A Changing Landscape: Traumatic Brain Injury in Military Combat and Civilian Athletics

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Diagnosing concussion has posed a special challenge in current military conflicts, as some symptoms and clinical findings are similar to acute stress reaction and other conditions. The Department of Defense (DoD) currently defines a traumatic brain injury (TBI) as: a traumatically induced structural injury and/or physiological disruption of brain function as a result of an external force that is indicated by new onset or worsening of at least one of the following clinical signs, immediately following the event: 1) any period of loss of a decreased level of consciousness (LOC), 2) any loss of memory for events immediately before or after the injury, 3) any alteration in mental state at the time of the injury (confusion, disorientation, slowed thinking, etc.), 4) neurological deficits (weakness, loss of balance, change in vision, praxis, paresis/plegia, sensory loss, aphasia, etc.) that may or may not be transient, or 5) the presence of an intracranial lesion (1). Diagnosing TBI currently depends on a thorough history and the patient’s status at the time of injury, and there is currently no single objective test or diagnostic biomarker for concussion/mild TBI (mTBI). Advancing diagnostic efforts, the U.S. Army Medical Research and Materiel Command is funding biomarker studies to identify the unique biological effects of TBI and leverage knowledge to develop more objective diagnostic tools to determine the severity of brain injury.

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TBI severity within the DoD are currently classified as mild/moderate/severe (1). Concussion/mTBI involves normal structural imaging, LOC for up to 30 min, alteration of consciousness up to 24 h, and post-traumatic amnesia up to 24 h. If a patient meets criteria in more than one category of severity, the provider assigns the higher severity level. Definition standardization remains a problem as concussion grading systems and definitions published by various organizations make comparing findings from various research studies extremely difficult. A collaborative effort among the DoD, Veterans Health Administration, Institute of Neurological Disorders and Stroke, the Brain Trauma Foundation, and the Centers for Disease Control and Prevention (CDC) is developing a medically useful definition and staging criteria for mTBI/concussion.

We live in a sport-crazed society, and although injury is usually an accepted consequence of "playing the game," there is a heightened awareness about sport concussions. Pick up a newspaper, or watch the evening news or "Sports Center," and you’re bound to read or hear something about sport concussions. The media are obsessed with this topic, particularly with the negative news that makes headlines and ultimately sells newspapers. Even so, there is good news to report, and progress is being made. Forty-nine states have passed concussion laws in the past 4 years, aimed at educating athletes, parents, and coaches about the symptoms of concussion and the dangers of continuing to play while still symptomatic. According to the CDC, Emergency Department diagnosis of youth sport concussions has increased by an estimated 60% over the past decade (2). Surprisingly, this is good news, as it speaks to the increased public awareness and better recognition of concussion, as opposed to an increase in actual concussions.

The Cost of Battle

Concussion remains a major military concern given the short- and long-term impacts to our service members; recent conflicts have sparked an increase in TBI research funding designed to accelerate medical innovation. There were 266,810 service members in the DoD from 2000 to 2012 who were diagnosed with TBI—81.7% of these injuries concussions (3). Although the risk for TBI is certainly higher in the combat environment, the majority of these injuries (83.4%) is actually nondeployment-associated (3). In parallel to sport-concussion awareness, military medicine has also taken significant policy steps to promote early identification and concussion treatment (4). In 2010, the DoD published a policy mandating that any deployed service member involved in a potentially concussive event (such as 50 m from a blast, vehicle collision or rollover, blow to the head, etc.) receive a medical evaluation using the Military Acute Concussion Evaluation; receive a minimum 24 h of downtime, even if he was not diagnosed with a concussion; and must be re-evaluated prior to returning to duty (5). Since then, the DoD has screened over 14,950 deployed service members for concussion and has staffed 11 Concussion Care Centers in Afghanistan that promote concussion recovery and medical oversight (internal DoD data; personal communication). The U.S. Army is implementing this concept worldwide to ensure one standard of concussion care, whether the injury occurs on the battlefield or in garrison. The Veterans Administration-DoD Clinical Practice Guidelines (6) were rated as the highest concussion-management guideline in a 2011 edition of Brain Injury (7). Beginning in 2009, the DoD has published numerous TBI clinical recommendations in collaboration with civilian experts in the areas of cognitive rehabilitation, driving assessment, postinjury neurocognitive testing in the deployed environment, management of neuroendocrine dysfunction, assessment and treatment of dizziness, and management of visual dysfunction (8), and an additional three clinical recommendations will be published this year to include graded return to activity, sleep disturbances, and use of neuroimaging.

