Catheter Ablation of Common Atrioventricular Nodal Reentry Tachycardia (AVNRT) using the Conventional Method

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Abstract

Background: Catheter Ablation of Common Atrioventricular Nodal Reentry Tachycardia is the commonest type of Supraventricular Tachycardia referred to the Electrophysiology lab and it constitutes about 70% of the arrhythmias admitted to the Emergency Department. The mechanism of Catheter Ablation of Common Atrioventricular Nodal Reentry Tachycardia is reentry where the slow pathway sited at the lower posterior region of Koch's triangle near the coronary sinus orifice while the fast pathway higher up near the His bundle at the antero superior aspect of Koch's triangle. The catheter ablation becoming first line therapy in drug refractory cases and may be first option before drug treatment according to the patient preference or the hemodynamic deterioration due to the Supraventricular Tachycardia.

Patients and Methods: Seventy patients with Catheter Ablation of Common Atrioventricular Nodal Reentry Tachycardia were selected from a total Supraventricular Tachycardia cases of 106 patients referred to the Catheter lab for ablation. Standard technique for Electrophysiological study done to induce the tachycardia. Three Electrophysiological catheters used in 90% of cases which include RA, His, RV and a fourth catheter introduced at the CS in 10% of the cases. Atrial programmed stimulation with S1 400msc, S2 300-230 and S3 of 250-220msc used to induce the Supraventricular Tachycardia in 85% of the cases and ventricular programmed stimulation in 15% of the cases. Differentiation of the AVNRT from Atrial Tachycardia and Atrio Ventricular Tachycardia done by ventricular entrainment where the PPI-TCL more than 115msc considered supportive of Catheter Ablation of Common Atrioventricular Nodal Reentry Tachycardia and the pattern post VP is VAV where AT is excluded. Dry ablation catheter of 4 mm tip used to modify the SP near the CS OS .The appearance of JR or JBs was a sign of effective application of the RF. The success of ablation was indicated by failure to induce the tachycardia with A and VPS. The success rate was 90% with 4 years follow up and the recurrence rate was 5%. Complete Heart Block developed in 3% who needed Permanent Pacemaker. The average total procedure time 45minutes and fluoroscopy time average 5 minutes.

Results: Catheter ablation was considered in drug refractory patients only in 57% of cases and in 22% in markedly symptomatic patient the RF ablation was first line therapy and in 22% in patient preference. The low complication rate and the high success rate make the procedure first line therapy in 75% of cases which may increase with more patient preference of the procedure over drug therapy.

Conclusion: Catheter radiofrequency catheter ablation therapy is becoming technically easy, safe and reliable as first line treatment in the majority of patients with Catheter Ablation of Common Atrioventricular Nodal Reentry Tachycardia.

Key words: Atrioventricular nodal reentry tachycardia, catheter ablation

Introduction

Atrioventricular nodal reentry tachycardia (AVNRT) is the most common form of regular narrow complex tachycardia (RNCT) referred to the catheter laboratory for ablation therapy[1]. AVNRT more commonly occurs in patients without structural heart disease, it is more common in females than males.[1,2] . The mechanism of AVNRT is reentry using two pathways one is slow and the other is fast , they are anatomically located at the triangle of Koch at the right atrium, the fast is close to the His bundle while the slow is just above the coronary sinus os [3-5] . The slow pathway is the antegrade conducting pathway and the fast is the retrograde conducting in the common type of AVNRT which is labeled accordingly as the slow/fast (s/f) type while the uncommon type is characterized by the fast pathway is conducting antegradely and the slow one conducting retrogradely and called fast/slow (f/s) type .[1,2] The superficial Electrocardiographic features of AVNRT are: 1, RNCT.2, either no P' seen where it is embedded within the QRS or P' seen just after the QRS as a pseudo r wave in V1 and aVR and /or pseud s in leads II,II and aVF [2] , Figure 1.

