

Clinical practice guidelines for mild traumatic brain injury and persistent symptoms

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Abstract

Objective To outline new guidelines for the management of mild traumatic brain injury (MTBI) and persistent postconcussive symptoms (PPCS) in order to provide information and direction to physicians managing patients' recovery from MTBI.

Quality of evidence A search for existing clinical practice guidelines addressing MTBI and a systematic review of the literature evaluating treatment of PPCS were conducted. Because little guidance on the management of PPCS was found within the traumatic brain injury field, a second search was completed for clinical practice guidelines and systematic reviews that addressed management of these common symptoms in the general population. Health care professionals representing a range of disciplines from across Canada and abroad were brought together at an expert consensus conference to review the existing guidelines and evidence and to attempt to develop a comprehensive guideline for the management of MTBI and PPCS.

Main message A modified Delphi process was used to create 71 recommendations that address the diagnosis and management of MTBI and PPCS. In addition, numerous resources and tools were included in the guideline to aid in the implementation of the recommendations.

Conclusion A clinical practice guideline was developed to aid health care professionals in implementing evidence-based, best-practice care for the challenging population of individuals who experience PPCS following MTBI.

New Canadian guidelines have been developed to aid health care professionals in implementing evidence-based, best-practice care for the challenging population of individuals who experience persistent postconcussive symptoms (PPCS) following mild traumatic brain injury (MTBI). The diagnostic criteria for MTBI are outlined in **Box 1**.¹ Mild traumatic brain injury, also commonly referred to as *mild head injury* or *concussion*, is one of the most common neurologic disorders occurring today and is gaining increasing public awareness particularly through concussion-in-sport prevention initiatives² as well as media attention on military blast injuries.³ Recently, a study examining both hospital-treated cases of MTBI and those presenting to family physicians calculated the incidence of MTBI in Ontario to be between 493 and 653 per 100 000 people.⁴ While it is expected that in most cases patients who experience MTBI will fully recover within days or months, the Centers for Disease Control and Prevention note that “up to 15% of patients diagnosed with MTBI may have experienced persistent disabling problems.”⁵ Although these cases represent a minority of patients, given the high incidence of MTBI, this potentially translates to a substantial number of individuals.

Physical, emotional, behavioural, and cognitive symptoms such as headache, sleep disturbance, disorders of balance, fatigue, irritability, and memory and concentration problems all commonly occur after MTBI. **Box 2** outlines some of the common symptoms.⁶ Although the International Classification of Diseases diagnosis of postconcussion syndrome (**Box 3**)⁷ and the *Diagnostic and Statistical Manual of Mental Disorders* diagnosis of postconcussional disorder (**Box 4**)⁸ are controversial,⁹ what cannot be debated is that persistent symptoms following MTBI can result in substantial functional disability interfering with patients' ability to return to work or school and can result in low levels

KEY POINTS Mild traumatic brain injury (MTBI) is one of the most common neurologic disorders occurring today. Persistent symptoms following MTBI might occur in 10% to 15% of patients and can include posttraumatic headache, sleep disturbance, disorders of balance, cognitive impairments, fatigue, and mood disorders. Persistent postconcussive symptoms can result in functional disability, stress, and time away from work or school. These guidelines address the fact that to date, other than for sport concussion, little information and direction has been available to physicians to manage recovery from MTBI.

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of satisfaction with quality of life.¹⁰ An evaluation of the quality of available guidelines for MTBI found that more guidance has become available in the past 2 years, with 4 clinical practice guidelines (CPGs) solely

dedicated to the topic having been published in that time.¹¹ However, very little guidance is provided for the assessment and management of persistent

Box 1. Diagnostic criteria for mild traumatic brain injury from the American Congress of Rehabilitation Medicine

A patient with mild traumatic brain injury has had a traumatically induced physiologic disruption of brain function, as manifested by 1 or more of

- any loss of consciousness up to 30 min,
- any loss of memory for events immediately before or after the accident for as much as 24 h,
- any alteration of mental state at the time of the accident (eg, feeling dazed, disoriented, or confused), or
- focal neurologic deficits that might or might not be transient, but where the severity of the injury does not exceed
- loss of consciousness exceeding 30 min,
- posttraumatic amnesia longer than 24 h, or
- a Glasgow Coma Scale score falling below 13 after 30 min.

Adapted from the Mild Traumatic Brain Injury Committee of the American Congress of Rehabilitation Medicine.¹

Box 2. Common symptoms of mild traumatic brain injury

Physical

- Headache
- Nausea
- Vomiting
- Blurred or double vision
- Seeing stars or lights
- Balance problems
- Dizziness
- Sensitivity to light or noise
- Tinnitus

Behavioural or emotional

- Drowsiness
- Fatigue or lethargy
- Irritability
- Depression
- Anxiety
- Sleeping more than usual
- Difficulty falling asleep

Cognitive

- Feeling "slowed down"
- Feeling "in a fog" or "dazed"
- Difficulty concentrating
- Difficulty remembering

Adapted from Willer and Leddy.⁶

Box 3. International Classification of Diseases⁷ (ICD-10) diagnostic criteria for postconcussion syndrome

A. History of head trauma with loss of consciousness preceding symptom onset by a maximum of 4 wk.

B. Symptoms in 3 or more of the following symptom categories:

- headache, dizziness, malaise, fatigue, noise intolerance;
- irritability, depression, anxiety, emotional lability;
- subjective concentration, memory, or intellectual difficulties without neuropsychological evidence of marked impairment;
- insomnia;
- reduced alcohol tolerance; and
- preoccupation with above symptoms and fear of brain damage with hypochondriacal concern and adoption of sick role.

