Traumatic Brain Injury

13

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Vignette

Sam is a 37-year old Veteran who served in the Army, and was deployed to Iraq three times. While overseas, he was exposed to multiple blasts, one of which was particularly memorable. In this incident, Sam was a passenger in a High Mobility Multipurpose Wheeled Vehicle (HMMWV; Humvee) that drove over an improvised

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explosive device (IED). Both the Humvee driver and a friend of Sam's were killed. His last memory prior to the explosion was driving down the road. He then recalled "waking up" and seeing his friend "slumped over." Soldiers from other vehicles in the convoy were already surrounding the damaged Humvee to assist. Sam recalled feeling "out of it" for several days after the incident: "I had the worst headache of my life." As the TBI was sustained early in the conflicts in Iraq, prior to the recognition that some individuals were incurring long-term effects from blast injuries, Sam proceeded in completing his duties without taking a break. "Other guys were way more hurt than I was. My buddy was killed." During his military service, Sam continued to have headaches, but he always pushed through. At times, he had trouble thinking as quickly as he was used to, but the structure of the military and support of his buddies were helpful, and he was able to compensate. After his last deployment, he did not apply for a military disability rating or associated benefits related to his TBI. Once home, Sam began having post traumatic symptoms (e.g., hypervigilance, nightmares). The chronic headaches continued and Sam began drinking to dull the pain. After receiving a DUI, he started substance use treatment at a local VA. He is also trying to find the right doctor to help him with his headache pain, as well as assistance with submitting a claim for veterans affairs (VA) service connection.

Introduction

Traumatic brain injury (TBI) is a common neurological condition, defined as a disruption to brain functioning caused by a blow, bump, jolt to the head, or a penetrating head injury [1]. The damage caused by the primary insult is exacerbated by the secondary injury (e.g., metabolic changes, cranial bleeding, swelling) [2]. Injury severity is graded as mild, moderate, or severe according to a number of factors, including duration of loss of consciousness, length of amnesia, level of responsiveness, and/or structural imaging results [3]. Military members, including those who have deployed in Operation Enduring Freedom, Operation Iraqi Freedom and/or Operation New Dawn (OEF/OIF/OND), have faced an increased risk for experiencing a TBI compared to civilian populations [4].

Mild TBI (mTBI), herein considered synonymous with concussion, is commonly referred to as one of the signature injuries of the military conflicts in Afghanistan and Iraq [5]. This is in part related to the use of improvised explosive devices (IED), resulting in blast-related injuries [6]. In addition, advancements in military body armor, battlefield medical care, and medical evacuations have improved survival rates for military members, as compared to those in previous conflicts, where brain injuries from blasts, flying debris, or other physical shocks were more likely to be fatal [7–9]. While these improvements in military medicine have reduced mortality, they have also dramatically increased the number of military members returning home from deployment with combat-related injuries, primarily TBI, musculoskeletal injuries, chronic pain, and mental health problems, collectively referred to as *polytrauma* [10–12].

In this chapter, the authors will discuss the epidemiology and etiology of TBI and associated comorbidities among military members and Veterans, and will describe challenges and considerations for treatment. Instructive vignettes will be used to outline evidence-based best practices for TBI and mental health comorbidities, as well as the management of symptoms.

Vignette

Carlos is a 25-year old Army Veteran who served in Afghanistan as a military bomb technician. His work while overseas was primarily comprised of improvised explosive device disposal (IEDD). Sometimes he and his teammates would be called in after IEDs had partially exploded. The scenes could be "messy." After returning home from deployment, Carlos was involved a motor vehicle accident in which he was hit head-on by a drunk driver at 60 miles per hour. Carlos remembers leaving his house that day and then "waking up" 10 days later in the hospital. He sustained a severe TBI, as well as a broken pelvis and left arm. Sequelae associated with the TBI included cognitive impairments, including problems with attention, memory, and problem-solving. After a prolonged period of inpatient rehabilitation, he was discharged from the military on Permanent Disability Retirement. His injuries were rated as 100% Service Connected by the VA. Returning home, he found himself without a job or a support system. Carlos became increasingly depressed and at times thought about ending his own life with a gun he had purchased prior to being injured. He is seeing a counselor at his local VA in the Mental Health Community-Based Outpatient Clinic (CBOC). As he lives in a rural community, the closest TBI specialty team is over 150 miles from his home. As no local TBI community providers were identified, Carlos's family drives him to see the polytrauma team at the Regional VA Medical Center.

