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EVALUATION of EFFICACY and SAFETY of VARIOUS CATHETER ABLATION METHODS in WOLFF-PARKINSON-WHITE SYNDROME

*¹Osman Can YONTAR, *¹Güney ERDOGAN

*¹University of Health Sciences, Samsun Training and Research Hospital, Cardiology Clinic,
Samsun, Turkey

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*Corresponding author: drcanyontar@gmail.com

Abstract

Wolff-Parkinson-White Syndrome (WPW) is a clinical entity that is diagnosed with typical surface electrocardiogram hallmarks and intermittent tachycardia episodes. Patients may present with sudden cardiac death due to wide QRS tachycardia or stay asymptomatic for life and may be diagnosed incidentally. Pharmacological treatment options are limited in this patient group. Cornerstone of therapy is ablation of the accessory pathway as it is recommended by guidelines. In this study, we aimed to evaluate single centre data of WPW patients, including procedural and follow up data, who had undergone ablation. Health Sciences University Samsun Training and Research Hospital electronic data between December 2015 and December 2018 were analysed. Data of patients who underwent ablation therapy were collected. Procedural data, baseline characteristics and follow up data were acquired. For all procedures, acute procedural success rate was 97%, long term success rate was 94%. Mean procedure time was 117,12±1,8 minutes, mean ablation time was 6,28±0,4 minutes. Median follow-up duration was 16,5 (6-38) months. Complication rates were: 3 (3,2%) groin/puncture site complications, 3 (3,2%) pericardial effusions, 1 (1%) stroke, 1 (1%) block requiring pacemaker, 1 (1%) spontaneously recovered cardiac perforation. Our results demonstrated that single centre rates for success were like expected rates and recurrences/complications were lower than expected rate in literature.

Findings suggest that flawed choice of equipment and technique contributes to prolonged procedure durations and failure of acute success and increased rate for recurrences. We think that operator experience, dedicated electrophysiology personnel and laboratory along with utilization of complex electroanatomic mapping systems are vital for more successful outcomes in complex procedures.

Key Words: Ablation, Recurrence, Wolff-Parkinson-White Syndrome

Özet

Wolff-Parkinson-White Sendromu (WPW) tipik elektrokardiyogram bulgularına eşlik eden taşikardi atakları ile kendini gösteren bir paroksizmal supraventriküler taşikardi tipidir. Hastalarda semptom olmayabileceği gibi ani kardiyak ölüme yol açabilecek geniş QRS taşikardi atakları tespit edilebilir. Farmakolojik tedavi seçenekleri oldukça kısıtlı olan bu sendromun tedavisinde kateter ablasyon ilk basamak tedavi olarak önerilmektedir. Çalışmamızda tek merkezde takip edilen WPW hastalarının demografik bulguları, işlem bilgileri ve sonuçları ile orta-uzun dönem takip sonuçlarını ve kullanılan teknik ve yöntemleri araştırdık. Çalışmaya Aralık 2015 ile Aralık 2018 tarihleri arasında Sağlık Bilimleri Üniversitesi Samsun Eğitim ve Araştırma Hastanesi'nde WPW tanısıyla ablasyon yapılan 92 hasta dahil edildi. Hastane elektronik ve dosya kayıtlarından hastaların verileri, elektrokardiyogramları ve ablasyon işlemi ile ilgili veriler elde edildi. Poliklinik kayıtları incelenerek hastaların takip verileri ve nüksler araştırıldı. Tüm işlemlerde, akut işlem başarısı %97, uzun dönem işlem başarısı %94 olarak bulundu. Ortalama işlem süresi 117,12±1,8 dakika, ortalama ablasyon süresi 6,28±0,4 dakika olarak hesaplandı. Ortanca takip süresi 16,5 (6-38) aydı. Komplikasyon oranlarına bakıldığında tüm hastalarda 3 (%3,2) girişim yeri komplikasyonları, 3 (%3,2) perikart efüzyonu, 1 (%1) serebrovasküler olay, 1 (%1) kalıcı pil gerektiren blok, 1 (%1) spontan iyileşen kardiyak perforasyon tespit edildi. Merkezimizde yapılan olguların sonuçlarına baktığımızda, kabul edilebilir nüks ve komplikasyon oranının daha altını ve beklenen işlem başarısı oranlarını yakalamış olduğumuzu gördük. Bulgularımız, akut başarının elde edilemediği, kısa dönemde nükslerin izlendiği ya da işlem süresinin görece uzun olduğu olgularda malzeme ve yöntemseçimlerinin bunlara yol açtığını işaret etmektedir. Operatör tecrübesinin ve üç boyutlu haritalama sistemlerinden faydalanmanın önemli olduğunu düşünüyor ve operatörü, yardımcı

