Usefulness of Physical Maneuvers for Prevention of Vasovagal Syncope

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Background It is known that approximately two-thirds of patients with vasovagal syncope have prodromal symptoms and when these start, physical maneuvers that can increase venous return may abort the syncopal attack. The aims of this study were to evaluate the effects of 3 physical maneuvers, squatting, leg-crossing with muscle tensing, and handgrip, on improving hemodynamic status, and to compare the effect of each on aborting or preventing vasovagal syncope.

Methods and Results Of 50 patients who underwent the head-up tilt test (HUT) to evaluate syncope, 27 patients with positive HUT were classified as group I (14 men, 13 women; mean age 44.5±15.3 years), 23 patients with negative HUT were classified as group II (13 men, 10 women; mean age 41.2±16.7 years), and 21 normal subjects were classified as group III (10 men, 11 women; mean age 28.6±6.3 years). The effects of the physical maneuvers were evaluated in 21 patients from group I who underwent a repeat HUT 1 week after the initial test. Leg-crossing significantly increased systolic blood pressure (SBP) in all 3 groups (8.0±5.8 mmHg in group I, 7.0±8.5 mmHg in group II, 8.7±5.7 mmHg in group III; p<0.05), but not diastolic blood pressure (DBP). Squatting significantly increased SBP and DBP in all 3 groups (7.1±5.1, 4.6±5.8 mmHg in group I, 7.8±5.9, 4.3±4.7 mmHg in group II, 6.5±5.0, 3.7±3.9 mmHg in group III; p<0.05). However, handgrip did not exert any significant influence on the hemodynamics in any group nor did heart rate change significantly during the physical maneuvers in any group. During the repeat HUT, prodromal symptoms with hypotension developed in 13 of the 21 patients and of these 5 fainted immediately after and were not able to do the physical maneuvers. Squatting and leg-crossing aborted syncope in 7 of 8 patients, but handgrip aborted syncope in only 1 patient.

Conclusion Squatting and leg-crossing with muscle tensing improved the hemodynamics of normal subjects as well as those of patients with vasovagal syncope. Squatting and leg-crossing can be used as a simple and effective preventive maneuver in patients with vasovagal syncope. (Circ J 2005; 69: 1084–1088)

Key Words: Hemodynamics; Physical maneuver; Syncope

Syncope is a sudden transient loss of consciousness and postural tone with spontaneous recovery. There are various causes, but vasovagal syncope is the most frequent. It is triggered by a reduction in the central venous volume because of venous pooling of blood in lower body veins during prolonged standing. Abnormal autonomic activity with excessive vagal tone and sympathetic withdrawal result in hypotension and bradycardia followed by syncope.

Management of vasovagal syncope has largely been empiric and many drugs have been tried. Although pharmacologic treatment has been satisfactory in uncontrolled trials or short-term controlled trials, several long-term prospective trials have been unable to show consistent benefit of the drug over placebo. Pacemaker implantation for the treatment of recurrent vasovagal syncope has also had conflicting results. There is increasing evidence that a tilt-training program is useful in the prevention of vasovagal syncope only highly motivated patient will get involved and moreover, recurrence and long-term compliance with the therapy when the patient becomes asymptomatic are still unresolved problems.

Many patients with vasovagal syncope experienced prodromal symptoms and when these start, physical maneuvers that can increase venous return may be able to abort the syncopal attack. Thus, we studied the effects of squatting, leg-crossing with muscle tensing, and handgrip on improving hemodynamic status and aborting or preventing syncope during the head-up tilt test (HUT).

Methods

Study Population From May 2004 to September 2004, 139 patients performed HUT to evaluate syncope, of whom 50 were enrolled. According to the results of HUT, patients were classified into 2 groups: 27 patients with positive HUT were classified as group I (14 men, 13 women; mean age 44.5±15.3 years) and 23 patients with negative HUT were
Study Protocol and HUT

HUT was performed after at least 4 h of fasting and under medical supervision. Hemodynamic parameters including blood pressure and heart rate during the physical maneuvers and HUT were monitored by continuous noninvasive hemodynamic monitoring (BIOPAC system, USA).

Handgrip, leg-crossing with muscle tensing, and squatting were performed for 30 s, 5 min before and after HUT. After baseline blood pressure and heart rate were measured while supine for 6 min, patients were tilted to 60° for 20 min. If syncope did not occur, sublingual nitroglycerin spray was administered, and patients continued the test for an additional 16 min. To enable leg-crossing with muscle tension and squatting, subjects were not strapped to the tilt table and at the first sign prodromal symptoms, the subject began physical maneuvers on the verbal order of the doctor or nurse.

The effects of the physical maneuvers on aborting or preventing syncope were evaluated in 21 patients from the group I who underwent a repeat HUT 1 week after the initial test (Fig 1).

Statistical Analysis

All parameters are presented as mean±standard deviation. Changes in hemodynamic parameters were compared by two-tailed paired t-test. A p-value less than 0.05 was considered statistically significant.

Results

Hemodynamic Changes According to the Physical Maneuvers

Handgrip performed before HUT did not exert a significant influence on blood pressure in any group (p=NS). Handgrip performed after HUT also did not exert a significant influence on blood pressure (p=NS) in groups II and III, although diastolic blood pressure (DBP) was significantly increased in group I (Table 1).

