Significance of Post-Headshake Nystagmus in the Evaluation of Peripheral Vestibular Dysfunction

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Outline

- Evaluation of the dizzy patient
- The headshake test
- Caloric testing
- Methodology
- Data
- Previously published findings
- Discussion
- Conclusions
The dizzy patient

“I’m 150 years old and I’m dizzy!”
Two primary responses

Vertigofugal response

Vertigopedal (otologist) response

I’d rather have calorics!

This *could* be a surgical problem...
Evaluation of the dizzy patient

- Hearing loss
- Headache
- Concomitant symptoms
- Tinnitus
- Aural fullness
- Onset, Duration
- Detailed History
- Nature

Bedside Vestibular Testing

- Head impulse test
- Head shake test
- Dynamic visual acuity
- Romberg test
- Fukuda stepping

Special Testing

- Pure tone audiometry
- VNG/ENG
- VEMP testing
- Rotatory chair testing
- Neuroimaging
Head Shake Test

- HST
  - Tilt head forward 30 degrees
  - 20-25 cycles at 2Hz

- Factors affecting reproducibility of bedside testing:
  - Nature of dizziness
  - Severity of dizziness
  - Timing: onset of symptoms to examination
  - Compensation: degree and capacity
  - Interpractitioner variability
  - Individual practitioner consistency
Head Shake Test: Findings

- **Head Shake Test**
  - Tilt head forward 30 degrees
  - 20-25 cycles at 2Hz

- **Post-headshake nystagmus**
  - Can be monophasic or biphasic
  - May beat toward OR away from the impaired side
  - May have a vertical component ("cross-coupled" nystagmus)

- **Signs of central etiology**
  - Pure vertical nystagmus
  - Prolonged nystagmus
  - Disconjugate nystagmus
Head Shake Test: two concepts
Head Shake Test: two concepts

Vestibular nerve discharge is nonzero

- Maximal Excitation
- Baseline Range
- Maximal Inhibition

Diagram showing:
- Turning motion
- Afferent fibers of N. VIII
- INCREASED firing
- DECREASED firing
- Fluid motion in ducts
Head Shake Test: two concepts

Central velocity storage mechanism
Caloric Testing

- More objective comparison of left and right peripheral vestibular function
- Easier to standardize
Caloric Testing

  - Peripheral vestibular disorders affect low-Hz spectrum earlier and more severely
  - Caloric testing induces an endolymphatic rotational velocity of 0.0003 Hz (1 cycle/5 ½ minutes)
  - Head shake testing is performed at ~2 Hz (6600 times faster)
# Previously Published Findings