Etiology and Epidemiology

Since 2000, the Defense and Veterans Brain Injury Center (DVBIC) has been maintaining a database to record incident TBI diagnoses among military members. Since then, nearly 384,000 incident TBI cases have been documented among military members [13, 14]. Approximately 82% of all TBI cases recorded by DVBIC have been mTBIs [13, 14]. Nearly 10% of cases were classified as moderate; characterized by a confused state lasting more than 24 hours, a longer duration of loss of consciousness (LOC), and the presence of posttraumatic amnesia (PTA—see Table 13.1). Over 1% (approximately 4000 cases) were classified as severe TBI, in which LOC, disorientation, and PTA extend for a longer period of time. 1.4% (approximately 5200 cases) were classified as penetrating TBI, in which there was an open head injury penetrating through the scalp, skull, and outer layer of the meninges, and the remaining 5.4% of cases had incomplete information to determine severity, and were deemed "not classifiable" [13, 14].

Table 13.1 TBI severity classification

Criteria	Mild	Moderate	Severe
Structural imaging	Normal	Normal or abnormal	Normal or abnormal
Alteration of consciousness/mental state (AOC)[a]	Up to 24 h	>24 h. Severity based on other criteria	>24 h. Severity based on other criteria
Loss of consciousness (LOC)	0–30 min	>30 min and <24 h	>24 h
Posttraumatic amnesia (PTA)	0–24 h	>24 h and < 7 days	>7 days
Glasgow coma scale (GCS) (best available score in first 24 h)	13–15	9–12	<9

Table adapted from Veterans Affairs/Department of Defense Clinical Practice Guideline for the Management of Concussion-mTBI [3]

[a] AOC must be immediately following the injury event. Symptoms may include: feeling dazed, confusion, difficulty thinking clearly or responding appropriately, and being unable to describe events immediately before or after the injury event

It is crucial to bear in mind that the above stated incidence rates alone do not adequately convey the disease burden of TBI in military and Veteran populations. According to alternate sources, TBI prevalence estimates among military members and Veterans of the Afghanistan/Iraq conflicts range from 7% to 23% [15, 16]. This wide degree of variation is due to several factors. Reporting injuries sustained during deployment can be logistically difficult, more so when an injury is "invisible" like a TBI. At times, reporting may be perceived as being discouraged, as stoicism and self-reliance are highly valued among those in the military. This was especially true during the earlier years of the Afghanistan/Iraq conflicts, before awareness grew regarding the long-term effects of TBI [17, 18]. Additionally, there has been a lack of consistency in both the measures used to screen for TBI [15, 16, 19] and the clinical symptom profiles used to diagnose TBI (see Sequelae and Symptoms below). Further, reliance on self-report and/or witness reports in a combat setting may have been particularly problematic when attempting to estimate the severity of a given injury [4].

Blast-related injuries, including blasts co-occurring with blunt trauma, are the most common mechanism of TBI during the Afghanistan/Iraq conflicts, stemming largely from the pervasive use of IEDs [20]. Contrary to public perception, however, the vast majority of incident TBI diagnoses among military members since 2000 have occurred in *non*-combat settings where the U.S. military maintains bases (e.g., Western Europe, Japan) or at a home station in the U.S. The leading mechanisms of non-combat related TBI are similar to those observed in civilian populations [21, 22], namely accidents (e.g., motor vehicle crashes, falls, strikes by/against objects), intentional assaults (e.g., fights), and sports or other recreational activities [23]. Additional risk factors for TBIs during non-combat periods specific to military culture include physically demanding operational and training activities, high rates of risky behaviors (e.g., binge drinking), and a largely male, younger (aged 18–24) population [24, 25].

Little is known about the lifetime history of TBI among military members and Veterans beyond what is captured by the Department of Defense (DoD) and the Department of Veterans Affairs (VA), which predominantly screen for TBIs that

occurred during the Afghanistan/Iraq conflicts (DoD and VA). One recent study used the Ohio State University TBI Identification Method [26], a structured, validated clinical interview which was used to establish the lifetime history of TBI among soldiers following return from an Afghanistan/Iraq deployment [27]. Over half of soldiers who did not report a TBI on their most recent deployment *did* report at least one prior TBI that occurred either during military service or prior to military service, and the median number of lifetime TBIs was 2 [27]. These data suggest that only assessing for recent deployment-acquired TBIs does not capture the full lifetime burden of TBI.

