International Journal of Community Medicine and Public Health
Rathod L et al. Int J Community Med Public Health. 2021 Oct;8(10):4950-4954
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20213800

Original Research Article

Clinical profile and outcome of traumatic brain injury in children: record-based descriptive study

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Received: 06 August 2021
Accepted: 13 September 2021

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ABSTRACT

Background: Paediatric head injury is considered to be a major public health problem and is often associated with significant morbidity and mortality in severe cases. The present study aimed to explore the demographics, mechanism of injury and clinical aspects of injury in children in a peripheral hospital attached to tertiary care centre.
Methods: Electronic medical records of all paediatric patients aged ≤12 years with traumatic brain injury admitted during one-year period from January to December 2018 were reviewed. Epidemiological and clinical data of paediatric patients with traumatic brain injury (TBI) were analysed using SPSS version 20.
Results: The medical records of 203 paediatric patients with TBI were analysed. The majority of the injury occurred in patients belonging to age-group 1-6 years. The number of male children outnumbered (58.1%) that of female children (41.9%). Fall from height was the most common mode of injury, followed by fall from a staircase. As per the Glasgow coma scale, 4% patients had severe head injury. Vomiting and headache was the most common symptom at admission (50.2%), a subdural hematoma was the most common lesion seen on computed tomography scans; frontal bone was the most common site of skull bone injury. Cutaneous injuries associated with contused lacerated wounds were the most common external injuries, 92.1% completely recovered with conservative management.
Conclusions: Increasing incidence of paediatric trauma suggests the need for supervision during play and identification of environmental risk factors for such injuries. Parental advice and supervision is recommended to prevent accidental falls.

Keywords: Glasgow coma scale, Mode of injury, Traumatic brain injury

INTRODUCTION

Traumatic brain injury (TBI), often referred to as the "silent epidemic", continues to be a growing public health concern and is the greatest contributor to death and disability among all trauma-related injuries globally.[1,2] Each year an estimated 69 million people worldwide are affected by TBI. Countries with low and middle incomes (LMICS) have a three-fold greater incidence of TBI when compared to high-income countries.[3] In India, children <15 years constitute 35% of the total population and contribute to 20-30% of all head injuries.[4] Head injury in infancy and childhood has been reported to be the single most common cause of death.[5] Several studies from developing countries have recorded TBI with a milder severity and most notably following motor vehicle accidents as a very serious public health problem.[6-9] Road traffic accidents (RTA) and falls from height are stated to be common causes of paediatric TBI.[10]

The impact of TBI is intense and can impair the child's neurophysiological functioning. Children who sustain TBI are at high risk for behavioural problems, and problems with adaptive functioning and educational performance.[11] Although more serious cases may cause greater levels of dysfunction, the majority of these cases are considered mild.[12] Mild TBI presents with concussion symptoms, affecting physical, cognitive, and emotional (affective) domains. Various degrees of autonomic and neurologic dysfunctions are seen in moderate and severe TBI cases in addition to mild TBI features.[13] TBI severity is assessed using the Glasgow coma scale (GCS) that assists in the assessment of the outcome of TBI cases. Therefore, thorough assessment is important if traumatic brain injury outcomes are to be accurately 'evaluated' in an emergency room. This will help in the long run to formulate preventive measures and programs for early detection that can reduce the effects of traumatic brain injury on the child, and decrease the duration of hospital stay and TBI-related complications. Therefore, this study was done to enhance the understanding of the mode of trauma, severity of injuries, and outcome in our hospital so that effective prevention and comprehensive management strategies could be established.

METHODS

Study setting and design

A record-based descriptive study was conducted among the cohort of paediatric cases with traumatic head injury, aged ≤12 years who presented to the emergency department (ED) during the period from January 2018 to December 2018 in a peripheral general hospital which is linked to Nair Municipal Medical College, Mumbai, Maharashtra, India. The study was conducted at Dr. Babasaheb Ambedkar Municipal General Hospital, Kandivali West, which is a 300-bedded hospital with a neurological intensive care unit and a paediatric intensive care unit. A comprehensive emergency department (ED) exists in this hospital, which provides lifesaving medical and surgical services to the patients under supervision of concerned specialists. Neurosurgical interventions are provided by neurosurgeons, and radiological images like head computerized tomography (CT) scans are read by radiologists at the hospital. The ED team initially manages and stabilizes all traumatic patients; for further management, patients who needed cross-consultation, are handed over to the respective specialty departments.

This peripheral hospital was set up to provide convenient and easy to access medical services for people seeking care for illnesses that do not require a visit to a major hospital. Over time, neurosurgical and orthopaedic emergencies were managed as well. In the present study, clinical data of all trauma patients aged ≤12 years presenting to the Emergency Department during the period from January 2018 to December 2018 were retrieved. The inclusion criteria were all patients who had sustained trauma through RTA, industrial incidents, electrical injuries, fall from height or level ground, or trauma related to assault, sports, and animals. Children with head injury who were managed on an outpatient basis, cases of sexual assault, poisoning, drowning, and patients with psychiatric disorders presenting with trauma were excluded from the study.

