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Long-term post-concussion symptoms

CLINICAL REVIEW

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Concussion is common and usually resolves without complications. However, persistent symptoms occur in 10–15 % of patients. These post-concussion symptoms are predominantly somatic, cognitive and emotional. The condition is most common in those with previous somatic and mental health issues. The causes underlying long-term post-concussion symptoms are unclear, but a biopsychosocial explanatory model is currently regarded as the most appropriate basis for diagnosis and treatment. This clinical review article is based on key literature and our own clinical experiences with patients who have these long-term post-concussion symptoms.

Concussion is defined as a transient alteration of cerebral function induced by a mild head injury that produces no findings on diagnostic imaging (1). Loss of consciousness may occur briefly, but is not required to make the diagnosis (1). At least 300 per 100,000 people seek emergency medical attention for concussion in Norway each year (2). However, the true incidence is likely to be higher since many people do not seek medical help.

Common causes of concussion are falls, violence, sporting activities and traffic accidents (3). Acute symptoms will subside in most people within a few days to a couple of weeks. However, it is widely known that 10–15 % of patients develop long-term symptoms that may persist for several months or years (4). There are various terms for this condition in the literature, most commonly post-concussion syndrome. However, many people think it is problematic to refer to the condition as a syndrome because the symptoms are not confined to the concussion and may vary between individuals (5). Therefore, in line with most articles published these days, we have chosen to use the term post-concussion symptoms for the long-term symptoms that can arise following concussion.

Patients with post-concussion symptoms often have a substantial symptom burden, as well as impaired functioning, ability to work and capacity to participate in family life and other activities. This has personal and sociomedical consequences, and is an issue deserving of more attention.

The aim of this article is to highlight the condition of long-term post-concussion symptoms. On the basis of a discretionary literature review and our own clinical experience, we will look at the symptoms, diagnosis, risk factors and potential causal mechanisms. Treatment options will be briefly summarised.

Clinical presentation

Many patients find that post-concussion symptoms are in many ways a continuation of the symptoms they had initially following the concussion. The symptoms are somatic, cognitive and emotional (Table 1) (4, 6). The

combination, intensity and duration of symptoms vary. Self-reporting questionnaires are useful to assess symptoms, for example the Rivermead Post-Concussion Symptom Questionnaire (7), which is also available in Norwegian (8).

Table 1

Common post-concussion symptoms (4, 6).

Somatic symptoms	Cognitive symptoms	Psychological symptoms
Headache	Impaired concentration	Anxiety
Fatigue	Impaired memory	Low mood
Dizziness	Word finding difficulty	Affective lability
Photophobia and phonophobia	Sluggish cognitive tempo	
Sleep disturbance		
Nausea		
Visual disturbances		
Tinnitus		

Headache is extremely common, and post-traumatic headache is classified as one of the secondary headache types. Post-traumatic headache often resembles migraine, usually in combination with tension headache (9).

Research has shown that measurable cognitive deficits revealed in neuropsychological tests early in the course subside and resolve within a few days to weeks following uncomplicated concussion (10). However, patients with post-concussion symptoms often report persistent problems with concentration and memory. There is only weak correlation between results of neuropsychological tests and these self-reported cognitive symptoms in the late phase (11). In cases of substantial cognitive difficulties, neuropsychological testing should also be included in the evaluation in the late phase and form a basis for advice.

Psychological symptoms are common (12). Assessing a patient's mental health may sometimes identify emotional lability, catastrophic thinking, depression, anxiety and negative stress. Some patients have read information about post-concussion symptoms that they find frightening, while others feel that they have received little information about their health issues.

Diagnosis

There is debate surrounding post-concussion symptoms. Reasons for this include the lack of clear relationship between the severity of the head injury and development of the resulting condition, the non-specificity of symptoms,

and the fact that objective findings are rarely revealed in the medical evaluation (11). There are some differences between the ICD-10 and DSM diagnostic criteria (13, 14). Many researchers and clinicians find these to be of limited usefulness, and would rather base diagnosis on the patient's symptoms and temporal relationship to the head trauma.

The absence of established and generally recognised criteria for the spectrum of symptoms, aetiology and duration has led to wide variations in diagnostic testing and inclusion criteria in both clinical practice and research (12). There is a presumption of a prior head injury that produced signs of concussion in cases of post-concussion symptoms, but the symptom profile is not specific to head injury. Similar symptoms are seen in patients with other conditions, including chronic pain, chronic fatigue and depression (11). Depressive symptoms occur in patients with post-concussion symptoms, which can make the differential diagnosis challenging in some cases. High incidence of similar symptoms has also been reported following trauma generally and in the normal population. However, a recent Norwegian study showed that if only symptoms of a specific intensity were investigated, there was a much higher incidence of post-concussion symptoms following concussion than following orthopaedic injury or in people without injury (15).

