Post-concussion syndrome

Post-concussion syndrome is common after head injury. It consists of a triad of physical, cognitive and psychological symptoms that occur after a head trauma and cause significant social and occupational disability. This article examines the clinical features, epidemiology, aetiology and treatment of the condition.

Head injury is not uncommon in the general population. Over 1 million head injuries occur annually in the UK, 90% of which are classified as mild. Mild head injury is associated with a Glasgow Coma Scale of 13–15, no loss of consciousness or loss of consciousness for less than 20 minutes and post-traumatic amnesia of less than 24 hours (Jennett and MacMillan, 1981; Yates et al, 2006). The outcome for most patients is good, and most will return to normal functioning within a short period of time. A significant minority experience significant functional morbidity and many of these are given a diagnosis of post-concussion syndrome. Patients with this condition can present with symptoms to a number of different medical specialties including emergency medicine, general practice, general medicine, neurology, ear, nose and throat, and psychiatry.

Controversies of post-concussion syndrome

The multiple differing names for post-concussional syndrome indicate its nebulous and controversial status as a clinical entity. As far back as 1942, Lewis described it as 'that common dubious psychopathic condition – the bugbear of the clear minded doctor and lawyer'. Similarly Lishman (1997) had difficulties with the syndrome as it was diagnosed in a 'somewhat capricious way… is rarely clearly defined, and different authors use different symptoms under the heading'. King (2003) listed multiple studies giving evidence for psychological processes being involved in its aetiology but also pointed out that there was too much evidence from pathological and neuroradiological studies for it to be completely functional. More tellingly, he suggested that given the prevalence of symptoms after trauma, mild head injury is not always a mild experience.

Epidemiology

After a mild to moderate head injury, up to half of patients will experience some symptoms of post-concussion syndrome (Bazarian and Atabaki, 2001). The variation in reported incidence of the syndrome reflects the significant differences in terms of diagnostic criteria and significant inter-clinician variability in making the diagnosis. The main criteria used are the *International Classification of Diseases* (ICD-10) (World Health Organization, 1992) and *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV) (American Psychiatric Association, 1994) criteria, and even use of these can give widely different results (Boake et al, 2004). One important aspect of post-concussion syndrome is that the severity of the original injury does not correlate with the risk of developing the syndrome. Increasing age and female gender is associated with higher risk despite head injury being more common in males (Bazarian and Atabaki, 2001).

Despite the obvious difficulties in establishing the diagnosis and estimating incidence, studies suggest 86% of patients will have at least one symptom of post-concussion syndrome on the first day after trauma. After 3 months this declines to a still not insignificant 49% (Lundin et al, 2006). Up to 8% may continue to experience symptoms after 1 year (Binder, 1997).

Clinical features

Post-concussion syndrome can be diagnosed using ICD-10 and DSM-IV (*Figure 1*), but both have significant diagnostic differences. Both emphasize that patients should experience physical symptoms such as headache, dizziness and fatigue, and cognitive symptoms such as impaired concentration, in addition to psychological symptoms like irritability and apathy. The symptoms should interfere with social function and not be present before the injury.

Headache is one of the most common symptoms after head injury. Paradoxically, headache is more common and of longer duration in those with mild rather than severe head injury (Couch and Bearss, 2001). The headache should have an onset within 7 days of the injury. The most common headache observed is tension type and this is complicated by analgesic overuse in up to half of cases (Evans, 2004). Less frequently the headache can be caused by post-traumatic migraine, temporomandibular joint damage, trigeminal nerve injury, CSF leakage or carotid dissection.

Dizziness is another common symptom which may be seen in up to half of patients and can be very disabling. Between 20% and 50% may complain of dizziness after a head injury. In addition to being associated with distress, it is also associated with failure to return to work (Chamelian and Feinstein, 2004).

Dr Kevin Foy *is Neuropsychiatry Fellow and* **Professor Kieran C Murphy** *is Professor of Psychiatry and Head of Department in the Department of Psychiatry, Beaumont Hospital, Dublin 9*

Correspondence to: Dr K Foy

Patients with post-concussion syndrome may complain of personality change including irritability, low mood and apathy. Family members will frequently state that the patient has changed or become a more extreme version of his/her pre-morbid personality. Patients frequently consider themselves to have changed after trauma, with different priorities in life, occupation and relationships. They are also more often in a dependent state (Rees and Bellon, 2007).

