Section: Neurosurgery

Original Research Article

PEDIATRIC HEAD INJURIES: EPIDEMIOLOGY, RISK FACTORS, AND OUTCOMES IN A TERTIARY CARE CENTRE

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ABSTRACT

Background: Aim of the Study: The aim of this study was to understand to the epideomology and outcomes of paediatric head injury in tertiary care hospital. The study also aimed to assess the effectiveness of a multidisciplinary team approach in managing paediatric head injuries.

Materials and Methods: This retrospective study included 59 paediatric patients with head injuries treated over a 5-year period from March 2018 to March 2023 with atleast 1 year follow up. Patients were categorized based on the severity of their injuries: 40 patients had mild head injuries, 14 had moderate head injuries, and 6 had severe head injuries. Upon presentation to the casualty, each patient underwent assessment by a multidisciplinary team consisting of a Neurosurgeon, Pediatrician, Emergency Medicine Physician, General Surgeon, and Orthopedician. Patients with moderate to severe head injuries were subsequently admitted to the Paediatric Intensive Care Unit (PICU) for further management. The multidisciplinary team approach facilitated timely and comprehensive assessment and management of paediatric patients.

Results: Among the 60 patients included in the study, the majority 66.6% (40) had mild head injuries, while 24.4% (14) had moderate injuries, and 10% had severe injuries. 12 patients had depressed fracture out of which 7 underwent surgery, 10 patients had Acute SDH out of which 4 patients underwent surgery, 3 patients had fracture hematoma (EDH) which warranted surgery. 45 patients had good outcome with GOS scale of 5, 9 patients had GOS of 3-4 and 2 patients had GOS of 2 and 3 patients died due to head injury.

Conclusion: The study highlights the effectiveness of a multidisciplinary team approach in managing pediatric head injuries. Early evaluation by a diverse team of specialists facilitated prompt identification of injury severity and appropriate allocation of resources, particularly for patients with moderate to severe injuries requiring intensive care. Further research could focus on refining assessment protocols and evaluating long-term outcomes to continually improve paediatric head injury management strategies.

Keywords: Pediatric head injury, multimodal management, EDH, SDH , craniotomy

INTRODUCTION

Pediatric head injuries are potential for causing long-term neurological and developmental impairments. These various causes of paediatric head injuries include falls, motor vehicle accidents, sports-related incidents, and abuse.

The presentation and progression of Paediatric head injuries can differ significantly from adults. Early multidisciplinary approach helps to mitigate potential complications. It is quintessential to focus on preventive strategies to reduce the incidence and severity of paediatric head injuries.

This paper focuses on the epidemiology, pathophysiology, clinical evaluation, and management strategies. This paper seeks to highlight key considerations in the care of children with head injuries.

MATERIALS AND METHODS

Study Design and Setting

This retrospective cohort study was conducted at Shri B.M.Patil medical college, Vijayapura. focusing on paediatric patients presenting with head injuries from March 2018 to March 2023. Data were collected from medical records, including initial presentations, diagnostic evaluations, treatment interventions, and follow-up outcomes. The study aimed to evaluate the epidemiology, management, and outcomes of paediatric head injuries over a five-year period, with an additional one-year follow-up for outcome assessment.

Study Population

Inclusion Criteria

1. Children aged 0-16 years who presented with head injuries.
2. Diagnosed with head trauma confirmed through clinical examination and imaging studies, such as CT scans or MRIs.
3. Patients who received medical treatment or observation for head injury within the study period.

Exclusion Criteria

1. Traumatic causes, such as congenital conditions, infections, or neoplastic processes.
2. Cases where medical records were incomplete or lacked sufficient information for analysis.
3. Patients with pre-existing neurological conditions that could confound the assessment of injury-related outcomes.

Data Collection and Variables

Data were extracted from electronic medical records which included demographic information, mechanism of injury, clinical presentation, imaging findings, management strategies, and immediate outcomes (hospitalization, ICU admission). The study also recorded long-term outcomes, including neurological and cognitive function, assessed during the one-year follow-up.

