Mortality and safety of catheter ablation for antiarrhythmic drug-refractory ventricular tachycardia in elderly patients with coronary artery disease

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BACKGROUND As the population ages, recurrent ventricular tachycardia (VT) is increasingly encountered in elderly patients with ischemic heart disease. Radiofrequency catheter ablation is useful for reducing VT therapy in patients with an implantable defibrillator. The utility of radiofrequency catheter ablation in the elderly is not well defined.

OBJECTIVE The purpose of this study was to evaluate the prognosis and safety of radiofrequency catheter ablation of postinfarct VT in elderly patients.

METHODS Radiofrequency catheter ablation was performed in 285 consecutive patients with recurrent postinfarct VT refractory to antiarrhythmic drugs. Mortality and outcomes were compared for an elderly group (age $\geq$75 years, n = 72) and a younger group (age $<$75 years, n = 213).

RESULTS The groups were similar with regard to baseline characteristics, except for a greater number of females in the elderly group (20.8% vs 10.8%, $P = .03$). Inducible VTs were abolished or modified in 79.2% of the elderly group and 87.8% of the younger group ($P = .12$). Major complications occurred in 5.6% of elderly patients and 2.3% of younger patients ($P = .48$). Periprocedural mortality was similar between both groups (2/72 in elderly and 9/213 in younger group, $P = .74$). During mean follow-up of 42 $\pm$ 33 months, 50.0% of the elderly group and 35.2% of the younger group died ($P = .08$). No VT was observed in 63.9% of the elderly patients and 60.1% of the younger patients, respectively (mean follow-up 18 $\pm$ 24 months, $P = .80$).

CONCLUSION Outcomes of catheter ablation are similar for selected elderly and younger patients. Advanced age should not preclude ablation when recurrent VT is adversely affecting quality of life in elderly patients who otherwise have a reasonable expectation for survival.

KEYWORDS Catheter ablation; Elderly; Coronary artery disease; Mortality; Radiofrequency catheter ablation; Safety; Ventricular tachycardia

ABBREVIATIONS ICD = implantable cardioverter-defibrillator; **LV** = left ventricle; **VT** = ventricular tachycardia

(Heart Rhythm 2010;7:740–744)

Introduction

Sustained ventricular tachycardia (VT) is an important cause of morbidity and mortality in patients with ischemic heart disease. Although implantable cardioverter-defibrillators (ICDs) reduce the risk of sudden death,[1,2] shocks are associated with reduced quality of life,[3] and episodes of VT are associated with reduced survival.[4] VT ablation is an effective therapy for reducing recurrent arrhythmias.[5,6] However, due to the complex underlying substrate, poor left ventricular function, and associated comorbidities, the success rates of ablation are lower for VT than for other arrhythmias, and a higher rate of complications is anticipated.[7,8]

The efficacy and risk of invasive procedures are generally less favorable in elderly compared with younger patients. Complication rates for supraventricular arrhythmias and atrial fibrillation have been reported to be similar in older and younger patients, although the risk of ablation of an accessory pathway may be increased in the elderly.[9–13] Furthermore, mortality due to ischemic heart disease is greater in the elderly regardless of arrhythmia.[14] These considerations favor avoidance of invasive procedures in the elderly, but the mortality, safety, and efficacy of catheter ablation of VT in elderly patients with coronary artery disease have not been well defined.

Dr. Roberts-Thomson is the recipient of a Postgraduate Research Scholarship from the National Health and Medical Research Council of Australia (NHMRC grant ID 489417) and the Astra-Zeneca Fellowship in Medical Research from the Royal Australian College of Physicians. Dr. Seiler has received a research grant from St. Jude Medical (Switzerland). Dr. Steven has received a research grant from Biosense Webster. Dr. Tedrow has received research grants from Biosense Webster and Boston Scientific, and speaking honoraria from Boston Scientific, Medtronic, and St. Jude Medical. Dr. Koplan is a consultant for Boston Scientific and St. Jude Medical and has received speaking honoraria from Boston Scientific, Medtronic, and St. Jude Medical. **Address reprint requests and correspondence:** Dr. Keiichi Inada, Cardiovascular Division, Department of Medicine, Brigham and Women's Hospital, 75 Francis Street, Boston, Massachusetts 02115. E-mail address: kinada@partners.org. (Received December 23, 2009; accepted February 10, 2010.)

1547-5271/$ -see front matter doi:10.1016/j.hrthm.2010.02.019

Methods

Study subjects

Data from a total of 289 consecutive patients with coronary artery disease and a prior myocardial infarction referred for VT ablation between January 1999 and September 2008 were reviewed. Patients who underwent only ethanol or cryothermal ablation (n = 4) were excluded. The study consisted of 285 consecutive VT patients who were divided into two groups according to age ≥75 years (elderly group) and <75 years (younger group).