Data collection

Data of the patients were obtained from electronic hospital records. Details of history and physical examination findings of all patients were recorded on a standard data collection sheet. Patients were profiled in terms of demographics, mechanism of injury and the chief complaints they presented with, type of fracture, sinus involvement, presence of skeletal and visceral injuries, vital signs at the time of presentation, and computed tomography (CT) findings like skull fractures, parenchymal injuries and intracranial haemorrhages. The severity of head injury was assessed using the Glasgow coma score (GCS) [defined as mild (GCS: 13-15), moderate (GCS: 9-12) and severe (GCS: 3-8)]. Details regarding duration of admitted stay, and hospital outcome were also collected.

Statistical analysis

Data entry was done in Microsoft Excel spread sheets and analysed using SPSS software version 20.0 (SPSS Inc., Chicago). Descriptive statistics were calculated. Mean and standard deviations were used to present continuous variables.

RESULTS

There were 900 paediatric patients who visited the emergency department from January to December 2018, of which 203 (22.5%) had TBI during a one-year study period. Of the total 203 patients, the average age range from 1-12 years with the mean age of 4.31±2.81 years, out of which (74.4%) patients were in the pre-school age group (≤6 years). Among 203 trauma patients, 118 (58.1%) were males and 85 (41.9%) females.

Table 1: Demographic profile of TBI patients (n=203).

Characteristics	Frequency	Percentage
Age group (years)		
1-6	151	74.4
7-12	52	25.6
Gender		
Male	118	58.1
Female	85	41.9

It was observed that fall from a height (≤4 feet) was the most common mode of injury among trauma patients (27.6%) followed by fall from staircase (19.2%). Trauma was also reported among 18.2% cases presenting in the emergency department due to motor vehicle accident.

Two wheeler (motorcycle) accidents were the commonest mode of transport that resulted in accidents. The database also revealed that 15.8% trauma resulted due to fall from height, 11.8% due to trauma after being hit by an object and 7.4% due to fall while playing.

Table 2: Particulars related to traumatic brain injury (n=203).

Characteristics	Frequency	Percentage
Mode of trauma		
Fall from ≤4 feet	56	27.6
Fall from >4 feet	32	15.8
Fall from a staircase	39	19.2
Fall while playing	15	7.4
Hit by object	24	11.8
Injury due to RTA	37	18.2
Clinical presentation		
Vomiting and headache	102	50.2
Loss of consciousness	43	21.2
Convulsion	18	8.9
Type of fracture		
Compound	10	4.9
Linear	64	31.5
Depressed	06	3
Normal	123	60.6
Multiple bone injury of head		
Occipital	14	6.9
Frontal	19	9.4
Orbital	6	3.0
Temporal	9	4.4
Sphenoid	4	2.0
Parietal	17	8.4
Zygomatus	1	0.5
Mastoid	2	1.0
Nasal	1	0.5
Cribriform	3	1.5
Associated injury		
Cutaneous injury	106	52.2
Skeletal injury	10	4.9
Visceral injury	02	1.0
Scalp	43	21.2
CT findings		
Subdural haematoma (SDH)	15	17.4
Subarachnoid haematoma (SAH)	24	11.8
Extradural haematoma (EDH)	9	4.4
Presence of parenchymal injury	15	7.4

The baseline characteristics and clinical profile of the patients along with presenting complaints are mentioned in Table 1. Vomiting and headache (50.2%) were the most common presenting complaints after trauma followed by loss of consciousness (21.2%). Convulsions were reported in 8.9% of the cases. Majority of the patients (86.7%) had mild TBI based on GCS grading; 8.6% had moderate and 4.4% had to severe TBI (Figure 1). In the present study, we retrieved data regarding associated injuries among TBI patients. Majority of them had cutaneous injuries (52.2%) followed by scalp swelling (21.2%). Other associated injuries were skeletal (4.9%) comprising upper and lower limb injuries, and visceral injury (1%). The mean duration of stay in the hospital was 3.33 days (2SD: 1.41 days).

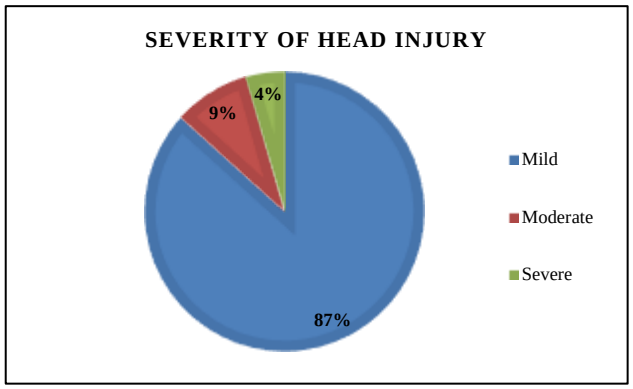

Figure 1: Severity of trauma among TBI patients as per Glasgow coma scale (GCS).

