

CLINICAL STUDIES

The Experience with Transcatheter Ablation of Supraventricular Tachycardia in Puerторican Adults

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Data of the transcatheter radio frequency ablations for patients with supraventricular tachycardia conducted in Puerto Rico is presented. One group includes the first 100 patients performed from September 1994 to March 1997 at the Cardiovascular Center of Puerto Rico and the Caribbean and the Second group includes 157 ablations done in the year 2003. Ablations performed in the different types of supraventricular tachycardias is analyzed including success rates and complications. Results are compared

to those reported in the 1998 NASPE registry. The results obtained demonstrated a high successful rate of procedures with minimal complications in both series of patients. One procedure related death occurred in the 2003 year group and none in the earlier group.

Key words: Transcatheter ablation, Radio frequency, Supraventricular tachycardia, Electrophysiology, Success rates.

The technique and use of transcatheter ablation has evolved a great deal in the past 15 years. This intervention was initially considered an experimental therapy and was used only as a last resort for patients whose arrhythmias were refractory to medical therapy. Prior to catheter ablation, surgical interruption of accessory pathways had been introduced in 1968 as a curative therapy for patients with symptomatic supraventricular tachycardia (1). For many years this was considered as the only means of achieving a permanent cure. In 1979, after the unexpected application of a high-energy electrical shock to a patient during an electrophysiologic study, the atrioventricular conduction was inadvertently interrupted (2). The first intentional attempts at transcatheter ablation of atrioventricular (AV) conduction in human beings were reported in 1982 (3,4). Subsequently different attempts were made to ablate accessory pathways by the same transcatheter technique and high-energy electrical shock (5-9). The use of this approach was initially limited due to the potential risk of serious complications associated to it, such as barotrauma. Subsequent radiofrequency current was introduced and has proven to be a safe and effective source of energy for transcatheter ablation (10). Today this technique constitutes an important therapeutic modality.

This procedure is now considered the treatment of choice for patients with symptomatic supraventricular tachycardias that are drug resistant; or in drug intolerant patients or in patients who do not desire long-term drug therapy (11).

In Puerto Rico, in 1994, a transcatheter ablation was first performed by Dr. Raul A. Jimenez at the Cardiovascular Center of Puerto Rico and the Caribbean (CCPRC). This transcatheter ablation program evolved as the first one performing such procedures in the Island. The purpose of this study is to describe the results obtained in the first 100 patients with trans-catheter ablation experience in supraventricular tachycardias in Puerto Rico. In addition, the results of the procedures performed during the year 2003 in the same laboratory will be presented.

Methods

Patients. The study group includes of the first 100 patients with supraventricular tachycardias (SVT) referred to the CCPRC from September 1994 to March 1997 for electrophysiologic study and radiofrequency catheter ablation. Also, the results of the 157 patients with SVT referred to the CCPRC and submitted to catheter ablation during the year 2003 are presented.

Electrophysiologic procedure. Written informed consent was obtained from each patient for the electrophysiologic study (EPS) and for the catheter ablation after benefits as well as potential risks were clearly explained to each patient in detail. Each patient underwent a baseline EPS in the fasting, unsedated state at least five

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half-lives after discontinuation of antiarrhythmic drugs. The technique of the intracardiac EPS performed before the ablation procedure has been the standard as described elsewhere. To identify the possible anatomic sites of the pathways a detailed mapping was performed in all patients before the ablation procedure.

Initially, a radioionic 3-C radiofrequency generator was used with 7 Fr 4mm big tip steerable Webster catheters for the ablation procedure. Constant voltage energy was delivered during the ablation. At the latter part of the study a Medtronic Atakr radiofrequency generator was used after obtaining FDA approval. This time Ablatr 7 Fr 4mm big tip steerable catheters were used; with a temperature control mode system for ablation. These types of unit monitor the temperature of the radiofrequency catheter and adjust the amount of energy delivered. Heparin was administered to all patients through the procedures; the dosages being administered using serial activated clotting time measurements.

Post ablation studies. Immediate EPS was performed in each patient after the ablation procedure. Then, intravenous isoproterenol was administered and a complete EPS was repeated once more in each patient. Ablation success was defined as no inducible or spontaneous SVT for patients with critical accessory pathways, dual atrioventricular nodal reentrant tachycardia (AVNRT) and atrial flutter; or complete heart block for atrioventricular (AV) junctional ablation.

Right heart catheterization was performed after discontinuation of isoproterenol and removal of intracardiac electrodes. Two-dimensional echocardiograms were performed after the ablation procedures. Patients that required cannulation of either a subclavian or an internal jugular vein were evaluated with a chest x-ray. All patients, after discharged from the hospital were routinely followed up within a month at an outpatient clinic.

