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NEW RESEARCH PAPERS

Should the Aortic Root Be the Preferred Route for Ablation of Focal Atrial Tachycardia Around the AV Node?

Support From Intracardiac Echocardiography

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ABSTRACT

OBJECTIVES The purpose of this study was to determine the optimal approach to focal atrial tachycardia originating from around the atrioventricular node.

BACKGROUND Focal atrial tachycardia (FAT) demonstrating earliest activation around the atrioventricular (AV) node during right atrial (RA) mapping has been eliminated by ablation at the RA para-Hisian region, from the left atrium (LA) or the noncoronary aortic cusp (NCC). However the optimal approach has not been determined.

METHODS We conducted a retrospective analysis of a consecutive series of 148 patients undergoing catheter ablation for FAT between 2006 and 2014 in our institution.

RESULTS Earliest activation was recorded in the peri-AV nodal region during RA mapping in 34 patients (23%). Of these, 7 patients (20.5%) had successful ablation at the RA septum, using either radiofrequency (n = 4) or cryoenergy (n = 3). Seven FATs (20.5%) were ablated from the LA at the region of the aortomitral continuity, and 20 patients (59%) had successful ablation in the NCC, including 1 patient with a recurrence after a temporarily successful cryoablation from the RA. The proportion of the 3 approaches in this series showed a significant temporal evolution and overall frequency favoring ablation in the NCC ($p = 0.011$ for time trend and 0.013 for actual vs. expected frequencies). Intracardiac echocardiography proved superior catheter stability with the NCC approach. There were 2 cases of atrioventricular block and 1 recurrence after RA ablation versus no complications or recurrent FAT with NCC and LA approaches.

CONCLUSIONS Most peri-AV nodal FATs can be safely and effectively ablated from the NCC. The strategy of preferential NCC approach avoids RA para-Hisian ablation with the accompanying risk of AV block. (J Am Coll Cardiol EP 2016;2:193–9)

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Focal atrial tachycardia (FAT) often originates from predilection sites including the crista terminalis and coronary sinus (1). During development, these sites initially retain their primitive phenotype and have spontaneous pacemaker activity. Another region with an initially primary myocardium phenotype is the atrioventricular (AV) canal. Bundles of specialized myocardium surround the right and left AV rings, and the so-called retroaortic node is formed at their junction in the region of the right fibrous trigone (3). Later during development, the conduction system phenotype becomes confined to the AV node, but remnants of nodal-type AV canal myocardium may be found around the AV rings of adult hearts (4). These vestiges have been connected to the frequent localization of both FAT and

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ABBREVIATIONS AND ACRONYMS

AMC = aortomitral continuity

FAT = focal atrial tachycardia

ICE = intracardiac echocardiography

LA = left atrium

LCC = left coronary cusp

NCC = noncoronary cusp

RA = right atrium

RCC = right coronary cusp

ventricular tachycardia to the AV rings and especially around the AV node (4–6).

Peri-AV nodal FAT is amenable to catheter ablation from multiple approaches including right atrial (RA) or, by transseptal puncture, left atrial (LA) access (7). Recently, ablation from the centrally positioned noncoronary cusp (NCC) of the aortic root has been introduced with much success (8–10). However the optimal approach to peri-AV nodal FAT has not been determined.

METHODS

STUDY POPULATION. With Institutional Review Board approval (no. 3587/2015), we retrospectively studied 148 patients undergoing catheter ablation for FAT in our institution from the time of the publication of the first series of FAT cases ablated from the NCC of the aortic valve (2006) (9), until the end of 2014. Of these, origins of FAT in 34 patients (23%) were mapped to a site adjacent to the AV node (within 1 cm of the maximal His-potential recording site) during right-sided mapping, including the coronary sinus (CS). These patients were grouped according to the site of the ultimate, permanently successful ablation: RA, LA, or NCC. Their clinical characteristics are summarized in **Table 1**.

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ELECTROPHYSIOLOGY PROCEDURE. After giving informed consent, patients underwent an electrophysiological (EP) study under light sedation (midazolam with or without fentanyl). After right and/or left femoral vein puncture, quadripolar EP catheters were positioned in the right ventricular apex and RA His bundle region, and a decapolar catheter was placed in the CS. A standard stimulation protocol at baseline and isoproterenol infusion (up to 5 μg/min), including atrial and ventricular burst, and extrastimulation was carried out to study AV and ventriculoatrial (VA) conduction, as well as induce tachycardia. The latter was diagnosed as FAT if it showed a centrifugal atrial activation pattern and overdrive pacing from the ventricle during tachycardia resulted in VAAV response (11). A steerable, roving EP catheter was used to map activation timing throughout the RA and exclude RA-free wall FAT. All FATs included in this study showed earliest RA activation in the para-Hisian region. Early during this 9-year experience, the LA was also mapped in most cases of peri-AV nodal FAT, and ablation was delivered to whichever atrium showed earlier activation. In the last 3 years, the approach changed, and the aortic root became the next area of mapping after the RA. After this time, the LA was mapped only when timing was considerably later or ablation failed in the NCC. The LA was approached through transseptal puncture and the aortic root through the right femoral artery. Intracardiac echocardiography (ICE) was used by advancing the ultrasound catheter (AcuNav, Biosense Webster, South Diamond Bar, California) to the RA for guiding catheter positioning in the NCC or LA. Coronary or aortic angiography was not performed. The surface p wave polarity in lateral (I, aVL) and inferior (II, III, and aVF) leads and in lead V_1 was classified as positive, negative, or isoelectric in relation to the baseline by an examiner blinded to procedural data. Local timing of atrial activation during FAT was determined relative to the CS ostium as a reference.

TABLE 1 Clinical Characteristics of Patients

	RA (n = 7)	NCC (n = 20)	LA (n = 7)	p Value
Age, yrs	51 ± 18	66 ± 9	57 ± 19	0.04
% of females	71	80	100	NS
% with hypertension	57	82	57	NS
% with diabetes	14	21	14	NS
% with persistent/incessant FAT	0	10	29	NS
LVEF, %	67 ± 8	63 ± 7	59 ± 10	NS
LAd, mm	48 ± 13	44 ± 5	37 ± 6	NS

Values are mean ± SD or %.

FAT = focal atrial tachycardia; LA = left atrium; LAd = left atrial diameter; LVEF = left ventricular ejection fraction; NCC = noncoronary cusp; NS = not significant; RA = right atrium.

Radiofrequency (RF) ablation was performed using a 7-F 4-mm-tip ablation catheter (Celsius or Navistar, Biosense Webster or AlCath, Biotronik, Berlin, Germany) with a target temperature of 60°C and a maximal power output of 30 W for 60 s. Cryoablation was carried out using a 4- or 6-mm-tip cryoablation catheter (Freezor; Medtronic, Edgewater, Maryland), with a target temperature of −80°C, for 4 min. During ablation, AV conduction was carefully assessed, and any prolongation or block was noted, prompting halting of energy delivery. The choice of the ablation energy (RF or cryoablation) was made at the discretion of the operator.

STATISTICAL ANALYSIS. Continuous data are mean ± SD and were compared using Student's *t* test or 1-way ANOVA. Proportions were compared by using the chi-square test, with the Mantel-Haenszel method for temporal trend and assuming equal distribution of expected frequencies. All analyses were carried out using SPSS software (SPSS Inc., Chicago, Illinois). A p value of <0.05 was considered statistically significant.

RESULTS

CATHETER ABLATION. Right atrial ablation. Of the 34 patients with peri-AV nodal FAT, 14 (41%) had