

# Rare left-sided accessory pathway successfully ablated with atrial insertion site at the left-side fossa ovalis

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## Abstract

**Introduction:** Left-sided accessory pathway (AP) with atrial insertion away from the annulus is an atypical variation. Conventional mapping and ablation performed along mitral annulus (MA) is usually ineffective.

**Methods:** A 14-year-old girl without structural heart disease presented with recurrent episodes of sudden onset palpitations and electrocardiogram (ECG) showed a narrow QRS complex tachycardia.

**Results:** Electrophysiology study (EPS) was done and anterograde atrio-ventricular reentrant tachycardia (AVRT) with AP was diagnosed. Conventional mapping and ablation performed along TA and MA was failed. 3D-activation mapping found the retrograde atrial insertion site of AP on the left atrium fossa ovalis (FO), and AP was successfully abolished by radiofrequency ablation at that site.

**Conclusion:** As reported, this patient is the first report of ablating a left-sided AP with retrograde atrial insertion on the left atrium FO.

## KEYWORDS

accessory pathway, anterograde AVRT, catheter ablation, fossa ovalis

## 1 | INTRODUCTION

Radiofrequency catheter ablation is well established as a definitive therapy of accessory pathways (APs).<sup>1</sup> However, left-sided AP with atrial insertion away from the mitral annulus (MA) is a rare atypical variation. Conventional mapping and ablation performed along MA are usually ineffective. Several prior reports have demonstrated left-sided APs successfully ablated with atrial insertion at the base of left atrium appendage (LAA) and the roof of left atrium (LA).<sup>2-5</sup> Here, we report a case of ablating a left-sided AP with retrograde atrial insertion at the left-side fossa ovalis (FO).

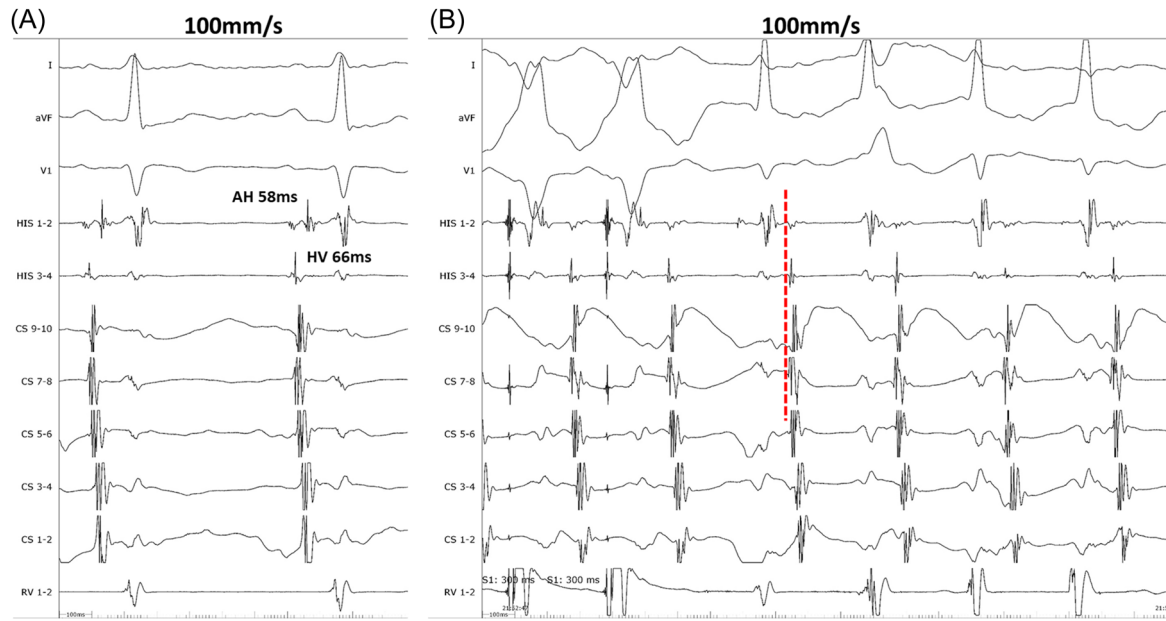
## 1.1 | Case report

A 14-year-old girl without structural heart disease presented with recurrent episodes of sudden onset palpitations and underwent radiofrequency catheter ablation. Electrocardiogram (ECG) showed a narrow QRS complex tachycardia. Transthoracic echocardiography revealed a structurally normal heart with normal ejection fraction.

