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Radiofrequency catheter ablation reduces the severity of anxiety in patients with atrioventricular nodal reentry tachycardia, regardless of age, sex, tachycardia type, and laboratory findings

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Abstract

Assess pre and postinterventional anxiety levels in radiofrequency catheter ablation recipients (RFCA) for atrioventricular nodal reentry tachycardia (AVNRT) and investigate whether changes are associated with demographic and clinical characteristics and AVNRT subtypes. This was a single-centre prospective study conducted from September 2019 to March 2020. A total of 51 patients who were to undergo RFCA due to newly diagnosed symptomatic AVNRT were included. Electrophysiological studies were performed on all patients, the AVNRT subtype was determined, and the RFCA procedure was applied. The severity of anxiety before RFCA and 3 months after the procedure was determined by the state-trait anxiety inventory. The mean age was 50.1±17.3 years and 70.6% (n=36) were women. The median STAI-State score after ablation (37 [33–42]) was significantly lower than before (63 [52–72]) (p<0.001). Similarly, median STAI-Trait scores after ablation (45 [39–49]) were found to be significantly lower than before the procedure (59 [46–69]) (p<0.001). There were no significant relationships between the decrease in STAI-State or STAI-Trait scores and analyzed parameters such as age, sex, AVNRT type and other laboratory values. Administration of RFCA in AVNRT can improve AVNRT-induced anxiety and could eliminate the potential need for antiarrhythmic or anxiolytic therapy. Therefore, RFCA may also positively impact quality of life, and reduce unnecessary treatments, and healthcare costs associated with AVNRT.

Keywords: Atrioventricular nodal reentry tachycardia, radiofrequency catheter ablation, anxiety, state-trait anxiety inventory, atrioventricular nodal reentry tachycardia subtype

Introduction

Supraventricular tachycardia (SVT) is the collective name for a diverse group of cardiac arrhythmic disorders that affect both adults and children [1]. As the name suggests, SVT refers to arrhythmias that begin or exceed the bundle of His, characterised by heart rates exceeding 150 beats per minute and a narrow QRS complex [2,3]. In the general population, the prevalence of SVT is 2.25/1000 people and the incidence is 35 per 100000 person-years [2]. Palpitation, which is the most common and often the first symptom (96%) [4], appears suddenly and resolves spontaneously, so the term paroxysmal SVT (PSVT) is frequently used in terminology [5].

PSVT can paradoxically manifest under different conditions, such as atrioventricular (AV) nodal reentry tachycardia (AVNRT), atrioventricular reentrant tachycardia (AVRT) or atrial tachycardia (AT) [3]. AVNRT is the most common type of SVT and accounts for 50–60% of diagnoses [4,6]. It refers to conditions resulting from reentry of electrical impulse in the area of the AV node and is particularly recognised in patients with dual AV nodal pathway [7]. AVNRT is usually benign, but can be confused with dysautonomia or psychosomatic diseases due to various reasons, including nonspecific symptoms, difficulty in obtaining electrocardiography (ECG) during an episode, and the absence of previous cardiovascular disease. Therefore, diagnosis

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may be difficult or delayed [6,8].

In addition to palpitations, PSVT symptoms include dyspnea, hyperventilation, syncope, diaphoresis, chest pain, fatigue, and anxiety [3,9]. In fact, SVTs have been shown to be associated with anxiety in about 20% of patients [10]. There is a complex relationship between AVNRT and anxiety. Symptoms caused by AVNRT and difficulties in diagnosing AVNRT can cause anxiety. In this situation, the primary pathology is AVNRT, not anxiety [7,11]. However, the difficulty in diagnosing AVNRT and the presence of overt anxiety symptoms may lead to misdiagnoses of anxiety, leading to years of highly ineffective treatment of anxiety [6].

Medication and catheter ablation are the only treatment modalities in the treatment of AVNRT [1,12]. However, catheter ablation is often required due to disadvantages of medical treatment such as side effects, intolerance and resistance to treatment, and high recurrence rate [1,13]. Catheter ablation is recognised as a highly effective and safe treatment method for various heart rhythm disorders. The success rate with ablation is quite high (85-95%) and complications rarely occur (5%) [1,11,14,15]. Several studies have reported significant improvements in anxiety and anxiety disorders among patients with AVNRT who received ablation therapy [16,17]. However, there are few studies that have investigated the relationships between post-ablation improvements in anxiety scores and demographic characteristics or laboratory results of patients [11,18]. Furthermore, to the best of our knowledge, there are no published studies on this subject that account for the AVNRT subtypes.

