

# Successful ablation of a right epicardial accessory pathway via the right ventricular diverticulum in a patient with Wolff-Parkinson-White syndrome

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## Abstract

**Introduction:** We describe one rare case of successful ablation of a right epicardial accessory pathway (AP) via the right ventricular diverticulum in a patient with Wolff-Parkinson-White syndrome. **Methods:** A 42-year-old woman being referred to the hospital for a catheter ablation of a Wolf-Parkinson White syndrome. Earliest activation was shown to be present in the region of the tricuspid annulus. However, ablation had no effect on the AP. **Results:** We decided to do a selected angiography, in which a big diverticulum near to the right tricuspid annulus was shown to be present. Ablation in this region successfully repressed the AP without any recurrences within a follow-up period of 12 months. **Conclusion:** The ventricular diverticulum mediated AP is a novel variant of pre-excitation. It can serve as an anatomical substrate of supraventricular tachycardia, and can be ablated endocardially using an irrigation tip catheter within the diverticulum.

## Successful ablation of a right epicardial accessory pathway via the right ventricular diverticulum in a patient with Wolff-Parkinson-White syndrome

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\* Correspondence: Zhijun Zhang MD, Department of Cardiology, Shanxi Bethune Hospital, Shanxi Academy of Medical Sciences, Tongji Shanxi Hospital, Third Hospital of Shanxi Medical University, Taiyuan, 030032, China E-mail: [zzj5431@163.com](mailto:zzj5431@163.com) Disclosures: None Funding: None Abstract Introduction: We describe one rare case of successful ablation of a right epicardial accessory pathway (AP) via the right ventricular diverticulum in a patient with Wolff-Parkinson-White syndrome. Methods: A 42-year-old woman being referred to the hospital for a catheter ablation of a Wolf-Parkinson White syndrome. Earliest activation was shown to be present in the region of the tricuspid annulus. However, ablation had no effect on the AP. Results: We decided to do a selected angiography, in which a big diverticulum near to the right tricuspid annulus was shown to be present. Ablation in this region successfully repressed the AP without any recurrences within a follow-up period of 12 months. Conclusion: The ventricular diverticulum mediated AP is a novel variant of pre-excitation. It can serve as an anatomical substrate of supraventricular tachycardia, and can be ablated

endocardially using an irrigation tip catheter within the diverticulum. Keywords: Arrhythmias, Ventricular diverticulum, Supraventricular tachycardia (SVT), Epicardial accessory pathway, Wolff-Parkinson-White syndrome, Catheter ablation,

## Introduction

Accessory pathway (AP) is an anomalous muscular connection between atrium and ventricle that bypasses the atrioventricular node. Radiofrequency catheter ablation (RFCA) of AP-mediated supraventricular tachycardia is recommended as first-line therapy with an overall success rate exceeding 92%<sup>1</sup>. RFCA of right-sided AP continues to be challenging<sup>1</sup>, resulting in lower success rates and higher recurrence rates. Atypical configuration of AP or cardiac structural abnormalities result in a lower initial success rate and a higher recurrence rate<sup>2</sup>. In a previous study, 8% of prolonged or failed ablation of AP was due to the presence of epicardial AP. We describe one rare case of successful ablation of a right epicardial accessory pathway via the right ventricular diverticulum in a patient with Wolff-Parkinson-White syndrome. Informed consent was obtained from the patient for publication of this case report and any accompanying images.

## Case Report

A 42-year-old woman with type B Wolff-Parkinson-White syndrome and documented recurrent episodes of narrow QRS complex AVRT (Figure 1A) was referred for catheter ablation. The earliest antegrade ventricular and retrograde atrial activation were distributed over a relatively wide range at the 7 to 8 o'clock position of the tricuspid annulus (TA). Initial RF ablation had no effect on antegrade and retrograde accessory pathway (AP) conduction with irrigated ablation contact force catheter (Thermocool SmartTouch™). While maneuvering the catheter in this region for further mapping, the catheter was positioned into an orifice with impedance rising from 120-130Ω to 160-200Ω. Selected angiography revealed the presence of a long diverticulum which protruded from the right lateral side of TA of right atrium(RA) to right ventricle (RV) (Figure 1B and Supplementary material online, Video 1-3). Further catheter dislodgment with 5g force touch in the middle cavity of the diverticulum suppressed AP function with impedance of 150-160Ω. Local ventricular activation (MAP 1-2) precedes the QRS onset by 37ms. Local mapping showed that the earliest ventricular activation was recorded within the chamber located lateral to the RV and far away from the TA. An A:V ratio of about 1:10 was observed in the local electrogram. There was no sign of AP conduction recurrence after catheter mechanical block of pathway conduction. RF ablation (25 W with 30 mL/min flow) at this site within the ventricular diverticulum was continued to 120 seconds, with the aid of a long sheath (Figure 1C). When gently pulling back the catheter to the ostium of ventricular diverticulum, the impedance decreased from 160-200 Ω to 120 Ω. 12-lead ECG showed disappearance of delta wave after ablation (Figure 1A). After a 30-minute waiting period, there was no sign of AP conduction recurrence and no complications occurred. Then, contrast-enhanced CT of RA and RV confirmed a pouch-like extension of cardiac muscles after ablation (Figure 1D). During 12 months follow-up, the patient experienced no tachycardia recurrence.

**Discussion** The ventricular diverticulum mediated AP is a novel variant of pre-excitation. Minois, D<sup>3</sup> reported a case of left ventricular diverticulum associated with two concealed atrioventricular accessory pathways. This is the first report of a right epicardial accessory pathway via the small right ventricular diverticulum in a patient with type B Wolff-Parkinson-White syndrome.

