

Comparison of strategies for catheter ablation of focal atrial tachycardia originating near the His bundle region



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BACKGROUND Recent studies have suggested that para-Hisian atrial tachycardia (AT) can be successfully ablated from the right atrium (RA), left atrium (LA), or noncoronary cusp (NCC) in the aorta; however, the best approach remains unclear.

OBJECTIVE This study aimed to compare different approaches to radiofrequency catheter ablation (RFCA) of para-Hisian AT.

METHODS We retrospectively analyzed 68 consecutive patients (49[72%] women; mean age 61 ± 13 years) treated with RFCA for this type of AT. Mapping of the RA (n = 68), LA (n = 21), and NCC (n = 52) was performed during AT to identify the earliest activation site and to apply RFCA.

RESULTS RFCA successfully terminated AT in the RA in 13 of 28 patients (46.4%), in the LA in 4 of 16 patients (25.0%), and in the NCC in 46 of 52 patients (88.5%) after 1 procedure ($P < .05$).

Atrioventricular block occurred only during RFCA in the RA in 4 of 28 patients (14.3%). After a mean follow-up of 33.5 ± 25.4 months, AT recurrence was observed in 5 of 13 patients (38.5%) ablated in the RA, 1 of 4 (25.0%) ablated in the LA, and 2 of 46 (4.4%) ablated in the NCC ($P < .05$). RFCA in the LA was effective only if the local activation time (LAT) was earlier than that in the RA. RFCA in the NCC was successful regardless of the LAT ($P < .05$).

CONCLUSION Mapping and ablation in the NCC should be always considered in cases of AT originating from the His bundle region, regardless of the LAT.

KEYWORDS Radiofrequency ablation; His bundle; Perinodal atrial tachycardia; Noncoronary aortic cusp; AV block; Mapping

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Introduction

Radiofrequency catheter ablation (RFCA) of para-Hisian atrial tachycardia (AT) represents a challenging task due to their anatomical proximity to the conduction system and the consequent risk of complete atrioventricular (AV) block.^{1,2} Several studies have suggested that para-Hisian ATs can be successfully ablated from the right atrium (RA), left atrium (LA), or noncoronary cusp (NCC) in the aorta.^{3–17} Currently, there are little and incomplete data comparing these different approaches for the treatment of para-Hisian ATs.^{3,7,8,12–16} Therefore, we aimed to compare the prevalence, safety, and efficacy of RFCA at different sites to ablate ATs arising near the AV node.

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Methods

Among 502 consecutive patients who underwent RFCA of ATs at 9 centers in Russia (6 centers; 329 patients), Kazakhstan (1 center; 39 patients), and Italy (2 centers; 134 patients) between January 31, 2006 and February 1, 2016, the AT originated near the His bundle (HB) region in 68 patients (13.6%; 72% women; mean age 61 ± 13 years). All 68 patients had documented sustained AT and were referred for RFCA after obtaining written informed consent under approval of the institutional review board of the 9 centers.

Electrophysiology study

All procedures were performed under conscious sedation. All antiarrhythmic drugs were withdrawn at least 5 half-lives before the procedure. Three or 4 catheters were introduced via the femoral and/or jugular veins and positioned at the RA, right ventricular apex, coronary sinus, and HB region

(in some cases, catheters were moved from one site to another). Bipolar electrograms (EGMs) were filtered at 30 to 500 Hz, and unipolar EGMs were filtered at 0.05 to 500 Hz. Overdrive atrial pacing and premature extrastimuli were used to induce AT. Intravenous isoproterenol (up to 5 µg/min) was administered if AT was not inducible or was nonsustained at baseline. The following criteria were used to confirm the diagnosis of focal AT: inability to advance atrial activation by premature ventricular beats delivered during tachycardia at a time of HB refractoriness; tachycardia induction and the maintenance of independent AV nodal conduction or the presence of anterograde AV block during tachycardia; and an intracardiac EGMs sequence immediately after ventricular-paced beats, showing an A-A-V pattern.¹⁸

Activation mapping was performed conventionally in 26 patients (38%) or with 3-dimensional electroanatomic mapping system in 42 patients (62%) (CARTO XP, CARTO 3, Biosense Webster, Inc., Diamond Bar, CA). Initially, the RA was mapped and when the earliest activation site (EAS)

was located closely to the HB, further detailed mapping of the LA via a transseptal approach and/or mapping of the NCC through a retrograde aortic approach was performed according to the operator's choice. Local activation time (LAT) was calculated as the time difference between earliest RA activation at the HB region and local EGM. Both the LAT and the timing of the onset of the local EGM in relation to the earliest onset of the P wave on the surface electrocardiogram (AoP) were used to define the EAS. The duration of the intra-atrial signal (Adur) was calculated for each mapped site.

