Deficits Are Underappreciated

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performed normally on standard clinical neurocognitive assessment, they had suppressed brain functioning [as measured by event-related brain potentials] at an average 3½ years post injury, including a decrease in attention allocation to things going on in their environment," lead investigator Steven Broglio, Ph.D., said in an interview.

The findings provide further evidence that concussion should not be considered a transient injury associated with short-lived neurologic impairment, he noted.

The authors of a widely reported Canadian case control study reached a similar conclusion. Louis De Beaumont, a graduate student at the University of Montreal, and his colleagues compared the neurocognitive status of currently healthy former university-level hockey and football players aged 50-65 years who had sustained a single concussion more than 30 years ago with that of former athletes with no concussion history. Electrophysiologic and neuropsychological tests indicated that individuals with a history of concussion had memory and attention problems along with slower reaction times relative to those of the controls (Brain 2009 Jan. 28 [doi: 10.1093/brain/awn347]).

At the more extreme end of the damage spectrum, biopsies of the brains of six former NFL players between the ages of 25 and 50 who had experienced multiple concussions during their careers revealed evidence of chronic traumatic encephalopathy, according to investigators at Boston University's Center for the Study of Traumatic Encephalopathy. All six players had had emotional and behavioral problems such as drug abuse, and two committed suicide, said Dr. Ann C. McKee, a neuropathologist and codirector of the center.

The mounting evidence of long-term effects of mTBI in athletes has led to growing concerns about the frequency of concussions among U.S. soldiers fighting in Iraq and Afghanistan. An anonymous survey of more than 2,500 active duty and reserve soldiers conducted 3-4 months after a year-long tour of duty in Iraq indicated that mTBI, when associated with a loss of consciousness, resulted in a significant increase in posttraumatic stress syndrome relative to soldiers who had sustained other types of injuries or no injuries (N. Engl. J. Med. 2008;358:453-63).

Considering the large number of U.S. combat soldiers at risk for mTBI, the Department of Defense has mandated that all deploying troops undergo a cognitive functional assessment to serve as a baseline measure for comparison in case of later mTBI. The Automated Neuropsychological Assessment Metric (ANAM) is a computerized game-like test that requires no special preparation and takes 15-20 minutes to complete, according to Army Lt. Col. Margaret Nava, the ANAM program director for the Pacific. The results are to be stored in the soldiers' electronic records and may be requested by physicians in the event of a TBI for comparison with a postincident test.

> **Mild TBI 'is sometimes called an invisible injury—people can look fine on the outside, but they may not be behaving fine, thinking fine, sleeping fine.'**

According to the Centers for Disease Control and Prevention, an estimated 5%-15% of individuals in the general population who sustain an mTBI have long-term deficits of some sort, although actual numbers are difficult to ascertain.

"Not all people who sustain a mild brain injury recognize some of the later cognitive and behavioral impairments as related to the injury, and many don't seek medical treatment," said Dr. Zasler. "This is why [mTBI] is sometimes called an invisible injury—people can look fine on the outside, but they may not be behaving fine, thinking fine, sleeping fine."

New evidence confirms suspicions that post-mTBI problems are substantially underreported. Karen Hux, Ph.D., of the University of Nebraska–Lincoln and her colleagues evaluated the implementation of a TBI screening procedure at vocational rehabilitation centers, domestic abuse and homeless shelters, and mental health centers. Of 1,999 screening protocols administered by professionals from four service agencies over a 6-month period, 531 were positive for a possible mTBI of sufficient severity to impact the individuals' quality of life (Brain Inj. 2009; 23:8-14).

To date, the only objective method for detecting or confirming mTBI is specialized medical imaging. "CT and MRI scans of patients suffering persistent cognitive impairment as a result of mild traumatic brain injury usually look totally normal. When you look at the raw images, you can't really see anything abnormal. What you need to do is look at the images quantitatively," said Dr. Michael Lipton of the department of radiology at Albert Einstein College of Medicine and Montefiore Medical Center, both in New York.

Dr. Lipton and his colleagues use MRI-based diffusion tensor imaging (DTI) to map the location, orientation, and anisotropy of the brain's white matter tracks. "We analyze each and every voxel of the brain looking for statistically significant differences between [mTBI] patients and healthy controls."