In this study, our aim was to contribute to the literature by presenting anxiety-related results among radiofrequency catheter ablation (RFCA) recipients for the treatment of AVNRT, and to investigate possible relationships of this improvement with some demographic and clinical characteristics -with an emphasis on the evaluation of AVNRT subtypes.

Material and Methods

Study Design and Ethical Requirements

This was a prospective cohort study conducted between September 2019 and March 2020 at the Department of Cardiology, Faculty of Medicine, Yüzüncü Yıl University, Van, Türkiye. Ethical approval for this study was acquired from the Ethics Committee of Yüzüncü Yıl University Faculty of Medicine. Written informed consent was obtained from each of the patients included in the study. The study was carried out in compliance with the 1964 Helsinki declaration and its later amendments.

Subjects, Inclusion, and Exclusion Criteria

In the study, there were 51 people with atrioventricular nodal reentrant tachycardia (AVNRT) who would undergo radiofrequency catheter ablation. For this reason, we carefully selected our sample by excluding certain individuals who might confuse the results. These groups consisted of patients under 18 years of age, pregnant women, those with arrhythmias due to other causes in addition to AVNRT, pacemaker recipients, and those who had taken antiarrhythmic or psychiatric medications in the past three months. Additionally, we also did not include people with significant metabolic, cardiovascular or psychiatric comorbidities; we did not enrol participants who had recently experienced major life events or those with preexisting neurological disorders that would predispose them to anxiety attacks. Finally, unsuccessful cases, incomplete recording of anxiety scores or invalid ratings led to exclusion as well. Such exclusions were necessary to determine whether AVNRT has an impact on anxiety levels during its treatment alone without interference from other factors affecting mood change.

Data Collection

The demographic data of the patients and the laboratory results obtained as part of their routine outpatient examinations were recorded. To ensure the reliability of our results, a professional psychologist was asked to oversee and verify the administration of the State Trait Anxiety Inventory (STAI) before and three months after radiofrequency catheter ablation. This step was taken so that anxiety assessments were performed based on standardised psychological procedures.

Atrioventricular nodal reentrant tachycardia diagnosis

First, patients underwent a detailed physical examination, ECG, and echocardiographic (for evaluation of other possible cardiac pathologies) evaluation, and routine laboratory examinations, including tests for thyroid function. Patients who required acute therapy were treated according to the current guideline [2]. Supraventricular tachycardia was defined as the presence of suggestive symptoms such as sudden rapid palpitations, dyspnea, chest pain or fullness, dizziness, fatigue, presyncope or syncope with a heart rate of >100 beats per minute due to pathology of the His bundle or more with characteristic arrhythmic changes [2]. In patients diagnosed or suspected of SVT, the diagnosis of AVNRT was made in light of the 2019 European Society of Cardiology Guidelines [2]. AVNRT was defined by the presence of suggestive symptoms and characteristic findings on standard ECG such as narrow complex tachycardia (QRS duration <120 ms), visible P wave, and a heart rate of 120-240 beats per minute with or without bundle branch block [2]. Patients with normal ECG findings and frequent symptoms were evaluated on a 48-hour Holter-ECG monitor (12-Lead Mortara H12+Digital Holter Recorder; eResearch Technology Inc, Philadelphia, USA) [12,19]. Patients with normal ECG findings, infrequent symptoms, and those with normal Holter-ECG findings were evaluated with a 30-day external cardiac event monitor (MCOT™ Monitor; CardioNET, Philadelphia, USA) [6,19]. Patients with typical arrhythmia findings and planned RFCA treatment, patients with typical paroxysmal palpitations for at least six months and whose typical arrhythmia could not be documented by standard ECG, Holter monitor, and event monitor, and patients with longer gaps between crises or low tolerance to external cardiac event monitor, who accepted the procedure, were evaluated by electrophysiological studies (EPS) [7,19]. The AVNRT subtypes were classified into four groups as follows: 'Slow-Fast', 'Fast-Slow', 'Slow-Slow', and 'Other'.

