

An unusual approach to intractable AVNRT in a pediatric patient

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Figure 1 Intracardiac electrogram during ablation on the left septum with the catheter position as shown in Figures 2 and 3. Note the atrial signals at the site of success (first beat) followed by an immediate junctional acceleration beat.

Introduction

Atrioventricular nodal reentrant tachycardia (AVNRT) is the second most frequent form of paroxysmal narrow complex tachycardia in the pediatric population.^{1,2} A conservative approach is used for ablation in children because of anatomical limitations and risks related to a permanent pacemaker in the case of atrioventricular nodal conduction damage. Cryoablation has emerged in the first years of the millennium and propagated thanks to the minimal risk to the native conduction tissue. Many reports in the literature advocate this approach as the gold standard combining high

rates of success with optimal procedure safety and minimal risks.^{3,4} However, electrophysiologists rarely encounter patients in whom neither a cryoablation strategy nor a cautious radiofrequency approach in the lower positions of the triangle of Koch seem to be effective in modifying the conduction properties of the slow pathway. Even though there are articles reporting this finding in the adult population,^{5–9} there is no literature advocating this approach in the pediatric population. The aim of this article is to attempt an alternative approach in intractable cases of atrioventricular reentry tachycardia in the younger population.

KEYWORDS AVNRT ablation; Pediatric electrophysiology; Left-septal ablation; Slow pathway ablation; Transeptal ablation (Heart Rhythm Case Reports 2015;1:34–36)

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Case report

A 13-year-old football player with a 1-year history of recurrent palpitations during exercise despite β -blocker therapy attended our Paediatric Arrhythmia Clinic. An initial electrophysiology study diagnosed typical slow-fast AVNRT. Despite an aggressive radiofrequency ablation procedure including

KEY TEACHING POINTS

- Atrioventricular nodal reentrant tachycardia is the second most frequent cause of supraventricular tachycardia in children, but it prevails in the older pediatric population.
- It is extremely rare to encounter a fetal or neonatal supraventricular tachycardia mediated by nodal reentry. The complex nodal region may continue to develop from the postnatal period to the first years of life.
- With the present technology in experienced hands, atrioventricular nodal reentrant tachycardia can be safely cured with an ablation procedure in the younger population.
- In those rare cases in which ablation in the inferior area of the triangle of Koch proves to be ineffective, a transseptal approach has proved to be curative in the pediatric population, corroborating the same finding that has been reported in the adult population.

lesions in the low, middle, and superior aspects of the triangle of Koch as well as in the coronary sinus, we could not induce any junctional response. After a conventional right-sided procedure, there was no modification in the tachycardia characteristics or in the slow pathway conduction (including tachycardia induction, cycle length, and slow pathway refractory period). A decision was made to attempt a left-sided procedure.

A steerable decapolar electrode catheter was placed in the coronary sinus, and the His position was again identified on the

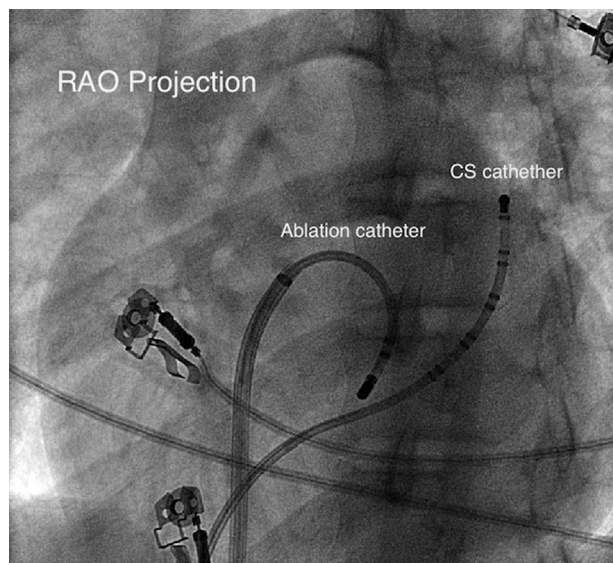


Figure 2 Catheter position at the site of success in the RAO projection. The CS decapolar catheter provides a useful landmark for transseptal access and ablation. CS = coronary sinus; RAO = right anterior oblique.

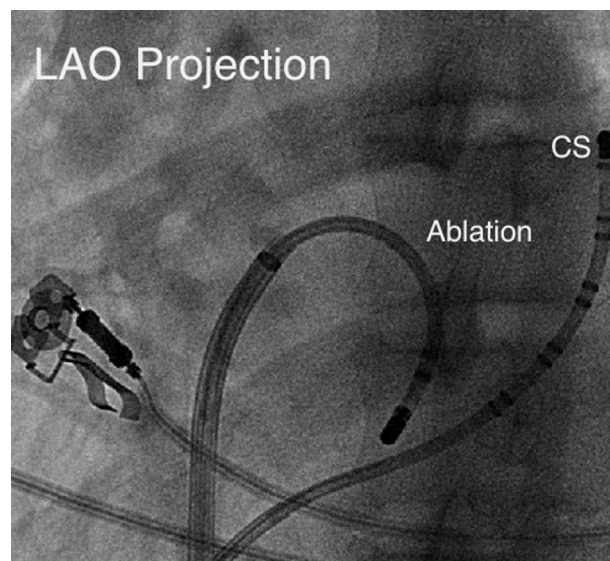


Figure 3 Catheter position at the site of success in the LAO projection. CS = coronary sinus; LAO = left anterior oblique.

