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Successful Ablation of an Epicardial Accessory Pathway via the Subxiphoid Approach in a Child

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ABSTRACT

Data is scarce regarding epicardial ablation in children. I herewith present a case of successful epicardial ablation in a child with previous unsuccessful attempts at endocardial ablation. This report could be used to guide further such attempts.

1. Introduction

The catheter ablation of arrhythmia substrates is an approved method in the current era for cardiac arrhythmia management in children. Historically, pediatric guidelines follow adult versions to ensure safety in dealing with small-sized but growing bodies. The ablation of accessory pathways is a routine procedure in many academic centers; what could pose a challenge, however, is the occasional complexity of the cardiac anatomy or the unusual location of the accessory pathway.

2. Case report

A 10-year-old boy, 42 kg in weight, was admitted with recurrent supraventricular arrhythmias and syncopes. The patient had a history of 2 unsuccessful endocardial ablations of the accessory pathways. The first unsuccessful attempt had been made by me about 4 years earlier and the second one by an adult electrophysiologist in another center about 5 months before the patient's latest admission.

The surface electrocardiogram showed a Wolff–Parkinson–White (WPW) pattern, in favor of a posteroseptal accessory pathway (Fig. 1).

The due legal process, including obtaining written informed consent from the child's parents, was accomplished, and the patient was transferred to the electrophysiology laboratory room.

Sedation was achieved with a single dose of midazolam and fentanyl and maintained via a propofol drip infusion. Two 6F quadripolar catheters (Irvine Biomedical, St Jude, USA) were advanced into the right atrium and the right ventricle, and a decapolar catheter (IBI, St Jude Medical, USA) was placed in the coronary sinus, all via the femoral veins. Programmed premature atrial pacing resulted in atrial fibrillation with a rapid ventricular response. The shortest preexcited RR interval was less than 240 milliseconds, indicating the high-risk nature of the accessory pathway (Fig. 2). Mapping was done with the aid of a 7F steerable catheter (Stinger, Boston Scientific, USA) under conventional fluoroscopic guidance. In addition to the endocardial search, mapping was continued by advancing the catheter into the coronary sinus and the epicardial veins. The earliest ventricular signals, which preceded surface QRS onset by 10–15 milliseconds, were recorded at the ostium of the coronary sinus and the posteroseptal region of the tricuspid ring where the previous radiofrequency (RF) applications had been applied (Fig. 3). RF application at 25–30W was applied with a cool-tip catheter at a flow of 17 ml per minute. Boluses of 15–20seconds duration were unsuccessful despite an impedance drop of 10–15 Ω. The application of 5 RF lesions of approximately 90 seconds total duration at the selected site failed to effect any change to the preexcitation pattern. As mapping had

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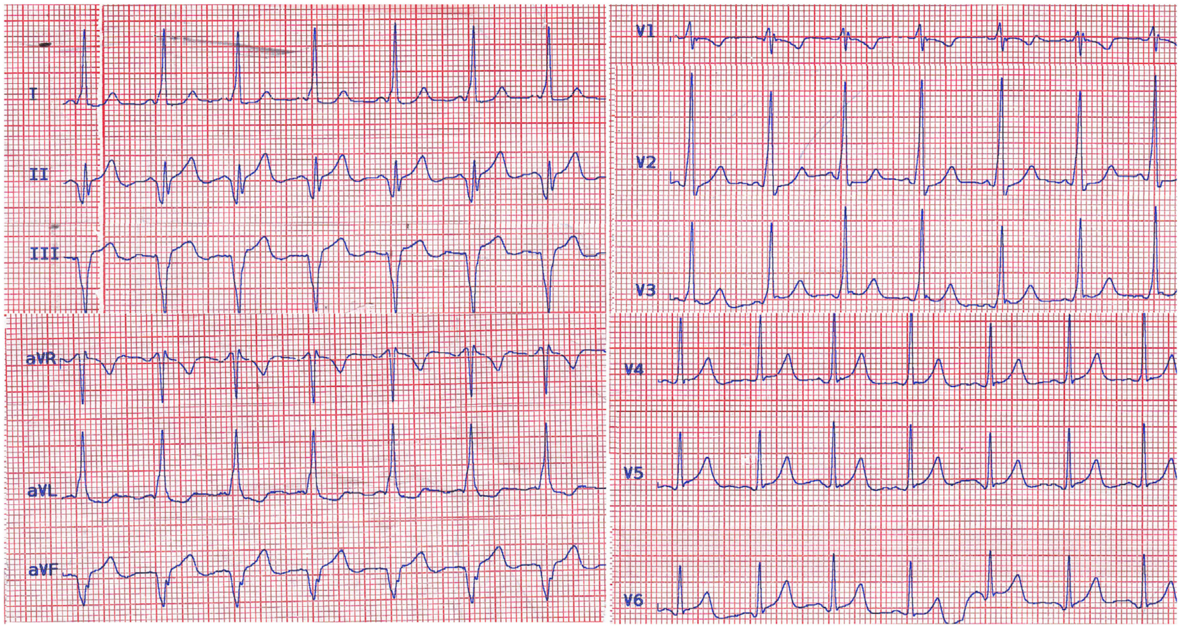