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Electrophysiological studies and ablation procedure

Before EPS and RFCA procedures, patients were informed about the procedures and their risks and benefits were explained. Only those who accepted ablation therapy were included in the study. The patients gave their informed consent in writing prior to the procedure.

Diagnostic EPS was performed using a standard protocol. Patients who were candidates for EPS and accepted the procedure were started with local anaesthesia and systemic anticoagulation in the minimum fasting state of 6 hours [1,10,11]. Standard 7 French 110 cm quadripolar diagnostic catheter (Marinr® SC Series; Medtronic, Minneapolis, USA) were placed in the high right atrium, His bundle region, and the apex of the right ventricle, and 7 French 90 cm decapolar coronary sinus catheter (Marinr® CS Series; Medtronic) was placed in the coronary sinus through the femoral vein [11].

Programmed stimulation was performed in the high right atrium and right ventricular apex to identify reentrant tachycardia of the slow-fast pathway of the AV node [11]. Patients with evidence of dual AV node physiology or inducible AVNRT during EPS were diagnosed with AVNRT. Dual AV node physiology was demonstrated by a 50 ms increase in the atrial to His (AH) interval with a 10-ms decrease in atrial extrastimuli [6]. After detailed mapping of the ablation target, RFCA manoeuvres were performed according to the standard protocol using a 7 French 110 cm ablation catheter (RF Marinr® MC; Medtronic) and a 60 watt RF generator (Atakr® II RF Ablation System; Medtronic) [1,11]. Ablation of the "slow paths" of the AV connection was performed [16]. Successful RFCA was defined as the successful elimination of residual slow-pathway conduction and/or non-inducibility of tachycardia during the post-ablation period [1,11].

The patients were monitored for 36 to 48 hours after the procedure. A standard 12-lead ECG was performed prior to discharge. No complications occurred in any of the patients during or after the procedure.

Atrioventricular nodal reentry tachycardia classification

The classification of AVNRT types was made using the data obtained during EPS as follows. The His-atrium (HA) interval was measured from the first deflection of the bundle of His activation to the first rapid deflection of the atrial activation in the His bundle electrogram [20]. The AH interval was measured from the initial deflection of the atrial electrogram (far or near field) to the initial deflection of the His bundle electrogram [21]. The ventricularuloatrial (VA) interval was measured from the onset of ventricular activation on the surface ECG to the earliest deflection of atrial activation on the His bundle electrogram [20]. The 'slow-fast' form of AVNRT (typical AVNRT) was defined as, AH/HA ratio is >1, HA interval is <70 ms and the VA interval is <60 ms. The 'fast-slow' form of atypical AVNRT was defined as AH / HA ratio is <1, HA interval is 70 ms, the AH interval is <185 ms or 200 ms, the VA interval is >60 ms. The “slow-slow” form of atypical AVNRT was defined as the AH / HA ratio is 1, the HA interval is 70 ms, the AH interval is >200 ms, the VA interval is >60 ms. Patients who could not be reliably classified due to ranges of borderline or variable were termed "others" [2,20].

The state-trait anxiety inventory

Patients were asked to complete the state trace anxiety inventory (STAI) 24 hours before the ablation procedure and on the control examination 3 months after the procedure. STAI is a self-assessment scale that is widely used to measure the severity of anxiety and evaluate its characteristics. It is a 40-item questionnaire consisting of two subscales, both of which are 20 questions. One of the subscales refers to state anxiety (STAI-State) and evaluates current anxiety. The other subscale measures trait anxiety (STAI-Trait). Participants are asked to rate each of the 20 questions with increasing severity between 1 and 4 on both subscales. Questions 1, 2, 5, 8, 10, 11, 15, 16, 19, and 20 in STAI-State and Questions 1, 3, 6, 7, 10, 13, 14, 16 and 19 in STAI-Trait are related to positive emotions, and so the scores given to these questions are rated in reverse. Thus, a total score is obtained for both subscores, with a minimum of 20 and a maximum of 80 points. A higher score reflects greater anxiety. If more than 3 questions on each subscale were left unanswered, the questionnaire was considered invalid [22,23].