Box 4. Diagnostic and Statistical Manual of Mental Disorders, 4th edition,⁸ diagnostic criteria for post-concussional disorder

A. A history of head trauma that has caused considerable cerebral concussion.*

B. Evidence from neuropsychological testing or quantified cognitive assessment of difficulty in attention (concentrating, shifting focus of attention, performing simultaneous cognitive tasks) or memory (learning or recall of information).

C. Three (or more) of the following occur shortly after the trauma and last at least 3 mo:

- becoming fatigued easily;
- disordered sleep;
- headache;
- vertigo or dizziness;
- irritability or aggression on little or no provocation;
- anxiety, depression, or affective instability;
- changes in personality (eg, social or sexual inappropriateness); or
- apathy or lack of spontaneity.

D. The symptoms in criteria B and C have their onset following head trauma or else represent a substantial worsening of pre-existing symptoms.

E. The disturbance causes considerable impairment in social or occupational functioning and represents a considerable decline from a previous level of functioning. In school-aged children, the impairment might manifest as a substantial worsening in school or academic performance dating from the trauma.

F. The symptoms do not meet criteria for dementia due to head trauma and are not better accounted for by another mental disorder (eg, amnesic disorder due to head trauma, personality change due to head trauma).

*The manifestations of concussion include loss of consciousness, posttraumatic amnesia, and, less commonly, posttraumatic onset of seizures. The specific method of defining this criterion needs to be established by further research.

symptoms that extended beyond the typical acute recovery period. The exceptions to this finding were guidelines developed by military groups. The study concluded that a clear need existed for systematically developed practice recommendations to guide health care professionals in the identification and management of patients who experience persistent symptoms following MTBI.

Scope

The present guidelines are intended to assist health care professionals with the assessment and management of PPCS following MTBI. The guidelines are appropriate for use with adults (≥ 18 years) who have experienced MTBI of various causes. The scope of the guidelines does not include penetrating brain injuries, birth injuries, brain damage from stroke or other cerebrovascular accidents, shaken baby syndrome, or moderate to severe brain injuries. Early, acute management of MTBI is addressed to a lesser extent in these guidelines, as their focus is the assessment and management of PPCS. Nonetheless, the most critical issues for early management have been incorporated because early management can influence the development and maintenance of persistent symptoms. The guidelines will be helpful to various health care professionals, including family physicians, neurologists, physiatrists, psychiatrists, psychologists, counselors, physiotherapists, occupational therapists, and nurses.

Development

Leadership. Development of the guidelines was led by a team composed of clinicians with substantial experience in treating MTBI as well as past experience in developing CPGs. The project team convened an MTBI Expert Consensus Group. The members of the consensus group were recruited so as to ensure adequate representation of the various health care professions serving the MTBI patient population, domain of expertise, and geographic location. With respect to health care professions, a range of disciplines including emergency medicine, neurology, physical medicine and rehabilitation, radiology, psychiatry, psychology, physical therapy, and occupational therapy were represented. In addition, relevant stakeholder organization representatives were included from the Ontario Neurotrauma Foundation, the Ontario Brain Injury Association, and the International Brain Injury Association, as well as an individual who experienced PPCS following MTBI. Individuals with expertise in physical, cognitive, and affective symptoms as well as in diagnosis, quality-of-life assessment, outcomes measurement, and knowledge translation all took part. Similarly the panel represented the various causes of MTBI with expertise from the sport, motor vehicle accident, and military fields. The members of the expert consensus group were recruited from across Canada and abroad.

Literature review. The Practice Guidelines Evaluation and Adaptation Cycle¹² was used as the model for development, and the first step taken was to search for and review existing guidelines addressing MTBI in order to identify high-quality recommendations that could be adapted to minimize repetition of previously completed work. A comprehensive search for existing CPGs published in English or French within the past 10 years (1998 to 2008) that were relevant to traumatic brain injury and that included recommendations for the care of individuals with mild injuries was undertaken. This was conducted using bibliographic databases (eg, Cochrane Library, National Guidelines Clearing House), MEDLINE, PsycINFO, and a general Web search, as well as searches of websites of relevant organizations (eg, Canadian Medical Association, National Institute for Health and Clinical Excellence). Twenty-three guidelines were identified. These were screened, and guidelines found to be more than 10 years old, those that did not address MTBI, those that were reviews only and that did not include practice recommendations, those that only addressed prehospital or acute care, and those that only addressed pediatric care were excluded from further review. Seven guidelines met the inclusion criteria (Table 1¹³⁻¹⁹), and recommendations relevant to MTBI were extracted.

