Idiopathic Ventricular Tachycardia in Children
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Ventricular tachycardia (VT) in childhood is rare and the rate of idiopathic VT (IVT) is high.1-2 In adults, most cases of VT are VT-associated ischemic heart disease, and IVT accounts for 10–20% of VT cases.3,4 Roggen et al reported the frequency of spontaneous VT in a pediatric population: 27 patients detected among 25,200 children aged <16 years, being a VT incidence of 1.1 episodes/100,000 childhood years; 13 patients (48%) had IVT, 3 had electrical heart disease, 11 had structural heart disease.1 The incidence of VT detected in children by school-based heart disease screening (ECG recording while at rest) in Japan was 0.2–0.8/10,000 children, and among 48 patients with VT detected by such screening, 2 had structural heart disease and the other 46 patients had IVT. They were thought to be healthy before the screening, and the majority of cases were asymptomatic non-sustained VT.2 VT usually has a benign course, and it has been observed that between 46% and 65% of patients after a certain duration of follow-up are completely free of any arrhythmia (Table).3,5,6 In particular, onset at infancy, monomorphic type, maximum runs of premature ventricular contractions <5 and catheter ablation are related to successful resolution of VT.7

Cardiac causes of VT in childhood are operated congenital heart disease, cardiomyopathies (dilated and hypertrophic cardiomyopathy; ARVC), myocarditis, cardiac tumor, long QT syndrome, CPVT, Brugada syndrome and electrolyte/metabolic disturbances. The clinical prognosis of pediatric VT differs according to the etiology of VT. Song et al reported that logistic regression analysis revealed that CPVT, cardiomyopathy-associated VT, polymorphic VT and sustained VT were significantly correlated with death and cardiac arrest.8 It is important to differentiate idiopathic RVVT from VT associated ARVC, which has a worse prognosis and is responsible for sudden death in the young and for which VT may be the only initial manifestation in the early phase.

The majority of the reports of IVT in pediatric patients include the clinical features and prognosis, but electrophysiological findings have not been reported except in a few studies including Fukuhara et al’s report.9 Generally, IVT in childhood and in the young is highly related to exercise and this could be characteristic of these ages. The mechanism of exercise-related VT is known to be triggered activity, but Fukuhara et al showed that variant mechanisms (not only triggered activity but also automaticity and reentry) present in this arrhythmia.8 Owing to technological advances in mapping and catheter ablation, the mechanisms and anatomical locations of IVT have been recognized in detail.9 VT arising from the right and left ventricular outlet tracts (RVOT, LVOT) has similar characteristics because of a common embryonic origin. The arrhythmogenic mechanism of RVOT and LVOT arrhythmias is cyclic AMP-mediated (adenosine sensitive) triggered activity.10 Other categories of IVT arising from the LV are reentry (verapamil sensitive) and automaticity (propranolol sensitive). Fascicular VT is known to be verapamil sensitive, and the mechanism is reentry with an excitable gap and zone of slow conduction. Most of the episodes occur at rest, but can be triggered by exercise and emotional stress.9 Adrenergic monomorphic VT is also referred as propranolol-sensitive automatic VT, and is thought to be automatic rhythms arising from within the Purkinje fibers.9 Recognition of the various forms of IVT and understanding the mechanisms are important for appropriate management.

Electrophysiological study and catheter ablation in children present some difficulties, because of their small bodies and lower induction rate with general anesthesia. A smaller sized mapping system would lead to higher success and safety. OTVT and fascicular VT are good indications for catheter

Table. Clinical Studies on Idiopathic Ventricular Tachycardia in Children

<table>
<thead>
<tr>
<th>Study</th>
<th>Patients (n)</th>
<th>Age group (years)</th>
<th>Sustained VT (n)</th>
<th>Symptoms (% patients)</th>
<th>Mortality (n)</th>
<th>VT free in follow-up (% patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pfammatter et al, 1999</td>
<td>98</td>
<td>0–16</td>
<td>36</td>
<td>36</td>
<td>0</td>
<td>65</td>
</tr>
<tr>
<td>Tsuji et al, 1995</td>
<td>46</td>
<td>9.4±3.1</td>
<td>14</td>
<td>28</td>
<td>1</td>
<td>65</td>
</tr>
<tr>
<td>Iwamoto et al, 2005</td>
<td>46</td>
<td>5–15</td>
<td>3</td>
<td>5</td>
<td>0</td>
<td>60</td>
</tr>
<tr>
<td>Song et al, 2010</td>
<td>37</td>
<td>0–15</td>
<td>27</td>
<td>76</td>
<td>1</td>
<td>46</td>
</tr>
</tbody>
</table>

VT, ventricular tachycardia.
ablation also in childhood, because of the high success rate. Studying the anatomical location, electrophysiological characteristics and clinical substrate in children will lead to a high cure rate in pediatrics.

References