

Original Article

Pediatric Head Injury: A Study of 120 Cases

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ABSTRACT

Objectives: Head injury in the pediatric age group is a significant worldwide cause of death and morbidity. Falls are the most common cause of head injury followed by road traffic accidents (RTAs) in such patients. This study aimed to evaluate incidence, mode, and severity of injury, treatment options and to determine the outcome in pediatric age group patients with head injury.

Patients & Methods: 120 pediatric patients with a head injury, with ages up to 15 years or less, were included. Detailed history, general and neurological examination including GCS were noted. The CT scans were conducted and the patients managed as per said protocol. Various surgical procedures were performed including craniotomies and evacuation of hematoma, the elevation of depressed fractures and repair of the dura, decompression craniotomies, and evacuation of Subdural collections and contusions.

Results: 60.1% of patients were boys and 39.16% were girls. In the majority (63%) of the children, the 'fall' was reported. The majority of children (68.3%) in our study had a mild head injury with GCS 13 – 15. 35.83% patients had normal CT scans, and 23.33% had isolated skull fractures. 68.75% patients were with a severe head injury and had a poor outcome. A poor outcome was noted in patients having brain edema, subdural hematoma, and brain contusions.

Conclusion: Head injury in the pediatric age group still continues to be a significant cause of mortality and morbidity. The outcome is directly being related to the severity of injury i.e., GCS. Falls and RTAs are the most common causes and preventive measures in different forms need to be addressed.

Keywords: Head Injury, Road Traffic Accidents, Glasgow Coma Scale, Concussion Injuries.

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INTRODUCTION

Head injury has become a major cause of disability and death in pediatrics group and is ubiquitous. It has got the attention of neurosurgeons because this age group population has to spend long years of life ahead. Head injury and its sequel have a bearing on the family, society, and the economics of a country.¹ Review of worldwide incidence rates revealed the variations by countries with a range from 47 – 280

per 100000 children.² In the United States, the annual admissions to emergencies reach a staggering half a million patients.³ The most common cause of death in children in the United States has been reported to be head injury and it approximates about 70 – 80%.^{4,5} Although the boys do suffer more head injury than girls, the incidence of mild head injury is more in girls.⁶ Among the High school age group girls have high rates of concussion, compared to boys.⁷

Falls are on the top while discussing the mode of injury followed by road traffic accidents.⁸ Child abuse is also an important reason for head injury especially in infants and young children as they are more vulnerable and dependent on adults.⁹ Head injury may be classified as mild (GCS 13 – 15), moderate (GCS 9 – 12), or severe (GCS 3 – 8).¹⁰ CT scan brain is the most effective and definitive tool to know the nature and severity of the injury which helps in decision making with regards to final treatment.^{11,12,13} A wide range of factors can be considered while making decisions and assessing prognosis. Practically only a few features were found to have most of the prognostic information.^{14,15,16} These include age, GCS, and CT findings indicating severity and nature of the head injury.¹⁷ In spite of the fact that the majority of the children do get a mild head injury, only a few percentages have complications and associated morbidity and mortality.^{18,19} It is well observed that such children may develop cognitive and behavioral problems after such concussions and posttraumatic stress disorder (PTSD).²⁰ Severe head injuries are relatively less common catering for 10% of head injury patients.²¹ Sharples et al²² had observed that 30% of deaths could be avoided. Quick and accurate diagnosis and provision of ICU care is of vital importance for decreasing the mortality rates. Secondary injuries to the brain, hypoxia, and hypotension, may develop early and play role in enhancing the effect of the primary injury. These must be managed at the earliest and best possible levels.²³ The current study evaluated the

incidence, mode, and severity of the injury, treatment options and to determine the outcome in pediatric age group patients with a head injury.

MATERIALS AND METHODS

Study Design & Setting

A cross-sectional study was conducted on 120 pediatric patients with age up to 15 years in the Department of Neurosurgery in DHQ Teaching Hospital/Sahiwal Medical College Sahiwal. The study was conducted for a period of one year from 1st July 2018 to 30th of June 2019.

Inclusion Criteria

Those patients were admitted who reported the head injury.

Exclusion Criteria

Multiple trauma patients.

Data Collection

Detailed history including age, sex, mode of injury was taken. General physical and systemic examinations including a central nervous system were done and Glasgow Coma Scores (GCS) were noted in every patient. Patients were grouped as mild, moderate, and severe head injuries on the basis of GCS. Patients were resuscitated and once vitally stable, the CT Scan brain was done and CT findings were noted and treatments were planned i.e. conservative/surgery. In the end, the ultimate outcome was assessed and grouped into good (normal or moderate disability) and poor (severe disability, vegetative, and death) following the Glasgow outcome scale.

