Radiofrequency Catheter Ablation of Atrioventricular Nodal Reentrant Tachycardia: Does the Number of Catheters Matter?

Alexander Mazur MD and Boris Strasberg MD

Department of Cardiology, Rabin Medical Center (Beilinson Campus), Petah Tiqva, Israel
Affiliated to Sackler Faculty of Medicine, Tel Aviv University, Ramat Aviv, Israel

Key words: radiofrequency catheter ablation, atrioventricular nodal reentrant tachycardia

IMAJ 2006;8:497–498

Atrioventricular nodal reentrant tachycardia is the most common mechanism of paroxysmal supraventricular tachycardia in adults and is relatively uncommon in children. While the precise anatomy of the reentry circuit underlying AVNRT and relative role of the atrioventricular node and extranodal atrial inputs remain controversial, the electrophysiologic mechanism of the arrhythmia involving the concept of dual AV nodal physiology is now well recognized. According to this concept, functional dissociation of AV nodal conduction to the fast (fast conduction and long refractoriness) and slow (slow conduction and short refractoriness) pathways serves as a key factor in sustaining reentry [1]. It has been demonstrated that the fast pathway conduction occurs superiorly in the region of His bundle recording, while conduction over the slow pathway is projected inferiorly over the coronary sinus ostium region, along the tricuspid annulus [2]. Recent evidence also suggests the presence of left-sided input to the AV node, and several case reports implicated left-sided reentry circuits in the mechanism of the AVNRT with successful ablation of the arrhythmia from the proximal coronary sinus or left side of the posterior septum, along the mitral annulus [3,4].

Although AVNRT is not a life-threatening arrhythmia, it can significantly affect the quality of life. Even in patients with infrequent symptomatic episodes, anticipation of arrhythmia recurrence may have considerable psychological impact on their everyday life. Prophylactic pharmacologic therapy with anti-arrhythmic agents is frequently ineffective or only marginally effective; moreover, long-term therapy with many of these agents is associated with the potential risk of side effects. Introduction of the catheter-based radiofrequency ablation technique into clinical practice in the late 1980s provided a non-surgical curative option for treating AVNRT patients. The initial ablation technique targeted the fast pathway close to the His bundle recording site and was associated with a success rate of 80–90% and up to 23% risk of high grade AV block [5]. Subsequently it was replaced by targeting the slow pathway in the coronary sinus ostium region [6]. Currently, the reported acute success rate of the ablation procedure targeting the slow pathway is approaching 99% and depends in part on the endpoints of ablation that are used to declare success. The incidence of high grade AV block requiring pacemaker implantation is less than 1% [5]. In some rare instances of failed ablation from the right atrium, ablation of left-sided circuits by targeting proximal coronary sinus or left posterior septum may be required [3,4]. Such a high success rate and relatively low risk of complication has made RF catheter ablation the first-line therapy for most symptomatic AVNRT patients. Many patients now choose this curative option before trying anti-arrhythmic drug therapy, even when confronted with a small risk of AV block. However, very few patients, even those who are highly symptomatic, would "trade" their arrhythmia for the possibility of permanent pacemaker implantation and in many of these patients an implanted pacemaker turns into psychological trauma.

In this issue of *IMAJ*, Topilski et al. summarize their long-term experience of RF catheter ablation of AVNRT [7]. The study confirms a very favorable risk-to-benefit ratio of the procedure with a relatively high success and a low risk of complications. However, it also indicates that the current technique has inherent limitations and the small risk of AV block remains unchanged despite growing experience. The authors report a retrospective series of 901 consecutive patients (age 9–92 years, mean 50.8 ± 18.2, 61.5% females) who underwent RF catheter ablation of AVNRT over a 14 year period in a single center [7]. Typical (slow-fast form) AVNRT was inducible in 92.5% of patients and the rest had different sub-forms of atypical AVNRT. The slow pathway was targeted in all patients. The acute success rate in rendering AVNRT non-inducible with no more than three residual AV nodal echo beats was 97.3%. Periprocedural AV block occurred in 31 patients (3.4%) and 8 (0.9%) required permanent pacemaker placement. During the follow-up, the arrhythmia recurred in 25 patients (2.8%) including 22 who had an initially successful procedure. A repeated procedure was performed in 17 of 25 patients with arrhythmia recurrence. Of them, 15 had successful slow pathway ablation and 2 patients underwent ablation of the AV node with permanent pacemaker implantation. The authors did not observe any changes in the procedure outcome during the study period, although the age of the patients undergoing the procedure and the proportion of patients with underlying heart disease has progressively increased. In the majority of patients in this series (64.8%), the procedure was performed using a "two-catheter approach" (a single diagnostic catheter placed in the high right atrium and an ablation catheter). The rest of the patients were managed with a "multi-catheter approach" using three diagnostic

AVNRT = atrioventricular nodal reentrant tachycardia

catheters (the right apex, His bundle area, and coronary sinus) and an ablation catheter. The "multi-catheter approach" was used more frequently (88.4%) in the first 225 patients, while the "two-catheter approach" was more frequently (82.5%) used in the last 676 patients. Because no significant difference in the procedure outcome was noted between these subgroups, the authors suggested that the two approaches have comparable risk-to-benefit ratio. However, no direct comparison between these approaches has been performed.

