

Full Length Research Paper

Personality analysis of Chinese patients with atrioventricular reentrant tachycardia and atrioventricular nodal reentrant tachycardia

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To explore psychological state in patients with atrioventricular reentrant tachycardia (AVRT) and atrioventricular nodal reentrant tachycardia (AVNRT), patients with AVRT and AVNRT and health people were investigated with Eysenck personality questionnaire (EPQ) revised by Gong YaoXian. Results showed that the scores of N in women with AVNRT were significantly higher than those in the control and the AVRT groups, and than those in men with AVNRT before radiofrequency ablation. However, no statistical differences were found between groups (AVRT, control group and men with AVNRT). After radiofrequency ablation, scores of N in women with AVNRT were significantly higher than those in the control and the AVRT group and than those in men with AVNRT. There was no statistical difference between, before and after radiofrequency ablation. It may be concluded that women with AVNRT appear to suffer from a higher degree of neuroticism. This may be the reason why the majority of patients with AVNRT were women. Psychological intervention should be a part of the therapy in patients with SVT, especially in women.

Key words: Atrioventricular reentrant tachycardia, atrioventricular nodal reentrant tachycardia, Eysenck personality questionnaire.

INTRODUCTION

The role of psychological factors in patients with coronary artery disease is an issue of ongoing debate (Rosenman et al., 1975; Denollet et al., 1966). A study confirmed that depression and anxiety were associated with cardiac events (Strik et al., 2003). In fact, anxiety was an independent predictor of both cardiac events and increased health care consumption and accounted for the relationship between depressive symptoms and prognosis. Patients with and without restenosis were compared with respect to EPQ-R parameters referring to neuroticism, extroversion and psychoticism. There was positive correlation between the level of neuroticism and the frequency of restenosis (logistic regression coefficient = 0.225; OR = 1.252; p = 0.03), but not with age and the level of education (Betkowska-Korpała et al., 2000).

Some authors have demonstrated significant alterations

of the QT interval in clinical cohorts of psychiatric patients, including subjects with social phobia (Nahshoni et al., 2004), panic disorder (Yeragani et al., 2000; Wang et al., 2010) and major depression (Nahshoni et al., 2000). Piercarlo Minoretti demonstrated that neuroticism scores, independently predicted QT interval duration, in apparently healthy men (Minoretti et al., 2006; Tajbakhsh et al., 2010).

Using the Barsky Somatosensory Amplification Scale, Paquette et al. investigated the tendency of atrial fibrillation patients to somatize, that is, to amplify benign bodily sensations and they showed that, a high tendency to somatize predicted a poor quality of life (Paquette et al., 2000). Eaker et al. reported an association between anger and hostility, but not type A behavior, and the development of atrial fibrillation (Eaker et al., 2004). Hemels et al investigated the degree of neuroticism in patients with paroxysmal atrial fibrillation (Hemelsa et al., 2006), surmise that patients with paroxysmal atrial fibrillation have on the average, a higher degree of

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neuroticism than other persons.

However, the results clearly indicated that this is not the case; although the Eysenck Personality Questionnaire scores on neuroticism, differed among the individual patients, mean score in the group as a whole was similar to the mean score in group of age and sex matched controls (4.1 ± 3.0 vs. 3.9 ± 3.1 , $p = \text{NS}$). In other words, patients with paroxysmal atrial fibrillation would appear to have on the average a "normal" degree of neuroticism (Hemelsa et al., 2006; Van den Berg et al., 2005; Zhang et al., 2010). These findings highlight the possibility that higher arrhythmic risk could be present, not only in patients with clinical depression but also in depression-prone, otherwise healthy individuals.

