Original Article

AH jump as predictor for successful Ablation of atrioventricular nodal reentrant tachycardia (AVNRT)

Ameen Al-Alwany* **MBChB, MSc.MD, PhD**
Hilal B. Al-Saffar** **MBChB, CABM , FRC, FACC**
Najeeb H. Mohammed** **MBChB, MSc, DM., PhD**

J Fac Med Baghdad 2015; Vol.57, No .2
Received Oct 2014
Accepted Jan.2015

Abstract:

Background: Atrioventricular nodal reentrant tachycardia (AVNRT) is the commonest regular supraventricular tachyarrhythmia. Ablation in the area of slow pathway (SP) has been successfully implemented in every day clinical electrophysiological practice for more than 20 years. Although the procedure is generally regarded as effective and safe, data on long-term effects and predictors of success or failure are incomplete.

Objectives: This study was designated to prove that AH interval is an electrophysiological parameter which serves as a predictor for successful AVNRT ablation.

Methods: While performing an electrophysiological study using a programmed atrial stimulation, thirty nine (39) patients (25 female and 14 males) with a mean age 51 ± 16.7 years with AVNRT were assessed and underwent AVNRT radiofrequency ablation using diagnostic and ablation catheters inserted via the right femoral veins. This study was performed during the period from February, 2013 to march, 2014 at the unit of Electrophysiogy in Leipzig heart center.

Results: Acute successful AVNRT ablation was achieved in 39 (100%) patients, including 23 (59%) with slow pathway (SP) ablation and 16 (41%) with SP modification. Patients with SP modification were younger male, had faster AVNRT cycle length, and had more frequent isoproterenol usage before ablation. During six months follow-up period, all patients experienced no AVNRT recurrences.   .

Conclusions: AH jump served as predictor for successful Ablation of atrioventricular nodal reentrant tachycardia with a better outcome.

Keywords: Electrophysiological study, AVNRT, AH Jump, catheter ablation .

Introduction:

Typical atrioventricular nodal reentrant tachycardia (AVNRT) is the most common paroxysmal supraventricular tachycardia among adults. The concept of dual pathway physiology remains widely accepted, although this physiology likely results from the functional properties of anisotropic tissue within the triangle of Koch, rather than anatomically distinct tracts of conduction. AVNRT is typically induced with anterograde block over the fast pathway and conduction over the slow pathway, with subsequent retrograde conduction over the fast pathway. On rare occasions, an anterograde AV node conduction occurs simultaneously through fast and slow pathways resulting in two ventricular beats in response to one atrial beat [1].AV nodal reentrant tachycardia (AVNRT) is the most common form of paroxysmal regular supraventricular tachycardia occurring in about 60% of these patients [2]. The presence of at least two AV nodal pathways, characterized by different refractory periods and conduction properties, is the anatomical prerequisite for the occurrence of these tachycardia's [3].Ablation in the area of slow pathway (SP) has been successfully implemented in everyday clinical electrophysiological practice for more than 20 years [4]. The electrophysiological data classify the AVNRT into common typical and uncommon atypical type. In common AVNRT, the anterograde conduction is via the slow pathway and the retrograde conduction is via the fast pathway ("slow-fast" AVNRT). In uncommon AVNRT, the anterograde conduction is via the fast pathway and the retrograde conduction is via the slow pathway ("fast-slow" AVNRT) [5]. Multiple slow pathways can exist so that both anterograde and retrograde conduction are over slow pathways ("Slow-slow" AVNRT) [1, 4]. Radiofrequency ablation of AVNRT is commonly guided by the slow and sharp bipolar potentials of the atrioventricular slow nodal pathways and has evolved as the therapy of choice for the AVNRT [5]. Slow pathways modification is commonly guided by bipolar potentials from the ablation electrode [6]. Although the procedure is generally regarded as effective and

**Al.Qassim Green University.*
*** Dept.of Medicine/ College of Medicine/ University of Baghdad*
***Dept.of Physiology/ College of Medicine/University of Baghdad*
Email: dr_najeebalmously@yahoo.com

safe, data on long-term effects and predictors for success or failure ablation are incomplete. Such issues as SP ablation vs. modification or the use of isoproterenol have been addressed recently by a few studies but results are not concordant [7]. Therefore, the aim of this study was to assess and identification of a predictor for successful AVNRT ablation.

Patients and methods:

The study group consisted of 39 patients (mean age 51.1 ± 16.7 years) with a history of palpitations due to AVNRT who underwent AVNRT ablation. All patients had symptoms due to AVNRT attacks and underwent ablation after antiarrhythmic drug treatment failure. This study was done in cooperation with Leipzig heart center from December 2013 to August 2014.In all patients a detailed history was taken, including duration of AVNRT-associated symptoms and approximate number of symptomatic AVNRT, as estimated by the patient. Detailed cardiovascular evaluation, including echocardiography and other tests as needed, was performed. .

