The Graduate Review

Volume 6 Article 6

2021

A Hidden Effect of War: Blast-Related, Traumatic Brain Injury (bTBI)

A Hidden Effect of War: Blast-Related, Traumatic Brain Injury (bTBI)

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Overview of Blast-Related TBI

There are many effects of war. Some are physical such as a lost limb or scars, and some are within the brain and invisible to the eye. These effects of war invisible to the eye are scars as well and are frequently the tragic effects of a traumatic brain injury (TBI). TBI is a brain dysfunction that can be caused by a variety of external forces (Bryden et al., 2019). While there are many categories of TBI, the most common form of TBI in military settings is blast-related TBI (bTBI), also known as mild TBI (mTBI) (McKee & Robinson, 2014). In a blast, the detonation of an explosive device elicits two phases of a blast wave, known as the positive and negative phases (Wallace, 2006). The positive phase of the blast wave contains "blast overpressure", which is formed from the compression of air in front of the blast wave; the movement of air molecules is heated and accelerated by the blast wave, and the atmospheric pressure comes in contact with the individual and pushes on the organs of the body, including the brain (Elsayed, 1997; Mayorga, 1997; Wallace, 2006). The negative phase of the blast wave is a result of sub-atmospheric pressure, and the amount of damage from the pressure wave relies on the peak pressure, duration, medium of the explosion, and distance from the explosion (Wallace, 2006). One of the primary consequences of this blast exposure is TBI, as the injuries from the blast disrupt the structure of the body and brain milliseconds after the explosion (Bryden, et al., 2019; Wallace, 2006).

bTBIs, previously known as "shell shock", can also be referenced by a variety of different names, such as mild TBI (mTBI), blast injury neurotrauma, and ballistic shock TBI (DePalma, 2015). Active members and veterans of all branches of the military often sustain TBIs from blast events (McKee, & Robinson 2014). Exposure to improvised explosive devices (IEDs), in particular, is the unfortunate and most common cause of TBI in service members on combat deployments in all branches of the military (McKee & Robinson, 2014). Enlisted members and veterans of all branches of the military report the common effect of war related to TBI. In 2012, out of 771,874 veterans, the U.S. Department of Veterans Affairs (VA) estimates 59,218 veterans involved in Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) were evaluated or treated due to conditions and symptoms related to TBI (Frieden & Collins, 2013). Population-based estimates of injuries and symptoms of service members and veterans related to TBI continue to be underreported as service members can be hesitant to report their health conditions and maintain a self-sacrificing

mindset even after service, which views seeking help as failure (Armistead-Jehle et al., 2017; Bryden et al., 2019).

Symptoms of bTBI can vary from person to person and occur without a physical trace. The effects of bTBI can be long or short term, with a wide range of symptoms (Bryden, et al., 2019). Symptoms of a mTBI include, but are not limited to, irritability, sleep disturbance, forgetfulness, anxiety, headaches, poor concentration, pain, and psychological distress, including behavioral changes, executive dysfunction, memory loss, and cognitive impairments (Walker & Tesco, 2013). Symptoms of bTBI can also heavily impact communication and language abilities when cognition is impaired (PTSD: National Center for PTSD, n.d.). Cognitive-communication impairments from bTBI can occur in a variety of different ways by impacting language and communication abilities (Nelson et al., 2015). These cognitive impairments can include difficulty following instructions, inattention, and a variety of memory difficulties (Nelson et al., 2015). Many symptoms of PTSD even overlap with TBI symptoms, specifically mTBI symptoms (Wallace, 2006). As of November 2020, 11%-20% out of every 100 veterans who served in OIF or OEF are diagnosed with PTSD annually, and enlisted service members returning from combat deployments are diagnosed with Post-Traumatic Stress Disorder (PTSD). For these returning service members, their communicative relationships with their families and friends can drastically change (PTSD: National Center for PTSD, n.d.). As a result of bTBI, these cognitive impairments, among others, can negatively impact veterans' language and communication with their family, friends, and even physicians and professionals, which can negatively affect their initiation of treatment, treatment care, and progress.