Complex causes

It is likely that post-concussion symptoms represent an individual response to the concussion or the event leading to it, but the reason for some individuals developing long-term and disabling symptoms following a mild head injury is still unclear. In our experience, there is a weak relationship in many cases between the severity of the trauma and the clinical symptoms that the patient develops. This is supported by several studies (5).

While it was previously thought that long-term symptoms following concussion were mainly due to psychosocial factors and/or hope of financial compensation, there is now increasing recognition that post-concussion symptoms can have both psychosocial and biological causes and should therefore be understood using a biopsychosocial model. This framework has wide support and is being further developed based on recent research (16).

Although there may be a premorbid susceptibility to developing post-concussion symptoms, it is not always the case that known risk factors will be present in individual patients. Nevertheless, research at a group level has provided knowledge about causal mechanisms. Certain factors that were present prior to the head injury may be associated with development and persistence of symptoms, e.g. being female, personality traits, life stresses, previous pain conditions, and other somatic and mental health issues (15). There may also be circumstances arising in the acute phase, such as stress, frightening experiences, inadequate medical follow-up or severe acute symptoms. Furthermore, circumstances in the initial period following the injury may contribute to the persistence of symptoms, e.g. difficulty sleeping,

low mood, post-traumatic stress, lack of support and other psychosocial factors. Catastrophic thinking, fear avoidance and inappropriate coping strategies may also be contributing factors in the prolongation of symptoms (11).

However, there is also increased interest today in understanding post-concussion symptoms based on the neurobiological processes that characterise head injuries (17). Experimental studies have provided evidence that even mild head injuries with no visible structural damage lead to an acute reduction in cerebral blood flow and cellular metabolic changes. Altered regulation of ionic flux in cells can result in cellular energy crisis. Increased glutamate release and stimulation of, for instance, NMDA receptors have a negative effect in cells (18). It is likely that these metabolic alterations can cause symptoms in the acute phase, although it is unknown whether they persist to any major extent in patients with post-concussion symptoms. Likewise, it is known that head injuries cause an inflammatory response with activation of cytokines and microglia, but it is not yet known whether this is of significance for symptom development (19).

The question remains as to which physiological disturbances in the brain are present in post-concussion symptoms. There is some evidence that there may be altered dynamic functional network connectivity in the brain (17). Most patients have concomitant headache, and recent studies show that post-traumatic headache is likely to have similar pathophysiology to migraine, involving for instance activation of the trigeminal sensory system, neuroinflammatory processes and elevated calcitonin gene-related peptide, which are all significant for central pain modulation (20). Changes to the brain's sensory network may potentially explain other symptoms such as photophobia, phonophobia and dizziness, but for the time being this is not known for certain.

Treatment and prevention

Many patients referred with persistent post-concussion symptoms report feeling alone and being unsure of how to deal with the symptoms. This demonstrates the need for better healthcare provision for this patient group. Many people do not seek emergency treatment in hospital or the out-of-hours primary care service, and therefore general practitioners play a key role.

There is no standardised or evidence-based treatment for the prevention or treatment of post-concussion symptoms, but recent guidelines provide some recommendations for management of post-concussion symptoms in the primary care service (21, 22). Provision of information and advice and regular follow-up in the early phase may be useful. Complete rest beyond the first couple of days is not advised.

The patient should be encouraged to gradually increase their level of activity, including physical activity, but also to take regular breaks. Short-term worsening of symptoms is common and not harmful, but it is beneficial to avoid worsening of symptoms that persists to the next day. Therefore, it is often necessary for the patient to be on sick leave.

We can recommend a short film aimed at patients with concussion which describes activity increase using a staircase model (23). Patients who so wish will eventually be able to start sports training, at which point it is recommended to exercise at a level of intensity just below the threshold for worsening of symptoms (24).

The acute symptoms may be unpleasant and frightening, and some patients may develop negative expectations, anxiety, fear avoidance and other emotional reactions. If the doctor addresses this and offers support and factual information, many patients will experience a reduction in stress, which can help reduce symptoms (11).

If symptoms persist for more than 2–3 months despite these interventions, it may be appropriate to refer the patient to the specialist health service, with an emphasis on interdisciplinary rehabilitation. Good provision should include guidance about activity and coping strategies, as well as assessment of the individual symptoms and whether these require specific treatment. The current provision for this is not adequately established in the health trusts or municipalities.

Conclusion

Concussion usually has a good prognosis, but 10–15 % of patients have persistent symptoms consistent with post-concussion symptoms. The underlying disease mechanisms are unclear, but recent research indicates that some patients have alterations in the trigeminal sensory system. There is often little correlation between the acute severity of the injury and later development of symptoms, and there are generally no objective medical or neuropsychological findings. Previous somatic and mental health issues and post-traumatic stress may indicate a risk of developing post-concussion symptoms, but many patients have no obvious risk factors. A biopsychosocial explanatory model is the best basis for treatment. Our recommendation is that patients who still have significant symptoms a few weeks following concussion should be offered closer follow-up with their GP or referred for appropriate provision in the specialist health service.

The article has been peer-reviewed.

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