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Complicating Factors Associated with Mild Traumatic Brain Injury: Impact on Pain and Posttraumatic Stress Disorder Treatment

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Abstract The nature of combat in Iraq and Afghanistan has resulted in high rates of comorbidity among chronic pain, posttraumatic stress disorder (PTSD), and mild traumatic brain injury (mTBI) in Veterans of Operations Enduring Freedom and Iraqi Freedom (OEF/OIF). Although separate evidence-based psychological treatments have been developed for chronic pain and PTSD, far less is known about how to approach treatment when these conditions co-occur, and especially when they co-occur with mTBI. To provide the best care possible for OEF/OIF Veterans, clinicians need to have a clearer understanding of how to identify these conditions, ways in which these conditions may interact with one another, and ways in which existing evidence-based treatments can be modified to meet the needs of individuals with mTBI. The purpose of the present paper is to review the comorbidity of pain, PTSD, and mTBI in OEF/OIF Veterans, and provide recommendations to clinicians who provide care to Veterans with these conditions. First, we will begin with an overview of the presentation, symptomatology, and treatment of chronic pain and PTSD. The challenges associated with mTBI in OEF/OIF Veterans will be reported and data will be presented on the comorbidity among all three of these conditions in OEF/OIF Veterans. Second, we will present recommendations for providing psychological treatment for chronic pain and PTSD when comorbid with mTBI. Finally, the paper concludes with a discussion of the need for a multidisciplinary treatment approach, as well as a call for continued research to further refine existing treatments for these conditions.

Keywords Pain · Posttraumatic stress disorder · Traumatic brain injury · Polytrauma · Integrated intervention

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Introduction

Operations Enduring Freedom and Iraqi Freedom (OEF/OIF) have been the largest US combat operations since the Vietnam War. There are several features of US engagements in Iraq and Afghanistan that have had a significant impact on the physical and mental health functioning of service members deployed to these war zones. First, in an effort to create a highly skilled and seasoned fighting force, service members have been asked to complete multiple tours of duty, extend the time of their current tours, or take shorter rest periods between tours when compared to troops from previous wars (Bruner, 2006). This strategy has resulted in higher rates of exposure to both combat and non-combat physical and mental health stressors (Hoge et al., 2004; King, King, Bolton, Knight, & Vogt, 2008). Second, recent advances in body armor and combat medicine have contributed to OEF/OIF deployers surviving injuries that would have proven fatal in previous conflicts (Tanielian & Jaycox, 2008). Third, OEF/OIF deployers are likely to be exposed to physical trauma in the war zone including blasts from suicide bombers and improvised explosive devises (IEDs). Combined, these factors have increased the risk for physical injuries and conditions such as chronic pain and mild traumatic brain injury (mTBI), as well as stress-related mental health problems, such as posttraumatic stress disorder (PTSD).

One of the challenges when working with Veterans who have comorbid pain, PTSD, and mTBI is that the overlapping symptoms that characterize these conditions (e.g., headache, irritability, sleep disturbance, memory impairments) can make accurate and differential diagnosis difficult because symptoms may be inaccurately attributed to another condition. This type of diagnostic error has been argued to have a negative impact on treatment decision making and expectations of recovery (Hoge et al., 2008). Given the high levels of comorbidity among these conditions, it is important that clinicians have a clear understanding of how each problem presents, the potential interactions that can occur, and the steps that can be taken to provide patients with the most effective course of treatment. Whereas a number of evidence-based treatments have been developed for pain and PTSD, relatively little is known about the effects of mTBI on patients' ability to engage and benefit from these treatments.

The purpose of the present paper is to review the comorbidity of pain, PTSD and mTBI in OEF/OIF Veterans, describe the impact that the presence of mTBI can have on the experience of pain and PTSD, and provide recommendations to clinicians who provide treatment of Veterans with these conditions. First we will begin with an overview of the presentation, symptomatology, and treatment of chronic pain, PTSD and mTBI in OEF/OIF Veterans. In addition, data will be presented on the comorbidity among these conditions in OEF/OIF Veterans. Second, we will present recommendations for providing psychological treatment for chronic pain and PTSD when comorbid with mTBI. Finally, the paper ends with a discussion of the need for a multidisciplinary treatment approach, as well as a call for continued research to further refine existing treatments for these conditions.