The effects of mTBI can be progressive (McKee & Robinson, 2014). The progressive nature, effects on cognition and communication, and devastating features and symptoms of mTBI in service members can result in late diagnosis and treatment (McKee & Robinson, 2014). Late detection and difficulty of diagnosis and treatment, combined with a lack of education about bTBI, may directly correlate to the current rate of suicide in veterans (National Veteran Suicide Prevention Annual Report, 2019; Richman, 2018). Richman (2018) reported that veterans with multiple brain injuries are twice as likely to consider suicide, and according to the Department of Veterans Affairs (VA) National Suicide Data Report in 2017, 6,139 veterans, an average of 16.8 per day, took their own lives (National Veteran Suicide Prevention Annual Report, 2019). Although mTBI is the most common brain injury affecting service members, it continues to be widely difficult to diagnose and is not largely well understood yet by professionals (McKee & Robinson, 2014). The blast events our active-duty service members and veterans have encountered cause a ripple effect in the form of bTBI, which impacts all aspects of their lives, including their communicative abilities and language.

"The Tipping Point"

Many service members returning from combat deployments have endured several blast events, whether in training missions for operations in preparation for deployment, explosions while on a combat deployment, or, most likely, a combination of both; and the number of blasts can be staggering. Experiencing multiple blast events can negatively impact the brain and brain function, resulting in long-lasting devastating and frustrating symptoms, such as cognitive-communication challenges (Dessy et al., 2015). As a retired Navy SEAL, a member of SEAL Teams Four and Six, and Silver Star and Purple Heart recipient, Will Chesney had experienced many blast events within training missions and deployments. His biography, written with Joe Layden, *No Ordinary Dog,* outlines Will's experience with his military working dog (MWD), Cairo, together in SEAL Teams Four and Six, and Operation Neptune Spear, the SEAL Teams' sixth mission that resulted in the death of Osama Bin Laden. Chesney's biography also highlighted his frustrating and long-standing experience with his bTBI.

After experiencing a large grenade blast while on deployment in Afghanistan in 2012, combined with the accumulation of blast events Will had endured during training missions and previous deployments while enlisted as a Navy SEAL, Will described the grenade blast in 2012 as a "tipping point" to his bTBI symptoms (W. Chesney, personal communication, July 22, 2020). His debilitating migraines, memory loss, tinnitus, frustration, irritability, and depression showed the invisible telltale signs of bTBI (Chesney & Layden, 2020; W. Chesney, personal communication, July 22, 2020). Will's language was impacted by this accumulation of blasts in the area of cognition, specifically, memory and learning. He noted that if he did not have a physical symptom of stress-induced hair loss, also known as alopecia, to validate his health concerns, he may have continued to second guess himself that something was wrong, "The memory loss was terrible, and just trying to communicate with other people exactly what's going on can be frustrating as well, especially when it's your own brain. If my hair didn't fall out a few times, I would second guess myself wondering, 'Am I making this stuff up?' 'What's wrong with me?' 'Am I really forgetting so much stuff?'" (W. Chesney, personal communication, July 22, 2020).

Will's deficits related to his memory posed a daily obstacle to his everyday life. His ability to recall spoken and written information suffered, forgetting names, phone numbers, and instructions moments after hearing them, and reading the same page of a book or passage multiple times in order to comprehend the written content (Chesney & Layden, 2020; W. Chesney, personal communication, July 22, 2020).

In a conversation with Will on July 22, 2020, he described his experience of maintaining self-awareness such that his inability to remember information and events surprised him. He tested his own memory through the execution of mental tasks within his daily life, such as a planned action; something as simple as filling a cup with water he would have difficulty remembering. Will described not only his daily symptoms to be of extreme frustration, but the trouble communicating what was going on in his own brain and feeling "off" to cause a taxing everyday frustration as well. While attending a variety of treatment centers and experimenting with an array of modalities, Will was frequently described by a variety of professionals as "high-functioning", although he still did not feel like himself. He continued to show awareness of his metacognition, in that he was aware his baseline skill level had been altered but had continued difficulty communicating exactly what had changed. He spoke about the rate of suicide in veterans, and his understanding the

frustration those veterans must have felt if the reason for suicide was due to or related to their brain health.

