

Combat Blast Injury and Veterans with TBI

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TBI Definition

Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) have brought to the forefront the importance of accurately identifying and treating service members with traumatic brain injury. In 2007, the Department of Defense's Task Force on Mental Health identified traumatic brain injury (TBI) as the signature injury of the OIF/OEF conflicts. The Department of Defense (DoD) defines TBI as "a blow or jolt to the head or a penetrating head injury that disrupts the function of the brain" (<http://www.pdhealth.mil/TBI.asp#bkgd>). Clinical symptoms of a TBI following a blow to the head are a loss or an alternation of consciousness and any loss of memory for events immediately before or after the injury (French, Spector, Stiers, & Kane, 2010). Other important clinical symptoms may include alteration in mental state at the time of the injury such as confusion, disorientation, and/or slowed thinking and neurological deficits which include, changes in motor functioning and sensory alterations. Intracranial abnormalities due to a TBI, such as contusions, diffuse axonal injuries, hemorrhages, or edema may be apparent on imaging.

Traumatic brain injuries are traditionally classified as mild, moderate, or severe based on the Glasgow Coma Scale (GCS) (Roebuck-Spencer & Sherer, 2008). The GCS is commonly used by medical professionals to assess the responsiveness of a patient based on eye opening, motor movement, and verbal communication. The scores on the GCS range from 3 to 15. A mild TBI (mTBI) is defined as a GCS of 13-15 and can occur with or without loss or alteration of consciousness or evidence of neurological impairment. A GCS of 9-12 is classified as a moderate TBI, with a score of 3-8 being a severe TBI.

Mild TBIs, or concussions as noted above, may or may not involve a loss of consciousness. Thus for the majority of TBIs, medical professionals must rely on patient report for diagnosis. An mTBI typically involves a loss of consciousness for less than 30 minutes or an alteration of consciousness and posttraumatic memory loss of less than 24

hours, and may also involve a short period of retrograde amnesia. The recovery period following an mTBI is 1 to 3 months (Mittenburg & Roberts, 2008). Cognitive symptoms following an mTBI can include difficulty with memory, attention, processing speed, and mental flexibility.

A moderate TBI involves a loss of consciousness of greater than 30 minutes to less than 24 hours, an alteration of consciousness for more than 24 hours, and posttraumatic amnesia lasting 1-7 days. Due to the increased severity of the injury, individuals who sustain a moderate TBI are likely to require inpatient or post-acute rehabilitation (Roebuck-Spencer & Sherer, 2008). Additionally, individuals with this type of injury are likely to require ongoing outpatient care as a part of their healing process.

For individuals who sustain a loss of consciousness lasting longer than 24 hours and having more than 7 days of posttraumatic amnesia, a severe TBI is diagnosed. Individuals with this level of TBI are often in comas for at least some period of time following their injury (Roebuck-Spencer & Sherer, 2008).

Mechanism of Injury

Improvised explosive devices (IEDs) and vehicle rollovers are the most common causes of TBI in the military population. Hoge et al. (2008) indicated that 79% of combat related TBIs with a loss of consciousness resulted from blast injuries. Traumatic brain injuries that occur as a result of a blast can occur during any one of four blast phases (DePalma, Burris, Champion, & Hodgson, 2005). Primary blast injuries result from either overpressurization or underpressurization due to the initial blast wave. Typical injuries resulting from this blast phase are rupture of the tympanic membranes (eardrum), pulmonary barotrauma, and concussion with acute gas emboli.

Secondary blast injuries result from objects that are placed in motion due to the blast leading to blunt and penetrating injuries (Barth, Isler, Helmick, Wingler, & Jaffee, 2010). For example, a secondary blast injury could occur when debris from a building damaged in the blast hits a service member. Tertiary blast injuries occur when service members are thrown off their feet and hit stationary objects, which often results in blunt trauma injuries. Quaternary blast injuries are sustained following a blast and cannot be

accounted for by the other phases of blast injury, which may include burns, toxic inhalation, exposure to radiation, asphyxiation, injuries as a result of dust inhalation, and crush trauma (Barth et al).