Chronic Pain

Pain that persists for longer than 3 months, that initially accompanies a disease process or bodily injury which may have resolved or healed, may be referred to as "chronic" pain (Merskey & Bogduk, 1994). Chronic pain is a significant problem among US Veterans, with nearly 50% of male Veterans and as many as 78% of female Veterans reporting that they experience pain on a regular basis (Haskell, Heapy, Reid, Papas, & Kerns, 2006; Kerns, Otis, Rosenberg, & Reid, 2003). Data also indicates that the presence of musculoskeletal pain conditions is growing among Veterans from OEF/OIF, with prevalence rates for women surpassing men as the years post-deployment advance (Haskell et al., in press). Consistent with a biopsychosocial model of illness, individuals with chronic pain often report that pain interferes with their ability to engage in occupational, social, or recreational activities. Their limited inability to engage in these activities may contribute to increased isolation, negative mood (e.g., feelings of worthlessness and depression), and physical deconditioning, all of which can exacerbate or contribute to the experience of pain. With the extreme forces used in combat and the resultant physical injuries, pain is a significant problem in OEF/OIF combat returnees (Ruff, Ruff, & Wang, 2009). Commonly reported locations of pain include the head, back, legs, and shoulders (Clark, Bair, Buckenmaier, Gironda, & Walker, 2007; Gironda, Clark, Massengale, & Walker, 2006; Lew et al., 2007). Current estimates suggest that the budgetary costs of providing disability compensation benefits and medical care to OEF/OIF Veterans over the course of their lives will range from $350 to $700 billion dollars (Bilmes, 2007). Given the negative impact that pain can have on quality of life and its financial impact on both civilian and government healthcare systems, efforts to provide accurate assessment and effective treatment for patients with chronic pain are a priority.

Psychological interventions such as cognitive-behavior therapy (CBT) have demonstrated efficacy for reducing pain and improving function in persons with a variety of pain-related conditions (Van Tulder et al., 2000). CBT is a brief, structured, goal-oriented treatment that seeks to

enhance patients' control over pain and change maladaptive thoughts and behaviors that serve to maintain and exacerbate the experience of pain. The cognitive-behavioral approach is informed by the understanding that people generally do not stop being active because of pain, but rather because they have become adjusted to the idea that they are physically "disabled." Thus, CBT for chronic pain involves challenging those beliefs and teaching patients ways of safely reintroducing enjoyable activities into their lives. This can be a particularly daunting task when thoughts related to disability have been in place for many years. There are several key components to CBT for chronic pain, including cognitive restructuring (i.e., teaching patients how to recognize and change maladaptive thoughts), relaxation training (i.e., diaphragmatic breathing, progressive muscle relaxation), time-based activity pacing (i.e., teaching patients how to become more active without overdoing it), and graded homework assignments designed to decrease patients' avoidance of activity and reintroduce a healthy, more active lifestyle. Because individuals who experience chronic pain often report reduced activity levels and declines in social functioning, CBT also focuses on promoting patients' increased activity and productive functioning (Otis, 2007). A substantial literature has documented the efficacy of CBT for a variety of chronic pain conditions. CBT produces reductions in pain in patients with osteoarthritis (Heinrich, Choen, Naliboff, Collins, & Bonebakker, 1985), chronic back and neck pain (Linton & Ryberg, 2001), and tension headache (Holroyd et al., 2001). In a meta-analysis of 22 randomized controlled trials of psychological treatments for chronic low back pain, cognitive-behavioral and self-regulatory treatments specifically were found to be efficacious (Hoffman, Papas, Chatkoff, & Kerns, 2007).

