



# Clinical Application: Implications of MTBI Research

**Research offers new insights into the management of MTBI symptoms and seeks evidence to support the most appropriate interventions.**

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**A**s veterans began returning to the US from the wars in Iraq and Afghanistan, it became increasingly obvious that exposure to bomb blasts and other forceful trauma increased these individuals' risks for mild traumatic brain injury (MTBI), which means the same thing as "concussion." According to Army estimates, between 10 and 20 percent of soldiers and Marines returning from combat duty in Iraq or Afghanistan may have experienced a concussion/MTBI while deployed. The Army in particular has been focusing on TBI and its impact on returning vets. In a pre-publication Executive Summary of the Military TBI Task Force's Official Position on the Role of Neuropsychology and Rehabilitation Psychology, the authors state that TBI "has been widely considered the 'signature injury' among United States military personnel involved in combat in Iraq and Afghanistan," and note that the rate of TBI among veterans returning from Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) "is thought to be significantly higher than any previous war."

Given these realities, the Army has instituted a screening assessment for symptoms of MTBI for soldiers returning from active duty. Implementation of a screening tool was among 47 recommendations described in an Army report in January that are intended to help "better prevent, screen, diagnose, treat, and research traumatic brain injury," according to a statement.

When the Department of Defense indicated that it would incorporate screening for mild-traumatic brain injury for

returning vets, Col. Charles Hoge, MD, an army psychiatrist at Walter Reed Army Institute of Research, enlisted colleagues to assess the clinical value of a screening tool for TBI when administered to returning vets a period of time after the traumatic event and to help elucidate epidemiological data about combat-related MTBI.

## Recent Findings

Dr. Hoge and colleagues surveyed 2,525 US Army infantry soldiers three to four months after they returned from a year-long deployment to Iraq to compare soldiers reporting mild traumatic brain injury with soldiers who reported other injuries.<sup>1</sup> MTBI was defined as an injury with loss of consciousness or altered mental status (e.g., dazed or confused). One-hundred-twenty-four (4.9 percent) respondents reported injuries with loss of consciousness, and 260 (10.3 percent) reported injuries with altered mental status, while 435 (17.2 percent) of respondents reported other injuries during deployment. MTBI was strongly associated with post-traumatic stress disorder (PTSD): 43.9 percent of those reporting loss of consciousness met criteria for PTSD, as did 27.3 percent of those reporting being "dazed and confused." Among those reporting other injuries, 16.2 percent met criteria for PTSD, compared to just 9.1 percent of those with no injury.

Mild traumatic brain injury—primarily with loss of consciousness—was associated with poor general health, missed workdays, medical visits, and a high number of somatic and

### Four MTBI Management Strategies

According to Dr. Hoge, these steps can help improve management of symptoms of MTBI.

1. **Don't over-emphasize causality.** It is imperative to diagnose and treat all identifiable co-existent conditions (such as PTSD), but it is not clinically necessary to ascribe a cause to pain. There is no difference in the management of headache resulting from MTBI or from PTSD.
2. **Recognize the validity of PTSD as a physical illness.** Evidence confirms that traumatic experiences cause physiological responses in the body that lead to the development of chronic pain and other physical manifestations of PTSD.
3. **Identify and address possible substance abuse.** Ongoing alcohol or drug abuse will complicate treatment.
4. **Set positive expectations.** When presenting the diagnosis, use terms that are as positive as possible. Consider that the diagnosis of "concussion" will likely sound less grave than that of mild traumatic brain injury. Set positive but realistic expectations for recovery.

*See main text for details.*

postconcussive symptoms to a greater degree than other reported injuries were. Of note, when the researchers adjusted for PTSD and depression, MTBI was no longer significantly associated with any of the studied physical health outcomes or symptoms, except for headache.

