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Veterans with mild traumatic brain injury have brain abnormalities

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Mild traumatic brain injury (TBI), including concussion, is one of the most common types of neurological disorder, affecting approximately 1.3 million Americans annually. It has received more attention recently because of its frequency and impact among two groups of patients: professional athletes, especially football players; and soldiers returning from mid-east conflicts with blast-related TBI. An estimated 10 to 20 percent of the more than 2 million U.S. soldiers deployed in Iraq or Afghanistan have experienced TBI.

A recent study by psychiatrists with the Iowa City VA Medical Center and University of Iowa Health Care finds that soldiers returning from Iraq and Afghanistan with mild TBI have measurable abnormalities in the white matter of their brains when compared to returning veterans who have not experienced TBI. These abnormalities appear to be related to the severity of the injury and are related to cognitive deficits. The findings were published online in December in the American Journal of Psychiatry.

"In the military population we studied, patients with TBI have more alterations, sometimes called 'potholes,' in the white matter of their brains than patients without a history of TBI," says senior study author Ricardo Jorge, M.D., UI professor of psychiatry. "The more severe the injury, the more white matter abnormalities occur. There is also a correlation between increased numbers of potholes and increased severity of cognitive alterations in executive functions—the ability to make a plan or a decision, for example."

Despite its prevalence, diagnosing mild TBI is difficult, often relying on a patient's recollection of a possible past head injury. In addition, symptoms of mild TBI tend to be wide-ranging and non-specific, including problems with vision, hearing, balance, emotions, and thinking. There are currently few good tools available to identify the condition or monitor the brain's recovery or deterioration.

Jorge and his colleagues used an MRI-based brain-scanning technique called diffusion tensor imaging (DTI) to study the brains of 72 veterans with mild TBI and 21 veterans without mild TBI. DTI measures the diffusion of water along thin fibers known as axons that form connections between brain cells. When axons are intact, water flow (diffusion) follows the axon boundaries and has a well-defined directionality. When the axon is damaged, water diffuses in many directions, a situation referred to as low fractional anisotropy.

"Decreased directionality of the water diffusion is a measure of lower integrity in the white matter," Jorge says.

Analysis of the DTI data allowed the researchers to detect areas of lower integrity in the patients' white matter even though these so-called potholes are scattered randomly throughout the brain and occur in different places in different patients.

Veterans with mild TBI had a significantly more potholes than veterans without TBI. The difference in the number of potholes was not influenced by age, time since trauma, a history of mild TBI unrelated to deployment, or coexisting psychological problems like depression, anxiety, or PTSD. The number of potholes did, however, correlate with poorer performance on cognitive tests measuring decision-making and planning skills.

The team also examined the brains of civilians with non-combat-related

mild TBI who were assessed early after the injury. These patients have even more white matter potholes than the military group.

Although the results suggest that DTI measurements might hold promise as a tool for detecting and tracking mild TBI in the brain, Jorge cautions that the current study is not large or specific enough to confirm that DTI-detected potholes are a biomarker for TBI brain damage.

"To establish if this DTI approach is a useful technique for diagnosing mild TBI, we need to replicate these findings in a larger study and with patients who have mild TBI from other causes," he says.

Provided by University of Iowa

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