Posttraumatic Stress Disorder (PTSD)

PTSD can occur following exposure to an event that is, or is perceived to be, threatening to the well being of oneself or another person. The distinctive profile of symptoms in PTSD include: 1) exposure to a traumatic event that involved the threat of death or serious injury that leads to a reaction of intense fear, helplessness, or horror (Criterion A); 2) re-experiencing the traumatic event (e.g., intrusive thoughts, nightmares, flashbacks to the traumatic event, or psychophysiological reactivity to cues of the traumatic event) (Criterion B); 3) avoidance of stimuli associated with the traumatic event, an emotional numbing (e.g., absence of emotional attachments, avoidance of thoughts, feelings and places associated with the event) (Criterion C); and 4) symptoms of hyperarousal (e.g., heightened startle sensitivity, sleep problems, attentional difficulties, hypervigilance, and the presence of irritability and anger) (Criterion D; American Psychiatric Association, 1994). The estimated lifetime prevalence rate for PTSD in the general population is 6.8% with women being more than twice as likely as men to have PTSD at some point during their lives (Kessler, Berglund, Demler, Jin, & Walters, 2005). Individuals who are engaged in military combat are at significant risk for exposure to traumatic events and the subsequent development of PTSD. For example, a recent study found that in a sample of 103,788 OEF/OIF Veterans seen at VA facilities, 13% were diagnosed with PTSD (Seal, Bertenthal, Miner, Sen, & Marmar, 2007).

Recently published VA guidelines on mental health services mandate the use of evidence-based treatments for PTSD with the recommendation that all Veterans in the VA system have access to one or both of two empirically supported therapies: Cognitive Processing Therapy (CPT), or Prolonged Exposure Therapy (PE) (Veterans Health Affairs, 2008). PE is a technique in which the patient confronts a feared situation, object, or memory that he or she has been avoiding. In PTSD treatment, the PE therapist guides the patient to recall the traumatic event in a controlled fashion, either through actively imagining it in session (i.e. "imaginal exposure") or writing about it in or out of session. Repeated exposure to the traumatic memories results in a reduction of fear and avoidance of these memories (Keane, Fairbank, Caddell, & Zimering, 1989; Keane & Kaloupek, 1982). Exposure therapies were considered to be the quickest acting and also one of the most effective psychotherapies for PTSD. CPT was originally developed by Resick and colleagues to treat female rape victims with PTSD (Resick & Schnicke, 1993), and there is strong empirical support for its efficacy in that population (Resick, Jordan, Girelli, Hutter, & Marhoefer-Dvorak, 1998; Resick, Nishith, Weaver, Astin, & Feuer, 2002). More recently, CPT has been adapted for use with Veterans suffering combat-related PTSD, and a recent study indicates efficacy with this population as well (Monson et al., 2006). This 12-session treatment includes a written exposure component, for which patients are required to write an account of their trauma, read it to the therapist, and re-read it daily. Cognitive restructuring is also a critical part of the therapy, and therapists work with clients on challenging false beliefs around themes of safety, trust, power and control, esteem, and intimacy.

Traumatic Brain Injury (TBI)

TBI refers to a traumatically induced structural injury and/or physiological disruption of brain function as a result of 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; Any loss of memory for events immediately before or after the injury; Any alteration in mental state at the time of the injury (confusion, disorientation, slowed thinking, etc.); Neurological deficits (weakness, loss of balance, change in vision, praxis, paresis/plegia, sensory loss, aphasia, etc.) that may or may not be transient; or Intracranial lesion (VA/DoD, Consus). TBI is a leading cause of morbidity and disability in OEF/OIF service members (Warden, 2006). Approximately 90% of all documented TBIs are classified as mild (Wasserberg, 2002). A number of diagnostic criteria for mTBI have been proposed, but presently the criteria set forth by the American Congress of Rehabilitation Medicine (1993) is widely accepted because it does not require a definite loss of consciousness to diagnose a mTBI; rather, the presence of posttraumatic amnesia, altered mental status, or focal neurological symptoms at the time of injury is sufficient. Using post-deployment questionnaires, studies have estimated that 12–23% of returning soldiers experienced a mTBI while deployed (Schneiderman, Braver, & Kang, 2008; Terrio et al., 2009), with the higher percentage confirmed using a structured clinical interview (Terrio et al., 2009). In OEF/OIF, the primary mechanism of injury is an explosion (Owens et al., 2008), due to the insurgency's use of improvised explosive devises (IEDs) as a primary weapon. The Department of Defense confirms that over 73% of all military casualties in OEF/OIF are caused by explosive weaponry (Defense Manpower Data Center, n.d.) and the overwhelming majority of battlefield TBIs are closed head injuries resulting from exposure to IEDs (Galarneau, Woodruff, Dye, Mohrle, & Wade, 2008). Such weapons can cause *primary blast injuries,* related to the high force of the blast waves, or by secondary, tertiary, or quaternary injuries, related to events following the explosion including, flying debris or missile fragments that hit the body, being thrown by the force of the blast, and toxic fumes associated with the munitions, respectively (DePalma, Burris, Champion, & Hodgson, 2005).

