

# Radiofrequency ablation of an atypical left accessory pathway from the left coronary cusp



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## Introduction

Endocardial radiofrequency (RF) catheter ablation of accessory pathways (APs) is the standard therapy for patients with AP-mediated atrioventricular reentrant tachycardia.<sup>1</sup> Endocardial catheter ablation has some limitations, such as the inability to access intramural or epicardial portions of the arrhythmia circuits. Epicardial location has also been related a contributing factor in up to 8% of failed RF ablations.<sup>2</sup> To date, only 3 cases of APs located near the mitral-aortic continuity and ablated from the left coronary cusp have been reported.<sup>3–5</sup>

## Case report

We describe the case of an 18-year-old woman with Wolff-Parkinson-White syndrome and recurrent supraventricular tachycardia referred to our institution for a redo procedure. The patient had a history of a left AP with a previous failed conventional ablation 6 months earlier with a retrograde approach in anterosuperior left ventricular aspect. Echocardiogram confirmed normal ejection fraction and absence of evident structural heart disease. Electrocardiogram (ECG) at the beginning of the study showed a manifest preexcitation, with sinus rhythm and delta wave (+) in DII, DIII, (-) in AVL, and with a “w” pattern in DI, (+/-) in V<sub>1</sub>, and (-) in V<sub>2</sub> (Figure 1A). The electrophysiological study demonstrated eccentric atrioventricular activation (Figure 1D),

**KEYWORDS** Accessory pathway; Catheter ablation; Radiofrequency ablation; Supraventricular tachycardia; Wolff-Parkinson-White syndrome (Heart Rhythm Case Reports 2020;6:947–950)

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The authors whose names are listed certify that they have NO conflict of interest and NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript. **Address reprint requests and correspondence:** Dr Laila Gonzalez-Melchor, University Clinical Hospital of Santiago de Compostela, Travesía de Choupana s/n, 15706, Santiago de Compostela, Spain. E-mail address: [dra\\_glezmelchor@hotmail.com](mailto:dra_glezmelchor@hotmail.com).

## KEY TEACHING POINTS

- A left coronary cusp location should be suspected in cases of electrocardiogram with preexcitation, “w” in DI, and left anterosuperior accessory pathway (AP) precordial suggestive pattern.
- In cases with retrograde aortic approach and no early ventricular activation in the left ventricle, the left sinus of Valsalva should be considered and explored.
- In difficult left APs it is recommended to explore the distal coronary sinus as well as the left atrial appendage with an initial transeptal approach and a secondary retrograde aortic approach.

refractory period of the AP <250 ms with no decremental properties, and orthodromic reentrant tachycardia induced with atrial decremental stimulation (Figure 1B and E). Transeptal puncture was performed using conventional references (a decapolar catheter in the coronary sinus [CS] and quadripolar catheter in His). An open-irrigated ablation catheter (ThermoCool SmartTouch; Biosense Webster, Irvine, CA) was advanced to the site of earliest ventricular activation at the base of the left atrial appendage (LAA) guided by an electroanatomical mapping system (CARTO3; Biosense Webster). Location of the catheter was confirmed after angiography of the LAA (Figure 2A and Supplemental Video 1). RF ablation (with a power of 30 W with an irrigation rate of 17 mL/h) at this location was unsuccessful. Earliest ventricular insertion mapping was performed in the anterosuperior left ventricle region as well as CS without remarkable precocity. Finally, throughout the retrograde approach, the left sinus of Valsalva (SoV) region was explored. Selective angiography through the cooled-tip ablation catheter was performed. A single RF application was performed with 5 grams force and 20 W at 30 mL/h, where an early ventricular activation was identified with a suggestive Kent potential leading to elimination of the AP within 2.5 seconds, so ablation power was titrated upwards (30 W at 30 mL/h)



**Figure 1** A: Twelve-lead electrocardiogram (ECG) showing sinus rhythm and atrioventricular preexcitation. B: Twelve-lead ECG during orthodromic reentrant tachycardia with 470 ms cycle length. C: Twelve-lead ECG demonstrating sinus rhythm and lack of preexcitation. D: Twelve-lead ECG in sinus rhythm and atrioventricular mild preexcitation with decapolar catheter electrogram in coronary sinus demonstrating eccentric atrioventricular activation. E: Twelve-lead ECG and endocavitary electrograms during orthodromic reentrant tachycardia.

and continued for 1 minute (Figures 2B–D and 3A–B, Supplemental Videos 2 and 3). Finally, ventricular stimulation during adenosine injection confirmed the success of the procedure. No complications were observed after the procedure and the patient remained without either preexcitation reappearance or AP-mediated tachycardia during 10 months of follow-up (Figure 1C).

