Sports Related Traumatic Brain Injuries

Ky Parrott
Otterbein University, ky.parrott@otterbein.edu

Follow this and additional works at: http://digitalcommons.otterbein.edu/stu_msn
Part of the Medical Pathology Commons, Nursing Commons, and the Sports Medicine Commons

Recommended Citation
Sports Related Traumatic Brain Injuries

Ky Parratt, RN, BSN
Otterbein University, Westerville, Ohio

Pathophysiology of Traumatic Brain Injury

Traumatic Brain Injury is an injury to the brain caused by a sudden, significant impact to the cranium by an external force (Lemiel-Village & Milam, 2012, p. 282). When force is applied to the head, the brain moves back and forth causing brain fibers to stretch, blood vessels to bleed, and inflammation to occur (King, Brughelli, Hume, & Gissane, 2014, p. 466). TBI’s have primary and secondary brain injury effects. The primary brain injury is the physical damage to the brain and environment that it is immediately sustained at the time of injury due to the direct contact, acceleration-deceleration, and rotational forces (Roth, 2000, p. 33). Secondary brain injury refers to the collection of molecular processes caused by the initial damage to the cerebral tissue, which is still occurring days to months following an injury (Tran, 2014, p. 10). Secondary injuries include neuronal inflammation, cell death, ionic disturbance, blood-brain barrier disruption, and mitochondrial toxicity (Tran, 2014, p. 26). This alteration in normal brain functioning, or neurometabolic cascades, 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 in individuals sustain 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. 251). After sustaining a head injury, hypoxia occurs, causing an upsurge in ATP and astrogliosis, which are unable to remove excess glutamate from the extracellular space. The elevated exposure to glutamate leads to the activation of the calcium channel N- methyl-d-aspartate (NMDA), triggering mitochondrial dysfunction and intracellular calcium entry (Tran, 2014, p. 31). When intracellular calcium exceeds the excursion rate, calcium is sequestered within the mitochondria to maintain intracellular homeostasis. Mitochondria are sensitive to calcium fluctuations and excess calcium stimulates 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 this occurs, the mPTP is opened, cytochrome c is released and interacts with apoptotic protein-activating factor-1 and forms apoptosis. Apoptosis provokes adenosine triphosphate (ATP) is activated and designates the cells to apoptosis, or regulated cell death (Tran, 2014, p. 32).

It is estimated that there are 1.6-3.8 million annual sports-related concussions or mild traumatic brain injuries (mTBI) (King et al., 2014, p. 446). In individuals 15 to 24 years of age, approximately 95% of mTBI’s are sports related (Tran, 2014, p. 31). Secondary 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, riding bike, lacrosse, wrestling, swimming, and cheerleading.

While considered a “mild” form of a TBI, concussion, especially subsequent concussions, can be detrimental. The severity of the signs and symptoms then determine whether the concussion is mild, moderate, or severe. Common symptoms for a mild TBI include headache, amnesia, confusion, drowsiness, numbness or tingling to extremities, light and noise sensitivity, dizziness, nausea, loss of balance, blurred vision or changes in sleeping patterns (Mason, 2013, p. 209). Late concussion symptoms include difficulty concentrating, learning disturbance, concentration problems, and increased aggression or a short temper (Masen, 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 more substantial symptoms for an extended period of time (Mason, 2013, p. 209).

Concussion

When while these symptoms could last from days to months, individuals should be closely monitored for signs and symptoms of TBI’s after receiving any signs or symptoms to the head. These injuries can be detrimental to the individual and their families and it is imperative that Advanced Practice Nurses, or APNs, are educated regarding preventing sports injuries and signs and symptoms to be aware of.

Subsequent Concussions

It is believed that multiple mTBI’s can cause long-term brain damage and affect motor and cognitive difficulties. Individuals with repeat concussion appear to have increased risk for the onset of long-term conditions such as attention deficit hyperactivity, confusion, and higher risk for future concussions (King et al., 2014, p. 438). Those with subsequent concussions have also shown to have a significant decrease in attention, thinking, motor coordination and immediate memory (King et al., 2014, p. 438). These long-term effects of concussions have caused researchers to study the elevated media due to the $765 million settlement between the NFL and retired football players (Roth, 2014, p. 449). Sports leagues are now taking subsequent concussions very seriously and are implementing changes regarding concussion monitoring and the best time to return to play.

Return to Play

Determining when an athlete is ready to return to play is frequently left in the hands of athletic trainers and coaches. While these individuals are not frequently educated regarding significance of mTBI’s, these athletes provide basic practice to improve outcomes of those affected by mTBI’s. Three commonly utilised forms for concussion evaluation and management are the Acute Concussion Evaluation (ACE), ACE Care Plans, and neuropsychological assessment. These long-term effects of concussions can be detrimental to the individual and their families. Those who suffer multiple mTBI’s in their athletic career are at significant risk for functional, psychological, and cognitive difficulties.

Sports related traumatic brain injuries affect an estimated 1.6 to 3.8 million people each year (King et al., 2014, p. 44). While these injuries are frequently overlooked as minor, the long-term consequences can be detrimental to the individual and their families. Those who suffer multiple mTBI’s in their athletic career are at significant risk for functional, psychological, and cognitive difficulties.

Implications for Nursing Care

Nurses play a substantial role in the prevention and management of concussions. Early diagnoses, management and education are imperative to prevent concussions and improve patient outcomes (Pyne et al., 2012, p. 42). Concussive injuries can be relatively minor and may safely return to play. APN’s may also need to educate school officials and family members regarding adjustments of school schedules and what to expect for the students temporary disruption of cognitive functioning.

Sports related traumatic brain injuries in our athletes. The pathophysiologic of traumatic brain injury is a case study.

References