TILT TABLE TESTING IN THE DIAGNOSTIC EVALUATION OF PRESYNCOPE AND SYNCOPE: A CASE-SERIES REPORT

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Abstract: Tilt table testing has long been used as a standard tool in the diagnostic evaluation of syncope. However, differences of opinion exist with regard to its utility in the evaluation of patients with only presyncopal attacks. We present the results of drug-free, 70-degree head-up tilt table tests (maximum duration of 45 minutes), conducted between May 2002 and May 2003 in the Department of Physiology at JIPMER. This series consisted of both male and female patients (age 6–79 yr) with presyncope (n = 43), unexplained syncope (n = 43) and asymptomatic healthy volunteers without a history of syncope (n = 14). 28 out of 43 patients with unexplained syncope had a history of recurrent syncope while the remaining 15 had only 1 episode. 2 out of 43 patients (4.6%) with a history of only presyncopal attacks had a positive test (induction of intense presyncope and/or syncope accompanied by hypotension and/or a relative bradycardia). 21 out of 43 patients (49%) with a history of syncope had a positive test. 7 had vasodepressor syncope due to hypotension, 6 had cardioinhibitory syncope characterized by asystole and 10 had a mixed form of the vasovagal syndrome characterized by hypotension as well as bradycardia. 18 out of 28 patients (64%) with recurrent unexplained syncope had a positive test. All fourteen healthy volunteers had a negative test. We conclude that tilt table testing is useful in the diagnostic evaluation of patients with unexplained syncope, especially those with recurrent syncope, but not in the evaluation of patients with presyncope alone.

Key words: tilt table test, presyncope, syncope, vasovagal syncope

INTRODUCTION

Syncope, a common clinical problem characterized by a sudden and transient loss of consciousness occurs due to an acute reduction in cerebral blood flow (1–4). It could be broadly classified into three subtypes i.e., cardiogenic, noncardiogenic and unexplained syncope (1). A diagnosis of the cause of syncope is usually made on the

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basis of history, clinical examination, baseline electrocardiogram and basic laboratory assessment. When history points to the possibility of vasovagal syncope (a neurally mediated syncopal syndrome), the diagnosis is usually ascertained by performing a tilt table test (1–5).

Tilt table testing has long been held as a standard diagnostic tool in the evaluation of syncope (1–5). It is warranted in the evaluation of recurrent syncope or a single syncopal episode in a high-risk patient whether or not the medical history is suggestive of vasovagal syncope (4). Vasovagal syncope is one of the most common causes of syncope (2). A diagnosis of vasovagal syncope is often made on the basis of a clear history. Lightheadedness, pallor, nausea and profound sweating typically characterize the vasovagal attack, sometimes leading to a transient loss of consciousness. Head-up tilt testing offers the possibility of establishing a diagnosis of vasovagal syncope when such a clear history is not forthcoming and also when the presentation is atypical (5). Passive head-up tilt produces a significant reduction in central blood volume and this is known to trigger the vasovagal reaction (1, 2). Individuals susceptible to vasovagal syncope are unable to maintain adaptive neurocardiovascular and neuroendocrine responses to upright tilt for prolonged periods (1, 2). However, differences of opinion exist with regard to the utility of tilt table testing in the evaluation of patients with presyncope or near-syncpe alone, a condition in which patients feel as though syncope is imminent i.e. it is characterized by a transient episode of altered consciousness (2, 4).

Tilt table tests are also performed with drugs (usually isoproterenol) that provoke syncope in susceptible individuals. Although such protocols minimize test duration and increase test yield, the potential for an increase in false-positive results exists (2, 3 and 4). Kapoor and Brant have expressed concern regarding the use of isoproterenol (6). Further, a drug-free tilt table test is more likely to reproduce hemodynamic changes that result in syncope in these patients in the natural course. This would have treatment implications.

In this paper, we address the utility of tilt table testing in the diagnostic evaluation of presyncope and syncope based on the results of tilt table tests carried out in the Department of Physiology, JIPMER, between May 2002 and May 2003.

