

Radiofrequency catheter ablation of atrial fibrillation in older patients: outcomes and complications

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Abstract

Introduction Catheter ablation (CA) of atrial fibrillation (AF) has become a treatment option for younger patients with drug refractory AF. It is not known whether pulmonary veins (PV) have an important mechanistic role in elderly patients with AF or whether CA is an effective treatment for the elderly.

Methods We evaluated 240 consecutive patients that were referred to the electrophysiology laboratory for CA for AF using a PV antral isolation approach. Linear ablations were not routinely performed. Clinical outcomes and healthcare resource utilization was evaluated during the 12 months after CA in patients <65 years old (Group I; 91 patients), 65–75 years old (Group II; 88 patients), and >75 years old (Group III; 61 patients).

Results Older patients were more likely to have persistent atrial fibrillation (I: 24%, II: 34%, III: 66%). Major complication rates (I: 1%; II: 1%; III: 0%; $p=ns$) and minor complication rates (I: 4%; II: 5%; III: 5%; $p=ns$) were similar for all three groups. At 12 month follow-up younger patients were more likely to be in sinus rhythm without prolonged episodes of atrial fibrillation without antiarrhythmic drug therapy (AARx) (I: 94%, II: 84%, III: 61%). However in Group III, effective treatment (AF <1 h/mo \pm AARx) was achieved in 82% of patients. After radiofrequency catheter ablation, hospitalizations, emergency

room and nonroutine clinic visits decreased significantly for all three groups during the 12 months after RFA (I: pre 22; post: 3; Group II: pre 26; post 4; III: pre 20; post 2).

Conclusions CA can be effective for treating AF in selected older patients as stand-alone therapy or as hybrid therapy with AARx. PVs appear to be an important arrhythmogenic structure regardless of age. CA is associated with decreased healthcare resource utilization in all age groups.

Keywords Ablation · Atrial fibrillation · Elderly

It is estimated that more than 5 million people in the United States have atrial fibrillation [1]. The incidence of atrial fibrillation increases with age from <1% before age 50 to 8–10% in people >80 years [2]. Unfortunately drug therapy is ineffective for long term treatment of atrial fibrillation, with a 60% failure rate over a 2 year treatment period [3, 4]. Several studies have demonstrated that radiofrequency catheter ablation is an effective treatment for atrial fibrillation particularly in younger patients [5–9]. However, it is not known whether or not radiofrequency catheter ablation can be performed safely in older patients. The purpose of this study was to evaluate whether or not success rates and complication rates are affected by age.

1 Methods

1.1 Patient selection

Two hundred and forty consecutive patients with symptomatic atrial fibrillation and no prior left atrial catheter or surgical procedure that underwent pulmonary vein isolation catheter ablation at Mayo Clinic Florida between December

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2004 and December 2006 were included in this study. Patients were divided into three groups based on age. The three age groups that were identified prior to the initiation of the study were <65 years, between 65 years and 75 years, and >75 years. The study was approved by the Mayo Clinic Institutional Review Board.

1.2 Ablation technique

Radiofrequency catheter ablation was performed using an 8 mm tipped catheter using temperature control to 60°C limiting power to 55 W. Ablation was performed in the left atrium at a position where pulmonary venous activation became disorganized with left atrial pacing. For patients in persistent atrial fibrillation, internal cardioversion was performed and ablation was performed with the patient in sinus rhythm. Ablation at a single location was stopped when one of two endpoints, 20 s or >50% attenuation in electrogram voltage, was reached. Esophageal location was monitored continuously by intracardiac echocardiography. Ablation strategy was chosen to avoid regions of left atrial tissue that were immediately adjacent to the esophagus or if ablation could not be avoided in a region near the esophagus, cryoenergy was used. Ablation was performed until isolation was reached confirmed by use of a 64 electrode basket catheter (Figs. 1 and 2). Endpoints for isolation included loss of pulmonary vein potentials with evidence for exit block (Exit block of spontaneous potentials or no atrial activation despite pacing from within the pulmonary veins with 10 mA), or dissociation of pulmonary vein activity from atrial activity (Fig. 2). No linear lines within the left atria were performed. Focal left atrial ablations were performed as required for atrial tachycardia but mapping for complex fractionated atrial electrograms was not performed. A cavotricuspid isthmus line was not routinely done unless the patient spontaneously developed typical atrial flutter during the procedure confirmed by entrainment mapping.

