

Research to Advance
the Care of
Traumatic Brain Injury



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TRAUMATIC BRAIN INJURY

Investigators with the Department of Veterans Affairs (VA) are conducting cutting-edge research to help veterans with traumatic brain injury regain maximum function.



Veterans Health Administration
Research & Development
Improving Veterans' Lives — www.research.va.gov

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A Message to Our Veterans

VA Research and Development Program: Unraveling the Complexities of Traumatic Brain Injury

With improvements in body armor and battlefield medicine, many military men and women are surviving modern warfare in Afghanistan and Iraq with multiple, complex injuries that would have proved fatal in previous wars. One such injury is traumatic brain injury (TBI), which can be caused without any visible wounds when explosives jar the brain inside the skull. Estimated to affect at least 20 percent of our troops wounded in the current conflicts, TBI can involve symptoms ranging from headaches, irritability, and sleep disorders to memory problems, slower thinking, and depression. TBI is also a major cause of disability outside of military settings—most often as the result of assaults, falls, automobile accidents, or sports injuries. In the civilian sector alone, TBI has been estimated to cost more than \$56 billion annually.

Because TBI can affect how a person thinks and acts, even mild brain injuries can significantly disrupt the lives of veterans and their families. Current therapeutic strategies can help patients with TBI regain some degree of function, but there remains a compelling need for improved methods of care.



Joel Kupersmith, M.D.
Chief Research and Development Officer
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VA Research is leading the way in TBI investigation, conducting studies that cover the spectrum of screening, diagnosis, rehabilitation, and treatment.

This brochure highlights some of the groundbreaking research projects being undertaken by VA's dedicated investigators—studies that promise, ultimately, to improve the care available to our courageous veterans coping with traumatic brain injury.



Spotlight on VA Research



VA's research related to traumatic brain injury (TBI) is wide-ranging. Among its goals: shedding light on the brain changes in TBI; improving screening methods and refining tools for diagnosing the condition; developing drugs to treat brain injury or limit its severity when it first occurs; designing improved methods for assessing treatment effectiveness; helping veterans with TBI to reintegrate into their communities; and learning the best ways to help family members cope and provide support.

Important areas of VA research in TBI include:

• Characterizing Brain Changes

TBI can result in sometimes-subtle brain damage with changes in memory, attention, thinking, personality, and behavior that are currently difficult to diagnose and treat. VA researchers are refining ways to reliably diagnose TBI and predict patients' outcomes and care needs.

In one example of this work, a VA research team is combining two new brain-scan technologies to help in detection of subtle brain injuries. One method records magnetic signals that brain cells give off as they communicate with each other, and the second method tracks the movement of water molecules through brain tissue.

At another site, VA researchers are studying brain cells that have been exposed to extreme pressure inside a lab device called a barochamber. The investigators are using the device, which simulates the effects of blasts, to help them understand how cells in the brain respond to an explosion. The study could support the development of therapies that troops would receive while in the combat zone—either before they go out on patrol, as a preventive measure; or after a blast has occurred, to limit damage to the brain.



Recent Milestones in Traumatic Brain Injury Research and Care

2005

VA establishes the Polytrauma and Blast-Related Injury Quality Enhancement Research Initiative (QUERI) to promote the successful rehabilitation of veterans with TBI and other blast-related injuries.

2006

VA, DoD, and other partners inaugurate the Center for the Imaging of Neurodegenerative Diseases at the San Francisco VA, where researchers study TBI as well as conditions such as Alzheimer's disease and Gulf War veterans' illnesses.

2007

VA initiates routine TBI screening for all veterans who served in Afghanistan or Iraq.

“As the stepping stone to advancements in care, research into the causes and treatment of TBI is crucial to so many veterans. Even mild to moderate TBI can have far-reaching effects on quality of life, though the outside world may see no telltale signs of the condition.”

Michael Selzer, M.D., Ph.D., Neurologist and VA's Director of Rehabilitation Research and Development

- **Regenerating Nerve Cells**

VA investigators are working to identify ways to repair the nervous system by supporting regrowth of nerve cells. Strategies being explored include gene therapy, tissue engineering, and adult stem cell transplantation. Advances in this area hold promise not only for TBI, but also for conditions such as spinal cord injury, multiple sclerosis, and Alzheimer's disease. In one example of recent research in this area, VA lab investigators demonstrated promising methods for coaxing adult stem cells within the hippocampus—the brain's memory and learning center—to develop into new brain cells.

