Multidisciplinary Clinical Model for Managing OIF/OEF Dizzy Patients

Robin Pinto, Au.D.
Robin.pinto@amedd.army.mil

CPT Karen Lambert, MPT, NCS
Karen.lambert@amedd.army.mil
Signs & Symptoms of TBI
http://www.dvbic.org/

• Headaches
• Dizziness
• Tendency to get tired easily
• Fatigue from having to maintain attention and activity
• Visual impairment
• Change in hearing - difficulty hearing in crowded rooms or ringing in your ears
• Alteration in your sense of taste
• Involuntary muscle tightness and stiffness
• Weakness in one side of the body
• Seizures
Post-Traumatic Vertigo & Imbalance

1. Positional Vertigo
   • BPPV
   • Cerebellar or Brainstem disturbances
2. Post-traumatic Meniere’s syndrome
3. Post-traumatic migraine
4. Cervical vertigo
5. Temporal bone fractures
6. Perilymph fistula
7. Epileptic vertigo
8. Diffuse Axonal Injury (DAI)
9. Post concussion syndrome (TBI)

WRAMC DIZZINESS REFERRALS

- PHYSICAL THERAPY
- ENT
- AUDIOLOGY
- OPHTHALMOLOGY
- NEUROLOGY
TYPICAL REFERRAL PATTERNS for OIF/OEF

PCM

ENT

AUDIOLOGY

PHYSICAL THERAPY
TYPICAL REFERRAL PATTERNS for OIF/OEF

PCM → AUDIOLOGY

AUDIOLOGY ↔ ENT

PCM → PHYSICAL THERAPY
TYPICAL REFERRAL PATTERNS for OIF/OEF

PCM

PHYSICAL THERAPY

AUDIOLGY

ENT
TYPICAL REFERRAL PATTERNS for OIF/OEF + ORTHOPEDIC

PM&R

PHYSICAL THERAPY

AUDIOLOGY

ENT
OIF/OEF Dizzy Patient Issues

- Timeliness of evaluations
- Poor coordination of care
- Inefficient use of provider and patient time
- Specialized providers
- Complexity of medical issues
- Individualized treatment
<table>
<thead>
<tr>
<th>ENT</th>
<th>AUDIOLOGY</th>
<th>PHYSICAL THERAPY</th>
</tr>
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<tbody>
<tr>
<td>Oto/Neuro exam</td>
<td>Posturography</td>
<td>Comprehensive Balance Assessment</td>
</tr>
<tr>
<td>Review Meds</td>
<td>VNG</td>
<td>Assess multifactorial variables</td>
</tr>
<tr>
<td>Review Rads</td>
<td>Rotary chair</td>
<td>Treatment Plan</td>
</tr>
<tr>
<td>Review Labs</td>
<td>Audiogram</td>
<td></td>
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</tbody>
</table>
Multi-Disciplinary Dizzy Clinic for OIF/OEF (referrals to AUDIOLOGY)

PCM

Multi-D Dizzy Clinic In Audiology

Labs Rads Meds

Comprehensive evaluation of the vestibular system

Treatment plan
TBI PATIENTS = COMPLEX

WRAMC
MULTI-DISCIPLINARY
TEAM INITIATED

WEDNESDAY MORNING CLINIC –
AUDIOLOGY VESTIBULAR LAB
45 MINUTE NEW EVALS + 2 hour Aud
15 MINUTE FOLLOW-UPS
Multi-D Team started in March 2009

• 55 patients seen first 5 months
• Variety of etiologies of dizziness
• Chronic patients initially
• Acute patients
Dizziness/Imbalance Diagnoses

- Exercise Induced
- Bell's Palsy
- Aphysiologic
- Meniere's
- Pharmalogically induced
- Psychogenic
- Blast induced disorientation
- Labrynthine concussion
- Central Vestibular
- BPPV
- Cervical Vertigo
- Migraine Associated Vertigo
- Post Concussion Syndrome

Patients
Initial Multidisciplinary Team Evaluation

Before clinic
- Vitals
- Symptom Questionnaire
- Dizziness Handicap Inventory
Patient Interview

• Introduction of Clinic Providers (establish lead interviewer, primary note writer)
• Explanation of “Group” Evaluation
• Chief Complaints
• “Tell me about your dizziness…..”
  – Dizziness
    • Description (spinning, lightheaded, imbalance, disorientation, etc.)
    • Temporal Characteristics (Frequency, Duration)
    • Onset (mechanism of injury)
    • Triggers, Severity, Accompanying symptoms
Chief Complaint: Dizziness that comes and goes since being injured in Iraq.

History of Present Illness:
The Patient is a 21 year old male. He reported: Headache He does have episodic headaches. They are hemicranial and frontal. The pain is mild (2/10). He could not describe the character of the pain well "a little of everything." They go "hand in hand" with his dizziness. They happen about daily, but are decreasing. No facial pain.

