

SAFETY AND EFFICACY OF ELECTROPHYSIOLOGICAL STUDIES AND RADIO FREQUENCY ABLATION OF PAROXYSMAL SUPRAVENTRICULAR TACHYCARDIA

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ABSTRACT

Introduction:

Cardiac electrophysiological study (EPS) and radiofrequency ablation (RFA) is an established mode of treatment either as first-line or for drug-refractory arrhythmias. Our center has recently started this service under 2-D mapping outside Kathmandu valley

Objective

The aim was to evaluate the safety and efficacy of EPS and RFA for paroxysmal supraventricular tachycardias (PSVT).

Methodology

This is an observational prospective study carried out in the Cardiac Unit of Nobel medical college, Biratnagar, Nepal. All cases diagnosed to have PSVT based on electrocardiogram or Holter recording from August 2018 and May 2019 were included in the study. Data on clinical profile and findings of EPS were recorded. Fifty-nine cases were chosen for safety and efficacy analysis, using SPSS statistical software version 19.

Result

There were 59 patients, 28(47.5%) males, and 31(52.5%) females. The mean age was 38.2 ± 15.9 years. Fifty-three patients underwent RFA while 6 patients underwent only EPS. In the Atrioventricular nodal reentry tachycardia (AVNRT) group, there was female dominance ($P=0.2$) while in Atrioventricular reentry tachycardia (AVRT) group, there was no significant gender difference ($p=0.4$). Left-sided pathway (68%) was more common in the AVRT group. Among the left accessory pathway (AP), left lateral AP (44%) was more common. No major complications including death were noted. Two cases of successful ablation relapsed in one month follow up.

Conclusions

Early results of this small study in patients with PSVT confirm the efficacy and safety of RFA in newly established electrophysiology (EP) laboratory.

KEYWORDS

Electrophysiological studies, Paroxysmal supraventricular tachycardia, Radiofrequency ablation.



INTRODUCTION

Paroxysmal supraventricular tachycardia (PSVT) is a common problem with a prevalence of approximately 1-3 cases per 1000 persons.¹ Radiofrequency ablation (RFA) has markedly changed the management of tachyarrhythmias. RFA of supraventricular tachyarrhythmias uses a high-frequency current that creates lesions through the thermal burn and damages the tissue in direct contact of the ablation catheter.² Electrophysiological study consists of placement of catheters in various structures of heart to obtain intracardiac signals and to electrically stimulate the various parts of the heart. Current RFA systems permit the temperature control, provide information about the adequacy of tissue heating and minimize the injury to surrounding tissues.³ RFA is an established modality in the treatment of supraventricular or ventricular arrhythmias as first-line therapy.⁴ The first RFA of SVT was performed in 1987 and it was started in Nepal since 2003.⁵ It has been established as the curative therapy for most of the PSVT. It is an effective and safe procedure with high success rates with very low procedural complications.⁶ Despite these encouraging results, this modality of treatment has not been widely used in resource-limited areas. The study aimed to evaluate the efficacy and safety of EPS and RFA in patients with PSVT in our newly established electrophysiology laboratory outside Kathmandu valley.

METHODOLOGY

This is an observational prospective study. All patients with the diagnosis of PSVT who were either referred or non-referred cases in the Emergency Room with tachycardia or visited the cardiology clinic of Nobel Medical College, Biratnagar from August 2018 to May 2019, and underwent EPS and/or RFA, were enrolled in the study. PSVT was confirmed based on ECG or Holter recording by a trained cardiologist based on their characteristics, including rapid onset, heart rates of 150 to 250 beats per minute, and regularity of the ventricular response.⁷ The objective of the study was to evaluate the safety and efficacy of EPS and RFA for PSVT by assessing the success rate, procedural complications and recurrence rate during 1 month follow up after the procedure.