The next step was to conduct a systematic literature search in order to capture all published research evaluating the effectiveness of treatments or interventions intended to prevent or manage persistent symptoms following MTBI. A comprehensive systematic review conducted by Borg and colleagues²⁰ was relied upon for literature published up to 2001, therefore requiring an updated search of the MEDLINE and PsycINFO databases for the period extending from 2001 to 2008. There were 9435 results obtained from MEDLINE and 8432 results obtained from PsycINFO. These were reviewed by 2 independent reviewers, and 36 met the criteria for inclusion.

Because very few guidelines on the management of symptoms following MTBI were found, a second search was completed for CPGs and systematic reviews that addressed the management of common symptoms (eg, insomnia) in the general population. Although these guidelines do not include recommendations specific to managing symptoms within an MTBI population, they do provide some general direction on how to best treat symptoms that commonly persist following MTBI. The procedures used to identify these CPGs and reviews were similar to those described above. The categories of symptoms for which CPGs were developed outside of the traumatic brain injury field, and from which recommendations were extracted, included cognitive dysfunction ($n=1$), fatigue ($n=1$), mood disorders ($n=4$), and sleep disorders ($n=4$).

Table 1. Existing traumatic brain injury guidelines evaluated in the process of developing the current guideline

AUTHOR	GUIDELINE
New South Wales Motor Accident Authority ¹³	<i>Guidelines for Mild Traumatic Brain Injury Following Closed Head Injury</i>
Defense and Veterans Brain Injury Center ¹⁴	<i>Updated mTBI Clinical Guidance</i>
New Zealand Guidelines Group ¹⁵	<i>Traumatic Brain Injury: Diagnosis, Acute Management and Rehabilitation</i>
State of Colorado Department of Labor and Employment ¹⁶	<i>Traumatic Brain Injury Medical Treatment Guidelines</i>
Workplace Safety and Insurance Board of Ontario ¹⁷	<i>Program of Care for Mild Traumatic Brain Injury</i>
National Institute for Health and Clinical Excellence ¹⁸	<i>Head Injury: Triage, Assessment, Investigation and Early Management of Head Injury in Infants, Children and Adults</i>
Concussion in Sport Group ¹⁹	Summary and Agreement Statement of the 2nd International Conference on Concussion in Sport, Prague 2004

Practice recommendations

The expert consensus group convened at a conference where they attended presentations on the methodologic factors critical to the development of evidence-based, best-practice care and were presented with the AGREE (Appraisal of Guidelines for Research and Evaluation) instrument rating scores for existing traumatic brain injury guidelines, the results of the systematic reviews of the literature, and the summary of recommendations and levels of evidence extracted from existing guidelines. In addition, the topics of definition, prognosis, and risk factors were also discussed. Attendees then worked in groups to adapt high-quality recommendations extracted from existing guidelines and to generate new recommendations based on current research and clinical expertise.

The group drafted 152 initial guideline recommendations. Final recommendations were produced using a modified Delphi process.²¹ A vote was taken at the conference after all initial recommendations had been presented. Following the conference, the draft recommendations and vote results were circulated to the consensus panel to ensure agreement with each recommendation. A recommendation was retained for inclusion if it met at least 1 of the following criteria: it was based on grade A evidence, it received either a minimum of 10 votes or 75% endorsement by the expert consensus group, or it represented an important care issue (ie, addressed a topic relevant to a large proportion of the MTBI population and clearly represented a current gap in treatment guidance). After applying these criteria, 71 recommendations remained and these comprise the current guideline.

The following system was used for grading levels of evidence and was applied to the guideline recommendations: grade A evidence included at least 1 randomized controlled trial, meta-analysis, or systematic review; grade B evidence included at least 1 cohort comparison, case study, or other type of experimental study; grade C evidence included expert opinion or the experience of a consensus panel.

A draft of the guideline was circulated to recognized experts in the field who did not participate in the development process. The external reviewers were asked to provide input about the validity and relevance of the guideline. This feedback was incorporated into the final draft.

Highlights

The 71 recommendations of the guideline are presented in **Table 2**.^{13-19,22-30} The complete guideline document²² can be obtained from the Ontario Neurotrauma Foundation's website (www.onf.org), and detailed information about the source of individual recommendations is provided in Appendix D of the complete document. In the complete document, background information pertaining to each topic precedes the specific recommendations to be implemented. Each section also includes relevant resources (eg, criteria for diagnosis of MTBI and postconcussion disorder), and various tools that can aid in assessment and management of symptoms (eg, patient advice sheet, standardized questionnaires, therapeutic options tables) are provided in appendices. There is evidence supporting the validity of several of the objective symptom monitoring tools included in the guideline for use with MTBI patients (Rivermead Post-Concussion Symptoms Questionnaire,^{31,32} Abbreviated Westmead Post-Traumatic Amnesia Scale,^{33,34} Fatigue Severity Scale,^{35,36} and the Patient Health Questionnaire-9^{37,38}). In contrast, such evidence was not identified for the PTSD Checklist-Civilian Version³⁹ or the Sport Concussion Assessment Tool 2⁴⁰ with this population. However, these tools are in use in clinical settings and the development group thought it was worthwhile to recommend their use so that practitioners would have some types of objective measures to use rather than no objective measures at all. In addition, a modified scoring procedure for the Rivermead Post-Concussion Symptoms Questionnaire exists (RPQ-13) that has been reported to possess improved psychometric characteristics according to one study.⁴¹