No vision problems. Not other than needing eye glasses. He says his vision will occasionally dim. He did not describe any particular visual field and no diplopia. Photophobia He just got transition lenses for this.

Nausea occurs with body motion while traveling (including while riding on elevators). New since his trauma.

Dizziness: He describes spells of vertigo that last about one minute each. They come in spells (with his headaches). He can go for days without one, then have 5 in a day. The duration does not vary much at all. Bending down seems to induce it, but he did not describe any other positional symptoms. This started soon after his head trauma and vertigo if so, how long does it typically last? How long was the longest spell? The shortest? When was the first one? The last one? No lightheadedness (standing, sitting, or laying down), no fainting, no disorientation, no memory lapses or loss, no mouth droop, no speech difficulties, no paralysis, and no frequent falls while walking. No difficulty with balance and no numbness of the face.

Anxiety:
No neck pain. No hearing loss, no hyperacusis, or noise-induced dizziness, no earache, the ears feel pressured, with an ability to 'pop', no discharge from the ears, and no tinnitus. Very rare.

• Chief Complaints
• Dizziness
  • Temporal Characteristics (Frequency, Duration)
  • Onset (mechanism of injury)
  • Triggers, Severity,
Past Medical History

- Physical Trauma (blast? Head injury?)
- Environmental Exposure (noise)
- Surgical History
- Diagnosis History
  - Acoustic trauma?
  - CNS infections?
  - Seizures?
  - Psychiatric disorders (including PTSD or adjustment disorder)
- Previous Therapy
  - Physical Therapy or Medications
- Personal History
  - Military Combat
  - Behavioral History/Smoking/Alcohol?
- Family History
  - Otologic disorders
  - Cancer/CNS neoplasms
- Review of Systems (current symptoms)
  - Cardiovascular, Pulmonary, GI, Psychological (to include sleep), etc
**Past medical/surgical history**

**Reported History:**
- Past medical history Unremarkable. He was seen in the TBI clinic for a cerebellar abnormality that was found after his trauma, but it probably is a pre-existing cavernoma.
- Medical: No neck trouble. No venereal disease and no cancer.
- Surgical / procedural: No surgical / procedural history
- Environmental exposure: No high level of environmental noise (prior to any event in the HPI)

**Physical trauma:** Trauma to the head (prior to any event in the HPI). He had a fall with LOC off of a jungle gym when he was 8 or 9. He had a scan at an ED, but no admission.

**Diagnosis History:**
- No acoustic trauma (explosive) (prior to any event in the HPI).
- Motion sickness Always got motion sick easily, now worse.
- No CNS infections
- No meningitis.
- No seizure disorder
- No Meniere’s disease (or other neurologic diseases).
- No psychiatric disorders (other than PTSD or adjustment disorder)
- No post-traumatic stress disorder.
- Adjustment disorder With anxiety

**Previous therapy**
- No history of modalities

**Personal history**
- Personal history: Military combat 13 April 09 - and IED in Iraq. He was in the turret of the vehicle when it went off. He was dazed with no LOC. He says he hit his head on the 50 cal. Everybody was hurt in some way, but one was killed.
- Behavioral history: Not smoking and not chewing nicotine-containing substances.
- Alcohol: Not using alcohol.
- Military: Military history First deployment. 31B (MP).
- Ototoxic medication - None.

**Family history**
- No hearing loss
- No CNS neoplasms.

**Review of systems**
- Systemic symptoms: Not feeling tired (fatigue).
- Cardiovascular symptoms: No chest pain or discomfort and no palpitations.
- Pulmonary symptoms: No dyspnea.
- Gastrointestinal symptoms: No nausea. No vomiting.
- Psychological symptoms: No depression. Sleep disturbances.

**Physical findings**
- Vital signs:
  - Current vital signs reviewed - Normal.

**Standard Measurements**
- Patient was not overweight.
Physical Exam

• Ocular Motor (without video)
  – Gaze
  – Saccades
  – Smooth Pursuit

• ENT Physical Exam

• Neuro Screen
  – Finger to Nose
  – Manual Muscle Test
  – Rapid Supination/Pronation Test
  – Romberg

• Video Infrared
  – Spontaneous
  – Gaze Vertical and Horizontal
  – Cervical
  – Head Shake Test
  – Dix-Hallpike
General appearance:  
* Normal.

Head:  
Appearance: * Head normocephalic.
Examination Of Face: * No facial abnormalities were observed.

Neck:  
Appearance: * Of the neck was normal.
Thyroid: * Showed no abnormalities.

