Cryoablation: better catheter stability compared to RF ablation

Kriyoablasyonun kateter stabilitesinde RF ablasyona üstünlüğü

Volkan Tuzcu, Maria B. Gonzalez, Dietmar Schranz**

Arkansas Children`s Hospital, University of Arkansas for Medical Sciences, Little Rock, AR, USA;
*Pediatric Heart Center, University of Giessen, Giessen, Germany

Introduction

Cryoablation has an increasing role in catheter ablation in children (1). Cryomapping leads to transient and reversible effect on the tissue. Cryoablation can safely be used for lesion formation in close proximity to the atrioventricular (AV) node without significant risk of AV nodal injury (2,3). One of the advantages of cryoenergy over radiofrequency (RF) ablation is the catheter stability during lesion formation (4,5).

We report a case of a child with Wolff-Parkinson-White Syndrome in whom a right anterolateral accessory pathway was successfully ablated with cryoablation after failed trial of RF ablation.

Case Report

A 10.5-year-old female patient with a history of Wolff-Parkinson-White Syndrome and exercise induced palpitations underwent an electrophysiological procedure. Exercise test demonstrated persistent preexcitation pattern. Echocardiogram revealed a normal cardiac anatomy and ventricular function. She has not been treated with antiarrhythmic medications. She experienced presyncope associated with palpitations once. There was no history of syncope.

The procedure was performed under deep sedation using propofol infusion and intermittent IV meperidine. Baseline electrocardiogram (ECG) revealed delta wave pattern consistent with the presence of a right sided accessory pathway (AP). His-ventricular (HV) interval was - 18 msec. The earliest antegrade ventricular activation was noted in the right side. Ventricular pacing demonstrated no VA conduction. Following that finding, mapping catheter was removed from coronary sinus and placed in the high right atrium. Atrial pacing demonstrated antegrade AP block at 365 msec and a Wenckebach cycle length of 350 msec. Atrial fibrillation was induced with burst atrial pacing. Shortest preexcited RR cycle length was 393 msec. Mapping during sinus rhythm demonstrated earliest ventricular activation in the right anterolateral region of the tricuspid valve annulus. Ventricular pacing following 0.2 mg of IV orciprenaline demonstrated decremental retrograde conduction through the AV node. Mapping during ventricular pacing confirmed retrograde decremental conduction through the AV node and no retrograde conduction was identified through the AP. Atrial extrastimulus protocol failed to show dual AV node physiology. The APERP was 330 msec during a drive train cycle length of 550 msec. Atrial extrastimulus protocol with a drive train of 400 msec also failed to show dual AV node physiology. There was no reentry or inducible supraventricular tachycardia (SVT). Double atrial extrastimulus protocol also failed to induce any reentry or SVT.

Despite the absence of inducible SVT, considering the patient`s symptoms which were consistent with SVT, we proceeded with RF ablation. Most likely mechanism was thought to be antidromic SVT utilizing the AP. A RF lesion (7 Fr. EPT Blazer II standard curve catheter, Boston Scientific Inc. , Natick, MA, USA) delivered at the AP location terminated the AP conduction in 7 secs. A 60 second lesion was then placed at the AP spot (average temperature 44oC, average impedance 107 ohms, average power 45 watts). Then AP conduction returned immediately following the termination of RF ablation. The 7 Fr short venous sheath was then exchanged with a 7 Fr long sheath in order to obtain better catheter stability and tissue contact. Second RF ablation attempt resulted in termination of AP conduction in 3.9 secs and another 60 second lesion was placed at that location (Average temperature = 43°C, maximum temperature = 45°C, average impedance = 109 ohms, average power = 46 watts) (Fig. 1). Preexcitation was not seen during the rest of the ablation time, however within 30 secs following the termination of RF ablation, AP conduction returned. The ablation catheter did not look very stable despite early successful elimination of the AP conduction. Despite the support with the long sheath, the catheter stability and tissue contact seemed to be the problem in this area of the tricuspid valve annulus. The RF catheter was exchanged with a 7 Fr 6-mm tip steerable cryoablation (Freezor Xtra, Cryocath Technologies Inc. Kirkland, Quebec, Canada) catheter. Cryomapping was performed at -30°C. AP conduction was terminated in 20 secs of cryomapping at -30°C. The local ventricular electrogram was 37 msec earlier then the onset of delta wave at that spot (Fig. 2). Cryoablation was started immediately and AP was success-

Address for Correspondence: Volkan Tuzcu, M.D., Associate Professor of Pediatrics Section of Cardiology Director of Electrophysiology and Pacing Arkansas Children's Hospital, 800 Marshall Street, Little Rock, AR† 72202, Phone: (501) 364-1479, Fax: (501) 364-3667, E-posta: TuzcuVolkan@uams.edu

fully ablated with a 360 second single lesion at -80oC. During the cryomapping and cryoablation, the catheter was attached to the tissue with stable temperatures. Fluoroscopy during ablation revealed significant movement of the catheter with the heart motion despite the fact that the tip of the catheter was fixed and stable at the AP location (Fig. 3). No other lesions were given. At the end of the 30-minute postablation waiting period, there was no preexcitation and HV interval measured 51 msec. Atrial pacing demonstrated a Wenckebach cycle length of 360 msec without any evidence of preexcitation.

