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**Special Report on  
Traumatic Brain Injury**



# THE TRUE TRAUMA OF TBI

**What is called “mild traumatic brain injury” has serious repercussions for warriors in a medical and cultural landscape of ignorance and bias.**

By Eric Minton, Editor

**S**imply put, the new doctor at the 399th Combat Support Hospital (CSH) in Tikrit, Iraq, seemed incompetent. MAJ Alea Morningstar, USAR, arrived at the unit in January 2007 with an impressive record. She was on her third activation and her second deployment to Iraq. She had served in the Special Forces clinic at Fort Campbell, Ky., and in theater in detainee care, in field hospitals, and as a mobile field surgeon, transferring all over Iraq wherever a doctor was needed. An osteopathic physician in her civilian life, she had been a family practice doctor since 1999 and worked in urgent care for a while in North Carolina while taking care of her ailing parents.

Yet at the 399th CSH, MAJ Morningstar was having trouble handling multiple traumas, forgetting to order blood and check X-rays. The nurses and others on the trauma team were able to cover for her, but they were concerned, and the chief nurse in the emergency room was furious. “She let me know to my face she thought I was an idiot,” MAJ Morningstar said.

What was odd, she said, was that she could do patient chart reviews, and the 399th commander assigned her the task of reviewing charts for all the doctors. She did “a splendid job,” she said; but give her more than one patient at a time, “I got lost.” Her supervisor wondered if the problem might be post-traumatic stress disorder (PTSD). After all, MAJ Morningstar had seen her share of combat.

The problem, it turned out, was another combat-related medical condition: traumatic brain injury (TBI). MAJ Morningstar had endured several mortar and improvised explosive device (IED) blasts. By her count: “Three good ones, and lots of little ones, where you feel the concussion.” She also had suffered a fractured skull from a blow in 1999, and the accumulative effect caused memory loss and other cognitive failures that were obvious to her colleagues in Tikrit—but not to her.

“The most humiliating experience of my entire medical career was to have the staff in an emergency room think I did not know what I was doing,” MAJ Morningstar said in a phone interview with *THE OFFICER* from her home in Hawaii. “I was not aware of my own mistakes, which was very frightening. At that point I didn’t know what was going on. I didn’t understand.”

Lack of understanding is the most prevalent impairment wrought by TBI, and not just by the person suffering the injury. The injury and its effects are often misunderstood by anybody who works, lives, or socializes with the injured person. It’s misunderstood by the military chain of command, by physicians, and by the medical and insurance community at large. Even the name of MAJ Morningstar’s injury, “mild TBI,” is something of a misnomer. While “severe TBI” results in a comatose condition, mild TBI still can cause cognitive impairment.

“This is not ‘mild’ TBI for me,” said

MAJ Morningstar, who has had to give up her medical license, can’t drive, and is facing medical retirement from the Army. “When it impacts people so they can’t perform a job they were trained to do, it’s not ‘mild.’”

## **White Matter Matters**

Think of yourself in a cell phone conversation. The other person is in mid-sentence and ... the talking stops. Then, the talking is there, but the signal cuts in and. Out. Sporadically. Just the way you read that.

“That’s what happens inside the head of someone who has had a concussion,” said Dr. Jamshid Ghajar, a neurosurgeon and clinical professor of neurosurgery at the Weill Cornell Medical Center in New York City and president of the Brain Trauma Foundation. Whatever may be wrong with the phone, it is the impaired transmission of the signal that causes the person to not comprehend.

The brain is composed of gray matter (brain cells) and white matter, which are the long connections among brain areas. With TBI, that white matter tears, and the more it tears, the more severe the injury, ranging from concussion (mild) to coma (severe). For years, the notion of brain injury was associated with penetration as in a gunshot wound, an internal trauma such as a stroke, or blunt force blow to the skull. Similarly, for years someone needed to lose total consciousness to be considered to have suffered a brain injury.

However, white matter can also tear

when the skull is subjected to rapid acceleration, such as whiplash that causes the brain to continue moving inside the cranium. This whiplash motion—literally, the snap at the end of the whip—occurs to people in an explosion. “If you watch slow motion video of somebody next to a blast, you see their head whipping around,” Dr. Ghajar said. “It’s called diffuse axonal injury, or DAI, and it can occur a little bit or a lot.”

DAI does not always result in loss of consciousness, even though some damage has occurred to the white matter. “It’s called *mild* because you are awake,” Dr. Ghajar said.

It’s what MAJ Morningstar calls “having your brain scrambled. You just pick up and carry on when you go through these blasts. You don’t stop and whine and say, ‘Send me home.’ And you go out and go through a blast again.”

