VESTIBULAR OBJECTIVE ASSESSMENT INTERPRETATION

Please refer to the Vestibular Testing handout for details of how to perform each test and what constitutes a positive test. This handout is to help with your interpretation of the findings/formulate a diagnosis from what you see.

Eye ROM
- Will identify any potential cranial nerve/central problems affecting the eyes, which will impact upon vestibular assessment and treatment.

Cervical ROM
- Need to check initially to determine if there are any precautions for testing/treatment. Remember that the Hallpike-Dix test and Epley manoeuvres utilise only 45 degrees rotation to either side and slight extension, you should not be approaching the VBI testing parts of the neck range.

Tests in room light:
Spontaneous nystagmus
- In the first couple of days after a vestibular nerve lesion (e.g., post-op acoustic neuroma surgery), a patient will display spontaneous nystagmus at rest. This called a static vestibular defect, meaning that it occurs with the head static. It is caused by unequal input from the 2 sides of the vestibular apparatus (i.e., normal input from the intact side and none from the damaged side). The brain interprets this mismatch in input as the person constantly turning towards the intact side, therefore the nystagmus will beat (described by the fast phase) away from the lesion side. There is no treatment for a static vestibular defect and it is too early to commence adaptation exercises if you see this. The patient needs a couple of days and the brain will adapt. However they will probably be left with a residual dynamic vestibular defect (i.e., when they are moving) which will need follow-up treatment.

Gaze holding nystagmus
- Gaze holding nystagmus which changes direction in different positions of gaze is a sign of a central problem and would need referral to a doctor (if there is no diagnosis already which would explain a central defect such as a TBI).
- Pure downbeating, pure upbeating or pure torsional nystagmus are always central signs.
- In a peripheral vestibular lesion/hypofunction are likely to would see:
  - 1st degree nystagmus (if there was a L sided lesion): the nystagmus is not present in central position (looking forwards), or gaze towards the L side, but is present in R gaze (i.e., away from the side of the lesion). The nystagmus would be horizontal nystagmus beating towards the R. 1st degree nystagmus would be most likely to be seen some time after a unilateral vestibular lesion; or
  - 2nd degree nystagmus (if there was a L sided lesion): the nystagmus seen in the central gaze position and is the same
direction but increased when looking to the R (away from the side of the lesion). The direction would be horizontal towards the R. Nystagmus would not be present in the L gaze position; or
  o 3rd degree nystagmus (if there was a L sided lesion): the nystagmus would be seen in the L gaze position (horizontal nystagmus to the R), it would be brisker (but the same direction) in central gaze and brisker again (but still the same direction) in gaze towards the R. 3rd degree gaze evoked nystagmus would only be seen in the first couple of days after a vestibular lesion.

Skew deviation
- Vertical misalignment of the eyes due to a peripheral or central otolith defect. The eye that is down – the one that pops up when you perform the test – is the side of the lesion.
- Acute loss of function of the utricle on one side from VIIIth nerve section or vestibular neuritis will cause a pathologic ocular tilt response due to the unopposed excitation of the intact utricle.

Vergence
- Abnormalities are a central problem

Head Thrust
- Unilateral Vestibular loss is identified by a positive test to the side of the lesion, ie. if the R head thrust is positive, there is likely to be a R UVL.

Smooth pursuit
- Abnormalities are due to a brainstem or cerebellar abnormality (ie. central problem). Note that smooth pursuit ability does decay a little with age.

Saccadic eye movement
- Abnormalities are due to brainstem or cerebellar pathology (central).

VOR cancellation
- The VOR must be suppressed during the head movement in order to keep focussed on the target which is moving synchronously with the head.
- Unilateral vestibular lesions do not impair VOR cancellation unless the spontaneous nystagmus from the lesion is so high that it prevents the eye tracking systems from functioning normally, therefore impaired VOR cancellation is almost always a sign of cerebellar, brainstem or cortical pathology.

Dynamic Visual Acuity
- This test compares visual acuity with the head still to visual acuity with the head moving at 2 Hz which is above the frequency that pursuit eye movements can be used to track the target – therefore requires the VOR to be working. With a normal VOR the patient’s eyes will move
smoothly in the opposite direction of the head such that ocular fixation is always maintained. They should be able to read within 2 lines dynamically of where they read statically, or a vestibular defect is likely.

- This test is strongly positive in patients with bilateral vestibular loss.
- Following vestibular adaptation exercises dynamic visual acuity improves, possibly because of the development of pre-programmed or anticipatory eye movements.

Tests with Frenzel / IR lenses:

Spontaneous nystagmus
- As above for spontaneous nystagmus in room light.
- Inhibiting visual fixation by the use of the lenses will enhance any nystagmus.

Gaze holding nystagmus
- As above for the test in room light.
- Inhibiting visual fixation by the use of the lenses will enhance any nystagmus.

Head shaking nystagmus
- The presence of nystagmus immediately after this test indicates a vestibular imbalance. This sign may persist indefinitely after a peripheral or central unilateral vestibular lesion.
- The nystagmus will beat towards the intact side.
- In patients with bilateral vestibular loss this test will not be positive.

