

EFFICACY OF RADIOFREQUENT ABLATION OF PAROXYSMAL ATRIOVENTRICULAR TACHYCARDIA IN PATIENTS WITH WPW-SYNDROME (RESULTS OF LONG-TERM OBSERVATION)

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Bu yazıda, aksesuar yola radyofrekans ablasyon (RFA) tedaviden sonra Wolf-Parkinson-White (WPW) Sendromlu hastaların uzun-sürelili takip sonuçları bildirilmiştir.

Aksesuar yola bağlı (WPW sendrom) paroksizmal atrio-ventriküler (A-V) taşikardili 48 hasta tanısı çalışmaya alınmıştır. WPW sendromu tanısı transözafegal elektrofizyolojik inceleme ile konuldu. Tüm hastalara, intrakardiyak elektrofizyolojik inceleme ve sonrasında aksesuar yol radyofrekans ablasyon yapıldı. Elektrokardiyografi (EKG) ve ekokardiyografi tüm hastalarda işlem öncesi ve 3-5 yıllık takiplerde tekrarlandı. İstatistik analiz için student t testi pair ve unpaired kriteri kullanıldı.

Kateter radyofrekans destrüksiyon sonuçları, 48 hastadan 45'inde (%93.7) pozitif idi. Taşikardi paroksizmaları AP'nin tam ablasyonu sonrasında kayboldu. Uzun-sürelili takipte, hastaların

hiçbirinde taşikardi rekürrensi, çarpıntı gibi komplikasyon yoktu. Ablasyon sonrası, hastaların antiaritmik ilaçları kesildi. Ekokardiyografik olarak ölçülen sol ventrikül çap, volüm ve kasılma parametreleri değişmedi.

Sonuçlar, WPW sendromunda paroksizmal A-V taşikardide kateter radyofrekans ablasyonunun üstün başarısını göstermiştir. Hastaların %93.7'sinde pozitif sonuç elde edilmiştir, aritmi paroksizmaları kaybolmuştur, anti-aritmik ilaçlar kesilmiş ve yaşam kalitesinde yükselme sağlanmıştır.

Anahtar kelimeler: Wolf Parkinson White, Radyofrekans ablasyon, Aksesuar yol

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INTRODUCTION

The prevalence of ventricular preexcitation is thought to be 0.1-0.3% in the general population¹. Estimates of arrhythmia incidence in patients with preexcitation varies widely, ranging from 12-80% in several investigations²⁻⁴. Wolff-Parkinson-White Syndrome is a form of ventricular preexcitation involving an accessory conduction pathway. The definition of WPW relies on the following electrocardiographic features: (1) a PR interval less than 0.12 seconds (2) with a slurring of the initial segment of the QRS complex, known as a delta wave, (3) a QRS complex widening with a total duration greater than 0.12 seconds, and (4) secondary repolarization changes reflected in ST segment-T

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wave changes that are generally directed opposite (discordant) to the major delta wave and QRS complex changes

Studies to evaluate the electrophysiologic basis of the WPW syndrome were first performed by Durrer and coworkers¹. They demonstrated that premature stimuli from either the atrium or the ventricle could initiate the tachycardia, which could be either orthodromic or antidromic. Furthermore, appropriately timed atrial or ventricular extrastimuli could be used to terminate the tachycardia. The work by these and other investigators provided the groundwork for the development of curative surgical and catheter-based approaches to localize and eliminate APs²⁻⁴. Prevalence may be higher in males. WPW syndrome is found in person for all ages. prevalence decreases with age due to loss of preexcitation. In patients with abnormal ECG findings indicative of WPW syndrome, the frequency of supraventricular tachycardia paroxysms increases from 10% in people aged 20-39 years to %36 % in people older than 60 years. A major reason for the interest in the WPW syndrome and AVRTs over the

Table 1: Electrocardiographic indices of AP conduction

Indices	Before RFA	After RFA	p
PQ, ms	119,1±8,4	140,0±5,2	<0,05
QRS, ms	111,6±4,0	86,9±3,3	<0,001
QT, ms	381,9±7,8	382,5±21,3	Not reliably

years is its associated morbidity and mortality^{2,4}. There is a well-established relationship between the presence of symptoms and the risk of sudden death. On the other hand, in asymptomatic WPW patients, the sudden death rate is low and is estimated to be about 1 per 1000 patient-years.⁵⁻⁶ Ventricular fibrillation has been reported to occur in 2.2% of symptomatic WPW patients over a 16-year period⁷. In some patients, ventricular fibrillation was the first manifestation of this syndrome. In a symptomatic young patient with WPW syndrome, the lifetime incidence of sudden death has been estimated to be about 3-4%.⁸ Unfortunately, up to 48% of young patients with WPW and cardiac arrest have no prior warning signs⁹.

