



US DEPARTMENT OF DEFENSE

BLAST INJURY RESEARCH PROGRAM COORDINATING OFFICE

Repetitive Blast Exposure

Effects of Repeated Blast Exposure on Markers of Neurodegeneration

Exposure to low levels of blast overpressure (BOP) may cause mild traumatic brain injury (mTBI) with progressive vascular and cellular changes that may contribute to neurodegeneration. To better understand this relationship, researchers at the Walter Reed Army Institute of Research (WRAIR; Silver Spring, MD) are studying two markers of neurodegeneration after repeated exposure to BOP: TDP-43, a very tightly regulated protein that is altered in neurodegenerative diseases such as frontotemporal lobar degeneration, and piezo2, a mechanosensitive ion channel previously shown to be dysregulated following blast exposure.

Using an advanced blast simulator that closely mimics “free-field” blast, rats were exposed one to four times to 13, 16, or 19 psi overpressure (n=6/group). TDP-43 levels were differentially affected by the number and magnitude of blast exposures, with the mean level being 38 percent greater in rats exposed multiple blasts of 16 psi compared to shams, and around 32 percent lower in rats exposed to only two blasts of varying intensities. Piezo2 levels were significantly higher in rats exposed to 19 psi blast compared with non-blasted shams (~17 percent), while levels were significantly decreased in rats exposed to 13 and 16 psi blasts (~52 percent), indicating that higher-intensity blast may have a differential effect on the brain’s response to mechanical stimuli compared to lower-intensity blast. These findings suggest that cumulative effects of repeated exposures to blast may lead to pathophysiological changes in the brain, demonstrating a possible link between blast injury and neurodegenerative disease.

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