Long-Term Follow-Up of Idiopathic Ventricular Arrhythmias in Otherwise Normal Children

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Clinical characteristics and long-term prognosis of 163 children with ventricular arrhythmias without underlying heart diseases (78 with ventricular premature contractions (VPC group), 39 with ventricular couplets (CPLT group), and 46 with ventricular tachycardia (VT group)) were studied by Holter electrocardiographic monitoring (Holter ECG) and treadmill exercise testing. The age of the subjects at the initial examination was 8.9±3.4 years in the VPC group, 9.9±3.5 years in CPLT group, and 9.4±3.1 years in the VT group. The duration of the follow-up was 71.7±32.1 months in the VPC group, 65.9±32.8 months in the CPLT group, and 84.0±31.9 months in the VT group.

VPC’s disappeared during the follow-up period in 22 (28%) of the 78 children in the VPC group. CPLT’s disappeared in 15 (38%) and VPC’s disappeared in 9 (23%) of the 39 children in the CPLT group. In the 46 children in the VT group, VT disappeared in 30 (65%), and VPC’s disappeared in 17 (37%). One child (2%) in the VT group died of heart failure due to drug-resistant sustained VT. The mean time until the disappearance of VPC’s in the 163 patients was estimated to be 115.2±4.3 months. The mean time until the disappearance of VT in the 46 children in the VT group was estimated to be 89.0±4.9 months.

Multivariate analysis of prognostic factors related to the disappearance of VPC’s indicated that nighttime VPC’s were significantly more likely to disappear (p=0.018), and that symptomatic VT was significantly more likely to disappear than asymptomatic VT (p=0.032), probably because more symptomatic cases received antiarrhythmic therapy.

Ventricular arrhythmias in children without underlying diseases often disappeared, and the prognosis was generally favorable. However, appropriate treatment and follow-up were required in children with sustained VT, symptomatic VT, or VT with a high rate of VT. (Jpn Circ J 1995; 59: 654—662)

According to recent Holter electrocardiographic evaluations1—5 ventricular premature contractions (VPC’s) are observed in 18—50% of healthy children, and this percentage increases with age2,6 Complex VPC’s of Lown’s grade 3 or higher are also seen in 4—16% of children2,4,5,7,8 The prognosis of idiopathic ventricular arrhythmias is considered to be generally favorable, but there are few reports on their long-term prognosis in children. In this study, clinical characteristics and long-term prognosis of

Key words: Idiopathic ventricular arrhythmia Holter ECG Treadmill exercise testing Long-term prognosis

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Children with idiopathic ventricular arrhythmias, but without underlying heart diseases, were evaluated by Holter ECG and a treadmill exercise testing. Prognostic factors related to the disappearance of VPC's and ventricular tachycardia (VT) were also studied by multivariate analysis using proportional hazards models.

METHODS

**Patient Selection**

The subjects consisted of 163 children with ventricular arrhythmias in whom 1,000 or more VPC's were observed in 1 day by Holter ECG, or reproducible ventricular couplets (CPLT's) or VT were observed by Holter ECG or treadmill exercise testing, who could be followed periodically for at least 2 years (except for 1 patient who died after a follow-up of 8 months) and who yielded relatively assessable Holter ECG. The records of these patients were examined retrospectively. Underlying heart diseases were excluded in all of these patients by non-invasive evaluation including physical examination, standard 12-lead electrocardiogram (standard ECG), chest x-ray, and echocardiography. Children in whom the QT interval was prolonged in a standard ECG (QTc > 0.45) were also excluded.

**Study Groups**

The patients were divided into three groups: 78 children (45 males and 33 females) in whom only VPC's were observed throughout the follow-up period (VPC group), 39 children (16 males and 23 females) consisting of 29 who showed CPLT's at the initial examination and 10 who showed only VPC's at the initial examination but later showed CPLT's (CPLT group), and 46 children (27 males and 19 females) consisting of 37 who showed VT at the initial examination, 4 who showed only VPC's at the initial examination but later showed VT, and 5 who showed CPLT's at the initial examination but later showed VT (VT group) (Fig. 1).

