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Efficacy and safety of atrial fibrillation ablation in patients aged ≥80 years: a retrospective study

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ABSTRACT

Catheter ablation is the first-line treatment for atrial fibrillation. Although the efficacy and safety of this procedure have been reported in older patients, they might diminish with age. Therefore, this study aimed to determine the safety and effectiveness of atrial fibrillation ablation in patients aged ≥80 years. We retrospectively analyzed the features of the catheter ablation and the subsequent clinical course and outcomes of 100 patients with atrial fibrillation aged ≥80 years who underwent ablation between July 2019 and December 2021 at Tosei General Hospital, Seto, Aichi, Japan. The average duration of atrial fibrillation was 6.0 ± 9.5 months, and 83% of the patients were symptomatic. Approximately 30% of patients developed heart failure, with 15% requiring hospitalization within one year before ablation. After ablation, 93% of patients were atrial fibrillation-free, and none required postoperative hospitalization due to heart failure. However, several complications have been observed, including cardiac tamponade, hematoma at the access site, and postoperative bradycardia. Notably, an enlarged left atrial diameter before ablation is a predictor of complications. In patients aged ≥80 years, atrial fibrillation ablation therapy demonstrated a high non-recurrence rate and may alter the progression of heart failure. Although the incidence of complications was relatively low, caution should be exercised when older patients with enlarged left atrial diameters undergo atrial fibrillation ablation.

Keywords: catheter ablation, atrial fibrillation, older patients, frailty

Abbreviations:
AF: atrial fibrillation
CBA: cryoablation
LA: left atrium
LVA: low-voltage area
PV: pulmonary vein
PVI: pulmonary vein isolation
RF: radiofrequency

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INTRODUCTION

Catheter ablation is an effective first-line treatment for atrial fibrillation (AF).[1-3] The pulmonary veins (PVs) play a crucial role in the pathogenesis of arrhythmia in AF, particularly in older individuals.[4] Thus, radiofrequency (RF) ablation has been proven to be effective in treating AF in older patients while maintaining a normal sinus rhythm and is associated with lower risks of mortality and stroke.[5,6] Another safe and effective procedure for older patients with AF is cryoablation (CBA), which requires a shorter procedural duration.[7,8] Postoperative recurrence rates in patients aged >80 years undergoing CBA have been reported to be similar to those observed in younger patients.[9]

Despite its safety and effectiveness, complications associated with catheter ablation tend to increase with age.[10,11] The recurrence rate of AF is significantly higher in patients aged ≥75 years who undergo RF or CBA.[10,12] Therefore, we aimed to determine the safety and effectiveness of AF ablation, including both RF and CBA, in patients aged ≥80 years and identify the incidence rate of complications and predictors of AF recurrence.

MATERIALS AND METHODS

Patient selection

This retrospective study analyzed data on catheter ablation obtained from patients with paroxysmal or persistent AF aged ≥80 years who underwent ablation therapy (RF or cryoballoon) at our hospital between July 2019 and December 2021. We analyzed the medical records of 100 consecutive patients of the 565 eligible patients who met our inclusion criteria. The Institutional Review Board of Tosei General Hospital approved this study (Approval No. 1070), and all patients provided written informed consent to participate.

Ablation protocol

Before the patients underwent ablation therapy, the antiarrhythmic medication taken by the patients needed to be discontinued for a minimum period of five half-lives. Patients were sedated with propofol and dexmedetomidine hydrochloride and received adaptive support ventilation. Heparin was administered to achieve an activated clotting time of ≥300 s, and oral anticoagulants (warfarin and direct oral anticoagulants) were administered continuously throughout the procedure. A multipole PentaRay NAV catheter (Biosense Webster, Irvine, CA, USA) or HD grid catheter (Abbott Laboratories, Chicago, IL, USA) was inserted via an SL0 sheath (Abbott Laboratories). Further, a Thermacool Smartouch SF (Johnson & Johnson, New Brunswick, NJ, USA) or a TactiCath SE irrigation catheter (Abbott Laboratories) was inserted via an Agilis steerable sheath (Abbott Laboratories) and introduced into the left atrium (LA).