In the last years, interventional arrhythmology has been developed as an independent medical area. Use of RFA in Kazakhstan has been started since 2001. Because the quantity of procedures performed due to tachyarrhythmias was increasing every year our experience in investigation of RFA efficacy is being accumulated.

MATERIALS and METHODS

Consecutive 48 patients with WPW Syndrome and paroxysms of atrio-ventricular (aV) tachycardia were included in this study. Frequency of the tachycardia paroxysms ranged from 1-3 times per day to 2-3 times per week. Patients were using drugs for prevention of paroxysms recurrence. In 18 cases of study population paroxysms of tachycardia were complicated by hemodynamic worsening such as hypotension and acute heart failure. Arrhythmia was resistant to drug therapy in 6 cases. Intolerance to various antiarrhythmic drugs was seen in 4 cases and 3 patients did not accept to use long term drug therapy.

Structural heart had been diagnosed in 11 patients (all of them had essential hypertension, including 7 cases in combination with ischemic heart disease). ECG, TTE and transesophageal electrophysiologic study were repeated for all patients before hospitalization. Accessory pathway (AP, Kent's Bundle) and presence of paroxysmal orthodromic atrio-ventricular tachycardia (WPW Syndrome) were found in out patient clinic. After

admission to the hospital, all patients were undergone intracardiac electrophysiologic investigation.

Electrophysiologic indices were measured in sinus rhythm and programmed electrical stimulation. AV node an AP properties were investigated. Mapping of vulnerable zone of tachycardia was carried out. After achievement of adequate electrophysiologic criteria, radiofrequency ablation was applied to the vulnerable zone by ablation catheter. Then, electrophysiologic investigation and control programmed electrical stimulation were repeated. ECG and TTE were carried out for all patients during 3-5 years follow-up period after radiofrequency ablation. Paired an unpaired Student's t-test were used for statistical analysis. P values <0,05 accepted as statistically significant.

RESULTS

Data of non-invasive electrophysiologic methods were confirmed by the intracardiac electrophysiologic investigation. All patients had paroxysmal orthodromic AVRT. Manifested WPW Syndrome was revealed in 27 patients, concealed WPW-in 21 ones. Left side Kent's Bundle was revealed in 33 patients, right side - in 10 ones, other 5 patients had both left and right side accessory pathways.

Ablation of Kent's Bundle was not successful in 9 cases and paroxysms of tachycardia were recurred after first procedure. In this case, the procedure has been carried out again in 7 patients (2 patients have refused). There was no complication after procedure. Successful results has been achieved in 93,7% patients. Paroxysms of tachycardia has been disappeared. Quality of life in patients was improved significantly because need for using antiarrhythmic drugs was decreased (p<0,05). During long period of observation none of the patients had recurrence of tachycardia, palpitation and all had discontinued antiarrhythmic drug therapy.

Electrocardiographic features of accessory pathway conduction had been disappeared (normalization of PQ interval and QRS complexes) in all patients with manifested WPW syndrome. Electrocardiographic parameters that were measured before and after the procedure were shown in Table 1.

Echocardiographic parameters related with size, volume and systolic function of the heart were not changed significantly during follow-up.

DISCUSSION

Wolff-Parkinson-White Syndrome is a form of ventricular preexcitation involving an accessory conduction pathway. The term "preexcitation" was first used by Öhnell in 1944 to denote premature activation of the ventricle by an atrial impulse using an accessory conduction system.¹⁰ The peculiar finding of preexcitation on the surface ECG and its associated tachyarrhythmias has long piqued the interest of clinician-scientists. Detailed works by countless investigators over the past century have resulted in substantial advances in the understanding and treatment of this syndrome.

