Cambridge City Publishers

Case Reports in Clinical Cardiology Journal

Case Report | Vol 5 Iss 2

Epicardial Accessory Pathway with Insertion into the Left Lateral Atrium in Atrioventricular Reentrant Tachycardia

Jacob Alexander Powell[1*] and Jason Cohen[2]

[1]Texas A&M College of Medicine, Bryan TX, USA

[2]Clinical Cardiac Electrophysiologist, Baylor Scott and White, College Station TX, USA

[*]**Corresponding author:** Jacob Alexander Powell, Texas A&M College of Medicine, Bryan TX, USA.

E-mail: japowell98@gmail.com

Received: January 12, 2025; **Accepted:** January 26, 2025; **Published:** February 15, 2025

Abstract

Atrioventricular reentrant tachycardia (AVRT) typically has an accessory pathway (AP) along the atrioventricular valve annulus during an electrophysiology study (EPS) that is treated with ablation. Some accessory pathways with epicardial components have been described, often requiring pericardial access for epicardial ablation. We present a 53-year-old lady who presented to the clinic with palpitations and was found to have AVRT with a wholly epicardial AP that easily terminated with radiofrequency ablation at the AP insertion site. After ablation, the tachycardia was no longer inducible. This case demonstrates the need to look further afield than the atrioventricular groove when an AVRT does not show an obvious accessory pathway.

Keywords: AVRT; Accessory pathway; Marshall bundle; Electrophysiology study

Introduction

Atrioventricular reentrant tachycardia (AVRT) is caused by electrical wavefront propagation over an accessory pathway between the atrium and ventricle separate from the normal conduction system. Depending on the properties of the accessory pathway, there may be propagation in one direction or the other, resulting in orthodromic or antidromic AVRT. Most accessory pathways can be mapped along the atrioventricular (AV) valve annulus during an electrophysiology study (EPS) and treated with ablation. A common hallmark of an accessory pathway is a narrowing of the distance between the atrial and ventricular signals along the AV valve annulus as you near the accessory pathway in addition to an additional signal (the "pathway potential"). The location of these pathways can often be determined by electrocardiogram (EKG) analysis and localized during an EPS. About 50-60% of the time, the accessory pathway insertion site is along the left lateral free wall [1].

The literature describes cases of accessory pathways with epicardial components that require pericardial access for epicardial ablation [2]. Further, a case series by Mah et al. in the pediatric population demonstrated epicardial connections between atrial appendages and ventricles that seem to completely bypass the typical AV groove locations [3].

In this case report, we present a rare case of AVRT with no apparent accessory pathway on endocardial mapping. This pathway mapped to a discrete point in the lateral left atrium, and ablation of this point terminated the arrhythmia, conduction over the accessory pathway, and all VA conduction.

Case Presentation

The subject is a 53-year-old female with a past medical history of palpitations presented to the emergency department with cough, dyspnea, and decreased exercise tolerance. She was noted to have narrow-complex tachycardia with a heart rate in the 140s-150s beats per minute (Figure 1). Adenosine resulted in a brief termination of the arrhythmia, but it recurred. Amiodarone was initiated for rhythm control, which was acutely effective. She was ultimately referred for outpatient electrophysiology evaluation, and an electrophysiology study was recommended.

