

Evaluation and Treatment of Persistent Cognitive Dysfunction Following Mild Traumatic Brain Injury

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ABSTRACT

The Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury (DCoE) and the Defense and Veterans Brain Injury Center (DVBIC) hosted a consensus conference to address persistent cognitive impairments following mild traumatic brain injury (mTBI) and the role of cognitive rehabilitation in this population. Fifty military and civilian subject matter experts developed clinical guidance for cognitive rehabilitation of Service members with cognitive symptoms persisting three or more months following injury. This article highlights the initial evaluation, comprehensive assessment and treatment recommendations contained within the guidance “Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury and Defense and Veterans Brain Injury Center Consensus Conference on Cognitive Rehabilitation for Mild Traumatic Brain Injury.” The full clinical guidance is available at: (<http://www.dcoe.health.mil/Resources.aspx>).

Mild TBI (mTBI) remains one of the most common injuries sustained by those serving in Operation Enduring Freedom and Operation Iraqi Freedom (OEF/OIF) due to the widespread use of explosive weapons, the increased survival rate due to advances in body armor and helmets, and increased awareness and screening for mTBI (Terrio et al., 2009). However, the true incidence of mTBI in OEF/OIF is unknown. Many servicemembers with mTBI do not seek medical care and therefore their injuries go unrecognized and unreported. Estimates of self-reported mTBI by servicemembers who served in Afghanistan and Iraq since 2001 range from 15-22% (Hoge et al., 2008; Terrio et al., 2009). Mild TBI as defined by the Department of Defense (DoD) is a traumatically induced structural injury and/or physiologic 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: period of loss of or a decreased level of consciousness 0 to 30 minutes; loss of memory for events immediately before or after the injury up to 24 hours; alteration in mental state at the time of the injury (confusion, disorientation, slowed thinking, etc) up to 24 hours; neurological deficits (weakness, loss of balance, change in vision, praxis, paresis/plegia, sensory loss, aphasia, etc) that may or may not be transient (Government report, 2007).

The substantial majority of individuals with mTBI have symptoms that last only a short period of time recovering within minutes to several weeks (McCrea, 2008). However, 5-15% of individuals who sustain an mTBI have symptoms that persist beyond this period of time and/or have functional limitations (Iverson et al., 2006; Ruff et al., 1996). There is strong consensus in the literature that persistent cognitive and emotional symptoms following mTBI can result in significant functional deficits and should be treated.

Because clinicians currently face an increasingly large

population of Wounded Warriors who have sustained an mTBI with a portion developing chronic symptoms and functional limitations, including cognitive impairment, the Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury (DCoE) and the Defense and Veterans Brain Injury Center (DVBIC) hosted a two-day consensus conference to address this issue. The term cognitive rehabilitation will be used synonymously with terms such as neurorehabilitation, neuropsychological rehabilitation, cognitive remediation, and cognitive retraining.

The DCoE/DVBIC Consensus Conference included fifty subject matter experts from the Department of Defense, the Department of Veterans Affairs, civilian rehabilitation centers, and academia and included a broad range of clinical and scientific disciplines. Military representatives were selected by their respective Surgeons' General offices. Representatives from the National Guard, Reserves, Special Operations, and Line also participated. The purpose of the Consensus Conference was to create guidelines regarding cognitive rehabilitation for the Service member who is three months or more post-concussion, has persistent post-concussive cognitive symptoms, and is receiving treatment in a military medical setting.

Cognitive rehabilitation has been identified as a well-accepted and common component of comprehensive rehabilitation for persons with moderate and severe TBI (Cicerone et al., 2005) and increasingly is used for persons with persistent symptoms following mTBI (Gordon et al., 2006). The American Congress of Rehabilitation Medicine defines cognitive rehabilitation as “a systematic, functionally oriented service of therapeutic activities that is based on assessment and understanding of the patient’s brain-behavioral deficits” (Cicerone et al., 2000, p 1597). The goal of cognitive rehabilitation is to improve a person’s ability to perform cognitive tasks by retraining previously learned skills, teaching compensatory strategies,

and making environmental modifications to the individual's domestic and work setting (Tsaousides & Gordon, 2009).

The conference attendees addressed the areas of assessment, intervention, outcome measurement, and program implementation. This article highlights the areas of assessment and therapeutic interventions.

REFERRAL

Referral to initial evaluation for cognitive rehabilitation can be made by any provider. Cognitive symptoms may be observed by the provider, reported by the patient, family, community, or any combination of the above. A referral may also be made even if the patient does not report cognitive symptoms but displays evidence of cognitive dysfunction in his/her daily social or occupational functioning.