Results in the First 100 Patients

A total of 100 patients were studied, some with multiple abnormal electric circuits, requiring 113 ablation procedures. The types of ablative procedures performed are summarized in Table 1. As illustrated by the table, ablation of accessory pathways constituted the largest number of procedures performed, with a total of 52 ablations. Forty AVnodal modification ablations were performed.

Table 2 summarizes the results of radiofrequency ablation in the 113 procedures performed including the incidence of success as well as of significant complications in the 100 patients undergoing ablation for SVT.

Success rates. As illustrated in Table II a 100% success

Table I. Description of the First 113 Ablations of Supraventricular Tachycardia

Type of Procedures	
AV junctional	19
Accessory pathway	52
AV nodal modification (AVNRT)	40
Atrial flutter	12
Total	113

AV= atrioventricular
AVNRT= atrioventricular nodal reentrant tachycardia

Table 2. Results of the First 113 Supraventricular Tachycardia Ablations

	AV junctional ablation	Accessory pathway ablation			AVNRT		
		LFW	RFW	Septal	Slow	Fast	Atrial flutter
Total performed	19	33	9	10	36	4	2
Success (%)	100	100	88	70	97	100	100
No. significant complications	0	1	0	0	3	0	0
Procedure-related deaths	0	0	0	0	0	0	0

AVNRT= atrioventricular nodal reentrant tachycardia
AV= atrioventricular
LFW= left free wall
RFW= right free wall

rate was obtained during the 19 A-V junctional ablations. This procedure was performed on patients with intractable atrial arrhythmias with fast ventricular responses despite the use of A-V slowing drugs. The patients had atrial fibrillation, atrial flutter, or automatic atrial tachycardia.

Concerning the 52 accessory pathway ablations a 100% success rate was obtained in patients with left free wall accessory pathways. This included, accessory pathways located at the left anterior, left anterolateral, left lateral, left posterolateral and left posterior wall. A total of 33 procedures were performed in this category and the majority of the accessory pathways were located on the left free wall.

In the 9 right free wall accessory pathways ablations an 88% success rate was obtained. The lowest success rate obtained in the accessory pathways category (70%) occurred in the 10 located in the septal area as three of the ten critical accessory pathways in the posteroseptal space could not be ablated presumably because of the epicardiac venous location. The success rate for catheter ablation of left free wall accessory pathways was higher than for catheter ablation of accessory pathways in other locations. The overall success rate obtained in 48 of 52 patients for a 92% rate.

A total of 40 patients with AVNRT underwent A-V nodal modifications with slow pathways ablations with a success rate of 97%. A 100% success rate was obtained in the fast pathway ablations, but this accounted for only 4 patients. Two atrial flutter ablations were performed in patients with this arrhythmia as the primary tachycardia. This ablation was performed at the latter part of the study period when data became available in the medical literature indicating the potential cure of patients with classical counterclockwise atrial flutter. This was done by ablation of the area of slow conduction of the critical isthmus.

Complications. A total of 4 significant complications occurred during the 113 procedures performed. Deep vein thrombosis occurred in 2 patients; both after being discharged from the hospital. This occurred despite the use of IV Heparin during the ablation procedure. One occurred during the ablation of a left free wall accessory pathway and the other occurred in a patient undergoing A-V nodal modification.

Two A-V node conduction abnormalities occurred during two A-V nodal modifications procedures. Of these one was a complete A-V block and the other was an advance second degree A-V block. Both patients required the implantation of a permanent pacemaker. No procedure related deaths occurred in the study population.

Results of the Ablations Performed in 2003

A total of 157 patients underwent an ablation procedure in the Cardiovascular Center of Puerto Rico and the Caribbean during the year 2003. These procedures were performed by three electrophysiologists. Table 3 summarizes the ablation procedures performed in 2003 for supraventricular tachycardias. The majority of cases consisted of the ablation of atrioventricular nodal reentry tachycardias, for a total of 93. The second most common procedure was the ablation of accessory pathways with a

Table 3. Ablations for Supraventricular Tachycardias Performed in 2003

Type of Procedures	
AV junctional	2
Accessory pathway	49
AV nodal modification (AVNRT)	93
Atrial flutter	9
Atrial tachycardia	2
Sinus node modification	2
Total	157

AV= atrioventricular

AVNRT= atrioventricular nodal reentrant tachycardia

total of 49 cases. Less common ablations were reported in cases of the following arrhythmias: atrial flutter (9 cases), atrial tachycardia (2 cases), atrial fibrillation (2 cases). Two patients with sinus node reentry tachycardia were also done.