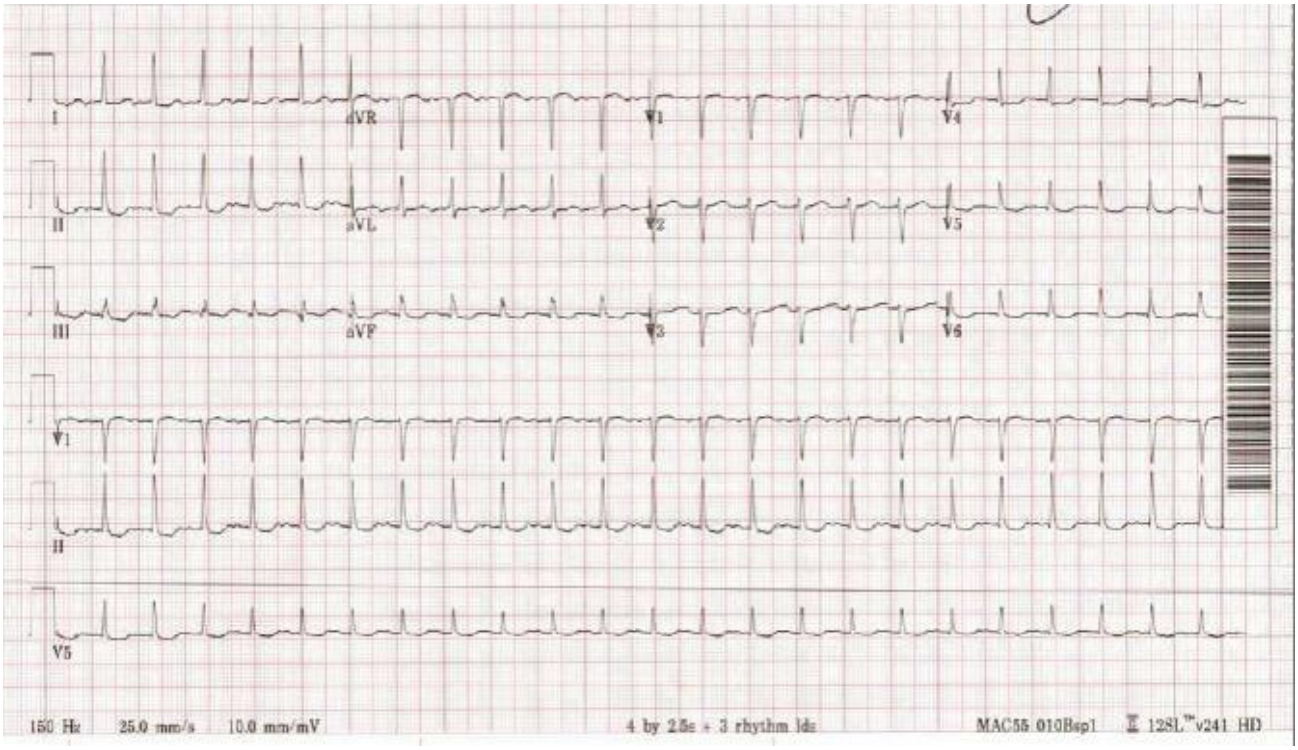
