Clinical Practice Guideline

Management of Concussion/mild Traumatic Brain Injury

April, 2009

VA/DoD Evidence Based Practice

VA/DoD CLINICAL PRACTICE GUIDELINE FOR

MANAGEMENT OF CONCUSSION/MILD TRAUMATIC BRAIN INJURY (mTBI)

Department of Veterans Affairs

Department of Defense

QUALIFYING STATEMENTS

The Department of Veterans Affairs (VA) and The Department of Defense (DoD) guidelines are based on the best information available at the time of publication. They are designed to provide information and assist in decision-making. They are not intended to define a standard of care and should not be construed as one. In addition, they should not be interpreted as prescribing an exclusive course of management.

Variations in practice will inevitably and appropriately occur when providers take into account the needs of individual patients, available resources, and limitations unique to an institution or type of practice. Every healthcare professional making use of these guidelines is responsible for evaluating the appropriateness of applying them in the setting of any particular clinical situation.

Version 1.0 – 2009

Prepared by:

The Management of Concussion/mTBI Working Group

With support from:
The Office of Quality and Performance, VA, Washington, DC
&
Quality Management Directorate, United States Army MEDCOM

Introduction

The Clinical Practice Guideline for the Management of Concussion/Mild Traumatic Brain Injury (mTBI) was developed under the auspices of the Veterans Health Administration (VHA) and the Department of Defense (DoD) pursuant to directives from the Department of Veterans Affairs (VA). VHA and DoD define clinical practice guidelines as:

> "Recommendations for the performance or exclusion of specific procedures or services derived through a rigorous methodological approach that includes:
>
> - Determination of appropriate criteria such as effectiveness, efficacy, population benefit, or patient satisfaction; and
> - Literature review to determine the strength of the evidence in relation to these criteria."

The intent of these guidelines is to:

- Reduce current practice variation and provide facilities with a structured framework to help improve patient outcomes
- Provide evidence-based recommendations to assist providers and their patients in the decision-making process related to the patient health care problems
- Identify outcome measures to support the development of practice-based evidence that can ultimately be used to improve clinical guidelines.

Background

The Centers for Disease Control and Prevention (CDC) has estimated that each year, approximately 1.5 million Americans survive a traumatic brain injury (TBI), among whom approximately 230,000 are hospitalized. Approximately 50,000 Americans die each year following traumatic brain injury, representing one third of all injury-related deaths. The leading causes of TBI are falls (28%), motor vehicle-traffic accidents (20%), struck by/against events (19%) and assaults (11%). It is estimated that of the total reported TBIs, the vast majority (75%-90%) of these fit the categorization of mild-TBI and that approximately ninety percent (90%) of these follow a predictable course and experience few, if any, ongoing symptoms and do not require any special medical treatment. More than 1.1 million patients with mTBI are treated and released from an emergency department each year. Only a small sub-set of these patients (10%) experience post-injury symptoms of a long lasting nature.

The incidence of TBI has significantly increased in the patient population of the DoD and VHA as a result of injuries during recent military and combat operations. In the past 8 years, TBI has emerged as a common form of injury in service men and women serving in Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF). Although penetrating TBI is typically identified and cared for immediately, mTBI may be missed, particularly in the presence of other more obvious injuries. Due to numerous deployments and the nature of enemy tactics, troops are at risk for sustaining more than one mild brain injury or concussion in a short timeframe.

As experience with this condition in OEF and OIF service persons and veterans accumulated, it became clear that screening for possible TBI in OEF and OIF veterans could contribute to ensuring that patients are identified and treatment implemented.

In response to this need, VHA established a task force including members with expertise in Physical Medicine and Rehabilitation, Neurology, Psychiatry, Psychology, Primary Care, Prevention, and Medical Informatics to develop a screening tool and evaluation protocol. Although TBI is a significant public health problem, currently there are no validated screening instruments specific to TBI that are accepted for use in clinical practice. Therefore, the task force reviewed existing literature on screening for TBI, examined the efforts of individual military Medical Treatment Facilities (MTF's) and Department of Veterans Affairs (VA) Medical Centers that had implemented TBI screening locally, consulted with the Defense and Veterans Brain Injury Center

(DVBIC), and considered data on the natural history of TBI. Based on these efforts, the task force developed a consensus document that included definitions, classification and taxonomy.

Following the development of a definition document, the task force constructed a screening instrument to assist in identifying OEF and OIF veterans who may be suffering from TBI, and a protocol for further evaluation and treatment of those whose screening tests are positive. Furthermore, a national electronic clinical reminder, VA-TBI Screening, was built incorporating this screening instrument. These protocols have been considered the seed for the development of this Evidence Based Practice Guideline. The DoD has published Clinical Guidance for Management of Mild-TBI in Theater and mTBI in Non-Deployed Medical Activities.

After the VA/DoD Working Group completed the review of the evidence for this guideline an Institute of Medicine (IOM) report addressing long-term consequences of Traumatic Brain Injury was published (IOM, 2009). The IOM committee concluded, on the basis of its evaluation, that there is limited/suggestive evidence of an association between sustaining a mild TBI resulting in loss of consciousness or amnesia and the development of unprovoked seizures, ocular and visual motor deterioration.

The committee found inadequate/insufficient evidence to determine whether an association exists between mild TBI and neurocognitive deficits and long-term adverse social functioning, including unemployment, diminished social relationships, and decrease in the ability to live independently.

For long-term outcomes, the IOM report describes limited/suggestive evidence of an association between mild TBI and Parkinson Disorder and between mild TBI and dementia of the Alzheimer's type when the injury included loss of consciousness. However, insufficient evidence of such association was found in mild TBI without loss of consciousness.

Scope of Guideline

- This Evidence Based Guideline applies to adult patients (18 years or older) who are diagnosed with concussion/mTBI and complain of symptoms related to the injury and who are treated in VA/DoD clinical settings for these symptoms at least 7 days after the initial head injury.
- The guideline is relevant to all healthcare professionals providing or directing treatment services to patients with concussion/mTBI in any VA/DoD healthcare setting, including both primary and specialty care.
- This guideline does not address: management of concussion/mTBI in the acute phase (< 7 days post injury), management of moderate or severe TBI, mTBI presented as polytrauma and managed in an inpatient setting, or mTBI in children

Development Process

The development process of this guideline follows a systematic approach described in "Guideline-for-Guidelines," an internal working document of VHA's National Clinical Practice Guideline Counsel.

The literature search identified publications from 2002 through 2008 that addressed adult patients with mTBI. The initial year (2002) was elected to succeed the World Health Organization, (WHO) systematic review of publications related to mTBI conducted in 2002. The WHO Collaborating Centre for Neurotrauma Task Force on Mild Traumatic Brain Injury (Carroll, et al., 2004) performed a comprehensive search and critical review of the literature published between 1980 and 2002 to assemble the best evidence on the epidemiology, diagnosis, prognosis and treatment of mild traumatic brain injury.

The literature identified by the search was critically analyzed and graded using a standardized format applying the evidence grading system used by the U.S. Preventative Services Task Force. For recommendations that are based on evidence the strength of recommendation grade (SR) is included in brackets following the recommendations. Where existing literature was ambiguous or conflicting, or where scientific data were lacking on an issue, recommendations were based on the clinical experience of the members of the Working Group and are presented without an SR grade.

Appendix A fully describes the guideline development process. (See Appendix A – Development Process.)

This Guideline is the product of many months of diligent effort and consensus building among knowledgeable individuals from the VA, DoD, and experts from the private sector. An experienced moderator facilitated the multidisciplinary Working Group.

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The complete list of participants and contact information is included in Appendix H

Implementation

The guideline and algorithms are designed to be adapted to individual facility needs and resources. The algorithms serve as a guide that providers can use to determine best interventions and timing of services for their patients to optimize quality of care and clinical outcomes. This should not prevent providers from using their own clinical expertise in the care of an individual patient. Guideline recommendations are intended to support clinical decision-making but should never replace sound clinical judgment.

Although this guideline represents the state of the art practice at the time of its publication, medical practice is evolving and this evolution will require continuous updating of published information. New technologies and increased ongoing research will improve patient care in the future. This clinical practice guideline can assist in identifying priority areas for research and optimal allocation of resources as regards to TBI in general and mTBI in particular. Future studies examining the results of clinical practice guidelines such as these may lead to the development of new practice-based evidence and treatment modalities.

A recently developed program that has been created for post-deployment personnel and veterans experiencing head injury deserves mention here. The program for post-deployment care which features an interdisciplinary team of a primary care staff, mental health clinician, and clinical social worker assist in implementation of post-deployment care models across the VA. The providers in these settings have received specialty training in this condition and treatment approaches. Assessment and treatment is organized in a collaborative team model. All referred patients are screened for the need for case management services and all severely ill or injured OIF and OEF patients are case managed.

Future research

There are unique circumstances related to research of concussion/mTBI that create challenges as regards the development of strong evidence based studies on which to build recommendations and difficulties in determining best practice diagnostic approaches and treatment modalities. These circumstances include: the lack of a standardized definition of mTBI; the fact that much of the literature that does exist is sports-injury based and may not extrapolate successfully to other populations; the fact that the symptoms these patients often exhibit are common to other conditions and that they occur frequently in the population as a whole; the confounding factors related to the existence of pre-morbid or co-occurring diseases or conditions along with the concussion/mTBI; the reality that patients who have suffered a head injury often do not present for treatment for days, weeks, or even months following the initial injury; and the special circumstances surrounding service personnel receiving head injuries in-theatre. **Currently, diagnosis of concussion/mTBI is based primarily on the characteristics of the injury event and not by the severity of symptoms at random points after the trauma.**

In addition to the diagnostic difficulties caused by diffuse symptoms of a non-specific nature, the common occurrence of a long time span between injury and presentation for treatment, and the confounding variables of pre-morbid and /or co-occurring morbidities; methodological weaknesses in the literature regarding mTBI are substantial.

The World Health Organization (WHO) in its systematic review of the mTBI literature found:

- Differing inception periods, diverse source populations, differing inclusion/exclusion criteria and varying case definitions
- No universally accepted definition of mTBI
- Criteria used by various authors was susceptible to information bias (i.e. using ICD coding to determine) and misclassification of cases
- Many studies did not identify the population at risk that should form the denominator in any incidence calculation.

Successful future research efforts will need to address these methodological difficulties and focus on areas of concern regarding the diagnosis and treatment of concussion/mTBI. For example, many aspects of concussion/mTBI (as with all blunt brain injury) remain confusing, particularly with regards to the spectrum of clinical outcomes that may result. The role of neuropsychological and physiological testing, in an attempt to further characterize the injury, needs additional application and study. The common occurrence of mTBI lends

itself to meaningful analysis, both within an institution and in the multi-institutional setting. Enhanced characterization of the mTBI injury will allow more appropriate utilization of the many subspecialists involved in post-traumatic care, including the trauma surgeon; neurologist; physiatrist; physical, cognitive and occupational therapists; psychiatrists; and primary care physicians.

Goals of this Guideline

- To promote evidence-based management of patients diagnosed with mild traumatic brain injury (mTBI)
- To promote efficient and effective assessment of patient's complaints
- To identify the critical decision points in management of patients with concussion/mTBI
- To improve local management of patients with concussion/mTBI and thereby improve patient outcomes
- To promote evidence-based management of individuals with (post-deployment) health concerns related to head injury, blast, or concussion
- To accommodate local policies or procedures, such as those regarding referrals to, or consultation with, specialists
- To motivate administrators at each of the Federal agencies and care access sites to develop innovative plans to break down barriers that may prevent patients from having prompt access to appropriate care
- To diagnose concussion/mTBI accurately and in a timely manner
- To appropriately assess and identify those patients who present with symptoms following a concussion/mTBI or other consequences of head injury
- To identify those patients who may benefit from further assessment, brief intervention and/or ongoing treatment
- To improve the quality and continuum of care for patients with concussion/mTBI
- To identify those patients who may benefit from early intervention and treatment to prevent future complications from concussion/mTBI
- To improve health related outcomes for patients with concussion/mTBI
- To reduce morbidity and mortality from concussion/mTBI.

Document Presentation:

- The Guideline is organized around three separate Algorithms:
  - **Algorithm A: Initial Presentation**
  - **Algorithm B: Management of Symptoms**
  - **Algorithm C: Follow-up of Persistent Symptoms**
- Annotations and recommendations in the text match the Box numbers and Letters in the respective algorithms.
- There are a limited number of recommendations that are based on best evidence literature. Therefore, in annotations for which there are evidence based studies to support the recommendations a section titled Evidence Statements follows the recommendations and provides a brief discussion of findings. The Strength of Recommendation [SR] based on the level of evidence is presented in brackets for these recommendations. In annotations for which there is not a body of evidence based literature there is a Discussion Section which discusses approaches defined through assessing expert opinion on the given topic. No SR is presented for these recommendations.

Evidence Rating

A	A strong recommendation that the clinicians provide the intervention to eligible patients. *Good evidence was found that the intervention improves important health outcomes and concludes that benefits substantially outweigh harm.*
B	A recommendation that clinicians provide (the service) to eligible patients. *At least fair evidence was found that the intervention improves health outcomes and concludes that benefits outweigh harm.*
C	No recommendation for or against the routine provision of the intervention is made. *At least fair evidence was found that the intervention can improve health outcomes, but concludes that the balance of benefits and harms is too close to justify a general recommendation.*
D	Recommendation is made against routinely providing the intervention to patients. *At least fair evidence was found that the intervention is ineffective or that harms outweigh benefits.*
I	The conclusion is that the evidence is insufficient to recommend for or against routinely providing the intervention. *Evidence that the intervention is effective is lacking, or poor quality, or conflicting, and the balance of benefits and harms cannot be determined.*

Conventions used in this Guideline:

The terms *concussion* and *mTBI* are used interchangeably. The use of the term concussion or history of mild TBI may be preferred when communicating with the patient, indicating a transient condition, avoiding the use of the terms "brain damage" or "brain injury" that may inadvertently reinforce misperceptions of symptoms or insecurities about recovery. The term *concussion/mTBI* will be used throughout this document as a convention.

Two terms commonly used in the literature, Post Concussive Syndrome (PCS) and Post-Concussion Disorder (PCD), also have the potential to reinforce illness behavior and the constellations of symptoms are not accurately described as either a syndrome or disorder. The term Persistent Post-Concussive Symptoms (PPCS) will be used throughout this document as a convention when referring to symptoms related to mTBI that do not remit despite initial treatment.

GUIDELINE KEY POINTS

General

- The management of patients who present with symptoms following a concussion/mTBI injury should focus on promoting recovery and avoiding harm
- A patient-centered approach should be used to provide the needed reassurance and motivation, since patients with prolonged symptoms are suffering, distressed, and in need of guidance, education, support, and understanding
- Currently, there are no universal standard criteria for the definition of concussion/mTBI and the diagnosis is based primarily on the characteristics of the immediate sequelae following the event
- Concussion/mTBI is a common injury, with a time-limited and predictable course. The majority of patients with concussion/mTBI do not require any specific medical treatment
- Experience in contemporary military operations suggests that substantial short-term and long-term neurologic deficits (similar to those following concussion/mTBI) can be caused by blast exposure without a direct blow to the head and may manifested in isolation or part of polytrauma.

Natural Course of disease

- The vast majority of patients who have sustained a concussion/mTBI improve with no lasting clinical sequelae
- Patients should be reassured and encouraged that the condition is transient and full recovery is expected. The term 'brain damage' should be avoided. A risk communication approach should be applied
- The vast majority of patients recover within hours to days, with a small proportion taking longer. In an even smaller minority, symptoms may persist beyond six months to a year
- The symptoms associated with Post-Concussion Syndrome (PCS) are not unique to mTBI. The symptoms occur frequently in day to day life among healthy individuals and are also found often in persons with other conditions such as chronic pain or depression.

Return to Work /Duty Activity

- Patients sustaining a concussion/mTBI should return to normal (work/duty/school/leisure) activity post-injury as soon as possible
- A gradual resumption of activity is recommended
- If physical, cognitive, or behavioral complaints/symptoms re-emerge after returning to previous normal activity levels, a monitored progressive return to normal activity as tolerated should be recommended.

Early intervention

- Early education of patients and their families is the best available treatment for concussion/mTBI and for preventing/reducing the development of persistent symptoms

- A primary care model can be appropriate for the management of Concussion/mTBI when implemented by an interdisciplinary team with special expertise.

Symptom Management

- Treatment of somatic complaints (e.g. sleep, dizziness/coordination problems, nausea, numbness, smell/taste, vision, hearing, fatigue, appetite problems) should be based upon individual factors and symptom presentation
- Headache is the single most common symptom associated with concussion/mTBI and assessment and management of headaches in individuals should parallel those for other causes of headache
- Medication for ameliorating the neurocognitive effects attributed to concussion/mTBI is not recommended
- Medications for headaches, musculoskeletal pain, or depression/anxiety must be carefully prescribed to avoid the sedating properties, which can have an impact upon a person's attention, cognition, and motor performance
- Treatment of psychiatric symptoms following concussion/mTBI should be based upon individual factors and the nature and severity of symptom presentation, and may include both psychotherapeutic and pharmacological treatment modalities
- In patients with persistent post-concussive symptoms (PPCS), which have been refractory to treatment, consideration should be given to other factors including psychiatric, psychosocial support, and compensatory/litigation.

Table of Contents

By Topics

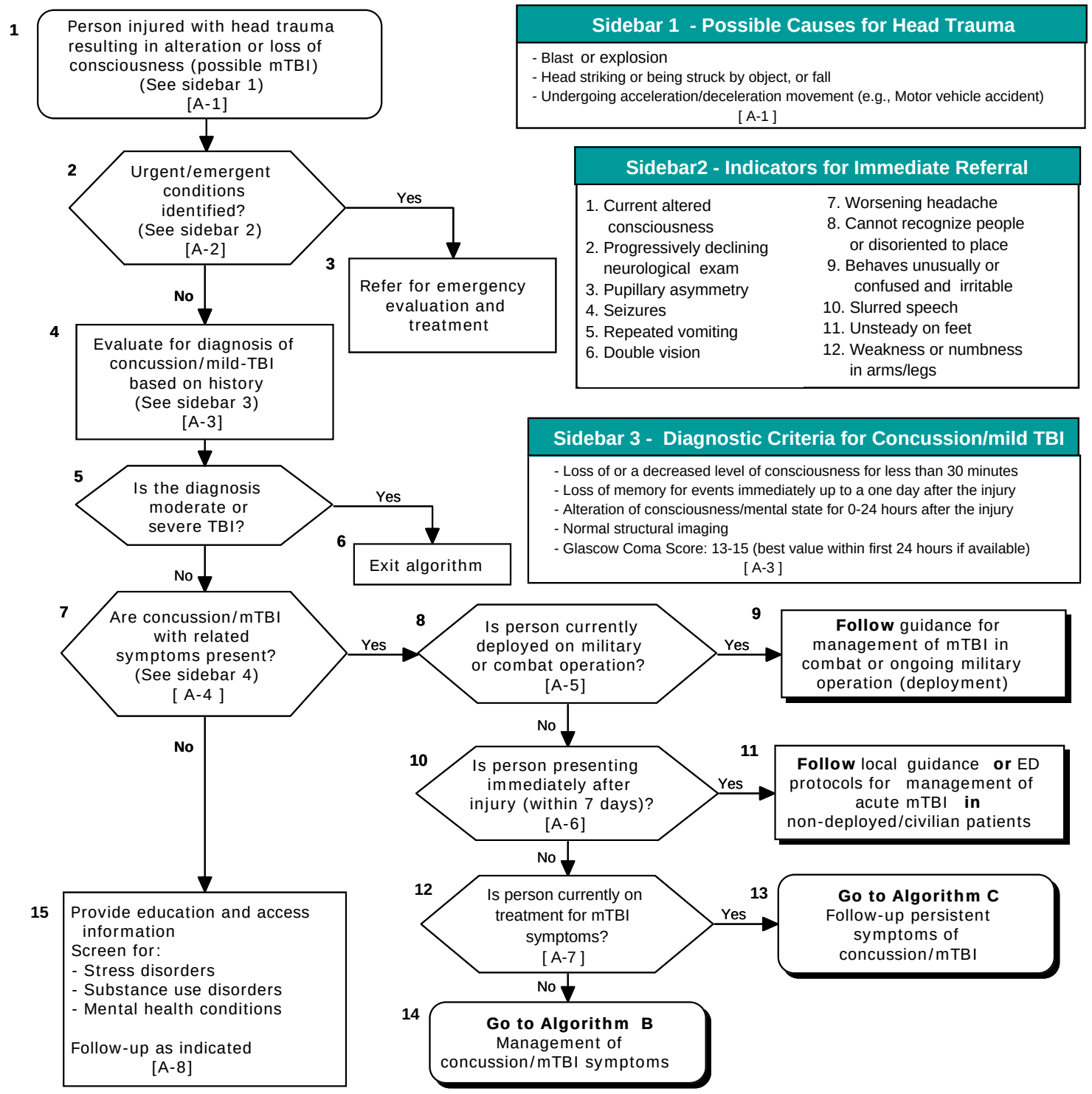
APPENDICES

Tables & Figures

Algorithms and Annotations

Table of Contents

VA/DoD Clinical Practice Guideline for Management of Concussion/mild-Traumatic Brain Injury
A: Initial Presentation



Sidebar 1 - Possible Causes for Head Trauma

- Blast or explosion
- Head striking or being struck by object, or fall
- Undergoing acceleration/deceleration movement (e.g., Motor vehicle accident)

[A-1]

Sidebar2 - Indicators for Immediate Referral

1. Current altered consciousness
2. Progressively declining neurological exam
3. Pupillary asymmetry
4. Seizures
5. Repeated vomiting
6. Double vision
7. Worsening headache
8. Cannot recognize people or disoriented to place
9. Behaves unusually or confused and irritable
10. Slurred speech
11. Unsteady on feet
12. Weakness or numbness in arms/legs

Sidebar 3 - Diagnostic Criteria for Concussion/mild TBI

- Loss of or a decreased level of consciousness for less than 30 minutes
- Loss of memory for events immediately up to a one day after the injury
- Alteration of consciousness/mental state for 0-24 hours after the injury
- Normal structural imaging
- Glascow Coma Score: 13-15 (best value within first 24 hours if available)

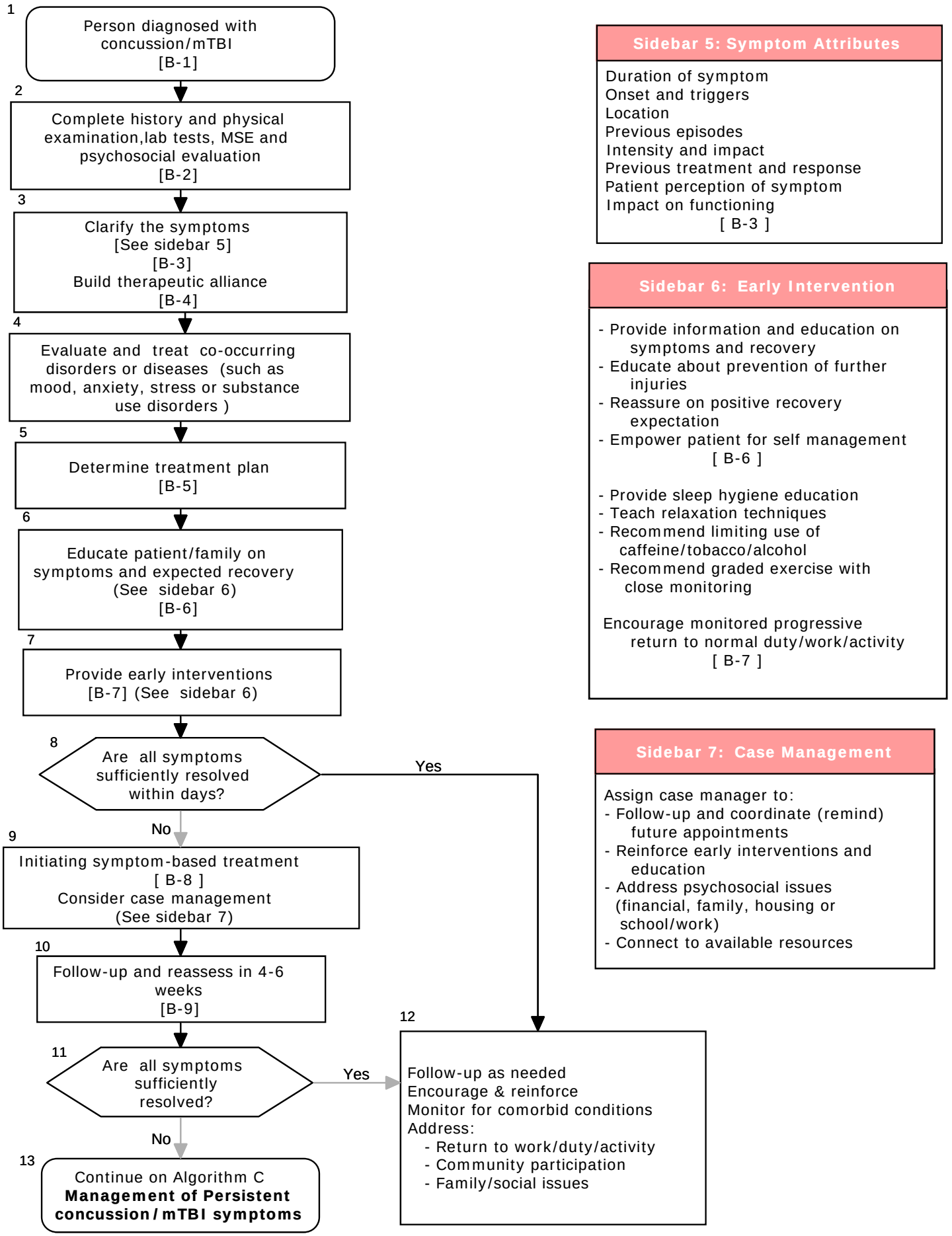
[A-3]

