Assessment and Prevention of Traumatic Brain Injury in High School, College, and Professional Football: A Catastrophy Spinning Out of Control

Read more at http://www.experts.com/Articles/Assessment-Prevention-of-Traumatic-Brain-Injury-in-Football-Catastrophy-Spinning-Out-of-Control-By-Michael-Perrotti#Hf3fIK8gRSwQTLic.99 Freeman et al. (2005) noted that it was in the mid-'80s when it was first noted that mild traumatic brain injury (MTBI) could result in serious and lasting consequences. Numerous studies with human and animal subjects have demonstrated the evidence of neurocognitive defects and delayed return to work in MTBI patients with postconcussive syndrome. Freeman (2005) notes that a recovery curve for MTBI in young, healthy athletes in football demonstrated mild neurocognitive deficits and a five- to ten-day natural recovery curve after very mild brain injuries. However, persisting symptoms after brain injury, including deficits in memory, attention, frontal lobe functions, executive skills, language, and vision perception deficits often go unrecognized. There is no doubt that athletes are at risk for multiple brain injuries. Incredibly a fatality occurred in high school and college football every year between 1945 and 1999, excluding 1990, resulting in a total of 712 fatalities (Mueller 2001). Moreover, 63 brain injuries sustained in high school football games resulted in permanent disability between 1984 and 1999 (Mueller 2001). In football, from 1977 to 1998, researchers found 118 deaths attributed to central nervous system injuries with an additional 200 neurological injuries with incomplete recovery. Only recently has MTBI in football received scientific investigation. It is hard to believe that despite this wide body of research that has been in place since the mid-'80s the NFL is apparently taking a position that they did not know about the severity and consequences, short and long-term, to young men's lives and careers involved in football. Harvey et al. (2011) notes increasing frequency of TBI among children and young adults interfering with educational and occupational potential.

Hyperglycolysis has been observed within minutes of injury in animal foot percussion studies. This relates to metabolic dysfunction referred to as an "energy crisis." There is an increased demand for energy but a decrease in the supply of glucose and blood. Transcranial Doppler ultrasonography demonstrates that MTBI patients experience disrupted autoregulation after induced rapid and brief changes in arterial blood pressure to compensate for reductions in blood supply. The authors note that MTBI patients are at risk for secondary hemorrhage and/or edema and that these results demonstrate the vulnerability to drastic and potentially fatal effects as a result of second head traumas, even those mild in nature.

The second-impact syndrome refers to the potential dangers of managing concussions and making return-to-play decisions as the threat after a first injury. Most often individuals sustain a second head injury before symptoms associated with the first have cleared. Individuals have been known to collapse to the ground semicomatose with rapidly dilating pupils, loss of eye movement, and evidence of respiratory failure (Cantu 1998). There is a loss of cerebrovascular autoregulation described in Hovda et al. (1999, Work After a Singular TBI).

Collins et al. (1999, 2002) found a growing body of evidence that subconcussive events or multiple concussions increase cumulative effects and risk for poor outcome.

In addressing the severity of injury there have been great advances with Cantu's system as well as the Committee on Head Injury Nomenclature of the Congress of Neurological Surgeons. Cantu's new concussion severity rating system defines a grade one concussion as no loss of consciousness with posttraumatic amnesia or postconcussive symptoms for less than 30 minutes, and grade two and grade three with symptoms of increasing severity. The athlete's capacity to recover from cumulative concussions sometimes becomes depleted, then lower levels of force and indirect blows to the torso and legs result in symptoms of concussion and provides further indication that the athlete's functional reserve has been exhausted. More persisting symptoms should guide the decision and terminate an athlete's career. At a minimum, common sense and medical concern regarding the vulnerability of the brain to more severe catastrophic injury dictates the need to hold players from contact situations until all neurologic neuropsychological symptoms have subsided. Yet even as recently as last year, Colt McCoy

received a hit from Harrison of great severity causing loss of consciousness yet he was placed back in the game. Later on his father was enraged with the NFL because of the handling of the situation. Indeed, the professional research indicates the need to implement standards to hold players from contact situations until all neurologic neuropsychological symptoms have subsided. Cantu establishes guidelines for return to play. There are also psychological components to MTBI: irritability, restlessness, depression, fatigue. Indeed, Junior Seau complained to a neighbor who was a soccer athlete that he had had headaches all of his life. One wonders whether the severity of his symptoms was related to the head injuries in football as well as the extremity of his actions. For example, after an alleged altercation with his significant other, he drove a car over a cliff. Thereafter, he ended up taking his life with no notes or warnings to anyone.