Leg-crossing with muscle tension performed before HUT significantly increased systolic blood pressure (SBP) (p<0.05), but not DBP (p=NS), in all groups and after HUT it significantly increased SBP in all groups and DBP was also increased significantly in group I (p<0.05) (Table 2).

Squatting performed before and after HUT significantly increased SBP and DBP (p<0.05) in all groups (Table 3).

The change in heart rate by leg-crossing with muscle tensing was significant in group II only. The changes in blood pressure and heart rate by the same physical maneuver were relatively similar in extent among the 3 groups, but the group I the changes by leg-crossing with muscle...
tensing or squatting were much exaggerated when the physical maneuvers were done after the completion of HUT.

**Effects of Physical Maneuvers on Aborting or Preventing Syncope (Fig 2)**

The repeat HUT in group I was negative in 8 patients and 13 patients showed prodromal symptoms accompanied by falling blood pressure. Of these, 5 fainted and could not perform physical maneuvers. Squatting and leg-crossing aborted syncope in 7 of 8 patients, but handgrip aborted syncope in only 1 patient. Syncope was not prevented by any kind of physical maneuvers in the remaining patient.

**Discussion**

We evaluated the hemodynamic response to physical maneuvers in patients with vasovagal syncope. Each patient performed the same physical maneuvers before and after HUT, because we expected that the hemodynamic response would differ according to the level of autonomic tone. In our study, handgrip did not improve the hemodynamics, but squatting and leg-crossing with muscle tensing significantly improved hemodynamics in both patients with a history of syncope and the normal control subjects. Brignole et al evaluated the cardiovascular response to handgrip and arm-tensing in healthy subjects and contrary to our results, found a maximum increase in SBP after 2 min of the maneuver of 31±16 mmHg for handgrip and 32±18 mmHg for arm-tensing.20 A possible explanation for this difference in results is that the duration of handgrip was much longer in their study than in ours (2 min vs 30 s). Our results suggest that squatting and leg-crossing with muscle tensing are more effective than handgrip. Moreover, the increase in blood pressure after squatting and leg-crossing was much higher in group I after HUT (positive HUT test) than in the other groups (negative HUT and controls), which also suggests that squatting and leg-crossing could be a preventive technique for patients with vasovagal syncope.

Many patients with vasovagal syncope experience prodromal symptoms associated with the hypotension and bradycardia that are triggered by the reduction in central venous volume caused by venous pooling of blood in the lower body veins during prolonged standing. At the onset of these symptoms, physical maneuvers that increase venous return and sympathetic tone may abort the syncopal attack.19–22 Brignole et al proposed handgrip as a method of treating vasovagal syncope,20 and Croco et al also reported a favorable effect of isometric arm exercise in aborting impending vasovagal syncope.21 However, in our study, handgrip prevented impending syncope in only 1 patient and the other 7 patients fainted despite doing handgrips, which is a similar result to that of Krediet et al22 who found that handgrip had only a trivial effect on the fainting response. Thus, the effects of handgrip should be validated by a well-designed randomized controlled study. Krediet et al also studied the effects of leg-crossing combined with muscle
tensing and reported that it increased SBP and DBP and prevented syncope. Van Dijk et al. also reported favorable effects of leg-crossing and muscle tensioning on hemodynamics such as cardiac output and mean blood pressure. In our study vasovagal syncope was prevented by leg-crossing combined with muscle tensioning in 7 of 8 patients. Thus, leg-crossing combined with muscle tensioning at the onset of prodromal symptoms could be a good, feasible, and simple method of treatment for vasovagal syncope. Our results for squatting were comparable with those for leg-crossing with muscle tensioning; only 1 of 8 patients fainted after performing squatting and leg-crossing with muscle tensioning. Secondary injury from falling down is a concern and therefore squatting is safer than leg-crossing and thus we propose squatting as the most simple, feasible and safe method of treating vasovagal syncope.

In our study, 5 patients fainted just after the onset of prodromal symptoms and therefore could not perform the physical maneuvers. This suggests that the interval from the onset of prodromal symptoms to syncope is important and patients with a longer time interval would gain the most benefit from performing physical maneuvers.

**Study Limitations**

HUT has some diagnostic limitations related to reproducibility. According to the guidelines of the European Society of Cardiology, the overall reproducibility of an initial positive HUT (31–92%) is lower than for an initial negative HUT (85–94%). In the present group I, 8 of 21 patients had a negative repeat HUT and the reproducibility was 61.9%. Because the patients in group I had a history of syncope and showed prodromal symptoms accompanied by objective hemodynamic changes at first HUT, we considered that they had vasovagal syncope regardless of the results of the second HUT. However, there is the possibility that a minority of patients in group I had a false-positive diagnostic HUT and a greater percentage of the patients in group II may have had a false-negative result.

To properly compare the 3 physical maneuvers, 3 HUT are needed, but we evaluated all 3 physical maneuvers during follow-up HUT performed after 1 week after the diagnostic HUT. Although each physical maneuver was
performed after the restoration of hemodynamics to baseline, the hemodynamic changes attributed to a particular physical maneuver may have been affected by the others.

To confirm the clinical use of the physical maneuvers, their effects on spontaneous syncopal attacks should be evaluated.

Conclusions

Squatting and leg-crossing with muscle tensing significantly improved hemodynamics in patients with vasovagal syncope as well as normal subjects, and aborted impending syncope. Thus, we propose these physical maneuvers as a feasible, simple and safe method of preventing an impending vasovagal syncope.

References