Eyes:  
General/bilateral:  
Extraocular Movements: * FND evaluation for eyetracking was normal. No spontaneous nystagmus. No gaze  

torsion. Three beats of left-beat post-headshake nystagmus. Left beat nystagmus with the head to the  
left (setting). Right Dix-Hallpike normal. Left Dix-Hallpike normal. No positional nystagmus. Frenzel goggles  
without fixation used for everything. * Normal - Normal gaze, smooth pursuit, and saccades. No INO.

Pupil: * Normal - equal, round, and reactive to light and accommodation.
External Eye: * Showed no abnormalities.

Ears:  
General/bilateral:  
Right ear:  
Outer Ear: * Normal - Normal.
Tympanic Membrane: * Normal (microscope used) - Normal. TM intact. No effusions. No retractions.

Left ear:  
Outer Ear: * Normal - Normal.
Tympanic Membrane: * Normal (microscope used) - Normal. TM intact. No effusions. No retractions.

Nose:  
General/bilateral:  
Cavity: * No nasal cavity abnormalities.

Oral cavity:  
* Normal.

Pharynx:  
Oropharynx: * Normal.

Musculoskeletal system:  
Cervical Spine:  
General/bilateral: * Cervical spine rotation was not diminished.

Neurological:  
* Mental status was normal.
Speech: * Normal. * Voice quality was normal.
Cranial Nerves: * Normal.

Coordination/Cerebellum: * No dysmetria was seen (finger to nose).
Balance: * Romberg's sign was absent.

Psychiatric Exam:  
Mood: * Euthymic.
Affect: * Congruent with the mood.

Tests:  
Laboratory studies:  
Audiometry:  
No audiometry - Audiogram reviewed. Normal pure-tones and speech.

Imaging studies:  
An MRI was performed - Brain images personally reviewed. Cerebellar lesion, but not in vestibu-co-cerebellum.
What else?

- Posturography
  - Sensory Organization Test
  - Motor Control Test
- Dynamic Gait Index
- Mallinson Criteria
- Review of Medications, Radiology and Labs by Neurotologist

**Dynamic Gait Index**

**Description:** Developed to assess the likelihood of falling in older adults. Designed to test eight facets of gait.

**Equipment needed:** Box (Shoebox), Cones (2), Stairs, 20' walkway, 15” wide

**Completion:**
- **Time:** 15 minutes
- **Scoring:** A four-point ordinal scale, ranging from 0-3. “0” indicates the lowest level of function and “3” the highest level of function.

**Total Score = 24**

**Interpretation:**
- $\leq 19/24 = \text{predictive of falls in the elderly}$
- $> 22/24 = \text{safe ambulators}$

---

**1. Gait level surface**

**Instructions:** Walk at your normal speed from here to the next mark (20’)

**Grading:** Mark the lowest category that applies.

- **(3)** Normal: Walks 20’, no assistive devices, good speed, no evidence for imbalance, normal gait pattern
- **(0)** Severe Impairment: Cannot walk 20’ without assistance, severe gait deviations or imbalance.

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**2. Change in gait speed**

**Instructions:** Begin walking at your normal pace (for 5’), when I tell you “go,” walk as fast as you can (for 5’). When I tell you “slow,” walk as slowly as you can (for 5’).

**Grading:** Mark the lowest category that applies.

- **(3)** Normal: Able to smoothly change walking speed without loss of balance or gait deviation. Shows a significant difference in walking speeds between normal, fast and slow speeds.
- **(2)** Mild Impairment: Is able to change speed but demonstrates mild gait deviations, or not gait deviations but unable to achieve a significant change in velocity, or uses an assistive device.
- **(1)** Moderate Impairment: Makes only minor adjustments to walking speed, or accomplishes a change in speed with significant gait deviations, or changes speed but has significant gait deviations, or changes speed but loses balance but is able to recover and continue walking.
- **(0)** Severe Impairment: Cannot change speeds, or loses balance and has to reach for wall or be caught.

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**Mallinson Criterion**

<table>
<thead>
<tr>
<th>Comprehensive Report</th>
<th>Mallinson Criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1 2.0: Jitter Not present</td>
<td></td>
</tr>
<tr>
<td>S2 2.0: Jitter Present</td>
<td></td>
</tr>
<tr>
<td>S3 2.0: Jitter Present</td>
<td></td>
</tr>
<tr>
<td>S4 2.0: Jitter Present</td>
<td></td>
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<tr>
<td>S5 2.0: Jitter Present</td>
<td></td>
</tr>
<tr>
<td>S6 2.0: Jitter Present</td>
<td></td>
</tr>
<tr>
<td>S7 2.0: Jitter Present</td>
<td></td>
</tr>
<tr>
<td>S8 2.0: Jitter Present</td>
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**Interpretaion:**
- $\leq 19/24 = \text{predictive of falls in the elderly}$
- $> 22/24 = \text{safe ambulators}$
VISUAL ANALOG SCALES FOR VESTIBULAR LIKE SYMPTOMS

