Safety and Tolerability of Tilt Testing and Carotid Sinus Massage in the “Oldest Old”

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Geriatric Cardiology and Medicine
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Tilt Table Test

Tilt Table Test (TTT) is the gold standard for the diagnosis of vasovagal syncope, if unexplained after initial evaluation.
Tilt Table Test

TILT PHASE (upright position):
- Passive phase (unprovoked, 20-45 minutes)
- Provocation phase (15 minutes)
Head-up Tilt: a useful test for investigating unexplained syncope

Rose Anne Kenny, John Bayliss, Ann Ingram, Richard Sutton

Head-up tilt, a recognised stimulus to vasovagal syncope, was used to investigate syncope that remained unexplained despite full clinical and electrophysiological assessment in fifteen patients, mean age 65 ± 10 years, who had had 15 ± 19 episodes of unexplained syncope over periods of a week to 26 years. After overnight fast systolic blood pressure and heart rate were continuously monitored during 40° head-up tilt for 60 min. Ten control subjects with no history of syncope were studied similarly. In ten patients (67%) and one control vasovagal syncope developed after 29 ± 19 min (p < 0.001). In symptomatic patients systolic blood pressure fell from 150 ± 32 to 56 ± 9 mm Hg (p < 0.001) and heart rate from 62 ± 9 to 38 ± 12 beats per min (p < 0.01). In each case symptoms during the test reproduced those previously experienced. No clinical findings predicted development of syncope during tilt. Baseline systolic blood pressure and heart rate did not differ significantly between patients and controls. Pacemakers were implanted in seven patients who have remained symptom-free since implant (follow-up 10 ± 3 mo).

The Italian Protocol...

SYNCOPE

‘The Italian Protocol’: a simplified head-up tilt testing potentiated with oral nitroglycerin to assess patients with unexplained syncope

A. Bartoletti¹, P. Alboni², F. Ammirati², M. Brignole⁶, A. Del Rosso⁶, G. Foglia Manzillo⁶, C. Menozzi⁷, A. Raviele⁸ and R. Sutton⁹

Chiara Mussi, MD,‡ Niccolò Marchionni, MD,† Giulio Masotti, MD† and The Gruppo Italiano di Studio della sincope dell’anziano

Carotid Sinus Massage

**Procedure**

- 10 seconds pressure where the carotid artery bifurcates
- both supine and in the upright position

Moya A. Eur Heart J, 2009
Parry SW. Heart, 2000
Carotid Sinus Syndrome, **CSS** (Method of Symptoms): reproduction of syncope in the presence of asystole longer than 3 seconds and/or a fall in systolic blood pressure > 50 mmHg.

Carotid Sinus Hypersensitivity, **CSH**: asystole > 3 seconds and/or BP fall > 50 mmHg in the absence of symptoms

Puggioni et al. Am J Cardiol, 2002
The diagnostic assessment of syncope is more difficult in elderly patients ...

- Difficulties taking medical history and information concerning syncope/falls
- Absence of prodromes or atypical presentation of syncope
- Frequent retrograde amnesia
TT and CSM in the elderly: From Literature...

- TT and CSM have a good diagnostic yield in elderly patients (Ungar, 2006. Del Rosso, 2002)
- The Italian Protocol has been validated in geriatric patients (Del Rosso, 2002)
- TT is safe in older people (Del Rosso, 2002) and in patients with comorbidities (Gieroba, 2004)
- TT is well tolerated in the elderly (Ungar, 2003. Del Rosso, 2002)

... no previous large studies evaluated TT and CSM in the “oldest old”
Tilt testing in elderly patients ...

an old story

Geriatria Universitaria
Ospedale Careggi
June 1996

Mr. L.B., 93 yo
Two unexplained syncopes

Head-up tilt test potentiated with glycercyl trinitrate

Was it safe ???
3 Syncope Units

Geriatric Cardiology and Medicine of the University of Florence, Italy
Geriatric and Gerontology Institute, University of Modena and Reggio Emilia, Italy
Department of Medical Gerontology, Trinity College of Dublin, Ireland

