

The Primary Role of Mental Health Treatment in Resolution of Persistent Post-concussive Symptoms

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Opinion statement

Symptoms that persist beyond the expected period of recovery following a mild traumatic brain injury (mTBI)/concussion are strongly linked to non-neurologic variables, notably mental health conditions such as posttraumatic stress disorder (PTSD), particularly among Iraq and Afghanistan Veterans. Despite acknowledgment of poor recovery in a sizeable minority of concussion cases and the strong contribution of psychological factors to this presentation, treatment of comorbid, and likely primary, mental health conditions, is not as widely practiced as the evidence would support. The attention drawn to TBI as a “signature injury” of the conflicts in Iraq and Afghanistan as well as from contact sports has had a positive impact on TBI awareness, identification, and prevention efforts. However, it may have had the unintended consequence of overshadowing treatment of comorbid mental health conditions and other symptomatic treatments that are likely to impart the greatest symptom reduction and treatment gains. Individuals with a history of concussion can successfully engage in structured mental health treatments and using cognitive behavioral treatments for psychiatric conditions, such as PTSD and depression, as primary treatment approaches for reducing persistent post-concussive symptoms is supported by the current research literature.

Introduction

Concussion

Concussion or mild traumatic brain injury (TBI) is defined as a blow or force to the head resulting in loss of consciousness (LOC) less than or equal to 30 min or alteration of consciousness (AOC) and/or posttraumatic amnesia (PTA) less than or equal to 24 h, Glasgow Coma Scale between 13 and 15, and no significant imaging findings [1]. 1.4 million people yearly will sustain a TBI in the USA, the overwhelming majority of which (approximately 80–85%) are classified as mild [2–4], implying briefer losses of consciousness, shorter periods of post traumatic amnesia, and the anticipation of a fuller recovery, as compared to a moderate or severe TBI. Common symptoms following concussion can include headaches, sensitivities to light and sound, dizziness/nausea, changes in thinking, fatigue, and irritability [5]. Complete resolution of these post-concussive symptoms is expected within 7–10 days, with the outer limit of normal recovery at 3 months. In fact, a World Health Organization (WHO) review concluded that, except in rare cases, objective cognitive deficits *attributable to the concussive event* do not persist beyond three-months post-injury [6]. Despite this, in anywhere between 15 and 30% of cases symptoms do not resolve as expected, leading to persistent post-concussive symptoms [7]. Although there are guidelines for symptomatic treatment in the post-acute phase following concussion [1], there is no systematic intervention for the overall constellation of persistent post-concussive symptoms [8••].

PTSD

Posttraumatic stress disorder (PTSD) can develop after a life threatening experience and is characterized by re-experiencing symptoms, intrusive thoughts, avoidance behaviors, cognitive distortions, heightened physiological arousal, and cognitive complaints and/or objective neuropsychological deficits. Approximately 3.6% of men and women in the U.S. between the ages of 18 and 54 have a diagnosis of PTSD in a given year [9]. Empirically supported efficacious treatments exist for PTSD. Gold standard psychotherapies for PTSD fall under the umbrella of cognitive behavioral therapies (CBT) and include Cognitive Processing Therapy (CPT) and Prolonged Exposure (PE) [10, 11]. Both an Institute of Medicine report and VA/DoD Clinical Practice Guidelines for the Management of Posttraumatic Stress strongly

advocate for use of cognitive therapy and exposure based treatments for treatment of PTSD [12, 13].

Concussion and PTSD comorbidity in veterans

While concussion and PTSD can and do occur in civilian populations, they are particularly notable in military and veteran populations, and are signature injuries of the conflicts in Iraq and Afghanistan. Prevalence rates of PTSD among Operation Enduring/Iraqi Freedom (OEF/OIF) service members are far higher than those in the general population, ranging from 8 to 16% [14, 15], though this is likely to be an underestimate due to underreporting. Among those veterans seeking care within the VA, approximately 15% have a diagnosis of PTSD [16]. Approximately 20% of those deployed to combat in OEF/OIF have sustained a concussion [17], with over 50,000 OEF/OIF Veterans enrolled in VA healthcare with evaluations or treatment for conditions possibly related to TBI [18].

