Clinical and electrophysiological characteristics in patients with atrioventricular reentrant and atrioventricular nodal reentrant tachycardia

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Aim To compare clinical, electrophysiological characteristics and transcatheter ablation results between two groups of patients, one with atrioventricular reentrant tachycardia (AVRT) and the other with atrioventricular nodal reentrant tachycardia (AVNRT).

Methods The study population consisted of 94 consecutive patients who underwent endocavitary electrophysiological study and radiofrequency (RF) ablation: 46 patients had AVRT due to an accessory pathway with only retrograde conduction while 48 patients had AVNRT.

Results In relation to general and clinical characteristics, differences between the two groups emerged regarding the age of symptom onset (25 ± 16 vs 37 ± 17 years, \( p = 0.001 \)), the prevalence of heart disease (8 vs 31%, \( p = 0.001 \)) and the correct diagnosis on surface ECG (50 vs 79%, \( p = 0.001 \)). Clinical presentation was quite similar apart from a higher prevalence of fatigue and sweating in the AVNRT group. Transcatheter RF ablation therapy results were similar.

Conclusions Patients with AVRT have a lower mean age at arrhythmia symptom onset compared with those with AVNRT and have fewer associated cardiac abnormalities. Clinical presentation is quite similar as well as their outcome after ablation. A correct diagnosis by standard ECG is more frequent in AVNRT.

Key Words: Paroxysmal supraventricular tachycardia, cardiac electrophysiology, transcatheter radiofrequency ablation, atrioventricular reentrant tachycardia, atrioventricular nodal reentrant tachycardia.

Introduction

Atrioventricular nodal reentrant tachycardia (AVNRT) and atrioventricular reentrant tachycardia (AVRT) due to a concealed accessory pathway are the most common forms of paroxysmal tachycardias and together represent about 90% of regular supraventricular tachycardias (SVT)². In patients undergoing endocavitary electrophysiological studies, AVNRT are seen in about 70% of cases, AVRT due to a concealed accessory pathway in 20% and the remainder are atrial tachycardias². Although these arrhythmias have long been known, there are relatively few studies in the literature that compare, in a systematic way, their clinical and electrophysiological characteristics². Moreover, the large majority of these studies consider as a single group patients with AVRT due to a concealed accessory pathway and patients with AVRT by manifest accessory pathways; the latter group probably present a more complex symptomatic profile due to a greater tendency to develop atrial fibrillation episodes².²

The aim of the study was to compare clinical, electrophysiological characteristics and transcatheter ablation results in two groups of patients, one with AVRT due to a concealed accessory pathway and the other with AVNRT.
Methods

Study population

From January 1999 to June 2000, 46 consecutive patients with AVRT due to a concealed accessory pathway underwent electrophysiological study and radiofrequency (RF) catheter ablation at our hospitals. Their clinical and electrophysiological characteristics were compared with a group of 48 consecutive patients with AVNRT who were studied at the same centres during the year 2000. All patients were seen 3 and 6 months after the procedure. They underwent an additional ablation procedure if a tachycardia relapse occurred.

Electrophysiological study

All patients gave their informed consent and were not under sedation during the procedure. Antiarrhythmic therapy was suspended before the study for a period equal to five half-lives of the drug. Two tetrapolar electrocatheters were introduced via the femoral vein and positioned under fluoroscopic guidance at the top of the right atrium, on the His bundle and successively at the right ventricular apex. A decapolar catheter was placed into the coronary sinus via the antecubital or subclavian vein. Intracardiac signals were amplified and filtered from 30 to 500 Hz and were recorded and analyzed by a digital polygraph system. All patients underwent incremental and programmed atrial–ventricular stimulation protocols in order to evaluate antegrade–retrograde conduction and tachycardia induction. The accessory pathway was defined as concealed if there was no ventricular preexcitation in sinus rhythm, during right and left atrial stimulation, after 20 mg i.v. adenosine infusion and antegrade conduction showed decremental characteristics during incremental atrial pacing. If the tachycardia could not be induced at baseline, we repeated the study after isoprenaline infusion.

Radiofrequency ablation

The ablation procedure was performed using deflectable quadripolar catheters with a distal electrode of 4 mm and an interelectrode space of 2 mm and temperature controlled RF generators. Right concealed accessory pathways were reached by the femoral vein approach while for those on the left we used either the transeptal catheterization or the transaortic retrograde approach. A RF power of 50 W and a temperature of 65°C were set during the ablations for a period of time of 45 s for accessory pathways and 20 s for AVNRT; the power output was titrated during RF application. Procedural endpoints for patients with AVRT were complete disappearance of the accessory pathway during ventricular pacing and inability to induce the tachycardia. In patients with AVNRT we performed catheter ablation targeting the slow nodal pathway, characterized by low amplitude and fragmented potential, located in most cases at the base of Koch’s triangle[15]. In this case the appearance of accelerated junctional rhythm during RF pulses was sought, but the endpoint consisted in the inability to restart the AVNRT even after isoprenaline infusion.

