Electroanatomical voltage mapping of atrial Mahaim potentials to guide catheter ablation

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Introduction

Ebstein's anomaly is associated with a wide range of cardiac dysrhythmias, including presence of 1 or more accessory pathways. We present a case of a girl with Ebstein's anomaly and symptomatic tachycardia. Electrophysiology study demonstrated a slow conducting decremental pathway as well as inducible antidromic reentrant tachycardia. Voltage mapping of the pathway potential was performed to locate and target the Mahaim fiber.

Case report

A 9-year-old girl with a history of moderate Ebstein's anomaly, pre-excitation, and hemodynamically unstable tachycardias (including wide complex tachycardia) underwent successful catheter ablation of 2 right free wall accessory pathways. Owing to hemodynamic instability after 5 hours of procedure time, she was left with a residual pathway and inducible tachycardia. Therefore, a repeat procedure was performed to ablate the tachycardia substrate.

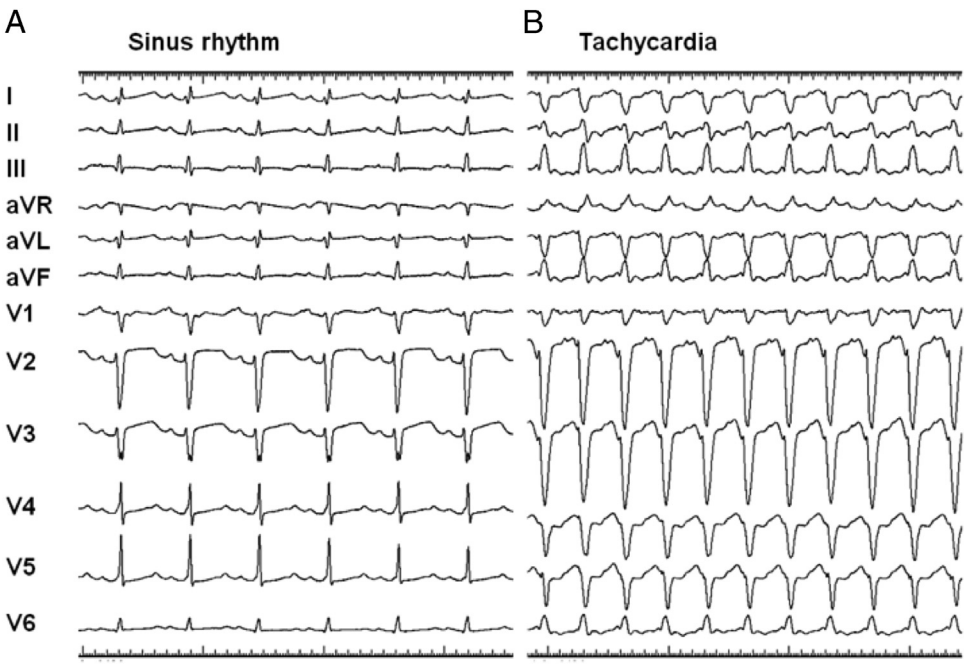

Figure 1 Twelve-lead electrocardiograms (ECGs) during the electrophysiology study. **A:** ECG in sinus rhythm. **B:** Wide complex tachycardia with left branch bundle block pattern.

KEYWORDS Mahaim potential; Voltage mapping; Case report; Ablation; Electroanatomical mapping (Heart Rhythm Case Reports 2016;2:499–501)

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Under general anesthesia, transvenous electrophysiologic catheters were placed in the right atrium, His bundle region, coronary sinus, and right ventricular apex. Wide complex tachycardia with left bundle branch block (LBBB) pattern was easily inducible with atrial extrastimulation (Figure 1). The pathway had decremental antegrade conduction with the same LBBB pattern as the tachycardia and hence was

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KEY TEACHING POINTS

- Mahaim fibers remain a challenge for successful mapping and ablation, owing to their characteristics of slow decremental antegrade conduction and lack of retrograde conduction.
- Conventional activation mapping cannot be used to identify the atrial insertion because of lack of retrograde conduction.
- Voltage mapping of the Mahaim potential may be an effective method to locate Mahaim fiber and to target the atrial origin for ablation.