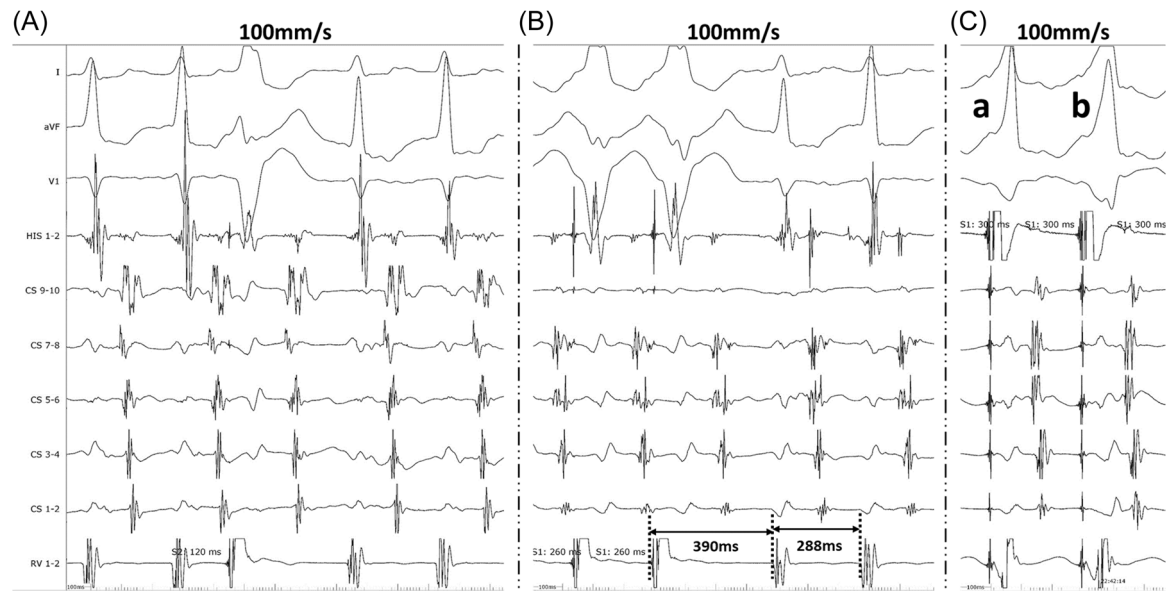
An electrophysiology study was performed after obtaining informed consent. During sinus rhythm, the A-H interval was 58 ms and H-V interval was 66 ms (Figure 1A). During decremental ventricular pacing with the cycle length (CL) from 450 to 300 ms, the V-A interval was 184 ms and remained constant. Narrow QRS

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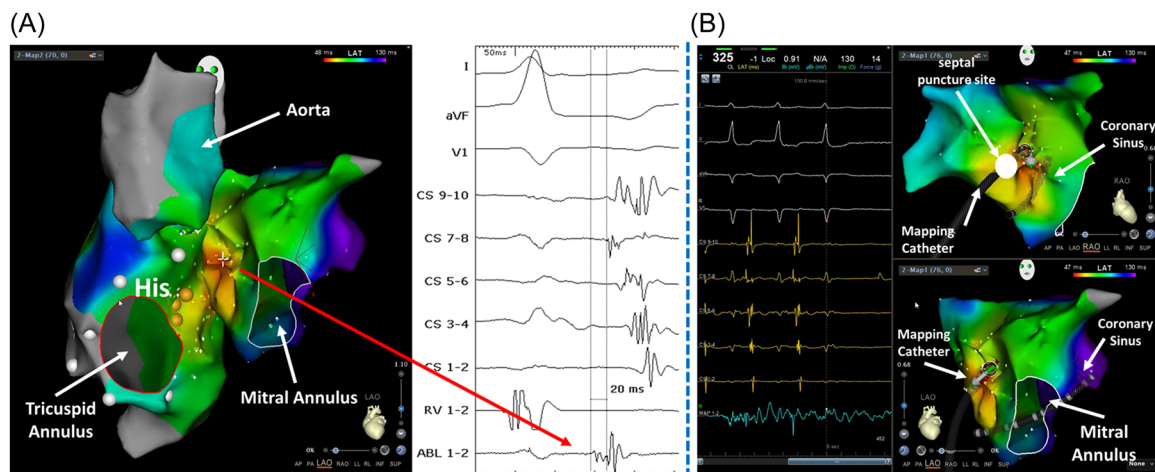
**FIGURE 1** (A) Sinus rhythm with A-H interval of 58 ms and an H-V interval of 66 ms. (B) Ventricular pacing with CL of 300 ms inducing tachycardia. The proximal coronary sinus (CS<sub>9-10</sub>) and the distal His bundle (HIS<sub>1-2</sub>) atrial activation timing are nearly simultaneous without VA fusion. CL, cycle length; CS, coronary sinus; HIS, His bundle; RV, right ventricle.



