Neuropsychological Assessment of Traumatic Brain Injury

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Abstract

Traumatic brain injury (TBI) is a complex injury with a broad spectrum of symptoms and disabilities. Traumatic brain injury usually results from a violent blow or jolt to the head or body. An object penetrating the skull, such as a bullet or shattered piece of skull, also can cause traumatic brain injury.

The ‘silent epidemic’ of traumatic brain injury (TBI) has been placed in the spotlight as a result of clinical investigations and popular press coverage of athletes and veterans with single or repetitive head injuries. Neuroinflammation can cause acute secondary injury after TBI, and has been linked to chronic neurodegenerative diseases; however, anti-inflammatory agents have failed to improve TBI outcomes in clinical trials. In this Review, we therefore propose a new framework of targeted immunomodulation after TBI for future exploration. Our framework incorporates factors such as the time from injury, mechanism of injury, and secondary insults in considering potential treatment options.

Structuring our discussion around the dynamics of the immune response to TBI — from initial triggers to chronic neuroinflammation — we consider the ability of soluble and cellular inflammatory mediators to promote repair and regeneration versus secondary injury and neurodegeneration.

Introduction

Traumatic brain injury is the leading cause of disability in people under 40, severely disabling 150-200 people per million annually. Neuropsychiatric sequelae outstrip the neuropsychological (such as ataxia or incontinence) as the major cause of disability. Problems with memory, attention, executive function, behavioural control, and regulation of mood, associated with injury to the frontal and temporal lobes, are particularly troublesome.

The vast majority of recovery after traumatic brain injury takes place in the two years after injury; after this the brain injured patient faces an uncertain future. In some patients further improvement is seen even as late as 5-10 years after injury. Thus some long term studies, unfortunately often weakened by low rates of follow-up, show surprisingly good outcomes. New-combe found that veterans who had had a head injury in the Second World War showed no evidence of deterioration many years after injury.\(^6\) This might have been due to the expert and systematic care they received very soon after the injury. But other researchers found that a proportion of patients deteriorated when assessed 10-20 years later. Millar et al studied 418 patients, 85% of whom had had a severe head injury, on average 18 years after they had been assessed at six months after the injury.\(^2\) Twice as many had deteriorated as had improved (30% v 14%).

Head injuries are most likely to occur in people aged 15-24 and as a result often disrupt important developmental processes, such as attaining independence from parental support, completing study and establishing a vocation, and forming social networks. The result is loss of self-esteem, social isolation, and a considerable burden for families.

Regardless of the age of the patient, it is the changes in cognition and behaviour that represent the greatest burden to families after a traumatic brain injury. Difficulties with social skills may arise from deficiencies in self-monitoring and social judgment. Morris et al found that avoidance of social contact may be partly due to the injured person’s inability to keep up with conversation as a result of slowed information processing, which in turn creates social anxiety.\(^3\)

Some of the symptoms the patients described at interview are often overlooked. They reported feeling self-conscious about physical signs of their injuries. They had a persistent sense of loss, due to failure to fulfill their dreams, and some described negative feelings from others, perhaps due to lack of understanding of the consequences of head injury.

There is also a growing awareness of the high incidence of long term psychiatric disorders after traumatic brain injury. Depression, anxiety, and substance misuse are common. Koponen et al found that psychiatric disorders persist at 30 year follow-up, with patients particularly susceptible to depressive episodes, delusional disorder, and persistent changes in personality.\(^4,5\) Who develops psychiatric problems and why are poorly understood; associations with injury severity are weak. Socioeconomic status before the injury still has an impact on outcome many years after injury. Curran et al found that the presence of anxiety and depression was more strongly associated with coping style than with severity or even the presence of brain injury in trauma patients.\(^5\) They found higher levels of symptoms in those with a non-productive coping style, characterised, for example, by self-blame and ignoring problems, than in those who dealt with problems in an active manner.

Neuropsychological assessment in the early stages of recovery will facilitate awareness of the cognitive and behavioural consequences of the injury. Educational programmes directed at the families, friends, and associates of those injured, and at the community at large, facilitate greater understanding and acceptance of the complex and often invisible problems of people with brain injury. The brain injured person will then need easy timely access to a variety of services. The recent National Service Framework for long term conditions in the UK describes how this can be achieved. Though it aims to meet the needs of all those with long term neurological disorders, its relevance for those with traumatic brain injury cannot be overemphasised. But change is needed. Early post-injury assessments may be concentrating more on physical disability than cognition.\(^6\) Perhaps partly explaining why unmet need is most evident in cognitive and psychosocial rehabilitation.\(^7\)
Equity of access is still an issue; for example, poorer access to services in rural areas is probably a global problem. In the end, it is the injured person who must negotiate a lifelong journey with a brain injury. Their perspective needs to be understood.

Conclusion

Although studies on severe brain injury and predictors of outcome following TBI have been cited most extensively, the current research focus appears to be on mild TBI and investigating treatment strategies for brain injury. Our review is not designed to supplant systematic reviews or meta-analyses in TBI, but rather synthesize the literature uniquely to permit a novel analysis of TBI research. As the TBI literature evolves, it will be important for future citation studies to re-evaluate existing patterns and trends within this growing field of research.

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