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The relationship between Chronic Traumatic Encephalopathy (CTE) and contact sport- a scoping review

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Abstract

Background: Chronic Traumatic Encephalopathy (CTE) is a neurodegenerative disease characterised by the accumulation of abnormal tau proteins leading to progressive neuronal destruction different to that of Alzheimer's disease or any other tauopathy (Mckee *et al.*, 2023). CTE is currently a pathological diagnosis following post-mortem brain examination. Such a diagnosis is usually associated with lifetime symptoms relating to cognition, memory behaviour and mood (Montenigro *et al.,* 2014). CTE has been well documented within the contact sports population suggesting some kind of underlying causal link but with no proven reason as to why (Maroon *et al.,* 2005). This report set out to investigate the link between contact sports and the onset of CTE through a scoping review.

Methods: The scoping review was conducted using the preferred reporting items for systematic reviews and meta-analyses (PRISMA) framework. This included the following aspects: development of research question, comprehensive search of the literature, data extrapolation, data analysis, data synthesis and discussion. Search strings were created to conduct a literature search which yielded a number of studies of which 5 were selected to be analysed in depth. This selection was based on relatability to the question and also inclusion and exclusion criteria. Data extrapolation was done using the Braun and Clarke method (Braun and Clarke, 2006) and the data was synthesised using a critical appraisal skills programme (Critical Appraisal Skills Programme, 2022).

Results: The data showed a causal link between repetitive traumatic brain injury and CTE pathology (McKee *et al.,* 2013) (Nowinski *et al.,* 2022). The data also showed the severity of brain injury was directly proportional to the pathological effects seen post-mortem (Viano *et al*, 2005) (Montenigro *et al.*, 2015). Further studies found an association between the allele ApoE4 and risk of CTE onset (Casson *et al.*, 2014). It should be said however that the studies included in this review suffered from a number of limitations including small sample sizes, ascertainment bias, subjective definitions of CTE, short time frame and contradicting data.

Conclusions: It appears that the commonality of CTE in contact sports athletes is due to the heightened frequency of traumatic brain injury. It also appears that the severity of the condition, both clinically and pathologically, is increased with more repeated trauma and also more severe trauma. Genetic predisposition, particularly the ApoE4 gene, appears to also contribute to onset and severity and provides some explanation for why not all athletes exposed to equal brain trauma develop CTE. There is potential for application to both clinical and public medicine. Clinicians can be more aware of the effects of repetitive brain injury and seek to manage it early, thus reducing devastating psychological consequences as in the case of ex NFL footballer Aaron Hernandez who tragically took his own life (Kilgore, 2017). Public health bodies and sports regulators can also implement and adapt rules to help reduce the frequency of head injuries in contact sports, thus reducing both short time and long-term pathological consequences.

Keywords: CTE | Trauma | Sport | Brain

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