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Traumatic brain injury – support for injured people and their carers

Background

Traumatic brain injury (TBI) is a major cause of lifelong disability and death worldwide, but is considered a 'silent epidemic' as society is largely unaware of the magnitude of the problem. TBI is a complex injury with a broad spectrum of symptoms and disabilities. Patients with a TBI may have a range of physical, mental, cognitive and social problems.

Objective

This article provides a summary of the available evidence for assessing TBI and managing the common mental health, physical and cognitive/behavioural issues associated with TBI.

Discussion

Translational and clinical research has revealed that TBI can no longer be regarded as a single clinical entity with a defined outcome. Each type of injury can lead to a distinct clinical condition that requires careful assessment and appropriate management to reduce long-term disability. In this article we discuss some of the more common health issues related to TBI.

Keywords

brain injuries, traumatic; rehabilitation; general practice

CPD

Traumatic brain injury (TBI) is a complex injury with a broad spectrum of symptoms and disabilities. It is defined as an alteration in brain function, or other evidence of brain pathology, caused by an external force.[1] Improvements in the acute management of TBI have resulted in a reduction in mortality rates for people with severe TBI. This, together with the relative youth of those who commonly sustain TBI, has led to a growth in the number of people living with disability as a result of TBI. The Australian Institute of Health and Welfare has reported a TBI rate of 107 per 100 000 population in Australia. Most studies suggest that approximately 20% of patients with TBI admitted to hospital have sustained moderate or severe head injuries, and the other 80% have mild injuries.[2] TBI is a subset of the wider diagnostic group of acquired brain injury (ABI). It includes brain injury acquired as a result of other mechanisms, such as vascular, metabolic, neoplastic and infectious mechanisms.

The majority of moderate-to-severe TBIs result from motor vehicle crashes. Other causes of TBI include falls, bicycle accidents, assaults and sports injuries and the latter causes a higher proportion of mild TBIs. With the ageing of the population there are an increasing number of older people injured and killed as a result of fall-related TBIs. A study has shown that TBI due to assault was 21 times more likely in Aboriginal and Torres Strait Islander peoples, compared with non-Indigenous Australians.[3] In recent years the use of explosive devices in armed conflict has added a new mechanism of injury – blast injury – the effects of which are the focus of considerable current research, particularly in the USA.

This article has been adapted and updated from earlier guidelines[4,5] and provides a summary of the current evidence on the management of some of the common conditions among people who have had a TBI.

Mechanisms of TBI

Neuropathological evidence suggests that there are several mechanisms of brain injury, some operating at the moment of impact and others as a consequence of secondary complications. This results in significant heterogeneity in the subsequent effects of injury across individuals. Acceleration or deceleration forces may cause laceration of the scalp, skull fracture and/or shifting of the intracranial contents, with resultant focal and diffuse changes. Focal changes include haematoma formation resulting from tearing of blood vessels, and contusion or bruising, most commonly on the basal and polar portions of the frontal and temporal lobes. Complications, including brain swelling, infection, raised intracranial pressure and respiratory arrest, may cause secondary brain injury. Results of clinical trials examining the efficacy of drugs that block various processes contributing to secondary brain injury have unfortunately been disappointing.[6–8]

Limitations in the sensitivity of imaging techniques make delineating the precise nature and extent of injury in an individual difficult. The scans may show decreasing brain volume with time, which correlates with diffuse axonal injury (DAI) and may assist in identifying severe brain injury. It is nevertheless apparent from the neuropathological evidence available that DAI is common, particularly in severe TBI caused by motor vehicle crashes, and its prognosis for recovery is different from that for stroke.[9] Long-term studies of recovery from TBI show ongoing improvements for at least 2–5 years after injury.[10]

Diagnosis and assessment of TBI

A TBI can range from a mild brain injury, to severe or profound brain damage. It is important to accurately assess the severity of the TBI as this is important for prognosis and management. The patient's recall of events at the time of the TBI and shortly after is often inaccurate. Therefore, the initial clinical documentation from the ambulance or hospital emergency department should be obtained before making decisions about investigation and management.

Two reliable indicators of damage severity include how long the person is in a coma and the length of time in post-traumatic amnesia (PTA). In Australia, the most common means of assessing PTA is the Westmead PTA Scale.[11] Clinical severity scores and neuro-imaging techniques are also used for diagnosing and determining the severity of brain injury. The commonly used clinical severity score is the Glasgow Coma Scale (GCS).[12] The accepted clinical classification of TBI severity with reference to initial GCS and PTA is shown in *Table 1*. Older age is a strong negative predictor of outcome. For clinical assessment of suspected severe TBI, standard assessments of cognitive status (such as the Mini Mental State Examination) are not sensitive enough to detect the types of cognitive impairment that are present and so computed tomography (CT) or magnetic resonance imaging (MRI) is used to detect structural changes in moderate-to-severe TBI.[13]