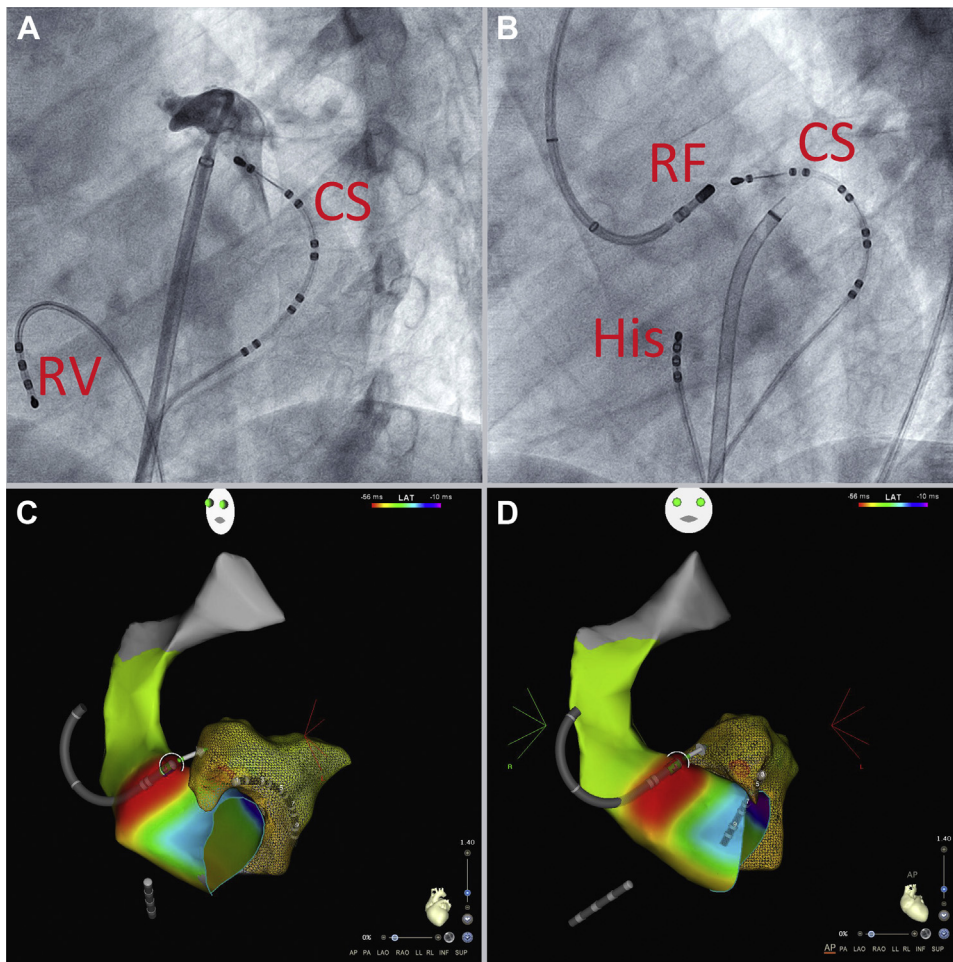
## Discussion

The most frequent reasons for prolonged or failed AP ablation include inability to reach the appropriate AP course, catheter stability, inadequate contact tissue, and the presence of epicardial APs.<sup>6,7</sup> Other factors include accurate electroanatomical mapping of some atypical located APs, such as the one described in this case, as well as multiple APs, slanted pathways, the broad-based nature of the connection, and