Catheter ablation procedures were performed in an electrophysiology laboratory (a cardiac cath lab with specific equipment for the EPS) of Nobel Medical College Teaching Hospital, Biratnagar, Nepal. RFA procedures were performed under fluoroscopy and the amount of radiation exposure was dependant on the length of the procedure being performed. For the EP study, all patients were draped with all aseptic precautions. Venous and arterial accesses were obtained under local anesthesia. Three 6 French femoral sheath were placed percutaneously in the same femoral vein. Three 6 Fr quadripolar diagnostic catheters were inserted: one in the high right atrium (RA), one in Bundle of His, and one in the right ventricle (RV). Coronary sinus was cannulated via the right internal jugular vein with 6 Fr decapolar CS catheters. The same side femoral vein or

femoral artery was cannulated with 7 French sheaths for placing 7 French ablation catheters. These catheters were orientated within the heart to allow pacing stimulation and intracardiac electrical signal recording of the RA, RV, His bundle and the coronary sinus.⁸ During ablation, radiofrequency energy of 35 - 45 watts was applied for 60 seconds with the temperature ranging from 45 to 60-degree celsius. For ablation, 6 Fr Biosense Webster catheters with a blue curve were used. The electrophysiology lab system consisted of a recorder, stimulator and an ablator. It was manufactured by Saint Jude, USA. Before ablation, various types of PSVT were induced or terminated by programmed and non-programmed stimulation and or use of isoprenaline infusion.

Statistical Analysis

Collected data were entered in Microsoft Excel 2007 and converted into SPSS 19 version. Percentage, mean and standard deviation were calculated for descriptive statistics. The tabular presentation was made wherever found necessary.

RESULT

A total of 59 patients were enrolled in the study. As shown in table 1, the mean age of the patients was 38.2 ± 15.9 years (ranges from 9 to 78 years). Female patients (52.5%) were more than male (47.5%). The mean age of male patients was 38.54 ± 16.2 years and female patients were 37.7 ± 15.98 years.

Fifty-three patients underwent EPS and RFA, six patients underwent only EPS. Tachycardia couldn't be induced in two patients. Among four cases in whom RFA was not attempted because one case was found to be left side atrial tachycardia, one atrial flutter/fibrillation, one atrial flutter with Ebstein anomaly and one Ventricular tachycardia (VT) as shown in table 2.

Table 1. Age and gender distribution of the study population

PSVT	Total	Mean Age (years \pm SD)	Male	Female	P-value
PSVT	59	Total: 38.2 ± 15.9 Male: 38.54 ± 16.2 Female: 37.74 ± 15.9	28(47.5%)	31(52.5%)	0.4
AVNRT	28	39.6 ± 14.8	9	19	0.02
AVRT	25	35 ± 17.0	14	11	

Abbreviations – PSVT: Paroxysmal supraventricular tachycardia, AVNRT: Atrioventricular nodal reentry tachycardia, AVRT: Atrioventricular reentry tachycardia

Table 2. Distribution of various supraventricular tachycardias.

Variables	Number (%)
AVNRT	28(47.5%)
AVRT	25(42.4%)
Not induced	2(3.4%)
Atrial tachycardia	1(1.7%)
Atrial flutter	1(1.7%)
Atrial flutter /fibrillation	1(1.7%)
Ventricular tachycardia	1(1.7%)



Abbreviations - AVNRT: Atrioventricular nodal reentry tachycardia, AVRT: Atrioventricular reentry tachycardia

In the AVNRT group, 19 patients were female and 9 patients were male with significant gender difference (P value 0.02). In the AVRT group, 11 patients were female and 14 were male. The mean age in the AVNRT group was 39.6 ± 14.8 years and in AVRT 35 ± 17 years.

As shown in table 3, we observed 11 different types of accessory pathways. Left-sided pathway (68%) was more common than a right-sided pathway. The left lateral pathway was the commonest (44%) of all AVRT followed by the left anterolateral pathway (6.8%).

We found a low recurrence rate (2 patients), and no major complications during periprocedural periods as shown in table 4.

Table 3. Location of accessory pathways

Left side		Right side	
Left lateral	11	Parahisian	2
Left anterolateral	3	Right posterior	2
Left anteroseptal	1	Right free wall	1
Left posterior	1	Right posteroseptal	1
Left anterior	1	Right anterolateral	2
		Midseptal	1
Total	17		8

Table 4: Safety and efficacy of RFA and EPS

	EPS	EPS + RFA
Total (N =59)	6	53
Major complications or death	0	0
Recurrence at 1 month follow up	-	2
Tachycardia not induced	2	0

Abbreviations: EPS: electrophysiologic study, RFA: Radiofrequency ablation

DISCUSSION

Early experience at our center confirms the safety and efficacy of RFA in the treatment of PSVT. We found a high success rate, a low recurrence rate (2 patients), and no complications.