<table>
<thead>
<tr>
<th>Vertigo</th>
<th>Oscillopsia</th>
<th>Motion Intolerance</th>
<th>Dysequilibrium</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;The Worst It could be&quot;</td>
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</tr>
<tr>
<td>&quot;No spinning at all&quot;</td>
<td>&quot;No difficulty seeing clearly at all&quot;</td>
<td>&quot;I am experiencing no motion sickness&quot;</td>
<td>&quot;I feel perfectly steady&quot;</td>
</tr>
</tbody>
</table>

10 cm = 3.94"
Motor Control Test

Weight Symmetry
Backward Translations

Weight Symmetry
Forward Translations

Latency (msec)
Backward Translations

Latency (msec)
Forward Translations

AMPLITUDE SCALING
Backward Translations

AMPLITUDE SCALING
Forward Translations

Data Range Note: User Data Range: 20–69

Post Test Comment:
### Mallinson Criterion

<table>
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<td>Better performance on first trial of SOT 1 &amp; 2 (when unaware of being measured)</td>
<td>N/A</td>
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<td><strong>SOT COG X-Y Plot</strong></td>
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<td>Circular sway patterns without any falls (excessive lateral sway without falls &gt;2.5deg)</td>
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<td><strong>Clinical Impression</strong></td>
<td></td>
</tr>
<tr>
<td>Clinical judgment (&quot;gut feeling&quot;)</td>
<td></td>
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**TOTAL SCORE** 1/9

0/9-2/9 = No suspicion of aphysiologic behavior  
3/9 = Possible suspicion raised  
4/9 = Probably Aphysiologic Performance  
5/9-9/9 = Definitely Aphysiologic Performance

### Sensory Organization Test

(Sway Referenced Gain: 1.0)

**Equilibrium Score**

<table>
<thead>
<tr>
<th>Conditions</th>
<th>FALL</th>
<th>Composite</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>3</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>4</td>
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</tr>
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<td>5</td>
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<td>75</td>
</tr>
<tr>
<td>6</td>
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Composite 29
### Mallinson Criterion

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### SOT COG X-Y Plot

- Circular sway patterns without any falls (excessive lateral sway without falls > 2.5 deg)

### Sway, Shear and Alignment Data

- Repetitive large amplitude "suspicious" anterior-posterior sway without falls

### Motor Control Test

- Exaggerated motor responses to small forward & backward platform translations
- Inconsistent, non-repetitive motor response to all translations and both adapting lines

### Clinical Impression

- Clinical judgment ("gut feeling")

| TOTAL SCORE | 1 | 0 |

0/9 - 2/9 = No suspicion of aphysiologic behavior

3/9 = Possible suspicion raised

4/9 = Probably Aphysiologic Performance

5/9 - 5/9 = Definite Aphysiologic Performance

---

**Sensory Organization Test COG Trace**

#### Trial 1

![SOG Trace Trial 1](image)

#### Trial 2

- FALL
- FALL
- FALL
- FALL
### Mallinson Criterion

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5/9-9/9 Definite Aphysiologic Performance
Dynamic Gait Index

Equipment needed: Box (Shoebox), Cones (2), Stairs, 20’ walkway, 15” wide
Completion:
Time: 15 minutes
Scoring: A four-point ordinal scale, ranging from 0-3. “0” indicates the lowest level of function and “3” the highest level of function.
Total Score = 24
Interpretation: < 19/24 = predictive of falls in the elderly
> 22/24 = safe ambulators

1. Gait level surface _____
Instructions: Walk at your normal speed from here to the next mark (20’)
Grading: Mark the lowest category that applies.
(3) Normal: Walks 20’, no assistive devices, good speed, no evidence for imbalance, normal gait pattern
(1) Moderate Impairment: Walks 20’, slow speed, abnormal gait pattern, evidence for imbalance.
(0) Severe Impairment: Cannot walk 20’ without assistance, severe gait deviations or imbalance.

2. Change in gait speed _____
Instructions: Begin walking at your normal pace (for 5’), when I tell you “go,” walk as fast as you can (for 5’). When I tell you “slow,” walk as slowly as you can (for 5’).
Grading: Mark the lowest category that applies.
(3) Normal: Able to smoothly change walking speed without loss of balance or gait deviation. Shows a significant difference in walking speeds between normal, fast and slow speeds.
(2) Mild Impairment: Is able to change speed but demonstrates mild gait deviations, or not gait deviations but unable to achieve a significant change in velocity, or uses an assistive device.
(1) Moderate Impairment: Makes only minor adjustments to walking speed, or accomplishes a change in speed with significant gait deviations, or changes speed but has significant gait deviations, or changes speed but loses balance but is able to recover and continue walking.
(0) Severe Impairment: Cannot change speeds, or loses balance and has to reach for wall or be caught.

