Original Research Article

Outcome of head injury among paediatric patients in a tertiary care institute

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Abstract

Background: Head injury in children accounts for a large number of emergency department visits and hospital admissions and is reported to be the leading cause of death and disability in children around the world. The Center for Disease Control (CDC) and Prevention and the National Center for Injury Prevention and Control label traumatic brain injury (TBI) a "silent epidemic." **Objective:** To study the outcome of head injury among paediatric patients reporting to a tertiary care institute. **Materials and Method:** All paediatric patients between ages one to 16 years, admitted with a history of head injury were included in the study. Children with underlying seizure disorder and with bleeding disorder were excluded from the study. Thus total 102 cases of head injury were enrolled in the present study. All patients were analyzed and classified according to their age, sex, pattern of injury, symptoms and examination findings at the time of presentation, CT Brain findings (if done), Glasgow Coma score. Patients managed in either pediatric ward or pediatric intensive care unit depending upon their severity and short term outcome analyzed at the time of discharge. **Results:** The incidence of head injury was more common in ≤ 5 years old children (45.1%). Fall from height was the most common cause (60.8%) of head injury in children followed by Accidents (25.5%), Strike against any object (10.8%) and Fights (2.9%). Good outcome was observed in 91 (89.22%) patients. Disability was observed in 7 (6.86%) patients. Case fatality rate of head injury was observed to be of 3.92%. Vomiting was the most common symptom following head injury. Vomiting and headache was not statistically significant as far as morbidity and mortality was concerned. Altered sensorium (0.008) was associated with poor outcome. All 4 patients who expired and 4 of who disabled had altered sensorium at the time of presentation. Seizures (0.007), depressed fracture (<0.001), associated injuries (<0.001), lacerations (<0.001) and swelling (0.03) were associated with poor outcome. Glasgow coma score ≤8 was associated with poor outcome. Presence of cerebral edema, extradural hematoma, subdural hematoma, contusions and cerebral herniation were more common in disabled and expired children. Surgical management was required only in 4 (3.92%) patients, rest of the patients were managed with medical treatment. **Conclusion:** Majority of the patients of head injury had good outcome. Disability was observed in 6.86% patients and case fatality rate of head injury was observed to be of 3.92%. Altered sensorium, Seizures, depressed fracture, associated injuries, lacerations, swelling and GCS ≤ 8 were associated with poor outcome. Presence of cerebral edema, extradural hematoma, subdural hematoma, contusions and cerebral herniation were more common in disabled and expired children.

Key Words: Head injury in children, outcome, Altered sensorium, Disability.

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INTRODUCTION

Traumatic brain injury in children accounts for a large number of emergency department visits and hospital admissions and is reported to be the leading cause of death and disability in children around the world. The Center for Disease Control (CDC) and Prevention and the National Center for Injury Prevention and Control label traumatic brain injury (TBI) a "silent epidemic." A head injury is divided into closed head injury and open head injury depending on intactness of dura mater. In closed head injury dura remains intact irrespective of whether the skull is fractured or not whereas in open head injury

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dura is lacerated or torn and it is open to possible infection.[1] An injury of the head may involve the scalp, the skull, the meninges or the brain itself. These structures may be involved singly or in any combination.[2] Injury to the brain can be divided in two i.e. primary and secondary injuries. Primary brain injury occurs at the time of impact due to diffuse neuronal lesion. Secondary brain injury occurs due to cerebral edema or intracranial haemorrhage.[3] Several factors influence childhood injuries, including age, sex, behavior and environment. Among all these, age and sex are the most important factors affecting the pattern of injury. Children of age up to 4 years and adolescents of age 15-19 years are most likely to sustain traumatic brain injury. In every age group, traumatic brain injury rates are higher for males than females. Males aged up to 4 years have highest rates of TBI related emergency department visits.[4] all these factors affect the outcome of head injury.

