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Case Report

Catheter ablation for Wolff–Parkinson–White syndrome with coronary sinus diverticulum in a 15-year-old boy

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ABSTRACT

The left posterior and posteroseptal accessory pathways often have an epicardial accessory and are associated with coronary vein anomalies, such as diverticulum, fusiform, or bulbous enlargement. We report the case of a 15-year-old boy who suffered from palpitation due to Wolff–Parkinson–White syndrome with coronary sinus diverticulum. An electrophysiology study revealed a left posterior accessory pathway and orthodromic atrioventricular reciprocating tachycardia. After the transseptal puncture, we performed mapping around the mitral annulus during sinus rhythm. We could not detect typical atrioventricular fusion accompanied with accessory pathway potential and failed to ablate around the mitral annulus. We revealed typical accessory pathway potential in a coronary vein and successfully ablated. After ablation, a right atrium angiography showed a successful ablation site was just at the neck of coronary sinus diverticulum. It is important for a successful and safe ablation to evaluate coronary vein anomalies in patients with left posterior and posteroseptal accessory pathways. <**Learning objective:** In pediatric patients, Wolff–Parkinson–White syndrome with the posteroseptal accessory pathway with coronary sinus diverticulum is rare. It is important to predict the left posterior and posteroseptal accessory pathways from the polarity of the delta wave; ablation for pediatric patients seems to be more effective and safe in confirming coronary sinus diverticulum by echocardiogram before electrophysiology study and performing coronary vein angiography before mapping of the accessory pathway.>

Introduction

Coronary vein anomalies, such as diverticulum, fusiform, or bulbous enlargement of small veins have been associated with posteroseptal and left posterior accessory pathways [1–4]. These accessory pathways can be recorded with accessory pathway potential in the middle cardiac vein and neck of coronary sinus diverticulum [1,3,5–7]. We report the case of a 15-year-old boy who suffered from palpitation due to Wolff–Parkinson–White (WPW) syndrome with coronary sinus diverticulum and underwent successful radiofrequency catheter ablation (RFCA) in the neck of coronary sinus diverticulum.

Case report

A 15-year-old boy was regularly followed at our hospital for the WPW syndrome. He was found to have a delta wave on the surface electrocardiogram of a school-based electrocardiogram screening by the first grade of elementary school. Twelve-lead electrocardiogram showed ventricular pre-excitation with an isoelectric delta wave in lead V1 and negative delta wave in leads II, III, aVF (Fig. 1). He had no symptoms and outpatient sessions followed regularly. He had felt the sudden beginning and sudden terminating of palpitations, which lasted for several minutes for 3 months previously. But he had no symptoms of faintness or syncope during the palpitations. Chest X-ray and echocardiogram detected no abnormalities. Holter electrocardiogram showed the maximum heart rate was up to 188 bpm but it was a sinus tachycardia. The treadmill-exercise-test showed that the maximal heart rate reached 204 bpm, but the delta rhythm did not disappear, as well as paroxysmal supraventricular tachycardia (PSVT) and atrial fibrillation (AF) were not induced. We judged that his recurrent palpitations were caused by PSVT and we performed an electrophysiological study (EPS) and RFCA under transvenous anesthesia. A 5F sheath was inserted into the left basilic vein, and a 5F electrode was arranged in the CS. An 8F and a 5F sheath were inserted into the right femoral vein, and 2F electrode catheters (EP star 2F Multi, Japan Lifeline, Tokyo, Japan) were arranged in the

