Sports concussions and chronic traumatic encephalopathy

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It's been widely reported that football and other contact sports increase the risk of a debilitating neurological condition called chronic traumatic encephalopathy (CTE).

But in the journal *Neuropsychological Review*, researchers are reporting only limited evidence showing a link between sports concussions and an increased risk of late-life cognitive and neuropsychiatric impairments.

Loyola University Medical Center clinical neuropsychologist Christopher Randolph, PhD, is a co-author of the paper. First author is Stella Karantzoulis, PhD, of New York University School of Medicine.

CTE is believed to be the cause of behavioral symptoms including irritability, anger, aggression, depression and suicidality; and cognitive symptoms including impaired learning, memory, language, information-processing speed and executive functioning. CTE is said to be linked to concussions and characterized by the buildup of abnormal substances in the brain called tau proteins.

But so far there is only limited evidence to support this CTE theory, Karantzoulis and Randolph write. These are among the limitations of the evidence:

- So far CTE cases have been reported following the autopsies of athletes' brains that were donated from families concerned about the players' cognitive and behavioral symptoms before dying. But

such non-random "samples of convenience" can bias findings because the samples may not be representative of the entire population of retired players.

- The largest epidemiological study of retired NFL athletes, which included 3,439 players, found that suicide rates were actually substantially lower among these athletes than among the general population. "Given that suicidality is described as a key feature of CTE, this finding is difficult to reconcile with the high rates of CTE that have been speculated to occur in these retired athletes . . . ," Karantzoulis and Randolph write. "It is likely that there are a diverse set of risk factors for suicidality (e.g. life stress, financial difficulty, depression, chronic pain, drug abuse) in retired athletes . . ."
- Two previous studies, including one by Randolph and colleagues, examined symptoms of retired NFL players who had mild cognitive impairment, a precursor to Alzheimer's disease. In both studies, symptoms seen in the retired players were virtually the same as those observed in non-athletes diagnosed with mild cognitive impairment. These findings cast doubt on the notion that CTE is a novel condition unique to athletes who have experienced concussions.
- The presence of abnormal tau proteins in the brain may not be a reliable indicator of CTE. For example, various case studies have found that between 20 percent and 50 percent of subjects who had abnormal tau deposits nevertheless did not have any symptoms. "Older persons without dementia can accumulate Alzheimer's disease pathology (including tau deposition) without any associated cognitive or clinical symptoms," Karantzoulis and Randolph write. "The actual clinical significance of 'abnormal' tau deposition in the brains of retired athletes therefore remains unclear."

The authors detail how CTE originally was identified in 1928 as "punch

drunk" syndrome in boxers. There is a striking parallel between the controversy over CTE today and punch drunk syndrome decades ago. In 1965, for example, a skeptic argued that punch drunk syndrome symptoms seen in boxers could have been due to alcoholism and venereal diseases, which were common in boxers at the time.

"One cannot deny that boxing and other contact sports can potentially result in some type of injury to the brain," Karantzoulis and Randolph write. "There currently are no carefully controlled data, however, to indicate a definitive association between sport-related concussion and increased risk for late-life cognitive and neuropsychiatric impairment of any form."

The authors say more rigorous and definitive studies are needed than the case reports and samples of convenience that have been done to date.

More information: "Modern Chronic Traumatic Encephalopathy in Retired Athletes: What is the Evidence?" Karantzoulis S, Randolph C.*Neuropsychol Rev*. 2013 Nov 22. [Epub ahead of print]. www.ncbi.nlm.nih.gov/pubmed/24264648

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