

LOCALIZATION AND ABLATION OF ACCESSORY PATHWAY BY AN ELECTROPHYSIOLOGICAL STUDY

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Date Received: September 06, 2014

Date Revised: October 12, 2014

Date Accepted: October 30, 2014

Contribution

All the authors contributed significantly to the research that resulted in the submitted manuscript.

All authors declare no conflict of interest.

This article may be cited as:
Hameedullah, Ghaffar R, Rauf MA,
Awan ZA. Localization and ablation of
accessory pathway by an
electrophysiological study. Pak Heart
J 2014;47(4): 202 - 6.

ABSTRACT

Objective: The aim of the study was to evaluate localization and ablation of accessory pathways based on electrophysiological study (EPS).

Methodology: This is a hospital based prospective study conducted in Cardiology department Hayatabad Medical Complex (HMC) and Electrophysiology laboratory (EP Lab) in Lady Reading Hospital (LRH) Peshawar from September 2006 to December 2012. All adult patients with palpitation, pre-syncope/near syncope, syncope, drop attack and dyspnea related to arrhythmias were included. Patient underwent EP study.

Results: During this period, 570 patients underwent EPS, 200(35%) of them for accessory pathways. The mean age of patients underwent EPS for accessory pathways was 33.14 ± 10 years (20-49 years). Males were 102(51%). All the patients were symptomatic and most common symptom was paroxysmal palpitation, reported in 174(87%) cases. Delta wave was recorded in 130(65%) and the remaining have concealed pathways. Structurally normal heart was reported in 190(95%) cases. Left lateral (LL) pathway was most frequent, found in 108(54%) cases. Postero-septal (PS) pathway in 52(26%), right free wall (RFW) was found in 24(12%), right antero-septal (RAS) pathway in 10(5%) and the remaining 6(3%) were miscellaneous, including multiple pathways. About 190(95%) of these pathways were successfully ablated.

Conclusion: Accessory pathway is a common diagnosis among patients undergoing EP study. Delta waves were common finding on ECG, left lateral pathway was the most frequent findings and transseptal approach was used in majority of the cases. Ablation was highly successful irrespective of the types of pathways and approaches, with no complications.

Key Words: Cardiac Electrophysiology, Accessory Pathways, WPW Syndrome

INTRODUCTION

Supraventricular tachycardia (SVT) has often been considered to be a benign disorder, but it causes considerable morbidity. The sufferer experience recurrent attack of palpitations leading to discomfort and in some cases syncope. Their life styles are also adversely affected. In a small percentage of patients, the tachycardia becomes life threatening, like atrial fibrillation (AF) in patients with Wolf-Parkinson-White (WPW) syndrome, in whom the risk of sudden death is about 1 per 100 patients-years.¹ WPW syndrome has an accessory pathway and abnormal connection between atria and ventricle with a very short anterograde refractory period.²

In last two decades, catheter based techniques has been developed to localize the focus and pathways of arrhythmia production and conduction.³ Catheter ablation is a non-surgical technique for curative therapy of cardiac arrhythmias. Initially it was used for ablation of AV node and subsequently used successfully for ablation of accessory pathways and modification of AV node.^{2,3}

Electro-Physiological study (EPS) is an emerging technique in invasive cardiology. This procedure was first performed in our set up on 2nd September 2006. In this study, we examined localization and ablation of accessory pathways based on EPS.

METHODOLOGY

It was a hospital based prospective study, conducted in cardiology department of Hayatabad Medical Complex (HMC) and electrophysiological laboratory (EP Lab) in government Lady Reading Hospital (LRH) Peshawar. The study period was between September 2006 and December 2012. All adult patients with palpitation, pre-syncope/near syncope, syncope, drop attack and dyspnea related to arrhythmias were included. "Palpitation" was defined as heart beat sensations in the chest or throat that feel like pounding or racing or an unpleasant awareness of heart beat or feeling of skipped beats or a pause. "Pre-syncope/near syncope" was defined as dizziness or light headedness or feeling faint or Graying out. "Syncope" was defined as sudden loss of consciousness with loss of postural tone, not related to anesthesia, with spontaneous recovery as reported by patient or observer. Patient may experience syncope when supine. "Drop attack" was defined as abrupt loss of postural tone (collapse) without reported loss of consciousness. Dyspnea was defined and classified according to New York Heart association (NYHA) functional class. Electrocardiogram (ECG) was evaluated for presence of, tachycardia, delta waves, axis, arrhythmias specially any documented SVT and other abnormalities, while echocardiography (Echo) was for ejection fraction (EF) and structural heart diseases.¹

Before the procedure, informed and written consent was obtained. The EPS was performed in the fasting state. Standard EPS and endocardial mapping was done with four multi-polar catheters in right atrium (RA), right ventricle (RV), coronary sinus (CS) and His bundle (HB). The catheters were positioned under fluoroscopy, and the exact site determined by the intra cardiac electrogram (EGM) signals. BARD electrophysiology stimulator was used for pacing the heart and give extra stimuli. St. Jude Medical EnSite Velocity amplifier was used for intra-cardiac signal amplification. The St. Jude Medical EP workmate 4.1 was used as electro-physiological platform. St. Jude medical EP-4 was used for 3D mapping. General Electronics (GE) innova was used for fluoroscopy.

