ORIGINAL ARTICLE

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Distribution of Accessory Pathways in Atrioventricular Reentrant Tachycardia in Southeast Anatolian Region of Turkey

ABSTRACT
Objective: We aimed to evaluate distribution of accessory pathway (AP) in atrioventricular reentrant tachycardia (AVRT) in southeast Anatolian region of Turkey.
Methods: The study was a retrospective cross-sectional design. Consecutive patients who underwent catheter ablation of AVRT between June 2012 and July 2014 were included in the study. All patients were taken to the electrophysiology laboratory in the non-sedated state and underwent an initial diagnostic study using three diagnostic catheters. The one of them was placed in coronary sinus. In those patients, in whom the AP was identified, ablation therapy was carried out using radiofrequency energy. We decided distribution of AP on fluoroscopy. Fluoroscopic images are obtained in and the left anterior oblique orientation.
Results: The study population consisted of 64 AVRT patients (63% female; mean age 34±14). Among AVRT 20(31%) patients had concealed AVRT, 44 (69%) patients had Wolf Parkinson White syndrome. Distribution of AP was 59% at the left free wall, 34% at the posteroseptum, 6% at the right free wall, and 3% at the anteroseptum. The locations of APs were compared. There was no any statistically significant among groups.
Conclusion: Distribution of AP location was in accordance with literature. The other characteristic of AVRT were similar with the current data.
Keywords: Wolf Parkinson White Syndrome, Accessory Pathway, Atrioventricular Reentrant Tachycardia

Güneydoğu Anadolu Bölgesindeki Atriyoventriküler Reentran Taşikardilerdeki Aksesuar Yolların Dağılımı

ÖZ
Amaç: Güneydoğu Anadolu bölgesinde atriyoventriküler reentran taşikardilerdeki (AVRT) aksesuar yolları değerlendirmeyi amaçladık.
Yöntem: Çalışma retrospektif kesitsel olarak yapıldı. Haziran 2012-Temmuz 2014 tarihleri arasında ardışık olarak AVRT nedeniyle ablasyon tedavisi yapılan hastaları çalışmaya dahil ettik. Bütün hastalar elektrofizyoloji laboratuvarına sedasyon yapılmadan alındı. 3 diyagnostik kateter kullanılarak elektrofizyolojik çalışma yapıldı. Koroner sinüse diyagnostik kateter yerleştirildi. Aksesuar yol tespit edildiğinde radyofrekans enerji kullanılarak tedavi yapıldı. Aksesuar yolların lokalizasyonu floroskopik olarak sol ön oblik pozisyonda belirlendi.
Bulgular: Çalışmaya 64 AVRT'li hasta dahil edildi (%63 kadın, yaş ortalaması 34±14). Atriyoventriküler reentran taşikardili hastaların 20 (%31)'si gizli AVRT, 44 (%63)'ü WPW sendromu olduğu saptandı. Aksesuar yolların bulunduğu yerlerin sol serbest duvar %59, posteroseptum %34, sağ serbest duvar %6 ve anteroseptum %3 olarak saptadık. Aksesuar yollar karşılaştırıldı. Gruplar arasında istatistiksel olarak herhangi bir fark yoktu.
Sonuç: Aksesuar yolların bulunduğu bölgelerin dağılımı literatür ile benzer bulundu. Atriyoventriküler reentran taşikardiler arasında herhangi bir fark olmadığını belirlendi.
Anahtar Kelimeler: Wolf Parkinson White Sendromu, Aksesuar Yol, Atriyoventriküler Reentran Taşikardi

INTRODUCTION

Atrioventricular reentrant tachycardia (AVRT) is a reentrant tachycardia with an anatomically defined circuit that consists of two distinct pathways, the normal atrioventricular (AV) conduction system and an AV accessory pathway (AP), linked by common proximal (the atria) and distal (the ventricles) tissues. Atrioventricular reentrant tachycardia is the second most common type of supraventricular tachycardia (SVT) (1). The Wolf Parkinson White (WPW) syndrome is a special type of AVRT. The WPW syndrome and AVRTs over the years is its associated morbidity and mortality (2,3). There is a well-established relationship between the presence of symptoms and the risk of sudden death. Accessory pathways location is important for ablation success. Thus, we aimed to evaluate distribution of AP in AVRT in southeast Anatolian region of Turkey.