RESULTS

Age Distribution

Out of 120 patients, 52 (43.3%) were of 5 years of

age, whereas, there were 68 (56.6%) patients who were between 6-15 years (**Table 1**).

Gender Distribution

73 (60.1%) were boys and 47 (39.16%) were girls, with male to female ratio of almost 3:2 (**Table 1**).

Table 1: Distribution of 120 Children with Regard to Age, Sex & Mode of Injury.

Parameter	Number	Percentage
Age Group		
≤ 5 (years)	52	43.33%
6 – 15 (years)	68	56.66%
Sex		
Male	73	60.83%
Female	47	39.16%
Mode of Injury		
Falls	76	63.33%
Road Traffic Accidents	30	25%
Others:		
Sport injury & Fire Area Injury	14	11.66%

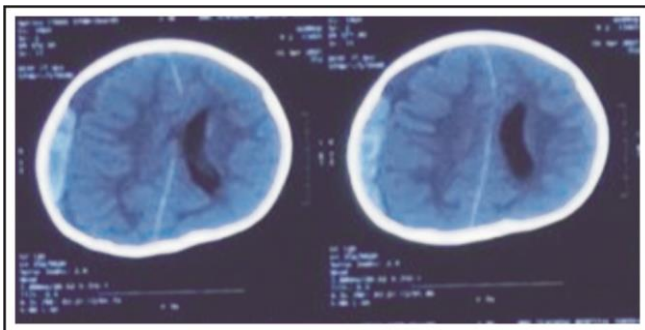


Figure 1: Subdural hematoma with mass effect in 5-year-old child.

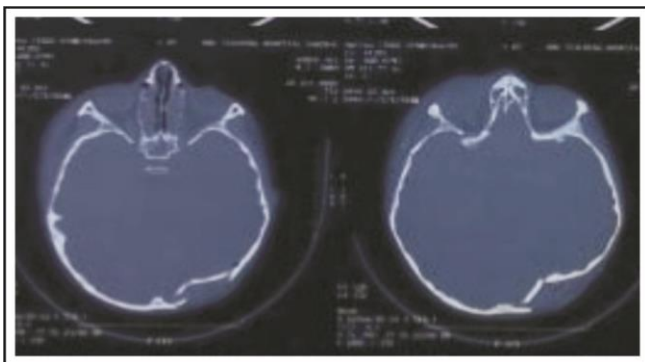


Figure 2: Depressed fracture 3-year-old child.

Mode of Injury

In the majority (63%) of the children, the 'fall' was reported, the preschool children followed by road traffic accidents was 25% and injuries from other modes (sports, arum injury, or collided with some hard object) were 11.66% (**Table 1**).

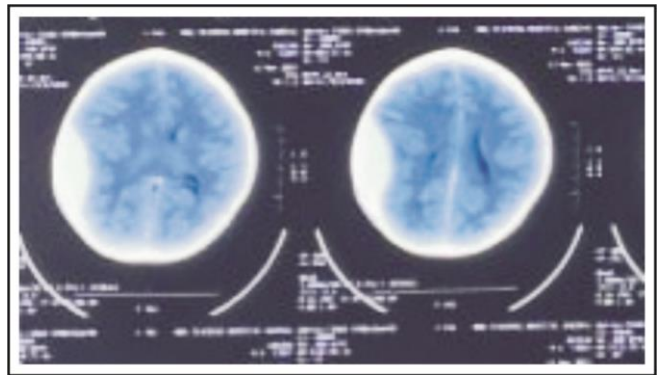


Figure 3: Extradural hematoma in 6-year-old child.

GCS Scores and Injury Levels

The majority of children (68.3%) in our study had a mild head injury with GCS 13 – 15, followed by moderate head injury (18.3%) with GCS 9 – 12, and severe head injury (13.3%) with GCS 3 – 8 (**Table 2**).

Findings of CT-Scans

Forty-three (35.83%) patients had normal CT scan, 28 (23.33%) had isolated skull fractures. Depressed fractures along with underlying brain contusions were noted in 12 (10%) children. Extradural hematomas were seen in 9 (7.5%) children. Six (5%) patients had Subdural hematoma with underlying brain contusions and 8 (6.66%) children had brain edema.

Subdural hematoma mentioned in **Figure 1**, depressed fracture in **Figure 2**, and extradural hematoma in **Figure 3** are the CT findings of our study.

Outcome from CT Scans

The ultimate outcome was assessed with the

Glasgow outcome scale. 11 (68.75%) patients with severe head injury had poor outcomes, followed by 6 (27.27%) patients with a moderate head injury. 2 (2.43%) children were with a mild head injury and had poor outcome (**Table 2**).

Table 2: Relationship of Glasgow Coma Score (GCS) with Outcome (Glasgow outcome scale).