**Follow-up Methods**

Holter ECG or treadmill testing was performed on outpatient visits at intervals of 3 months to 2 years, and ventricular arrhythmias were considered to have disappeared when they were completely absent on two consecutive examinations.

**Definitions**

The frequency of VPC's was expressed as
TABLE I CLINICAL AND ELECTROCARDIOGRAPHIC FEATURES IN EACH GROUP

<table>
<thead>
<tr>
<th></th>
<th>VPC (n=78)</th>
<th>CPLT (n=39)</th>
<th>VT (n=46)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>45 (58%)</td>
<td>16 (41%)</td>
<td>27 (59%)</td>
<td>N.S</td>
</tr>
<tr>
<td>Age (years)</td>
<td>8.9±3.4</td>
<td>9.9±3.5</td>
<td>9.4±3.1</td>
<td>N.S</td>
</tr>
<tr>
<td>VPC/THB* (%)</td>
<td>10.0±8.9</td>
<td>13.0±9.5</td>
<td>18.9±18.6</td>
<td>P&lt;0.01</td>
</tr>
<tr>
<td>Site of origin of VPC's</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RV</td>
<td>46 (59%)</td>
<td>29 (74%)</td>
<td>34 (74%)</td>
<td>N.S</td>
</tr>
<tr>
<td>LV</td>
<td>30 (38%)</td>
<td>4 (10%)</td>
<td>6 (13%)</td>
<td>P&lt;0.01</td>
</tr>
<tr>
<td>Multiform</td>
<td>2 (3%)</td>
<td>6 (16%)</td>
<td>6 (13%)</td>
<td>N.S</td>
</tr>
<tr>
<td>Type of VPC occurrence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All-day</td>
<td>56 (72%)</td>
<td>30 (77%)</td>
<td>23 (50%)</td>
<td>N.S</td>
</tr>
<tr>
<td>Day</td>
<td>16 (21%)</td>
<td>8 (20%)</td>
<td>22 (48%)</td>
<td>N.S</td>
</tr>
<tr>
<td>Night</td>
<td>6 (8%)</td>
<td>1 (3%)</td>
<td>1 (2%)</td>
<td>N.S</td>
</tr>
<tr>
<td>Exercise-related</td>
<td>3 (4%)</td>
<td>9 (23%)</td>
<td>30 (65%)</td>
<td>P&lt;0.01</td>
</tr>
<tr>
<td>Symptomatic cases</td>
<td>2 (3%)</td>
<td>2 (5%)</td>
<td>13 (28%)</td>
<td>P&lt;0.01</td>
</tr>
<tr>
<td>Treated cases</td>
<td>2 (3%)</td>
<td>4 (10%)</td>
<td>33 (72%)</td>
<td>P&lt;0.01</td>
</tr>
<tr>
<td>Observation Period (months)</td>
<td>71.9±32.1</td>
<td>67.1±34.2</td>
<td>84.0±31.9</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Number of examinations</td>
<td>3.8±1.4</td>
<td>4.0±1.8</td>
<td>10.1±4.9</td>
<td>P&lt;0.01</td>
</tr>
<tr>
<td>Disappearance of VPC's</td>
<td>22 (28%)</td>
<td>9 (23%)</td>
<td>17 (37%)</td>
<td>N.S</td>
</tr>
<tr>
<td>Deaths</td>
<td>0</td>
<td>0</td>
<td>I (2%)</td>
<td></td>
</tr>
</tbody>
</table>


*VPC/THB: initial total number of VPC's per day: total number of heart beats per day by Holter electrocardiogram.

a percentage of the number of VPC's to the total number of heart beats (THB) per day (VPC/THB %). VPC's, CPLT's, and VT were considered to have originated from the right ventricle when the QRS morphology showed a left bundle-branch block pattern, from the left ventricle when it showed a right bundle-branch block pattern, and to be multiform when it showed two or more clearly different patterns.

