

Traumatic Brain Injury in Pediatric Patients Clinicoradiological Evaluation along with Outcome Assessment

Nikhil Khantal¹, Vivek Kankane², Aditya Shrivastava³, Avinash Sharma⁴

Department of Neurosurgery, GR Medical Collage & JAH Groups of Hoaspital, Gwalior, MP, India

Abstract: ***Aim:** 1) The aim of this study was to study the relationship with mode of injury and radiological features of injury. 2) To study factor determining outcome in different subgroup in pediatric head injury. **Material and Method:** Prospective observational study done in JAH and GRMC Gwalior between August 2021 to July 2022 in 50 cases under 14 years of age. **RESULTS** Most common mode of injury was fall from height (56%) followed by Road traffic Accident(28%). Most cases had GCS in between 13-15(80%) at the time of presentation and most patient discharged with Kings Outcome Scale for Childhood Head Injury (KOSCHI) of 5(84%). **Conclusion:** Initial GCS is the most common predictor of mortality. As age increases the incidence from fall from height increases and RTA increases. This study highlights need for focus on grading of severity of TBI rather than on factor like age ,mode of injury. Early referral to Neuro trauma centre and subsequent management should be considered to prevent ongoing physiological and pathological sequel.*

Keywords: Traumatic, Head injury, Pediatric, outcome

1. Introduction

Traumatic Brain Injury (TBI) is defined as an acquired injury to the brain caused by an external physical force, resulting in total or partial functional disability or psychosocial impairment or both, that adversely affect a child's educational performance. The term does not apply to brain injury that are congenital, degenerative, or brain injuries induced by birth trauma. Level of consciousness is the most common and reliable clinical parameter used for evaluating brain injury severity. The most widely used measure of level of consciousness is the Glasgow Coma Scale [1]. TBI is one of the most common indications for hospitalization among children and is often associated with important morbidity and mortality [2]. CT is the reference standard for emergently diagnosing TBI although some brain injuries are not seen on CT [3]. Children who sustain TBI are at high risk for problems in behaviour, adaptive functioning and educational performance [4]. Most of these cases are considered to be mild. Although more severe cases may cause greater levels of dysfunction, mild TBI occurs in much larger numbers and its consequences are not trivial [5]. Current literature (ie.) studies on learning, memory, cognitive functioning and academic achievement suggests that deficits persists long term in children and adolescents who are severely injured, whereas children and adolescents with mild to moderate TBI showed fewer deficits and greater recovery [6]. Fall were the most common cause of injury (58%) in all ages and most predominant in the under two year old age group, followed by cycling and pedestrians involved in road traffic accidents in the group of children aged over six years old [7]. Falling and being struck by an automobile were the 2 most common causes of head injuries in children [8]. Blunt head trauma is very common in children and can result in a skull fracture in upto 30% [9]. Facial injuries were one of the most common concomitant injuries, especially in the patients aged 1 and 4 years [10]. Management focuses on limiting the progression of the primary brain injury and minimizing secondary brain

injury. In this study, we attempted to analyze epidemiological factors, management, and outcome of TBI.

Aims and Objective

- 1) To establish the relationship between mode of injury and radiological feature of the injury.
- 2) To study the prognosis of the patient and its relationship with the radiological feature of the injury.
- 3) To establish the clinico radiological relation and compare with previous guidelines for better management of the patients.

2. Materials and Methods

My Study is prospective anSingle institute observational study. It was done for duration from August 2021 to July 2022 at JAH and GRMC Gwalior with Sample size of 50

Inclusion Criteria

- All the patients with head injury under 14 years of age.
- Patients with traumatic head injuries.

Exclusion Criteria

- Non-traumatic brain injuries.
- Head injury with other injuries associated.
- Head injury in patients with other diseases such as brain tumor, vascular malformation, coagulopathy etc.

Kings outcome scale for childhood head injury (Koschi)

We assessed the outcome of TBI at the time discharge using Kings Outcome Scale for Childhood Head Injury(KOSCHI) KOSCHI is a 5-scaled tool. KOSCHI-5 is classified as good recovery KOSCHI-4 as moderate disability KOSCHI-3 as severe disability KOSCHI-2 as persistent vegetative state KOSCHI-1 as death.

After the discharge from our institution, regular follow-up was done at our outpatients department for 6 months.

3. Results

Out of total 50 cases of TBI admitted during the period of August 2021–July2022 Under 14 years of 35(70%)were male and 15(30%) were female.

Out of 50 children with TBI, 28 were of mild, 15 moderate, and 7 severe TBI.

Overall, Fall from height 28(56%) is the most common mode of injury followed by RTA 19(38%).Clinical evaluation revealed, LOC in 41(82%) patients, vomiting in 39 (78%) patients, neurological deficit in 7(14%) patients, ENT bleeding in 5 (10%) and seizure in 4 (8%) cases.

CT scan findings revealed fracture skull 28 (56%), extradural contusion 12 (24%), contusion 7 (14%), diffuse axonal injury 6(12%), subdural hematoma 6 (12%), as main radiological injury patterns

Out of 50 cases 45 managed conservatively, and surgical intervention was done in 5(10%) cases. Of 4 surgical cases, Elevation of depressed fracture segment was done in 2 cases, evacuation of EDH in 2 cases, evacuation of acute SDH in 1 case.

