

TELE-REHABILITATION GUIDELINE

Dizziness and Balance Disturbances after Traumatic Brain Injury

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- I. **Definition, Assessment, Diagnosis** (Shepard, Handelsman, & Clendaniel, 2012)(Lan & Hoffer, 2019) (Jessu & Nitu-Marquise, 2024) (Gianoli, 2022)
 - A. Definitions: Balance function is determined by multiple systems including sensory input from nerves and muscles, the visual system, the vestibular system, and the brain. While the cerebellum plays a large role in balance and coordination, all areas of the brain can influence balance function.
 1. Dizziness: Non-specific term for perception of light-headedness, floating, tilting, other imbalance, or disorientation.
 2. Vertigo: A subtype of dizziness in which asymmetric or impaired input into the vestibular system results in the illusion of movement of oneself or one’s surroundings.
 3. Dizziness is a common complaint after all severities of Traumatic Brain Injury (TBI) and has been reported to occur in up to 80% of TBI cases.
 4. Vestibular System: Balance is controlled via the vestibular system both peripherally and centrally.
 - a. Peripheral system: this includes the visual system, the inner ear (i.e., labyrinth with semicircular canals, cochlea), and cranial nerve VIII. Dizziness may occur with hearing loss.
 - i. Benign Paroxysmal Positional Vertigo (BPPV): One of the most common reasons for dizziness/vertigo. Results from debris (otoliths) freely floating in the semicircular canals. Positional changes result in vertigo.
 - ii. Labyrinthine Concussion: Sudden onset hearing loss and vertigo following head trauma. Not associated with temporal bone fracture. The forceful movement of fluid and tissues within the inner ear results in tissue injury and deterioration/death of metabolically active inner ear cells. Can result in secondary Meniere’s disease.
 - iii. Temporal Bone Fracture: Longitudinal fractures through the temporal bone can affect the external auditory canal and middle ear. Transverse fractures can affect the vestibular system and internal auditory canal.
 - iv. Labyrinthine Dehiscence/Perilymphatic Fistula (LD/PLF): Due to a compromise in the boundary between the inner and middle ear resulting leakage of perilymph fluid.

- b. Central system: Direct trauma via diffuse axonal injury (DAI) and its connections to the brainstem and cerebellum will result in balance impairments and dizziness. Post traumatic migraines, seizures, and psychological disturbances may also result in imbalance and dizziness.
5. Non-Vestibular causes of dizziness (Maskel, 2006) (Lan & Hoffer, 2019)
 - a. Orthostatic hypotension: Hypotension resulting from inadequate physiological response changes in position. This can result from deconditioning, medullary injury, medication side-effects, etc. Work up will show a decrease in systolic blood pressure of 20mmHg or a decrease in diastolic blood pressure of 10mmHg or more within 3 minutes of standing from sitting/supine or head up tilt to 60° via tilt-table testing.
 - b. Cervical injury/Whiplash associated disorders resulting in proprioceptive cervicogenic dizziness- this is uncommon and can be difficult to diagnose.
 - c. Seizures
 - d. Preexisting medical conditions: Presyncope, Cardiac diseases, Dysautonomia, Diabetes Mellitus, and Pituitary dysfunction
6. Balance impairments have been associated with severity of TBI, older age, underlying medical conditions, and acute hospital length of stay. (Greenwald, et al., 2001)

B. Assessment

1. History:
 - a. Blunt force head trauma
 - b. Penetrating head trauma
 - c. Blast injury
 - d. Skull fracture (especially temporal bone)
2. Signs and Symptoms:
 - a. Dizziness
 - b. Light-headedness
 - c. Spinning sensation (“spinning, whirling, tilting”)
 - d. Ataxia
 - e. Impaired balance (“imbalance, wobbly”)
 - f. Frequent falls or near-falls
 - g. Syncope/Presyncope (“passing out, blacking out, losing consciousness”)
 - h. Vision impairment, nystagmus, convergence disorder
 - i. Hearing impairment (including but not limited to tinnitus and sensation or aural fullness)
 - j. Peripheral Disorders (Lan & Hoffer, 2019) (Shepard, Handelsman, & Clendaniel, 2012) (Gianoli, 2022)