EP technique and criteria used for localization of accessory pathways included: 1) electrocardiographic (ECG) criteria, 2) Differential pacing from high RA and proximal CS, 3) Endocardial pacing of the site of earliest atrial activation during Orthodromic Atrio-Ventricular Re-entrant Tachycardia (AVRT), 4) Pre-excitation index, 5) Change in VA interval with aberration during Orthodromic AVRT, 6) Site of earliest ventricular activation recorded during sinus rhythm. Localization was mainly based on endocardial mapping and other criteria were used as ancillary.

EP criteria for presumptive diagnosis of second or multiple pathways included, 1) Different pre-excited QRS configuration with differential pacing from RA and proximal CS, 2) Multiple QRS configuration during AF, 3) different retrograde atrial activation sequences during AV reentrant tachycardia or ventricular pacing ; and 4) presence of pre-excited reentrant tachycardia.

All data entered into SPSS version 18. Results were expressed in frequency and percentages. Chi square test for categorical and Pearson two tail student t test for nominal data were applied.

RESULTS

A total of 570 patients underwent EPS from September 2006 to December 2012. EPS based diagnosis of arrhythmias has been shown in Table 1. The accessory pathways were 200 (35%). 194 (97%) having single well defined AP while 6 (3%) having multiple pathways or difficult to localize pathways. Mean age of the patients with accessory pathways was 33 ± 10 years (20-49 years). Male and female were 102 (52%) and 98 (48%) respectively. Most of the patients were poly symptomatic during the episode of tachycardia, but palpitation was noted in 148 (74%) of patients either alone or as part of other symptoms. Echo and six channels ECG were done in all patients. Heart was structurally normal in 190 (95%) patients ; Delta wave was recorded on ECG in 130 (65%) cases. Two (1%) of the patients have previous accessory pathway ablation done elsewhere and presented with recurrence of symptoms.

Table 1: Distribution of Tachyarrhythmia's based on EPS

DIAGNOSIS	FREQUENCY	PERCENTAGE
Atrio Ventricular Nodal Re-entrant Tachycardia (AVNRT)	305	54%
Accessory Pathways (AP) including WPW syndrome	200	35%
Atrial Tachycardia (AT)	15	2.6%
Atrial Fibrillation (A.Fib)/Atrial Flutter (A.Flu)	14	2.5%
Idiopathic Left Ventricular Tachycardia (ILVT)	16	2.4%
Normal EP Study	20	3.5%

Both of them have RAS pathway. Nine (5.5%) of the patients have documented atrial fibrillation (AF) with pre excitation. Trans-septal (inter-atrial) puncture was done in 122 (61%) cases while retrograde studies through aortic root and left ventricular (LV) cavity were performed in 8 (4%) cases. The remaining 70 (35%) were standard right sided EPS. Location based distribution of AP has been shown in Figure 1. The most frequent pathway was LL, documented in 108 (54%) cases. Accuracy for LL pathway was best (99%) and ablation of this pathway was also best, 99%. Figure 2 shows catheter position for ablation of LL accessory pathway. Localization and successful ablation of other pathways was 94% (190 cases) collectively. Failure to localize and ablate in first attempt was mainly due to multiple pathways or unidirectional conducting pathways and was rare with LL pathways. No major complication recorded during and after the procedure. Recurrence of symptoms upto one year of ablation was 5 (2.5%).

Figure 1: Distribution and Localization of Accessory Pathway

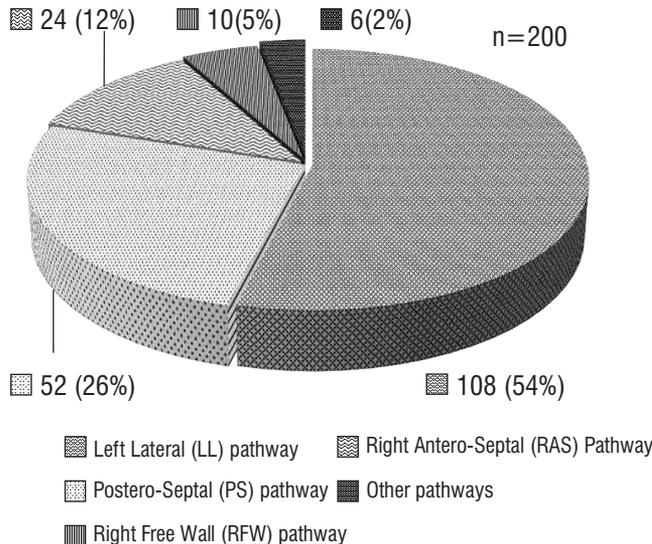
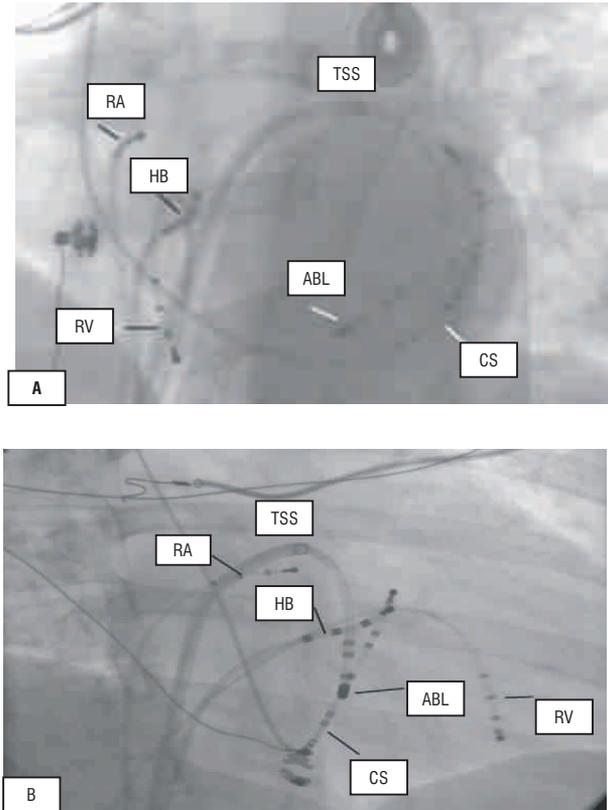


