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## The Evaluation and Treatment of Dizziness in Mild TBI

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### Objectives

- Review incidence and Anatomy of Dizziness in mTBI
- Differential diagnosis of Dizziness in mTBI
- Evaluation
- Treatment

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### No Financial Disclosures

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## Incidence of Dizziness and mTBI

mTBI

- 5% of the US population per yr (16 million), likely higher number as many not reported
  - mTBI is loss of consciousness 30 mins-1 hour
  - 25-39% of mTBI pts reported dizziness within the 1<sup>st</sup> year after injury
  - "post-concussive" symptoms
  - 20% of patients with mTBI do not return to work, often due to debilitating symptoms including dizziness

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## Anatomy

The diagram illustrates the anatomy of the human ear, divided into three main sections: Outer Ear, Middle Ear, and Inner Ear. The Outer Ear includes the Helix, Scapha, Triangular fossa, Anthelix, Concha, and Auricular lobe (Earlobe). The Middle Ear contains the Temporal muscle, Temporal bone, External acoustic meatus (Ear canal), Malleus, Incus, and Stapes. The Inner Ear consists of the Semicircular canals, Cochlea, Vestibular nerve, Cochlear nerve, Tympanic membrane (Eardrum), Tympanic cavity, and Eustachian tube. Cartilage is also shown connecting the outer ear to the middle ear.

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## Anatomy

Select an area to comment on

**Peripheral Apparatus**

The diagram shows the peripheral apparatus of the inner ear. On the left, a cross-section of the cupula is shown with endolymph, receptor cells, and a nerve. The central part shows the three semicircular canals: Superior, Horizontal, and Posterior. The bottom part shows the Utricule and Saccule-Macule. The Cochlea is shown on the right. Labels include: Endolymph, Cupula, Receptor cells, Nerve, SEMICIRCULAR CANALS (Superior, Horizontal, Posterior), Cristae within ampulla, Utricule, Saccule-Macule, and Cochlea.

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## Anatomy

### Dizziness and Vertigo

#### Cerebellum

The diagram shows the cerebellum and its connections to the brain stem. The Brain stem is connected to the Spinocerebellum, Cerebrocerebellum, and Vestibulocerebellum. The Vestibulocerebellum is connected to the Utricule. The diagram illustrates the regulation of muscle tone, coordination of skilled voluntary movement, planning and execution of voluntary activity, storage of procedural memories, and maintenance of balance, control of eye movements.

- Superior lateral - Limb movement
- Superior midline (vermis) - Trunk movements and motor control of speech articulation (paravermal area)
- Inferior - Oculomotor control and vestibular adaptation

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## Vestibular system

What does the vestibular system do?

- Linear and angular accelerometer
- Senses rotational/angular movements of the head  
via the Semicircular Canals
- Senses linear movements of the head  
via Utricle (horizontal) and Saccule (vertical)
- Senses head position in space

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## Differential Diagnosis

CENTRAL

- Diffuse Axonal Injury (Microstructural Brain Injury)
- Post-Traumatic Vestibular Migraine
- Psychological/ PTSD/Post concussive syndrome
- Low CSF Pressure
- Brain Tumor
- CVA
- Multiple Sclerosis

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## Differential Diagnosis

<p>PERIPHERAL</p> <ul style="list-style-type: none"> <li>Labyrinth Disorders                             <ul style="list-style-type: none"> <li>BPPV</li> <li>Exertional Dizziness</li> <li>Labyrinthine Concussion</li> </ul> </li> <li>Vestibular Disorders                             <ul style="list-style-type: none"> <li>Peri lymphatic Fistula</li> <li>Superior Semicircular Canal Dehiscence</li> <li>Temporal Bone Fracture</li> <li>Otolith Disorders</li> </ul> </li> </ul>	<p>Posttraumatic Meniere's Disease (excess Endolymph inner ear)</p>
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## Evaluation

HISTORY

- Most important step
- Can use Dizziness Questionnaire
- Dizziness Handicap Inventory

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## Evaluation – Dizziness Questionnaire

I. When you are “dizzy” do you experience any of the following symptoms

1. Light-headedness or swimming sensation in the head?
2. Blacking out or loss of consciousness?
3. Tendency to fall? to the left? to the right? forward? backward?
4. Objects spinning or turning around you?
5. Sensation that you are spinning or turning
6. Loss of balance while walking? veering to the left? veering to the right?
7. Headache?
8. Nausea or vomiting?
9. Pressure in the head?
10. Tingling in your fingers, toes or around your mouth?