- II. Management and treatment recommendations (Lan & Hoffer, 2019) (Sabini, 2021) (Gianoli, 2022)
- A. Treatment options for post-traumatic vestibular disorders include medications, surgery, and Vestibular and Balance Rehabilitation Therapy (VBRT). LD/PLF will generally not respond to VBRT.
- For mild TBI, 85-90% of patients have resolution of their symptoms by 3 weeks and monitoring/supportive care is recommended. From 3 weeks-3 months, only VBRT is recommended. For >3 months, will require further diagnostic workup and medications/surgery.
 - Limited data is available on specific guidelines for dizziness/balance related to moderate/severe TBI.
- B. VBRT: A rehabilitation program that takes advantage of neural mechanisms and plasticity to promote habituation, adaptation, compensatory techniques to manage vertigo, dizziness, and imbalance.
- Types of VBRT:
 - Habituation – Repeated exposure to stimuli- in this case, head movements- with goals of symptom reduction toward the stimulus.
 - Adaption – Similar to exercises for habituation but with goals of reducing symptoms by using head movements to produce long-term plastic changes in the neural response to a given movement.
 - Substitution – Used in individuals with bilateral vestibular loss, this technique utilizes alternative strategies for gaze stability and postural control.
 - BPPV- Most cases resolve spontaneously. The Epley maneuver, which is a series of positional changes designed to move otoconia out of the involved canal, can be used to resolve persistent cases.
 - HMD- Use of head mounted virtual reality device, especially useful for people with motional aspects of distress (Sabini, 2021)
 - Medications used to help with dizziness and vertigo should be used short term and on “as needed basis” as they can impede central vestibular compensation. VBRT and elimination of vestibular suppressant medications can expedite central vestibular compensation process. (Shepard, Handelsman, & Clendaniel, 2012) (Sabini, 2021) (Gianoli, 2022)
 - Antihistamines:
 - Meclizine 25-100mg/day divided BID to TID.
 - Promethazine – 25mg PO BID
 - Anticholinergics: Scopolamine 1.5mg transdermal patch, apply one patch every 3 days.
 - Phenothiazine: Prochlorperazine 5-10mg every 6-8 hours, max dose 40mg/day. Monitor for leukocytopenia.
 - Benzodiazepines (Diazepam, Lorazepam & Clonazepam) – This drug class is used in patients who are unable to tolerate antihistamines and/or anticholinergics (e.g., patients with glaucoma or benign prostatic hypertrophy, other urinary retention disorders)

- g. Surgery: Although not routinely done, surgery may be considered in patients with temporal bone injuries and/or labyrinthine dehiscence/perilymphatic fistulas. (Shepard, Handelsman, & Clendaniel, 2012) (Gianoli, 2022)
- h. Temporal bone fractures: if no dural tears/brain exposure, the external ear canal can be microdebrided and repair can be done to injured structures.
- i. Labyrinthine dehiscence/Perilymphatic fistulas: Typically treated conservatively with limited bedrest, elevation of head, and avoidance of straining. May consider carbonic anhydrase inhibitors and diuretics. If symptoms do not resolve, surgical exploration/repair may be warranted.
- j. Prevention and Education

A. Patients and family should be educated regarding the process of VBRT and should be told that the exercises will provoke symptoms.

B. Medications are only recommended for short term use and can prolong treatment and recovery from vestibular disorders.

C. Patients and families should be provided with educational material for fall prevention including environmental modifications (i.e., improved lighting, removal of rugs and electrical cords, installation of handrails).

This guideline was developed to improve health care access in Arkansas and to aid health care providers in making decisions about appropriate patient care. The needs of the individual patient, resources available, and limitations unique to the institution or type of practice may warrant variations.

Guideline Developers

Guideline developed by Claire Althoff, John Peyton, Nam Vo, DO, and Rani Haley Gardner, MD, in collaboration with the TRIUMPH team led by Thomas S. Kiser, MD, and Rani H Gardner, MD.

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