SIdebar 4 - Post-Concussion/mTBI Related Symptoms *

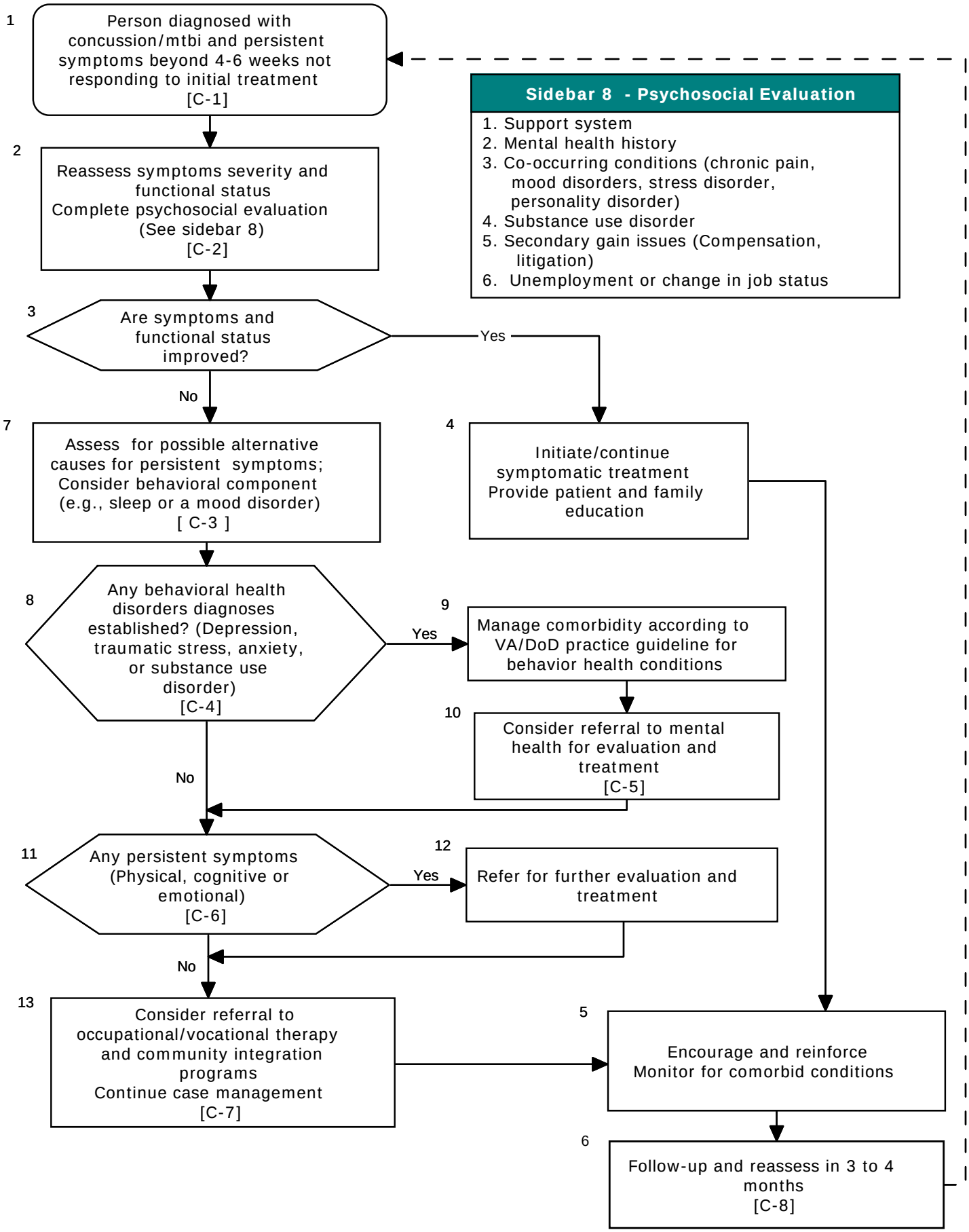
Physical Symptoms :	Cognitive Symptoms :	Behavior/Emotional Symptoms :
Headache, dizziness, balance disorders, nausea, fatigue, sleep disturbance, blurred vision, sensitivity to light, hearing difficulties/loss, sensitivity to noise, seizure, transient neurological abnormalities, numbness tingling	Attention, concentration, memory, speed of processing, judgment, executive control.	Depression, anxiety, agitation, irritability, impulsivity, aggression.

* Symptoms that develop within 30 days post injury

VA/DoD Clinical Practice Guideline for Management of Concussion/mild-Traumatic Brain Injury
B: Management of Symptoms



VA/DoD Clinical Practice Guideline for Management of Concussion/mild-Traumatic Brain Injury
C: Follow-up Persistent Symptoms



A: Initial Presentation

Annotation A-1	*Person Injured with Head Trauma Resulting in Possible Alteration or Loss of Consciousness*

1 DEFINITIONS/CLASSIFICATIONS

1.1 Definition of Traumatic Brain Injury

A traumatically induced structural injury and/or physiological disruption of brain function as a result of an external force that is indicated by new onset or worsening of at least one of the following clinical signs, immediately following the event:

- Any period of loss of or a decreased level of consciousness (LOC)
- Any loss of memory for events immediately before or after the injury (post-traumatic amnesia [PTA])
- Any alteration in mental state at the time of the injury (confusion, disorientation, slowed thinking, etc.) (Alteration of consciousness/mental state [AOC])
- Neurological deficits (weakness, loss of balance, change in vision, praxis, paresis/plegia, sensory loss, aphasia, etc.) that may or may not be transient
- Intracranial lesion.

External forces may include any of the following events: the head being struck by an object, the head striking an object, the brain undergoing an acceleration/deceleration movement without direct external trauma to the head, a foreign body penetrating the brain, forces generated from events such as a blast or explosion, or other forces yet to be defined.

The above criteria define the event of a TBI. Not all individuals exposed to an external force will sustain a TBI, but any person who has a history of such an event with immediate manifestation of any of the above signs and symptoms can be said to have had a TBI.

1.2 Severity of Brain Injury Stratification

TBI is further categorized as to severity into mild, moderate, or severe based on the length of LOC, AOC, or PTA (see Table A-1). Acute injury severity is determined at the time of the injury.

- The patient is classified as mild/moderate/severe if s/he meets any of the criteria in Table A-1 within a particular severity level. If a patient meets criteria in more than one category of severity, the higher severity level is assigned.
- If it is not clinically possible to determine the brain injury level of severity because of medical complications (e.g., medically induced coma), other severity markers are required to make a determination of the severity of the brain injury.
- Abnormal structural imaging (e.g., Magnetic Resonance Imaging or Computed Tomography Scanning) attributed to the injury will result in the individual being considered clinically to have greater than mild injury.

In addition to traditional imaging studies, other imaging techniques such as functional magnetic resonance imaging, diffusion tensor imaging, positron emission tomography scanning; electrophysiological testing such as electroencephalography; and neuropsychological or other standardized testing of function have been used in the evaluation of persons with TBIs, but are not considered in the currently accepted criteria for measuring severity at the time of the acute injury outlined in Table A -1.

The severity level has prognostic value, but does not necessarily predict the patient's ultimate level of functioning. There is substantial evidence that the epidemiology, pathophysiology, natural history, and

prognosis for concussion/mTBI are different than for moderate and severe TBI. For example, moderate and severe TBI are often associated with objective evidence of brain injury on brain scan or neurological examination (e.g., neurological deficits) and objective deficits on neuropsychological testing, whereas these evaluations are frequently not definitive in persons with concussion/mTBI. The natural history and prognosis of moderate and severe TBI are much more directly related to the nature and severity of the injury in moderate and severe TBI, whereas factors unrelated to the injury (such as co-existing mental disorders) have been shown to be the strong predictors of symptom persistence after a concussion/mTBI.

Table A-1. Classification of TBI Severity

Criteria	Mild	Moderate	Severe
Structural imaging	Normal	Normal or abnormal	Normal or abnormal
Loss of Consciousness (LOC)	0–30 min	> 30 min and < 24 hrs	> 24 hrs
Alteration of consciousness/mental state (AOC) *	a moment up to 24 hrs	> 24 hours. Severity based on other criteria	
Post-traumatic amnesia (PTA)	0–1 day	> 1 and < 7 days	> 7 days
Glascow Coma Scale (best available score in first 24 hours)	13-15	9-12	< 9

* Alteration of mental status must be immediately related to the trauma to the head. Typical symptoms would be: looking and feeling dazed and uncertain of what is happening, confusion, difficulty thinking clearly or responding appropriately to mental status questions, and being unable to describe events immediately before or after the trauma event.

Concussion

The terms *concussion* and *mTBI* can be used interchangeably. The use of the term concussion or history of mild TBI may be preferred when communicating with the patient, indicating a transient condition, avoiding the use of the terms "brain damage" or "brain injury" that may inadvertently reinforce misperceptions of symptoms or insecurities about recovery. The patient who is told s/he has "brain damage" based on vague symptoms complaints and no clear indication of significant head trauma may develop a long-term perception of disability that is difficult to undo (Wood, 2004).

The term *concussion/mTBI* will be used throughout this document as a convention.

Annotation A-2 *Urgent/emergent conditions identified?*

RECOMMENDATIONS

1. The following physical findings, signs and symptoms ("Red Flags") may indicate an acute neurologic condition that requires urgent specialty consultation (neurology, neuro-surgical) :
    a. Altered consciousness
    b. Progressively declining neurological examination
    c. Pupillary asymmetry
    d. Seizures
    e. Repeated vomiting
    f. Double vision
    g. Worsening headache
    h. Cannot recognize people or is disoriented to place
    i. Behaves unusually or seems confused and irritable
    j. Slurred speech
    k. Unsteady on feet
    l. Weakness or numbness in arms / legs

Annotation A-3 *Evaluate for Diagnosis of Concussion/mTBI, Based on History*

1.3 Diagnostic Criteria for mTBI

BACKGROUND

In the U.S., the most widely accepted criteria for mild TBI are those proposed by the American College of Rehabilitation Medicine (ACRM, 1993). They are "a physiological disruption of brain function as a result of a traumatic event as manifested by at least one of the following: alteration of mental state, loss of consciousness (LOC), loss of memory or focal neurological deficit, that may or may not be transient; but where the severity of the injury does not exceed the following: post-traumatic amnesia (PTA) for greater than 24 hours, after the first 30 minutes Glasgow Coma Score (GCS) 13 - 15, and loss of consciousness is less than 30 minutes." There are other criteria used by other medical groups. However, most agree that common criteria include GCS score of 13-15, brief LOC, brief PTA and negative head computed tomography (CT) scan.

RECOMMENDATIONS

1. A diagnosis of mTBI should be made when there is an injury to the head as a result of blunt trauma, acceleration or deceleration forces or exposure to blast that result in one or more of the following conditions:
    a. Any period of observed or self-reported:
        - Transient confusion, disorientation, or impaired consciousness
        - Dysfunction of memory immediately before or after the time of injury
        - Loss of consciousness (LOC) lasting less than 30 minutes.
    b. Observed signs of neurological or neuropsychological dysfunction, such as:
        - Headache, dizziness, irritability, fatigue or poor concentration, when identified soon after injury, can be used to support the diagnosis of mild TBI, but cannot be used to make the diagnosis in the absence of loss of consciousness or altered consciousness.
2. The severity of TBI must be defined by the acute injury characteristics and not by the severity of symptoms at random points after trauma.

DISCUSSION

The lack of standardized criteria and the variable quality of the current literature on mTBI (Carroll et al., 2004), poses the risk of misclassification of patients with concussion symptoms. Although this is an important issue for research, the implications for care could cause over- or under-diagnosing of patients with mTBI. This led the Working Group to rely on expert opinion in determining recommendations for intervention.

Annotation A-4 *Are Concussion/mTBI with Related Symptoms Present?*

1.4 Symptoms Associated with Concussion/mTBI

Concussion/mTBI is associated with a variety of symptoms that will manifest immediately following the event, and may resolve quickly, within minutes to hours after the injury event, or they may persist longer. The most typical signs and symptoms after concussion fall into one or more of the following three categories:

a. Physical: headache, nausea, vomiting, dizziness, fatigue, blurred vision, sleep disturbance, sensitivity to light/noise, balance problems, transient neurological abnormalities
b. Cognitive: attention, concentration, memory, speed of processing, judgment, executive function

c. Behavioral/emotional: depression, anxiety, agitation, irritability, impulsivity, aggression.

Signs and symptoms may occur alone or in varying combinations and may result in functional impairment.

Although a variety of symptoms can occur in association with TBI, they are *not* part of the definition of TBI, and there are no pathognomonic symptoms or signs. The term "mild TBI" refers only to the initial injury severity and should not be interpreted referring to the level of the severity of the symptoms.

Signs and symptoms, following the concussion, should not be attributed to concussion/mTBI if they are better explained by pre-existing conditions or other medical, neurological, or psychological causes except in cases of an immediate exacerbation of a pre-existing condition.

Symptoms associated with concussion/mTBI are not unique. These symptoms occur frequently in day-to-day life among healthy individuals and are often found in persons with other conditions such as chronic pain, depression or other traumatic injuries. These symptoms are also common to any number of pre-existing/pre-morbid conditions the patient may have had.

Each patient tends to exhibit a different mix of symptoms and the symptoms themselves are highly subjective in nature. Research studies do not offer strong support for a consistent pattern of the types of symptoms occurrence and resolution following mild TBI. Symptoms do not appear to cluster together in a uniform, or even in a consistent expected trend. The presence of somatic symptoms is not linked predictably to the presence of neuropsychiatric (i.e., cognitive, emotional, or behavioral) symptoms, and the neuropsychiatric consequences of mTBI are not linked consistently to one another. Additionally, there is little evidence of coupling of symptom resolution following mTBI. Few persons with multiple post-concussion symptoms experience persistence of the entire set of their symptoms over time. (Arciniegas, 2005)

This lack of symptom consistency may reflect the complex effects of head injury on the brain and also the interaction between the injury and each individual's pre- or post-injury psychosocial factors (Alexander 1995; King 1996).

Annotation A-5 *Is Person Currently Deployed on Combat or Ongoing Military Operation?*

RECOMMENDATIONS

1. Management of service members presenting for care immediately after a head injury (within 7 days) during military combat or ongoing operation should follow guidelines for acute management published by DoD. (See: Recommendations for acute management of concussion/mTBI in the deployed setting, **Defense and Veterans Brain Injury Center Consensus August, 2008**)

   (This guidance is not included in this evidence-based guideline.)

Annotation A-6 *Is Person Presenting Immediately (Within 7 Days) After Injury? (Non-Military/Civilian Setting)*

RECOMMENDATIONS

1. Management of non-deployed service members, veterans, or civilian patients presenting for care immediately after a head injury (within 7 days) should follow guidelines for acute management. (See Recommendations for acute management in guideline published by the American College of Emergency Medicine and the Center for Disease Control and Prevention (ACEP/CDC, 2008)

   (These protocols and guidance are not included in this evidence-based guideline.)

1.5 Post Deployment Delayed Awareness and Delayed Reporting of Symptoms

BACKGROUND

The elapsed time since the exposure to the head injury (trauma) and the self-reporting of symptoms by the patient to their primary care provider may vary. This period is very important in assessing the risk of developing concussion/mTBI symptoms and determining the appropriate intervention.

The concussion/mTBI algorithms are designed to accommodate patients entering the healthcare system at different intervals post-injury. Algorithm A (Initial Presentation) describes a new entry into the healthcare system and is not dependent on the time since injury. It does not follow the traditional acute, sub-acute, and post-acute phases of brain injury. This is particularly important with combat-related TBI that may inherently lead to delays in seeking treatment due to discounting or misattributing symptoms, and reluctance to report health problems. The initial management of symptoms related to concussion/mTBI is then described in Algorithm B (Management of Symptoms). Algorithm C (Follow-up Persistent Symptoms) will apply to any service person/veteran for whom treatment of concussion symptoms previously had been started.

1.5.1 Initial Stages following mTBI/Concussion

Example: Individual sustains a head injury and presents to a provider two weeks following the injury. The provider uses Algorithm A to diagnose concussion/mTBI, and Algorithm B to initiate the management of symptoms. If the symptoms do not remit within 4 to 6 weeks of the initial treatment, the provider follows Algorithm C to manage the persistent symptoms.

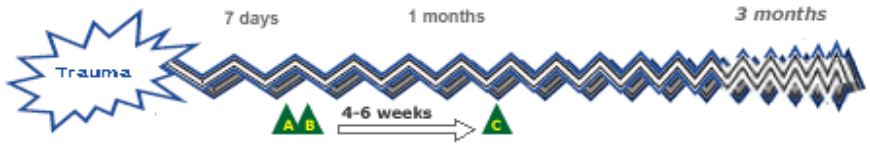


Figure 1. Initial Stages following mTBI/Concussion

1.5.2 Delayed Initial Presentation of Symptoms

Example: Individual sustains a head injury followed by experiencing of symptoms. The patient does not access medical care for weeks or months post-injury. Despite the long elapsed time since injury, the provider uses Algorithm A and B for the initial work-up to make the diagnosis and initiate treatment. This initial treatment may be provided in a setting designated for diagnosis and management of mTBI. If the symptoms do not remit within 4 to 6 weeks of the initial treatment, the provider follows Algorithm C to manage the persistent symptoms.

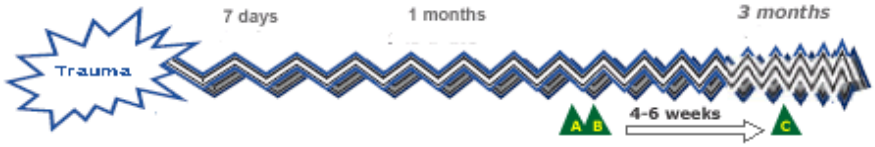


Figure 1. Delayed Initial Presentation of Symptoms

RECOMMENDATIONS

1. Service members or veterans identified by post deployment screening or who present with symptoms should be assessed and diagnosed according to ***Algorithm A – Initial Presentation***. The initial evaluation and management will then follow the recommendations in ***Algorithm B*** – Management ***of Symptoms***.
2. Patients who continue to complain of concussion/mTBI-related symptoms beyond 4 to 6 weeks after treatment has been initiated, should have the assessment for these chronic symptoms repeated and should be managed using ***Algorithm C – Follow-up Persistent Symptoms.***
3. Patients who continue to have persistent symptoms despite treatment for persistent symptoms (Algorithm C) beyond 2 years post-injury do not require repeated assessment for these chronic symptoms and should be conservatively managed using a simple symptom-based approach.
4. Patients with symptoms that develop more than 30 days after a concussion should have a focused diagnostic work-up specific to those symptoms only. These symptoms are highly unlikely to be the result of the concussion and therefore the work-up and management should not focus on the initial concussion.

DISCUSSION

Posttraumatic complaints after concussion/mTBI are not well understood. This ambiguity can be further attributed to: issues associated with delays in seeking treatment; providers' lack of knowledge about the detection and diagnosis of mTBI (CDC, 2003); symptom overlap with other diagnoses or conditions (Borg et al., 2004); patients seeking benefit from litigation claims (Binder & Rohling, 1996) or an underlying mood disorder (Rapoport et al., 2003). Unfortunately, there are no sensitive diagnostic tools or biochemical markers that correlate uniquely to concussion/mTBI symptom reports (Borg et al., 2004).

Several authors advocate use of standard criteria for defining mTBI. Indeed, in a review article, Kushner (1998) suggests that mild TBI can be misleading as a diagnostic term as it may include a spectrum of manifestations ranging from transient mild symptoms to ongoing disabling problems.

Symptomatic individuals will frequently present days, weeks, or even months after the trauma. These delays are associated with the injured person discounting symptoms, incorrectly interpreting symptoms, guilt over the circumstances involved in the injury, and denial that anything serious occurred (Mooney et al., 2005). Delay in seeking treatment may be important in mTBI recovery, where reports indicate that early interventions to reduce disability are most effective when provided during the initial post injury phase (McCrea, 2007).

Annotation A-7 *Is Person Currently On Treatment for mTBI Symptoms?*

1.6 Persistent Symptoms after Concussion/mTBI

BACKGROUND

Most symptoms and signs that occur in the acute period following a single concussion resolve quickly (within hours or days) after the injury. There is debate about the incidence of developing persistent symptoms after concussion, largely due to the lack of an accepted case definition for persistent symptoms and the fact that none of the symptoms are specific to concussion. There is no consensus on a case definition for persistent symptoms attributed to concussion/mTBI and no consensus on the time course when acute symptoms should be considered persistent. As a result, the important focus should be on treating the symptoms rather than on determining the etiology of the symptoms.

RECOMMENDATIONS

1. Persons who complain about somatic, cognitive or behavioral difficulties after concussion/mTBI should be assessed and treated symptomatically regardless of the elapsed time from injury.
2. The assessment of an individual with persistent concussion /mTBI related symptoms should be directed to the specific nature of the symptoms regardless of their etiology.
3. The management of an individual who has sustained a documented concussion/mTBI and has *persistent* physical, cognitive and behavioral symptoms after one month should not differ based on the specific underlying etiology of their symptoms (i.e., concussion vs. pain, concussion vs. stress disorder).
4. In communication with patients and the public, this guideline recommends using the term *concussion* or *history of mild-TBI* and to refrain from using the term 'brain damage'.

DISCUSSION

It can be difficult to clinically determine if symptoms are attributable to concussion. This difficulty is due to the subjective nature of these symptoms, the very high base rates of many of these symptoms in normal populations (Iverson, 2003; Wang, 2006), and the many other etiologies that can be associated with these symptoms. Common conditions that may present with similar symptoms include PTSD, depression, anxiety disorders, pain, other injuries, and disorders such as fibromyalgia, medical side-effects, and negative illness perceptions by patients (Iverson et al., 2007).

Since post-concussive symptoms may occur as non-specific responses to trauma, studies compare patients with concussions to patients with other types of trauma. Results are inconsistent. In a cross sectional study

of Vietnam veterans with a history of mild TBI compared with a history of other injuries, the prevalence of post-concussive symptoms were significantly higher in the mTBI group (Vanderploeg, 2007). Research has yielded inconsistent evidence about acute neuropsychological differences between patients with mTBI with PCS symptoms and controls (Landre 2006; Ponsford et al., 2000). Several studies have shown that persons with non-head traumas have similar rates of "post-concussion syndrome" or symptoms compared with persons with a concussions/mTBI, both in the acute period and out to 3 months post-injury. Therefore, not only are these symptoms non-specific responses to trauma, it is also unclear if timing of the onset of symptoms can be helpful in determining if they are due to the concussion (Boake et. al., 2005; Landre, 2006; McCauley, 2001; Meares et al., 2008).

Somatic, cognitive, and behavioral symptoms after concussion/mTBI rapidly resolve by 2 to 4 weeks in the majority of individuals (McCrea, 2003). "Post-concussion syndrome" (PCS) is a term frequently used to describe a constellation of symptoms that clinicians have described as occurring at least 1 to 3 months after concussion. The association of post-concussion syndrome with concussion has not met generally accepted epidemiological criteria for causation. There are two commonly used case definitions, one from the Diagnostic and Statistical Manual for Mental Disorders (DSM-IV-TR, 2000) and the other included in the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10). A study that directly compared the two definitions showed poor correlation between them and there was no way to determine which one is more accurate (Boake et al., 2004). Another study indicated that the ICD-10 definition "accurately classified" mTBI patients one month after the concussion injury, but was unable to after 3 months (Kashluba et al., 2000). Because symptoms of PCS are not specific to mTBI, the use of ICD-10 diagnostic criteria for PCS is problematic and may be misleading as it incorrectly suggests that the basis of PCS is a brain injury (Carroll et al., 2004).

The term post-concussion syndrome (PCS) is used in the literature for individuals who have persistent non-focal, neurologic symptoms (at least two). These are most commonly dizziness, headache, cognitive deficits (attention, memory, and judgment), behavioral changes (irritability, depression, nightmares) and/or sleep disturbance, at between one month (ICD-10, 1992) and three months (DSM-IV definition, 1994) post-mTBI. PCS is seen in between 15% (DSM-IV) to 50% (WHO-ICD-10) of persons with mTBI, depending on how it is defined (McCrea, 2003). Various studies of persisting symptoms have employed various symptom checklists rather than uniform criteria-based diagnoses. As a result, large differences are reported in the frequency of patients meeting the diagnostic criteria sets. Some have argued that the rate of 15percent, initially reported by many, is incorrect and argued that the more accurate rate may be closer to 3-5 percent (Iverson, 2007; McCrea, 2007).