VPC's, CPLT's, and VT were considered to be of the daytime type when 70% or more of the total number per day were recorded when the patients were awake, to be of the nighttime type when 70% or more of the total number per day were recorded when the patients were asleep, and to be of an all-day type when they did not fall into either of the other two categories.

VPC's, CPLT's, or VT observed during exercise or within one minute after exercise were regarded as exercise-related.

VPC's occurring in 3 or more consecutive beats at a rate of 120/min or higher were regarded as VT. VT was considered sustained when it persisted for 30 sec or longer or when VPC's continued for 100 or more consecutive beats, and as non-sustained otherwise.

Statistical Analysis

Group data are presented as the mean± standard deviation. The differences between the mean values of two groups were examined by Student's t-test, differences between the mean values of three groups were examined by the Kruskal-Wallis test, and differences between ratios were examined by the chi-square test or Fisher's exact probability test. The persistence rates and the mean periods of persistence, i.e. the mean period until the disappearance of VPC's and VT, were calculated from Kaplan-Meier's survival curves using the disappearance of VPC's and VT as the end-point. Multivariate analysis was performed using proportional hazards models to evaluate the relationships between the disappearance of VPC's and VT to various prognostic factors.

RESULTS

Clinical Features

The patients ranged in age from 1 month to 18 years (9.3±3.4 years). As shown in Table I, there was no significant difference.
TABLE II  RELATION BETWEEN SYMPTOMS AND ELECTROCARDIOGRAPHIC CHARACTERISTICS OF VT

<table>
<thead>
<tr>
<th>VT rate (min)</th>
<th>&lt;150</th>
<th>150-199</th>
<th>200&lt;</th>
<th>sustained</th>
<th>non-sustained</th>
<th>exercise-related</th>
<th>exercise-unrelated</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=23 (50%)</td>
<td>n=14 (30%)</td>
<td>n=9 (20%)</td>
<td>n=14 (30%)</td>
<td>n=32 (70%)</td>
<td>n=30 (65%)</td>
<td>n=16 (35%)</td>
<td></td>
</tr>
<tr>
<td>asymptomatic</td>
<td>22 (96%)</td>
<td>8 (57%)</td>
<td>3 (33%)</td>
<td>6 (43%)</td>
<td>27 (84%)</td>
<td>19 (63%)</td>
<td>14 (87%)</td>
</tr>
<tr>
<td>palpitation</td>
<td>1 (4%)</td>
<td>2 (14%)</td>
<td>3 (33%)</td>
<td>4 (29%)</td>
<td>2 (6%)</td>
<td>6 (20%)</td>
<td>0</td>
</tr>
<tr>
<td>chest pain</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1 (7%)</td>
<td>1 (3%)</td>
<td>2 (7%)</td>
<td>0</td>
</tr>
<tr>
<td>heart failure</td>
<td>0</td>
<td>0</td>
<td>1 (11%)</td>
<td>3 (21%)</td>
<td>1 (3%)</td>
<td>2 (7%)</td>
<td>2 (13%)</td>
</tr>
<tr>
<td>syncope</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1 (3%)</td>
<td>1 (3%)</td>
<td>0</td>
</tr>
</tbody>
</table>

Fig.2. Persistence rate of ventricular premature contraction by the Kaplan-Meier method

in the sex ratio or the mean age among the three groups.

Arrhythmias were detected by mass-screening for heart disease in school in 125 (77%), incidentally during examination by a physician in 31 (19%), and due to symptoms in 7 (4%) of the 163 patients. Six of the 7 patients in whom arrhythmias were detected due to symptoms had VT, which was sustained in 3 and non-sustained in the remaining 3. The 3 patients with non-sustained VT showed a VT rate of 200/min or higher.

