



US DEPARTMENT OF DEFENSE

BLAST INJURY RESEARCH PROGRAM COORDINATING OFFICE

Mechanisms of Injury Experimental TBI in Swine

Researchers from the Toxicology Evaluation Program, US Army Public Health Command (USAPHC), and ADVANCE LLC completed data analysis from a DARPA-sponsored study which examined blast-induced TBI in swine, including functional, behavioral, and pathological outcomes. Swine are good models for studying TBI in humans because the swine cerebral cortex is also gyrencephalic, or highly convoluted, and the ratio of white matter to gray matter is very similar in both species. Explosive detonation was used to produce realistic blast overpressure signatures equivalent to those in theatre. Experimental conditions were controlled to exclude all other injury mechanisms attributed to explosions other than primary blast overpressure. The entire body (including sensory organs) was blast-protected with the exception of the head. A neuropsychological automated test battery evaluated sensory/memory function while a kinematic motion analysis system examined the neurologic function in swine before and up to one week after exposure. The blast-exposed swine had significant memory loss and decreased neurologic function for the first two days following exposure, but function recovered after one week. Sleep disturbances were noted to be temporally similar to the observed functional decrements. Histopathological evidence of injury was mild, yet consistent, with no evidence of neuronal injury or death. The appearance of pathology after one week, when function is recovered, suggests that injured axons may not be a contributor to the observed functional impairments. The current study indicates that swine are a good model for detecting functional and behavioral deficits associated with mTBI, and suggests the need for future research to increase our understanding of the relationship between axonal injury and mTBI.