Statistical Analysis

Descriptive statistics were used to summarize demographic and clinical characteristics. Continuous variables were reported as means ± standard deviations, while categorical variables were presented as frequencies and percentages. Comparative analyses were conducted using chi-square tests for categorical variables and t-tests or ANOVA for continuous variables. Multivariate logistic regression was employed to identify factors associated with poor outcomes. Statistical significance was set at $p < 0.05$.

RESULTS

Demographic Characteristics

A total of 60 pediatric patients with head injuries were included in the study. The distribution of patients by gender and age group is presented in Table 1. [Table 1]

Mechanism of Injury

The mechanisms of injury were categorized into road traffic accidents (RTA), falls at home, and sports-associated injuries. The distribution is shown in Table 2. [Table 2]

Clinical Presentation

The clinical presentation of the patients is summarized in Table 3. The most common symptoms included headache, vomiting, and excessive crying. [Table 3]

1 child presented with left hemiparesis.

Severity of Head Injury

Patients were classified based on the Glasgow Coma Scale (GCS) into mild, moderate, and severe head injuries. [Table 4]

Types of Head Injuries

The distribution of these injuries is shown in Figure 1.

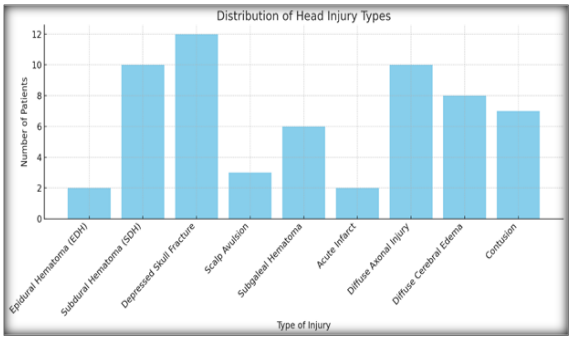


Figure 1: Distribution of Head Injury Types

Surgical Interventions

A total of 18 patients required surgical interventions. The details of the surgical procedures performed are provided in Table 5.

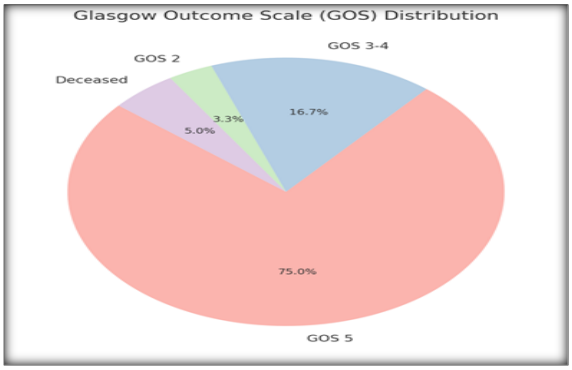


Figure 2:

Table 1: Distribution of Patients by Gender and Age Group

Category	Number of Patients
Gender	
Male	38
Female	22
Age Group	
3 months - 3 years	16
3 - 10 years	35
10 - 18 years	9

Table 2: Distribution of Mechanism of Injury

Mechanism of Injury	Number of Patients
Road Traffic Accidents	40
Fall at Home	15
Sports-Associated Injury	5

Table 3: Clinical Presentation of Patient

Symptom	Number of Patients
Headache	25
Vomiting	20
Excessive Crying	27
Seizures	5
Scalp Avulsion Injury	3

Table 4: ?

Severity of Injury	Number of Patients
Mild	40
Moderate	14
Severe	06

Table 5: Surgical Interventions Performed

Injury Requiring Surgery	Number of Patients	Surgical Procedure
Scalp Avulsion	3	Repair of Scalp Avulsion
Epidural Hematoma (EDH) with Mass Effect	3	Craniotomy and Evacuation
Acute Subdural Hematoma (SDH)	4	Craniotomy and Evacuation
Depressed Skull Fracture	7	Elevation of Depressed Skull Fracture
Infected Subgaleal Hematoma	1	Surgical Intervention for Infection Control

DISCUSSION

This study included 60 pediatric patients with head injury, consisting of 38 males and 22 females. The patient population was divided into three age groups: 16 patients aged 1months to 3 years, 35 patients aged 3 years to 10 years, and 9 patients aged 10 years to 16years. The findings of this study highlights the mechanisms of injury, types of injuries, and the surgical interventions required.