Electrocardiographic Features

At the initial Holter ECG examination, VPC/THB was significantly different among the three groups, and was higher in the CPLT and VT groups (p<0.05). There was no significant difference in the incidence of arrhythmias of right ventricular origin among the three groups. However, arrhythmias of left ventricular origin were significantly more frequent in the VPC group (30/78, 38%) than in the other groups (p<0.01). There was no difference in the percentage of multi-form VPC’s among the three groups. Arrhythmias were frequently of the all-day type and infrequently of the nighttime type in all three groups, although these differences were not significant. In the VT group, the percentage of arrhythmias of the daytime type was higher than those in the other groups. The percentage of exercise-related arrhythmias was significantly higher in the VT group (p<0.01) (Table I).

Symptoms

Arrhythmias were symptomatic in 2 (3%) of the 78 patients in the VPC group (chest pain), 2 (5%) of the 39 patients in the CPLT group (chest pain), and 13 (28%) of the 46 patients in the VT group, with significant differences among the three groups (p<0.01) (Table I).

The percentage of symptomatic patients in the VT group was significantly higher (4/6, 67%) in those with VT of left ventricular origin (p<0.01).

VT was symptomatic in 11 (37%) of the 30 patients with exercise-related VT, as opposed to only 2 (13%) of the 16 patients with exercise-unrelated VT, but this difference was not significant. Eight (57%) of the 14 patients with sustained VT and 5 (16%) of the 32 patients with non-sustained VT were symptomatic (p<0.05). The rate of VT was less than 150 in 23 patients, of whom only one (4%) was symptomatic (palpitation). Of the 23 patients in whom the rate of VT was 150 or higher, 12 (52%) were symptomatic, and the percentage of symptomatic patients was significantly higher than that among patients in whom the rate of VT was
TABLE III MULTIVARIATE ANALYSIS OF PROGNOSTIC FACTORS FOR THE DISAPPEARANCE OF VPC's BY A PROPORTIONAL HAZARDS MODEL USING THE STATISTICAL ANALYSIS SYSTEM (SAS)

<table>
<thead>
<tr>
<th>Prognostic factor</th>
<th>hazard ratio</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex (male : female)</td>
<td>0.798</td>
<td>0.472</td>
</tr>
<tr>
<td>Age (&lt;12 years : &gt;12)</td>
<td>1.011</td>
<td>0.978</td>
</tr>
<tr>
<td>Symptoms (- : +)</td>
<td>0.963</td>
<td>0.871</td>
</tr>
<tr>
<td>Therapy (- : +)</td>
<td>1.801</td>
<td>0.274</td>
</tr>
<tr>
<td>VPC/THB* (every 10% increase)</td>
<td>0.774</td>
<td>0.093</td>
</tr>
<tr>
<td>Exercise (unrelated : related)</td>
<td>1.071</td>
<td>0.889</td>
</tr>
<tr>
<td>Site of origin (RV : multiform)</td>
<td>1.165</td>
<td>0.749</td>
</tr>
<tr>
<td>Type of occurrence (all-day : day)</td>
<td>1.898</td>
<td>0.071</td>
</tr>
<tr>
<td>(all-day : night)</td>
<td>3.841</td>
<td>0.018</td>
</tr>
<tr>
<td>Groups (VPC-G : CPLT-G)</td>
<td>0.836</td>
<td>0.682</td>
</tr>
<tr>
<td>(VPC-G : VT-G)</td>
<td>0.642</td>
<td>0.391</td>
</tr>
</tbody>
</table>

*VPC/THB: initial total number of VPC's per day/total number of heart beats per day by Holter electrocardiogram, Z: PH = -1.95 - 1.51.

less than 150 (p<0.01). Of the patients in whom the rate of VT was 150–199, 2 had chest pain, and 2 had heart failure (one of whom died). Of those in whom the rate of VT was 200 or higher, 2 had heart failure, and 1 had syncope. Patients with a higher VT rate tended to have more severe symptoms (Table II).

