



US DEPARTMENT OF DEFENSE

BLAST INJURY RESEARCH PROGRAM COORDINATING OFFICE

Brain Injury Diagnostics

Altered Brain Activity during Word Finding in Mild Traumatic Brain Injury

Patients with a history of mild traumatic brain injury (mTBI) and objective cognitive deficits frequently experience word finding difficulties in normal conversation. Researchers at the National Intrepid Center of Excellence (NICoE; Bethesda, Maryland) at Walter Reed National Military Medical Center (Bethesda, Maryland) sought to improve the understanding of this phenomenon by determining if the scores on standardized cognitive testing are correlated with measures of brain activity evoked in a word retrieval task (confrontational picture naming). The study participants ($n = 57$) were Service members with a history of mTBI. The General Memory Index (GMI) determined after administration of the Rivermead Behavioral Memory Test, Third Edition, was used to assign subjects to three groups: low cognitive performance (Group 1: $GMI \leq 87$, $n = 18$), intermediate cognitive performance (Group 2: $88 \leq GMI \leq 99$, $n = 18$), and high cognitive performance (Group 3: $GMI \geq 100$, $n = 21$).

Magnetoencephalography data were recorded while participants named 80 pictures of common objects. Group differences in evoked cortical activity were observed relatively early (within 200 milliseconds from picture onset) over a distributed network of left hemisphere cortical regions including the fusiform gyrus, the entorhinal and parahippocampal cortex, the supramarginal gyrus and posterior part of the superior temporal gyrus, and the inferior frontal and rostral middle frontal gyri. Differences were also present in bilateral cingulate cortex and paracentral lobule, and in the right fusiform gyrus. All differences reflected a lower amplitude of the evoked responses for Group one relative to Groups two and three.

These findings may indicate weak afferent inputs to and within an extended cortical network including association cortex of the dominant hemisphere in patients with low cognitive performance. The association between word finding difficulties and low cognitive performance may therefore be the result of a diffuse pathophysiological process affecting distributed neuronal networks serving a wide range of cognitive processes. These findings also provide support for a parallel processing model of lexical access.

In conclusion, this study demonstrates that patients with a history of mTBI, word finding difficulties, and reduced cognitive function exhibit altered activity of the brain's left hemisphere that may help determine those at risk for sustained post-concussive symptoms and inform the development of treatment strategies to alleviate those symptoms.

This study was funded by NICoE.