Sequelae and Symptoms

Most individuals with one mTBI report returning to baseline functioning within 1 year, however, as many as 15%, report experiencing persistent post-concussive symptoms (PCS) [28, 29]. Less is known about recovery after multiple mTBIs, particularly among those with co-occurring mental health conditions. This will be discussed further below. While the definition of persistent PCS has varied, it is commonly accepted that it includes specific symptoms (usually three or more; see Table 13.2) that occur shortly after the TBI, which last at least 3 months post-injury, and which present functional challenges for those living with such injuries [31].

Psychological Sequelae

It is important to note that mTBIs that occur in combat settings, particularly blast-related mTBIs, may have distinct features that complicate recovery. Such exposures may result in sensory and physical impairments [6, 25]. Recovery may also be further complicated by the presence of mental health comorbidities such as posttraumatic stress disorder (PTSD), depression, anxiety, substance use problems, and chronic pain [30, 32–34]. A particular challenge associated with diagnosing and treating combat-related mTBI is that many of the signs and symptoms associated with such injuries overlap with those frequently associated with PTSD (e.g., trouble concentrating, insomnia, irritability) [35]. While such diagnostic and treatment

Table 13.2 Common symptoms of post-concussion syndrome

Physical symptoms	Cognitive symptoms	Behavior/emotional symptoms
Headache, dizziness, imbalance, nausea, incoordination, vomiting, blurred vision, sensitivity to light, hearing difficulties/loss, tinnitus, sensitivity to noise, numbness, tingling	Problems with attention, concentration, memory, speed of processing, judgment, executive control	Depression, anxiety, posttraumatic stress disorder, agitation, irritability, impulsivity, aggression, fatigue, insomnia

Table adapted from [3, 30, 31]

challenges have been a focus of research and practice following the most recent conflicts, similar co-morbidities were surely present among those who served in previous conflicts (e.g., "shell shock" in World War I) [36].

Moderate to Severe TBI Symptoms and Psychological Sequelae

While less common than mTBI, moderate and severe TBIs are often associated with more significant post-injury sequelae. In addition to the physical, cognitive, and psychological impairments associated with mTBI, military members and Veterans with moderate and severe TBIs also contend with additional, often lifelong conditions that can adversely impact their reintegration into civilian life. Moreover, it is estimated that only approximately 20% of individuals with a moderate or severe TBI report a return to baseline functioning [37], and it can take years (two or more) to experience improvements in symptoms and function [38].

Currently, there are no methods for predicting whether a Veteran with moderate or severe TBI will fully recover functional independence [39]. Individual predictors of worse functional outcomes, however, include increasing age [39], lower educational attainment [40], minority race [41, 42], and a TBI in which the injury resulted in penetration of the skull [43]. It is unclear whether sex influences moderate or severe TBI outcomes, with evidence both for and against female sex as a protective factor [39, 44].

Among many, much of the symptom burden in Veterans with moderate or severe TBI, and therefore most treatment efforts, relate to cognitive dysfunction. Specifically, moderate or severe TBI can affect both complex processes such as attention, judgment, and insight, as well as simpler processes, such as completing daily tasks or keeping track of appointments [38]. Neurocognitive deficits may also manifest as behavioral changes, most notably, disinhibition, impulsivity, and verbal or physical aggression, all of which can interfere with rehabilitation care [45], psychosocial functioning, and community reintegration. Estimates vary between populations, but up to a third of patients with a moderate or severe TBI may exhibit such significant behavioral changes [46, 47].

In the long term, up to 20% of moderate or severe TBI survivors will experience seizures related to posttraumatic epilepsy [48], which may manifest early in the recovery process, or years post-injury [49]. Additionally, emerging evidence suggest that patients with moderate or severe TBI experience increased risk of developing dementia in later life compared to people without such a TBI [50]. There is also evidence to suggest that patients with a hereditary predisposition to Alzheimer's disease experience poorer functional outcomes after a TBI [51].