Statistical analysis

Obtained results are expressed as mean ± SD. Comparison between continuous variables were performed by the Student t test while proportion comparison was performed by the Fischer exact test.

Results

General and clinical characteristics

According to the general and clinical characteristics (Table 1) patients with AVRT were younger at symptom onset, had a lower prevalence of associated heart disease and a lower percentage of correct diagnosis of the arrhythmia made on surface ECG. The symptomatic profile during the tachycardia episodes (Table 2) and the presence of precipitating factors such as physical activity, emotional stress and postural changes did not differ between the two groups, with the exception of fatigue and sweating.

Electrophysiological characteristics

Significant electrophysiological characteristics differences were seen regarding: AH interval, antegrade Wenckebach point, modality of induction of the tachycardias during electrophysiological study and induced tachycardia cycle length (Table 3). Sustained atrial fibrillation induction did not differ between the two groups. No patient had dual diagnoses (inducibility of both types of tachycardia). We did not evaluate in a systematic way possible differences between the two groups regarding intra–inter atrial conduction properties. The concealed accessory pathways were located on the left side in 93% of the cases and in the remaining 7% on the right side. None of them showed decremental type conduction patterns.

Catheter ablation results, procedural complications, tachycardia recurrence

Using the same number of energy applications, catheter ablation success rate was similar in the two groups. Procedural complications were observed in a similar percentage of patients procedure-related complications were observed 4% in those with a concealed accessory pathway.
pathway (one transient cerebral ischaemic attack and one episode of ventricular fibrillation, induced by a burst of premature ventricular complexes in a patient with ischaemic heart disease during catheter manipulation) and 2% in patients with AVNRT (one transient atrioventricular block). There were no late complications. During the 12 month follow-up period tachycardia recurrence was similar in the two groups; these patients underwent a successful additional procedure (Table 3).

**Discussion**

The aim of the present study was to compare clinical and electrophysiological characteristics between two groups of consecutive patients, one with AVRT due to concealed accessory pathway and the other with AVNRT. The main results of the study can be summarized as follows.

 Patients with AVRT had a lower mean age at the arrhythmia symptom onset compared with those with AVNRT and this finding is similar to that found by other authors [3,5,8–10,16]. The reason is not precisely known but it seems to be due to the fact that AVRT has a well defined circuit tachycardia, which is congenital and, therefore, has a greater probability of earlier activation, while AVNRT may require more time before the circuit pathways (slow nodal pathway, fast nodal pathway and perinodal atrium) acquire the electrophysiological properties necessary to allow sustained reentry.

We observed a greater prevalence of organic heart disease (especially the ischaemic-hypertensive type) in patients with AVNRT. This finding was confirmed by other studies where, on average, 45% of the patients with AVNRT and 18% with AVRT had heart disease [3,8,10]. This can possibly be explained by the fact that patients with AVNRT were older.

A greater number of AVNRT were recognized on the surface ECG compared with AVRT. To distinguish the two types of tachycardia we did not use any particular algorithms [17] but only the RP interval duration (a value $\leq 70$ ms was indicative of nodal tachycardia and $\geq 70$ ms of concealed tachycardia). In our study population, many cases of AVRT had a RP interval of nearly 70 ms and were erroneously classified as AVNRT. The difficulty in correctly identifying the retrograde P wave could have contributed to this diagnostic error.

Although fatigue and sweating were seen more frequently in patients with AVNRT, the symptomatic profiles of the tachycardia were similar in the two groups. In particular we did not see any significant difference in the incidence of the episodes associated with haemodynamic instability and syncope. Haemodynamic deterioration induced by the tachycardia was correlated with a higher heart rate and atrial contraction with atioventricular valves closed which are more commonly seen in tachycardias with VA $<200$ ms and

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**Table 1 Patients' general and clinical characteristics**