Will pursued relief and improvement of his brain health and continues to do so. The variety of treatment methods he implemented included prescription medications, hormone therapy, vitamins and supplements, neurofeedback, brain stimulation, and additional treatment methods through the National Intrepid Center of Excellence (NICoE) within the Walter Reed National Military Medical Center, VA hospitals, and the Brain Treatment Center affiliated with the University of Southern California (USC) Neurorestoration Center (Chesney & Layden, 2020; W. Chesney, personal communication, July 22, 2020). He attributes his lasting migraines to a combination of stress, the effects of losing friends while in service, previously self-medicating with alcohol, and residual symptoms of his bTBI from the grenade blast in 2012. While Will reports improvement of his memory, he stated he continues to have difficulty recalling names (W. Chesney, personal communication, July 22, 2020). Will's experience reiterates the level of difficulty to diagnose, understand, and treat bTBI, as well as the extended recovery service members with bTBI can face upon returning home (Bryden, et al, 2019; McKee & Robinson, 2014).

Will's recovery is ongoing, and he works on it every day. Approximately eight years after the grenade blast, Will speaks of continuous improvement through a combination of treatment and time to heal (Chesney & Layden, 2020; W. Chesney, personal communication, July 22, 2020). Fortunately, Will has been able to find improvement and support of his brain health through continued treatments and research, daily breathing exercises, physical exercise, cognitive mental tasks to aid his memory and a better night's sleep, and comfort from his dogs. Will advocated for himself and continues to advocate for himself and others who share his experience with bTBI as well as sharing his own experience. When describing this he said, "I think it'd be good for everybody to know that they're not making it up if they're saying my memory's not great, and I'm having these symptoms, so they can kind of understand a bit more" (W. Chesney, personal communication, July 22, 2020). Understanding the hidden symptoms of bTBI can aid in providing a mutual-trusting relationship between the individual and health-care professionals, with the goal of improving the overall therapeutic process.

Diagnosis

Similar to Will's recovery, research related to diagnosis, treatment, and even prevention of bTBI is continuously ongoing. There are a variety of tools, techniques, and technologies used to diagnose bTBI, but they are not all available to service members while serving on combat deployments where bTBIs are frequently sustained (McKee & Robinson 2014). The use of Computed Tomography (CT) imaging is described as the standard of care in diagnosing TBI, but most military-related TBIs present as mTBI, and CT imaging is then utilized for ruling out severe injury rather than finding a specific radiographic diagnostic biomarker for mTBI (Bryden, et al., 2019). In addition to biomarkers providing insight into the diagnosis of bTBI, they also provide insight into prognosis of the sustained brain injury (Bryden, et al., 2019). Any other imaging modality such as magnetic resonance imaging (MRI), functional MRI, diffusion tensor imaging, positron emission tomography (PET), magnetoencephalography, and electroencephalography are not commonly utilized or available when stationed in combat settings, whereas most procedures in civilian medical practices would include one or more of these modalities to aid in diagnosis (Bryden, et al., 2019).

There is a common consensus among researchers regarding the continued difficulty to diagnose bTBI due to the difficulty in locating an imaging biomarker with adequate sensitivity and specificity with predictable outcomes (Agoston & Kamnaksh, 2015; Bryden, et al., 2019; Salat et al., 2017). This difficulty is due to the multitude of variables that occur within a military-related blast scenario such as clinical variability of TBI; lack of quality, acute, and longitudinal data; and confounding factors and comorbidities in the military population. These variables relate to any developing connections between bTBI neuroimaging findings and neurobehavioral consequences in order to adequately diagnose bTBI. (Bryden, et al., 2019). Research related to specific biomarkers of bTBI and the relationship to jobs within branches of the military is still ongoing. One area of research is related to specific jobs service members can have while in service, such as "breachers", where the job involves explosive entry of doors and enduring a multitude of low-level blasts over long periods of time, making them more susceptible to bTBI due to the nature of their job and position (Bryden, et al., 2019).