Table 2. Guideline recommendations: Appendices, tables, and figures referred to in the following table are located in the full Guidelines for Mild Traumatic Brain Injury and Persistent Symptoms.²²

RECOMMENDATION	GRADE*
1. Diagnosis and assessment of MTBI	
Diagnosis and assessment of MTBI	
1.1. MTBI in the setting of closed head injury should be diagnosed early, as early recognition will positively affect health outcomes for patients. ¹³	A
1.2. Diagnosis of MTBI should be performed through a combined assessment of clinical factors and symptoms. ¹³	A
1.3. Standardized measurement of posttraumatic amnesia should be routinely performed to assist with the monitoring, diagnosis, early management, and prognosis of patients who have experienced MTBI. The A-WPTAS (Appendix 1.1) is a standardized tool that can be used to monitor posttraumatic amnesia. ¹³	A
1.4. Medical assessment should include screening for health and contextual factors (flags) to identify patients at increased risk of persistent symptoms and urgent complications, such as subdural hematoma. Table 7 outlines health factors and contextual risk factors (flags). ¹³	B
Emergency department clinicians	
1.5. Hourly clinical observation should occur until at least 4 hours after the injury. If the patient meets recommended discharge criteria at 4 hours after the injury, they should be considered for discharge. [†]	C
1.6. At 4 hours after the injury, if the patient has a Glasgow Coma Scale score of 15, is clinically improving, and has normal CT scan findings or there is no indication for CT based on the Canadian CT Head Rules (Figure 3), but their A-WPTAS score is < 18, then clinical judgment is required to determine whether the patient should be discharged home before a normal score for this measure is obtained. ¹³	C
1.7. If CT is not indicated on the basis of history and examination, the clinician may conclude that the risk to the patient is low enough to warrant discharge to own care or to home, as long as no other factors that would warrant a hospital admission are present (eg, drug or alcohol intoxication, other injuries, shock, suspected nonaccidental injury, meningism, cerebrospinal fluid leak) and there are appropriate support structures for safe discharge and for subsequent care (eg, competent supervision at home). [†]	C
1.8. All patients with any degree of brain injury who are deemed safe for appropriate discharge from an emergency department or the observation ward should receive verbal advice and a written brain injury advice card (Appendix 1.2). The details of the card should be discussed with the patient and their care providers. When necessary, communication in languages other than English or by other means should be used to convey the information. ¹⁸	C
1.9. If the patient returns to the emergency department with symptoms related to the initial injury, the following should be conducted ¹³ : full re-assessment; A-WPTAS assessment; and CT scan, if indicated. Also emphasize that the patient should visit his or her family physician for follow-up after discharge.	C
Health care providers	
1.10. On presentation, the primary care provider should conduct a comprehensive review of any patient who has sustained MTBI. The assessment should include taking a history, physical examination, cognitive screening, postconcussive symptom assessment, and a review of mental health. ¹³	A
1.11. An appraisal of the severity and effect of postconcussive symptoms should be made. A standardized tool such as the Rivermead Post-Concussion Symptoms Questionnaire (Appendix 1.3) can aid in this. ¹⁵	C
1.12. Clinicians should consider that an individual who has sustained an MTBI is likely to experience reduced cognitive functioning after the injury, which might resolve in a few days or continue for months before resolving; this can include problems with recall of material, speed of information processing, or concentration and attention. ¹³	A
2. Management of MTBI	
Management of MTBI	
2.1. Because a variety of factors, including biopsychosocial, contextual, and temporal preinjury, injury, and postinjury factors, can affect the outcomes of patients who have sustained MTBI, clinicians should consider these factors when planning and implementing management plans for patients. ¹³	A
2.2. Minor problems should be managed symptomatically, and the person should be offered reassurance and information on symptom management strategies. ¹⁵	C
2.3. All people who have sustained possible or definite MTBI should receive information about common symptoms and reassurance that recovery over a short period of time (days to a few weeks) is anticipated. ¹⁵	B
2.4. A person who sustains an MTBI should not drive for at least 24 hours and might require medical re-assessment. An extension of the recommended 24-hour time period is advised if there are symptoms or complications that result in loss of good judgment, decreased intellectual capacity (including slowed thinking), posttraumatic seizures, visual impairment, or loss of motor skills. If there are complications, a medical assessment is required before an individual returns to driving. ¹³	C
2.5. Symptomatic patients should be followed every 2 to 4 weeks from the time of initial contact until they are no longer symptomatic or until another re-assessment procedure has been put in place. ¹⁴	C

