12-Month Single-Procedure Outcomes after Atrial Fibrillation Catheter Ablation in Phramongkutklao Hospital: A Single Center 10-Year Experience

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ABSTRACT

Objective: This study aimed to report the efficacy and safety of 1-year outcome for single-procedure radiofrequency catheter ablation (RFCA) at Phramongkutklao Hospital.

Methods: Review of medical records was carried out on consecutive patients with symptomatic atrial fibrillation (AF) who had undergone first-time RFCA in Phramongkutklao Hospital between January 2009 and December 2018. The efficacy and safety of outcomes after 1 year of RFCA were collected, analyzed, and validated using descriptive data.

Results: 61 patients underwent RFCA for the first time. 77.05% were male, with a mean age of 58.31 ± 10.83 years. Paroxysmal AF presented in 65.57%. 49.18% had hypertension, 9.84% had a history of ischemic stroke or transient ischemic attack, 6.56% had diabetes, 6.56% had coronary artery disease, and 4.92% had heart failure. 96.72% of RFCA procedures were performed under local anesthesia and conscious sedation. Pulmonary vein isolation was performed in all patients. Roofline, mitral isthmus line, and posterior wall isolation were created in 27.87%, 13.11%, and 3.28%, respectively. Additional complex fractionated atrial electrograms (CFAEs) were targeted in 19.67%. After 12 months, 45.45% remained in sinus rhythm, with only one patient experiencing a procedure-related complication with cardiac tamponade.

Conclusion: The 1-year results of single-procedure RFCA for treating AF at our center, while not highly successful in our first decade, were comparable to other series. Notably, there was a relatively low rate of complications.

Keywords: Atrial fibrillation; radiofrequency ablation (Siriraj Med J 2021; 73: 114-120)

INTRODUCTION

Atrial fibrillation (AF) is a significant health problem and the most common form of arrhythmia. The prevalence tends to fluctuate between 1-4% in European countries, but 0.49-1.9% in Asian countries.[1] In Thailand, the prevalence is 1.88% in the elderly population.[2] This prevalence tends to be higher in patients with comorbidity, such as 3.46% in patients with hypertension and 22.55% in patients with ischemic stroke.[3,4] Moreover, AF is one of the severe independent risk factors of mortality. It is associated with an increased risk of death, at 2.15 times in female patients and 1.72 in male patients.[5] It is also associated with an increased risk of stroke, at 3.2 times in females and 3.4 times in males. Furthermore, it causes increased risk of heart failure at 3.4 times in both females and males.[6] In addition to the treatment of specific comorbidity and anticoagulant therapy for stroke prevention in patients with AF, rhythm control is an advertent practice. This approach can help relieve patient's symptoms and improve quality of life, which demonstrates its higher effectiveness

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and safety compared to antiarrhythmic drug therapy.[7] Besides symptoms improvement, it can also enhance the left ventricular ejection fraction (LVEF) by up to 9%.[8] There are numerous trends showing the additional benefits of catheter ablation in patients with AF, though data is sparse concerning aspects such as reduced stroke rate, mortality rate, and the risk of dementia.[9,10]

Treating AF patients with catheter ablation was developed and has increased in popularity over the last decades. In 2019, data from the Asia-Pacific region showed this procedure was performed in 446.1 patients per 1 million in the Japanese population, but in only 1.9 patients per 1 million in the Thai population.[11] Even though this treatment method has been used for many years, the success rate is a point of concern. Although the success rate of catheter ablation is higher than antiarrhythmic therapy, the success rate for these treatments is only 64% and 58%, respectively.[12]

The strategy used in catheter ablation, learning curve, and experience of the operator are all critical success factors. Phramongkutklao Hospital, the largest hospital serving the Royal Thai Army, has played a significant role in caring for soldiers and civilians with AF for decades. Information for patients with AF and treatment outcomes after catheter ablation would be beneficial for the development of patient care. The aim of this single-center, retrospective, observational study was to analyze the safety and efficacy of single-procedure catheter ablation for AF.

