

Neurodegeneration and Traumatic Brain Injury in the Military

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Abstract

Unfortunately, Traumatic Brain Injury (TBI) is a frequent occurrence in the military. The public is now more aware of TBI in the military as a result of the battles in Afghanistan and Iraq. The most prevalent damage mechanism specific to the military is blast exposure. Recent veterans have been particularly concerned about blast-related mild TBI (mTBI), while there is still debate over whether or not post-traumatic stress disorder and the associated postconcussion syndrome should be considered separate disorders. TBI is also a risk factor for the emergence of neurodegenerative conditions such as Alzheimer's Disease and Chronic Traumatic Encephalopathy (CTE) (AD). Chronic inflammation is connected to AD, TBI, and CTE. Genome-Wide Association Studies (GWAS) have discovered several genetic loci linked to AD that point to inflammation and, in particular, microglia, as important regulators of the degenerative processes linked to AD and TBI. TREM2 and TYROBP/DAP12 are parts of a crucial molecular hub that connects inflammation and microglia to the pathogenesis of AD and perhaps TBI, according to recent research. Reviewing the data on the link between Traumatic Brain Injury (TBI) and dementia in the context of how it relates to military veterans.

Introduction

Traumatic Brain Injury (TBI) is a common cause of morbidity and mortality in both civilian and military populations. According to Hyder and colleagues, there are 10 million TBI cases worldwide annually and 1.7 million U.S. citizens attend emergency rooms regularly. These estimates probably underestimate the real prevalence of TBI because they exclude injuries treated in military or Veterans Affairs (VA) hospitals, outpatient clinics, medical offices, or at home. The frequency of TBI is probably higher in a combat environment for the military. Hoge and colleagues used established clinical instruments to conduct 25 surveys with actionable data on two Operation Iraqi Freedom (OIF) Army combat units. A TBI with Loss of Consciousness (LOC) (4.9%) or changed mental state affected almost 15% of respondents (10.3%). An OIF army combat brigade (n = 3973) was screened by Terrio and colleagues, and those reporting injuries were clinically assessed. A total of 22.8% (n = 907) of the sample had clinically verified brain lesions, the majority of which were minor. Similar to this, according to surveys given to service members after they returned from deployment, Schell and Marshall's research estimated that 19.5% (with a 22.7% upper limit estimate) of personnel serving in either Operation Enduring Freedom (OEF) (Afghanistan) or OIF had the condition.

The frequency of chronic TBI with lingering symptoms is poorly understood, and there is less information on those who have numerous TBIs. Over 38,300 US service members worldwide had TBIs between 2000 and 2018. Due to the prevalence of TBI in the conflicts in Iraq and Afghanistan, public awareness of military-related TBI has lately grown. 10% to 20% of the more than 1.5 million Iraq and Afghanistan veterans who had left active service as of June 30, 2012, were thought to have had a TBI. The moderate to severe end of the damage spectrum received the most attention at first. This is the range of TBI that would be noticed in the field, and the Iraq War has been linked to more severe service-related TBIs than any other conflict since the Vietnam War. The fact that many mTBIs were happening but going unnoticed at the time of injury, however, took some time to become apparent. Worldwide, an estimated 42 million individuals have a Mild Traumatic Brain Injury (MTBI) or concussion each year. A range of neurodegenerative illnesses, such as Alzheimer's disease, Parkinson's disease, and Amyotrophic Lateral Sclerosis (ALS), is known to be increased by more severe Traumatic Brain Injury (TBI). Recent big epidemiological studies have also linked MTBI to an increased risk of dementia. Less research has been done on how MTBI affects PD or ALS risk. Several neurodegenerative conditions, including Chronic Traumatic Encephalopathy (CTE), have been related to an increased risk of recurrent MTBI and sub-concussive head trauma. CTE is a distinct neurodegenerative tauopathy that was initially identified in boxers but has now been seen in several contact sport athletes, veterans, and civilians who have repeatedly been exposed to MTBI. The majority of Traumatic Brain Injuries (TBIs) in military contexts are mild TBIs (mTBIs). Although military members are also prone to concussions, blast exposure is the primary cause of mTBI for U.S. soldiers deployed to Afghanistan and Iraq in Operation Enduring Freedom (OEF), Operation Iraqi Freedom (OIF), and Operation New Dawn (OND). An estimated 320,000 soldiers may be affected by the frequency of mTBI among returning military personnel, which ranges from 15.2% to 22.8%.

Despite their prevalence, the short- and long-term repercussions of mTBI have, until very recently, received little attention from the medical community. Unquestionably, one of the main causes of the perception of inconsequentiality has been the "invisible" character of mTBI, particularly the absence of any outward physical signs of injury to the head or brain. However, there is mounting evidence that some people have long-lasting cognitive and behavioral abnormalities as a result of moderate neurotrauma. The rationale for "shell shock" was debated during World War I, and the argument over the relative contributions of physical brain damage and Posttraumatic Stress Disorder (PTSD) to chronic sequelae following mTBI continues today. A significant socioeconomic and public health issue, Traumatic Brain Injury (TBI) is now recognized as a chronic illness process with a wide range of pathophysiological symptoms that are followed by permanent disability. It sets off several, complex metabolic processes that result in neurodegeneration and cognitive decline. The pathophysiological characteristic of neurodegenerative diseases like Alzheimer's disease (AD), Chronic Traumatic Encephalopathy (CTE), and amyotrophic lateral sclerosis is proteinopathy. Recent studies have provided strong evidence that patients with a history of TBI have a tendency to develop proteinopathy. The major focus of this study is on the processes that lead to AD, CTE, and ALS following TBI and how they affect the progression of these neurodegenerative disorders. TBIs associated with the military can happen in a variety of ways, including motor vehicle accidents, injuries received while training, as well as sports or other leisure activities. In fact, Department of Defense (DoD) records show that 80% of TBIs sustained by active duty soldiers take place in non-deployed settings, indicating that most military-related TBIs are caused by processes comparable to those found in everyday life. The most common TBI due to blast damage, however, is one that is comparatively specific to the military. While exposure to mortars, artillery shells, and Improvised Explosive Devices (IEDs), among other blast-related mechanisms, was the main cause of TBI in Iraq and Afghanistan, blast injuries are a rare cause of TBI in civilian life.