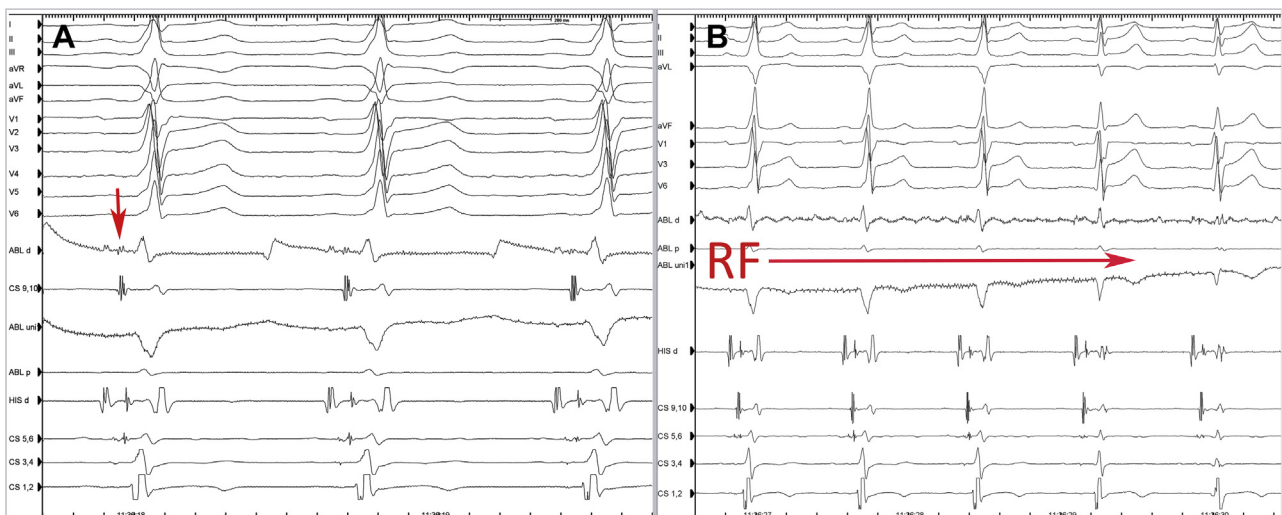
close proximity to atrial appendage or major coronary artery.<sup>8</sup> To date, only 3 cases of APs ablated from the left coronary cusp have been reported.<sup>3–5</sup>

Sacher and colleagues<sup>9</sup> described the characteristics of patients after a prior failed ablation, which included inaccurate mapping, epicardial AP, or APs that lie near or within the coronary sinus. Identification of the AP location by means of the ECG is sometimes challenging. They can be suspected when there is a manifest preexcitation. A “w” pattern in DI (although not exclusive of these APs, since it can also be found in outflow tract premature ventricular complex) is very characteristic of APs from the SoV, along with an early precordial R/S transition in precordial leads, with transition appearing in lead V<sub>3</sub> or later.<sup>10,11</sup>

Under our point of view, some take-home messages can be drawn from this case report. First of all, it is mandatory



**Figure 2** **A:** Left atrial appendage angiogram in left anterior oblique view. **B:** Fluoroscopic image of decapolar catheter in coronary sinus, quadripolar catheter in His, and radiofrequency catheter at ablation site. **C:** Electroanatomic activation mapping in left anterior oblique view with catheter in ablation site. **D:** Electroanatomic activation mapping in right anterior oblique view with catheter in ablation site. CS = decapolar catheter in coronary sinus; His = quadripolar catheter in His potential site; RF = radiofrequency ablation catheter; RV = quadripolar catheter in right ventricle.



**Figure 3** **A:** Twelve-lead electrocardiogram (ECG) and local electrogram at site of anterolateral pathway before ablation. **B:** Twelve-lead ECG and local electrogram at site of anterolateral pathway during and after ablation. Red arrow shows Kent potential (speed: 50 mm/s). RF = radiofrequency ablation.

to do a precise examination of the ECG, at baseline or after pacing maneuvers aimed to increase the degree of preexcitation. This is important because the accuracy of the commonly accepted location algorithms improves with maximal preexcitation.<sup>12–14</sup> Nevertheless, it must be highlighted that atypical APs are not represented in these algorithms. Subsequently, a step-wise strategy for mapping and ablation of these atypical APs is needed. Exploration of the distal CS and great cardiac vein is also recommended in patients with failed prior ablations. In this setting the current electroanatomic mapping systems can assist in the detailed course and location of these pathways, which very often, as was the case in our patient, require a transeptal access.<sup>9</sup>

Potential limitations in this case should be considered, such as the absence of mapping during supraventricular tachycardia and the lack of use of a high-density catheter or intracardiac echocardiography. Even though we consider the importance of thoughtful use of fluoroscopy, angiography of the LAA and of other structures is also at times very helpful, since it is useful to determine the location of the appendage and its size and morphology in order to avoid complications and assure safe ablation in a complex region of the myocardium.

In summary, under our point of view, in those patients with previous unsuccessful ablation procedures in the vicinity of the LAA region it is important to reevaluate alternative approaches, either by retrograde or anterograde access, in order to explore the left ventricular anterosuperior region, the mitral-aortic continuity, and the SoV. Importantly, prior to the RF application, selective angiography through a cooled-tip catheter can be performed in order to avoid collateral damage to nearby coronary arteries.<sup>15</sup>

## Conclusion

We report a case of an AP successfully ablated from the left coronary cusp. Atypical locations such as the one herein described must be taken into account when dealing with challenging APs. Particular considerations at the time of mapping and ablation of these locations need to be addressed in order to avoid potential complications.

## Appendix Supplementary data

Supplementary data associated with this article can be found in the online version at <https://doi.org/10.1016/j.hrcr.2020.09.012>.

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