International Journal of Cardiology xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

International Journal of Cardiology

journal homepage: www.elsevier.com/locate/ijcard

Very long-term clinical outcomes after radiofrequency catheter ablation for atrial fibrillation: A large single-center experience

Tetsuma Kawaji [a], Satoshi Shizuta [a,*], Takeshi Morimoto [b], Takanori Aizawa [a], Shintaro Yamagami [a], Takashi Yoshizawa [a], Chihiro Ota [c], Naoaki Onishi [d], Yasuhiro Sasaki [e], Mitsuhiko Yahata [f], Kentaro Nakai [g], Mamoru Hayano [h], Tetsushi Nakao [a], Koji Hanazawa [i], Koji Goto [j], Takahiro Doi [a], Koh Ono [a], Takeshi Kimura [a]

[a] Department of Cardiovascular Medicine, Graduate School of Medicine, Kyoto University, Japan
[b] Department of Clinical Epidemiology, Hyogo College of Medicine, Japan
[c] Department of Cardiovascular Medicine, Faculty of Medicine, University of Tsukuba, Japan
[d] Department of Cardiovascular Medicine, Otsu Red-Cross Hospital, Japan
[e] Department of Cardiovascular Medicine, Kobe City Medical Center General Hospital, Japan
[f] Department of Cardiovascular Medicine, Shizuoka General Hospital, Japan
[g] Department of Cardiovascular Medicine, Uji-Tokusyukai Medical Center, Japan
[h] Department of Cardiovascular Medicine, Kansai Electric Power Hospital, Japan
[i] Department of Cardiovascular Medicine, Wakayama Red Cross Hospital, Japan
[j] Department of Cardiovascular Medicine, Saitama Medical University International Medical Center, Japan

ARTICLE INFO

Article history:
Received 1 June 2017
Received in revised form 18 August 2017
Accepted 6 September 2017
Available online xxxx

Keywords:
Atrial fibrillation
Radiofrequency catheter ablation

ABSTRACT

Aims: Radiofrequency catheter ablation (RFCA) has become widely used for drug-refractory atrial fibrillation (AF). However, there is a paucity of data on the long-term clinical outcomes after RFCA for AF. The aim of the present study was to investigate the very long-term outcomes after RFCA for AF in a large number of consecutive patients.

Methods and results: In this retrospective single-center study, we evaluated very long-term follow-up results in 1206 consecutive patients undergoing first RFCA for AF. The primary outcomes were adverse outcomes at 30-day as a safety outcome measure and event-free rates from recurrent atrial tachyarrhythmias as efficacy outcome measures. Final follow-up rate reached 99.3% with a mean follow-up duration of 5.0 ± 2.5 years. The incidence of overall 30-day adverse outcomes was 3.6% without death. The 10-year event-free rates from recurrent atrial tachyarrhythmias after the initial and last procedures were 46.9% and 76.4%, respectively. Arrhythmia recurrence occurred most commonly during the first year and decreased beyond 3-year, although it continued to occur at an annual rate of 2.0% and 1.3%, respectively, throughout the 10-year follow-up period. The cumulative 10-year incidences of stroke and major bleeding were 4.2% and 3.5%, respectively, with annual rates of 0.3%. Discontinuation rate of oral anticoagulation at 1-, 3-, and 10-year was 34.6%, 53.4%, 58.0% and 61.9%.

Conclusions: RFCA for AF provided favorable very long-term arrhythmia-free survival without much safety concerns. The 10-year rates of stroke and major bleeding were low even with discontinuation of oral anticoagulation in a large proportion of patients.

