



US DEPARTMENT OF DEFENSE

BLAST INJURY RESEARCH PROGRAM COORDINATING OFFICE

Injury Models

Characterization of a Rat Model of Blast-Induced mTBI: Pathophysiological Interplay of Primary and Tertiary Blast

Many Service Members who sustain blast-induced TBI in combat are exposed to a brain insult resulting from a combination of both a shock wave (i.e., blast overpressure) and a biomechanical perturbation related to rapid acceleration and/or impact with a solid object. The TBI resulting from these combined insults is likely to be fundamentally different than that seen from either insult alone. By generating a closely associated insult to the brain (and other organs as well), blast overpressure may interactively compromise the brain's resilience to this additional insult and worsen the pathophysiological consequences that increase the likelihood of long-term deleterious outcome. Working collaboratively with researchers at Duke University and the USUHS, investigators at WRAIR are experimentally combining these biomechanical perturbations in rats to explore this interplay and to characterize the neurobehavioral and neuropathological changes resulting from blast overpressure exposures combined with impact/acceleration. Brain injury sequelae, including disrupted vestibulomotor function and spatial learning and memory, have been characterized and are accompanied by pathological features such as phosphorylated tau protein, which is a recognized hallmark of neurodegenerative disorders, such as CTE. Light microscopic and diffusion tensor imaging (DTI) analysis reveal striking exacerbation of disruptions following combined insults, with prominent microstructural disruptions and axonal injury. These results point to the utility of a "dual insult" model of blast-induced TBI as a valuable experimental tool to assist ongoing efforts to predict and mitigate the risks of blast-induced TBI in Service Members.