Atrioventricular reentrant tachycardia (AVNRT) and atrioventricular nodal reentrant tachycardia (AVNRT) are the two most common forms of PSVT in clinical practice. Radiofrequency catheter ablation provides curative treatment with excellent success and minimal complication rates for patients with AVNRT and AVRT. The incidence and risk factors for cardiac arrhythmias differ between men and women. At the supraventricular level, atrial fibrillation and the WPW syndrome, seem to occur more frequently in men, whereas atrial tachycardias are more common in women (Porter et al., 2004). Rodríguez et al. (1992) found a predominance of AVNRT with a higher prevalence in women 2:1 compared to men. However, this ratio was inverted for AVRT, that is, it was 2:1 for men with respect to women (Porter et al., 2004; Rodríguez et al., 1992; Wolbrette et al., 2002). But few studies have evaluated the patients personality traits, in patients with AVRT and AVNRT. However, there have been no systematic studies, comparing gender differences in personality traits, in patients with AVRT and AVNRT. The purpose of this study was to assess the psychological state in patients with AVRT and AVNRT and to find out which personality traits predispose to increased risk of AVRT and AVNRT.

METHODS

Patients

607 consecutive patients, varying in age between 18 and 70 years, 52% are female; 76% are married or living together; 17% have a low level of education, 53% have a middle level of education and 30% have a high level of education, with symptomatic typical supraventricular tachycardia, who underwent catheter ablation of atrioventricular reentrant tachycardia (AVRT) and atrioventricular nodal re-entrant tachycardia (AVNRT), at the Department of Cardiology of the University Hospital, from January 2003 to December 2008, were analyzed.

Three dimensions of personality

Informed consents, procedures and questionnaires were reviewed and approved by relevant ethics committees in China. All individuals over 16 years old were invited to participate in this study. They completed a series of questionnaires relating to family and

medical history, as well as lifestyle and diet. As a part of the interview, participants also completed the Eysenck Personality Questionnaire-Revised (short-form; EPQ-R) by Gong Yaoxian. The EPQ consists of 85 'True-False' items:

Psychoticism (20 items), Extraversion (21 items), Neuroticism (24 items) and Lie (20 items). The Lie-scale measures social desirability (Gong et al., 1999).

Electrophysiologic study

Patients gave written informed consent before the procedure. The radiofrequency catheter ablation techniques we used, have been described in detail previously (Dagres et al., 1999; Clague et al., 2001). In brief, three electrode catheters were placed in the coronary sinus, at the His bundle region and at the right ventricular apex. Twelve-lead electrocardiograms and intracardiac electrograms filtered at a band pass of 60 to 500 Hz were displayed and recorded simultaneously on digital multichannel systems (EMS, Maastricht, The Netherlands, or EPMed Systems, Mount Arlington, New Jersey). Measurements were performed using on-line calipers at a paper speed of 100 to 300 mm/s. Electrical stimulation was performed using 2-ms rectangular impulses, at approximately twice the diastolic threshold, delivered at the coronary sinus ostium. The baseline measurements included sinus cycle length and AH, HV and RR intervals.

Atrioventricular (AV) and ventriculoatrial (VA) block cycle lengths were assessed by incremental pacing. Fast pathway effective refractory period (ERP) and AV nodal ERP, were measured using an 8-beat drive train of 500 ms, by delivering 1 extra stimulus in 10-ms decrements, beginning from a coupling interval of 450 ms. The coupling interval was decreased until the AV nodal ERP was reached or down to a minimum value of 200 ms, whichever came first. All patients had inducible AVRT and AVNRT, either in the basal state or after the infusion of isoproterenol, 1 to 3 $\mu\text{g}/\text{min}$ and/or atropine 0.5 to 1.5 mg. Standard electrophysiologic criteria were used to diagnose AVRT and AVNRT. Patients were monitored for 24 to 48 h after the procedure. A 12-lead electrocardiogram (ECG) was obtained before discharge. The reported radiation dose, is the dose-area product as measured by a dose-area product meter (Diamentor D, PTW, Freiburg, Germany).

Follow-up

The patients were seen 6 and 12 months after ablation in the hospital or by the referring physician. Furthermore, patient reports concerning clinical course, symptoms and medication, as well as the Eysenck Personality Questionnaire-Revised questionnaires, were regularly sent to us by the referring physicians. Useful data were sent back by all 607 people.