Screening in the DoD and VA

Routine post-deployment screening for mTBI began in 2008 with the implementation of the DoD's updated post-deployment health surveillance program. The program for the first time included screening for TBI using a 4-item questionnaire

modified from the Brief Traumatic Brain Injury Screen [17], and assessed for TBI that occurred on the *most recent deployment* only. Generally, those who sustained more severe injuries were medically evacuated, and therefore did not participate in post-deployment screening (such injuries were therefore likely identified in the context of medical care received). A positive screen for possible TBI is defined as report of: (1) an injury event (e.g., blast, motor vehicle accident) followed by (2) an alteration of consciousness or LOC. Positive screens suggest that further clinical evaluation may be indicated. In 2007, the Veterans Health Administration (VHA) also implemented a systematic screening program for Veterans who had deployed to the Afghanistan/Iraq conflicts, and included the same 4-item questionnaire. Since then, upon entrance to the VHA, Veterans who deployed in the Afghanistan/Iraq conflicts are screened for possible TBI that occurred *during any OEF/OIF/OND deployment.* Veteran's who reported immediate and ongoing post-concussive symptoms following the injury event and AOC/LOC met criteria for a positive screen, which the VHA triggers further clinical evaluation.

Screening and Evaluation of Lifetime History of TBI

Because the DoD and the VA TBI screening instruments only assess for TBIs that occurred during an OEF/OIF/OND deployment, military members or Veterans presenting for care in a civilian setting may have a history of TBI that was not previously documented in the DoD or VA or recognized by the individual. The Ohio State University Traumatic Brain Injury Identification Method (OSU TBI-ID) is structured clinical procedure for eliciting a person's lifetime history of TBI in a 3–5 min structured interview [26, 52]. The OSU TBI-ID is based on Centers for Disease Control and Prevention recommendations for TBI surveillance, uses validated injury recall methods, and captures information about presence, severity (e.g., worst), nature of alteration of loss of consciousness, and age of injuries [26, 52, 53]. If clinicians do not have the training or time to do a full evaluation for lifetime history of TBI with the OSU TBI-ID, the OSU TBI-ID—Short Form Screening Items could be used to assess for probable history of lifetime TBI relatively quickly. The first five questions of the OSU TBI-ID can be used to assess whether a patient has experienced a lifetime TBI (see Table 13.3), and if it occurred in a particular setting (e.g., military service, motor vehicle accident, etc.) [54]. While the fifth item specifically screens for military-related TBIs and mentions blasts/explosions, it does not solicit information specific to hitting one's head on tank doors or other common types of military-specific injuries. An affirmative response to any of the five questions should prompt further assessment using the full OSU TBI-ID [26].

The TBI-4 was developed as a brief screening based on the OSU-TBI-ID for inclusion in the mental health assessment process for Veterans entering the VHA [55]. On the TBI-4, a "yes" response to any of the questions is indicative of a possible TBI history (see Table 13.4). A positive response to question 2 is a more reliable indicator of possible TBI. If an individual answers "no" to all of the TBI-4 questions, a comprehensive assessment is likely not warranted, however, this does not mean that a TBI has not occurred, nor that full recovery has taken place.

Table 13.3 OSU TBI-ID short form screening items

1. In your lifetime, have you ever been hospitalized or treated in an emergency room following an injury to your head or neck? Think about any childhood injuries you remember or were told about.	Y/N
2. In your lifetime, have you ever injured your head or neck in a car accident or from crashing some other moving vehicle like a bicycle, motorcycle, or ATV?	Y/N
3. In your lifetime, have you ever injured your head or neck in a fall or from being hit by something (for example, falling from a bike or horse, rollerblading, falling on ice, being hit by a rock?) Have you ever injured your head or neck playing sports or on the playground?	Y/N
4. In your lifetime, have you ever injured your head or neck in a fight, from being hit by someone, or from being shaken violently? Have you ever been shot in the head?	Y/N
5. In your lifetime, have you ever been nearby when an explosion or a blast occurred? If you served in the military, think about any combat-or training-related incidents.	Y/N