<table>
<thead>
<tr>
<th></th>
<th>AVRT 46 patients</th>
<th>AVNRT 48 patients</th>
<th>p</th>
</tr>
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<tbody>
<tr>
<td>Gender, males</td>
<td>65%</td>
<td>50%</td>
<td>ns</td>
</tr>
<tr>
<td>Heart disease</td>
<td>8%</td>
<td>31%</td>
<td>=0.01</td>
</tr>
<tr>
<td>Age of onset of PSVT (years)</td>
<td>25 ± 16</td>
<td>37 ± 17</td>
<td>=0.001</td>
</tr>
<tr>
<td>Age at ablation (years)</td>
<td>48 ± 14</td>
<td>53 ± 16</td>
<td>ns</td>
</tr>
<tr>
<td>Symptom duration (years)</td>
<td>22 ± 16</td>
<td>17 ± 13</td>
<td>ns</td>
</tr>
<tr>
<td>Annual incidence of PSVT</td>
<td>13 ± 21</td>
<td>24 ± 67</td>
<td>ns</td>
</tr>
<tr>
<td>PSVT incidence in the past 12 months</td>
<td>38 ± 68</td>
<td>51 ± 100</td>
<td>ns</td>
</tr>
<tr>
<td>Correct ECG diagnosis*</td>
<td>50%</td>
<td>79%</td>
<td>=0.001</td>
</tr>
<tr>
<td>Minimal PSVT duration (mn.)</td>
<td>16 ± 28</td>
<td>16 ± 23'</td>
<td>ns</td>
</tr>
<tr>
<td>Maximal PSVT duration(mn.)</td>
<td>237 ± 515'</td>
<td>238 ± 304'</td>
<td>ns</td>
</tr>
<tr>
<td>Precipitating factors</td>
<td>30%</td>
<td>35%</td>
<td>ns</td>
</tr>
<tr>
<td>Spontaneous atrial fibrillation episodes</td>
<td>11%</td>
<td>8%</td>
<td>ns</td>
</tr>
</tbody>
</table>

AVRT, atrioventricular reentrant tachycardia; AVNRT, atrioventricular nodal reentrant tachycardia; PSVT, paroxysmal supraventricular tachycardia.

*Diagnosis was based on RP interval evaluation: tachycardia with RP $<70$ ms was classified as AVNRT; tachycardia with RP $\geq 70$ ms was classified as AVRT.

**Table 2 PSVT symptom profile**

<table>
<thead>
<tr>
<th></th>
<th>AVRT 46 patients</th>
<th>AVNRT 48 patients</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palpitation</td>
<td>100%</td>
<td>100%</td>
<td>ns</td>
</tr>
<tr>
<td>Fatigue</td>
<td>24%</td>
<td>59%</td>
<td>=0.001</td>
</tr>
<tr>
<td>Dyspnoea</td>
<td>26%</td>
<td>46%</td>
<td>ns</td>
</tr>
<tr>
<td>Presyncope</td>
<td>50%</td>
<td>60%</td>
<td>ns</td>
</tr>
<tr>
<td>Syncope</td>
<td>8.7%</td>
<td>8.3%</td>
<td>ns</td>
</tr>
<tr>
<td>Headache</td>
<td>2%</td>
<td>6%</td>
<td>ns</td>
</tr>
<tr>
<td>Feeling warm</td>
<td>4.3%</td>
<td>6.2%</td>
<td>ns</td>
</tr>
<tr>
<td>Confusion</td>
<td>6.5%</td>
<td>4.1%</td>
<td>ns</td>
</tr>
<tr>
<td>Sweating</td>
<td>10.8%</td>
<td>37.5%</td>
<td>=0.006</td>
</tr>
<tr>
<td>Chest discomfort</td>
<td>21.7%</td>
<td>39.6%</td>
<td>=0.014</td>
</tr>
</tbody>
</table>

AVRT, atrioventricular reentrant tachycardia; AVNRT, atrioventricular nodal reentrant tachycardia; PSVT, paroxysmal supraventricular tachycardia.
therefore in patients with AVNRT\textsuperscript{[18]} However, this was not confirmed in our study population. In accordance with our findings, Wood et al.\textsuperscript{[10]} noticed that the incidence of syncope was similar in the two types of tachycardia (16% in patients with AVNRT and 27% in patients with AVRT; \( p = \text{ns} \)) and was significantly correlated with a heart rate \( \geq 170 \text{ bpm} \). It is, however, probable, as recently suggested\textsuperscript{[19]}, that syncope during tachycardia is due to vasovagal activation and that an altered cardiovascular reflex status plays a more important role in determining episodes of syncope during tachycardia than the heart rate and the tachycardia mechanism.

Regarding the electrophysiological characteristics, some differences between the two groups were seen in AH intervals, antegrade Wenckebach cycle and induced tachycardia cycle length. A multivariate analysis was not performed, but it is possible that these differences derived from the different age of the two groups of patients and were not correlated with the mechanism of the arrhythmia. There were no significant differences regarding other characteristics, such as gender, annual incidence, incidence during the year prior to ablation (a significant increase was observed in both groups), duration of the tachycardia episodes, precipitating factors, association with spontaneous episodes of atrial fibrillation, rate of catheter ablation success, procedural complication and late recurrence of the tachycardia. These findings are consistent with those reported in the literature\textsuperscript{[5,7,10,13,20,21]}

**Study limitation**

This study was conducted with a relatively small number of patients and this could have rendered some differences insignificant between the two groups. Patient history was taken in some cases years after the beginning of the symptoms and might have been incorrectly given by the patient. The study was conducted in tertiary arrhythmological centres where the majority of patients are more symptomatic and refractory to pharmacological therapy and, therefore, may not reflect the true natural history of patients with these types of tachycardia in the general population.

**References**


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