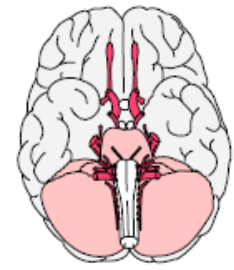


## TRAUMATIC BRAIN INJURY (TBI)



### DEFINITION:

According to the IDEA, (2004), traumatic brain injury is defined by as:

An acquired injury to the brain caused by an external physical force, resulting in total or partial functional disability or psychosocial impairment, or both, that adversely affects a child's educational performance. Traumatic brain injury applies to open or closed head injuries resulting in impairments in one or more areas, such as cognition; language; memory; attention; reasoning; abstract thinking; judgment; problem-solving; sensory, perceptual, and motor abilities; psychosocial behavior; physical functions; information processing; and speech. Traumatic brain injury does not apply to brain injuries that are congenital or degenerative, or to brain injuries induced by birth trauma (Sec. 300.8 (c) [12]).

According to the *Brain Injury Association* (2005), traumatic brain injury can result in impairments that may be temporary or permanent and can cause partial or total functional disability or psychosocial. A brain injury can also be referred to as an acquired brain injury. The *Brain Injury Association* (2005) has a further definition of an acquired injury:

- An acquired brain injury is an injury to the brain, occurring after birth, which is not hereditary, congenital, degenerative, or induced by birth trauma.
- It commonly results in a change in neuronal activity, which affects the physical integrity, the metabolic activity, or the functional ability of the cell. An acquired brain injury may result in mild, moderate, or severe impairments in one or more areas, including cognition, speech-language communication; memory; attention and concentration; reasoning; abstract thinking; physical functions; psychosocial behavior; and information processing. It takes place at the cellular level; therefore injury can affect cells throughout the entire brain, instead of just in specific areas as with traumatic brain injury.

A brain injury is unpredictable in its consequences and it affects who we are, the way we think, act, and feel. The most important things to remember:

- A person with a brain injury is a person first
- No two brain injuries are exactly the same
- The effects of a brain injury are complex and vary greatly from person to person
- The effects of a brain injury depend on such factors as cause, location, and severity

### ACCORDING TO THE BRAIN INJURY ASSOCIATION:

- 5.3 million Americans (just over 2% of the population) currently live with a disability resulting from a TBI
- 1.5 million people sustain an TBI each year
- 50,000 die due to TBI each year

- Every 21 seconds a person in the US sustains an TBI

These are all quotes from individuals that have endured a traumatic brain injury. They are either discussing long and/or short-term goals and/or physical and cognitive struggles they deal with as a result of the injury. As a group, due to a brain injury, these individuals have dealt with the loss of eyesight, clear speech, coordination, independent walking, and independent living, to name a few (Hrenko, Rees, Lox & O'Connor, 2003).

- "A home. To be able to wash dishes and cook my food, tie my shoes."
- "Maybe ten percent of the time people are willing to wait to hear me. The other 90% of the time, people are too busy."
- "For example, yesterday, I had a video in, then out, then in to test my ability to coordinate my hands. Just yesterday, I peeled an orange. I half peeled a banana too. For you it's so easy to do, but me, I go, 'hmmm how?'"
- "My short term goals are just remembering to brush my teeth, take my pills, eat my breakfast. Just the simple things."

## A HEALTHY BRAIN

To understand what happens when the brain is injured, it is important to realize the functions of healthy brain. The brain is enclosed inside the skull, which serves as a protective covering for the soft brain tissue. The brain is made of neurons (nerve cells) that form tracts that route throughout the brain. These nerve tracts transport messages in the form of electrical impulse and hormonal messengers to various parts of the brain and the brain uses these messages to perform functions. The functions include the coordination of our body's systems to maintain homeostasis; thought processing; body movements; personality; behavior; and the senses, such as vision, hearing, taste, smell, and touch.

The function of maintaining homeostasis is perhaps the most important function of the coordination of the brains function (Martini, Timmons, & Tallitsch, 2003). Homeostatic functions included but are not limited to breathing, heart rate, body temperature, and metabolic functions. Each part of the brain serves a specific function and links with other parts of the brain to form more complex functions.

The brain is divided into 6 major regions: (a) cerebrum, (b) the diencephalon, (c) the mesencephalon, (d) the pons, (e) the cerebellum, and (f) the medulla oblongata.