bTBI and the Speech-Language Pathologist

As one of the main symptoms of bTBI is cognitive communication impairment, a speech-language pathologist (SLP) is involved in a multitude of processes regarding TBI. The professional role and responsibilities of the SLP include the screening, assessment, and treatment of individuals with TBI, as well as prevention, advocacy, education, administration, and research of TBI (American Speech-Language-Hearing Association [ASHA], n.d). This role can include a variety of responsibilities to aid in the best possible care and understanding of the individual with bTBI. As resources are not comprehensive in therapy, diagnosis, and in turn, intervention and treatment from health-care professionals such as a SLP, treatments are commonly administered when service members return home from deployment (ASHA, n.d.; Bryden et al., 2019).

Treatment Rationale

A highly important aspect of treatment of an individual with bTBI is collaboration and communication with their treatment team (ASHA, n.d). Although bTBI, also called "mild" traumatic brain injury (mTBI), is given the classification of "mild", it does not remove the fact that the brain endured a traumatic event. The traumatic event of a blast disturbs and alters the structure of the brain (Bryden et al, 2019). The blast can impact multiple aspects of the body and its functions, resulting in a team of specialists to aid in the individual's recovery, including a SLP to address any cognitive deficits (ASHA, n.d.). Disturbance in the brain can result in cognitive-communication impairments, impacting language and communication

in the areas of following instructions, inattention, and a variety of memory difficulties (Nelson et al., 2015).

After the blast, the overall goal of intervention designed by a SLP is to maximize the individual's gains and reach their highest level of independent functioning for participation in their daily living (ASHA, n.d.). Following the structure of the World Health Organization's (WHO) International Classification of Functioning, Disability, and Health (ICF) framework to assist individuals in reaching their highest level of independent functioning, treatment plans are focused on maximizing the individual's strengths and addressing their weaknesses related to any body structures and functions that impact their communication (ASHA, n.d.). Treatment plans also include assistance in acquiring new skills and strategies to aid in their communication, as well as modifying contextual factors to enhance and encourage successful independent communication and participation, while implementing the development and use of appropriate accommodations (ASHA, n.d.).

Communication and Cognition

The hidden symptoms of bTBI can translate to a cognitive-communication deficit. The treatment of cognitive-communication deficits and person- and family-centered care are within the SLP's scope of practice and aid in the restoration and compensation of deficits (ASHA, n.d.). Person- and family-centered care is another form of collaboration in which the SLP is involved that incorporates the individual and family preferences and priorities within the intervention plan (ASHA, n.d.). It also provides services such as counseling and emotional support, information and resources, coordination of services, and instruction of specific skills to aid in facilitating communication (ASHA, n.d.). Not only are these service members coming home with an "invisible" injury, they also have often endured additional physical and mental states that are not common in civilian life or injury (Bryden, et al, 2019). Individuals' physical and mental states at the time of injury can impact the outcome of their injury, as they have often endured sleep deprivation and are under incredible amounts of mental and emotional stress before, during, and after the time of their injury, justifying the need for services embedded in the approach of person- and family-centered care (ASHA, n.d.; Bryden, et al., 2019).

A SLP can address an individual's cognitive deficits in following directions, attention, and memory due to bTBI through direct treatment approaches that focus on expanding their strengths (ASHA, n.d.; Nelson et al., 2015). Communication and language treatment related to TBI can be restorative and/or compensatory (ASHA, n.d.). Restorative treatment approaches encompass direct therapy methods with the goal of improving or restoring the individual's impaired functions through retraining and treatment. These treatment approaches are often organized hierarchically (ASHA, n.d.). The hierarchy begins with targeting specific processes in the domain containing the deficit, then moves to the demand of higher-level tasks, and concludes with the generalization of skills within activities and tasks functional to the individual (Sohlberg & Mateer, 2001). Frequently utilized alongside restorative treatment approaches are compensatory approaches, which include teaching and learning new or different methods of completing functional tasks in order to minimize the individual's difficulties (National Institutes of Health [NIH], 1998). In general, compensatory treatment approaches involve the individual's strengths to expand their abilities and maximize their gains (ASHA, n.d.).