3. Gait with horizontal head turns _____
Instructions: Begin walking at your normal pace. When I tell you to “look right,” keep walking straight, but turn your head to the right. Keep looking to the right until I tell you, “look left,” then keep walking straight and turn your head to the left. Keep your head to the left until I tell you “look straight,” then keep walking straight, but return your head to the center.
Grading: Mark the lowest category that applies.
(3) Normal: Performs head turns smoothly with no change in gait.
(2) Mild Impairment: Performs head turns smoothly with slight change in gait velocity, i.e., minor disruption to smooth gait path or uses walking aid.
(1) Moderate Impairment: Performs head turns with moderate change in gait velocity, slows down, staggers but recovers, can continue to walk.
(0) Severe Impairment: Performs task with severe disruption of gait, i.e., staggers outside 15” path, loses balance, stops, reaches for wall.
**Tests**

**Laboratory studies:**

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
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<tr>
<td>Posturography</td>
<td>SOT: composite score 29/100 with difficulty across all conditions, greatest difficulty with conditions 5 and 6; raw data reveals appropriate balance reactions</td>
</tr>
<tr>
<td>MCT</td>
<td>Unable to draw conclusions based on computerized results will need to review raw data</td>
</tr>
<tr>
<td>VAS: Vertigo</td>
<td>0.8/10 Oscillosia 1.0/10 Motion Intolerance 2.8/10 Dysequilibrium 1.9/10</td>
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<td>Dynamic Gait Index</td>
<td>22/24</td>
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**PLAN:** Pt to complete vestibular testing and return to clinic for counseling 10 June. Pt to return to physical therapy for exercises to address apparent unilateral hypofunction with compensatory exercises.
Neurotologist: Review of Medications, Radiology and Labs

PROCEDURE:
MRI, BRAIN W/ W/ GAD

EVENT DATE:
15-Apr-2009 15:10:00

ORDER COMMENT:
NO BRIEF COMMENT

REASON FOR ORDER:
EB Blast 5MM hyperdense area w/o mass effect which was stable on 12H repeat
CHANGED TO W/O GAD PER ABBOTT

EXAM #: 09044992

EXAM DATE/TIME: 15-Apr-2009 15:16:00

TRANSCRIPTION DATE/TIME: 16-Apr-2009 09:15:00

PROVIDER: CAIN, STEVEN M

REQUESTING LOCATION: L 8D LANDSTUHL

STATUS: COMPLETE

RESULT CODE: SEE REPORT TEXT

INTERPRETED BY: MAHLON, MICHAEL ANDREW

APPROVED BY: MAHLON, MICHAEL ANDREW

APPROVED DATE: 16-Apr-2009 09:28:00

REPORT TEXT:
CHCS 09044992

MRI brain with contrast:

TECHNIQUE: Unenhanced axial and sagittal T1, axial FLAIR, axial diffusion, and axial and sagittal T2 WI were obtained of the brain in axial and sagittal planes. Gadolinium enhanced axial and coronal images were subsequently obtained.

COMPARISON STUDY: None

FINDINGS: There is a focal 9 mm high T2/ FLAIR signal foci within the left cerebellum in the region of the dentate nucleus. There is significant blooming artifact on the SWI sequence consistent with hemosiderin. No blooming artifact is identified on the remainder of the sequences. This lesion lesion has low signal on diffusion. No significant post contrast enhancement is identified. Normal signal, size and configuration of the remaining brain parenchyma and CSF-containing spaces. No mass-effect, space-occupying lesion, or pathologic fluid collection. Normal calvarial bone marrow signal.

IMPRESSION: MRI findings consistent with traumatic brain injury of the left cerebellum. Differential diagnosis to include remote focal infarct. Recommend clinical correlation.

The above findings were discussed with PA-C Cain at 0912 hours on 16 April 2009.
Preliminary Assessment & Plan

- Differential Diagnosis
- Audiology Tests
- Radiology Orders (if necessary)
- Laboratory Orders (if necessary)
**Preliminary Assessment & Plan**

**A/P Written by LITTLEFIELD, PHILIP D @ 21 May 2009 09:12 EDT**

1. Dizziness: Unclear etiology. Probably part of a post-concussive syndrome. He links them to his headaches, but he is not describing the typical characteristics of migraine-associated dizziness. It sounded like BPPV by history, but this was not supported on today’s exam. It does not sound like a typical vestibular concussion either. The nystagmus with turning his neck brings up the possibility of cervical dizziness, but it is uncommon for this to be vertigo, usually just spatial disorientation. There is a cerebellar abnormality, but it is in the hemisphere, which is not an area expected to cause vertigo. Of course, there may be some anxiety component since we know that he has an adjustment d/o with and anxiety component. He definitely could benefit from further testing.