Safety and tolerability of TT and CSM in the oldest old

Aims

• To evaluate safety of TT and CSM in patients aged 80 and older;
  • To identify predictors of complications;
• To evaluate the tolerability of the neuroautonomic evaluation in the oldest old.
1401 patients referred to our Syncope Units (Florence, Modena, Dublin) were enrolled, 707 < 80 years old (50.5%) and 694 ≥ 80 years old (49.5%).

Indications:
- Unexplained syncope and/or falls
- Differential diagnosis with epilepsy
# Outcomes of the neuroautonomic evaluation

<table>
<thead>
<tr>
<th></th>
<th>All patients (n=1401)</th>
<th>Age &lt; 80 years (n=707)</th>
<th>Age ≥ 80 years (n=694)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neurally mediated diagnoses, n (%)</td>
<td>852 (60.8)</td>
<td>422 (59.7)</td>
<td>430 (62)</td>
<td>Ns</td>
</tr>
<tr>
<td>Positive TT, n (%)</td>
<td>692 (49.4)</td>
<td>371 (52.5)</td>
<td>321 (46.3)</td>
<td>0.02</td>
</tr>
<tr>
<td>Positive CSM, n (%)</td>
<td>147 (10.5)</td>
<td>68 (9.6)</td>
<td>79 (11.4)</td>
<td>Ns</td>
</tr>
<tr>
<td>CSH, n (%)</td>
<td>107 (7.6)</td>
<td>52 (7.4)</td>
<td>55 (7.9)</td>
<td>Ns</td>
</tr>
<tr>
<td>Orthostatic Hypotension, n (%)</td>
<td>458 (32.7)</td>
<td>134 (18.9)</td>
<td>324 (46.7)</td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>
# Tilt Testing results

**Positive TT**

<table>
<thead>
<tr>
<th></th>
<th>Positive TT (n=692)</th>
<th>Positive TT, age &lt; 80 years (n=371)</th>
<th>Positive TT, age ≥ 80 years (n=321)</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td>VASIS I, n (%)</td>
<td>145 (21)</td>
<td>88 (4.0)</td>
<td>57 (4.8)</td>
<td>Ns</td>
</tr>
<tr>
<td>VASIS IIA, n (%)</td>
<td>23 (3.3)</td>
<td>14 (3.8)</td>
<td>9 (2.8)</td>
<td>Ns</td>
</tr>
<tr>
<td>VASIS IIB, n (%)</td>
<td>56 (8.1)</td>
<td>47 (12.7)</td>
<td>9 (2.8)</td>
<td>0.0001</td>
</tr>
<tr>
<td>VASIS III, n (%)</td>
<td>405 (58.5)</td>
<td>198 (53.4)</td>
<td>207 (64.5)</td>
<td>0.003</td>
</tr>
<tr>
<td>Exaggerated response to ntg, n(%)</td>
<td>61 (4.4)</td>
<td>28 (4.0)</td>
<td>33 (4.8)</td>
<td>Ns</td>
</tr>
</tbody>
</table>

*Note:* p values are calculated for comparisons between age groups and VASIS subtypes.

**Results**

Total positive tilt testing (TT) rate: **49.4%** (n=692)

- 52.5% < 80 years, p = 0.02
- 46.3% ≥ 80 years

Exaggerated response to ntg: 61 (4.4%)
## CSM results

### Results

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### Cardio-inhibitory CSS

<table>
<thead>
<tr>
<th></th>
<th>CSS (n=147)</th>
<th>CSS, age &lt; 80 (n=68)</th>
<th>CSS, age ≥ 80 (n=79)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardio-inhibitory CSS, n (%)</td>
<td>95 (64.6)</td>
<td>46 (67.6)</td>
<td>49 (62.0)</td>
<td>Ns</td>
</tr>
</tbody>
</table>

