A standardized education protocol significantly reduces traumatic injuries and syncope recurrence: an observational study in 316 patients with vasovagal syncope

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Received 1 December 2010; accepted after revision 6 October 2011; online publish-ahead-of-print 1 November 2011

Aim

The aim of this study was to assess the role of a non-pharmacological approach on the frequency of traumatic injuries and syncope recurrence in patients with vasovagal syncope and normal hearts. We report the experience in our syncope centre with a standardized education and teaching protocol for patients with vasovagal syncope. The treatment of vasovagal syncope is often complex and discouraging. Besides medical options, behavior modification is a main component of therapy but has no statistical evidence to support its use.

Methods and results

Between January 1999 and September 2006, we prospectively enrolled all patients with vasovagal syncope. The patients were counselled about the benign nature of their disease. Specific recommendations were made according to a standardized education protocol established at our syncope centre. A pre-/post-study was conducted to investigate the effectiveness of our approach on syncope recurrence and frequency of injury as the study endpoints. Complete follow-up data were available from 85% of the study population (316 of 371) after a mean time of 710±286 days (mean age 50 years; standard deviation ±18 years, 160 female). Eighty-seven patients (27.5%) had a syncope recurrence with 22 suffering an injury during syncope. During the follow-up period, the syncope burden per month was significantly reduced from 0.35±0.03 at initial presentation to 0.08±0.02 (P<0.001). The frequency of traumatic syncope was significantly lower at the time of recurrence compared with the initial presentation (25 vs. 42%; McNemar’s test P=0.02).

Conclusion

A standardized education protocol significantly reduces traumatic injuries and syncope recurrence in patients with vasovagal syncope.

Keywords

Vasovagal syncope • Autonomic nervous system • Tilt table test

Introduction

Syncope, a symptom defined as a transient, self-limited loss of consciousness, is one of the most frequent causes of admission in an emergency room, representing 1–3% of all hospitalizations.1 Vasovagal syncope, the most common cause of recurrent syncope,2 typically has a benign prognosis.3 However, a sudden loss of consciousness is relatively rapid in most cases and often results in traumatic falls and injuries. Thus, the incidence of syncope-related traumatic injuries seems to contradict the general notion that syncope is a benign disorder.

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Treatment of vasovagal syncope is often complex and discouraging, and a variety of medications has been proposed. However, none has shown a substantial effect in large clinical trials. Therefore, non-pharmacological measures, such as behaviour modification, are preferred as first line therapy to reduce syncope recurrence and injuries, despite a lack of clinical evidence.

The present study assessed the effectiveness of a standardized education protocol on syncope recurrence and subsequent injuries in patients with vasovagal syncope.

Methods

Study design and patient population

This prospective study included consecutive patients with vasovagal syncope who were referred to the syncope centre in the Department of Cardiology. All patients had a history of two or more syncopes. Patients with syncope due to any cardiac, neurological, or psychiatric cause were excluded. A complete physical examination, standard laboratory tests, 12-lead surface electrocardiogram (ECG), exercise test, 24 h ambulatory heart rate, and blood pressure monitoring were performed on all patients. When indicated in selected cases, further diagnostic procedures were added such as an electrophysiological study or coronary angiography. Additional exclusion criteria were carotid sinus hypersensitivity, reduced left ventricular function, and any conduction abnormality on 12-lead electrocardiography.

No medications were commenced for treatment of vasovagal syncope. The local institutional ethics committee approved the protocol and all subjects gave written informed consent.

Head-up tilt table test

The tilt table test was performed at 2:00 p.m. with the patient in a fasting state. All cardiovascular medications were discontinued for at least five half-lives before the tilt table test, which was performed in a quiet, closed room using a standardized protocol. All subjects underwent a resting phase in horizontal position for 10 min, before they were brought to the upright position at 60° for 45 min. If syncope did not occur, pharmacological provocation with 0.4 mg nitroglycerine sublingual was performed keeping the patient in upright position for further 10 min. Continuous ECG (Siemens Sirecust 1280) and non-invasive (Siemens Siredoc 220) blood pressure was monitored throughout the test.