thought to be a Mahaim fiber. Atrial pacing from multiple sites was performed at long cycle lengths (500–600 msec) until maximal pre-excitation with a short HV interval was identified in the right lateral wall (Figure 2). A deflectable 7 French 4-mm-tip ablation catheter with 2-5-2 electrode spacing was used to perform electroanatomical mapping of the atrial side of the right atrioventricular ring. Mahaim potentials were identified along the right anterolateral area. The potentials were used to create a voltage map by setting a voltage sampling window starting beyond the atrial paced evoked potential and ending prior to the ventricular potential. A linear line of 29 points were obtained through the area of interest, with 9 interpolations between mapping points. Total range of 0.04–0.24 mVs was displayed as a color map, with maximal Mahaim potential voltage being displayed in blue (Figure 3). Radiofrequency energy delivered at 70 W power generated a tip temperature of 56 degrees and resulted in accelerated automaticity from the Mahaim fiber with spontaneous onset of tachycardia (Supplemental Figure 1, available online). Therefore, a second lesion was placed adjoining the first and also over the area of maximal Mahaim potential, resulting in early termination of Mahaim conduction and automaticity.

An additional right paraseptal concealed accessory pathway was also mapped and ablated, resulting in no further inducible tachycardia.

Discussion

Mahaim fibers remain a challenge for successful catheter mapping and ablation. Because a Mahaim fiber does not have retrograde conduction, its atrial insertion cannot be identified through activation mapping. The ventricular termination of a Mahaim fiber can be identified through activation mapping, but because of the tendency to have a wide insertion in the ventricle, ablation at its ventricular breakout is less likely to be successful. Therefore, a Maham fiber must be located through identification of Mahaim potentials, either on the atrial side of the right atrioventricular groove or along the course of the Mahaim fiber as it courses beneath the endocardial surface of the right ventricle toward the apex.[1–4]

Voltage mapping of Mahaim potentials may represent an effective method to locate and target the atrial origin of a Mahaim fiber.