Rollovers are another mechanism of head injury that occur in the combat theater. The vehicles primarily used in the combat setting such as the High Mobility Multipurpose Wheeled Vehicle (HMMWV) and the Mine Resistant Ambush Protected (MRAP) do not have the same safety equipment as civilian passenger vehicles. While they are equipped with safety belts, there are no airbags. During a rollover, personnel may hit their heads on the vehicle, other passengers, or items that become dislodged during the accident, and can be ejected from the vehicle.

TBI, PCS, and PTSD

When working with returning veterans it is important for providers to be able to determine whether an individual has a mild TBI that has not resolved which is referred to as Postconcussion Syndrome (PCS), Post Traumatic Stress Disorder (PTSD)/post traumatic spectrum disorder, or both. While symptom management is key, knowing the root cause of a symptom such as irritability, can direct treatment that targets the root cause and improves the efficiency of the recovery process. While most mild TBI symptoms resolve within 1-3 months of the event, in rare cases symptoms may persist longer. When the neuropsychological symptoms last beyond the initial 1-3 month time period, PCS is diagnosed. Common symptoms of PCS are difficulty with memory, changes in mood, problems paying attention and concentrating, decreased energy, and mental slowness. Interestingly, these symptoms are also seen in PTSD. Despite advances in our understanding of mTBI, it is still unclear why some individuals recover faster than others after a mild TBI

Posttraumatic stress disorder is also a prevalent injury as a result of the current military conflicts. According to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (American Psychiatric Association, 2000), in addition to experiencing a trauma with an intense emotional reaction, multiple symptoms must occur for a PTSD diagnosis. A key diagnostic feature is the persistent re-experiencing of the trauma through reoccurring and intrusive thoughts during the day,

distressing dreams, feeling as if the event is occurring again (flashback), and/or a psychological or physiological reaction based on a cue from the event. Another criterion that must be met is avoiding stimuli associated with the trauma, such as avoiding conversations, places, and people that remind one of the trauma. Others may not be able to recall an important aspect of the event. Additionally, decreased interest in activities, feeling detached or numb, and a sense of doom are all possible ways an individual may attempt to avoid the trauma. There is also an increased arousal that occurs with PTSD that often includes difficulty with sleep, irritability, difficulty concentrating, hypervigilance, and an exaggerated startle response.

Since most combat related TBIs occur during a blast, the basic criteria for trauma and an intense emotional reaction are likely already met. As listed above, many of the symptoms of increased arousal and mechanisms used to avoid stimuli associated with the trauma are similar to PCS. For example, decreased interest in activities, feeling detached or numb, and difficulties with sleep, anger, and concentration are all prevalent in individuals with both PTSD and PCS. In order to determine the correct diagnosis, a clinical interview which focuses on how an individual personally understands the traumatic event is invaluable. It is important to first determine whether the individual actually experienced a concussion (loss or alteration of consciousness, retrograde amnesia, posttraumatic amnesia) and the severity of a potential concussion. Next, to the clinician must determine whether there was an emotionally charged event associated with the blast such as someone in their unit getting severely injured or killed. Although, military members are trained for such incidents and know that injury and death are a possibility in combat, they are still vulnerable to emotional reactions to such traumatic events. However, it is incorrect to assume that if a service member experiences a blast, has difficulty paying attention, is irritable, and cannot remember as well as they once could, that the individual has a mTBI or PTSD. Both possibilities must be assessed, and it is very common to diagnose both conditions in the individuals who have been exposed to multiple blasts and traumatic emotional events. Additionally, it is important for the clinician to establish with an individual a timeline of when the traumatic event(s) occurred and the development of symptoms (Vasterling, J. J., MacDonald, H. Z., Ulloa, E. W., & Rodier, N., 2010).

Determining whether a patient has sustained a brain injury, has PTSD, or a combination of both is critical for treatment. It is likely that a patient with a moderate or severe TBI will be correctly diagnosed with a head injury, but a patient with a mild TBI may not be as easily identifiable. To further complicate the issue, as noted above, many of the PCS symptoms are similar to PTSD. It is important to distinguish between these diagnoses because psychological health has an impact on physical recovery (Holbrook, Anderson, Sieber, Browner, & Hoyt, 1999; Michaels et al., 2000).