Definitions

Syncope was defined as a sudden, transient loss of consciousness with abrupt decrease of the postural tone, and spontaneous recovery. The diagnosis of a vasovagal syncope was made on history taking criteria outlined in the guidelines of the European Society of Cardiology (ESC). Vasovagal syncope was diagnosed if syncope was precipitated by emotional distress or orthostatic stress and was associated with typical prodromes and circumstances. The diagnosis of vasovagal syncope was independent of the result of the tilt table test. The tilt table test was considered positive according to the guidelines of the ESC. The response to the tilt table test was classified according to the Vasovagal Syncope International Study (VASIS) criteria as mixed (type I) when hypotension was associated with only mild bradycardia (>40 b.p.m.). Cardiocinhibitory (type II) response was defined as a marked bradycardia (<40 b.p.m. for >10 s), or prolonged asystole (>3 s) occurring at the time of syncope. Hypotensive or vasodepressor (type III) response was defined when isolated hypotension was observed during syncope without a decrease in heart rate.

Injury was defined as any damage or harm suffered by the patient triggered by a vasovagal syncope. The criterion of ‘injury induced by syncope’ was fulfilled if an injury occurred during the last syncope prior to enrolment in our study. The criterion of ‘injury induced by syncope recurrence’ was fulfilled if an injury occurred during the first syncope after presenting at our clinic.

General measures and recommendations

All patients counselling was performed using a standardized protocol to inform and educate the patient (Information→Education→Reaction).

As a first step, patients were informed about the benign nature of their condition with special emphasis on potential risks and overall prognosis. The patients received information about pathophysiology and probable trigger events in their specific situation.

After explaining the condition, we informed the patient how to avoid potential unfavourable situations such as excessive intake of caffeine or nicotine.

Patients were motivated to increase their water intake to at least 2 L per day and start regular physical activities. In cases of dizziness or other symptoms coupled with the vasovagal reflex, the patients were taught to adopt a supine position with their legs elevated at the onset of such symptoms. If possible, isometric counter-pressure manoeuvres such as tensing the arms with locked of clenched fists, leg pumping, and leg crossing should be attempted to avert or attenuate episodes (Table 1).

Statistical analysis

Data are presented as a mean ± standard deviation for normally distributed data and as a median with the interquartile range (IQR) for non-normally distributed data. Divergences between patient groups were analysed using the Student’s t-test for continuous and normally distributed variables, the Mann–Whitney U test for continuous, non-parametric variables, the two-sided Fisher’s exact test, and McNemar’s test for categorical variables. We considered P values <0.05 as statistically significant. Data were analysed using SPSS Software (SPSS 13.0 for windows, Copyright SPSS Inc. 1989–2004).

Follow-up and study endpoint

We contacted the patients by telephone or mail using a standardized questionnaire. Patients were asked about the number of recurrences of syncope and injuries every 3 months.

Results

Out of 371 patients referred for the tilt table test from January 1999 to September 2006 316 patients had complete data and...
were included in the study. All patients had initially a minimum of two synapses (median 3 ± 6 IQR) with a mean frequency of 0.35 ± 0.03 synapses per month per patient. Demographics, clinical characteristics, and comorbidity profiles were homogeneous, revealed a typical distribution of cardiovascular risk factors, and are displayed in Table 2 and Figure 1. The youngest and oldest patient enrolled was 11 and 84 years, respectively. Injury induced by syncope was observed in 133 patients (42%) prior to enrolment. In these 133 patients, 165 injuries (multiple answers possible) occurred and were subdivided as follows: 89 haematoma, 28 minor bleedings, 27 bone fractures, 13 cerebral contusions, 5 craniocerebral trauma, and 3 tongue lesions.

