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CASE REPORT

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Right-sided Mahaim-mediated tachycardia combined with atypical atrioventricular nodal reentrant tachycardia and left free wall accessory pathway: A case report

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Abstract

A 37-year-old man was admitted to our hospital with paroxysmal palpitation for half year. A previous electrogram showed a narrow complex tachycardia. Electrophysiologic study (EPS) found a concealed left-sided free wall pathway accessory. In addition, a transseptal approach was used for radiofrequency ablation. After successful ablation, EPS induced a wide complex tachycardia and a narrow complex tachycardia. The wide complex tachycardia was diagnosed as a right-sided Mahaim fiber atriofascicular accessory pathway, and the narrow complex tachycardia was diagnosed as atypical atrioventricular nodal reentrant tachycardia (AVNRT). Then, the right-sided Mahaim fiber atriofascicular accessory pathway and atypical AVNRT were successfully ablated. Herein, we report a rare case of a concealed left-sided accessory pathway combined with a right atriofascicular Mahaim fiber and atypical AVNRT.

KEYWORDS
atypical atrioventricular nodal reentrant tachycardia, left free wall accessory pathway, Mahaim fibers, right-sided

INTRODUCTION

In 1941, Mahaim and Winston firstly described a rare nodoventricular accessory pathway, so-called Mahaim fibers, with unique decremental properties (Mahaim & Winston, 1941). Mahaim fibers are usually found on the right side of the heart, which can present with an antidromic atrioventricular reentrant tachycardia (AVRT) with the appearance of typical left bundle branch block (LBBB; Aliot et al., 1998). The preferred treatment is radiofrequency ablation. The most frequent coexisting arrhythmia is A–V node reentrant tachycardia (AVNRT), which is a common finding in right sided Mahaim type accessory pathway (AP) but has not been described a right sided Mahaim type AP combined with an atypical AVNRT and concealed left-sided free wall AP. We present a patient with a unique combination of atypical AVNRT with right-sided Mahaim type AP and a concealed left-sided free wall AP.

CASE PRESENTATION

A 37-year-old man presented to our hospital with intermittent palpitations for initial catheter ablation. A previous electrogram showed a narrow complex tachycardia. He had undergone electrophysiologic study (EPS; HT-Viewer system) using a decapolar catheter in the coronary sinus, and two quadripolar catheters in the right ventricular and his bundle region. The retrograde VA activation was eccentric,