Therapies
Symptomatic arrhythmias, exercise-related arrhythmias, sustained VT, and VT with a high VT rate were treated. Pharmacological treatments were administered in 2 (3%) of the 78 patients in the VPC group, in 4 (10%) of the 39 patients in the CPLT group, and in 33 (72%) of the 46 patients in the VT group, with significant differences among the three groups (p<0.01) (Table I).

In the VT group, treatment was considered to have been effective when VT was completely absent in at least 2 consecutive Holter ECG or treadmill exercise tests. The percent effectiveness was high with class IC (propafenon) (4/6, 67%), class II (propranolol, carteolol, pindolol) (16/28, 57%), and class IV (verapamil) (11/14, 79%) agents using the Vaughan-Williams classification.

Follow-up Data
The follow-up period ranged from 8 months (death) to 165 months, and averaged 71.9±32.1 months in the VPC group, 67.1±34.2 months in the CPLT group, and 84.0±31.9 months in the VT group.

In the VPC group, VPC's disappeared during the follow-up period in 22 (28%) of the 78 patients. Two of these patients received medication (mexiletin in 1, and propranolol in 1), which has since been discontinued. Observation was discontinued in 12 of the 22 patients in whom VPC's disappeared (Fig. 1).

In the CPLT group, CPLT's disappeared in 15 of the 39 patients, and VPC's disappeared in 9 (23%). Four patients received medication (mexiletin in 2, and propranolol in 2), which has since been discontinued in 3 cases (Fig. 1).

In the VT group, VT disappeared during
TABLE IV  MULTIVARIATE ANALYSIS OF PROGNOSTIC FACTOR FOR THE DISAPPEARANCE OF VT BY A PROPORTIONAL HAZARDS MODEL USING THE STATISTICAL ANALYSIS SYSTEM (SAS)

<table>
<thead>
<tr>
<th>Prognostic factor</th>
<th>hazard ratio</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex (male : female)</td>
<td>0.731</td>
<td>0.634</td>
</tr>
<tr>
<td>Age (&lt;12 years : &gt;12)</td>
<td>2.010</td>
<td>0.161</td>
</tr>
<tr>
<td>Site of origin (RV : multiform)</td>
<td>0.652</td>
<td>0.464</td>
</tr>
<tr>
<td>Type of occurrence (all-day : day)</td>
<td>1.628</td>
<td>0.348</td>
</tr>
<tr>
<td>VPC/THB* (every 10% increase)</td>
<td>0.950</td>
<td>0.813</td>
</tr>
<tr>
<td>Therapy (− : +)</td>
<td>3.742</td>
<td>0.094</td>
</tr>
<tr>
<td>Exercise (unrelated : related)</td>
<td>2.341</td>
<td>0.151</td>
</tr>
<tr>
<td>Sustained (− : +)</td>
<td>2.20</td>
<td>0.160</td>
</tr>
<tr>
<td>Symptoms (+ : −)</td>
<td>0.391</td>
<td>0.032</td>
</tr>
</tbody>
</table>

*VPC/THB: initial total number of VPC's per day/total number of heart beats per day by Holter electrocardiogram, Z: PH = −0.97~0.75.

the follow-up period in 30 (65%) of the 46 patients. VPC's also disappeared in 17 (37%) of the 30 patients in whom VT disappeared. VT disappeared spontaneously without treatment in 4 of the 17 patients. Medication has been continued to date in only 2 patients (propranolol in 1, and verapamil in 1). Of the remaining 15 patients, 10 no longer receive medication, and 5 are no longer followed up. In 13 (28%) of the 30 patients, VT disappeared, but CPTL's or VPC's persisted, and 5 no longer receive medication. VT persisted in 15 (33%) of the 46 patients. Five of these patients are currently receiving medication (mexiletine in 1, propranolol in 1, verapamil in 2, and propafenon in 1), while the remaining 10 are asymptomatic and no longer receive medication (Fig. 1).