MATERIALS AND METHODS

Population and data collection

Consecutive patients with symptomatic AF who had undergone first-time radiofrequency catheter ablation (RFCA) at Phramongkutklao Hospital between January 2009 and December 2018 were enrolled in this research. The study protocol was approved by the institutional review board of the Royal Thai Army Medical Department (Issued No. S069h/2019_Exp). AF diagnosis was confirmed by documentation of 12-leads electrocardiography (ECG) or ambulatory ECG monitoring. AF was classified into two groups as paroxysmal and persistent type according to all standard international guidelines. We collected the essential baseline characteristics of the patients, which included age, gender, weight, height, comorbid diseases, antiarrhythmic drug use, and history of electrical cardioversion. Echocardiographic data before the procedure, which could affect the outcomes, were also recorded.

Pre-procedural care

Pre-procedural care was performed in the usual manner, with adequate anticoagulant administered for at least three weeks or until there was no thrombus in the left atrium detected by transesophageal echocardiography, before performing the procedure.

Ablation strategies

The RFCA was performed in the fasting state under conscious sedation with local anesthesia or general anesthesia according to the patient's and operator's preference. The ablation technique and strategy were designed by the operator, but pulmonary vein isolation (PVI) was targeted in all patients with point-by-point RF ablation widely encircling the antrum of the pulmonary veins. PVI strategy alone were performed in patients with paroxysmal AF. Additional ablation such as the roofline, mitral isthmus line, posterior wall isolation, cavotricuspid isthmus, and complex fractionated atrial electrograms (CFAEs) ablation were performed according to the operator's consideration in patients with persistent AF. Ablation catheters with contact force sensing were used in all patients. The radiofrequency energy was delivered with the power of 30-35 watts at anterior wall and 25-30 watts at posterior wall. The endpoint of the procedure was PVI, which confirmed by entrance block into pulmonary vein. Anticoagulant management with activated clotting time was performed under standard guidelines. The fluoroscopic time was also collected. If any complications occurred, the details were prescribed.

Post-procedural care

All patients were monitored for 24 hours as inpatient before discharge. Unless there were complications, the anticoagulant was routinely restarted in the evening on a procedural day. We also monitored all the possible complications throughout the period of admission.

Follow-up and outcome measures

All patients received initial follow-up at Phramongkutklao Hospital in an outpatient clinic not more than two weeks post-procedure, followed by every one to three months according to the doctor and patient's preference. To provide adequate time concerning the evaluation of the efficacy and safety of the procedure, patients' data with at least twelve months of follow-up period were included in the analysis of outcomes. At follow-up, each patient's heart rhythm was clinically evaluated and subjected to 12-lead electrocardiogram (ECG). Selected patients had 24 or 48 hours of ambulatory ECG monitoring if the doctor requested, depending on each patient's symptoms. After three months of the blanking period, each patient's rhythm was recorded at

every outpatient visit for 12 months after the procedure. The antiarrhythmic drugs utilized after the procedure were also recorded.

The recurrence of arrhythmia was defined as any episode of atrial tachyarrhythmia, including atrial fibrillation, atrial flutter, or atrial tachycardia, lasting more than 30 seconds recorded beyond the first three months after the procedure.

Clinically-relevant complications associated with the procedure were monitored throughout the follow-up period.

Statistical analysis

The data are presented using descriptive statistics. Continuous variables are expressed as mean ± standard deviations and categorical variables as percentages. To determine the success rate of the procedure, we assessed arrhythmia-free survival using the Kaplan-Meier method.

RESULTS

Patient characteristics

From January 2009 to December 2018, a total of 72 RFCA procedures were performed. Sixty-one patients underwent RFCA for the first time, while 11 had a previous AF ablation. The baseline characteristics of the patients who underwent RFCA for the first time are shown in Table 1. Overall, 77.05% of patients were male, with a mean age of 58.31 ± 10.83 years. Mean body mass index (BMI) was 26.11 ± 6.53 kg/m^2. Paroxysmal AF presented in 65.57% of the patients, while 34.43% had persistent AF. According to the comorbidity of the patients, 49.18% had hypertension, 9.84% had a history of ischemic stroke or transient ischemic attack, 6.56% had diabetes, 6.56% had coronary artery disease, and 4.92% had heart failure. The mean CHA_2DS_2VASc was 1.46. The mean time between initial diagnosis and the procedure was 2.33 ± 2.95 years.