She said the first of her three “good blasts” occurred on her first tour in 2004 when she was assigned to Abu Ghraib. A mortar blast in her vicinity threw her into a concrete barrier. Her second was a mortar attack that knocked her to the floor from her bunk. The third time she was in a convoy, and the truck in front of hers was hit by an IED. “Everybody in the truck I was in got blasted pretty bad: ears ringing, headaches. The Soldier next to me had a bloody nose. I concentrated on making sure he was OK.”

## Diagnosing Brain Injury

According to a Rand study published earlier this year—titled “Invisible Wounds of War: Psychological and Cognitive Injuries, Their Consequences, and Services to Assist Recovery”—as many as 320,000 servicemembers who have served in Iraq or Afghanistan have a TBI. A prevalent notion among the public, and one brought up in the Rand study, is that thanks to body armor and better in-theater medical practices, the higher incidence of TBI is due to survivability of traumatic head wounds.

TBI, however, is not a new phenomenon. “It has been around since man developed,” Dr. Ghajar said. Nor are its causes limited to combat or other acts of violence. MAJ Morningstar’s first TBI came in 1999 when she was knocked out by a hospital automatic door. Dr. Ghajar said up to 4 million people a year might incur a concussion, and while 80 percent fully recover in three months, the remaining 20 percent suffer persistent symptoms.

Studies on athletes indicate damage can accumulate through succeeding incidents. The Army, in a chain-teaching program sent to all Active and Reserve Component units in the summer of 2007, noted that many Soldiers, even before deploying to combat, may already have suffered a TBI in a variety of activities ranging from boot camp to horseplay. Thus, Soldiers needed to be aware of the greater potential for damage from TBI in theater, the Army training program said.

Gauging the prevalence of mild TBI is problematic because diagnosing mild TBI remains difficult, not only in combat but in sports, auto accidents, fights, or running into doors. “I can tell somebody’s in a coma, and I can get a brain scan,” Dr. Ghajar said. “But somebody with a concussion, they can see OK, they can move. Everything seems to be intact, but conversations or interaction seem to be out of sync.”

As of yet, no exact tests exist to diagnose occurrence of TBI. Dr. Ghajar has been part of an eight-year study conducted by the

## A Mother Speaks Out on TBI

By Gi Gi Szelesta

**I am the proud mother and godmother of two brave young men who have both sustained brain injuries as a result of their service in Iraq and Afghanistan.**

**My son Stan was injured in a helicopter crash while performing reconnaissance in Afghanistan. He was one of the seriously injured, suffering facial and head trauma. Stan was flown to Germany where he received excellent medical care and returned to Afghanistan to complete his deployment. He recently returned home from his third deployment since Sept. 11, 2001.**

**My godson Steven was injured in Iraq in August 2004 by an improvised explosive device, which fortunately didn’t go off completely or it would have killed him. He lost his left eye and sustained a brain injury. However, his brain injury was not diagnosed until October 2007. Between August 2004 and October of 2007, he became addicted to pain medications that were prescribed for his injuries and was treated as a psychiatric patient. Since being diagnosed with a brain injury, he’s received appropriate treatment for his substance abuse and his brain injury. However, I exhausted all resources with two Veterans Affairs (VA) medical centers, and eventually turned to the Brain Injury Association of Virginia and the Virginia Brain Injury Council to seek help for him. Steven was in intelligence and military police, and is a decorated war hero. He is currently medically retired at the age of 22.**

**It is imperative that greater funding and resources be made available to the civilian sector, because of the overwhelming number of veterans and their families who need treatment but are having tremendous difficulty receiving timely and appropriate treatment through the VA medical centers. Waiting for the Department of Defense (DoD) or the VA to build an infrastructure to deal with traumatic brain injury (TBI) while simple, standard operating procedures can be established and local resources utilized for TBI veteran care is unacceptable. DoD must be willing to open its doors to the civilian sector in treating our veterans and Active Duty warriors who suffer from TBI.**

**Our nation’s finest deserve the very best. Excuses for anything less are unacceptable. As a nation, we sent these brave, unselfish men and women to war. Therefore, as a nation we are responsible for their care.**

*Mrs. Szelesta and her husband, John, reside in Amherst County, Va. She has served on the Community Action Council and the Army Community Services Committee of Fort Campbell, Ky. She was mayor of Gardner Hills housing area and was a rape crisis counselor for the Department of Social Services of Fort Campbell. This year, she was appointed to the Virginia Brain Injury Council by Mr. James Rothrock, commissioner of the Department of Rehabilitative Services.*

Cornell Medical Center and the University of California using an alternative form of Magnetic Resonance Imaging (MRI) called the Diffusion Tensor Imaging (DTI) that can pick out tiny tears in the frontal lobe's white matter that typical CT (Computed Tomography) scans and MRIs can't. He is optimistic that DTI—tested in emergency rooms in New York and San Francisco—could become a diagnostic tool.