Discussion

This case demonstrates the potential significant advantage of cryoablation for the ablation of APs located in areas where catheter stability would be an issue with RF ablation catheter. A limitation of RF ablation is catheter stability in certain locations.

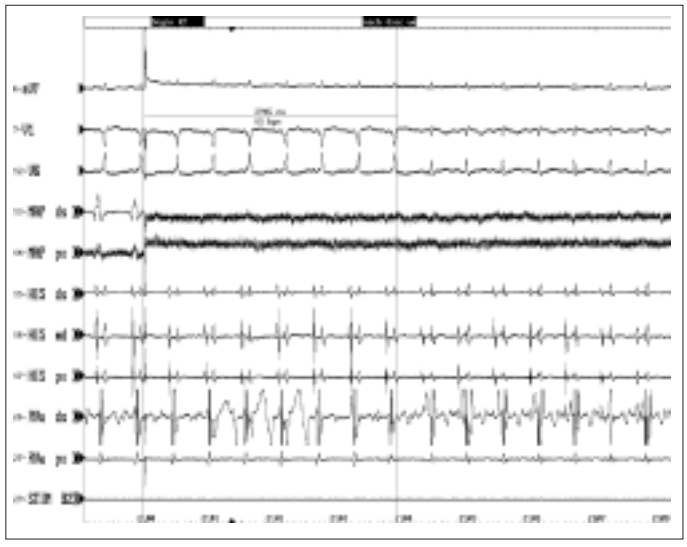

Figure 1. Successful elimination of AP conduction in 3.9 secs with RF ablation

Figure 2. Intracardiac electrograms at the successful cryoablation location. Local ventricular activation at the mapping catheter is 37 msec earlier then delta wave

The patient presented here, had a right anterolateral AP where we failed to obtain stable catheter position and temperature despite using a long sheath to stabilize the RF ablation catheter on the tricuspid valve annulus. Another common issue regarding catheter stability is the catheter dislodgement due to the AV dissociation occurring after the elimination of AP conduction when RF ablation is being performed during ventricular pacing in some unstable locations (6). Therefore, catheter dislodgement during RF ablation may result in failure of elimination of AP in relatively unstable locations. This was not the problem in the current case due to the transition from preexcitation to normal AV conduction in sinus rhythm.

Cryoablation has the significant advantage of offering stable catheter position. Ice formation during cryoablation affixes the catheter adherence to the surrounding tissue (4,5). Cine images obtained in two phases of cardiac cycle during cryoablation demonstrate the tricuspid annular movement while the cryoablation catheter is attached to the annulus (Fig. 3). One can imagine the difficulty of obtaining a stable position and temperature with a RF ablation catheter at that location. Since a stable and effective catheter position was obtained during lesion formation, a 360-sec long single cryoablation lesion was placed rather than a 240-sec one (7).

Cryoablation was shown to have distinct advantages in para-Hisian APs and atrioventricular nodal reentrant tachycardia (AVNRT) (2, 3, 8, 9). However, the cryoablation experience for nonseptal accessory pathways is limited. Although the acute procedural success rate of catheter cryoablation may be slightly lower than that reported for radiofrequency ablation, it might be considered for target locations where stability of the ablation catheter might be an issue (2).

This case demonstrates that cryoablation may be an effective technique for ablation of APs where catheter stability can be a problem. Cryoablation might be considered as the initial ablation approach in such areas. However, to demonstrate the improved efficacy compared to the RF ablation in such locations, prospective studies will need to be performed.

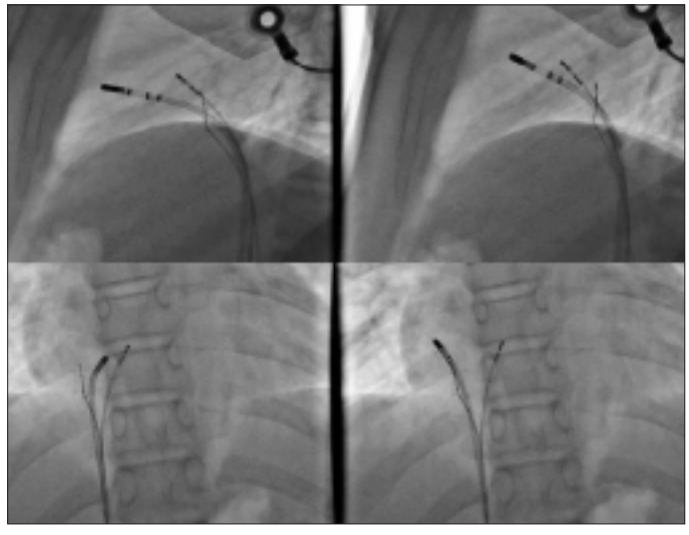

Figure 3. Cine still images obtained during cryoablation. Images represent catheter movement due to the tricuspid annulus movement during the cardiac phase. The cryoablation catheter was attached to the tissue firmly despite this movement

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