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Chronic neurodegenerative consequences of traumatic brain injury

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Abstract. Traumatic brain injury (TBI) is a serious public health concern and a major cause of death and disability worldwide. Each year, an estimated 1.7 million Americans sustain TBI of which ∼52,000 people die, ∼275,000 people are hospitalized and 1,365,000 people are treated as emergency outpatients. Currently there are ∼5.3 million Americans living with TBI. TBI is more of a disease process than of an event that is associated with immediate and long-term sensomotor, psychological and cognitive impairments. TBI is the best known established epigenetic risk factor for later development of neurodegenerative diseases and dementia. People sustaining TBI are ∼4 times more likely to develop dementia at a later stage than people without TBI. Single brain injury is linked to later development of symptoms resembling Alzheimer's disease while repetitive brain injuries are linked to later development of chronic traumatic encephalopathy (CTE) and/or Dementia Pugilistica (DP). Furthermore, genetic background of ß-amyloid precursor protein (APP), Apolipoprotein E (ApoE), presenilin (PS) and neprilysin (NEP) genes is associated with exacerbation of neurodegenerative process after TBI. This review encompasses acute effects and chronic neurodegenerative consequences after TBI.

Keywords: Traumatic brain injury, traumatic axonal injury, chronic traumatic encephalopathy, dementia pugilistica, amyotrophic lateral sclerosis, Parkinson's disease, Alzheimer's disease, dementia

1. Traumatic brain injury

Traumatic brain injury (TBI) is a global public health concern and a leading cause of death and disability both in combat and civilian situations with limited treatment options (Honeybul, 2011; Huang, 2013; Ling and Ecklund, 2011; Signoretti et al., 2010). TBI is an acquired form of brain injury (Maas et al., 2008), defined as a damage to the brain resulting from an external mechanical force caused by rapid acceleration/deceleration due to the mechanical impact, blast waves, or penetration by a projectile (Xiong et al., 2013). With particular reference to combat situation, the Department of Veterans Affairs (DVA) and the Department of Defense (DoD) have defined TBI as "A traumatically induced structural injury and/or physiological disruption of brain function as a result of an external force that is indicated by new onset or worsening of at least one of the clinical signs including any period of decreased or loss of consciousness (LOC) or any period of post-traumatic amnesia or any alteration of cognition (confusion, disorientation, slow-thinking), immediately following the event" (Capehart and Bass, 2012).

The most common causes of TBI include accidental falls, assaults, violence, and motor vehicle/construction/sports accidents. TBI has a greater prevalence among children (0–14 years of age) and older people (>65 years of age); with a greater occurrence among males than females [http://www.cdc.gov/traumaticbraininjury/tbi_ed.html]. Each year, an estimated 1.7 million TBIs occur in the United States,

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