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Differences in Vestibular Measures Following Blast Versus Blunt Trauma in the Military: A Systematic Review

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Background

- Mild Traumatic Brain Injury (mTBI) is considered to be the hallmark injury of Operations Enduring and Iraqi Freedom (OEF, OIF) resulting from improvised explosive devices and roadside bombs.
- Injuries associated with blast mTBI result in many impairments, including vestibular impairments.
- There is a poor understanding of how vestibular outcomes vary across the spectrum of blast injuries versus blunt injuries.

Purpose

- Investigate differences in the following vestibular outcomes after a blast, blunt, or mixed trauma: vestibulo-ocular reflex (VOR), sensory organization testing (SOT), motor control testing (MCT), dizziness handicap inventory (DHI), and the Activity-Specific Balance Confidence Scale (ABC).

Methods

Study Design

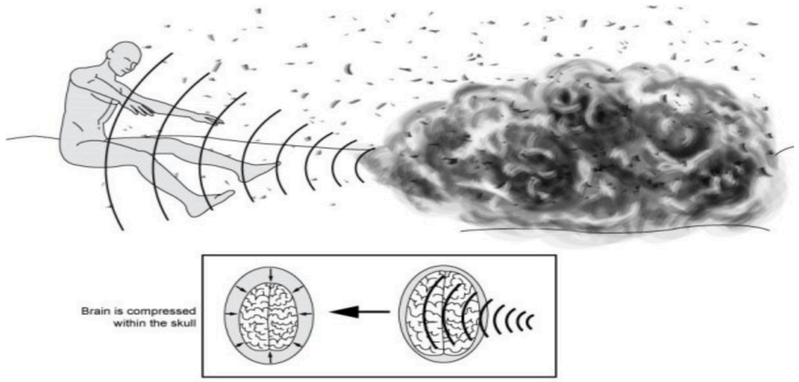
- Systematic review
  - Embase, CINAHL, PubMed.
  - Search terms included: military personnel, TBI, blast injury and/or blunt injury, concussion, vestibular symptoms

Subjects

- Military personnel
- Diagnosed with mTBI
- Active duty and veteran populations exposed to blast and/or blunt trauma in combat and/or in training settings.

Results

- Six studies included:
  - 504 subjects, 19-57 years old
  - Blast exposures:1-100/person
  - Time from injury: 72 hours- 2 years
  - Five studies looked at combat exposure
  - One study looked at low level blast exposure during training
- Blast cohort only: 2 studies
- Blast vs. blunt cohorts: 1 study
- Mixed blast & blunt cohorts: 3 studies
- The most commonly utilized clinical vestibular assessment measures were VOR and SOT.



Results

Vestibulo-ocular Reflex (VOR)

VOR was assessed primarily using rotational chair (RC) with only one study assessing head impulse test. There were no clear patterns of results across studies from RC testing, with four studies showing abnormalities between cohorts[1,2,3,4] and one showing no significant abnormalities between cohorts[6].

Sensory Organization Test (SOT)

Five out of the six studies assessed SOT with mixed results. Three out of five showed abnormalities between cohorts[2,5,4] and two showed no significant abnormalities between cohorts[1,6].

Motor Control Test (MCT)

Three of the six studies assessed MCT with mixed results. One of the three showed abnormalities between cohorts, with blast exposure performing worse than blunt[1]. Two showed no significant abnormalities between cohorts[4,6].

Dizziness Handicap Inventory (DHI) & Activity-Specific Balance Confidence Scale (ABC)

Three of the six studies collected results from the DHI and ABC, however, only one study reported their results. Scherer, et al. found that there were clinically and statistically significant differences between asymptomatic and symptomatic service members who were mostly mixed blast/blunt exposure.

Conclusions

- Mechanism of injury (blast vs. blunt vs. mixed) results in a variety of vestibular outcomes amongst service members.
- While there is overlap in vestibular clinical measures for blast and blunt populations, there also seem to be notable differences between subcategories of military personnel with particular symptoms including vertigo, amnesia, PTSD, migraines, and dizziness.
- Interpreting the results of these studies is complicated by:
  - Inconsistencies in the language used to describe blast injuries.
  - Variability of population characteristics within studies such as age, time from exposure, and number of blasts.

Clinical Relevance

Standardize language

- Without a common language, research in this area will be limited in its ability to shape clinical practice.
- Standard language should improve our ability to understand the etiology and sequelae across the entire spectrum of blast injuries.

Modification of study design

- Need for consistency related to population characteristics such as age, time from exposure, number of blasts, and blast intensity

Assessment tools

- Continued use of rotational chair, posturography, head impulse test, and self report measures as standard practice for assessing vestibular dysfunction

Recommendations

- More extensive VOR assessment acutely in theater using head impulse test.
- Report individual SOT conditions and composite scores.
- Consider alternative tools such as helmet mounted pressure sensors to better quantify blast intensity.

Acknowledgements / References

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