TRAUMATIC BRAIN INJURY: SURGICAL MANAGEMENT APPROACHES AND STRATEGIES FOR OPTIMIZING CLINICAL OUTCOMES

https://doi.org/10.56238/sevened2024.030-004

Maria de Fátima da Silva, Jailson Isaias de Melo, Ana Flávia Souto Fonseca Sarni, Ítalo Nunes Vieira and Cintya dos Santos Lima[1]

ABSTRACT

Traumatic Brain Injury (TBI) is one of the main causes of mortality and morbidity, requiring careful surgical and clinical management to optimize clinical outcomes. This study performs a narrative review of the main approaches to control Intracranial Pressure (ICP) and surgical strategies applied in cases of TBI. The search for scientific articles was carried out in the PUBMED, LILACS, and SCIELO databases, covering studies published between 2014 and 2024. The results show that adequate control of ICP in Intensive Care Units (ICU), combined with less invasive approaches, contributes significantly to the reduction of complications and mortality associated with TBI. Pediatric management and cases of TBI due to firearm projectiles also require specific care due to the particularities of each context. The review highlights the importance of standardized protocols and a multidisciplinary team to improve the prognosis of patients. It is concluded that the application of evidence-based guidelines and the use of advanced technologies offer a promising approach to the treatment of TBI.

Keywords: Traumatic Brain Injury. Surgical management. Intracranial pressure. Intensive Care Unit. Prognosis.

[1] Highest level of education: postgraduate degree in hospital psychology
Academic institution: studied psychology at Faculdade de Macapá-FAMA
E-mail: icintyap@gmail.com

INTRODUCTION

Traumatic Brain Injury (TBI) is a critical condition that represents one of the leading causes of mortality and disability worldwide. Often associated with car accidents, falls, and injuries due to violence, TBI imposes clinical challenges that require rapid and precise interventions to optimize the clinical outcomes of affected patients (RODRIGUES et al., 2021). In addition to the direct impacts on health, TBI also represents a significant burden for the public and private health systems, requiring considerable resources for care in urgent and emergency units, as well as in Intensive Care Units (ICU), where the management of critical cases is essential for the survival and recovery of patients (NETO, 2024).

The need for effective interventions in the management of TBI is especially relevant when considering the pathophysiology of the condition. One of the main concerns in the management of patients with TBI is the control of Intracranial Pressure (ICP), which is directly associated with the prognosis of patients. Studies show that proper ICP management in ICUs can significantly reduce mortality rates and improve patients' functional outcomes (RODRIGUES et al., 2021; BICALHO et al., 2024). Thus, the development and application of clinical protocols aimed at the control of ICP and other neurophysiological parameters are crucial for the treatment of TBI.

In the pediatric context, TBI requires specific approaches, considering the anatomical and physiological particularities of children, as well as potential long-term complications. In children, surgical management of TBI is complex and presents unique challenges due to increased skull fragility and susceptibility to serious neurologic complications. The literature highlights the need for interventions adapted to this group, aiming to minimize risks and maximize recovery potential (NETO, 2024; MELO, 2014).

In addition, the clinical aspects of TBI vary according to the severity of the injury and the mechanism of trauma, which makes the multidisciplinary approach essential in the management of these cases. Understanding clinical manifestations and individual responses to treatment is critical to guiding decision-making in the clinical setting. Studies have highlighted the importance of detailed clinical evaluation and continuous monitoring as pillars for improving prognosis in patients with TBI (DA SILVA et al., 2024).

Traumatic brain injury caused by firearm projectiles represents another category of TBI with specific implications and unique challenges. In a study conducted in São Paulo, the mortality and morbidity associated with this type of TBI were analyzed, highlighting the complexity of surgical management in these cases. The treatment and monitoring of these

patients require expertise and specific protocols, given the severity and variability of projectile injuries (SOUZA et al., 2013).