Most of what is known regarding the neuropsychology of mTBI comes from studies of blunt trauma, such as that from motor vehicle accidents, falls, and assaults. The majority of patients who suffer mTBI report a number of symptoms within the first week following injury including headaches, dizziness, fatigue, memory deficits, anxiety, and depression (Sheedy, Geffen, Donnelly, & Faux, 2006). Acutely, mTBI produces deficits in cognition that are sufficient to interfere with daily activities (Alexander, 1995), and the severity and persistence of neuropsychological deficits appear to depend on the severity of the head injury (Dikmen, Machamer, & Winn, 1995). Cognitive domains typically affected in TBI include attention and working memory (McAllister, Flashman, McDonald, & Saykin, 2006), speed of information processing (Barrow, Collins, & Britt, 2006; Barrow, Hough, et al., 2006), and certain aspects of executive function (Belanger, Curtiss, Demery, Lebowitz, & Vanderploeg, 2005). Amongst those with mTBI, most make a favorable to complete recovery (Iverson, Zasler, & Lang, 2007) within minutes, to days, to weeks of injury (Bigler, 2008; Ruff, 2005). However, some individuals continue to experience concussive symptoms beyond 3 months, with estimates ranging from 10 to 20% of cases (e.g., Ruff, 2005; Wood, 2004) to as high as 44% of hospitalized mild TBI cases (Dikmen, Machamer, Fann, & Temkin, 2010). While estimates of PCS vary, McCrea (2008) states that the true incidence of persistent PCS after mTBI is likely much lower than has been previously reported in the literature, perhaps as low as 1–5% of all mTBI cases. Furthermore, he suggests that PCS is fueled more by psychological, social, and motivational factors than acute injury characteristics of mTBI. The Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV; APA, 1994) defines post-concussion syndrome (PCS) as a clinical state where three or more symptoms of concussion persist for more than 3 months following heading injury. Symptoms of concussion include: fatigue; disordered sleep; headache; vertigo or dizziness; irritability or aggression with little or no provocation; anxiety, depression, or affective liability; changes in personality; and apathy or lack of spontaneity. Of note, headache pain is nearly a universal symptom of PCS (Alexander, 1995).

Lundin, de Boussard, Edman, & Borg (2006) reported a range of neurological and cognitive sequalea of mTBI three months post-injury that included somatic symptoms (headaches, dizziness, nausea/vomiting, fatigue), cognitive symptoms (slowed processing speed, memory problems, concentration difficulties), and emotional symptoms (feelings of depression, frustration, restlessness, irritability, sleep disturbance); the most prominent, lasting symptoms at 3 months were poor memory, sleep disturbance, and fatigue, which corresponds well with other previous civilian studies (King, Crawford, Wenden, Moss, & Wade, 1995; Wade, King, Wenden, Crawford, & Caldwell, 1998). In their study of clinically confirmed mTBI in a US Army brigade combat team, Terrio et al. (2009) reported that after returning from deployment, memory deficits (16%), headache (20%), and irritability (21%) were the most predominant PCS symptoms.