Table 13.4 TBI-4 screening items

1. Have you ever been hospitalized or treated in an emergency room following a head or neck injury?	Y/N
2. Have you ever been knocked out or unconscious following an accident or injury?	Y/N
3. Have you ever injured your head or neck in a car accident or from some other moving vehicle accident?	Y/N
4. Have you ever injured your head or neck in a fight or fall?	Y/N

In the first vignette, Sam experienced a LOC due to the IED blast. Post-exposure he also noted feeling "out of it." His blast injury would be classified as an mTBI using the severity classification presented in Table 13.1. Sam's injury is typical of that experienced by deployed military members who served during the earlier years of combat operations in Afghanistan and Iraq. This was before the DoD and VA implemented policies and programs to improve awareness, diagnosis, treatment, and research, as well as to attempt to reduce stigma [56]. Given that he did not undergo screening or treatment for TBI during his military service, Sam's TBI would have gone undetected until he was evaluated by a primary care physician or mental health care provider in a non-military setting. This may not have happened for years post-injury. Additionally, although he was obtaining care for his substance use disorder in the VA, he was seeking care for his TBI-related headaches from his non-VA primary care provider, potentially contributing to less integrated and coordinated care. Accurate assessment of his symptoms (e.g., cognitive complaints) were also complicated by pain medications which impacted his ability to concentrate. Veterans with TBI and/or pain have been more likely to receive prescription opioids [57, 58], and thus, the lack of coordinated care may increase risk of negative opioid-related outcomes. Further, substance use treatment practices may require modifications to address the cognitive and neurobehavioral sequelae of TBI [59–61], yet it remains unclear how comfortable or knowledgeable substance use providers are regarding assessing for or providing accommodations for treating patients with a history of TBI.

For Carlos in the second vignette, his severe TBI diagnosis was well documented in his VA health record, yet his ability to access VA polytrauma transitional rehabilitation services was logistically difficult because he lived so far away from one of the VA polytrauma system of care locations [62]. Carlos has been accessing local VA services for depression treatment. In providing depression care, his provider should consider modifications to evidence-based psychotherapies that may be required to facilitate treatment uptake (see Accommodating the Symptoms of TBI [63]). Moreover, there is some evidence to suggest that those with moderate to severe TBI also benefit from antidepressants [64]. His providers should also consider that TBI has been associated with elevated risk for death by suicide among Veterans, and of further concern, moderate/severe TBI is associated with an increased risk of death by firearm among decedents [65]. Carlos's therapist should incorporate conversations about lethal means safety since Carlos owns a firearm, has expertise using a firearm from military training, and has already struggled with suicidal thoughts since his TBI injury (see https://www.mirecc.va.gov/lethalmeanssafety/—[66]).

Evaluation of Sequelae and Function

Once TBI history and severity have been established, a thorough evaluation of sequelae, as well as functioning is recommended. See Table 13.5 for a selection of instruments that can be used to augment standard clinical interviews. Many of the measures are highlighted in the VA/DoD Clinical Practice Guidelines for the Management of Concussion–mild Traumatic Brain Injury and co-occurring conditions [3]. For further information about comorbidities of mTBI see the chapter by Brenner et al. [28].

Even though Sam in the first vignette is receiving treatment for his unhealthy alcohol use, his history of witnessing his friend's death, subsequent minimization of this trauma ("Other guys were way more hurt than I was"), and ensuing nightmares and hypervigilance all indicate he should be evaluated for PTSD (PCL-5). Additionally, Sam's report that he has "trouble thinking as quickly as he used to" and his frequent headaches warrant an assessment of PCS, perhaps using the NIS. Lastly, his service history suggests that he was able to draw upon a strong social support system while deployed, but that he may not have a supportive social network now that he is reintegrating into civilian life. Evaluation of his psychosocial quality of life is also likely warranted (WHOQOL-BREF).