"We modeled our study after the questionnaire that is now part of the screening," Dr. Hoge explains. "We wanted to determine whether the questions that were selected identified health concerns expected among soldiers who had a history of concussion or MTBI during deployment." Results of the study showed that the screening question pertaining to loss of consciousness was a stronger predictor of poor physical health outcomes compared with a screening question pertaining to change in consciousness ("dazed or confused"), but that neither question could reliably distinguish symptoms due to the concussion/MTBI in the post-deployment period. Perhaps most important was the finding that "PTSD and to some extent depression—but mostly PTSD—explained the bulk of symptoms that soldiers experienced," Dr. Hoge says. Post-concussive symptoms clustered in soldiers with PTSD, and were much more strongly associated with PTSD than with the concussions themselves. This association of MTBI symptoms with PTSD is not surprising to Dr. Hoge. The incidents in which soldiers experience the closed head injury are "incredibly traumatic, life-threatening events," he says, noting that many soldiers witness the injury or death of fellow soldiers in addition to receiving their own injuries and subsequently fearing for their own safety and life.

PTSD is associated with a host of physiologic changes in the body, Dr. Hoge reminds. In response to the traumatic event, increased release of cortisol leads to dysregulation of autonomic function and subsequent alteration of cell-mediated immune function. These changes help explain the chronic pain and chronic headaches that are associated with PTSD. These are likely to be the symptoms that bring veterans of OEF and OIF to military or civilian neurologists.

### Clinical Implications

Sharing her personal assessment as a clinician, Col. Jamie B. Grimes, MD, a neurologist and psychiatrist at Brook Army Medical Center where she is Site Director of the Defense and Veterans Brain Injury Center (DVBIC), says, "Traumatic brain injury has been overlooked not just in the military but in civilian practice. It has been labeled by the Centers for Disease Control as the silent epidemic in the US, especially in young men, long before service members were serving in Iraq and Afghanistan." She notes that the Defense and Veterans Head Injury Program (DVHIP) was created in 1992 by congressional mandate to coordinate care for military of all services suffering moderate to severe TBI. "This nation-wide care coordination included partnership between three major Military Treatment Facilities (major military medical centers), four Specialty Polytrauma Veterans Administration (VA) Hospitals, and a few select civilian partner facilities. Ultimately the name changed to its current one, DVBIC, but despite 15 years of existence in early 2007, DVBIC was mostly unknown like TBI itself." See the sidebar on page 46 for a description of recent developments regarding MTBI research and care.

First and foremost, accurate identification of MTBI is crucial. "Due to this increased focus service members have on TBI, they will sometimes attribute recent symptoms including headaches, insomnia, memory and concentration complaints, to remote and trivial head injury," Dr. Grimes observes. "Clinical interview is key to establish timeline of events and relationship of symptoms to injury event. Also, if their symptoms are worsening over time, that is also unlikely to be MTBI but much more likely to be due to other conditions, especially PTSD." She points out the literature suggests the vast majority of MTBI have resolution or near-resolution of symptoms by three months or less, with a few with residual symptoms that persist past a year. "Even moderate and severe head injury patients are markedly better in one year, so to have a clinical course of worsening over time must invoke consideration of other diagnoses than concussion," she stresses.

While she agrees that "MTBI is more difficult to identify in soldiers/Marines/sailors/airmen than an athlete on the playing field," Dr. Grimes says she doesn't "believe blast brain injury to be markedly different from physical blow to the brain; I do

## Additional Recent Findings

Theeler et al. determined that the prevalence of migraine among returning soldiers may be higher than that in the general population. He and his colleagues distributed a self-administered headache questionnaire to a brigade of US Army soldiers (stationed at Ft. Lewis, Washington) within 10 days of return from a one-year combat tour in Iraq. Three months after their return from Iraq, soldiers who screened positive for migraine were surveyed again by phone.

Nineteen percent of soldiers screened positive for migraine: there was a 17.4 percent prevalence among male soldiers (95 percent of the total sample were males) and 34.9 percent prevalence among female soldiers during a one-year deployment. In contrast, the one-year prevalence of migraine among 18- to 29-year-olds in the general US population is six percent for males and 20 percent for females. An additional 17 percent of soldiers screened positive for possible migraine.