Annotation A-8 *Provide Education and Access Information; Follow-Up as Indicated*

1.7 Follow-Up and Monitoring

It is important to closely monitor the injured person for concussion/mTBI related symptoms and provide supportive education over the initial 30 days. Individuals who sustain a concussion/mTBI and are asymptomatic can be reassured and advised about precautionary measures to prevent future head injury.

RECOMMENDATIONS

1. Individuals who sustain a concussion/mTBI and are asymptomatic should be reassured about recovery and advised about precautionary measures to prevent future head injury.
2. Patients should be provided with written contact information and be advised to contact their healthcare provider for follow-up if their condition deteriorates or they develop symptoms.
3. Individuals who sustain a concussion/mTBI and are asymptomatic should be screened for comorbid mental health disorders (MDD, PTSD, and SUD) and dangerousness.

B: Management of Concussion/mTBI Symptoms

Annotation B-1 *Person Diagnosed with Concussion/mTBI*

2 INITIAL PRESENTATION

The vast majority of individuals with concussion/mTBI will have no difficulties or complaints lasting more than a couple of weeks following the injury.

Although, early interventions have been shown to prevent symptoms, some persons sustaining a concussion/mTBI during deployment will not receive early diagnosis or will not seek treatment, and therefore their symptoms will be addressed only after a temporal delay. This guideline recommends that these individuals will be first treated following the algorithm and annotations in Algorithms A and B. If treatment has already been rendered for concussion/mTBI related symptoms and despite treatment the patient continues to experience symptoms, the management will follow recommendations in Algorithm C.

Patients managed in Algorithm B are service persons or veterans identified by post deployment screening, or who present to care with symptoms or complaints related to head injury.

Patients presenting for care immediately after head injury (within 7 days) should follow guidelines for acute management and should not use this algorithm. (See Annotation A-5 and A-6)

Annotation B-2 *Complete a History, Physical Examination; Minimal Mental Examination and Psychosocial Evaluation*

3 ASSESSMENT OF SYMPTOMS AND SEVERITY

3.1 History, Physical Examination, Laboratory Tests, Imaging

BACKGROUND

Although the initial part of the screening process for mild TBI depends on self-report, the second-level assessment relies on obtaining a careful detailed medical history, physical examination, and a psychosocial assessment. The goal of the assessment is to evaluate the symptoms in order to optimize care, to improve outcomes, and ultimately reduce disability following a concussion/mTBI. It is recognized that patients may not present for medical care immediately following concussion/mTBI. Therefore, the purpose of the assessment may vary slightly based on the timing of the presentation following injury. For patients presenting immediately after the injury event, assessment will include the necessity to rule out neurosurgical emergencies. In patients who present with delayed injury-to assessment intervals, the assessment will include confirmation linking the symptoms to the concussive event. Regardless of the time that has elapsed since injury, management should begin with the patient's first presentation for treatment.

3.1.1 History

Taking an accurate history is an essential part of the diagnostic work-up. The first and most critical step in the evaluation of persons with possible concussion symptoms should clearly characterize the initial injury and determine whether the symptoms are temporally related to the event characterized as a concussion/mTBI.

RECOMMENDATIONS

1. Individuals who are presumed to have symptoms related to concussion/mTBI or who are identified as positive for mTBI on the initial screening should receive specific assessment of their symptoms.
2. Medical history should include the following:
    a. Obtaining detailed information on the patient's symptoms and health concerns.

b. Obtaining detailed information of the injury event including mechanism of injury, duration and severity of alteration of consciousness, immediate symptoms, symptom course and prior treatment
c. Screening for pre-morbid conditions, potential co-occurring conditions or other psychosocial risk factors, such as substance use disorders that may exacerbate or maintain current symptom presentation (using standardized screening tools such as, PHQ-2, Audit-C, PTSD screen)
d. Evaluating signs and symptoms indicating potential for neurosurgical emergencies that require immediate referrals
e. Assessing of danger to self or others.

3. Patient's experiences should be validated by allowing adequate time for building a provider-patient alliance and applying a risk communication approach.

   (See Appendix B: Structured Interview for Collecting Head Trauma Event Characteristics)

DISCUSSION

- Clarifying pre-injury developmental, medical, neurological, psychiatric, academic, and employment histories are essential, particularly in regards to conditions that may influence recovery following mild TBI.
- Psychiatric and substance disorders, cranial and cervical trauma, and other primary neurological and somatic disorders may produce symptoms that overlap with those commonly produced by TBI.
- Persons sustaining concussion/mTBI are at risk for the harmful and potentially addictive use of alcohol, medication, and illicit drugs. Standardized screening instruments should be used to screen for these conditions. (See VA/DoD clinical practice guidelines for mental health disorders). A concussion is not a contraindication for referral to a substance abuse treatment program.

3.1.2 Physical Examination

RECOMMENDATIONS

2. The physical examination of the person sustaining a concussion/mTBI should focus on the following:
   a. A focused neurologic examination, including a Mental Status Examination (MSE), cranial nerve testing, extremity tone testing, deep tendon reflexes, strength, sensation, and postural stability (Romberg's Test, dynamic standing)
   b. A focused vision examination including gross acuity, eye movement, binocular function and visual fields/attention testing
   c. A focused musculoskeletal examination of the head and neck, including range of motion of the neck and jaw, and focal tenderness and referred pain.
3. The following physical findings, signs and symptoms ("Red Flags") may indicate an acute neurologic condition that requires urgent specialty consultation (neurology, neuro-surgical) :
   a. Altered consciousness
   b. Progressively declining neurological examination
   c. Pupillary asymmetry
   d. Seizures
   e. Repeated vomiting
   f. Double vision
   g. Worsening headache

h. Cannot recognize people or is disoriented to place
i. Behaves unusually or seems confused and irritable
j. Slurred speech
k. Unsteady on feet
l. Weakness or numbness in arms/legs.

3.1.3 Laboratory Tests

BACKGROUND

Because diagnostic and cognitive tests have limited ability to predict long-term outcomes for persons with concussion/mTBI, investigators are focused on searching for biochemical markers that may be useful in diagnosis and prognosis.

RECOMMENDATIONS

1. Laboratory testing is not necessary to confirm or manage symptoms associated with concussion/mTBI.
2. Laboratory testing may be considered for evaluating other non-TBI causes of the symptoms presented.
3. There is insufficient evidence to support the use of serum biomarkers for concussion/mTBI in clinical practice. [SR = I]

EVIDENCE STATEMENTS

Does research identify biomarkers that may be useful in the diagnosis and prognosis of concussion/mTBI?

Biomarker research has not identified markers with clinical utility in management of mTBI. The biomarker that has been most widely studied, S-100B, is only detectable in the first few hours after injury. The Working Group reviewed 30 studies that were identified by the search. Only 8 met the inclusion criteria and were utilized in the final analysis.

- Elevated S-100B has been associated with abnormal CT scans (Biberthaler, 2001), and prolonged duration prior to return to work (Stranjalis et al., 2004) but has also been detected in other types of trauma, soft tissue injuries, burns, and in vigorous physical activity (Mussack et al., 2003; Stalnacke et al., 2003).
- At this time, there is no consistent marker that is useful in the acute or post-acute periods for mTBI (Iverson et al., 2007).
- S-100B (corrected or uncorrected) and C-tau have not been shown to be predictive of the development of post-concussive syndrome (Bazarian et al., 2006; Bazarian et al., 2006). In addition, S-100B has not been shown to be related to the development of headaches at three months (Bazarian et al., 2006).
- Immediately following acute concussion/mTBI, a normal S-100B test (i.e., absent) in the absence of clinical findings of nausea, dizziness, neck pain, or vomiting correlates with absence of post-concussive syndrome at six months. (de Krujik et al., 2002).

3.1.4 Imaging

BACKGROUND

The role of neuroimaging in diagnosing concussion/mTBI continues to evolve and be debated in the literature. Various neuroimaging modalities can be employed in helping to identify structural neuropathology. Structural imaging modalities include Computed Tomography (CT) Scan, Magnetic Resonance Imaging (MRI) Diffusion Tensor Imaging (DTI). Functional imaging modalities include Single Photon Emission Computed Tomography (SPECT), Positron Emission Tomography (PET) and functional

MRI (fMRI). However, many of these modalities are still at the preliminary/research stage of development. Currently, CT scan is the modality of choice as a diagnostic tool for acute concussion/mTBI. The absence of abnormal findings on CT does not preclude the presence of concussion/mTBI.

RECOMMENDATIONS

1. A patient who presents with any signs or symptoms that may indicate an acute neurologic condition that requires urgent intervention should be referred for evaluation that may include neuroimaging studies.
2. Neuroimaging is not recommended in patients who sustained a concussion/mTBI beyond the emergency phase (72 hours post-injury) except if the condition deteriorates or red flags are noted.

DISCUSSION

Since neuroimaging studies are not necessary for all patients with concussion/mTBI beyond the acute phase, the Working Group did not review the literature regarding the use of neuroimaging in mTBI.

In general, structural imaging techniques play a role in acute diagnosis and management, while functional imaging techniques are being evaluated in an attempt to clarify the pathophysiology, symptom genesis and mechanism of recovery from concussion/mTBI (McAllister et al., 2001). The primary objective of the initial clinical evaluation of patients sustaining a concussion/mTBI is the immediate detection of any neurological deterioration. In particular, patients who exhibit a declining neurologic status, including progressive lethargy, pupillary dilatation, or focal neurologic deficit not explained by systemic sources, should have an urgent CT scanning and neurosurgical consultation. Patients with signs and symptoms indicating an acute neurologic condition should be referred for urgent evaluation

After a concussion/mTBI, there is a very small risk of intracranial hematoma. The presence of this potentially fatal complication may become apparent only after there is clinical deterioration. Consequently, a cranial CT may be utilized in the acute evaluation of concussion/mTBI to exclude the possibility of occult hematoma. Other imaging techniques may be used to investigate persistent symptoms and deterioration. The provider requires very clear decision rules for the appropriate use of a CT in the acute evaluation of concussion/mTBI.

3.2 Multiple Concussions

BACKGROUND

Some patients presenting for an initial evaluation may report a history of repeated concussions that have worsened their symptoms. The approach of symptom-based assessment and treatment of repeated concussion should be similar to the management of exposure to a single injury.

RECOMMENDATIONS

1. The management of a patient who has sustained multiple concussions should be similar to the management for a single concussion/mTBI. [SR = I]
2. The patient with multiple concussions and his/her family should be educated to create a positive expectation of recovery. [SR = I]

EVIDENCE STATEMENTS

Is there a difference in interventions in individuals with repeated concussion/mTBI?

Out of 17 studies identified by the initial search, 10 studies were included for further review of full text documents. Five of those studies met inclusion criteria for evaluating the effect of multiple concussions.

The evidence is inconsistent regarding whether or not cumulative concussions are associated with worse or longer recovery.

- Most studies are based on self-reported data of historical concussions. As a whole, many studies are difficult to interpret because of potential confounders. Some research tools have demonstrated subtle abnormalities in the presence of normal clinical presentations and

neuropsychological test performance. Two well-controlled studies of football concussions reached opposite conclusions regarding the cumulative impact of three or more concussions. The NCAA study (Guskiewicz et al., 2003) showed a dose response relationship in duration of neurocognitive recovery associated with multiple concussions in the acute period after injury, whereas the NFL study (Pellman et al., 2004) showed no such relationship.

- The literature is insufficient to conclude that there is an association between mild TBI and neurodegenerative disorders (e.g., Alzheimers disease) although there is evidence that patients with severe TBIs may have increased risk (Guskiewicz et. al., 2005; Mehta et al., 1999).
- History of prior head injury has been shown to be associated with poorer outcomes in terms of lingering symptoms (Binder, 1997; Ponsford et al., 2000).

Annotation B-3 *Clarify the Symptoms*

3.3 Assessment of Symptoms

BACKGROUND

Patients who have sustained a concussion/mTBI may complain about post-injury symptoms that can be grouped into three categories: physical, cognitive, and emotional/behavioral. (See Annotation A-4) The clinical presentation is expected to include at least some elements of the classic constellation of post-concussive symptoms and gradual, although sometimes incomplete, symptomatic improvement over time.

Although post-concussive symptoms (PCS) are most often discussed in the context of mTBI, these terms and their clinical referents are not synonymous with mTBI: mTBI describes a type of injury whereas the post-concussion symptoms describe a set of problems presumably resulting from the injury.

It is particularly important to define clearly the patient's symptoms, as well as the course and resolution (or lack thereof) of those symptoms since the time of injury. Documenting frequency and severity of symptoms is important to set a baseline for monitoring subsequent treatment efficacy or establishment of co-occurring conditions. (See Table B-1)

Patients should be asked about the impact of their symptoms on their daily function. Individuals with a concussion/mTBI are typically independent in basic activities of daily living (ADLs) (e.g., grooming, bathing, dressing, toileting, and mobility). However, a small minority of patients may present with problems in areas of instrumental ADLs (IADLs). These abilities may affect independent functioning in tasks such as driving, home management, childcare, financial management, and performance at work.

Patients with symptoms should be asked open-ended questions to allow them to describe their difficulties. Presenting patients with symptom checklists is not recommended, however these lists may be useful in documenting symptoms and symptom intensity.

Patient Perception of Symptoms

Patients should be given the opportunity to relate their experiences and complaints at each visit in their own way. Although time-consuming and likely to include much seemingly irrelevant information, this has the advantage of providing considerable information concerning the patient's intelligence, emotional make-up, and attitudes about their complaints. This also provides patients with the satisfaction that they have been "heard-out" by the clinician, rather than merely being asked a few questions and exposed to a series of laboratory tests.

As the patient relates the history, important nonverbal clues are often provided. The clinician should observe the patient's attitude, reactions, and gestures while being questioned, as well as his or her choice of words or emphasis. The impact from the symptoms may range from annoying to totally disabling and patient perceptions regarding the cause and impact are important to understand in managing the disorder. Stressors such as occupational and family issues should also be explored.

RECOMMENDATIONS

1. Self-reported symptomatology is an appropriate assessment of the patient's condition in concussion/mTBI when the history is consistent with having sustained an injury event and having a subsequent alteration in consciousness. [SR = C]
2. Assessment of the patient with concussion/mTBI should include detailed questioning about the frequency, intensity and nature of symptoms the patient experiences, and their impact on the patient's social and occupational functioning.
3. Assessment should include a review of all prescribed medications and over-the-counter supplements for possible causative or exacerbating influences. These should include caffeine, tobacco and other stimulants, such as energy drinks.
4. The patient who sustained a concussion/mTBI should be assessed for sleep patterns and sleep hygiene.
5. If the patient's symptoms significantly impact daily activities (such as child care, safe driving), a referral to rehabilitation specialists for a functional evaluation and treatment should be considered.

DISCUSSION

Clarify the Symptoms

Questions that may prompt patients to provide important attributes of their symptoms are summarized in the following table.

Table B-1. Clarification of Symptoms

Symptom Attributes	Questions
Duration	o Has the symptom existed for days, weeks, or months? o Has the symptom occurred only intermittently? o Particularly with regard to pain and fatigue, can the patient define if these symptoms occurred only two or three days per month or constantly? o Is the symptom seasonal? o Are there times of the day when the symptom is worse?
Onset	o Can the patient recall exactly how the symptom began? o Were there triggering events, either physical or emotional? o Was the onset subtle and gradual, or dramatic and sudden? o Have the triggering events tended to be the same over time or are there changing patterns?
Location	o Is the symptom localized or diffuse? o Can the patient localize the symptom by pointing to it? o If the pain is diffuse, does it involve more than one body quadrant?
Co-morbidity	o Does the patient have any diagnosed co-existing illnesses? o What is the time relationship between the onset and severity of the co-existing illnesses and the symptoms of fatigue and/or pain? o What are the symptoms other than pain and/or fatigue? o Are there co-morbid diagnoses? o Are there changes in the patient's weight, mood, or diet?
Previous episodes	o If the symptoms are episodic, what is the pattern in regard to timing, intensity, triggering events, and response to any prior treatment?
Intensity and impact	o How severe are the symptoms (use the 1 to 10 Numerical Rating Scale) o Ask the patient to describe any new limitations they have experienced compared to their usual life-style, including limitations in physical endurance or strength (e.g., climbing stairs, shopping, and amount or quality of their sleep).
Previous treatment and medications	o Exploring this aspect of the history may be complicated and require obtaining prior medical records, or having an authorized telephone conversation with the prior treating clinician. o Ask the patient to bring in their medication bottles on a subsequent visit and document the exact names of the medications. o Find out which medications have/have not been helpful.
Past medical, surgical and psychological history	o This area includes chronic and major acute illnesses and injuries, allergies, surgical procedures, and hospitalizations. The psychological history may take several visits to clarify, depending upon the ease with which the patient can articulate their emotional status and past and present issues. Explore stressors such as occupational and family issues.
Patient perception of symptoms	o Often omitted from the history-taking are questions designed to gain some understanding of what the patient believes is happening. Ask the patient about their hunches and fears.

EVIDENCE STATEMENTS

Is there a relationship between self-awareness and response to treatment of cognitive and psychological deficits in individuals with concussion/mTBI?

Out of 40 studies identified in the initial search addressing self-reporting in mTBI, seven studies were found relevant to mild-TBI and of scientific quality.

Unlike patients with more severe TBI, patients with concussion/mTBI are aware of their symptoms and can report these to providers. However, symptom-reporting is subjective by nature, and some patient reporting may not correspond with observed or objective findings.

- Use of self-reported symptomatology in post-concussion/mTBI is an appropriate assessment methodology, although comorbid mental health or socio-economic status conditions can undermine its reliability (Dirette et al., 2007; Gunstad & Suhr., 2001; Malec et al., 2007; Stulemeijer et al., 2007; Uomoto et al., 2004). (SR = C)
- Mild TBI is not associated with any reduced awareness of symptoms or problems (Dirette et al., 2007; Malec et al., 2007; Pagulayan et al., 2007; Stulemeijer et al., 2007; Uomoto et al., 2004)
- Some individuals with mTBI over-report symptoms. Over-reporting is associated with comorbid mental health conditions and lower levels of education (Gunstad & Suhr., 2001; Stuhlemeijer et al., 2007; Uomoto et al., 2004).
- Self-reported cognitive complaints are more strongly related to premorbid traits and physical and emotional state factors than to actual cognitive impairments (Gunstad & Suhr., 2001; Stulemeijer et al., 2007; Uomoto et al., 2004).

Annotation B-4 *Build Therapeutic Alliance*

BACKGROUND

Interactions with patients/ families that involve real or suspected mTBI may be highly emotional, with reactions ranging from disbelief to anger to frustration to relief. Some patients will present with diagnosable symptoms, while others may believe they're suffering from mTBI when subsequent medical assessments may indicate otherwise. In both situations, medical staffs face the difficult challenge of effectively communicating the diagnosis, treatment, and prognosis for recovery to patients/ families, while minimizing and/or avoiding undue anxiety.

The information provided by medical personnel to individuals who have experienced a concussion/mTBI can either amplify and increase their symptoms and distress (iatrogenic factors), or can minimize and normalize their symptoms and reduce distress.

The lack of a definitive diagnosis or single effective treatment can make the management of patients with concussion/mTBI symptoms challenging and may also cause frustration for both the patient and the provider. To counter this, a high level of patient trust and faith in the clinician is required in order to maintain continuity of care and continue patient management through regular follow-up appointments. A therapeutic alliance between the patient and clinician should be established during the initial evaluation.

Risk communication approaches include:

1. **Caring and empathy**, including perceived sincerity, ability to listen, and to see issues from the perspective of others. Of the four factors, patient perceptions of caring and empathy are the most important.
2. **Competence and expertise**, including perceived intelligence, training, experience, education level, professional attainment, knowledge, and command of information. These are the easiest factors to establish because health care providers are automatically perceived by the public to be credible sources of information.

3. **Dedication and commitment**, including perceived altruism, diligence, self-identification, involvement, and hard work. Perceptions of dedication and commitment are influenced by patient perceptions of the health care provider's hard work in the pursuit of health goals.
4. **Honesty and openness**, including perceived truthfulness, candidness, fairness, objectivity, and sincerity. Perceptions of this factor result from both nonverbal cues (i.e., posture, eye contact, facial expressions, interruptions, indirect language) and language that convey sincerity and concern. Sensitivity to nonverbal cues is especially invaluable in ultimately understanding and communicating effectively with the patient and their family.

Useful strategies to strengthen the partnership with the patient:

- Acknowledge and indicate commitment to understand the patient's concerns and symptoms
- Encourage an open and honest transfer of information that will provide a more comprehensive picture of the patient's concerns and medical history
- Present information regarding a positive outcome and symptom remission to create an expectation of recovery
- Indicate commitment to allocate sufficient time and resources to resolving the patient's concerns
- Avoid open skepticism or disapproving comments in discussing the patient's concerns
- At each patient visit, the clinician should consider the following:
  - Ask if there are unaddressed or unresolved concerns
  - Summarize and explain all test results
  - Schedule follow-up visits in a timely manner
  - Explain that outstanding or interim consultations will be reviewed during the follow-up visits
  - Offer to include the concerned family member or significant other in the follow-up visit.

Research has shown that the quality of health care provider-patient communications can critically influence the quality of life for patients and families, as well as patient health outcomes. Risk communication techniques (See Appendix C: Health Risk Communication***)*** have been demonstrated as effective for providers in communicating with patients with diagnosed or suspected concussion/mTBI and their families. Regardless of the diagnosis, medical staff must communicate "bad news" in a manner that clearly communicates the necessary medical information, while balancing the physical, emotional, and social needs of the patient/ family. The ability to do this successfully requires excellent and well-practiced risk communication skills. It is important to note that even when risk communication is effective, not all conflicts can be resolved.

Annotation B-5 *Determine Treatment Plan*

4 TREATMENT

4.1 Treatment Plan

BACKGROUND

After the screening, assessment, and diagnosis of concussion/mTBI are completed decisions are made about treatment. Treatment for patients with concussion/mTBI focuses on symptom management and education of patient and family. Education should emphasize recovery, gradual resumption of work and social responsibilities, and teaching compensatory strategies and environmental modifications. Most patients with symptoms following a single concussion/mTBI of recent onset can be successfully managed in the primary care setting without the need for specialty intervention.

Patients should be encouraged to implement changes in life-style including exercise, diet, sleep hygiene, stress reduction, relaxation training, scheduling leisure activities and pacing to improve treatment outcomes.

RECOMMENDATIONS

1. Develop and document a summary of the patient's problems.
2. Develop a potential treatment plan that includes severity and urgency for treatment interventions.
3. Discuss with the patient the general concept of concussion sequelae, treatment options and associated risk/benefits and prognosis of illness to determine the patient's preferences.
4. Emphasizing good prognosis and empowering the patient for self-management,
5. Implement the treatment plan and follow up.
6. Referral to specialty care is not required in the majority of patients with concussion/mTBI, if their symptoms resolve in the early post acute recovery period as expected.
7. Treatment should be coordinated and may include consultation with rehabilitation therapists, pharmacy, collaborative mental health, and social support.

DISCUSSION

The need for a consistent and cohesive approach by an interdisciplinary team is paramount when treating persons with the cognitive and behavioral impairments that can occur with concussion/mTBI. The interdisciplinary team is made up of practitioners from multiple disciplines that function collaboratively to achieve common objectives. The team determines specific interventions based on analysis of the assessment information with feedback from all team members including the patient and caregiver(s). Interventions are formalized into an individualized plan of care with specific long-term goals, short-term objectives. Both the persons with concussion/mTBI and their support system should be active participants in the process of developing and reviewing the treatment plan.

Role of the Provider in the Initial Care Setting

The provider in the initial setting of care should develop a problem list that summarizes the patient's problems. The provider should determine the severity of each identified problem and the impact it will have on the patient's functional ability and quality of life, so that a baseline can be established against which improvements can be assessed. The provider should also identify problems for which treatment is most urgently recommended. The most urgent treatments may be defined as those treatments expected to result in the greatest improvement when addressing the most severe problems.

Treatment Interventions

Cost-effective interventions (e.g., giving the patient an information booklet about symptoms and coping strategies, a telephone follow-up, or "as-needed services") were effective in alleviating chronic symptom development (Mittenberg et al., 1996; Paniak et al., 2000; Ponsford, 2005). Still, other healthcare professionals suggest that cognitive rehabilitation and emotional support are likely to improve the outcomes for persons with mTBI (Paniak et al.; Tiersky et al., 2005).

Cicerone and associates' review (2005) found that neuropsychological rehabilitation therapies involving combination therapies for persons with cognitive, emotional, interpersonal, and motivational deficits are usually focused on those with moderate to severe brain trauma. Although there is evidence that rehabilitation is beneficial for improving community integration and return to work for persons with moderate-to-severe injuries, this evidence is *not* available for those with milder injuries. Research concerning optimal treatment for those with mTBI suggests that less expensive approaches may be effective and that the more comprehensive, multidisciplinary treatment should be targeted toward those with pre-injury psychiatric problems (Ghaffar et al., 2006).

