International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Predictors of Outcome in Pediatric Head Injury at a Teaching Hospital, Chitwan

Subina Bajracharya[1], Ajit Shrestha[2]

[1]Associate Professor, School of Nursing, Chitwan Medical College, Bharatpur, Chitwan, Nepal
Corresponding Author Email: *bajracharyasubina[at]gmail.com*

[2]Associate Professor, Neurosurgery Unit, Department of Surgery, Chitwan Medical College, Bharatpur, Chitwan, Nepal
Email- *ajitligal[at]gmail.com*

Abstract: ***Head injury a significant cause of morbidity and mortality in children worldwide. The outlook of head injury still continues to be a major challenge in our part of the world. This study explored the predictors of outcome in pediatric head injury. All the patients from 1 day to 18 years admitted with head injury in different departments of Chitwan Medical College over the period of 5 years (2016/1/1 to 2020/12/31) were studied retrospectively. Data were collected from patient's record using semi-structured data collection performa and analyzed using descriptive and inferential statistics. The outcome of all these patients was assessed by Glasgow outcome scale and divided into favorable (normal, moderate disability) and unfavorable (severe, vegetative, dead) outcome. Outcome was assessed in relation to age, sex, mode of injury, diagnosis, surgical intervention, associated injury and GCS at admission. A total of 419 patients were included in the study comprising 69.2% males and 30.8% females, 36.8% were from age group 1-5 years (mean age 8.56 years S.D. 5.41). The common modes of injury were road traffic accidents (52.7%) followed by fall (43.4%). Highest number of patients had skull fracture (28.9%), followed by EDH (22.2%). Surgical interventions were required in 24.3% and 16.5% had other associated injuries. Majority of patients had mild head injury (63.5%), followed by moderate head injury (25.1%) and severe head injury (11.5%). Favorable outcome was seen in 95.2% while 4.8% had unfavorable outcome with mortality rate of 3.6%.Association between outcomes of head injury with diagnosis and severity of head injury were statistically significant (p<0.05). Outcome was greatly influenced by GCS at admission, as ratio of unfavorable outcome was greater with severe head injury.***

Keywords: Pediatric; Head injury; Glasgow Coma Scale, Outcome

1. Introduction

Head injury aka traumatic brain injury is a broad and inclusive term designating a wide range of pathology that results from an external force to the cranium and underlying brain. Pediatric head injurya silent epidemic is a significant public health concern that affects nearly every population and every demographic regardless of location or socioeconomic status. Using the most conservative incidence estimates of 50 per 100,000 persons, head injury affects more than 3 million children worldwide every year.[1]Incidence rate ranged from 75 to 1,373 per 100,000 among children aged below 15 years in the United States, Australia, and New Zealand. However, the public health importance of these injuries remains underemphasized and neglected in developing countries.[2]

Injuries claimed 4.9 million lives globally in 2016. More than quarters (29%) of these deaths were due to road traffic injuries. Low-income countries had the highest mortality rate due to road traffic injuries with 29.4 deaths per 100 000 population. The global rate was 18.8. Road traffic injuries were also among the leading 10 causes of death in low, lower middle and upper-middle-income countries.[3]

Head injury affects children differently than adults. An injury of any severity to the developing brain can disrupt a child's developmental trajectory that results in changes affecting a child's daily life. Glasgow Coma Scale (GCS), and the pediatric coma scale measure the severity of head injury. As defined by the GCS, a score of 13-15 is labeled as mild, a score of 8-12 is labeled a moderate, and a score less than 8 is labeled a severe head injury.[4]

Head injury in children forms a major subset of trauma patients. The outcome in these patients is distinctive because of the unique biophysical properties of the child's skull and brain. The outcome in children with head injuries in various studies varies widely with a mortality ranging from 9% to 75% (in severe head injury).The special attributes of the pediatric skull and brain accounts for their outcome being different than in adults.[5]

Head injury is a main cause of functional disability and death in children worldwide. The epidemiologic characteristics and outcomes of pediatric head injury have not been adequately documented.[6]Though having a significant burden on public health; importance of these injuries remains underemphasized and neglected in developing countries like ours.