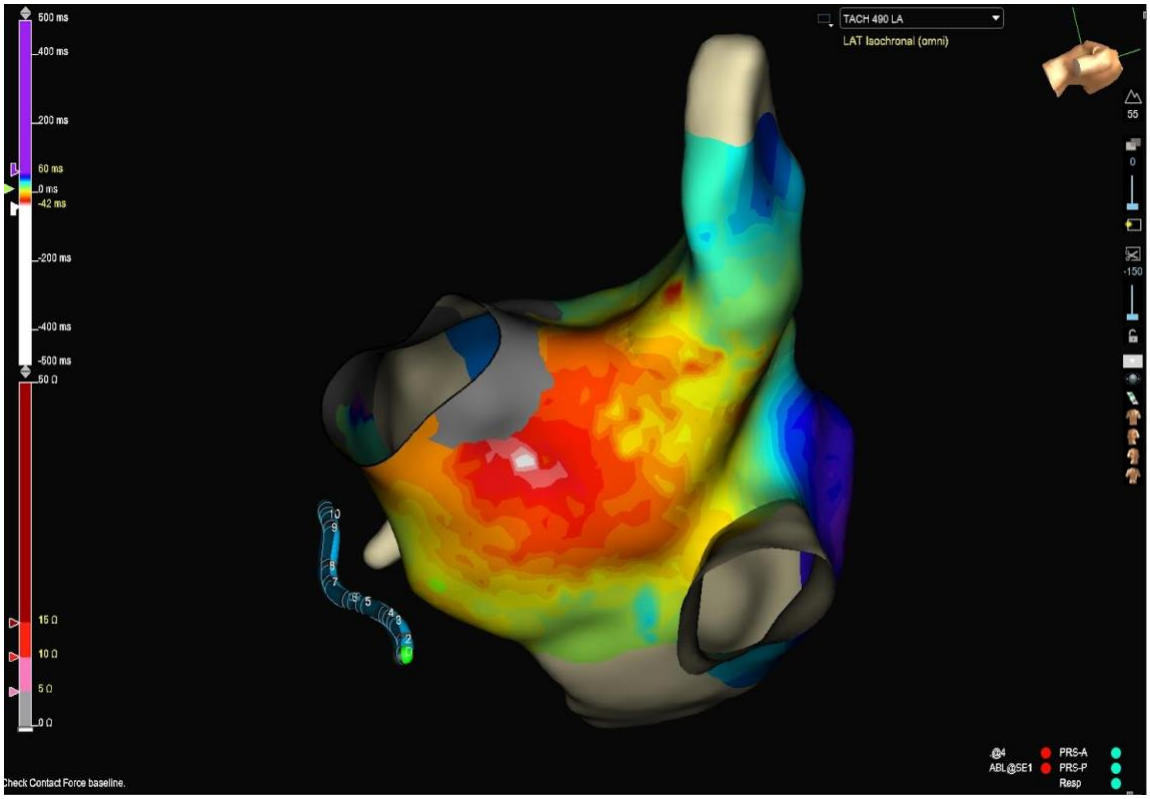


