Sports Related Traumatic Brain Injuries

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Sports Related Traumatic Brain Injuries

**Pathophysiology of Traumatic Brain Injury**

Traumatic Brain Injury (TBI) is an injury to the brain caused by a sudden, significant impact to the cranium from an external force (Jenm-Vilaplana & Micalizzi, 2010, p. 282). When force is applied to the head, the brain moves back and forth causing brain fibers to stretch to be stretched, blood vessels to bleed, and inflammation to occur (King, Brugha, Huang, & Gosain, 2014, p. 46). TBIs have primary and secondary brain injury effects. The primary brain injury is the physical damage to the brain and existing conditions that is immediately sustained at the time of injury due to the direct contact, acceleration-deceleration, and rotational forces (Fahk & Both, 200, p. 23). Secondary brain injury occurs to the cells in the context of molecular processes caused by the initial damage to the cerebral system involved with normal functioning (Tran, 2014, p. 10). Secondary injuries include neuroinflammation, cell death, ionic disturbances, blood-brain barrier disruption, and mitochondrial toxicity (Tran, 2014, p. 10).

This alteration in normal brain functioning, or neurodegenerative cascade, requires energy to re-establish homeostasis. However, immediately following a TBI, there is a decrease in cerebral blood flow and oxygen, and ongoing mitochondrial dysfunction, which impairs energy supply and demand (King, et al., 2014, p. 202).

When the individual sustains a head injury, glutamate is released from the presynaptic nerve terminal at an uncontrolled rate, and excitotoxicity occurs, in which neurons become damaged due to persistent glutamate exposure (Tran, 2014, p. 31). After sustaining a head injury, hypoxia occurs, which causes an upregulation of ATPases and astrocytes are unable to remove excess glutamate from the extracellular space. The elevated exposure to glutamate leads to the activation of the calcium channel in the glial cell of the astrocyte's NMDA receptor, triggering mitochondrial dysfunction and intracellular calcium entry (Tran, 2014, p. 31). Intra-cerebral calcium excess causes the mitochondria to stimulate the opening of the mitochondrial permeability transition pore (mPTP) (Tran, 2014, p. 31). This disruption triggers more calcium to invade the mitochondria, which in return causes the mitochondria to swell and burst. When the mPTP is opened, cytochrome c is released and interacts with apoptotic protease activating factor-1 and forms apoptosomes. Apoptosomes provide a death signal, which is activated and designates the cells to apoptosis, or regulated cell death (Tran, 2014, p. 31).

It is estimated there are 1.6-3.8 million annual sports-related concussions or mild traumatic brain injuries (mTBI) (King, et al., 2014, p. 46). In individuals 15 to 24 years old, TBIs are the second most common form of TBI (King, et al., 2014, p. 46). Concussion injuries occur in both men and women and can occur to individuals of all ages. Sports-related mild traumatic brain injuries could be attributed to athletic activities including football, soccer, basketball, wrestling, field hockey, lacrosse, wrestling, swimming, and wrestling (King, et al., 2014, p. 31). Once an individual has received a concussion they should practice prevention of future mTBIs to minimize long-term complications.

While these symptoms could last from days to months, individuals should be closely observed for the first few days following a mild TBI. Individuals should be monitored for dysphoria changes, dizziness, nausea, loss of consciousness, anterograde amnesia, and increased risk for on the field injury. Early diagnosis, management, and education are imperative to prevent concussions and improve patient outcomes. Early diagnosis, awareness, family members, and coaches regarding risks of sports-related concussions and prevention strategies, and what to expect and be on alert for after concussions should be considered. Sports leagues are now taking concussion monitoring and the best time to return to play.

**Concussion**

Concussion is the term used to describe a temporary disruption of normal brain function. While these individuals are not frequently overlooked as minor, the long-term consequences can be significant. A concussion is a type of mild traumatic brain injury (mTBI). It can cause long-term damage and affect both physical and cognitive difficulties. Individuals with repeat concussions have been shown to have an increased risk for on-the-field loss of consciousness, intermittent amnesia, confusion, and higher risk for future concussions (King, et al., 2014, p. 418). Those with subsequent concussions have also shown to have a significant decrease in athletic performance, motor coordination, and immediate memory (King, et al., 2014, p. 418). These long-term effects of concussions have been found to be related to the media due to the $765 million settlement between the NFL and retired football players (Mclernon, 2014). Neuronal and glial cell damage is believed to be due to the long-term consequences of mild traumatic brain injury (TBI). Neurocognitive testing is used to assess the severity of the signs and symptoms then determine whether the concussion is mild, moderate, or severe. Common symptoms for a mTBI can include headache, amnesia, confusion, drowsiness, numbness or tingling to extremities, light and sound sensitivity, dizziness, nausea, loss of balance, blurred vision or changes in sleeping patterns (Mason, 2013, p. 205). Late concussion symptoms include difficulty concentrating, mood or behavior problems, concentration problems, and increased aggression or a short temper (Mason, 2013, p. 209). These symptoms may last for weeks or months. Individuals who experience multiple concussions are at a significantly higher risk for developing a severe TBI and will likely show substantial symptoms for an extended period of time (Mason, 2013, p. 209).

**Subsequent Concussions**

It is believed that multiple mTBIs can cause long-term brain damage and influence both motor and cognitive difficulties. Individuals with repeat concussions have been shown to have an increased risk for on-the-field loss of consciousness, intermittent amnesia, confusion, and higher risk for future concussions (King, et al., 2014, p. 418). Those with subsequent concussions have also shown to have a significant decrease in athletic performance, motor coordination, and immediate memory (King, et al., 2014, p. 418). These long-term effects of concussions have been found to be related to the media due to the $765 million settlement between the NFL and retired football players (Mclernon, 2014). Neuronal and glial cell damage is believed to be due to the long-term consequences of mild traumatic brain injury (TBI). Neurocognitive testing is used to assess the severity of the signs and symptoms then determine whether the concussion is mild, moderate, or severe. Common symptoms for a mTBI can include headache, amnesia, confusion, drowsiness, numbness or tingling to extremities, light and sound sensitivity, dizziness, nausea, loss of balance, blurred vision or changes in sleeping patterns (Mason, 2013, p. 205). Late concussion symptoms include difficulty concentrating, mood or behavior problems, concentration problems, and increased aggression or a short temper (Mason, 2013, p. 209).

**Concussion Implications for Nursing Care**

Nurses play a substantial role in the prevention and management of concussions. Early diagnosis, management, and education are imperative to prevent concussions and improve patient outcomes. Early diagnosis, awareness, family members, and coaches regarding risks of sports-related concussions and prevention strategies, and what to expect and be on alert for after concussions should be considered. Education and resources to adequately diagnose and manage traumatic brain injuries in our athletes.