Annotation B-6 *Educate Patient/Family on Symptoms and Expected Recovery of Concussion/mTBI*

4.2 Early Education

BACKGROUND

Education provided to patients and their support system about the nature and common manifestations of concussion/mTBI is a critical aspect of intervention. Communication of health information from providers helps manage patient expectations and can prevent the development of concussion/mTBI symptoms and/or reduce their duration, number, and severity. It is generally recommended that the initial educational intervention occur at the time of establishing the concussion/mTBI diagnosis. Follow-up education should take place at intervals and in a format that is appropriate to the treatment and services provided. Additionally, the patient's learning needs, reading skills, vision or hearing difficulties, cultural and religious beliefs, and emotional or cognitive limitations should be taken into consideration when delivering educational information.

Components of Patient Education

- *Provision of information about concussion/mTBI*
- *Strategies for prevention of further injury*
- *Education/normalization*
- *Awareness of limitation*
- *Self-monitoring of symptoms*
- *Contact information.*

RECOMMENDATIONS

1. Patients who sustain a concussion/mTBI should be provided with information and education about concussion/mTBI symptoms and recovery patterns as soon as possible after the injury. Education should be provided in printed material combined with verbal review and consist of:
    a. Symptoms and expected outcome [SR = A]
    b. Normalizing symptoms (education that current symptoms are expected and common after injury event) [SR = A]
    c. Reassurance about expected positive recovery [SR = A]
    d. Techniques to manage stress (e.g., sleep education, relaxation techniques; minimize consumption of alcohol, caffeine and other stimulants). [SR = B]
2. Information and education should also be offered to the patient's family, friends, employers, and/or significant others.
3. Symptomatic management should include tailored education about the specific signs and symptoms that the patient presents and the recommended treatment.
4. Patients should be provided with written contact information and be advised to contact their healthcare provider for follow-up if their condition deteriorates or if symptoms persist for more than 4-6 weeks. [SR = B]

RATIONALE

Fears and misconceptions of the injury and its sequelae can amplify or sustain symptoms and result in poor outcomes. The observation that patients respond positively across most symptom domains to appropriate

information and reassurance given shortly after injury, suggests that an early educational intervention can speed the recovery and decreases the severity of post concussion symptoms.

EVIDENCE STATEMENTS

Does early intervention education decrease the incidence and severity of chronic concussion/mTBI symptoms and lead to better outcomes?

The Working Group reviewed abstracts of nineteen articles published since 2002. One systematic review of randomized trials and one individual study assessing the efficacy of early education that were not included in the WHO task force project were identified. In the final analysis, based on two systematic reviews (Borg 2004, Comper 2005), there is strong evidence to recommend early educational intervention for patients with concussion/mTBI.

- Borg (2004) in assessing the WHO findings referenced five studies (Paniak et al, 1998, Paniak et al 2000, Wade et al 1997, Wade et al., 1998; Mittenberg 1996) that supported the idea that a single session intervention was as effective as more elaborate assessments and interventions. The WHO Task Force did not find strong evidence that any non-surgical treatment has a clinically important effect on symptoms or disability after mTBI but that a few studies on early intervention provided some evidence that early, limited, educational intervention reduces long-term complaints. The task force recommended that early, structured, educational information in connection with acute care or within one week after should be provided to patients with uncomplicated mTBI; information about the injury, about common complaints and how to cope with them, reassurance about a good outcome, and information on how to get access to further support when needed should be included and these patients should be encouraged to become active as soon as possible after their injury.
- Comper (2005) in a systematic review included seven trials (Paniak 1998, 2000, Hinkle 1986, Mittenberg, 2001, Ponsford, 2002, Wade 1997, 1998) assessing the efficacy or information provision intervention. The review found that there is sufficient evidence to support patient-centered interaction and the provision of symptom-related information through treating practitioners as effective in assisting individuals in their recovery from concussion/mTBI. The three studies that compared minimal and intensive education interventions found consistent evidence that brief educational and reassurance-oriented intervention is as effective as a potentially more intensive and expensive educational model. The four studies that compared an educational intervention to usual hospital services found that patients who received an enhanced level of care including print educational materials experienced fewer or less severe PCS symptoms and less disruption of social and functioning ability than patients who received usual hospital care. In most studies, simple education and support appeared to benefit individuals with concussion/mTBI with respect to somatic and psychological complaints.
- Provision of educational information regarding the common symptoms of mTBI and the expected and typical positive prognosis, reduces symptom intensity and duration (Mittenberg et al., 1996; Ponsford et al., 2002).
- Printed educational material alone may not be helpful (Gronwall, 1986), but printed material combined with verbal review has been shown in multiple studies to be helpful.
- Teaching stress and symptom self-management techniques may be useful in reducing symptom intensity and duration, particularly in combination with other educational and normalization interventions (Mittenberg et al., 1996).

Annotation B-7 *Provide Early Interventions*

4.3 Provide Early Intervention

BACKGROUND

Concussion/mTBI can significantly impact some patients' physical, mental and social well-being. Treatment should address these three main areas. Initial interventions expected to improve physical well-

being include education, improved sleep habits, a graduated exercise regimen (monitored through physical therapy, exercise trainers, and social supports), and medication (monitored by a clinician). Mental well-being may be improved through stress relief and relaxation, medication, and creating a supportive social network. Social well-being may be improved through resolving legal, financial, occupational, or recreational problems.

RECOMMENDATIONS

1. Provide early intervention maximizing the use of non-pharmacological therapies:
    a. Review sleep patterns and hygiene and provide sleep education including education about excess use of caffeine/tobacco/alcohol and other stimulants
    b. Recommend graded aerobic exercise with close monitoring.

4.4 Return to Activity (Duty/Work/School/Leisure)

BACKGROUND

A successful treatment outcome for a patient who has sustained a concussion is the return to duty/work/school or other usual daily activities. Part of the early intervention for concussion/mTBI involves protecting the patient from a secondary insult or further injury by limiting or eliminating their duty status or job requirements until proper recovery is obtained. Although rare, the possibility of second impact syndrome must be prevented by altering a concussed patient's vocational duties when they are high risk for re-injury. Exertional testing prior to the return to work or military duty may help to ensure adequate resolution of symptoms in a high stress state or combat environment.

Return to activity assessment is based on an inventory of symptoms and their severity and the patient's job-specific tasks. With the exception of those activities and duties that are characterized as high-risk for repeat concussions, all individuals with concussion/mTBI should be encouraged to expediently return to activity at their maximum capacity.

Activity restrictions are an important part of the treatment regimen for patients with concussion/mTBI. *Activity* restriction *does not imply complete bed rest but rather a restful pattern of activity throughout the day with minimal physical and mental exertion.*

RECOMMENDATIONS

1. Immediately following any concussion/mTBI, individuals who present with post-injury symptoms should have a period of rest to avoid sustaining another concussion and to facilitate a prompt recovery.
2. Individuals with concussion/mTBI should be encouraged to expediently return to normal activity (work, school, duty, leisure) at their maximal capacity.
3. In individuals who report symptoms of fatigue, consideration should be given to a graded return to work/activity.
4. In instances where there is high risk for injury and/or the possibility of duty-specific tasks that cannot be safely or competently completed, an assessment of the symptoms and necessary needs for accommodations should be conducted through a focused interview and examination of the patient.
5. If a person's normal activity involves significant physical activity, exertional testing can be conducted that includes stressing the body.
6. If exertional testing results in a return of symptoms, a monitored progressive return to normal activity as tolerated should be recommended.
7. Individually based work duty restriction should apply if:
    - There is a duty specific task that cannot be safely or competently completed based on symptoms
    - The work/duty environment cannot be adapted to the patient's symptom-based limitation
    - The deficits cannot be accommodated

- Symptoms reoccur.

RATIONALE

There is limited utility in using the sports related return to play guidelines or research to make return to work determinations. The purpose of most sport studies is to predict subsequent concussion rather than recovery of symptoms or health outcomes. In the sports arena, there is an opportunity to observe the concussion and continuously monitor the players including access for pre- and post-injury function assessment. The uniqueness of these characteristics does not allow generalizing the conclusions of sport research to the clinical setting.

In the lack of evidence, the Working Group concluded that with the exception of those individuals returning to activity/duty with a high repeat concussion risk, all individuals with concussion/mTBI should be encouraged to expediently return to work at their maximal capacity.

Return to activity assessment is based on an inventory of symptoms and job-specific tasks. There is no available research to support the validity or utility of physical, cognitive or behavioral stress testing as a predictor of ability to return to activity/duty following concussion/mTBI. Physical exertional testing for evaluating readiness has not been shown to cause harm in patients with concussion/mTBI.

EVIDENCE STATEMENTS

What are the key factors in successful return to work in individuals with concussion/mTBI?

There has been no research evidence that early return to work after concussion/mTBI with or without symptoms is detrimental. Most of the literature regarding criteria for return to activities after concussion has been focused on sports medicine and return to play. Sports organizations have developed return to play guidelines, however these were consensus based. Research evidence supports that a sports-specific stepwise return to play program after resolution of symptoms is recommended in sports concussion (Kissick & Johnston, 2005].

- Current guidelines for grading sports-related concussions base their return-to-play recommendations largely on two parameters: the severity of the injury and the patient's history of concussion.
- The two most widely used guidelines are those of the American Association of Neurological Surgeons (AANS) and those of Cantu. Both guidelines use a grading system to assess the injury severity that takes into account the nature and duration of key injury characteristics. Concussion is graded as I (mild), II (moderate), and III (severe). The AAN guidelines emphasize the qualitative importance of loss of consciousness (LOC), whereas Cantu guidelines (1986; 1998) distinguish between brief and extended LOC, and draw attention to the duration of posttraumatic amnesia.
- According to the Cantu Guidelines, athletes with Grade I concussions may return to play if no symptoms are present for one week.
- Grade II concussion involves loss of consciousness for less than five minutes or exhibit posttraumatic amnesia between 30 minutes and 24 hours in duration. Players who sustain this grade of concussion may also return to play after one week of being asymptomatic.
- Grade III concussions involve posttraumatic amnesia for more than 24 hours or unconsciousness for more than five minutes. Players who sustain this grade of concussion should be sidelined for at least one month, after which they can return to play if they are asymptomatic for one week.
- The guideline recommendation for complete cessation of symptoms before return-to-play is not based on evidence of harm in those who continue to play with persistent symptoms, nor is it based on evidence of lack of harm in athletes who play after their symptoms have completely resolved (Peloso et al., 2004).
- Following repeated concussions, a player should be sidelined for longer periods of time and possibly not allowed to play for the remainder of the season.

Annotation B-8 *Initiate Symptom-Based Treatment Modalities*

5 SYMPTOM MANAGEMENT

Concussion/mTBI is associated with a variety of symptoms that will manifest immediately following the event, and may resolve quickly, within minutes to hours after the injury event, or they may persist longer. Signs and symptoms may occur alone or in varying combinations and may result in functional impairment.

The most typical signs and symptoms following concussion include:

a. Physical: headache, nausea, vomiting, dizziness, fatigue, blurred vision, sleep disturbance, sensitivity to light/noise, balance problems, transient neurological abnormalities
b. Cognitive: attention, concentration, memory, speed of processing, judgment, executive control
c. Behavioral/emotional: depression, anxiety, agitation, irritability, impulsivity, aggression.

There is a complex relationship among concussion/mTBI symptoms (sleep, headache, cognition, and mood) and it is clinically reasonable to expect that alleviating/improving one symptom may lead to improvement in other symptom clusters. The presence of comorbid psychiatric problems such as a major depressive episode, anxiety disorders (including post-traumatic stress disorder [PTSD]), or substance use disorder (SUD) – whether or not these are regarded as etiologically related to the concussion/mTBI – should be treated aggressively using appropriate psychotherapeutic and pharmacologic interventions.

The expected outcome of intervention should be to improve the identified problem areas, rather than discover a disease etiology or "cure." The persistence of some concussion related symptoms despite the effective treatment for others does not necessarily suggest treatment failure, but may instead indicate the need for additional therapies targeting specific residual symptoms.

The following recommended interventions focus on initial management of the physical, cognitive and behavioral symptoms. Patients with symptoms that persist despite these initial treatment interventions should be managed using **Algorithm C: Follow-up Persistent symptoms**

5.1 Physical Symptoms

BACKGROUND

For purposes of this guideline, physical complaints include headache, pain, sleep disturbances, dizziness, coordination issues, nausea, numbness, smell/taste, vision difficulties (photophobia, phonophobia), hearing difficulties, fatigue, and appetite disturbances. In the majority of cases, these symptoms are markedly improved or have disappeared within 3 months after the injury.

RECOMMENDATIONS

1. Initial treatment of physical complaints of a patient with concussion/mTBI should be based upon a thorough evaluation, individual factors and symptom presentation.
2. The evaluation should include:
    a. Establishing a thorough medical history, completing a physical examination, and review of the medical record (for specific components for each symptoms see Table B-2 Physical Symptoms-Assessment)
    b. Minimizing low yield diagnostic testing
    c. Identifying treatable causes (conditions) for patient's symptoms
    d. Referring for further evaluation as appropriate.
3. The treatment should include:

a. Non-pharmacological interventions such as sleep hygiene education, physical therapy, relaxation and modification of the environment (for specific components for each symptoms see Table B-3 Physical Symptoms-Treatment)
b. Use of medications to relieve pain, enable sleep, relaxation and stress reduction.

4. A consultation or referral to specialists for further assessment should occur when:
   a. Symptoms cannot be linked to a concussion event (suspicion of another diagnosis)
   b. An atypical symptom pattern or course is present
   c. Findings indicate an acute neurologic condition that requires urgent neurologic/neuro-surgical intervention (see Section 3.1.2 – Physical Examination)
   d. There are other major co-morbid conditions requiring special evaluation.

EVIDENCE STATEMENTS

- The WHO task force did not find strong evidence that any non-surgical treatment has a clinically important effect on symptoms or disability after mTBI (Borg, 2004). The review of the literature since the report of the WHO task force did not reveal any research evidence to support the role of specific interventions to improve any of the somatic (physical) complaints after concussion/mTBI.
- Self reported symptoms are common after concussion/mTBI; however there is little consistency in findings about how long such symptoms persist. The stronger studies of mTBI that use appropriate control groups and consider the effects of other non-mTBI factors generally show resolution of symptoms within weeks or a few months (Holm, 2005).
- Several uncontrolled and/or observational studies found the following physical symptoms are reported by persons after a concussion/mTBI:
  - Headache (See Appendix D)
  - Dizziness (Ernst et al., 2005; Hoffer et al., 2004; Staab et al., 2007) - Acute and persistent. [SR = I] (See Appendix D)
  - Upper and lower extremity coordination (Catena et al., 2007; Heitger et al., 2006; Parker et al., 2006) - Acute and persistent. [SR=I] (See Appendix D)
  - Sleep (Chaput et al., 2007; Mahmood et al., 2004; Oullette et al., 2006), acute and persistent [SR = C] (See Appendix D)
  - Fatigue (Borgaro et al., 2005; Stulemeijer et al., 2006), persistent [SR = I] (See Appendix D)
  - Hearing: Persistent [SR=C]
    - Hyperaccusis, tinnitus, auditory acuity deficits, auditory processing disorders (Nolle, 2004)
  - Vision:
    - Visual tracking (saccades) (Dehaan et al., 2007; Heitger et al., 2004; Suh et al., 2006; Suh et al., 2006), acute and persistent [SR = C]
    - Visual attention (Dehaan et al., 2007; Halterman et al., 2006; Tinius et al., 2003), acute and persistent [SR = C]
- There is inconsistent evidence to support the association of concussion/mTBI with the following symptoms during the initial presentation for post-concussive symptoms, although some patients may still report them:
  - Numbness

  - Appetite disturbance
  - Nausea
  - Smell
- Research evidence supports that auditory symptoms may improve more rapidly than physiologic measures of auditory function (Nolle et al., 2004).
- Multiple non-TBI related factors can also be associated with above symptoms:
  - Sleep (Chaput, et al., 2007; Oullette et al., 2006)
  - Vision (Heitger et al., 2004)
  - Fatigue (Stulemeijer et al., 2006; Ziino et al., 2005)

Table B-2. Physical Symptoms – ASSESSMENT

Common Symptoms Following Concussion/mTBI *	Meds Review	Assess for HTN	Physical Examination					Sleep Review	Depression Screen	Differential Diagnoses Include:
			GI	Neuro	Musc	Vision	Otological			
Headaches	√	√		√	√	√	√	√		*Pre-existing headache disorder (migraine, tension)* *Cervical spine or musculature abnormality or pain* *CSF leak or pressure abnormality* *Sinus infection* *Visual acuity issues (needs glasses)*
Feeling dizzy - Loss of balance - Poor coordination - Clumsy	√			√	√	√	√			*Inner ear infection* *Labyrinthitis* *CSF leak or pressure abnormality* *Meniere's disease* *Orthostatic hypotension* *Central medication effect*
Nausea	√		√		√	√	√			*GI ulcer* *GERD* *Medication effect*
Change in appetite	√		√							*Nasal polyps* *Sinus infection* *Traumatic injury to olfactory or lingual nerves*
Sleep disturbance - Difficulty falling or staying a sleep (insomnia)	√							√	√	*Behavioral health issues* *Sleep disorders* *Pain*
Vision problems - Blurring - Trouble seeing - Sensitivity to light	√				√	√	√	√		*Retinal detachment* *Traumatic injury to lens* *Corneal abrasion* *Optic nerve damage*
Hearing difficulty - Sensitivity to noise	√						√			*Inner ear infection* *Ear drum inflammation* *Ear drum injury* *Traumatic auditory nerve injury*

* Other less common symptoms following concussion/mTBI include:
- **Numbness or tingling on parts of the body** – Review of medications, neurological exam and EMG to rule out *stroke, multiple sclerosis, spinal cord injury, peripheral neuropathy, or thoracic outlet syndrome*
- **Change in taste and/or smell** – neurological exam to rule out nasal polyps, sinus infection, or traumatic injury to olfactory or lingual nerves

Table B-3. Physical Symptoms – TREATMENT

Common Symptoms Following Concussion/mTBI	Pharmacologic Treatment	Non-Pharmacologic Treatment
Headaches	- Non narcotic pain meds - NSAIDs - Triptans (migraine type)	- Sleep hygiene education - Physical therapy - Relaxation
Feeling dizzy	- Antibiotics, decongestants for infections and fluid	- -
Loss of balance **Poor coordination**	-	- Physical therapy
Nausea	- Antiemetics	- Sleep hygiene education
Change in appetite	-	-
Sleep disturbances - Difficulty falling or staying asleep (insomnia)	- Sleep Medications	- Sleep hygiene education
Vision problems - Blurring - Trouble seeing - Sensitivity to light	-	- Sleep hygiene education - Light desensitization - Sunglasses
Hearing difficulty - Sensitivity to noise	-	- Environmental Modifications

5.2 Cognitive Symptoms

BACKGROUND

Although initial cognitive complaints and problems are common in the first hours and days after a concussion/mTBI, the vast majority of individuals recover within one to four weeks. Early psychoeducational, supportive, and stress management interventions have been shown to increase rate and extent of recovery from somatic, cognitive and behavioral symptoms. As rapid recovery is expected, patients should always be provided with positive expectations.

See Table B-4: Behavioral and Cognitive Symptoms – ASSESSMENT and B-5: Behavioral and Cognitive Symptoms – TREATMENT

RECOMMENDATIONS

1. All individuals who sustain a concussion/mTBI should be provided with information and education about concussion/mTBI symptoms and recovery patterns as soon as possible after the injury [SR = A] (See Early Education, Section 4.2)
2. A patient sustaining a concussion/mTBI should be evaluated for cognitive difficulties using a focused clinical interview. [SR = C]
3. Comprehensive neuropsychological/cognitive testing is not recommended during the first 30 days post injury. [SR = D]
4. If a pre-injury neurocognitive baseline was established in an individual case, then a post injury comparison may be completed by a psychologist but should be determined using reliable tools and test-retest stability should be ensured. [SR = B]

EVIDENCE STATEMENTS

Are there cognitive rehabilitation techniques that have been shown to result in better outcomes in individuals with concussion/mTBI?

The working group reviewed 23 studies related to cognitive factors associated with concussion/mTBI that were published after 2002. However, none were found acceptable for the purpose of this guideline. Most addressed patients with moderate or severe TBI, or did not provide evidence related to the question. Several older studies that are included were referenced in the systematic review published by Comper et al., (2005) and three meta-analyses (Belanger et al., 2005; Belanger & Vanderploeg, 2005; Schretlen & Shapiro, 2003).

- Under standardized and controlled conditions and using reliable instruments, initial cognitive decline and subsequent recovery have been demonstrated by comparing base-line assessment to post-injury assessment of cognitive performance in athletes (Macciocchi et al., 1996; McCrea et al., 2003; McCrea et al., 2002).
- There is good evidence from three meta-analyses that cognitive performance declines in the immediate period after a concussion/m/TBI injury (initial 7-30 days). Studies have demonstrated initial cognitive impairments using standardized and valid measuring instrument (Belanger et al., 2005; Belanger & Vanderploeg, 2005; Schretlen & Shapiro, 2003).
- Cognitive impairment in the initial 7 – 30 days has been demonstrated in the following domains; memory, complex attention or working memory, and speed of mental and motor performance (including verbal and non-verbal generative tasks) (Belanger et al., 2005; Belanger & Vanderploeg, 2005).
- Group data shows resolution of cognitive problems in most patients in 7 –30 days after injury (Belanger et al., 2005; Belanger & Vanderploeg, 2005; Schretlen & Shapiro, 2003).
- Some studies show that a subgroup of individuals continue to have both subjective symptoms (Alves et al., 1993; Deb et al., 1999; Dikmen et al., 1986; Hartlage et al., 2001; Luis et al., 2003; Powell et al., 1996) and lower cognitive test performance even after 90 days (Belanger et al., 2005; Binder et al., 1997; Vanderploeg et al., 2005).

- In the acute phase of recovery brief psychoeducational, supportive, stress management, and/or cognitive-behavioral interventions have consistently been shown to result in improvement in subjective complaints including cognitive issues (Anson & Ponsford, 2006; Bédard et al. 2002, Mittenberg et al., 1996, Hinkle et al., 1986; Comper et al., 2005)
- The relationship between subjective complaints and test performance is complex. There is more correlation in the acute phase than post-acute phase.
- There is limited evidence for the diagnostic validity of cognitive testing and other diagnostic tools for mild traumatic brain injury (Cassidy et al., 2004).

5.3 Behavioral Symptoms

BACKGROUND

Depending upon diagnostic criteria (ICD-9 versus DSM-IV) the following behavioral or personality changes may be considered part of the post-concussion syndrome: irritability, depression, anxiety, emotional lability, fatigue, insomnia, reduced alcohol tolerance, personality changes such as increases in socially inappropriate behaviors, and apathy or lack of spontaneity. Anxiety and depression and other mental health problems also have been associated with concussion/mTBI.

The presence of comorbid psychiatric problems such as a major depressive episode, anxiety disorders (including post-traumatic stress disorder), or substance abuse – whether or not these are regarded as etiologically related to the mild TBI – should be treated aggressively using appropriate psychotherapeutic and pharmacologic interventions.

See Table B-4: Behavioral and Cognitive Symptoms – ASSESSMENT and B-5: Behavioral and Cognitive Symptoms – TREATMENT

RECOMMENDATIONS

1. Patients with concussion/mTBI should be screened for psychiatric symptoms and co-morbid psychiatric disorders (Depression, Post Traumatic Stress, and Substance Use).
2. Treatment of psychiatric/behavioral symptoms following concussion/mTBI should be based upon individual factors and nature and severity of symptom presentation, and include both psychotherapeutic [SR = A] and pharmacological [SR = I] treatment modalities.
3. Individuals who sustain a concussion/mTBI and present with anxiety symptoms and/or irritability should be provided reassurance regarding recovery and offered a several week trial of pharmacologic agents (See Appendix E) .[SR = I]

EVIDENCE STATEMENTS

- There is considerable evidence that several psychiatric conditions are associated with mTBI – specifically affective disorders (Fann, 2004; McCauley et al., 2001; Suhr, 2002), combat-stress spectrum disorders (Hoge et al., 2008; McCauley, et al., 2001; Moore, 2006) and some association with Substance Use Disorder(Carroll, 2004; Horner, 2005; Parry-Jones, 2004).
- There is some support for the effectiveness of treating post-traumatic stress symptomatology following mTBI using cognitive-behavioral therapy (Bryant et al., 2003; Soo & Tate, 2007), as well as a combination of cognitive-behavioral therapy and neuropsychological rehabilitation (Soo & Tate, 2007; Tiersky et al., 2005).
- Co-morbid depression or other mental disorders are associated with higher rates of persistent post-concussive symptoms and poorer outcomes following concussion/mTBI (Iverson, 2006; Mooney et al., 2001; Rapoport, 2006).