After deployment, Carlos from the second vignette began to experience depression and suicidal ideation, and reported having purchased a firearm. The severe TBI he sustained in the motor vehicle accident further complicated his situation, and he continues to experience cognitive difficulties after completing rehabilitation. Like Sam in Vignette #1, Carlos would benefit from an assessment of his psychological symptoms, depression (PHQ-9), and overall quality of life (WHOQOL-BREF). Social isolation and unemployment are additional stressors for Carlos, and it is also likely that he has some persistent post-traumatic stress related to his work disposing of IEDs in "messy" combat settings (PCL-5). More importantly, as Carlos reports

Table 13.5 Psychometrically sounds measures of PCS severity, mental health symptoms, or function/disability/quality of life/participation

Symptom	Comorbid with mTBI	Measure	# of items	Time to administer (min)
Anxiety	17–31%	Neurobehavioral Symptom Checklist (NSC)	5	30
		Beck Anxiety Inventory (BAI)	21	5–10
		General Anxiety Disorder—7 Item (GAD-7)	7	5–10
		Traumatic Brain Injury Quality of Life (TBI-QOL)	20	5–10
Depression	31–50%	Beck Depression Inventory (BDI-II)	21	5–10
		Patient Health Questionnaire—9 (PHQ-9)	9	5–10
		TBI-QOL	20	5–10
Post-traumatic stress	63–77%	PTSD Checklist for DSM-5 (PCL-5)	20	5–10
At-risk substance use	4–19%	AUDIT Alcohol Consumption Questions (AUDIT-C)	3	5
		Drug Abuse Screening Test (DAST-10)	10	5–10
Post-concussive symptoms	15%	Neuro-behavioral Symptom Inventory (NSI)	22	15
Functioning/ disability/quality of life/participation	N/A	Craig Handicap Assessment and Reporting Technique Short For (CHART)	19	15
		World Health Organization Quality of Life (WHOQOL-BREF)	26	15
		TBI-QOL	20	5–10
		Daily Living Activities—20 (DLA-20)	20	Completed by provider
		Participation Assessment with Recombined Tools-Objective (PART-O)—17	17	10–15
Suicide risk	0.5% (suicide attempts)	Columbia-Suicide Severity Rating Scale Screener (C-SSRS-Screener)	6	5
		Beck Scale for Suicide Ideation (BSS)	19	5–10

Citations for table: [28, 67, 68]

having access to lethal means, it is crucial that he undergo continued assessment of his suicidal symptoms (CSSRS-Screener). While he is receiving polytrauma care at a VA outpatient clinic, he may benefit from psychiatric/psychological treatment via telehealth. Safety planning, a brief intervention to reduce suicide risk, should be initiated [69]. As Carlos has difficulty with his memory, educating his family members about the Safety Plan is also indicated.

Intervention and Management

Mild TBI

It is important to note that the majority of individuals who experience a mTBI recover fully [29], and providing Veterans with an expectation of full recovery, particularly if their injury was recently sustained, may help to alleviate fears. However, for many, symptoms do persist. While mTBI symptoms may resolve without intervention, the length of time until resolution can vary, ranging from days to months [70, 71]. Treatment, therefore, is focused on symptom management and a return to activities (e.g., work, play). For individuals with an mTBI who do not return to baseline function within a year, Clinical Practice Guidelines suggest non-pharmacological therapies as a first line of intervention [3]. Management of persistent headaches may include medication for acute pain, but principally focuses on education for avoiding exacerbating substances (e.g., caffeine, tobacco, alcohol), and minimizing environmental exposures that may promote headache (e.g., noisy environments, strong scents). Sleep disturbances are also common after mTBI [72], and interventions often entail education on topics such as avoiding stimulants and developing consistent sleep habits (i.e., sleep hygiene). For sleeplessness, interventions may include cognitive behavioral therapy tailored for insomnia (CBTi), relaxation strategies, dietary modification, and physical activity, among others [3]. Finally, for cognitive difficulties or behavioral concerns, cognitive-behavioral interventions, psychoeducation, and supportive stress management may be used and adapted for patients' individual treatment goals. Given that some patients with a TBI struggle with executive functioning (e.g., planning/organization, impulsivity), providers should be prepared to adapt treatments to accommodate such limitations. It is recommended that patients are only referred for neuropsychological assessment with a specialist if the symptoms do not improve or resolve after 90 days [3]. In most cases, research also supports employing evidence-based practices (medications, psychotherapy) among those with TBI and co-occurring mental health conditions [28].

