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For More Information

Contact:

1319 Colony Street
Saskatoon, SK S7N 2Z1
Bus. 306.651.4300
Fax. 306.651.4301
info@skprevention.ca
www.skprevention.ca

The Saskatchewan Prevention Institute is supported by:

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Brain Injury Due to Trauma

It is important to educate children and adults alike that the brain controls everything that we do. We must realize that we are who we are because of our brains and that every effort must be made to protect the brain from harm. In order to explain the importance of the brain it is necessary to understand what happens to the brain when it is injured.

How is the brain injured?

The terms “head injury” and “brain injury” are often used interchangeably. “Head injury” is an encompassing term that includes injury to the scalp and skull as well as to the brain. The term “brain injury” is more specific and refers to an injury that causes a change in the structure and/or the functioning of the brain.

Brain injury can occur due to a traumatic incident such as sudden impact or violent shaking, from spontaneous bleeding, or from lack of oxygen. This fact sheet will focus on brain injury due to trauma.

A traumatic brain injury is commonly divided into the primary and secondary events that cause the actual damage to the brain. The primary event is the injury that is caused at the time of the incident and the secondary event is the damage that occurs to the brain from only minutes to hours and days after the initial injury. These secondary injuries result because of the cycle of changes to the brain, such as swelling or lack of oxygen, that begin because of the initial trauma.

The Primary Event

Traumatic brain injury is a mechanical injury. Mechanical energy is the energy of motion that is not harmful on its own but becomes harmful when it is transferred to the body. The speed of the mechanical energy determines the damage that can be done. More speed means more energy can be transferred to the body and therefore more damage can be done.

There are three types of injuries to the head that can lead to brain injury: closed, open and crush injuries.

A **closed head** injury occurs when there is a rapid acceleration of the brain inside the skull. This type of injury can occur from a sudden deceleration of the head (as in a car collision or fall), a violent rotation of the head (from a punch), from extreme whiplash (as in shaken baby syndrome) or other means. The brain is forced to follow the direction of the skull and can become twisted and the blood vessels can tear causing bruising. The brain may also collide with the inside of the skull that is rough and jagged and more damage to the brain may result. Often, closed head injuries combine the acceleration with impact and the injuries may be even more severe.

An **open head** injury occurs when the brain is exposed through the skull due to the injury that has occurred. An open head injury can be the result of falling onto a sharp surface, being hit by a bullet or many other means. If the open head injury is not accompanied by an acceleration injury, often the damage to the brain is contained to the immediate area of the injury. Often, however, an open head injury is combined with an acceleration injury.

A **crushing head** injury occurs when the head is caught between or under something. These injuries are not very common but they are serious. Often the damage in a crushing head injury is to the base of the skull and the brain stem.

The Secondary Event

The secondary event of the injury is the damage that happens to the brain as a result of the initial injury. The secondary injury that occurs in the brain is at the cellular level and is chemical in nature. The secondary injury can result in bruising, swelling, infection, bleeding that leads to blood clots and increased pressure within the skull, and post-traumatic hydrocephalus (accumulation of cerebral fluid in the brain). Toxic processes that result from chemical changes and imbalance in the brain leads to the death of brain cells.

Effects of Injury on Brain Function

Depending on the severity of the injury, the individual may experience effects ranging from a dizzy sensation to coma to death. With a severe head injury, the individual may also experience loss of the use of limbs, impaired speech, difficulty with swallowing and other significant problems. The brain injury may also lead to difficulties with breathing and with problems with the heart and with blood pressure. In the long term, the individual may also have significant changes with personality and thought processes.

Prevention

Medical advances are providing better treatment and aftercare for those who have experienced a brain injury. Treatment is part of the prevention continuum, however, people must be convinced that the brain must be protected.

A head injury, leading to severe brain damage, can occur many ways including a bicycle-related incident, a car crash or by shaking a baby. Prevention strategies for these types of injuries are in place.

- Helmet use in activities such as cycling, in-line skating, hockey and other sports is promoted. Helmet use is also promoted in some work environments.
- Children, as well as all other occupants, must be regularly and correctly buckled up in all vehicles.
- Being aware of shaken baby syndrome, understanding prevention strategies such as asking for help when coping with a difficult child may prevent a tragic brain injury.
- Playgrounds must be built to meet the voluntary Canadian Standards Association guidelines, which includes safe surfacing and guardrails on surfaces of a certain height in order to protect children from falls.

The brain does not heal like other parts of the body. The improvement in the individual's condition comes as a result of the undamaged parts of the brain compensating for the damaged areas. Depending on the extent of the damage to the brain, recovery may never be complete and the recovery that does occur depends on a long process of re-education and rehabilitation.

As individuals and as parents and caregivers of children, the aim should be prevention of brain injury. Protecting the brain should become second nature and the practices required to protect the brain, such as helmet use, seatbelt use and the development of safe environments should be used and respected by everyone.

Information for this fact sheet was adapted from:

Neuro Trauma Nexus Law, Brain Injury, 2004.

Brain Injury Association of America, What is Brain Injury, retrieved May, 2006.