In summarizing recent work addressing blast-related brain injuries, Cernak and Noble-Haeusslein (2010) concluded "What is clear from the effort to date is that the pathobiology of military TBIs, particularly BINT (blast induced neurotrauma), has characteristics not seen in other types of brain injury, despite similar secondary injury cascades" (p. 255). Even so, it has been difficult to identify a dissociable neuropsychological signature associated with

blast mTBI. Belanger et al. (2005) conducted the only study to date to compare blast-related TBI with non-blast TBI (due to falls, motor vehicle accident, etc.). The results failed to demonstrate differences in neuropsychological performance as a function of TBI mechanism (i.e., blast vs. non-blast). One consideration might be the lack of enduring effects for a single blast exposure in combat. It is unclear from the study by Belanger et al. whether participants were exposed to one or multiple blasts, but this might be an important factor. Research investigating repeated injuries suggest that, while a first concussion may be asymptomatic, residual pathology is often evident in the case of second injuries, where a prior concussion increases the likelihood of a second one with greater morbidity (Moser, Schatz, & Jordan, 2005; Omalu et al., 2005; Wall et al., 2006). As noted by Bigler (2008), this suggests that while asymptomatic, a first concussion is not benign, and that the brain can adapt quickly in most cases. Another important factor in determining whether blast injury is associated with a specific pattern of functional impairment was suggested in a recent study by Wilk et al. (2010). They found that blast-related mild TBI may be differentially susceptible to persistent postconcussive syndrome compared to non-blast mechanisms of TBI (Wilk et al., 2010) depending on the definition of concussion. Specifically, blast-related mild TBI was significantly associated with persistent headache and tinnitus three to 6 months postdeployment when the blast was associated with a loss of consciousness compared to when the blast resulted in only an alteration of consciousness. More research investigating the functional outcome of blast-related mild TBI and its association with persistent postconcussive syndrome is greatly needed, as the incidence of blast exposures and blast-related injuries in OEF/OIF service members continues to increase.

Prevalence of Comorbid Pain, PTSD and TBI

Recent data obtained from OEF/OIF Veterans receiving care at polytrauma rehabilitation centers in VA facilities has served to inform and heighten awareness of the level of comorbidity among pain, PTSD and mTBI. Sayer et al. (2009) found that in a sample of 188 combat injured service members treated at one of four Level 1 Polytrauma Rehabilitation Centers (PRC; i.e., treatment facilities for the most impaired Veterans), 93% incurred a combat-related TBI, 81% endorsed a pain problem, and 52.6% received some type of mental health services. In a study of 50 OEF/OIF Veterans treated at a Level 1 PRC, 80% of patients reportedly incurred a combat related TBI (penetrating = 58%, closed = 22%), 96% reported at least one pain problem, and 44% reported experiencing PTSD (Clark et al., 2007). Lew et al. (2007) found that in a sample of 62 patients evaluated at a Level 2 Polytrauma Network Site (PNS), 97% reported 3 or more post-concussive symptoms (i.e., headache, dizziness, fatigue), 97% complained of chronic pain, and 71% met criteria for PTSD. Lew et al. (2009) performed a comprehensive review of the medical records of 340 OEF/OIF Veterans seen at a Level 2 PNS. Analyses indicated a high prevalence of all three conditions in this population, with chronic pain, PTSD, and mTBI (i.e., persistent post-concussive symptoms) being present in 81.5%, 68.2%, and 66.8%, respectively. The frequency with which these three conditions were present in isolation (10.3%, 2.9%, and 5.3%, respectively) was significantly lower than the frequency at which they were present in combination with one another, with 42.1% of the sample being diagnosed with all three conditions simultaneously. Taken together, the results of these studies demonstrate the high co-prevalence rates among pain, PTSD and mTBI.