Moderate to Severe TBI

For military members and Veterans who have experienced a moderate or severe TBI in deployed or non-deployed settings, TBI treatment is often provided through the Polytrauma System of Care (PSC), a national network of providers and specialized clinics distributed across VA medical centers [73]. These interdisciplinary teams address both psychological and physical issues faced by Veterans. Of note, for Veterans living in sparsely populated or rural areas, particularly Veterans with moderate to severe TBIs like Carlos, accessing care in the VA's PSC can be difficult. VA Points of Contact are sometimes available in smaller clinics, but they function

primarily as care coordination and case management for injured Veterans. In Carlos's case, his family drives him to a Regional VA Medical Center for his TBI rehabilitation services. That being said, he may be able to receive some of his polytrauma care via telehealth. Either way, his polytrauma and mental health providers should work collaboratively to address current symptoms (depression), decrease suicide risk (e.g., Safety Planning), and increase function (e.g., identify avocational activities of interest and help Carlos engage in such activities).

Prevention

After the first several years of combat operations in Afghanistan and Iraq, significant concern emerged about the acute and long-term health effects for military members with deployment-acquired TBI, and the DoD and VA began improving assessment and prevention efforts. In 2010, the DoD began implementing an incident-based policy to improve identification of potentially concussive events in theater as close to the point of injury as possible, which required that following all potentially concussive incidents, military members must receive a medical evaluation before being cleared to return to duty [74]. By relieving military members from duty until fully recovered, this reduced the likelihood of sustaining a *second* head injury while the brain is still recovering from metabolic abnormalities associated with the initial injury, and therefore, reduced risk for long term neurologic injury [20].

Evaluations of the success of the incident-based policy have reported mixed results. As of 2018, it was estimated that, depending on the service branch, TBI reporting among active duty military members increased by approximately 50–250% [75]. Much of this variation was due to inconsistencies in how widely the policy was disseminated and communicated [14]. Increases in reporting also coincided with increases in TBI-related medical evaluations, primarily CT scans, mental health evaluations, and physical therapy assessments [76], however, it remains unknown if there was a corresponding increase in injured military members being relieved from duty or given adequate time to recover. Crucially, among military members who experience a non-combat-related mTBI, up to 40% initially seek care in private purchased care settings. In such cases, the military member may not report the TBI to commanding officers or military clinicians, making civilian settings the only point of contact for TBI treatment. Clinicians in civilian settings should be aware of this possibility when treating military members. For military members and Veterans alike, particularly those who have a history of TBI, clinicians should encourage helmet use and recommend protective gear suited to specific activities, such as motorcycling and bicycling.

Conclusion

Civilian clinicians and mental health providers should be encouraged to screen their patients for prior military service, with the understanding that patients with a history of military service may be more likely to have a history of TBI and its associated comorbidities. Using the OSU TBI-ID short form is recommended for evaluating an individual's lifetime history of TBI. In addition, augmenting traditional clinical interviews with psychometrically sound tools (e.g., depression, post traumatic symptoms) is indicated. Training civilian clinicians to screen for lifetime history of TBI and its associated co-occurring conditions and symptoms will be invaluable to improve the health and wellbeing of our nation's military members and Veterans. In addition, providers with less experience working with military members or Veterans are encouraged to become familiar with military culture (see https://psycharmor.org/courses/15-things-veterans-want-you-to-know/—[77]). The acute and potentially lasting effects of TBI on physical and mental health, functioning, and overall quality of life necessitate ongoing research into the pathophysiology of head injury, as well as continued improvement in rehabilitation and treatment methods.

Clinical Pearls

- Mild TBI (mTBI), herein considered synonymous with concussion, is commonly referred to as one of the signature injuries of the military conflicts in Afghanistan and Iraq
- Most individuals with one mTBI report returning to baseline functioning within 1 year, however, as many as 15%, report experiencing persistent post-concussive symptoms
- A particular challenge associated with diagnosing and treating combat-related mTBI is that many of the signs and symptoms associated with such injuries overlap with those frequently associated with PTSD (e.g., trouble concentrating, insomnia, irritability)
- While less common than mTBI, moderate and severe TBIs are often associated with more significant post-injury sequelae. In addition to the physical, cognitive, and psychological impairments associated with mTBI, military members and Veterans with moderate and severe TBIs also contend with additional, often lifelong conditions that can adversely impact their reintegration into civilian life.
- TBI treatment is often provided through the Polytrauma System of Care (PSC), a national network of providers and specialized clinics distributed across VA medical centers [73]. These interdisciplinary teams address both psychological and physical issues faced by Veterans.

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