

A case of Wolff–Parkinson–White syndrome in which two-dimensional speckle-tracking echocardiography was useful for identifying the location of the accessory atrioventricular pathway

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Background

In Wolff–Parkinson–White (WPW) syndrome, accessory atrioventricular pathways (AP) result in abnormal pre-excitation around the atrioventricular annuli and produce a dyssynchronous contraction of cardiac chambers. Identification of the AP affects the outcome of catheter ablation.

Case summary

We report a case of WPW syndrome and paroxysmal atrial fibrillation in a 65-year-old man. Wolff–Parkinson–White syndrome Type B was suspected from lead V1, but when two-dimensional speckle-tracking echocardiography (2D-STE) was performed, a decrease in regional strain was observed in the anterior basal wall of the left ventricle. We identified the earliest site of atrioventricular conduction, and improvement in the regional strain at the site of ablation was observed after successful AP ablation.

Discussion

Various echocardiographic techniques have been investigated as non-invasive alternatives for AP localization. Longitudinal 2D-STE accurately identified contractile abnormalities associated with the AP, allowing us to non-invasively estimate the localization of the AP in WPW syndrome.

Keywords

Case report • Accessory atrioventricular pathway • Wolff–Parkinson–White syndrome • Radiofrequency ablation • Speckle tracking

Learning points

- In Wolff–Parkinson–White (WPW) syndrome, the effectiveness of ablation is dependent on the precise localization of the accessory atrioventricular pathway (AP).
- A decrease in regional strain was observed in the anterior basal wall of the left ventricle using longitudinal two-dimensional speckle-tracking echocardiography (2D-STE), and the finding is consistent with endocardial mapping associated with the localization of AP.
- Longitudinal 2D-STE accurately identified contractile abnormalities associated with the AP.

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Introduction

In Wolff–Parkinson–White (WPW) syndrome, accessory atrioventricular pathways (AP) are fibres that connect the atrium to the ventricle outside the normal atrioventricular nodal–His–Purkinje conduction system. Patients were grouped into Type A or B based on conventional 12-lead electrocardiography (ECG),¹ with pre-excitation from the posterolateral base of the left ventricle (LV) in Type A and from the right ventricular free wall or interventricular septum in Type B. Atrioventricular pathways result in abnormal pre-excitation around the atrioventricular annuli and produce a dyssynchronous contraction of cardiac chambers.² Radiofrequency catheter ablation (RFCA) is a well-established treatment for patients with WPW syndrome associated with tachyarrhythmias. The effectiveness of ablation is dependent on the precise localization of the AP.³ We report a case of WPW syndrome and longitudinal two-dimensional speckle-tracking echocardiography (2D-STE) accurately identified contractile abnormalities associated with the AP.

Timeline

Six years before admission	Repeatedly visiting the emergency department because of palpitation. Wolff–Parkinson–White syndrome was suspected from the 12-lead electrocardiography.
Three months before admission	Paroxysmal atrial fibrillation was detected.
Day 1	Pre-catheter ablation, longitudinal 2D-STE showed a decrease in regional strain in the anterior basal wall of the left ventricle.
Day 3	Cauterization was performed at the earliest site of atrioventricular conduction. Subsequently, pulmonary vein isolation and radiofrequency ablation of the cavo-tricuspid isthmus line were performed.
Day 4	Post-catheter ablation, longitudinal 2D-STE showed improvement in the regional strain at the site of the ablation.
Day 5	Discharged from hospital.
One month after discharge	Follow-up: asymptomatic patient.

Case presentation

The patient was a 65-year-old man who had been repeatedly visiting the emergency department because of palpitations. Wolff–Parkinson–White syndrome was suspected from the 12-lead ECG finding obtained at that time, and an antiarrhythmic drug was prescribed; however, it did