Electrophysiologic study

Each patient gave written informed consent. Studies and data review were performed according to protocols approved by the Human Research Committee of Brigham and Women's Hospital. Ventricular mapping and ablation were performed with saline irrigated or nonirrigated tip catheters as previously described.[15–17] The mapping catheter was advanced into the left ventricle (LV) by either a retrograde aortic or a transseptal approach. Intravenous heparin boluses were administered to maintain the activated clotting time >250 seconds. Conscious sedation was achieved with fentanyl and midazolam.

Electroanatomic mapping was performed with the CARTO system (Biosense Webster, Diamond Bar, CA, USA). Bipolar electrograms were bandpass filtered from 30 to 500 Hz and digitally recorded along with a 12-lead surface ECG CardioLab EP system (General Electric Healthcare, Buckinghamshire, UK).

VT was induced with up to three extrastimuli from the right ventricular apex. Ablation was guided by substrate mapping with or without entrainment mapping depending on VT stability.[16] A total of 22 patients with failed endocardial ablation underwent percutaneous epicardial mapping and ablation as described by Sosa et al.[18,19] Irrigated radiofrequency ablation was performed generally starting at 30 W and titrated to a maximum of 50 W. For nonirrigated ablation, energy was titrated to achieve a temperature of 60°C or a maximum power of 50 W.[20] Applications were repeated in an area until pacing at 10 mA at 2-ms stimulus strength failed to capture.

VT inducibility was assessed using programmed stimulation with up to three extrastimuli after 600-ms and 400-ms basic drive and burst pacing from the right ventricle. *Sustained VT* was defined as VT having a duration ≥30 seconds. *Acute success* was defined as the inability to induce any sustained VT or modification of inducible VTs with abolition of one or more clinical or presumptive clinical VTs.[6] *Procedural failure* was defined as persistently inducible clinical or presumptive clinical VT. VT inducibility was not assessed after ablation if we believed that VT could adversely affect hemodynamic stability. After the procedure, patients were treated with heparin for the initial 24 to 48 hours, followed by either aspirin or warfarin.

Follow-up

After ablation, all patients were observed with continuous ECG monitoring until hospital discharge. After discharge, all patients had follow-up either at an outpatient clinic or with their referring cardiologist. Recurrent VT was evaluated based on ECG recordings, 24-hour ambulatory monitoring, and/or ICD interrogation. In addition, the Social Security Death Index database queried between June 2 and June 6, 2009, was used to evaluate mortality. Periprocedural mortality was defined as death within 10 days of the procedure.

Major complications were defined as those that resulted in permanent adverse effect, required surgical intervention, or required or delayed hospitalization.[21] For patients with multiple procedures, the last procedure was included in the analysis, and follow-up was assessed from that procedure.

Statistical analysis

Values are expressed as mean ± SD. Comparison between groups was performed using Student's t-test (unpaired). Proportions were compared using Chi-square analysis. Differences with $P < .05$ were considered significant. Survival curves were created and compared using the Kaplan-Meier method.

Results

Patient characteristics

Clinical characteristics, except for age and gender, were similar between the elderly and younger groups (Table 1). The elderly group had more females than did the younger group (20.8% vs 10.8%, $P = .03$). All patients had failed antiarrhythmic therapy. Amiodarone was used in 59 (82%) of the elderly patients and 154 (72%) of the younger patients. Sotalol was used in 6 (8%) of the elderly patients and 32 (15%) of the younger patients.

Acute ablation outcome

Procedural characteristics and outcome are listed in Table 2. The number of inducible sustained monomorphic VTs (range 1–8) was not different between the two groups (2.7 ± 1.5 in the elderly group and 2.4 ± 1.5 in the younger group, $P = .20$). Elderly patients tended to have slower VTs (Table 2). Ablation was guided based only on substrate mapping during sinus or paced rhythm in 14 (19.4%) elderly patients and 68 (31.9%) younger patients, whereas both substrate and

Table 1 Clinical characteristics of the elderly and younger groups

	Elderly group ≥75 years (n = 72)	Younger group <75 years (n = 213)	*P* value
Mean age (years)	78.9 ± 3.5	62.1 ± 8.9	<.0001
Gender (male/female)	57/15	190/23	.03
ICD prior to procedure	66 (91.7%)	188 (88.3%)	.62
Time since last MI (months)	142.1 ± 114.3	127.2 ± 106.0	.43
Ejection fraction (%)	28.5 ± 10.4	28.7 ± 13.0	.94
Coronary artery bypass graft	38 (52.8%)	111 (52.1%)	.95
MI site			.39
Anterior	20 (27.8%)	51 (23.9%)	
Inferior	47 (65.3%)	136 (63.8%)	
Anterior + inferior	3 (4.2%)	19 (8.9%)	
Prior ablation procedure	32 (44.4%)	97/116 (45.5%)	.87
No. of procedures	1.6 ± 0.7	1.7 ± 1.1	.22

Values are given as number (%) or mean ± SD.
ICD = implantable cardioverter-defibrillator; MI = myocardial infarction.