Treatment of PTSD is typically instituted by a mental health provider. The evidence-based approach that is widely used in military settings is Prolonged Exposure (PE). This has been found to be an effective method of working with victims of trauma (<http://www.ptsd.va.gov/public/pages/prolonged-exposure-therapy.asp>). PE involves education about typical reactions to trauma and breathing training to help individuals decrease arousal. Patients then practice doing things they have been avoiding. After patients have started to manage their stress reactions in these real-life situations, the traumatic event is talked about multiple times with the therapist in order to gain control over the distressing nature of the event. Not only is it used in the military setting, but it has been modified for use in combat zones (Cigrang, 2005).

Recovering from PCS often includes symptom “normalization” and education, sleep hygiene, stress management, pain management, cognitive retraining, and psychological treatment (Pickett, Bender, & Gourley, 2010). However, rehabilitation from a moderate to severe TBI is much more rigorous and typically involves intensive medical treatment and intervention with physical therapy, speech therapy, and cognitive rehabilitation (an individualized process that includes focusing on cognitive, behavioral, and emotional problems). This will be discussed in-depth in a later section.

TBIs in the Combat Setting

Since TBIs occur on the battlefield it is important to have a way to assess the severity of an injury onsite, rather than having to evacuate a member to a higher level of care for assessment. Researchers have found that when military members are treated closer to the location of the incident, soon after an injury, and around their unit members, the overall outcome is better and they are more likely to return to duty (Barth et al.,

2010). Keeping service members close to their unit when possible, also allows for mission accomplishment.

In the military, the frontline medics, either a Combat Medic or a Corpsman are trained to administer the Military Acute Concussion Evaluation (MACE; DVBIC, 2007) to those exposed to blast forces and/or a concussion. If a military member performs below the cutoff score and presents with red flag symptoms (seizures, vomiting, worsening headache), the Combat Medic/Corpsman consults with a medical provider to determine disposition (i.e. return to duty vs. remove from combat) and determine if medical evacuation to a higher level of care is necessary. If no symptoms are present and the score on the MACE reflects impairment, rest and observation are recommended along with careful consideration to determine how and when an individual should return to duty. If no symptoms are reported and the MACE is within normal limits, return to duty may be immediate.

Service members who are deployed at larger facilities may be seen by a primary care provider and reevaluated every 3 days for continued symptoms. If after 7 days, symptoms persist, the member will be screened for depression and acute stress disorder symptoms and referred to a mental health provider if needed. If after being followed by a mental health provider without symptom improvement, evacuation to a higher level of care where a more neurologically based assessment is available is recommended.

In addition to evaluation, all medical providers, including physicians and Combat Medics/Corpsmen are trained to provide education on concussion to all patients and encourage the use of reduced stimulus environments. Recommendations are available for medications following a concussion with implementing duty restrictions. Clinicians are advised to consider the use of higher levels of medical care if symptoms persist and to document in the member's electronic medical record appropriate coding to track concussions.

Carefully making return to full duty decisions is of the utmost importance to ensure that the brain has fully healed. However, it should be noted that for most mild TBIs, there is a natural recovery curve that occurs within minutes to several months following an injury. Individuals typically recover and are able to return to their pre-injury level of functioning following a single concussive event. For individuals with

multiple concussive blows, it is critical to their recovery that they fully heal between concussions. Multiple sub-concussive and concussive blows perhaps without full recovery between events may lead to persistent cognitive impairment and early development of the degenerative disease, Chronic Traumatic Encephalopathy (CTE). Thus, early intervention (rest) and full recovery from a concussion will limit the risk for prolonged treatment and rehabilitation, and reduce the risk of developing a neurodegenerative disease.

Impact of a TBI

Following a TBI attention and concentration, learning and memory, executive functioning, reasoning, judgment, and/or self-awareness can be impacted (Pickett, Bender, & Gourley, 2010). Rehabilitation in these areas typically focuses on learning compensatory strategies. This approach includes a variety of ways to improve cognitive functioning and extends to the use of external cognitive compensatory devices such as notebooks or technology based devices. Other cognitive rehabilitation is implemented through computer-based programs. During cognitive rehabilitation rarely is only one strategy used, rather a combination of interventions are employed and individualized for each patient.

