

Cognitive Consequences After Traumatic Brain Injury (TBI)

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1. Abstract

A traumatic brain injury (TBI) can cause temporary dysfunction of brain cells. More severe craniocerebral injuries can lead to bruising, perforation and tissue rupture, bleeding, and other physical damage to the brain that can lead to long-term complications or death (Bigler, 2016). Consequences of TBI can include physical, sensory, behavioral, and communication disorders, as well as disturbances in cognitive functioning.

1.1. Aim: To investigate cognitive consequences after traumatic brain injury (TBI)

1.2. Materials and Methods: An international literature review was performed cognitive consequences after traumatic brain injury (TBI)

1.3. Conclusion: Cognitive deficits (impairments in thinking skills) may include changes in perception of his environment, distraction, lack of rational thinking, inability to solve problems, and executive functionality (eg, goal setting, planning, movement, self-knowledge, self-control, and evaluation). Although re-learning ability is affected by memory deficits, long-term memory impairment for events and things that happened before the injury, however, the general state of memory may remain unaffected.

2. Introduction

A craniocerebral injury can have a wide range of physical and psychological consequences. Some signs or symptoms may appear immediately after the traumatic event, while others may appear days or weeks later (Bigler, 2016) [3]. In terms of their extent, brain damage can range from mild to severe. Traumatic brain dam-

age results in permanent neurobiological damage that can lead to varying degrees of deficient abilities many times over a lifetime. Moderate to severe brain damage is usually characterized by injuries that have the following characteristics:

- Moderate TBI is defined as a brain injury that results in loss of consciousness from 20 minutes to 6 hours and a score on the Glasgow Scale from 9 to 12.
- Severe TBI is defined as a brain injury resulting in loss of consciousness for more than 6 hours and scores on the Glasgow Scale from 3 to 8.

The impact of a moderate to severe brain injury depends on the severity of the initial injury, the rate and completeness of the recovery of normal reactions, the functions affected, the extent of the dysfunction caused to the patient, the resources available for the individual to fully recover and its functions that remain unaffected despite the TBI.

3. Consequences after TBI

Consequences of TBI can include physical, sensory, cognitive, behavioral, and communication disorders, as well as disturbances in functional processes such as swallowing. These problems significantly limit the sufferer's ability to live independently. Problems vary depending on how diffuse the brain damage is and what the location of the injury is. Behavioral changes include changes in the perception, expression of emotions, agitation and / or militancy (aggression), anxiety or anxiety disorders, and depression. A person with TBI may also experience intense and abrupt mood swings, impulsivity, irritability, and decreased frustration tolerance. Cognitive deficits (impairments in thinking skills) may in-

clude changes in perception of his environment, distraction, lack of rational thinking, inability to solve problems, and executive functionality (eg, goal setting, planning, movement, self-knowledge, self-control, and evaluation). Although re-learning ability is affected by memory deficits, long-term memory impairment for events and things that happened before the injury, however, the general state of memory may remain unaffected (e.g., the person remembers the names of friends and family) (Neumann, 2009) [9]. The person may have difficulty starting their tasks and setting goals to complete them. Difficulties can also be observed in the planning and organization of a project and in the self-evaluation of the project. The sufferer often seems disorganized and needs help to perform even simple tasks. Problem solving and situation management are also greatly affected, sufferers often experience an inability to solve rational problems and quite often show spontaneous reactions to stressful situations (Novack, 2002) [9]. Communication deficits are often characterized by difficulty understanding or producing correct speech (aphasia), unstructured speech resulting in weak muscles (dysarthria), and / or difficulty controlling the mouth muscles to produce speech (inactivity). In people with TBI, understanding written and spoken language quite often proves to be quite difficult. They may also have difficulty spelling, writing and reading. Some people may have difficulty communicating socially, such as having difficulty rotating in conversation and having problems maintaining a topic during conversation. More frustrating for their families and friends, people with TBI may have little or no awareness of how inappropriate their behaviors are (Theofilidis, 2020) [12].

4. Mobility disorders

Most people with TBI are able to walk and use their hands within 6-12 months of injury. In most cases, physical difficulties do not prevent a return to independent living, including work and driving. Physical problems may include loss of consciousness, convulsions, headaches, dizziness, nausea / vomiting, decreased muscle strength (paralysis / paralysis), movement disorders, balance, and / or coordination, including dyspraxia / inactivity (ASHA, 2016) [2]. In the long run, TBI can reduce coordination or cause weakness and balance problems. For example, a person with TBI may have difficulty engaging in pre-injury sports. Intense fatigue can also lead to inability to engage in specific activities, especially those that require muscle strength and endurance (Neumann & Lequerica, 2009)[9]. Difficulty swallowing (dysphagia) is highly noticeable among people with TBI and is due to the weakness and / or lack of coordination of the muscles in the mouth and throat.