not improve the symptom. Later, paroxysmal atrial fibrillation (AF) was detected, and the patient was hospitalized for catheter ablation therapy. On admission, the heart rate was 63 b.p.m. in sinus rhythm, and 12-lead ECG revealed shortening of the PR interval (0.12 s) and extension of the QRS width with delta wave (0.11 s) (Figure 1A). Wolff–Parkinson–White syndrome Type B was suspected from lead V1, but when 2D-STE was performed (iE33, Philips Medical Systems, Andover, MA, USA), a decrease in regional strain was observed in the anterior basal wall of the left ventricle (LV) (Figure 2A). We identified the earliest site of atrioventricular conduction in sites of 3 and 4 of the coronary sinus catheter under rapid right ventricular pacing (interval, 324 ms) (Figure 3). The area was explored with an ablation catheter (Figure 4), and multiple cauterizations were performed at the most probable site (Figure 5). The conduction disruption of the AP was confirmed, and cauterization of the circumference was additionally performed. Subsequently, pulmonary vein isolation and radiofrequency ablation of the cavo-tricuspid isthmus line were performed successfully. Twelve-lead ECG revealed normal duration of the PR interval (0.16 s) and shortening of the QRS width (0.10 s) (Figure 1B). When 2D-STE was performed on the day after the catheter ablation, improvement in the regional strain at the site of the ablation was observed (Figure 2B).

Discussion

We report a case of WPW syndrome and longitudinal 2D-STE accurately identified contractile abnormalities associated with the AP. In WPW syndrome, AP are fibres that connect the atrium to the ventricle outside the normal atrioventricular nodal–His–Purkinje conduction system. Atrioventricular pathways result in abnormal pre-excitation around the atrioventricular annuli and produce a dyssynchronous contraction of cardiac chambers.³ Non-invasive diagnostic modalities to localize AP with high accuracy before performing catheter ablation can result in a shorter procedure time and fluoroscopy durations.

Various echocardiographic techniques have been investigated as non-invasive alternatives for AP localization.² Strain echocardiography by speckle tracking has been successfully applied to study myocardial deformation and dyssynchrony. Since electrical pre-excitation in WPW causes systolic dyssynchrony, strain by speckle tracking can be used to identify the site of earliest mechanical activation.⁴ In this case, the loss of systolic shortening in the early activated region observed using longitudinal 2D-STE, and the finding is consistent with endocardial mapping associated with the localization of AP. Previous studies demonstrated that low local afterload during early activation, which allows rapid shortening before ejection, followed by reduced systolic shortening or even (rebound) stretching owing to a lower sarcomere length and shortening deactivation.^{5,6}

Patients with WPW syndrome were divided into two groups: those having contractile abnormalities within the LV-free wall (anterior, anterolateral, and inferolateral) and those within the interventricular septum (inferior, inferoseptal, and septal).⁴ Regional strain values were decreased in the inferoseptal and inferior basal and mid-ventricular walls in patients with AP of the interventricular septum. In contrast, a decrease in regional strain was observed in the anterior basal wall in patients with an LV-free wall AP. In this case, regional strain values of the anteroseptal basal area were decreased before and after successful ablation. The anteroseptal basal area is