The broad behavioral and emotional problems that are focused on during rehabilitation are agitation, hypoarousal, and depression (Pickett, Bender, & Gourley, 2010). Treatment for agitation and related symptoms is typically focused on behavioral management plans and environmental manipulation. Pharmacological therapies may also be used if the initial treatment fails to ease agitation. While depression can be a natural part of TBI recovery, it is important to identify and effectively treat it. There is not a single approach that works best in treating symptoms of depression, but a combination of treatments. Normalization and a positive rehabilitation program are key features to overcoming the depression associated with TBI. Additionally, individual, family, and group counseling can be utilized depending on an individual's situation.

Rehabilitation in CONUS

Once a TBI occurs, rehabilitation begins, whether on the battlefield or in the continental United States (CONUS). While the symptoms of most mild TBIs will resolve shortly after the injury, symptoms associated with multiple concussions or moderate and severe TBIs require evacuation to a higher level of care and return to the United States. It is likely that a traditional course to rehabilitation will begin at that point. If needed, patients are admitted to an Acute Care Unit for medical stabilization and begin undergoing assessments by psychiatry, neurology, neuropsychology, physical therapy, occupational therapy, and speech and language pathology (Pickett et al., 2010). Individuals who are unable to tolerate at least 3 hours of therapy per day or who have not returned to consciousness, are placed in sub-acute rehabilitation programs.

As patients improve they transition to acute inpatient rehabilitation (Pickett et al., 2010) with a goal to ‘set the stage for optimal community reintegration post discharge and to restore functional independence’ (Pickett et al., 2010, p. 185). This is also the setting in which individuals with moderate to severe TBIs become self-aware of their injuries and limitations. Many individuals with TBIs will make effective recoveries during acute rehabilitation programs. Those that do not may be referred to transitional rehabilitation programs with a goal of community reintegration or a return to the least restrictive environment. Transitional rehabilitation programs may be residential, community based day treatment as part of a larger medical system, or a home-based model.

The U.S. Department of Veterans Affairs has designed a polytrauma system of care (PSC) to offer specialized rehabilitation to veterans in areas closer to their home than most major military treatment centers (Pickett et al., 2010). The PSC consists of five levels of care. There are four polytrauma rehabilitation centers, the first level of care, spread across the U.S. (Minnesota, California, Virginia, and Florida) with a goal of acting as a hub for acute medical and rehabilitation care, along with research and education in the fields of polytrauma and TBI.

The second level of care is the polytrauma network site (PNS), which there are 21 sites across the nation with a focus on postacute rehabilitation for veterans and their families. Polytrauma Support Clinical Teams (PSCT) make up the third level of care and

include case management and monitoring changes in veterans to ensure they are at an appropriate level of care. Polytrauma points of contact, level four, are staff members located at Veterans Health Administration (VHA) facilities that assess and identify patients in their local area to ensure each individual is receiving the appropriate services from the larger PSC. Level five, Polytrauma Transitional Programs are co-located with PRC programs and are residential programs which are goal oriented and time limited.

Another option for care is the Defense and Veterans Brain Injury Center (DVBIC). DVBIC brings together the DoD, VA, and civilian providers to assess and treat TBIs, provide education, and conduct research. In addition to active duty military members and veterans, DVBIC also provides care to military beneficiaries who have sustained a TBI.

Conclusion

TBI has become a signature injury of the OIF/OEF conflicts. Within the military setting, TBIs are typically caused by blast injuries, which have a unique mechanism of injury. Assessment and evaluation measures are readily available for Combat Medics/Corpsmen to use along with credentialed medical providers to accurately identify service members with TBI. Assessment and return to duty decisions can be made on the battlefield and may not require medical evacuation to a higher level of care. If symptoms persist, it is important to determine if psychological symptoms are occurring in addition to physical symptoms. Treatment and rehabilitation programs have been developed in the United States to help veterans recover from TBIs and PTSD. As more and more veterans return home, it is important to keep these types of injuries in mind, as they are not as easily identifiable from the outside, as other war related injuries.

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