The motor changes observed in people with TBI fall mainly into one or more of the following categories:

- Orthopedic in nature. Injuries that occur in TBI patients can include: fractures or bruises, sprains or ruptures of ligaments, muscles or tendons. External and internal

stabilizing medical devices and splints are often used as healing mechanisms (Vanderploeg, Belanger, Duchnick & Curtiss, 2007) [13].

- Heterotopic ossification (EO). It is the development of bones in muscles and joints, where there is usually no bone. This can happen over time when body parts do not move in the full range of motion. Heterotopic ossification can be painful and restrict movement and in the long run limit function in daily life (Vanderploeg, Belanger, Duchnick & Curtiss, 2007) [13].
- Contractions occur when the muscle tissue is shortened or stretched. Causes movement restriction on a link. If a person is unable to move their ligaments over time due to injury or pain, they may experience contractions. Full range of motion is necessary to prevent such an eventuality. Family and caregivers play a role in preventing contractions by helping the individual do a range of motion exercises. Splints and medical casts can also be used for the same purpose (Vanderploeg, Belanger, Duchnick & Curtiss, 2007) [13].

Muscle problems are also common after a brain injury. Problems include:

- Muscle weakness from limited use. There may also be muscle injury that can add to the weakness. Even more so the energy required for healing can reduce the energy required for muscle strength.
- Lack of endurance. People with TBI still have a lack of endurance or a decrease in energy, due to long sleep intervals, low energy reserves and large amounts of energy required for their retraining. This problem is a big challenge for the individual, especially when trying to do basic tasks (Chua, Ng, Yap & Bok, 2007) [4].
- Loss of control is also a very serious problem. The brain's ability to say muscle at work can be lost or severely reduced after a brain injury. An injury to the right side of the brain can cause problems with movement on the left side of the body, while an injury to the left side of the brain can cause problems with movement to the right side of the body. When the injury causes loss of muscle control or paralysis on one side of the body, it is called hemiplegia, while when the injury causes loss of muscle control or paralysis on both sides of the body, is called quadriplegia and affects all 4 limbs of the patient. The motor neuron centers of the brain that control the muscle may need to be retrained after TBI challenge (Chua, Ng, Yap & Bok, 2007) [4].
- Poor balance is a common problem after a brain injury. The extent of the problem usually determines the amount of help the person will need to avoid falls and ensure their

safety.

5. Sensory disorders

Aesthetic deficits can include all the aesthetic details, depending on the areas of the brain involved. A TBI can lead to the well-being of the individual, either more or less sensitivity or change / loss of consciousness, or even cause the sufferer to be unable to synthesize his senses causing him geographical and temporal disorientation (Chua, Ng, Yap & Bok, 2007) [4].

Changes in the senses may include the following:

- Brain injury can cause changes in the way a person feels or reacts to pain.
- It can also lead to changes in a person's ability to feel temperature or touch (Tombaugh, Stormer, Rees, Irving & Francis, 2006) [11].
- Impossibility of feeling the parts of their body in relation to the surrounding area or even in extreme cases in relation to the rest of their body resulting in be more vulnerable to injury. For example, the person may not be able to feel their hand on sharp objects, etc. (Vanderploeg, Belanger, Duchnick & Curtiss, 2007) [13].

Changes in vision

Brain injury can cause changes in vision. These may include: hemianopsia (where the person is blind in half of each field of view in each eye) or visual neglect, where visual information received from one visual input of the body is not processed by the brain (Tombaugh, Stormer, Rees, Irving & Francis, 2006) [11].

6. Cognitive consequences

Perception of perception

Perceptual disorders are diseases that affect the human senses, such as smell, sight, taste, hearing, touch, and can be devastating to a person because people rely heavily on the senses to function in their daily lives (Andrewes, 2002) [1].

Perception disorder can be encountered in the following 3 ways:

- Sensory distortions, ie the distorted perception of objects
- Sensory deception, ie the perception of objects or events that are usually not in line with external stimuli
- Disorders in the sense of time when the patient misunderstands the time (morning / evening etc) or the time period (previous years etc) (Haggard, 2006)

Disorders can also be observed in the intensity of aesthetic perceptions. The person may experience hallucinations or an increase in the senses or a decrease in the normal sensory threshold. Some examples are hypereaction (increased sensitivity to noise), hypoea (decreased sensitivity to noise), change in the shape of an object, microscopy (the patient sees objects smaller or farther away than they really are) and macropsy (the patient sees objects closer or larger than they really are) and more. The patient may also experi-

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ence symptoms of hallucinations and obsessions (Haggard, 2006).