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2.6. A patient experiencing reduced cognitive functioning in the first few days following injury should be expected, with education and support, in most cases to have these symptoms resolve and preinjury cognitive functioning return within days or up to 3 months. However, patients who 1) have comorbidities or identified health or contextual risk factors (Table 7) and do not improve within 1 month or 2) have persistent symptoms at 3 months should be referred for more comprehensive evaluation in a specialized brain injury environment (see Appendix 2.1). ¹³	A
2.7. Patients with preinjury psychiatric difficulties should be provided with multidisciplinary treatment. ²³	A
Primary care providers	
2.8. Management of MTBI patients by primary care providers should involve guidance on strategies to minimize the effects of symptoms and to gradually resume activity and participation in life roles. ¹³	A
2.9. The primary care provider should consider referral of a patient who has had MTBI to specialist services when symptoms and concerns persist and fail to respond to standard treatments for any of the 3 spheres of physical, behavioural or emotional, and cognitive symptoms. [†]	C
2.10. The primary care provider should consider the risk of depression or other mental health disorders in patients who have experienced MTBI and that the emergence and maintenance of symptoms might be influenced by maladaptive psychological responses to the injury. ¹³	B
Providing education	
2.11. Education about symptoms, including an advice card (Appendix 1.2), and reassurance should be provided to all patients who have experienced MTBI. Education should ideally be delivered at the time of the initial assessment or minimally within 1 week of the injury or first assessment. ^{13,15}	A
2.12. Elements that can be included in the education session are as follows ^{14,17} :	C
<ul style="list-style-type: none"> • information about common symptoms, • reassurance that it is normal to experience some symptoms and that a positive outcome is expected, • information about typical timelines (allowing for individual differences) and the course of recovery, • advice about how to manage or cope with symptoms, • advice about gradual reintegration of regular activities, • information on how to access further support if needed, and • advice on stress management. 	
3. Sport-related MTBI	
Assessment and management	
3.1. Patients with sport-related MTBI might present acutely or subacutely. If any one of the signs or symptoms outlined in Table 8 are observed at any point following a blow to or jarring of the head, MTBI should be suspected and appropriate management instituted. ¹⁵	C
3.2. When a player shows any symptoms or signs of MTBI ¹⁵	C
<ul style="list-style-type: none"> • the player should not be allowed to return to play in the current game or practice; • the player should not be left alone and should be regularly monitored for deterioration; • the player should receive a medical evaluation, including evaluation of reported complaints (eg, somatic symptoms [Rivermead Post-Concussion Symptoms Questionnaire, Appendix 1.3], balance, and cognition); • return to play must follow a medically supervised stepwise process; and • a player should not be returned to play until he or she is asymptomatic at rest and with exertion. 	
Return-to-play decisions	
3.3. A player should never return to play while he or she is symptomatic. "If in doubt, sit them out." ^{13,19}	C
3.4. Return to play after MTBI should follow a stepwise process, proceeding to the next level only if the player remains asymptomatic. If any symptoms recur, the person should revert to the previous asymptomatic level and try to progress again after 24 hours.	C
<ol style="list-style-type: none"> 1. No activity. When asymptomatic, proceed to level 2. 2. Light aerobic exercise such as walking or stationary cycling; no resistance training. 3. Sport-specific training (eg, skating in hockey, running in soccer). 4. Non-contact training drills. 5. Full-contact training after medical clearance. 6. Game play. <p>See the "Safe Steps to Return to Play After a Possible Traumatic Brain Injury"¹⁵ algorithm from the New Zealand Guidelines Group (Appendix 3.3).^{15,19}</p>	
3.5. An additional consideration for return to play is that athletes who have experienced MTBI should not only be symptom free but should also not be taking any pharmacologic agents or medications that might affect or modify the symptoms of concussion. ¹⁹	C