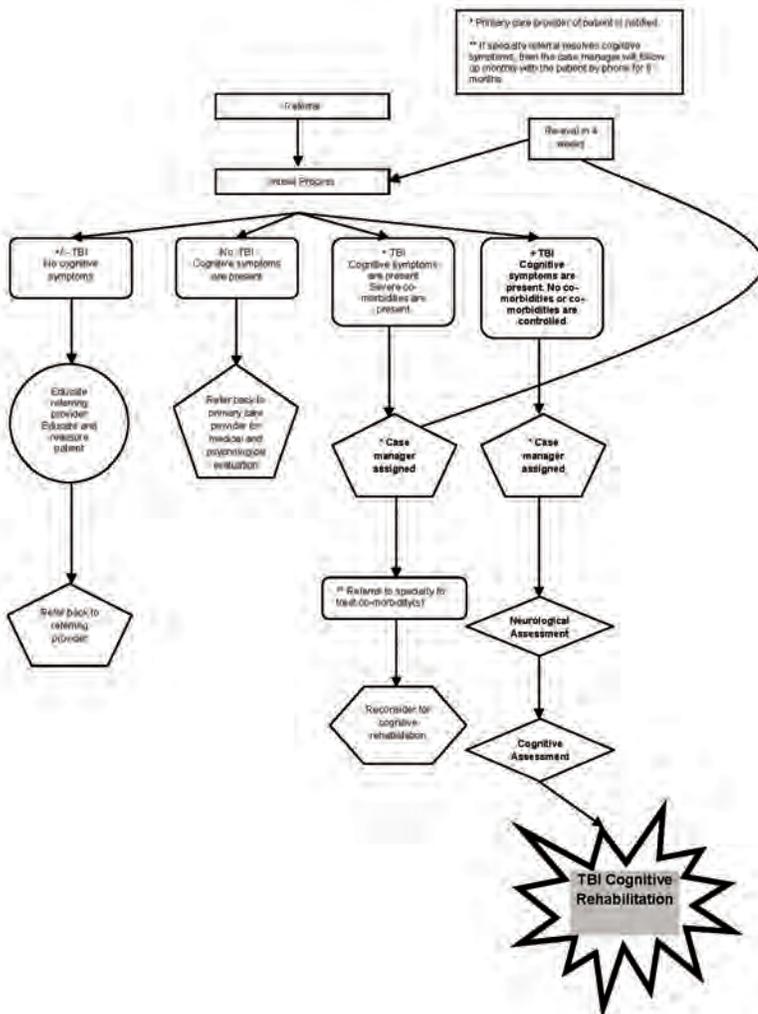
ASSESSMENT

The initial evaluation is required to determine the clinical indication for cognitive rehabilitation and to guide the treatment plan. This evaluation should be conducted within 30 days of referral and in the primary care setting by a TBI-experienced provider (e.g., nurse, nurse practitioner, physician assistant) who is also familiar with other deployment-related health conditions. The purpose of this initial evaluation is to determine if the individual has a history of an mTBI with persistent cogni-

tive symptoms or signs of cognitive impairment (self-reported or observed/reported by the patient's family, command, or community) and to determine if the individual has any co-morbidities that may affect cognitive function. This process should include a thorough intake history to include description of the injury event and the duration of loss of consciousness or altered mental status, confirmation of mTBI diagnosis, evaluation of ongoing symptoms using a tool such as the Neurobehavioral Symptom Inventory (NSI) or the Posttraumatic Stress Disorder Checklist – Military or Civilian Version (PCL-M, PCL-C), a mental health evaluation, and an evaluation for chronic pain, sleep disorders, and substance abuse. The patient will likely match one of the following scenarios:

1. The patient does not have any cognitive symptoms. Education and reassurance to both referring provider (if different from provider conducting the initial assessment) and patient should occur.
2. There are no indications that the patient sustained an mTBI but cognitive symptoms are present. The patient should be referred back to the primary care provider for further evaluation of either a medical or mental health condition.
3. The patient has other co-morbidities or other symptoms (chronic pain or substance abuse) that are too severe for him/her to undergo cognitive assessment. The patient should be referred to the appropriate specialty clinic and have a case manager assigned. If the patient is referred to a specialty clinic, he/she should be re-evaluated for cognitive rehabilitation in four weeks in addition to receiving case management follow-up. This will ensure that these patients may still receive a cognitive assessment and that they are not lost to follow-up. If referred to a specialty clinic and all the cognitive symptoms resolve, the patient should be followed via monthly telephone consultation by the case manager to ensure that the symptoms remain resolved for six months.
4. The patient sustained an mTBI and has symptoms that warrant further cognitive assessment.

Figure 1
Referral Process



It should be noted that any suspicion of an mTBI with persistent cognitive symptoms is reason for referral for further cognitive evaluation. After the patient has undergone this initial evaluation, a note should be sent to the patient's primary care provider and the referral source (if different) to ensure continuity of effective communication and treatment coordination.