SLAM methodology (Barth 2002) remains the gold standard, using preseason and postseason neurocognitive assessments. Preseason cognitive testing allows for control of premorbid cognitive dysfunction. Why with a gold standard is the NFL and NFLPA debating this?

This writer has seen tremendous magnification of anger and depression in individuals with head injuries, much of which is not within their control. Moreover, these individuals are then horrified at their actions in public. Moreover, the phenomenon of pseudobulbar affect can occur wherein individuals cry, are sad, or are depressed and there is no psychological reason for this because the depression is neurologically driven.

Of course, with regard to sideline and neuropsychological assessment, many athletes minimize their injuries to "play through the pain" and receive their playing time. However, there have been great advances in neuropsychological assessment, computerized, as well as brief neuropsychological measures. Indeed, the researchers suggests that all athletes at risk for a concussion receive preseason screening to determine each individuals baseline level of cognitive functioning. This writer wrote to the commissioner, Roger Goodell, in an effort to be proactive because of this writer's great concern with the heartbreaking stories of injuries and even death to athletes in professional football. As of writing of this article, there has been no response from Mr. Goodell. This writer had indicated that he was reaching out to Mr. Goodell because of frustration with the NFLPA and the NFL medical committee, both of which did not respond to this writer's attempts to offer assistance in this area in terms of assessment and intervention.

The key word is "prevention." Athletes should undergo conditioning and strengthening of the neck muscle as a means of reducing transmission of impact forces to the brain. This was delineated by Johnston et al. (2001) in his research. Moreover, playing arenas, or surfaces, should be inspected at each game to ensure that there are no hazards that might increase the risk of injury (Powell 1999). Films should be reviewed to provide additional information about the mechanism of injury and athletes, coaches, and medical personnel should be educated about the seriousness of concussions so that athletes receive proper medical attention and are withheld from play until they fully recover.

Hard Science for Hard Questions references the laws of motion and mechanics of injury, indicating that forces applied to the brain are likely reduced when athletes are prepared for contact and more severe brain injuries from unanticipated impacts: witness wide receivers with unexpected hits. When an athlete is not prepared for acceleration and when there are significant changes in velocity in several directions, there is potential for more serious sports-related brain injuries. Multiple acceleration vectors likely account for the greatest histokinetic changes as evidenced by axonal injury found in MTBI. Thus traumas may lead to the most dramatic changes in neurobehavioral outcomes after a sports-related concussion. Use of Newtonian laws is essential in determining how to best protect athletes from sports-related injuries. Freeman et al.(2005) notes that as recently as 1971-75 there were 59 deaths directly related to brain trauma. The majority of these deaths occurred at the high school level of competition, as reported by Mueller (1998). Recent heightened emphasis on strength conditioning of the head and neck muscles has reduced the risk of injury.

This writer has worked with neuroradiologists at USC Neurology in cases of MTBI wherein a gradient was used in neuropathological interpretation wherein nuclear studies can retrospectively "look back" in time and examine present symptomatology and see if it is related to any past impacts or trauma. Moreover, frequently CTs and MRIs can be negative yet single-photon emission-computed tomography (SPECT) can indicate reduced microscopic blood flow to areas of the brain resulting in egregious damage to brain tissue and function.

It is hoped that the players of the NFL speak with one voice as well as parents of high school athletes speak with one voice in terms of demand for greater safety measures, especially early intervention and assessment of athletes in football. The trail of deaths, injuries, dementia, and the toll on human life has been enough. It is time to take action. A young man recently turned down an NFL contract to attend law school because of the concussion issue. Maybe he has the right idea!

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