1. Introduction

Since Hasissaguerre M. et al. reported the importance of pulmonary veins (PVs) as the origins of ectopic beats triggering atrial fibrillation (AF) in 1998 [1]. PVs have been targeted in radiofrequency catheter ablation (RFCA) procedures. Several randomized controlled trials showed that PV isolation (PVI) significantly reduced AF burden compared with conventional therapy using antiarrhythmic drugs (AADs) [2–5], and the current guidelines recommend RFCA for symptomatic paroxysmal AF refractory to AADs as class I indication [6]. However, most randomized controlled trials enrolled small number of selected patients and evaluated short-term clinical outcomes mostly within 2 years [2–5]. In addition, although several large-scale multicenter registries have been reported, consecutiveness of the patient enrollment was unclear and the follow-up duration was usually limited within 1 year [7,8]. Most studies, furthermore, focused only on the utility of the RFCA procedure in eliminating AF and rarely evaluated the clinical outcomes after RFCA, including stroke and bleeding events in association with discontinuation of oral anticoagulation (OAC) [9]. Consequently, we sought to investigate the very long-term outcomes after RFCA for AF in a

* Corresponding author at: Department of Cardiovascular Medicine, Graduate School of Medicine, Kyoto University, 54 Shogoin Kawahara-cho, Sakyo-ku, Kyoto 606-8507, Japan.
E-mail address: shizuta@kuhp.kyoto-u.ac.jp (S. Shizuta).

https://doi.org/10.1016/j.ijcard.2017.09.023

large number of consecutive patients from a single center database, focusing on the incidence of recurrent atrial tachyarrhythmias as well as clinical outcomes, including total and cardiovascular mortality, stroke, bleeding, and heart failure.

2. Methods

2.1. Study design

Between February 2004 and March 2015, 1250 patients underwent first catheter ablation for AF in Kyoto University Hospital. Excluding 43 patients who received cryoballoon ablation for AF and 1 patient who refused study participation at the time of follow-up, the present study enrolled 1206 consecutive patients. Patients were divided into 3 tertiles according to the procedure period: the first tertile between February 2004 and October 2010 ($N = 402$), the second tertile between October 2010 and February 2013 ($N = 402$), and the third tertile between February 2013 and March 2015 ($N = 402$) (Supplementary Fig. 1). Written informed consent for the RFCA procedure and follow-up was obtained from all the patients. Follow-up information was obtained by hospital-chart review and/or telephone contact with the patient, relatives, and/or referring practitioners. The study protocol was approved by the institutional review board of Kyoto University Hospital.

Table 2
Adverse outcomes at 30-day compared between paroxysmal and non-paroxysmal atrial fibrillation.

	Overall $N = 1206$	Paroxysmal AF $N = 854$	Non-paroxysmal AF $N = 352$	*P* value
Any adverse outcomes at 30-day	44 (3.6%)	29 (3.4%)	15 (4.3%)	0.48
Death	0 (0%)	0 (0.0%)	0 (0.0%)	–
Cardiac tamponade	20 (1.7%)	15 (1.8%)	5 (1.4%)	0.67
Atrio-esophageal fistula	1 (0.1%)	0 (0%)	1 (0.3%)	0.30
Stroke	1 (0.1%)	0 (0%)	1(0.1%)	0.30
Systemic embolism	2 (0.2%)	0 (0%)	2 (0.6%)	0.09
Sepsis	1 (0.1%)	0 (0%)	1 (0.3%)	0.30
Pneumothorax	0 (0%)	0 (0%)	0 (0%)	–
Phrenic nerve palsy	9 (0.8%)	3 (0.4%)	6 (1.7%)	0.02
Gastric motility disturbance	4 (0.3%)	3 (0.4%)	1 (0.3%)	0.6
Arterio-venous fistula	4 (0.3%)	4 (0.5%)	0 (0%)	0.25
Femoral pseudoaneurysm	7 (0.6%)	6 (0.7%)	1 (0.3%)	0.35

AF = atrial fibrillation.

Table 1
Patient and procedure characteristics compared between paroxysmal and non-paroxysmal atrial fibrillation.