MATERIALS AND METHODS

The study was a retrospective cross-sectional design. Consecutive patients who underwent catheter ablation of AVRT between June 2012 and July 2014 at the Dicle University Heart Hospital were included in the study. All participants gave an informed consent and the study was approved by local ethics committee (***Date***: ***26.03.2014, No:171***). Patient information regarding indication, procedural details and possible complications of the ablation procedure was provided during an outpatient visit at our institution or at the referring institution prior to the planned procedure. All patients were taken to the electrophysiology laboratory in the non-sedated state and underwent an initial diagnostic study using three diagnostic catheters. The one of them was placed in coronary sinus. In those patients, in whom the AP was identified, ablation therapy was carried out using radiofrequency (RF) energy.

We decided distribution of AP on fluoroscopy. Fluoroscopic images are obtained in and the left anterior oblique orientations. When it was shown at leftside, five thousand IU of heparin were administered intravenously in patients before the ablation procedure. Five thousand IU of heparin were administered intravenously in all patients following the ablation procedure. Procedural success was defined as absent of pre-exitasyon on electrocardigraphy (ECG) and disappearance of an accessory pathway potential in patients with WPW syndrome and non-inducibility of the tachycardia after ablation, including atropine challenge in patients in whom a tachycardia had been induced after cholinergic inhibition before the ablation in all patients. All patients in the outpatient group spent a minimum of twelve hours following the ablation in a postprocedure recovery room prior to their discharge. In all patients a predischarge ECG was recorded to confirm sinus rhythm, to exclude procedure-related bundle branch block or AV block as well as persisting block in case of an accessory pathway with antegrade conduction. Echocardiography was routinely performed after ablation procedure for detection of pericardial effusion. Patients who underwent ablation were given acetylsalicylic acid 100 mg / day for a month after the ablation.

All patients underwent clinical follow-up four to twelve weeks after the ablation procedure at our outpatient clinic. This follow-up visit included a 12-lead ECG in all patients and holter in patients with persisting symptoms. We tried to reach all of patients through the phone calling for knowing last status in August 2014.

Statistical analysis: Continuous variables are presented as mean ± standard deviation. Categorical variables are expressed as number and percentage and compared using a Chi-square (χ^2) or Fisher's exact test as appropriate. Procedural outcomes, complications, were assessed according to one patient group treatment. Continuous variables between groups were compared using an unpaired Student's t-test or the Mann-Whitney U test for not normally distributed variables. Variance analysis was performed with Kruskal-Wallis test. Statistical analyses were performed using SPSS 15.0 (SPSS Inc, Chicago, Illinois). A p value less than 0.05 was considered significant. The study was conducted in accordance with the regulations of the institutional ethics committee.

RESULTS

The study population consisted of 64 AVRT patients (63% female; mean age 34±14). The basic clinical characteristics of the study population are shown in Table 1.

Table 1. Basic clinical characteristics of the study group (n=64)

Age, year	34±14
Female (%)	63
Smoking (%)	9
Hypertension (%)	10
Diabetes mellitus (%)	2
Coronary artery disease (%)	2
Duration of symptoms (year, median)	4
An electrocardiography showing tachycardia (%)	85
Symptom frequency (number of episodes/month, median)	2
Ejection fraction (%)	61±6
RF duration (ms)	184±95
Number of RF (median)	5
Fluoroscopy duration (min)	35±10
PR duration after ablation (ms)	167±17
Ablation success (%)	92
Abbreviation: AVRT; atriyoventricular re-entry tachycardia, RF: radiofrequency, WPW: Wolf Parkinson White	

More than 91% of the patients had symptoms persisting for more than a year and more than 88 % of those were suffering at least 2 episodes per month. Overall, 83% of the patients were on at least 1 antiarrhythmic agent which were beta blockers and calcium channel blockers commonly, five patients were on propafenone.