Patients were followed in clinic at 1 month, 6 months, and 12 months. Patients that developed recurrent atrial fibrillation within the first 90 days underwent cardioversion or repeat ablation. Data analysis was started 90 days after the initial ablation procedure. Antiarrhythmic medication was used based on the investigator's judgment during the first 90 days. After 90 days antiarrhythmic medication was stopped. After the first 90 days, patients with recurrent arrhythmia were treated with antiarrhythmic medication or repeat catheter ablation based on the medical situation and patient preference. Twenty-four hour ambulatory electrocardiogram monitoring, 30 day event recorder, or 21 day mobile cellular outpatient telemetry was performed whenever the patient had symptoms, when stopping anticoagulation was being considered, or 12 months after the index ablation procedure prior to clinic evaluation. Episodes >2 min were considered significant.

Healthcare resource utilization was evaluated by evaluation of the medical record and direct questioning of the patient at clinic follow-up visits.

1.3 Statistical methods

Continuous data among groups was evaluated using analysis of variance. Categorical variables were compared using a chi squared or Fisher exact test. Kaplan Meier curves are provided for comparison. Data are reported as mean \pm standard deviation. *P* values <0.05 were considered significant.

2 Results

Patients were divided into three prespecified groups based on age: <65 years (Group I), 65–75 years (Group II), and >75 years (Group III): The characteristics of the patient groups are shown in Table 1. Group III patients were more likely to be women, were more likely to have persistent atrial fibrillation. Prior to radiofrequency catheter

Fig. 1 *Left*, angiogram of the left upper pulmonary vein. *Right*, 64 electrode basket catheter deployed within the pulmonary vein and left atrium. The 64 pole electrode catheter is placed so that electrograms from the entire vein circumference can be obtained and it is positioned so that electrodes 4 and 5 correspond to the approximate location of the pulmonary vein os

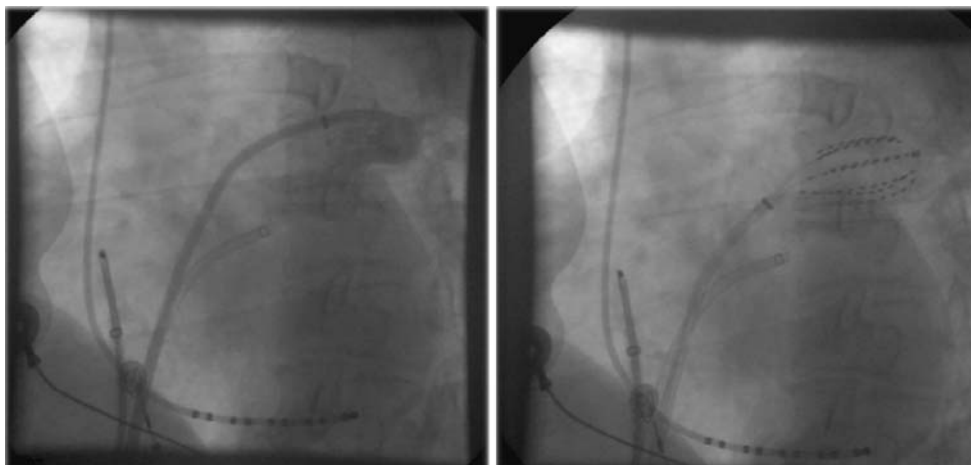
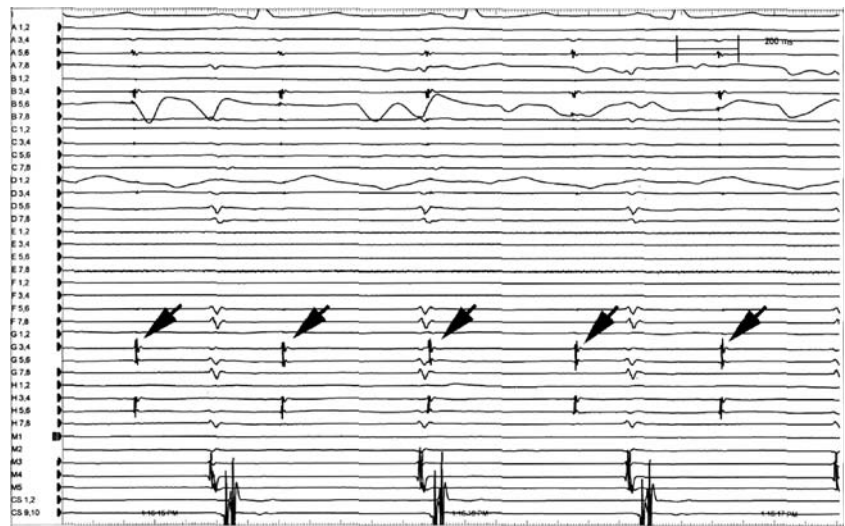


Fig. 2 Persistent pulmonary vein tachycardia (*arrows*) within the left upper pulmonary vein after isolation



ablation, antiarrhythmic medications were being used in 77 patients in Group I (amiodarone: 36; Class IC: 23; Class III: 18), 83 patients in Group II (amiodarone: 52; Class IC drug: 12; Class III: 19), and all 61 patients in Group III (amiodarone: 54; Class IC drug: 2; Class III: 5).