anterior septum. The transseptal puncture was performed using the usual technique under fluoroscopy guidance without complications, followed by heparin administration. A deflectable catheter with a 4-mm tip was introduced into the left atrium, and the septal aspect of the mitral valve was mapped. A balanced atrioventricular signal with multicomponent atrial electrograms and low amplitude potentials was identified in the posteroseptal aspect of the mitral annulus, 3 mm above the coronary sinus (Figure 1). This left site clearly corresponded with the usual target for a conventional right-sided procedure (Figures 2 and 3). At this point, a single radiofrequency application resulted in an immediate accelerated junctional response with stable retrograde ventriculoatrial conduction. This application also resulted in temperatures of 55°–60° and was continued for 60 seconds. After this ablation, AVNRT was not inducible despite aggressive atrial stimulation on isoprenaline. The procedure was terminated without complications, and the patient did not show recurrence of palpitations afterward.

Discussion

AVNRT can be safely cured with a slow pathway ablation procedure in the inferior triangle of Koch in 95% of the cases.¹⁰ However, atrioventricular nodal tissue has a wide spectrum of anatomy variability, and this classical approach is not always effective. The evidence for this finding has to be searched in the complex characteristics of the 3-dimensional nodal “box.”

The nodal area anatomy consists of 2 main inputs from the right atrium: (1) the fast wavefront composed of transitional cells in the region extending from the compact node to the anterior aspect of the triangle of Koch and (2) the slow wavefront composed of a deeper inferoposterior extension. A third wavefront has been described that extends from the septal left atrial tissue to the compact region via the septal region and the roof of the coronary sinus.

The mechanisms that guide the development of the nodal morphological and electrical characteristics and the reason why in rare cases the left input prevails are unclear. The cases of successful left-sided AVNRT ablation procedures reported in the literature do not include young patients. Is this anisotropic conductive region still developing during the first years of life? We cannot exclude the fact that this highly complex tissue continues to evolve in the postnatal period, resulting in unusual electric extensions at a later age. Pediatric electrophysiologists know well that an early onset of AVNRT is extremely rare; the vast majority of non-pre-excited supraventricular tachycardias in the fetus and during the first years of life are due to concealed accessory pathways.¹¹

Whatever may be the explanation of this rare phenomenon, there is 1 well-known fact: a better understanding of the peculiarities and variants of the nodal region is essential for performing successful ablation procedures with minimal risks.

References

1. Ko JK, Deal BJ, Strasburger JF, Benson DW. Supraventricular tachycardia mechanisms and their age distribution in pediatric patients. *Am J Cardiol* 1992;69:1028–1032.
2. Elvas L, Gurosoy S, Brugada J, Andries E, Brugada P. Atrioventricular nodal reentrant tachycardia: a review. *Can J Cardiol* 1994;10:342–348.
3. Hanninen M, Yeung-Lai-Wah N, Massel D, Gula L, Skanes A, Yee R, Klein G, Manlucu J, Leong-Sit P. Cryoablation versus RF ablation for AVNRT: a meta-analysis and systematic review. *J Cardiovasc Electrophysiol* 2013;24:1354–1360.
4. Santangeli P, Proietti R, Di Biase L, Bai R, Natale A. Cryoablation versus radiofrequency ablation of atrioventricular nodal reentrant tachycardia. *J Interv Card Electrophysiol* 2014;39:111–119.
5. Jais P, Haissaguerre M, Shah DC, Costa P, Takahashi A, Barold SS, Clémenty J. Successful radiofrequency ablation of a slow atrioventricular nodal pathway on the left posterior atrial septum. *Pacing Clin Electrophysiol* 1999;22:525–527.
6. Altemose GT, Scott LR, Miller JM. Atrioventricular nodal reentrant tachycardia requiring ablation on the mitral annulus. *J Cardiovasc Electrophysiol* 2000;11:1281.
7. Sorbera C, Cohen M, Woolf P, Kalapatapu SR. Atrioventricular nodal reentry tachycardia: slow pathway ablation using the transeptal approach. *Pacing Clin Electrophysiol* 2000;23:1343–1349.
8. Kilic A, Amasyali B, Kose S, Aytemir K, Celik T, Kursaklioglu H, Iyisoy A, Ozmen N, Yuksel C, Lenk MK, Isik E. Atrioventricular nodal re-entrant tachycardia ablated from the atrial septum: clinical and electrophysiological characteristics and long-term follow-up results as compared to conventional right-sided ablation. *Int Heart J* 2005;46:1023–1031.
9. Giazitzoglou E, Korovesis S, Kokladi M, Venetsanakos I, Paxinos G, Katritsis D. Slow-pathway ablation for atrioventricular nodal re-entrant tachycardia with no risk of atrioventricular block. *Hellenic J Cardiol* 2010;51:407–410.
10. Katritsis DG, Giazitzoglou E, Zografos T, Ellenbogen KA, Camm AJ. An approach to left septal slow pathway ablation. *J Interv Card Electrophysiol* 2011;30:73–79.
11. Killen S, Fish F. Fetal and neonatal arrhythmias. *Neoreviews* 2008;9:e242–e252.