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## Evaluation – Dizziness Questionnaire

II.

1. My dizziness is: Constant? In attacks or episodes?
2. When did the dizziness first occur?
3. If in attacks: How often do attacks occur
4. How long do they last?
5. When was the first episode?
6. What was the duration of the shortest attack?
7. Do you have any warning that it is going to occur?
8. Do they occur at any particular time of day or night?
9. Are you completely free of dizziness between attacks?
10. Does change of position make you dizzy?
11. Do you have trouble walking in the dark?
12. When you are dizzy, must you support yourself when standing?
13. Do you know any possible cause of your dizziness?
14. Do you know of anything that will: Stop your dizziness or make it better? Make your dizziness worse? Precipitate an attack? (e.g.: fatigue, exertion, hunger, menstrual period, stress, emotional upset, alcohol) Were you exposed to any irritating fumes, paints, etc. at the onset of dizziness?

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## “Million Dollar Clues”

Dizzy after rolling in bed = BPPV

Most common etiology, 9% of pts>65 seeing Doctor for other issues

Very light sensitive during dizzy spells or Difficulty in visually-stimulating surroundings = Migraine associated Dizziness

One ear feels like it’s going to explode and/or roaring tinnitus = Meniere’s (Endolymph. Hydrops)

Triggered by Salt, caffeine, dehydration and emotional stress

Sounds make my vision jump or blur = Semicircular Canal Dehiscence (SSCD)

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## Dizziness Handicap Inventory

**Instructions: The purpose of this scale is to identify difficulties that you may be experiencing because of your dizziness. Please check “always”, or “no” or “sometimes” to each question. Answer each question only as it pertains to your dizziness problem.**

	Questions	Always	Sometimes	No
P1	Does looking up increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E2	Because of your problem, do you feel frustrated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F3	Because of your problem, do you restrict your travel for business or pleasure?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P4	Does walking down the aisle of a supermarket increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F5	Because of your problem, do you have difficulty getting into or out of bed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F6	Does your problem significantly restrict your participation in social activities, such as going out to dinner, going to movies, dancing or to parties?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F7	Because of your problem, do you have difficulty reading?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F8	Does performing more ambitious activities like sports, dancing, and household chores, such as sweeping or putting dishes away, increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E9	Because of your problem, are you afraid to leave your home without having someone accompany you?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E10	Because of your problem, have you been embarrassed in front of others?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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## Dizziness Handicap Inventory

P11	Do quick movements of your head increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F12	Because of your problem, do you avoid heights?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P13	Does turning over in bed increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F14	Because of your problem, is it difficult for you to do strenuous housework or yard work?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E15	Because of your problem, are you afraid people may think that you are intoxicated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F16	Because of your problem, is it difficult for you to go for a walk by yourself?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P17	Does walking down a sidewalk increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E18	Because of your problem, is it difficult for you to concentrate?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F19	Because of your problem, is it difficult for you to walk around your house in the dark?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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## Dizziness Handicap Inventory

E20	Because of your problem, are you afraid to stay home alone?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E21	Because of your problem, do you feel handicapped?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E22	Has your problem placed stress on your relationship with members of your family or friends?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E23	Because of your problem, are you depressed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F24	Does your problem interfere with your job or household responsibilities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P25	Does bending over increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

GP Jacobson and CW Newman,  
1990

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## Dizziness Handicap Inventory

Always = 4 Sometimes = 2 No = 0

Subscales  
P = physical E = emotional F = functional

Notes:

1. Subjective measure of the patient's perception of handicap due to the dizziness
2. Top score is 100 (maximum perceived disability)
3. Bottom score is 0 (no perceived disability)
4. The following items can be useful in predicting BPPV
  - Does looking up increase your problem?
  - Because of your problem, do you have difficulty getting into or out of bed?
  - Do quick movements of your head increase your problem?
  - Does bending over increase your problem?