Comorbidity of concussion with other mental health conditions is high in veterans [19••], with 80% of those with positive TBI screens also carrying psychiatric diagnoses [20]. PTSD, in particular, is highly comorbid with concussion in OEF/OIF Veterans. In those with a history of concussion, the rate of PTSD is 43.9%, compared to 16.2% in those with other injuries, and only 9.1% in the absence of physical injuries [21]. Particularly in combat, concussions may be sustained in the context of psychologically traumatic events where the context of the concussive event and the index trauma for PTSD may be intertwined into the same incident. The relationship between concussion and PTSD may be reciprocal or bidirectional. Premorbid PTSD symptoms and somatic symptoms predict post-concussive symptoms post-deployment [22] but sustaining a concussion is also a risk factor for developing PTSD [23, 24]. There is evidence from the animal literature that blast exposure can instigate biochemical, neuroanatomical, and electrophysiological changes involved in developing PTSD [25] and in humans can increase risk of PTSD arousal, avoidance, and re-experiencing symptoms [26]. Conversely, neurobehavioral or emotional distress symptoms have the potential to intensify effects of blast exposure.

Persistent post-concussive symptoms

The comorbidity between concussion and mental health conditions is particularly relevant to cases in which acute concussion symptoms do not resolve as expected. Protracted recovery from concussion is

notable in the OEF/OIF military and Veteran population; rates of poor outcomes following concussion are 2–4 times greater in service members as compared to civilians [27••]. Almost 40% of veterans with a history of concussion reported at least one post-concussive symptom one-year post-injury [28]. A majority of those referred for concussion care in the post-acute phase have comorbid PTSD or other mental health conditions [29] and comorbidity of concussion with mental health conditions contributes to poorer functional outcomes for those with concussion [5]. Individuals with a concussion history tend to endorse significantly more severe PTSD symptomatology than those without concussion and conversely those with PTSD have significantly higher persistent post-concussive symptom reporting than those without PTSD [7, 19, 30]. In fact, presence of psychiatric disorders more strongly predicts persistent post-concussive symptoms than history of concussion itself [31, 32]. In a large civilian cohort of individuals seeking care in the emergency room (ER) for either TBI or other non-TBI injuries, rates of “post-concussive” symptom reporting were largely equivalent between the TBI and non-TBI group at a three-month follow-up. Furthermore, history of concussion predicted PTSD but not post-concussive syndrome. Post-concussive symptom clustering was also more consistent with the hyperarousal dimension of PTSD as opposed to post-concussive syndrome, with no symptoms proximally linked to the event leading to the ER visit [33•]. In Veterans, numerous studies also demonstrate that persistent symptoms and poor outcomes are more strongly driven by PTSD than concussion [21, 34]. While the initial concussive event may have resulted in *expected* post-concussive symptoms, the *persistence* of these symptoms beyond the expected recovery period is likely independent of, or at best only indirectly related to the concussion. Persistent post-concussive symptoms are non-specific and can and do arise from numerous other conditions besides concussion, especially in the post-acute phase of recovery. The non-specificity of the persistent symptoms further contributes to the challenge in treating them.

A diathesis-stress model fits this presentation where initial symptoms are directly related to the neurological consequences of the concussion but then are reinforced by a negative feedback loop [5, 35]. Specifically, a concussive event occurs resulting in acute neurobehavioral symptoms. If realistic expectation

management is not provided at the time of the acute event, these distressing symptoms can lead to increased stress, which fuels avoidance, exacerbating mood/poor functioning, which in turn may further increase neurobehavioral symptoms. “The basis for persistent PCS is almost always “biopsychosocial,” combining the acute neurologic effects of MTBI and a host of influential psychosocial factors, all of which are best suited for psychological and/or psychiatric treatment,” ([5], p. 170). A unique longitudinal study that evaluated 347 OEF/OIF service members at the time of medical evacuation from combat theater and again within a year, found extremely high rates (62–96%) of personnel with concussion experiencing poor outcomes [27••]. The authors commented that “One of the most striking findings in this report is that over a 5-year period from 2008 to 2013, the severity of disability, PTSD, and depression after concussive TBI in deployed US military personnel improved only marginally. A reasonable conclusion from our result could be that more effective interventions to treat those with PTSD and depression in this setting should be considered a top priority” [27••].

