

Radiofrequency Catheter Ablation for Wolff Parkinson White Syndrome: A Single Center Retrospective Study

Jamal KHEYI* | Hicham BOUZELMAT | Ali CHAIB

*Correspondence: Jamal KHEYI

Address: Service de rythmologie, hôpital militaire d'instruction Mohammed V, Rabat, Morocco

e-mail ✉: kheyi.jamal@gmail.com

Received: 14 May 2021; Accepted: 28 May 2021

Copyright: © 2021 Jamal K. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided that the original work is properly cited.

ABSTRACT

Background: The purpose of the study was to report our experience with radiofrequency catheter ablation of accessory pathway in a military hospital of Rabat and to evaluate their short and middle-term clinical outcomes. Materials and Methods: This descriptive study was carried out in the Cardiac Electrophysiology Laboratory of our department, from January 2017 to June 2019. Radiofrequency catheter ablation was performed in 366 consecutive patients to interrupt the accessory pathway. Results: Most patients are symptomatic (93%). On ECG findings, 331 accessory pathways were overt (90%). The most frequent location of the accessory pathway was in the septum. Radiofrequency catheter ablation was used with an overall success of 89, 07% and a complication risk of complete Atrioventricular block in 3 patients and recurrence of preexcitation in 6,3% during 3 months of follow up. No death occurred. Encouraging results of publication of RF catheter ablation of AP should lead us to recruit more patients and extend our experience to other new techniques of ablation.

Keywords: Wolff Parkinson White Syndrome, Radiofrequency Catheter Ablation

Introduction

Conduction from the atria to the ventricles normally occurs via the atrioventricular (AV) node and His-Purkinje system. Some patients have an additional or alternative pathway, known as an accessory pathway (AP) or bypass tract, which directly connects the atria and ventricles and bypasses the AV node. Most patients with this preexcitation are asymptomatic and are discovered incidentally on an ECG obtained for unrelated reasons (Issa *et al.*, 2009). When symptoms occurs, The two most common types of arrhythmias in the WPW syndrome are atrioventricular re-entrant tachycardia (AVRT) and atrial fibrillation. Furthermore, the incidence of sudden cardiac death in patients with the WPW syndrome has been estimated from 0.15% to 0.39% over a 3- to 10-year follow-up (Issa *et al.*, 2009). Percutaneous radiofrequency catheter ablation is accepted as the curative approach for patients suffering from symptomatic drug-refractory tachyarrhythmia associated with an AP and for patients with a high risk of sudden death (Blomström *et al.*, 2003). Both the safety and efficacy of this therapeutic approach have been demonstrated in the short- and medium-term follow-up (Fisher *et al.*, 1994; Manolis *et al.*, 1994).

The aim of this study is to report our experience with radiofrequency catheter ablation of AP in Moroccan patients and to assess their short and medium-term clinical outcomes.

Materials and Methods

After obtaining informed consent, 366 consecutive patients with accessory pathway from January 2017 to June 2019, referred to our department and underwent electrophysiological exploration and radiofrequency ablation at our Cardiac Electrophysiology Laboratory. All antiarrhythmic drugs were discontinued at least three half-lives of the respective drugs before the study. A 12-lead electrocardiogram (ECG) was recorded in each patient during sinus rhythm before the procedure at a paper speed of 25 mm/s and a gain of 10 mm/mV. Four diagnostic EP catheters were introduced, two each through the right and the left femoral veins and placed at the following sites (Fig. 1): high right atrium, quadripolar 6-Fr catheter), right ventricular apex (quadripolar 6-Fr), His bundle region (quadripolar 6-Fr catheter) and Coronary sinus (CS) (decapolar 6-Fr catheter). A 7-Fr 4 mm ablation catheter was introduced through the right femoral vein. Left sided pathways were approached retrogradely by right femoral artery catheter or transeptally, via interatrial septal puncture, by using multipurpose 7-Fr sheath. Conduction intervals and refractory periods were measured, and complete anterograde and retrograde electrophysiological studies were conducted in each patient using incremental and extrastimulus testing techniques. The site of AP was identified by mapping of the bipolar electrogram from the regular recording catheters. Catheter ablation was performed after the initial electrophysiological study and careful mapping. Heparin (3,000–5,000 units intravenously(i.v)) was administered in patients with arterial catheterization and those with transeptal puncture. The power, the temperature, and the duration of radiofrequency were variable depending on the location of the AP. Successful ablation of the AP was defined as disappearance of preexcitation and mainly as disappearance of anterograde and retrograde accessory pathway conduction after ablation and sometimes during administration of isoproterenol infusion (Jackman *et al.*, 1991). The site of successful ablation was recorded on cine film (Fig.1).