Initial description of the preexcitation syndrome dates back to the early 1910s. The first case of preexcitation syndrome was reported by Cohn and Fraser¹¹ in 1913, and it involved two patients with peculiar QRS complexes and paroxysmal SVT that was able to be terminated with vagal maneuvers. In 1915, Wilson¹² reported on an individual with preexcitation and paroxysmal SVT that was also able to be terminated with a vagal maneuver. Isolated cases of preexcitation syndrome were reported over the following two decades by Webb¹³ in 1921, Bain and Hamilton in 1926,¹⁴ Bach in 1929,¹⁵ and Hambur-ger¹⁶ in 1929. The most detailed description of this syndrome is credited to Drs. Wolf, Parkinson, and White.¹⁷ In 1930, these investigators reported on 11 young and healthy patients with peculiar ECG findings that included short PR interval and bundle branch block. These patients also suffered from paroxysms of SVT. This eventually became known as the Wolf-Parkinson-White Syndrome.

Patients with the WPW pattern on ECG have a short PR interval and a slurred upstroke of the QRS complex (delta wave) but may never have any arrhythmias¹⁴⁻¹⁸. Those who have the WPW Syndrome have both the WPW ECG pattern and the paroxysmal tachyarrhythmias. Detailed clinicopathologic studies have shown that APs comprise microscopic strands of morphologically normal myocardium that are located along the cardiac annulus or septum. More than 50% of APs are located at the left free wall, 20-30% at the posteroseptum, 10-20% at the right free wall, and 5-10% at the anteroseptum¹⁴⁻¹⁸.

In patients with an antegradely conducting AP, ventricular activation during sinus rhythm is via both the AV node and the AP, and as a result, the QRS

complex is a fusion complex between conduction over the node versus the pathway.

APs are classified into different types depending on their conduction properties. Manifest APs are those that conduct more rapidly in the antegrade direction than the AV node, resulting in a discernible delta wave on the surface ECG. Concealed APs only conduct in the retrograde direction. Furthermore, when the pathway is concealed, there is no delta wave on the ECG at baseline, in response to atrial decremental or extrastimuli pacing, or with vagal maneuvers. Latent APs are those that have the capability to conduct in the antegrade direction. Latent pathways are most often far left lateral pathways where the conduction time to the AV node is much shorter than to the pathway. Pacing closer to the pathway may elicit preexcitation and uncover its presence¹⁷⁻¹⁸.

Orthodromic AVRT comprises 95% of spontaneous and laboratory-induced AVRTs¹⁷⁻¹⁸. For tachycardia initiation, an atrial premature complex (APC), either spontaneous or induced by pacing in the EP laboratory, blocks at the AP and travels down the AV node-His-Purkinje system (Antidromic AVRT is much less common and comprises 3-6% of spontaneous and laboratory-induced AVRTs¹⁷⁻¹⁸. Initiation and termination are the reverse of what is expected for its orthodromic counterpart.

In our study, all patients had paroxysmal orthodromic atrioventricular tachycardia. Manifested WPW Syndrome was shown in 27 patients, concealed WPW in 21 ones. Left side Kent's Bundle was revealed in 33 patients, right side Kent's Bundle in 10 ones, other 5 patients had both left and right side accessory pathways. Ablation of Kent's Bundle was not successful in 9 cases and paroxysms of tachycardia were recurred after first procedure. In this case, the procedure has been carried out again in 7 patients (2 patients have refused). There was no complication after procedure. Successful results has been achieved in 93,7% patients. Paroxysms of tachycardia has been disappeared. Quality of life in patients was improved significantly because need for using antiarrhythmic drugs was decreased.

In one study that has been done by Calkins et al¹⁹ 250 consecutive patients with the Wolff-Parkinson-White Syndrome or paroxysmal supraventricular tachycardia involving a concealed accessory AV connection underwent catheter ablation with the use of radiofrequency current. In 179 of the 250 patients, catheter ablation was performed at the time of an initial electrophysiology test. Two hundred thirty-five patients had one accessory AV connection and 15

patients had two or more. One hundred eighty-three accessory AV connections were manifest and 84 were concealed. One hundred sixty-one were located in the free wall of the left ventricle, 47 were in the right free wall, 44 were posteroseptal, 10 were anteroseptal, and five were intermediate test, and the ablation procedure was recorded for each patient, as was the total duration of fluoroscopy. A follow-up electrophysiology test was performed 2-3 months after the ablation procedure. Ninety-four percent of patients had all accessory AV connections successfully ablated and remained free of symptomatic tachycardia during a mean follow-up of 10 +/- 4 months. Two hundred nineteen patients (88%) had all accessory AV connections ablated during the initial attempt at catheter ablation. Mean duration of the entire procedure was 134 +/- 75 minutes. Procedure duration was longest in patients with multiple accessory AV connections, shortest in patients with intermediate septal accessory AV connections, and similar in all other locations. A nonfatal complication occurred in nine patients (4%).