Catheter ablation was performed using a three-dimensional mapping system, CARTO 3 (Johnson & Johnson) or Ensite Velocity (Abbott Laboratories), and cryoablation was performed based on PV characteristics such as size, branch, and shape.[13] A 12.5-F delivery sheath (FlexCath Advance; Medtronic Inc, Minneapolis, MN, USA) was introduced into the LA over the wire, along with an Arctic Front Advance cryoballoon catheter (Medtronic Inc). The cryoballoon and sheath were delivered using a dedicated inner lumen-mapping catheter (Achieve; Medtronic, Inc).

All patients underwent PV isolation (PVI), which was confirmed using a bidirectional block. Regardless of the RF or CBA cases, adenosine and isoproterenol (ISP) were subsequently administered to determine dormant conduction, confirm the PV arrhythmia substrate, and induce non-PV foci. Dormant conduction and non-PV foci were evaluated by administering 30 mg adenosine

followed by reaction confirmation and 3 μg/min ISP for 5 min. Non-PV foci were defined as ectopic beats that induced AF, supraventricular tachycardia, and frequent or repetitive premature atrial contractions. The origin of non-PV foci (when identified) was mapped using a multipole catheter, and additional ablation was performed. Patients with drug-induced AF underwent AF induction via rapid atrial pacing, and spontaneous AF after defibrillation was evaluated.

Follow-up

Outpatient symptoms were evaluated using self-administered questionnaires during follow-up. Furthermore, the patients were examined using 12-lead electrocardiography (ECG) and Holter monitoring at 1, 3, 6, and 12 months after ablation. Recurrent AF was defined as an ECG record of AF for >30 s, with or without drug therapy. However, we excluded AF and other atrial tachycardias recorded during the first three months after treatment (blanking period) from the recurrence analysis.

Statistical analysis

Continuous data were expressed as medians and interquartile ranges. Within-group comparisons of continuous variables were performed using Wilcoxon signed-rank tests. The Kaplan–Meier method was used to estimate AF recurrence and postoperative mortality rates. Predictors of complications were analyzed using logistic regression models, whereas predictors of AF recurrence were analyzed using Cox proportional hazards models. All data were statistically analyzed using SPSS v 22.0 for Windows, IBM Corp, Armonk, NY, USA), and statistical significance was set at $p < 0.05$.

RESULTS

Baseline characteristics of patients

Table 1 shows data derived from 100 patients (53 men; mean age 83.1 ± 3.0 years). Among them, 61 had paroxysmal AF, 39 had persistent AF, and only 3 had experienced AF for ≥1 year. The average duration of AF was 6.0 ± 9.5 months, and 83% of the patients were symptomatic. Hypertension and heart failure (NYHA Cardiac Function Classification Levels II–IV) were observed in 58 and 30 patients, respectively. Fifteen patients required hospitalization for heart failure one year before ablation therapy. Antiarrhythmic drugs were administered to 65% of our patient cohort. Furthermore, 16% of the patients were diagnosed with cancer, and 21% were considered frail, estimated based on the evaluation method proposed by Fried et al.[11] The mean left ventricular ejection fraction and LA diameter were 64.8 ± 7.4 and 38.7 ± 6.1 mm, respectively. Risk indicators such as congestive heart failure, hypertension, and age >75 years were scored using a CHADS2 as 1, and diabetes previous stroke/transient ischemic attack were scored as 2, and serum levels of brain natriuretic peptide increased with age.

Table 1 Baseline characteristics of patients

Parameters	
N (sex: male/female)	100 (53/47)
Age (years)	83.1 ± 3.0
Type of AF	
Paroxysmal (n [%])	61 (61%)
Persistent (n [%])	39 (39%)
Long-standing persistent (n [%])	3 (3%)
Duration of AF (months)	6.0 ± 9.5
Symptomatic (n [%])	83 (83%)
Previous antiarrhythmic therapy (n [%])	65 (65%)
BMI (kg/m^2)	22.9 ± 3.8
Hypertension (n [%])	58 (58%)
Diabetes (n [%])	10 (10%)
Structural heart disease (n [%])	10 (10%)
Congestive heart failure (n [%])	30 (30%)
Hospitalization for heart failure within 1 year (n [%])	15 (15%)
Coronary artery disease (n [%])	18 (18%)
Post other ablation therapies (n [%])	4 (4%)
Stroke/transient ischemic attack (n [%])	12 (12%)
Cancer (n [%])	16 (16%)
Frailty (n [%])	21 (21%)
CHADS2 score	2.1 ± 0.9
CHA2DS2-VASc score	3.6 ± 1.2
HADBLED score	1.8 ± 0.7
LVEF (%)	64.8 ± 7.4
LAD (mm)	38.7 ± 6.1
Creatinine (mg/dL)	1.1 ± 0.4
CCr (mL/min)	50.0 ± 18.6
BNP (pg/mL), n = 50	308.1 ± 280.2
NT-pro-BNP (pg/mL), n = 50	1762.5 ± 1966.2