In terms of pre-procedural management, 11.48% underwent electrical cardioversion prior to RFCA. Antiarrhythmic drugs were prescribed in 60.66% of patients. Amiodarone, propafenone, and flecainide were prescribed in 34.43%, 24.59%, and 1.64% of patients, respectively.

Echocardiographic findings

The mean LVEF was 64.10 ± 11.12 %. The mean LA size was 42.15 ± 5.31 mm in diameter and 63.23 ± 27.01 ml in volume. The mean tissue Doppler E/E' ratio was 9.18 ± 4.09.

Procedural details

In 61 patients who underwent RFCA for the first time, 96.72% of procedures were performed under local anesthesia and conscious sedation. Pulmonary vein isolation was performed in all patients. Roofline, mitral isthmus line, and posterior wall isolation were created in 27.87%, 13.11%, and 3.28% of patients, respectively. Additional CFAEs were targeted in 19.67%. The mean fluoroscopic time was 109.03 ± 32.12 minutes. Table 2 provides the details of the procedure.

Procedural outcome

After 12 months of follow-up, there was complete data in 44 patients. Twenty patients (45.45%) remained in sinus rhythm after a single RFCA. Among the patients for whom sinus rhythm could not be maintained, eighteen patients (40.91%) had atrial fibrillation, and six patients (13.64%) had atrial flutter recurrence within one year. Table 3 shows the overall outcomes. Arrhythmia-free survival curve after a single RFCA attempt is shown in Fig 1.

Complications

From a total of 61 patients, only one patient (1.64%) had cardiac tamponade, while one patient (1.64%) had non-clinically significant pericardial effusion. In the latter case, the operator detected minimal pericardial effusion during RFCA and decided to stop the procedure. There was no esophageal injury, phrenic nerve injury, vascular complication at the puncture site, deep vein thrombosis, or stroke/transient ischemic attack found.

DISCUSSION

AF is the most common type of arrhythmia and is increasing in terms of its prevalence. Hence, there are numerous patients who require treatment. Apart from treating patients' comorbidity, lifestyle modification, and anticoagulant therapy to prevent stroke, rhythm control by RFCA is one of the procedures gaining interest due to its promising outcomes. Due to the complexity of this procedure, which may result in some complications, however infrequently, it can be life-threatening. The single-procedure success rates demonstrated in several studies vary depending on not only the patients' characteristics such as type of AF and comorbidity, but also the center's experience. According to a recent meta-analysis, the pooled overall single-procedure success rate, defined as the percentage of patients free of atrial arrhythmia or not requiring a second procedure at 12 months, was

TABLE 1. Baseline characteristics of the patients.

Characteristics	Patients (*n*=61)
Age (years) mean ± SD	58.3 ± 10.8
Male n (%)	47 (77)
BMI (kg/m^2) mean ± SD	26.4 ± 7.6
Type of atrial fibrillation n (%)	
Paroxysmal	40 (65.6)
Persistent	21 (34.4)
Comorbidity n (%)	
CAD	4 (6.6)
Previous stroke/TIA	6 (9.8)
Heart failure	3 (4.9)
Hypertension	30 (49.2)
Diabetes	4 (6.6)
CHA_2DS_2VASc score mean ± SD	1.5 ± 1.4
Previous cardioversion n (%)	7 (11.5)
Time between initial diagnosis and procedure (years) mean ± SD	2.3 ± 2.9
AAD before procedure n (%)	
Amiodarone	21 (34.4)
Flecainide	1 (1.6)
Propafenone	15 (24.6)
AAD after procedure n (%)	
Amiodarone	26 (42.6)
Flecainide	0 (0)
Propafenone	14 (23)
Echocardiographic features mean ± SD	
LVEF (%)	64.1 ± 11.1
LA diameter (mm)	42.2 ± 5.3
LA volume (ml)	63.2 ± 27
E/e'	9.2 ± 4.1

Abbreviations: AAD, antiarrhythmic drug; BMI, body mass index; CAD, coronary artery disease; LA, left atrium; LVEF, left ventricular ejection fraction; TIA, transient ischemic attack

TABLE 2. Details of the procedure.