Ablation protocol:

The procedure was performed in non-sedated patients after informed written consent had been obtained. The diagnostic and ablation catheters were inserted via the right femoral veins, and placed in the coronary sinus, His bundle area and right ventricle The diagnosis of AVNRT was based on the presence of jump and echo initiating tachycardia during programmed atrial stimulation and/or during incremental atrial pacing close to the Wenckebach point. Typical jump was defined as a sudden prolongation of A-H interval > 50 ms with an increase of 10 ms of S1–S2 interval during programmed atrial pacing (Figure 1). When this interval was shorter, there was more than one jump or there was no jump at all, this phenomenon was called 'non-typical jump.

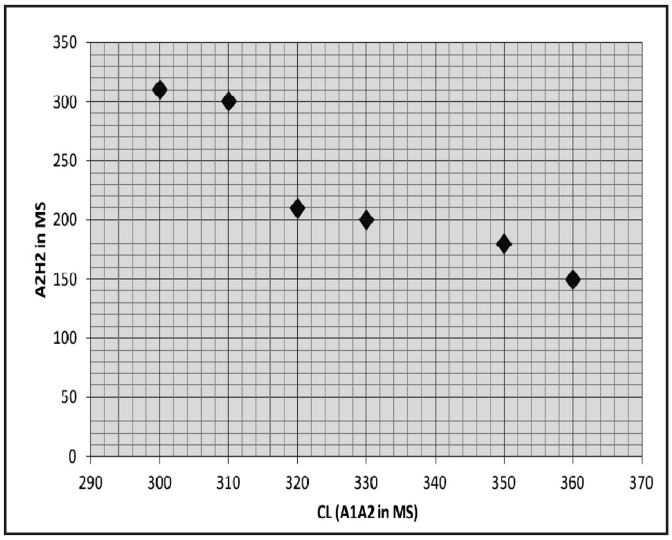

Figure (1): the relation between atrial extrastimuli and the AH interval in patients with double AV nodal pathways

Isoproterenol was used in incremental doses in order to facilitate AVNRT induction. Patients in whom AVNRT was not inducible but there was a jump with echo and ECG documentation of clinical AVNRT also underwent ablation.Radiofrequency current was generated from an EP-Shuttle system (Stockert, Webster Corp. Watertown, MA, and U.S.A.). Ablation was performed in temperature-guided mode (preselected maximum temperature at 70 C) applying a stepwise upward approach. Energy was limited at 30 W with a maximum time period of 60 s. After successful ablation by appearance of accelerated junctional rhythms during energy delivery as an indicator of possible good ablation, the electrophysiological study with the same programmed stimulation that was used in the beginning was repeated 30 min after the last radiofrequency energy application without and with administration of Orciprenaline (0·5–1 mg) to prove noninducibility of AVNRT, if it induced, ablation was repeated again and then during repeated EPS we notice if there was noninducibility but persistent AH jump and/ or Echo beat.

Statistical analysis:All values were expressed as means ± SD. The data were analyzed using SPSS program (v.17). Statistical analysis was performed using Student's t-test for unpaired variables including F-test for analysis of variance to compare two sets of data; a P-value of <0·05 was considered to be significant.

Results:

Thirty nine (39) patients with AVNRT were enrolled in this study; there were 25 female (64.1%) in 6 of them modification of slow pathway was done and 14 male (35.9%) in 10 of them modification of slow pathway was done. After all measurements and in all patients , radiofrequency ablation was performed until accelerated juctional rhythms appeared, then we applied the same atrial programmed stimulation protocol that induced AVNRT in the beginning, to confirm that no AVNRT induced again after ablation. Although there was no AVNRT induced but some electrophysiological data (e.g. jump and single echo beat) was noticed in some patients after ablation that means modulation or modification of the pathways in these cases, and the result was significant regarding ablation of the pathways in 23 patients (59%) versus modulation of pathways 16 patients (41%) and table (1) compares between those patients after radiofrequency ablation in all forms of AV nodal pathways.

Table :(1) electrophysiological data post ablation

No. of AV pathway	No.with jump or echo	No.withoutjump or echo	P.value
2	11 (45.8%)	13 (54.2%)	NS
3	3 (23.1%)	10 (76.9%)	<0.05
4	2 (100%)	0	NS
Total	16 (41%)	23 (59%)	<0.05

Table (2) clarifies the relation of application radiofrequency energy in all forms of AVN nodal pathways according to the result of ablation whether it's fully ablated or modified the pathways, and the study was revealed that the number of energy deliveries required for successful and complete ablation is less in patients with two AV nodal pathways versus patients with more than two pathways, and this was statistically significant P.value < 0.05, that means that presence of more pathways required more energy.

Table (2): Relation between AV nodal pathways and radiofrequency ablation

Number of RF			
AV nodal Pathways	Ablation N=23	Modification N=16	p.value
2	6.5±4.3	7.4±3.8	NS
3	5.7±3.8	11.5±6.3	<0.05
4		12.7±4.6	

RF=radiofrequency

Table (3), all the procedure parameters were compared between patients with slow pathway ablation vs modification. Patients with SP modification were younger male, had faster tachycardia cycle length, most frequently used isoprotrenol before ablation. The number of RF applications and procedure duration were significantly higher in patients with SP modification than in those with SP ablation.