AF: atrial fibrillation
BMI: body mass index
BNP: brain natriuretic peptide
CHADS2: congestive heart failure, hypertension, age (>75 years = 1 point), diabetes, and previous stroke/transient ischemic attack (2 points)
CHA2DS2-VASc: congestive heart failure, hypertension, age ≥75 years (doubled), diabetes, stroke (doubled), vascular disease, age 65–74 years, and sex category (female)
CCr: creatinine clearance
HADBLED: hypertension, abnormal liver/renal function, stroke history, bleeding history or predisposition, labile international normalized ratio (INR), elderly, drug/alcohol usage
LAD: left atrial diameter
LVEF: left ventricular ejection fraction
NT-pro-BNP: N-terminal (NT) pro-hormone BNP

Ablation results

Table 2 summarizes the details of the ablation procedure. The mean procedural duration was 125.6 ± 31.5 min, and 83 patients were treated by RF ablation and 17 patients by cryoablation. RF ablation was not used as a supplement to PVI, and PVI was achieved solely with CBA in all cases. A voltage map of the LA during sinus rhythm, created using a multipolar catheter, showed that 11 (50%) of 22 patients had low-voltage areas (LVAs) (defined as amplitudes between 0.1

Table 2 Ablation data

Parameters	
Procedural duration (min)	125.6 ± 31.5
RF (n [%])	83 (83%)
First-pass isolation (n [%])	80 (96.4%)
Cryoballoon (n [%])	17 (17%)
Isolation by one freezing (n [%])	13 (76.5%)
Left atrial low-voltage area (n [%]), n = 22	11 (50%)
LVA location	
Anterior (n [%])	9 (40.9%)
Posterior (n [%])	1 (4.5%)
Extensive (n [%])	1 (4.5%)
Adenosine (n [%])	87 (87%)
Isoproterenol (n [%])	89 (89%)
Dormant conduction (n [%]), n = 98	11 (11.2%)
PV arrhythmogenicity (n [%])	47 (47%)
PVI only (n [%])	59 (59%)
+ CTI block line (n [%])	16 (16%)
+ Box isolation (n [%])	7 (7%)
+ LA anterior AT (n [%])	7 (7%)
+ Roof line (n [%])	3 (3%)
+ PMI (n [%])	1 (1%)
+ SVC isolation (n [%])	4 (6%)
+ RA AT (n [%])	2 (2%)
+ Slow-pathway ablation (n [%])	1 (1%)
+ PAC focal ablation (n [%])	6 (6%)

AT: atrial tachycardia
CTI: cavotricuspid isthmus
LA: left atrium
LVA: low-voltage area
PAC: premature atrial contraction
PMI: perimitral isthmus
PV: pulmonary vein
PVI: pulmonary vein isolation
RA: right atrium
RF: radiofrequency
SVC: superior vena cava

mV and 0.4 mV) mostly in the anterior wall (n = 9; 40.9%), and the procedure was completed after PVI alone in 59 patients. Dormant conduction was induced using adenosine and ISP in 11 (11.2%) of 98 patients. The non-PV foci were ablated when inducible tachycardia was observed. The cavotricuspid isthmus was the most common target site for ablation. The average hospital stay after ablation was 1.11 ± 0.47 days. None of the patients required an urgent visit before outpatient follow-up, which occurred within one month after discharge.