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4. General recommendations for diagnosis and assessment of persistent symptoms following MTBI	
Diagnosis and assessment	
4.1. Clinicians should assess and monitor persisting somatic, cognitive, and emotional or behavioural symptoms following MTBI. ¹³	A
4.2. A standardized scale, such as the Rivermead Post-Concussion Symptoms Questionnaire (Appendix 1.3), should be used to monitor symptoms. ¹³	C
4.3. Persistent symptoms following MTBI can be nonspecific. Therefore, careful and thorough differential diagnoses should be considered, as similar symptoms are common in chronic pain, depression, anxiety disorders, and other medical and psychiatric disorders (see Table 9 and Appendix 4.1). [†]	C
5. General recommendations for management of persistent symptoms following MTBI	
Management	
5.1. Patients should be advised that they are likely to experience 1 or more persistent symptoms as a consequence of their MTBI for a short period and that this is expected and normal. ¹³	A
5.2. The patient should be advised that a full recovery from symptoms is expected. ¹³	A
5.3. Where there are prolonged and substantial complaints after MTBI, primary care providers should rule out other contributing or confounding factors (Table 7). ¹³	A
5.4. Those with MTBI and preinjury mental health conditions, or any other health or contextual risk factors, should be considered for early referral to a multidisciplinary treatment clinic capable of managing postconcussive symptoms, because these factors have been associated with poorer outcomes. [†]	C
6. Posttraumatic headache	
Assessment	
6.1. Take a focused headache history, identifying headache frequency, duration, location, intensity, and associated symptoms (eg, nausea or vomiting) to try to determine which primary headache type it most closely resembles (eg, episodic or chronic migraine, episodic or chronic tension-type headache, primary stabbing headache, occipital neuralgia). Unfortunately, some posttraumatic headaches cannot be classified. To aid in determining the specific phenotype of headache disorder present, refer to the ICHD II classification criteria in Appendix 6.3. Refer to the advice regarding assessment of posttraumatic headache provided in Appendix 6.6. [†]	C
6.2. Perform a neurologic examination and musculoskeletal examination, including cervical spine examination (refer to Appendix 6.5). [†]	C
Management	
6.3. Management of posttraumatic headache should be tailored to the class of nontraumatic headache it most closely resembles (eg, chronic tension, migraine). Refer to the treatment algorithms specific to the appropriate class of headache taken from the ICSI guideline (Appendices 6.7 to 6.9) for treatment guidance. Refer to the advice regarding management of posttraumatic headache in Appendix 6.6. ¹⁶	C
7. Persistent sleep disturbances	
Diagnosis and assessment	
7.1. Advise patients that the goal of treatment is to improve the continuity and restorative quality of sleep, not to make them "8-hour sleepers." More often than not the total sleep time will be less than 8 hours per night. ²⁴	C
7.2. Provide the sleep hygiene advice included in Appendix 7.1. ²⁵	C
7.3. Relaxation training is effective and recommended therapy in the treatment of chronic insomnia. ²⁶	C
7.4. Pharmacotherapy is generally recommended at the lowest effective dose as short-term treatment lasting less than 7 days. Although long-term use of hypnotic agents is discouraged owing to the potential for tolerance and dependence, there are specific situations and circumstances under which long-term use of hypnotics might be appropriate. Refer to the therapeutic options table taken from the Toward Optimized Practice guideline. See Appendix 7.2 for suggestions on useful medications. ²⁴	C
7.5. Some insomnia patients spend excessive time in bed trying to attain more sleep. Sleep consolidation is accomplished by compressing the total time in bed to match the total sleep need of the patient. This improves sleep efficiency. See Appendix 7.3 for advice on achieving sleep consolidation. ^{24,25}	C
8. Persistent mental health disorders	
Assessment	
8.1. Given their prevalence and potential effects, all patients with persistent symptoms following MTBI should be screened for mental health symptoms and disorders, including the following: <ul style="list-style-type: none"> • depressive disorders; • anxiety disorders, including PTSD; • irritability or other personality changes; • substance use disorders; and • somatoform disorders. The use of self-report questionnaires can aid in the assessment and monitoring of common mental health disorders, such as the depression module of the PHQ-9 (Appendix 8.2) and the PTSD Checklist–Civilian Version (Appendix 8.3). Screen for other symptoms using the Rivermead Post-Concussion Symptoms Questionnaire (Appendix 1.3). [†]	C

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Management	
8.2. Referral to a psychiatrist or mental health team (ideally with experience in treating individuals with persistent symptoms following MTBI, if available) should be obtained if ¹⁵	C
<ul style="list-style-type: none"> • the presentation is complex or severe, • initial treatment is not effective within 2 months, • psychosis or bipolar disorder are suspected, • there is a failure of or contraindication to medication strategies that are familiar, • the risk of suicide is judged to be considerable, or • there are risk factors known to potentially affect the course of recovery (Table 7). 	
8.3. While awaiting specialist referral, the initial steps of treatment should not be delayed and symptoms should not be left unmanaged. General measures can be instituted, and common symptoms such as headache, sleep disturbance, dizziness, and pain can be addressed in an ongoing manner. [†]	C
8.4. For medication trials, a "start low and go slow" approach is recommended. Nonetheless, dose optimization might be required before an antidepressant response is observed or a trial of medication is abandoned. ¹⁵	C
8.5. A selective serotonin reuptake inhibitor is recommended as the first-line drug treatment for mood and anxiety syndromes after MTBI. However, in some cases the combination of sedative, analgesic, and antimigraine effects from a tricyclic antidepressant might be particularly desirable, although these agents are generally considered second-line options. ¹⁵	C
8.6. Follow-up should occur at regular intervals: initially every 1 to 2 weeks, while increasing medication to monitor tolerability and efficacy; thereafter, every 2 to 4 weeks might be sufficient. ¹⁵	C
8.7. CBT has well-established efficacy for treatment of primary depression; as such it is appropriate in the treatment of mood symptoms following MTBI. ¹⁸	C
8.8. Individuals with PTSD following MTBI should be offered a trial of trauma-focused CBT. The need for concurrent pharmacotherapy should also be assessed, depending upon symptom severity and the nature of comorbid difficulties (eg, major depression, prominent somatic symptoms, severe hyperarousal, and sleeplessness, which all might limit psychological treatment). [†]	C
9. Persistent cognitive difficulties	
Assessment	
9.1. When there are persistent cognitive complaints, the health care provider should make efforts to formally screen for cognitive deficits. Objective measures of those domains most commonly affected after MTBI (ie, attention and concentration, information processing speed, and memory) should be used. Although there currently is no screening measure specific to cognitive difficulties following MTBI, the Rivermead Post-Concussion Symptoms Questionnaire (Appendix 1.3) includes items assessing cognition. [†]	C
9.2. Due consideration should be given to potential comorbid diagnoses that could be present and have the potential to influence cognition, such as anxiety, depression, PTSD, pain, fatigue, sleep disturbance, or acute stress disorder. [†]	C
9.3. If screening reveals evidence of cognitive dysfunction that is likely attributable to the MTBI itself or if cognitive symptoms are reported to persist at 3 months, then more formal assessment should be considered and referral should be made. If available, refer such patients to a neuropsychologist (ideally with experience with TBI). When a local neuropsychologist is not available or known, referral to a TBI centre can be made (see Appendix 2.1 for a list of TBI centres in Ontario). For systems with long wait times, practitioners should consider referral earlier than 3 months. [†]	C
Management	
9.4. Following MTBI, acute cognitive deficits are common, and spontaneous cognitive improvement is expected in most injured individuals. Rehabilitation of cognitive impairments should be initiated if	C
<ul style="list-style-type: none"> • the individual exhibits persistent cognitive impairments on formal evaluation or • the learning of compensatory strategies is necessary in order to facilitate the resumption of functional activities and work or there are safety issues in question (ie, possible harm to self or others).¹⁷ 	
9.5. For cognitive sequelae following MTBI, the cognitive rehabilitation strategies that should be considered include compensatory strategies and restorative approaches. ¹⁷	C
9.6. Electronic external memory devices such as computers, paging systems, or portable voice organizers have been shown to be effective aids for improving TBI patients' everyday function. ²⁷	B
10. Persistent balance disorders	
Assessment	
10.1. Clinicians should screen for balance deficits (Figure 4) for assessment of postural stability because clinical testing of balance offers additional information about the presence of ongoing symptoms and assists in the subsequent management of patients who have sustained MTBI. ¹³	C
10.2. If symptoms of benign positional vertigo are present, the Dix-Hallpike maneuver (Appendix 10.1) should be used. ²⁸	A

