Decision-making process in children with severe TBI and bilateral mydriasis: An ISPN survey including demonstrative cases

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Introduction

Traumatic brain injury (TBI) is a significant global health issue, with an estimated 27 to 60 million new cases annually and 55 million people living with TBI-related disability. Pediatric TBI differs from adult TBI in terms of mechanism, pathophysiology, and outcome [1-6].

Despite the lack of uniformity in TBI definitions [7], severe TBI is routinely defined as a Glasgow Coma Scale (GCS) score < 9 in the acute setting [2, 8]. Although GCS was originally introduced for adults, it is now commonly used to also describe TBI severity in children.

Functional outcomes of severe pediatric TBI can be devastating, lead to chronic vegetative state, and constitute a major psychological and financial burden to children, families and society[9].

Accurate worldwide incidence of severe TBI in the pediatric population is variably estimated. Only a minority of children sustaining TBI will require surgery[10].

Bilateral mydriasis (BM), or bilaterally fixed and dilated pupils, in the acute setting after severe TBI, reflects brain stem compromise and is associated with grave prognosis [11]. Some may argue that BM in the setting of severe TBI is a "beyond salvage" situation. Others argue that, in children, reversibility may occur more than in adults and therefore maximal treatment should follow despite BM. This issue is important for treatment protocols, alignment of expectations with families, and avoidance of chronic vegetative state in survivors.

Discrepancies and variations in clinical practice among pediatric neurosurgeons remain unassessed and other factors might play a significant role in the decision-making process of the pediatric neurosurgeon to treat such cases. Such other factors could be age/weight of the child, other systemic factors, existence of global ischemia, duration of BM, GCS, and pattern of traumatic injury seen on imaging.

Namely, GCS-Pupil score (GCS-P, that incorporates pupil reactivity to GCS), seems more strongly associated with mortality and poor functional outcome, whereas in a series of 88 children with severe TBI and non-pharmacologic GCS 3, up to 20% had what was considered a good long-term outcome (Glasgow

Outcome Scale of 4 or 5). In this study, lack of bilateral non-reactive mydriasis was the most important factor associated to survival [11, 12]

The role of decompressive craniectomy (DC) in adult TBI is debated, with the DECRA and other studies showing reduced mortality with increase in the number of significantly impaired function [13]. Similar results of reduction in mortality and increased survivors in a vegetative state, or with severe disability, was found by the RESCUEicp trial[14].Despite these level-1 studies, DC is still very widely practiced.

Effectiveness of decompressive surgery in pediatric patients has remained questioned, considering also that there is lack of universally accepted "normal" values for intracranial pressure in children and that conditions such as brain edema or hypotensive episodes seem to have different incidence in children and adults[15]. A more recent comprehensive literature review has suggested that early (within 24h) or ultra-early (within 6-12 hours) Decompressive Craniectomy should be offered to pediatric patients with severe TBI and refractory ICP elevation[16, 17] and a more recent meta-analysis suggests a rate of favorable recovery (17%) following DC in adults patients with transtentorial herniation and bilateral fixed dilated pupils secondary to space occupying lesions[18].

Objective

To identify trends of treating extremely severe pediatric TBI (GCS3-4) presenting also with BM.
If our assessment does find a variability in practice, it would support multi-center research that would potentially answer the question of whether decompressive surgery is warranted.

Study design

We designed an online survey with hypothetical cases, to be distributed among members of the International Society of Pediatric Neurosurgery (ISPN) and associated societies, about their activity, decision-making process when dealing with pediatric severe TBI with bilateral mydriasis. Other associated pediatric neurosurgery members will also be approached.

Methods

Members of the ISPN and associated societies will be contacted online and the following questionnaire will be sent to them (https://www.surveymonkey.com/r/severeTBI). Dr. Andrea Bartoli and the ISPN TBI and research committees will be supervising the project

Anonymization and analysis

Data from the responders will be anonymized. Data will be handled by the principal investigator and sub-investigators.

Appropriate descriptive statistical analysis will be carried out from the collected data. If the quality of data allows, a three-dimensional plotting will be elaborated to illustrate the limits considered by neurosurgeons to proceed for surgery in children with bilateral mydriasis after sustaining severe TBI.

Time schedule

Study approval: end of January 2025
Start of the survey: March 2025
Data collection until end of May 2025
Data analysis until end of August 2025

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