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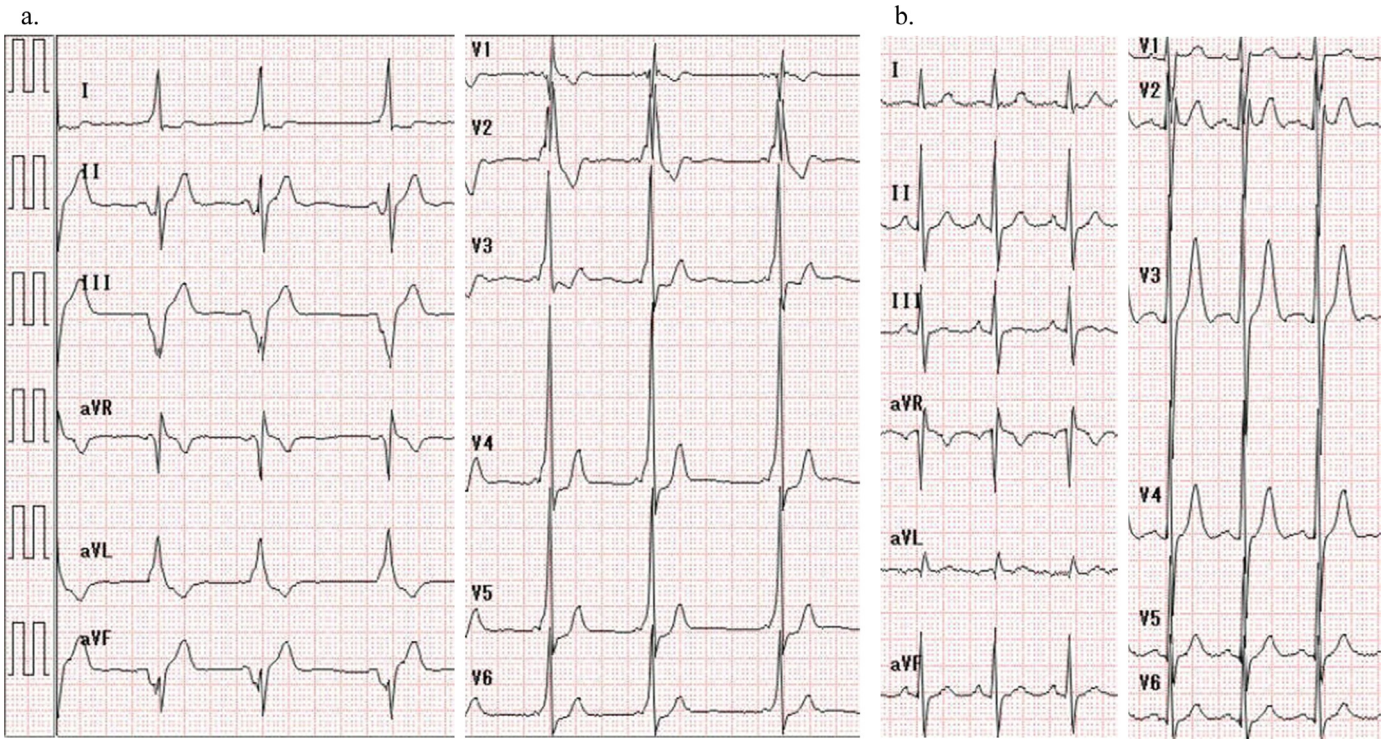

Fig. 1. Twelve-lead electrocardiogram (ECG) before and after radiofrequency catheter ablation. (a) ECG showing V1 isoelectric and II, III, aVF negative delta wave, especially III, aVF showed steep negative delta wave. (b) Normal PQ interval and no delta wave.

high right atrium, the His bundle, and the right ventricular apex. During ventricular pacing, the earliest atrial activation was at CS proximal (CS5-6) (Fig. 2c) and decremental property was not demonstrated. Narrow QRS tachycardia induced by atrial stimulation was demonstrated to advance in the atrial electrogram due to single ventricular stimulation during the His bundle refractory period. An atrial program stimulation revealed the antegrade accessory pathway effective refractory period (ERP) were <600–220 ms, <450–200 ms, respectively. It was diagnosed as an orthodromic atrioventricular reciprocating tachycardia (AVRT) by the left posterior accessory pathway. After performing a transseptal puncture using intracardiac echocardiogram and