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Management	
10.3. For persons with functional balance impairments and a positive screening result on a balance measure, consideration of further balance assessment and treatment with physiotherapy might be warranted pending clinical course. [†]	C
10.4. A canalith repositioning maneuver should be used to treat benign positional vertigo if the Dix-Hallpike maneuver result is positive. ²⁸	A
10.5. Vestibular rehabilitation therapy is recommended for unilateral peripheral vestibular dysfunction. ²⁹	A
11. Persistent vision disorders	
Assessment	
11.1. A) Take an appropriate history relevant to visual symptoms. B) Perform fundoscopic examination and examination of visual acuity, visual fields, and extraocular movements for symptoms of visual disturbance including visual field disturbance, blurring, diplopia, and photosensitivity. [†]	C
11.2. If visual abnormalities are observed, refer the patient to an ophthalmologist, ideally a neuro-ophthalmologist or one specializing in brain injury. [†]	C
12. Persistent fatigue	
Assessment	
12.1. Determine whether fatigue is an important symptom by taking a personal history, reviewing the relevant items from the Rivermead Post-Concussion Symptoms Questionnaire (Appendix 1.3), or by administering the FSS (Appendix 12.1). [†]	C
12.2. Characterize the dimensions of fatigue and identify alternative, treatable causes that might not be directly related to the injury. ³⁰	C
<ul style="list-style-type: none"> • Take a complete medical history, review medications (see Appendix 12.2 for a list of medications associated with fatigue, asthenia, somnolence, and lethargy), and review systems, with particular attention to iatrogenic (medication) causes for comorbid medical conditions associated with fatigue (eg, metabolic disorders, thyroid dysfunction, anemia, low calcium, malnourishment). • Obtain a sleep history to help identify primary or secondary sleep disorders (see optional self-report sleep questionnaire in Appendix 7.1). • Evaluate for depression (loss of interest in activities; feelings of sadness, worthlessness, or guilt; changes in appetite or sleep; or suicidal thoughts), anxiety, stress, or other psychological distress. • Conduct a general medical examination and a focused neurologic examination. 	
Management	
12.3. If identified as an important symptom, key considerations that might aid in the management of persistent fatigue can include	C
<ul style="list-style-type: none"> • aiming for a gradual increase in activity levels that will parallel improvement in energy levels; • reinforcing that pacing activities across the day will help patients to achieve more and to avoid exceeding tolerance levels; • encouraging good sleep practices (especially regularity of sleep time and avoidance of stimulants and alcohol) and proper relaxation times; • planning meaningful goals, using a notebook to record activity achievement and identify patterns of fatigue; and • acknowledging that fatigue can be exacerbated by low mood. 	
Provide patients with a pamphlet containing advice on coping strategies for fatigue (Appendix 12.3). ¹⁵	
12.4. If fatigue is persistent, refer the patient to a brain injury specialist for consideration of a medication trial. [†]	C
13. Considerations for returning to work or school	
Considerations for returning to work or school	
13.1. When managing a patient's return to work or study, the health care provider should consider patient-related and contextual variables. These include physical difficulties arising from the injury, psychosocial issues, cognitive impairment, and cultural or work-related contextual factors (eg, workload and responsibilities; workplace environment; transportation or driving issues; and hours, shifts, or rest breaks). Refer to Appendix 13.1 for guidance on considerations for return to work or study. ¹³	C
13.2. For individuals who experience persistent deficits following MTBI, or who have difficulty once back at work, return-to-work programs should be implemented, which require carefully designed and managed plans. Specifically, referral to an occupational therapist to review the return-to-work process is recommended. ¹⁶	C
<p>A–WPTAS—Abbreviated Westmead Post-Traumatic Amnesia Scale, CBT—cognitive behavioural therapy, CT—computed tomography, FSS—Fatigue Severity Scale, ICHD—International Classification of Headache Disorders, ICSI—Institute for Clinical Systems Improvement, MTBI—mild traumatic brain injury, PHQ—Patient Health Questionnaire, PTSD—posttraumatic stress disorder, TBI—traumatic brain injury.</p> <p>[†]Grade A evidence includes at least 1 randomized controlled trial, meta-analysis, or systematic review; grade B evidence includes at least 1 cohort comparison, case study, or other type of experimental study; grade C evidence includes expert opinion or the experience of a consensus panel.</p> <p>[‡]Recommendation based on consensus of the MTBI Expert Consensus Group.</p>	

