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CASE REPORT

Supraventricular Tachycardia with Multiple Accessory Pathways

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Abstract

Ablation of supraventricular tachycardia (SVT) with multiple accessory pathways remains challenging to electrophysiologists. We presented a case of recurrent SVT despite 2 previous successful ablations of 3 different accessory pathways. This patient underwent the third ablation. We would like to discuss the electrophysiologic property of multiple accessory pathways and the cause of SVT recurrence in this patient.

Keywords: Supraventricular tachycardia, Accessory pathways, Permanent junctional reciprocating tachycardia

Introduction

Supraventricular tachycardia (SVT) with multiple accessory pathways poses a significant challenge to electrophysiologists during ablation. Whether there are multiple pathways or one pathway with multiple atrial insertions remains difficult to define during procedure. We described a case of SVT with multiple recurrences despite successful ablation of accessory pathway and tried to define the electrophysiologic property in patient suspected to have multiple accessory pathways.

Case report

A 60-year-old man had been experiencing palpitation since 2021 and ECG during palpitation showed long RP tachycardia with negative P wave in II, III, aVF. ECG during sinus rhythm showed no evidence of pre-excitation.

He had history of paroxysmal supraventricular tachycardia in 2011 with ECG showing short RP tachycardia. Electrophysiological (EP) study at that time induced an orthodromic atrioventricular reciprocating tachycardia (OAVRT) with a concealed accessory pathway over anterior mitral annulus. No antegrade conduction of the accessory pathway was noted. The pathway was successfully ablated over the atrial side of the pathway via retrograde trans-aortic approach. Ventriculoatrial (VA) dissociation was noted after ablation (Figure 1). However, he had recurrent SVT 6 months after ablation and ECG showed short RP tachycardia again. Repeated EP study was performed in 2012. It initially induced an OAVRT with a new concealed accessory pathway over posterolateral mitral annulus. There was no antegrade conduction of the accessory pathway. One thing that was in particular different from last EP study was the presence of retrograde pathway potential (PP) during OAVRT. During OAVRT, the most prominent retrograde PP was over lateral mitral annulus (CS 3–4) while the earliest retrograde atrial signal (A) was over posterolateral mitral annulus (CS 5–6). Ablation catheter was positioned over atrial side of the pathway via antegrade trans-septal approach. Ablation was then performed during OAVRT, targeting the location with earliest retrograde A (CS 5–6). During ablation, there was gradual delay of retrograde A in CS 5–6 followed by disappearance.
Figure 1. A. LAO view of coronary sinus catheter position. Ablation catheter over anterior accessory pathway. LAO, left anterior oblique. B. During sinus rhythm, there was no anterograde accessory pathway. C. During ventricular pacing, earliest A was at CS 1-2 (anterior mitral annulus). A, atrial signal; CS, coronary sinus. D. During OAVRT, earliest A was again at CS 1-2 (anterior mitral annulus). A, atrial signal; CS, coronary sinus; OAVRT, orthodromic atrioventricular reentry tachycardia. E. Ablation was performed during ventricular pacing, targeting the location with earliest retrograde A (CS 1-2). The ablation catheter tip was over atrial side because the A signal was more prominent than V signal in distal pair of electrodes of ablation catheter. VA dissociation was noted soon after starting ablation. A, atrial signal; V, ventricular; VA, ventriculoatrial; CS, coronary sinus.
Figure 1. (Continued).
of retrograde PP. However, the OAVRT persisted with earliest retrograde A shifting to CS 9–10 without retrograde PP. Another concealed accessory pathway over posteroseptal mitral annulus was suspected. Ablation over posteroseptal mitral annulus during ventricular pacing successfully achieved VA dissociation (Figure 2).

Patient agreed for another EP study in 2022 because of recurrent SVT. Baseline ECG showed sinus rhythm with no pre-excitation but intracardiac electrogram showed a sharp potential between atrial and ventricular signals over posterolateral mitral annulus (CS 3–4, CS 5–6 and CS 7–8) which was not present in previous 2 EP studies. The sharp potential during sinus rhythm was likely antegrade PP. The timing of antegrade PP over CS 3–4, CS 5–6 and CS 7–8 were similar. Long RP SVT was induced by a spontaneous premature ventricular complex (PVC). The sharp potential was again seen between ventricular signal (V) and A over posterolateral mitral annulus (CS 5–6 and CS 7–8) during SVT. The earliest retrograde PP was over CS 7–8. Ventricular entrainment demonstrated V-A-V response, excluding atrial tachycardia. His-refractory PVC advanced next A, confirming the diagnosis of OAVRT with a slowly conducting accessory pathway. Angiogram of coronary sinus did not reveal any abnormality. Ablation catheter was positioned over an optimal position of mitral annulus via antegrade trans-septal approach as evidenced by the similar amplitudes of A and V in distal pair of electrodes of ablation catheter. We planned to target the most prominent antegrade PP (CS 5–6) during sinus rhythm first and then target the earliest retrograde PP (CS 7–8) during ventricular pacing if the first ablation failed. Luckily, the first ablation targeting the most prominent antegrade PP (CS 5–6) during sinus rhythm was successful. During ablation, there was gradual delay of antegrade PP followed by disappearance of PP. Timing of ventricular signal was not affected despite delay of antegrade PP during ablation, indicating that antegrade conduction via accessory pathway was too slow and ventricular activation was mostly via atrioventricular node. VA dissociation was noted during ventricular pacing after ablation (Figure 3).