Fig. 1. The image illustrates the initial 12-lead surface electrocardiogram of the case. Ventricular preexcitation in favor of a posterior septal accessory pathway is seen.

Fig. 2. The image illustrates the intracardiac signals of the case during rapid-response atrial fibrillation. The tip of ablation catheter was at the right atrioventricular ring. HRA-D: Right atrial signals, RV-D: Right Ventricular signals, ABL-D: Ablation catheter signals, CS: Coronary sinus signals.

been done from the left side in the previous session by an expert electrophysiologist and to avoid heparin injection before subxiphoid approach, it was not repeated at this session.

Following the failure of the endocardial attempt, the subxiphoid epicardial approach was adopted. The subxiphoid site was punctured with a PeriVac Pericardiocentesis Kit (Boston Scientific, USA) under fluoroscopic guidance while the electrical signals recorded by the needle tip were monitored. When the signals confirmed the appropriate placement of the electrodes in the epicardium, a 0.032 mm guidewire was advanced into the pericardial sac (Fig. 4A&B). An 8F sheath was advanced over the guidewire, and an 8F ablation catheter (EZ Steer ThermoCool, Biosense Webster, USA) was advanced into the sheath (Fig. 4C&D). Surprisingly, a sharp accessory pathway signal was recorded at the first approach of the catheter tip to the epicardium. As the catheter was still in the sheath, it was advanced and looped to allow for appropriate mapping. The accessory pathway potential was detected around the entrance location of the sheath at an approximate distance of 1 cm from the earliest endocardial recording of the ventricular signals, which was the last endocardial RF application site (Figs. 4 and 5). The local electrogram preceded surface QRS onset by approximately 20 milliseconds which was earlier than the electrograms recorded endocardially. Contrast injection was done to visualize the coronary anatomy. Since no nearby coronary branch was found; 20 W RF was applied at a flow rate of 17 ml per minute with the Cool Flow irrigation system (STOCKER, Biosense Webster,USA). The accessory pathway potential disappeared and the pathway conduction was abolished about 3 seconds after the commencement of

