



Concussion, Mild, Moderate and Severe Brain Injury.
Complex Cases. Outcomes that Work.



VESTIBULOPATHY:
*Complex Issues
Following Traumatic
Brain Injury*

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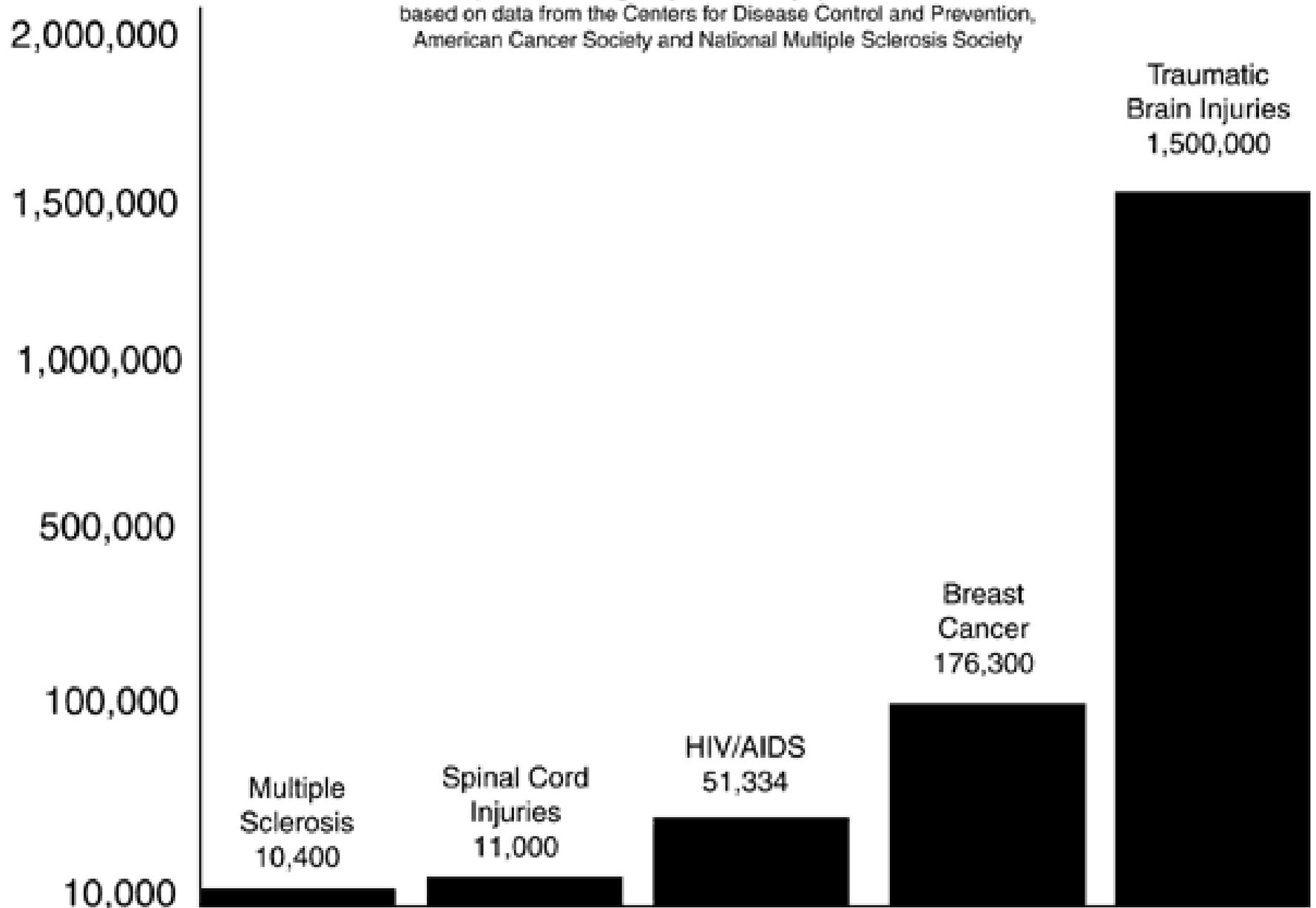
Objectives

- Define mild traumatic brain injury (MTBI) and associated terminology which explains the mechanism of injury, what to look for during assessment and common associated sequela.
- Define vestibulopathy and resulting symptoms, showing the common incidence of vestibulopathy after MTBI.
- Identify interventions and treatment models for successful management of vestibulopathy.



