

## Collaboration of neuroscience in the care of victims of traumatic brain injury



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### Wanderson Santos de Farias

Doctorate in Educational Sciences  
Logos University International, Unilogos, USA.

### Uanderson Pereira da Silva

Doctorate in Health Sciences  
Logos University International, Unilogos, USA

### Anne Brandão Silva

Honorary Doctorate in Public Health  
Logos University International, Unilogos, USA

### Marina Costa Arruda

Postgraduate in Public Health with emphasis on Family Health  
Municipal Health Secretary of Casinhas/PE

### Luana Lima de Farias

Postgraduate in family health  
Municipal Health Department of Casinhas/PE

### Andrea da Silva Barbosa Soares

Specialization in Women's Health Nursing  
Municipal Health Department of Casinhas/PE

### Gislaine Maria Barbosa

Specialist in Public Health and FHP for nurses  
Municipal Health Department of Casinhas/PE

### Karina Raquel Barreto Barbosa

Postgraduate in public health with emphasis on family health  
Municipal Health Department of Casinhas/PE

### Monique Ellen de Sousa e Silva Farias

Postgraduate in obstetrics  
Municipal Health Department of Casinhas/PE

### ABSTRACT

TEC is an injury that has been investigated mainly in terms of epidemiological aspects and care protocols. Neuroscience aims to study the nervous system, its embryonic and histological formation, as well as the connection of the physiology of the whole body, for which it has collaborated to understand the stimulus-response mechanisms, a mechanism that is important to understand the body's response. human in injuries such as TEC. Based on this principle, the problem raised for this research was: What care is offered to TEC victims and the collaboration of neuroscience. Therefore, the main objective of this study was to describe the pathophysiology of TEC, the therapeutic support for victims of this condition and the collaboration of neuroscience. This study is an integrative review. Therefore, the following guiding question was elaborated: What care is offered to patients who are victims of TEC and the collaboration of neuroscience. motor, sensory, cognitive, language, emotional or even behavioral.

**Keywords:** Traumatic, Brain Injury, Neurosciences, Surgery.

## 1 INTRODUCTION

Traumatic brain injury (TBI) is defined as an injury resulting from an external force where it can make the brain go against the skull. At the research level, the epidemiological numbers of TBI in Brazil have a shortage due to several situations such as underreporting (CIPOLAT, 2022).

[...] As for the pathophysiology, it can be divided into two phases. The first corresponds to brain injury, which is characterized by tissue trauma and dysregulation of brain blood flow and metabolism, in this case there is tissue ischemia, which occurs due to an accumulation of lactic acid from anaerobic glucose, which leads to an increase in cell membrane permeability



and consequent tissue edema. In the second phase, the cascade of events begins with a terminal depolarization of the membrane along with the excessive release of excitatory neurotransmitters, which activate receptors and open the sodium-dependent and calcium-dependent channels (MACHADO; CHAMBER, 2019). [...]

At first after the lesion installed in the brain tissue is the shear stress at the axon level and may also cause the rupture of local cell membranes, in both situations may occur secondary event of pathophysiology as rapid and disorganized depolarization, which leads to the release of neurotransmitters of the type stimulants in the synaptic cleft we can cite as an example the Glutamate (CIPOLAT, 2022).

[...] The lesion caused by TBI can affect the skull, its envelopes and its contents and be classified into cerebral contusion and concussion, traumatic subarachnoid hemorrhage, hypoxia brain injury, brain swelling, diffuse axonal injury, fractures and perforating skull injuries. Regarding intracranial hemorrhagic lesions, they can be differentiated into multiple focal vascular lesion, subarachnoid hemorrhage, intraventricular hemorrhage, extradural hematoma, subdural hematoma (acute and chronic), intracerebral hematoma and lobar explosion (ROCHA et al., 2020). [...]

It is important to note that TBI not only causes internal damage such as concussion, but also has structural consequences of the skull such as laceration of scalp, local or diffuse fracture, meningeal inflammation and even at the vascular level that would be an expected event categorized as primary in the pathophysiology of TBI, these changes can further lead to transient or permanent cognitive or functional events (RAMOS et al., 2021).

In terms of categorizing the severity of TBI we know through a name ada Glasgow Coma Scale (GCS) where the TBI is classified as mild, moderate or severe. It is important that, in the initial approach of patients with TBI, all possible care is adopted, with scientific and clinical basis, since it will be a basis for treatment and prognosis. When performing the initial care it is necessary to perform an evaluation to categorize the state of severity of the trauma, paying attention to the airway, correct immobilization of the cervical spine, venous access as needed and maintain the patient's temperature still at the site of the event, so it is necessary to follow what the literature brings in the manuals and protocols (ROCHA et al., 2020).

