SIGNATURE INJURIES OF WAR: LESSONS FROM VETERANS WITH BRAIN INJURY

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The Mindset Lab

The Ohio State University
Amputation  PTSD

Severe Burns

Traumatic Brain Injury
BLAST INJURIES

Tertiary blast mechanisms
(i.e. effect of the impacts with other objects)

Site of impact "coup"

Injury to the brain opposite the site of impact "contrecoup"

Secondary blast mechanisms
(i.e. effect of the missiles being propelled by blast force)

Tertiary blast-induced neurotrauma
(coup-contrecoup)

Primary blast mechanisms
(i.e. effects of the blast wave itself)
Identifying Neural Biomarkers of PTSD/TBI
Blast Injury: Sgt. N

- **Sgt. N presented to the Neuropsychology Clinic at the Durham VA complaining of difficulties with his memory, attention, hearing, and balance:** “My brain has been rattled”

- **Sgt. N was exposed to multiple blast injuries during his work in the Explosive Ordnance Disposal Service (EOD)**

- **Patient specialized in identification and disposal of munitions, as well as developing dynamic entry operations**
<table>
<thead>
<tr>
<th>Cognitive Domain</th>
<th>Test</th>
<th>Standard Score (Percentile)</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intelligence Testing</td>
<td>Verbal IQ</td>
<td>106 (66)</td>
<td>Average</td>
</tr>
<tr>
<td></td>
<td>Performance IQ</td>
<td>105 (63)</td>
<td></td>
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<tr>
<td></td>
<td>Full Scale IQ</td>
<td>106 (66)</td>
<td></td>
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<tr>
<td>Memory: Free Recall</td>
<td>CVLT Delayed</td>
<td>9 (50)</td>
<td>Average</td>
</tr>
<tr>
<td></td>
<td>RCFT Delayed</td>
<td>(54)</td>
<td>Average</td>
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<tr>
<td>Memory: Recognition</td>
<td>CVLT Recognition</td>
<td>-1.5</td>
<td>Borderline</td>
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<tr>
<td></td>
<td>RCFT Recognition</td>
<td>(21)</td>
<td>Low</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Average</td>
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<tr>
<td>Executive Functions</td>
<td>Trails B</td>
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<td>Impaired</td>
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<td>WCST</td>
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<td>DKEFS NL Switching</td>
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<tr>
<td></td>
<td>DKEFS Free Sort</td>
<td>3</td>
<td>Impaired</td>
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</table>
A case of frontal neuropsychological and neuroimaging signs following multiple primary-blast exposure
Mr. M. and Sgt. M. were in the control group.
WHITE MATTER & POSTCONCUSSION SYNDROME

MILLER ET AL., 2016
Traumatic Axonal Injury (TAI)

Normal axon

Injured axon

Taber & Hurley, 2013
Random motion of water molecules except in restricted fibers of the brain

Hayes et al., 2016
TAKE HOME: WHAT DID WE LEARN?

• White matter disruptions in blast mtBI are spread out in the brain, supporting previous post-mortem work.

• Loss of consciousness is an important marker of blast-related mtBI severity.

• For the first time, we provide evidence that white matter disruption is a mechanism by which blast-related mtBI impacts memory.

• Although symptoms in TBI and PTSD overlap, there may be different brain mechanisms.
EVIDENCE FOR NEURODEGENERATION FOLLOWING TBI

(Barnes et al., 2014)
ONGOING PROJECTS

• **Longitudinal assessment of TBI, traumatic stress, Alzheimer’s disease and accelerated aging**
  - NIH funded project
  - Mindset/bbal/cbi data repository
QUESTIONS WE STUDY

• What are the long-term effects of concussive hits/blast on the brain and cognition? How does it compare to stress from psychological trauma?

• What are the processes by which traumatic memories are persistent, vivid, and uncontrollable?

• What factors make someone vulnerable to neurodegenerative disease (e.g., Alzheimer’s disease) or accelerated aging following concussion and/or psychological trauma?