2. Methods

This is a five-year retrospective study of clinical records of all patients from 1 day to 18 years, treated for head injury at different departments of Chitwan Medical College, teaching hospital between 2016/1/1 to 2020/12/31. Data collection performa was used for collecting the data of 419 patients. Detailed history of the patients was taken which included age, sex, mode of injury, diagnosis, surgical intervention, associated injury, GCS at admission and GOS (Glasgow Outcome Scale) at discharge. Based on GCS, the patients were divided into mild head injury (GCS 13–15), moderate head injury (GCS 9–12), and severe head injury (GCS ≤ 8) categories. The outcome of all these patients was assessed by Glasgow outcome scale and divided into favorable (normal, moderate disability) and unfavorable (severe,

vegetative, dead) outcome. Outcome was assessed in relation to age, sex, mode of injury, diagnosis, surgical intervention, associated injury and GCS at admission.

Ethical approval was obtained from Chitwan Medical College Institutional Review Committee (CMC-IRC). Obtained data were analyzed using descriptive statistics (frequency, percentage, mean and standard deviation) for socio-demographic information. Inferential statistics (chi square) was used for measuring the association between outcome of head injury and its predictors.

3. Results

Table 1: Socio-demographic Characteristics, n=419

Variables	Frequency (%)
Age group*	
1-5yrs	154 (36.8%)
6-11yrs	132 (31.5%)
12-18yrs	133 (31.7%)
Sex	
Male	290 (69.2%)
Female	129 (30.8%)
Address	
Chitwan	214 (51.1%)
Out of Chitwan	205 (48.9%)
Area of stay in hospital	
Ward	110 (26.3%)
HDU	61 (14.6%)
ICU	248 (59.2%)
Outcome of hospitalization	
Discharged	351 (83.8%)
Transferred	32 (7.6%)
Referred	2 (0.5%)
Absconded	1 (0.2%)
Discharged on request	18 (4.3%)
Expired	15 (3.6%)

**Mean 8.56 years S.D. 5.41*

Table 1 presents the socio-demographic characteristics of the patients. Maximum number of patients (36.8%) was from the age group 1-5 years with mean age 8.56±5.41; most of them (69.2%) were male, almost half (51.1%) of the patients were from Chitwan district. Maximum number (59.2%) of the patients was admitted in ICU and majority of the patients (83.8) were discharged from hospital, while 3.6% of the patients expired.

Table 2: Injury related Characteristics, n=419

Variables	Frequency (%)
Diagnosis	
Contusion	68 (16.2%)
Skull fracture	121(28.9%)
EDH (Epidural hematoma)	93 (22.2%)
SDH (Subdural hematoma)	28 (6.7%)
SAH (Subarachnoid hemorrhage)	26 (6.2%)
Diffuse Axonal injury	28 (6.7%)
Others*	55 (13.1%)
Mode of injury	
Fall	182 (43.4%)
RTA	221 (52.7%)
Physical assault	16 (3.8%)
Associated Injury	
Present	69 (16.5%)
Absent	350 (83.5%)
Surgery	
Done	102 (24.3%)
Not done	317 (75.7%)
Type of surgery (n-102)	
Craniotomy	91 (89.2%)
Debridement	11 (10.8%)

**Others-abrasion, avulsion, concussion & laceration*

Table 2 shows the injury related characteristics of the patients with head injury. Highest number of patients (28.9%) presented with skull fracture followed by EDH (22.2%), least number of patients had SAH (6.2%). Road traffic accident was the commonest (52.7%) mode of injury followed by fall (43.4%). Associated other injuries were present in 16.5%. Surgery was performed in 24.3% of the patients and among them craniotomy was the commonest procedure performed (89.2%).

Table 3: Glasgow Coma and Outcome Scale Score of the Patients with Head Injury, n=419

Variables	Frequency (%)
Glasgow Coma Scale (GCS)	
Mild	266 (63.5%)
Moderate	105 (25.1%)
Severe	48 (11.5%)
Glasgow Outcome Scale (GOS)	
Death	15 (3.6%)
Persistent vegetative state	3 (0.7%)
Severe disability	2 (0.5%)
Moderate disability	26 (6.2%)
Good recovery	373 (89%)
GOS	
Favorable Outcome	399 (95.2%)
Unfavorable Outcome	20 (4.8%)

Table 3 presents the Glasgow coma and outcome scale of the patients. Highest number of patients had mild head injury (63.5%), and 11.5% had severe head injury. Good recovery was found in 89% of the patients and mortality was found to be 3.6%. Re-categorizing the outcome scale into favorable and unfavorable by merging GOS score 1, 2 and 3 as unfavorable and 4 and 5 as favorable, it was found that 95.2% of the patients had favorable outcome and 4.8% had unfavorable outcome.