Safety and effectiveness of the first ablation

Table 3 and Figure 1 summarize the effectiveness and safety of the first ablation procedure. The mean follow-up duration was 16.7 ± 8.4 months. AF did not recur in 93% of patients

Table 3 Safety and effectiveness of ablation in the first session

Parameters		P-value
AF free (n [%])	93 (93%)	
Re-ablation (n [%])	5 (5%)	
Hospitalization for heart failure after ablation (n [%])	0 (0%)	
Changes in blood tests before and after ablation		
Creatinine (mg/dL)	1.1 ± 0.4 vs 0.9 ± 0.3	<0.001
CCr (mL/min)	50.0 ± 18.6 vs 59.7 ± 20.6	<0.001
BNP (pg/mL)	308.1 ± 280.2 vs 100.1 ± 97.7	<0.001
NT-pro-BNP (pg/mL)	1762.5 ± 1966.2 vs 584.5 ± 779.7	<0.001
Adverse events		
Cardiac tamponade (unknown source of bleeding) (n [%])	2 (2%)	
Hematoma at access site (n [%])	2 (2%)	
Arteriovenous fistula or aneurysm at access site (n [%])	0 (0%)	
Sedation-related complication (Postoperative bradycardia requiring temporary pacemaker due to sedation) (n [%])	4 (4%)	
Pneumothorax (n [%])	0 (0%)	
Phrenic nerve damage (n [%])	0 (0%)	
Pericarditis (n [%])	0 (0%)	
Fluid overload (n [%])	0 (0%)	
Transient ischemic attack or stroke (n [%])	0 (0%)	
Atrioesophageal fistula (n [%])	0 (0%)	
Pulmonary vein stenosis (n [%])	0 (0%)	

AF: atrial fibrillation
BNP: brain natriuretic peptide
CCr: creatinine clearance
HF: heart failure
NT-pro-BNP: N-terminal (NT) pro-hormone BNP

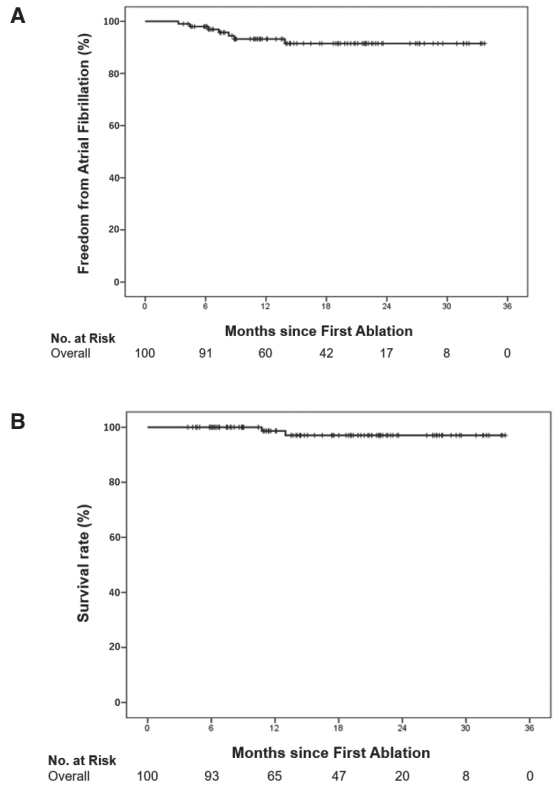

Fig. 1 Outcomes of the first ablation session

Fig. 1A: Resolution of atrial fibrillation (AF). The rates of sustained sinus rhythm after ablation are presented. AF recurrence developed in 7% of the patients, and sinus rhythm was maintained in 93% of the patients.

Fig. 1B: Survival rate after ablation. Three confirmed deaths after ablation were caused by cancer in two patients and senility in one. No patients died of ablation-related or cardiovascular events during the study period.

(Figure 1A). However, seven patients experienced recurrent AF, of whom five underwent additional ablation. No postoperative atrial tachycardia was observed. Two patients died of cancer (n = 2) and one died of senility (n = 1) after ablation (Figure 1B). An aspect of particular note was that none of the patients were hospitalized with heart failure after ablation, indicating that the procedure was effective. Furthermore, renal function and serum levels of brain natriuretic peptide and N-terminal prohormone brain natriuretic peptide significantly improved after the ablation therapy ($p < 0.001$). We believe that these improvements represent an important benefit of AF ablation in geriatric patients. Cardiac tamponade and hematoma were found at the access site in two patients. However, none of the patients required blood transfusions, and tamponade severity improved after pericardial drainage. Four patients experienced postoperative bradycardia due to sick sinus syndrome caused by sedation and required a temporary pacemaker based on the surgeon's judgment.