MATERIALS AND METHOD

The present longitudinal observational study was conducted in the department of pediatrics of KEM hospital Pune, a tertiary care hospital with 28 bedded pediatric ward and 10 bedded pediatric intensive care unit. The study was conducted from February 2013 to April 2014. All paediatric patients between ages one to 16 years, admitted with a history of head injury were included in the study. Children with underlying seizure disorder and with bleeding disorder were excluded from the study. Thus total 102 cases of head injury were enrolled in the present study. Demographic data of the enrolled patients including name, age, sex, detailed address was recorded on a prestructured proforma. Details of trauma, time of injury, mode of injury, type of treatment received before arrival, state of consciousness, symptoms before and at presentation was also recorded. Clinical data including temperature, heart rate, respiratory rate and pattern, blood pressure, capillary refill time, associated injuries, modified Glasgow coma scale, detail neurological examination were noted. CT scan was performed in selected patients of required. All the patients were managed as per standard protocol. All the patients were followed up regularly and the outcome was recorded. The collected data was entered in Microsoft excel and was analysed. Qualitative data such as symptoms and signs at presentation, CT brain findings expressed in frequency and percentage.

RESULTS

Table 1: Age and sex wise distribution of study patients

	Age (yrs)	No. of patients (n=102)	Percentage
Age group	≤ 5	46	45.1%
	5.1 – 10	35	34.3%
	> 10	21	20.6%
Gender	Male	68	66.7%
	Female	34	33.3%
Mode of Injury	Fall	62	60.8%
	Accident	26	25.5%
	Fights	03	02.9%
	Strike	11	10.8%

In the present study incidence of head injury was more common in ≤ 5 years old children (45.1%). The incidence of head injury was two times more common in males (66.7%) compared to females (33.3%). It was observed that fall from height was the most common cause (60.8%) of head injury in children followed by Accidents (25.5%), Strike against any object (10.8%) and Fights (2.9%).

Table 2: Distribution of patients according to outcome

Outcome	No. of patients (n=102)	Percentage
Good	91	89.22
Disabled	7	6.86
Expired	4	3.92

It was seen that out of total 102 patients of head injury good outcome was observed in 91 (89.22%) patients. Disability was observed in 7 (6.86%) patients. Case fatality rate of head injury was observed to be of 3.92%.

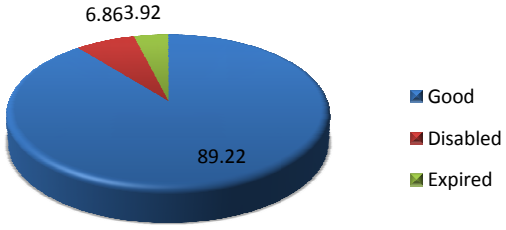

Figure 1: Distribution of patients according to outcome

Table 3: Distribution of patients with respect to symptoms at the time of presentation and outcome

Symptoms*		Outcome			Total	*p*-value
		Good	Disabled	Expired		
Vomiting	Present	40	5	1	46	0.291
	Absent	51	2	3	56	
Headache	Present	19	3	0	22	0.223
	Absent	72	4	4	80	
Altered Sensorium	Present	23	2	4	29	0.008*
	Absent	68	5	0	73	
Seizure	Present	18	4	3	25	0.007*
	Absent	73	3	1	77	
Laceration	Present	18	4	2	24	< 0.001*
	Absent	73	3	2	78	
Swelling	Present	34	7	4	45	0.03*
	Absent	57	0	0	57	
Depressed Fracture	Present	2	2	3	7	< 0.001*
	Absent	89	5	1	95	
Associated Injury	Present	13	6	3	22	< 0.001*
	Absent	78	1	1	80	

*Multiple responses obtained

Vomiting was the most common symptom following head injury. Vomiting and headache was not statistically significant as far as morbidity and mortality was concerned. Altered sensorium (p=0.008) was associated with poor outcome. All 4 patients who expired had altered sensorium at the time of presentation. Seizures (p=0.007), depressed fracture (p<0.001), associated injuries (p< 0.001), lacerations (p<0.001), swelling (p=0.03) were also associated with poor outcome.

Table 4: Distribution of patients with respect to Glasgow coma score and outcome

Glasgow coma Scale	Outcome			Total	*p*-value
	Good	Disabled	Expired		
≤ 8	3	4	4	11	< 0.001
9 – 12	24	3	0	27	
> 12	64	0	0	64	
Total	**91**	**7**	**4**	**102**	

In the present study, Glasgow coma score ≤ 8 was associated with poor outcome. Out of 11 children who had severe head injury (GCS ≤ 8) 4 expired and 4 were disabled. Glasgow coma score > 12 was associated with good outcome.