- **Using Medications for TBI Symptoms**

The Defense and Veterans Brain Injury Center, a collaboration between VA and the Department of Defense (DoD), is studying the effectiveness of various drugs for treating TBI symptoms such as headaches, anxiety, and mood swings.

- **Advancing Personalized Medicine**

Because genetic factors may play a role in how TBI develops after an injury and how patients respond to treatment, a new VA registry will analyze anonymous DNA samples from veterans who served in Afghanistan and Iraq. The goal is to learn how to use individuals' genetic information to optimize care and treatment for TBI.

- **Treating Blast-Related Sensory Loss**

VA Research is increasing its focus on the hearing and vision loss that often occurs as part of TBI. For example, investigators at VA's National Center for Rehabilitative Auditory Research are partnering with audiologists at Walter Reed Army Medical Center to study central auditory processing—how the brain interprets incoming sounds—in soldiers who have been exposed to blasts.

Other teams of VA investigators are studying the prevalence and nature of vision problems among veterans with TBI. Their findings point to the need for more comprehensive evaluations that include, for example, binocular function tests, which may detect subtle but distressing vision problems that may be missed in standard eye exams.

- **Supporting Reintegration**

VA investigators are examining ways to help veterans with TBI achieve a smooth transition back into daily life, including family, school, and work roles. To restore independence to veterans with TBI, investigators are looking at such innovative techniques as robotic movement therapy and driving simulators for assessment and training. Researchers are also focusing on supporting caregivers, by assessing their needs and the resources currently available to them.

2008

VA establishes the Center of Excellence for Research on Returning War Veterans, based at the Central Texas Veterans Healthcare System, to study TBI, PTSD, and related conditions.

DoD establishes the Defense Center of Excellence for Psychological Health and Traumatic Brain Injury, which will incorporate the Defense and Veterans Brain Injury Center — a program begun by DoD and VA in 1992—and be fully operational by late 2009.

VA holds a state-of-the-art conference on TBI to further advance research and care.



• Promoting Best Practices

VA's Quality Enhancement Research Initiative (QUERI) focuses on rapidly translating research findings into patient care. A Polytrauma and Blast-Related Injury QUERI coordinating center has been established to promote evidence-based "best practices" in care and thereby support the rehabilitation, psychological adjustment, and community reintegration of veterans affected by TBI and other injuries.

Plans for Further Research

In an effort to maximize the benefits from traumatic brain injury research, VA's Office of Research and Development recently held a conference titled "Research to Improve the Lives of Veterans: Approaches to Traumatic Brain Injury Screening, Treatment, Management, and Rehabilitation." Recommendations from the conference included calls for enhanced access to TBI data through a central database, increased recruitment of TBI researchers into the VA system, and additional support for TBI clinical trials. VA has already acted on recommendations from the TBI conference and issued a request for new study proposals reflecting priorities discussed.



Team Approach to TBI Care

Because TBI often occurs along with other severe injuries, some patients with TBI receive care through regional VA polytrauma teams. Polytrauma refers to multiple, complex injuries, often including burns, limb loss, spinal cord injury, vision or hearing loss, and related medical complications. Those needing the most intensive care are treated at one of VA's four main polytrauma centers, in Minneapolis, Tampa, Richmond, or Palo Alto.

Initially established as TBI clinics in the early 1990s, these sites now provide comprehensive care for polytrauma. VA is building a fifth polytrauma center in San Antonio.

(<http://www.polytrauma.va.gov>)

More Information

A recent issue of VA's Journal of Rehabilitation Research & Development (Volume 44, Number 7, 2007) is devoted entirely to scientific research on TBI

and polytrauma. Among the articles is a discussion of recent studies linking posttraumatic stress disorder (PTSD) and TBI. Other articles cover topics such as military and VA telemedicine systems for patients with TBI; a neuropsychiatric perspective on TBI; hearing, vision, awareness, and balance problems following TBI; and community-integrated rehabilitation for TBI. The articles are available online at www.rehab.research.va.gov.



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