BRAZILIAN JOURNAL OF IMPLANTOLOGY AND HEALTH SCIENCES

ISSN 2674-8169

Prognostic Indicators in Traumatic Brain Injury

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https://doi.org/10.36557/2674-8169.2025v7n12p1328-1335
Artigo recebido em 10 de Novembro e publicado em 20 de Dezembro de 2025

ORIGINAL RESEARCH ARTICLE

ABSTRACT

The study characterized patients with Traumatic Brain Injury (TBI) who underwent surgical treatment in the Greater Florianópolis region and evaluated the prognostic value of the Glasgow-P score. Demographic, etiological, clinical, and tomographic data were correlated with mortality. Glasgow-P did not demonstrate clinically significant superiority over the Glasgow Coma Scale alone for the analyzed outcomes, including the need for decompressive craniectomy, basal cistern obliteration, intensive care unit (ICU) admission, and death.

Keywords: Traumatic Brain Injury, Prognosis, Glasgow Coma Scale.

Indicadores Pronósticos en el Traumatismo Craneoencefálico

RESUMEN

El estudio caracterizó a pacientes con Traumatismo Craneoencefálico (TCE) sometidos a tratamiento quirúrgico en la región de la Gran Florianópolis y evaluó el valor pronóstico de la escala Glasgow-P. Los datos demográficos, etiológicos, clínicos y tomográficos se correlacionaron con la mortalidad. La escala Glasgow-P no demostró una superioridad clínica significativa en comparación con la Escala de Coma de Glasgow sola para los desenlaces analizados, incluyendo la necesidad de craniectomía descompresiva, la obliteración de las cisternas basales, el ingreso en la Unidad de Cuidados Intensivos (UCI) y la muerte.

Palabras clave: Traumatismo Craneoencefálico, Pronóstico, Escala de Coma de Glasgow.

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INTRODUCTION

The Centers for Disease Control and Prevention (CDC) defines traumatic brain injury (TBI) as an alteration in normal brain function caused by external forces or a penetrating head injury.[1] Considered a "silent epidemic," TBI is the leading cause of death and disability among children and young adults worldwide and is involved in nearly half of all trauma-related deaths.[2] Many years of productive life are lost, and many individuals experience long-term disability following brain injury, resulting in a projected burden that exceeds that of conditions such as cerebrovascular disease and dementia.[3]

TBI is a disorder that affects approximately 50 million people each year and more than half of the global population over their lifetime, with enormous economic consequences for individuals, families, and society. TBI-related costs in Europe were estimated at €33 billion in 2010,[4] while in the United States, estimates reported costs of approximately US$60.4 billion.

Incidence and mortality rates related to TBI vary widely across countries and regions[5]. In low-income countries, higher incidence is mainly associated with traffic accidents, whereas in high-income countries, TBI increasingly affects older adults, primarily due to falls.[6]

According to data from the Hospital Information System of the Department of Informatics of the Brazilian Unified Health System (SIH/DATASUS),[7] during the study period—from January 2014 to April 2019—there were 16,639 hospital admissions due to external causes at the Regional Hospital of São José Doutor Homero Miranda Gomes, of which 385 resulted in death. At Hospital Governador Celso Ramos, 12,490 admissions due to external causes were recorded, with 207 deaths. Between 2014 and 2018, there was an increase of approximately 17.8% in the number of hospitalizations due to external causes in the study hospitals, followed by a reduction of approximately 20.9% between 2018 and 2019. Considering the entire period from 2014 to 2019, there was an overall reduction of 6.8%. The greatest increase occurred between 2015 and 2016, totaling approximately a 10% rise in hospital admissions. The total cost related to external causes in both hospitals during the study period was R$45,621,725, with an

average cost per hospitalization of R$1,566.20.[8]

In this context, robust epidemiological data are essential to quantify the public health burden caused by TBI, in order to inform prevention policies, improve understanding of patients' healthcare needs, and enable the appropriate allocation of healthcare resources.

