

Chronic Traumatic Encephalopathy In Athletes And Military Populations

Recently the examination of the brain of Junior Seau revealed the diagnosis of chronic traumatic encephalopathy, or CTE. The recent diagnosis of chronic traumatic encephalopathy (CTE) after examination of the brain of Junior Seau underlines the seriousness not only of repetitive brain trauma in professional sports and in military populations but also raises continuing serious questions about the management and prevention of CTE in athletic sports.

Introduction to Concepts: CTE, originally termed dementia pugilistica, is associated with memory disturbance, neurobehavioral disturbance, parkinsonism, and motor and speech abnormalities.

There has been increasing attention to neurological sequelae of concussive injuries in sports. While one has heard frequently of individuals having a "concussion" and then returning to play after the "concussion," what is not realized is that players, as McKee et al. (2009) note, may experience thousands of subconcussive hits over the course of a single season. These are cumulative, and repetitive head trauma is applicable to athletes and military veterans.

Clinical Pathology: CTE was first introduced by Martland in 1928, who introduced the term "punch drunk" to a symptom complex related to repeated blows to the head. Symptoms of CTE are firstly deteriorations in functions of attention, concentration, and mnemonic functions as well as disorientation and confusion occasionally accompanied by dizziness and headaches. Junior Seau frequently complained of headaches to peers. With progressive deterioration, additional symptoms, such as lack of insight, poor judgment, and dementia, become manifest. Severe cases are related to progressive slowing of muscular movements, gait disturbance, and speech disturbance. Corsellis et al. describe three stages of clinical deterioration. The first stage is characterized by affective disturbance and psychotic symptoms. Social instability, erratic behavior, memory loss, and initial symptoms of Parkinson's appear during the second stage. The third stage consists of general Chronic Traumatic Encephalopathy in Athletic and Military Populations cognitive dysfunction progressing to dementia and often accompanied by full-blown parkinsonism as well as speech and gait abnormalities.

Incidence: It is estimated that, in cases of repetitive concussion, there is mild traumatic brain injury (MTBI). At least 17% of these individuals develop CTE. Moreover, 1.6 to 3.8 million sports-related concussions occur annually in the U.S.

Prevention and Treatment: Of course, the most direct way to manage CTE and decrease incidents is to decrease the number of concussions or mild [traumatic brain injuries](#) by limiting exposure to trauma. The NFL is making some attempts at this, such as a second look at run backs after kickoffs as well as prescriptions against, or mandates against, helmet-to-helmet contact. However, from the players' point of view, they are vocal in asking for independent medical personnel or independent health-care providers on the sidelines to make decisions about "concussions."

Asymptomatic individuals have been shown to have persistent decreases in P300 amplitudes in response to an auditory stimulus at least five weeks after a concussion thereby casting doubt on the validity of the absence of symptoms as a guidepost. Neuropsychological tests have also helped provide estimates as to the appropriate time for athletes to return to play.

McKee et al. (2009) note that PET (positron emission tomography), DTI (diffusion tensor imaging), and MRI (magnetic resonance imaging) studies have all shown abnormalities in concussed athletes or non-athletes with TBI lasting for two to four weeks. Thus, these studies indicate safe return-to-play guidelines might require at least four to six weeks to facilitate more complex recovery and protect from reinjury as a second concussion occurs much more frequently in the immediate period after a concussion. Animal

studies note that there is expansion of brain injury and inhibition of functional recovery if the animal is subjected to overactivity within the first week.

Lack of Baseline Measures: There does not appear to be protocols followed from SLAM technology (pre-competition/post-competition baseline testing) both in college and in professional football concerning comparison of an individual's test results to baseline measures that are taken pre-season or pre-competition. Thus, an individual is subjected to a concussion and then "feels ready to play." There does not appear to be a comparison to prior baseline measures.

More disturbing is the fact that there does not appear to be any compliance with protocols for post injury assessment of TBI. For example, individuals who are said to have concussed are sent back into play if there is an absence of symptoms. As the research in this paper indicates, asymptomatic individuals have been found to have neuropathological abnormalities. Moreover, individuals can have a negative MRI or a negative CAT scan and nuclear studies with single-photon emission-computed tomography (SPECT) or functional magnetic resonance imaging (fMRI) that may reveal abnormalities in microscopic blood flow. It does not appear that professional sports has either been able or willing to go these extra steps because this would mean taking individuals out of play for extended periods of time. There are issues of [economics](#) and issues of the players themselves. For example, in the case of McElroy of the New York Jets, he reportedly concealed his concussion symptoms from the staff. It was only noticed when he became very symptomatic in the weight room postgame.

Ibolja Cernak of Johns Hopkins presented a lecture (2008) on neuroblast trauma which indicated that there is neurological damage done by shockwaves, blast, and flash. There certainly are shockwave injuries from the violent collisions in sports, especially football. These need to be studied specifically as neurotrauma events and not all subsumed to the category of "concussion." Moreover, Cernak related that in military populations there are individuals who have been found dead with no marks whatsoever on them, pointing to the issues of shockwave and blast injuries. Cernak also noted that individuals have been found to have subdural hematomas up to two years post injury.

Conclusions: It is interesting that there is a confluence or a convergence of dire outcomes both in athletic and military populations. For example, the case of Jim McMann of the Chicago Bears who presents with symptoms of dementia and his significant other has to arrange his days and appointments due to his memory impairment and confusion. Similarly with Junior Seau, there was a decline in his condition with increasing depression, withdrawn behavior, marked mood swings, etcetera.

Until the sport acts decisively to decrease the incidence of repetitive brain injuries, the carnage is quite likely to continue to players, to families, in military populations in increasing numbers of young men coming home, in marriages, and in families being destroyed by forces and events operating out of control.

It is difficult to assess the true motivations of the NFL and the NFLPA. This writer wrote a letter to Roger Goodell reaching out to him to offer assistance in the area of traumatic brain injury and its impact on players. There was no response. Moreover, calls to the NFLPA offering assistance to players with issues of domestic violence were also not returned.

It appears that the crescendo of problems continues to elevate significantly, with numerous suicides in professional football players over the past years. This all begs the question of the fact that it is incumbent on professional sports to begin pre-competition baseline testing, neuropsychological testing, proper and extensive brain imaging to evaluate injuries as well as more of an emphasis on the well-being of the players rather than trying to get them back in the game in an expeditious fashion. Similarly with military populations, there needs to be a network of neuropsychologists in cities close to where the men live after returning home who could be available to them for assessment and treatment.

Bibliography

Cernak, Ibolja. Johns Hopkins University. Personal communication, 2008.

McKee, et al. (2009). Chronic traumatic encephalopathy in athletes: progressive tauopathy following repetitive head injury. *Journal of Neuropathology and Experimental Neurology*.