Neuroscience aims to study the nervous system, its embryonic and histological formation as well as the connection of the physiology of the whole body, for this it has collaborated to understand the stimulus-response mechanisms, a mechanism that is important to understand the response of the human body in injuries such as TBI (FELICIANO, 2023).

Based on this principle, the problem raised for this research was: What care is offered to TBI patients and the collaboration of neuroscience. Thus, this study had as main objective to describe the pathophysiology of TBI, the therapeutic support for the victims of this disease and the collaboration of neuroscience.



## 2 METHODOLOGY

This study is an integrative review. Therefore, the following guiding question was elaborated: What care is offered to TBI patients and the collaboration of neuroscience. The operationalization of this research began with a consultation of the Descriptors in Health Sciences (DeCS), through the Virtual Health Library (VHL); and the Medical Subject Headings (MeSH) of the National Library, for knowledge of universal descriptors. Therefore, the controlled descriptors were used, in Portuguese: Traumatic Brain Injury and Neurosciences and Surgery.

The following inclusion criteria were defined: articles published in full, available electronically, in Portuguese, Spanish and English, whose results contemplated aspects related to head trauma or approach to patients with cranial and brain involvement. Newspapers and articles that did not fully contemplate the perspective of the study were excluded.

Articles were selected from April 2019 to 2023. Data collection was performed in two stages. The first consisted of the advanced search in the databases, detailing the quantity of the articles through scientific bases. After the selection and identification of the articles that met the determined inclusion criteria, prior reading of all titles, abstracts, 12 publications were selected. Therefore, the duplicate studies were computed only once, resulting in a sample of nine articles. After rereading each of the articles, an instrument was filled out with the following information: title, authors, journal, year of publication, objectives, methodology, research results, highlighting the care of patients with TBI and the collaboration of neuroscience, which are presented in summary.

Table 1 - Distribution of references included in the integrative review, according to scientific databases, in order of year of publication, 2023.

Article	Type of study	Goal
Scientific advances related to diseases of the Nervous System: neuroscience was the area where the greatest advances happened scientific in recent decades.	Literature review	To point out the evidence, the main scientific advances of neuroscience and their contribution to the treatment of the most frequent diseases; Neurological.
Paper of oxidative/inflammatory process in the pathophysiology induced by recurrent concussions in young rats.	Experimental	Paper of oxidative/inflammatory process in the pathophysiology induced by recurrent concussions in young rats.
Fundamental neuroanatomophysiology.	Literature review	Facilitating tool for understanding the morphophysiological aspects of the nervous system.
Traumatic brain injury as a public health problem: an integrative literature review.	Integrative review	To investigate the contributing factors to make TBI a problem of Public Health and what are the consequences of this problem.
Nurse's performance in the care of patients who are victims of traumatic brain injury.	Bibliographic review, descriptive	To know the care provided by nurses to patients with traumatic brain injury in the hospital emergency service.



The importance of radiological examinations for the diagnosis of post-trauma cerebral hemorrhage.	Bibliographic review, descriptive	Creation of a book on Trauma and Emergency.
Pre-hospital care (PHC) for hemorrhage Exsanguinating Traumatic Brain Injury Related	Case report	To describe the experience of the nursing team in the care of patients who are victims of traumatic brain injury, based on protocols adopted in pre-hospital care aimed at improving the morbidity and mortality of this profile of patient/trauma.
Indication of urgent head CT in mild traumatic brain injury (TBI) in patients on anticoagulant or antiaggregant treatment.	pective observational cohort study	To detect differences in intracranial hemorrhagic complications between patients with mild TBI and those using anticoagulant or antiaggregant and patients without this treatment.
Practical contributions of the nursing process related to traumatic brain injury: An integrative review.	Integrative review	To analyze the international scientific evidence on the nursing process in the care of adults with traumatic brain injury.
Systematic review of randomized controlled trials for rehabilitation functional of traumatic brain injury.	Systematic review	To conduct a systematic review to evaluate the physiotherapeutic modalities that reestablish function more effectively in the treatment of patients with TBI.
Pupillary score of the Glasgow Coma Scale (GCS-P) and hospital mortality in severe traumatic brain injury: analysis of 1,066 Brazilian patients.	Prospective study	We evaluated the accuracy of the GCS-Pupil score (GCS-P) as a prognostic index towards predict hospital mortality in Brazilian patients with severe TBI and compare it with a model that combines GCS and pupillary response with clinical prognostic factors and additional radiological.
Evaluation of Pre-Hospital Time and Neurological Evolution in 30 Days of Patients Victims of Moderate and Severe Traumatic Brain Injury	Documental, prospective analysis	To associate the pre-hospital time with the outcomes of patients suffering from moderate and severe TBI in the first 30 days of hospital evolution.