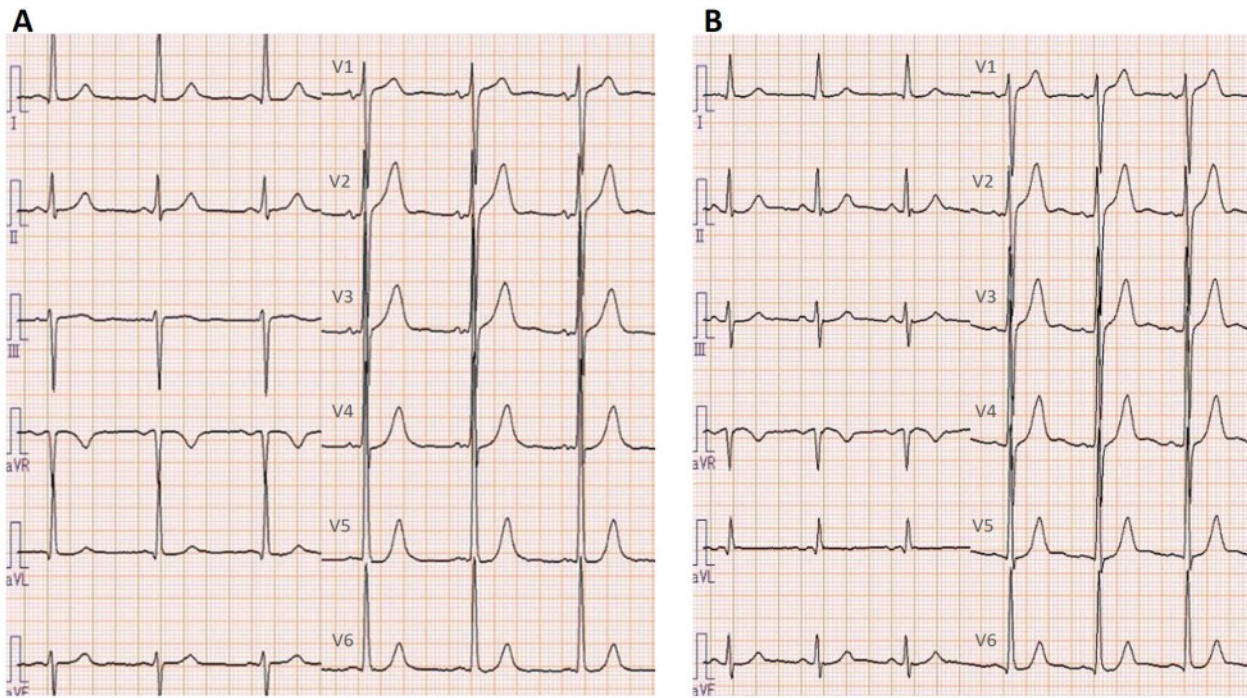


Figure 1 Twelve-lead electrocardiography revealed shortening of the PR interval and extension of the QRS width (A). After successful accessory atrioventricular pathway ablation, 12-lead electrocardiography revealed normal duration of the PR interval and shortening of the QRS width (B).

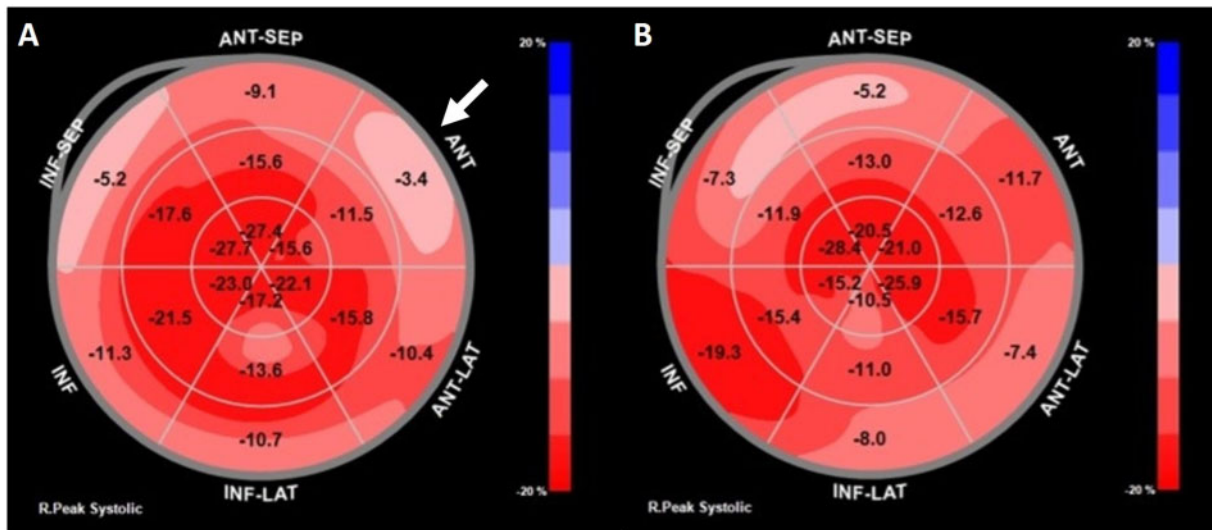


Figure 2 Peak longitudinal strain values before (A) and after accessory atrioventricular pathway ablation (B). The regional strain value in the anterior basal wall of the left ventricle was decreased (A, arrow). Improvement in the regional strain at the site of ablation was observed after successful accessory atrioventricular pathway ablation.