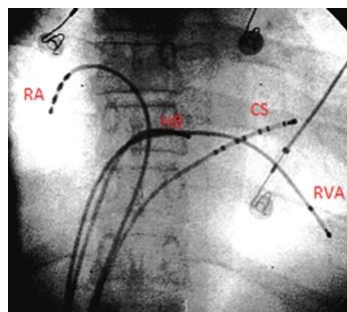


Figure 1: projection radiographs showing different catheters using in electrophysiological tests in patient with AP. (CS: coronary sinus; HB: His bundle; RA: Right atrium; RVA: right ventricle apex.)

All patients were observed in the hospital for at least 24 hours. Two 12-lead electrocardiogram were done during the observation period. The patients then underwent follow-up examination in the clinics and an electrocardiogram is required 2 to 3 months later.

Results

The mean age of our patients was 35,7±9 years (7 to 65 years), with male to female ratio of 1,3/1. 25 patients (6,8%) were asymptomatic. Symptoms during arrhythmia were distributed as follows: palpitations (48%), dizziness (15%), and syncope (10%). Sudden death was occurred in four patients. Symptoms were present daily in 12% of the symptomatic patients, weekly in 42% and monthly in 46 %. Underlying heart diseases were: Dilated cardiomyopathy (6 patients), arterial hypertension (6 patients), Ebstein's disease (4 patients), mitral stenosis (2 patients) and Charcot-Marie-Tooth disease (1 patient). A mean of 1, 7 antiarrhythmic drugs had been ineffective or not tolerated because of side effects. Beta-blockers were administered in 58%, Class I drugs in 24% of the patients, Class III drugs in 11%, calcium channel blockers in 4%, and digoxin in 2%.

On ECG findings, 331 accessory pathways were overt (90,4%) and 35 concealed (9,5%). [Table 1](#) summarizes the location among the patients who underwent RF ablation at our center.

Table 1: distribution of the different AP's locations after electrophysiological study

	number	%
Left free wall pathways	160 (35 concealed pathway)	43,7 (9.5)
Septal pathways	173	47,2
Antéroseptal	59 (28 parahisian pathway)	16,1
Midseptal	22	6
Postéroseptal	92	25,1
Right free wall Pathways	22	6
Multiple pathways	8	2,1
Mahaim	3	0,8

The mean procedure time was 58 ± 12 minutes, the mean fluoroscopic exposure time 17 ± 9 minutes, the mean number of applications 4 ± 1. The mean power level of RF was 23 ± 2 Watts, the mean temperature 58°C and the mean application duration 24 ± 11 seconds for patients. An irrigated-tip catheter was used for the ablation of AP resistant to conventional radiofrequency ablation in 4 patients.

The RF energy was stopped if a pathway was not visualised in a 30 sec break. Also after successful ablation, a confirmatory burn for 60 sec at 50 watts was given in all cases to reduce the risk of recurrence. The acute success of the radiofrequency procedure was achieved in 332 patients (90,7%). The ablation was unsuccessful in 34 patients (9 right free wall, 11 anteroseptal and parahisian, 12 others locations).