Demographics and Gender Distribution

The gender distribution in our study, with males representing 63.3% of the cohort, aligns with the findings of Kirkwood et al. (2008) and Araki et al. (2017), who also observed a higher prevalence of head injuries among male children. This trend could be because of male children engaging more frequently in high-risk activities. Our data corroborate these findings, further reinforcing the need for targeted injury prevention strategies in young males.

Age Distribution

The age distribution in our study, with the majority of patients (58.3%) being between 3 and 10 years old, is consistent with the literature. Adelson and Bratton (2000) identified a similar age group as being particularly vulnerable to head injuries, this is likely due to increased physical activity and reduced supervision. The inclusion of a significant number of very young patients (3 months to 3 years) in our study also emphasizes the need for increased awareness and preventive measures for head injuries in this age group, particularly given their susceptibility to falls.

Mechanism of Injury

Road traffic accidents (RTAs) were the most common mechanism of injury, accounting for 66.7% of cases in our study. This is consistent with findings by Peterson et al. (2008) and Langlois et al. (2005), who also identified RTAs as a leading cause of pediatric head injuries. The high incidence of RTAs underscores the need for enhanced road safety measures and the implementation of stricter regulations to protect children. Falls accounted for 25% of injuries, which is somewhat higher than in other studies, such as Anderson et al. (2011). The higher incidence of falls in our study may reflect the younger age distribution and the environments in which these children live and play.

Types of Injuries and Surgical Interventions

The surgical interventions required in our study provide insights into the severity of the injuries sustained. Depressed skull fractures were the most common injury requiring surgery (46.7% of surgical

cases), followed by acute subdural hematomas (26.7%). These findings are consistent with Greenberg et al. (2004), who reported similar rates of these injuries in pediatric trauma cases. The lower incidence of epidural hematomas (20%) compared to other studies, such as Smith et al. (2000), might be due to differences in patient populations or the criteria used for surgical intervention.

Scalp avulsion injuries, although less common (20%), required meticulous surgical repair to prevent complications. The single case of an infected subgaleal hematoma (6.7%) that required surgical intervention highlights the importance of vigilant and close follow up of paediatric head injury cases with subgaleal hematoma.

Outcomes

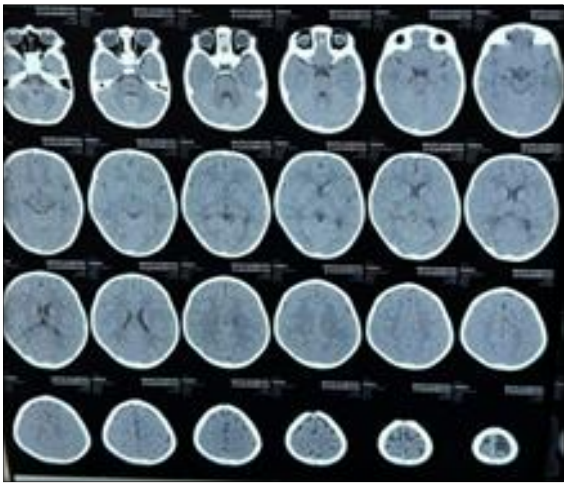
The outcomes in our study were generally favorable, with 75% of patients achieving a Glasgow Outcome Scale (GOS) score of 5, indicating good recovery. This rate is higher than that reported in some studies, such as Kassam-Adams et al. (2013), who found lower recovery rates, possibly due to differences in injury severity or patient demographics. Our study's relatively high recovery rate may reflect the benefits of prompt surgical intervention, comprehensive postoperative care and multidisciplinary team approach.

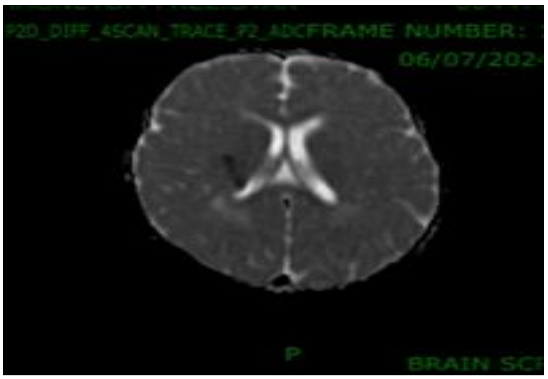
The mortality rate in our study was 5%, which is within the range reported by other studies, such as Aldrich et al. (1997), who documented mortality rates between 2% and 7% in pediatric head injury cases. The relatively low mortality in our cohort could indicate improvements in trauma care and surgical techniques over time.