Implementation and update plans

The Ontario Neurotrauma Foundation is developing an MTBI strategy to improve care across the population, with one subcommittee focused on the evaluation and implementation of these guidelines. Particular barriers to implementation include the multiple clinical settings in which individuals present after MTBI. For example, given the symptom spectrum, patients might be seen in the emergency setting, a family physician's office, or a specialist setting, including neurology, physiatry, psychiatry, or otolaryngology. The evaluation process will include a pilot test of the guideline recommendations. Feedback from front-line clinicians and their patients during the pilot implementation phase, as well as findings from an ongoing literature review, will inform the update of these recommendations scheduled for 2012.

Comparison with other guidelines

As mentioned previously, other CPGs address the care of individuals who have experienced MTBI. There are guidelines that focus on traumatic brain injury in general, but which provide some recommendations addressing mild injuries.^{15,16,18} Also, recent guidelines have been developed that focus specifically on MTBI.^{13,14,17,19,40,42} When work began on our guidelines, only the earlier version of the Concussion in Sport Group guidelines¹⁹ and the guidelines from New South Wales,¹³ the Defense and Veterans Brain Injury Centre,¹⁴ and the Ontario Workplace Safety and Insurance Board¹⁷ had been published. However, aside from the clinical guidance document from the Defense and Veterans Brain Injury Centre (which is not a formal guideline), the other pre-existing guidelines offered little to no guidance on the care of persistent symptoms. The Veterans Affairs–Department of Defense guideline⁴² was published in 2009, when development of our guidelines was well under way, and has independently taken a similar approach to creating guidelines addressing persistent symptoms following MTBI in order to fill the current lack of direction for clinicians in managing this challenging patient population. But, as noted, the Veterans Affairs–Department of Defense guideline was developed for use with military personnel with a focus on blast injury and management within the military medical infrastructure.

Limitations

Our guidelines are constrained by the paucity of supporting evidence in most of the topic areas for which recommendations for practice were considered necessary and relevant. This constraint necessitated a heavy reliance on practice recommendations and clinician resources developed for other clinical populations (eg, headache, sleep disorder), as opposed to MTBI patients specifically. Because very few randomized controlled trials were found in the review of the literature, many of the

guideline recommendations are based on the opinions and expertise of the consensus group members (grade C).

A further limitation or challenge is the ongoing controversy and debate surrounding the pathogenesis of postconcussional disorder or postconcussion syndrome. Despite evident dysfunction and disability occurring frequently after injury, health care providers and funders have emphasized the issue of validation of the diagnosis and issues of potential secondary gain,^{7,43,44} as MTBI has generally been perceived as a self-limiting and nondisabling condition. The expert consensus group agreed it would be most beneficial for clinicians to focus on the development of guidance for management of PPCS following MTBI, emphasizing a symptom-based approach as opposed to deliberating diagnostic criteria.

Gaps in MTBI knowledge

Most of the guideline recommendations are based on expert consensus opinion, thereby highlighting the notable gaps in MTBI knowledge that should be addressed by research, including the following.

Consensus definition. A consensus definition for patients with persistent symptoms following MTBI is needed. The consensus group could not formally endorse either the *Diagnostic and Statistical Manual of Mental Disorders* diagnosis of postconcussional disorder or the International Classification of Diseases diagnosis of postconcussion syndrome.

Timing of intervention. The ideal timing for delivery of interventions, follow-up assessment, and referral for specialist care is not known.

Effectiveness of intervention. The effectiveness of treatment intervention for specific symptoms following MTBI is not known.

Effects of coexisting injuries on MTBI outcomes. There are a variety of causes of MTBI, such as sports-related injury, motor vehicle accidents, blast injury, work-related injury, and falls. Evidence suggests sport-related MTBI has a lower incidence of persistent symptoms compared with other traumatic causes; however, the reason for this is unknown. In contrast, other causes, such as falls and motor vehicle collisions, are more likely to result in multiple trauma including fractures and internal organ injury or substantial emotional reactions to unanticipated injury, which might predispose patients to acute and posttraumatic stress disorders. The effect of factors related to more complex presentations remains a knowledge gap.

Implementation and dissemination of guidelines. The ideal method for implementation and

dissemination of guidelines across multiple health care specialties, health care professionals, and different settings remains unknown.

Conclusion

The current guidelines are intended to fill a gap in delivery of care and to serve as a resource for clinicians who encounter patients with MTBI with the intent of either preventing symptoms from becoming chronic or minimizing the effects of PPCS. Further research is required both to improve the evidence for provision of care for MTBI and PPCS and to identify the best methods for uptake and implementation of guidelines that span multiple types of health care professionals and health care settings.

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Contributors

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Competing interests

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