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Radiofrequency catheter ablation of atrioventricular node reentrant tachycardia in children with limited fluoroscopy

Moshe Swissa [a,b,*], Einat Birk [c], Tamir Dagan [c], Sody Abby Naimer [d], Michal Fogelman [c], Tom Einbinder [c], Elchanan Bruckheimer [c], Rami Fogelman [c]

[a] Kaplan Medical Center, Rehovot, Israel
[b] The Hebrew University, Jerusalem, Israel
[c] Schneider Children's Medical Center Israel, Petach Tikva, and Sackler School of Medicine, Tel Aviv University, Israel
[d] Department of Family Medicine, Siaal Family Medicine and Primary Care Research Center, Faculty of Health Sciences, Ben-Gurion University of the Negev, Beer-Sheva, Israel

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ABSTRACT

Background: Limited fluoroscopy cryo-ablation using a 3D electro-anatomical system (3DS) has been used for AVNRT in children. We aimed to facilitate a fluoroscopy limited approach of RF ablation of AVNRT in children.
Methods: A retrospective study was performed of procedure parameters in children undergoing RF ablation of AVNRT in 75 consecutive children (June 2011 to November 2013 — Group A) using standard fluoroscopy techniques compared to those of 64 consecutive children (December 2013 to May 2015 — Group B), using a fluoroscopy limited approach with 3DS.
Results: The acute success rate was 98.7% (74/75) and 98.4% (63/64) for groups A and B, respectively. The recurrence rate was 2.7% (2/74) and 0% (0/63) with a mean follow-up period of 45.5 ± 12.1 and 14.3 ± 6.1 months for group A and group B, respectively. The mean procedure and fluoroscopy times were significantly lower for group B compared to group A (119 ± 37 (43–203) and 0.83 ± 1.04 (0.05–3.83) minutes versus 146 ± 53 (72–250) and 16.1 ± 8.9 (4.39–55) minutes, $p < 0.003$ and $p < 0.0001$, respectively). There were no ablation-related complications.
Conclusions: A fluoroscopy limited approach for RF ablation of AVNRT in children using a 3DS is easily acquired and adapted, and significantly reduces the fluoroscopy and procedure time with excellent efficacy, safety and low recurrence rate.
Condensed ABSTRACT: This study confirmed that a 3D mapping system (3DS) to guide ablations of AVNRT in children reduces radiation exposure. Combined, limited fluoroscopy and 3DS in a methodology that resembles the familiar conventional fluoroscopy approach for RF ablation of AVNRT in children is proposed. Combined limited fluoroscopy and RF-energy in children with AVNRT are associated with a shorter procedure time, minimal fluoroscopy time, a high success rate and a low recurrence rate.

1. Introduction

Catheter ablation has revolutionized the treatment of supraventricular tachycardia (SVT) in children [1–3] and in particular for AVNRT however, despite the high efficacy it is still associated with atrioventricular block (0.5–1%) [4,5]. Fluoroscopy is traditionally used to guide catheter placement with reported times for AVNRT ablation ranging from 16 to 27 min [6–8]. Radiation exposure is associated with increased incidence of dermatitis, genetic defects, cataracts, and malignancy [9], especially in children [10], and the recent advent of 3D electro-anatomic mapping systems (3DS) have significantly reduced or eliminated radiation exposure with comparable safety and efficacy [11–15]. The use of cryoablation has been proposed to prevent AV block and the combination with 3DS may afford a fluoro-less slow pathway (SP) ablation for AVNRT in children [14,15]. However, cryoablation is associated with longer procedure times and a higher rate of recurrence 7–24% when compared to 3–5% using RF energy [4,5,8–10,16]. The aim of this study was to demonstrate that a combination of the advantages on procedure time and recurrence rate associated with RF

Abbreviations: SVT, supraventricular tachycardia; RF, radiofrequency; AVNRT, atrioventricular nodal reentrant tachycardia; 3DS, 3D electro-anatomic mapping system; AVB, atrioventricular block; RVA, right ventricular apex; HRA, high right atrium; CS, coronary sinus.

* Corresponding author at: Heart Institute, Kaplan Medical Center, P.O. Box 1, Rehovot 76100, Israel.
E-mail address: swissam@mail.huji.ac.il (M. Swissa).

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can be safely combined using 3DS with limited fluoroscopy with similar success to RF with regular fluoroscopy methodologies in a pediatric population.

2. Patients and methods

This study was conducted at The Schneider Children's Hospital of Israel, Division of Cardiology, Petach Tiqva, Israel. The database was built prospectively and the patient's records were reviewed with the approval of the institutional review board at the Schneider Children's Hospital of Israel.

2.1. Patients

From June 2011 to May 2015 139 children with AVNRT underwent RF ablation of the slow pathway (SP). Group A: the first 75 consecutive children (from June 2011 to November 2013) underwent RF ablation of the SP guided by the standard fluoroscopy approach. Group B: the next 64 consecutive children (from December 2013 to May 2015) underwent RF ablation of the SP guided by the 3DS and limited fluoroscopy. The inclusion criteria were symptomatic patients with documented SVT, confirmed to be AVNRT in EPS. The demographic and clinical data collected included the patient's age, gender, ethnicity, height, weight, body surface area, medical history and clinical manifestations.