The patient who died of heart failure due to drug-resistant sustained VT was an 8-year-old boy who had sustained VT of the right bundle-branch block left-axis deviation with a VT rate of 188/min. VT of the all-day type progressed to heart failure and ventricular fibrillation, and the patient died after about 8 months. He was an early case, and was not given verapamil.

Statistical Analysis

The persistence curve of VPC's was constructed using the Kaplan-Meier method with the disappearance of VPC's as the endpoint (Fig. 2). The percentage of patients in whom VPC's persisted decreased with time. The time until the disappearance of VPC's was estimated to be 115.2 ± 4.3 months (mean ± SE) in all patients, 115.2 ± 6.4 months in the VPC group, 116.5 ± 9.4 months in the CPTL group, and 113.2 ± 5.8 months in the VT group, with no significant differences among the groups by a log-rank test. Therefore, multivariate analysis was performed to evaluate the contribution of factors such as sex, age, symptomatic (+ / −), treatment (− / +), number of VPC's in the initial Holter ECG, exercise-related (− / +), site of origin of the arrhythmias, temporal pattern of occurrence of the arrhythmias, and kind of arrhythmia, to the disappearance of VPC's. Since proportionality was maintained (Z: PH = −1.95~1.51), a proportional hazards model was used. VPC's tended to be resolved more readily in treated patients than in untreated patients, with a hazard ratio of 1.801, and in the daytime than in the all-day type, with a hazard ratio of 1.898, but these differences were not significant. Nighttime-type VPC's disappeared significantly more readily than all-day-type VPC's, with a hazard ratio of 3.841 (p = 0.018) (Table III).

In the VT group, there was no significant difference in the persistence rate of VT between the treated and untreated cases (p = 0.538) (Fig. 3). Therefore, multivariate analysis was performed regarding the prognostic factors for VT, similarly to those for VPC's, using a proportional hazards model (Z: PH = −0.97~0.75) (Table IV). VT in patients aged 12 years or above at the initial examination, VT in treated patients,
DISCUSSION

Clinical Features

Complex VPC’s are believed to occur more frequently as the frequency of VPC’s increases. Paul et al. reported that the frequency of isolated VPC’s was higher than 30/h by Holter ECG in 20 of 22 children who had CPTL without underlying heart disease. In this study, the frequency of VPC (VPC/THB) was significantly different among the three groups (p<0.05), with the CPTL and VT groups showing many VPC’s in the first day (Table I). CPTL & VT were often detected by Holter ECG, and, in some patients, although only VPC’s were observed on the initial Holter ECG or treadmill exercise testing CPTL’s & VT were also observed thereafter. Therefore, patients who show frequent VPC’s should be examined repeatedly for complex VPC’s by Holter ECG. VT has been reported to be induced in an exercise test in 5-11% of patients with isolated VPC’s. In this study, VT was often detected for the first time by the exercise test. Therefore, an exercise test, in addition to Holter ECG, is considered to be useful for detecting VT.

Sustained VT, exercise-related VT, and VT with a high rate of VT are often reported to be symptomatic. In this study, a significantly higher percentage of patients with sustained VT or VT rates of 150 or above were symptomatic, and the symptoms tended to be more severe with a higher rate of VT. These forms of idiopathic VT are considered to be of clinical importance and require careful follow-up and appropriate treatment.

Prognosis

Jacobsen et al. reported that VPC’s disappeared in the ECG’s of 9 (53%) of 17 children during a mean follow-up period of 7.2 years, and that the prognosis was favorable. Nishida et al. examined Holter ECG in 13 children with VPC’s and reported significant decreases in VPC’s in 6 and the disappearance of VPC’s in 4 (31%) during a mean follow-up period of 4 years.