Comparison of Annual Incidence

Data compiled and arranged by the Brain Injury Association of America based on data from the Centers for Disease Control and Prevention, American Cancer Society and National Multiple Sclerosis Society



TBI Facts

- Traumatic Brain Injuries outnumber Non-Traumatic Brain Injuries 1,700,000 to 917,000 annually.
- Falls are the largest percentage of traumatic injuries, making up 35% of them.
- At any age, male injuries number greater than female injuries. Although, females are catching up.
- As we are living longer in our homes, and falling, the average age on an Inpatient Brain Injury Unit rises.

Brain Injury Association Website



Causes of Brain Injury

National Percentages

- Falls 29%
- Motor Vehicle 20%
- Struck by/against 19%
- Other 13%
- Assaults 11%
- Unknown 09%

ReMed Percentages

- Motor Vehicle 51%
- Other 19%
- Falls 14%
- Disease 09%
- Assaults 05%
- Sports 01%

Post Injury Demographics

(trends that are interesting to note)

- Post injury balance disturbance is present in 40% of the BI population
- Vertigo and headache were the most common sequelae for non return to work after 5 years
Symptoms **do not always appear immediately** and are frequently missed or misdiagnosed

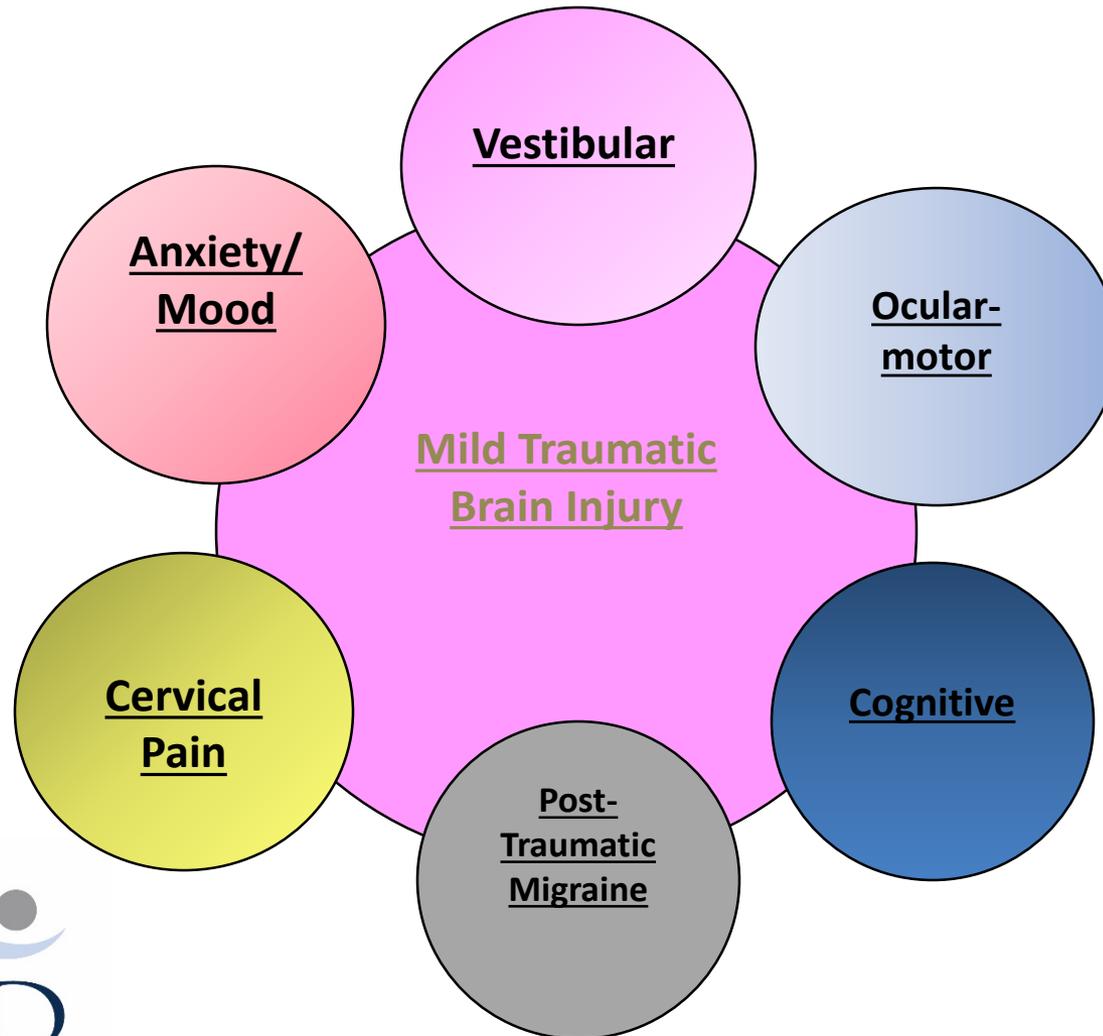


Mild Traumatic Brain Injury

- 75% of brain injuries are considered “mild”
- Loss of consciousness is less than 20 minutes, which is a large span from 0 time to 20min
- Glasgow Coma Score is 13-15/15 and measures eye opening, verbal response and motor response at the scene
- About 5.3 million Americans have a long term disability after a traumatic brain injury (in general, not just mild)
- Looking at annual costs for traumatic brain injury in the nation
 - greater than \$76.5 billion (with mild costs around 16.5 bil)



Common Changes after MTBI



Vestibular Symptoms



Mild Symptoms

- Symptoms Involve:
 - Dizziness and/or Vertigo
 - Imbalance
 - Spatial Disorientation
 - Vision, Hearing, Taste and Sense of Smell issues
 - Musculoskeletal complaints
 - Headaches, Fatigue, difficulty Concentrating, decreased Comprehension
 - Irritability, Depression, Anxiety



Equilibrium

- A complex function requiring accurate information from several sensory modalities, including: vestibular, visual and somatosensory.
- The vestibular system in an internal reference which offers 2/3 of what is needed for equilibrium. This system tells a person where the head is in space as well as the direction and acceleration of the head.
- The vision and somatosensory systems are external references.



Function of the Vestibular System That internal part of Equilibrium

- Communicate with other systems.
- The VOR (vestibulo-ocular) relationship works to stabilize gaze.
- The VSR (vestibulo-spinal) works to stabilize posture.
- The VCR (vestibulo-colic) acts in the neck and has specific head control response.

Vestibular System Basic Review

- Semicircular canals – respond to angular acceleration and deceleration, not constant velocity, and are oriented in horizontal, anterior and posterior positions in the inner ears.