Table 5: Distribution of patients with respect to CT scan findings and outcome

CT Scan Findings		Outcome			Total	p-value
		Good	Disabled	Expired		
Normal	Present	16	0	0	16	0.640
	Absent	75	7	4	86	
Fracture	Present	18	3	1	22	0.279
	Absent	73	4	3	80	
Cerebral Edema	Present	12	4	2	18	0.005*
	Absent	79	3	2	84	
Extradural hematoma	Present	2	3	2	7	<0.001*
	Absent	89	4	2	95	
Subdural hematoma	Present	0	1	2	3	<0.001*
	Absent	91	6	2	99	
Contusions	Present	2	4	1	7	<0.001*
	Absent	89	3	3	95	
Herniation	Present	0	0	1	1	0.039*
	Absent	91	7	3	101	

It was observed that skull fracture was the most common finding on CT brain but it was not statistically significant as far as morbidity and mortality was concerned. Presence of cerebral edema, extradural hematoma, subdural hematoma, contusions and cerebral herniation were more common in disabled and expired children.

Table 6: Distribution of patients with respect to intervention required

Interventions required*		No. of patients	Percentage
Medical	Fluid resuscitation	55	53.92%
	Mannitol	32	31.37%
	Anticonvulsants	31	30.39%
	Ventilation	12	11.76%
	Ionotropes	9	8.82%
Surgical	Craniectomy	4	3.92%

*Multiple responses obtained

The above table shows, that surgical management was required only in 4 (3.92%) patients. All the rest were managed with medical treatment. Fluid resuscitation (53.92%) was the most common medical management followed by was manitol (31.37%) and anticonvulsant (30.39%).

DISCUSSION

The present prospective observational study was conducted in department of pediatric of KEM Hospital, Pune, a tertiary care hospital to study the Outcome of head injury among paediatric patients. This study included a total of 102 children with head injury, out of which 36 children required pediatric intensive care and 45 children out of 66 who were admitted in the pediatric ward required only observation. A total of 91 children were normal at discharge, 7 children had some form of disability and 4 expired during hospitalization because of head injury. It was observed that incidence of head injury was more common in ≤ 5 years old children (45.1%). Holn Bon *et al*[5] reported similar findings. Udoh *et al*[6] found incidence more in 7-10 years old children. It was seen that boys (66.7%) were more prone to head injury as compared to girls (33.3%). Hassen *et al*,[7] verma *et al*,[8] Chabok *et al*,[9] Haln Bon *et al*[5] and Shao *et al*[10] also reported similar findings in their studies. Fall from a height constituted the commonest cause of head injury (60.8%) in the present study, followed by road traffic accidents (25.5%), Strike against any object (10.8%) and Fights (2.9%) were observed. Verma *et al*,[11] Bhargawa *et al*,[12] Shao *et al*[10], Zhu *et al*[13], Siraj *et al*,[14] and Lee *et al*[15] reported similar findings in their studies. However Chabok *et al*[9] found accidents as the commonest cause. Vomiting was the most common symptom following head injury. Vomiting and headache was not statistically significant as far as morbidity and mortality was concerned. Altered sensorium (p=0.008) was associated with poor outcome. All 4 patients who expired had altered sensorium at the time of presentation. Seizures (p=0.007), depressed fracture (p<0.001), associated injuries (p< 0.001), lacerations (p<0.001), swelling (p=0.03) were also associated with poor outcome and the difference observed was also statistically significant. Thus altered sensorium, seizures, presence of associated injuries or depressed fracture at the time of admission was found to be associated with poor outcome. It was seen that Glasgow Coma score (GCS) of ≤ 8 was poor predictors of outcome. Out of 11 children who had severe head injury (GCS ≤ 8) 4 expired and 4 were disabled. Glasgow coma score > 12 was associated with good outcome. Grinkeviciute *et al*[16] reported a threshold of 5 for GCS was associated with potential mortality in children with severe head injury. Kamal *et al*[17] reported GCS < 12 as an important predictor of death or neurological deficit. Suresh *et al*[18] and Udoh *et al*[6] found GCS score of ≤ 8 as a poor predictor of outcome. Ghaffarpasand *et al*[19] suggested in pediatric age group the cut-off value for severe traumatic brain injury should be set at 5 instead of 8 in order to predict the outcome more precisely. In the present study CT scan was performed in total 74 children. The children who had mild head injury did not require neuroimaging. Shireen *et al*[20] also suggested no role of CT in mild childhood head injury in the absence of risk factors. Risk factors in such situation were dizziness, skull fracture, sensory deficit, mental status changes, age younger than 2 yrs, Glasgow Coma Scale score less than 15, and evidence of basilar skull fracture. Skull fracture was the most common finding on CT scan followed by cerebral edema, contusions, extradural hemorrhage, subdural hemorrhage and herniation. Ciurea *et al*[9] reported similar findings in their study, whereas Suresh *et al*[18] found contusions and Bhargawa *et al*[12] found extradural hematoma as most common lesion on CT brain in pediatric patients of traumatic head injury. Cerebral edema, extradural hematoma, subdural hematoma and cerebral herniation were found to be associated with poor outcome. Three patients had subdural hematoma out of which two expired and 1 was disabled. One patient had cerebral herniation that expired. It was seen that 47 patients did not require any treatment and were discharged after 24 hours of observation. Surgical management was required only in 4 (3.92%) patients. All the rest were managed with medical treatment. Four children required craniectomy out of which two expired and one was disabled. 12 children required ventilation out of which four expired and three were disabled. Fluid resuscitation (53.92%) was the most common medical management followed by was manitol (31.37%) and anticonvulsant (30.39%). Lee *et al*[15]