2.2. Electrophysiological study (EPS)

EPS has been described in detail in a previous study [17]. All patients underwent EPS using the same protocol by two senior adult or pediatric electrophysiologists each with experience of over 10 years in this field. For group B, a 3DS (EnSite NavX™, St. Jude Medical, St. Paul, MN, US) was used to define anatomical and electrical landmarks and to reduce fluoroscopy time. An EPS was performed to ensure dual AV node

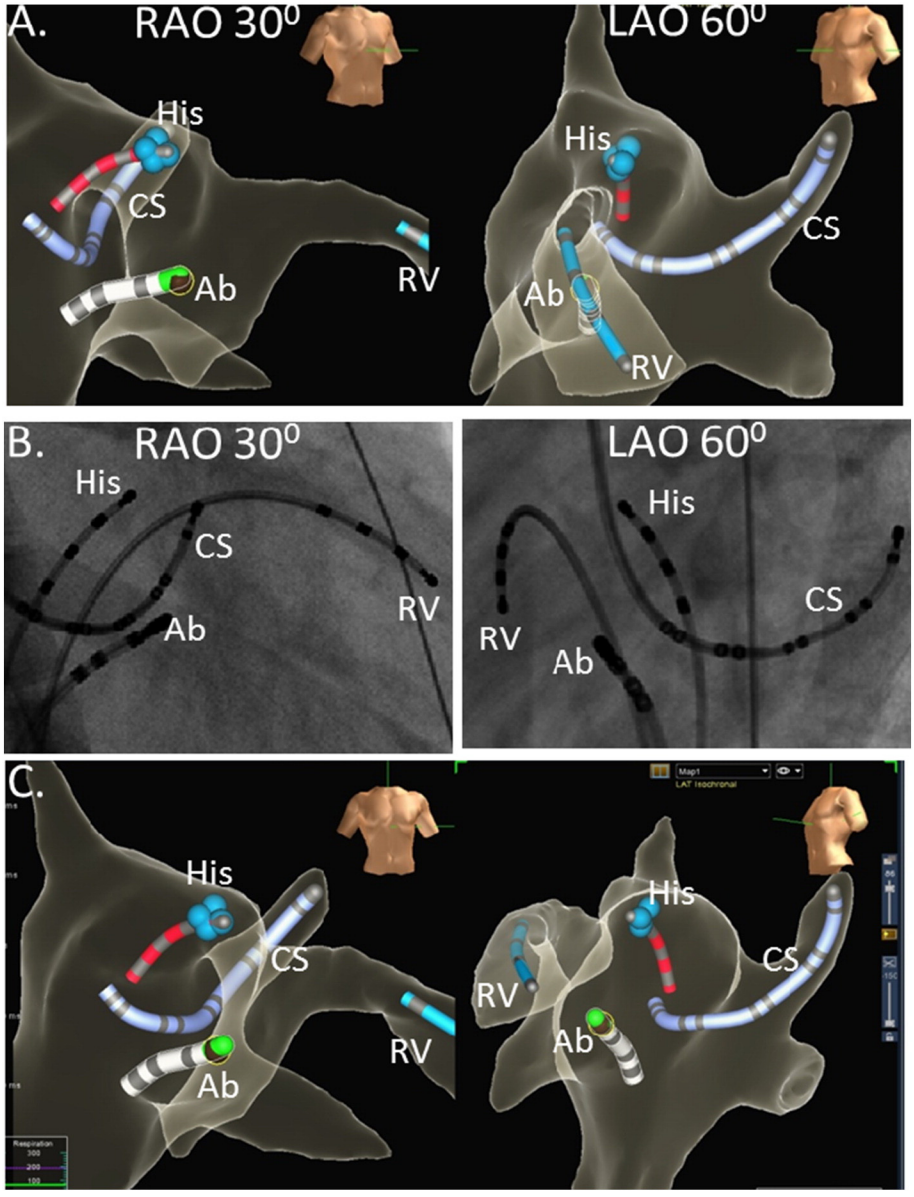

Fig. 1. A and B. A single biplane image by EnSite NavX™ mapping system in RAO 30° and LAO 60° views (A) and a single dual plane fluoroscopic image in RAO 30° and LAO 60° projection (B). It can be appreciated that the EP electrodes interrelated by these two methods are quite different in both views (especially the His and CS catheters in the RAO view and the RV and Ablation catheters in the LAO view). C. Rotating the acquired 3DS views (in Figure 1A) and scrolling up/down and right/left till achieving a perfect match with the fluoroscopy views (pay attention to the different catheter orientation and the body image (in the upper right corner) in panel A as compared to panel C). RAO — right anterior oblique, LAO — left anterior oblique, RA — right atrium, RV — right ventricle, CS — coronary sinus, Ab — ablation catheter.

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