A largely psychological etiology to persistent symptoms after concussion is not a new concept. Almost 10 years ago McCrea (2008) summarized it well stating “...while the neuropathophysiological effects of MTBI start this process in motion, the development and maintenance of persistent PCS [post-concussive syndrome] are more directly the result of psychological, psychosocial, and other non-MTBI-specific factors” (McCrea, 2008, p.171). Others have similarly concluded that concussion is not a primary factor in post-deployment mental health outcomes [19••, 34]. Both Elder et al., (2014) and Toyinbo et al., (2017) concur that “The clear message from many studies is that much of what is presently being called post-concussion syndrome secondary to blast-related mTBI is really PTSD” p. 5 [25, 26].

Given the evidence presented above and within the diathesis-stress framework, psychological interventions hold great promise for this population. The current paper reviews the evidence for those with a concussion history to successfully engage in and benefit from structured PTSD treatment as well as the empirical support for using CBTs for PTSD as the primary intervention for reducing persistent post-concussive symptoms. It should be noted that there is lack of consensus and controversy regarding labeling symptoms as “post-concussive” beyond the expected recovery window, particularly given that a preponderance of research suggests that persistent

post-concussive symptoms are not objectively related to the concussive event. However, “persistent post-concussive symptoms” is recognized within the VA/DoD [1] and widely used in the literature to describe these sequelae of symptoms. Therefore, this terminology will be used here as well.

Treatment

Mental health treatment as a means to reduce persistent post-concussive symptoms

Structured psychotherapy for PTSD is feasible in those with a concussion history

The intertwined nature of concussion and PTSD, particularly in Veterans, begs the question of why mental health treatments are not more widely applied for those with a history of concussion. In the post-acute phase, significant emphasis has been placed on “TBI treatment,” often to the detriment of the mental health contribution to the symptom and functional presentation in those with persistent post-concussive symptoms. Given the high comorbidity between PTSD and concussion in Veterans and the preponderance of evidence that psychological factors are likely primary in the persistence of neurobehavioral symptoms in this comorbid presentation, treating PTSD in this population is paramount. However, there has been a great deal of concern that the cognitive impairment and emotional control problems associated with concussion and/or PTSD may complicate or possibly impede recovery from either problem [17, 36, 37]. CBTs, such as CPT, and exposure based treatment, such as PE, are good choices for use in veterans with comorbid PTSD and TBI because of their structure, directive nature, concrete goals, and psychoeducation. Despite this, anecdotal and research reports reveal a hesitancy to use CPT for patients with comorbid concussion in part because of the cognitive complexity of therapy sessions and homework [38]. These concerns are unfounded, however, as CBT has empirical support in treating persistent post-concussive symptoms as well as persistent post-concussive symptoms in concert with comorbid PTSD or other mental health conditions. Tiersky et al., (2005), utilized a CBT treatment protocol to target post-concussive symptoms. Their results showed a decrease in general symptom reporting, depression, and anxiety, and an increase in attention/working memory following their treatment [39]. Potter et al., (2016) conducted a two-site randomized controlled trial (RCT) of CBT for those with persistent symptoms following TBI, also demonstrating improvements in post-concussive symptoms, quality of life, and fatigue [40]. Davis et al. (2013) demonstrated the feasibility of conducting CPT with comorbid PTSD/TBI populations, providing initial support that a history of concussion does not necessarily influence treatment adherence [41]. Bryant et al., (2003) reported that CBT (including exposure-based components and cognitive restructuring) for acute stress disorder with comorbid TBI was more effective at preventing the continuation of PTSD symptoms than supportive therapy [42]. Both CPT and CPT-C (CPT without the trauma narrative) were effective in reducing PTSD and depressive symptoms for veterans in a

