



US DEPARTMENT OF DEFENSE

BLAST INJURY RESEARCH PROGRAM COORDINATING OFFICE

Injury Models

Prevention of Blast-Related Injuries

Researchers at Wayne State University (WSU) received funding from the Psychological Health/Traumatic Brain Injury Research Program (PH/TBIRP) managed by the Congressionally Directed Medical Research Program (CDMRP) to conduct a study to determine the cause of mild TBI (mTBI) due to blast overpressure (BOP) and, if possible, determine the human tolerance to BOP. The purpose of this study is to determine the specific mechanisms of injury in primary, secondary, and tertiary blast outcomes, and to translate that knowledge to the design of PPE or find effective neuroprotective agents. This project includes a wide spectrum of analyses ranging from examining injury at the cellular and tissue level using preclinical and human cadaver models to validating the molecular findings with sophisticated computational models in order to fully understand the specific injury mechanisms associated with blast-related injuries. The experimental portion will include comprehensive histological assessments of brains collected from 12 swine and six cadaveric human specimens that will be exposed to blast. This experimental effort will be supplemented by a computer modeling effort which will extend the results of the experimental tests to blast scenarios that are not easily obtained experimentally. During FY16, a detailed histological study of blast-exposed swine brains demonstrated the presence of damage to both axons and neuronal cell bodies using standard staining techniques. Specifically, animals exposed to open field blast demonstrated marked axonal changes in the cortex and cortical white matter tracts of the frontal lobes as measured with beta-amyloid precursor protein immunohistochemistry and changes in the number of astrocytes and microglia. In addition, the presence of Glial Fibrillary acidic protein (GFAP) was noted almost exclusively in the white matter tracts which may support an ongoing axonal injury. GFAP may be considered as one of the key serum markers of blast-induced changes due to the high astrocyte counts, close association of GFAP staining in the white matter tracts, and the increased GFAP levels within the serum of the animals exposed to blast. The team is currently completing the quantification of the immunohistochemistry from the posterior aspects of the brain that will offer insights into the extent of the injury in various lobes of the brain including the brainstem. To date, one cadaver has been tested and researchers are in the process of obtaining additional samples. In addition, the previously developed computer models of the swine and human brain are in the process of being validated against the acquired experimental data. Once these models are developed and validated, they can be used to develop more effective personal protective equipment (PPE) in order to lessen the likelihood of blast-related injuries within the military population.

