



Efficacy and safety of atrial fibrillation ablation in patients with aged 80 years or older

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Abstract

Atrial fibrillation (AF) is the most common cardiac arrhythmia observed in the elderly. Its prevalence rises with age, particularly in individuals over 80 years old. While catheter ablation has emerged as a first line therapy for the patients with symptomatic AF, evidence on its application in elderly patients remains controversial. This study aimed to assess safety and efficacy outcomes of AF ablation in patients aged ≥ 80 years. Consecutive 1327 patients who underwent a first pulmonary vein isolation (PVI) for AF were retrospectively analyzed. Patients aged ≥ 80 years (elderly group, $n = 107$) were compared with patients aged < 80 years (younger group, $n = 1220$). At 1-year follow-up, there was no significant difference in AF free rate between the elderly and the younger group (72.0% vs. 73.9%, $P = 0.786$). Regarding major complications, the elderly patients had a greater incidence of periprocedural stroke (1.9% vs. 0.1%, $P = 0.018$). The rates of cardiac tamponade, phrenic palsy, and vascular complications were not significantly different between the 2 groups. PVI for AF is effective in patients aged ≥ 80 years with a similar success rate, but periprocedural stroke risk was higher compared to the younger population.

Keywords Atrial fibrillation · Ablation · Elderly patients

Introduction

Atrial fibrillation (AF) is the most common arrhythmia in elderly subjects and a significant risk factor for ischemic stroke. Prevalence increased with age, from 0.1% among persons younger than 55 years up to 9.0% in subjects aged 80 years or older [1]. Meanwhile, catheter ablation is being developed as a first line therapy for AF in selected patients according to the current guideline [2], and has been widely applied to elderly patients [3–15]. However, evidence on catheter ablation of AF in elderly patients is still controversial. This study aimed to analyze safety and efficacy outcomes in patients aged ≥ 80 years submitted to AF ablation.

Methods

Study population

Consecutive 1324 patients who underwent a first pulmonary vein isolation (PVI) for AF between January 2017 and December 2021 in Nippon Medical School Hospital were retrospectively analyzed. The clinical characteristics and outcome of catheter ablation for AF in 107 patients aged 80 years or older (elderly group) were compared to 1217 subjects < 80 years of age (younger group). We compared baseline clinical characteristics, acute procedural success rates, complications, and recurrence rates after 1 year follow up. This study was approved by our local Ethical Committee (B-2020-307).

Ablation procedure

All patients were taking appropriate dose of oral anticoagulants (OACs) at least 1 month prior to the ablation procedure, and underwent cardiac CT scan or transesophageal

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echocardiography (TEE) to exclude left atrial appendage (LAA) thrombus within 1 month before the ablation procedure.

Catheter ablation was performed with patients under deep sedation using midazolam and dexmedetomidine. Deep conscious sedation was achieved through the intravenous administration of midazolam (10 mg), pentazocine (15 mg), and hydroxyzine (25 mg), followed by a continuous dexmedetomidine infusion (7 µg/kg/hr for 10 min). The dexmedetomidine dosage was adjusted based on BIS (Bispectral Index) monitoring, maintaining a range between 50 and 60. PVI was done with the second-generation cryoballoon (ArcticFront Advance, Medtronic, Minneapolis), or a radiofrequency (RF) point-by-point ablation. The procedures were guided with an 3D electroanatomical mapping system (CARTO, Biosense Webster or Ensite NavX, St. Jude Medical).

RF ablation was performed using two transeptal sheaths for a circumferential decapolar electrode catheter and irrigated tip catheter (SmartTouch, Biosense Webster or Tacti-cath, St. Jude Medical). Additional ablation was performed according to the discretion of the operator. The radiofrequency power was delivered at 30–50 W, and the upper limit of the esophageal temperature was set as 39.5 °C to prevent esophageal thermal damage. Regarding periprocedural anticoagulation, warfarin was uninterrupted and direct OACs was interrupted on the morning of the procedure. After the transeptal puncture, the heparin infusion rate was adjusted to keep the activated clotting time between 300 and 350 s.

Follow up

After discharge, the patients were followed in the outpatient clinic every month for 1 year, and 24 h Holter monitoring was recorded during 3–6 months after the procedure. AF recurrence was defined by occurrence of any documented symptomatic or asymptomatic episode of AF or atrial tachycardia (AT) lasting > 30 s, after a blanking period of 3 months.