**Discussion**

We suspected the slowly conducting accessory pathway over posterolateral mitral annulus in the 3rd ablation was iatrogenic. It was actually a recurrence of the ablated posterolateral accessory pathway in the 2nd ablation but with a much slower conduction velocity due to previous ablation. The resulting SVT in our patient mimicked permanent
Figure 2. A. LAO view of coronary sinus catheter position. Ablation catheter over posterolateral accessory pathway (left) and posteroseptal accessory pathway (right). LAO, left anterior oblique. B. During sinus rhythm, there was no antegrade accessory pathway. C. During OAVRT, the most prominent retrograde PP was over lateral mitral annulus (CS 3-4) while the earliest retrograde A was over posterolateral mitral annulus (CS 5-6). OAVRT, orthodromic atrioventricular reentry tachycardia; PP, pathway potential; CS, coronary sinus; A, atrial signal. D. Ablation was performed during OAVRT, targeting the location with earliest retrograde A (CS 5-6). The ablation catheter tip was on the atrial side because the A signal was more prominent than V signal in the distal pair of electrodes of the ablation catheter. During ablation, there was gradual delay of retrograde A in CS 5-6 followed by disappearance of retrograde PP. However, the OAVRT persisted with earliest retrograde A shifting to CS 9-10 without retrograde PP. Another concealed accessory pathway over posteroseptal mitral annulus was suspected. OAVRT, orthodromic atrioventricular reentry tachycardia; A, atrial; V, ventricular; CS, coronary sinus; PP, pathway potential.
junctional reciprocating tachycardia (PJRT) which is an orthodromic atrioventricular reentry tachycardia using a concealed slowly conducting accessory pathway as the retrograde limb [1]. The interesting part in this iatrogenic slowly conducting accessory pathway in our case was that it also conducted antegradely and a very clear PP could be seen during sinus rhythm. There is no report from the
Figure 3. A. LAO view of coronary sinus catheter position. Ablation catheter over posterolateral accessory pathway. LAO, left anterior oblique. B. In sinus rhythm, PP was clearly seen between atrial and ventricular signals over posterolateral mitral annulus (CS 3-4, CS 5-6 and CS 7-8). The most prominent antegrade PP was over CS 5-6. PP, pathway potential; CS, coronary sinus. C. During OAVRT (long RP tachycardia), PP was clearly seen between ventricular and atrial signals over posterolateral mitral annulus (CS 5-6 and CS 7-8). The earliest A was over CS 7-8. The most prominent retrograde PP was over CS 5-6. OAVRT, orthodromic atrioventricular reentry tachycardia; PP, pathway potential; CS, coronary sinus; A, atrial signal. D. Ablation was performed during sinus rhythm, targeting the location with most prominent antegrade PP (CS 5-6). The ablation catheter tip was over an optimal mitral annular position because the amplitudes of A and V signals were similar in distal pair of electrodes of ablation catheter. During ablation, there was gradual delay of antegrade PP followed by disappearance of PP. PP, pathway potential; CS, coronary sinus; A, atrial; V, ventricular.
literature describing this type of newly developed antegrade conduction of pathway after previous ablation. We postulated that there was all along intermittent weak antegrade conduction of the pathway in our patient but unluckily there was no antegrade conduction of the pathway at the time of first and second ablations.

In the 3rd ablation, the PP was seen over wide area of mitral annulus (CS 3–4, CS 5–6 and CS 7–8). It suggested a serpiginous course of accessory pathway through coronary sinus with possible multiple atrial insertions. It might explain the reason of multiple recurrences of SVT after previous successful ablations because we might have only ablated one of the multiple atrial insertions or part of the serpiginous accessory pathway (Figure 4). Previous studies also reported multiple atrial insertions in patients with PJRT [2,3]. We hypothesize that we have to target the location with earliest or most prominent PP in order to achieve complete disconnection of accessory

![Figure 3. (Continued).](image)
Another postulation is that ablation at the ventricular insertion of this type of serpiginous accessory pathway might be more effective than ablation at the atrial insertion because of possible multiple atrial insertions.

The accessory pathway over anterior mitral annulus in the 1st ablation might be one of the multiple atrial insertions of the serpiginous accessory pathway (Figure 4). However, the accessory pathway over posteroseptal mitral annulus in the 2nd ablation was likely to be a separate accessory pathway different from posterolateral accessory pathway. When ablating the posterolateral accessory pathway during SVT in the 2nd ablation, there was progressive lengthening of retrograde A in CS 5–6 followed by disappearance of retrograde PP but the OAVRT persisted with earliest retrograde A shifting to CS 9–10 without retrograde PP. Hence, the retrograde conduction of posteroseptal accessory pathway was clearly independent of the posterolateral PP.

In our patient, we showed a case of iatrogenic PJRT. We also illustrated the presence of a serpiginous course of accessory pathway through coronary sinus with possible multiple atrial insertions and, at the same time, the presence of a separate posteroseptal accessory pathway.

**Ethics information**

Not applicable.

**Acknowledgements and funding**

None.

**Conflict of interest**

There is no relevant financial disclosure or conflicts of interests.

**References**