residential TBI/PTSD program; importantly, level of TBI severity did not impact PTSD treatment outcomes [43, 44]. A pilot study employing mindfulness based stress reduction has also been shown to be effective in reducing PTSD symptoms and improving attention in those with PTSD and a history of concussion [45]. Prolonged exposure (PE) was also found to be well tolerated and effective at reducing PTSD symptoms in Veterans with PTSD and mild to moderate TBI history in a small pilot study [46], a clinic sample, and post-hoc analyses with a small sample of individuals with both PTSD and TBI from an RCT comparing PE to present centered therapy [38]. Taken together, there is no compelling evidence that concussion, in and of itself, should prohibit participation in empirically supported treatments for PTSD.

Structured psychotherapy for PTSD is effective in reducing neurobehavioral symptoms

Perhaps the more compelling question is whether empirically supported treatments for PTSD also reduce neurobehavioral symptoms. In addition to demonstrating feasibility of utilizing CBTs in individuals with both PTSD and persistent post-concussive symptoms, there is emerging research that treating PTSD also results in a clinically significant drop in post-concussive/neurobehavioral symptoms in this comorbid population. In a recent case study report, CPT led to clinically significant reductions in PTSD, neurobehavioral, and cognitive symptoms, including resolution of what was likely psychogenic stuttering, in a veteran with PTSD and a history of TBI [47]. Following a residential treatment program for PTSD/TBI, reductions in PTSD symptoms were significantly associated with a corresponding decline in neurobehavioral symptoms [48]. A more rigorous RCT approach compared CPT-C with CPT-C augmented with psychoeducation about TBI and compensatory cognitive strategies (SMART-CPT) in 106 Veterans with PTSD and a history of mild to moderate TBI and current cognitive complaints [49]. Both CPT and SMART-CPT resulted in clinically significant reductions in both PTSD and neurobehavioral symptomatology, as well as improvement in objective cognitive functioning [50]. While those in the SMART-CPT group experienced differential benefit to the cognitive domains of attention, memory, and novel problem solving, significantly above and beyond that of the CPT group, the data nonetheless support that treating PTSD serves as a key mechanism for improving post-concussive symptoms, including neurocognitive functioning, in those with history of persistent post-concussive symptoms.

Barriers to engagement in psychotherapy for PTSD and persistent post-concussive symptoms

Although the sum total of systematic study in this area is limited, the nascent evidence is nonetheless compelling. Despite this, treatment of comorbid, and likely primary, mental health conditions is not as widely practiced as the evidence would support. Reasons why individuals with persistent post-concussive symptoms are not more systematically being directed to engage in mental health interventions are multifaceted. Although a complete review is beyond the scope of this paper, ongoing stigma of PTSD and mental health treatment paired with unintended consequences of excessive focus on potential long-term consequences of concussion may be particularly relevant.

The stigma of mental health diagnoses and undergoing treatment for behavioral health conditions remains strong. Despite psychoeducational efforts to combat it, stigma associated with PTSD, in particular, remains high among Veterans and may contribute to treatment avoidance [51]. Seeking treatment for a perceived medical condition, such as TBI, may be more palatable than seeking mental health treatment. However, continually linking current symptoms to concussion/brain damage can inadvertently imply permanence of symptoms, with no room for change or improvement. As discussed below, psychoeducation about concussion, the concussive event functioning as a catalyst in a negative cycle of events, and the possibility and positive expectation for changing that cycle, is essential.