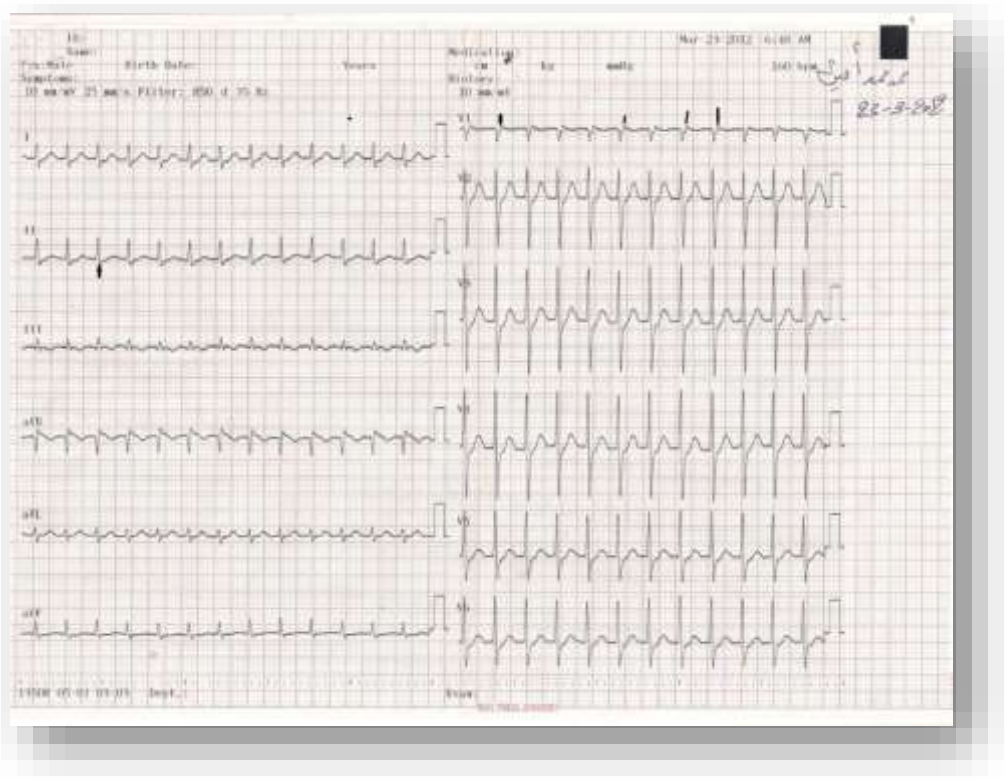

Figure 1. Twelve leads ECG of SVT showing RNCT of short RP long PR type and pseudo r wave at V1 and aVR and pseudo s wave at lead II (arrows) . These features suggesting common s/f type AVNRT.

The electrophysiological characteristics include: 1, AH interval jump during atrial programmed stimulation and induction of the tachycardia.2, during SVT a short VA interval less than 80msc. 3, with ventricular over drive stimulation (ventricular entrainment) during the SVT a VAV pattern seen with a post pacing interval (PPI) –Tachycardia Cycle length (TCL) is more than 118msc. [2] Figure 2.