- Hair cells in gelatinous material called endolymph will move as they are excited or inhibited in these canals.
- The Utricle and Sacculle are gravity detectors that also sense linear acceleration. The Utricle houses otoconia which are calcium carbonate crystals embedded in the gel in this organ.
- The semicircular canals as well as the utricle and saccule work to maintain balance in an individual and are affected by injury, inflammation or changes in messaging to the area.
- Problems occur when the otoconia dislodge and move into the semicircular canals, which is what frequently happens in a traumatic event secondary to the nature of the injury.



Vestibular Communication with the Brain

- Cerebellum
- Brainstem
 - Vestibular nuclei in the medulla
 - As well as the pons
- Cerebral Cortex (vestibular cortex)
 - Parietal
 - Superior Temporal



Vestibular Tracts

- The Central Nervous System takes the sensory input and creates a motor response. It essentially tells a person if she/he is moving or the world is moving. It works with vestibular tracts (some mentioned before):
 - Vestibulo-Ocular
 - Vestibulo-Spinal
 - Vestibulo-Cerebellar
 - Vestibulo-Cortical



Vestibulopathy

- According to the medical dictionary, it is any abnormality of the vestibular apparatus
- Peripheral Dizziness Issues with this system are: BPPV, Meniere's Disease, Vestibular Neuritis
- Central Dizziness Issues with this system are: Migraine, Concussion or other Acquired Brain Injury
- Autoimmune Disease can mimick a Vestibular Issue
- Undiagnosed or untreated vestibulopathy may lead to the development of anxiety disorders such as agoraphobia
- It is important to tease out the intensity, duration, associated symptoms and provoking factors to isolate vestibulopathy



Symptoms Of Vestibulopathy are Similar to MTBI

- Dizziness=off balance, nondescript
- Vertigo=spinning
- **Oscillopsia=swinging vision**
- **Blurred Vision**
- Spatial Disorientation
- Nausea/Vomiting
- Sensitivity to environmental stimuli: lights, noise, crowds, motion, touch supermarkets, malls, etc



Continued Symptoms to Compare

- Decreased memory, attention, organization
- Irritability associated with increased visual/sensory stimuli
- Hearing loss, tinnitus (ringing in ears)
- Fatigue
- “Shut-down behavior” or sleepiness associated with increased visual/sensory stimuli or cognitive tasks – not socializing or working



What the Family is Noticing

- Reading issues
- Negotiating stairs or an escalator or a curb in the community goes awry
- Scanning while walking or driving is faulty
- ADL issues
- Less interested in family events, etc
- Missing work
- Perhaps not getting out of bed



Assessment

- Neuro ENT – Neuro Otology-Neuro Ophthalmology
- ENG Calorics/Rotary Chair/Posturography
- *PT/OT evaluations by practitioners familiar with brain injury and vestibular certification often the best, cost effective and quickest way to diagnose and start treating.