Those with a positive migraine screen had a mean of 3.1 headache days per month, a mean headache duration of 5.2 hours, and a mean of 2.4 impaired duty days per month due to headache. Soldiers with migraine made a total of 490 sick call visits for headache over a three-month period compared with 90 sick call visits among those with possible migraine.

Findings suggest the migraine in soldiers is both under-recognized and under-treated. Just one in four soldiers who screened positive for migraine carried a self-reported diagnosis of migraine by a medical professional. Data suggest nearly half of migraine sufferers in the general population are not diagnosed. Only nine percent of soldiers who screened positive for migraine in the study used a prescription medication for headache (versus 41 percent of diagnosed migraine sufferers in the general US population).

—Theeler BJ, Mercer R, Erickson JC. *Prevalence and Impact of Migraine Among US Army Soldiers Deployed in Support of Operation Iraqi Freedom. Headache* 2008;48:876-882.

believe mechanism of injury is different, but literature to date does not support that there is a marked difference.” Instead, she says, difficulty, “lies in special issues that are in play during combat.” In battle, attention and triage is understandably first to life threatening injuries and to establishing control of hostile and even lethal situations. “Concussion/MTBI can be brief and transient, easily overlooked in the heat of battle, leading to delay in evaluation which is not true on the sports field for the most part.” She says that the “most accurate recognition and diagnosis of TBI is acutely after it occurs,” but it is “just not reasonable or practical during combat operations.” Dr. Grimes notes an emphasis on training all military personnel in the combat theater to recognize acute concussion during exposure to blast or other potential trauma to the head and to get evaluation as soon as feasible and operational conditions allow.

While findings by Dr. Hoge’s team and others regarding the association of MTBI symptomology and PTSD present interesting avenues for research, there may be few immediate clinical implications for those currently diagnosing, assessing, and treating veterans (or civilians) with MTBI. “I think PTSD is what’s really driving the symptomatology,” Dr. Hoge admits, but adds, “To some extent, it is not helpful to chase after attribution.” While it’s important to determine whether an individual has PTSD, a history of MTBI, or any other diagnosis, focusing on the cause of chronic pain may not affect the management course.

“It’s important to identify factors like depression or PTSD, as they do have treatments available. Get treatment as soon as possible so that symptoms do not become chronic or debilitat-

ing,” Dr. Hoge urges. “You must first rule out something that is immediately treatable...identify the symptoms and treat them.” But, he adds, “The bottom line is: you don’t really treat headache any differently if the patient has a history of concussion, especially if the traumatic event was long ago in the past.”

The issue of alcohol and substance abuse is important to consider. Alcohol abuse may be associated with PTSD and, if unaddressed, will likely stymie any treatment protocol.

Perhaps more pertinent to clinical care is the clinician’s attitude toward PTSD, MTBI, or depression and his/her philosophy of patient communication and education.

“There is this notion of mind/body separation,” Dr. Hoge observes, “We need to get beyond that.” Despite the body of published research on posttraumatic stress disorder, some clinicians still consider it a “psychological” rather than a physical condition. And that can lead to delayed or insufficient treatment. Patients may not receive appropriate drug therapies and may not receive referrals for mental health support.

Importantly, neurologists who identify MTBI or any other diagnosis must carefully consider the manner in which they present the diagnosis to affected individuals. Many clinicians fail to recognize that “how they communicate with patients about their condition actually has a direct impact on the patient’s chance of recovery,” Dr. Hoge says, noting that studies confirm that when physicians provide positive expectations for recovery after MTBI/concussions, patients have better results.

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In fact, Dr. Hoge says, providing positive expectations is “the only evidence-based intervention that has been shown in trials to reduce the severity or chronicity of symptoms after an MTBI/concussion.” Therefore, he encourages both military and civilian neurologists to focus on cognitive education of symptoms and to promote understanding of the diagnosis and long-term implications. In the case of MTBI, he says, word choice can be important. Whereas patients told they have a concussion generally expect to make a full recovery, “mild traumatic brain injury” sounds like a much more serious and potentially detrimental condition.