	Overall $N = 1206$	Paroxysmal AF $N = 854$	Non-paroxysmal AF $N = 352$	*P* value
Age (years)[a]	64.3 ± 9.5	64.6 ± 9.7	63.6 ± 8.8	0.07
≥75 years	151 (13%)	116 (14%)	35 (9.9%)	0.07
Duration of AF History (years)[a]	2.4 (0.6–6.1)	2.4 (0.7–6.9)	2.2 (0.6–5.7)	0.83
Female[a]	350 (29%)	281 (33%)	69 (20%)	<0.001
History of heart failure[a]	98 (8.1%)	53 (6.2%)	45 (13%)	<0.001
Hypertension[a]	707 (59%)	484 (57%)	223 (64%)	0.03
Diabetes[a]	195 (16%)	144 (17%)	51 (15%)	0.29
Ischemic stroke	121 (10%)	79 (9.3%)	42 (12%)	0.17
Intracranial hemorrhage	11 (0.9%)	9 (1.1%)	2 (0.6%)	0.33
Vascular disease	117 (9.7%)	85 (10%)	32 (9.1%)	0.63
Hypertrophic cardiomyopathy	36 (3.0%)	21 (2.5%)	15 (4.3%)	0.11
Dilated cardiomyopathy	19 (1.6%)	9 (1.1%)	10 (2.8%)	0.03
Post cardiac electronic device implantation	44 (3.6%)	35 (4.1%)	9 (2.6%)	0.18
Post cardiac surgery	26 (2.2%)	19 (2.2%)	7 (2.0%)	0.79
CHA_2DS_2 score	1.2 ± 1.1	1.1 ± 1.0	1.2 ± 1.1	0.06
CHA_2DS_2-VASc score	2.0 ± 1.5	2.0 ± 1.5	2.0 ± 1.5	0.44
≥2[a]	706 (59%)	506 (59%)	200 (57%)	0.39
Echocardiography				
Left ventricular diastolic diameter (mm)	46.3 ± 6.2	46.0 ± 5.9	47.1 ± 6.6	0.004
>55 mm[a]	77 (6.4%)	42 (5.1%)	34 (9.7%)	0.004
Left ventricular ejection fraction (%)	63.1 ± 12.6	64.5 ± 11.9	59.7 ± 13.5	<0.001
<50%[a]	153 (12.7%)	91 (10.7%)	62 (17.6%)	0.001
Left atrial diameter (mm)	40.9 ± 6.9	39.4 ± 6.6	44.3 ± 6.4	<0.001
>40 mm[a]	644 (53.5%)	374 (44.0%)	270 (76.7%)	<0.001
Medications				
Oral anticoagulation	1137 (94%)	802 (94%)	335 (95%)	0.38
Warfarin	636 (53%)	450 (53%)	186 (53%)	0.98
Dabigatran	312 (25.9%)	221 (25.9%)	91 (25.8%)	0.96
Rivaroxaban	110 (9.1%)	76 (8.9%)	34 (9.6%)	0.69
Apixaban	76 (6.3%)	52 (6.1%)	24 (6.8%)	0.65
Antiplatelet	261 (22%)	188 (22%)	73 (21%)	0.87
Class I/III AAD	396 (33%)	352 (41%)	44 (13%)	<0.001
ACE-I/ARB	498 (41%)	334 (39%)	164 (47%)	0.02
Beta blockers	416 (35%)	269 (32%)	147 (42%)	<0.001
Procedure characteristics				
PV isolation success	1203 (99.8%)	852 (99.8%)	351 (99.7%)	0.88
Additional ablations				
Tricuspid valve isthmus ablation	1136 (94%)	798 (94%)	338 (96%)	0.13
SVC isolation	339 (28%)	259 (30%)	80 (23%)	0.006
CFAE ablation	295 (24%)	74 (8.7%)	220 (63%)	<0.001
Left atrial roof line	34 (2.8%)	9 (1.1%)	25 (7.1%)	<0.001
Mitral isthmus line	36 (3.0%)	8 (0.9%)	28 (8.0%)	<0.001

AAD = antiarrhythmic drug; ACE-I = angiotensin converting enzyme inhibitor; AF = atrial fibrillation; ARB = angiotensin receptor blocker, ATP = adenosine triphosphate, CFAE = complex fractionated atrial electrogram, PV = pulmonary vein, SVC = superior vena cava.

[a] Indicated variables incorporated in the multivariable Cox proportional hazard models evaluating the independent risk factors for recurrent atrial tachyarrhythmia.

Please cite this article as: T. Kawaji, et al., Very long-term clinical outcomes after radiofrequency catheter ablation for atrial fibrillation: A large single-center experience, Int J Cardiol (2017), https://doi.org/10.1016/j.ijcard.2017.09.023