Dr. Ghajar also is working on an eye-tracking device that could determine within 30 seconds a person's ability to pay attention, or be "in sync," and the Brain Trauma Foundation received a \$4.6 million grant from the Department of Defense for the project.

Go back to the brain-as-cell-phone analogy. The brain operates more in a "predictive state" than in a reactionary state, Dr. Ghajar said. Essentially, in your normal functioning and conversations, your brain knows what should come next. Three sections of the brain work together to create this state of expectancy, he said, and a tear in the connections—in the white matter—can disrupt this state of expectancy, just as a faulty cell phone signal can disrupt your phone conversation.

The eye-tracking device Dr. Ghajar and his colleagues are honing measures the brain's capacity to expect things. The patient focuses on a dot circling in a steady pace on a screen while a camera measures how well the patient's eye keeps up with the dot. "Somebody with a concussion, their expectancy is messed up, so their timing is off where they think the dot is going to be," Dr. Ghajar said. "Sometimes it's fast, sometimes it's slow, and the eye jitters around."

He foresees such a device being installed in theater where it can be used to screen military members' fitness for duty, whether they are suffering from a concussion, fatigue, substance abuse, or some other distraction, all factors that can interfere with the brain's ability to pay attention. While research is ongoing to see if the device can delineate among these factors, Dr.



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**MAJ Morningstar**

Ghajar feels it already would benefit combat operations. "I want to know if somebody after a blast or extended tour of duty is paying attention; that's what I really want to know, and knowing that, you can then decide whether to send them back out into combat."

### **Suicidal Cells**

Meantime, the protocol for diagnosing mild TBI in theater is, more or less, observation and query. Two criteria must be met to diagnose TBI: a history of injury and an alteration of consciousness, ranging from being dazed to confused to losing consciousness.

The problem with the latter criteria is that the injured often don't acknowledge they are injured, as MAJ Morningstar pointed out. Sometimes this lack of disclosure is not intentional; they may not be aware of the injury themselves. Because the brain's cognitive function is affected, the brain might not have the cognitive capability to recognize its own injury.

"It's not denial, it's agnosia, lack of recognition," said Dr. Gregory O'Shanick, medical director for the Center for Neurorehabilitation Services in Richmond, Va., and the national medical director for the Brain Injury Association of America. "They literally don't know they are injured."

This is where the battle buddy-system helps warriors get quick and proper treatment. Similarly, family members may notice changes in cognitive ability that their loved ones don't acknowledge. In such situations, the buddy or family member not only needs to be persistent to get the servicemember into treatment, but

also needs to accompany the patient when visiting a doctor. "It's absolutely critical if you are assessing anybody with a brain injury that you have a collateral informant, somebody who knew the person before who can give comparisons on external behaviors," Dr. O'Shanick said.

Furthermore, TBI symptoms sometimes don't manifest for a few hours or days, and the effects of accumulative injuries may not show up for months. Research indicates that two things happen in a DAI. The first is the direct damage to the brain's mechanics at the time of the injury. The second is a chemical change that occurs due to a mismatch between the glucose and oxygen the brain cells need to function and their ability to get the raw materials they need to produce proteins to maintain the brain cell structure. The first is called *cell murder*; the second, *cell suicide*.

"In moderate and severe brain injury, what is most often observed is a high proportion of cell murder," Dr. O'Shanick said. "In mild TBI, it's the reverse: there is more cell suicide than cell murder. These symptoms start to emerge later."

In the wake of a concussion, most people have headaches, balance problems, blurry vision, and some audio-cognitive problems for one to two weeks. "But they'll bounce back in two weeks without intervention, provided the individual is able to sleep well and doesn't sustain another event," Dr. O'Shanick said. In combat, of course, individuals often do sustain another event.

Cognitive disorder can persist depending on the number and degree of concussions and the state of the brain. White matter injuries usually occur in the frontal lobe, the portion of the brain that organizes and synthesizes information. The frontal lobe is still developing in women through about age 22, and in men to about 25. "So young men and women who get injured, we're talking about developmental disability," Dr. O'Shanick said.