Eighty-seven patients (27.5%) had a syncope recurrence during a follow-up time of 2 years. A total number of 557 synapses were reported during the follow-up period. This represented a significant reduction in syncope burden to 0.08 ± 0.02 per month per patient (from 0.35 ± 0.03 prior to study, Figure 2). Median time to first recurrence was 274 days. Female patients had a higher risk of syncope recurrence (odds ratio 2.4; 95% confidence interval, 1.40–3.95; P = 0.001). Nineteen patients were admitted to an emergency department due to a syncope recurrence. Hospital admission due to syncope recurrence was statistically not correlated with gender (P = 0.6), injury at syncope prior or after inclusion in the trail (P = 0.3, resp. 0.1), hypertension (P = 0.4), hyperlipidaemia (P = 0.4), diabetes (P = 0.8), history of syncope in the family (P = 0.3), or the result of the tilt table test (P = 0.1). Twenty-two patients suffered from substantial injury due to a syncope recurrence, including bone fractures in 3, haematoma in 13, minor bleedings in 3, severe cerebral contusion in 1, craniocerebral trauma in 1, and tongue lesion in 1. The clinical characteristics of the patients with traumatic injuries are displayed in Table 2. In our statistical analysis, only the number of syncope per month and patient showed an inverse significant correlation with traumatic injuries at initial syncope in a multivariate analysis. However during the follow-up period, we noticed a higher risk for injuries at the time of syncope recurrence for female patients (P = 0.04). The frequency of traumatic synapses was significantly lower during follow-up than at presentation (25% at follow-up, from 42% at presentation; McNemar’s test P = 0.02) (Table 2).

Cardiovascular mortality was low in our study population (1.3%): six patients died during the follow-up period because of myocardial infarction (n = 4), pneumonia (n = 1), and prostate carcinoma (n = 1) of whom only one (with myocardial infarction) had a positive tilt table response. A positive tilt table test was not associated with cardiovascular death (P = 0.55).

One-hundred and twenty-five patients (40%) had a positive tilt table test. Out of these, 61 were induced after sublingual application of nitroglycerine. Forty patients (32%) showed a VASIS type-I response. Twenty-one patients (16%) had a type-II cardioinhibitory response with bradycardia at 40 b.p.m. or slower and asystole in four cases. A type-III reaction was observed in 64 (52%) patients. A reduction of syncope recurrence was both seen in patients with positive and negative result (Figure 3).

According to our analysis, the result of the tilt table test was without value to identify patients at higher risk for injuries or recurrence (Table 3).

Table 2 Clinical characteristics of patients

<table>
<thead>
<tr>
<th></th>
<th>All patients</th>
<th>Initial syncope with</th>
<th></th>
<th></th>
<th></th>
<th>Syncope recurrence with</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 316</td>
<td>133 (42%)</td>
<td>183 (56%)</td>
<td></td>
<td>22 (25%)</td>
<td>55 (75%)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>50 ± 18</td>
<td>50 ± 18</td>
<td>51 ± 19</td>
<td>0.4</td>
<td>47 ± 17</td>
<td>53 ± 24</td>
</tr>
<tr>
<td>Number of synapses (median ± interquartile range)</td>
<td>3 ± 6</td>
<td>3 ± 4</td>
<td>4 ± 8</td>
<td>&lt;0.001</td>
<td>0.1</td>
<td>2.5 ± 6</td>
</tr>
<tr>
<td>Number of synapse per month and patient</td>
<td>0.35 ± 0.03</td>
<td>0.3 ± 0.4</td>
<td>0.4 ± 0.3</td>
<td>&lt;0.001</td>
<td>0.04</td>
<td>1.4 ± 1.4</td>
</tr>
<tr>
<td>Male gender</td>
<td>156 (49.4%)</td>
<td>70 (52%)</td>
<td>83 (45%)</td>
<td>0.4</td>
<td>3 (14%)</td>
<td>26 (40%)</td>
</tr>
<tr>
<td>Positive tilt table test</td>
<td>125 (40%)</td>
<td>52 (39%)</td>
<td>73 (40%)</td>
<td>0.9</td>
<td>6 (27%)</td>
<td>32 (49%)</td>
</tr>
<tr>
<td>Final heart rate at positive tilt test (b.p.m.)</td>
<td>72 ± 29</td>
<td>78 ± 26</td>
<td>69 ± 29</td>
<td>0.03</td>
<td>0.2</td>
<td>58 ± 16</td>
</tr>
<tr>
<td>Hypertension</td>
<td>99 (31.3%)</td>
<td>44 (33%)</td>
<td>55 (30%)</td>
<td>0.5</td>
<td>9 (43%)</td>
<td>17 (26%)</td>
</tr>
<tr>
<td>Hyperlipidaemia</td>
<td>67 (21.2%)</td>
<td>30 (23%)</td>
<td>37 (20%)</td>
<td>0.3</td>
<td>7 (33%)</td>
<td>18 (28%)</td>
</tr>
<tr>
<td>Diabetes type 1</td>
<td>3 (0.9%)</td>
<td>2 (2%)</td>
<td>1 (1%)</td>
<td>0.5</td>
<td>0</td>
<td>1 (1.5%)</td>
</tr>
<tr>
<td>Diabetes type 2</td>
<td>12 (3.8%)</td>
<td>6 (5%)</td>
<td>6 (3%)</td>
<td>0.8</td>
<td>0 (6%)</td>
<td>2 (3%)</td>
</tr>
<tr>
<td>Injury at syncope prior to enrolment</td>
<td>87 (27.5%)</td>
<td>–</td>
<td>–</td>
<td></td>
<td>12 (55%)</td>
<td>23 (37%)</td>
</tr>
</tbody>
</table>