Pappone et al²⁰ published a randomized study of prophylactic catheter ablation from 1997 to 2002, among 224 eligible asymptomatic patients with the Wolff-Parkinson-White Syndrome, patients at high risk for arrhythmias were randomly assigned to radiofrequency catheter ablation of accessory pathways (37 patients) or no treatment (35 patients). The end point was the occurrence of arrhythmic events over a five-year follow-up period. Patients assigned to ablation had base-line characteristics that were similar to those of the controls. Two patients in the ablation group (5 percent) and 21 in the control group (60 percent) had arrhythmic events. One control patient had ventricular fibrillation as the presenting arrhythmia. The five-year Kaplan-Meier estimates of the incidence of arrhythmic events were 7 percent among patients who underwent ablation and 77 percent among the controls ($P < 0.001$ by the log-rank test); the risk reduction with ablation was 92 percent (relative risk, 0.08; 95 percent confidence interval, 0.02 to 0.33; $P < 0.001$).

In one study Pappone et al²¹ performed a randomized study in which prophylactic radiofrequency catheter ablation of accessory pathways was compared with no ablation in asymptomatic children (age range, 5 to 12 years) with the Wolff-Parkinson-White Syndrome who were at high risk for arrhythmias. The primary end point was the occurrence of arrhythmic events during follow-up. Of the 165 eligible children, 60 were determined to be at high risk for arrhythmias.

After randomization, but before any ablation had been performed, the parents withdrew 13 children from the study. Of the remaining children, 20 underwent prophylactic ablation and 27 had no treatment. The characteristics of the two groups were similar. There were three ablation-related complications, one of which led to hospitalization. During follow-up, 1 child in the ablation group (5 percent) and 12 in the control group (44 percent) had arrhythmic events. Two children in the control group had ventricular fibrillation, and one died suddenly. The cumulative rate of arrhythmic events was lower among children at high risk who underwent ablation than among those at high risk who did not. The reduction in risk associated with ablation remained significant after adjustment in a Cox regression analysis. In both the ablation and the control groups, the independent predictors of arrhythmic events were the absence of prophylactic ablation and the presence of multiple accessory pathways.

Calkins et al²² reported 166 consecutive patients were referred for the management of documented, symptomatic paroxysmal supraventricular tachycardias (66 patients) or the Wolff-Parkinson-White Syndrome (40 patients). Among the 66 patients with paroxysmal supraventricular tachycardias, the mechanism was found to be atrioventricular nodal reentry in 46 (70%) (typical in 44 and atypical in 2), atrioventricular reciprocating tachycardia involving a concealed accessory pathway in 16 (24%), atrial tachycardia in 2 (3%), and noninducible paroxysmal supraventricular tachycardia in 2 (3%). A successful long-term outcome was achieved in 57 of 62 patients (92%) with paroxysmal supraventricular tachycardia in whom ablation was attempted and in 37 of 40 patients (93%) with the Wolff-Parkinson-White Syndrome. The only complications were one instance of occlusion of the left circumflex coronary artery, leading to acute myocardial infarction, and one instance of complete atrioventricular block. The mean (+/- SD) duration of the electrophysiologic procedures was 114 +/- 55 minutes.

CONCLUSIONS

The results of this study indicate that catheter ablation of accessory AV connections with radiofrequency current can be performed safely and expeditiously in a majority of patients and confirm in a large series the feasibility of catheter ablation at the time of an initial diagnostic electrophysiology test. This abbreviated therapeutic approach avoids the need for electropharmacological testing, long-term anti-

arrhythmic drug therapy, and surgical therapy in the majority of patients with the Wolff-Parkinson-White syndrome or with symptomatic tachycardias involving accessory AV connections.

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