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Helping fighters combat brain injury

Maryland is at the forefront, but more federal research funding is needed

By Gary Fiskum

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An Iraqi insurgent shot him in the chest. Later, he was wounded in the back in an ambush. But what left this U.S. Marine debilitated, perhaps for life, was a blast-induced, traumatic brain injury that initially went undetected.

Advanced body armor is saving our troops' lives, but soldiers have little protection against blast-induced, traumatic brain injury, the "signature injury" in today's wars. There is a need for research that can help reduce such injuries, and Maryland has a unique ability to do it — with additional federal help.

Since 2000, more than 150,000 U.S. military personnel have experienced mild to severe traumatic brain injuries, according to the Department of Defense, and more are believed to be unreported. In war zones, the primary cause of these brain injuries is blast, particularly from improvised explosive devices. Scientists think intense pressure waves injure the brain, causing headaches, dizziness, loss of consciousness and concentration problems. Some soldiers get better. Others, though, experience continued brain cell death, with devastating long-term cognitive and psychiatric consequences.

The costs are horrific. Care for some individuals could run into the millions over a lifetime. A 2008 Rand study, "Invisible Wounds of War," estimates that care for all veterans with traumatic brain injuries could cost almost $1 billion in the first year after diagnosis. Personal costs are the most tragic. After experiencing the hell of war, those with brain injury face another battle — one of lost potential and shattered dreams. "It is really hard to let go of the person you were before," said one Army lieutenant with blast-induced brain injury from an IED.

Such injuries may be reduced, as the automotive industry has shown. Airbags and seat belts reduced head injuries in car crashes by 75 percent, according to the National Highway Safety Administration. In war, if blast pressures causing brain injuries could be detected, medical personnel could potentially arrest brain cell death. Generally, the Rand study recommended the same kind of early screening and treatment.

But more research is urgently needed. Blast-induced brain injury differs from other kinds of brain injuries in ways scientists still seek to understand. We have little clinical data to guide us, and we need more.

This research requires a multidisciplinary effort, and this is happening in Maryland. The local effort includes explosive experts at the Naval Surface Warfare Center at Indian Head and the Energetics Technology Center in La Plata; neuroscientists, radiologists and trauma physicians at the University of Maryland School of Medicine in Baltimore; and engineers at the Center for Energetic Concepts Development at the University of Maryland, College Park.

The immediate goal is to determine how a blast injures the brain. Indian Head's explosive experts are showing how various blasts work, especially using a proven computer model that has assessed blasts on ships and other structures. This is guiding medical research on how blasts affect the brain. Once understood, the model can be adjusted to predict brain responses to various blasts.

Such predictions can drive development of advanced protection against blast-induced brain injuries. For example, blast effects might be reduced by improved vehicle and helmet designs. Also, blast pressures causing brain injuries could be detected by tiny, unpowered sensors — and Indian Head has developed such devices. Additionally, this detection could allow medical personnel to arrest brain cell death with pharmaceuticals and other means, also developed with help from computer predictions.

The need isn't going away. The major cause of blast-induced traumatic brain injuries — IEDs — was addressed in the Army's 2010 posture statement: "The IED continues to be our adversary's weapon of choice in our current fights in Iraq and Afghanistan and it is expected to remain a staple of irregular warfare."

The multidisciplinary research going on in Maryland — an integration of engineering and medical research capabilities — is unique. We have the world's foremost explosive experts and top-tier medical researchers working together. But they need help.

The auto industry spent billions researching and developing protection against head injuries in car crashes. Maryland's research centers do not have the same deep pockets, but they have the capability to research blast-induced traumatic brain injuries and have invested more than $1 million in this endeavor.

Maryland's continued effort now depends on funding from the Defense Department, which received $40 million for traumatic brain injury research in 2010. That federal support is now the critical element in protecting U.S. soldiers from a lifelong, debilitating injury.

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