Clinical Findings

- Unfortunately, until someone with knowledge of vestibulopathy addresses the issues, these clients are often misdiagnosed as phobic or malingering. The details are lost in their pain related issues. They need specialized evaluation and treatment.



Therapeutic Assessment

- It is important to ask about dizziness, nausea, motion sensitivities, fall history and function from walking to driving.
- Separate descriptions between 3 separate issues:
 - BPPV
 - Imbalance
 - Visual Disturbance



Vestibular Rehabilitation

- The systematic progression of exercise protocols which reduce or extinguish hallucination of movement and the exaggeration of motion while restoring coordination of head and eye movement, balance and equilibrium function.



Interventions and Treatment Models

- Adaptation – exercises given to extinguish symptoms through the repetition of provoking behaviors
- Substitution – “substitution of alternative strategies to replace lost or compromised function” – forces a client to use remaining function
- Habituation – the way we learn by ignoring the familiar, predictable and moving on

Therapy Sessions

Advice of the Experts

- Deal with BPPV first (Benign Paroxysmal Positional Vertigo)
- Look at how the client is dealing with the environment, whether acute or chronic: response to light, handling noise, behavior outdoors
- Address neck pain and strengthening as separate from headache
- Then, address vestibular therapy as pure vestibular therapy separate from these other entities



Visual Concerns

- There are a variety of visual problems that may be an issue post TBI: visual field loss, damage to the eye, damage to the optic nerve, cortical blindness or visual agnosia are examples
- Visual abilities associated with the vestibular system include: near eye focusing and eye focus flexibility, eye teaming, eye movement and fixation abilities, eye hand coordination



Vestibular-Oculomotor Exercises

- Rely on neural plasticity and must keep advancing
- VOR=eye mvt produced opposite head mvt to maintain an image
- Saccades=ballistic, rapid eye mvt, changing the point of fixation for reading or scanning a room
- Pursuits=slower tracking that would keep a moving stimulus on the fovea
- Convergence=eyes work together for near vision



Advancing Vision Exercises

- Increase the repetitions; change speed; look at the complexity of the visual backgrounds and surfaces; alter lighting conditions; provide auditory distractions.
- Add movement of the Client.



Proprioception & Balance

- Static Standing
- Transitions: sit – stand
- Dynamic Balance
- Eyes open and closed
- Use variable surfaces
- Move from basic to more complex movements

Challenge the body physically and then add in the vision here. You have now addressed all areas of equilibrium.

Compensatory Strategies

- Visual fixation in the home and community
- Adapting the environment to support a task like reading
- Relaxation techniques
- Pacing and planning; ie: Google Calendar
- Rest periods = True Rest
- Slowed transitional movements
- Glasses and specializations
- Hand support for proprioception and balance



Treatment for MTBI

- Therapy Disciplines should have training and expertise in MTBI/Concussive Care
 - Interdisciplinary Therapy evaluations to address cognitive, physical and psychological issues
 - Individualized hierarchy of activity resumption/have a concrete plan
 - Monitor adherence to the protocol by investigating how it is really getting don
 - Add cognitive tasks to exercises to work on vision, movement and higher level cognitive skills simultaneously
 - Screen for obstacles to activity resumption
- Utilize Case Management for care coordination to liaison directly with the physician, treatment specialists, consultants and employer to monitor progress and compliance with rehabilitation.



Functional Approach

- Stable schedule that is individualized
- Structured/generalized setting for therapy
- Repetition and practice of strategies and skills throughout the day
- Therapy in the clinic setting, community and home
- Focus on return to previous life roles and work



The End.....

Questions & Comments



References

- Jeff Walter Vestibular Rehabilitation Course 2016
- PPTA Conference: Vestibular Presentation 2016
- American Institute of Balance Vestibular Rehabilitation Workshop 2017
- ReMed Therapist Reports: Kim Belkowski, PT; Amy Vtipil, MPT; Michelle, PT, C/NDT; 2018
- APTA Conference: Vestibular Updates 2019
- Brain Injury Association Website
- Healy, G.B. Archives of Otolaryngology
- Berman, J.M. and Fredrickson, J.M Vertigo After Head Injury: 5 Year Follow-Up. Journal of Otolaryngology
- Siverberg and Iverson, “Is Rest After Concussion the Best Medicine?” JHTR 2013