CT scan findings were noted as normal in 90 patients (44.3%), subarachnoid haemorrhage in 24 (11.8%), extradural haemorrhage (EDH) in 9 (4.4%), subdural haemorrhage (SDH) in 15 (7.4%) and subgaleal haemorrhage in 22 (10.8%). CT scan also revealed parenchymal injury (7.4%) showing haemorrhagic and non-haemorrhagic contusions and soft tissue contusions. Frontal bone fracture (9.4%) was the most common CT scan finding in children, followed by parietal bone fracture (8.4%). Majority of the TBI cases had a linear skull fracture (31.5%). Lacerated wounds over the face and scalp were the common concurrent injuries.

Table 3: Management and outcome of TBI patients.

Characteristics	Frequency	Percentage
Management		
Conservative management	187	92.1
Surgical intensive care unit (SICU)	14	6.9
Required surgery	1	0.5
Outcome of patient		
Recovered and discharged	190	93.6
Death	2	1.0
Referred to higher centre	9	4.4
Required neurosurgery	2	1.0

Most of the TBI cases (92.6%) were managed conservatively and the main indications for surgery were large extradural hematomas which was required for only 2 patients. The ED team along with concerned specialty treated and discharged 190 (93.6%) patients in a stable condition while the remaining 4.4% required referral to a

higher institute for further evaluation and treatment by the trauma surgical teams. Two patients died (1%), one of whom died within 2 days of admission and one who died within four days.

DISCUSSION

India is passing through a major sociodemographic, epidemiological, technological and media transition. India has witnessed rapid urbanisation, motorisation, industrialization and migration of people as a result of socio-economic development in the last two decades. In India, trauma is emerging as an epidemic with severe and far-reaching consequences for individuals and a leading cause of morbidity and mortality in children.[14] In India, up to a quarter of hospital admissions and roughly 15 % of children's deaths are caused by injury.[15]

In the emergency department, we observed male children were predominant trauma victims (58% of cases). In India, similar findings were seen in a study conducted by Mahapatra et al in Delhi, and Nitnaware et al in Maharashtra.[16,17] Various international studies have also confirmed a male preponderance.[18-20] However, Sambasivan et al has reported an equal number of males and females in the series on paediatric head injury.[21] It was seen that almost three-fourth paediatric cases affected in the age group from 0-6 years. The higher incidence of trauma among this age group may be explained by the fact that they start moving around by themselves and start going to nursery and school.

In this study, we have explored traumatic brain injury severity and mode of injury. Severity of traumatic brain injury is well determined by the mode of injury and has been a very important predicting factor. Data show fall from height <4 m as the most common cause of paediatric head injury. This peculiarly occurs from unguarded rooftops and open windows while the child is playing. Accidental fall was observed as the most cause of head injury in children in many studies.[22,23] However, Osmond et al from Canada cites motor accidents as the most common cause of injury.[19] Children fall is the most frequent cause of traumatic brain injury which stresses upon the need of preventive aspect to be dealt properly by the parents/family members.[24] Since most head injuries occurred at home in sport activities or during recreational activities, counselling of parents and children regarding home and sports safety for older children will be key in preventing such incidents.

Precisely early prediction of survival and functional outcome is crucial in life saving management. Therefore, the neurological scale, Glasgow coma scale (GCS), has utmost importance in describing the extent of impaired consciousness in acute head injury. It also helps predict the outcome. We have noted that GCS was good at presentation, as children have open fontanels and a greater ability to deal with head trauma as the intracranial tension does not increase with mild to moderate head trauma. GCS score predicted a severe outcome in 4% cases. Similar findings were observed in various studies related to head injury in children.[25,26] The most common clinical symptom noted after head injury in children was vomiting and headache (50.2%) followed by loss of consciousness (21.2%). Similar findings were reported by Maw et al.[26] The most common site of injury was the frontal bone and linear fracture was the most common fracture involved in head injury. Similar findings were observed by Maheshwari et al and Kumar et al.[27,28]

In the present study, it was observed that subdural haemorrhage was present in 17.4% cases followed by subarachnoid haemorrhage in 11.8%. In a study done by Kumar et al, it was observed that majority of the cases had subarachnoid haemorrhage (33%).[28]

In our study, 14 children (6.9%) were admitted in the surgical intensive care unit and 1 paediatric patient needed surgical intervention. It was noted that the majority of trauma cases (82.3%) needed hospitalization for less than 5 days and 17.7% of them had a hospital stay of 5 days and above.

CONCLUSION

The present study revealed that fall from height is a very common mode of injury. Many strategies can be implemented from a preventive standpoint: for example, installing furniture and beds away from the windows, installing good lighting over staircases for better visualisation and installing rugs and carpets to prevent the head from hitting a hard surface after a fall. Early intervention and active medical treatment are recommended to reduce morbidity and mortality when necessary especially for moderate and serious cases of head injury in children.

ACKNOWLEDGEMENTS

The principal author would like to thank the records department at the hospital for their continuous support during data collection.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Rathod L, Shidam UG, Kesaria R, Mohata S, Lakhe P, Prabhudesai S, et al. Clinical profile and outcome of traumatic brain injury in children: record-based descriptive study. Int J Community Med Public Health 2021;8:4950-4.