METHODOLOGY

This is a retrospective, analytical, longitudinal, multicenter cohort study based on the analysis of data from electronic medical records and computed tomography scans available in a patient data storage system of individuals with traumatic brain injury (TBI) who underwent neurosurgical procedures between December 2013 and April 2023 at two referral hospitals in the Greater Florianópolis area.

RESULTS ANE DISCUSSION

The descriptive analysis of categorical variables showed that most individuals were male (88.3%). The age group with the highest representation (48.2%) was between 33 and 67 years. Most individuals (52.1%) had completed only elementary education.

The year with the highest frequency of TBI was 2018 (25.9%). June was the month with the highest incidence of cases (12.7%). The second quarter of the year showed the highest incidence, accounting for 30.1% of cases.

Most patients in this study (55.1%) presented with severe TBI according to the Glasgow Coma Scale at hospital admission. More than half of the patients (64.2%) had isocoric pupils without abnormalities at admission. Among the causes of TBI, motorcycle accidents were the most frequent (28.2%), followed by falls from height (17.4%), same-level falls (12.1%), and pedestrian run-over accidents (11.3%). Most individuals (49.2%) did not present associated traumatic injuries. However, when associated injuries were present, they were generally multiple (28.1%). When an isolated associated injury occurred in addition to TBI, orthopedic trauma was the most frequent (9.1%).

Most patients (83.9%) required admission to the intensive care unit (ICU), with the most frequent length of ICU stay ranging from 7 to 15 days (22.3%). Regarding total

hospital length of stay, most patients (23.8%) were hospitalized for up to 7 days, although it is important to note that three patients were not included in this analysis because they were transferred. In most cases (68.7%), patients did not die; however, 44.3% presented with sequelae at hospital discharge, most frequently multiple sequelae (25.2%). Regarding isolated sequelae at discharge, physical sequelae were the most common (7.6%), followed by cognitive impairment (3.9%) and lack of interaction with the environment (3.2%). The most frequent Glasgow Outcome Scale (GOS) score among individuals was 1 (death), accounting for 32.1% of cases.

The present study reinforced several variables as prognostic predictors, in accordance with previous studies and established models. Variables such as patient age, Glasgow Coma Scale score, pupillary reactivity, and tomographic findings have been widely validated in prior studies as the most important prognostic characteristics in patients with TBI. [9-10]

Although it is impossible to predict with certainty the outcome of traumatic events in an individual, research over recent decades has provided greater clarity regarding prognostic probabilities. Accordingly, this study compared the Glasgow Coma Scale with the newer scale incorporating subtraction of the Pupillary Reactivity Score, using model accuracy based on the area under the receiver operating characteristic curve (AUC). The results obtained when comparing both scores using the outcomes “need for decompressive craniectomy,” “midline shift,” “presence of basal cistern obliteration,” “need for ICU admission,” and “death” demonstrated no clinically relevant incremental benefit between them.

In the multivariate model, among associated injuries, patients with thoracic and orthopedic trauma had a higher likelihood of death. This finding may be attributed, respectively, to impaired pulmonary function and compromised volemia, which contribute to the worsening of secondary brain injury, primarily due to hypoxia and hypotension.[11-13]

Worldwide, patterns of TBI are changing,[14] with an increase in traffic accidents in low-income countries and a growing burden of falls among older adults in high-income countries. In this context, the age at which the insult occurs correlates with prognosis, as causes vary according to age group and the likelihood of systemic

complications increases with advancing age.

The retrospective identification of the profile of TBI victims from two referral hospitals in the Greater Florianópolis area enabled a critical analysis focused on both public health policies and institutional care pathways. However, as this was a document-based study using medical records as the data source, many data elements were found to be inadequately recorded or missing. Therefore, investment in efficient systems for data collection and sharing is necessary to develop more robust and reliable databases, as well as to standardize methods for epidemiological surveillance.

FINAL CONSIDERATIONS

No clinically relevant benefit was observed with the use of the Glasgow-P score compared with the Glasgow Coma Scale alone for the evaluated outcomes. A predominance of male patients was observed. At hospital discharge, most individuals presented some degree of sequelae, with multiple sequelae being the most frequent, highlighting the significant functional impact of traumatic brain injury.

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