Recognizing that an increasing number of OEF/OIF Veterans were returning from combat with high comorbidity rates of pain, PTSD, and mTBI, a conference was sponsored by the Office of Mental Health Services and the Office of Rehabilitation Services, Department of Veterans Affairs with the goal of developing specific practice recommendations to improve the healthcare services, educational, and systems coordination for Veterans with comorbid pain, PTSD, and TBI (Report of VA Consensus Conference, 2010). A number of recommendations were made based on this meeting. First, the consensus panel agreed that providers need more education or ways to properly assess for pain, PTSD, and mTBI. With regard to treatment, it was recommended that providers develop an interdisciplinary treatment plan that incorporates input from all necessary disciplines. Finally, in the absence of information suggesting that current treatments need to be modified when conditions are comorbid, current clinical practice guidelines should be followed as these represent best practices (www.healthquality.va.gov).

Treatment of Pain, PTSD, and mTBI

Whereas a number of studies have documented high rates of comorbidity among pain, PTSD, and mTBI in OEF/OIF Veterans, far less is known about the best ways to approach treatment for these conditions when they co-occur. Because evidence-based cognitive-behavioral treatments for pain and PTSD are believed to rely on intact cognitive resources (i.e., executive function, memory, concentration) for skills to be acquired and practiced, questions have been raised that cognitive deficits due to mTBI could negatively impact a person's ability to actively engage in treatment for pain or PTSD. For example, as noted by Vasterling et al. (2010), exposure-based interventions for PTSD require the

controlled retrieval and modification of trauma memories. Similarly, cognitive-behavioral therapies require the ability to identify maladaptive thoughts, as well as the cognitive flexibility to interpret thoughts and feelings in a more adaptive manner. To date, however, there is no evidence to suggest that CBT is contraindicated for patients with mTBI, and as Soo and Tate (2007) suggest, the structure provided by CBT interventions may in itself benefit patients with cognitive deficits. In evaluating CBT for the treatment of acute stress disorder following mTBI, Bryant, Moulds, Guthrie, and Nixon (2003) found that CBT reduced the development of PTSD immediately post-treatment and 6 months later, providing preliminary evidence for the effectiveness of CBT in patients with psychological trauma exposure and mTBI. However, many questions remain regarding more subtle associations between cognitive deficits and treatment response and whether treatment modifications or augmentations may be beneficial for patients with mTBI-related cognitive deficits.

There have only been a few studies to date that have examined the effectiveness of integrated, novel, and inter-disciplinary treatment approaches for Veterans with combinations of pain, PTSD and mTBI. Otis, Keane, Kerns, Monson, and Scioli (2009) described the development of an integrated treatment for Veterans with comorbid chronic pain and PTSD. A 12 session integrated treatment for chronic pain and PTSD was created that included components of CPT for PTSD and CBT for chronic pain management. Core elements of the integrated treatment included relaxation training, activity goal setting and weekly goal completion, cognitive restructuring, pleasant activity scheduling and pacing, and relapse prevention. Overall, participants who completed the integrated treatment program responded well to therapy and reported that they generally liked the format of treatment, and appreciated learning about the ways that chronic pain and PTSD share some common symptoms and ways that the two disorders can interact with one another. A randomized controlled trial of this treatment is still ongoing. Although this study did not assess for mTBI, its results may inform future research on best practices when pain and PTSD occur with mTBI. Based on feedback received by OEF/OIF Veterans and in an effort to develop a more expedient form of therapy, Otis and colleagues are currently investigating the efficacy of an intensive, 3-week treatment approach for Veterans with comorbid chronic pain and PTSD. This study will also include participants with mTBI and assess the relationships among participation in treatment, treatment outcome, and cognitive functioning across a variety of domains.

Ruff et al. (2009) examined the effectiveness of a sleep intervention program for Veterans with blast-induced mTBI and headache. A sleep intervention was chosen because Veterans expressed that they did not want to take any medication that would compromise sexual function or have cognitive side effects. The sample included 126 Veterans with blast-induced mTBI caused by an explosion during deployment in OEF/OIF. Of the 126 Veterans included, 74 participants reported posttraumatic headaches and deficits in neurological functioning. Of those participants, 71 had PTSD and 69 had poor sleep. Treatment included sleep hygiene counseling (9 weeks) and nightly oral Prazosin, a brain active alpha-1-adrenergic agonist that is commonly used in general medicine for treatment of hypertension and urinary outflow obstruction caused by benign prostatic hypertrophy. At post-treatment 65 of 69 Veterans reported restful sleep, headache pain decreased from 7.28 to 4.08 (0–10), headaches frequency decreased from 12.4 to 4.77 per month, and Montreal Cognitive Assessment Scores improved from 24.5 to 28.6. These gains were maintained at 6-month follow-up. The results suggest that addressing sleep is a good first step in treating posttraumatic headache for Veterans with mTBI.