Figure 2: Catheter Positions for Trans-septal Approach to Ablation of Left Free Wall Accessory Pathway



A) Left anterior oblique (LAO) view showing the preformed trans-septal sheath (TSS) crossing the foramen ovale and used to position the ablation catheter (ABL) along the proximal mitral annulus.

B) Right anterior oblique (RAO) view of catheter positions. The ablation catheter has been moved slightly more distally. Note that the tip of the ablation catheter is slightly on the ventricular side of the coronary sinus catheter (CS). (HB) His bundle catheter; (RA) right atrial catheter; (RV) right ventricular apical catheter.

DISCUSSION

Cardiac electrophysiology is an emerging modality in invasive cardiology.^{1,3} It can provide curative care to many cardiac arrhythmias as compared to only palliative care by pharmacotherapy.^{4,12} The EPS needs sophisticated EP laboratory and dedicated and well trained EP team. In Pakistan, the only recognized center is EP department in Armed Forces Institute of Cardiology (AFIC) Rawalpindi. The facility is partially available in Karachi and Lahore. Despite all these, availability of EPS and RFA in Peshawar is not less than a miracle.

Recurrent SVT is a common cardiac problem and it is very distressing in many occasions. The patient needs frequent visit to hospital emergency, needs injections to control the rapid rhythm and at times need DCC.^{1,4} Delta wave is an

important landmark in diagnosis of accessory pathway. We recorded delta waves in 120(60%) patients in our study. The remaining have concealed pathway. Transeptal puncture is a risky procedure in EPS due to normal size left atrium and close proximity of aortic cusps. The risk of pericardial tamponade, cardiac rupture, aortic cusps damage and death is high in transeptal puncture as compared to transeptal puncture in severe mitral stenosis for mitral balloon valvotomy because of large left atrial size.

EPS is a safe diagnostic modality with high sensitivity and specificity.⁴ No mortality or major complications were attributed to the procedure in our study. There are many reasons behind the low morbidity and no mortality. Majority of the patients were young with average age of 34 years, having structurally normal heart (94%) and no serious co morbidity. These otherwise healthy patients tolerated the procedure very well. In a study carried out in AKU and NICVD in Karachi, one death was reported but in our study, no mortality recorded.¹⁰ Our 95% success in radio frequency ablation without any major complication is comparable to any good EP center in the world.^{4,7,10}

A study by Sharma et al, showed 92% single pathways, 8% multiple pathways, 54% LL pathway, mean age of 32 years and male to female ratio of 1.8.¹² Localization of LL pathway was easy to locate (99% sensitivity and positive predictive value), most frequently present (54%) and easy to surgically ablate (99%).¹³ Our results closely coincide with the findings in this study.

Localization of accessory pathways was based on surgically defined areas in previous studies. The RAS pathway connects RA to RV while PS pathway runs from RA to LV. LL and RFW are free wall pathways respectively. The presence of multiple pathways was problematic because of one "dominant" pathway may be involved in most of observed phenomenon, making diagnosis difficult, when second pathway is septal and conducts in retrograde direction only.¹³

There is no gold standard to compare the diagnostic accuracy and ablation efficacy. Failure to induce tachycardia after ablation, disappearance of delta waves in WPW syndrome and , recurrence of symptoms are surrogate markers of procedure success and failure. In our study, recurrence of symptoms in one year was 2.5% while immediate success was 94%. Our data is comparable to major centers.¹³ Surgical option for pathway ablation is not available in Peshawar.

CONCLUSION

Accessory pathway is a common diagnosis among patients undergoing EP study, all patients were symptomatic and most have structurally normal heart. Delta waves were common finding on ECG, left lateral pathway was the most

frequent findings and trans septal approach was used in majority of the cases. Ablation was highly successful irrespective of the types of pathways and approaches, with no complications. There are very few patients with recurrence of symptoms after one year of follow up.

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