Statistical analysis

Measurements are presented as mean value ± SD. Comparisons of measurements between two groups were analyzed by Mann–Whitney U test. Fisher's exact test was used for discrete variables. Kaplan–Meier analysis and Cox regression model of proportional hazards were used to compare the recurrence rate of AF between the two groups in terms of arrhythmia control. A p value < 0.05 was considered as significant. All statistical analyses were performed using EZR (Saitama Medical Center, Jichi Medical University, Saitama, Japan) [16].

Results

Baseline characteristics

Baseline characteristics are shown in Table 1. The mean age of the patients was 82.5 years in the elderly group, 65.2 years in the younger group. The majority of the elderly patients were female, whereas the younger patients were predominantly male. As expected, mean height, weight, body mass index, CHADS₂ score and CHA₂DS₂-VASc score were higher in elderly patients than those in younger patients. Prevalence of hypertension, previous stroke or transient ischemic attack were also higher in elderly patients than those in younger patients. Mean left ventricular ejection fraction (LVEF) was slightly higher in the elderly patients than that in the younger patients. Distributions of OACs are shown in Fig. 1. Majority of the elderly patients were taking apixaban or edoxaban, whereas majority of the younger patients were taking dabigatran or edoxaban.

Procedure outcomes and complications

Comparison of procedural characteristics from the ablation procedure between the two groups is shown in Table 2. The younger patients were more likely to undergo additional

Table 1 Comparison of each parameter between younger and elderly patients

	Younger group (n = 1217)	Elderly group (n = 107)	p value
Age (years)	65.2 ± 10.1	82.5 ± 2.2	<0.001
Male	884 (72.6%)	42 (39.3%)	<0.001
Height (m)	165.3 ± 10.4	155.3 ± 8.8	<0.001
Weight (kg)	67.7 ± 14.0	56.8 ± 10.1	<0.001
BMI (kg/m ²)	24.6 ± 4.1	23.5 ± 3.4	0.001
LAD (mm)	39.5 ± 6.9	39.3 ± 6.2	0.941
LVEF (%)	63.7 ± 11.8	66.5 ± 9.1	0.035
HF	237 (19.5%)	25 (23.4%)	0.375
HT	698 (57.4%)	74 (69.2%)	0.019
DM	200 (16.4%)	24 (22.4%)	0.138
Stroke/TIA	43 (3.5%)	16 (15.0%)	<0.001
CHADS ₂ score	1.3 ± 1.1	2.4 ± 1.1	<0.001
CHA ₂ DS ₂ -Vascscore	2.3 ± 1.5	4.1 ± 1.3	<0.001
Persistent AF	536 (44.0%)	41 (38.3%)	0.265
AADs	238 (19.6%)	21 (19.6%)	1.000
Symptomatic AF	1026 (84.3%)	97 (90.7%)	0.091

AADs antiarrhythmic drugs, AF atrial fibrillation, BMI body mass index, DM diabetes mellitus, HF heart failure, HT hypertension, LAD left atrial diameter, LVEF left ventricular ejection fraction, TIA transient ischemic attack

Fig. 1 Distribution of oral anticoagulants (OACs) in each group

Distribution of OACs

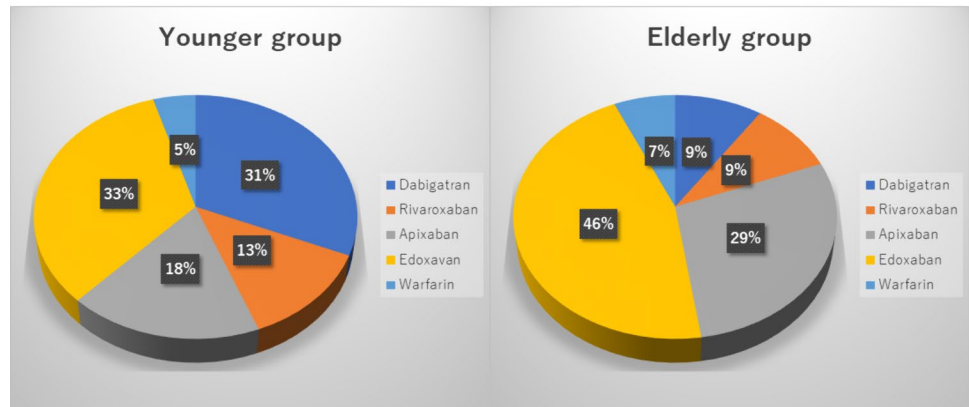


Table 2 Comparison of procedural characteristics between younger and elderly patients