Table 3: Comparison of periprocedural data between patients with slow pathway ablation vs. slow pathway modification

Parameter	Slow pathway ablation (n = 23)	Slow pathway modification (n=16)	P. Value
Age	43 ± 16	39±18	0.046
Gender (F/M)	19(76%)	6 (24%)	0.05
AVNRT inducible	100%	100%	NS
AVNRT cycle length	380±70	340 ± 65	0.03
Typical jump	100%	100%	NS
Isoproterenol use before ablation	1	5	0.04
Isoproterenol use after ablation	23(100%)	16 (100%)	NS
Number of RF applications	6.8±4.6	12.7± 5.4	0.003
Procedure duration min	58± 28	72± 26	0.004

Discussion:

The main finding of the present study is that SP ablation yields better long-term results than SP modification, although is not an independent predictor of successful outcome. Typical jump, contrary to no jump or multiple jumps, was such an independent variable (8). Our results showed that patients with SP modification were younger, had faster AVNRT, more often received isoproterenol after ablation, and had a higher number of applications as well as procedural time (1,7). These findings may in part be due to the fact that all operators aimed at SP ablation rather than only modification (higher number of applications and procedural duration); however, it is also possible that in patients in whom SP modification was only achieved, AVNRT characteristics were different from those in patients with complete SP elimination. The patients had shorter cycle of AVNRT which may suggest smaller reentry circuit. Another possible explanation, why in these patients only SP modification was achieved, is that SP was localized closer to the AV node and operators were reluctant to ablation higher in the septum (9, 10). Thus, when during the course of ablation procedure a SP modification is achieved, it is worth attempting to perform additional RF applications in order to achieve complete SP ablation, especially in patients with a large echo window (6,8) or in whom the AV nodal refractory period is only slightly prolonged following ablation (5). On the other hand, acute failure is associated with a significantly higher recurrence rate, although not all patients with AVNRT still inducible after ablation suffer from recurrences during (10).

Conclusion:

This study produced further evidence that complete SP elimination may be associated with a better outcome than SP modification. Typical features of AVNRT such as typical jump are also associated with a higher efficacy rate. During short period of follow up our study showed that there is no AVNRT recurrences in first six month but the recurrence may occur as late after ablation and the electrophysiological profile of patients in whom complete SP elimination was achieved may differ from that of patients in whom only SP modification was possible.

Authors Contribution:

Ameen Al-Alwany: phD student who preform the study protocol including selection of the patients,examination and doing the concerned tests.
Hilal B. Al-Saffar: supervisor who help the student in preforming, data collection and interpretations.
Najeeb H. Mohammed: supervisor who design the protocol of the study and support in writing the thesis.

References:

1. Al Mehairi M, Al Ghamdi SA, Dagriri K, Al Fagih A.Simultaneous antegrade dual AV node conduction initiates AV nodal re-entrant tachycardia (a rare initiation mechanism). J Saudi Heart Assoc. 2013 Jan;25(1):35-7. doi: 10.1016/j.jsha.2012.07.005. Epub 2012 Aug 22.PMID: 24174843 [PubMed]

2. Porter MJ, Morton JB, Denman R et al. Influence of age and gender on the mechanism of supraventricular tachycardia. Heart Rhythm, 2004; 4: 393–396

3.Wang L, Wu T. Predictors of long-term success in catheter ablation of atrioventricular nodal reentrant tachycardia: a multivariate regression analysis. Int J Cardiol, 2002; 86: 289–294.

4-Delise P, Sitta N, Zoppo F et al. Radiofrequency ablation of atrioventricular nodal reentrant tachycardia: the risk of intraprocedural, late and long-term atrioventricular block. The Veneto Region multicenter experience. Ital Heart J, 2002; 3: 715–720

5. Femenia F, Arce M, Arrieta M et al. Long-term results of slow pathway ablation in patients with atrioventricular nodal reentrant tachycardia simple approach. J Electrocardiol, 2012; 45: 203–208

6.Eckardt LL, Leal M, Hollis Z et al. Cryoablation for AVNRT: Importance Of ablation endpoint criteria. J Cardiovasc Electrophysiol, 2012; doi 540-8167.2011

7.Andrey V Ardashev, Alexandr S Makarenko, Eugeny G Zhelyakov and Andrey A Shavarov:Atrioventricular Nodal Reentrant Tachycardia Treatment using Novel Potential This information is current as of October 30, 2012: Asian Cardiovasc Thorac Ann 2010;18:529-535

8- Demosthenes, G. Katritsis, MD, and Mark E Josephson: classification of electrophysiological types of Atrioventricular Nodal Reentrant Tachycardia Euro pace 2013 15:1213- 1240.

9.Josephson ME: Supraventriculatachycardia's. In: Josephson ME, ed. ClinicalCardiac Electrophysiology, 4rded. Philadelphia: Lippincott, Williams & Wilkins; 2012

10.Kułakowski P, Piotrowski R, Stec SM, Kryński T, Iwańska B, Soszyńska M, Błachnio E, Łopatka R. Ablation of atrioventricular nodal reentrant tachycardia: predictors of long-term success. Kardiol Pol. 2013;71(9):903-10. doi: 10.5603/KP.2013.0224.