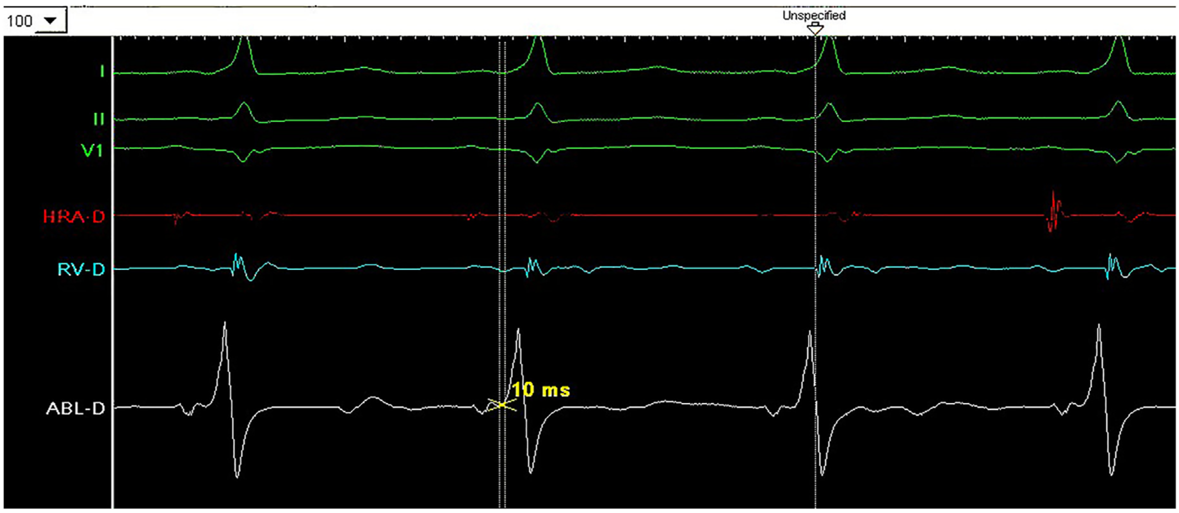

Fig. 3. The image demonstrates the earliest ventricular signals recorded by endocardial mapping while the tip of ablation catheter was at the posteroseptal region. HRA-D: Right atrial signals, RV-D: Right Ventricular signals, ABL-D: Ablation catheter signals.