Hallpike-Dix testing
- To diagnose BPPV, there needs to be nystagmus occurring.
- The following tables summarise the assessment findings and treatments for the different types of BPPV:

<table>
<thead>
<tr>
<th>Canal</th>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior</td>
<td>Up and right torsional</td>
<td>Up and left torsional</td>
</tr>
<tr>
<td>Anterior</td>
<td>Down and right torsional</td>
<td>Down and left torsional</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Horizontal</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cupulolithiasis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canalithiasis</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Left (ageotrophic)</td>
<td>Right (ageotrophic)</td>
</tr>
<tr>
<td></td>
<td>Right (geotrophic)</td>
<td>Left (geotrophic)</td>
</tr>
</tbody>
</table>

*Geotrophic = beats toward the earth  Ageotrophic = beats away from the earth

<table>
<thead>
<tr>
<th>Canal</th>
<th>Type</th>
<th>Canalithiasis (Severe)</th>
<th>Canalithiasis (Mild)</th>
<th>Cupulolithiasis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior</td>
<td>BPPV</td>
<td>CRT*</td>
<td>Brandt-Daroff* CRT</td>
<td>Liberatory *</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Liberatory</td>
<td>CRT</td>
<td>Brandt-Daroff</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Brandt Daroff</td>
<td>Brandt-Daroff</td>
<td></td>
</tr>
<tr>
<td>Anterior</td>
<td>BPPV</td>
<td>CRT*</td>
<td>Brandt-Daroff* CRT</td>
<td>Modified Liberatory*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Modified Liberatory</td>
<td>CRT</td>
<td>Brandt-Daroff</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Brandt Daroff</td>
<td>Modified Liberatory</td>
<td></td>
</tr>
</tbody>
</table>

*Treatment of choice
**Horizontal BPPV**

<table>
<thead>
<tr>
<th>Bar-B-Que*</th>
<th>Bar-B-Que*</th>
<th>Quick Bar-B-Que</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modified Brandt Daroff</td>
<td>Modified Brandt Daroff</td>
<td>Forced Prolonged Position</td>
</tr>
</tbody>
</table>

Canalithiasis = short duration nystagmus  
Cupulolithiasis = persistent nystagmus

**Head Roll test**
- Nystagmus as described in the above tables will identify horizontal canal BPPV.
- Some patients with unilateral vestibular loss will be symptomatic in the Hallpike-Dix and Head Roll tests, but not have nystagmus. In this case, the symptoms arise due to motion sensitivity, so the MSQ testing sheet would be helpful to perform and direct your habituation treatment.

**Pressure test**
- Nystagmus or drift of the eyes when there is positive or negative pressure applied to the external auditory canal is present in patients with perilymphatic fistula, SCC dehiscence, hypermobile stapes and occasionally in Meniere’s disease or hydrops.

**Gait and Balance Tests:**
**Heel-toe/Sharpened Romberg/Tandem**
- Bilateral vestibular hypofunction <5s with eyes closed
- Predictive of vestibular hypofunction in children
- Difficult for older adults to perform
- 60% of community dwelling older adults able to perform >10s
- 5.4% of nursing home older adults able to perform >10s

**Single leg stance**
- Difficult for older adults to perform; healthy 60-69 y.o. ≥5s.
- This test has been correlated with injurious falls in older adults
- R and L times should be similar
- Not a very sensitive test for vestibular patients

**Modified CTSIB**
- Excellent test-retest reliability in older adults
- Vestibular patients perform more poorly on condition 4 (foam/EC)
- Useful for determining treatment strategies

**Timed Up and Go**
- Time <10s is normal
- 11-20s is considered within normal limits for frail elderly or individuals with a disability
- ≥13.5s correlated with fall risk in older adults
- Sensitive and specific in vestibular patients using cut-off of 11s.
- Score >30s indicates dependency in most ADL’s and mobility skills
Timed 10m walk

- Normative data:

<table>
<thead>
<tr>
<th>Age</th>
<th>Preferred (m/s) Men</th>
<th>Preferred (m/s) Women</th>
<th>Maximal (m/s) Men</th>
<th>Maximal (m/s) Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>20's</td>
<td>1.09</td>
<td>1.06</td>
<td>1.95</td>
<td>1.96</td>
</tr>
<tr>
<td>30's</td>
<td>1.27</td>
<td>1.16</td>
<td>1.83</td>
<td>1.65</td>
</tr>
<tr>
<td>40's</td>
<td>1.13</td>
<td>1.08</td>
<td>1.74</td>
<td>1.57</td>
</tr>
<tr>
<td>50's</td>
<td>0.94</td>
<td>1.09</td>
<td>1.17</td>
<td>1.49</td>
</tr>
<tr>
<td>60's</td>
<td>0.95</td>
<td>0.87</td>
<td>1.21</td>
<td>1.27</td>
</tr>
<tr>
<td>70's</td>
<td>0.94</td>
<td>0.85</td>
<td>1.35</td>
<td>1.19</td>
</tr>
<tr>
<td>frail</td>
<td>0.36</td>
<td>0.42</td>
<td>0.60</td>
<td>0.48</td>
</tr>
</tbody>
</table>

Dynamic Gait Index

- Assess ability to modify balance while walking in the presence of external demands
- Initial score <11 indicates severe impairment and likely to remain at risk for continued falls at discharge, so likely to require advice regarding assistive devices to improve safety and reduce risk for falls.
- Significant improvements are >2 points change
- History of falls are significantly correlated with DGI score <20.
  - Vestibular patients with score <20 were 2.58 times more likely to fall.

Motion Sensitivity Testing

- This will guide your treatment to habituate symptoms provoked by certain movements.
- 2 or 3 of the more moderately provoking manoeuvres are the basis for the treatment.
- Patient performs up to 5 reps once or twice daily.