



US DEPARTMENT OF DEFENSE

BLAST INJURY RESEARCH PROGRAM COORDINATING OFFICE

Brain Injury Diagnostics

Reduced Sustained Visual Attention is Associated with Remote Blast Mild Traumatic Brain Injury and Current Posttraumatic Stress Disorder

Attention problems, including sustained attention, are common cognitive complaints of Veterans with traumatic brain injury (TBI) and posttraumatic stress disorder (PTSD) (*Arciniegas et al. 2005, Arciniegas, Held, and Wagner 2002, Aupperle et al. 2012*). A mild traumatic brain injury (mTBI) sustained in a combat environment often results from intense and emotionally traumatic events where threat of death or serious injury to self or others is prominent thus, mTBI is frequently associated with comorbid mental health disorders, such as PTSD. Researchers at the Minneapolis Veterans Affairs Health Care System (Minneapolis, Minnesota) and University of Minnesota (Minneapolis, Minnesota) sought to examine neural correlates of sustained attention in Veterans with blast mTBI and/or current PTSD. By examining event-related potentials (ERPs) elicited during a performance task, researchers found that participants with TBI and PTSD showed reduced amplitude of the P3b ERP at the midline electrode site (Pz) compared to the control group, suggesting that this task-related amplitude reduction may be an index of pathology after combat trauma.

The study participants consisted of 124 Veterans of Operation Enduring Freedom/ Operation Iraqi Freedom, with self-reported traumatic combat experiences or exposure to explosive blasts during their most recent deployment. Participants completed a clinical interview, and symptoms of mTBI were assessed by interview using the semi-structured Minnesota Blast Exposure Screening Tool. Based on blast TBI severity scoring, participants were separated into four groups: Blast mTBI, PTSD, Blast mTBI + PTSD, and Control. Electrophysiological data collection took place while participants completed a degraded stimulus version of the continuous performance task (DS-CPT). This computer-based assessment of vigilance evaluates the ability of the test-taker to maintain, over a prolonged period of time, continuous and focused attention for detecting and responding to visual stimuli. Group differences in electrophysiological component amplitudes (as associated with target detection) were examined separately for event-related potential components at lateral parietal electrode sites, an occipital midline site, and three midline sites.

Analysis of the electrophysiological data determined that the amplitude of the early sensory-related ERPs did not differ as a function of group membership, suggesting that sensory processing of stimuli was intact in the three affected groups (Figure 1). However, P3b amplitude at site Pz showed a group effect such that the Blast mTBI, PTSD, and Blast mTBI + PTSD groups showed a comparable reduction in P3b amplitude compared to Controls. Variation in P3b amplitude reflects attentional allocation to stimulus processing and the updating of working memory for preceding stimulus events.

In conclusion, the reduced P3b amplitude in the Blast mTBI, PTSD, and Blast mTBI + PTSD groups,





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compared to the Control group, may reflect reduced neural capacity in attentional resource allocation compared to Controls. P3b amplitude elicited during the DS-CPT task was similarly reduced across these three groups as compared to the Control group (*Gilmore et al. 2018*).

The study indicated that a specific electrophysiological marker elicited by a sustained-attention task (DS-CPT) may be indicative of brain pathology after combat trauma. Those with blast-related mTBI and/or current PTSD showed a reduction in this ERP reflecting cognitive dysfunction common across both conditions. This marker could be valuable as part of a clinical profile for use in the diagnosis and/or assessment of brain injury symptom recovery and resolution, informing clinical decision-making.

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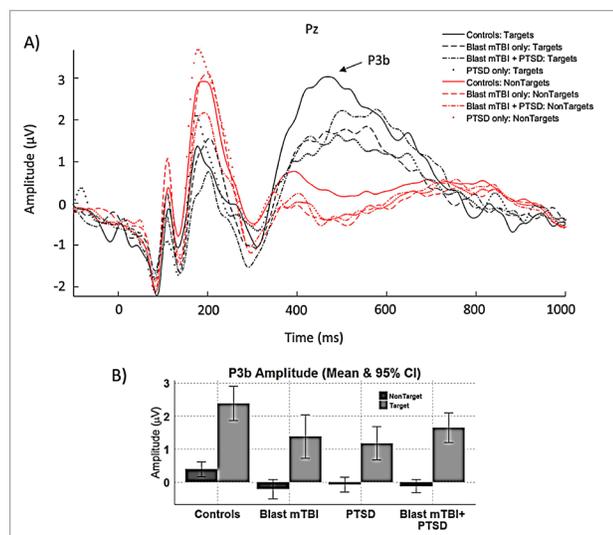


FIGURE 70: A) Average ERPs elicited during the degraded-stimulus continuous performance task (DS-CPT), at midline parietal site Pz only, from Controls (solid lines), Blast mTBI (dash lines), PTSD (dotted lines), and comorbid Blast mTBI + PTSD (dash-dot lines) groups for Target (the “0” stimulus that required a button-press response in the DS-CPT; black lines) and Non-Target (red lines) stimuli. B) Bar plot showing the mean P3b amplitude (calculated as the mean amplitude within the 350–650 ms time window (see Methods section); bars represent the 95% Confidence Interval) for each Group for both Target and Non-Target stimulus conditions. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.) (Figure from Gilmore et al. (2018) used with permission from the authors)

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