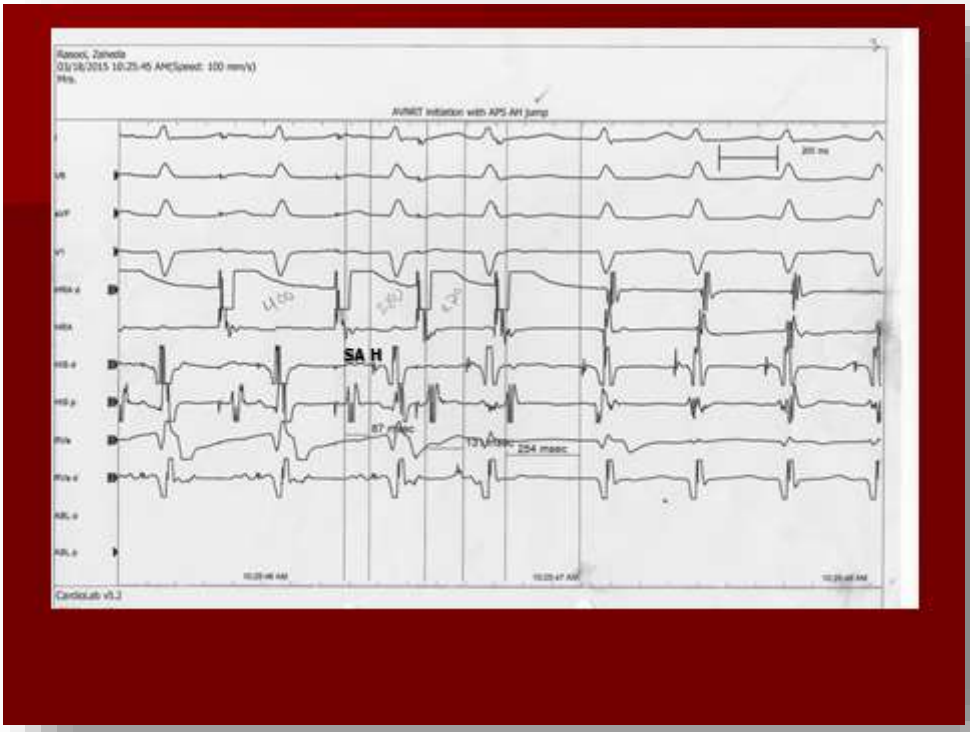

Figure 2. The EP trace shows atrial programmed stimulation where AH interval jump is followed by SVT induction, this is highly suggesting AVNRT s/f type. The speed of recording is 100mm/sec.

Catheter radiofrequency catheter ablation therapy (CRFAT) targeting the fast or the slow pathway has been used for more than two decades. [3-6] The slow pathway ablation became the most widely used. [1,2] In Iraq the first slow pathway CRFAT was done at Kadhymia teaching hospital in the year of 2001 and at Nasiriya Heart Centre in the year of 2007. [7] In Kurdistan it was done in the year of 2011 at Alhassani cardiac center at Sulaimanya. More recently more cases are done using the new system of Cartoo and the Ensite at Najaf and Nasiriya heart centers.

Patients and Methods

From November 2011 up till December 2017, a total of 106 patients with SVT referred to the catheter lab at Alhassani cardiac center. Seventy patients who fulfilled the criteria of AVNRT were included in this study. The mean age of the patients was 46.8+-15 years (range 24-55Y.). Sixty patients were females and 10 patients were males. The main symptoms they presented with were palpitation in 100%, dizzy spells encountered in 35% and pre syncope in 2 patients. The indication of CRFAT was drug inefficacy in 40 patients and as first line therapy in 30 patients. In 15 patients RF ablation was first line therapy because of severe symptoms and in 15 was due to patient preference for ablation versus drug therapy. All patients underwent basic 12 leads electrocardiogram (ECG) and

all available ECGs during tachycardia and sinus rhythm were carefully inspected for the ECG signs suggesting AVNRT. Basic blood biochemistry, thyroid function tests and chest X ray (CXR) were done. Electrophysiological study (EPS) was done using conventional EP System, GE Medical Systems CardioLab v5.2 and Bloom cardiac stimulator with Boston Scientific (BS) ablation generator. All antiarrhythmic drugs omitted for a period of at least 14 days before the EPS. Skin sterilization and then 2% Xylocaine used for local anesthesia of the left and right inguinal area for femoral veins (FV) approach where triport 14 F sheaths introduced on the right FV and 7F sheath at the left FV. Under fluoroscopy, three Qudripolar EP catheters from Boston Scientific (BS) or Access Point Technology (APT) introduced through the right femoral vein sheath and positioned at the RA, His and RV apex subsequently. Figure 3.

