



Original Article (BRAIN)

Patterns of Head Injuries in Pediatric Patients Treated in Emergency Department of Children Hospital and Institute of Child Health Lahore

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ABSTRACT

Objective: To analyze the pattern of head injuries along with characteristics and outcomes among pediatric age group presenting in The Children hospital Lahore, Pakistan.

Material and Methods: A cross-sectional study was conducted and a total of 384 children of both genders aged up to 12 years presenting with head injuries were included. After initial review and resuscitation by the trauma unit or neurosurgery unit, children were evaluated clinically and radiologically and the plan was decided for further treatment. Gender, age, place of injury occurrence, etiology of injury, Glasgow coma score (GCS) at the time of enrollment, the interval between injury and admission, management, outcome, and total duration of hospital stay were recorded on a predesigned proforma.

Results: In a total of 384 children, 249 (64.8%) were boys. Overall, the mean age was 5.8 ± 3.3 years. Falls were the commonest etiology in 210 (54.7%) children while motor vehicle accidents were the cause of head trauma among 78 (20.3%) children. The mean interval between injury and presentation was noted to be 3.2 ± 2.1 hours. Mortality was reported in 56 (14.6%) children and it was observed that a significant association was noted between outcome and GCS at the time of presentation ($p < 0.0001$).

Conclusion: The majority of the pediatric head injury cases were male and aged above 5 years. The most common etiology of head injuries was falls followed by motor vehicle accidents. $GCS \leq 8$ at the time of presentation was significantly linked with poor outcomes.

Keywords: Glasgow coma score, Head Injury, Fall, Motor Vehicle Accident, Mortality.

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Date of Revision: 19-01-2022
Date of Acceptance: 10-03-2022
Date of Online Publishing: 31-03-2022
Date of Print: 31-03-2022

DOI: 10.36552/pjns.v26i1.640

Date of Submission: 21-11-2021

INTRODUCTION

Head injuries following fall from height and road traffic accidents are the leading cause of mortality and morbidity among children in Pakistan.¹ This also implies the Significance of road traffic safety measures to reduce roadside accidents. This will reduce traffic Injuries among children who are at risk as vehicle occupants or pedestrians. In Europe, sports-related pediatric head trauma is very common. There is a need for hospital-based as well as nationwide surveillance programs to document injury patterns among the pediatric age groups so that preventive measures could be taken. Information regarding external causes of injuries is much needed for a targeted population.² This is a study to describe pediatric head injuries patterns and identify factors that lead to the requirement of advanced care among children. Pediatric head injuries behave differently compared to adults' head injuries because pediatric brains are in an active phase of development and have more fluid contents.³ Such injuries can leave children with lifelong disabilities.⁴

Younger children with head injuries show different symptoms clinically (less likely to develop loss of conscious level also they are less able to describe what happened) and it is difficult sometimes to diagnose brain injuries in younger children.⁵ Pediatric head trauma (> 4 years old) is often motor vehicle related and the percentage increases with increasing age i.e., 20% in children 0 to 04 years of age and up to 66% in adolescents with a peak incidence in 6 to 10 years age group.⁶ Motor vehicles accidents account for 27 – 37% of all pediatric head injuries in children younger than 15 years. Head injuries from falls are most common in children younger than 4 years and are 24% of all pediatric head trauma whereas assault accounts for 10% of all firearm-related head injuries 2%, child abuse 24% of pediatric patients younger than 2 years.⁷

For a better outcome of pediatric head injury, timely evaluation and treatment are critical as

children can deteriorate from secondary brain injury faster than adults.⁸ Also this helps us save important hospital resources. Sensitization of the emergency trauma team regarding the pattern of head injury and the association of these factors with the need for advanced care for patients is very important. Moreover, this information can be used to counsel parents regarding outcomes and treatment options, and preventive measures.⁹

Children from low socioeconomic status are at high risk of head injuries probably due to a lack of adequate adult supervision and a lack of understanding and implementation of road safety measures.¹⁰ Child neglect and abuse are becoming the most prominent cause of head injuries among children. Clinically GCS at presentation is an important marker for mortality prediction.¹¹ Other factors that can affect the outcome in children include the severity of the injury, multisystem trauma, and secondary insult. This study was done to analyze the pattern of head injuries along with characteristics and outcomes among the pediatric age group presenting in the children hospital Lahore.