Statistical Analysis

All analyses were performed on IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, NY, USA). For the normality check, the Kolmogorov-Smirnov test was used. Data are given as mean±standard deviation or median (1st quartile - 3rd quartile) for continuous variables according to the normality of the distribution and as frequency (percentage) for categorical variables. Repeated measurements were analysed with the Wilcoxon signed ranks test. Spearman correlation coefficients were calculated to evaluate the relationships between the change in STAI scores and other variables. The values of $p<0.05$ values were accepted as statistically significant results. A post hoc power analysis was performed, which indicated that the study approached but did not reach the standard power level of 0.80 with a real power close to this threshold. This provides moderate confidence in our findings, considering the limitations imposed by the sample size (Figure 1).

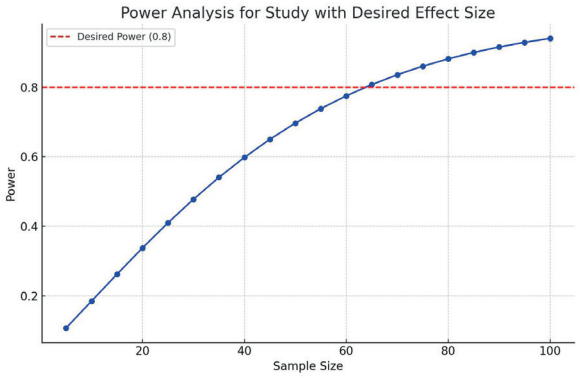

Figure 1. Power analysis relative to sample size

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Results

The mean age of the patients was 50.10±17.29 and 70.6% (n=36) were female. The clinical and demographic characteristics of the patients, laboratory measurements, and STAI scores are summarised in Table 1. The median STAI-State score of the patients after ablation (37 [33-42]) was significantly lower than before the procedure (63 [52-72]) (p<0.001). Additionally, the STAI-State score was found to have decreased in all patients. Similarly, the median STAI-Trait scores of the patients after ablation (45 [39-49]) were significantly lower than before the procedure (59 [46-69]) (p<0.001) (Figure 2). The STAI-Trait score remained the same in 2 patients, increased in 1 patient, and decreased in other patients. There were no significant relationships between the decrease in STAI-State or STAI-Trait scores after the procedure and the parameters examined such as age, sex, type of AVNRT and laboratory values (Table 2).

Table 1. Summary of patient characteristics, laboratory measurements and State-Trait Anxiety Inventory scores

Age	50.10±17.29
Sex	
Female	36 (70.6%)
Male	15 (29.4%)
AVNRT type	
Slow-fast	38 (74.5%)
Fast-slow	5 (9.8%)
Slow-slow	4 (7.8%)
Other	4 (7.8%)
Creatinine	0.74 (0.66-0.83)
AST	22 (17-26)
ALT	20 (15-27)
Glucose	94 (87-123)
HDL	45.77±10.66
LDL	113.45±33.30
Triglyceride	130 (105-199)
Hemoglobin	14.21±1.56
Platelet (x10^3)	257.61±75.91
STAI-state score	
Before	63 (52-72)
After	37 (33-42)
p	**<0.001**
STAI-trait score	
Before	59 (46-69)
After	45 (39-49)
p	**<0.001**

Data are given as mean±standard deviation or median (1st quartile-3rd quartile) for continuous variables according to normality of distribution and as frequency (percentage) for categorical variables.
ALT: alanine aminotransferase, AST: aspartate aminotransferase, AVNRT: atrioventricular nodal reentry tachycardia, HDL: high density lipoprotein, LDL: low density lipoprotein, STAI: State-Trait Anxiety Inventory

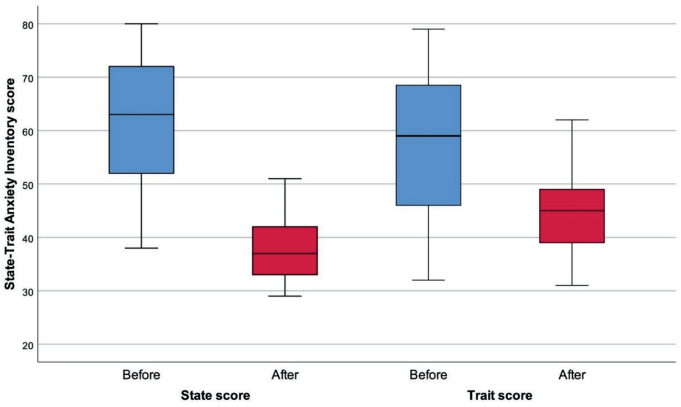

Figure 2. State-Trait Anxiety Inventory scores before and after ablation

Table 2. Correlation analyses between the decrease in STAI scores and other variables

