Cardiac Electrophysiological Study & Radiofrequency Ablation: 
Our Experience in Nepal

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ABSTRACT

Background and aim - Cardiac Electrophysiological Study and Radiofrequency ablation is a form of cardiac intervention for diagnosing and treating cardiac arrhythmias. Various catheters are placed in the various parts of the heart to record signals and radiofrequency energy is used for the ablation.

Methods - A total of 768 patients with paroxysmal supraventricular arrhythmias underwent the procedure at Shahid Gangalal National Heart Centre, Kathmandu, Nepal in a period between October 2003 to September 2011.

Results - The success rate is high (92%) and the complication rate is low (0.8%) which is comparable to the results shown in various literatures.

Conclusion - Cardiac Electrophysiological study and Radiofrequency ablation is fairly safe and provides a definitive cure to the patients with paroxysmal supraventricular tachycardia.

INTRODUCTION

Cardiac Electrophysiological Study (EPS) and Radiofrequency Ablation (RFA) is a cardiac interventional method of diagnosis and treatment for cardiac arrhythmias. Before its advent, antiarrhythmic medications were the only treatment option available; which were poor substitutes. The history of EPS goes back to late 70s when it was limited to diagnostic purpose only. During the initial period, treatment of the arrhythmias started with Direct Current (DC) application. A standard defibrillator was used for that purpose. Use of DC application had its drawback as it resulted in extremely high temperatures and concussive explosion in the heart. Later on it was replaced with Radiofrequency Energy. Radio frequency energy is used to create a lesion at the part of the heart where the ectopic focus or the accessory pathway is located. The purpose is to inactivate the accessory pathway, an ectopic focus or simply create a line of conduction block. The usage of radiofrequency energy was first introduced by Huang et al in 1985.

An electrophysiological study consists of placement of catheters in various chambers and structures of heart. They serve the purpose of obtaining intracardiac signals as well as to electrically stimulate various parts of the heart. The aim is to diagnose, measure the basic cardiac intervals, measure the conductivity and refractoriness, to induce arrhythmia, elucidate the mechanism of arrhythmia, to map the site of origin of arrhythmia and to treat various forms of cardiac arrhythmias.

METHODS

It is a retrospective study. All the patients who underwent cardiac electrophysiological procedure at Shahid Gangalal National Heart Centre in the period between October 2003 to September 2011 were included in the study. The patients were either referred, attended Emergency Room with tachycardia or visited the outpatient department. The EP lab used was Biosense Webster’s EP tracer with Stockert EP-Shuttle ablator. In the year 2011 there was one more addition, Saint Judes EP Workmate with IB1 – 150T11 Cardiac ablation generator.

In a standard EP procedure, the patient is draped with all aseptic precautions, venous accesses and if required arterial access are obtained under local anaesthesia. From the right and the left groin two femoral venous accesses from each and from the right neck a right internal jugular access are obtained. In case of a left sided accessory pathway, an additional right femoral arterial puncture is made. All of the vascular accesses were made using modified Seldinger technique. From the internal jugular a 6 French (Fr) decapolar catheter was inserted and placed in coronary sinus, a 6 Fr Josephson type quadripolar catheter was inserted from the right groin access and place over the His bundle region, two quadripolar 6 Fr diagnostic catheters were inserted from the left
RESULTS
A total of 857 patients underwent cardiac electrophysiological procedure during the period at Shahid Gangalal National Heart Centre (SGNHC). Majority of them i.e. 768 underwent EPS plus RFA and only 89 underwent EP study. Among the 89 EP studies, males dominated with 60 (67.4%) compared to 29 (32.6%) females. Fifty seven had normal EP findings and thirty two had disease of the conduction system. Among the latter the average age was 63 yrs ± 17, the youngest being 28 and the oldest 85 years of age. Eight had EP findings suggestive of sick sinus syndrome and twenty four had evidence of His Purkinje system disease. Thirty two patients with either documented or suspected tachycardia did not have inducible tachycardia.