The degree of injury would be relatively greater for people who depend upon their highly functioning

frontal lobes, such as those with a higher level of education or demand for multitasking. “So, part of the effect of the injury is going to be based on what your rank is, what your [military operational specialty] is, and what your responsibilities are,” Dr. O’Shanick said. Thus, while MAJ Morningstar may get adequate scores on memory tests post-TBI compared to other patients, she no longer has the multitasking capability to fix a meal in her kitchen, let alone operate in a hospital emergency room.

### **Nobody Understands This**

Mild TBI is so misunderstood that the patient may be misdiagnosed and the impact of the injury underappreciated. “The first issue,” Dr. O’Shanick said, “is correct identification. The person would get in the wrong system of care, and they are going to go downhill fast.”

As Dr. Ghajar’s eye-tracking tests suggest, the symptoms of mild TBI could be taken for fatigue, substance abuse, a psychological disorder, or simply a bad attitude. Anecdotal evidence is surfacing that a number of Afghanistan and Iraq War vets have received disciplinary actions from their commanders for overly apathetic or aggressive behavior, which, investigators are discovering, may result from the servicemember incurring a concussion up to two years before.

MAJ Morningstar said she encountered ignorance of TBI on her journey through the military medical system from Iraq through Walter Reed Army Medical Center, where she spent 11 months. She is currently assigned to a warrior transition brigade in Hawaii. (MAJ Morningstar began that journey in April 2007, only five months after the Defense and Veterans Brain Injury Center issued its clinical practice guideline and recommendations on diagnosing and treating mild TBI in military operational settings on Dec. 22, 2006, and four months before the Army issued its chain teaching program on TBI and PTSD; and she points out that since she has been at Tripler Army Medical Center, she has seen the Army making greater efforts to improve treatment for patients with TBI.)

Keep in mind, she is talking about attitudes in the military health-care community. How then is mild TBI regarded by the civilian health-care community, which is not inculcated in a TBI-frequency environment such as a combat theater?

“There is a bias, a prejudice against this population similar to the bias and prejudice we saw back in the 1980s against psychiatric disorders,” Dr. O’Shanick said. “Part of it has to do with the widespread misconception among lay people as well as many medical personnel that you cannot sustain a traumatic brain injury unless you are unconscious, or cannot sustain traumatic brain injury without being hit in the head—this, even though there is scientific information two decades old that you don’t need to have blunt force to the head, and scientific information going back five decades that you don’t have to lose consciousness.”

That bias, he said, coupled with economic factors, is reflected in insurance coverage. Except for some policies issued by Aetna, the average health insurance policy, including Tricare, fails to cover cognitive rehabilitation. “They say that cognitive rehabilitation for brain injury is unproven, in spite of the fact that there have been over 400 articles and dozens of well-designed studies published,” Dr. O’Shanick said. “When they do pay for cognitive rehab, neurorehabilitation, or cognitive remediation, they set artificial and arbitrary time and pay limits that have nothing to do with outcomes that allow the person to go back to being independent, to no longer needing a caregiver at home, or to interact in the community, or interact with his or her kids.”

Ten U.S. senators on Aug. 4 and 60 House members on Sept. 19 sent letters to Secretary of Defense Robert Gates urging Tricare coverage of cognitive rehabilitation for brain injury patients.

Both a medical community ignorant of the cause and effects of mild TBI and an insurance industry disregarding ongoing treatment for mild TBI have disturbing ramifications, especially for Reserve Component members who return home before the symptoms of accumulated concussions appear.

MAJ Morningstar wants to be part of an education effort for the general public on TBI and its effects, but her greatest concern is for family members. She attends a weekly group therapy session with seven other servicemembers, all diagnosed with mild TBI. A common theme running through the sessions, she said, is how families can’t cope with this different person who has returned from the war. “The biggest problem the Army faces right now is educating the families and helping the families cope, because we warriors don’t realize how bad we are,” she said.

“I’ve had horrible problems with my family and friends,” she said. “Nobody understands this. They think you’re lying or plain stupid. It’s very frustrating.” ●

### **TBI vs. PTSD**

They have been called, in tandem, the signature wounds of Operations Iraqi Freedom and Enduring Freedom: traumatic brain injury (TBI) and post-traumatic stress disorder (PTSD). While TBI and PTSD have in common a number of symptoms—such as deficits in attention and memory, irritability, and sleep disturbance—there are key differences.

Distinguishing symptoms of mild TBI are headache, dizziness, balance problems, and nausea. Another distinguishing factor is the servicemember’s description of the course of events before, during, and after the traumatic injury: post-traumatic amnesia is less common in PTSD but part of the diagnostic protocol for TBI.

However, the two conditions often co-exist. Higher rates of PTSD have been found in the population of patients with mild TBI than with more severe injuries.—EM