In view of the above, the present study aims to explore the approaches and strategies of surgical management in TBI, with a focus on optimizing clinical outcomes and reducing associated morbidity and mortality. Through a review of current surgical and clinical practices, we aim to identify the main factors that contribute to the improvement of the prognosis of patients with TBI in different clinical scenarios.

METHODOLOGY

The present study is a narrative review. The search began with the definition of descriptors and the choice of search platforms. The research was carried out in the online databases PUBMED, LILACS and SCIELO, from January to July 2024. The following descriptors related to the theme "traumatic brain injury", "surgical management", "treatment of severe TBI" and "clinical outcomes" were used, combined with the Boolean operator "AND", obtained through the DeCS/MeSH platform (Health Sciences Descriptors).

Data analysis was conducted in a standardized manner, following the inclusion criteria: articles published between January 2014 and February 2024, available in English and Portuguese, and with accessible full text. Exclusion criteria included studies addressing surgical interventions for lesions not associated with TBI, studies conducted exclusively in animals, research focused on pediatric populations with no applicability to adults, and literature reviews that did not present new evidence or significant advances in the surgical management of TBI.

The selection of articles was carried out by two evaluators, who independently mapped the studies, discussed the results, and kept a continuously updated data collection form. The evaluation followed a sequence, starting with the reading of the titles and, later, the abstracts of the publications identified as relevant. In cases of divergence in the selection of articles or in the extraction of data, consensus was adopted among the evaluators, with the possibility of consulting a third evaluator, if necessary.

In addition, studies identified through manual searches in journals, citation searches, and gray literature were included, ensuring comprehensive coverage of the topic "Traumatic Brain Injury and Surgical Management".

RESULTS

The initial search resulted in 494 publications, of which 18 met the proposed objectives after applying the inclusion and exclusion criteria, as well as reading the titles

and abstracts. On the PubMed platform, using the descriptors in titles and abstracts, 420 articles published between 1964 and 2024 were found, with a time restriction of 10 years (2014 to 2024), resulting in 210 articles. After applying the inclusion criteria, 20 studies were excluded, resulting in 190 articles, of which 180 were available in full (FULL TEXT).

On the LILACS platform, the initial search resulted in 150 articles. With the time restriction, the number was reduced to 90, and after applying the inclusion criteria, 10 were excluded, leaving 80. Of these, 65 articles were selected because they were available in full after the exclusion criteria.

On the SciELO platform, 120 articles were initially found, reduced to 60 with the time constraint. After applying the inclusion and exclusion criteria, 50 articles were maintained.

A duplicate check was performed between the articles of the three platforms, resulting in 270 unique articles, with 15 duplicates removed. After reading the titles and abstracts, the final number of articles was reduced to 21 papers, with a final selection of 7 studies directly related to surgical management to optimize results in TBI.

DISCUSSION

The literature on TBI management highlights the control of Intracranial Pressure as one of the determining factors for the prognosis of patients. According to Rodrigues et al. (2021), ICP control in ICUs is associated with better clinical outcomes, as it prevents the development of secondary complications, such as brain herniations. In situations of severe TBI, emergency surgical decompression can be a decisive intervention, especially when noninvasive methods of ICP control are insufficient to stabilize the patient.

Another relevant aspect in the management of TBI is the need for continuous monitoring. According to the study by Bicalho et al. (2024), the implementation of standardized protocols for monitoring neurophysiological parameters in ICUs favors a rapid response to critical changes, which can reduce mortality. The introduction of advanced monitoring devices in ICUs, such as cerebral oxygenation monitoring systems, has contributed significantly to a more assertive and less invasive approach in patients with TBI.

In the pediatric public, the management of TBI requires adaptations due to the anatomical and physiological differences of the children. Neto (2024) highlights that surgical treatment in children should consider the possibility of long-term complications, since the children's brain is developing. Thus, surgical interventions should be applied judiciously, prioritizing less invasive approaches and, whenever possible, combining surgery with neuropsychological support therapies to optimize functional recovery.