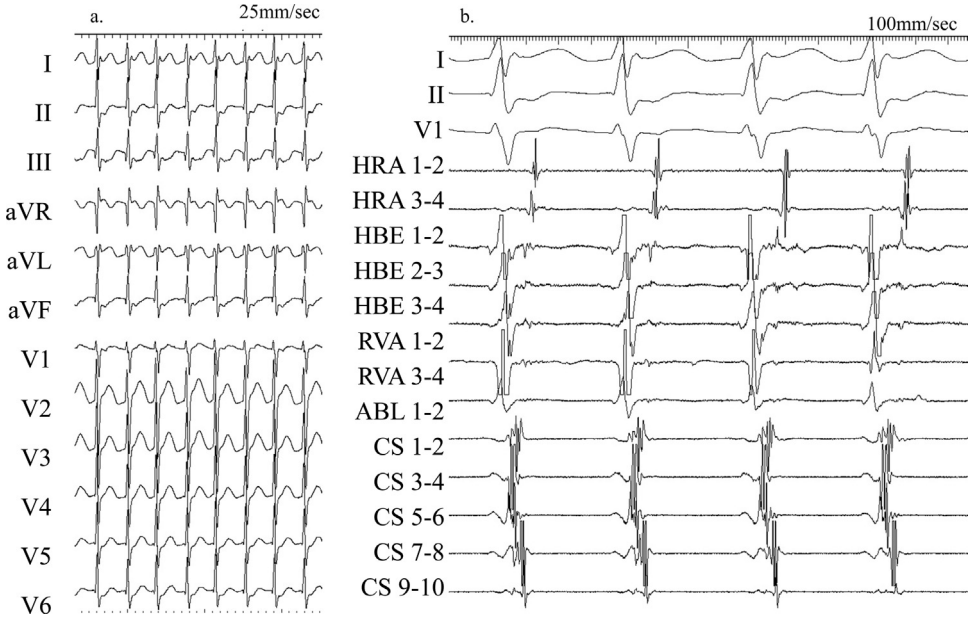

Fig. 2. Successful ablation site, 12-lead electrocardiogram (ECG) and intracardiac ECG of induced supraventricular tachycardia (SVT). (a) 12-lead ECG of induced SVT (b) Intracardiac ECG of induced SVT showed retrograde earliest atrial activation site at CS5-6. (c) Intracardiac electrogram showed typical AV fusion accompanied with accessory pathway potential at ABL. (d) Delta wave was interrupted for 2.4 s with a radiofrequency pulse (RF on). (e) Right and left anterior oblique right atrium angiography. Arrow denotes the coronary sinus diverticulum. The position of ablation catheter is at the site of successful ablation. ABL, ablation catheter; CS, CS electrode; His, His bundle electrode; RVA, RVA electrode.

