Mini Review

Cognitive Changes and Dementia Risk after Traumatic Brain Injury: Implications for Aging Military Personnel

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Abstract

Traumatic brain injury (TBI) is recognized as an important risk factor for the long-term cognitive health of military personnel, particularly in light of growing evidence that TBI increases risk for Alzheimer's disease and other dementias. In this article, we review the neurocognitive and neuropathologic changes after TBI with particular focus on the potential risk for cognitive decline across the life span in military service members. Implications for monitoring and surveillance of cognition in the aging military population are discussed. Additional studies are needed to clarify the factors that

empirically supported interventions to mitigate the impact of TBI on cognition across the life span.

Previous studies suggest an association between depression and dementia in military veterans. The most likely biologic mechanisms that may link depression and dementia among military veterans include vascular disease,

and alterations of nerve growth factors. In addition, military veterans often have depression comorbid with posttraumatic stress disorder or traumatic brain injury. Therefore, in military veterans, these hypothesized biologic pathways going

depression, posttraumatic stress disorder, or traumatic brain injury could alter these pathways and as a result decrease the risk for dementia. Given the projected increase of dementia, as well as the projected increase in the older segment of the veteran population, in the future, it is critically important that we understand whether treatment for depression alone or combined with other regimens improves cognition. In this review, we summarize the principal mechanisms of this relationship and discuss treatment implications in military veterans.

Keywords: Alzheimer's disease; Traumatic brain injury; Risk factors; Military medicine; Dementia

Introduction

ere is growing evidence that a history of traumatic brain injury (TBI) places individuals at greater risk for developing neurodegenerative diseases such as dementia of the Alzheimer's type (DAT) and other dementias across the life span. Although much of the research has focused on the increased risk associated with moderate-to-severe brain injuries, emerging evidence suggests that mild head injuries, particularly repeated mild injuries, may also serve as a risk factor [1]. Both the Department of Defence (DoD) and the Department of Veterans A airs (VA) have recognized the importance of better understanding this relationship, particularly given the incidence of TBI in the military resulting from combat exposures, the growing evidence of dementia risk a er TBI, emotional disorders and other nonspeci c factors, and concern for the implications of these factors on the aging service member [2].

e purpose of this article is to review neurocognitive and neuropathology changes a er TBI, with a focus on the potential risk for cognitive decline across the life span in military service members with a history of TBI. We will begin by de ning TBI and summarizing expected short- and long-term cognitive and behavioral outcomes. Next, we will summarize evidence for increased risk of dementia, particularly DAT and chronic traumatic encephalopathy (CTE), a er a history of TBI. We will review TBI assessment protocols, outcomes, and lessons learned within the military and will end with a discussion of implications for monitoring and surveillance of cognition in the aging military population [3-4]. Given the current and projected growth of the older segment of the veteran population a better understanding of the link between depression and risk of dementia is important, especially for possible treatment and prevention. However, there are several challenges to understanding this link. For example, major depressive disorder is common among patients with dementia, occurring in up to 20% of patients with Alzheimer disease (AD) and up to 50% of patients with vascular dementia and, thus, disentangling which came rst can be di cult. In addition, although depression and dementia are considered separate clinical entities, they share some common symptoms, such as impairment in attention and working memory, changes in sleep patterns, and a decrease in social and occupational function. Moreover, the concept of "pseudo dementia" highlights the blurriness of the distinction between depression and dementia [5]. us, the interrelationship of depression and dementia is complex and sometimes indistinguishable and this complicates the ability to determine the exact relationship of depression to dementia.

Material and Methods

TBI overview

Similar to the de nition of TBI from the Centers for Disease Control and Prevention the VA/DoD de ne TBI as a traumatically induced structural injury and/or physiological disruption of brain function resulting from an external force that is indicated by new onset or worsening of at least one of the following clinical signs immediately following the event: any period of loss of or decreased

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level of consciousness; any loss of memory for events immediately before or a er the injury; any alteration in mental state at the time of the injury (confusion, disorientation, slowed thinking, etc.); neurologic de cits (weakness, loss of balance, change in vision, praxis, paresis/plegia, sensory loss, aphasia, etc.) that may or may not be transient; or intracranial lesion. Relevant to the military and veteran populations [6-7], this de nition further speci es that external forces may include the head being struck by an object, the head striking an object, the brain experiencing acceleration/deceleration movement without external trauma to the head, a foreign body penetrating the brain, or forces generated from events such as a blast or explosion.

Cognitive outcome after TBI

e e ect of TBI on cognition and subsequent recovery varies as a function of injury severity. Individuals sustaining a mTBI will