Statistical analysis

Statistical analyses were performed using the SPSS Version 11.0 (SPSS, Chicago, IL, USA) and MedCalc (Mariakerke, Belgium) packages. Data are expressed as mean \pm SD. Student's t test and the Mann-Whitney test were used to compare continuous variables. Simple regression analysis was performed where indicated. A p value < 0.05 was considered statistically significant.

RESULTS

Baseline demographics

The study included 607 patients (mean age 42 ± 14 years).

Table 1. Baseline characteristics.

Variable	AVNRT (n = 308)		AVRT (n = 299)	
	Male	Female	Male	Female
N	104	204	187	112
%	33.8	66.2	62.5	37.5
Age (years)	42.3 ± 11.8	49.3 ± 22.9 ▲	38.9 ± 18.0	39.1 ± 14.7
Acute success rate	100 (96%)	198 (97%)	185 (99%)	111 (99%)
Recurrences	6 (6%)	10 (5%)	9 (5%)	6 (5%)

▲: P < 0.05, vs AVRT group and male AVNRT patients.

Table 2. Procedure parameter.

	AVRT		AVNRT	
	Male	Female	Male	Female
Fluoroscopy time	45.0 ± 23.2	46.7 ± 25.7	34.5 ± 26.1	33.3 ± 23.0
Radiation dose (cGy × cm ²)	4401 ± 331	3709 ± 554	2567 ± 321	2097 ± 135
No. of RF applications	3.9 ± 5.3	4.3 ± 4.1	3.0 ± 3.0	3.0 ± 3.3
Procedure duration (min)	115 ± 54	127 ± 33	100 ± 34	97 ± 23

All underwent successful ablation. Demographic details are listed in Table 1. Compared to those with AVRT, the patients presenting with AVNRT were older (48.58 ± 16.31 vs 36.44 ± 16.73 years, $p < 0.05$). The female patients with AVNRT were older than the female and male patients with AVRT and at the same time, they were older than the male patients with AVNRT ($p < 0.05$). But there were no differences, regarding the age of male AVNRT patients with AVRT patients. The distribution of PSVT mechanism was significantly influenced by gender. In AVNRT, 66% were women and 34% were men. In AVRT, 63% were men and 37% were women ($p < 0.05$).

Success and complications

Success rates were similar in male and female patients. In the total study population, ablation acute success rate was achieved in 288 (99%) male and 306 (97%) female patients ($p = \text{NS}$). There was also no difference in success rates between men and women, in patients with accessory pathway and with AVNRT ablation. In patients with accessory pathways, catheter ablation was successful in 185 (99%) male and 111 (99%) female patients ($p = \text{NS}$); in patients with AVNRT, successful ablation was performed in 100 (96%) male and 198 (97%) female patients ($p = \text{NS}$). Demographic details are listed in Table 2.

No procedure-related deaths occurred. Complication rates were similar in men and women. There were 20 (7.0%) complications in procedures performed in male patients and 25 (8.0%) in female patients ($p = \text{NS}$). These

were of minor importance in most cases, including transient complete atrioventricular (AV) block, new bundle branch block, transient completely reversible neurological symptoms (hemianopsia, central scotoma, disorientation, etc.), femoral nerve paralysis, vascular complications (arteriovenous fistula, pseudoaneurysm), minor pericardial effusion not requiring treatment, conservatively treated retroperitoneal hematoma and extensive groin hematoma.

Procedure-related parameters and outcome

Procedure-related parameters are given in Table 2. Fluoroscopy time, number of radiofrequency applications and procedure duration were similar in male and female subjects undergoing accessory pathway ablation, as well as in male and female subjects undergoing AVNRT ablation. Owing to the higher proportion of AVNRT as underlying arrhythmia in women, female patients required a shorter fluoroscopy time and procedure duration and fewer energy applications in the total study population. Radiation dose was significantly lower in women.