<table>
<thead>
<tr>
<th>Plan:</th>
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<tbody>
<tr>
<td>1. Vestibular testing.</td>
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<tr>
<td>2. PT</td>
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<tr>
<td>3. Patient counseled with the team (this care coordination was over 20 of 40 minutes).</td>
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<tr>
<td>4. Follow-up after testing.</td>
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<td>5. Continue with other care.</td>
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**Procedure(s):**
- Extraocular Movements ENT Evaluation Of Positional Nystagmus x 1
- Extraocular Movement ENT Evaluation Of Spontaneous Nystagmus x 1

**Disposition Written by LITTLEFIELD, PHILIP D @ 21 May 2009 09:12 EDT**

Released w/o Limitations

Follow up: 1 month(s) or sooner if there are problems. - Comments: After testing.

Discussed: Diagnosis, Medication(s)/Treatment(s), Alternatives, Potential Side Effects with Patient who indicated understanding. - Comments: Medications reviewed and reconciled with the patient.

40 minutes face-to-face/floor time. >50% of appointment time spent counseling and/or coordinating care.
Preliminary Assessment & Plan

• Differential Diagnosis
• **Audiology Tests**  
  – scheduling appointments
• Radiology Orders (if necessary)
• Laboratory Orders (if necessary)
# Audiology

## 2 Dedicated Vestibular Audiologists

<table>
<thead>
<tr>
<th></th>
<th>MONDAY</th>
<th>TUESDAY</th>
<th>WEDNESDAY</th>
<th>THURSDAY</th>
<th>FRIDAY</th>
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<tbody>
<tr>
<td><strong>MORNING</strong></td>
<td></td>
<td>1 HOUR FOLLOW-UP AUDIOLOGY</td>
<td>MULTI-D CLINIC – 4 new patients</td>
<td>2 HOUR VESTIBULAR EVALS IN AUDIOLOGY X 2</td>
<td>2 HOUR VESTIBULAR EVALS IN AUDIOLOGY X 2</td>
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<tr>
<td><strong>AFTERNOON</strong></td>
<td>1 HOUR FOLLOW-UP AUDIOLOGY</td>
<td>WRITE NOTES</td>
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*WALTER REED ARMY MEDICAL CENTER*
Audiology Tests

- VNG
- Dynamic Visual Acuity Test
- Rotary Chair (SHA: 0.8, 0.32 and 0.01 Hz, 240 step and UCF with SVV) – if tolerated
- Audiogram
- OAEs
- VEMP (under research protocol)
Audiology Assessment

**Previous tests**
Ocular motor: normal results (saccades, smooth pursuit and OKN)

Rotary chair:
- Sinusoidal harmonic acceleration (SHA) demonstrated normal VOR phase, gain and symmetry for 0.01 to 1.75 Hz. A few mild beats of RB nystagmus noted after high frequency SHA testing, 1.75 Hz.
- Step test to 240 deg/sec demonstrated normal peak eye velocities.
- Normal static SVV
- UCF SVV revealed normal results (right = -8, center = -0.3, left = 3.7)
- Previous AUDIO WNL, AU.

**Tests**
1. No evidence of spontaneous nystagmus. SLight right beating present with cervical evaluation, head right, not latent.
2. No headshake nystagmus.
3. Hallpike left negative for symptoms or nystagmus. Upbeating nystagmus noted with hallpike right, pt reported feeling "uneasy". Upbeating present upon return to sitting, less in degree.
4. No positional nystagmus.

**Test conclusions**
Normal audio. Normal Rotary chair. Essentially normal VNG; only significant finding was upbeatt nystagmus with right hallpike. Not likely BPPV. Note, pt did take anxiety meds this morning.
No evidence of peripheral vestibulopathy.
FINAL Assessment & Plan

• Team Meeting
• Patient Counseling
  – Explanation of test results
  – Diagnosis
  – Plan of Care
  – Expectations
• Referrals (i.e. Physical Therapy, Ophthalmology, etc.)
A/P Written by LITTLEFIELD, PHILIP D @ 10 Jun 2009 1643 EDT

1. dizziness: Migraine associated dizziness (post-concussive) - declined prophylactic medications today. I encouraged prn medications (Tylenol or Motrin) to help with the pain, at least, but they do not help the dizziness. He declined this as well.

Testing showed no vestibular dysfunction. I think his dizziness is central - migraine and post-concussive dysfunction.

