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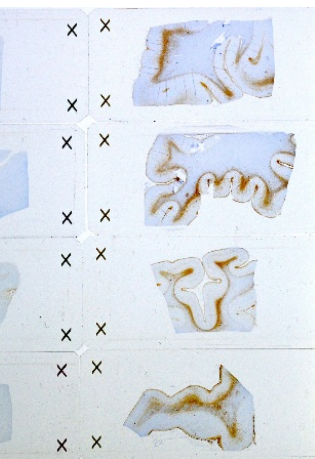
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### **'Invisible Wounds of War' Now Visible**

*Major Breakthrough: New Defense Health Program-funded Study Published in Lancet Neurology Identifies Biological Changes in Brains due to Blast Traumatic Brain Injury*

**Bethesda, MD** – Scientists have discovered a unique pattern of scarring in the brains of deceased service members who were exposed to blast injury that differs from those exposed to other types of head injury. This new research was published online June 9 in *Lancet Neurology*, "Characterisation of Interface Astroglial Scarring in the Human Brain after Blast Exposure: a Post-mortem Case Series."

"Our findings revealed those with blast exposure showed a distinct and previously unseen pattern of scarring, which involved the portion of brain tissue immediately beneath the superficial lining of the cerebral cortex – the junction between the gray and white matter – and the vital structures that are adjacent to the cavities within the brain that are filled with cerebrospinal fluid. Those areas of the brain, damaged by blast, suggest that they may be correlated with the symptoms displayed by those who sustained a traumatic brain injury, or TBI," said Dr. Daniel Perl, study senior author and professor of Neuropathology at the Uniformed Services University of the Health Sciences. "This scarring pattern also suggests the brain has attempted to repair brain damage from a blast injury."



Uniformed Services University of the Health Sciences photo

Tissue samples of blast TBI brain injuries (right) compared to non-blast TBI samples indicate the presence of a distinctive pattern of scarring, as reported online in *Lancet Neurology*, June 9, 2016.

To better understand these blast brain injuries, researchers from the Uniformed Services University of the Health Sciences (USU), the Department of Defense Joint Pathology Center and the University of Colorado's School of Medicine, examined brain tissue specimens derived from deceased service members, who had been exposed to a high explosive blast injury and had suffered several persistent symptoms. The researchers examined the brain tissues from five service members with remote blast exposures, as well as brain tissues of three service members who died shortly after severe blast exposures. They also compared these results with brain tissues from civilian (non-military) cases, including five with remote impact TBIs, and three cases with no history of a TBI.

"This changes the earlier paradigm of 'battle injury' and demonstrates unique and specific biological changes in brains due to these injuries," said Perl, who also serves as director of USU's Center for Neuroscience and Regenerative Medicine TBI Brain Tissue Repository.

Military members sustaining a TBI have often reported suffering from persistent post-concussive symptoms, which include a mixture of both neurologic and behavioral disturbances.

"These can include problems such as headaches, difficulty concentrating, sleep disorders, memory problems, depression and anxiety. Despite these prominent symptoms, conventional neuroimaging for mild TBIs typically has not allowed providers to "see" brain abnormalities, leading this to be considered the "invisible wound," said Perl.

## *Learning to Care for Those in Harm's Way*

“This publication sheds some light, for the first time, into the nature of the persistent behavioral/ neurologic issues being reported in numerous service members who have been exposed to high explosives. It will certainly stimulate important further research and change how we think about these problems. DoD, through the Military Health System, is at the cutting edge of research dedicated to caring for our troops, and I hope that these findings will point the way into devising more rational approaches to their diagnosis, prevention and treatment,” Perl said.

Other members of the research team include co-lead authors Sharon Shively, MD, research assistant professor in USU's Department of Pathology and USU contract employee of the Henry M. Jackson Foundation for the Advancement of Military Medicine; Iren Horkayne-Szakaly, M.D., neuropathologist and neuromuscular pathologist, Joint Pathology Center, Defense Health Agency; Robert V. Jones, M.D., senior neuropathologist, Joint Pathology Center, Defense Health Agency; James P. Kelly, M.D., professor of Neurosurgery and Physical Medicine & Rehabilitation, Colorado School of Medicine; and Regina C. Armstrong, M.D., professor of Anatomy, Physiology and Genetics, and director of USU's Center for Neuroscience and Regenerative Medicine at USU.

Funding for the study was provided by the Defense Health Program.

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### **About the Uniformed Services University of the Health Sciences**

The Uniformed Services University of the Health Sciences, founded by an act of Congress in 1972, is the nation's federal health sciences university and the academic heart of the Military Health System. USU students are primarily active duty uniformed officers in the Army, Navy, Air Force and Public Health Service who receive specialized education in tropical and infectious diseases, TBI and PTSD, disaster response and humanitarian assistance, global health, and acute trauma care. A large percentage of the university's more than 5,200 physician and 1,000 advanced practice nursing alumni are supporting operations around the world, offering their leadership and expertise. USU also has graduate programs in biomedical sciences and public health committed to excellence in research, and in oral biology. The University's research program covers a wide range of clinical and other topics important to both the military and public health. For more information about USU and its programs, visit [www.usuhs.edu](http://www.usuhs.edu).