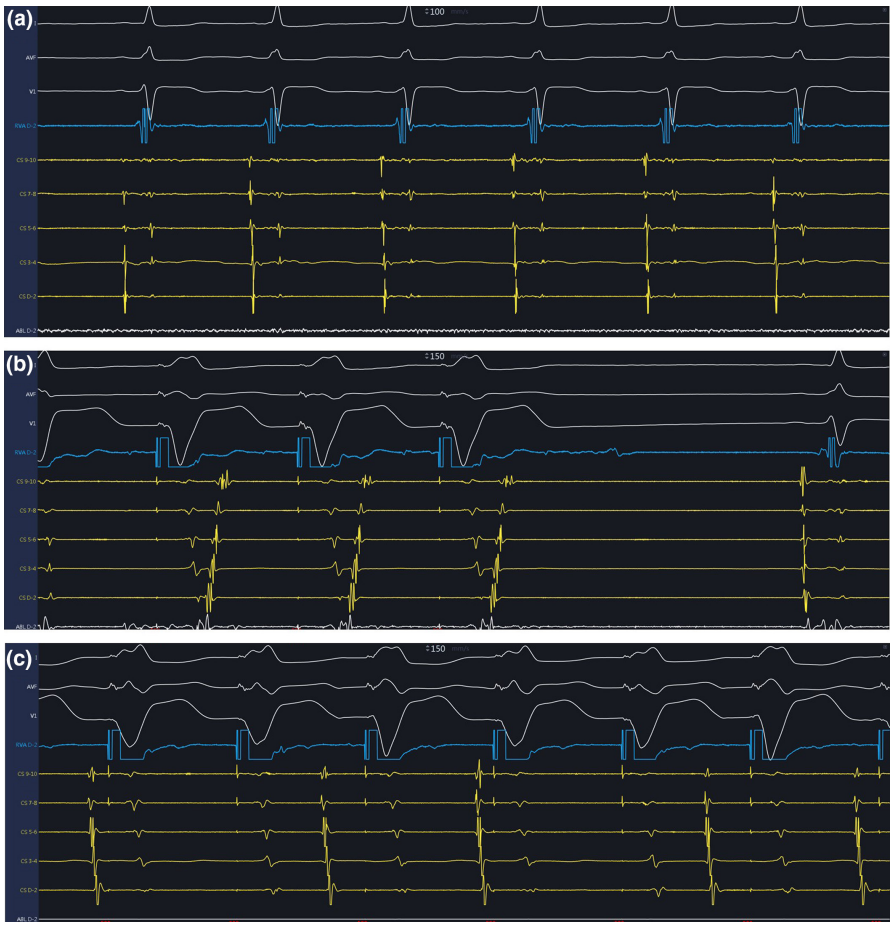

FIGURE 1 (a) EPS showed a normal intracardiac electrograms. (b) The retrograde VA activation was eccentric and the earliest atrial activation at CS 1–2. (c) The left free wall accessory pathway was successfully ablated during ventricular stimulation

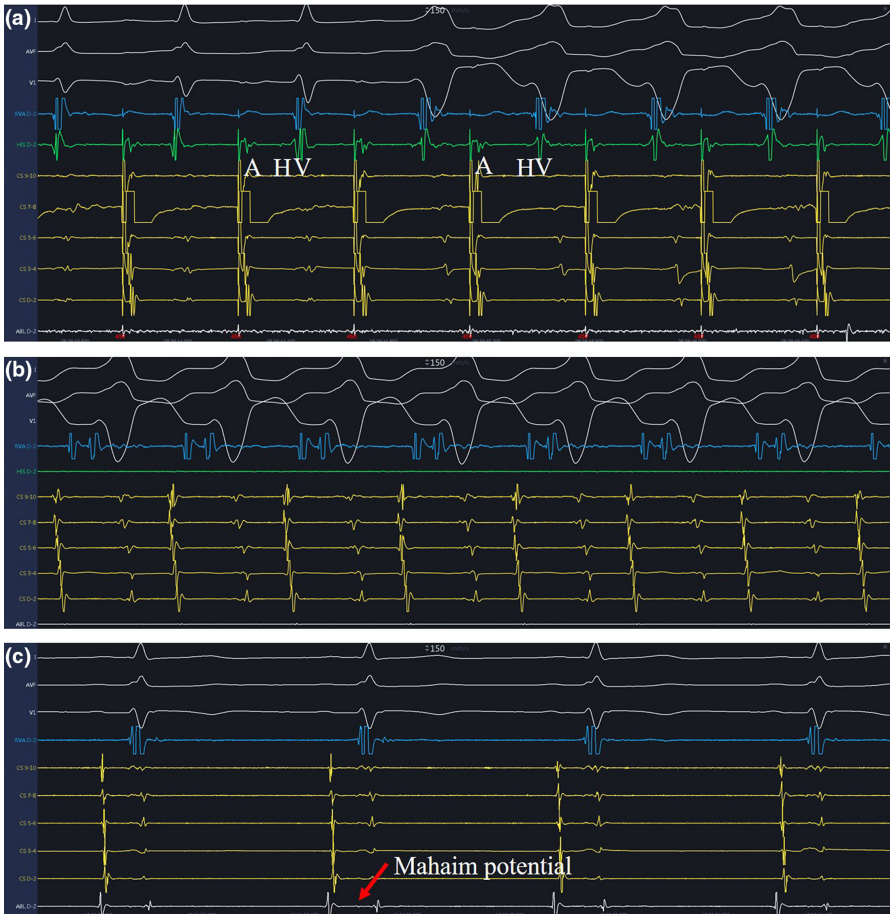

FIGURE 2 (a) Programed stimulation S1S1 450/450 ms induced pre-excitation of QRS complexes with left bundle branch block. It presents antegrade long conduction with lengthening of the A-H interval and A-V interval, a contemporary shortening of the H-V interval. (b) Tachycardiac 1 with broad complex LBBB surface ECG morphology. (c) The target in ablated catheter presented Mahaim potentials

with the earliest atrial activation at CS 1–2 (CS distal), suggesting conduction via a left-sided free wall accessory pathway (Figure 1). A transseptal approach was used for left-sided free wall AP ablation. An 8.5-Fr sheath was placed into the right femoral vein. Radiofrequency ablation catheter inserted through the sheath, advanced to mitral annuls. The catheter was then placed at CS1-2 that had the shortest interval between local ventricular and atrial electrograms during ventricular pacing in the presence of concealed accessory pathway. Then, left AP were successfully ablated with lesions (30 W for 120 s, temperature limit 60°C; Figure 4a).

