Understanding and managing the long-term cognitive consequences of traumatic brain injuries

This editorial critically evaluates the current data on traumatic brain injuries and their effects on cognitive function. It discusses management strategies and clinical considerations to improve patient outcomes in light of these findings.

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Introduction

Traumatic brain injury has been brought into sharp relief by a panoply of high-profile media and legal cases in elite sports. However, traumatic brain injury also affects the general population, with around 2% of the UK population presenting annually to emergency rooms with head injuries (Frost et al, 2013). Estimates of the lifetime prevalence of mild traumatic brain injury in western nations range from 14.3% to 40% (Frost et al, 2013; Lennon et al, 2023). Given the prevalence of traumatic brain injury and increasing community disquietude about its cognitive effects, clinicians need more accurate data to explain the long-term consequences, especially of mild traumatic brain injury, and methods to maintain and regain capacity post-traumatic brain injury. This article explores recent evidence around mild traumatic brain injury and long-term cognitive function, initial management post-traumatic brain injury and how the focus of current management practices may need to change in light of new evidence.

Relationship between traumatic brain injury and cognitive function

The authors' group recently published the PROTECT-TBI study, which analysed 15 764 participants to understand the link between cognitive impairments and neurocognitive conditions caused by mild traumatic brain injury. A mild traumatic brain injury is defined as a transient alteration in mental state or loss of consciousness for less than 30 minutes, whereas a moderate–severe traumatic brain injury is loss of consciousness for more than 30 minutes (Malec et al, 2007; Lennon et al, 2023). The study included patients aged 50–90 years (mean 62.7 years) who answered a questionnaire outlining their traumatic brain injury history and were followed up for 4 years to assess cognitive function. The results showed that those who had sustained three mild traumatic brain injuries over their lifetime or one moderate–severe traumatic brain injury showed statistically significant deterioration in baseline cognitive functioning compared to counterparts with no injuries. Those who had three mild traumatic brain injuries showed a statistically significant decrease in baseline executive function and attention, and those with four or more mild traumatic brain injuries showed decreased attention, processing speed and working memory compared to those without traumatic brain injuries. Clearly, different cognitive domains are affected depending on the number and severity of traumatic brain injuries. The cognitive domains most affected in this study were attention and executive function, while processing speed and working memory were affected to a lesser degree (Lennon et al, 2023).

This study also demonstrated that the more traumatic brain injuries an individual sustained, the worse the outcomes for baseline cognition. However, the trajectory of cognitive decline over the 4 years of the study was unchanged, ie after an initial drop to baseline cognitive function post-traumatic brain injury, the cognitive deficit did not continue to worsen over time – findings congruent with previous studies (Ashman et al, 2008; Ruttan et al, 2008). This suggests that the long-term cognitive impacts post-mild traumatic brain injury are fixed and dose-dependent (Ashman et al, 2008; Ruttan et al, 2008; Lennon et al, 2023).

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Initial management of traumatic brain injury and risk assessment

Lennon et al (2023) showed that having as few as three mild traumatic brain injuries in one's lifetime increases the risk of cognitive decline, indicating that a low threshold may be needed for referral for cognitive rehabilitation. Doctors may need to alter their practice. When a patient presents post-traumatic brain injury, clinicians should consider having an informed conversation with the patient around risk after managing any acute symptoms. The individual may need a thorough assessment where the clinician treats the present condition and discusses their history of past traumatic brain injuries (Silverberg et al, 2020).

Based on what is now known, a patient who presents with a traumatic brain injury, even if they have not had one in the past, needs to be warned of the adverse effects of traumatic brain injury on cognition. The doctor may want to discuss with them the need for protective strategies to minimise the risk of another traumatic brain injury (McCrory et al, 2017; Silverberg et al, 2020). Studies show that 'client self-awareness' is a crucial factor in effective cognitive rehabilitation, highlighting the importance of individuals who have experienced traumatic brain injuries understanding the risks for their overall and future cognitive function (Downing et al, 2019). A patient who had had a traumatic brain injury should be informed that in the long term, they are cognitively worse off than an individual who has never had a traumatic brain injury. Clinicians must inform them that each additional traumatic brain injury is associated with worsened attention, executive function, processing speed and working memory (Lennon et al, 2023).