Table B-4. Behavioral and Cognitive Symptoms – ASSESSMENT

Common Symptoms Following Concussion/mTBI	**Review Medications**	**Lab Tests: Electrolytes CBC TFT**	**Review Sleep Habits**	**Screen for: - Depression - PTSD - SUD**	**Differential Diagnosis or Comorbid Conditions Include:**
Fatigue - Loss of energy - Getting tired easily	√	√	√	√	- *Anxiety disorders* - *Chronic Fatigue Syndrome* - *Chronic pain* - *Depression or other mood disorders* - *Insomnia* - *Metabolic disorders* - *Sleep Apnea* - *Stress disorders* - *Substance use*
Cognitive difficulties - Concentration - Memory - Decision-making	√	√	√	√	
Feeling anxious	√	√	√	√	
Emotional difficulties - Feeling depressed - Irritability - Poor frustration tolerance	√	√	√	√	

Key: *CBC-complete blood count; TFT-thyroid function test; PTSD-post-traumatic stress disorder; SUD-substance use disorder*

Table B-5. Behavioral and Cognitive Symptoms – TREATMENT

Common Symptoms Following Concussion/mTBI	**Job Review**	**Pharmacologic Treatment**	**Non-Pharmacologic Treatment**	**Referral after failed response to initial intervention**
Fatigue - Loss of energy - Getting tired easily	√	*	Reassurance Encourage regular scheduled aerobic exercise Activity restriction adjustment Sleep hygiene Education Sleep study	- Mental Health
Cognitive difficulties - Concentration - Memory - Decision-making	√	SSRI *		Consider referral to: - Cognitive rehabilitation - Mental Health - TBI specialist
Feeling anxious	√	Anxiolytic (short term) SSRI		- Mental Health - Social support
Emotional difficulties - Feeling depressed - Irritability - Poor frustration tolerance	√	Anti epileptics SSRI		

* Consider in the specialty care setting after ruling out a sleep disorder

5.4 Pharmacotherapy

BACKGROUND

At present, there is no clinically validated specific brain targeted pharmacotherapy that will ameliorate the neurocognitive effects attributed to TBI (e.g., enhancing memory and attention, recovering from the brain injury). No medication has received approval from the United States Food and Drug Administration (FDA) for the treatment of any neurological or psychiatric consequence of mTBI.

There are a number of effective adjunctive treatments for symptoms, that when used appropriately and cautiously can improve neurological and functional outcome. While there is little empiric evidence, some experts prescribe medications for attention, irritability, sleep, and mood disorders.

Table B-6. Considerations in Using Medication for Treatment of Symptoms

- Avoid medications that lower the seizure threshold (e.g., bupropion or traditional antipsychotic medications) or those that can cause confusion (e.g., lithium, benzodiazepines, anticholinergic agents).
- Before prescribing medications, rule out social factors (abuse, neglect, caregiver conflict, environmental issues).
- Unless side effects prevail, give full therapeutic trials at maximal tolerated doses before discontinuing a medication trial. Under-treatment is common. Start low and go slow with titration.
- Brain injured patients are more sensitive to side effects: watch closely for toxicity and drug-drug interactions.
- Limit quantities of medications with high risk for suicide as the suicide rate is higher in this population.
- Educate patients and family/care givers to avoid the use of alcohol with the medications.
- Minimize caffeine and avoid herbal, diet supplements such as "energy" products as some contain agents that cross-react with the psychiatric medications and lead to a hypertensive crisis.
- Avoid medications that contribute to cognitive slowing, fatigue or daytime drowsiness.

For suggested classes of medication treatment for specific symptoms, see Tables B-3 and B-5.
For selected agents, dosages, and pharmacological data, see Appendix E.

RECOMMENDATIONS

1. Medication for ameliorating the neurocognitive effects attributed to concussion/mTBI is not recommended.
2. Treatment of concussion/mTBI should be symptom-specific.
3. Medications may be considered for headaches, musculoskeletal pain, depression/anxiety, sleep disturbances, chronic fatigue or poor emotional control or lability.
4. Appropriate and aggressive pain management strategies should be employed.
5. When prescribing any medication for patients who have sustained a concussion/mTBI, the following should be considered:
    a. Review and minimize all medication and over-the-counter supplements that may exacerbate or maintain symptoms
    b. Use caution when initiating new pharmacologic interventions to avoid the sedating properties that may have an impact upon a person's attention, cognition, and motor performance.
    c. Recognize the risk of overdose with therapy of many medication classes (e.g., tricyclics). Initial quantities dispensed should reflect this concern.
    d. Initiate therapy with the lowest effective dose, allow adequate time for any drug trials, and titrate dosage slowly based on tolerability and clinical response.
    e. Document and inform all those who are treating the person of current medications and any medication changes.

EVIDENCE STATEMENT

- The use of drugs in the treatment of various concussion/mTBI symptoms has not been studied in prospective studies. Thus, there is insufficient evidence to form specific recommendations.
- Medication(s) targeting any presumed underlying processes are not supported by the literature.
- In the absence of published studies with which to guide treatment, the selection of pharmacologic agents is based on expert opinion following the approach and experience used to select such agents for patients with cognitive, behavioral, or physical symptoms arising from other neurological or behavioral conditions.

5.5 Physical Rehabilitation

BACKGROUND

Therapeutic exercise has been shown to positively impact the vast majority of disabilities. These exercises can be general and directed at an overall improvement in cardiopulmonary health, physical strength and power, and overall well-being; or focused at specific musculoskeletal, sensory or neuromuscular impairments that limit performance of daily activities. Following concussion/mTBI, those individuals that have persistent symptoms will often lapse in their overall conditioning. This will in turn result in a decrease in short- and long-term global health (physical and behavioral) and put them at an elevated risk for disability, pain, and handicap (i.e., difficulty with return to work, maintaining peer networks.)

RECOMMENDATIONS

1. There is no contraindication for return to aerobic, fitness and therapeutic activities after concussion/mTBI. Non-contact, aerobic and recreational activities should be encouraged within the limits of the patient's symptoms to improve physical, cognitive and behavioral complaints and symptoms after concussion/mTBI. [SR = B]
2. Specific vestibular, visual, and proprioceptive therapeutic exercise is recommended for dizziness, disequilibrium, and spatial disorientation impairments after concussion/mTBI. (See Appendix D)
3. Specific therapeutic exercise is recommended for acute focal musculoskeletal impairments after concussion/mTBI.

5.5.1 General Exercise

Symptoms of concussion/mTBI amenable to general fitness programs are multiple somatic complaints without specific identified mechanisms of injury and an absence of physical findings. The type of exercise (strength training, core stability, aerobic activities, ROM) is no different than those recommended for individuals without concussion/mTBI. However, one should consider a gradual increase in duration and intensity due to the activity intolerance and fatigue that is commonly associated with concussion/mTBI. Implementation of a scheduled daily routine and incorporation of peer networks may improve compliance.

5.5.2 Focused Exercise

Focal impairments (e.g., upper cervical root entrapment, impaired gaze stability, oculomotor dysfunction) benefit from tailored exercise programs that promote adaptation of or compensation for the affected systems (vestibular, visual, and proprioceptive) or specific musculoskeletal/neuromuscular impairments (decreased ROM, weakness, timing). The exercises that are commonly prescribed for these systems/impairments will be warranted. It is the delivery of instruction, guidance and follow-up needs that will be greater for those with mTBI. As well, the duration and intensity level may need to be considered when looking at the overall presentation of the individual.

5.6 Alternative Modalities

BACKGROUND

The vast majority of individuals with concussion/mTBI will have no difficulties or complaints following injury. While early interventions have been shown to prevent and treat persistent somatic, cognitive and behavioral

deficits, certain individuals will have persistent difficulties. Additionally, a significant percentage of individuals with concussion/mTBI will not receive early diagnosis or will not seek treatment, and therefore their symptoms will be addressed only after a temporal delay. In many of these individuals with chronic persistent symptoms after mTBI, traditional medical interventions are less than successful. Complementary alternative medicine (CAM) may be sought by the patient or patient's family. CAM interventions may assist in the treatment of certain symptoms associated with concussion/mTBI. An evidence-based approach to the implementation of complementary medicine strategies will be useful to prevent over- or underutilization of CAM.

- Acupuncture
- Bio-feedback

Novel therapy (hyperbaric oxygen, nutritional supplements) modalities in the management of concussion/mTBI are being explored in the field as potential treatment approaches. It is the recommendation of the Working Group that interventions which lack sufficient empirical support should occur only under the auspices of an IRB reviewed protocol. However, complementary techniques such as acupuncture may be used at the discretion of the provider and patient.

RECOMMENDATIONS

1. Complementary-alternative medicine treatments may be considered as adjunctive treatments or when requested by individuals with concussion/mTBI. [SR = I]

Annotation B-9 *Follow-Up and Assess in 4-6 Weeks*

6 FOLLOW-UP

RECOMMENDATIONS

1. All patients should be followed up in 4 – 6 weeks to confirm resolution of symptoms and address any concerns the patient may have.
2. Follow-up after the initial interventions is recommended in all patients to determine patient status. The assessment will determine the following course of treatment:
    a. Patient recovers from acute symptoms – provide contact information with instructions for available follow-up if needed.
    b. Patient demonstrates partial improvement (e.g., less frequent headaches, resolution of physical symptoms, but no improvement in sleep) – consider augmentation or adjustment of the current intervention and follow-up within 4-6 weeks.
    c. Patient does not improve or status worsens – Focus should be given to other factors including psychiatric, psychosocial support, and compensatory/litigation. Referral to a specialty provider should be considered.

C: Follow-Up Management of Persistent Concussion/mTBI Symptoms

Annotation C-1 *Person Diagnosed with Concussion/mTBI and Persistent Symptoms Beyond 4-6 Weeks*

The vast majority of individuals with concussion/mTBI will have no difficulties or complaints following injury. While early interventions have been shown to prevent physical, cognitive and behavioral deficits, certain individuals will have persistent difficulties. Additionally, a significant percentage of individuals with concussion/mTBI will not receive early diagnosis or will not seek treatment, and therefore their symptoms will be addressed only after a temporal delay. This guideline recommends that these individuals should first be treated following the algorithm and annotations in the sections addressing initial presentation and diagnosis. For patients with symptoms that do not respond to initial treatment, the recommendations in this section will apply. This section also includes suggestions for further evaluations and for referrals to specialty providers.

Annotation C-2 *Reassess Symptom Severity and Functional Status*
Complete Psychosocial Evaluation

7 ASSESSMENT OF PERSISTENT SYMPTOMS

BACKGROUND

In patients with persistent post-concussive symptoms that have been refractory to treatment, consideration should be given to other factors, including behavioral health (e.g., stress disorders, mood disorders, and substance use disorders), psychosocial support, and compensation/litigation.

RECOMMENDATIONS

1. Follow-up after the initial interventions is recommended in all patients with concussion/mTBI to determine patient status and the course of treatment.
2. Evaluation of patients with persistent symptoms following concussion/mTBI should include assessment for dangerousness to self or others.
3. In assessment of patients with persistent symptoms, focus should be given to other factors including psychiatric, psychosocial support, and compensation/litigation issues and a comprehensive psychosocial evaluation should be obtained, to include:
    a. Support systems (e.g., family, vocational)
    b. Mental health history for pre-morbid conditions which may impact current care
    c. Co-occurring conditions (e.g., chronic pain, mood disorders, stress disorder, personality disorder)
    d. Substance use disorder (e.g., alcohol, prescription misuse, illicit drugs, caffeine)
    e. Secondary gain issues (e.g., compensation, litigation)
    f. Unemployment or/change in job status
    g. Other issues (e.g., financial/housing/legal).

DISCUSSION

Table C-1 includes key domains of functional assessment and suggested questions to guide the patient assessment.

Table C-1. Functional Assessment

Work	• Have there been any changes in productivity? • Have co-workers or supervisors commented on any recent changes in appearance, quality of work, or relationships? • Is there an increase in tardiness, loss of motivation, or loss of interest? • Has the patient been more forgetful, easily distracted?
School	• Have there been changes in grades? • Have there been changes in relationships with friends? • Has there been a recent onset or increase in acting-out behaviors? • Has there been a recent increase in disciplinary actions? • Has there been increased social withdrawal? • Has there been a change in effort required to complete assignments?
Family Relationships	• Have there been negative changes in relationship with significant others? • Is the patient irritable or easily angered by family members? • Has there been a withdrawal of interest in or time spent with family? • Has there been any violence within the family?
Housing	• Does the patient have adequate housing? • Are there appropriate utilities and services? • Is the housing situation stable?
Legal	• Are there outstanding warrants, restraining orders, or disciplinary actions? • Is the person regularly engaging in, or at risk to be involved in, illegal activity? • Is the patient on probation or parole? • Is the patient seeking litigation for compensation? • Is there family advocacy/Department of Social Services (DSS) involvement?
Financial	• Does the patient have the funds for current necessities including food, clothing, and shelter? • Is there a stable source of income? • Are there significant outstanding or past-due debts, alimony, child support? • Has the patient filed for bankruptcy? • Does the patient have access to healthcare and/or insurance?
Unit/Community Involvement	• Does the patient need to be put on profile, MEB, or limited duty? • Is the patient functional and contributing in the unit environment? • Is there active/satisfying involvement in a community group or organization?

Annotation C-3 *Assess for Possible Alternative Causes for Persistent Symptoms*

7.1 Risk Factors for Persistent Post-Concussion Symptoms

BACKGROUND

Identifying risk factors for persisting symptoms and understanding the relationship between risk factors and short- and long-term outcomes can help enhance assessment and treatment. Some risks are pre-existing factors that may predispose an individual to worse outcomes following a concussion/mTBI; others are potentially directly causative (e.g., the injury itself or medical/legal iatrogenic factors); and still others are potentially perpetuating factors which may occur during the peri-injury or post-injury timeframe.

Table C-2. Risk Factors for Persistent Symptoms and/or Poorer Overall Outcomes

Pre-injury	Peri-injury	Post-injury
- **Age** (older) - **Gender (female)** - Low SES - **Less education** / Lower levels of intelligence - Pre-neurological conditions - **Pre- or co-occurrence of mental health disorders (depression, anxiety, traumatic stress, or substance use)**	- **Lack of support system** - Acute symptom presentation (e.g., headaches, dizziness, or nausea in the ER) - Context of injury (stress, combat-related, traumatic)	- **Compensation** - **Litigation** (malingering, delayed resolution) - **Co-occurrence of psychiatric disorders** - Co-occurrence of chronic pain conditions - Lack of support system - **Low education**

Bold text *indicates support of Level C evidence*

RECOMMENDATIONS

1. Assessment of the patient with concussion/mTBI should include a detailed history regarding potential pre-injury, peri-injury, or post-injury risk factors for poorer outcomes. These risk factors include:
    a. *Pre-injury:* older age, female gender, low socio-economic status, low education or lower levels of intellectual functioning, poorer coping abilities or less resiliency, pre-existing mental health conditions (e.g., depression, anxiety, PTSD, substance use disorders).
    b. *Peri-injury:* lower levels of or less available social support
    c. *Post-injury:* injury-related litigation or compensation, comorbid mental health conditions or chronic pain, lower levels of or less available social support,
2. Any substance abuse and/or intoxication at the time of injury should be documented.
3. Establish and document if the patient with concussion/mTBI experienced headaches, dizziness, or nausea in the hours immediately following the injury.

EVIDENCE STATEMENTS

Previous Head Injury

- History of prior head injury has been shown to be associated with poorer outcomes in terms of lingering symptoms (Binder, 1997; Ponsford et al., 2000).

Demographic

- There is consistent evidence that older age individuals who sustain a concussion/mTBI have poorer outcomes in terms of sustained symptoms (Binder, 1997; McCauley, 2001; Farace and Alves, 2000).

- Well-designed observational studies indicate that females have increased risk of developing post-concussive symptoms following mTBI (Binder, 1997; Bazarian et al., 2001; Broshek et al., 2005; McCauley, 2001).
- Lower levels of education or IQ are associated with greater levels or duration of post-concussion symptoms (Binder, 1997; Colligan et al., 2005; Dawson et al., 2007; Luis et al., 2003).

Social Support

- Lower level of social support or higher level of psychosocial stress are risk factors for long-term post-concussive symptoms (Luis et al., 2003; McCauley, 2001).

Mental Health

- Individuals with pre-existing mental health problems are more likely to have sustained post-concussion symptoms (Binder, 1997; Evered et al., 2003; Luis et al., 2003, Kashluba et al., 2008).
- Co-morbid mental health problems are associated with higher levels or greater duration of post-concussion symptoms (Colligan et al., 2005; Ponsford et al., 2000).
- The prevalence of chronic pain was greater in patients with mTBI than with moderate or severe TBI. Chronic pain contributes to morbidity and poor recovery after brain injury. (Nampiaparampil, 2008).
- There are contradictory findings on whether substance abuse and/or intoxication at the time of injury is associated with poorer outcomes (Ashman et al., 2004; Bigler et al., 1996; Bombardier et al., 2003; MacMillan et al., 2002) or not (Dikmen et al., 2004, Moldover et al., 2004; Turner et al., 2006).

Peri-Injury Factors

- Peri-injury severity variables within the criteria of mTBI, including GCS, duration of PTA, and presence of loss of consciousness (LOC)*, have not been* shown to be an independent predictor of persistent long-term symptoms (Carroll et al., 2004; Dawson et al., 2007; Iverson et al., 2006; van der Naalt et al., 2001).
- Substance abuse and/or intoxication at the time of injury may be associated with poorer psychological and functional outcomes (Ashman et al., 2004; Bigler et al., 1996; Bombardier et al., 2003; Colligan, et al., 2005; MacMillan et al., 2002) but others have not found this relationship (Dikmen et al., 2004; Moldover et al., 2004; Turner et al., 2006).
- Early symptoms of headaches, dizziness, or nausea in the immediate period (e.g., in the Emergency Department) after mTBI have been associated with sustained post-concussion symptoms months after injury (Chamelian & Feinstein, 2004; de Kruijk et al., 2002).

Post-Injury Litigation/Compensation

- Litigation or compensation seeking at time of assessment has consistently been associated with greater levels of symptoms and poorer outcomes (Binder & Rohling, 1996; Carroll et al., 2004; Suhr et al., 1997, Kashluba et al., 2008).

7.2 Compensation Seeking/Non-Validated Symptoms

BACKGROUND

The majority of people with concussion/mTBI will have no difficulties or complaints following injury. However, a minority of patients will continue to have ongoing symptoms that may result in a disability. Though these symptoms lose specificity with time and may be wrongly attributed to the mTBI/concussion, they may also interfere with an individual's recovery. Even after a careful differential diagnosis, it remains a challenge for providers to quantify non-specific, subjective complaints for the purposes of disability compensation.

RECOMMENDATIONS

1. Symptom exaggeration or compensation seeking should not influence the clinical care rendered, and doing so can be counter-therapeutic and negatively impact the quality of care.
2. Focus of the provider-patient interaction should be on the development of a therapeutic alliance (SR=C).

EVIDENCE STATEMENTS

Although there is compelling evidence of a relationship between persistence of symptoms and litigation/compensation seeking, this relationship is complex, and there is no therapeutic benefit to attributing symptom expression to malingering or intentional efforts to receive compensation.

- Multiple researchers have found that there is compelling evidence that individuals in litigation or seeking compensation following concussion/mTBI have poorer long-term outcomes. Binder & Rohlings (1996), in a meta-analysis looking at the effect of money on recovery after mTBI, recommended that clinicians consider the effects of financial incentives.
- There is compelling evidence that individuals in litigation or seeking compensation following mTBI have poorer long-term outcomes, including requiring more days to return to work (Gottshall et al., 2007; Reynolds, 2003), greater symptom severity (Paniak et al., 2002) and poorer neuropsychological functioning (Belanger et al., 2005a).
- There is also some evidence to suggest that compensation-seeking behavior resolves more rapidly with immediate compensation, such as sick pay and/or worker's compensation (Reynolds et al., 2003; Rose et al., 2005).
- There is evidence to support the conclusion that non-validated symptoms occur with higher frequency in individuals with mTBI who are seeking compensation and that the incidence of such symptoms increases with higher financial incentives (Bianchini, et al., 2006).

7.3 Persistent Post-Concussive Symptoms (PPCS)

BACKGROUND

For concussion/mTBI patients, most symptoms and signs that occur in the acute period resolve quickly (within hours or days) after the injury. There is debate about the incidence of developing persistent symptoms after concussion, largely due to the lack of an accepted case definition for persistent symptoms and the fact that none of the symptoms are specific to concussion. There is no consensus on a case definition for persistent symptoms attributed to concussion/mTBI and no consensus on the time course when acute symptoms should be considered persistent.

See discussion in Section 1.6 Persistent Symptoms after Concussion, and Table C-3 Post-Concussion Symptoms.

Table C-3. Post-Concussion Symptoms

Somatic Symptoms	Psychological	Cognitive
o Headache * o Fatigue * o Sensitivity to light/noise * o Insomnia & sleep disturbances * o Drowsiness * o Dizziness * o Nausea & vomiting * o Vision problems * o Transient neurological abnormalities o Seizures o Balance problems	o Problems controlling emotions * o Irritability * o Anxiety * o Depression *	o Problems with memory * o Cognitive disorders * o Problems with concentration * o Functional status limitations *

** In common with Post Concussive Syndrome (PCS)*

RECOMMENDATIONS

1. For clinical treatment purposes the use of post-concussion syndrome, post-concussive syndrome (PCS) or post-concussion disorder (PCD) as a diagnosis is not recommended. The unique individual pattern of symptoms should be documented and be the focus of treatment.

For the purpose of this CPG, the term *persistent post-concussive symptoms* will be used.

DISCUSSION

Somatic, cognitive and behavioral symptoms after concussion/mTBI rapidly resolve by 2 to 4 weeks in the majority individuals (McCrea, 2003). The term *post-concussion syndrome* (PCS), also known as *post-concussive syndrome* (PCS) or *post-concussion disorder* (PCD) is used for individuals who have persistent non-focal, neurologic symptoms (at least 2), most commonly dizziness, headache, cognitive deficits (attention, memory, and judgment), behavioral changes (irritability, depression, nightmares) and/or sleep disturbance.

- In late or persistent PCS, symptoms last for over six months.
- The PCS cluster of symptoms is not unique to concussion (occurs with many medical and psychiatric conditions as well as in normal individuals)
- The exact cluster of symptoms varies substantially across concussion patients; therefore it does not meet criteria for a "syndrome."
- The definition of PCS is plagued by several factors including poor reliability of diagnostic criteria and no specificity of PCS symptoms.
- PCS is seen in between 15% (DSM-IV) to 50% (WHO-ICD-10) of persons with mTBI, depending on how it is defined (McCrea, 2003).
- For all individuals with an initial mTBI, <5% may have persistent difficulties by 12 months (Iverson, 2007).
- Physical symptoms dominate in the first 4 weeks after injury, whereas emotional disturbances predominate later (at 4 - 8 weeks) (Yang, 2007).

Annotation C-4 *Any Behavioral Health Diagnosis Established?*

7.4 Persistent Behavioral Symptoms

BACKGROUND

Patients with persistent post-concussive symptoms have a higher incidence of co-occurring mental health conditions (e.g., Stress disorders [ASD, PTSD]), other anxiety disorders, mood disorders, Substance Use Disorders [SUD]) and a pre-injury history of mental health conditions.

In patients with persistent post-concussive symptoms (PPCS), that have been refractory to treatment, a referral to mental health may help elucidate other factors which may be involved in the exacerbation or maintenance of concussion symptoms. These include prior psychiatric history, lack of psychosocial support, financial compensation/litigation, chronic pain, and somatoform spectrum disorders.

See Table C-6: Behavioral Symptoms – TREATMENT

RECOMMENDATIONS

1. Patients with persistent symptoms following concussion/mTBI should be re-evaluated for psychiatric symptoms and co-morbid psychiatric disorders.
2. Treatment of psychiatric symptoms following concussion/mTBI beyond the acute phase should still be based on individual factors and nature and severity of symptom presentation, including psychotherapeutic [SR = A] and pharmacologic [SR = I] treatment modalities.
3. In patients with persistent post- concussive symptoms (PPCS), which have been refractory to treatment, consideration should be given to other factors including psychiatric disorders, lack of psychosocial support, and compensation/litigation.

Annotation C-5 *Consider Referral to Specialty Care*

8 CONSULTATION AND REFERRAL

RECOMMENDATIONS

1. A consultation or referral to specialists should occur in a patient with concussion/mTBI who complains of persistent or chronic symptoms when:
    a. An atypical pattern or course (worsening or variable symptom presentation) is demonstrated
    b. The patient is experiencing difficulties in return to pre-injury activity (work/duty/school)
    c. Problems emerge in the role of the patient in family or social life.
2. Patients with multiple problems may benefit from an inter-disciplinary approach to include occupational therapy, recreation therapy, social work, psychology and/or psychiatry, neurology, ENT, ophthalmology or audiology, based on individual symptoms. The patient's provider should remain involved in the patient's care.
3. Referral to mental health specialty of patients with persistent behavioral symptoms should be considered.

See Table C-4 Indications for Referral to Mental Health

Table C-4. Indications for Referral to Mental Health

- Failure to respond to acute supportive interventions
- Worsening of stress related symptoms
- High potential for dangerousness
- Development of PTSD
- Exacerbation of pre-existing psychiatric conditions
- Deterioration in function
- New onset stressors, poor social supports or inadequate coping skills
- Impairment in family or vocational role function

Annotation C-6 *Any Persistent Symptoms (Physical, Cognitive or Emotional)?*

7.5 Persistent Physical Symptoms

RECOMMENDATIONS

1. Patients who are refractory to treatment of physical symptoms in the initial care setting should be referred to specialty care for further evaluation and management (**See** Appendix D – Treatment of Physical Symptoms).