COMPREHENSIVE COGNITIVE ASSESSMENT

If the results of the initial evaluation indicate the need for further cognitive assessment, the patient must first undergo a comprehensive neurological examination. This comprehensive neurological examination does not need to be completed by a neurologist, but rather, can be completed by a physician with sufficient expertise and knowledge in the examination and medical work-up of cognitive symptoms. During this time, if any other medical conditions that may result in cognitive impairment are found, then they should be further evaluated and

treated. This comprehensive examination should also include a thorough review of the medical records to look for prior cognitive disorders. If no confounding findings are noted, the patient should receive a comprehensive cognitive assessment.

Table 1: Assessment Domains

Attention	
Memory	
Processing Speed	
Executive Functioning	
	reasoning and problem solving
	organizing, planning and self-monitoring
	emotional regulation
Post-Traumatic Stress Disorder (PTSD)	
Post-Concussive Syndrome (PCS) Symptom Rating	
Pain Screen	
Symptom Validity Test	
Substance Abuse Screen	
Depression Screen	

The comprehensive cognitive assessment preferably should be performed by an interdisciplinary group that includes a neuropsychologist, occupational therapist, and speech-language pathologist but may be completed by a smaller group if resources are limited. Regardless of the team complement, these providers must be competent in evaluating individuals with known or suspected TBI and be capable of making appropriate differential diagnoses in complicated cases. In all situations, a team leader should be appointed. The cognitive assessment should consist of a thorough neurobehavioral and cognitive evaluation and include measures of effort. There are a variety of neurobehavioral assessment tools and approaches available. While no one tool or method is recommended over another, providers may consider the World Health Organization's (WHO) approach towards the purpose of assessments: to identify and describe strengths, deficits, and effects of the deficits on capacity and function in everyday activities; to identify barriers to successful participation and rehabilitation (Carroll et al., 2004). Another resource is the American Academy of Clinical Neuropsychology's (AACN) guidelines for evaluation (AACN Practice Guidelines for Neuropsychological Assessment and Consultation, 2007). The comprehensive assessment should include a measure of motivation and engagement. Sub-optimal results on measures of effort should not automatically disqualify an individual for consideration for cognitive rehabilitation but rather, should be further evaluated as there are many potential reasons for poor engagement. The key domains that should be evaluated include:

Upon completion of the cognitive assessment, it is important to determine the following:

1. What is the primary factor contributing to symptoms (i.e., is mTBI the primary cause of the symptoms or is a co-morbidity such as major depression considered the primary contributor?)

2. What are the cognitive deficits associated with the diagnosis of mTBI?
3. Is cognitive rehabilitation needed? Warranted?
4. What kind of rehabilitation is needed? (This should be patient specific and target return to daily life functioning)
5. What are the short- and long-term goals (both functional and measurable)?

The cognitive assessment may determine that the patient requires a) a full cognitive rehabilitation program, b) a limited program that assists with goal-setting, or c) a short return-to-duty refresher training to increase confidence in one's ability to return to full duty. The outcome of the assessment should result in a treatment plan. Due to the increased risk of co-occurring disorders seen in patients with TBI (e.g., mood, anxiety and substance use disorders), a mental health assessment and mental health treatment, if indicated, should occur in conjunction with the cognitive assessment and treatment plan.

INTERVENTIONS

There is presently no evidence to suggest that the different mechanisms of injury between combat and non-combat related mTBI result in different cognitive deficits or require different interventions (Belanger et al., 2009). Attention, memory, executive functioning, and social pragmatics are the most common cognitive domains affected by TBI and interventions, such as the examples listed in Table 2, are targeted to these areas. For the full list of interventions, please refer to the Cognitive Rehabilitation Consensus Conference Report.

CONCLUSIONS

Cognitive rehabilitation may be useful in the treatment of Service members with mTBI who complain of cognitive symptoms or display signs of cognitive dysfunction greater than three months post injury. Initial evaluation and assessment are critical elements that determine if cognitive rehabilitation is an appropriate treatment for an individual with persistent cognitive symptoms and help to shape the treatment plan. The DCoE/DVBIC consensus conference and resultant clinical guidance is the first step toward addressing persistent cognitive symptoms and cognitive dysfunction in individuals with mTBI. The DCoE/DVBIC clinical guidance, with its additional emphasis on the standardization of military cognitive rehabilitation program outcome measures, provides the foundation for future research and discussions regarding cognitive rehabilitation in Service members with mTBI. As this area continues to evolve, ongoing refinement of the clinical guidance will ensue.

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Table 2: Examples of Interventions

Area of Cognitive Impairment	Empirically-supported Interventions	Specific Examples
Attention	Attention process training	Completing two cognitive tasks simultaneously
Memory	Various mnemonic techniques	Acronyms
Attention Memory	Memory notebook	PDA
Executive functioning Social pragmatics	Social communication skills training groups	Group cognitive therapy

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