AUDIT ARTICLE

# Cardiac electrophysiologic procedures — A ten years experience at National Institute of Cardiovascular Diseases, Karachi

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## Abstract

**Objectives:** To review 10 years of clinical practice of cardiac electrophysiology study and radiofrequency catheter ablation in the treatment of supraventricular tachycardia.

**Methods:** The retrospective chart review was conducted at the National Institute of Cardiovascular Diseases, Karachi, and comprised records of all patients who underwent electrophysiological study and / or radiofrequency catheter ablation from January2007 to December 2016. SPSS 21 was used for data analysis.

**Results:** Of the 627 patients, 335(53.4%) were females. The overall mean age was 40.99±13.59 years. The major indication for procedure was supraventricular tachycardia 376(59.97%). Final electrophysiological study diagnosis was typical slow fast atrioventricular nodal re-entrant tachycardia in 303(48.3%) patients. The overall success rate was 472(75.3%). Procedure-related complications were reported in 25(4%) patients, and there was 1(0.15%) mortality.

**Conclusion:** Cardiac electrophysiology studies and radiofrequency catheter ablation were found to be an effective and safe method for diagnosis and treatment of supraventricular tachycardia.

**Keywords:** Cardiac electrophysiology, Radiofrequency catheter ablation, Supraventricular tachycardia, Wolff-Parkinson-White syndrome, WPW. (JPMA 69: 68; 2019)

## Introduction

Supraventricular tachycardia (SVT) is a group of common rhythm disturbances, representing one of the most common classes of arrhythmia requiring medical attention. They are generally benign; in rare situations, like in the presence of structural heart disease, they can have catastrophic consequences because of rapid heart rates.[1] SVTs, if recurrent, can result in significant impairment in the quality of life.[2] An electrophysiological study (EPS) is recommended for patients with symptomatic, paroxysmal SVT.[3] Often, long-term medical therapy for SVTs is ineffective because of recurrent episodes despite the use of medications.[4] Radiofrequency catheter ablation (RFCA) has become the treatment of choice due to its high primary success rates and low complication rates.[5-7]

The field of clinical cardiac electrophysiology has evolved dramatically over the last 30 years, beginning with the first description of the His bundle (H) recording in 1969.[8] RFCA has established its role as the definitive treatment for most forms of SVT since the 1990s.[9] Despite the growing number of patients suffering from, at times recurrent and distressing SVTs, only a few patients are actually being guided appropriately by primary physicians and, hence, referred for RFCA.[10] Another issue is the relative deficiency of specialised physicians and centres offering this therapy across Pakistan.[11]

There is no large-scale data on the efficacy and safety of EPS/RFCA in Pakistan. The current study was planned to describe our 10-year experience of EPS and RFCA for SVTs.

## Patients and Methods

The retrospective chart review was conducted at the National Institute of Cardiovascular Diseases (NICVD), Karachi, and comprised records of all patients aged 18 years or above who underwent EPS and / or RFCA from January 2007 to December 2016.

Approval was obtained from the institutional review committee, and all patients had signed informed consent before undergoing the procedure. All procedures were performed by experienced operators. Patients' characteristics, diagnoses, procedural details, and indication for the procedure as well as complications related to EPS and outcome of RFCA were extracted from hospital records.

All patients had undergone standard diagnostic cardiac EPS using multi-electrode catheters. Rate-limiting medications were held before the procedure for 5 elimination half-lives. Tachycardia was induced in the electrophysiology laboratory with conventional pacing protocols.[12] In cases of difficulty in the induction of SVT,

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intravenous (IV) doses of atropine or infusion of dobutamine were used in addition to pacing protocols to facilitate tachycardia induction. All cases were recorded on EP recording system (EP Med workstation, St. Jude Medical Inc., USA for initial cases and EP Tracer, Cardiotek Inc., Netherlands, later on). A final EPS diagnosis of SVT was established after routine observations during tachycardia and use of manoeuvres to facilitate diagnosis.

Atakr II (Medtronic Inc., USA) was used as the radiofrequency generator for ablation with optimal temperature setting for ablation usually set at 50-60°C and 4mm, non-irrigated tip radiofrequency ablation catheters were used to perform RFCA. A trans-septal approach or retrograde aortic approach was opted for mapping and ablation of left-sided accessory pathways, depending on operator's preference. Post-ablation EP testing was performed for re-inducibility of tachycardia and repeated after a waiting time of 30 minutes, with or without dobutamine, to ensure that clinical tachycardia was no longer inducible. A successful RFCA procedure was defined as achieving successful endpoints of ablation; loss of pre-excitation in cases of accessory pathways or non-inducibility of tachycardia at the end of ablation.