Table 4: Association between Outcomes of Head Injury with Selected Variables

Variables	Outcome		χ^2	*p*- value
	Favorable No. (%)	Unfavorable No. (%)		
Age group			0.727	0.695
1-5 years	148 (96.1%)	6 (3.9%)		
6-11 years	126 (95.5)	6 (4.5%)		
12-18 years	125 (94%)	8 (6%)		
Sex				0.566

Male	275 (94.8%)	15 (5.2%)	0.33	
Female	124 (96.1%)	5 (3.9%)		
Mode of injury				
Fall	176 (96.7%)	6 (3.3%)		
RTA	207 (93.7%)	14 (6.3%)	2.861	0.164€
Physical assault	16 (100%)	0		
Diagnosis				
Contusion	63 (92.6%)	5 (7.4%)		
Skull fracture	119 (98.3%)	2 (1.7%)		
EDH	92 (98.9%)	1 (1.1%)	26.691	0.000€
SDH	27 (96.4%)	1(3.6%)		
SAH	24 (92.3%)	1 (7.7%)		
Diffuse axonal injury	20 (71.4%)	8 (28.6%)		
Others*	54 (98.2%)	1 (1.8%)		
Surgery				
Done	98 (96.1%)	4 (3.9%)	0.215	0.636€
Not done	301 (95%)	16 (5%)		
Associated injury				
Present	66 (95.7%)	3 (4.3%)	0.033	0.854
Not present	333 (95.1%)	17 (4.9%)		
Severity of Head Injury				
Mild	265 (99.6%)	1 (0.4%)		
Moderate	104 (99%)	1 (1%)	127.791	.000€
Severe	30 (62.5%)	18 (37.5%)		

Significant Level at 0.05 *€ Fischer's Exact* **Others-abrasion, avulsion, concussion & laceration*

Table 4 shows the association between outcomes of head injury with selected variables. Statistically significant association was not found between outcomes and age, sex, mode of injury, performance of surgery and presence of associated injury ($p>0.05$). Association between diagnosis and outcomes of head injury and severity of head injury and outcomes of head injury were found to be statistically significant ($p<0.05$)

4. Discussion

Head injury in children represents a significant public health burden. This study showed that the male child is more at risk (69.2%) of head injury than the female, and the under-five groups (36.8%) are particularly more vulnerable. The reason for the male preponderance was not obvious from the study. However, a study conducted in Ilorin also observed higher incidence in males (65%) within similar age bracket[7], findings of other studies also were similar 61.2%[8],63%[9]and 81%[6]incidence in male children. However one study revealed that the most affected group was teenagers (15–18 years; 40%) followed by infants/toddlers (≤ 4 years; 23%)[6]. Children in the age group of 0–5 years are often left in the care of adolescent or young adults, who may be negligent or inexperienced in their role to care for and monitor the child.

Road traffic accident was the commonest (52.7%) mode of injury followed by fall (43.4%) in this study. The finding is supported by other studies that revealed road traffic collision (47.3%) was the most frequent mechanism of injury followed by falls (21.6%)[6]. The rate of RTA was greatest in Africa and Southeast Asia (56%)[1]. Contrary findings were revealed in another study, which showed fall (57%) was the commonest mode followed by RTA (33.8%)[9].

Highest numbers of patients (28.9%) were diagnosed with skull fracture followed by epidural hematoma (22.2%) and contusion (16.2%). The outcome had statistically significant association with the diagnosis of patient. Patient with diffuse axonal injury had more unfavorable outcome compared to other groups ($p<0.05$).

Surgery was performed in 24.3% of the patients and among them craniotomy was the commonest procedure performed (89.2%).Contrary to this finding only 3.7% of the cases with head injury required neurosurgical intervention in the other study[8].The higher number of surgical intervention in current study could be explained by fact that minor injuries might have been managed at local health centers and injuries requiring interventions were referred to this tertiary level hospital.

The current study revealed that maximum number (59.2%) of patients required ICU care and majority of the patients (83.8) were discharged from hospital. The rate of discharge was similar in another study that showed 82% of patients were discharged with complete recovery[10]. Mortality rate was at 3.6% in this study, which is lower than other studies that showed 5.7%[9] and 13%[6] mortality.

The study revealed that highest number of patients had mild head injury (63.5%), followed by moderate head injury in 25.1% and 11.5% had severe head injury. The finding is similar to another study, which revealed majority of patients had mild head injury (57.3%), followed by moderate head injury (29.8%), and severe head injury (13%)[9]. In this study, good recovery was found in 89% of the patients. 95.2% of the patients had favorable outcome and 4.8% had unfavorable outcome. The finding is similar to another study that showed normal outcome of 81.9%[9].