See Table C-5 Physical Symptoms – TREATMENT

7.6 Persistent Cognitive Difficulties

BACKGROUND

Although initial cognitive complaints and problems are common in the first hours and days after a concussion/mTBI, the vast majority of individuals recover within one to four weeks. However, a small minority either continue to report cognitive problems or report worsening symptoms over the months and even years post-injury. This subgroup frequently has premorbid or comorbid conditions such as depression, anxiety, poor health, and chronic pain or poor psychosocial support or other coping resources.

Assistive technology for cognition (ATC) refers to a subset of assistive technology used to compensate for cognitive impairments in memory, attention, and executive function. Devices in this category are also known as memory aids or cognitive prostheses. They are designed to assist individuals with concussion/mTBI to carry out everyday tasks by providing cues or limiting demands on impaired cognitive skills. Devices can range from simple electronic tools, such as a wrist watch with an alarm function to sophisticated personal digital assistants and global positioning systems. Successful long-term utilization of ATC by persons with concussion/mTBI requires selection of appropriate devices and effective training using the device in real-life contexts.

See Table C-6 Cognitive Symptoms – TREATMENT

RECOMMENDATIONS

1. Patients who have cognitive symptoms that do not resolve or have been refractory to treatment should be considered for referral for neuropsychological assessment. The evaluation may assist in clarifying appropriate treatment options based on individual patient characteristics and conditions. [SR = B]
2. Neuropsychological testing should only be conducted with reliable and standardized tools by trained evaluators, under controlled conditions, and findings interpreted by trained clinicians. [SR = C]
3. Individuals who present with memory, attention, and/or executive function problems which did not respond to initial treatment (e.g., reassurance, sleep education, or pain management) may be considered for referral to cognitive rehabilitation therapists with expertise in TBI rehabilitation

(e.g., speech and language pathology, neuropsychology, or occupational therapy) for compensatory training [SR = C]; and/or instruction and practice on use of external memory aids such as a PDA. [SR = C]

EVIDENCE STATEMENTS

- Some studies show that a subgroup of individuals continue to have both subjective symptoms (Alves et al., 1993; Deb et al., 1999; Dikmen et al., 1986; Hartlage et al., 2001; Luis et al., 2003; Powell et al., 1996) and lower cognitive test performance even after 90 days (Belanger et al., 2005; Binder et al., 1997; Vanderploeg et al., 2005)
- There is limited support for the effect of working memory and dual task training on improving attention and processing speed following in mild TBI (Cicerone et al., 2002).
- One study found that even in the chronic phase a combination of psychotherapy, support, and cognitive remediation treatment improved symptoms and actual cognitive performance (Tiersky et al., 2005).
- A systematic review of the literature in the moderate to severe TBI rehabilitation literature showed that attention, memory, and executive functioning deficits after TBI can be improved using interventions emphasizing strategy training (i.e., training patients to compensate for residual deficits, rather than attempting to eliminate the underlying neurocognitive impairment) including use of assistive technology or memory aids (Cicerone et al., 2005).

Table C-5. Persistent Physical Symptoms – TREATMENT

Common Symptoms Following concussion/mTBI	Pharmacologic Treatment	Non-Pharmacologic Treatment	Referral After Failed Response to Initial Treatment
Headaches	- Non narcotic pain meds - NSAIDs - Triptans (migraine type)	- Sleep education - Physical therapy - Relaxation	Neurology Pain clinic
Feeling dizzy	- Antibiotics, decongestants for infections and fluid	-	Dizzy : ENT/Neurology after ENT interventions
Loss of balance **Poor coordination**	-	- Physical therapy	Neurology
Nausea	- Antiemetics	- Sleep education	GI
Change in appetite	-	-	Consider Mental Health
Sleep disturbances - Difficulty falling or staying asleep (insomnia)	- Sleep Medications	- Sleep education	Mental health PM&R Neurology
Vision problems - Blurring - Trouble seeing - Sensitivity to light	-	- Sleep education - Light desensitization - Sunglasses	Optometry Ophthalmology **
Hearing difficulty - Sensitivity to noise	-	- Environmental modifications	Audiology ENT Sensitivity to Noise : Speech and Language Pathology

** Depending on the local resources, impaired vision may be referred in some facilities to neuro-ophthalmologists. Note that the impaired vision may be due to problems with oculomotility as well as due to disorders of the retina and visual pathways.

Table C-6. Persistent Behavioral and Cognitive Symptoms – TREATMENT

Common Symptoms Following Concussion/mTBI	Job Review	Pharmacologic Treatment	Non-Pharmacologic Treatment	Referral after failed response to initial intervention
Fatigue - Loss of energy - Getting tired easily	√	Stimulant*	Reassurance Encourage regular scheduled aerobic exercise Activity restriction adjustment Sleep hygiene Education Sleep study	- Mental Health
Cognitive difficulties - Concentration - Memory - Decision-making	√	SSRI Stimulant*		- TBI specialist for cognitive rehabilitation or mental health
Feeling anxious	√	Anxiolytic (short term) SSRI		- Mental Health - Social support
Emotional difficulties - Feeling depressed - Irritability - Poor frustration tolerance	√	Anti epileptics SSRI		

* Consider in the specialty care setting after ruling out a sleep disorder

Annotation C-7	*Consider Referral to Occupational or Vocational Therapy and Community Integration Programs (Continue Case Management)*

9 REHABILITATION OF PATIENTS WITH PERSISTENT POST-CONCUSSION SYMPTOMS (PPCS)

BACKGROUND

Role of Consultants

For patients who will be referred to specialty care, treatment will be provided by the specialty consultant as recommended in the management of specific symptoms or other clinical practice guidelines. The referring care provider is expected to serve as the focal point for an inter-disciplinary approach to treatment that may span the continuum of care. With patient consent, it may be found useful to involve the patient's employer/supervisor, spouse, and friends and significant others within the patient's social support network.

In patients with persistent post concussion/mTBI symptoms (PPCS), the role of mental health providers (psychiatry, psychology, neuropsychology, social work, and others) will be more essential in providing input into implementing psychotherapeutic treatment in the outpatient setting. Social workers should help build family and social support networks, or recommend changes in the patient's living situation, in order to create a positive support network.

9.1 Case Management in the Care of Patients with mTBI

BACKGROUND

Patients presenting with symptoms should be considered both initially and on an ongoing basis for referral to case management. Whether the patient has recently returned from deployment or combat, or is a veteran who has sustained non-combat related head trauma, the need for a collaborative and coordinated approach to comprehensive care is necessary.

Table C-7 Case Managers Serve Multiple Functions

- Complete an in-depth assessment of functional status and coordinate treatment resources
- Ensure that the patient is screened for social service needs and mental health problems.
- Assure that referrals are coordinated and made as appropriate to the responsible discipline
- Ensure that the patient and family have received appropriate education
- Participate in setting short- and long-term goals
- Assist in the process of moving between facilities and levels of care
- Monitor patient progress
- Coordinate and collaborate with the multi-disciplinary team

RECOMMENDATIONS

1. Patients with persistent symptoms following concussion/mTBI may be considered for case management.
2. Case managers should complete a comprehensive psychosocial assessment of the patient and the patient's family. It may be necessary or beneficial to meet with other members of the patient's support system (family, care giver) and/or invite the patient to ask them to come to an appointment together with the patient.
3. Case managers should collaborate with the treatment team, the patient, and the patient's family in developing a treatment plan that emphasizes the psychosocial needs of the patient.
4. Case managers (in collaboration with the treatment team) should prepare and document a detailed treatment plan in the medical record describing follow-up care and services required.

5. Case managers who provide care in the clinical setting should communicate and coordinate with other potential care coordinators that provide care for the patient (such as a VHA social worker liaison or military social worker at the referring Military Treatment Facility, Patient Treatment Advocate (PTA)).
6. Case managers may provide assistance to the patient and family who are transferred to another facility (e.g., a polytrauma rehabilitation center).
7. Case management may serve as the main point of contact for the patient and family. This may include the following :
    a. Provide the patient with contact information including after hours calls
    b. Maintain frequent contact by phone to remind about or facilitate an appointment
    c. Facilitate access to supportive services to the patient and family
    d. Serve as a liaison for the patient's family and as an advocate for the patient and the patient's family
    e. Provide easy-to-understand information in writing for the patient and the patient's family.

9.2 Patient and Family Education

RECOMMENDATIONS

1. All members of the treatment team should be involved in patient education as part of their interaction with the patient experiencing persistent symptoms.
2. Educational interventions should generally include information and a description of the specific procedures and events the patient will experience at the various phases of treatment and continue throughout the continuum of care.
3. General supportive counseling (e.g., eliciting and validating the patient's anxieties, fears, and concerns) may also be helpful. Open-ended questioning, active listening techniques, eliciting anticipation of future stressors, encouraging the patient to ask questions, and eliciting and encouraging utilization of the patient's social support resources are important strategies regardless of whether information-giving or coping skills training interventions are being used.
4. Educational interventions may also include coping techniques for symptom management, such as patient education handouts and helpful tips.

See Appendix B: Health Risk Communication

9.3 Functional and Vocational Activities

BACKGROUND

A return to the normal patterns of daily life and safe, independent living requires a practical, individualized application of therapeutically-based treatment. This includes the assessment and reestablishment of structured routines in daily activities, marriage/family dynamics, educational activities, vocation, and community involvement.

The emphasis of the team at this point is to enhance functional outcome and reduce disability associated with the symptoms. This is accomplished by treatment that improves patient function and by interventions that mitigate and adjust the environment in which the patient is expected to function (e.g., family, vocational and community).

Potentially modifiable psychosocial barriers to patient functioning could include the following:

Living environment—Homelessness can perpetuate chronic illness as the result of environmental exposure and virtually non-existent personal hygiene.
Support systems—Negative supports on the part of the spouse, family, or significant other can impair and even worsen functionality.
Job—Work place factors have been associated with illness-related behavior.

Finances—Disability compensation can perpetuate illness by requiring continuing symptoms and disability for the worker to be eligible for benefits.

RECOMMENDATIONS

Family Support

1. As with other chronic conditions, the focus of the management of patients with persistent symptoms following concussion/mTBI should shift to the psychological and social impacts on the patient.
2. The clinician should consider having the spouse or partner accompany the patient with concussion/mTBI to a consultation, to help them better understand the condition and provide an opportunity to discuss any coping difficulties.
3. Family members should be encouraged to consider joining a support group to provide education, advice and opportunities to exchange coping strategies for dealing with the day-to-day difficulties of living with an individual with persistent symptoms following concussion/mTBI.

Vocational Rehabilitation

1. Vocational interventions for the patient with persistent symptoms following concussion/mTBI may include modifications such as:
    - Modification of the length of the work day
    - Gradual work re-entry (e.g., starting at 2 days/week and expanding to 3 days/week)
    - Additional time for task completion
    - Change of job
    - Environmental modifications (e.g., quieter work environment; enhanced level of supervision)
2. Patients who have not successfully resumed pre-injury work duties following injury should be referred for a vocational evaluation by clinical specialists with expertise in assessing and treating concussion/mTBI.
3. For patients with persistent symptoms following concussion/mTBI, return to full work/duty in the jobs they have previously preformed may not be possible. Patients may need to proceed through medical or disability evaluation processes. This process should follow national and local regulations and is beyond the scope of the guideline.

Community participation

4. A referral to a structured program that promotes community integration may be considered for individuals with residual persistent post-concussive symptoms that impede return to pre-injury participation in customary roles.

DISCUSSION

Vocational Rehabilitation

Following a concussion/mTBI, most individuals are able to resume normal work duties within a week to month with secondary prevention precautions and education requiring little or no additional therapeutic intervention. A small percentage of individuals with concussion/mTBI may be instructed to temporarily reduce the amount, type and/or intensity of their work duties or temporarily remain out of work entirely.

In instances where residual impairments are such that a career change may be needed, referral to a vocational rehabilitation program that provides comprehensive services, e.g., assessment, identification of work skills, alternatives for future employment, and referral for training and education may be considered.

Clinicians may be asked to act as advocates for their patients in negotiations with employers, educational institutions, and social welfare organizations. For instance, the patient may need assistance in arranging part-time work or school alternatives or securing disability allowances.

In a survey of concussion/mTBI patients 4 to 6 months post-injury, key emerging issues for participants who return to work were the invisibility of their injury, continuing symptoms affecting their ability to do their job and lack of advice and guidance on returning to work. Return to work support systems were considered to be poorly coordinated and managed (Gilworth et al., 2008).

Community Participation (also called Community Reintegration)

This refers to the resumption of age, gender, and culturally appropriate roles in the family, community and workplace. Individuals with residual symptoms from concussion/mTBI experiencing problems returning to their pre-injury level of activity may benefit from individual and/or group interventions that focus on development of skills and strategies to address impairments (e.g., behavior regulation, interpersonal relationships, and functional cognition). Cicerone (2005) suggests that intensive cognitive rehabilitation seems to help with community integration in individuals with moderate to severe TBI. Additionally, it appears that peer support groups result in higher reported quality of life scores and less depressive symptoms (Hibbard, 2002).

Annotation C- 8 *Follow-Up and Reassess in 3-4 Months*

10 FOLLOW-UP

BACKGROUND

The goal of follow-up visits is to monitor the severity of symptoms, impact of the symptoms on activities, effects of treatments, and presence of adverse effects to treatments, and to assess patients for new symptoms suggestive of other diagnoses.

Although natural improvement is generally expected, recovery can be prolonged and a minority of patients still have symptoms at 6 months. The use of telephonic and other distance technologies may be used to monitor the recovery process, reinforce education, and prevent development of secondary problems.

RECOMMENDATIONS

1. Scheduled follow-up visits are recommended. The amount of time between visits will vary depending on a number of factors, including the following:
    a. Quality of the provider/patient relationship
        - Distress of the patient
        - Need for refinement of the treatment plan or additional support
        - Presence or absence of psychosocial stressors.
    b. Severity of the symptoms
        - Initially, a follow-up at two to three weeks would be appropriate
        - As soon as the patient is doing well, then follow-up every 3 to 4 months would be recommended
        - Telephone follow-up may be sufficient to evaluate resolution of symptoms and reinforce education.
    c. For concussion/mTBI patients with complicated histories, comorbidities, and lack of social support consider case management.
2. Continually re-evaluate the patient for worsening of chronic symptoms or presence of new symptoms suggestive of other diagnoses.

APPENDICES:

Appendix A: Guideline Development Process

The development of the VA/DoD Clinical Practice Guideline for Management of Concussion/mTBI followed the steps described in "Guideline for Guidelines," an internal working document of the VA/DoD Evidence Based Practice Working Group, that requires an ongoing review of the work in progress. The Working Group of the VA/DoD was charged to update the evidence-based action recommendations whenever possible.

The Offices of Quality and Performance and Patient Care Services, in collaboration with the network Clinical Managers, the Deputy Assistant Under Secretary for Health, and the U.S. Army Medical Command for the DoD identified clinical leaders to champion the guideline development process. During a preplanning conference call, the clinical leaders defined the scope of the guideline and identified a group of clinical experts from the VA and DoD that formed the Management of Concussion/mTBI Working Group. Working Group members included representatives of the following specialties: primary care, internal medicine, physical medicine and rehabilitation (PM&R), psychiatry, neuropsychology, neurology, neurophysiology, neuroradiology, social work/case management, occupational therapy, physical therapy, speech-language therapy, and vocational therapy.

The Working Group defined a set of clinical questions within the area of the guideline. This ensured that the guideline development work outside the meeting focused on issues that practitioners considered important and produced criteria for the search and the protocol for systematic review and, where appropriate, meta-analysis.

The Working Group participated in an initial face-to-face meeting to reach consensus about the guideline algorithm and recommendations and to prepare a draft update document. The draft continued to be revised by the Working Group at-large through numerous conference calls and individual contributions to the document. Following the initial effort, an editorial panel of the Working Group convened to further edit the draft document. Recommendations for the performance or inclusion of specific procedures or services were derived through a rigorous methodological approach that included the following:

- Determining appropriate criteria, such as effectiveness, efficacy, population benefit, or patient satisfaction
- Reviewing literature to determine the strength of the evidence in relation to these criteria
- Formulating the recommendations and grading the level of evidence supporting the recommendation
- Experts from the VA and DoD reviewed the final draft and their feedback was integrated into the final draft document.

This update of the Concussion/mTBI Guideline is the product of many months of diligent effort and consensus building among knowledgeable individuals from the VA, DoD, academia, as well as guideline facilitators from the private sector. An experienced moderator facilitated the multidisciplinary Working Group. The list of participants is included in Appendix H.

FORMULATION OF QUESTIONS

The Working Group developed researchable questions and associated key terms after orientation to the scope of the guideline and to goals that had been identified by the Working Group. The questions specified:

- **P**opulation – Characteristics of the target patient population
- **I**ntervention – Exposure, diagnostic, or prognosis
- **C**omparison – Intervention, exposure, or control used for comparison
- **O**utcome – Outcomes of interest.

These specifications served as the preliminary criteria for selecting studies. Literature searches were conducted on all topics identified in the algorithm or recommendations. After reviewing the initial search for systematic reviews and meta-analyses, the Working Group decided to focus the search for individual randomized controlled trials (RCT) on the following questions:

Questions for Literature Search

1. Is there a difference in intervention in individuals with repeated concussion or repeated mTBI?
2. Is there a relationship between self-awareness and response to treatment of cognitive and psychological deficits in individuals with mTBI?
3. Do educational interventions decrease the incidence & severity of chronic mTBI symptoms and lead to better outcomes in individuals with mTBI-related symptoms.
4. Do early cognitive-behavioral interventions decrease the incidence & severity of chronic mTBI symptoms and lead to better outcomes in individuals with mTBI-related symptoms?
5. Are there compensatory strategies/techniques that have been shown to result in better outcomes in individuals with mTBI?
6. Do treatment techniques for vestibular disorders (liberatory maneuvers, balance exercises, computerized posturography) reduce symptoms and provide long-term improvement in outcome in patients with mTBI?

Selection of Evidence

The evidence selection was designed to identify the best available evidence to address each key question and ensure maximum coverage of studies at the top of the hierarchy of study types. Published, peer-reviewed RCTs, as well as meta-analyses and systematic reviews that included randomized controlled studies were considered to constitute the strongest level of evidence in support of guideline recommendations. This decision was based on the judgment that RCTs provide the clearest, most scientifically sound basis for judging comparative efficacy. The Working Group made this decision recognizing the limitations of RCTs, particularly considerations of generalizability with respect to patient selection and treatment quality. When available, the search sought out critical appraisals already performed by others that described explicit criteria for deciding what evidence was selected and how it was determined to be valid. The sources that have already undergone rigorous critical appraisal include Cochrane Reviews, Best Evidence, Technology Assessment, and AHRQ systematic evidence reports.

In addition to Medline/PubMed, the following databases were searched: Database of Abstracts of Reviews of Effectiveness (DARE) and Cochrane Central Register of Controlled Trials. For Medline/PubMed searches, limits were set for language (English), and type of research (RCT, systematic reviews and meta-analysis).

As a result of the literature reviews, articles were identified for possible inclusion. These articles formed the basis for formulating the guideline recommendations. The following inclusion criteria were used for studies:

- English language only of studies performed in United States, United Kingdom, Europe, Australia, Japan, New Zealand

- Full articles only
- Study populations age limited to adults greater than 18 years; all races, ethnicities, cultural groups
- Randomized controlled trials or prospective studies
- Published from 2001 to 2008.

Admissible evidence (study design and other criteria):

- Original research studies that provide sufficient detail regarding methods and results to enable use and adjustment of the data and results.
- Randomized controlled trials (RCT); systematic reviews and meta-analyses.
- Relevant outcomes must be able to be abstracted from data presented in the articles.
- Sample sizes must be appropriate for the study question addressed in the paper.

PREPARATION OF EVIDENCE TABLES (REPORTS) AND EVIDENCE RATING

The results of the search were organized in evidence summary reports and copies of the original studies were provided to the Working Group for further analysis. Each study was appraised for scientific merit, clinical relevance, and applicability to the populations served by VA and DoD health care system. The body of evidence was rated for quality and level of evidence.

Recommendation and Overall Quality Rating

Evidence-based practice involves integrating clinical expertise with the best available clinical evidence derived from systematic research. The Working Group received an orientation and tutorial on the evidence rating process, reviewed the evidence and independently formulated the Strength of Recommendation (see Table A-1).

Table A-1. Evidence Rating System

A	A strong recommendation that the clinicians provide the intervention to eligible patients. *Good evidence was found that the intervention improves important health outcomes and concludes that benefits substantially outweigh harm.*
B	A recommendation that clinicians provide (the service) to eligible patients. *At least fair evidence was found that the intervention improves health outcomes and concludes that benefits outweigh harm.*
C	No recommendation for or against the routine provision of the intervention is made. *At least fair evidence was found that the intervention can improve health outcomes, but concludes that the balance of benefits and harms is too close to justify a general recommendation.*
D	Recommendation is made against routinely providing the intervention to patients. *At least fair evidence was found that the intervention is ineffective or that harms outweigh benefits.*
I	The conclusion is that the evidence is insufficient to recommend for or against routinely providing the intervention. *Evidence that the intervention is effective is lacking, or poor quality, or conflicting, and the balance of benefits and harms cannot be determined.*

LACK OF EVIDENCE – CONSENSUS OF EXPERTS

Where existing literature was ambiguous or conflicting, or where scientific data was lacking on an issue, recommendations were based on the clinical experience of the Working Group.

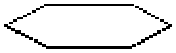
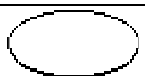
ALGORITHM FORMAT

The goal in developing the guideline for management of Concussion/mTBI was to incorporate the information into a format which would maximally facilitate clinical decision-making. The use of the algorithm format was chosen because of the evidence that such a format improves data collection, diagnostic and therapeutic decision-making and changes patterns of resource use. However, few guidelines are published in such a format.

The algorithmic format allows the provider to follow a linear approach to critical information needed at the major decision points in the clinical process, and includes:

- An ordered sequence of steps of care
- Recommended observations
- Decisions to be considered
- Actions to be taken
-

A clinical algorithm diagrams a guideline into a step-by-step decision tree. Standardized symbols are used to display each step in the algorithm (Society for Medical Decision-Making Committee, 1992). Arrows connect the numbered boxes indicating the order in which the steps should be followed.

	Rounded rectangles represent a clinical state or condition.
	Hexagons represent a decision point in the guideline, formulated as a question that can be answered Yes or No. A horizontal arrow points to the next step if the answer is YES. A vertical arrow continues to the next step for a negative answer.
	Rectangles represent an action in the process of care.
	Ovals represent a link to another section within the guideline.

A letter within a box of an algorithm refers the reader to the corresponding annotation. The annotations elaborate on the recommendations and statements that are found within each box of the algorithm. Included in the annotations are brief discussions that provide the underlying rationale and specific evidence tables. Annotations indicate whether each recommendation is based on scientific data or expert opinion. A complete bibliography is included in the guideline.

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Appendix B: Structured Interview for Collecting Head Trauma Event Characteristics

Head Trauma Event Characteristics

Name: _____

Date/Time of Injury_____

Reporter: ____ Patient ____ Parent ____Spouse _____ Other

1 Injury Description

1a. Is there evidence of a forcible blow to the head (direct or indirect)?
____Yes ____ No ____ Unknown

1b. Is there evidence of intracranial injury or skull fracture?
____ Yes ____ No ____ Unknown

1c. Location of Impact:

____ Frontal ____ Left temporal
____ Left Parietal ____ Right temporal
____ Right Parietal ____ Occipital
____ Neck ____ Indirect force

2 Cause: ____ MVC ____ Pedestrian-MVC
____ Fall ____ Assault
____ Sports ____ Blast
____ Other (specify) _____

3 Amnesia Before (Retrograde)

Are there any events just BEFORE the injury that you/person has no memory of (even brief)? ____ Yes ____ No ____Duration

4 Amnesia After (Anterograde)

Are there any events just AFTER the injury that you/person has no memory of (even brief)? ____ Yes ____ No Duration _____

5 Loss of Consciousness

Did you/person lose consciousness? ____Yes ____ No Duration _____

6 EARLY SIGNS

___ Appears dazed or stunned ____ Is confused about events
___ Answers questions slowly ____ Repeats Questions
___ Forgetful (recent info)

7 Were seizures observed? ____ No ____Yes Detail _____

8 Any deaths/injuries to others that occurred as a result of this event?
_____ No ____ Yes

Instructions for collecting injury characteristics information:

Q1	Obtain description of the injury: how injury occurred, type of force, location on the head or body (if force transmitted to head). Different biomechanics of injury result in differential symptom patterns (e.g., occipital blow may result in visual changes, balance difficulties).
Q2	Indicate the cause of injury. Greater forces associated with the trauma are likely to result in more severe presentation of symptoms.
Q3 & 4	Amnesia: Amnesia is defined as the failure to form new memories. Determine whether amnesia has occurred and attempt to determine length of time of memory dysfunction – before (retrograde) and after (anterograde) injury.
Q5	Loss of consciousness (LOC) – If occurs, determine length of LOC.
Q6	Early signs. If present, ask the individuals who know the patient (parent, spouse, friend, etc) about specific signs of the concussion that may have been observed. These signs are typically observed early after the injury.
Q7	Inquire whether seizures were observed or not.
Q8	Deaths or injuries that occur during an event can contribute to the development of mental health symptoms.