The function of the cerebrum is "conscious thought processes, intellectual functions, memory storage and retrieval." The origination of complex motor patterns comes for the cerebrum. The diencephalon region is responsible for relaying and "processing centers of sensory information". The mesencephalon, also known as the midbrain and is responsible for insuring that visual and auditory data is processed, reflexive somatic motor responses are generated, and consciousness is maintained. The pons, also known as the metencephalon region of the brain, relay sensory information for the cerebellum and the thalamus and are responsible for the somatic

subconscious and visceral motor center. The cerebellum “coordinates complex somatic motor patterns and adjusts output of other somatic motor centers in the brain and spinal cord”. The medulla oblongata is responsible of “autonomic centers and the regulation of visceral functions such as cardiovascular, respiratory, and digestive activities” (p.383).

## **AN INJURED BRAIN**

When a brain injury occurs, the functions of the neurons, nerve tracts, or sections of the brain can be affected, possibly preventing or interfering with the transport of messages that command the brain. This can change the way a person thinks, acts, feels, and moves the body. A brain injury may produce a diminished or altered state of consciousness and results in impairments of physical, cognitive, social, behavioral or emotional functioning (Porretta, 2000). Brain injuries can also change the complex internal functions of the body such as homeostatic functions; bowel and bladder control. These changes can be temporary or permanent. They may cause impairment or a complete inability to perform a function.

## **CAUSES OF TRAUMATIC BRAIN INJURY**

A traumatic brain injury occurs when an outside force impacts the head hard enough to cause the brain to move within the skull (closed head injury) or if the force causes the skull to break and directly hurts the brain (open head injury). These injuries can occur from motor vehicle crashes; gunshot wounds, falls, shaking (a baby), sports, and physical violence, such as hitting or striking with an object.

A rapid acceleration and deceleration of the head can force the brain to move back and forth across the inside of the skull. The stress from the rapid movements pulls apart nerve fibers and causes damage to brain tissue. This type of violent movements can cause damage to the blood brain barriers (BBB) which is responsible for maintain a constant environment for the brain. The environment is needed in order for proper function and control and the central nervous system (Martini, Timmons, & Tallitsch, 2003). This type of injury often occurs as a result of motor vehicle crashes and physical violence, such as Shaken Baby Syndrome.

Causes of brain injury can include, but are not limited to:

- Airway obstruction
- Near-drowning, throat swelling, choking, strangulation, crush injuries to the chest
- Electrical shock or lightening strike
- Trauma to the head and/or neck
- Traumatic brain injury with or without skull fracture, blood loss from open wounds, artery impingement from forceful impact, shock
- Vascular Disruption
- Heart attack, stroke, arteriovenous malformation (AVM), aneurysm, intracranial surgery
- Infectious disease, intracranial tumors, metabolic disorders

- Meningitis, certain venereal diseases, AIDS, insect-carried diseases, brain tumors, hypo/hyperglycemia, hepatic encephalopathy, uremic encephalopathy, seizure disorders
- Toxic exposure- poisonous chemicals and gases, such as carbon monoxide poisoning
- Asthma attack

Injuries can range from very mild to very severe, and depending on the location of the brain injury, impairments may include:

- Lack of coordination
- Slowness or confusion in the planning and sequencing of movements
- Muscle spasticity
- Speech disorders
- Seizures
- Paralysis
- A variety of sensory impairments, including vision and hearing loss (Porretta, 2000)
- Increase in metabolic activity which can cause or enhance impairments ( Marion et al., 1997)

Social, emotional, and behavioral impairments may include:

- Mood swings
- Depression
- Lowered self-esteem
- Lack of motivation
- Difficulty relating to others

Cognitive impairments, which can affect both the physical and emotional self, often result in:

- Short and/or long term memory loss
- Poor attention, judgment, and concentration
- Communication disorders related to speech, writing, and reading are other examples of physical impairments.

For information and resources about brain injury, please contact the Brain Injury Association of America's Helpline at 1-800-444-6443 or email: <mailto:familyhelpline@biausa.org>.

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#### **RECOMMENDED WEB SITES**

- [National Institute of Neurological Disorders and Stroke \(NINDS\) Traumatic Brain Injury Information Page](#)
- [National Disability Sports Alliance](#)

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This information was created by Betsy Hrenko, Doctoral student in Adapted Physical Education at Texas Woman's University, Fall Semester 2003. Updated by Kelley Humphries, Master's Student (Summer 2007).

*Information on this sheet contains only suggested guidelines. Each student must be considered individually, and in many cases, a physician's written consent should be obtained.*