The Effect of Orthostatic Training in the Prevention of Vasovagal Syncope and Its Influencing Factors
Hui ZENG,¹ MD, Kanyi GE,¹ Weilun ZHANG,¹ Guang WANG,¹ MD, and Lijun GUO,¹ MD

SUMMARY
Recently orthostatic training has been proposed as an effective treatment for vasovagal syncope, even though some patients may relapse. This study was undertaken to assess the effect of orthostatic training on patients with vasovagal syncope and its influencing factors.

The study group comprised 125 consecutive patients (51 males and 74 females), aged 40 ± 19 years, with a history of syncope and a positive head-up tilt test. They were randomized into an orthostatic training group (64 patients) and a no treatment group (controls, 61 patients). The training programme consisted of daily 30-minute sessions of upright standing against a vertical wall 6 days a week for at least 4 weeks.

After one year of follow-up, 45 (72.6%) of 62 orthostatically trained patients reported no syncopal recurrence, while only 22 of 61 controls (36.1%, P < 0.05) reported the same. Furthermore, in the training group, the patients with recurrence were older, and the number of syncopal spells in the preceding year was less than in the patients with no recurrence in the same group.

Orthostatic training is an effective therapy for the prevention of vasovagal syncope. This kind of therapy was of greater benefit to patients who were younger or experienced frequent spells of syncope. (Int Heart J 2008; 49: 707-712)

Key words: Vasovagal syncope, Head-up tilt test, Orthostatic training

Vasovagal syncope is a relatively common cause of syncope characterized by a decline in blood pressure and/or bradycardia caused by excessive cardiac sympathovagal reaction. Head-up tilt testing is widely used to diagnose vasovagal syncope in patients with syncopal episodes. At present, there is no effective therapy for vasovagal syncope. Recent reports have shown that orthostatic self-training is a promising therapy for vasovagal syncopal patients in both short-term and long-term follow-up study,¹-⁴) while some patients still suffer from recurrence. We performed a follow-up interview in a cohort of 125 consecutive patients with a history of syncope and positive head-up tilt testing to test the efficacy of orthos-
tatic training in preventing syncope and to assess the factors that have an influence on the training effect.

**METHODS**

**Patients:** The study population consisted of 125 consenting patients (51 males, 74 females, mean age, 40 ± 19) referred to our outpatient clinic for recurrent syncope and positive head-up tilt testing between 2004 and 2006. A complete history and physical examination, which included a neurological assessment, were performed. No cardiovascular or nervous system diseases were observed. There was no history of administration of drugs known to cause orthostatic hypotension, and verification of a normal heart structure and function by echocardiography was possible. Informed consent for participation in the study was obtained from all patients.

**Baseline head-up tilt test:** Patients underwent a head-up tilt test (HUTT) between 2 and 4 PM, after fasting for at least 3 hours. After obtaining baseline blood pressure and heart rate measurements in the supine position, the patients were tilted to 80° for 40 minutes. Continuous ECG monitoring of heart rate and rhythm was performed, while blood pressure was measured noninvasively. The endpoint of the test was the reproduction of syncope. A positive head-up tilt test was considered positive when syncope was reproduced in association with hypotension, bradycardia, or both. Positive responses were classified according to the criteria of the Vasovagal Syncope International Study:5) type 1 (mixed), type 2 (cardioinhibitory), and type 3 (vasodepressor). Time to syncope was defined as the interval from the beginning of the head-up tilt test to the loss of consciousness.

**Orthostatic training:** An orthostatic training program was taught at the hospital and continued at home by the patient. The orthostatic training program consisted of daily sessions 6 days a week for at least 4 weeks. Patients were instructed to perform orthostatic training at home by standing against a wall (with the ankles together 20 cm from the wall) once a day for a planned duration of up to 30 minutes, depending on their orthostatic tolerance. Patients were instructed to maintain the standing position until presyncopal symptoms appeared prompting early cessation, or otherwise to terminate their session at 30 minutes. Patients were asked to perform orthostatic training sessions in a comfortable and safe environment in order to avoid the risk of trauma, preferably under the supervision of a family member, and were given a form to record each training session, its duration, and symptoms.6,7)

**Study design:** After diagnostic head-up tilt testing was performed, the patients were randomized to orthostatic training (64 patients) or no treatment (controls, 61 patients). No patient received any other treatment. In order to test the effect of
orthostatic training, each patient was asked to report any recurrence of spontaneous syncope, and they were contacted by telephone for one year.

**Statistical analysis:** Parametric data are presented as the mean and SD, while nonparametric data are expressed as the median and interquartile range. Patients were classified as positive or negative for the orthostatic training and their clinical course on the basis of whether or not syncope occurred. Statistical analysis was performed using a $t$ test, $\chi^2$ test, and rank sum test. Differences in $P < 0.05$ were considered significant.

## RESULTS

**Patient characteristics:** The clinical baseline characteristics of the patients in the two groups are listed in Table I. No significant difference between the groups with respect to any variable was observed.

**Orthostatic training:** In the training group, a total of 62 (96.9%) patients completed training lasting at least 4 weeks, with an average training duration of 52 ± 17 days. Two patients (3.1%) did not complete orthostatic training because of intolerance.