Second ablation

Table 4 summarizes the details of the second ablation to treat recurrent AF in five patients (mean age, 82.6 ± 3.1 years). Four patients experienced paroxysmal AF before the first session,

but none had persistent AF. Moreover, four patients with AF recurrence underwent RF ablation. The first ablation achieved PVI in all five patients, the superior vena cava (SVC) was isolated in one patient, and the PV was reconnected during the second procedure in three patients. Induction using ISP and pacing resulted in the addition of box isolation in three patients, a line of block in the cavotricuspid isthmus in one patient, and SVC isolation in one patient. One patient had an LVA of the anterior LA wall in the first ablation and atrial tachycardia at the same site where the isthmus was induced during the second ablation. Therefore, the anterior LA wall was ablated.

Table 4 Details of the second ablation session

Parameters	
N (male/female)	5 (3/2)
Age (years)	82.6 ± 3.1
Type of AF before first session	
Paroxysmal (n [%])	4 (80%)
Persistent (n [%])	1 (20%)
Long-standing persistent (n [%])	0 (0%)
After RF ablation (n [%])	4 (80%)
After cryoballoon ablation (n [%])	1 (20%)
Contents of the first session of ablation	
PVI only (n [%])	4 (80%)
+ SVC isolation (n [%])	1 (20%)
First-pass isolation (n [%])	5 (100%)
Left atrial low-voltage area (n [%])	1 (20%)
Dormant conduction (n [%])	0 (0%)
PV arrhythmogenicity (n [%])	3 (60%)
Contents of the second ablation session	
PV reconnection (n [%])	3 (60%)
+ Box isolation (n [%])	3 (60%)
+ CTI block line (n [%])	1 (20%)
+ LA anterior AT (n [%])	1 (20%)
+ SVC isolation (n [%])	1 (20%)

AF: atrial fibrillation
AT: atrial tachycardia
CTI: cavotricuspid isthmus
LA: left atrium
PV: pulmonary vein
PVI: pulmonary vein isolation
RF: radiofrequency
SVC: superior vena cava

Predictors of complications and AF recurrence

We examined the baseline characteristics of the patients and ablation outcomes. We determined the predictors of complications in the first ablation in eight patients and those of AF recurrence after ablation in seven (Table 5A and B). Increased LA diameter before ablation was the sole significant predictor of ablation complications (Table 5A). The mean LA diameter was 43.3 ± 3.1 mm in the eight patients who developed complications after the first ablation. This indicated that complications were more likely to occur in patients with LA enlargement. Neither persistent AF nor procedural duration predicted complications. No significant predictors of AF recurrence were identified (Table 5B).

Table 5A Predictors of complications associated with ablation

Parameters	n	OR	95% CI	P-value
Age (per year)	100	1.101	0.883–1.374	0.392
Sex: male (vs female)	100	0.769	0.181–3.266	0.722
AF type: persistent (vs paroxysmal)	39	2.843	0.639–12.649	0.170
Duration of AF (per month)	39	0.991	0.880–1.116	0.884
Structural heart disease	10	3.458	0.597–20.043	0.166
Congestive heart failure	30	1.444	0.322–6.474	0.631
CHADS2 score (per point)	100	0.993	0.445–2.217	0.987
LAD (per mm)	100	1.196	1.020–1.403	**0.028**
Frailty	21	0.514	0.060–4.429	0.545
Ablation device: CRYO (vs RF)	17	n.c.		
Ablation time (per min)	100	1.017	0.992–1.043	0.182
Ablation contents: additional ablation (vs PVI only)	41	0.853	0.192–3.784	0.834
Not first-pass isolation	7	2.048	0.215–19.482	0.533
Left atrial LVA	22	0.450	0.035–5.843	0.542
Dormant conduction by adenosine or ISP	11	n.c.		
PV arrhythmogenicity	47	0.333	0.064–1.741	0.193