Complications observed during hospitalization were distributed as follows: a complete atrioventricular block in three patient (0.3%) with septal accessory pathway for which a pacemaker was implanted in 2 patients, one patient refused the implantation. Three others had an important groin haematoma treated conservatively and were linked to the arterial approach used for the ablation. 5 cases of non sustained ventricular tachycardia spontaneously reduced were observed. A vasovagal syncope has occurred in 4 patients.

No major complications such as mortality, cardiac tamponade, significant bleeding, systemic or pulmonary embolism, arterial or venous thrombosis were encountered during and after ablation.

Pre-excitation recurrence was demonstrated during 3 months of follow-up on the repeated ECGs in the 21 patients (6,3%) being ablated for an overt accessory pathway (7 parahisian, 6 posteroseptal, 8 others) and 3 for a concealed pathway. A second ablation was successful in 18 patients. An overall ablation success after 3 months was 89, 07%.

Discussion

Atrioventricular re-entrant tachycardia mediated by atrioventricular accessory pathways is one of the most common forms of paroxysmal supraventricular tachycardia (PSVT). The incidence in males was twice than in females and highest in the first year of life with a secondary peak in young adulthood (Issa *et al.*, 2009). Our study found also the predominance in the young adult men. The distribution of AP is not homogeneous: 46% to 60% of APs are found within the left free wall space; 25% are within the posteroseptal space; 13% to 21% of BTs are within the right free wall space; and 2% are within the anteroseptal space (Cain *et al.*, 1992). In our study, the left free wall location was frequent but there is a slightly predominance of septal location (47,2%). Radiofrequency catheter ablation, introduced in the late 1980s (Borggreffe *et al.*, 1987; Kuck *et al.*, 1988), has become first-line curative therapy for symptomatic PSVT associated with accessory pathways (Fisher *et al.*, 1994; Manolis *et al.*, 1994; Cain *et al.*, 1992; Borggreffe *et al.*, 1987; Kuck *et al.*, 1988; Jackman *et al.*, 1991). In experienced centers, immediate success rate of accessory pathway ablation has exceeded 90%, while procedures complications remain low (Jackman *et al.*, 1991; Wang *et al.*, 1993). Ablation of right free wall AP is associated with a success rate of 93% to 98%, a recurrence rate of 21% (Issa *et al.*, 2009). The immediate success rate of transaortic ablation of left free wall BTs is 86% to 100% (highest with anterograde AP activation), and the recurrence rate is 2% to 5% (Issa *et al.*, 2009). The transseptal approach is associated with a success rate of 85% to 100%, a recurrence rate of 3% to 6.6% (Issa *et al.*, 2009). Success rate of ablation in our study was approximately consistent

with results of other studies. Previous studies showed that inability in positioning the ablation catheter at target points, or instability of ablation catheter, contributed to more

than one half of primary ablation failures (Morady *et al.*, 1996; Xie *et al.*, 1997). In our study, this inability is found especially with right free wall. Right free wall, posteroseptal, and multiple accessory pathways are associated with high incidence of recurrence (Wang *et al.*, 1994; Calkins *et al.*, 1996).

In most series, in addition to the very small risk associated with the routine electrophysiology study acute major complications when ablating from the right side appear to be minimal but, mainly, they do include complete atrioventricular block when ablating septal pathways (Saul *et al.*, 1993; Jackman *et al.*, 1991). A lower complication rate was associated with increased operator experience. Our 3 patients who presented an atrioventricular block, had a septal accessory pathway location. Thus, the use of cryoablation may further reduce risk of complete heart block during parahisian pathway ablation because this new technique allows to reversibly test the functionality of an ablation site prior to production of a permanent lesion (Skanes *et al.*, 2002).