There are other possible implications for civilian care coming directly from study of MTBI among military personnel—especially in neuro-imaging, Dr. Grimes says. “Currently in MTBI, which is cerebral dysfunction rather than destruction, it is not expected to find abnormalities on conventional imaging including MRI, but functional MRI and DTI already look promising for providing diagnostic detail of dysfunction in MTBI.” She also suspects that current research “can further establish evidence-based guidelines for MTBI including evaluation and therapy which currently do not exist. Long has there been a history of significant medical advances in caring for our wounded, including blood banking and trauma surgery.”

## Future Directions

“First and foremost an epidemiologist,” Dr. Hoge hopes future research will elucidate the prevalence and impact of PTSD. Given that 15-20 percent of returning veterans will develop PTSD, he’s interested in the epidemiology or natural history/causal factors associated with some people developing worse or longer-lasting symptomology or, by contrast, some individuals seeming to have greater resilience. Furthermore, he welcomes new findings regarding the diagnosis of MTBI and, more importantly, its management—particularly if diagnosed long after a traumatic event. “Mild TBI affects the largest percentage of the population compared to moderate or severe TBI, which are very distinct classifications,” he says. “The latter present with injuries visible on imaging and symptoms identifiable on physical exam, and you can predict recovery based on the location of injury.” This currently is not possible for MTBI; physicians can’t identify who will suffer long-term sequelae like headache. “The ‘looming question’ is the best way to treat symptoms labeled as post-concussive, identified by screening months after the injury,” he says, noting a lack of evidence-based studies to offer insight. **PN**

1. Hoge CW, McGurk D, Thomas JL, Cox AL, Engel CC, Castro CA. Mild traumatic brain injury in U.S. Soldiers returning from Iraq. *N Engl J Med.* 2008 Jan 31;358(5):453-63.

## A Recent History of TBI Research and Care in the Military

“An enormous, intense focus especially on MTBI began initially in February 2007 with anchor Bob Woodruff’s ABC special report, ‘To Iraq and Back’, in which he openly discussed his own penetrating TBI in Iraq from shrapnel and his dramatic recovery,” Dr. Grimes says. “He also expressed concern that large numbers of service members returning from combat will have sustained TBI but not be likely to get the care and rehab that had been essential for his recovery. His was a national voice that raised a serious alarm that if an estimated 10 percent of the 1.5 million service members deployed to Iraq and Afghanistan likely had sustained TBI, this would equate to 150,000 young people with potentially serious ongoing medical issues.” She points out that the 10 percent incidence pertains overwhelmingly to MTBI or concussion, not severe brain injury like Mr. Woodruff’s.

The next month a Washington Post report of its investigation of questionable care for wounded military, including those with TBI, at Walter Reed Army Medical Center in Washington, DC led to Congressional investigations, hearings, and ultimately legislative bills including the Heroes at Home Act 2007 which had the support of key members of the American Academy of Neurology, Dr. Grimes says. “Massive funding then followed for evaluation, research, and treatment of both MTBI as well as PTSD, an increasingly recognized co-morbid condition with MTBI. Formal clinical practice guidelines for all severity TBI were created for use in combat theater, and a standardized screening tool—MACE, Military Acute Concussion Evaluation—was established and instituted at all levels of care.”

Now, according to Dr. Grimes, screening for both TBI and PTSD is mandated just after deployment and again at regular intervals. “Preparatory training for all providers deployed to combat began to include TBI recognition and treatment. All Army wide, including civilian contractors working with military, were required in 2007 to undergo set training module in the recognition and care of MTBI and PTSD. And clinical practice guidelines for stateside care for MTBI and post-concussive syndrome evaluation and treatment were established.”

Finally, Dr. Grimes notes, numerous large monetary grants were awarded for TBI and PTSD research, “and just this past month, disability ratings for diagnosis of TBI have been increased from former 10 percent to potential 40 percent rating. In sum, since early 2007, there has been massive focus on MTBI in the military.”