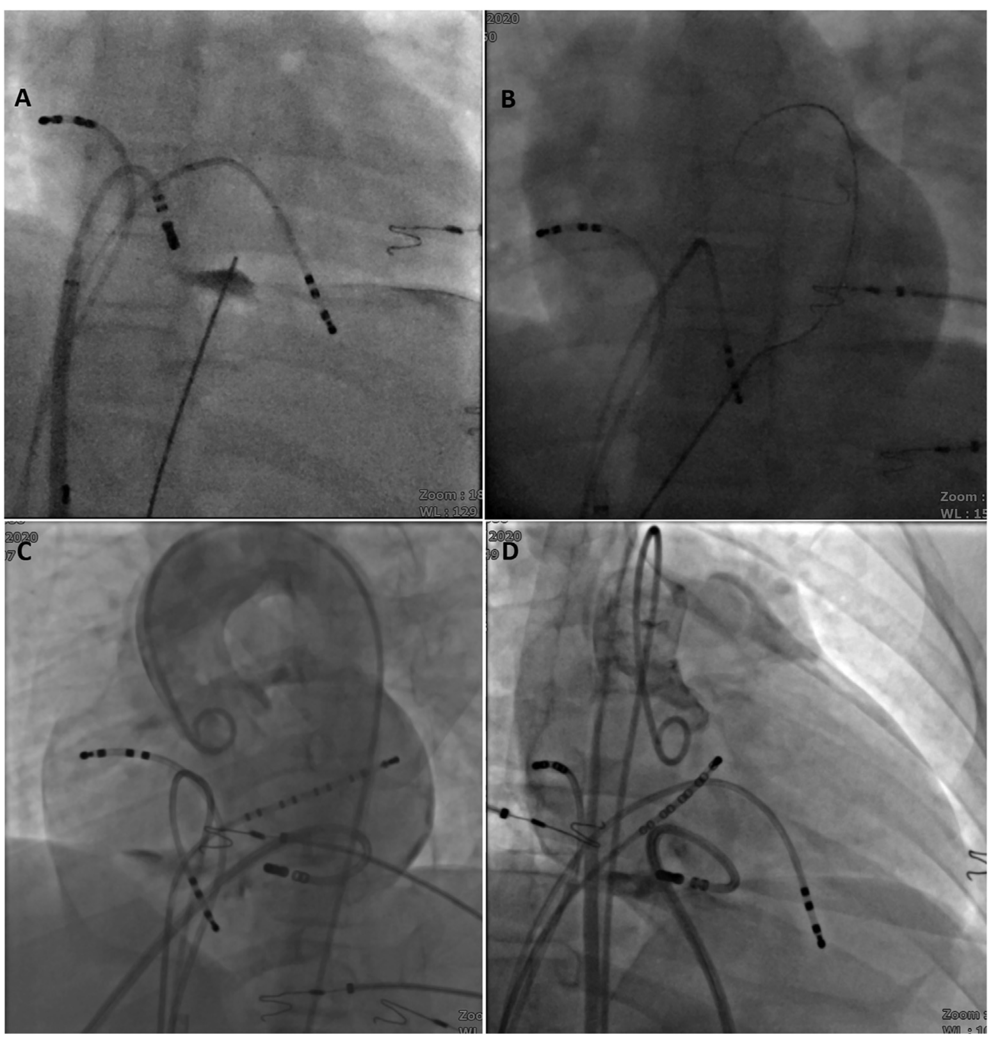

Fig. 4. Fluoroscopic images of the case are presented herein. A: Subxiphoid puncture in the anteroposterior view. The endocardial ablation catheter is seen with its tip at the earliest point of ventricular electrogram. The coronary sinus catheter is temporarily removed for better catheter placement. B: Advancement of the wire into the pericardial sac. C and D: Positions of the electrophysiology catheters in right anterior oblique and left anterior oblique views, respectively.

RF application (Fig. 5). An impedance drop of 9–10 Ω was observed with the first 5 seconds of RF application. RF application was continued for 1 minute. Recurrence was not observed during a waiting period of 30 minutes, and adenosine injection confirmed the complete disappearance of the accessory pathway. Two 30-s assurance RF applications were applied around the same focus.

The post-ablation electrophysiology study, performed after another 15-min waiting period, revealed a normal cardiac conduction system and no other inducible arrhythmias including atrial fibrillation. The procedure was terminated successfully following the injection of a single dose of triamcinolone (2 mg/kg) and with a pigtail catheter in the pericardial sac (PeriVac Pericardiocentesis Kit, Boston Scientific, USA), which was extracted the day after. Post-procedural 12 lead ECG is shown in Fig. 6.

The patient was discharged from the hospital 2 days later. At the follow-up visit in the outpatient clinic, he was in good health and normal sinus rhythm.

3. Discussion

Catheter ablation is an effective and relatively low-risk method for the management of arrhythmia substrates in the pediatric population with success and complication rates almost similar to those reported in adults.[1] The coexistence of cardiac structural anomalies creates additional challenges to the pediatric electrophysiologist in the treatment of this age group. Even in a heart with complex cardiac anomalies, arrhythmia substrates are usually accessible via the endocardial approach.[2] The epicardial approach is a fully accepted method for the ablation of ventricular tachycardia substrates.[3] Nevertheless, the literature contains a dearth of data on the use of the epicardial percutaneous subxiphoid approach to the mapping and ablation of accessory pathways.

It is worthy of note that most reports include adult patients, which renders the decision-making process vis-à-vis children with high-risk preexcitation syndrome difficult. In their review of articles from 2001 to 2016, Sternick et al. [4] reported 42 cases with an overall success rate of 42%. Based on the statement from the PACES/HRS Expert Consensus, the use of catheter ablation has a Class I indication in the WPW pattern with syncope and the presence of high-risk predictors for cardiac arrest.[5] Upadhyay et al. [6] described 9 pediatric patients who underwent 10 epicardial ablation procedures between 2002 and 2013. Accessory pathway ablation was performed in only 3 of these patients, of whom 1 needed endocardial re-approach for success.

Some authors have reported that subepicardial pathways exhibit a negative delta wave in lead II, while others have found sharp coronary sinus signals preceding atrial activation during orthodromic reciprocating tachycardias. These findings, however, have only moderate sensitivity and my patient exhibited none of them. [7].

Intraprocedurally, my search for an early ventricular activation recording by the ablation catheter yielded a sharp accessory pathway signal. Never in my previous experiences had I observed such sharp signals, with the exception of those in Mahaim pathways. The disappearance of the signal after RF application and the concomitant abolishment of conduction over the accessory pathway confirmed that it was a real accessory pathway potential. What I unfortunately ignored at this point was a noisy unipolar ablation signal.