**FIGURE 2** (A) His-refractory premature ventricular contraction delivered, advance the next atrial signal, and reset the tachycardia with no change in the atrial activation pattern. (B) Entrainment of the tachycardia with ventricular pacing. A ventricular-atrial-ventricular response post pacing is yielded with the difference of post-pacing interval and tachycardia cycle length 102 ms. (C) Para-Hisian pacing with His capture (a) and without His (b) capture with the same stimulation to earliest atrial activation time. CL, cycle length; CS, coronary sinus; HIS, His bundle; RV, right ventricle.

complex tachycardia was induced via the ventricular pacing with CL of 300 ms (Figure 1B). During tachycardia, the atrial activation pattern was the same as ventricular pacing, and the earlier atrial activation was recorded nearly simultaneously at the proximal coronary sinus (CS<sub>9-10</sub>) and the distal His bundle (HIS<sub>1-2</sub>) without VA fusion (Figure 1B). His-refractory premature ventricular

contraction advanced the next atrial signal with no change in the atrial activation pattern and reset the tachycardia (Figure 2A). Entrainment of the tachycardia with ventricular pacing yielded a ventricular-atrial-ventricular response post pacing and the post-pacing interval-tachycardia cycle length difference was 102 ms (Figure 2B). Para-hisian pacing showed same stimulation to earliest



**FIGURE 3** (A) Retrograde atrial activation mapping during tachycardia performed in RA, LA, and aortic root. Mapping results indicate the earliest retrograde activation at the left-side FO in LAO projection (left), where the atrial activation timing is earlier than the proximal CS 20 ms (right). (B) Tachycardia is terminated immediately after RFA performed (left). The successful ablation site is at the anterior edge of left-side FO with display on CARTO system in RAO and LAO projections (right). ABL, mapping catheter; CS, coronary sinus; FO, fossa ovalis; LAO, left anterior oblique; RAO, right anterior oblique; RV, right ventricle.

atrial activation time with His capture (a) and without His (b) capture (Figure 2C). So, anterograde atrioventricular reentrant tachycardia with AP was diagnosed.

Firstly, AP mapping was performed along MA and tricuspid annulus separately during tachycardia, and mapping along MA was via a transeptal approach. Mapping results demonstrated that the earliest site of atrial activation was at left-sided midseptal, but this timing was no obvious earlier than other sites septal timing and no AP potential could be found. Several times attempt ablation applications were unsuccessful. Then further mapping found atrial activation times along the MA were later than both the left and right atrial septal timing. So, activation mapping of retrograde atrial activation during tachycardia was performed in both atriums and aortic root using the CARTO3 mapping system (Biosense Webster). The earliest atrial activation was located at the anterior edge of left-side FO, which was tightly adjacent to the atrial septal puncture site (Figure 3A,B). The local activation timing at this site was earlier than CS<sub>9-10</sub> by 20 ms, and the amplitude of atrial and ventricle potentials was 0.29 and 0.1 mV (Figure 3A). Subsequently, the application of an ablation (35 W, 17 ml/min) at this site was performed, the tachycardia was terminated immediately with AP conduction eliminated (Figure 3B). This patient has been followed up for 3 months without recurrence of tachyarrhythmia and any other adverse events.

## 2 | DISCUSSION

Left-side APs with atrial insertion away from the MA are an atypical variation, and there are only a few cases have been reported. Several prior reports have demonstrated left-sided pathways were successfully ablated at the base of LAA and the roof of LA with atrial

insertion away from the MA.<sup>3-6</sup> But there are no reports of atrial insertion sites at atrial septum, especially at the FO. Mah et al. reported three young patients with APs had unsuccessful endocardial ablations, and they found the appendages were diffusely adherent to their ventricles by fibrofatty connections and dissection of the appendages led to loss of pre-excitation during the operation in the operating room.<sup>2</sup> This report indicates existing direct connection between the LAA and the ventricle. Steven et al. reported a concealed decremental anteroseptal AP that was ablated on the LA roof.<sup>3</sup> Long et al. reported seven patients involved ablation of left-sided APs with atrial insertion away from the MA. Atrial insertions were at the base of the LAA in five patients and at the anterior roof of LA in two patients.<sup>4</sup> The amplitude of atrial and ventricle potentials at the atrial insertions were averaged  $2.2 \pm 0.7$  and  $0.1 \pm 0.1$  mV, respectively, and the atrial potential was significantly larger.

In our patient, the earliest atrial activation site was at the center of left-side atrial septum and tightly adjacent to the atrial septal puncture site, and the amplitude of atrial potential at that site was 0.29 mV. The atrial potential was significantly smaller than other points site on LA mapping. The amplitude of LA atrial potential was almost over 1 mV except for the fossa ovalis region. The atrial potential characteristic is consistent with electrographic characteristics of the FO which were recently reported by Yu et al.<sup>7</sup> They indicated that electrographic characteristics of the FO center are distinct from those of the surrounding regions with atrial electrogram voltage at  $0.33 \pm 0.21$  mV, and the amplitude of atrial potential at the FO annulus was  $1.70 \pm 0.72$  mV. According to the characteristics of the electrical signal and the spatial location of this patient, we identify the AP atrial insertion locates at the anterior edge of left-side FO, and it is the first report of atrial insertion site at the FO. However, how to bridge the atrium and the ventricle about this unusual AP is still unintelligible.

### 3 | CONCLUSIONS

As reported, left-side APs with atrial insertion away from the MA are an atypical variation, and this patient is the first report of ablating a left-sided AP with retrograde atrial insertion at the LA FO.

#### CONFLICT OF INTEREST

The authors declare no conflict of interest.

#### DATA AVAILABILITY STATEMENT

The study data is available upon request.

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