	Younger group (n = 1217)	Elderly group (n = 107)	p value
Procedure time (min)	124.9 ± 45.0	112.4 ± 44.2	0.003
Cryoballoon ablation	178 (14.6%)	20 (18.7%)	0.323
Additional LA linear ablation	631 (51.8%)	44 (41.1%)	0.043
Additional CTI ablation	258 (21.2%)	27 (25.2%)	0.395
Additional SVC ablation	50 (4.1%)	3 (2.8%)	0.687
<i>Complications</i>			
Cardiac tamponade	9 (0.7%)	1 (0.9%)	0.823
Stroke/TIA	1 (0.1%)	2 (1.9%)	0.018
Vascular complications	7 (0.6%)	1 (0.9%)	0.491
Phrenic palsy	7 (0.6%)	1 (0.9%)	0.491

CTI cavotricuspid isthmus, LA left atrium, SVC superior vena cava, TIA transient ischemic attack

LA linear ablation had longer procedure time than elderly patients.

Regarding major complications, elderly patients had a greater incidence of periprocedural stroke ($n = 2$, 1.9% vs. $n = 1$, 0.1%, $P = 0.018$). However, strokes were minor in patients in elderly group. All of the three stroke patients were discharged without neurologic disability (modified Rankin scale 0). The rates of cardiac tamponade, phrenic palsy, vascular complications were not significantly different between the two groups.

Clinical outcome

One patient died of pneumonia 6 months after the ablation procedure in the younger group, and all-cause mortality at 1 year was 0.1%. Meanwhile, no patients died within 1 year after the ablation procedure in the elderly group. At 1-year follow-up, AF recurrence was demonstrated in 27 patients in the elderly group, whereas 281 patients in the younger group. There was no significant difference in AF free rate

between elderly and younger group (72.0% vs. 73.9%, log-rank test $P = 0.786$, Fig. 2).

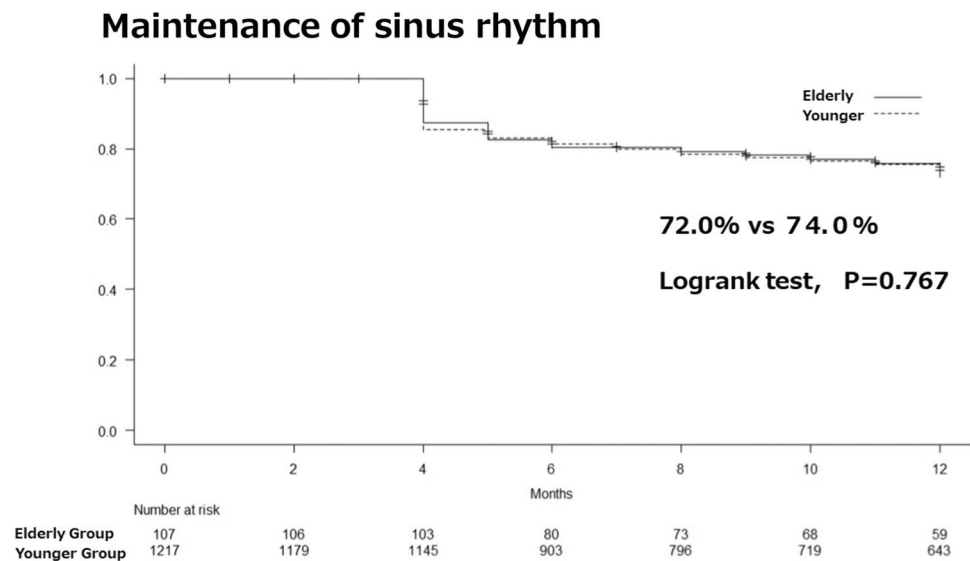
Discussion

The present study demonstrated that no significant difference was observed in AF free rate between elderly and younger group. Meanwhile, the elderly patients had a greater incidence of periprocedural stroke than that in the younger patients.

Characteristics of elderly patients

The majority of the elderly patients were female, whereas the younger patients were predominantly male. Although the reason of this difference is not clear, the women patients with AF were reported to be older than men [17, 18]. Furthermore, female patients have a lower quality of life compared with the men [17]. Thus, elderly female patients

Fig. 2 Kaplan–Meier curves of the rate of maintenance sinus rhythm for both groups



might be likely to undergo catheter ablation because of the AF related symptoms. In the present study, the prevalence of symptomatic AF patients was comparable between the younger and elderly patients. However, prevalence of previous stroke or transient ischemic attack was higher in the elderly patients than those in the younger patients. This is a possible reason why asymptomatic elderly AF patients underwent catheter ablation.