AF: atrial fibrillation
CHADS2: congestive heart failure, hypertension, age (>75 years = 1 point), diabetes, previous stroke/transient ischemic attack (2 points)
CI: confidence interval
ISP: isoproterenol
LAD: left atrial diameter
LVA: low-voltage area
n.c.: not calculable
OR: odds ratio
PVI: pulmonary vein isolation
RF: radiofrequency

Table 5B Predictors of atrial fibrillation recurrence

Parameters	n	HR	95% CI	P-value
Age (per year)	100	0.984	0.758–1.278	0.905
Sex: male (vs female)	100	0.571	0.128–2.552	0.463
AF type: persistent (vs paroxysmal)	39	1.322	0.296–5.914	0.715
Duration of AF (per month)	39	0.845	0.513–1.392	0.509
Structural heart disease	10	1.437	0.173–11.949	0.737
Congestive heart failure	30	0.865	0.168–4.468	0.863
CHADS2 score (per point)	100	0.550	0.199–1.525	0.251
LAD (per mm)	100	1.011	0.895–1.141	0.862
Frailty	21	0.486	0.058–4.053	0.505
Ablation device: CRYO (vs RF)	17	1.720	0.333–8.877	0.517
Ablation time (per min)	100	0.990	0.967–1.013	0.373
Ablation contents: additional ablation (vs PVI only)	41	0.623	0.121–3.214	0.572
Not first-pass isolation	7	n.c.		
Left atrial LVA	22	n.c.		
Dormant conduction by adenosine or ISP	11	n.c.		
PV arrhythmogenicity	47	0.940	0.210–4.218	0.936

AF: atrial fibrillation
CHADS2: congestive heart failure, hypertension, age (>75 years = 1 point), diabetes, previous stroke/transient ischemic attack (2 points)
CI: confidence interval
HR: hazard ratio
ISP: isoproterenol
LAD: left atrial diameter
LVA: low-voltage area
n.c.: not calculable
PVI: pulmonary vein isolation
RF: radiofrequency

DISCUSSION

Main findings

Although the efficacy and safety of catheter ablation for AF has been demonstrated previously, in the present study, we focused on patients aged >80 years, a population for whom few such reports on efficacy and safety exist, and retrospectively analyzed real-world clinical data. As patients get older, they generally have more comorbidities, become increasingly frail, and develop strong reactions to sedation. This raises concerns about safety; however, our aim is to achieve high effectiveness with permanent cure and as little ablation as possible. We believe the findings of this study will serve as an index in this regard.

Our study has four main findings. First, AF ablation had a high non-recurrence rate despite the advanced age of the patients. Second, AF ablation improved renal function, which is consistent with previous studies.[14,15] The patients in these reports were approximately 60 years old; however

our results demonstrated the efficacy of this procedure in older patients. Third, although the efficacy of AF in heart failure cases has been previously reported,[16] this study did not target patients over 80 years old. In contrast, we demonstrated that it effectively reduced the incidence of hospitalization due to this condition in patients aged ≥80 years. Finally, we observed that an enlarged LA diameter before AF ablation was a significant predictor of complications; thus, clinicians should closely monitor such patients for complications during ablation therapy.

We believe that our findings provided new insights into using catheter ablation as a treatment option for AF. We found evidence supporting the safety and effectiveness of catheter ablation in patients with acute-phase AF. We also identified risk factors associated with complications of AF ablation and reported long-term outcomes in patients aged ≥80 years.

Characteristics of older patients who underwent AF ablation

Only three patients in this study experienced long-standing persistent AF (overall mean duration, 6.0 ± 9.5 months). We believe this is because among the elderly, many long-standing persistent cases are excluded from the indications for ablation owing to concerns regarding efficacy and safety. Overall, 83 (83%) patients were symptomatic, whereas 15 (15%) were hospitalized for heart failure within one year of ablation therapy. Therefore, AF ablation is a viable targeted treatment option for older patients with heart failure. This finding is particularly important because asymptomatic patients with persistent long-standing, persistent AF are difficult to identify. The present study also showed that improving AF symptoms would benefit patients diagnosed with cancer and frailty. Preoperative antiarrhythmic therapy was administered to 65% of the patients because of concerns regarding possible side effects in older adults. Furthermore, an evaluation of LA voltage confirmed an LVA on the anterior LA wall in 9 (40.9%) of the 22 patients. Among them, seven patients with LVA-related atrial tachycardia induction during the initial ablation period received additional ablation therapy. These results suggest that anterior wall LVA may be common in older patients. Moreover, our patients were aged ≥80 years, and many were hypertensive. Thus, our results are consistent with the previous findings of a higher risk of LVA formation in older adults.[17-19]