SPSS v21 was used for data analysis. Categorical data was reported as frequencies and percentages and continuous data as mean ± standard deviation (SD). Stratification was done with regards to gender and age of the patients and chi-square test was performed to evaluate the effect of stratified variables on study outcome.

## Results

Of the 627 patients, 335(53.4%) were females. The overall mean age was 40.99±13.59 years (Table-1). Besides, 390(62.2%) patients had history of recurrent palpitations with no available electrocardiography (ECG) documentation of SVT while 237(37.8%) had ECG documentation. Final EPS diagnosis of typical slow-fast atrioventricular nodal re-entrant tachycardia (AVNRT) was found in 303(48.3%) patients, and 210(33.5%) patients had atrioventricular reciprocating tachycardia (AVRT) secondary to Wolff-Parkinson-White (WPW) syndrome. Of these patients, a culprit left lateral accessory pathway was found in 105(16.7%), a right-sided accessory pathway in 77(12.3%), and 28(4.5%) patients were diagnosed to have multiple accessory pathways.

No RFCA procedure-related complication was observed in 602(96.01%) patients. Transient complete atrio-ventricular (AV) block after ablation was observed in 12(1.91%) patients, which resolved later; 5(0.8%) patients developed right bundle branch block, while 1(0.16%) patient developed persistent complete AV block for which a permanent pacemaker was implanted. Also, 1(0.16%) patient expired 10 hours post-ablation. The patient collapsed immediately on getting up from the bed for ambulation and could not be revived (Table-2).

**Table-1:** Baseline characteristics of the patients.

| Baseline characteristics | Total (n=627) |
|---|---|
| **Gender** | |
| Male | 292 [46.57%] |
| Female | 335 [53.43%] |
| **Age (years)** | |
| Mean | 40.99 ± 13.59 |
| Less than 30 years | 149 [23.76%] |
| 30 to 50 years | 337 [53.75%] |
| More than 50 years | 138 [22.01%] |
| Missing | 3 [0.48%] |
| **Indication of procedure** | |
| Recurrent SVT | 237 [37.8%] |
| Recurrent Palpitations | 376 [59.97%] |
| WPW With AFIB | 6 [0.96%] |
| Syncope Evaluation | 8 [1.28%] |
| Wide complex tachycardia | 17 (2.7%) |
| **Documented arrhythmia** | |
| Yes | 281 (44.8%) |
| No | 346 (55.2%) |
| **Arrhythmias diagnosed on EPS** | |
| AVNRT | 303 [48.33%] |
| Left Lateral Accessory Pathway | 105 [16.75%] |
| Right Septal Accessory Pathway | 77 [12.28%] |
| Multiple Pathways | 28 [4.47%] |
| Ventricular Tachycardia | 17 [2.71%] |
| Atrial Tachycardia | 13 [2.07%] |
| Typical Atrial Flutter | 12 [1.91%] |
| Mahaim Type Accessory Pathway | 5 [0.8%] |
| Miscellaneous | 67 [10.69%] |
| **Structural heart disease** | |
| Normal Heart | 605 [96.49%] |
| Heart Failure with reduced ejection fraction (HFrEF) | 9 [1.44%] |
| Ebstein Anomaly | 5 [0.8%] |
| ASD | 4 [0.64%] |
| Rheumatic Heart Disease | 2 [0.32%] |
| Miscellaneous | 2 [0.32%] |

SVT: (Supraventricular Tachycardia). WPW: (Wolff- Parkinson-White). AFIB: (Atrial Fibrillation). EPS: (Electrophysiological Study). AVNRT: (Atrioventricular Reentrant Tachycardia). ASD: (Atrial Septal Defect).

RFCA was successful in 472(75.28%) patients. Success was found to be dependent on gender, age and arrhythmia diagnosis at the time of EPS (p=0.025, p<0.001 and p<0.001 respectively). Female patients had higher success rate in 265(79.1%) compared to male patients 207(71.38%). Significantly higher success rates were observed in patients of age more than or equal to 30 years 375(79.11%) compared to patients of age less than 30

**Table-2:** Result of RF ablation and complications.

| | Total (n=627) |
|---|---|
| **Complications** | |
| CHB requiring PPM | 1 [0.16%] |
| Transient CHB | 12 [1.91%] |
| RBBB | 5 [0.8%] |
| Left main dissection | 1[0.16%] |
| Mortality | 1[0.16%] |
| Access site hematoma | 7 [1.12%] |
| **Result of RF Ablation** | |
| Unsuccessful | 153 [24.4%] |
| Successful | 472 [75.28%] |
| Missing | 2 [0.32%] |

CHB: (Complete Heart Block). PPM: (Permanent Pacemaker).
RBBB: (Right Bundle Branch Block). RF: Ablation (Radiofrequency Ablation).