The attention drawn to concussion in the military and in contact sports has had a positive impact on TBI awareness, identification, and prevention efforts. However, strong media focus on negative outcomes following concussion may contribute to iatrogenic effects. While acute concussive injuries warrant treatment and should never be taken lightly, intimations that singular concussive events will all have poor outcomes stands in stark contrast to the vast majority of scientific data and could unintentionally be doing harm. One of the strongest predictors of good recovery following concussion is expectation of positive outcomes; individuals that receive psychoeducation regarding expected symptoms and trajectory of recovery are significantly more likely to have full recoveries than those who do not receive this information [52]. Perception of illness or injury has an impact on outcomes, particularly in mild TBI. Psychoeducation regarding expected recovery trajectory is key as shown in the classic study by Mittenberg et al., (2001) but also supported by studies such as Whittaker et al., (2007) who showed that following concussion, individuals who hold maladaptive beliefs about the long-term negative consequences of their concussive symptoms are significantly more likely to have protracted and poor outcomes [53]. It stands to reason then, that if individuals with concussion either do not receive appropriate expectation management or have negative expectations of recovery (fueled more by media or lay information than established research), they are at higher risk for persistent symptoms. A more recent concussion consensus statement recommended a graded or progressive return to activity, as tolerated, as opposed to complete avoidance of any activity for extended periods of time [54•], and is an example of how treatment recommendations may serve to mitigate some negative expectations of concussion recovery.

The amassing evidence that repeated concussions or even subconcussive blows to the head may result in long-term, negative outcomes, including Alzheimer's disease and chronic traumatic encephalopathy (CTE) [55], cannot be disregarded. Because repetitive concussive and subconcussive blows to the head appear to be necessary but not sufficient for development of CTE, and a "threshold" of number of concussions required for CTE to develop is unknown [56] (but those with a singular concussive event are at low risk), predicting with any certainty who might experience long-term neurodegenerative consequences is not yet possible. Certainly, one should not ignore risk for possible negative long-term outcomes following concussion, but exclusive focus on dementia as an

inevitable endpoint may have the unfortunate effect of discouraging people from seeking symptomatic treatments, especially since TBI remains only one factor that could increase risks for poor cognitive aging. There is no downside to aggressively treating mental health comorbidities while also continuing to look for treatments to halt potential neurodegenerative cascade of events. Whether CTE and persistent post-concussive symptoms are have similar, distinct, or overlapping presentations and etiologies remain to be determined. But, given the evidence to date that treating PTSD and other comorbid mental health conditions has a notable positive impact on mood and neurobehavioral symptoms, behavioral health interventions as a primary treatment component seems valuable irrespective of the underlying etiology.

Conclusion

Comorbidity of concussion and PTSD and subsequent persistent post-concussive symptoms are prominent in the treatment seeking OEF/OIF Veteran population. Yet, there remains a dearth of rigorously conducted prospective investigations of the efficacy of established mental health interventions for PTSD or mood disorders to reduce neurobehavioral symptoms in comorbid presentations. Although limited, the current state of the science does strongly suggest that cognitive-behavioral treatments, notably CPT, have been shown to be feasible and effective in reducing mood/PTSD and neurobehavioral symptoms. That is, treatment for PTSD is the treatment for persistent post-concussive symptoms in this comorbid group. Despite empirical support and treatment guidelines advocate treating comorbidities as a key intervention for persistent post-concussive symptoms, treatment of comorbid, and likely primary, mental health condition is not as widely practiced as the evidence would support. Every concussion event and full history need to be taken into account when making treatment recommendations and genuine neurological symptoms should not be ignored. However, neither should mental health treatment. In the majority of persistent post-concussive symptoms, primary focus on treatment of PTSD or other mental health comorbidities is likely to produce the greatest symptom and functional improvement. The evidence that concussion can induce neurological changes and raise risk for poor cognitive aging outcomes is not incompatible with the research that indicates comorbid mental health conditions are significant contributors to functional changes and should be the primary target of treatment for persistent post-concussive symptoms. It behooves clinician scientists to continue to rigorously study conditions such as CTE and explore links between TBI or repeated sub-concussive events to the development of CTE or dementia, but not to the exclusion of treating symptoms that can improve quality of life in the here and now that also potentially could abate risk for poor distal outcomes. Instead of thinking about treatment of comorbid mental health conditions and concussion treatment as two distinct entities, evidence would support thinking of empirically supported psychotherapies as *the* treatment for persistent post-concussive symptoms.

Compliance with Ethical Standards

Conflict of Interest

Amy Jak declares that she has no conflicts of interest.

Human and Animal Rights and Informed Consent

This article reviews published papers. Papers cited in references for which one of the authors was also and author were completed in compliance with ethics guidelines.

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