Among AVRT 20(31%) patients had concealed AVRT, 44 (69%) patients had Wolf Parkinson White (WPW) syndrome. The RF ablation was applied on 62 patients. The RF ablation was not applied to in 1 patient with intermittent WPW syndrome and in 1 patient with concealed AVRT because couldn't be placed the coronary sinus catheter. Overall RF ablation success rate was 92%. Overall recurrence was 4 (7%) of 58 patients during the follow-up period 14±7 (1-24) months. Transient ischemic attack was developed in one patient who had lateral left side concealed AVRT. She was improved two minutes later. The types of AVRT were compared. There was no any statistically significant between groups. The comparison for the type of AVRT is shown in Table 2. Distribution of accessory pathway was 59% at the left free wall, 34% at the posteroseptum, 6% at the right free wall, and 3% at the anteroseptum. The locations of accessory pathways were compared. There was no any statistically significant among groups. The comparison for location of accessory pathway is shown in Table 3. Recurrence was occur 3 in patients with accessory pathway at left free wall and 1 in patient with accessory pathway at posteroseptum. The groups with and without recurrence were compared and there was no any statistically significant. The comparison of groups with and without recurrence is shown in Table 4.

Table 2. The comparison for the type of AVRT (n=64).

	WPW syndrome (n=44)	**Concealed AVRT** (n=20)	**p**
Age (year)	35±15	33±14	0.49
Female (%)	64	65	0.91
Tachycardia cycle length (ms)	297±53	312±58	0.31
RF duration (ms)	177±96	198±95	0.42
Fluoroscopy duration (min)	35±10	34±8	0.89
Ablation success (%)	91	95	1.0
Recurrence (%)	5	11	0.58
Location of accessory pathway			0.39
Left free wall (%)	54	68	
Posteroseptum (%)	39	21	
Right free wall (%)	5	11	
Anteroseptum (%)	3	0	
Abbreviation: AVRT: atriyoventricular re-entry tachycardia, RF: radiofrequency, WPW: Wolf Parkinson White			

Table 3. The comparison for location of accessory pathway (n=62)

	Left free wall (n=36)	**Postero-septum (n=21)**	**Right free wall (n=4)**	**Antero-septum (n=1)**	**p**
Age (year, mean±SD)	36±15	29±11	27±10	36±0	0.10
Gender (F, %)	67	67	50	100	0.80
Tachycardia cycle length (ms, mean±SD)	295±49	305±58	325±70	270±0	0.88
RF duration (ms, mean±SD)	178±100	186±100	203±36	298±0	0.87
Fluoroscopy duration (min, mean±SD)	35±10	35±10	36±5	48±0	0.94
Ablation success (%)	94	86	100	100	0.60
Recurrence (%)	9	5	0	0	0.87
Abbreviation: AVRT: atriyoventricular re-entry tachycardia, RF: radiofrequency, WPW: Wolf Parkinson White					

Table 4. The comparison of groups with and without recurrence

	Recurrence (-) (n=54)	**Recurrence (+)** (n=4)	**p**
Age (year)	33±14	39±9	0.42
Female (%)	67	75	1.0
Type of AVRT			0.23
WPW syndrome	38	1	
Concealed AVRT	16	2	
Location of accessory pathway			0.87
Left free wall	56	75	
Posteroseptum	35	25	
Right free wall	7	0	
Anteroseptum	2	0	
Tachycardia cycle length (ms)	300±54	280±14	0.45
RF duration (ms)	186±94	1161±129	0.62
Fluoroscopy duration (min)	35±10	31±5	0.45
PR duration after ablation (ms)	167±17	174±16	0.44
Abbreviation: RF: radiofrequency			