Using either the transatrial or the retrograde aortic approach, patients undergoing catheter ablation of a left-sided accessory pathway are at risk for early and late thromboembolic complications. The incidence of thromboembolic complications has been reported to be 0.8-1.3% (Hindricks, 1993). Most centers report the use of anticoagulation during and after the procedure when a left heart location is targeted. However, there is no standard approach to anticoagulation, and a wide variety of protocols are used. Our protocol included administration of Heparin (3,000–5,000 units i.v) in all patients with left sided AP.

The limitations of our study are those inherent to retrospective studies of small diverse clinical populations where data have been collected in a clinical context. Additionally, Long-term clinical outcome in our patients is not well known. This limitation is found in most published studies in which authors report only short- or medium-term follow-up Data (Dagres *et al.*, 1999; Twidale *et al.*, 1991; Chen *et al.*, 1994).

Conclusion

Despite the retrospective nature of our study, encouraging results of this morrocan publication of RF catheter ablation of AP should lead us to recruit more patients and extend our experience, to cryoablation (Atienza *et al.*, 2004) which can be used as an alternative to RF energy to ablate APs that are in close proximity to the AV node or bundle of His. Currently, the development of ablation's technique interest to AP and include nonfluoroscopic electroanatomic mapping (Chen *et al.*, 2010), which allow

more precise localization of APs and more both patient and physician safety.

What is already know on this topic: Catheter ablation of WPW Syndromes is a safe treatment. It's must be done in experienced centers

What this study adds: A single center results in an African center encourages others centers to share their experience.

Authors' contributions: All the authors participate in collecting DATA.

References

Atienza F, Arenal A, Torrecilla EG, García-Alberola A, Jiménez J, Ortiz M, Puchol A, Almendral J. Acute and Long-Term Outcome of Transvenous Cryoablation of Midseptal and Parahissian Accessory Pathways in Patients at High Risk of Atrioventricular Block During Radiofrequency Ablation. *Am J Cardiol* 2004; 93: 1302–1305.

Blomström-Lundqvist C, Scheinman MM, Aliot EM, Alpert JS, Calkins H, Camm AJ, Campbell WB, Haines DE, Kuck KH, Lerman BB, Miller DD. ACC/AHA/ESC guidelines for the management of patients with supraventricular arrhythmias. *Circulation* 2003; 108: 1871-1909.

Borggreffe M, Budde T, Podczeczek A, Breithardt G. High frequency alternating current ablation of an accessory pathway in humans. *J Am Coll Cardiol* 1987; 10: 576–582.

Cain ME, Luke RA, Lindsay BD. Diagnosis and localization of accessory pathways. *Pacing Clin Electrophysiol* 1992; 15: 801.

Calkins H, Prystowsky E, Berger RD, SAUL JP, Klein LS, Bin Liem L, Stephen Huang SK, Gillette P, Yong P, Carlson M, Atakr Multicenter Investigators Group. Recurrence of conduction following radiofrequency catheter ablation procedures—relationship to ablation target and electrode temperature. *J Cardiovasc Electrophysiol* 1996; 7: 704–712.

Chen M, Yang B, Ju W, Chen H, Chen C, Hou X, Zhang F, Cui J, Zhang C, Shan Q, Zou J. Right-sided free wall accessory pathway refractory to conventional catheter ablation: lessons from 3-dimensional electroanatomic mapping. *J Cardiovasc Electrophysiol* 2010; 21: 1317-1324.

Chen X, Kottkamp H, Hindricks G, Willems S, Haverkamp W, Martinez-Rubio AN, Rotman B, Shenasa M, Breithardt G, Borggreffe M. Recurrence and late block of accessory pathway conduction following radiofrequency catheter ablation. *Circulation* 1994; 5: 650-658.

Dagres N, Claguet JR, Kottkamp H, Hindricks G, Breithardt G, Borggreffe M. Radiofrequency catheter ablation of accessory pathways. Outcome and use of antiarrhythmic drugs during follow-up. *Eur Heart J* 1999; 20: 1826-1832.