Plan:
1. Physical therapy - start agility exercises.
2. PRN medications for HA.
3. F/U in a few weeks.
4. Counseled for about 10 minutes with the team.
FINAL Assessment & Plan

• Team Meeting
• Patient Counseling
  • Explanation of test results
  • Diagnosis
  • Plan of Care
  • Expectations
• Referrals (i.e. Physical Therapy, Ophthalmology, etc.)
Physical Therapy

CPT Karen Lambert, MPT, NCS
Vestibular Training for Physical Therapists

- Basics covered as part of PT school
- Continuing Education Courses provided throughout year
- Gold Standard “Emory Course”
  - APTA sponsored
  - Competency Based Course for Evaluation and Rehabilitation of Vestibular Dysfunction
- MVAR: Military Vestibular Assessment and Rehabilitation
Physical Therapy Vestibular Evaluation

- UE/LE motor screen
- Cervical ROM screen
- Ocular Motor screen
- Slow VOR
- VOR Cancellation
- Post Head Shake
- Head Impulse (Thrust)
- Dix Hallpike (PC/AC)

- Roll Test (HC)
- Balance Assessment (SLS/Romberg)
- Dynamic Gait Assessment
- Posturography
- Dynamic Vision/Gaze Stabilization
Functional Measures of Balance

• **Dynamic Gait Index (DGI) >19 normal**
  - Ambulation
  - Change in speed
  - Horizontal head turns
  - Vertical head turns
  - 180 degree pivot turn
  - Step over obstacle
  - Step around obstacle
  - Up and down steps

• **Functional Gait Assessment (FGA)**
  - adds: Narrow Base of Support, Eyes Closed, Ambulating Backwards

• **HiMAT**
  - Walk, walk backwards, Run, skip, bound, tip toes, hop, stairs
Physical Therapy Plan of Care

- Individualized to patient diagnosis, goals, comorbidities
- Goal oriented
  - Patient specific goals are set at evaluation (Short Term Goals – STG vs. Long Term Goals – LTG)
  - Progress towards goals measured on monthly basis
    - Subjective measures: DHI, ABC
    - Functional measures: DGI, HiMAT
    - Posturography/inVision: SOT, HSSOT, eSOT, DVA, GST
- Develop Home Exercise Program (HEP)
- PATIENT EDUCATION – diagnosis, impairment, expected outcomes
Treatment Sessions

- Neuromuscular Re-education (97112)
  - Canal Repositioning
  - Static/Dynamic Balance
  - High Level Balance
  - Activity Specific Retraining
BPPV

- Posterior/Anterior Canal
  - Epley Repositioning Maneuver
  - Complex patients
    - Cervical ROM: Tilt table
    - Orthopedic Concerns: Alternate techniques

- Horizontal Canal
  - 270°/360° BBQ roll
Adaptation Exercises: Goal to increase the gain of the VOR – Return it to 1:1 ratio
- Requires retinal slip for recovery
- Exercises to be performed 3-5x/day
- Expected duration of care: 4-6 weeks
Adaptation Exercises VOR x 1

- VOR x 1:
  - Sitting, standing, tandem, ambulating
  - Solid surface, compliant surface
  - Horizontal, vertical, diagonal
  - Begin slow pace, increase speed (use metronome to guide HEP and progress)

- Head movement, target stationary

Monitor progress with inVision DVA/GST
Adaptation Exercises VOR x 2

- Considered a progression of VORx1
- Incorporates movement of head and target with eyes maintained on target
- Perform horizontally, vertically, and diagonally
Bilateral Vestibular loss

• Substitution Exercises:
  – vestibular system is no longer sufficient to maintain postural control/ocular stability
  – use of other reflexes/postural control systems

• Cervical Ocular Reflex (x1 view, remembered targets)

• Use of visual/somatosensory systems (foam, hip/ankle strategies)

• Exercises to be performed 3-5x/day

• Expected duration of care: 3-6 months
Motion Sensitivity

- Motion Sensitivity Quotient
  - patient response to movement
  - 16 positions associated with motion related symptoms
- With or without true vestibular pathology
- Often accompanied by anxiety
# Motion Sensitivity Quotient

<table>
<thead>
<tr>
<th></th>
<th>Intensity</th>
<th>Duration</th>
<th>Score (I + D)</th>
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<tbody>
<tr>
<td>Baseline Sx</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Sit ⇒ Supine</td>
<td></td>
<td></td>
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<tr>
<td>2. Supine ⇒ Left side</td>
<td></td>
<td></td>
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<tr>
<td>3. ⇒ ⇒ Right side</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Supine ⇒ Sit</td>
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<td></td>
<td></td>
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<tr>
<td>5. Left Hallpike</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. ⇒ ⇒ Sit</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>7. Right Hallpike</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. ⇒ ⇒ Sit</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>9. Sit ⇒ Nose Lt Knee</td>
<td></td>
<td></td>
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<tr>
<td>10. ⇒ ⇒ Sit erect</td>
<td></td>
<td></td>
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<tr>
<td>11. Sit ⇒ Nose Rt Knee</td>
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<td></td>
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<tr>
<td>12. ⇒ ⇒ Sit erect</td>
<td></td>
<td></td>
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<tr>
<td>13. Head Rotation</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>14. Head flex / ext</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>15. Stand Rotation Rt</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>16. Stand Rotation Lt</td>
<td></td>
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<tr>
<td>TOTAL</td>
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Habituation

