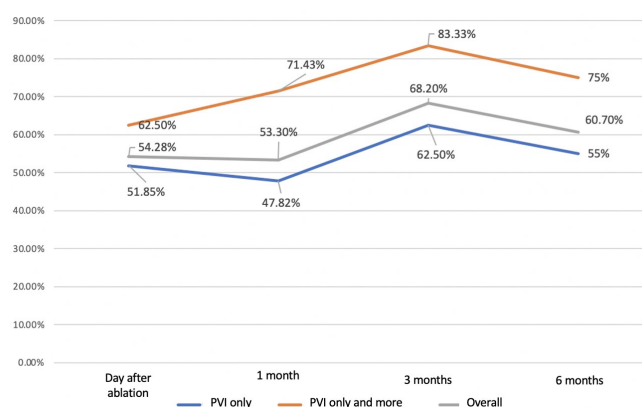


Figure 2. Freedom of AF on Holter ECG after ablation

Figure 2 shows that in our study, the success rate of rhythm control 6 months after was 60.7%. The PVI and more groups had a higher rate of AF freedom than the PVI-only group. Patients' symptoms before ablation were 67.5% in European

Heart Rhythm Association (EHRA) IIb and 32.5% in EHRA III. A positive change occurs after 6 months: 57.1% in EHRA I, 14.3% in EHRA IIa, and 28.6% in EHRA IIb.

3.3. Safety of persistent AF ablation

Table 2. Blood tests and cardiac echoes at baseline and follow-up

Tests	Before (n = 40)	After 1 month (n = 30)	After 3 months (n = 22)	After 6 months (n = 28)
Dd (mm)	46.29 ± 5.89	46.64 ± 4.58	47.36 ± 4.08	47.06 ± 4.61
Ds (mm)	29.82 ± 5.41	29.54 ± 5.17	29.64 ± 3.63	29.0 ± 4.14
EF (%)	64.89 ± 7.0	64.5 ± 6.49	65.07 ± 7.82	67.37 ± 6.65
Left atrial diameter (mm)	38.39 ± 6.12	36.27 ± 5.14	35.29 ± 5.92	34.85 ± 6.5
Grade of MVR*	0.87 ± 0.62	0.95 ± 0.37	0.81 ± 0.81	0.7 ± 0.67
Grade of TVR*	1.08 ± 0.36	1.27 ± 0.55	1.05 ± 0.22	0.93 ± 0.474
Pulmonary artery pressure (mmHg)	30.67 ± 5.54	34.09 ± 6.1	29.55 ± 6.32	32.0 ± 8.02

*MVR: Mitral valve regurgitation. TVR: Tricuspid valve regurgitation.

There was no significant difference in blood tests and cardiac echoes before and after ablation at three

follow-up visits; all the means were within the normal range. We had no record of any major complications in

our study (e.g., cardiac tamponade, air embolism, atrial esophageal fistula, and pericarditis).

4. Discussion

All 40 patients had completed PVI, confirming bidirectional block by pacing from PV and CS electrodes. Kirchhof and Calkins's guidelines on AF ablation: Only PVI in the first time [3]. If the patient is recurrent and undergoes a second intervention, the pulmonary vein isolation will be checked and re-isolated. If PVs are entirely isolated, other strategies should be applied depending on the experience of each center. For our patients, because of the high cost of an AF one-time ablation intervention, if we recognize signs suggesting that ablation is necessary, we usually conduct it at the same time to minimize the cost for patients. In our study, the procedure and fluoroscopy times were shorter than those of Fiala (2008) or Ouyang F (2010) [4]. However, as compared with the latest multicenter study conducted in the United States and Canada on a group of patients with persistent AF by Mousa M (2020), we spend more time on procedure and fluoroscopy. Most patients participating in this research were under general anesthesia, using a state-of-the-art 3D mapping system and the next generation of catheter ablation in real terms.

When performing ablation intervention only once, the success rate of maintaining SR in our study after 6 months was 60.7%. Other studies reported similar rates: Numminen et al (2021) [5] reported 61.3% after 1 year and Mousa Mansour (2020) [6] reported 64.2% after 6 months. Researchers have agreed that persistent AF ablation is effective in maintaining SR. However, more than two interventions per patient are usually required to maintain efficacy. Symptoms and quality of life are closely related to the rate of maintaining SR. Terricabras et al. (2020) studied 549 patients with AF at 35 cardiovascular centers in Europe, Canada, Australia, China, and Korea. The findings revealed that the improvement in the quality of life physically, mentally, and socially was evident at the level of a 70% reduction in AF burden after interventional treatment [7].

No major complications were recorded in our study. Linh et al (2016) [8] reported two cases of cardiac tamponade because of setting high power (35W) in the process of roof ablation. Our study followed a low-

power (25W) setting for the roof and posterior wall and 30-35W for the anterior left atrium.

5. Conclusion

The success rate of maintaining SR after 6 months was 60.7%. The pulmonary vein isolation group showed a success rate of 55%, and the combined ablation group, 75%. The group that successfully maintained SR had moderate symptom severity at EHRA I, and the recurrent group had EHRA IIb symptom severity.

Persistent AF ablation is safe and effective, has a low rate of severe complications.

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