Figure 1: Initial EKG on presentation in the ER. Long RP narrow complex tachycardia with a ventricular rate of 141 bpm.

The patient underwent an EPS, during which tachycardia was easily inducible. The tachycardia was narrow complex with a cycle length of 510 ms and a VA time of 210 ms. The coronary sinus catheter showed eccentric activation (Figures 2A and 2B). The tachycardia was terminated after an early premature ventricular contraction (PVC) (Figure 3). Ventricular overdrive pacing revealed a V-A-V response (Figure 4). While pacing from the right ventricle (RV) apex, there was clear retrograde conduction to the atrium with eccentric activation of the coronary sinus (CS) catheter. No obvious pathway potential was noted on the CS catheter signals, even though the catheter was moved distally within the coronary sinus. Moreover, atrial and ventricular signals remained well separated in sinus rhythm, supraventricular tachycardia (SVT), and ventricular pacing. Endocardial mapping of the mitral valve annulus (MA) using an Abbott Advisor HD Grid mapping catheter did not reveal any apparent pathway potentials or areas of converging ventricular and atrial signals along the annulus consistent with an accessory pathway.

(A)



(B)

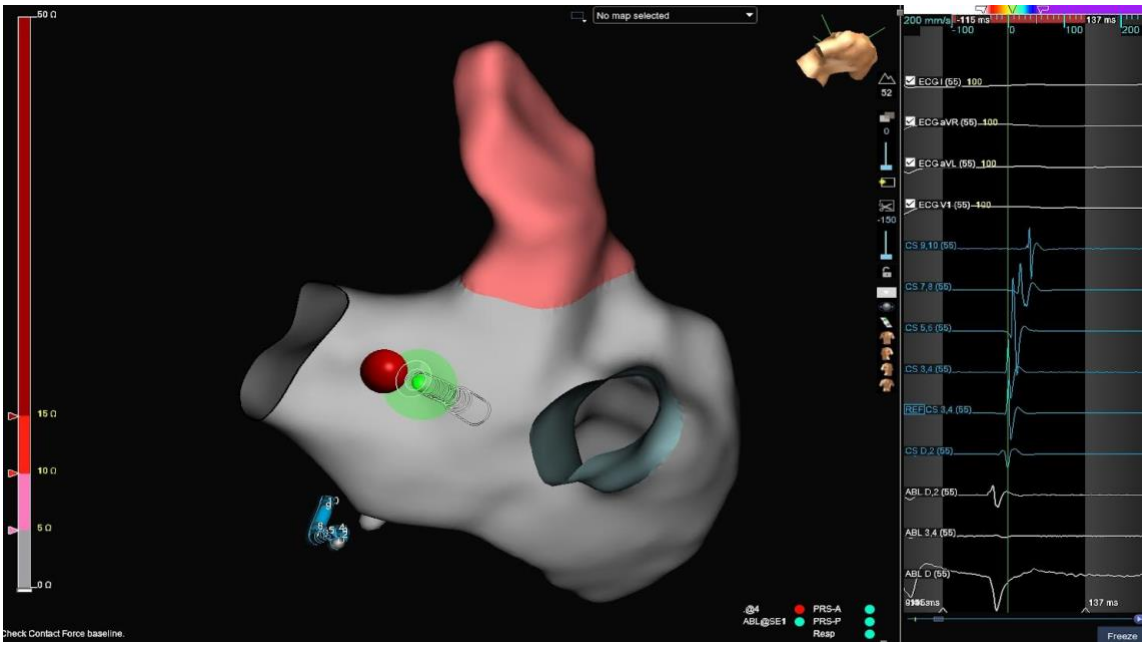


Figure 2: (A): Endocardial activation map of Left Atrium in SVT. This view shows decapolar catheter in the CS; **(B):** Endocardial map of left atrium: This image shows decapolar catheter in the CS as well as ablation catheter on lateral left atrium. Local electrograms of CS catheter in blue (Distal on bottom) and ablation in white with unipolar distal on bottom. There is a clear QS signal on unipolar which precedes all other local electrograms.

Figure 3: Introduced PVC. This is a rhythm strip during SVT which shows clear termination with an introduced PVC, consistent with AVRT. His catheter (yellow) was in RV and decapolar catheter (blue) was in coronary sinus (distal electrodes on bottom).

Figure 4: Ventricular Overdrive Pacing. This is a rhythm strip during ventricular overdrive pacing which demonstrates a V-A-V response, consistent with AVRT or AVNRT. Mapping catheter (green) in RV and decapolar catheter (blue) in coronary sinus with distal electrode on bottom.

While in tachycardia, the earliest atrial activation was mapped, using the Abbott Advisor HD Grid mapping catheter. This was found in the left atrium at a discrete point in the lateral left atrium inferior to the left atrial appendage. This site was targeted for radiofrequency ablation. While ablating, the SVT terminated after approximately one second of radiofrequency (RF) energy (Figure 5). After ablation, the tachycardia was no longer inducible. Additionally, there was no longer VA conduction while pacing from the RV apex (Figure 6).