Appendix C: Health Risk Communication

Risk communication is the process of exchanging information among interested parties about the nature, magnitude, significance, or control of a risk. (1) In a health care setting, risk communication occurs during every patient visit when discussing diagnoses, medications, treatments or procedures; some topics are more challenging than others. Treating patients with obvious or suspected mTBI/ concussion will likely be complex, due in part to the uncertainty related to the history of the traumatic event; uncertainty related to the exact etiology of the presenting physical symptoms; previous medical treatment provided; the patient's psychosocial, emotional, cognitive, and physical issues; and cultural and/or linguistic issues. In addition, conversations about sensitive issues, such as instances where patients are emotional or when care fails to help the patient, can be very difficult for health care providers and other members of the health care team. Fortunately, research in health communication, particularly in cancer care, has been conducted over the past several decades, providing numerous lessons learned that can be applied to the treatment of mTBI/concussion patients. Patients with good communication skills may have more successful interactions with health care providers; however, this guide is targeted toward the health care provider/ team.

Effective communication is often bypassed in general practice due to time constraints, lack of skills, and priorities. A patient-centered approach that integrates effective risk communication can meet the needs of both patient and health care provider, without sacrificing limited time.(2) Certainly, one of the health care provider's primary tasks is to provide information to the patient, such as treatment plan, possible reasons for symptoms, and medication instructions. But effectively communicating with patients continues to be a source of frustration for many health care providers, particularly under time constraints. While communicating information is important, it is also worth noting that information alone does not necessarily equate to understanding; it is only one component of a doctor-patient partnership deemed to be satisfactory to both parties.

Patients with actual or suspected mTBI/ concussion will likely be emotionally distressed, experiencing anxiety, fear, frustration, confusion, uncertainty, lack of choice and control, helplessness, or hopelessness, and other responses. In primary care settings, 76 percent of patients provided emotional clues, yet health care providers responded positively to these clues only 21 percent of the time.(3) Most health care providers and nurses also incorporate "blocking behaviors" that typically move the discussion away from patient concerns and emotions, (4) yet health care providers who communicate effectively and provide compassionate care have been found to have a positive impact on patients' emotional distress, often in as little as 40 seconds. (5) While many health care providers believe that "patient-centered" visits are more time-consuming, those where the dialogue was primarily psychosocial did not result in visits that were significantly longer than others. (6) Improving risk communication skills can more effectively identify and address patient concerns and emotions without sacrificing time. These skills are especially critical when treating mTBI/ concussion patients where a diagnosis has not yet been established, and cognitive complexity and/or emotional distress may be involved.

Research strongly suggests that the quality of health care provider-patient communications can critically influence the quality of life for patients and families, as well as patient health outcomes. Health care providers understandably rely on a patient's medical information to diagnose and provide treatment; yet clinical care that focuses primarily on biological and physiological factors alone -- if they can even be identified, is likely to be ineffective in relieving symptoms.(7) Improved communications have also been shown to provide benefits to health care providers and health care systems. For example:

- The quality of communications were found to positively affect, in descending order of frequency, emotional health, symptom resolution, function, physiologic measures (i.e., blood pressure), and pain control. (8)
- Improved communications produce more complete information about the patient; align health care provider and patient agendas, using time more wisely; increase patient satisfaction with care provided; increase patient compliance, knowledge, understanding and recall; and ultimately improve the long-term psychologic adjustment of the patient. (9, 10)

- The quality of health communication can influence the physiologic health outcome of diabetic patients, such as blood pressure or blood sugar level. (8)
- Compassionate care has been shown to reduce patients' anxiety and emotional distress.(5)
- Communication that included preparing the cancer patient for diagnosis, giving the patient clear information, providing written information, discussing questions and feelings, and being reassuring may lower anxiety. (11)
- Conversely, reassuring high-anxiety cancer patients before patient's concerns are elicited is not helpful.(12)
- Cancer patients reported greater hope when health care providers actively encourage their participation as partners in determining treatment options. (13)
- Feeling valued, having realistic goals, pain/symptom relief, and meaningful relationships are key factors that increase hope in terminally ill patients. (14)

In order for effective communication to occur, the health care provider-patient relationship must be based on mutual trust. Distrust may be especially acute when a cause or explanation for the patient's concerns has not yet been, or cannot be, readily determined. The effectiveness of communications involving a highly personal issue, such as a patient's individual health, is primarily determined by the patient's perception of trustworthiness and credibility of the health care provider. Trust and credibility may not be quickly or easily established, but can result from building and maintaining partnerships between the health care provider, the patient, and their family over time. Four key factors have been found to influence perceptions of trust and credibility during discussions of high-concern issues: (15)

1. **Caring and empathy**, including perceived sincerity, ability to listen, and to see issues from the perspective of others. Of the four factors, patient perceptions of caring and empathy are the most important.
2. **Competence and expertise**, including perceived intelligence, training, experience, education level, professional attainment, knowledge, and command of information. These are the easiest factors to establish because health care providers are automatically perceived by the public to be credible sources of information.
3. **Dedication and commitment**, including perceived altruism, diligence, self-identification, involvement, and hard work. Perceptions of dedication and commitment are influenced by patient perceptions of the health care provider's hard work in the pursuit of health goals.
4. **Honesty and openness**, including perceived truthfulness, candidness, fairness, objectivity, and sincerity. Perceptions of this factor result from both nonverbal cues (i.e., posture, eye contact, facial expressions, interruptions, indirect language) and language that convey sincerity and concern. Sensitivity to nonverbal cues is especially invaluable in ultimately understanding and communicating effectively with the patient and their family.

Integrating these factors into a patient-centered approach can better address the needs of both health care provider and patient. Health care providers generally want to provide high-quality clinical care within the time limits provided. But patient expectations of the medical visit, their illness, and the consequences of potential exposures may differ significantly from the health care provider's. Patients bring a set of beliefs about themselves and the meaning of their symptoms and possible injuries to their encounters with the health care provider based on a complex set of factors, to include personal values; perceptions of benefits and level of control; degree of social trust; and heuristics. (16) It is therefore critical for the health care provider and patient to work together collaboratively to set an agenda for each visit, and to develop an appropriate treatment plan.

The goals of the health care provider, therefore, should include attempting to understand the patient's beliefs, informing the patient about pertinent scientific information, and establishing a collaborative and negotiated understanding upon which further communication and work can be based. Excellent risk communication skills are essential in communicating clearly, while effectively addressing the emotional and psychosocial needs of the patients and families. This requires that the health care provider: (17,18,19)

- Build rapport with the patient through compassion and empathy.
- Elicit, acknowledge and discuss the patient's social and emotional concerns.
- Be mindful of the patient's and your own body language.
- Align agendas by exploring the patient's perspective (i.e., what the patient already knows, what the patient wants to know).
- Encourage patient participation in discussions and decision-making; make appropriate adjustments to align expectations, preferences, needs and goals.
- Speak in the patient's language.
- Be completely honest.
- Listen actively by paraphrasing your understanding of patient and family input.
- Convey a sense of optimism and hope regarding diagnosis, treatment, and prognosis.
- Co-create the treatment plan.
- Be prepared for a reaction.

At each patient visit, the health care provider should:

- Ask open-ended questions, focusing on and clarifying psychological issues.
- Ask if there are unaddressed or unresolved concerns.
- Provide orientation statements to help the patient develop appropriate expectations of the visit.
- Speak the patient's language and periodically check for patient understanding, by observing subtle, nonverbal cues of patient confusion; then rephrase or restate the information to validate patient report.
- Be sensitive to nonverbal cues, both your own and those of the patient's.
- Summarize and explain all test results, being sure to address any outstanding or interim test results and consultations that will be reviewed during follow-up visits.
- Offer to include the concerned family member or significant other in follow-up visits, being sensitive to patient preferences.
- Schedule follow-up visits in a timely manner.
- Recognize miscommunications and repair them.

Communicating in a high-concern, low-trust environment, such as when caring for mTBI/concussion patients, can be difficult for even the most skilled health care provider. In order to successfully treat patients with mTBI/ concussion, health care providers and health care systems must support or mandate health risk communication training and patient-centered care and communication. Doing so will help assist in successful information transfer; form more effective health care provider-patient relationships; avoid longer patient visits; and ultimately improve the overall health outcome of patients and families, while limiting caregiver burnout.

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Appendix D
Treatment of Physical Symptoms

This Appendix includes recommendations for treatment of a selected list of physical symptoms that are most common in patients presenting with symptoms following a concussion/mTBI. The recommendations were formulated based on Consensus of clinical experts.

D-1. HEADACHE

BACKGROUND

Post-traumatic headaches occur acutely in up to 90% of all individuals who sustain a concussion. Post-traumatic headaches usually develop within 7 days of head trauma. The International Headache Society classification category is headaches associated with head and neck trauma. The category was established because the most frequent forms of civilian head trauma also cause injury to the cervical spinal column, spinal cord and neck musculature. Cervicogenic pain can include headache as well as neck pain. Individuals who sustain head and neck injury can have headaches in which the pain originates from both the head and the neck. Although post-traumatic headaches represent a unique category of headache, they often share features of other types of headaches. The three most common patterns of post-traumatic headaches are:

1. Tension-type headaches, including cervicogenic component
2. Migraine headaches, or
3. Combined migraine and tension-type headaches.

Table D-1. Criteria for characterizing post-traumatic headaches as tension-like (including cervicogenic) or migraine-like based upon headache features.

	Headache Type	
Headache Feature	**Tension-like (include cerviogenic pain)**	**Migraine-like**
Pain Intensity	Usually mild-moderate	Often severe or debilitating
Pain Character	Dull, aching, or pressure. Sharp pain may be present, but is not predominant	Throbbing or pulsatile, can also be sharp/stabbing or electric-like
Duration	Usually less than 4 hours	Can last longer than 4 hours
Phono- or photo-phobia	One but not both may be present	One, or both usually present
Able to carry out routine activities /work	Usually	Usually not, or with a decreased level of participation
Location	Bilateral frontal, retro-orbital, temporal, cervical and occipital, or holocephalic	Usually unilateral and may vary in location among episodes
Nausea or malaise	Not present	Usually present
Palpable muscle tenderness or contraction	Pericranial muscles including temporalis, masseter, pterygoid, posterior neck muscle, sternocleidomastoid, splenius or trapezius	Localized muscle tenderness is not typical, muscle tenderness may be present with long duration headaches

RECOMMENDATIONS

ASSESSMENT

Physical Examination

1. Acute assessment focuses on determining if an individual has intracranial pathology as a consequence of the head injury. Include examination of the head and neck; cranial nerve examination including: test of olfaction, funduscopic evaluation, measurement of pupil size and reaction to light, and observation of eye movements. The examination also evaluates muscle strength and tone, gait and upper and lower extremity coordination. Warning signs of intracranial pathology that will require neurosurgical intervention include: drowsiness, impaired motor function (hemiparesis or hemi-ataxia), unsteady gait or inability to stand, vomiting with or without head pain, headache with valsalva maneuvers such as coughing, papilledema or pupil asymmetry of size or reactivity to light. Patients with warning signs of intracranial pathology need to have additional assessment including intracranial imaging.
2. As indicated in **Table D-1**, focal muscle contraction can be identified in some individuals with tension-type headaches or cervicogenic pain.

Medication Review

3. Medication Review is required for people with headaches that have been present for more than two weeks and for individuals with frequent or daily headaches. Chronic use (particularly daily) of non-steroidal anti-inflammatory drugs (NSAIDs) or acetaminophen (alone or combined with caffeine) particularly daily, may lead to rebound headaches that are similar to tension-type headaches in character. Headaches associated with chronic NSAID/acetaminophen usage should be addressed to a headache specialist. Excessive use or rapid withdrawal of caffeine or tobacco can also trigger headaches. Particular caution is required for individuals who have frequent headaches and who state that headaches respond only to opioid medications. Such individuals should be directed to a pain clinic or headache specialist.

Sleep

4. The lack of sleep can cause or exacerbate headaches and/or light sensitivity as well as problems with many cognitive/emotional functions. Ascertain current sleep/wake cycles and provide counseling regarding appropriate sleep hygiene (limiting use of stimulants, encouraging exercise, reducing pre-sleep stimuli from lights/noise, reducing pre-sleep fluid intake, discouraging naps). Concussion is also associated with impaired sleep; i.e., disturbed abnormal breathing patterns, or disruptions in progression of sleep cycles.

TREATMENT

See table Appendix E for suggested list of selected medications used in treatment of headache

5. Pharmacotherapy and non-pharmacologic treatments to reduce the frequency of headaches and to treat acute headaches are based upon the character of the headaches. Patients who have mixed migraine/tension-like headaches may need treatment for both headache types. Based upon currently available information, most individuals with concussion/mTBI will have improvement in their headaches during the first 3 months of treatment. Consider referring patients who do not respond to treatments to headache specialists or pain treatment programs. It is important to maintain a positive outlook and to encourage active patient ownership and involvement in the care plan. It is also important to recognize co-morbid conditions, especially sleep disorders, anxiety disorders (PTSD) and depression. Treatment of these conditions may also improve headache.

Episodic tension-type headaches

6. Episodic tension-type headaches usually respond to non-steroidal anti-inflammatory medications (NSAID) that can be obtained over-the-counter. Unfortunately, tension-type headaches associated with concussion may be resistant to medication alone. Patients may achieve better pain relief if medication treatment is coupled with other treatment modalities such as relaxation training and biofeedback. Patients should be encouraged to engage in physical therapy to exercise neck muscles and maintain appropriate range of motion. Increased physical activity may help to reduce the frequency and intensity of tension headaches. These non-pharmacologic modalities may help patients

control or moderate their headaches enabling them to gain control of their pain. NSAID medications including aspirin, ibuprofen or choline-magnesium-trisalisylate and acetaminophen are the first-line medications for treating tension headaches. The choice of an NSAID or acetaminophen depends upon individual response and severity of side effects. Aspirin is more likely to produce gastrointestinal distress and upper gastrointestinal bleeding than other NSAID medications. Acetaminophen is often the best tolerated in terms of lower likelihood to produce gastrointestinal distress. When used appropriately, side effects with acetaminophen are rare. The most serious side effect is liver damage due to large doses, chronic use or concomitant use with alcohol or other drugs that also damage the liver. Acetaminophen should be avoided in individuals with hepatitis. Choline-magnesium-trisalisylate occasionally provides a good balance of efficacy and reduced likelihood of gastrointestinal distress. Ibuprofen can also be used to treat episodic tension headaches. If patients exhibit gastrointestinal side effects, therapy with proton-pump inhibitors and histamine blockers may be considered. Pain treatment is more likely to be successful if the medication is taken at the onset of a headache rather than waiting for the headache pain to escalate.

7. *Combination medications* can be effective in treating episodic tension headaches, but persistent usage can lead to rebound headaches. Aspirin, acetaminophen, or both are often combined with caffeine or a sedative drug in a single medication. Combination drugs may be more effective than NSAIDs or acetaminophen alone. Analgesic-sedative combinations can be obtained only by prescription because they may produce dependency, or trigger addiction in vulnerable individuals. This may lead to chronic daily headache. Combinations of acetaminophen or aspirin and an opioid should be used with great caution. These drugs should not be used more than two days a week due to concern for side effects and the potential for dependency.

8. Patients who experience more than three tension headaches per week may benefit from prophylactic therapy designed to prevent tension headaches**.** Poorly controlled tension headaches may indicate that attention should be directed to physical or psychological factors that may be triggering the headaches.

Migraine Headaches

9. Medical treatment of migraine headaches includes strategies for acute interventions and headache prevention. Many patients with migraine can be effectively treated with various acute headache medications and nonpharmacologic strategies. See Appendix E for list of pharmacologic treatments that can be used to treat and prevent migraine headaches. Patients need to be aware of factors that can trigger migraines and avoid those that trigger their headaches. Headache risk factors and triggers include: sleep disruption, delaying meals, stress, and, for some people, specific foods, beverages or odors can trigger migraine attacks. Nonpharmacologic treatments are often adjunctive to acute treatment although at times and especially early in the evolution of a migraine they may be effective and may eliminate the need for pharmacologic interventions. Nonpharmacologic treatments commonly employed are relaxation, biofeedback, visualization, extracranial pressure, and cold compresses. Regular exercise, maintaining regular sleep and meal schedules are an important part of the overall treatment regimen but are more effective as preventives than as treatments.

10. Interventions to reduce headache frequency should be considered when migraine headaches occur more than once a week or any of the following criteria exist:
    a. Headache attacks that are disabling despite aggressive acute interventions
    b. Patient's desire to reduce frequency of acute attacks
    c. Headaches compromise work attendance, societal integration or daily life

11. Effective acute treatment requires that patients recognize their specific warning signs (aura) of an impending headache. A migraine headache often begins with mild to moderate pain that may be similar to the pain of a tension-type headache. As the migraine progresses, the headache includes the typical migraine features such as throbbing pain, nausea and phono- or photophobia. Acute treatment is more likely to succeed if medication is taken as soon as the patient recognizes the warning signs.

12. It is important that acute migraine treatment be used prudently to avoid inducing headaches due to medication overuse or rebound. Headaches associated with medication overuse are typically tension-like in character. Treatment of medication overuse headaches requires stopping daily use of acute headache medication treatment, which will lead to withdrawal symptoms that include rebound headaches. Patients can fall into a pattern of continued medication overuse to avoid rebound

headaches. When patients are caught in a pattern of medication-overuse, they are usually refractory to preventive medications. In most cases, headaches improve after an analgesic washout period. It is important to educate patients that acute migraine medication treatment be limited to 3 treatments a week or less on a regular basis. A headache diary including frequency and medication history use may be useful in detecting medication overuse.

13. If acute treatment of a migraine is not effective, rescue treatment may be needed to break the migraine cycle (see **Table D-2**). If rescue therapy is required more than once a month, then the patient should receive prophylactic treatment as well as acute treatment.

Table D-2: Rescue interventions for migraine

Intervention	Comment
Medications	Due to nausea medications should be administered via injection or suppository
NSAID - Ketorolac	Gastric protection against ulceration may be considered.
Triptans or Ergotamines	These agents are available in parenteral formulations, nasal sprays and oral tablets. Given early, may abort migraine attack, may be ineffective for an advanced migraine attack.
Tramadol	The side effect of sedation can be useful as migraine attacks can abate with sleep.
Divalproex sodium	Intravenous administration of 500mg can break a migraine
Butorphanol (Stadol)	This is available in a nasal inhalation formulation; given early may be able to abort a migraine attack
Opioids	Morphine sulfate 2-4mg or comparable dose of another parenteral opioid can be useful in breaking a migraine attack. Regular usage can lead to habituation. This class of medications is usually avoided in mTBI patients.
Oxygen Inhalation	This treatment can be given in conjunction with other interventions. Oxygen is typically provided as 2-4 liters per minute via nasal prongs or mask.
Prochlorperazine	Rectal suppositories 25 mg twice daily may cause sedation
Promethazine	Rectal suppositories 12.5-25 mg every 4-6 hours as needed may cause sedation

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D-2. DIZZINESS AND DISEQUILIBRIUM

BACKGROUND

Dizziness and disequilibrium are common symptoms/signs of many diagnoses, concussion/mTBI being one of them. Dizziness, impaired balance and altered coordination have been reported in as many as 30% of people after mTBI (Cicerone, 1995). Dizziness and disequilibrium disorders that may result from concussion/mTBI can be organized into the following disorders: inner ear disorders (peripheral vestibular disorders), central nervous system disorders, psychological disorders and musculoskeletal disorders.

Table D-3: Criteria for categorization and referral for dizziness and disequilibrium after mTBI (Shumway-Cook, 2007; Shepard et al, 2007)

	Possible Diagnosis	Symptoms	Duration/Provocation	Referral
Inner Ear Disorders (Peripheral Vestibular Disorders)				
1	Benign positional vertigo	• Vertigo • Lightheadedness • Nausea	• Spells that last for seconds and are associated with changes in head position • Nystagmus usually observed when symptomatic	• Canalithic repositioning maneuver • Vestibular Rehabilitation
2	Labyrinthine Concussion	• Vertigo with movement • Disequilibrium • Oscillopsia with head movements • Nausea & vomiting (acute)	• History of event, symptoms improved since event but remain problematic • Mostly related to fast head movements/turns	• ENT • Physical Therapy
3	Post-traumatic endolymphatic hydrops	• Vertigo • Disequilibrium • Aural fullness • Tinnitus	• Spontaneous, episodic spells that can last for hours	• ENT
4	Perilymphatic fistula	• Loud tinnitus • Hearing loss • Vertigo	• Onset related to an event • Increase in abdominal pressure can elicit symptoms	• ENT
5	Bilateral labyrinthine dysfunction	• Disequilibrium • Vertigo & oscillopsia if lesions asymmetrical	• Related to one or more events, induced by head movements, difficulty with postural control in the dark or on uneven surfaces	• ENT • Physical Therapy
Central Disorder				
6	Frontal lobe contusion	• Decreased attention • Impulsivity • Imbalance • Apraxia	• Postural issues related to increased attentional demands, both internal (multi-tasking) and external (environmental)	• Physiatry • Physical Therapy
7	Migraine-induced vestibulopathy	• Motion sensitivity • Disequilibrium • Headache	• Movement induced spells of vertigo that usually last for minutes to one hour, usually close temporal relationship with headache	• See Section D-1: Headache • Physical Therapy
8	Visual dysfunction	• Dizziness • Disequilibrium • Blurred vision • Diplopia • Impaired visual-spatial orientation • Eye-hand incoordination • Excessive peripheral vision stimulation	• Difficulties with balance on uneven, conforming terrain • Dizziness with increased environmental stimulation • Squinting/closing one eye during activities • Difficulty standing in midline or noted head tilt	• Ophthalmology • Vision Rehabilitation

	Possible Diagnosis	Symptoms	Duration/Provocation	Referral
Psychological Disorder				
9	Depression, anxiety, somatization	• Lightheadedness • Floating • Rocking • Vague/bizarre accounts	• May be related to event but could report chronic history, symptoms can be induced by eye movments with head still	• Psychiatry • Psychology • Physical Therapy
Musculoskeletal Disorder				
10	Flexion-extension, cervical injury (cervicogenic)	• Vertigo • Disequilibrium • Lightheadedness • Neck pain	• Onset with event • Symptoms coincide with movement of cervical spine	• Physiatry • Physical Therapy
Uncommon Central Disorders				
11	Brain stem or cerebellar dysfunction	• Vertigo • Disequilibrium • Nausea & Vomiting • Head/trunk tilt • Lateropulsion • Ataxia • Sensory disturbance • Oscillopsia • Vision deficits • Incoordination	• Onset with event • Can be exacerbated by movement	• Neurology • Physical Therapy • Ophthalmology • Vision Rehabilitation
12	Vertebral-basilar insufficiency related to occipitoatlantal instability	• Nausea & vomiting • Vertigo • Visual hallucinations/ loss • Visual field deficit • Numbness/weakness • Ataxia • Drop attacks • Diplopia • Headaches	• Related to an event • Usually symptoms induced by cervical extension and rotation	• Neurology • Neurosurgery
13	Temporal bone fracture	• Conductive hearing loss • Vertigo • Disequilibrium • Nausea & vomiting • Oscillopsia	• Onset with event • Will follow the course of labyrinthine concussion	• ENT • Physical Therapy

RECOMMENDATIONS

ASSESSMENT

Physical Examination

1. Observation and patient interview are key elements to the exam and often guide the clinician in determining the plan of care. Evaluation should include a thorough neurologic examination and the following systems review: vision (acuity, tracking, saccades, nystagmus), auditory (hearing screen, otoscopic exam), sensory (sharp, light touch, proprioception, vibration), motor (power, coordination) and vestibular (dynamic acuity, positional testing). Evaluation of functional activities should include sitting and standing (Romberg with eyes open/closed, single leg stance) balance, transfers (supine↔sit, sit↔stand) and gait (walking, tandem walking, turning).

Medication Review

2. A detailed medication history is warranted. Numerous medications include dizziness as a potential side effect. The following classes of medication can cause or aggravate dizziness: stimulants,

benzodiazepines, tricyclics, monoamine oxidase inhibitors, tetracyclics, neuroleptics, anticonvulsants, selective serotonin agonists, beta blockers and cholinesterase inhibitors. The temporal relationship to the onset of dizziness and the initiation/dosing of these medications should be investigated.