Before radiofrequency ablation, the scores of N in patients with AVNRT were higher than the control group and the AVRT group, but there was no significance. The scores of N in women with AVNRT were significantly higher than that in the control group and the AVRT group, the scores of N in women with AVNRT were significantly higher than that in men with AVNRT. However, no differences were found between AVRT group and the control group. Demographic details are listed in Tables 3

Table 3. The dimensions of EPQ-R scale for the three samples before RF.

	n	P	E	N	L
AVRT	299	7.31±2.24	9.09±2.33	9.61±4.03	14.24±3.51
AVNRT	308	6.81±1.37	8.94±4.60	10.74±5.22*	14.33±3.710
Control	50	7.43±2.84	9.24±4.60	9.87±5.13	13.86±2.49

Table 4. The dimensions of EPQ-R short scale for males and females before RF.

	Control		AVNRT		AVRT	
	M (n=22)	F (n=28)	M (n=104)	F (n=204)	M (n=187)	F (n=112)
P	7.40±2.33	6.82±2.65	7.08±1.19	7.93±2.23	6.76±2.61	7.64±2.44
E	9.80±4.61	9.34±4.35	9.81±3.28	10.00±2.43	9.08±2.61	10.56±2.19
N	8.92±4.50	9.36±2.08	9.88±2.57	12.93±2.70*▲	9.11±2.89	9.63±2.38
L	15.35±2.73	15.95±3.65	14.85±2.67	15.09±3.13	15.14±2.71	14.94±2.72

*P < 0.01, women in AVNRT group vs. both sexes in AVRT group and control group; ▲P < 0.05, woman in AVNRT group vs. man in AVNRT group.

Table 5. The dimensions of EPQ-R scale for the three samples after RF.

Group	N	P	E	N	L
AVRT	299	6.85±2.32	9.12±4.30	9.64±4.75	14.09±3.33
AVNRT	308	7.23±1.02	8.14±4.60	10.74±5.22	14.11±3.27
Control	50	7.43±2.84	9.24±4.60	9.87±5.13	13.86±2.49

and 4.

After radiofrequency ablation, the scores of N in patients with AVNRT were higher than the control group and the AVRT group, but there was no significant difference. The scores of N in women with AVNRT were significantly higher than that in the control group and the AVRT group, the scores of N in women with AVNRT were significantly higher than that in men with AVNRT. However, no differences were found between the AVRT group and the control group. There were no differences between before and after radiofrequency ablation. Demographic details are listed in Tables 5 and 6.

DISCUSSION

AVNRT and AVNRT are the two most common forms of PSVT in clinical practice. The incidence and risk factors for cardiac arrhythmias differ between men and women (Porter et al., 2004). Compared to those with AVRT, the patients presenting with AVNRT were older (48.58 ± 16.31 vs 36.44 ± 16.73 years, $p < 0.05$). The female patients with AVNRT were older than the female and male patients with AVRT, and at the same time, they were older than the male patients with AVNRT; but there were no

differences regarding the age of male AVNRT patients with AVRT patients. The distribution of PSVT mechanism was significantly influenced by gender. In AVNRT, 66% were women and 34% were men.

In AVRT, 63% were men and 37% were women. The majority of patients with AVRT were men whereas the majority of patients with AVNRT were women. These results are consistent with previous findings (Porter et al., 2004), sex hormones may be a cause. Experimental studies suggest that sex hormones may influence the electrophysiologic properties of the AV node (Saba et al., 2002). In clinical practice, this effect is supported by the relation between tachycardia occurrence and the phase of the menstrual cycle in women. Rosano et al. found that, the frequency and duration of tachycardia episodes were positively correlated with progesterone levels and inversely correlated with β -estradiol levels.

The occurrence of tachycardia increased during the luteal phase of the menstrual cycle compared with the ovulatory stage (Rosano et al., 1996). Myerburg et al. (1999) studied AVNRT induction in women with the perimenstrual clustering of tachycardia episodes. They found that although dual AV node physiology could be repeatedly demonstrated during the menstrual cycle, the probability of tachycardia induction was greater during the

Table 6. The dimensions of EPQ-R short scale for males and females for the three samples after RF.