He was opted to proceed with repeat EPS and used with intravenous infusion of isoproterenol. Programed stimulation S1S1 450/450 ms resulted in antegrade long conduction times were detected, along with a progressive lengthening of the A–H interval and A–V interval, a contemporary shortening of the H–V interval and a progressive pre-excitation of QRS complexes with LBBB. Atrial programmed stimulation S1S1 300/300 ms induced tachycardiac 1 with broad complex LBBB surface ECG morphology. The tachycardia 1 has an LBBB pattern, long AV interval, and short VA interval. The earliest atrial activation was detected at the His-bundle electrodes during the tachycardia (Figure 2). The EPS features demonstrated AVRT with a right-sided accessory pathway, consistent with right-sided Mahaim fiber atriofascicular accessory pathway. Mahaim fiber was localized at right atrial free wall of tricuspid annulus (9–10 o'clock). The right-sided Mahaim fiber AP was successfully ablated with lesions (30 W for 120 s, temperature limit 60°C; Figure 4b).

For further reperformed EPS, the patient was injected isoproterenol again. The programmed CS stimulation with introduction of single and double premature extrastimuli induced a narrow complex tachycardia. The earliest atrial activation seen at the CS 9–10. During the programed stimulation, a jump phenomenon was presented. Entrainment was performed from the RV apex pacing at cycle length 20 to 40 ms shorter than tachycardia cycle length. At the end of ventricular entrainment, we observed S-V-A-V (Figure 3). The patient was diagnosed as atypical AV node reentry tachycardia. The atypical AVNRT was successfully ablated with lesions (30 W for 120 s, temperature limit 55°C) (Figure 4c).