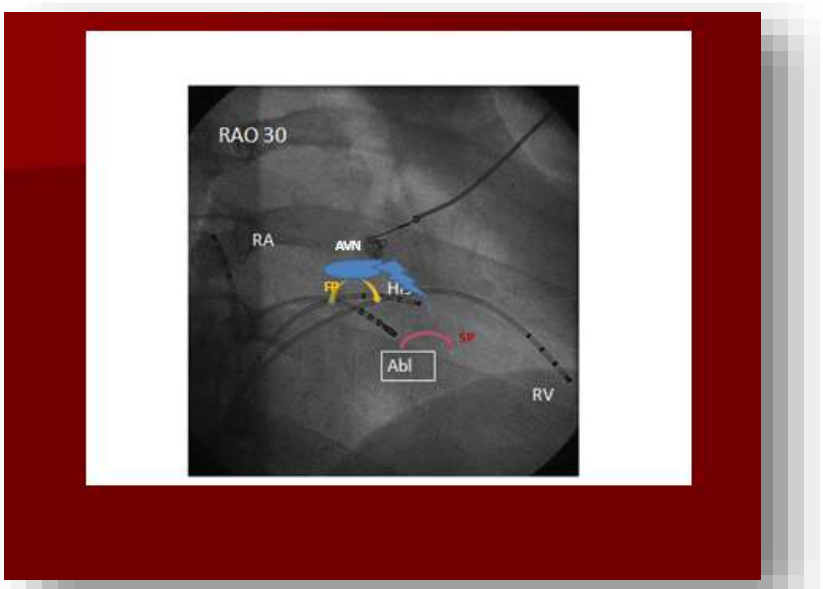

Figure 3, X ray showing the EP and ablation catheters position in correlation to the slow and fast pathway site.

In few patients' coronary sinus catheter introduced if deemed necessary. Basic conduction measurements done and then induction of the arrhythmia attempted with atrial programmed stimulation (APS) and when AH interval jump observed this indicate dual AV nodal physiology. Ventricular programmed stimulation (VPS) used if the SVT is not induced by APS. The induced SVT is diagnosed as s/f AVNRT if the followings criteria seen: 1, AH jump of more than 50msc with reducing the APS pacing cycle length of 10msc .2, VA interval during SVT is less than 80msc. 3, with ventricular entrainment (ventricular stimulation during the SVT) VAV pattern seen after cessation of VPS and PPI minus TCL more than 118msc. Figures 3.

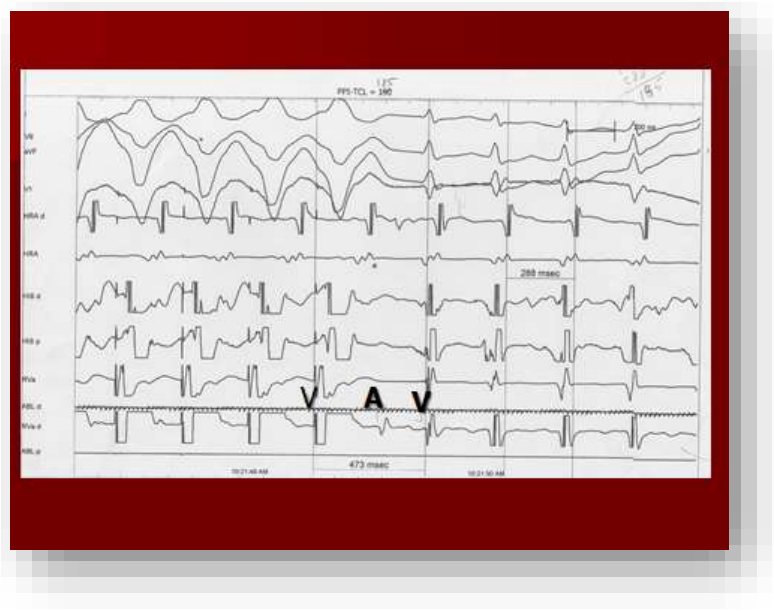

Figure 3, Ventricular entrainment maneuver during the SVT showing PPI-TCL of 185msc and VAV pattern , suggesting s/f AVNRT and excluding AT & AVRT. The speed of recording is 100mm/second.