Fisher JD, Cain ME, Ferdinand KC, Fisch C, Kennedy JW, Kutalek SP, Lambert CR, Nissen SE, Okike ON, Ryan T, Saksena SV. American College of Cardiology Cardiovascular Technology Assessment Committee. Catheter ablation for cardiac arrhythmias: clinical applications, personnel and facilities. *J Am Coll Cardiol* 1994; 24: 828-833.

Hindricks GO, Multicentre European Radiofrequency Survey (MERFS) investigators of the Working Group on Arrhythmias of the European Society of Cardiology. The Multicentre European Radiofrequency Survey (MERFS): complications of radiofrequency catheter ablation of arrhythmias. *Eur Heart J* 1993; 14: 1644-1653.

Issa ZF, Miller JM, Zipes DP, editors. Clinical Arrhythmology and Electrophysiology: A Companion to Braunwald's Heart Disease. 1st ed. Philadelphia: Saunders; 2009.

Jackman WM, Wang X, Friday KJ, Roman CA, Moulton KP, Beckman KJ, McClelland JH, Twidale N, Hazlitt HA, Prior MI, Margolis PD. Catheter ablation of accessory atrioventricular pathways Wolff_Parkinson_White syndrome by radiofrequency current. *N Engl J Med* 1991; 324: 1605-1611.

Jackman WM, Wang XZ, Friday KJ, Roman CA, Moulton KP, Beckman KJ, McClelland JH, Twidale N, Hazlitt HA, Prior MI. Catheter ablation of accessory atrioventricular pathways (Wolff-Parkinson-White syndrome) by radiofrequency current. *N Engl J Med* 1991; 324: 1605-1611.

Kuck KH, Kunze KP, Schluter M, Geiger M, Jackman WM, Naccarelli GV. Modification of a left-sided accessory atrioventricular pathway by radiofrequency current using a bipolar epicardial-endocardial electrode configuration. *Eur Heart J* 1988; 9: 927-932.

Manolis AS, Wang PJ, Estes NAM. Radiofrequency catheter ablation for cardiac tachyarrhythmias. *Ann Intern Med* 1994; 121: 452-461.

Morady F, Strickberger SA, Man KC, Daoud E, Niebauer M, Goyal R, Harvey M, Bogun F. Reasons for prolonged or failed attempts at radiofrequency catheter ablation of accessory pathways. *J Am Coll Cardiol* 1996; 27: 683-689.

Saul JP, Hulse JE, De W, Weber AT, Rhodes LA, Lock JE, Walsh EP. Catheter ablation of accessory atrioventricular pathways in young patients: use of long vascular sheaths, the transseptal approach and a retrograde left posterior parallel approach. *J Am Coll Cardiol* 1993; 21: 571-583.

Skanes AC, Yee R, Krahn AD, Klein AD, Klein GJ. Cryoablation of atrial arrhythmias. *Cardiac Electrophysiol Rev* 2002; 6: 383-388.

Twidale N, Wang X, Beckman KJ, McClelland JH, Moulton KP, Prior MI, Hazlitt HA, Lazzara R, Jackman WM. Factors associated with recurrence of accessory pathway conduction after radiofrequency catheter ablation. *Pacing Clin Electrophysiol* 1991; 14: 2042-2048.

Wang LX, Hu DY, Ding YS, Powell AC, Davis MJE. Predictors of early and late recurrences of atrioventricular accessory pathway conduction after apparently successful radiofrequency catheter ablation. *Int J Cardiol* 1994; 46: 61-65.

Wang LX, Hu DY, Ding YS. Catheter ablation of atrioventricular accessory pathways by radiofrequency current. *Int J Cardiol* 1993; 42: 155-160.

Xie B, Heald SC, Camm AJ, Rowland E, Ward DE. Radiofrequency catheter ablation of accessory atrioventricular pathways-primary failure and recurrence of conduction. *Heart* 1997; 77: 363-368.