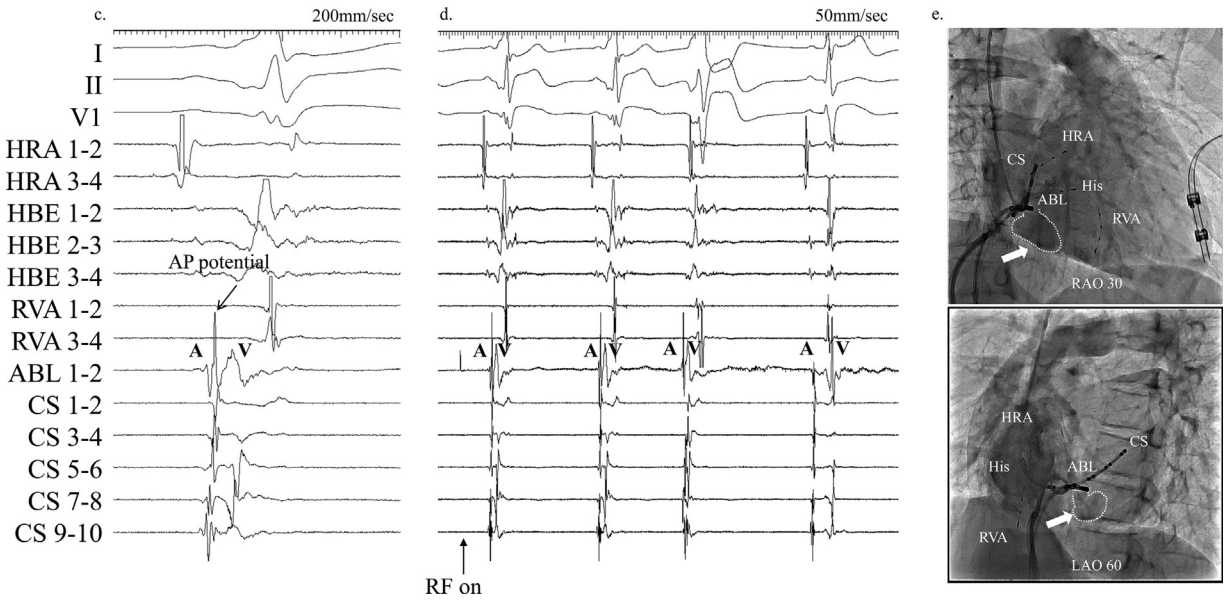

Fig. 2. (*Continued*).

radiofrequency needle, a long sheath (SL-2 Diag, St. Jude Medical, Saint Paul, MN, USA) was inserted into left atrium. Mapping was started using a 4 mm-tip ablation catheter (BLAZER II, Boston Scientific Japan, Tokyo, Japan). Mapping was performed during the sinus rhythm around the mitral valve annulus and RFCA was performed at the earliest ventricular activation and relatively short atrioventricular conduction site but pre-excitation persisted. The possibility of an epicardial accessory pathway or a right posteroseptal accessory pathway was raised; therefore, further mapping was performed on the right side. A typical fusion of atrioventricular conduction with accessory pathway potential was obtained in the coronary vein approximately 10 mm distal from the coronary sinus ostium. The delta wave disappeared and the accessory pathway conduction was interrupted at 2.4 s after initiation of ablation (thermal control, 19 W at 50 °C up to 105 Ohm) (Fig. 2a–c). After RF application, there was no accessory pathway ventriculoatrial conduction at ventricular pacing. At EPS after RFCA, a ventricular program pacing showed no VA conductions of AP and AV node, and any other SVT was induced by an atrial and ventricular program stimulation. After RFCA, a right atrium angiography was performed and demonstrated coronary sinus diverticulum. It revealed the ablation site was just in the neck of coronary sinus diverticulum. The next day after RFCA, echocardiogram demonstrated the coronary sinus diverticulum sizing at 9.9 mm × 12.8 mm, which was approximately 10 mm from the coronary sinus ostium. The pericardial effusion did not exist (Fig. 3a and b). A computed