Characteristics	Patients (*n*=61)
RFCA strategy n (%)	
PVI	61 (100)
Roofline	17 (27.9)
MI line	8 (13.1)
CFAEs	12 (19.7)
PWI	2 (3.3)
CTI	11 (18)
Fluoroscopic time (minutes) mean ± SD	109 ± 32.1

Abbreviations: CFAEs, complex fractionated atrial electrograms; CTI, cavotricuspid isthmus; MI, mitral isthmus; PVI, pulmonary vein isolation; PWI, posterior wall isolation; RFCA, radiofrequency catheter ablation

TABLE 3. Efficacy and safety outcome after 12 months of follow-up.

Outcome	Patients (*n*=44)
Overall free from atrial arrhythmia n (%)	20 (45.4)
Complication n (%)	
Pericardial effusion	1 (1.6)
Cardiac tamponade	1 (1.6)
Esophageal injury	-
Phrenic nerve injury	-
DVT	-
Vascular complication at puncture site	-
Stroke/TIA	-
Death	-

Abbreviations: DVT, deep vein thrombosis; TIA, transient ischemic attack

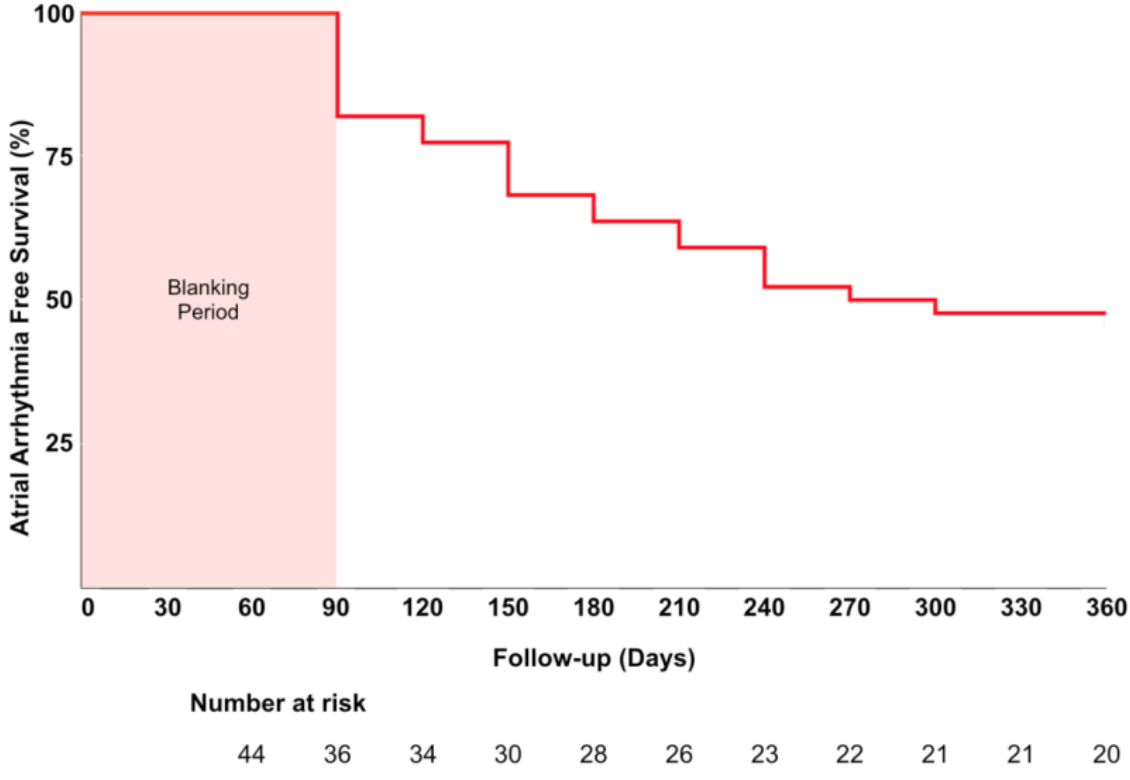

Fig 1. Atrial arrhythmia free survival after 12 months of follow-up.

64.2%.[13] Although a pioneering group demonstrated a very high success rate of 86% in treating paroxysmal AF with RFCA[14], the rate decreased to less than 70% in more recent studies. A study comparing the success rate based on the results of 7-day Holter monitoring at six months follow-up in two different RFCA strategies showed 42% after circumferential, and 66% after segmental pulmonary vein ablation in sinus rhythm.[15] Another study revealed the arrhythmia-free survival rate after single RFCA was 40% at one year.[16] These differences in outcomes can be attributed to the learning curve and supplementing technological development. In our studies, the overall success rate after a single RFCA was 45.45%, which is somewhat lower than some published data. The higher recurrence may have been due to the operator's experience; it should be presumed there are many things to deal with in the learning curve for this new procedure. Moreover, certain sophisticated technologies which could improve the success rate were not available at our center in the early part of the past decade. An individual patient's characteristics also might influence the outcome after RFCA. In our series, there were a number of non-paroxysmal AF patients and also a long duration between the time of first diagnosis and RFCA, which could have caused higher recurrence rates. The latter factor is one of the variables in a simple score model for predicting AF recurrence after RFCA.