Chard et al. (2010) recently presented results of a study investigating the efficacy of a CPT based treatment program for Veterans with comorbid PTSD and TBI. A total of 43 Veterans were recruited for participation. The treatment consisted of a modified CPT program for PTSD presented in both individual and group treatment formats. Modifications included audiotaped or videotaped sessions, booster sessions, and modifications to treatment materials. CBT techniques were integrated into CPT to bolster PTSD treatment success. Weekly visits with specialty staff were included as needed (i.e., speech therapy, occupational therapy, physical therapy). The overall goal of the program was to teach Veterans to notice the connection between thoughts and feelings, feel natural emotions, and examine disruptive thoughts that contribute to unwanted emotions. Trauma accounts were not part of the treatment. Pretreatment to posttreatment changes in assessment responses indicated significant reductions on measures of PTSD and depressed mood. This study was significant because it demonstrates that CPT can be modified to meet the learning needs of Veterans with mTBI. This treatment approach is supported by recent research by Lippa, Pastorek, Benge, and Thornton (2010) indicating that posttraumatic stress symptoms may account for a substantial portion of the PC symptom presentation of Veterans with mTBI. Overall, the results of these studies support an integrated approach to treatment and the tailoring of existing evidence-based treatments to meet the specific needs of Veterans.

Clinical and Research Recommendations

The complexity and array of clinical and research challenges that continue to emerge as observations about the

high co-prevalence rates of chronic pain, PTSD, and mTBI are documented can be overwhelming to some. Even from an epidemiological perspective, questions remain about the true co-prevalence in larger, more broadly representative samples of OEF/OIF Veterans. The article by Haskell et al. (in press) that highlights gender differences in the report of pain among these Veterans is one explicit example of the complexity of the problem. This article can also serve as a cue to consider differences by ethnicity and race, branch of service and rank, age, and other potentially important individual difference variables. Associations with other common medical and mental health comorbidities such as alcohol and substance use disorders (perhaps especially prescription opioid misuse, abuse and dependence) and sleep disorders are also important to consider. The development of a sound theoretical framework for understanding the nature of these comorbidities may serve a critical role in informing both basic and applied research. On the clinical front, research and practice innovations that focus on development and systematic evaluation of specific integrative interventions, such as that proposed by Otis et al. (2009), as well as novel interdisciplinary and multimodal systems of care, are particularly exciting and promising. Ideally, as these initiatives advance, efforts will focus on the role of cognitive impairment as a moderator or mediator of therapeutic processes such as engagement and participation as well as outcomes such as reductions in pain severity, PTSD symptom severity, physical and social role functioning, and overall quality of life. Particular attention to barriers to engagement and full participation in these treatments is also encouraged.

As just one example of the complexities inherent in work in this area, we are reminded of some of the challenges associated with one critical clinical process, namely assessment. Pain is a subjective experience, and continued research is needed to develop reliable and accurate assessments of pain in individuals with various levels of cognitive impairment. Pain assessment in the communication-impaired patient represents one of the most significant challenges in the field of pain management (Herr et al., 2006). Most research has been conducted on pain assessment in patients with cognitive impairment secondary to dementia. Little evidence exists for pain assessment in other communication-impairment etiologies, including pain associated with trauma (Buffum, Hutt, Chang, Craine, & Snow, 2007). Although there are measures that have been validated and are commonly used when assessing pain in patients with impaired functioning or non-communicative patients including the Wong-Baker Faces Scale (Wong & Baker, 1998) and the Pain Assessment in Advanced Dementia (PAINAD; Warden, Hurley, & Volicer, 2003), these measures have not been validated on Veterans with TBI. Consequently, patients are vulnerable to the consequences of both under-treatment (inadequate treatment) and over-treatment (potential adverse medication effects). Compounding the problem is that persons with severe cognitive impairment tend to report fewer complaints (Fisher et al., 2002). Extrapolating from the empirical evidence related to pain assessment in persons with less severe cognitive impairment, it appears that patient self-report may be reliable (Chibnall & Tait, 2001; Horgas, Elliott, & Marsiske, 2009; Pautex et al., 2006). Nevertheless, future research should specifically examine the reliability of commonly employed pain assessment tools in the Veteran population with varying levels of cognitive impairment associated with TBI. Research should similarly examine the psychometric properties of measures commonly employed in the context of studies of novel treatments for pain, PTSD and mTBI.