- Repeated exposure to symptom provoking stimuli will result in gradual decrease in symptoms over time
- Exercises to be performed 3-5x/day
- Expected duration of care: 6-12 mos (pt does NOT need to attend daily/weekly PT)
Co-morbidities

- Vestibular dysfunction in presence of TBI: Time frames for all treatment philosophies increase (multiply x 2)
- Vestibular dysfunction with Anxiety: strong relationship between anxiety and subjective reports of dizziness
  - Psychogenic
  - Otogenic
  - Interactive
Visual/Vestibular Retraining

- Stationary Targets
- Moveable Surround
Otolith Stimulation

- Linear Movement
- Lunges
- Total Gym
- Physioball
- Use of treadmill
- CAREN platform
CAREN - Computer Assister Rehab ENviron

• Motion capture system
• Motion Platform
• Treadmill
• 120° Screen
• Video Projectors
• Audio System
• Safety Features
Physical Therapy Summary

- Individualized Goals
- Progression of program dependent on patient response
- Challenge patient
- KEEP IT FUN
Improvements in OIF/OEF Dizzy Patient Care

• Timely evaluations
• Coordination (between ENT, PT, Aud)
• Efficient use of provider and patient time
• Guaranteed specialists
• Group management of multi-factorial patients
• Group patient education
• Individualized treatment
Audiologists: Purpose of Vestibular Evaluation

- Impairment? Peripherally or centrally?
  - Ocular Motor System Impairment?
- Is there an injury to the vestibular system?
- Which side is affected?
- Has the patient compensated for the injury?
- Is the patient a candidate for vestibular rehabilitation therapy?
- Is there a “balance impairment”? 
Diagnostic Equipment in Audiology
• **INNER EAR VESTIBULOPATHIES**
  – Pressure Fistula Test
  – Tullio
  – Electrocochleography

• **VOR MEASURES**
  – VNG
  – Gaze Stabilization Test
  – Dynamic Vestibular Acuity Test (DVA)
  – Rotational Vestibular Assessment
    • Sinusoidal
    • Velocity Step Test
    • Visual Fixation Suppression
  – Vestibular Auto-Rotation Test (Active Head Shake)

• **VESTIBULOSPINAL MEASURES**
  – Dynamic Posturography
    • SOT
    • Head Shake SOT
    • Motor Control Testing
    • Adaptation Test
  – VEMP (click / tone / tuning curve)
  – Modified CTSIB

• **OTOLITH MEASURES**
  – Subjective Visual Vertical
  – Subjective Visual Horizontal
  – Rotational Vestibular Assessment
    • Off Axis Rotation
The vestibular system: Diagnostic Tests

- Calorics
- Rotational testing
- Dynamic Unilateral Centrifugation (UCF)
- Vestibular Evoked Myogenic Potential (VEMP)
- Dix-Hallpike for BPPV
- Roll Test for BPPV
VESTIBULAR OCULAR REFLEX (VOR)

- VNG (Caloric)
- Rotary Chair
- Active Head Rotation
  - Gaze Stabilization Test
  - Dynamic Visual Acuity
  - Head Thrust Test
Rotary Chair

Evaluate Compensation
Status of Vestibular Weakness

High Frequency VOR Testing

High Velocity Impulse Test: Lateralize Peripheral Abnormalities

Utricular (Otolith) Function Testing
Vestibular Myogenic Potential (VEMP)

- Saccule (Otolith)
- Inferior Vestibular Nerve
- Unilateral test
Interpreting the SOT

NeuroCom Clinical Integration lab Manual
Complete Multi-D Dizziness Clinic Evaluation

- Audiogram
- DPOAEs
- VNG + head shake, cervical test
- VEMP (VCR?)
- Rotary Chair (VOR + utricle)
- Computerized Posturography - SOT & MCT (VSR)
- Computerized Dynamic Visual Acuity Test (VOR)
- Dizziness Handicap Inventory (subjective questionnaire)
- Dynamic Gait Index (10 minute assessment, falls risk?)
High tech vs. Low tech

- High frequency VOR:
  - Rotary Chair
  - Head Thrust

- Postural Stability Test:
  - Computerized Posturography
  - Gans Sensory Organization Performance Test (Gans SOP)

- Dynamic Visual Acuity:
  - Computerized DVA
  - DVA with EDTRS (Snellen chart)

- SVV:
  - in Rotary Chair
  - “Homemade”
QUESTIONS?