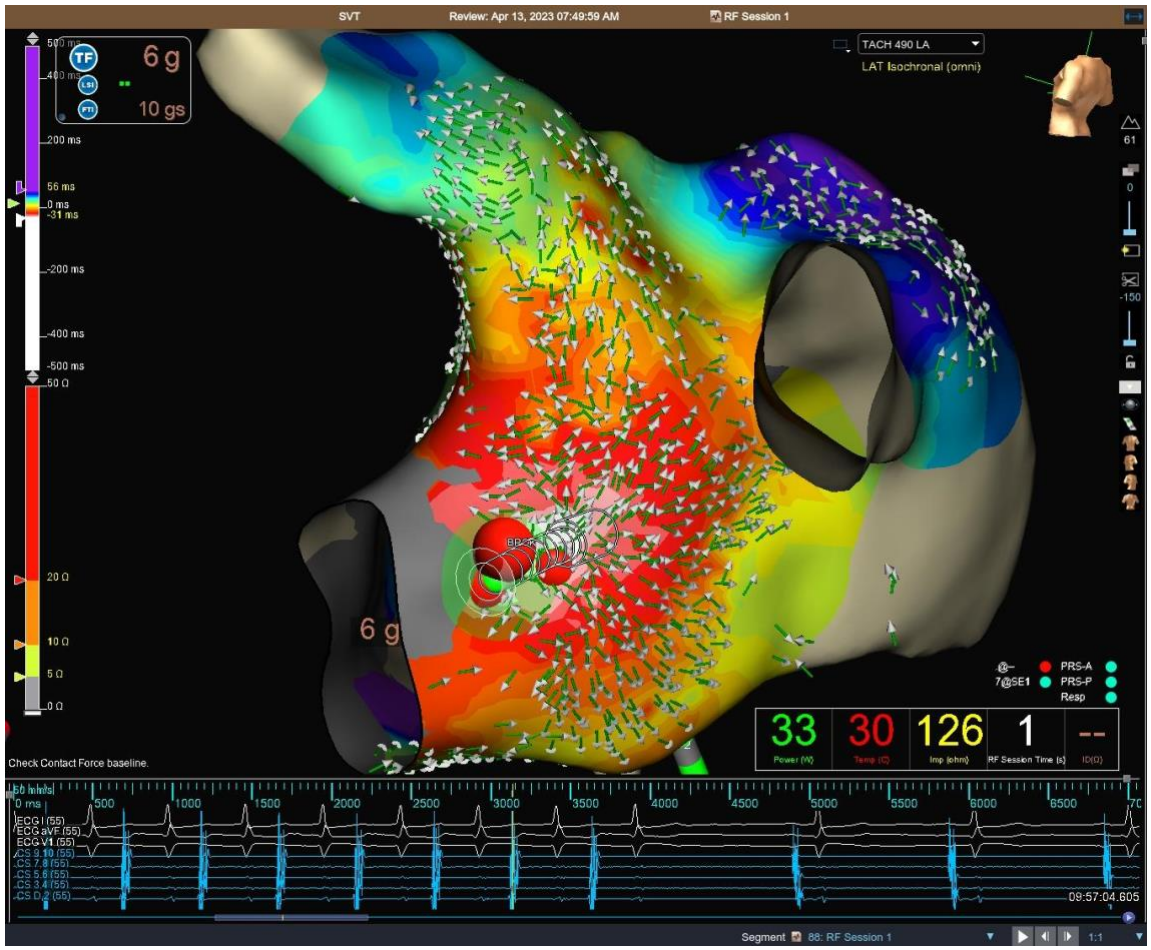


Figure 5: EPS image. The color mapping and arrows depict the atrial activation. White is early, and purple is late. Gray areas denote areas with a signal amplitude below the mapping threshold. The red dots represent ablation lesions. The electrograms below show surface leads (white) and coronary sinus catheter signals (blue). This strip was captured during ablation and shows termination after 1 second of energy delivery. Eccentric CS activation during tachycardia returns to concentric activation with sinus rhythm.

Figure 6: Ventricular pacing post ablation within left atrium. With pacing of the RV at a cycle length of 600 ms there is no VA conduction.

Discussion

This was an interesting case of a rare presentation of orthodromic AVRT. While concealed AVRT with a left lateral insertion is not uncommon, the atrial insertion site remote from the annulus without any apparent evidence of an endocardial pathway is rare. This case highlighted an AV accessory pathway that seems to have been inserted discretely into the lateral left atrium remote from the annulus or left atrial appendage. Ultimately, the tachycardia and pathway were eliminated with a single lesion in the lateral left atrium. This also resulted in the elimination of VA conduction. As a result of this EP study, the suspected mechanism of the patient's tachycardia is AVRT with a wholly epicardial course of the accessory pathway and a discrete insertion into the left atrium.

This case is rare and interesting for a few reasons. For one, this patient had no evidence of an accessory pathway with endocardial mapping, either on CS electrograms or with high-density endocardial mapping. Moreover, this patient had a singular focal insertion site remote from the annulus and atrial appendage into the atrium. While AVNRT can use leftward extensions and exhibit eccentric CS activation during an EP study, these tachycardias should not terminate with a PVC in the His refractory period and should not have an apparent point focus [4,5]. In their paper, Hwang et al. eliminated AVNRTs with leftward extensions with ablation of the slow pathway at the typical location in the right atrium [6]. A focal atrial tachycardia would certainly map to a point focus; however, a V-A-V response to ventricular entrainment is not consistent with atrial tachycardia nor termination with a PVC. What's more, ablation of an atrial tachycardia should not affect VA conduction.