Consequences of TBI

A TBI can affect the way a person thinks, feels and behaves. However, these sequelae vary in nature and severity. Physical consequences are less common. Common health issues related to TBI are presented in *Table 2*. These health issues affect quality of life and functioning of individuals. The association of mild TBI with post-traumatic stress disorder (PTSD) and post-concussion syndrome (PCS) are debated.[16–18] PCS is the term used to describe a collection of symptoms that can last for several weeks or months after the concussion.[5]

In most patients with moderate-to-severe TBI, cognitive difficulties are the most prominent impairments. However, functional difficulties can occur and are more much more common in patients with very severe TBI. Functional and cognitive status is dynamic but generally improves over the first 2 years after a TBI. Family support, work and socialisation have a pivotal role in quality of life after a TBI.[19]

Recovery from TBI

Mechanisms of recovery are poorly understood and there is considerable variability in patterns of recovery. People with very mild and mild TBIs can be expected to recover quickly. However, some will have psychological consequences of the injury that will require assessment and management. Most people experiencing mild TBI recover fully within days to months, but a small percentage (1–20%) of individuals continue to experience symptoms 3 months after injury.[14,15] Recovery from moderate or severe TBI tends to follow a negatively accelerating curve, which is most rapid in the first 3–6 months, but may continue for several years.[20]

Much of the early spontaneous recovery after TBI is explained by the resolution of temporary physiological changes. In addition there are regenerative neuronal changes that have been associated with behavioural improvement. However, the potential for regenerative growth is limited, particularly in the case of severe injuries. It is thought that most recovery beyond this occurs through the substitution or reorganisation of neural structures and/or functions. There is a growing body of evidence to suggest that environmental stimulation, and specifically behavioural therapies, can alter brain function and organisation after injury.

Table 1. Determining the severity of TBI[12,30]

Severity	Initial GCS	Post-traumatic amnesia
Mild	13–15	<1 hour
Moderate	9–12	1–24 hours
Severe	3–8	1–7 days
Very severe	–	1–4 weeks
Extremely severe	–	>4 weeks

GCS, Glasgow Coma Scale

Table 2. Common health issues in TBI[5]

Health issues	Diagnostic features	Treatment	Prognosis
Common physical health issues			
Seizures: • early • late	Increased risk of post-traumatic epilepsy with: • TBI with history of early seizures • single CT lesion • a focal EEG at 1 month GCS is not significantly correlated with post-traumatic epilepsy	Post-acute phase: • phenytoin may reduce early post-traumatic seizures Prophylactic: • phenytoin, carbamazepine and valproate have no effect on prevention of late post-traumatic seizures	Post-traumatic epilepsy is more likely to be associated with: • disinhibition • irritability • aggression • agitated behaviour
Somatic complaints: • headaches • dizziness • pain • sleep disturbances	• Self-reports of dizziness are sensitive and specific in TBI patients • Dizziness Handicap Inventory is a useful and reliable method for evaluating the efficacy of antivertigo/dizziness drugs	• No TBI-specific treatment for headache and sleep disturbances • Vestibular rehabilitation (including exercise therapy) is effective in the early stages of dizziness • Betahistine 48 mg/day for 8 weeks has been reported to significantly reduce dizziness	• Somatic complaints usually persist for the long term in many patients
Post-concussion syndrome (PCS)	Useful tools for diagnosis: • Rivermead Post Concussional Symptoms Questionnaire (RPQ) • WHO criteria	• Early cognitive and educational interventions are effective	• Most cases of PCS resolve within 3 months of injury
Common mental health issues			
Depression	Beck Depression Inventory scale is a useful tool	Sertraline: • studied in patients with TBI and depression • effective and well tolerated Community-based outreach rehabilitation: • effective in improving depression scores in initial years post-injury	Spontaneous recovery from depression without treatment in >50% of patients with TBI
Anxiety	No validated tools for diagnosing anxiety within TBI population	CBT: • acute stress disorder following mild TBI CBT combined with neuro-rehabilitation: • may be effective for generalised anxiety symptomatology Telephone counselling has also been found to be helpful	An extended period of unconsciousness may be protective against the development of PTSD
Schizophrenia	Likely presentation: • paranoia • auditory hallucinations of gradual onset	• Antipsychotic medications are the standard treatment • Specific treatments in TBI populations have not been investigated	No longitudinal evidence available

Table 2. Common health issues in TBI[5]

Health issues	Diagnostic features	Treatment	Prognosis
Cognitive and behavioural issues			
Cognitive impairment	Self-reported problems: • impaired memory • language difficulties • planning • writing Other useful tools: • Cognitive subscale of TIRR • Rancho Los Amigos Levels of Cognitive Functioning (RLCF)	Cognitive rehabilitation focusing on remediation and compensation is helpful	Cognitive impairment: • most cases resolve within 3 months in mild TBI • continues for ≥2 years in moderate-severe TBI
Personality and behavioural changes	Presentation: • depressive temperament • irritability • impatience • socialisation problems Potentially useful tools for assessing and monitoring behavioural outcomes of TBI: • The Neurobehavioural Functioning Inventory (carer-rated)* • Neurobehavioural Rating Scale-Revised NRS-R (clinician-administered)* • TIRR (self-report)*	No definitive evidence for the effectiveness of drug therapy for behavioural problems in TBI patients	Behavioural problems post-TBI are often chronic