Atypical (f/s) AVNRT are not included in this study. AT and AVRT are excluded through the ventricular entrainment maneuver mentioned above. The SVT was terminated by APS after confirming the diagnosis of s/f AVNRT. Radiofrequency Catheter ablation procedure: After confirming the diagnosis of common s/f AVNRT done by EP study, a 4mm tip dry ablation catheter from BS or APT introduced through the left femoral sheath and positioned at the lower posterior part of Koch triangle just above the CS os where the SP is sited. Ablation always done during sinus rhythm and no ablation done during the SVT. Once a satisfactory anatomical position achieved through RAO and LAO fluoroscopy view and once an Electrocardiogram (EGM) trace at the distal pole of the ablation catheter showed an A to V ratio of 1/5-10 with or without slow pathway potential, the RF delivery started with temperature control mode and delivering 35 Watt for 1 minute to achieve a temperature of 60-70 degree centigrade. Main sign of successful RF delivery is the appearance of junctional rhythm (JR) which if not appeared within 10 seconds RF delivery will be stopped and a better position of the ablation distal pole achieved. If quite fast JR appeared and VA block seen RF delivery is stopped immediately to avoid the occurrence of AV block. Figure 4.

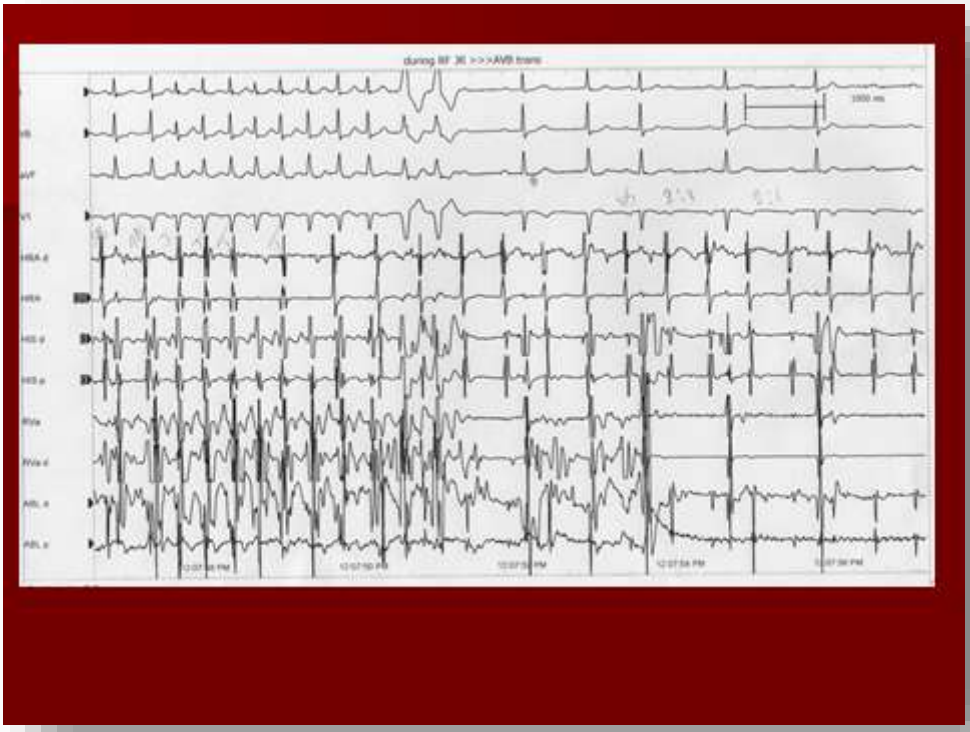

Figure 4, The appearance of fast junctional rhythm and transient AV block with the RF application. The speed of recording is 25mm/sec.

Slow JR is a good sign of effective RF delivery and successful SP ablation. The end point of ablation is non inducibilty of the AVNRT with APS and VPS without and without Isuprnaline infusion. The author reports no conflict of interest.