studied pediatric head injury in 96 patients at Kyungpook National University Hospital, Korea. They Found that Pedestrian vehicle accident and fall as leading causes. They concluded that outcome of the pediatric head injury was significantly related to the initial mentality, worsening of hematoma or edema on follow up CT scan, and complications such as pneumonia and electrolyte imbalance during admission. Early recognition of these factors would contribute to the improvement of the outcome of the pediatric head injury patients. Greenwood R *et al*[21] discussed causes, pathology, imaging, associated problems and predictors. According to him admission Glasgow Coma score, papillary responses, hypoxic injuries, imaging findings and depth of lesion are predictors to formulate prognosis when the patient is seen subacutely. Suresh *et al*[18] studied prognosis of head injury in 340 children and found that Glasgow coma scale, pupillary reaction and ocular movements as very significant predictors of outcome. In increasing order fracture, extradural hemorrhage, contusion, diffuse head injury and acute subdural hemorrhage had poor outcome. Khilnani P. *et al*[22] discussed the pathogenesis, clinical evaluation and various aspects of management of pediatric head injury. He found that the outcome after severe head injury is poor in children less than 4 years of age. Severe traumatic brain injury is a common problem with significant morbidity and mortality and a proper medical management needs an organized team approach ranging from prehospital care, emergency room and pediatric intensive care management. He also suggested use of helmets, seat belts, infant seats and restraints are probably most important measures to prevent severe injuries in case of an accident. In addition, child and adult education regarding road safety, following traffic signals, care during road crossing can go a long way. Kamal *et al*[23] did a study to find out predictors of outcome in pediatric intensive care unit following traumatic brain injury in pediatric age group. They studied 106 children less than 12 years of age who had traumatic brain injury. They found that most important risk factors for death or neurological deficit are combined brain pathologies and GCS ≤8. They concluded Glasgow coma score, brain CT findings, combined brain pathologies, hypotension, high liver enzymes and low serum albumin predict outcome after TBI in pediatric age group.

CONCLUSION

We conclude that majority of the patients of head injury had good outcome. Disability was observed in 6.86% patients and case fatality rate of head injury was observed to be of 3.92%. Altered sensorium, Seizures, depressed fracture, associated injuries, lacerations, swelling and GCS ≤ 8 were associated with poor outcome. Presence of cerebral edema, extradural hematoma, subdural hematoma, contusions and cerebral herniation were more common in disabled and expired children.

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