SHORT COMMUNICATION

Children's brain plasticity and severe craneoencephalic trauma

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ABSTRACT

Craneoencephalic trauma is one of the most common causes of brain damage in young individuals around the world; the severity, location of the injury, intellectual level, and, most importantly, age, all influence the patient's brain's potential to reorganise and adapt due to plasticity treatments.

A 12-year-old boy suffers Sever Craneoencephalic Trauma in a car accident, resulting in the loss of most physical and cognitive functions; six months later, due to his brain plasticity, the patient regains a high percentage of his cognitive and self-sufficiency skills, despite the trauma's sequences regarding anterograde memory, lengthy reaction times, executive functioning, and low frustration tolerance. With a quantitative methodology and a non-experimental design, the case is handled using an empirical analytical paradigm. The results of the neuropsychological evaluation reveal a cognitive profile with weaknesses, particularly in the areas of academics, learning, and peer relationships. Due to his age and intimate and acquainted commitment with each of the therapists engaged, his prognosis is favourable.

Key Words: *Cerebral damage; Craneoencephalic trauma; Cognitive profile; Neuropsychology; Cerebral plasticity*

INTRODUCTION

Since the 1990s, it has been documented in Colombia that Craneoencephalic Traumas (CET) have been one of the leading causes of death or disability among people aged 40 and under, with children, adolescents, and young adults being the most vulnerable. CET is primarily caused by car accidents, domestic violence, and other factors. In affluent countries, the prevalence is between 150 and 350 instances per 100,000 people. According to a survey from the Clinica Universidad De la Sabana, there are 200 cases of CTE per 100,000 people in Colombia, with 70% of them making a full recovery. The long-term effects of these traumas are determined by the medical attention given to the patient, the specific zone where the injury is locked, age, and premorbid educational level, rather than severity level, which is used as a prognostic method for the patient. It has been found in several studies that there are no differences in patient symptomatology according to severity level, but there are differences in affected zone, with attention, memory, language, and executive function being altered primarily [1]. Another factor that influences these patients' outcomes is the type of CET that has been presented, which can be opened and expressed focalized and specific symptoms of the injury's area. Normally, no conscience is lost, and the prognosis is better. The closed type, on the other hand, has more complications and a poor prognosis because mechanical forces can damage not only the direct hit zone, but also the contralateral zone, as well as the parenchyma and axonal connections, due to the twist, compression, and elongation of the encephalitic mass, causing fiber breaking and contusion on an extended form, resulting in the loss of conscience. Furthermore, hematomas, edemas, or bleedings might be caused by a secondary mechanism that raises intracranial pressure, producing broad damage in the area where the pressure rises.

Prehospital care, surgical management, and multimodal monitoring in severe cranioencephalic trauma

In developed countries, traumatic brain injury is the primary cause of death. Only in the United States, it is estimated that around 100,000 individuals die each year, and among the survivors, there are a substantial number of persons with impairments, resulting in significant health-care costs. The brain parenchyma is impacted in more than 55% of patients after moderate and severe traumatic injury, according to research. Head trauma management is crucial in emergency rooms all over the world. A review of the literature on prehospital treatment, surgical management, and intensive care monitoring in patients with severe cranioecephalic trauma is presented [2].

The frontal and parietal lobes are the most affected brain zones in CET, resulting in generalised symptomatology, including damage to spatial-global perception, motor sequencing, monitoring ability, selective and alternant attention, long and short term memory, negative emotional states, and behaviour planning and organisation. Several of these disturbances are caused by failures in the information integration and higher hierarchy's functional systems, making the patient's adaptation difficult and leaving him with a functional deficit. Most of these abnormalities (particularly on cognitive process) begin to recover roughly six months after the lesson (sometimes even shorter time), during which time the brain decongests and manages damage sustained through a spontaneous process of recovery. It can also be given a greater recovery on cognitive functions through brain plasticity, which is defined as the ability to reorganise and generate new neuronal connections in order to establish new functional systems on non-affected areas in order to compensate for the functioning of affected areas.

Plasticity allows the brain to readapt its neuronal and synaptic architecture in order to regain cognitive functions that have been lost due to damage; however, many of these functions are not recoverable in the premorbid stage. This is demonstrated by the Kennard principle, which states that the younger one is, the better the recovery and adaptation capabilities becomes, because functions aren't as specialised and allow the brain to develop a significant reorganisation process. This process can be improved if a neuropsychological rehab programme is implemented early on, which follows the same principles as brain neuroplasticity and is tailored to the patient's unique needs, promoting autonomy [3].

K-BIT is Kaufman's short intelligence test

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DISCUSSION

CET is one of the etiologies of brain damage that causes the most incapacity in children; the most common causes are vehicle accidents, falls, violent events, workplace accidents, and sports. Physical disorders, cognitive

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impairments, and emotional and behavioural issues are the three most common causes of CET.

Paralysis, migraines, convulsions, and exhaustion are all common symptoms in the first section. Information processing speed, attentional deficiency, anterograde spatial memory, learning, language and communication modifications, as well as executive functions deficit are all addressed in the second category. Depression, anxiety, aggression, personality changes, and substance misuse may all be present in the third category. Paralysis, migraines, convulsions, and exhaustion are all common symptoms in the first section. Information processing speed, attentional deficiency, anterograde spatial memory, learning, language and communication modifications, as well as executive functions deficit are all addressed in the second category. Depression, anxiety, aggression, personality changes, and substance misuse may all be present in the third category. It is about the effects of CET, and it is mentioned that there are affections on physical, cognitive (possibly disabling for the person), behavioural, and social levels in the mid and long term, with the most common ones being decreased alertness and processing speed, attentional, memory, and learning deficits, language alterations (especially regarding communication), and executive function deficits. CET frequently results in neuropsychological deficiencies in attention, processing speed, memory, and executive skills; also, a CET may result in altered consciousness, followed by a state of confusion and memory loss (posttraumatic amnesia or amnesic loophole). Children with severe CTE have serious cognitive repercussions, but most make a full recovery one year after the injury. Furthermore, several research have discovered a link between posttraumatic amnesia and parameters like IQ six months after an accident, which impacts cognitive functioning, memory, social development, and eventual labour situation, among other things. The presence of problems in the patient is predicted by the cause, kind of damage, fracture, or other injury.

In the face of these challenges, there's cerebral plasticity, which is the nervous system's ability to adapt, reorganise, and change within certain limits, particularly during neurodevelopment, learning, experience, and, in this case, brain damage, all in order to minimise the effects of structural or physiological alterations caused by endogenous and exogenous influences at any point in life, modifying its proper structural and functional organisation. The brain's ability to adapt to and overcome the effects of injury is partially greater in the early years of life, which explains the patient's rapid recovery, especially in the first six months following the injury, when she remains a high percentage of her independence in behaviours such as walking, grasping, feeding, sphincter control, and personal care. With the support of numerous professionals such as occupational therapists, language physicals, psychologists, and neuropsychologists, among others, the minor's spontaneous recovery continued, although at a slower speed, with the help of various intervention and rehabilitation procedures [5]. Every cerebral function can be re-established in a high percentage of cases due to cerebral plasticity, sometimes naturally but more often therapeutically, pharmacologically, through neurobehavioral adaptations and sensitive stimulation combined with physical and psychological rehabilitation.

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