Results

Among the 70 patients included in this study 68 (97%) patients had acute success with non inducibilty of the tachycardia at the end of the ablation procedure. In two patients the procedure failed and the tachycardia still inducible after ablation where a left sided SP was suspected. In one patient fast pathway ablation resulted in success and non inducibilty of the VT but a first degree heart block developed with a PR interval of 240msc and prolonged AH interval of 185msc but a normal HV interval. Complete atrio-ventricular (AVB) block occurred in 3 patients, in two of them the AVB persisted and permanent pacemaker implanted and in one patient the AVB resolved within 24 hours. The average procedure time was 72+- 21 minutes and fluoroscopy time was 10+- 5.4 minutes. The follow up period ranged from 1.5-6 years. There was a recurrence in two patients after 6 months and one year in both a second ablation done and followed for 2 years with no recurrence. All patients discharged from the hospital in the same day within 4-8 hours after the procedure and they are advised to rest for 24 hours after which they can resume normal daily life activities.

Discussion

AVNRT of s/f type accounts about 85% of the AVNRT and 75% of the RNCT seen in the ED or the cath lab. The presenting symptomatologies previously described by Wood were palpitation in 96%, dizziness in 75%, dyspnea in 47%, and syncope in 0.5%. [8] We noticed palpitation in 100%, dizziness in 35%, and syncope in 20% and dyspnea in 40 %. AVNRT is commonly seen in structurally normal heart but patients with structural heart disease occasionally develop AVNRT. In our series only three patients (4%) have previous IHD. While in other's series structural heart disease seen in 6-19%. [8-11] The typical s/f type is far more common than the uncommon f/s type.[10-12]. In our series only s/f type are included. The treatment of AVNRT depends on the effect of the tachycardia on the hemodynamics and life activities of the patient. Findings a cure has always been the main goal of therapy. [11-13]. Drug treatment might be effective in minority of patients but it has to be lifelong therapy with all the possible side effects .Patient compliance to drug therapy, the drugs side effects and the cost are the three main limiting factors for the life lasting drugs therapy. When ablation therapy first used by delivering DC shock or open heart surgery ablation it gave a hope for a future easier, safer and highly effective ablation procedure and that is when CRFAT came over and the energy source with RF became so well controlled and refined the ablation results became highly encouraging to achieve total cure of many arrhythmias and on the top of the list is the AVNRT. The excellent outcome of ablation is mainly due to the development of anatomical and electrical mapping procedures and precisely defining the slow pathway ablation site. [14, 15, 16] To achieve high success rate in AVNRT ablation we need: 1, well set EP and ablation generator systems. 2, trained medical and technical staff. 3, Reliable X ray fluoroscopy set up with RAO and LAO projection. 4, EP and ablation catheters. We started with self-training program locally at Kadhymia teaching hospital, Nasiriya heart center and then at Alhassani cardiac center in Sulaimanya where the cases included in this study. Our acute success rate was 98% and the long term success was 100% where in two patients recurrence occurred and needed another SP ablation where no recurrence within two years follow up . The reported recurrence rate ranges from 3-6% [5, 18-22] . Complete atrio ventricular block (AVB) developed in three patients, in two permanent pacemaker was implanted and in one the AVB resolved after 24 hours, these results are comparable to other series. [16] The appearance of junctional rhythm during RF delivery is considered a marker of effective RF delivery and then as a successful ablation by many authors. [17, 18-20]. However the absence of JR does not increase the risk of recurrence of the AVNRT but technically it indicate non effective RF delivery .[5, 21-22] CRFAT improves health related quality of life to a greater extent than do medications and cost wise it is less expensive therapy compared to long life lasting drug therapy among patients who have 1-2 attacks of SVT per month. [17, 18]

Conclusion: CRFAT is both safe and effective supporting our and other author's suggestion to consider it as first line therapy for the majority of patients with AVNRT unless the patient prefers drug therapy trial before CRFAT.

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