According to ASHA (n.d.), blast events in military settings affect communication and language most frequently in the area of cognition, and cognitive-communication treatment can be implemented to aid in reestablishing skills or compensating for the individual's deficits. Treatment can be restorative, compensatory, or a combination of the two, dependent on the functional needs of the individual. Cognitive-communication treatment can also include sensory stimulation, dual-task training, and computer-assisted treatment (CAT). For example, when implementing cognitive-communication treatment, the clinician can utilize a multitude of teaching techniques during treatment such as direct instruction, strategy-based instruction for metacognitive skills training, compensatory strategy training, internal aids, external aids, as well as errorless learning. The treatment methods and techniques of CAT, internal aids, and errorless learning share the goal of addressing and further understanding the relationship of the cognitive domain of memory, specifically, the effect of attention and short-term memory deficits related to new learning.

Resources and Education in the Community

All service members and veterans have access to a Department of Veterans Affairs (VA) hospital or facility. Upon diagnosis, they can then access a variety of intervention options, including treatment with a SLP, depending on the individual's diagnosis in related to the SLP's scope of practice. As the largest integrated health-care system in the United States, the Veterans Health Administration provides a variety of care types within their 1,243 health-care facilities across the United States (Veterans Health Administration, n.d.). Within the 1,243 health-care facilities, 170 facilities are VA Medical Centers and 1,063 are outpatient sites (Veterans Health Administration, n.d.). These centers provide care to more than 9 million enrolled veterans annually (Veterans Health Administration, n.d.). Between 2019 and 2020, the Defense and Veterans Brain Injury Center (DVBIC) reported approximately 414,000 TBIs in U.S. service members, and over 185,000 veterans have been diagnosed with at least one TBI. These veterans look to the VA for their health care (VA Research on Traumatic Brain Injury (TBI), n.d.). Rather than a lack of resources, the complicated nature of bTBI lends itself to the collaboration of many health-care professionals for treatment. As Will Chesney stated, "It's not that support isn't available, it's that you don't know which lifeline to grab" (Chesney & Layden, 2020, p. 284). With almost half a million veterans depending on VA treatment and medical centers for treatment, understanding, and answers related to bTBI within the VA's 1,243 health-care facilities in the United States, consistency of collaboration, counseling, and further education and research must be implemented to ensure meaningful care for veterans.

Within 1,243 health-care facilities associated with the VA, there are a variety of health care professionals working together. Consistency of treatment does not mean consistency only within treatment sessions or evaluations. Consistency may also include counseling and collaboration with the individual's family, their team of health care professionals, as well

as further education and research related to bTBI. As symptoms of bTBI can overlap with the symptoms of PTSD, veterans and their families are coming to the VA for support, help, and answers (Wallace, 2006). SLPs can continue to educate health-care professionals such as nurses, medical technicians, medical assistants, physician assistants, or any other professionals who encounter veterans with bTBI during scheduling, consultations, evaluations, and treatment sessions to improve consistency and proper level of care. Understanding the hidden symptoms of bTBI that are within the SLP's scope of practice, such as cognitive impairments and difficulty following directions, inattention, and memory deficits, could help improve the widespread care of this population, as some health-care professionals may not have been trained to recognize the invisible deficits and language difficulties veterans may face within their daily lives (Nelson et al., 2015).

