

THE WALTER REED ARMY INSTITUTE OF RESEARCH

Closed-Head Brain Injury

Investigators in this program conduct basic and applied research on the mechanisms of primary and secondary injury resulting from exposure to blast. Although most studies address the mechanisms of closed-head injury, much effort is also focused on the complex interactions among head injury, hemorrhage, and other body trauma. Through a variety of animal and other laboratory experiments and mathematical modeling techniques, program scientists work to develop standardized models of blast injury allowing better coordination of research across diverse laboratories, to develop high-fidelity simulations of head injury to speed research while limiting the need for animals studies, to better understand whether cellular and organ level processes in head trauma are a unique form of injury, and to develop recommendations for better soldier protection, such as improved helmet design.

Mission

- To conduct basic and applied research on militarily relevant closed-head injury resulting from exposure to blast(s), including studies of blast(s) accompanied by polytrauma and hemorrhage.
- To discover, evaluate and advance therapies or doctrinal changes that would improve survival and functional outcomes following these injuries.

Research Priorities:

- Develop a nationally and internationally recognized animal model of blast concussive injuries.
- Determine if explosions produce a unique form of brain injury.

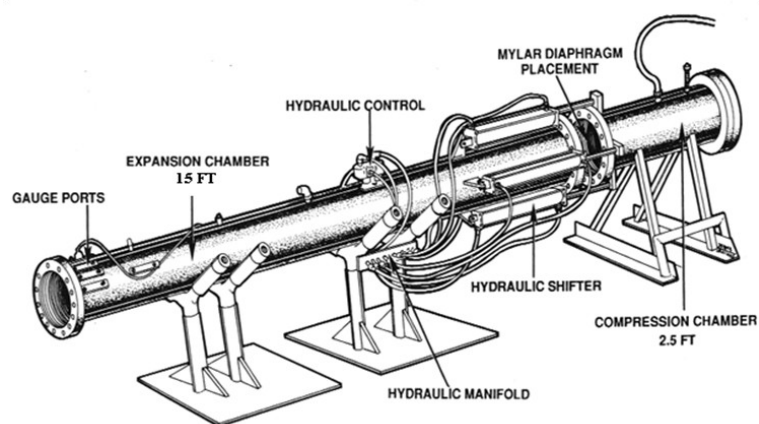


Illustration of shock tube simulation utilized by our scientists

Our expertise is in:

- Modeling of blast-induced closed head injury, including large animal explosive blast.
- Polytrauma and hemorrhage and the interplay of systemic insults with traumatic brain injury.

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The scope of research challenges

- 195,547 service men and women have suffered traumatic brain injury between the beginning of 2000 and the third quarter of 2010. More than 98% of these are closed-head injuries without penetration of the skull and more than 75% are caused by blasts.
- Blast exposures pose a significant threat to civilian populations throughout the world.
- Direct effects of blast overpressure or combined effects of overpressure plus impact acceleration (tertiary effects) are considered the most likely mechanisms of injury, but it is largely unknown how these insults cause brain damage and/or impair its function.
- Blast exposures of significant magnitude frequently result in severe whole body trauma which can result in secondary injury to the brain extending the damage.



Neuropathology assessments in experimental closed-head brain injury research

Major Accomplishments

- Demonstrated blast exposure from either real explosions of compressed air shock tube can cause axonal injury
- Demonstrated that a thoracic Kevlar vest provides protection to the brain from air shock as may be experienced in blast exposures
- Demonstrated that a second shock tube blast exposure at 24 hours results in worsened axonopathy

Our future directions include:

- Developing an ecologically validated model of blast plus impact/acceleration (tertiary blast effect)
- Establishing capabilities to compare results of pre-clinical model to human disease using high resolution MRI
- Evaluating the effects of progesterone on outcome measures following blast plus hemorrhage.
- Determining if multiple blast exposures lead to chronic traumatic encephalopathy.

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