One possible explanation for the eccentric site of insertion of the accessory pathway is the use of the Marshall Bundle (MB) within the LOM. The location of the apparent insertion point of this accessory pathway was between the MA and the left pulmonary veins inferior to the left atrial appendage. This area is associated with the MB and may often involve atrial arrhythmias [7]. While it has been noted that pathways involving the LOM can be difficult to ablate [8], it would give an anatomical explanation for the location of the pathway insertion point.

Long et al. presented a case series of left-sided accessory pathways with unsuccessful initial ablations and who underwent a repeat EPS [9]. Of the 29 patients included in this study, 7 had accessory pathway insertions away from the mitral annulus and had successful ablation at the insertion sites of these pathways. Kanzaki et al. presented a case report of a patient undergoing EPS for AVRT who did not have a termination of the tachycardia after ablation at multiple sites of the mitral annulus and coronary sinus [10]. After these initial ablations, they mapped the accessory pathway insertion site to the left atrial ridge and successfully ablated here and terminated the tachycardia. The accessory pathway was hypothesized to utilize an LOM connection to the coronary sinus. Our case is similar to cases presented in these studies, but our patient is not in the pediatric population and had no prior ablation, which was seen in much of the available literature.

Conclusion

We believe this is a case of an AVRT with an accessory pathway inserted into the left atrium's lateral free wall with a wholly epicardial course. It is possible for such pathways to be terminated with ablation at the insertion site without the need to ablate the mitral annulus or coronary sinus. This case demonstrates the need to look further afield than the AV groove when an AVRT does not show an obvious accessory pathway.

REFERENCES

1. Obel OA, Camm AJ. Supraventricular tachycardia: ECG diagnosis and anatomy. Eur Heart J. 1997; 18: 2-11.
2. Scanavacca MI, Sternick EB, Pisani C, et al. Accessory atrioventricular pathways refractory to catheter ablation: role of percutaneous epicardial approach. Circ Arrhythm Electrophysiol. 2015; 8: 128-136.
3. Mah D, Miyake C, Clegg R, et al. Epicardial left atrial appendage and biatrial appendage accessory pathways. Heart Rhythm. 2010; 7: 1740-1745.
4. Padanilam BJ, Ahmed AS, Clark BA, et al. Differentiating Atrioventricular Reentry Tachycardia and Atrioventricular Node Reentry Tachycardia Using Premature His Bundle Complexes. Circ Arrhythm Electrophysiol. 2020; 13: e007796.
5. Shah AN, Field J, Clark BA, et al. Diagnostic utility of early premature ventricular complexes in differentiating atrioventricular reentrant and atrioventricular nodal reentrant tachycardias. Heart Rhythm. 2022; 19: 1836-1840.
6. Hwang C, Martin DJ, Goodman JS, et al. Atypical atrioventricular node reciprocating tachycardia masquerading as tachycardia using a left-sided accessory pathway. J Am Coll Cardiol. 1997; 30: 218-225.
7. Vlachos K, Denis A, Takigawa M, et al. The role of Marshall bundle epicardial connections in atrial tachycardias after atrial fibrillation ablation. Heart Rhythm. 2019; 16: 1341-1347.
8. Kim DT, Lai AC, Hwang C, et al. The ligament of Marshall: a structural analysis in human hearts with implications for atrial arrhythmias. J Am Coll Cardiol. 2000; 36: 1324-1327.
9. Long DY, Dong JZ, Sang CH, et al. Ablation of left-sided accessory pathways with atrial insertion away from the mitral annulus using an electroanatomical mapping system. J Cardiovasc Electrophysiol. 2013; 24: 788-792.
10. Kanzaki Y, Morishima I, Miyazawa H, et al. Antidromic and orthodromic reciprocating tachycardias over a novel left-sided accessory pathway involving the vein of Marshall and coronary sinus musculature. J Cardiovasc Electrophysiol. 2023; 34: 2398-2402.