We agree with the authors that some selected AVNRT patients can be managed with a minimal number of catheters without compromising the procedure outcome when experienced operators are involved. This strategy would definitely be cost-saving compared to the standard supraventricular tachycardia catheter set-up. Nevertheless, even clinically "classical" AVNRT patients may have different arrhythmia mechanisms, atypical forms of AVNRT or multiple arrhythmia mechanisms. In many of these patients the standard catheter set-up may facilitate accurate arrhythmia diagnosis and may actually be time-saving. In this series, a sizable proportion of patients (15.5%) had another arrhythmia mechanism in addition to AVNRT and 7.5% of patients presented with atypical forms of AVNRT. Whether unselective use of the "two-catheter approach" in all suspected AVNRT patients will translate into reduction of procedure and fluoroscopy time remains to be determined. Furthermore, catheters positioned at the His bundle recording site and coronary sinus serve as on-line important anatomic landmarks of the triangle of Koch and may add to the safety of the procedure by avoiding damage of the AV node during application of the RF energy and inadvertent catheter displacement.

In recent years, percutaneous catheter cryoablation has emerged as an alternative technique to RF ablation. Several studies involving cryoablation have shown promising results as curative treatment of AVNRT [8-10]. The potential advantages of cryoenergy over RF are the ability of the catheter tip to adhere to the tissue, thereby preventing its inadvertent displacement, as well as the ability to assess the functional significance of the lesion before causing irreversible tissue damage (so-called ice mapping). The latter feature practically excludes the risk of permanent AV block, and this complication with the use of cryoablation in AVNRT patients has not been reported to date. However, the reported success and recurrence rate with the use of cryoenergy for AVNRT still remains inferior to RF ablation [9,10]. More studies are needed to determine the ultimate role of this new technology.

References

1. Scheinman MM, Yang Y. The history of AV nodal reentry. *Pacing Clin Electrophysiol* 2005;28:1232–7.
2. Sung RJ, Waxman HL, Saksena S, et al. Sequence of retrograde atrial activation in patients with dual atrioventricular nodal pathways. *Circulation* 1981;64:1059–67.
3. Otomo K, Wang Z, Lazarra R, Jackman WM. Atrioventricular nodal reentrant tachycardia: electrophysiological characteristics of four forms and implications for the reentrant circuit. In: Zipes DP, Jalife J, eds. Cardiovascular Electrophysiology: From Cell to Bedside. 3rd edn. Philadelphia: WB Saunders, 1999:504–21.
4. Jais P, Haissaguerre M, Shah DC, et al. Successful radiofrequency ablation of a slow atrioventricular nodal pathway on the left posterior atrial septum. *Pacing Clin Electrophysiol* 1999;22:525–7.
5. Morady F. Catheter ablation of supraventricular arrhythmias: state of the art. *J Cardiovasc Electrophysiol* 2004;15:124–39.
6. Jackman WM, Beckman KJ, McClelland JH, et al. Treatment of supraventricular tachycardia due to atrioventricular nodal reentry, by radiofrequency catheter ablation of slow-pathway conduction. *N Engl J Med* 1992;327:313–18.
7. Topilski I, Rogowski O, Glick A, et al. Radiofrequency ablation of atrioventricular nodal reentry tachycardia: a 14 year experience with 901 patients at the Tel Aviv Souraky Medical Center. *IMAJ* 2006;8:455–9.
8. Skanes AC, Dubuc M, Klein J, et al. Cryothermal ablation of the slow pathway for the elimination of atrioventricular nodal reentrant tachycardia. *Circulation* 2000;102:2856–60.
9. Friedman PL, Dubuc M, Green MS, et al. Catheter cryoablation of supraventricular tachycardia: the results of the multicenter prospective "frosty" trial. *Heart Rhythm* 2004;1:139–40.
10. Zrenner B, Dong J, Schreieck J, et al. Transvenous cryoablation versus radiofrequency ablation of the slow pathway for the treatment of atrioventricular nodal re-entrant tachycardia: a prospective randomized pilot study. *Eur Heart J* 2004;24:2226–31.

Correspondence: Dr. B. Strasberg, Dept. of Cardiology, Rabin Medical Center (Beilinson Campus), Petah Tiqva 49100, Israel.
Fax: (972-3) 924-9850
email: strasbergb@clalit.org.il