NCC mapping was performed in 52 patients and was guided by 3-dimensional electroanatomic mapping system in 32 patients (62%), intracardiac echocardiography (10-F ACUSON AcuNav, Siemens AG, Munich, Germany) in 16 patients (32%) (Figure 1), or conventional fluoroscopy in 20 patients (38%). No additional aortography was performed to facilitate NCC mapping and ablation in any patients. Upon fluoroscopic imaging, there can be an overlap between the right cusp and NCC in the left anterior oblique projection.

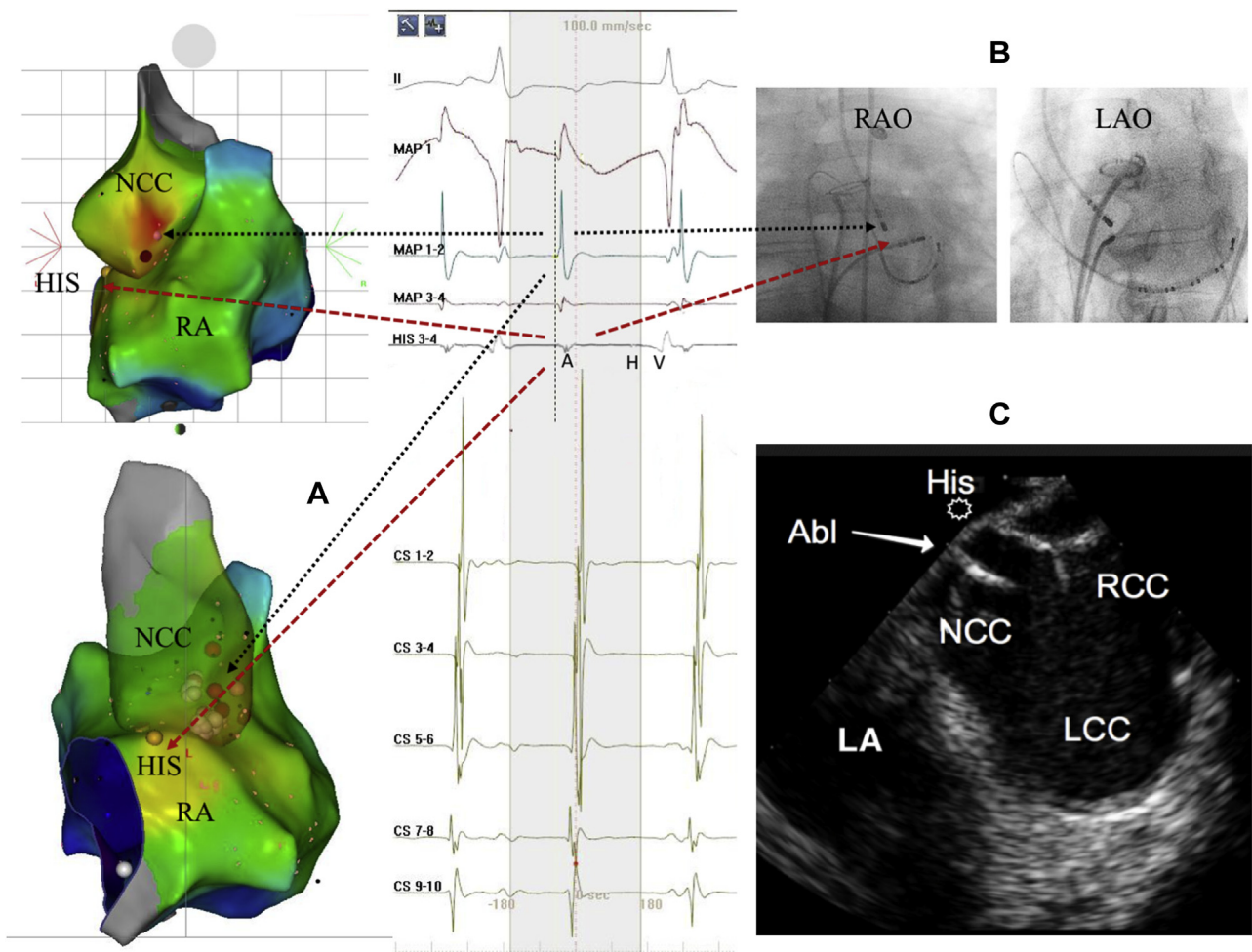


Figure 1 Activation mapping of atrial tachycardia using 3-dimensional electroanatomic maps (CARTO 3, Biosense Webster, Inc., Diamond Bar, CA) (A), fluoroscopic imaging (B), and intracardiac imaging (C). Left lateral and posteroanterior projection of the aortic root and the right atrium (RA) and their close anatomical relation are shown. An ablation catheter is positioned in the noncoronary cusp (NCC). The earliest activation site of the RA was at the His bundle region (HIS 3-4). The local activation time of the NCC is shown (MAP 1; MAP 1,2; and MAP 3,4). Ablation catheter in the NCC is indicated by a white arrow. A = atrium; CS = coronary sinus; H = His; LA = left atrium; LAO = left oblique projection; LCC = left coronary cusp; MAP and Abl = mapping and ablation catheter; RAO = right oblique projection; RCC = right coronary cusp; V = ventricle.

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