Traumatic Brain Injury and Behavior: A Practical Approach

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KEYWORDS

• Traumatic brain injury • Psychosis • Suicide • Behavioral abnormalities • Seizures • Mania • Depression • Sleep-wake disorder

KEY POINTS

- Traumatic brain injury (TBI) comprises a heterogenous array of disorders that stem from an initial trauma to the head and in many patients leads to death or significant morbidity and disability. Presently an estimated 1.4 million cases of TBI occur annually in the United States.
- TBI is associated with a broad spectrum of neurologic and psychiatric abnormalities that directly affect the patient's behavior. Cognitive decline (particularly memory loss), epilepsy, and mood disorders are among the most common complications of TBI.
- Frontal lobes are prone to injury in the course of TBI, and damage to these areas and their neuroanatomic connections to other cortical and subcortical regions may cause frontal lobe syndromes and executive dysfunction syndromes.
- A wide array of sleep-wake disorders including insomnia, excessive daytime sleepiness, posttraumatic hypersomnia, circadian rhythm sleep wake disorders, narcolepsy, sleep-related breathing disorder, REM sleep behavior disorder, non-REM parasomnias (sleepwalking, sleep terrors), periodic limb movements in sleep, and rhythmic movement disorders may occur in patients with TBI.

INTRODUCTION

Traumatic brain injury (TBI) is a significant cause of morbidity and mortality in adult and pediatric populations. Rather than being a congenital or neurodegenerative injury to the brain, TBI results from the application of external mechanical force to the head and leads to transient or permanent damage. The negative outcomes of TBI include, but are not restricted to, cognitive decline, neurologic and physical deficits, and impairment of psychosocial activities and function. Clinically, TBI may present with decreased or altered mental status. Rather than being a simple event, TBI is a complex

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neuroanatomic, neuropathologic, and biochemical process that affects several areas of the human brain through the original impact and injury and via secondary events, such as ischemia, seizure, and infection. TBI interrupts the physiologic activity of the brain. In addition, TBI is not a solitary disorder with a clear-cut set of clinical manifestations. Indeed, the term TBI is a multifaceted and heterogeneous group of disorders, which adversely affects a wide range of neuropsychiatric functions of the patient. Neuropsychiatric disorders, and particularly cognitive decline, are common following TBI and reflect the depth and width of the injury induced by the initial impact to the head. As an injury, TBI stems from penetrating, blunt, or acceleration-deceleration forces.

Based on a comprehensive report by the Centers for Disease Control and Prevention to the United States Congress in 2010, an estimated 2.5 million emergency room visits resulted from TBI, which included isolate TBIs and TBIs associated with other injuries.[1] TBIs affect civilians and military individuals. TBIs are categorized as mild, moderate, and severe based on the victim's clinical manifestations and the associated outcomes. Most civilian cases of TBI are mild. Grossly, TBI is divided into penetrating and nonpenetrating. Most cases of TBI are mild; nonpenetrating; and result from falls, motor vehicle accidents, violence and assault, and sport and recreational activities.[1]

Epidemiologic data indicate that annually in the United States, more than 2 million cases of TBI occur and a significant number of them occur in the elderly population.[2] A significant number of patients with TBI require hospital admission and treatment. Every year an appraised 300,000 sports-associated TBI cases occur in the United States.

Clinically, TBI is associated with a wide gamut of neurologic and psychiatric disorders that include, but are not limited to, amnesia, cognitive decline, seizures, attention and concentration deficits, depression, manic behavior, psychosis, hostile and violent behavior, and personality alterations. Civilian TBIs most often stem from falls, motor vehicle accidents, getting hit in the head by a moving or standing object, and being attacked. Military TBIs mainly are cause by blasts and shock waves from explosives. In both populations, TBI can be blunt or penetrating. Because TBI includes a heterogeneous group of disorders, therapy and rehabilitative efforts should be designed based on the type of injury and the patient's specific needs.

COGNITIVE DECLINE FOLLOWING TRAUMATIC BRAIN INJURY

TBI sets off an array of primary and secondary insults to the human brain that, in turn, affect the neurophysiologic activity of the cerebral cortex, subcortical structures, and neuroanatomic pathways, which serve cognition. All or any of these areas are potentially affected by TBI, which most often translates into cognitive impairment. Cognitive decline, a broad-term that covers many aspects of human cognition, is observed more often following moderate to severe TBIs and is less frequently associated with mild TBI cases. Cognitive decline, particularly memory loss, is a common and well-recognized complication of TBIs. Impairment of cognitive capabilities directly and adversely affects the patient's intellectual creativity and productivity and causes disability. Other troubling cognitive issues include attention deficit; difficulty with concentration and multitasking; impairments of language use and visual perception; and difficulty with abstract reasoning, thought process, problem-solving, insight, and judgment. These impairments, indeed, pose significant and insurmountable barriers to patients' paths toward having a normal independent life, securing a job, and establishing social adaptation.[3]