There was no significant difference in overall complication rates detected among the three groups. Minor complications were observed in 4% of Group I patients, 5% of Group II patients, and 5% of Group III patients. In the study, two significant complications were observed. One patient in Group I had a significant retroperitoneal hematoma that required blood transfusion and a 5 day hospitalization 1 week after her radiofrequency catheter ablation. A patient in Group II developed a pericardial effusion during the ablation procedure that did not require pericardiocentesis but was associated with an additional 2 day stay in the intensive care unit and an extended overall hospital stay of 4 days.

Acutely all patients were in sinus rhythm at the end of the procedure. During the first 90 days, 78 additional procedures for the treatment of atrial fibrillation were performed. Cardioversions were performed in 14 patients in Group I, 18 patients in Group II, and 18 patients in Group III. Repeat radiofrequency catheter ablations were performed in 11 patients in Group I, 14 patients in Group II, and three patients in Group III. After the initial 90 day period from the initial ablation procedure, the percentage of patients in sinus rhythm without subsequent (>90 day) treatment with antiarrhythmic medications, repeat catheter ablations, or cardioversions is shown in Fig. 3(a). Patients in Group I were more likely to be in sinus rhythm without subsequent use of catheter ablation, cardioversion, or antiarrhythmic medication. Between months 3 and 12, 18 procedures for atrial fibrillation were performed. Cardioversion was performed in 0 patients in Group I, 3 patients in Group II, and 5 patients in Group III. and repeat radiofrequency catheter ablation was performed in one patients

in Group I, 3 patients in Group II, and 6 patients in Group III. Successful rhythm control at 1 year for all three groups is shown in Fig. 3(b). At 1-year follow-up, 96% of patients in Group I, 95% of patients in Group II, 82% of patients in Group III were in sinus rhythm. For maintenance of sinus rhythm antiarrhythmic medications were used in one patient in Group I (Class III antiarrhythmic medication), 5 patients in Group II (Class IC drug: 2; Class III: 3), and 13 patients in Group III (amiodarone: 6; Class IC drug: 5; Class III: 2).

During the 12 month follow-up after radiofrequency catheter ablation, emergent evaluations such as hospitalizations, emergency room, and nonroutine clinic visits decreased significantly for all three groups (I: pre 22; post: 3; Group II: pre 26; post 4; III: pre 20; post 2). However, 96 elective cardiac procedures for treatment of recurrent atrial fibrillation were required after the initial radiofrequency catheter ablation (38 repeat ablations and 58 cardioversions).

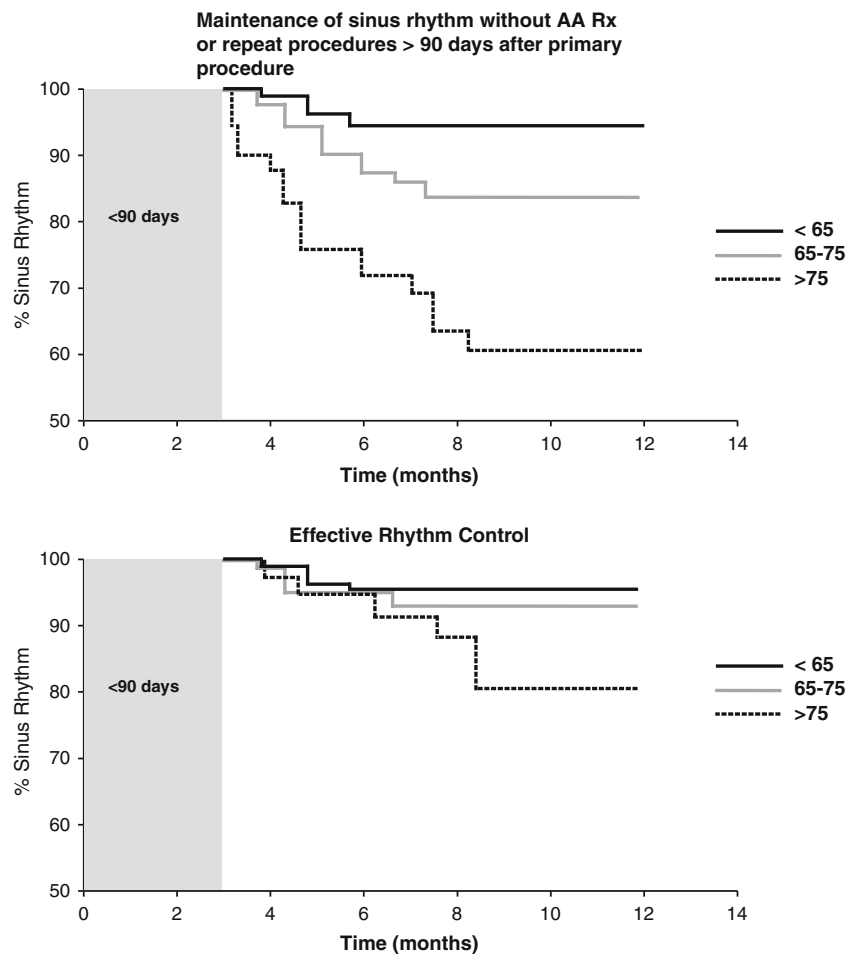
3 Discussion

Radiofrequency catheter ablation has emerged as an important treatment option for selected patients with drug