MATERIALS AND METHODS

Study Design & Setting

A cross-sectional study was conducted at the Department of Pediatric Neurosurgery, The Children Hospital & University of Child Health Sciences, Lahore, Pakistan from November 2020 to October 2021.

Inclusion Criteria

Children of both genders aged up to 12 years who presented with head injuries received in the accident & emergency (A&E) department.

Exclusion Criteria

Children with multiple fractures or those who succumbed during initial resuscitation. Children

who were referred to any other hospital for any reason were not included. Children whose parents or guardians refused to be part of this study were also not included.

Data Collection

Approval from Institutional Ethical Committee was acquired. Informed and written consent was taken from parents or guardians of all the children. As per inclusion and exclusion criteria, a total of 384 cases were enrolled. After initial review and resuscitation by the trauma unit or neurosurgery unit, children were evaluated clinically and radiologically and a plan was made decided for further treatment. Children with GCS 15/15 were discharged from the A&E department while patients with GCS > 13, focal neurological deficit, cranial nerve palsies, raised intracranial pressure, seizures, skull fracture, or an aerocele on skull radiographs, or clinical signs of basal skull fracture (rhinorrhea, otorrhea, sub-conjunctival hemorrhage and per orbital or retro auricular ecchymosis) were admitted in the neurosurgical unit. Patients with moderate (GCS 9 – 12) or severe (GCS ≤ 8) head injuries and brain stem involvement (clinically or radiologically) and /or acute respiratory insufficiencies were admitted to the intensive care unit. Advanced care children were labeled as those who required treatment beyond the A&E department. Relevant investigations like cranial ultrasonography, CT scan, or MRI brain were done. All the study data was collected from the parents/adult family member or caregiver who accompanied the child to the emergency department after informed written consent. Gender, age, place of injury occurrence, etiology of injury, GCS at the time of enrollment, the interval between injury and admission, management, outcome, and total duration of hospital stay were recorded on a predesigned proforma.

Statistical Analysis

All the data were analyzed using SPSS version 26.0. The quantitative statistics were presented in the form of mean ± standard deviation (SD) while qualitative data were presented as frequency and percentage. The Chi-square test was applied considering $p \leq 0.05$ as significant.

RESULTS

Characteristics of the Children

Of a total of 384 children, 249 (64.8%) were boys. Overall, the mean age was estimated to be 5.8 ± 3.3 years whereas 226 (58.9%) children were above 5 years of age. Place of injury was home in 214 (55.7%) children. Falls were the commonest etiology in 210 (54.7%) children while motor vehicle accidents were the cause of head trauma among 78 (20.3%) children. The mean interval between injury and presentation was noted to be 3.2 ± 2.1 hours. Mean GCS at the time of presentation was calculated to be 13 ± 2 . Table 1 is showing the characteristics of children at the time of presentation.

Table 1: Characteristics of Children at the Time of Presentation with Head Injuries (n=384).

Characteristics	Number (%)	
Gender	Boys	249 (64.8%)
	Girls	135 (35.2%)
Age in Years	≤ 5 years	158 (41.1%)
	> 5	226 (58.9%)
Area of Residence	Rural	217 (56.5%)
	Urban	167 (43.5%)
Place of Injury Occurrence	Home	214 (55.7%)
	Street/highway	110 (28.6%)
	Others	60 (15.6%)
	Pedestrian accidents	21 (5.5%)
Etiology of Injury	Motor vehicle accidents	78 (20.3%)
	Sports	34 (8.9%)
	Violence/assault	13 (3.4%)
	Falls	210 (54.7%)
	Falling objects	3 (0.8%)
	Stab injuries	12 (3.1%)

GCS at the Time of Presentation	Gun-shot injuries	6 (1.6%)
	Child abuse	7 (1.8%)
	Mild (13 – 15)	255 (66.4%)
	Moderate (9 – 12)	83 (21.6%)
	Severe (≤ 8)	46 (12.0%)

Outcomes

There were 301 (78.4%) children who underwent advanced care while a total of 31 (8.1%) children required neurosurgery. The mean duration of

hospital stay was noted to be 4.6 ± 2.1 days. Mortality was reported in 56 (14.6%) children while 328 (85.4%) were discharged from the hospital. Table 2 is showing the association of outcome (mortality/discharged) concerning GCS at the time of presentation and it was observed that significant association was noted among outcome and GCS at the time of presentation ($p < 0.0001$).

Table 2: Association of Final Outcome among Children having Head Injuries concerning GCS at the Time of Presentation (n = 84).