Success rates. The 4 summarizes the results of ablation in the 157 patients including the success rates as well as of the significant complications and procedures related deaths.

Table 4. Results of the Supraventricular Tachycardia Ablations in 2003

	AV junctional ablation	Accessory pathway ablation			AV node modific	SAN modif	Atrial flutter
		LFW	RFW	Septal			
performed							
Success (%)	100	98	100	100	100	50	78
No. significant complications	1	0	0	0	2	0	0
Procedure related deaths	1	0	0	0	0	0	0
Total	2	34	2	13	93	2	9

AVNRT= atrioventricular nodal reentrant tachycardia SAN= sinoatrial node

AV= atrioventricular

LFW= left free wall

RFW= right free wall

An overall success rate of 97% was documented. A 100% success rate was obtained during the 93 ablations of the A-V node. The conditions involved in these procedures were A-V nodal reentry tachycardia, atrial fibrillation, and non-physiologic sinus tachycardia. In the 49 patients with accessory pathways the successful rate was 96%. One case of partially successful left free wall accessory pathway was reported. Also in one patient, all the bypass tracts could not be localized and ablated. A 100% success rate was obtained in the 2 patients with right free wall accessory pathways, and in the 13 patients with septal accessory pathways.

A total of nine flutter ablations were performed. One of them was unsuccessful due to equipment failure; the other one failed because of recurrence of the arrhythmia after the procedure for a success rate of 78%.

Two cases of sinus node modification were performed. One of these was unsuccessful, as the patient remained with inappropriate sinus tachycardia.

Complications. One death occurred after an A-V node ablation for atrial fibrillation control was performed. This patient had hypotension and respiratory failure after the procedure. Two patients with A-V nodal modification suffered from transient second degree A-V block after the

procedure. Neither of them had a permanent pacemaker implant. No other procedure related complications were reported.

Discussion

This study provides us with objective information about the performance of the catheter ablation program at the CCVPRC in its initial period, and during last year. An overall success rate of 91% was documented. The specific numbers will allow us to have an idea of where we are and where we need to be in relation to catheter ablative procedures.

Very few complications occurred during the performance of this procedure. No other complications occurred like the ones reported in the medical literature such as cardiac perforation, tamponade, or major bleeding (12).

In 1997 the North America Society of Pacing and Electrophysiology (NASPE) authorized the establishment of a voluntary prospective catheter ablation registry. A total of 68 centers in the United States submitted the information in 1998, which included 3,357 patients in which 3,423 ablative procedures were performed (13). It revealed that the successful rates for av nodal junctional ablations was 97.4%, for av nodal modifications was 96.17%, for accessory ablations was 94.0% and for atrial flutter was 86.0%. The success rate obtained in Puerto Rico in the first 100 patients and in the year 2003 revealed figures for av junctional, av nodal modifications and accessory ablations similar or favorable to those of the NASPE registry. The Atrial flutter, including only 9 patients, had a 78% success rate in the year 2003 as compared 86% in the NASPE Registry. It was the only result slightly lower than the Registry figures but the sample is small for valid comparisons.

Despite our initial small numbers our results are similar to those reported in the published national registries and large series (13-14). This report documents the success of our program in the Caribbean area and points to those procedures requiring further improvements. In summary, ablations of supraventricular tachycardias in the CCVPRC are very safe and efficient. The cardiologists of Puerto Rico have this valuable resource in their reach when treating refractory SVT's to conventional therapy.

Conclusion

Transcatheter radiofrequency ablation of supraventricular arrhythmias is being carried on at the Cardiovascular Center of the Puerto Rico and the Caribbean since 1994. An analysis of the first 100 patients intervened from September, 1994 to March 1997 and the total patients

for the year 2003 (157 patients) demonstrate high successful rates with minimal complications similar to the NASPE registry results.

Resumen

Se presentan los datos y los resultados de las ablaciones por radiofrecuencia para taquicardias supraventriculares conducidas en Puerto Rico. Un grupo lo constituyen los primeros 100 pacientes intervenidos en el Centro Cardiovascular de Puerto Rico y del Caribe desde septiembre de 1994 hasta marzo de 1997 y el otro grupo los 157 pacientes intervenidos en el año 2003. Las ablaciones hechas en los diferentes tipos de taquicardias supraventriculares se analizan incluyendo éxitos y complicaciones. Se comparan los resultados con los informados por el registro de NASPE en el 1998. Esto demuestra un por ciento de éxito alto y mínimo de complicaciones en ambas series de pacientes. En el grupo del año 2003 ocurrió una muerte.

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