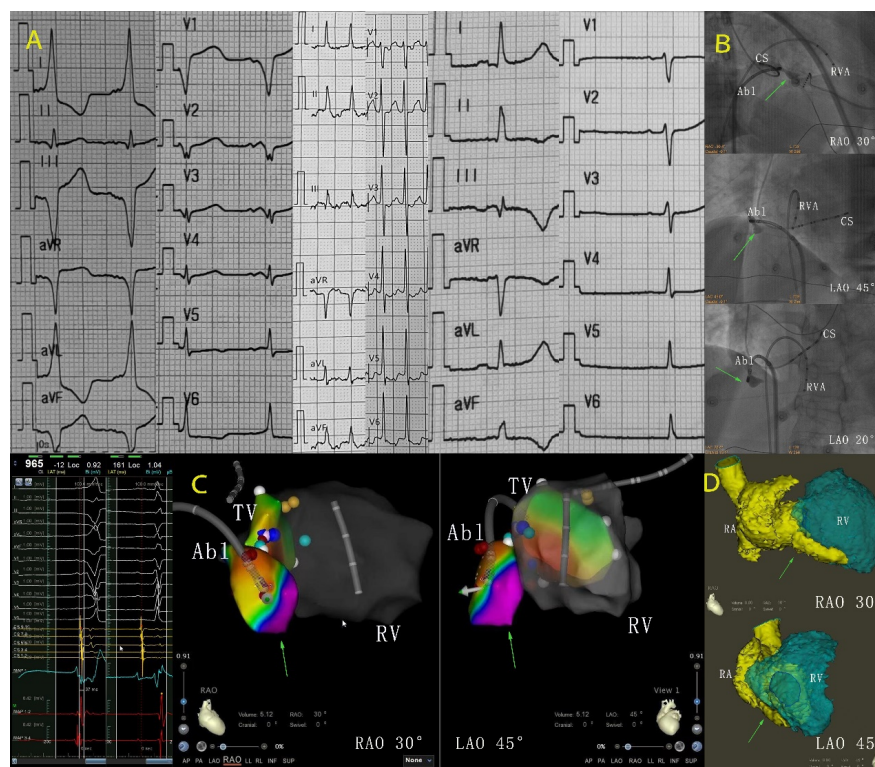
In clinical practice, routine mapping of AP insertion is generally performed along the edge of mitral and tricuspid annuli. Right-sided APs with atrial insertion far from TA were reported<sup>2, 4</sup>. In our case, the successful RF target localized to the ventricular diverticulum side of right ventricle far from the TA. It is an extremely rare condition for such a lengthy ventricular diverticulum musculature to transmit an electrical impulse from RA to the right ventricle. Similar to the posterior septal AP mediated by middle cardiac vein<sup>5</sup>, the connections between ventricular diverticulum musculature and ventricular myocardium are the anatomic basis of the ventricular diverticulum mediated AP. The angiography and electroanatomic mapping also showed that the small right ventricular diverticulum located lateral to the RV far from TA.

Patients with prior failed ablation of AP may have APs with unique anatomical substrates<sup>6, 7</sup> such as small cardiac vein<sup>8</sup> or axillary ventricular<sup>9</sup>. It is feasible to enlarge the range of electroanatomic mapping region

to identify atrial or ventricular insertion far from the annulus. Interestingly, the serendipitous discovery of ventricular diverticulum in this case was partially due to the sudden rise in impedance and catheter dislodgment. Then, local mapping excluded a pouch-like extension of cardiac muscles and angiography confirmed the opening of the ventricular diverticulum. Thus, if the ventricular insertion is found in a ventricular orifice far from TA and the local impedance is above 160  $\Omega$ , a ventricular diverticulum related AP should be considered.

Another distinctive characteristic of ventricular diverticulum related AP is the vulnerability to RF energy. In this case, AP conduction block was simply achieved by catheter-induced mechanical stress. With precise activation mapping and cautious power delivery, endocardial catheter ablation of ventricular diverticulum related AP with an irrigated catheter appears to be effective and safe.

**Conclusion** The ventricular diverticulum mediated AP is a novel variant of pre-excitation. This is the first report of a right epicardial accessory pathway via the right ventricular diverticulum in a patient with type B Wolff-Parkinson-White syndrome. The ventricular diverticulum can serve as an anatomical substrate of supraventricular tachycardia, and ventricular diverticulum-related AP can be identified and ablated endocardially using an irrigation tip catheter within the diverticulum.



**Figures** Figure 1. (A) 12-lead ECG showing delta wave before ablation, narrow QRS tachycardia, and disappearance of delta wave after ablation. (B) Selected angiography in right anterior oblique (RAO30°), left anterior oblique (LAO45°), and LAO20° projections depicting a long diverticulum which protruded from the right lateral side of TV of RA to RV. (C) The site of successful ablation was in the middle cavity of the diverticulum, local ventricular activation (MAP 1-2) precedes the QRS onset by 37ms, an A:V ratio of about 1:10 was observed in the local electrogram. (D) Contrast-enhanced CT of RA and RV showed a large-sized diverticulum located lateral to the RV after ablation.

Supplementary material online, Video 1. Selected angiography in right anterior oblique (RAO30°) projection depicting a large-sized diverticulum.

Supplementary material online, Video 2. *Selected angiography in left anterior oblique (LAO45°) projection depicting a large-sized diverticulum.*

Supplementary material online, Video 3. *Selected angiography in left anterior oblique (LAO20°) projection depicting a large-sized diverticulum.*

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