The Vulnerability of Athletes to Brain Degeneration due to Chronic Traumatic Encephalopathy (CTE) Caused by Repetitive, Mild-traumatic Brain Injuries in Football and other Sports

David L Margules
Temple University, Department of Psychology, USA

Corresponding author: David L Margules
dlmnrw@yahoo.com

Ph.D, Full Professor, Temple University, Department of Psychology, USA.

Citation: Amianto F. Psychopathology of Eating Disorders According to Neurobiology of Attachment: An Instrument to Overcome Resistances to Treatment?. Acta Psychopathol. 2015, 1:3.

The power of social forces can be overwhelming. This is especially shocking in the case of activities that damage the brain. Take boxing as an example. Over 87 years ago Harrison Martland, a New Jersey pathologist, described the clinical aspects of a progressive neurological deterioration ('punch drunk') that occurred after repetitive brain trauma in boxers [1]. This was the first report of a CTE-like disorder. Martland's findings have been largely ignored all these years and boxing continues to this day as a legitimate and well-attended sport. Individuals with CTE may show symptoms of dementia such as memory loss, aggression, confusion and depression, which generally appear years or even decades after the trauma. They may even become suicidal.

Although CTE has been primarily associated with boxing, CTE may also occur as a consequence of American football, hockey, wrestling, rugby and exposure to blast or concussive injuries associated with military service. In American football concussions result most often from a form of tackling known as spear tackling or head-first tackling. The National Collegiate Athletic Association banned spear tackling in 1976. Recently, the National Football League (NFL) began penalizing and fining athletes who do a spear tackle. Unfortunately, all of this did little to reduce the practice of spear tackling.

In CTE, as in Alzheimer’s, the disease starts slowly and becomes progressive as neurodegeneration spreads. CTE is characterized by the widespread deposition of a protein known as tau. Upon damage, this protein transforms into a highly toxic form made up of neurofibrillary tangles. The tangles destroy the transportation system in neurons and they die. The vector for this spread appears to be our own immune cells of the brain, the microglia [2]. These cells carry tiny vesicles known as exosomes that are filled with a misfolded and tangled form of tau protein, the actual toxic agent. The exosomes can be exported from the microglia to infect many other cells in the brain including neurons with its toxin. It is the microglia that facilitates the propagation of tau protein between neurons by first phagocytosing it as part of their waste-disposing duties and then releasing it from exosomes. This would make CTE transmissible from cell to cell [2].

Some support for the diagnosis of CTE in football players comes from brains and spinal cords collected by Center for the Study of Traumatic Encephalopathy (CSTE) at Boston University School of Medicine. The CSTE brain bank analyzes brains and spinal cords after the death of athletes, military veterans and civilians who experienced repetitive mild traumatic brain injury. Data for 34 football players [3] showed that their stage of CTE correlated with increased duration of football play, survival after football and age at death. CTE was the sole diagnosis in 43 cases (63%), by far the most common diagnosis; 8 cases were also diagnosed with motor neuron disease (12%), 7 with Alzheimer’s disease (11%), 11 with Lewy body disease (16%) and 4 with front temporal lobar degeneration (6%). Clearly more than one neurodegenerative disease is at work here. Moreover, there may be more than one form of CTE.

Gardner et al. [4] drawing from 158 published case studies illustrated critical differences between boxing-derived CTE (the ‘classic’ syndrome) and current CTE (the ‘modern’ syndrome). Differences included age of onset, natural history, clinical features, pathology and diagnostic criteria. This suggests that modern CTE is a different syndrome [4]. Nonetheless, either is cause for concern.

Worries about concussions and brain damage have upset the parents of young athletes. These parents are keen on finding safer forms of the game for their children [5]. They do not want their children playing tackle football. A form of American football called touch football or flag football does not involve tackling

Received: November, 03 2015, Accepted: November 11, 2015, Published: November 18, 2015
[6] and is a safer form of the game for both children and adults. Unfortunately, as in boxing, social pressure supports the most harmful form of the sport for adults.

Recently, the American Academy of Pediatrics recommended that the small number of touch football leagues should be increased. As for professional athletes who develop CTE, the NFL [7] would not admit any responsibility, but they did reach a $765 million dollar settlement in a class action suit with thousands of football players who had developed CTE.

This issue is far from settled. There is still a cloud hanging over high school and collegiate sports. CTE usually develops in the elderly, but it can develop as early as the age of 17 [3]. Will these schools be sued as their athletes’ develop CTE? Do coaches have a duty to have injured athletes tested, on site with a newly developed blood test for concussions [8] and if positive, to advise them not to go immediately back into the game? And after 2 or 3 concussions should colleges and universities require that an athlete retire? Much of the uncertainty on these three questions can be removed by on-site blood tests that can provide coaches and doctors with the critical information needed to make better judgments on possible concussions in their athletes.

Perhaps the most persuasive example of the power of CTE to disperse the initial seeds of tau tangles comes from traumatic brain injury. As a result of axon damage, the tau concentration in cerebrospinal fluid may increase by as much as a factor of 40,000 [9]. Apparently tau, a major part of the transportation system in all neural axons, is fragile enough to shatter and break apart upon traumatic injury. This is bad news. We all have to be careful not to sustain sharp blows to the head, which may come from falling, tripping and other accidents.

The good news is that now, for the first time, the accurate blood test has been developed by Papa L, et al. [8] can detect brain damage that has occurred within six hours of any concussion. This test may spell the beginning of the end for tackle football. It’s time to throw a challenge flag and review contact sports for our children and generations to come.
References