Among the patients who went EPS and RFA, 347 (45.2%) were male and 421 (54.8%) were female. The age ranged from 11 years to 78 years, mean being 39.18 yrs ± 14.3. Accessory pathway mediated tachycardia also known as Atrio Ventricular Re entrant tachycardia (AVRT) formed the major bulk 416 (54.2%) of patients, followed by Atrio Ventricular Nodal Re entrant Tachycardia (AVNRT) 322 (41.9%), 12 (1.5%) atrial tachycardia and 18 (2.3%) were others (Atrial flutter, focal PVCs and fascicular VT etc). The mean age of patients with AVRT was 36 yrs ± 13.3 while that of AVNRT was 43.5 yrs ± 14.5. Among the accessory pathways Left sided accessory pathways predominated followed by septal and right sided pathways. Left sided pathways constituted 246 (59.1%), septal pathway constituted 78 (18.8%), right sided pathway 72 (17.3%), 16 (3.8%) had more than one accessory pathway and 4 (1%) had Mahaim accessory pathway. Likewise the manifest accessory pathway i.e. documented WPW ECG constituted 223 (56.2%) and concealed accessory pathway (pathway able to conduct in retrograde direction only) constituted 174 (43.8%). Out of the 768 patients who underwent RFA, ablation was not attempted in 24 (9.1%), failure to ablate in 24 (9.1%), immediate successful ablation was in 699 (91%), tachycardia recurred in 16 (2.1%) and 5 (0.7%) were re ablated at a later date. Regarding complications there were no deaths, two pseudo aneurysms of femoral artery, one high degree atrio ventricular block, one deep venous thrombosis of femoral vein, one peripheral embolization, one severe vasovagal reaction, one cardiac tamponade and one minor bleeding.

DISCUSSION
50% of permanent pacemakers are implanted for bradyarrhythmias caused by Sinus Node Dysfunction (SND). SND showed a median annual incidence of complete AV block of 0.6% (range 0% to 4.5%) with a total prevalence of 2.1% (range 0% to 11.9%). This suggests that the degenerative process also affect the rest of the conduction system, although the rate of progression is slow.4

Among the Paroxysmal Supraventricular Tachycardias (PSVTs) the most common is Atrio Ventricular Nodal Re entrant Tachycardia (AVNRT) - 52%.6 During mid 70s after almost a decade of experience with Wolf Parkinson White (WPW) syndrome the existence of concealed accessory pathway was discovered.6 The presence of concealed accessory pathway accounts for approximately 38% of patients6 with apparent PSVT and about 10% is due to atrial tachycardia.14-15 Atrial tachycardias are usually focal (originates from a single site) in origin and can originate from one or both atria. The sex difference went along with the findings in the literature for both AVNRT and AVRT. Males were 101 (31.4%) while females were 221 (68.6%) in AVNRT and in case of AVRT males were 228 (54.8%) and the females were 188 (45.2%).5-9 Contrary to the findings in the literature AVRT predominated in our study followed by AVNRT, one of the reasons being inclusion of patients with overt WPW in our study. Various other studies show the incidence of concealed by pass tract to range from 15% to 50%;5-13 If we solely consider the patients with only concealed accessory pathway in our study, the number drops to 174 (22.6%).

The prevalence of ventricular pre excitation is thought to be 0.1 to 3 per 1000 people in the general population.53,54 Estimates of arrhythmia incidence in patients with pre excitation vary widely, ranging from 12% to 80% in several surveys. Approximately 4 newly diagnosed cases of WPW syndrome per 100,000 population occur each year. The location of the APs, in decreasing order of frequency, is 53%, the left free wall, 36%, posteroseptal, 8%, right free wall, and 3%, anterosetal. Approximately 80% of patients with WPW syndrome have a reciprocating tachycardia, 15-30% will develop AF, and 5% have atrial flutter.56,57

WPW syndrome is found in persons of all ages. Most patients with WPW syndrome present during infancy. However, a second peak of presentation is noted in school-aged children and in adolescents. This interesting bimodal age distribution is due to permanent or transitory loss of pre excitation during infancy in some patients and during late adolescence in others. The prevalence of WPW syndrome decreases with age as a consequence of apparent attenuation of conduction speed in the AP. About one fourth of patients lose pre excitation over a 10-year period, probably as a result of fibrotic changes at the site of insertion of the accessory bypass tract. Cases have been described in which ECG evidence of pre excitation disappears completely. One tenth of patients with concealed APs lose retrograde conduction over 10 years.