METHODS

Patients: This series consisted of both male and female patients (age 6–79 yr). They were classified into two groups viz., presyncope (n = 43, 20 males and 23 females) and unexplained syncope (n = 43, 21 males and 22 females) on the basis of history, clinical examination and 12-lead electrocardiogram. Out of 43 patients with unexplained syncope, 15 (7 males and 8 females) had a history of only one episode of syncope, whereas 28 patients (14 males and 14 females) had 2 or more syncopal spells. None of the patients in our series had a history of diabetes mellitus or laboratory evidence of hypoglycemia, orthostatic intolerance, a history suggestive of cardiac disease or clinical evidence of a cardiac cause for their symptoms. None of the patients had evidence of orthostatic
instances, the patient was immediately returned to the supine position. The test was considered negative, if even at the end of 45 minutes of head-up tilt, the patient did not develop any presyncopal symptoms.

The institute ethics committee approved the study protocol. All patients included in this series were referred to the Polygraph laboratory by physicians in JIPMER hospital outpatient clinics for a tilt table test. Before the test was done, we explained to the patients that the test was intended to reproduce their symptoms, and that it was a standard test in the stepwise evaluation of recurrent presyncope/syncope, meant to distinguish the cause of their symptoms and that there were no risks involved. Their consent was then obtained. In the case of patients < 18 y, consent was obtained from their parents. To all control subjects, we explained the purpose of the study, the tilt table test, and their role in the study and then obtained written informed consent.

Protocol: All patients underwent a 70-degree, drug-free head-up tilt for a maximum duration of 45 minutes. The tests were carried out in the Polygraph laboratory of the Department of Physiology between 9 am and 12 noon, 1-3 hr after a light breakfast or meal. The environment was quiet, the temperature between 30 and 35 degrees Celsius and the lighting subdued. Testing did not involve any intravascular instrumentation or administration of drugs at any stage. Tilting was done after familiarizing the patient with the testing procedure and at least 10 minutes of rest in the supine position. The patients were instructed to relax and breathe quietly (12–15 per minute) during the test. We used a manually operable tilt table with a footboard. The patient was secured to the table by safety restraints. Patients were instructed to report presyncopal symptoms immediately. A physician was available in the vicinity of the patient throughout the test. The test was considered as positive when it produced intense presyncope or syncope accompanied by hypotension and/or a relative bradycardia (2–5, 7). In such

hypotension. All patients had a normal baseline 12-lead ECG. However, a 40-year-old male who had a myocardial infarction 1 yr ago was included in this study since the cause for syncopal symptoms was unexplained even after echocardiography and Holter monitoring at the time of testing. At the time of testing, all patients were in sinus rhythm and none of the patients were on any medication influencing autonomic function. The series also included 14 asymptomatic healthy volunteers (controls) without a history of syncope.

Equipment: ECG (a bipolar chest lead) was continuously acquired throughout the test using the BIOPAC MP 100 hardware (BIOPAC Inc., USA) and the ECG and instantaneous heart rates were continuously plotted using the BIOPAC AcqKnowledge 3.7.1 software (BIOPAC Inc., USA) and a Microsoft Windows-based PC. Blood pressure was measured at 5-minute intervals by an automated non-invasive blood pressure monitor (Press-Mate BP 8800, Colin Corporation, Japan). Blood pressure was also taken whenever patients reported symptoms.
RESULTS

The results are given in Table I, II. 2 out of 43 (4.6%) patients with presyncope attacks alone had a positive test whereas 21 out of 43 (49%) patients with unexplained syncope had a positive test. 18 out of 28 (64%) patients with a history of recurrent syncope had a positive test. All fourteen healthy volunteers (controls) had a negative test. There were only 4 patients in this series (3 males and 1 female) aged > 65 y. Two of them had a history of only presyncope and two of them a history of syncope. One patient with a history of recurrent syncope (aged 75 y) had a positive test. There were 34 patients < 18 y. In this age group, 9 out of 12 (75%) with unexplained syncope had a positive test. The time to syncope across all ages was 26 ± 12 minutes (mean ± SD). The time to syncope in patients < 18 y was 29 ± 10 minutes. All the patients who had a positive test regained consciousness promptly once recumbency was achieved and none required any resuscitative measures. In all of them, resumption of normal sinus rhythm occurred in less than 30 seconds. The longest duration of asystole recorded was 12 seconds. None of them had convulsive movements following syncope.

DISCUSSION

The fact that nearly 50% of patients with unexplained syncope had a positive tilt table test suggests that a neural mechanism is involved in its etiology since prolonged upright tilt is known to trigger the vasovagal reaction (1). The fact that the incidence of positive tests was higher in patients with recurrent syncope further supports a neural pathogenetic mechanism. In fact, besides vasovagal syncope, carotid sinus syncope, deglutition syncope, micturition syncope and the diving reflex.