Safety and effectiveness of AF ablation in patients aged ≥80 years

We found that AF ablation in older adults resulted in a lower risk of hospitalization for heart failure, improved renal function, reduced cardiac load, and a high non-recurrence rate. These results are consistent with previous findings that ablation is effective in patients with heart failure[16] and improves renal function and serum brain natriuretic peptide levels.[14,15,20] The mechanisms underlying these effects include the restoration of atrial function by maintaining sinus rhythm and increased urinary output. Furthermore, restored renal function may be associated with improvements in AF and heart failure after reducing the doses of antiarrhythmic and diuretic agents. In particular, ablation improved these factors, even in patients aged ≥80 years, and none of them were hospitalized for heart failure after ablation therapy.

Cardiac tamponade developed in two (2%) patients but not in 465 (aged ≤79 years) who underwent AF ablation at our hospital during the same period. The incidence in this study was higher than those reported in previous studies, which remains a concern for AF ablation in geriatric patients.[21] Furthermore, the incidence of postoperative bradycardia and hypotension was higher in older patients who underwent ablation under sedation.

Additionally, four patients required a temporary pacemaker that was withdrawn on the day after ablation.

Interestingly, we observed that an increased LA diameter before ablation was a significant predictor of complications but not of an extended procedure, probably because the enlarged LA

diameter increased the difficulty of the ablation procedure (due to more ablation points), hampered visualization of the fluoroscopic image, and unusual catheter operations were required because of morphological changes in the LA. Therefore, indications for ablation should be carefully considered in older patients with an enlarged LA diameter.

Previous studies have indicated that an increased LA diameter, persistent AF, and heart failure are predictors of AF recurrence.[22] However, we did not identify these factors as predictors of AF recurrence; this might be attributed to the low rate of AF recurrence. Similarly, the effectiveness of ablation is limited in frail patients.[23] However, 21 (21%) of our frail patients had a low AF recurrence rate and a favorable treatment course. Moreover, frailty was not a predictor of complications or AF recurrence, even though we treated several symptomatic patients with AF, including those with heart failure. Therefore, ablation is safe and effective for older patients and even for those with frailty.

Study limitations

This study has several limitations. First, the number of patients was relatively small because this study was performed at a single institution and included only patients aged ≥80 years. This might have affected our findings; indeed, in terms of determining the safety of AF ablation in geriatric patients, we were only able to identify a few predictors of complications and AF recurrence. Therefore, further studies with larger patient cohorts are required to validate our findings. Nevertheless, this study reflected real-world clinical settings. Second, although scars on the anterior wall of the LA were frequently observed in our patients, we could not assess all patients using voltage maps. This was because many patients were assessed based only on anatomical maps before PVI completion. Therefore, accumulating and analyzing more voltage map data may reveal new information. Third, our follow-up methods were limited to 12-lead ECG and Holter monitoring, and patients were not monitored over a long term. Therefore, some patients with recurrent AF may not have been identified. Finally, this was a retrospective study with inherent disadvantages of the study design. Hence, future prospective studies with blinded assessments should include validation cohorts to confirm these findings.

CONCLUSIONS

Although this was a single-center retrospective study, the AF recurrence rate after ablation was very low in patients aged ≥80 years. Treatment of AF with ablation is safe and effective in this age group and may prevent the progression of heart failure. The incidence of complications was relatively low. Nonetheless, caution should be exercised when patients with increased LA diameters undergo AF ablation.

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Ethics approval and consent to participate

All procedures involving human participants in this study were performed in accordance with the ethical standards of Tosei General Hospital and the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. This study was approved by the Bioethics Committee of Tosei General Hospital (No.1070). All patients provided written informed consent prior to participation.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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