In our study, VPC’s disappeared in 22 (28%) of the 78 patients in the VPC group during a mean follow-up period of 71.6 months. This percentage is lower than those in earlier reports, probably because VPC’s were considered to have disappeared when no VPC’s were observed on 2 consecutive Holter ECG or treadmill exercise testing. Since several factors are believed to be involved in the disappearance of VPC’s, multivariate analysis was conducted for factors considered to be related to the disappearance of VPC’s. VPC’s tended to disappear more readily when they were treated and when they were of the daytime type. Nighttime-type VPC’s were significantly more likely to disappear (p=0.018). Nishida et al. also reported that nighttime VPC’s are more likely to disappear. The parasympathetic tone during sleep reportedly decreases with age. This may be related to the finding that nighttime VPC’s which may involve parasympathetic activity were more readily resolved.

In the VPC group, only 2 patients (3%) were symptomatic (chest pain), and no severe symptoms or sudden deaths were observed. The prognosis of VPC’s without underlying heart diseases was favorable, as in earlier reports.

Paul et al. evaluated the prognosis of CPTL in 22 children with normal hearts by Holter ECG, and reported the disappearance of CPTL’s in 13 (59%) during a mean observation period of 2.5 years. Although 17 (77%) of the 22 patients were symptomatic, the symptoms were invariably mild, eg palpitation, with none showing transition from CPTL’s to VT. Based on these findings, they suggested that the prognosis of CPTL’s in normal hearts is favorable, as in VPC’s without underlying heart diseases.

In this study, only 2 (5%) of the 39 patients in the CPTL group were symptomatic (chest pain), and no severe symptoms or sudden deaths were noted. Therefore, the prognosis of CPTL’s was considered to be favorable. In our patients, VT appeared during the follow-up for CPTL’s in 5 patients, suggesting that careful follow-up is needed in cases of CPTL.
Idiopathic VT is generally considered to have a good prognosis, but severe symptoms and sudden deaths have also been reported. In this study, sustained VT and VT with a high VT rate were occasionally accompanied by severe symptoms, and these types of VT require careful follow-up and appropriate treatment. There have been reports that myocardial biopsy reveals myocardial disorders in many presumably idiopathic cases with no apparent underlying diseases. We did not obtain an autopsy in the patient who died, and the possibility of trivial pathological myocardial abnormalities could not be excluded. VT which is considered to be idiopathic may include that which is related to slight pathological abnormalities.

Multivariate analysis suggested that asymptomatic VT was significantly less likely to disappear than symptomatic VT (p < 0.05). Since more patients with exercise-related, sustained, or symptomatic VT were treated, VT is considered to have disappeared in a significantly higher percentage of these patients.

This study suggested that ventricular arrhythmias in children without underlying heart diseases are likely to disappear. However, the incidence of VPC's is believed to increase with age. The incidence of VPC's varies widely, depending on factors including the patient group, their age, and the method used to record the ECG (short-time record or Holter ECG). In addition, while VPC's disappear in many cases, they newly appear in surprisingly many cases. In individual cases, however, VPC's without underlying heart diseases are considered to be likely to disappear.

Clinical Implications

Clarification of the long-term prognosis of idiopathic ventricular arrhythmias could reduce the psychological and economic burdens on the patients and their parents by avoiding unnecessary examinations and treatments. If organic heart diseases can be excluded, treatment or long-term follow-up for sporadic VPC's (isolated and monomorphic) may be unnecessary, unless the patient is symptomatic. In addition, frequent VPC's, exercise-related VPC's, and CPLT's may be left untreated, unless they are symptomatic. Non-sustained VT and exercise-related VT need not be treated unless they are symptomatic but require careful follow-up. VT with a high rate of VT, sustained VT, and symptomatic VT must be treated appropriately and followed with care to prevent sudden death. These should also be evaluated for latent cardiac diseases.

CONCLUSIONS

Ventricular arrhythmias in children without underlying heart diseases disappeared in many cases, and their prognosis was generally favorable. VT may be associated with severe symptoms and requires careful follow-up. However, it is often resolved by appropriate treatment, and its prognosis is also considered to be generally favorable.

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