Aetiology

Post-concussion syndrome is the prototypal psychosomatic illness with both physical and psychosocial factors playing an important role in its aetiology. It is likely that early symptoms are biological in origin, while psychological factors are more important later on. Head injury is associated with significant structural and biochemical changes. Some authorities suggest post-concussion syndrome results from ongoing central and systemic physiological regulatory dysfunction after traumatic brain injury, some of which is secondary to prolonged rest with deconditioning and secondary effects (Leddy et al, 2007).

Some studies have found abnormal single photon emission computed tomography scans and neocortical electroencephalograms in post-concussion syndrome (Agrawal et al, 2005; Gaetz and Weinberg, 2000). Other studies have postulated hypoperfusion as a cause as a result of disruption of the blood–brain barrier (Lewine et al, 2007). However, such changes are inconsistent and one study found no differences in cerebral perfusion between a very small number of cases and controls and very mild difference when patients were given spatial working memory task during positron emission tomography scanning (Chen et al, 2003).

Psychosocial opinions on the aetiology of post-concussion syndrome are particularly interesting. Symptoms seen are very similar to those in anxiety disorders, post-traumatic stress disorder, depression or somatoform disorders. Anxiety and depression can produce similar cognitive deficits to those observed in post-concussion syndrome and treatments for both can improve the symptoms of post-concussion syndrome. Up to half of these patients have a past history of depression. They also have higher rates of depression, anxiety and post-traumatic disorder than the general population (Meares et al, 2006). Some studies have found more psychological predispositions, poor coping skills and less social supports among patients who suffered prolonged symptoms than among those whose symptoms had remitted (McCauley et al, 2001).

Some psychologists suggest that a range of beliefs may support development of the symptom (Moss-Morris et al, 2002; Whittaker et al, 2007). These include:

1. Beliefs involving the illness or diagnostic label
2. Beliefs concerning the aetiology of the symptoms
3. Beliefs concerning the expected duration and treatability or control of symptoms
4. Beliefs those patients have concerning the consequences of their symptoms.

This is quite helpful when considering why different patients might be more or less likely to develop long-standing symptoms of post-concussion syndrome. A rugby player will view the label of head injury as minor,

Figure 1. Diagnostic criteria for post-concussion syndrome.

Classification	Criteria	
International Classification of Diseases (10th edition) criteria (F07.2)	A syndrome that occurs following head trauma (usually sufficiently severe to result in loss of consciousness) and includes a number of disparate symptoms such as headache, dizziness, fatigue, irritability, difficulty in concentration and performing mental tasks, impairment of memory, insomnia, and reduced tolerance to stress, emotional excitement or alcohol (World Health Organization, 1992)	
Diagnostic and Statistical Manual of Mental Disorders (4th edition) (DSM-IV) criteria (American Psychiatric Association, 1994)	a. History of traumatic brain injury causing 'significant cerebral concussion'	
	b. Cognitive deficit in attention and/or memory	
	c. Presence of at least three of eight symptoms that appear after injury and persist for 3 months*:	Fatigue
		Sleep disturbance
		Headache
		Dizziness
		Irritability
		Affective disturbance
		Personality change
		Apathy
	d. Symptoms that begin or worsen after injury*	
	e. Interference with social role functioning	
	f. Exclusion of dementia as a result of head trauma and other disorders that better account for the symptoms	

*Criteria c and d require symptom onset or worsening to be contiguous to the head injury, distinguishable from pre-existing symptoms, and have a minimum duration of 3 months

he may expect any symptoms he experiences to be short lived and of little consequence because a number of his friends on the pitch may have experienced more severe injuries. In contrast a woman after a head injury following an assault might consider the label of mild head injury as severe and devastating, she may be preoccupied by any symptoms she subsequently experiences and consider herself irreparably changed forever as a result of the injury.

Differential diagnosis

The potential differential diagnoses in post-concussion syndrome are summarized in *Table 1*. The possibility that the symptoms represent a neurological condition should never be forgotten, especially in patients who were not assessed after the injury or in those with atypical symptoms or focal neurological signs. The clinician should enquire about past psychiatric history. Similarly the clinician should be aware of social or occupational restrictions or impending litigation as a result of the injury.