a Univariate statistical analysis.
b Multivariate statistical analysis.
c McNemar’s test for pre-post-analysis of the frequency of injuries induced by vasovagal syncope.
Discussion

This is the first study to show a positive effect of a standardized non-pharmacological didactic protocol of behaviour modification on syncope recurrence and traumatic injuries in patients with vasovagal syncope. This approach is effective in the therapy of vasovagal syncope. The strategy was safe, with no evidence of adverse events and easy to apply.

A systematic diagnostic evaluation followed by information and education on how to prevent vasovagal stress dramatically decreased syncope burden. The frequency of traumatic injuries was also reduced by >40%. Overall, the outcome of vasovagal syncope is excellent as long as neurological, cardiac, or psychiatric causes are excluded.

The results of pharmacological trials for the treatment of vasovagal syncope are disappointing. Our approach was developed on general recommendations to avoid trigger factors, increasing water and salt intake, and performing counter-manoeuvres. As stated in the new guidelines for the diagnosis and management of syncope (version 2009) ‘non-pharmacological ‘physical’ treatments are emerging as a new front-line treatment of reflex syncope’, but this is based mainly on expert opinion.

Physical manoeuvres for combating orthostatic dizziness and syncope in autonomic failure were first described in a trial in the year 1992 and was seen effective in case reports. Two controlled clinical trials and one multicentre prospective trial (PC-Trial) have shown that isometric physical counter-manoeuvres

**Figure 1** Study flow chart; outcome in vasovagal syncope. HUT, head-up tilt table test; Pos., positive; Neg., negative.

**Figure 2** Number of syncope per month at initial presentation and during follow-up after using a standardized protocol for the treatment of vasovagal syncope in all patients.

**Figure 3** Number of syncope per month at initial presentation and during follow-up after using a standardized protocol for the treatment of vasovagal syncope in patients with positive and negative head-up tilt table test.
of the legs, or of the arms, are able to deter or delay loss of consciousness in most cases. However, these study populations consisted of selected patients with a high number of syncopal spells and a positive tilt table test. In contrast, our patients are more typical of patients encountered in everyday clinical practice, in which the diagnosis of vasovagal syncope was based on history taking criteria outlined in the ESC guidelines and not upon a positive tilt table test.

The recurrence rate of our study cohort during a follow-up period of 710 days was 27.5%. The reported recurrence rates depend on the clinical setting and vary between 15 and 40% with a follow-up of 1–3 years in untreated patients. The Task Force on Syncope of the European Society of Cardiology reports a recurrence rate of 35% during 3 years of follow-up.