CBT, cognitive behaviour therapy; GCS, Glasgow Coma Scale; TBI, traumatic brain injury
*Bias in these measures is likely and it may be useful to use more than one in practice

This is termed neuroplasticity,[21] which may occur by the reorganisation of neural circuits within or associated with the damaged area, or via reorganisation of the remaining circuits. The capacity for reorganisation decreases as the size of the damaged area increases because presence of intact tissue seems to be important to allow this reorganisation of function to occur.[22] It also varies according to genetic differences, pre-injury experience and age. There is some evidence that sensory or motor stimulation results in reorganisation of sensory–motor functions, but the evidence relating to cognitive functions is much more limited. However, task-specific engagement as relevant to the individual, and stimulation to encourage neuroplasticity should be the underlying principles in assisting the person with severe TBI.

Rehabilitation after TBI

For individuals with identified TBI (usually severe), a period of acute care stabilisation occurs within the hospital. Because recovery after TBI is often greater than expected initially, people with TBI who have some level of responsiveness are routinely referred to rehabilitation services to maximise potential for recovery.

Rehabilitation settings are typically characterised by a treatment team approach to meet the complex needs of the person recovering from severe or extremely severe TBI. TBI rehabilitation physicians are responsible for the overall coordination of care both in the inpatient and outpatient settings, and provide specific expertise with reference to prognosis, monitoring and selected interventions. Other team members are neuropsychologists; rehabilitation nurses; physical therapists; occupational therapists; speech therapists; recreational, art and music therapists; vocational counsellors and social workers/care coordinators/case managers.[4] In most regions of Australia there are specialised brain injury rehabilitation services that will accept referrals for people with persisting disability after TBI.

Carers and families

The impact of TBI on the person and family carers is significant and long term, such that people with TBI require continuing support and care in various aspects of their lives many years after the injury. Children of affected parents may struggle to understand the wide-reaching effects of TBI and the subsequent changes in roles and relationships in the family. TBI in a parent can cause significant

Table 3. Some useful resources for TBI

Organisations	Websites
Acquired Brain Injury Outreach Service Queensland	www.health.qld.gov.au/abios/
Brain Injury Rehabilitation Program New South Wales	www.aci.health.nsw.gov.au/networks/brain-injury-rehabilitation/brain-injury-rehabilitation-program
Brain Injury Rehabilitation Services South Australia	www.rah.sa.gov.au/birs/
Headwest Western Australia	www.headwest.asn.au/
Brain injury Australia	www.braininjuryaustralia.org.au/
Lifetime Care and Support Authority New South Wales	www.lifetimecare.nsw.gov.au/
National Disability Insurance Scheme	www.ndis.gov.au/
Acquired Brain Injury Western Australia	www.abiwa.org.au/

emotional, behavioural and relationship difficulties. A recent analysis from the Finnish Birth Cohort study has reported that parental TBI is associated with increased use of specialised psychiatric services.[23]

Caregiver stress is greater if the patient has a troubled pre-injury psychosocial history and in those who have financial barriers to accessing services. General practitioners (GPs) should screen carers for depression and it would also be appropriate to screen for stress and anxiety. The use of validated tools such as the Kessler K10 Index (K-10),[19] DASS-21 scale[24] and the Zarit Burden Scale[25] may assist in this process.

Long-term issues for people with severe TBI

The effects of severe TBI are long-lasting, and patients and their families require continued care and support, often for the rest of their lives, leading to a substantial impact at a societal level. TBI is most prevalent in young adult life and often disrupts important developmental processes, such as attaining independence from parental support, completing study and establishing a vocation/returning to work and forming social networks.[26,27] The result is loss of self-esteem, social withdrawal and a considerable burden for families.

The GP is likely to be familiar with the scenario of a patient who has suffered severe TBI and has continuing disability related to challenging behaviour, hazardous drug and alcohol use, mental health problems, and housing and employment issues. It may be appropriate to coordinate support for these patients through general practice chronic disease management plans and/or mental health plans. There are other more specialised resources that may be of assistance and these are usually state-based, for example, the NSW government publication *Care and Support Pathways for People with an Acquired Brain Injury*.[28] *Table 3* provides further resources.

The future development of the National Injury Insurance Scheme (NIIS) and the National Disability Insurance Scheme (NDIS)[29] is intended to provide lifetime care and support to people who sustain a catastrophic injury from a motor vehicle, workplace, medical treatment injury or general accident. The full realisation of these programs would be likely to improve quality of life for people with severe disability resulting from a TBI, their families and carers through greater equity and access to care.

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