Final Outcome	GCS at the Time of Presentation			Total	P-Value
	Mild (13 – 15)	Moderate (9 – 12)	Severe (≤ 8)		
Discharged	250 (98.0%)	65 (78.3%)	10 (21.7%)	328 (85.4%)	< 0.0001
Mortality	5 (2.0%)	18 (21.7%)	36 (78.3%)	56 (14.6%)	(Significant result)
Total	255 (66.4%)	83 (21.6%)	46 (12.0%)	384 (100%)	

DISCUSSION

Pediatric head injuries are considered to be a major public health issue all around the world. In the present study, we noted that 64.8% of children with head injuries were boys. Data from northern India also showed that the majority of the children with head injuries were male.¹² Local data from Karachi evaluating 181 children with head injuries revealed 69.6% of the children to be boys which is quite similar to our findings.¹³ A study from Rawalpindi noted that 76% of children are male.¹⁴ In this study, the etiology of head injuries was falling among 54.7% of children while motor vehicle accidents constituted 20.3% of cases. A study from India by Madaan et al. revealed 59% of children with head injuries have etiology as accidental falls while road traffic and rail accidents were noted among 34% of cases.¹² Local data showed that 63.3% of children with head injuries were due to falls while road traffic accidents were the cause of head injuries among 25% which is close to what we noted in the present study.¹⁵ Data from Iran differs from our findings where motor vehicle accidents were the

etiology behind the majority of head injury cases among children.¹⁶

In the present study, mortality was reported in 14.6% of cases. Local data from Sahiwal found poor outcomes among 15.8% of children with head injuries¹⁵ while others reported mortality among 9.9% of children with head injuries.¹³ Significant association of mortality was observed between severe GCS and mortality ($p < 0.0001$) as 78.3% of the children with $GCS \leq 8$ died while mortality was reported to be only 2% among children with mild GCS at the time of presentation. Our findings showing predominantly poor outcomes among children with $GCS \leq 8$ were not surprising as these children are expected to have poor outcomes due to neurological and physical compromise at the time of presentation. In a study from India analyzing 403 cases of pediatric trauma, mortality was reported among 65.3% of children with $GCS \leq 8$ while mortality was only 2.6% among children with GCS between 13 to 15.¹⁷ A local study analyzing 120 children with head injuries showed that 68.8% of the children with $GCS \leq 8$ were

having poor outcomes.¹⁵ Despite advancements in the diagnostic and interventional modalities in pediatric head injuries, these injuries are still the cause of significant morbidity and mortality in a developing country like Pakistan. Although, head injuries among children are treated pretty similar to adults with head injuries researchers have shown that children are found to have better outcomes when compared to adults with head injuries.¹⁸ Unlike in the present study where we noted presenting GCS to be a very strong predictor of outcomes among children with head injuries, some researchers have argued that GCS is not a reliable predictor of outcomes in the absence of hypoxia and/or ischemia.^{19,20} This could be due to improper resuscitation at the peripheral healthcare facilities or late referrals to proper neurosurgical settings, patients are expected to suffer from hypoxia that can lead to worse outcomes among cases of head injuries.^{17,21}

Limitations

Our study had some limitations as well. As this was a single-center study, our findings should not be generalized. We were unable to correlate radiological findings with the outcome in the present study.

CONCLUSION

The majority of the pediatric head injury cases were male and aged above 5 years. The most common etiology of head injuries was falls followed by motor vehicle accidents. GCS \leq 8 at the time of presentation was significantly linked with poor outcomes. Timely resuscitation and referrals must be made from non-neurosurgery centers to specialized neurosurgery centers for children with head injuries. Community education programs about the preventable causes of pediatric head injuries must be planned for the prevention of pediatric head injuries.

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Additional Information

Disclosures: Authors report no conflict of interest.

Ethical Review Board Approval: The study was conformed to the ethical review board requirements.

Human Subjects: Consent was obtained by all patients/participants in this study.

Conflicts of Interest:

In compliance with the ICMJE uniform disclosure form, all authors declare the following:

Financial Relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Shahid Iqbal	1. Study design and methodology.
2.	Lubna Ijaz	2. Paper writing and data calculations.
3.	Laeq ur Rehman	3. Data collection and calculations.
4.	Farrukh Mehmood Sattar	4. Analysis of data and interpretation of results etc.
5.	Muhammad Waqas-ur-Rehman	5. Literature review and referencing.
6.	Malik Muhammad Nadeem	6. Analysis of data and quality insurer.