



US DEPARTMENT OF DEFENSE

## BLAST INJURY RESEARCH PROGRAM COORDINATING OFFICE

# Neurocognitive and Psychological Health Outcomes Brain Volume, Connectivity, and Neuropsychological Performance in Mild Traumatic Brain Injury: The Impact of Posttraumatic Stress Disorder Symptoms

Posttraumatic stress disorder (PTSD) is a common co-morbidity of mild traumatic brain injury (mTBI) (whether caused by blast or blast plus impact) in military Veterans who served in operations in Iraq and Afghanistan; it is also found to a lesser degree in the civilian population. Several studies have examined the comorbid effects of PTSD/mTBI on functional outcomes but none have looked at the effects on brain structure, specifically volume and structural connectivity, or cognitive function. What is apparent is that individuals with co-morbid PTSD/mTBI do not recover cognitively as quickly as those with mTBI alone.

National Institutes of Health (NIH) researchers with the Center for Neuroscience and Regenerative Medicine (CNRM), Uniformed Services University of the Health Sciences, examined brain volume, structural connectivity, and cognitive function using neuroimaging modalities and neurocognitive testing. The researchers hypothesized that individuals with PTSD/mTBI comorbidities would demonstrate changes in brain volume in areas associated with attention and memory as well as differences in memory circuits and these changes would correlate with neuropsychological test results. They found that individuals with PTSD/mTBI, when compared to individuals with mTBI alone, showed a larger volume in the right entorhinal cortex region, a region involved in memory retrieval, as well as white matter alterations in the right cingulum bundle, a white matter tract implicated in facilitating memory suppression processes (*Lopez et al. 2017*). These results correlated with poorer performance on neuropsychological tests in the PTSD/mTBI group compared with the mTBI group, especially in the areas of learning and memory encoding and retrieval. From these results, the group postulates that a de-regulated memory retrieval process allows traumatic intrusive memories to interfere with retrieval of those related to the cognitively demanding task at hand, resulting in the poorer scores in the PTSD/mTBI group. Overall, these results support theoretical models of PTSD and its relationship to learning deficits and suggest that PTSD treatments may benefit from therapies directed toward memory encoding and retrieval problems as well as associated re-experiencing and avoidance symptoms.

In conclusion, this research facilitates the diagnosis of mTBI patients with PTSD symptoms so that the appropriate therapeutic intervention can be utilized for optimum recovery of the Service member from blast and blast-related effects.

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**REFERENCES:**

Lopez, K. C., Leary, J. B., Pham, D. L., Chou, Y. Y., Dsurney, J., and Chan, L. 2017. "Brain Volume, Connectivity, and Neuropsychological Performance in Mild Traumatic Brain Injury: The Impact of Post-Traumatic Stress Disorder Symptoms." *J Neurotrauma* 34 (1):16-22. doi: 10.1089/neu.2015.4323.