[17] Even with the lack of operator's learning curves and advanced technologies, the complication rate related to RFCA in our series was relatively low. Only one patient had a significant procedure-related complication, cardiac tamponade, which was promptly treated and resulted in a good outcome. Cardiac tamponade remains the most common potentially life-threatening complication associated with RFCA. The overall incidence of pericardial complication is 1.5%, which corresponds to our series. Importantly, the infrequency of complications at our center can ensure patients' safety with our safety protocols.

The data from this study demonstrate the safety and efficacy of RFCA for AF patients in our center. However, there were some limitations, which are commonly seen in retrospective studies. First, there was missing follow-up data in a number of patients. Second, symptom improvement and quality of life were the main treatment targets, but data was not systematically recorded. Hence, data collection was not possible for analysis. Finally, an important limitation was the lack of several lifestyles and risk factor modification data, which evidently may reduce the AF burden.[18] While we applied this treatment strategy to all AF patients, there were many missing

records. If individual risk factors are not be modified, it could cause the recurrence of atrial arrhythmia, even after successful RFCA.

CONCLUSION

The 1-year results of single-procedure RFCA for treating AF at Phramongkutklao Hospital, while not highly successful in our first decade, were comparable to other series. Notably, there was a relatively low rate of procedure-related complications. Other factors, which were not measured in this study, such as the operator's experience and ongoing advanced technologies as well as the enthusiastic treatment of associated risk factors, may contribute to improved outcomes in AF patients.