	Control		AVNRT		AVRT	
	M (n=22)	F (n=28)	M (n=104)	F (n=204)	M (n=187)	F (n=112)
P	7.40±2.33	6.82±2.41	7.08±2.72	7.52±2.64	7.44±1.68	7.51±2.64
E	9.80±4.64	9.34±4.31	9.45±2.33	9.51±1.29	8.78±2.44	9.65±2.69
N	8.92±4.59	9.36±5.08	9.67±2.64	12.84±2.87*▲	8.71±2.64	10.03±2.58
L	15.35±2.73	15.95±3.65	14.32±1.17	15.91±2.13	15.11±2.53	14.58±2.33

*P<0.01, women in AVNRT group vs. both sexes in AVRT group and control group; ▲P<0.05, woman in AVNRT group vs. man in AVNRT group.

premenstrual phase or at the onset of menses. These findings suggest that even when dual AV node physiology exists, AVNRT occurrence can be modulated by sex hormonal factors. In line with this concept, most women with concomitant heart disease, experienced their first episodes of tachycardia before menopause. Experimental studies support a direct hormonal effect on the expression and function of cardiac ion channels, thus providing a possible explanation for the gender-linked differences in cardiac electrophysiologic parameters but we found that, the female patients with AVNRT were older than the other patients. The underlying mechanism of these findings is unclear, whether these effects are a result of sex hormones, cellular electrophysiologic effects or of some factor not yet described, is unknown.

It is well-known that depressed patients show an increased risk for a number of cardiovascular complications, including ischemic heart disease (Rowan et al., 2005; Alim et al., 2009), serious ventricular arrhythmias (Hemingway et al., 2001) and sudden cardiac death (Luukinen et al., 2003). Neurotism appears to affect the frequency of restenosis (Betkowska-Korpala et al., 2000). Some authors have demonstrated significant alterations of the QT interval in clinical cohorts of psychiatric patients, including subjects with social phobia (Nahshoni et al., 2004), panic disorder (Yeragani et al., 2000) and major depression (Nahshoni et al., 2000). Neuroticism scores independently predicted QT interval duration, in apparently healthy men (Minoretta et al., 2006). Eaker et al. reported an association between anger and hostility but not type A behavior, and the development of atrial fibrillation (Paquette et al., 2000). Hemelsa et al. (2006) investigated that patients with paroxysmal atrial fibrillation would appear to have on the average, a "normal" degree of neuroticism. These findings highlight the possibility that, a relation exists between tachycardia occurrence and personality.

AVNRT and AVRT are two main arrhythmias seen in clinical practice. The incidence for cardiac arrhythmias differs between men and women. However, no studies have assessed whether a relation exists between AVNRT and AVRT and personality. EPQ-P is regarded as a genetically based dimension that reflects aggressiveness,

hostility and characteristics that are "normal" aspects of what in the more extreme would result in a clinical diagnosis of "psychosis." Antisocial behaviors and impulsivity are characteristics of people with high P scores. The primary component of EPQ-E is sociability. The extrovert is a carefree, easy-going person who is usually quite optimistic, whereas the introvert is a quite retiring person who appears reserved and cautious. A highly neurotic (EPQ-N) person is anxious, frequently worries, is moody and is often depressed.

Overly emotional, the neurotic may react strongly to a variety of stimuli. The low N individual may be called "stable" and is usually even tempered and controlled. Before radiofrequency ablation, the scores of N in patients with AVNRT were higher than the control group and the AVRT group, but there were no significance. The scores of N in women with AVNRT were significantly higher than that in the control group and the AVRT group, the scores of N in women with AVNRT were significantly higher than that in men with AVNRT.