Can use subscale scores to track change as well

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## Office Evaluation Tests

Dix-Hallpike – In Head down position looking for Horizontal or Vertical Nystagmus

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## Frenzel Goggles

Usually with a light source and magnifying lenses. Allows examiner to see eye movements with patient not able to fixate or focus



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## Office Evaluation Tests

Dix-Hallpike – Nystagmus in BPPV, sustained Central

Spontaneous Nystagmus – Central more with fixation, peripheral jerky, more with Frenzel goggles for no fixation

Gaze Nystagmus – Central Jerky, to direction of gaze, downbeat

Smooth Pursuit (60 degrees to each side)– Central not smooth, saccadic, marching

Saccades (alt gaze between fingers) – Over/undershoot, slow or late

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## Office Evaluation Tests

Vergence – Central with a break, slow recovery

Head Shake (shake head 2HZ horizontal and vertical 20 secs eyes closed, then open with Frenzel) – Peripheral with nystagmus usually towards intact side

Dynamic Visual Acuity (read eye chart head still and then with Head Shake 0.2Hz) – Peripheral = >3 line drop in acuity

Fixation Suppression (Pt fixates on thumb while rotate body in chair) – Central = Nystagmus towards rotation

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## Office Evaluation Tests

Aural Pressure/Sound (positive pressure or sound stim to ear) – Peripheral = Nystagmus or eye deviation

Cerebellar tests (Heel to Shin, Finger to nose) – Central = abnorm mvmts

Posture/Gait – Periph Neuropathy or Central

Somatosensory (tuning fork, toe position) – Impt in determining Somatosensory portion of disequilibrium

Vestibulo-Ocul Motor Test (Focus on written material while moving head) – Sxs of any type = dysfunction

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### Vestibular/Ocular Motor Screening (VOMS)

	NT	Headache 0-10	Dizziness 0-10	Nausea 0-10	Fogginess 0-10	Comments
Baseline Symptoms	N/A					
Smooth Pursuit						
Saccades Horizontal						
Saccades Vertical						
Convergence (Near Point)						(Near Point in cm) 1. 2. 3.
VOR Horizontal						
VOR Vertical						
Visual Motion Sensitivity Test						

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### Diagnostic Testing

- MRI/HCT
- Blood Tests
- Ultrasound
- Electronystagmogram or Videonystagmogram
  - Warm or cool air into ears, observe eyes
- Vest Evoked Potentials
- Electrocochleography
- Hearing testing

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### Treatment

Diagnosis of Etiology/Location directs treatment

Concussion/TBI

- Supportive care, therapies, RTW or Sports gradual with guidelines and activity increase to tolerance and limited/no symptoms and education, Headache mgmt

Ocular Treatment

- Vest Therapy, vision therapy, refer to NeuroOptometry

Vestibular Rehabilitation

- Gaze Stability and Adaptation exercises, postural Control training(Yoga, Tai Chi)

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### Treatment

- Epley Maneuver/Canalith Repositioning (when appropriate)
- Visual Motion Sensitivity training
- Cervicogenic symptoms treatment
  - Manual therapy, AROM, posture
- Increase Activity Tolerance

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## Epley Maneuver



**90% effective in treating BPPV**  
**Sxs may resolve spontaneously**  
**Recurrence 15%**

1. Lie down on your back, turn head to left for 1 minute
2. Then turn head to right for 1 minute
3. Turn whole body to right, head facing towards floor for 1 minute
4. Sit up slowly, head tilted forward for 1 minute

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**If above does not work to relieve nausea and dizziness, try:**

1. Lie down on your back, turn head to right for 1 minute
2. Then turn head to left for 1 minute
3. Turn whole body to left, head facing towards floor for 1 minute
4. Sit up slowly, head tilted forward for 1 minute

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