personeliyle birlikte özelleşmiş elektrofizyoloji laboratuvarının kompleks işlemlerde daha başarılı sonuçlar elde edeceğine inanıyoruz.

Anahtar Kelimeler: Ablasyon, Nüks, Wolff-Parkinson-White Sendromu

1. Introduction

Among arrhythmias which progress with bouts, paroxysmal supraventricular tachycardias are the most frequently encountered group (Morady, 2004). Accessory pathway related tachycardias, which show specific electrocardiographic findings, attract attention because of their compelling rule-out from myocardial infarction diagnosis and their possibility to degenerate into ventricular fibrillation and sudden cardiac death (Wolff et al., 1930). The clinical entity is named as Wolff-Parkinson-White Syndrome, if there are specific electrocardiographic findings (preexcitation with delta wave) and symptoms due to bouts of tachycardia (Wolff et al., 1930). Many rate controlling drugs are contraindicated and can increase mortality; so that physicians deliver medical therapy in limited situations and generally radiofrequency ablation treatment is advised at first step (Brugada et al., 2020). Success and complication rates are usually low; however, it depends on accessory pathway localization and ablation techniques and type of ablation energy (Morady, 2004). In our study we aimed to investigate the effect of clinical, demographic and procedural characteristics of patients who underwent ablation treatment and factors which contribute to short and mid-term follow-up findings.

2. Material and Methods

Patients who underwent radiofrequency ablation due to Wolff-Parkinson-White Syndrome at Samsun Training and Research Hospital were enrolled for the study between December 2015 and December 2018. No exclusion criteria were applied, and all patients were included in this retrospective observational study. From hospital virtual archive and patients' files, all 92 patients' records were scanned. Age, risk factors, diagnosis, procedural information and postprocedural follow-up data were obtained. All procedures were done by same operator. Diagnostic electrophysiology procedure was performed via femoral transvenous sheaths. A coronary sinus catheter (DECANAV Catheter, Biosense Webster Inc, USA) and two diagnostic catheters in high right atrium and His position (Soloist® Quadripolar fixed curve catheter, Medtronic Inc, USA)

were placed. Patients were anticoagulated with intravenous heparin administration during procedure. As an institutional rule, right after catheter placement it was settled that accessory pathway was right or left sided. Then, atrial and ventricular programmed and continuous stimulations were applied (EP Tracer, Schwarzer Cardiotek Inc, Netherlands) to check atrioventricular and ventriculoatrial conduction and effective refractory periods of atrioventricular node and accessory pathway. Clinical tachycardia (antidromic or orthodromic) was induced. After all of these diagnostic studies, exact location of accessory pathway was detected by utilization of local intracardiac electrograms and ablation therapy was applied if local electrogram on distal tip of ablation catheter was at least 30 milliseconds earlier than surface delta wave or there was a Kent potential, therapy was stopped if delta wave was not abolished in first 15 seconds of application and continued to look for a better target. If delta wave was abolished, ablation energy was delivered for a total of 60 seconds. If accessory pathway was left sided, ablation therapy was delivered through a transseptal long sheath. For conventional ablation, a dry tip multicurve catheter (Marinr® Quadripolar 4 mm tip catheter, Medtronic Inc, USA), for cryoablation a 6 mm tip cry catheter (Freezor 6 mm tip catheter, Medtronic Inc, USA) were utilized. When needed, a novel complex mapping system (Columbus® 3D EP Navigation System, Microport Inc, China) and its dedicated irrigated tip catheter (Firemagic® 3D irrigated Ablation catheter, Microport, China) were utilized. After resolution of delta wave patients were observed in operation room to make sure that preexcitation did not recur. During this period, electrophysiological tests were done again, and refractory periods were measured and tachycardia inducibility was evaluated. If procedure was unsuccessful, ablation was performed again at a better target or at sane target with higher energy and after delta wave resolution same steps were followed. After sheath removal, patients were hospitalized for 24 hours. After discharge, they were planned to admit outpatient clinic at 1.-3.-6. and 12. months. After first year, six months periods were arranged for controls. Informed consent was obtained from all patients before procedures. Study protocol was endorsed by local scientific board.