However, no differences were found between AVRT group and the control group. After radiofrequency ablation, the scores of N in patients with AVNRT were higher than the control group and the AVRT group but there were no significance. The scores of N in women with AVNRT were significantly higher than that in the control group and the AVRT group, the scores of N in women with AVNRT were significantly higher than that in men with AVNRT. There were no differences before and after radiofrequency ablation. After radiofrequency ablation, the scores of N in patients with AVNRT were higher than the control group and the AVRT group but there were no significance. The scores of N in women with AVNRT were significantly higher than that in the control group and the AVRT group, the scores of N in women with AVNRT were significantly higher than that in men with AVNRT. However, no differences were found between AVRT group and control group. After radiofrequency ablation, the scores of N in patients with AVNRT were higher than the control group and the AVRT group but there were no significance. The scores of N in women with AVNRT were significantly higher than that in the control group and the AVRT group, the scores of N in

women with AVNRT were significantly higher than that in men with AVNRT. There were no differences before and after radiofrequency ablation.

An accessory pathway (AP) is a strand of myocardium that acts as an additional electrical connection between atrium and ventricle at a site around the mitral or tricuspid valve annulus. Two-thirds of APs conduct only in the retrograde direction, from ventricle to atrium and are called concealed APs. Women with AVNRT appear to have a higher degree of neuroticism. The classic hallmark of AVNRT is dual AV node physiology, when it is possible to demonstrate two anatomically and functionally distinct areas of perinodal atrial tissue ('fast pathway' and 'slow pathway') that form the atrial inputs into the AV node. Typically, the fast pathway has a faster conduction velocity and longer refractory period. During sinus rhythm, the fast pathway dominates and governs the time taken for the impulse to enter and travel through the AV node. Both pathways have plenty of time to recover before the next sinus impulse reaches them. A premature beat, however, may catch the fast pathway while it is still refractory.

If the slow pathway, which has the shorter refractory period, has recovered, the impulse is conducted slowly into the AV node and on to the ventricle. If by this time the fast pathway has recovered, the impulse is able to turn around within the AV node and exit retrogradely, back through the fast pathway into the atrium, producing another P wave (echo beat). If this is subsequently conducted back down the slow pathway, tachycardia occurs (Betts et al., 2006).

The reason why women with AVNRT appear to have a higher degree of neuroticism is unclear. Neuroticism is a dimensional measure of an individual's tendency to experience negative emotions that are manifested at one extreme as anxiety, low mood, and hostility and at the other, as emotional stability. Reflecting a tendency toward states of negative affect, it, together with extraversion and psychoticism, constituted the three key dimensions of personality, according to Eysenck and Eysenck, and has been included in nearly all theories of personality. Neuroticism is also known to possess good psychometric properties of item and construct validity, stability and cross-cultural validation (Eysenck and Eysenck, 1985; Hettema et al., 2004).

Zobel et al. (2004) found that cortisol levels subsequent to Dex/CRH challenge were associated with neuroticism; high-neuroticism subjects revealed a higher HPA activation, increased excretion of cortisol and catecholamines. Catecholamines prolong the anterograde effective refractory period of the fast-conducting AV nodal pathway and increases the difference between the refractory period of the fast and slow conducting AV nodal pathway. When the difference of these refractory periods is reduced by the action of catecholamines, AVNRTs may be inducible, if the conduction velocity of the slow conducting AV nodal

pathway is reduced by the effect of catecholamines and if the retrograde conduction is improved.

Conclusion

Atrioventricular nodal reentry tachycardia (AVNRT) is the most common type of reentrant supraventricular tachycardia (SVT). After radiofrequency ablation, the scores of N in patients with AVNRT were higher than the control group and the AVRT group but there was no significant difference. The scores of N in women with AVNRT were significantly higher than those in the control and the AVRT group and than that in men with AVNRT.

However, no statistical differences were found between AVRT and control groups. There were no differences between before and after radiofrequency ablation. Women with AVNRT appear to suffer from a higher degree of neuroticism. This may be the reason why the majority of patients with AVNRT were women. Psychological intervention should be a part of the therapy in patients with SVT, especially in women.

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