anatomically close to the aorta, and the image quality may have prevented accurate tracking. Improvement in the regional strain after successful ablation was observed and the present findings highlight the accuracy of 2D-STE in the assessment of pre-systolic contractile

events in WPW syndrome. Ishizu *et al.*⁷ investigated the ability of a new imaging technology based on three-dimensional (3D) STE in localizing AP in WPW syndrome. Three-dimensional STE is free from the loss of tracking of the target ultrasonic speckle within the

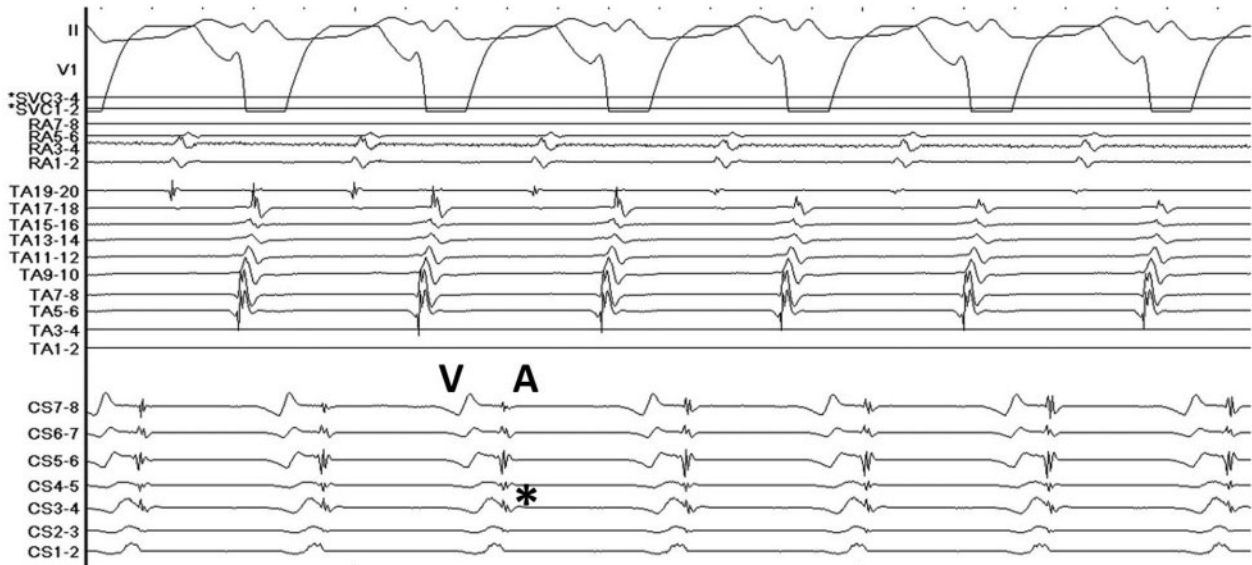


Figure 3 Invasive electrophysiological study showing the earliest site of atrioventricular conduction was identified in sites of 3 and 4 (asterisk) of the coronary sinus catheter under rapid ventricular pacing. A, atrial potential; V, ventricular potential.