In terms of OACs, majority of the elderly patients were taking apixavan or edoxavan. A recent study showed that direct OACs were associated with a lower incidence of clinically relevant bleeding in patients with AF and hypertrophic cardiomyopathy compared to Warfarin [19]. In addition, direct OACs were reported to be associated with lower risk of all-cause mortality in the elderly heart failure patients with AF and renal dysfunction compared with vitamin K antagonist [20]. A meta-analysis of direct OACs compared with warfarin in patients > 75 years of age showed that apixaban was the only direct OAC that significantly reduced all three outcomes of systemic embolization, major bleeding, and intracranial hemorrhage compared with warfarin, suggesting apixaban appears to offer the best combination of efficacy and safety [21]. A recent prospective multicenter cohort study demonstrated that edoxaban is feasible in very elderly patients (age \geq 80 years) with AF even if frail [22]. So far, apixavan and edoxavan may be safe and effective in elderly patients with AF.

Efficacy of catheter ablation in elderly patients

A series of studies have reported the similar efficacy of AF ablation in elderly patients compared to younger patients [3–9]. A meta-analysis including 18 observational studies with 21,039 patients revealed that elderly AF patients

aged \geq 75 years old had similar incidence of recurrent AF or atrial tachyarrhythmias and complication after AF ablation compared to non-elderly patients with AF [10]. Regarding patients aged 80 or older, catheter ablation of AF has shown similar success rates compared to younger patients in four small observational studies [11–14]. Meanwhile, a retrospective analysis of catheter ablation for AF in a large volume center reported that good arrhythmia control was inferior in elderly patients (\geq 70 years) as compared with the younger cohort, both without and with antiarrhythmic drugs [15]. In addition, Bunch et al. examined impact of age after AF catheter ablation and demonstrated that older patients had significantly higher rates of recurrences when analyzed with long-term follow-up [23]. A recent meta-analysis reported that the elderly group was significantly associated with a lower rate of freedom from AF, as well as a higher incidence of safety outcomes (cerebrovascular events, serious hemorrhage complications, all-cause death) compared to younger patients [24]. In the present study, there was no significant difference in AF free rate between elderly and younger group at 1 year follow up. The inconsistency of the results may be due to selection bias or differences of ablation strategy. Taken together, majority of the reports showed similar efficacy of AF ablation in elderly patients, and the efficacy of AF ablation in elderly patients is considered to be comparable to that in younger patients.

Safety of catheter ablation in elderly patients

In the present study, the elderly patients showed shorter procedure time than younger patients. Special consideration might be given to elderly patients, because longer procedure time may be associated with significant complications.

Many papers reported similar safety of AF ablation in elderly patients compared to younger population [3–10, 15]. However, A German ablation registry demonstrated significant difference between periprocedural stroke rates in the elderly (> 75 years) versus the younger cohort (1.3% vs. 0.1%, $P < 0.01$), which is consistent with the present study [25]. Fortunately, the two patients who developed stroke were recovered and discharged without disabilities in this study. Adequate adherence to direct OACs was reported to be associated with reduced ischemic stroke severity in patients with AF [26]. However, the stroke patients were taking direct OACs, which were interrupted on the morning of the procedure in the present study. A recent meta-analysis showed a protective effect of uninterrupted direct OAC on silent cerebral ischemic events after catheter ablation of AF, suggesting uninterrupted direct OAC might be favorable for prevention of periprocedural stroke [27]. The number of comorbidities is increased with age, which may be associated with periprocedural complications. In fact, CHADS2 score, CHA2DS2-VASc score and prevalence of hypertension, previous stroke or transient ischemic attack were higher in elderly patients than those in younger patients in the present study. A Japanese registry revealed that increased age was independently and significantly associated with overall complications including cardiac tamponade, stroke or TIA, sick sinus syndrome, pneumonia, vascular access complications [28]. Close attention should be paid to avoid periprocedural complications in elderly patients who undergo catheter ablation for AF.

Study limitations

There are limitations in this study. First, it was retrospective and single center study. A large scale prospective multicenter study is warranted to validate our findings. Second, our study showed relatively low proportion of the elderly (aged ≥ 80 years) patients, limiting the statistical power. Third, as the indication of catheter ablation largely depended on the physician's judgement, elderly patients with comorbidities such as such as frailty, dementia, and others might have been excluded. Finally, detection of AF episodes, especially in the asymptomatic patients, is difficult despite regular screening with Holter monitoring. We may have underestimated the actual incidence of recurrent AF.

Conclusions

PVI for AF is effective in patients aged ≥ 80 years with a similar success rate, but periprocedural stroke risk was higher compared to the younger population.

Table 2 Comparison of procedural characteristics between younger and elderly patients

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Declarations

Conflict of interest All authors have no relationships to disclose.

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