<table>
<thead>
<tr>
<th>Study</th>
<th>n</th>
<th>Controls</th>
<th>Disorder</th>
<th>Condition</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hain, Fetter, &amp; Zee (1987)</td>
<td>6</td>
<td>7</td>
<td>Complete UVH</td>
<td>Peripheral vestibular lesion</td>
<td>100%</td>
<td>43%</td>
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<tr>
<td>Wei, Hain, &amp; Proctor (1989)</td>
<td>108</td>
<td>-</td>
<td>Dizziness</td>
<td>No bilateral weakness</td>
<td>40%</td>
<td>60%</td>
</tr>
<tr>
<td>Vinci, Casani, &amp; Ghilardi (1989)</td>
<td>277</td>
<td>73</td>
<td>Referred for ENG</td>
<td>-</td>
<td>29%</td>
<td>90%</td>
</tr>
<tr>
<td>Vinci, Casani, &amp; Ghilardi (1989)</td>
<td></td>
<td></td>
<td>UVH</td>
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<td>40%</td>
<td>60%</td>
</tr>
<tr>
<td>Hall &amp; Laird (1992)</td>
<td>340</td>
<td>20</td>
<td>Dizziness</td>
<td>-</td>
<td>-</td>
<td>50%</td>
</tr>
<tr>
<td>Takahashi, Fetter, Koenig, &amp; Dichgans (1990)</td>
<td>16</td>
<td>-</td>
<td>UVH</td>
<td>-</td>
<td>90%</td>
<td>64%</td>
</tr>
<tr>
<td>Takahashi, Fetter, Koenig, &amp; Dichgans (1990)</td>
<td>116</td>
<td>-</td>
<td>Dizziness</td>
<td>-</td>
<td>27%</td>
<td>85%</td>
</tr>
<tr>
<td>Jacobson, Newman, &amp; Safadi (1990)</td>
<td>115</td>
<td>17</td>
<td>Dizziness</td>
<td>-</td>
<td>44%</td>
<td>65%</td>
</tr>
<tr>
<td>Burgio, Blakley &amp; Myers (1991)</td>
<td>115</td>
<td>17</td>
<td>Dizziness</td>
<td>-</td>
<td>-</td>
<td>65%</td>
</tr>
<tr>
<td>Goebel &amp; Garcia (1992)</td>
<td>214</td>
<td>-</td>
<td>Dizziness</td>
<td>UVH BVH</td>
<td>42%</td>
<td>18%</td>
</tr>
<tr>
<td>Fujimoto, Rutka, &amp; Mai (1993)</td>
<td>259</td>
<td>-</td>
<td>Vestibular weakness</td>
<td>&gt;20% UVH &gt;40% UVH &gt;60% UVH &gt;80% UVH</td>
<td>Overall 50.2% 64.3% 49.2%</td>
<td>73.1% 71.6%</td>
</tr>
<tr>
<td>Harvey, Wood, &amp; Feroah (1997)</td>
<td>105</td>
<td>-</td>
<td>Dizziness</td>
<td>-</td>
<td>35%</td>
<td>92%</td>
</tr>
<tr>
<td>Tseng &amp; Chao (1997)</td>
<td>258</td>
<td>-</td>
<td>Canal paresis</td>
<td>-</td>
<td>90%</td>
<td>53%</td>
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<tr>
<td>Giudetti, Monzani, &amp; Civiero (2002)</td>
<td>273</td>
<td>-</td>
<td>Confirmed peripheral weakness</td>
<td>Initial visit Six months recovery</td>
<td>74% 45%</td>
<td>Could not calculate</td>
</tr>
<tr>
<td>Iwasaki, Ito, Abbey, &amp; Murofushi (2004)</td>
<td>231</td>
<td>-</td>
<td>Dizziness</td>
<td>UVH &gt;20%</td>
<td>66%</td>
<td>77%</td>
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<tr>
<td><strong>Totals</strong></td>
<td>2219</td>
<td>117</td>
<td></td>
<td></td>
<td>56%</td>
<td>70.90%</td>
</tr>
</tbody>
</table>
Materials and Methods

- VNG Review of 445 Charts
  - Retrospective review of patients who had a VNG for dizziness

- 15 Patients Excluded
  - Could not tolerate, declined calorics, canceled VNG

- 132/430 Dizzy Patients
  - Positive HSN (31.9%)

- Binary quantification
  - + Sensitivity, Specificity, PPV, NPV
Results

- 132/430 (31.9%) dizzy patients had HSN
- Unilateral caloric weakness: RVR 20% or greater with contralateral DP
- Sensitivity 26.5%
- Specificity 83.9%
Discussion: variables

- Severity and nature of dizziness
- Inter-practitioner variability
- Loss of Velocity Storage mechanism
  - Complete unilateral loss may initially show no HSN
- Timing of patient compensation
  - ~100% Sensitivity for acute phase VN
  - HSN is evidence that a problem in the vestibular system exists or has existed
- Functional fluctuation of vestibular system
  - Meniere’s disease
  - BPPV
- Definition of +HSN
- Definition of “abnormal” caloric testing
Conclusions: Head Shake Test

- Depends on intact central velocity storage mechanism
- Cannot quantify a weakness or exclude coexistence of central pathology
- Useful bedside vestibular exam, high specificity (83.9%)
- Commonly positive in dizzy population (31.9%)
- When positive, may be helpful in establishing presence of peripheral lesion
- May help determine need for further testing
Bibliography