<table>
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<tr>
<th>Group</th>
<th>No. of subjects</th>
<th>Males : females</th>
<th>Age (y) Mean</th>
<th>Range</th>
<th>Positive tests</th>
<th>Mean time to syncope (min)</th>
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<tr>
<td>Presyncope</td>
<td>43</td>
<td>20 : 23</td>
<td>25</td>
<td>8-70</td>
<td>2</td>
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<td>21 : 22</td>
<td>34</td>
<td>6-79</td>
<td>21</td>
<td>26±12</td>
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<td>14</td>
<td>9 : 5</td>
<td>30</td>
<td>8-55</td>
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<tr>
<th>Group</th>
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<td>11</td>
<td>8-17</td>
<td>1</td>
<td>25</td>
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<tr>
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<td>5 : 7</td>
<td>13</td>
<td>6-17</td>
<td>9</td>
<td>29±10</td>
</tr>
<tr>
<td>Controls</td>
<td>3</td>
<td>1 : 2</td>
<td>11</td>
<td>8-13</td>
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are all thought to be at least in part neurally mediated (1).

Because of its high diagnostic yield, tilt table testing is warranted in the evaluation of recurrent unexplained syncope or a single syncopal spell accompanied by physical injury even if the history is not suggestive of vasovagal syncope (2, 4). Out of 23 patients with a positive test, 6 had cardioinhibitory syncope characterized by asystole lasting more than 3s, 7 had vasodepressor syncope due to hypotension and 10 had a mixed form of the vasovagal syndrome characterized by hypotension as well as bradycardia. The characterization of the hemodynamic changes leading to syncope is significant in as much as it could influence treatment plans.

Fitzpatrick et al have reported a mean time to syncope of 24 ±10 minutes (mean ±SD) and suggested a tilt duration of 45 minutes (8). In our series, the time to syncope was 26 ±12 minutes. In keeping with this result, a tilt duration of 50 minutes would seem appropriate since it would encompass mean ±2 SD.

3 patients in this series had evidence of postural tachycardia syndrome. During head-up tilt, they experienced presyncopal symptoms even when their heart rate was higher than baseline supine heart rate by at least 30 beats/min. All of them went on to have a positive test. Orthostatic intolerance in this condition has been shown to be associated with decreased peripheral vasoconstriction during orthostatic stress (9).

9 out of 12 (75%) patients < 18 y with unexplained syncope had a positive test. The mean time to syncope was 29 ±10 minutes, slightly higher than in adults. The appropriate duration of tilt in children is uncertain (4). In keeping with the possibility that orthostatic stress during tilt is less in children (4), we subjected them to the same protocol as adults. Despite the small size of the study population, it is interesting to note that, in them, a significant proportion have a susceptibility to vasovagal attacks. Neurally mediated syncope is the commonest cause of syncope in pediatric patients (2). In fact, it has been suggested that a tilt table test may not be necessary for further evaluation of syncope in pediatric patients who present with a normal physical examination, absence of abnormal laboratory findings and a history suggestive of vasovagal syncope (4).

Only 2 out of 43 patients with a history of only presyncopal attacks had a positive test. The fact that these patients have not had even a single episode of syncope suggests that adaptive reflex mechanisms are sufficient to maintain blood pressure and cerebral blood flow during presyncopal attack and prevent syncope from occurring. On the basis of our data, we suggest that tilt table tests be not used in the routine evaluation of presyncope alone. None of fourteen control subjects in our series had a positive test. In a series by Raviele et al, none among 35 control subjects developed syncope during drug-free, 60-degree head-up tilt for 45 minutes (9).

Since we do not have a beat-to-beat blood pressure monitor, we measured blood pressure intermittently. Therefore it was
impossible to determine whether the blood pressure fell earlier or at the same time as the fall in heart rate. Therefore, our classification of positive tilt table tests may not be accurate in keeping with criteria proposed by Sutton et al (11). Also, we considered a steadily falling blood pressure accompanied by intense presyncope enough evidence to stop the test (2). This would have underestimated the cardioinhibitory response to a certain extent.

We conclude that tilt table testing is not useful in the routine evaluation of patients with presyncope alone. Tilt table testing is useful in the evaluation of patients with a history of recurrent syncope even if the history is not suggestive of vasovagal syncope, especially when there is no clinical evidence of a cardiac cause for their symptoms. It should be used early in the diagnostic evaluation of recurrent unexplained syncope because a significant proportion of patients with recurrent syncope have vasovagal syncope.

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REFERENCES