**Table-3:** Variables affecting success rate of RF ablation.

| | Successful n [%] | Unsuccessful n [%] | P-values |
|---|---|---|---|
| **Gender** | | | |
| Male | 207 [71.38%] | 83 [28.62%] | 0.025* |
| Female | 265 [79.1%] | 70 [20.9%] | |
| **Age** | | | |
| Less than 30 years | 95 [64.19%] | 53 [35.81%] | <0.001* |
| More than equal to 30 years | 375 [79.11%] | 99 [20.89%] | |
| 30 to 50 years | 260 [77.15%] | 77 [22.85%] | 0.099 |
| More than 50 years | 115 [83.94%] | 22 [16.06%] | |
| **Arrythmia diagnosed** | | | |
| AVNRT | 293 [96.7%] | 10 [3.3%] | <0.001* |
| Left Lateral Accessory Pathway | 75 [71.43%] | 30 [28.57%] | |
| Right Septal Accessory Pathway | 49 [63.64%] | 28 [36.36%] | |
| Multiple Pathways | 17 [60.71%] | 11 [39.29%] | |
| Ventricular Tachycardia | 2 [12.5%] | 14 [87.5%] | |
| Atrial Tachycardia | 0 [0%] | 13 [100%] | |
| Typical Atrial Flutter | 6 [50%] | 6 [50%] | |
| Mahaim Type Accessory Pathway | 2 [40%] | 3 [60%] | |

p-values reported are for chi-square test,
*Statistically Significant at 5% level of significance.
AVNRT: (Atrioventricular Reentrant Tachycardia). RF: Ablation (Radiofrequency Ablation).

years 95(64.19%). Relatively high procedural success rate was observed in patients with an EPS diagnosis of AVNRT 293(96.7%) compared to patients with left-sided accessory pathways 75(71.43%), right-sided accessory pathways 49(63.64%) and multiple accessory pathways 17(60.71%) (Table-3).

## Discussion

Overall outcome of EPS and RFCA for SVT patients remained encouraging at our centre. This is the first large-scale observational study from Pakistan and NICVD appears to be the largest EPS facility. As a matter of fact, SVT is very low-risk arrhythmia but associated with significant morbidity and multiple emergency room (ER) visits. A chronic medical therapy proves to be non-attractive[12] and thus, RFCA appears to be a better choice for these patients. Its safety and efficacy has been judged over the last few decades.[12-14] Its recurrence rate is also less than 3%.[15,16] RFCA is affordable to patients and that makes it more acceptable.[12]

Interestingly, female patients had a higher success rate compared to male patients in the current study. The worldwide initial success rate for RFCA was reported as 90% to 95% in patients with WPW syndrome[13,17,18] and 98% to 100% in AVNRT.[14,17,19] A study reported 10-year data of EPS and RFCA done in 2012 with a success rate of 99% in AVNRT and 94% in AVRT, while major complications were 0.45% including 3 patients requiring permanent pacing. Our 10-year success rate for AVNRT was 96%with overall complication rate of 4%, only one of our patients required permanent pacemaker. This shows that NICVD proved to be satisfactorily promising in high success rate, especially for AVNRT and low over all complication rates.

Previous studies support the fact that EPS success rate at a new centre improves after initial certain number of cases.[19] A study showed that unsuccessful cases at a centre decreased from 24% in the first 50 cases to 4% after the first 250 cases. Compared to this data, although our learning curve was almost similar, our 10-year experience at NICVD was slightly lower.

Comparing the complication rates of 2-5% of other centres,[14,17,19] we documented a complication rate of 4%, including a single case of persistent 3rd degree AV block requiring permanent pacemaker and one mortality.

These success rates and low complications indicate that ablation procedures are safe and efficacious option for the management of SVT.

The major limitation of our study is its retrospective and descriptive nature. Since this was not an analytical study, we are not in a position to rationalise the difference in success and complication rates with other studies cited above. Lastly, in the resource-poor environment of NICVD, re-sterilized catheters were used in a huge majority of patients, and that may have affected the success and complication rates.

## Conclusion

This is the largest observational study from Pakistan of EPS and RFCA experience for SVTs. The review showed the procedure to be an effective modality for treatment of SVT with high success rates and low rates of

complications.

**Disclaimer:** None.

**Conflict of Interest:** None.

**Funding Sources:** None.

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