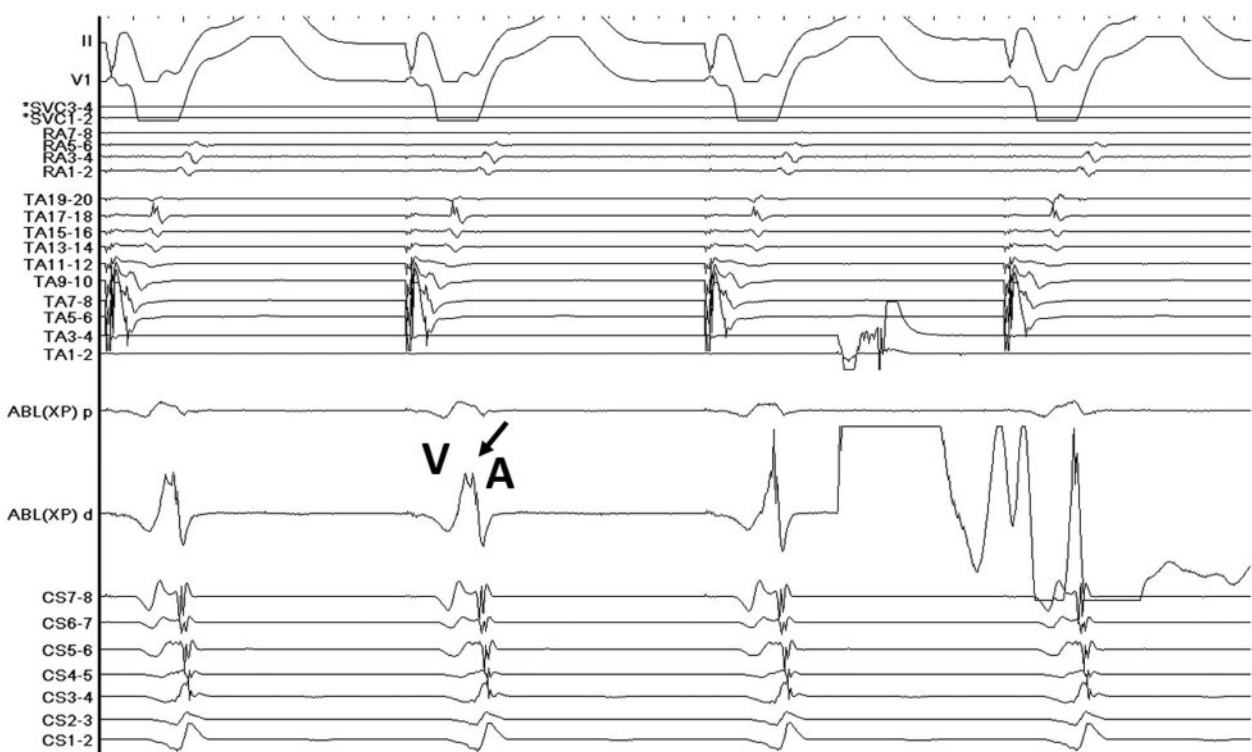


Figure 4 The local electrograms at the site of the earliest atrial potential observed (arrow) and the successful ablation site. A, atrial potential; V, ventricular potential.

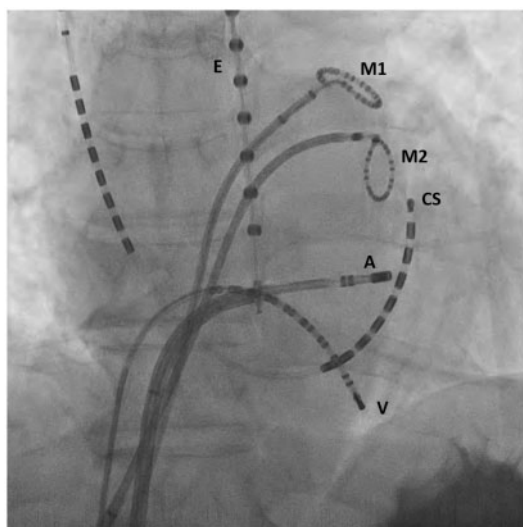


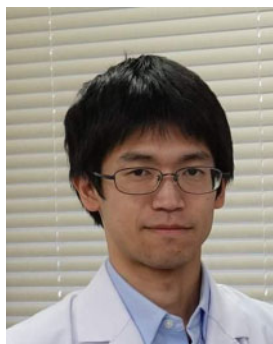
Figure 5 X-ray performed during atrioventricular pathways ablation. A, ablation catheter; CS, coronary sinus catheter; E, oesophageal thermometer; M1, mapping catheter 1; M2, mapping catheter 2; V, right ventricular pacing catheter.

3D region of interest and may provide a new visual method for the assessment of myocardial dyssynchrony.⁸

Conclusions

Longitudinal 2D-STE accurately identified contractile abnormalities associated with the AP, allowing us to non-invasively estimate the localization of the AP in WPW syndrome.

Lead author biography



Junya Tanabe is a resident cardiologist at Shimane University Hospital (Japan).

Supplementary material

Supplementary material is available at *European Heart Journal - Case Reports* online.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as [Supplementary data](#).

Consent: The authors confirm that written consent for submission and publication of this case report including images and associated text has been obtained from the patient in line with COPE guidance.

Conflict of interest: None declared.

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