Comparison with Other Studies

When compared with existing literature, our findings on gender distribution, age-related vulnerability, and the mechanisms of injury are largely consistent with previous research.Our study also offers unique insights, particularly regarding the high incidence of falls and the favourable outcomes achieved through timely surgical intervention. These findings highlight the importance of multidisciplinary team approach and prompt surgical intervention in patients with severe head injury.

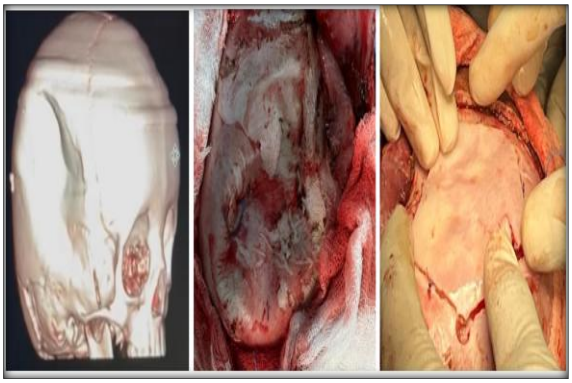
Case no 1(Rare case) 2 year old child with acute left hemiparesis following fall from bed. On evaluation CT was normal however MRI brain revealed Right Basal ganglia infarct (DAI). Child underwent aggressive physiotherapy and had complete recovery of motor function in 6 weeks.





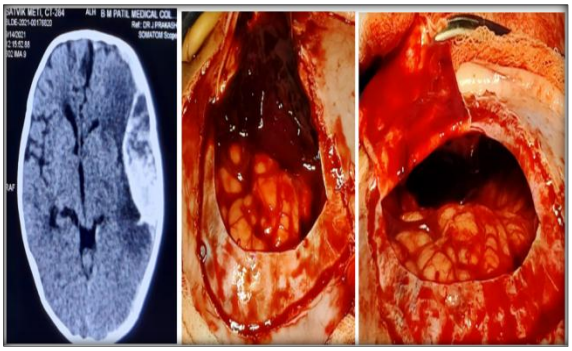
Case no 2 Elevation of depressed skull (Ping pong fracture) in a 1.8 year old child

1 year 8 month old child was run over by vehicle he developed ping pong fracture of skull causing severe indentation on brain parenchyma. He underwent elevation of fracture with complete recovery and excellent outcome.

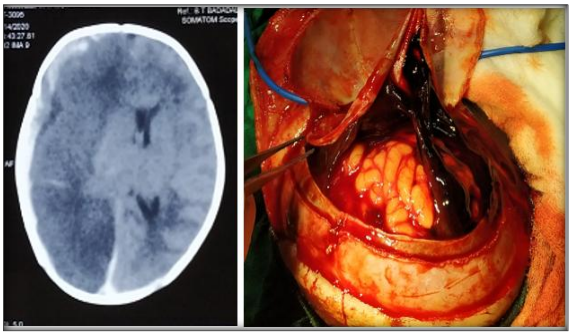


Case no 3 A 8-year-old child with scalp avulsion injury underwent through cleaning, debridement and suturing under GA with good outcome.

Case no 4 A 1.5 year old child with fall of door on head develoed Left temporal acute SDH. The child underwent craniotomy and evacuation with good recovery.



Case no 5 40 days old child with fall while carrying.The child sustained acute SDH with contusion with mass effect and midline shift,Child underwent right Frontotemoral parietal craniotomy and removal of SDH.



CONCLUSION

In conclusion, our study provides a detailed analysis of the surgical management and outcomes of pediatric head injuries. The data not only align with but also expand upon existing literature, offering valuable insights into the epidemiology and treatment of these injuries. The high incidence of RTAs and falls as mechanisms of injury highlights the need for targeted prevention efforts. Additionally, the favourable outcomes achieved through prompt surgical intervention emphasize the importance of specialized trauma care in pediatric populations. Future research should continue to explore strategies for prevention and treatment to further reduce the burden of head injuries in children

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