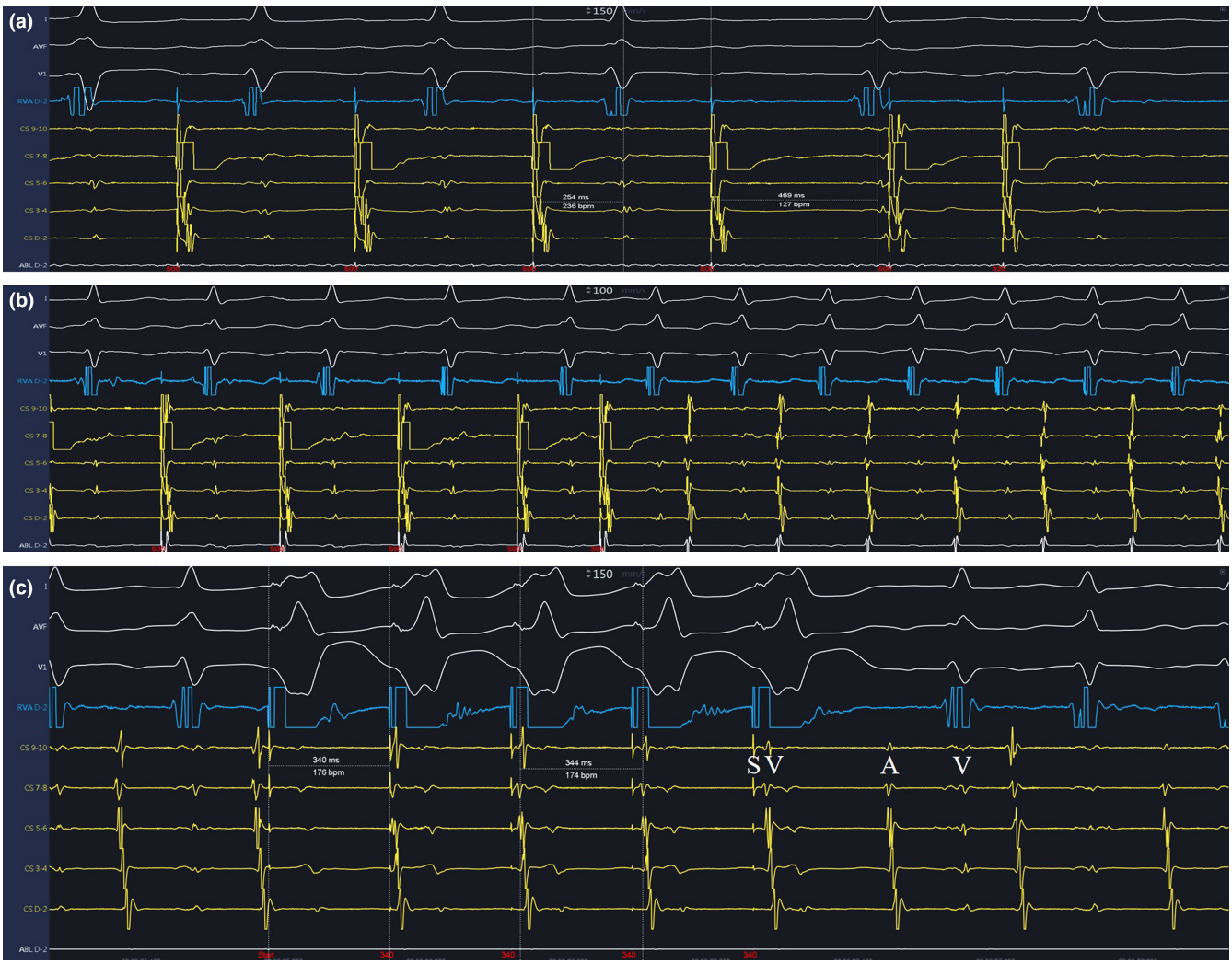

FIGURE 3 (a) Programed stimulation S1S1 500/500 ms showed a dual A-V node pathway (jump phenomenon). (b) Programmed CS stimulation induced a narrow complex tachycardia. (c) At the end of ventricular entrainment, we observed S-V-A-V sequence