Source: prepared by the authors according to the scientific databases in order of year of publication, 2023.

### 3 TRAUMA CRANIOENCEPHALIC: BASE NEUROSCIENTIFIC TOWARDS DRIVING THE VICTIM

TBI can be conceptualized as a more predominant trauma, as well as trauma where there is a high rate of death, referred to as a severe type of trauma, specifically, agent of 30 to 70% of the causes of death soon after the event. In addition, TBI, however, is the trauma that predominantly establishes morbidity as well as the evolution of the individual, where often these victims usually usually have very relevant sequelae in what deals with structural and/or organic involvement as well as the damage to the particularity of life (LARA, 2023).

Neuroscience provides health professionals mainly those who are linked to neurology and neurosurgery and a neurofunctional framework, since each anatomical structure has a response/function be it cognitive or motor, local or systemic for such, neuroscience applied to trauma



makes scientific thinking to subsidize the conducts in the face of TBI, technological advancement and neurointensive care came to be based on the exploration and applicability of neuroscience making care professionals a skilled technician in more advanced neurological practices (FELICIANO, 2023).

It is important to emphasize that a portion of the individuals who survive a TBI have the possibility of proceeding with permanent damages implying in motor, sensory, cognitive, language, emotional or even behavioral deficits. Research indicates that on average 50 to 75% of individuals with TBI manifest cognitive and even behavioral changes (RAMOS et al., 2021).

Still for Ramos et al (2021), when the patient is admitted to the traumatology service or in the emergency room, whether it is pre or hospital, whether his condition is serious or not, he will be attended by a team of health professionals where, most of the time, the management of care is by a nurse and shared the management of the scenario with the doctors. The care of the traumatized should be conducted by the Advanced Trauma Life Support (ATLS) protocol, this protocol was founded in the USA, where it provides immediate recognition and treatment in a sequenced way.

[...] The severity of TBI is classified according to the Glasgow Coma Scale (GCS), whose parameters are obtained by eye opening, verbal response and motor response. This scale was described in 1974 by Teasdale and Jennet, who categorized TBI as severe a score from 3 to 8, moderate 9 to 12 and mild 13 to 15. Although the tests and evidence on TBI and its neurological sequelae are increasingly real, the population still does not take it seriously, because only 60% of patients who survive TBI are left with motor and cognitive impairments (SANTOS et al., 2021) [...]

Still for Santos et al (2021), it is necessary to evaluate the configuration of the care offered to individuals with TBI, where we need to attend in a welcoming way, with technical knowledge and based on the principles of humanization. We must emphasize the importance that public health policies have regarding the development of preventive strategies with association with external causes such as automobile accidents and drug and alcohol consumption.

## **4 DISCUSSIONS**

The brain injury can be categorized into two stages where the first corresponds to an injury at the tissue level and with the disorder of blood flow in the brain as well as change at the metabolic level, it is in this situation that an ischemia occurs at the tissue level due to the accumulation of lactic acid due to anaerobic glucose, such an event causes the cell membrane to be more pervious and there time the tissue edema. When we approach the second phase of the lesion, the literature brings the cascading event where it begins through terminal depolarization of the cell membrane associated with a high release of excitatory neurotransmitter (MACHADO; CÂMARA, 2019) and (CIPOLAT 2022).

Concussion can be conceptualized as a change in brain functioning caused by an external energy. In the course of these past years until today, concussion has been investigated and given attention in the scientific world due to its discrete outcomes, which are able to unite and potentiate



some secondary injury. Studies point to an increase in secondary effects of concussion in adolescence, as well, it has been seen that it can induce in the constitution and metabolism at the neural level in adulthood as well as in different circumstances and pathologies (FELICIANO, 2023).

RAMOS et al (2021) and SANTOS et al (2021 ), point out the degree of severity of the trauma and through the ECG, where the eye opening, verbal, motor response and pupillary evaluation are evaluated, the TBI is classified as severe TBI scores from 3 to 8, the moderate from 9 to 12 and the mild we have 13 to 15 points. Driving should be based on ATLS as it brings evidence to identify, address and lead TBI victims.

CIPOLAT (2022) and FELICIANO (2023) point out the relevance of neurophysiology and neuroanatomy in the context of the approach to the patient with TBI, neuroscience in addition to addressing morphofunctional content, has neuroimaging, neuropharmacology and neurological physiology. Such contents need to be related to aggregate with the medical and nursing sciences, for example, to provide care to the individual.

## **5 FINAL CONSIDERATIONS**

Given the above, it is necessary that professionals working in neurology, respectively neurotraumatology, is essential the knowledge of neuroscience for an approach with more solid knowledge about the structures and physiology of the nervous system.



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