		Decrease in STAI-State score	Decrease in STAI-Trait score
Age	**r**	-0.073	-0.082
	p	0.614	0.570
Sex, Male	**r**	-0.042	-0.024
	p	0.767	0.870
AVNRT	**r**	0.073	0.106
	p	0.612	0.460
Creatinine	**r**	-0.067	0.037
	p	0.640	0.796
AST	**r**	-0.034	-0.134
	p	0.811	0.349
ALT	**r**	0.074	-0.084
	p	0.606	0.556
Glucose	**r**	-0.221	-0.116
	p	0.119	0.419
HDL	**r**	-0.214	-0.034
	p	0.132	0.815
LDL	**r**	0.012	-0.006
	p	0.936	0.964
Triglyceride	**r**	0.043	0.020
	p	0.766	0.887
Hemoglobin	**r**	0.005	0.078
	p	0.970	0.584
Platelet	**r**	0.084	0.116
	p	0.560	0.419

ALT: Alanine aminotransferase, AST: Aspartate aminotransferase, AVNRT: Atrioventricular nodal reentry tachycardia, HDL: High density lipoprotein, LDL: Low density lipoprotein, r: Spearman correlation coefficient, STAI: State-Trait Anxiety Inventory

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Discussion

Although AVNRT is not usually life threatening, anxiety caused by AVNRT can lead to deterioration in quality of life (QoL), loss of working hours, decreased productivity, more frequent visits to emergency rooms and hospitalisations, and increased health care costs [1,5]. The main findings of this study demonstrate that patients with AVNRT showed a significant improvement in anxiety scores 3 months after RFCA treatment, regardless of age, sex, AVNRT type, and laboratory findings.

In AVNRT patients, the uncertainty of episodes and the sudden onset of symptoms cause anxiety. Unless a meticulous approach is taken to examine patients, the characteristics of the symptoms may lead to an incorrect diagnosis of anxiety disorder. This may result in some patients with AVNRT receiving treatment for anxiety alone, which cannot improve the underlying pathology [11,24]. Catheter ablation is the modern day treatment-of-choice for AVNRT [1]. Several studies have shown that catheter ablation provides a better and longer-lasting improvement in quality of life and arrhythmic complaints compared to medical therapy [1,25]. In the present study, it was shown that anxiety levels in AVNRT patients were significantly reduced with RFCA treatment. A similar study demonstrated that RFCA treatment of the three most common forms of PSVT (AVNRT, AVRT, AT) significantly reduced STAI-trait and STAI-state levels by eliminating arrhythmia episodes [26]. In another similar study, AVNRT patients evaluated with the hospital anxiety and depression scale were found to have clinically relevant anxiety (in 63.6%) or subclinical anxiety (in 33.3%) before RFCA. However, after RFCA and 6 months of follow-up, none of the patients was found to have clinically relevant anxiety and there was a significant decrease in the number of patients with subclinical anxiety. Furthermore, at 12 months of follow-up, there were no patients with anxiety [17]. In a study from Turkey, it was reported that the RFCA procedure caused a significant improvement in quality of life and anxiety levels (measured by STAI) in PSVT patients [11]. Erkabayev et al. evaluated the quality of life of patients with AVNRT before and after RFCA using the short form 36 questionnaire and the hospital anxiety and depression scale. They found significant improvements in role functioning, physical functioning, general health, anxiety, and depression 12 months after treatment compared to pretreatment [16]. Haloot et al. showed that catheter ablation treatment in patients with anxiety and PSVT significantly reduced the average number of psychiatric medications 3 months after the procedure [9].