2.1. Statistical Analysis

All statistical data recording and analysis were done with SPSS 16.0 programme. Student-T-Test and Paired Samples Test were utilized for parametric and continuous variables, Mann-Whitney U Test and Chi-square Test were used for nonparametric and categorical variables. A p value of <0,05 was accepted for significant difference between data sets.

3. Results and Discussion

Initial evaluation showed that mean age was 41.3 ± 14.2 and 63 patients were female (68.5%). Demographic and medical characteristics of patients were listed in Table 1. The most conspicuous thing in table is 31% (n=29) of all patients were on rate limiting drug therapy. Acute procedural success (both abolition of delta wave and no inducible tachycardia) was 97% and long-term success (no recurrence of delta wave and freedom from clinical tachycardia) was 94% for all procedures. Mean procedure duration was 117.12 ± 1.8 minutes, mean ablation duration was 6.28 ± 0.4 minutes. Median follow-up duration was 16.5 (6-38) months. Of all patients, 7 of them (7.6%) had coexisting atrioventricular nodal re-entry tachycardia, 3 (3.2%) had atrial tachycardia and 11 of them had frequent premature ventricular contractions (11.9%) and these arrhythmias were also ablated. Only 3 patients had multiple accessory pathways.

Table 1: Clinical and demographical characteristics of all patients

Variable	n	%
Female gender	63	68.5
Diabetes	5	5.4
Hypertension	3	3.3
Smoker	21	22.8
Coronary artery disease	4	4.3
Beta blocker usage	12	13.0
Calcium channel blocker usage	17	18.4
Renin-Angiotensin-Aldosterone system blocker usage	2	2.1
Symptom		
Palpitation	81	88.0
Syncope	4	4.3
Asymptomatic	7	7.7

Accessory pathway locations were variable and were listed in Table 2. There were 12 patients who had shown spontaneous atrial fibrillation during procedure or incidental atrial fibrillation on Holter recordings. However, only 2 patients had atrial fibrillation bouts during follow-up period. While ablating left sided accessory pathways, approach by septostomy was 72% and by retrogradely was 28%. Complication rates were as follows: 3 (3.2%) puncture site complications, 3 (3.2%) pericardia effusion, 1 (1%) cerebrovascular accident, 1 (1%) block needed permanent pacemaker, 1 (1%) spontaneously healed cardiac perforation.

Table 2: Distribution of accessory pathway localizations

Location	n	%
Right free wall	6	6.5
Left free wall	34	37.0
Right septal	13	14.1
Left septal	9	9.8
Right anterior septal	11	12.0
Posterior septal	19	20.7
Total	92	100.0

In our study we evaluated single centre data for patients who underwent ablation treatment because of Wolff-Parkinson-White Syndrome. Ablation treatment was found to be safe with low complications and effective with little recurrence rates in mid to long term follow-up period. In septal accessory pathway settings, in which permanent pacemaker risk increases, utilization of complex mapping systems seemed more effective than cryoablation.