We found KOSCHI-5 in 38 (76%) patients, KOSCHI-4 in 5cases (10%), KOSCHI-3 in 4cases (8%), KOSCHI-2 in 2 cases (4%), and KOSCHI-1 in 3 cases (6%).

The maximum death occurred in severe head injury 3, followed by moderate head injury Causes of death in children <5 years were DAI and SDH .In the age group of 10–15 years, death was due to DAI , EDH and contusion.Considering both the age group DAI was the single most common cause of death.

Mode of injury	Number of patients
Fall from height	28(56%)
RTA	19(38%)
Fall of heavy object	29(4%)
assault	1(2%)

Severity of head injury	Number of patients
mild	28(56%)
moderate	15(30%)
severe	7(14%)

CT Findings	No. of patients
Fracture Skull	28(56%)
EDH	12(24%)
Contusion	7(14%)
DAI	6(12%)
SDH	6(12%)
Diffuse Brain Oedema	6(12%)
SAH	4(8%)
IVH	1(2%)

KOSCHI Grade	No. of patients
1) Death	3(6%)
2) Persistent vegetative state	2(4%)
3) Severe disability	4(8%)
4) Moderate disability	5(10%)
5) Good recovery	38(76%)

4. Discussion

In India, children between 1 and 14 years constitute about 35% of the total population. Head injury in infancy and childhood has been documented as the single most common cause of death. Moreover, the modes of injury, the mechanisms of damage, and the management of specific problems differ significantly between the adult and pediatric populations. Globally, TBI is a burning issue with an annual incidence of about 200 per 1 lakh per year, and mortality of 20 per 1 lakh per year.

In India, Gururaj G. *et al.* (2012) reported the incidence, mortality and case fatality rates due to TBI were 150/1 lakh, 20/1 lakh, and 10%, respectively. While assessing children with TBI, depth and duration of impaired consciousness, presence of diffuse cerebral edema, cerebral hypoperfusion, brain infarction, and degree of parenchymal injury are the determinants for poor outcome.

Chiaretti *et al.* hypothesized that the higher incidence of TBI in boys might be due to larger head circumference, more muscular and physical activities in comparison to girls. In our study, boys outnumber girls in the incidence. We do believe the hypothetical factors, described by Chiaretti *et al.*, might contribute to the higher incidence of TBI in boys in our study.

Falls from height the most important cause of pediatric head injury, and slight carelessness on the part of parents can help avoid disastrous consequences for the children. Several literature reported fall from a height as the commonest mode of injury in TBI followed by RTA in children. Fall from a height, fall from the unprotected roof, fall from staircase account for the most common mode of TBI in infancy and childhood. However, Osmond *et al.* found a higher incidence of RTA while reviewing severe pediatric TBI over a period of 4-year. We found fall from height as the most common mode of TBI in the pediatric population.

We think the teenage passion for bicycling, bike riding, and vulnerability for physical assault might be the possible factors contributing to the higher incidence of RTA in the age group of 10–15 years. Children with TBI due to RTA are in fact pedestrians as observed in several studies. In our study, we found RTA being more common in children beyond 5 years age, the maximum in the age group of 10–15 years. Fall of heavy objects can also contribute to some extent as reported by Sambasivan.

Biochemical and biomechanical consequences of isolated brief LOC without any other symptoms or signs of TBI are somehow less in comparison to documented LOC for few seconds while assessing the outcome of traumatic head injury in children. Vomiting *per se* in children is a nonspecific symptom. Many children with vomiting as

presenting symptom do not have an intracranial injury, but a history of any vomiting the following trauma to head increases the subsequent risks. We found LOC as the commonest presenting symptom followed by vomiting similar to other studies. In our study, conservative management far exceeds craniotomies owing to a large number of cases of mild TBI (GCS 13–15). In our series, we achieved good recovery in 90% cases with an overall mortality of 10 % similar to other Indian studies.

The seizure was seen in 8% of our patients; a similar incidence has been reported by others also. A mortality of 20–50% has been reported for severe head injury. The severity of head injury is directly related to mortality and inversely to a better outcome. We found the highest mortality in children with DAI owing to the severity of the injury. Mortality in our study is attributable to late arrival to our institute, unpreparedness for the surgery in time, last but not the least the low socioeconomic status.

5. Conclusion

TBI in children generally carries a good outcome, if referred early to a pediatric neurotrauma center and subsequently managed on an individual basis to treat the primary lesion with the objective to prevent the ongoing biomechanical, physiological, and pathological sequels owing to TBI.

Severe head injury is a predictor of poor outcome. Most of these injuries are preventable in infancy and childhood by ensuring proper vigilance, tender care by the parents and the caretaker, and in adolescence by pursuing safe driving with helmet and counselling for maladaptive behavioral patterns. Timely investigation to establish intracranial pathology and early surgical intervention can lead to a good outcome. Even within the immature brain, there seems to be age-dependent responses following TBI in children.

Take home message

- Most of these injuries are preventable in infancy and childhood by ensuring proper vigilance, tender care by the parents and the caretakers.
- Timely investigations to establish intracranial pathology and early surgical intervention can lead to favorable outcome.
- Need to focus on grading the severity of TBI rather than on factors like age, mode of injury, presence or absence of external injuries
- Any clinician or researcher interested in pediatric neurotrauma must be familiar with its unique pathophysiological characteristics.
- Proper guidelines for pediatric to be established as pediatric population is vulnerable and future of the country.

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