### Vasodepressive CSS

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<tr>
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<th>CSS (n=147)</th>
<th>CSS, age &lt; 80 (n=68)</th>
<th>CSS, age ≥ 80 (n=79)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vasodepressive CSS, n (%)</td>
<td>33 (22.5)</td>
<td>13 (19.1)</td>
<td>20 (25.3)</td>
<td>Ns</td>
</tr>
</tbody>
</table>

### Mixed CSS

<table>
<thead>
<tr>
<th></th>
<th>CSS (n=147)</th>
<th>CSS, age &lt; 80 (n=68)</th>
<th>CSS, age ≥ 80 (n=79)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed CSS, n (%)</td>
<td>19 (12.9)</td>
<td>9 (13.2)</td>
<td>10 (12.7)</td>
<td>Ns</td>
</tr>
</tbody>
</table>
Results

**Multivariate analysis**

Positive TT
- Prodromes (p=0.0001)
- Predisposing conditions (p=0.009)

Negative TT
- Nitrates (p=0.002)
- Pacemaker (p=0.003)

Positive CSM
- Age (p=0.003)
- Male Sex (p=0.04)

Rafanelli et al. 2013
Complications of neuroautonomic evaluation

- **CSM** (Auscultation of the carotid arteries, eventually carotid Doppler ultrasound)
  - no complications (0/1401)

- **TT** 3.3% of patients (46/1170)
  - 15 patients < 80 years (2.1%)
  - 31 patients ≥ 80 years (4.5%)
  - p = 0.01

Mean age 77.2 ± 12.1 years (71.8 ± 16.9 years, p=0.03)
Orthostatic hypotension (50% vs 32.1%, p=0.01)
Venous incompetence (47.8% vs 31.1%, p=0.02)
## TT complications

<table>
<thead>
<tr>
<th>Complications</th>
<th>Patients with complications, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>TIA/Stroke</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Non sustained ventricular tachycardia</td>
<td>1 (0.07)</td>
</tr>
<tr>
<td>Sustained ventricular tachycardia</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Ventricular fibrillation</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Bradycardia/Asistole (atropine)</td>
<td>2 (0.1)</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>3 (0.2)</td>
</tr>
<tr>
<td>Mild prolonged hypotension</td>
<td>6 (0.4)</td>
</tr>
<tr>
<td>Prolonged hypotension with fluid administration</td>
<td>15 (1.1)</td>
</tr>
<tr>
<td>Minor side-effects</td>
<td>19 (1.4)</td>
</tr>
</tbody>
</table>

**Results**

- **Severe Complications (0.07%)**
- **Moderate Complications (0.4%)**
- **Minor Complications (2.9%)**
TT complications in different decades
Analysis of TT complications

Results

92.8% (non sustained ventricular tachycardia)
Predictors of complications
(Multivariate analysis)

Orthostatic hypotension (p=0.03)

Age

TT complications
Test intolerance

68.2% Orthostatic intolerance

Results (1.7%)
Therefore ...

- Complications occurred in 3.3% of patients (86.9% minor complications)
- Minor complications were prevalent in older and younger patients (90% and 80%)
  - Orthostatic hypotension is a predictor of complications
  - 46.7% orthostatic hypotension in patients ≥ 80 years
Therefore ...

- No complications
- No neurological complications

Therefore...

Walsh et al. 2006

CSM is safe
Therefore ...

- Low % of intolerance in both groups
- Intolerance rate similar across the decades
- Mainly due to orthostatic intolerance

Good tolerability

Paling et al. 2011
• Tilt Testing and Carotid Sinus Massage have a good diagnostic yield in elderly patients
• Tilt Testing and Carotid Sinus Massage are safe and well tolerated in the «Oldest old»

The “Oldest old” should NOT be excluded from neuroautonomic evaluation
Thank you for your attention