The ability to detect subtle neuronal injury has important clinical implications for the management of mTBI, Dr. Lipton said. "Right now, there are a lot of candidate therapies, but if you look at the literature, all of the treatment trials have been failures. This is because almost all of them are conducted in patients with moderate to severe brain injury. In those patients, it's too late." Identifying individuals with mild injury would allow the use and evaluation of candidate therapies designed to arrest the progression of damage.

While the clinical utility of DTI has been established and the technology is being used at many academic centers for clinical measurement, "with the current state of the art, it requires specialized expertise to be able to extract information from the images," Dr. Lipton emphasized.

The early identification and management of mTBI should get a boost from clinical guidelines by the American College of Emergency Physicians and the CDC that provide evidence-based recommendations on the following four issues:

- Which patients with mild TBI should have a noncontrast head CT scan in the emergency department.
- Whether there is a role for head MRI over noncontrast CT in the emergency department evaluation of a patient with acute mild TBI.
- Whether brain-specific serum biomarkers are predictive of acute traumatic intracranial injury.
- Whether individuals with an isolated mild TBI and a normal neurologic evaluation result may be safely discharged from the emergency department if a noncontrast head CT scan shows no evidence of intracranial injury (Ann. Emerg. Med. 2008;52:714-48).

Although the guidelines are written primarily for emergency physicians, "we know that many patients with mild traumatic brain injury seek care from other practitioners such as internists, family practitioners, geriatricians, pediatricians, and neurologists," said Dr. Andy Jagoda of Mount Sinai School of Medicine in New York, and chair of the guideline writing panel. For that reason, clinicians across the spectrum should be made aware of them. ■

Headache Pain Persists in Veterans With TBI

BY HEIDI SPLETE

Persistent headaches occurred in nearly 98% of soldiers who suffered head trauma, blast exposure, or concussion while on duty in Iraq or Afghanistan, according to results of a survey of soldiers who returned from deployment between June and October 2008.

"Our goal was to try to determine the types, the duration, the frequency, and any occupational dysfunction caused by headaches in soldiers with a history of head trauma, concussion, or blasts," Dr. Brett J. Theeler of the Madigan Army Medical Center in Tacoma, Wash., said in an interview.

Previous research has shown that about 15% of soldiers deployed to Iraq or Afghanistan experience mild traumatic brain injuries, but the prevalence and characteristics of the headaches associated with these injuries have not been well studied, he noted.

Dr. Theeler and his colleagues conducted a study based on a 13-item headache questionnaire. The study participants included 963 men and 15 women who returned from Iraq or Afghanistan within 3 months prior to enrolling in the study. The average age of the soldiers was 27 years.

The complete study results will be presented at the annual meeting of the American Academy of Neurology in April.

Overall, 351 of the 957 soldiers (37%) who reported headaches said that they started having headaches within a week of their injuries, and 20% reported that they started having headaches 1-4 weeks after their injuries.

Of those whose headaches began within 1 week of their injuries, 60% had headaches that met three or more criteria for migraines, and 40% said their headaches interfered with their normal activities. Of all of the soldiers who reported headaches, 30% said they had at least 15 days of headaches per month.

"We were very interested in the headache types," Dr. Theeler said.

In an earlier study on headaches in soldiers, he and his colleagues found that more of these posttraumatic headaches had migraine features, compared with headaches in the general population (CLINICAL NEUROLOGY NEWS, Sept. 2006, p. 17). The current study had similar results.

"That doesn't mean that the head trauma or concussion is directly related to migraine, but we think head trauma is one of those important factors that lead these soldiers to have a higher frequency of migraines than people in the general population," he said.

Identifying a specific type of headache might lead to a better diagnosis and possibly better treatments for the soldiers, Dr. Theeler said.

One of the take-home points for clinicians is that soldiers who have persistent migraine-type headaches might respond to migraine treatments, although the treatment of these soldiers has not been systematically studied, Dr. Theeler added.

Additional research is needed to determine the best acute medications and the best prophylactic treatments for soldiers who have headaches with migraine features after head trauma, and Dr. Theeler and his colleagues are currently conducting studies to address these issues.

Dr. Theeler said he had no financial conflicts to disclose. ■