In 1913, Kent et al. had shown that atrioventricular connection was not single in some patients and that may not be solely depending on atrioventricular node (Stanley Kent,1913; Kent, 1913). In 1930 authors Wolff, Parkinson and White described their first patients with paroxysmal tachycardia and showed short PR interval and right bundle block pattern on surface electrocardiogram (Wolff et al., 1930). Years later the term “preexcitation” was introduced to literature which meant that whole or partially activation of myocardium before activation wave front reaches there over normal conduction system (Ohnell, 1944). Classical WPW syndrome is noticed by short PR interval (<120 milliseconds) and prolonged QRS complex. The slurred upstroke of initial part of QRS complex, the delta wave, represents the abnormal excitation of ventricle. Clinical reflections may differ among patients, however most frequent symptoms are syncope and palpitation. Nonetheless, asymptomatic patients are not rare whereas first symptom may be sudden cardiac death. Ablation treatment is advised to all symptomatic patients and some of asymptomatic patients in specific conditions (who are interested in competitive sports or are pilots, bus drivers etc.). Accessory pathway ablation procedure has its own risks such as major complications like death, cardiac perforation, stroke, coronary artery injury related infarction. Major complicate, ones are catastrophic, however risks are generally low (Morady, 2004). In our centre we did not meet any case end up with death however only one case (1.08%) experienced cerebrovascular accident, who had left sided accessory pathway got ablated transeptally. In left

sided pathway ablations one of two options to approach target area is antegradely by septostomy to ablate atrial insertion and other is retrogradely by aortic valve to ablate ventricular insertion (Wood and Swartz, 2000). Procedural success is similar for both methods and is 85-100%. Both interventions carry risk for stroke, however antegrade approach has additional risk for cardiac perforation, aortic puncture and pericardial effusion (Ohnell, 1944). Nevertheless, our single centre data showed that our septostomy (n=31) complications were substantially lower than acceptable rates (%3 vs. %0-6). On the other hand, retrograde approach carries risk for left main coronary damage (%1-2). In our case series we did not meet any left main coronary damage in retrograde approach (n=12). We believe that operator experience is the most important thing to consider when septostomy is preferred.

One of the most complication prone locations during ablation procedure is the parahisian region. (Macedo et al., 2010). Permanent pacemaker implantation may be necessary (2-4%) after ablation. Generally, cryo energy is preferred rather than radiofrequency for ablating accessory pathways at this location due to safer profile (Lemola et al., 2008). There are 33 (35.8%) patients who undergone parahisian/midseptal accessory pathway ablation and only one (3%) patient had permanent pacemaker implantation. In 9 cases (27.2%) we preferred cryo energy, in remaining 24 cases (72.8%) we utilized radiofrequency energy. Although acute procedural success was same and 100%, procedural duration was longer in cryoablation cases (for cryo 140.56±28.0 minutes vs 112.92±12.8 minutes, p=0,002). There were 3 long term recurrences, 2 of them were done with cryo (22.2%) and one of them was done with radiofrequency (4.1%). These findings are compatible with acceptable results and show the safer but less effective nature of cryo energy (Lemola et al., 2008). Of all ablation cases only 5 (5.4%) patients undergone second procedure which is compatible with acceptable rates in literature (2.2-4%). One of these cases was right ventricle free wall accessory pathway ablation (16.6%). Recurrence risk is substantially high (21%) for these pathways because of insufficient energy delivery due to large tricuspid annulus and catheter stabilization problems (Fishberger et al., 2009). An explanation for our lower recurrence rate may be our increased utilization of complex mapping systems. When we look at all procedures, 43 (46.7%) of them were performed under three-dimensional mapping systems. We believe that increased utilization of electroanatomic mapping systems pave the way for both acute and long-time success, shorter procedural durations, shorter ablation time and increased operator comfort leading to lower complication and recurrence rates.

4. Conclusion

After evaluating our single centre data for ablation procedures, it is notable that recurrence and complication rates are lower than acceptable rates in the literature. Relatively low patient amount and harvesting single centre data may be reasons for this. In procedures which did not end up successfully or show short term recurrences or take relatively longer time, we hypothesize that preprocedural planning for methods and/or equipment. We emphasize that it is important to plan procedural equipment and approach carefully and experienced electrophysiology laboratories with dedicated personnel and operators play major role in the pursuit of success in more complex cases.

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