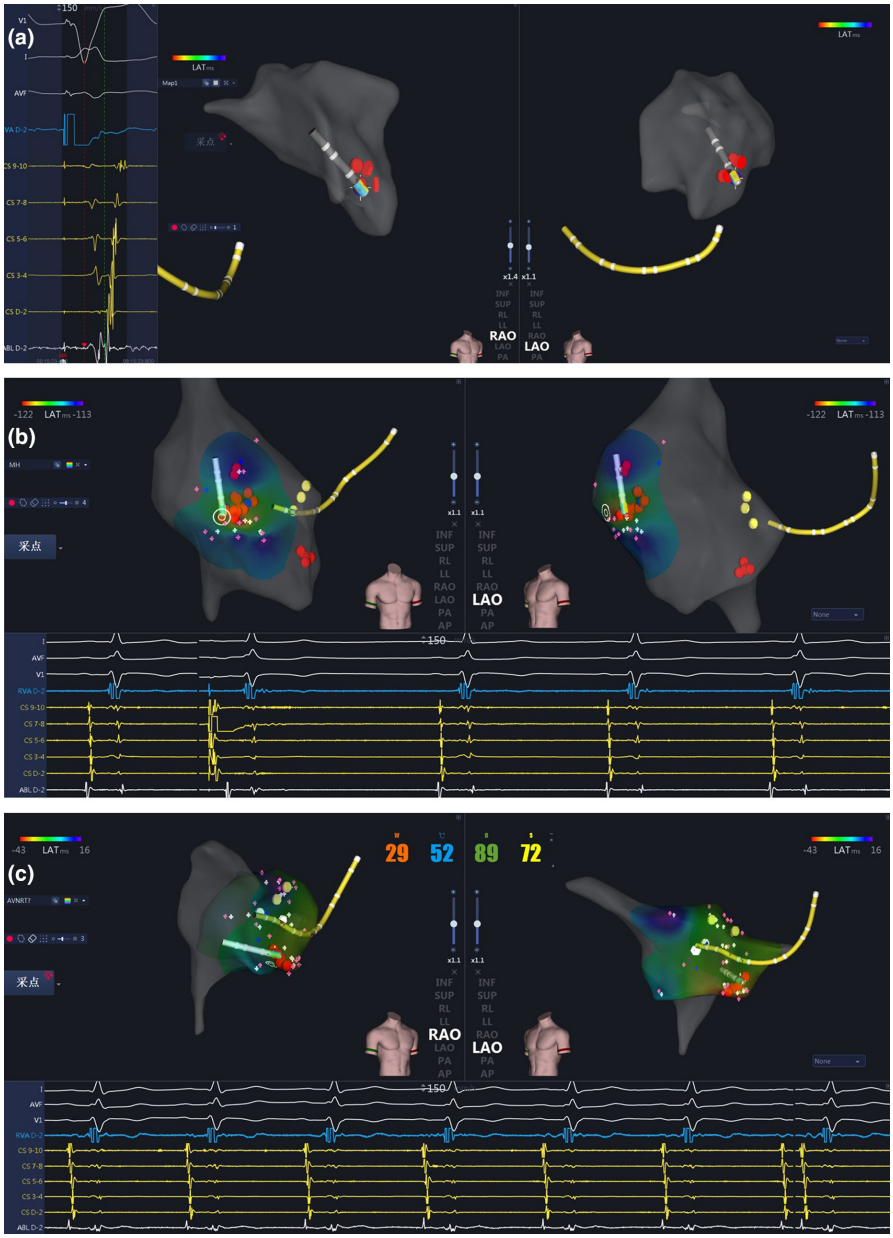

FIGURE 4 (a) The targets of left free wall accessory pathway during electroanatomical mapping of the right atrium. (b) Mahaim fiber was localized at right atrial free wall of tricuspid annulus (9–10 o'clock). (c) The targets of atypical AVNRT during electroanatomical mapping of the right atrium

DISCUSSION

In 1941, Mahaim and Winston originally described the Mahaim fibers with unique decremental property. Mahaim fibers has specific electrophysiological properties as followings. No or minimal pre-excitation is usually observed on ECG, there is no retrograde conduction over the accessory pathway, rapid atrial pacing elicits prolongation of the AH interval, AV interval and QRS intervals with shortening of the HV interval, a reversed pattern from right bundle branch to His bundle, and wide QRS waves tachycardia may be seen (Gillette et al., 1982; Klein et al., 1988). Our patient was confirmed with Mahaim accessory pathway properties. Most of Mahaim fibers are reported at right-sided location, while only sporadic Mahaim fibers cases located on the left heart have been reported. In this case, the patient presented a wide QRS tachycardia with LBBB pattern. And EPS confirmed Mahaim accessory pathway derived from right side and ablated successfully.

Mahaim-type accessory pathways (MAPs) usually originate within the lateral tricuspid annulus and cross the AV junctions, and display decremental conduction, inserting into the distal right ventricular free wall. Most reported decremental conducting MAPs are right-sided. The most frequent coexisting arrhythmia is AV node reentrant tachycardia (AVNRT), which is a common finding in right sided Mahaim type APs. Mahaim fiber may combine with other accessory pathway (Kalbfleisch et al., 2008). Via et al. reported a rare case coexisting Mahaim and left lateral accessory pathway, both of which were involved in tachycardia (Vali et al., 2021). Other heart conditions, including dual A-V node pathway may complicate the appropriate diagnosis of the clinical tachycardia. Right Mahaim type fiber combined with atypical

AVNRT are unusual, but not impossible. We describe an unusual, previously unreported, right sided Mahaim fiber mediated tachycardia in combination with atypical AVNRT and concealed left-sided free wall AP.

CONCLUSION

Mahaim-type APs are uncommon. The combination of right-sided Mahaim-type AP, concealed left-sided free wall AP and atypical AVNRT has not been reported previously. For this kind of patients, detailed electrophysiological study and correct diagnosis are required for the successful ablation.

AUTHORS CONTRIBUTIONS

Mingxian Chen and Xuping Li contributed signigicantly to data collection and manuscript preparation. Zhihong Wu contributed to the conception of this case. Zhenjiang Liu and Lin Hu performed the patient management. Xuping Li and Qiming Liu performed the pacemaker implantation. Shenghua Zhou performed the analysis with constructive discussions. All authors agree on the order in which their names will be listed in the manuscript.

CONFLICT OF INTEREST

We declare that we have no financial and personal relationships with other people or organizations that can inappropriately influence our work.

ETHICAL APPROVAL

We identify that ethics committee of The Second Xiangya Hospital of Central South University have approved the case, and that this case conforms to recognized standards, Declaration of Helsinki.

INFORMED CONSENT

The written informed consent was obtained from this patient.

DATA AVAILABILITY STATEMENT

It is a case report. No data is available.

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