In the relative absence of a strong evidence base to inform clinical practice and policy, care for Veterans with these comorbid conditions should be informed by overarching principles that encourage establishment of strong therapeutic relationships, shared medical decision making, and individual tailoring and flexibility in developing and enacting treatment plans. Whereas structured treatment protocols are often necessary to establish the efficacy of new psychological treatments, strict adherence to protocol may not be clinically beneficial when working with a patient who has cognitive impairments secondary to mTBI. However, in many instances, manualized treatments already have sufficient flexibility built in to allow individualization to the neurocognitive strengths and weaknesses of the patient. Thus, when necessary, clinical materials and method of presentation can be tailored to fit the specific needs of the patient while maintaining treatment integrity. For example, given that some individuals with mTBI may experience difficulty with verbal memory, the patient's acquisition of skills could be facilitated by the development of printed handouts or therapy workbooks that the patient could review between treatment sessions. In circumstances in which a patient is unable to comprehend material associated with cognitive restructuring, additional therapy sessions could be scheduled to allow additional time to review the necessary information. More complex concepts can be broken down into smaller pieces of information to make them easier to learn, or modified to make them simpler to understand. If cognitive material is overly challenging, emphasis can be placed on concrete and behavioral skills including behavioral activation, activity pacing, relaxation training, pleasant activity scheduling, and sleep hygiene. Homework completion and therapy attendance can be encouraged using reminder emails, phone calls, or reminders on iPhone or other technology.

Preliminary research on pain and PTSD treatment for Veterans with comorbid mTBI is encouraging, as results

suggest that current evidence-based treatments can be modified to meet the needs of patients with mild cognitive impairments. Research should strive to identify best practices but also consider that that even if best practice models are developed, they may not work equally well or be feasibly implemented across all settings. Researchers interested in examining treatment effectiveness should investigate the impact of other comorbidities (e.g., sleep problems, smoking, lack of employment, marital/relationship issues, substance use and depression) as these are likely to have a significant impact on a person's ability to engage in treatment or effectively cope with the these conditions. Research should also investigate if there is benefit in specifically addressing cognitive issues related to mTBI prior to engagement in pain or PTSD treatment (e.g., teaching memory strategies), or if the process of engaging in CBT is itself therapeutic and beneficial in terms of strengthening cognitive skills. Such decisions may have to be made on a case by case basis depending on the cognitive impairments reported by the patient.

Summary

In sum, advances in life-saving treatments combined with changes in how warfare is conducted have produced an epidemic of co-morbid psychological and biomechanical trauma in OEF/OIF returnees (Warden, 2006). The primary challenge for clinicians and researchers is to understand the biomedical and psychological impact of combined pain, PTSD, and mTBI in OEF/OIF returnees. Independently, each disorder has extensive literatures documenting the cognitive/emotional correlates in both civilian and military populations. However, the impact of pain, PTSD, and mTBI on neural integrity and cognition is not well understood, with knowledge regarding their ramifications for rehabilitation and treatment evolving. The complex profile of injuries often observed supports the use of a biopsychosocial approach for assessment and treatment. To maximize clinical success, providers across disciplines will likely benefit from working together to develop treatments that are complementary, based on theory, and supported by empirical evidence. It is imperative that we begin to investigate the synergistic impact of these factors to help providers give the best care for Veterans.

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