Table 1 Baseline characteristics of the patients

	<65 years	65–75 years	>75 years	Statistics
Patients (n)	91	88	61	
Gender M/F	72/19	64/24	37/24	
Age	56±6.7	69±2.4	78±2.7	
Atrial fibrillation:				
Paroxysmal	76%	66%	34%	<i>P</i> <0.01
Persistent	24%	34%	66%	
CHADS score	0.6±0.6	1.0±0.7	1.8±0.5	<i>P</i> <0.01

Fig. 3 *Top.* Kaplan Meier curves showing maintenance of sinus rhythm without adjunctive therapy such as repeat ablation or antiarrhythmic drug therapy (AARx) after 90 day “blanking” period following the initial radiofrequency catheter ablation for the three age groups. *Bottom.* Kaplan Meier curves showing maintenance of sinus rhythm with adjunctive therapy such as repeat radiofrequency catheter ablation or antiarrhythmic drug therapy after the 90 day “blanking” period for the three age groups



refractory atrial fibrillation. The current study suggests that radiofrequency catheter ablation can be performed successfully in older patients with no significant increase in complication rates. In a group of older patients with drug refractory atrial fibrillation (>90% with failure or significant side-effects with of amiodarone), radiofrequency catheter ablation with adjunctive antiarrhythmic drug therapy was effective in maintaining sinus rhythm in 82% of patients at 1 year. More importantly, no major complications were observed in the >75 year old patient group and minor complication rates were similar among all three age groups.

Initial reports on radiofrequency catheter ablation evaluated younger patients with atrial fibrillation [5–7]. Two studies have specifically evaluated the use of radiofrequency catheter ablation in older patients. One preliminary study found similar efficacy for radiofrequency catheter ablation in patients <70 years and >70 years, but found that the incidence of thromboembolic events was four times higher in patients >70 years [10]. More recently, Nademanee and colleagues evaluated the effects of catheter ablation on

atrial substrate by targeting complex fractionated atrial electrograms [11]. In a group of 635 patients with a mean age of 67 ± 12 years and 27% of patients >75 years, 84% of patients remained in sinus rhythm after a mean follow-up of almost 2 years. Similar to our study antiarrhythmic medications were a useful adjunctive therapy and were used in 13% of patients that were in sinus rhythm. Importantly they found that maintaining sinus rhythm was associated with a significant increase in survival.

The current study suggests that the pulmonary veins remain an important mechanistic cause for atrial fibrillation in a substantial portion of elderly patients. It is possible that additional ablation of complex fractionated atrial electrograms would have increased success rates in the current study but at the cost of additional ablation lesions that might not be necessary in an individual patient.

Radiofrequency catheter ablation is associated with a reduction in emergent healthcare resource utilization. However, there are significant costs associated with an ablation strategy because of the requirement for additional procedures such as cardioversion and repeat ablation. In

addition, rate control will remain the most commonly used and most cost effective strategy for the majority of elderly patients with atrial fibrillation, with radiofrequency catheter ablation reserved for selected very symptomatic patients with few comorbidities [12].

The major limitation of this study is that it is a single center study and while age group evaluation and endpoints were prespecified there is no randomized control group of patients treated with medical therapy. However, the goal of the study was not to compare radiofrequency catheter ablation with drug therapy but rather to determine whether radiofrequency catheter ablation is a feasible option in the elderly. The important finding of this study is that radiofrequency catheter ablation can be considered in the elderly and that radiofrequency catheter ablation may have a potential adjunctive role in patients where maintenance of sinus rhythm is important for treatment of symptoms. Another limitation of the study is the absence of echocardiographic data on left atrial size and function.

4 Conclusions

Catheter ablation for atrial fibrillation can be safely performed in selected older patients. The pulmonary veins remain an important mechanistic cause for atrial fibrillation in a subset of older patients. Radiofrequency catheter ablation can be effectively combined with drug therapy to maintain sinus rhythm. Although effective in reducing urgent hospitalizations and emergency department visits, radiofrequency catheter ablation can be associated with significant utilization of healthcare resources due to the additional procedures that are often required to maintain sinus rhythm.

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