Among PSVT, AVNRT is the most common arrhythmia accounting for around 50% of cases.⁹ The presence of concealed accessory pathway accounts for approximately 38% of patients⁹ with PSVT and about 10% is due to atrial tachycardia (AT).¹⁰ In our study, AVNRT was the most common cause of PSVT accounting for 47.5% of total cases followed by AVRT (42.4%) with only one case of AT.

Similar to other studies done in National Heart Centre in Nepal,¹¹ AVNRT was more common in females (67.8%) and AVRT was more common in males (56%).

RFA of the slow pathway has been recommended as first-line therapy for the treatment of AVNRT and has been demonstrated to significantly improve the quality of life.¹² Slow pathway modification results in a high success rate for permanent cure of AVNRT. Ablation is done in the postero-

septal right atrium; often close to the roof of the coronary sinus ostium by targeting specific electrograms.¹³ RFA is associated with less than 5% complication rate and over 90% success rates in the treatment of SVT.¹⁴ Our study showed no complications of the procedure except the recurrence of tachyarrhythmia in two patients.

The arrhythmia in AVRT is due to an AV re-entry circuit which involves a connection other than the AV node, called an accessory pathway. These accessory pathways are congenital in origin and sometimes give rise to PSVT.¹⁵ WPW syndrome is a common AVRT with manifest ventricular pre-excitation during the asymptomatic period which found in persons of all ages. The prevalence of WPW syndrome decreases with age as a result of attenuation of conduction speed in the accessory pathway. After a long time of discovery of WPW syndrome, the existence of a concealed accessory pathway was found which accounts for approximately 38% of patients with accessory pathway.¹⁰

These accessory pathways are distributed unevenly along the right and left atrioventricular valve annuli. The left-sided accessory pathways are most common and may be approached by using the transeptal approach or the retrograde aortic approach. In our study, 68% of patients had a left-sided pathway with left lateral pathway being the most common (65%) which is consistent with another study.¹⁶

The occurrence of mid septal pathways is 5% or less among accessory pathways.¹⁷ There is an increased chance of damage to the AV node and bundle of His during RFA. We had only one case of the mid septal pathway that was successfully ablated without complication.

All were accessed by using the retrograde aortic approach. The retrograde aortic approach has the potential for complications related to arterial access and manipulation of a stiff catheter across the aortic valve.^{18,19} The rate of complications differs depending on the cardiac procedure that is being performed. Complications are related to vascular access, location of the accessory pathway in the heart, manipulation of catheter, trans-septal or trans-aortic approach and delivery of radiofrequency energy. Serious complications are rare for most ablation procedures.^{20,21} In our study, no such complications were noted.

In the case of atrial tachycardia, ablation is indicated in patients with recurrent, symptomatic tachyarrhythmia. In focal AT, localization of the ectopic focus is required which needs the help of 3-D mapping technology. We had one case of AT who underwent only EPS and referred to the national cardiac center in Kathmandu for ablation. Similarly, one case of each Atrial flutter, paroxysmal AF and Ventricular tachycardia were referred for ablation.

CONCLUSION

Short term follow up results of this study in patients with PSVT of different age groups confirm the efficacy and safety



of RFA with no complications and a very low recurrence rate. These findings need to be confirmed by a larger study with long-term follow-up. RFA is increasingly used as front line therapy as it is a safe procedure and potentially cures the PSVT and avoids the need for long-term drugs and its related adverse effects.

LIMITATIONS OF THE STUDY

This is a small size study with short-term follow up and needs further follow up to look for late recurrence rate. Data on

radiation exposure time was not noted. Due to a lack of 3-D mapping technology, ablation of complex cases like AT, paroxysmal AF, atrial flutter and VT cases were not performed.

CONFLICT OF INTEREST

None

FINANCIAL DISCLOSURE

None to disclose.

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