DISCUSSION

The AV node generally forms the only connection between atrial and ventricular tissue, with the remainder of the atrial tissue and ventricular tissue separated by the fibrous annulus that forms the scaffolding for the mitral and aortic valves (4). Accessory pathway cause the another connection between atrial and ventricular tissue. Detailed clinicopathologic studies have shown that APs comprise microscopic strands of morphologically normal myocardium that are located along the cardiac annulus or septum (5,6). Accessory pathways can usually conduct in both directions, from atrium to ventricle and from ventricle to atrium. However, some accessory pathways can only conduct in one direction, usually from ventricle to atrium. These accessory pathways are often called "concealed," because their presence is not observed during sinus rhythm (no atrioventricular activation) but they can participate in supraventricular tachycardia because of robust ventricle-to-atrium depolarization. Some accessory pathways conduct very slowly, more like AV node tissue (4).

Based on a study of 1754 patients undergoing catheter ablation of 1856 SVTs (excluding atrial fibrillation, atrial flutter, and inappropriate sinus tachycardia) between 1991 and 2003, Porter et al found AVRT as the second most SVT mechanism (27%) (1). Similar to this data we found AVRT (32%) as the second most common type of SVT. The most commonly observed arrhythmia is orthodromic AVRT, in which a reentrant circuit develops that travels in the normal atrioventricular direction over the AV node and retrogradely over the accessory pathway, it results in a normal QRS complex (unless baseline bundle branch block or aberrant conduction is present). The rarest arrhythmia is antidromic AVRT, in which the reentrant circuit is reversed with anterograde activation over the accessory pathway and retrograde over the AV node. The antidromic AVRT results in fully preexcited, wide QRS complexes. Orthodromic AVRT comprises approximately 95% of spontaneous and laboratory induced AVRTs (7,8). Antidromic AVRT is much less common and comprises 3-6% of spontaneous and laboratory-induced AVRTs (7,8).

The WPW syndrome is a special type of AVRT. This is manifest form of AVRT. 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 arrhythmias. Those who have the WPW syndrome have both the WPW ECG pattern and the paroxysmal tachyarrhythmias (7,9). In patients with a "concealed" accessory pathway a normal PR interval will be present and a delta wave will not be observed since there is no anterograde conduction over the accessory pathway. It has been suggested that some pathways are concealed because they are thinner and the voltage generated by accessory pathway depolarization is not sufficient to depolarize adjacent ventricular tissue. However, since the atria are thinner, retrograde depolarization of atrial tissue can still occur, and for this reason these patients still develop supraventricular tachycardia (4).

The WPW syndrome and AVRTs over the years is its associated morbidity and mortality (2,3). 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 (9-11). Ventricular fibrillation has been reported to occur in 2.2% of symptomatic WPW patients over a 16-year period (12,13). 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% (2,10,14) Unfortunately, up to 48% of young patients with WPW and cardiac arrest have no prior warning signs (15). In our study, there was a patient with WPW syndrome and atrial fibrillation, in which catheter ablation was performed successfully.

The ECG is the single most important noninvasive tool for identifying the presence of an accessory pathway. In a patient with a right-sided accessory pathway the QRS complex will be negative in V1 and positive in the lateral leads V5, V6, I, and aVL. Conversely, in patients with a left-sided accessory pathway the QRS complex will be positive in V1. If the accessory pathway is located at the lateral wall of the mitral annulus, the delta wave will be negative in I and aVL due to ventricular depolarization traveling away from this area. If the accessory pathway is located more inferiorly and closer to the septum the delta waves will be negative in the inferior leads (II, III, and aVF) (4). 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 anteroseptum (16). Similar to this data we found that 59% of APs are located at the left free wall, 34% at the posteroseptum, 6% at the right free wall, and 3% at the anteroseptum in our study. Catheter-based ablative techniques using RF energy have been used extensively to effectively and safely eliminate accessory pathways (17-20). Based on recommendations from the 2003 American College of Cardiology / American Heart Association/European Society of Cardiology guidelines, asymptomatic preexcitation is associated with a class IIa indication for catheter ablation (21). In our study, overall RF ablation success rate was 92%.

As a conclusion, distribution of AP location was in accordance with literature. The other characteristics of AVRT were similar with the current data.

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