GCS	Good Outcome	Poor Outcome	Total
13 – 15	80	2 (2.43%)	82 (68.33%)
9 – 12	16	6 (27.27%)	22 (18.33%)
≤ 8	5 (31.25%)	11 (68.75%)	16 (13.33%)

As far as CT scan findings and outcomes are concerned, a poor outcome was noted in patients having brain edema, subdural hematoma, and brain contusions. Various surgical procedures were performed including craniotomies and evacuation of hematoma in 9 (7.5%) patients, the elevation of depressed fractures, and repair of dura in 22 (10%) patients. Six (5%) patients underwent decompression craniotomies, evacuation of Subdural collections, and contusions. Poor outcomes were in those patients who presented late due to delayed referred.

DISCUSSION

The functional impact of head injury in a pediatric age group may be different as compared to adults. The Neurosurgical changes may not be apparent at the time of impact as the pediatric brain is in the process of development. The children head injury is supposed to be a slowly progressive disease rather than one-time event because the symptoms may change and unfold over time.²⁴ Head injured in children are commonly affected by post-concussion syndrome and cognitive impairment. A piece of quick advice and prompt treatment can allay worse outcomes. In the developed world, the availability of specialized intensive care units and by a

multidisciplinary approach, the outcome of head injury patients have improved dramatically, but it is still a major challenge for the neurosurgeons in developing nations like ours.⁵

Despite the development in the field of medicine in general and neurosurgery field, the significant morbidity and mortality persist in pediatric head injury patients.²³ It has been observed that the outcome of children is better than the adults. However, some studies claim that children below 5 years show a poor outcome.²⁷⁻²⁸ Garg et al²³ had observed that the patient's age bears a significant impact on the outcome. They reported a mortality rate of 57% in children below one year as compared to 12% in children older than 5 years. In this study, 69% of patients were boys which is consistent with findings. Rivera et al²⁹ had reported that the incidence of head injury in boys, doubles that of girls. Although this gender difference is important in the rate of head injury, it does not have adverse effects on ultimate outcome.

In our study, the commonest modes of head injury were 'falls' (63.33%), followed by road traffic accidents (25%), and 11.66% had other modes of injuries i.e., sports injury, firearm injury, and injury by something hit to head. In a study by Abrar,²⁵ the most common modes of head injury were falls (57%) followed by RTAs (33.8%) and other modes were in 6.7% only. Many authors had mentioned that GCS is an excellent predictor of outcome/mortality.^{30,31} Abrar²⁵ mentioned their patients with GCS 13 – 15 (57.3%) who had poor outcome (2.6%), followed by GCS 9 – 12 (29.8%) with poor outcome in 2.52% patients. In patients with GCS 8 or below (13%), a poor outcome was observed in 65.4% patients. A study by Astrand et al³² had shown a poor outcome of 0% in patients presenting with GCS of 13-15, in patients with GCS 9 – 12 as 6.2% and in patients with GCS 8 and below had 22% poor outcomes. In this study, the outcome was poor in severe head injury (GCS 8 or lower) and was noted in 11 (68.75%) patients, followed by moderate head

injury (GCS 9 – 12), the poor outcome was noted in 6 (27.27%) patients. If the injury was mild (GCS 13 – 15), then there was a poor outcome in 2 (2.43%) patients. In our study, we have noticed the presenting GCS as a strong determinant of clinical outcome. Ong et al³³ and Aldrich et al³⁴ have reported that the GCS as an unreliable predictor of outcome in the absence of conditions like hypoxia or ischemia. Due to poor resuscitation at the peripheral hospitals and late referral to Specialized Neurosurgical Units, patients do suffer from hypoxia leading to poor outcomes in such head-injured patients. A review of different studies has shown that falls i.e., from rooftop, stairs, windows, walls, and trees, are the commonest modes of head injury in children. It has been stressed to follow the preventive measures to avoid such injuries i.e., safer designs of houses, roof walls should have boundary walls and stairs should be well guarded. Environmental preventive measures – abide by traffic rules, use of seat belts, use of helmets, traffic calming measures, road safety measures, must be sustained to avoid the RTAs and head injuries.

CONCLUSION

From this study we concluded that:

1. Falls are the commonest modes of head injury followed by road traffic accidents, preventive measures related to the environment must be strictly observed to reduce the incidence of pediatric head injuries.
2. Primary resuscitation measures in peripheral hospitals must be followed to avoid hypoxia and secondary brain injury and early referral to Specialized Neurosurgical Units must be encouraged.

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Additional Information

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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.	Muhammad Asif	Study design and methodology.
2.	Muhammad Asif	Paper writing, referencing, data calculations and
3.	Waqar Aziz Rehman	Data collection and calculations.
4.	Sumaira Serwar	Analysis of data and interpretation of results etc.
5.	Muhammad Asif	Literature review and manuscript writing.
6.	Sumaira Serwar	Analysis of data and quality insurer.