Sufficient information and education on how to prevent vasovagal trigger situations may reduce recurrence and injuries. The observation of a significant decrease in the frequency of syncopal episodes after diagnosis and counselling alone without special training was seen in smaller cohorts, but no standardized approach was used. In a study by Sheldon, the median frequency of pre-test spells was 0.3/month. After tilt test, the median frequency dropped ~90% to 0.03 per month. Sheldon et al. explained this decline by a combination of the natural history of the syndrome, reassurance, counselling on the pathophysiology of syncope, and coaching on appropriate postural manoeuvres to prevent pre-syncpe from progressing to syncope. However, in contrast to our study, no standardized protocol was defined to educate the patients and patients with negative tilt table test were excluded.

As a major finding, our data do suggest that even in patients with a negative tilt table test, with using a simple education protocol the reduction of the syncope burden per month is similar to patients with a positive tilt table test—once neurological and cardiovascular reasons are ruled out.

### Injury

Our study is the first to investigate the efficacy of a non-pharmacological therapy to reduce traumatic injuries in vasovagal syncope. Our standardized education protocol reduced the frequency of injuries due to vasovagal syncope by >40%. A better knowledge of the initial signs of vasovagal syncope, rapid counter-manoeuvres, and positioning on the ground may explain the reduction of traumatic injuries.

Injuries due to vasovagal syncope are an important complication. Forty-two per cent of our patients reported injury due to syncope before referral. In a single-centre study with 1114 patients by Bartoletti et al., physical injuries were reported in 29.5% of all patients with syncope referred to the emergency department. Five per cent of this cohort suffered from severe trauma. Graham and Kenny showed that in over one-third of a 62-patient cohort with two or more syncope, episodes occurred suddenly and without prodromal symptoms. Fifty-three per cent sustained an injury during syncope, and 13% exhibit a fracture. Ninety-four (27.2%) of the 346 patients who were investigated by Ammirati et al. reported at least one syncope-related traumatic injury. In 31 of 346 cases (8.9%), the severity of trauma warranted hospital admission and surgical treatment. According to a single study, patients with trauma also showed a higher prevalence of positive cardioinhibitory response to tilt table test than those without trauma.

The number of syncope per month was significantly more often from an injury at the time of syncope recurrence than male patients. Yet the meaning of this observation is limited by the fact that female patients presented a higher recurrence rate in general. Furthermore, the number of syncope per month was significantly lower in patients with injury at first presentation. This observation may be explained by the fact that patients with an injury were presented earlier to our clinic.

### General course of vasovagal syncope

Six patients died during a follow-up period of nearly 2 years, four of whom suffered myocardial infarction. This observation is in line with the Framingham Study: during 26 years of follow-up isolated syncope was not associated with stroke or myocardial infarction. Similarly, isolated syncope without structural heart disease was not associated with incidence of all-cause or cardiovascular mortality including sudden death.

### Study limitations

We have a selected patient cohort in our outpatient clinic department, because general practitioners and office-based cardiologists saw patients initially, before they referred them to our University.
hospital. Furthermore, we have performed a pre-/post analysis and not a randomized controlled trial. It remains difficult to quantify specific effects of protocols in observational studies. However, we believe that a control group of patients with no treatment at all is difficult to accomplish, because every interaction between physician and patient, even a brief conversation about the results of a diagnostic test, may influence the outcome of this patient. The data may be biased by the fact that a cluster of syncopal spells often triggers the need for intensive clinical investigations and the clinical pattern may often improve spontaneously without any intervention or therapy.

No patient received an implantable loop recorder, because only patients with clear clinical evidence of vasovagal syncope took part in the study. We did not use permanent pacemaker implantation as a therapeutic option even in patients with cardioinhibitory reaction during the tilt table test.

Conclusions
A standardized education protocol significantly reduces traumatic injuries and syncope recurrence in patients with vasovagal syncope. First-line therapy of vasovagal syncope should be based on lifestyle measures. The information about the benign nature of the disease, the education about possible trigger factors and teaching coping strategies are the most important parts of a successful therapy of vasovagal syncope.

Conflict of interest: none declared.

References