In asymptomatic patients, antegrade conduction across the accessory pathway (AP) may spontaneously disappear with advancing age (one fourth of patients lose antegrade bypass tract conduction over 10 years). In patients with abnormal ECG findings indicative of WPW syndrome, the frequency of SVT paroxysms increases from 10% in people aged 20-39 years to 36% in people older than 60 years.16 Overall, about 50% of patients with WPW develop tachyarrhythmias. WPW syndrome has been found to be more frequent in males. One study documented a male-to-female ratio of approximately 2:1. Another reported 1.4 cases of WPW syndrome per 1000 men and 0.9 cases per 1000 women. A third study found a 3.5-fold higher prevalence of WPW syndrome in men. No clear racial predilection appears to exist. The success rates for AVNRT ablation from reported trials are more than 95%.17,18 We had only one relapse giving us the success rate of 99.7% with a solitary complication, as one patient developed high degree AV block which is comparable to one series by Huang et al in which 6 patients out of 2333 developed complete heart block.20 Success rates for left sided pathway is highest of any AP location and are typically greater than 90%,21-31 In our series we successfully ablated 237 out of 246 left sided pathways giving the success rate of 96.3%. We mostly used the retrograde aortic approach for the ablation of the left sided pathways, but at occasions especially for the pathways located anteriorly trans septal approach was used.
Superoseparaseptal APs comprise 6% - 7% of all APs in most large series. About 80% of them exhibit anterograde conduction while 20% are retrograde only conducting (concealed); 5% conduct exclusively in the anterograde direction.31 Mid septal pathways are 5% or less of all accessory pathways.32 Due to close proximity of AV node and Bundle of His there is increased risk of damage to these structures during ablation, but we did not have any incidence of such damage in our study. Studies indicate the success rate for superoparaseptal pathways to be 95% with 1% risk of heart block and 10% risk of right bundle branch block.52 We had one incidence of right bundle branch block after ablation of superoparaseptal pathway. For practical purpose it should be noted that antero septal and paranasi pathways are both considered to be superoparaseptal pathway. For posteroseptal pathways the success rate is similarly high, at 93% - 98%,36 – 43 our success rate for septal pathway is 80.8% which is mainly due to pathways which had antero septal, mid septal or para Hisian locations and were not attempted due to close proximity to AV node and His bundle. The success rates for the right free wall are the lowest for any AP location, ranging from 66% - 100% in different series averaging about 90%.44 - 50 If we consider posteroseptal pathways only then our success rate goes up to 46 out of 51 i.e. 90.2%.

Complications are related to vascular access, vessel involved, location of the region of AP, slow pathway or ectopic foci in the heart, catheter manipulation, trans septal or trans aortic approach and radiofrequency energy delivery. We had very low rate of complications of 0.8% which is well below that shown in the literature.

CONCLUSION
In conclusion radiofrequency ablation is a safe and a definitive cure for significant majority of patients with Paroxysmal Supraventricular Tachycardias (PSVTs). This form of interventional treatment has high rate of immediate and long term success with low rate of complications. Shahid Gangal National Heart Centre situated at Bansbari is the only centre providing such facility inside Nepal. With success rates comparable to the literature and remarkably low rate of complications it is definitely the treatment of choice for PSVTs.

REFERENCES
24. Yip ASB, Chow WH, Yung TC, et al. Radiofrequency catheter ablation of left sided accessory pathways using a transseptal...