PSVT and anxiety can mutually affect each other. On the one hand, symptoms caused by PSVT and difficulties in diagnosis cause anxiety; while underlying anxiety can increase the risk of PSVT by increasing stress [11]. These interconnections are among the factors that complicate the clinical picture, leading to misdiagnosis and the use of antianxiolytics [9]. RFCA is effective in breaking the vicious circle between these two conditions and, if there is no other cause of anxiety, it can improve both PSVT symptoms and anxiety, thus increasing quality of life. Almost all of the published literature on the subject has shown that RFCA treatment can improve anxiety and / or quality of life [11,17,26,27]. The results of this study also support the existing literature and expand on the analysis of potential relationships with other characteristics of the patient by performing a prospective analysis. However, the short follow-up period of our patients should be taken into account when interpreting the study results (3 months). Because there are studies that report data from long term follow up (>1 year) after RFCA [28,29] and the fact that a large retrospective cohort study found that significant improvements in anxiety among patients with AVNRT could be delayed for more than 4 years, as demonstrated by some patients with sustained anxiety 4.5±1.3 years after RFCA [27].

In the literature, there are few studies that examine the relationships between PSVT treatment with catheter ablation and its effects on anxiety or quality of life considering demographic differences and clinical characteristics [11,30]. More importantly, we did not find any study that examined the effects of AVNRT subtypes on anxiety improvement after RFCA. In the current study, the improvement in anxiety scores was not found to be associated with the AVNRT subtype, age, sex, and laboratory findings. Carnlöf et al. investigated the issue in terms of sex difference. They reported that, according to the 36-minute short survey questionnaire, there was no difference in health-related quality of life when the sexes were compared at baseline, except that the females scored lower on 'Vitality' than the males, but at 6-month follow-up after RFCA, the only difference was that the females scored lower on 'social functioning' than the males. In addition, they noted that, comparing the scores from baseline to the 6 month follow-up, there were four domains that did not improve significantly for women: 'Physical functioning, bodily pain, social functioning and emotional role'. Males experienced improvements in all domains except for “Bodily pain”, which remained unchanged [30]. Yıldırım et al. reported that the improvement in anxiety and QoL after RFCA in PSVT patients was independent of sociodemographic characteristics such as sex, educational status, and marital status of patients [11], similar to our findings. Considering the results reported in the literature [1,18,24] and the present study, it can be said that successful RFCA results in a significant decrease in anxiety and significant improvements in social, emotional, personal, and physical scores among patients with SVT, regardless of age, sex, or SVT and subtype AVNRT.

There are several possible limitations of the current study that need to be considered when interpreting its results. The relatively small sample size of a single centre limits the generalisation of the study findings to other institutions. However, the limited number of patients was largely associated with the fact that we imposed a set of rigorous exclusion criteria to be able to perform our prospective follow-up in a homogeneous group of patients who had successful RFCA and did not have any disease or factors that could confound the results. We believe that this approach was crucial to an accurate assessment of a complex

topic such as anxiety, which is highly intertwined with the target pathology being examined. As a result of the distribution of AVNRT subtypes, patient counts in different groups may have been insufficient for accurate statistical analysis. Since the main purpose of the study was to investigate the improvement in anxiety, we knowingly accepted the exclusion of analyses regarding the comorbidities of the patients, the variety of symptoms other than anxiety, and the duration and post-treatment status of these symptoms. In considerable separation from the literature, no assessment of the QoL scale was performed and this may be considered a limitation; however, since only patients with successful RFCA were included, the results would have been skewed, as well as the fact that the QoL improvements are well documented in the literature. Therefore, the interpretation that anxiety improvement may also contribute to better quality of life was interpreted according to the established relationships between these parameters in patients [11,17].

Conclusion

In conclusion, AVNRT treatment with RFCA provided significant improvements in the severity of state and trait anxiety caused by AVNRT. This improvement was independent of age, sex, type of AVNRT, and laboratory findings. Administration of RFCA in AVNRT can improve AVNRT-induced anxiety and could prevent the initiation of other antiarrhythmic or anxiolytic therapies. Therefore, RFCA may also positively impact quality of life, reduce unnecessary treatments, and healthcare costs associated with AVNRT.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
Van Yüzüncü Yıl University Clinical Research Ethics Committee: date 03/07/2019 - decision no: 05.

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