7. Memory disorder

Memory disorders are the result of damage to the neuroanatomical structures that prevent the storage, preservation and retrieval of memories. Some examples of memory disorders include:

Ignorance is the inability to recognize certain objects, faces or sounds, but there are many more specific diagnoses of ignorance depending on the characteristics of the symptoms. Ignorance is usually caused by damage to the brain (usually the occipital or parietal lobe) or a neurological disorder. Treatments vary depending on the location and cause of the lesion. Recovery is possible, depending on the severity of the disorder and the severity of the brain damage. Some examples of specific types of ignorance include: Associative visual ignorance, auditory ignorance, acoustic verbal ignorance, person cognition, visual ignorance etc. (Haggard, 2006)

Amnesia is an abnormal mental state in which memory and learning are disproportionately affected by other cognitive functions in a patient with full alertness and response (Theofilidis, 2020) [12].

There are two forms of amnesia: Progressive amnesia and retrograde amnesia, associated with hippocampal or temporal lobe lesions. Patients with progressive amnesia have difficulty learning and retaining information that emerged after brain damage. Patients with retrograde amnesia retain some memories generally have memories of personal experiences or memories that belong to a general framework of independent semantic information (Kopelman, 2002) [7].

8. Attention disorders

Attention disorders concern: Rapid exhaustion: typically seen in people with TBI and fractures of the white or gray matter of the frontal lobes.

Prone to distraction: observed in patients with parietal or frontal lesions or in patients in a state of confusion. Attention Deficit Disorder is a neurobiological-based developmental disorder characterized by 3 predominant symptoms: short attention span, intense mobility, and impulsivity. The difference between patients and people who may have the same symptoms is that people with Attention Deficit Disorder present the above behaviors at a level inconsistent with their developmental level, age and frequency or power that is a significant burden in key areas of their daily lives and interpersonal relationships. In a patient with attention deficit disorder, mental retardation and speech and joint disorders are observed. The general clinical observation of the immediate repetition of a series of words, a sequence of numbers and the inability to concentrate the gaze at a fixed point even in a familiar place are some of the symptoms / indications for further clinical examination.

9. Language disorder

When a person is unable to produce speech sounds properly or flu-

ently, or has problems with his voice, then he suffers from a speech disorder. Difficulty pronouncing sounds or joint disorders, and stuttering are examples of speech disorders. Also when a person has trouble understanding others (receptive language), or sharing thoughts, ideas and feelings (expressive language), then he or she has a language disorder. A stroke or brain injury (especially in the right hemisphere) is the most common cause of these disorders in adults, while in children the genetic factor plays a fairly large role. Language disorders are often characterized by difficulty in understanding or producing speech (aphasia), slurred speech as a consequence of weak muscles (dysarthria), and / or difficulty in programming the mouth muscles to produce speech (inactivity). In people with TBI understanding spoken and written language can be a difficult achievement and usually resembles the effort you make when a healthy person is trying to understand a foreign language.

10. Conclusions

In summary, people suffering from craniocerebral injury may present disturbances at any level of the cognitive function process. Any Short-term memory impairment during the initial stage of recovery occurs rarely and especially in cases with serious injuries. During post-traumatic amnesia, the cause of long-term memory impairment and the assessment of other cognitive functions remain unclear. Damage to semantic memory is possible although they are rarely completely lost information obtained. Regarding the expected memory, it rarely records lesions in cases of craniocerebral injury, but without being an element of great importance for the patient to reintegrate into his obligations and social total (Hammill, 1998).

Possible memory impairments appear to affect the functioning of the language. The patients with impaired memory have difficulty finding the right word, in spelling and reading as well as the sequence of a large number of commands. All these result in the fragmentation of the language, which lacks in accuracy, sequence, specificity and logic (Hagen, Malkmus, & Durham, 1972) [6].

Another memory-related disorder is disorientation due to inability of the patient to recall older and newer information. The presence confusion due to disorientation after TBI makes his cooperation difficult patient with specialist. Disorientation occurs at four levels: in time, in space, in the individual situation and in the individual himself. Of the above categories of disorientation, the most common is that of time. Patients experience confusion related to year, month and even hour which they go through. They also have difficulty estimating how time passes. The patients with this confusion have been injured in the right hemisphere (Pimental & Kingsbury, 1989) [10]. People with spatial disorientation do not recognize the place they are located or misidentified (Pimental & Kingsbury, 1989) [10].

The next category is the one that' s disorienting the patient about

what happened to himself. It is a selective or total kind of disorientation in which the patient refuses to accept his condition. Thus, it is concluded that the denial may be the result of TBI with specific lesions in the parietals lobes or be a way of manifesting a psychological protective mechanism to facilitate the patient in the management of reality. The fourth and last category of disorientation is that associated with confusion in the patient who has an inability to identify people from his environment and make proper use of their names.

The results of a craniocerebral injury appear to contain a wide range of deficits involving almost all cognitive functions. This fact should be taken seriously in any rehabilitation program for these patients.

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