Weighted risk against benefits needs thorough consideration in joint consultation with the patient and the practitioner. The doctor must counsel the individual, based on their individual risk, to reduce or cease engagement in high-risk activities (McCrory et al, 2017; Silverberg et al, 2020). They also need to refer the patient for assessment and rehabilitation, if required.

Changing the focus of rehabilitation post-traumatic brain injury

Education is integral in managing individuals who have experienced multiple mild traumatic brain injuries (Downing et al, 2019). As outlined above, there appears to be a variation in the affected cognitive domains based on the severity and episodes of traumatic brain injury. Each affected cognitive function can significantly interfere with an individual's day-to-day functioning, independence, employment and leisure (Sherer et al, 2002; Downing et al, 2019). In light of findings from the PROTECT-TBI study, cognitive rehabilitation post-traumatic brain injury should emphasise areas that are most likely to be affected (Sherer et al, 2002; Lennon et al, 2023).

Downing et al (2019) surveyed the current practice of traumatic brain injury management. A comprehensive online survey was sent to those involved in cognitive rehabilitation, including speech pathologists, physiotherapists, neuropsychologists and occupational therapists. The survey was completed by 297 clinicians, who supplied data about their occupation, their current techniques and resources used, and their reflections on the cognitive rehabilitation process. These data showed that 82% of participants in clinical practice focused on rehabilitating memory and 49% provided training in executive functioning. Only 19% were involved in cognitive retraining to improve attention capacity (Downing et al, 2019). These findings highlight the areas that allied health teams need to focus on when providing rehabilitation. Based on the PROTECT-TBI study, it seems that attentional abilities have a higher incidence of being affected post-traumatic brain injury. However, the results from Downing et al's (2019) survey show that attention is not a domain of focus when providing rehabilitation and provides some insight into what may need to change in future.

There are significant long-term effects of repetitive exposure to mild traumatic brain injuries and, therefore, clinicians and sporting authorities should meticulously assess the decision regarding an individual returning to the field. The Sports Concussion Assessment Tool, 5th edition (SCAT 5), is the current gold standard for neurological and cognitive testing before returning to the field. This comprises an on-field component completed on-site on sustaining an injury and an off-field element assessing neurocognitive functioning while the athlete is at rest (Echemendia et al, 2017). While only some of the cognitive domains from the authors'

Key points

- The long-term cognitive effects of post-mild traumatic brain injury are fixed and dose-dependent.
- Individuals must be counselled based on their risk profile to reduce or cease engagement in high-risk activities after sustaining a traumatic brain injury.
- Post-traumatic brain injury rehabilitation strategies should target the most likely and severely affected cognitive domains.

study are represented by the SCAT 5 and, therefore, it is somewhat limited in its thoroughness, it is the best tool currently available to provide easily accessible, concise neurocognitive data.

As part of a multidisciplinary approach, it would be prudent to use this tool for individuals engaging in contact sports, even before sustaining a mild traumatic brain injury. Any athlete engaging in a high-risk and impact contact sport should complete the off-field component of the SCAT 5 and have it recorded as their baseline data. If they sustain a mild traumatic brain injury, a medical practitioner should conduct the SCAT 5 analysis and compare these data against the baseline data to determine the effect of the injury and help allied health practitioners provide targeted therapy. Should an individual sustain another mild traumatic brain injury in the future, the previous data will help to make a well-informed decision regarding their cognitive risk and whether that individual should return to sport. Providing optimal treatment and prevention for traumatic brain injury and related comorbidities will give patients the best chance of living a healthy, happy, independent later life.

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