REFERENCES

1. Zulkifly H, Lip GYH, Lane DA. Epidemiology of atrial fibrillation. Int J Clin Pract 2018;72:e13070.
2. Phrommintikul A, Detnuntarat P, Prasertwitayakij N, Wongcharoen W. Prevalence of atrial fibrillation in Thai elderly. J Geriatr Cardiol 2016;13:270-3.
3. Sutamnartpong P, Dharmasaroja PA, Ratanakorn D, Arunakul I. Atrial fibrillation and paroxysmal atrial fibrillation detection in patients with acute ischemic stroke. J Stroke Cerebrovasc Dis 2014;23:1138-41.
4. Krittayaphong R, Rangsin R, Thinkhamrop B, Hurst C, Rattanamongkolgul S, Sripaiboonkij N, et al. Prevalence and associating factors of atrial fibrillation in patients with hypertension: a nation-wide study. BMC Cardiovasc Disord 2016;16:57.
5. Andersson T, Magnuson A, Bryngelsson IL, Frobert O, Henriksson KM, Edvardsson N, et al. All-cause mortality in 272,186 patients hospitalized with incident atrial fibrillation 1995-2008: a Swedish nationwide long-term case-control study. Eur Heart J 2013;34:1061-7.
6. Stewart S, Hart CL, Hole DJ, McMurray JJ. A population-based study of the long-term risks associated with atrial fibrillation: 20-year follow-up of the Renfrew/Paisley study. Am J Med 2002;113:359-64.
7. Mark DB, Anstrom KJ, Sheng S, Piccini JP, Baloch KN, Monahan KH, et al. Effect of Catheter Ablation vs Medical Therapy on Quality of Life Among Patients With Atrial Fibrillation: The CABANA Randomized Clinical Trial. JAMA 2019;321:1275-85.
8. Hunter RJ, Berriman TJ, Diab I, Kamdar R, Richmond L, Baker V, et al. A randomized controlled trial of catheter ablation versus medical treatment of atrial fibrillation in heart failure (the CAMTAF trial). Circ Arrhythm Electrophysiol 2014;7:31-8.
9. Lin YJ, Chao TF, Tsao HM, Chang SL, Lo LW, Chiang CE, et al. Successful catheter ablation reduces the risk of cardiovascular events in atrial fibrillation patients with CHA_2DS_2-VASc risk score of 1 and higher. Europace 2013;15:676-84.
10. Bunch TJ, Crandall BG, Weiss JP, May HT, Bair TL, Osborn JS, et al. Patients treated with catheter ablation for atrial fibrillation have long-term rates of death, stroke, and dementia similar to patients without atrial fibrillation. J Cardiovasc Electrophysio. 2011;22:839-45.
11. Asia Pacific Heart Rhythm Society [Internet]. Singapore 2019. https://www.aphrs.org/publications/the- aphrs-white-book (Accessed November, 2019).
12. Asad ZUA, Yousif A, Khan MS, Al-Khatib SM, Stavrakis S. Catheter Ablation Versus Medical Therapy for Atrial Fibrillation: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. Circ Arrhythm Electrophysio. 2019;12:e007414.
13. Ganesan AN, Shipp NJ, Brooks AG, Kuklik P, Lau DH, Lim HS, et al. Long-term outcomes of catheter ablation of atrial fibrillation: a systematic review and meta-analysis. J Am Heart Asso. 2013;2:e004549.
14. Pappone C, Augello G, Sala S, Gugliotta F, Vicedomini G, Gulletta S, et al. A randomized trial of circumferential pulmonary vein ablation versus antiarrhythmic drug therapy in paroxysmal atrial fibrillation: the APAF Study. J Am Coll Cardiol 2006;48:2340-7.
15. Karch MR, Zrenner B, Deisenhofer I, Schreieck J, Ndrepepa G, Dong J, et al. Freedom from atrial tachyarrhythmias after catheter ablation of atrial fibrillation: a randomized comparison between 2 current ablation strategies. Circulation 2005;111:2875-80.
16. Weerasooriya R, Khairy P, Litalien J, Macle L, Hocini M, Sacher F, et al. Catheter ablation for atrial fibrillation: are results maintained at 5 years of follow-up? J Am Coll Cardiol 2011;57:160-6.
17. Abstracts of the 8th Annual Congress of the European Cardiac Arrhythmia Society, April 20-22, 2012, Munich, Germany. J Interv Card Electrophysiol 2012;33:261-383.
18. Chung MK, Eckhardt LL, Chen LY, Ahmed HM, Gopinathannair R, Joglar JA, et al. Lifestyle and Risk Factor Modification for Reduction of Atrial Fibrillation: A Scientific Statement From the American Heart Association. Circulation 2020;141:e750-e72.