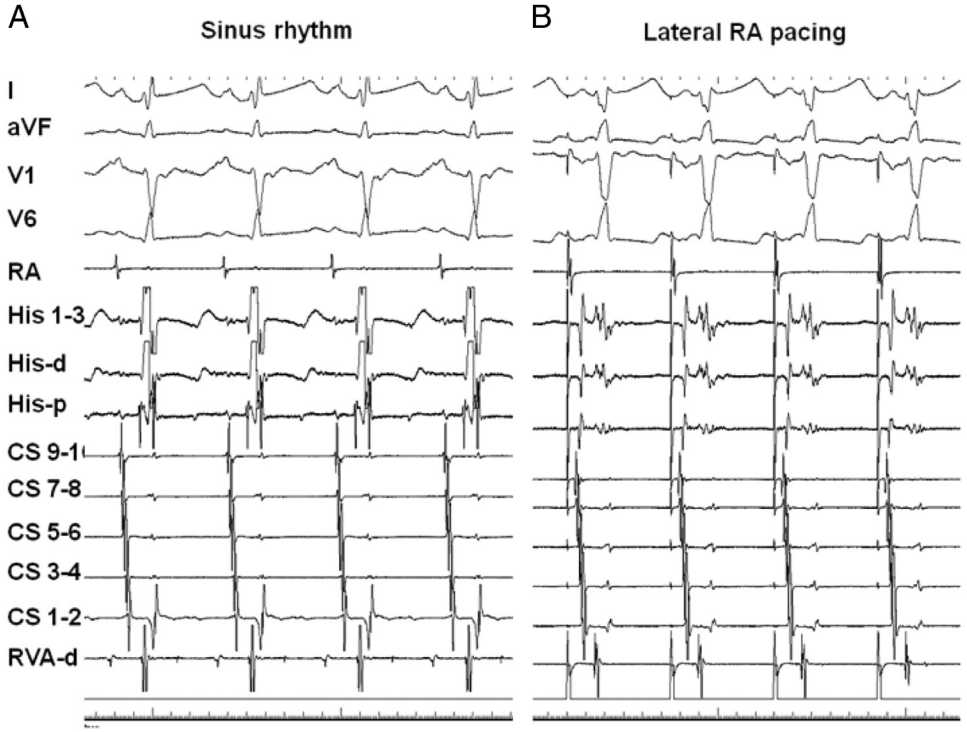

Figure 2 The tracings from top to bottom are the surface electrocardiogram leads I, aVF, V, and V_6, followed by intracardiac electrogram recordings from the right atrium (RA), His bundle, coronary sinus (CS), and right ventricular apex (RVa) recordings. **A:** Sinus rhythm. **B:** Right atrial pacing with maximal pre-excitation with short HV interval.

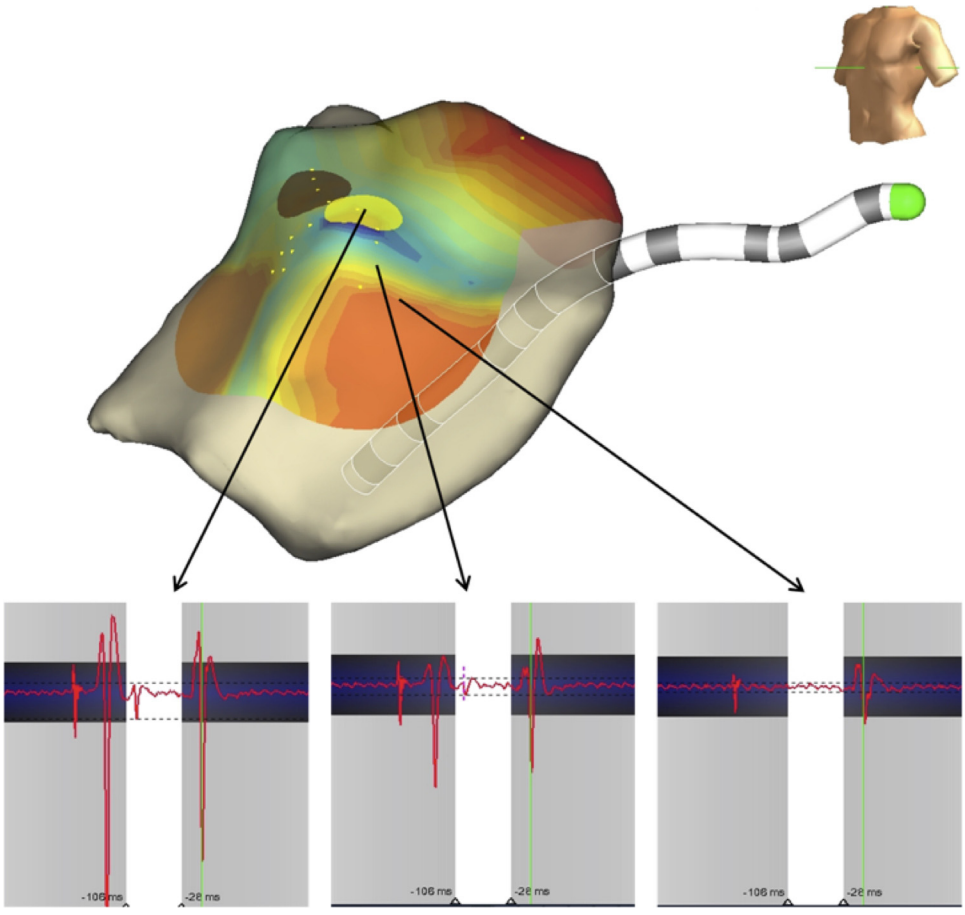

Figure 3 Voltage map of the Mahaim potential.

Appendix

Supplementary data

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.hrcr.2016.07.008.

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