Assessment

The assessment of a patient with symptoms indicative of post-concussion syndrome should note details of the circumstances when the head injury occurred. The clinician should note whether the patient lost consciousness, the duration of post-traumatic amnesia and the Glasgow Coma Scale after trauma. Ideally clinical notes from ambulance, accident and emergency, and hospital stays should be reviewed and results of investigations and treatment noted. If available, occupational health notes pertaining to both before and after the trauma are also very useful. The patient should be questioned about the onset of the symptoms and the clinician should be particularly mindful as to whether any of the symptoms predated the trauma. The evolution of symptoms over time and functional impairment should be noted. A full psychiatric assessment should be performed and past psychiatric history noted. In these cases a full collateral history from a close family member is essential to confirm that symptoms are indeed post-traumatic and not premorbid and also to note the impact of the injury on the patient. In most cases a neurological examination is worthwhile.

Table 1. Differential diagnoses

Medical	Deficits in executive function or cognitive function
	Arterial dissection
	Cerebral haemorrhage
	Space-occupying lesions
	Tension headaches
	Migraines
	Benign positional vertigo
Psychiatric	Adjustment disorder
	Depressive episode
	Panic disorder
	Post-traumatic stress disorder
	Hypochondriasis
	Malingering
Psychosocial	Adjustments to restrictions or legal issues pending
	Family problems
	Employment issues

Investigations

In an effort to predict patients likely to develop post-concussion syndrome, many studies have looked at levels of brain-related proteins in the blood at the time of injury. Many proteins, including S-100, cleaved tau and neuron-specific enolase, have been examined. Of these S-100 has been the most frequently studied. This is a protein normally found in cells derived from the neural crest which can be elevated in brain pathology and functions as a regulator of inflammatory response and cell growth. Unfortunately such studies are frequently beset with difficulties of poor sensitivity and specificity, and low numbers. Systematic reviews have suggested that there is no test which can reliably be used to predict post-concussion syndrome (Begaz et al, 2006).

Neuropsychological testing, if available, is useful, particularly tests such as the Rivermead Postconcussion Symptoms Questionnaire (King et al, 1995). This interviewer- or self-administered test asks the patient to grade the severity of 16 different symptoms associated with post-concussion syndrome compared to before the head injury. The test can be repeated at further appointments to chart progression or resolution of symptoms. Since head injury may be associated with apparently silent prefrontal cortex dysfunction, tests of executive function such as the Stroop, trails-b or verbal fluency tests may be useful.

Treatment options

It is important to make sure that there is no evidence that symptoms could be the result of physical illness. A high index of suspicion is needed if the patient complains of unusual symptoms, has focal signs or was incompletely worked up at the time of initial presentation. Simple reassurance and education that symptoms will improve with time is often the best treatment. Early intervention is particularly effective. In one study, compared with treatment as usual, outcome was better in a group of patients who received an information booklet outlining the symptoms associated with mild head injury and suggested coping strategies (Ponsford et al, 2002).

Treatment should be individualized to the patient's particular complaints. Vertigo can be treated with anti-emetics. Headache may be treated with paracetamol and

analgesic overuse may be treated with low-dose amitryptyline and reduced analgesics. Psychiatric disorders such as depression or post-traumatic stress disorder should be promptly identified and treated using both pharmacological and psychotherapeutic strategies (Mittenberg and Burton, 1994).

Anticholinesterase inhibitors have been extensively used in traumatic brain injuries for treatment of subsequent cognitive problems. Unfortunately, such trials involve small numbers and examine patients with moderate and severe head injury (Griffin et al, 2003).

Prognosis

Prognosis is generally good. The vast majority of patients recover by 3 months, although symptoms persisted after a year in 7–8% (Binder, 1997). The factors that are thought to be associated with poorer prognosis include litigation, multiple head traumas, female gender and premorbid physical limitations or psychiatric illness (Holm et al, 2005).

Conclusions

Post-concussion syndrome is an important cause of morbidity after a mild head injury, and may be experienced by up to 90% of patients. The syndrome consists of a triad of physical, emotional and cognitive symptoms. The best treatment is multidisciplinary with symptomatic treatment of physical symptoms and prompt identification and treatment of psychiatric disorders. BJHM

Conflict of interest: none.

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KEY POINTS

- Post-concussion syndrome remains a controversial area of psychiatry but up to half of those with a head injury will experience symptoms of it.
- Symptoms consist of a mixture of physical symptoms like headaches, cognitive symptoms such as poor concentration, and psychological symptoms such as low mood.
- The best treatment is usually reassurance or symptomatic treatment.
- The prognosis is good for most although symptoms may become chronic in a significant minority.