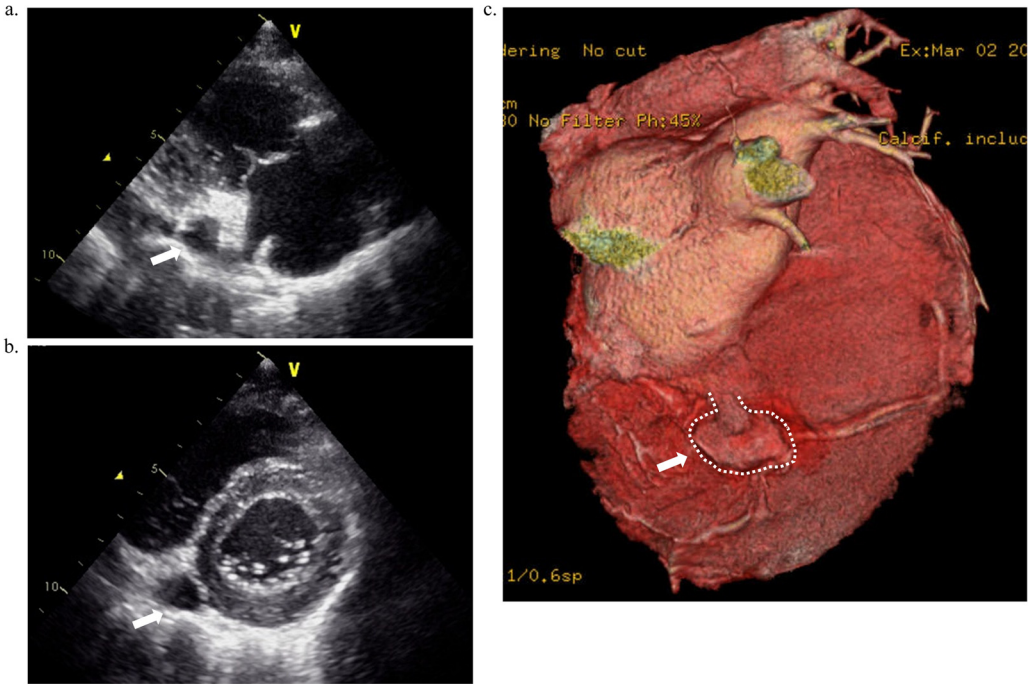

Fig. 3. Transthoracic echocardiogram and 3-dimensional computed tomography of coronary sinus diverticulum. (a) Long axis, (b) short axis, and (c) posteroinferior view. Arrow denotes the coronary sinus diverticulum.

tomography was performed for further assessment of the coronary sinus diverticulum and to rule out other congenital cardiac anomalies. It demonstrated the single coronary sinus diverticulum and no other coronary vein anomalies (Fig. 3c).

Discussion

In pediatric patients, WPW syndrome with posteroseptal accessory pathway with coronary sinus diverticulum is rare [8,9]. The indication of coronary sinus diverticulum was reported in 36 (7.5%) of 480 patients with left posterior and posteroseptal accessory pathways in adult patients. The reasons for difficulty in ablating the left posterior and posteroseptal accessory pathways are myocardial coat and anomalies of coronary sinus [3,4]. In this patient, we successfully ablated posteroseptal accessory pathway at the neck of coronary sinus diverticulum, but it took much time because of the mapping of the mitral annulus via transseptal approach.

It is important to prevent the complications of RFCA in pediatric patients. Before EPS, based on the electrocardiographic findings of delta wave, it was necessary to predict the presence of an epicardial accessory pathway [1]. In this case, it was predictable with negative delta waves of the lead II, the possibility of the left posterior and the posteroseptal accessory pathways. Although we predicted the site of accessory pathway at the left posterior or the posteroseptal before EPS, the intracardiac electrocardiogram of induced SVT showed the earliest atrial activation at CS5-6. Some reports demonstrated algorithms of accessory pathway in adult patients were less accurate in pediatric patients. We judged left posterior accessory pathway and underwent left side mapping before right side mapping.

There are some reports that the coronary sinus diverticulum is demonstrated by computed tomography and echocardiogram [5–7]. If the coronary sinus diverticulum was revealed before the ablation by the echocardiogram, it is useful to perform a mapping of the accessory pathway. A coronary vein angiography is useful to detect coronary vein anomalies [4,5,8,9]. During an EPS for patients with left posterior and posteroseptal accessory pathways, coronary vein angiography is recommended for the detection of coronary vein anomalies, such as coronary sinus diverticulum, fusiform, and enlargement of small coronary veins [5,7–9]. When the optimal ablation site is in the coronary sinus, because of avoiding complications of perforation, coagulation formation, excess heat, and right coronary artery stenosis, it is recommended to use temperature control ablation, irrigated RF ablation, and cryoablation [8,9]. In this patient, we performed low temperature RF application and avoided any complications. If we demonstrated the coronary sinus diverticulum by echocardiogram before ablation and we performed three-dimensional computed tomography before EPS or coronary vein angiography before mapping, it was more efficient and safer.

In Japan, school-based electrocardiogram screening is performed for all students, at the first level of elementary school, junior high school, and high school. There are many cases of WPW syndrome, which are discovered by this electrocardiographic screening system but most students are asymptomatic. In the patients with tachycardia, catheter ablation is adaptable in the same indication as the adult patients with WPW syndrome [2]. In adult patients, it is reported that accessory pathways with coronary sinus diverticulum tend to have a rapid atrioventricular conduction, and there is risk of sudden death during AF [10]. In pediatric patients, if rapid atrioventricular conduction or AF is revealed, it should be ablated. In this patient, antegrade accessory pathway ERP was very short, and we performed RFCA.

In conclusion, it is important to predict the left posterior and posteroseptal accessory pathways from the polarity of the delta wave. It seems to be more effective and safe ablation for pediatric patients in confirming coronary sinus diverticulum by the echocardiogram before EPS and performing coronary vein angiography before the mapping of the accessory pathway.

Conflict of interest

The authors declare that there is no conflict of interest.

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