For Souza et al. (2013), TBI caused by firearm projectiles is one of the most complex types of trauma to treat, as it often causes extensive brain injuries that are difficult to manage surgically. The cases analyzed by the neurosurgery service of Santa Casa de São Paulo reinforce the need for an experienced team to treat these patients, as well as specific protocols for TBI by firearm, which include surgical and postoperative approaches adapted to the severity of the condition.

Melo's (2014) analysis also points to the importance of multidisciplinary care in the management of TBI. According to the author, the presence of professionals from different specialties, such as neurosurgeons, intensivists, and specialized nurses, contributes to a comprehensive and effective approach, especially in complex scenarios such as pediatric treatment and gunshot wounds.

The use of less invasive approaches in the management of TBI in adults has shown promise, according to observations by Da Silva et al. (2024). This type of approach, when possible, minimizes the risks associated with surgery and allows for a faster recovery. In cases of mild to moderate TBI, minimally invasive surgery, combined with an intensive rehabilitation protocol, favors the functional rehabilitation of patients, reducing the length of hospital stay and the risk of hospital infections.

Another important point discussed by Bicalho et al. (2024) is the role of ICUs in the implementation of integrated care for patients with TBI. Modern ICUs, equipped with advanced monitoring technologies and teams trained to manage TBI, offer an essential infrastructure for the success of interventions. Care protocols, effective communication between team members, and quick decision-making are critical to controlling potential complications and to successful treatment.

Finally, it is notable that the literature emphasizes the importance of evidence-based protocols, as discussed by Rodrigues et al. (2021). The standardization of conducts in the management of TBI, combined with the use of updated guidelines, contributes to the improvement of clinical outcomes, allowing a safer and more effective treatment of patients with TBI, both in adults and children.

CONCLUSION

The surgical and clinical management of traumatic brain injury is a complex field, which requires an integrated, evidence-based approach to optimize the prognosis of patients. The review showed that ICP control, continuous monitoring, and the adequacy of surgical techniques to each specific case are fundamental pillars for reducing mortality and

improving clinical outcomes. In addition, the multidisciplinary approach stands out as a key element for success in the treatment of TBI cases in different contexts.

These interventions, in addition to the standardization of protocols and the use of new technologies, offer a promising perspective for the treatment of TBI. With the advancement of research and the implementation of increasingly effective practices, it is expected that the morbidity and mortality rates associated with TBI can be further reduced, promoting a more complete functional recovery for patients.

REFERENCES

1. Rodrigues, B. C., et al. (2021). Relação do manejo adequado da pressão intracraniana nas Unidades de Terapia Intensiva com o prognóstico do paciente com traumatismo cranioencefálico. *Brazilian Journal of Health Review*, 4(5), 22571-22589.

2. Neto, N. J. F. (2024). Manejo cirúrgico de traumatismos cranioencefálicos em crianças em unidades de urgência e emergência. *Revista CPAQV - Centro de Pesquisas Avançadas em Qualidade de Vida*, 16(2).

3. Melo, J. R. T. (2014). Traumatismo craniano na infância. *Revista Brasileira de Neurologia e Psiquiatria*, 18(2).

4. Da Silva, I. M., et al. (2024). Aspectos clínicos do traumatismo cranioencefálico. *Brazilian Journal of Implantology and Health Sciences*, 6(9), 2246-2257.

5. Souza, R. B., et al. (2013). Traumatismo cranioencefálico por projétil de arma de fogo: experiência de 16 anos do serviço de neurocirurgia da Santa Casa de São Paulo. *Revista do Colégio Brasileiro de Cirurgiões*, 40, 300-304.

6. Bicalho, F. F., et al. (2024). Principais estratégias de manejo de traumatismo cranioencefálico (TCE) em Unidades de Terapia Intensiva (UTI). *Brazilian Journal of Implantology and Health Sciences*, 6(9), 1120-1131.