Several types of complications have been observed in association with epicardial catheter ablation, one of the most important of which is coronary artery injury. Regrettably, the paucity of data

Fig. 5. The image demonstrates the intracardiac signals of the case during ablation. Note the disappearance of the accessory pathway potential (depicted with yellow circle) and coincident abolishing of the accessory pathway conduction. A: The display speed of 40 mm/seconds. B: The display speed of 100 mm/seconds. ABL-D: Ablation catheter signals, HRA-D: Right atrial signals, RV-D: Right Ventricular signals.

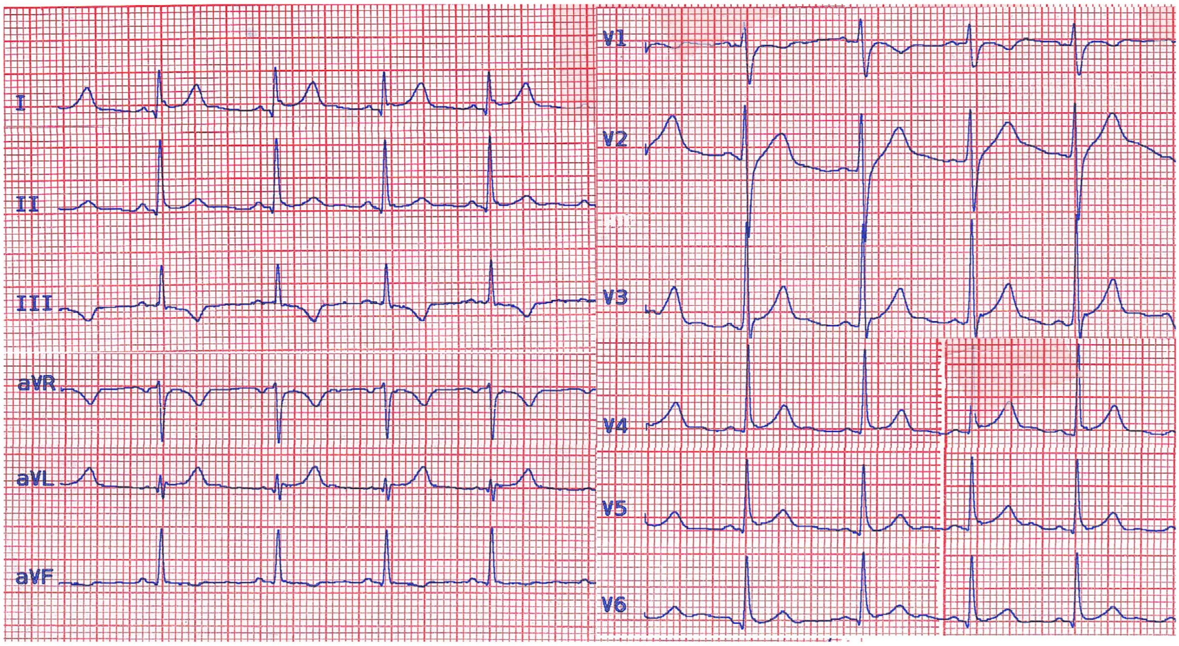

Fig. 6. The 12 lead surface ECG of the case after successful ablation procedure.

regarding children precludes statistical comparisons. Nonetheless, it is judicious that coronary arteries be paid sufficient heed given their smaller calibers.

I placed a pigtail catheter in the pericardial sac in case there might be an undiagnosed injury to the cardiac wall and/or the coronary arteries or veins. The catheter could also provide an easy access in the case of early recurrence. It should be noted that this course of action is not a standard recommendation.

Postprocedural injection of corticosteroids in the pericardial sac is done by some electrophysiologists for cases via the epicardial approach. The background is based on a study by d'Avila et al. [8] Whether or not this approach is beneficial has yet to be elucidated.

After more than 1000 catheter ablations in the pediatric age group, the present case was my first experience with the epicardial ablation of an accessory pathway via the Subxiphoid Approach. The procedure was straightforward and without any complications; still, I would urge that this be resorted to only if absolutely necessary taking adequate caution against possible complications.

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Declaration of competing interest

None.

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