TREATMENT

Pharmacologic Treatment

3. Initiating vestibular suppressants for dizziness may delay central compensation or promote counterproductive compensation (Hain & Yacovino, 2005; Pyykko I, 1988). Vestibular suppressants might be helpful during the acute period of several vestibular disorders but have not been shown to be effective in chronic dizziness after concussion (Zee, 1985). Medications should only be considered if symptoms are severe enough to significantly limit functional activities. Trials should be limited to 2 weeks. With concussion/mTBI be particularly careful regarding dosing and titration due to the effects on arousal and memory as well as potential addictive qualities of these medications (Arciniegas, 2005). First line medication choice would be meclizine, followed by scopolamine and dimenhydrinate depending upon symptom presentation. Pharmacotherapy with clonazepam, diazepam or lorazepam should be carefully considered due to their sedating and addictive qualities. (See Table D-6)

Non-Pharmacologic Treatment

4. Non-pharmacologic interventions for post-traumatic dizziness may be useful as an alternative to pharmacotherapies (de Kruijk et al., 2002), although the effectiveness of such interventions is not fully established with concussion/mTBI. Efficacy of vestibular and balance rehabilitation has been found in different populations with vestibular disorders (Herdman et al., 1995; Shepard & Telian, 1995; Yardley et al., 1998). Patients with vestibular disorders who received customized programs showed greater improvement than those who received generic exercises (Shepard & Telian, 1995). Studies utilizing vestibular exercises have shown up to 85% success rate in reducing symptoms and improving function in the population with peripheral vestibular disorders (Krebs et al, 2003; Shepard & Telian, 1995). With concussion/mTBI, recovery of vestibular lesions is often limited or protracted due to the co-existence of central or psychological disorders (Gottshall et al., 2007).
5. Knowledge of the canalith repositioning procedures (Fife, 2008) for the treatment of benign positional vertigo would be beneficial for primary care physicians. The types of exercise to treat dizziness and disequilibrium are beyond the scope of this guideline. Central and psychological disorders need a coordinated team effort to address the underlying impairments to maximize outcome of vestibular rehabilitation.

EVIDENCE STATEMENT

- Concussion/mTBI in the acute stage may cause dizziness (Ernst, 2005; Hoffer, 2004; Staab, 2007) [Level of Evidence = B]
- Subjective reports of dizziness correlate with objective testing only during the first week post-injury of concussion/mTBI (Gottshall, 2007). [Level of Evidence = B]
- Concussion/mTBI may cause coordination deficits of the lower extremities (imbalance) and/or upper extremities (dysmetria) (Catena, 2007, Heitger, 2006; Parker, 2006) [Level of Evidence = B]
- Cognitive distractions or performance of dual tasks are sensitive provocative tests for detection of imbalance and coordination deficits in the acute stage of Concussion/mTBI (Catena, 2006; Parker, 2006) [Level of Evidence = B]
- Adjusted for age, gender, educational and employment status, concussion/mTBI patients who had dizziness and/or headache were almost three fold more likely to develop persistent symptoms at one month (Savola & Hillborn, 2003). [Level of Evidence = C]
- Some evidence suggests that vestibular rehabilitation may improve post-traumatic dizziness symptoms (Hoffer, 2004) [Level of Evidence = C]

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D-3. FATIGUE

BACKGROUND

Fatigue is the third most common symptom reported in concussion/mTBI. It can be due to a primary effect related to central nervous system dysfunction or a secondary effect such as common co-existing disorders in concussion/mTBI such as depression or sleep disturbances. Medications, substance use and lifestyle may also contribute to fatigue.

Table D-4. Criteria for Characterizing Fatigue

Effect	Assessment	Treatment
Metabolic (uncommon in concussion/mTBI)	Positive lab findings	Further medical evaluation
Physical	Usually subjective, state of weariness related to physical exertion resulting in diminished capacity for work or decreased response to stimuli	Individualized fitness program
Cognitive	Usually subjective, state of weariness related to increased mental effort resulting in diminished capacity for work or decreased response to stimuli	Cognitive rehabilitation (Educational Programming, Cognitive Behavioral Therapy)
Sleep Disturbance	Self-reported, Positive sleep studies	See section D-4 Sleep Disorder
Depression	Depression screen	See Algorithm C: Persistent Emotional and cognitive Symptom management

RECOMMENDATIONS:

ASSESSMENT

1. A detailed history looking at pre/post-injury level of physical activity, cognitive function and mental health is important to determine the effects of fatigue in relation to the injury. The ability to maintain a job is often a good measure of the impact of this symptom. Several outcome measures exist for fatigue and many have been studied in other diagnostic populations. Common measures in TBI include the Multidimensional Assessment of Fatigue (MAF), Fatigue Impact Scale (FIS) or Fatigue Assessment Instrument (FAI.) For concussion/mTBI there is no specific scale recommended. Laboratory tests may include blood count, metabolic panel, vitamin B12 and folate levels, thyroid function test and Erythrocyte Sedimentation Rate (ESR).

MEDICATION REVIEW

2. Due to the large number of centrally acting medications, a medication review is necessary. If a medication appears contributory, performance of an Applied Behavioral Analysis (ABA) trial is indicated to determine the association. Review of illicit drugs, alcohol, tobacco and caffeine/other stimulants should be performed.

TREATMENT

Pharmacologic treatment

3. All medical and psychological disorders underlying fatigue should be treated. Modifiable factors should be addressed and typical conservative measures taken prior to initiating pharmacotherapy for fatigue. Several stimulants have had success in other disease states associated with fatigue. Although widely used in TBI, there is limited evidence in use of these medications for treatment of fatigue in concussion/mTBI.

If symptoms have persisted for more than 4 weeks post-injury and the fatigue level has not improved with the management of sleep, pain, depression, or lifestyle, then a neurostimulant may be tried. (See Appendix E)

Medication trials should persist for at least 3 months. Use of neurostimulant medications is contraindicated if there is a history of substance abuse.

Non-pharmacologic treatment

4. Education is important in the treatment of fatigue. Educational efforts should be in the areas of factors contributing to fatigue, importance of well balanced meals, promotion of sleep hygiene and regular exercise. Exercise routines should be individualized to maximize benefit and promote proper ratio of activity/rest. Scheduling of exercise may need to be addressed depending upon when the patient is at his or her best. Cognitive-behavioral and physical therapy can be tried to decrease fatigue level and improve functional performance in patients with concussion/mTBI.

EVIDENCE STATEMENTS

- Several studies have demonstrated the association between concussion/mTBI and fatigue (Borgaro et al., 2005; Stulemeijer et al., 2006; 2006b).
- There is some evidence to supports that multiple concussion/mTBI-related and -non related factors contribute to fatigue (Stulemeijer 2006; Stulemeijer 2006b; Ziino et al, 2005). That association is not related to the severity of TBI (Borgaroet al., 2005).
- In a controlled descriptive study, patients with concussion reported greater fatigue than those in the control group despite similar levels of mood disorders (Lachapelle, 1998; Zinio et al, 2005).
- Persistent post-concussion fatigue is related to early fatigue symptoms but can also develop over time (Norrie et al, 2007).
- There is no research evidence to support a specific treatment regimen for fatigue, however management of associated factors (e.g., mood, sleep, pain, medication effect) has been advocated (Borgaro et al, 2005; Stulemeijer et al., 2006a, 2007; Ziino et al, 2005).
- There is research evidence to support improvement of fatigue symptoms after mTBI during the first 6 months (Borg et al, 2004; Stulemeijer et al., 2006b).
- Several pharmacologic agents have been trialed in TBI with variable success. A recent study in the population with TBI found that there was no consistent or persistent clinical significance with use of modafinil over placebo (Jha, 2008.)

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D-4. SLEEP DYSFUNCTION

BACKGROUND

Sleep disturbance often occurs acutely after concussion. Persistent difficulty falling asleep or staying asleep despite the opportunity (insomnia) is a common symptom of post trauma. Concussion/mTBI might contribute to the emergence of circadian rhythm sleep disorders. Two types of these disorders have been observed: delayed sleep phase syndrome and irregular sleep–wake pattern. Sleep apnea, depression, pain, and other conditions may contribute to the overall poor quality of sleep. (See Table D-5 Management of Sleep Dysfunction)

RECOMMENDATIONS

1. Pharmacological approaches to sleep regulation may prove beneficial. (See Appendix E)
2. Cognitive behavioral sleep interventions have also been shown to be effective in normalizing sleep, these might include sleep restriction, sleep hygiene education, relaxation training and others. The goals of sleep management should be to establish a regular, unbroken, night-time sleep pattern and to improve perceptions of the quality of sleep.
3. If a patient with concussion/mTBI has a concurrent *primary* sleep disorder (e.g., sleep apnea, restless leg syndrome, or narcolepsy) a specific appropriate intervention may be required.
4. The aim of sleep management is to establish a regular, normalized sleep-wake pattern. Patients should be encouraged to:
    - Avoid alcohol
    - Restrict the night-time sleep period to about eight hours
    - Avoid going to bed too early in the evening
    - Avoid stimulants, caffeinated beverages, power drinks, and nicotine during the evening period
    - Arise from bed at a regular time in the morning (e.g., by 8 a.m.)
    - Wake at a regular time in the morning (e.g., 7 a.m.)
    - Reduce (to less than 30 minutes) or abolish daytime naps
    - Engage in daytime physical and mental activities (within the limits of the individual's functional capacity)
    - Avoid stimulating activities before bedtime (e.g., exercise, video games, T.V.)

Table D-5: Management of Sleep Dysfunction

Acute Phase	Chronic Phase (>3 months).
• Provide education about concussion with regard to changes in sleep quality and duration sometimes associated with concussion. • Provide information on good sleep habits with specific suggestions to improve the quality and duration of sleep, e.g., regularly scheduled bedtime. • Provide information about the potential effects of medications, caffeine, tobacco, and alcohol on sleep. • Sleep medications may be helpful in the short-term (non-benzodiapenes).	• Review current medications and other current health conditions for factors which might contribute to chronic sleep disturbances, including chronic pain. Provide information about the potential effects of medications, caffeine, tobacco, and alcohol on sleep. • Evaluate for potential co-morbid psychiatric conditions, including depression and anxiety and, if present, consider using standard medications which may improve sleep. • If patient has a chronic pain disorder, appropriate pain management may assist with improving sleep duration and quality. • Consider sleep study to provide objective evidence of sleep disturbance and to rule out co-existing sleep apnea or other sleep disorders. • Training in behavioral techniques, such as relaxation training or meditation to improve the quality of sleep. • Consider a course of Cognitive Behavioral Therapy (CBT) focused on sleep with additional behavioral interventions to include Sleep Restriction, Stimulus Control and Relapse Prevention Techniques.

For additional recommendations –See VHA Pharmacy Benefit Management (PBM) guideline for Insomnia:

http://www.pbm.va.gov/guidelines/Treatment%20of%20Acute-Chronic%20Insomnia-Guidance%20for%20Tx%20of%20Insomnia%20in%20Primary%20Care%20Setting-Recommendation%20for%20Use%20Zolpidem%20IR.doc

Patient Resources for Basic Hygiene Education

http://www.womenshealth.gov/faq/insomnia.htm#5

http://www.aasmnet.org/FactSheet.aspx

http://www.sleepfoundation.org/

Example of a sleep diary:

http://www.nhlbi.nih.gov/health/prof/sleep/insom_pc.pdf

Professional Education:

http://www.sleepfoundation.org/

http://www.ahrq.gov/clinic/epcsums/insomnsum.htm

D-5. PERSISTENT PAIN

(See also D-1 for a complete discussion of headache pain)

BACKGROUND

Pain other than headache pain is common in patients with concussion/mTBI. Musculoskeletal pain is a common comorbid condition in concussion. Evaluating pain and treating it symptomatically is important

as pain is associated with poor outcomes in TBI. Pain can be caused by any of a number of co-morbid conditions as well as musculoskeletal injuries or secondary damage to soft tissue.

Assessing patients for pain and its underlying causes is an essential component of the clinical work-up. It is important to attribute symptoms correctly and to identify and treat any comorbid conditions. If medication is being considered, it is essential that the underlying cause has been established prior to prescribing.

RECOMMENDATIONS

1. Pain management must be a priority and all patients presenting with concussion should be assessed for pain on a regular basis.
2. Choice of treatment modalities for patients with concussion should be based upon risk benefit.
3. Pain management for patients with concussion should be based on a patient-centered model of care.
4. A pain management plan must consider the causation, psychosocial factors and general physical condition of the patient with concussion.
5. Effective drugs for pain relief for the patient with concussion include nonsteroidal anti-inflammatory drugs (NSAIDs), or muscle relaxants.
6. Physical therapy may be beneficial in conjunction with medications for the patient with concussion.

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D-6. MANAGEMENT OF OTHER SYMPTOMS

The following recommendations for treatment of other physical symptoms, less common in patients presenting with concussion/mTBI symptoms, were formulated based on consensus of clinical experts.

Vision Difficulties

BACKGROUND

Vision difficulties, including sensitivity to light, diplopia, blurring and other difficulties seeing, occur acutely in up to half of all individuals who sustain a concussion. Symptoms are either blurring of vision ("double vision") that worsens over the course of the day or difficulty with visual stimulation with resultant pain (headache, eye ache) or sensitivity. The vast majority resolve within a month. Aggressive, focal treatments aimed at symptom management (reassurance, pain management, controlling environmental light, sunglasses, intermittent patching for double vision) in the first 4-6 weeks are usually effective. True abnormalities in visual acuity, visual fields or structural damage the eye are extremely rare with mTBI. Other causes of problems are also extremely rare and often not related directly to the concussion injury. Pre-injury visual deficits are common and need to be ruled out.

RECOMMENDATIONS

1. Perform an ophthalmologic examination to include extraocular movements, pupils and visual fields by confrontation.
2. Refer to optometry and/or ophthalmology as indicated.
3. Allow initial use (until in therapy) of sunglasses and then give formal weaning program (decrease by 15 minutes every 2 hours).
4. Consider non-organic vision loss in patients who present with prolonged sunglass use even in low light settings.

Hearing Difficulties

BACKGROUND

Hearing difficulties, including altered acuity and sensitivity to noise, occur acutely in up to three-quarters of all individuals who sustain a blast related concussion. Symptoms are either of decreased auditory acuity or sensitivity to noise. The vast majority of those symptoms resolve within a month, unless there is significant or permanent injury to the ear drum. Aggressive, focal treatments aimed at symptom management (reassurance, pain management, controlling environmental noise, white noise generators) in the first 4-6 weeks are usually effective. True abnormalities in central auditory acuity or processing are extremely rare with mTBI. Other causes of problems are also extremely rare and often not related directly to the concussion injury. Pre-injury hearing deficits are common and need to be ruled out.

RECOMMENDATIONS

1. Perform an otologic examination.
2. Review medications for ototoxicity.
3. Refer to audiology for hearing assessment if no other apparent cause is found.

Smell (Olfactory Deficits)

BACKGROUND

Post-traumatic olfactory deficits (anosmia) are not common in individuals who sustain a concussion, occurring in less than 25%. Symptoms are typically seen with a decreased appetite, but this may be a sign of a significant injury to the frontal lobe and other central difficulties must be ruled out. The vast majority

resolve within a 6 month period. Treatments have limited effect and are usually aimed at flavoring/spicing food to enhance taste. Other causes are also extremely rare and often not related directly to the concussion injury. Pre-injury causes of anosmia need to be ruled out.

RECOMMENDATIONS

1. Perform a nasal and oropharyngeal examination and depression screen.
2. Refer to ENT for further evaluation if needed.
3. If neurologic status is stable and no objective findings then reassurance and monitoring is appropriate. Increase spicing of foods (+/- dietary referral). Monitor weights.

Changes in Appetite

BACKGROUND

Post-traumatic appetite deficits are not common in individuals who sustain a concussion, occurring in less than 5%. When a change in appetite is noted, it may be related to mood, medications, smell, or other factors and will likely resolve. Treatments have limited effect and are usually aimed at flavoring/spicing food to enhance taste or managing depression. Other causes are also extremely rare and often not related directly to the concussion injury. Pre-injury causes of appetite issues need to be ruled out.

RECOMMENDATIONS

1. Perform nasal and oropharyngeal examination.
2. Review neurovegetative signs with patient to assess for depressed affect or clinical depression.
3. Assess medication list for agents that can cause olfactory or gustatory abnormalities (centrally acting medications, in particular anti-epileptics, some antibiotics).
4. If neurologic status is stable and no objective findings then reassurance and monitoring is appropriate. Increase spicing of foods (+/- dietary referral). Monitor weights.

Numbness

It is extremely rare to see numbness with mTBI in the absence of peripheral nerve injury, and it usually represents somatization. If neurologic status is stable and no objective findings then reassurance and monitoring is appropriate.

RECOMMENDATION

1. Perform a sensory examination.

Nausea

BACKGROUND

Post-traumatic nausea occurs occasionally acutely after concussion, most often in combination with dizziness, as a secondary effect of medications (pain), or due to an exacerbation of underlying GERD/GI dysfunction. Assessment initially is limited and focus should be on rapid management of dizziness and return to activity.

RECOMMENDATIONS

1. Define triggers and patterns of nausea.
2. Assess medication list for agents that may cause or worsen GI symptoms.
3. Perform oropharyngeal examination.

Appendix E: Pharmacotherapy

Pharmacotherapy in Concussion/mTBI – List of Selected First line Agents

	Potential side effects	Contraindications/ Comments	Common issues in concussion/mTBI
Stimulants (In specialty care after ruling out sleep disorder.)			
First line agents: **Methylphenidate** 5 mg every 8 am and 1 pm, increasing total daily dose by 5 mg every 2 weeks to a maximum of 20 mg twice daily	• Insomnia • Decreased appetite • GI upset • Headaches • Dizziness • Motor tics • Irritability • Anxiousness • Tearfulness	Ongoing substance abuse.	Possible addiction potential Requires additional prescription regulation under federal/state law. Cannot be refilled, only one month of therapy at a time may be prescribed
Modafanil start with 100 mg every morning. Increase in 100 mg amounts, using split daily dosing up to maximum of 400 mg/day	• Headache, asthesia		
Amantadine 100-400 mg daily	• Nausea • Dizziness • Dry mouth		
Antidepressants			
First line agents: **Citalopram** 10 mg daily for 1 week, then 20 mg daily if tolerated (up to 80 mg daily if needed) **Sertraline** 25 mg daily increasing weekly in 25 mg increments to maximum dose of 200 mg/day	• Nausea • Insomnia • Agitation • Asthesia • Nausea • Insomnia • Dry mouth • Headache	Do not initiate concomitant therapy with a benzodiazepine	May cause sexual dysfunction
Non-benzodiazepine Sleep Agents			
First line agent: **Zolpidem** 5 mg at night, if poor results after 3 nights of therapy increase to 10 mg nightly			
Prazosin initiate therapy with 1 mg at bedtime for three days. May increase to 2 mg at bedtime through day 7. If patients continued to have nightmares, the dosage may be increased to 4 mg at bedtime through day 14. The dosage could be increased to 6 mg at bedtime through day 21 and to 10 mg at bedtime through day 28.The maximum daily dose is 10 mg at bedtime.	• Orthostatic hypotension		For patients with nightmares and/or violent or outburst or agitation during sleep

	Potential side effects	Contraindications/ Comments	Common issues in concussion/mTBI
NSAIDS for headache			
Ibuprofen 400-600 mg three to four times daily **Naproxen** 500 mg twice daily	• GI upset • Dizziness • vertigo		Potential renal impairment with long term use Rebound headache may occur with continuous use
Abortive agents for migraine/migraine-like headaches			
Zolmitriptan oral 5-10 mg at onset of headache, may repeat once if headache is not resolved in 2 hours **Zolmitriptan nasal** one spray of 5 mg for the treatment of acute migraine. If the headache returns the dose may be repeated after 2 hours. The maximum daily dose should not exceed 10 mg in any 24-hour period **Sumatriptan oral** 50-100 mg at onset of headache, may repeat once if headache is not resolved in 2 hours **Sumatriptan nasal** 10 mg spray in one nostril, may repeat in 2 hrs not to exceed 40 mg/day **Sumatriptan injectable** 6 mg injected subcutaneously may repeat in 1 hour. Not to exceed 12 mg/day	• unusual taste (nasal formulation), paresthesia, hyperesthesia, dizziness, chest tightness • Dizziness, vertigo, tingling, hypertension, injection site reactions,		Serious cardiac events, including myocardial infarction, have occurred following the use of zolmitriptan and sumatriptan tablets and nasal spray. These events are extremely rare and most have been reported in patients with risk factors predictive of CAD
Prophylactic headache agents			
First line agents: **Divalproex sodium extended release** 250 mg twice daily, increase by 250 mg/day every week to a maximum of 1000 mg/day	• Asthenia, dizziness, somnolence, tremor, nausea, diplopia	Hepatic failure resulting in fatalities has occurred in patients receiving valproic acid and its derivatives	May take up to 3 months to receive the full benefit from any of the prophylactic medications Association with teratogenecity, neural tube effects. Caution in women of childbearing potential
Topiramate 25-100 mg twice daily	• Anorexia, sedation, ataxia, dizziness		May worsen cognitive dysfunction May cause renal stones
Metoprolol initiate with 25 mg twice daily, increase dose up to 100 mg twice daily if needed, wait 3-4 weeks between dose increases	• Somnolence • Cold extremities • bradycardia	There are two formulations- tartrate is immediate release, dosed 2 times daily and succinate is sustained release, dosed one time daily.	Use with caution in asthmatic and diabetic patients

	Potential side effects	Contraindications/ Comments	Common issues in concussion/mTBI
Vestibular Suppressants			
Meclizine 12.5-50 mg every 4-6 hours	• Hallucinations, blurred vision	**All of the agents may cause sedation and require caution when driving or operating machinery**	
Scopolamine 0.5 mg patch every 3 days	• Dry mouth • Topical Allergy • Tachyarrhythmia		
Dimenhydrinate 50 mg every 4-6 hours orally	• Dry mouth		
Lorazepam 0.5 mg twice a day orally **Clonazepam** 0.25 -0.5 mg twice a day orally **Diazepam** 2-10 mg orally, IM, or IV	• Drug dependence • Respiratory depressant		Avoid use of benzodiazapines in mTBI if at all possible

Appendix F: Education Intervention Studies

Education and Support Intervention Studies with Mild TBI Patients

First Author	Design	Treatment(s) Tested	Study Sample	Control and Tx Groups	Follow-Up Period	Tx Better Than Control?
Mittenberg et al., 1996	RCT	Handout + one-hour session	Hospitalized after mild TBI	N = 29 N = 29	6 months	Yes
Relander et al., 1972	RCT	Activity encouraged; good prognosis emphasized	Within 36 hours of hospitalization	N=96 N=82	1 year	Yes
Minderhoud et al., 1980	Retrospective comparison	Printed + verbal education + activity encouraged	Hospitalized after mild TBI	N=352 N=180	6 months	Yes
Gronwall, 1986	Not randomized	Printed education	Within 2 weeks of injury	N=54 N=34	3 months	No
Alves et al., 1993	RCT	1. Education only 2. Education + reassurance about recovery	Hospitalized after mild TBI	N=210 N=176 N=201	3, 6, 12 months	Yes*
Ferguson & Mitenberg, 1996 as reported in Miller & Mittenberg, 1998	Case Description	12-session manualized cognitive-behavioral treatment	Referrals to outpatient clinic	N=4	12 weeks	Yes
Wade et al., 1998	RCT	Printed and verbal education + continued support	7 to 10 days post-injury	N=130 N=184	6 months	Yes
Paniak et al., 2000	RCT	Single session education	Hospital emergency room	N=59 N=60	3 to 4 months	Yes**
Tiersky et al., 2005	RCT with multiple baselines	CBT+cognitive treatment for 11 weeks	Average of 5 years post-injury	N=7 (milds) N=11	1 and 3 months	Yes
Ghaffar et al., 2006	RCT	Multidiscipline treatment	Within 1 week of injury	N=94 N=97	6 months	No
Mittenberg, 2001	SR	Booklet guide	varied	N=1014	6 months	Yes
Ponford, 2002	CT	Provision of booklet	202	C= 123 N= 79	1 week and 3 months	Yes

Notes: *For reassurance treatment group only, assuming that patients not seen at follow-up are asymptomatic.
**No differences in outcomes between single session and extensive outpatient therapy.
RCT = randomized control trial; CBT = cognitive behavioral therapy; Tx = Treatment.

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Appendix G: Acronym List

ACRM	American College of Rehabilitation Medicine
ADL	Activities of Daily Living
ATC	Assistive Technology for Cognition
AOC	Alteration of Consciousness/Mental State
CAM	Complementary Alternative Medicine
CDC	Centers for Disease Control and Prevention
CT	Computed Tomography
DVBIC	Defense and Veterans Brain Injury Center
DSM-IV	Diagnostic and Statistical Manual for Mental Disorders – Fourth Edition
GCS	Glasgow Coma Score
IADL	Instrumental Activities of Daily Living
ICD-10	International Classification of Diseases - 10th Revision
LOC	Level of Consciousness
MSA	Mental Status Examination
mTBI	Mild Traumatic Brain Injury
PCD	Post-Concussion Disorder
PCS	Post-Concussion Syndrome or Post Concussive Syndrome
PPCS	Persistent Post Concussive Symptoms
PTA	Post-Traumatic Amnesia
PTSD	Post-Traumatic Stress Disorder
OIF/OEF	Operations Iraqi Freedom and Enduring Freedom
SR	Strength of the Recommendation
USPSTF	United States Preventative Services Task Force
WHO	World Health Organization

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