The tests for detecting concussion and tracking recovery are becoming more sensitive, especially when used in combination with other tools to create a multimodal approach to concussion assessment.

Despite all that has been accomplished, caring for service members and athletes at risk for sustaining cerebral concussion has always been a challenging task and never more so than in today’s litigious society. Concussion is different from other injuries, in that we still rely heavily on an athlete’s or a service member’s subjective reporting of symptoms for decisionmaking, and we lack the neuroimaging protocols that might allow us to identify the damage and understand its severity. The cause-and-effect relationships, or lack of same, between repetitive head trauma and neurodegenerative diseases such as Alzheimer and chronic traumatic encephalopathy (CTE) are the subject of significant debate. Several published case reports have described tau deposits in the brains of deceased contact-sport athletes, but most of the neuroscience community does not believe that controlled experimental research has yet identified a causal relationship linking repetitive head trauma in sports and CTE (9–12). Innovative neuroimaging techniques are on the horizon and will eventually permit tau and other proteins to be traced in vivo. This should allow for prospective investigations comparing head-impact exposure with tau accumulation, leading to earlier detection and interventions for these chronic neurodegenerative diseases. In the meantime, our responsibility is to safely care for our service members and athletes, to educate them about what is known and unknown regarding the long-term effects of repetitive head trauma, and to ensure that family members, coaches, and military unit leaders implement supportive recovery practices. Unfortunately, the large amount of misinformation on this topic sometimes results in hysteria rather than rational thinking.
Snowflakes on the Turf

Concussions are like snowflakes: no two are alike, and no cookbook or calendar can specify exactly how they should be treated. Therefore, we need to go the extra mile. In many cases, it’s a matter of counseling our service members and our athletes about the short- and long-term risks of not reporting symptoms, returning to play or duty while still experiencing symptoms, or not modifying risky behaviors that can predispose them to future concussions. We need individualized and sports-specific return-to-play progressions that ensure that service members and athletes are physically and cognitively prepared to return to activity. No checkbox system can be applied to every concussion, and as concussions are diverse and unique injuries that affect each athlete differently, we must learn how to treat them individually. Likewise, concussed service members and athletes are unique, and we must work to understand what makes them different. Sports medicine clinicians must play the important role of counselor to our athletes. Getting to know each athlete’s mindset and reaction to injuries allows us to build trust and forge honest lines of communications, thus enabling us to develop an appropriate and individualized plan for managing concussion, which is just as vital as knowing how to interpret the results of a cognitive or balance test.

Within a 6-month period, four major consensus or evidence-based documents focused on concussion management will have been released, including the new “Zurich International Guidelines” or the Consensus Statement on Concussion in Sport: the 4th International Conference on Concussion in Sport (13–16). This, along with other manuscripts published or soon to be published by the American Medical Society for Sports Medicine, the American Academy of Neurology, and the National Athletic Trainers’ Association, should all be mandatory reading for sports medicine clinicians, as they will define the standard of care for sports medicine clinicians for at least the next 4–5 years. These documents are well-prepared and will make significant contributions to the sports medicine community. The landscape is changing, and these evidence-based guidelines are leading us in a better direction. Although the neuroscience community has learned much about concussion in the last two decades, we admittedly have much more to investigate and to understand.

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