### Table I. Baseline Characteristics of the Patients

<table>
<thead>
<tr>
<th></th>
<th>Orthostatic training $(n = 64)$</th>
<th>Controls $(n = 61)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>39 ± 18</td>
<td>42 ± 20</td>
</tr>
<tr>
<td>Gender (male/female)</td>
<td>26/38</td>
<td>25/36</td>
</tr>
<tr>
<td>Lifetime syncopal spells, median (interquartile range)</td>
<td>5 (3-10)</td>
<td>5 (2-10)</td>
</tr>
<tr>
<td>Syncopal spells in the last year, median (interquartile range)</td>
<td>3 (1-3)</td>
<td>2 (1-3)</td>
</tr>
</tbody>
</table>

### Table II. Distribution of Baseline Clinical Characteristics Between the Relapse Group and Nonrelapse Group After Orthostatic Training

<table>
<thead>
<tr>
<th>Clinical course</th>
<th>Nonrelapse group $(n = 45)$</th>
<th>Relapse group $(n = 17)$</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>32 ± 11</td>
<td>51 ± 17</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Gender (male/female)</td>
<td>20/25</td>
<td>7/10</td>
<td>ns</td>
</tr>
<tr>
<td>Frequency of syncope 1 year prior to training (median)</td>
<td>3 (1-5)</td>
<td>1 (1-2)</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Time of occurrence of syncope in the HUTT (minutes)</td>
<td>19 ± 6</td>
<td>22 ± 8</td>
<td>ns</td>
</tr>
<tr>
<td>Type of response to HUTT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardioinhibition</td>
<td>4 (8.8%)</td>
<td>2 (12.5%)</td>
<td>ns</td>
</tr>
<tr>
<td>Vasodepression</td>
<td>11 (23.5%)</td>
<td>5 (29.2%)</td>
<td>ns</td>
</tr>
<tr>
<td>Mixed</td>
<td>30 (67.7%)</td>
<td>10 (58.3%)</td>
<td>ns</td>
</tr>
<tr>
<td>Duration of continuous training (days)</td>
<td>51 ± 16</td>
<td>49 ± 20</td>
<td>ns</td>
</tr>
</tbody>
</table>

HUTT indicates head-up tilt test.
Follow-up: All patients were followed-up for 1 year. In the orthostatic training group, spontaneous syncope recurred in 15 patients (24.2%) and presyncope recurred in 2 patients (3.2%). No syncope recurred in the other 45 patients (72.6%). In the control group, spontaneous syncope recurred in 39 patients (63.9%) while there was no syncope recurrence in 22 patients (36.1%). The difference was significant ($P < 0.05$). The orthostatic training group patients were then grouped on the basis of whether or not syncope occurred. Table II shows the distribution of the baseline clinical characteristics in these 2 subgroups. There were no differences in gender, time to syncope during head-up tilt test, distinct type of responses during tilt testing, and the duration of orthostatic training between the two groups. However, the patients in the relapse group were older than those in the nonrelapse group ($P < 0.01$), and they suffered from syncope less frequently in the one year prior to the training ($P < 0.05$).

DISCUSSION

Recurrent vasovagal syncope represents a common clinical event and a therapeutic challenge. Many pharmacological treatments have been proposed, but randomized, controlled studies have yielded conflicting results.$^{8,9}$ Pacemaker implantation has proved to be effective,$^{10,11}$ but recently this issue has been questioned$^{12}$ and is not useful in all these patients.

In our study, only 27.4% of treated patients still had a recurrence, in contrast to 63.9% of patients in the control group, findings that are similar to 2 previous studies.$^{13,14}$ Orthostatic training is one useful therapy for the prevention of vasovagal syncope, and one of the mechanisms may be that orthostatic training decreases sympathetic activity in the early stage of the upright position.$^{15,16}$ However, the daily performance of orthostatic training itself may have a desensitizing effect on the cardiopulmonary receptors that are believed to trigger the neurocardiogenic reaction.$^{17}$

Some previous studies regarded head-up tilt testing as the endpoint and thus obtained a distinctively different or even opposite conclusion.$^{18,19}$ This may be due to differences in the diagnostic tilt testing protocol. Some positive results can only be obtained by pharmacological stimulation, and thus the specificity of head-up tilt testing is greatly reduced.$^{19}$ Moreover, repeat tilt testing for diagnostic purposes may have a limited role. Once patients have been tilted, their responses may change because they are aware of what to expect and attempt to respond. Some previous studies have demonstrated that tilt testing is not useful in evaluating treatment efficacy, mainly due to its poor reproducibility.$^{10}$ Thus, even tilt training should be better evaluated by the outcome during the follow-up.$^{20}$

In the present study, 45 of 62 patients who underwent orthostatic training
remained completely asymptomatic after a follow-up of more than 12 months, while spontaneous syncope or presyncope recurrence occurred in the remaining 17 patients. The relapsed patients were significantly older than the nonrelapsed patients, and there were 3 patients above 60 years old. Older patients appear to have a more generalized cardiovascular decline, with attenuated cardiac and autonomic responses to stress, so orthostatic training failed to reduce syncope. On the other hand, young people and patients with very frequent and refractory syncope spells seldom relapse because they appear to have excessive cardiac and autonomic responses to stress and are sensitive to the training. Furthermore, the patients had learned to recognize some symptoms preceding syncope through repeated postural training, and would take corrective action, such as sitting down or lying down, to avoid the occurrence of syncope.

Gender and prolongation of training time were not related to the efficacy of the training programme. All 62 patients completed the 1-2 months of training.

The short-term orthostatic training was mostly applied in the relative studies. The period of about 1 month was demonstrated to be enough for improving the clinical conditions of the patients. The effect of orthostatic training would not be changed and patients could lose confidence and give up if the duration is prolonged.

All patients with vasovagal syncope are the same with respect to pathogenesis and pathophysiology, so the outcome of orthostatic training was the same in the 3 clinical types.

In conclusion, the condition of the majority of patients with vasovagal syncope improved with the orthostatic training and the effect was more marked in the patients who were younger or had frequent spells of syncope, although it is not yet clear whether this difference contributed to the orthostatic training or the natural course of the syncope itself.

REFERENCES