Speech-Language Pathologists' Scope of Practice

It is within the SLP's scope of practice to advocate for individuals with TBI and their families as well as to educate other professionals, third-party payers, and legislators about the needs of individuals with TBI (ASHA, n.d.). It is also within the SLP's scope of practice to remain informed about research within the area of TBI, as evidence-based practice (EBP) is critical and ever-changing in the therapeutic process (ASHA, n.d.). Staying informed about current research related to bTBI will not only aid in the SLP's knowledge but can be used to continue to enhance the education and knowledge of TBI with other professionals, third-party payers, and legislators (ASHA, n.d.). In addition to providing education and counseling information to other professionals, third-party payers, and legislators, it is within the SLP's scope of practice to provide education and counseling to individuals with TBI and their families (ASHA, n.d.). Education, enhancement of knowledge, collaboration, and counseling strategies related to bTBI could also benefit VA staff who encounter veterans with this diagnosis.

Understanding, compassion, and collaboration can create a positive environment and meaningful treatment for individuals with bTBI, as some, like Will Chesney, have trouble communicating just what exactly had happened within their brain and the cognitive-communication difficulties they are having (W. Chesney, personal communication, July 22, 2020). Knowing that the individual has awareness of their own ability and baseline-skill level, as they have completed tasks and training where many fail due to mental or physical obstacles while enlisted in the military, can create trust. An important part of counseling is listening to and understanding the individual's concerns and validating them (ASHA, n.d.). This can be done through thorough review and education of past and recent research of bTBI and understanding the variety of confounding factors service members and veterans may have when beginning any form of treatment for their injuries. There are a variety of key values that are instilled in service members such as selflessness, not accepting failure, and supporting the needs of the group or team over personal needs (Bryden et al., 2019). These are thought to be the building blocks of their mental state and hierarchy of needs throughout their service (Bryden et al., 2019). As these key values are important and even lifesaving while in combat, seeking treatment can be thought of as accepting failure, and many service members and veterans may struggle with this change of mindset upon returning home (Bryden, et al., 2019). Unfortunately, the continued mindset that had saved lives in combat can be the demise of many veterans when seeking care.

Importance of Collaboration, Education, and Research of bTBI

The level of difficulty and delay of diagnosis and treatment, lack of education about bTBI, and the continued self-sacrificing mindset of service members and veterans may correlate to the current rate of suicide in veterans (National Veteran Suicide Prevention Annual Report, 2019; Richman, 2018). Veterans with bTBI are at an even higher risk of suicide, as veterans with multiple brain injuries are twice as likely to consider suicide (Richman, 2018). With an average of 16.8 veterans taking their own life each day in 2017, it is of utmost importance to practice and implement collaboration, counseling, and the broadening of education of bTBI with all health-care professionals who encounter this population (National Veteran Prevention Annual Report, 2019). Within a variety of settings, including VA facilities, student clinicians and practicing SLPs can assist in the implementation of increased collaboration, counseling, and broadening and continuing education of bTBI with nurses, medical technicians, medical assistants, physician assistants, or any other health-care professionals who encounter service members and veterans with bTBI. This consistency of care could range from scheduling, consultations, evaluations, and treatment sessions to improve reliability and proper level of care to service members and veterans with bTBI.

The blast itself can be quick, but what happens after the blast can be anything but quick. After the blast, many service members and veterans face a long recovery in many unfamiliar places, with many unfamiliar people, and with an unfamiliar mindset (McKee & Robinson, 2014). Their entire life may have shifted upon returning home, from their job or position to family and friends, to their physical health and wellbeing, and to their brain health. They may come home with an inability to communicate why or how they feel "off" or different, as day-to-day tasks are now increasingly difficult for them, and they do not receive the support they truly need. Research related to bTBI is ongoing and advocating for this population as well as understanding the complexities of bTBI are increasingly important as it continues to be difficult to diagnose the source of language and cognitive deficits, which is a risk factor for suicide in veterans, and is not well understood by professionals (McKee & Robinson, 2014). As students and practicing clinicians in the field of speech-language pathology, continuing collaboration, education, and research serve to aid in improved treatment for service members and veterans with a hidden effect of war, bTBI.

To any currently enlisted members or veterans reading this, thank you for your service.

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