It was found that GCS at admission had significant impact on outcome. The patients with low GCS had a poor outcome as is expected. The patients who had a GCS of 13-15 had unfavorable outcome in 0.4%, followed by GCS of 9-12

with 1% unfavorable outcome, and followed by GCS of 8 or less with 37.5% unfavorable outcome. Association between GCS score and outcomes of head injury was found to be statistically significant ($p<0.05$). Study conducted in India revealed the similar findings. The patients who had a GCS of 13-15 had a poor outcome in 2.6%, followed by GCS of 9-12 who had a poor outcome in 2.52%, followed by GCS of 8 or less who had a poor outcome in 65.4%, which was statistically significant ($p<0.05$)[9]. The developing and underdeveloped areas like ours have poorer outcome probably due to lack of pre-hospital resuscitation and late presentation to hospital.

5. Conclusion

Male children were at more risk for head injury as more than $2/3^{rd}$ of the patients were male. Under 5 years children were more vulnerable. RTA was the commonest cause of head injury followed by falls. Skull fracture was the most common diagnosis. More than half of the patients required ICU care; $1/4^{th}$ of patients required surgical intervention. Only $1/10^{th}$ of the patients suffered from severe head injury but the outcome was greatly influenced by GCS at admission as more severe the head injury more unfavorable was the outcome.

Patients with head injury often require intensive care including greater amount of time required from the surgical and nursing team. The causes behind injury are most often preventable. The outlook can be better if preventive efforts are geared toward domestic and road safety campaign, including better orientation of road safety law enforcement agents and awareness programs for children, teachers, parents, and caregivers.

References

[1] Dewan MC, Mummareddy N, Wellons III JC, Bonfield CM, The epidemiology of global pediatric traumatic brain injury: a qualitative review, *World Neurosurgery*. 2016, doi: 10.1016/ j.wneu.2016.03.045.
[2] Yusuf AS, Adeleke NA, Omokanye HK, Nasir AA, Kolade OA. Clinical parameters, management, and outcomes of childhood traumatic brain injury in Ilorin. *Journal of Pediatric Neuroscience*. 2019; 14; 127-32
[3] Global Health Estimates 2016: Deaths by Cause, Age, Sex, by Country and by Region, 2000-2016. Geneva, *World Health Organization*. 2018.
[4] Centers for Disease Control and Prevention. Report to Congress: The Management of Traumatic Brain Injury in Children. *National Center for Injury Prevention and Control; Division of Unintentional Injury Prevention. Atlanta, GA.* 2018
[5] Suresh HS, Praharaj SS, Indira Devi B, Shukla D, Sastry Kolluri VR. Prognosis in children with head injury: An analysis of 340 patients. *Neurology India*. 2003; 51: 8-16
[6] El-Menyar A, Consunji R, Al-Thani H, Mekkodathil A, Jabbour G, Alyafei KA. Pediatric Traumatic Brain Injury: a 5-year descriptive study from the National Trauma Center in Qatar. *World Journal of Emergency Surgery*. 2017 12, 48. https://doi.org/10.1186/s13017-017-0159-9
[7] Yusuf AS, Adeleke NA, Omokanye HK, Nasir AA, Kolade OA. Clinical parameters, management and outcomes of childhood traumatic brain injury in Ilorin. *Journal of Pediatric Neurosciences.* 2019; 14;127-32
[8] García García JJ, Manrique Martínez I, TrenchsSainz de la Maza V, Suárez Suárez A, Martín de la Rosa L, Travería Casanova FJ, Sebastián Barberan V, Crespo Rupérez E, AlcaláMinagorre PJ, Canals Baeza A, Sitjes Costas J, Nadal Amat J, LuacesCubells C. Registry of mild cranio-cerebral trauma: multicenter study from the Spanish Association of Pediatric emergencies. *AnPediatr (Barc).* 2009; 71(1):31-7
[9] Wani AA, Sarmast AH, Ahangar M, Malik NK,Chhibber SS, Arif SH, Ramzan AU, Dar BA,Ali Z.Pediatric Head Injury: A Study of 403 Cases in a Tertiary Care Hospital in a Developing Country. *Journal of Pediatric Neuroscience.* 2017 Oct-Dec; 12(4): 332–337. doi: 10.4103/jpn.JPN_80_17
[10] Iranmanesh F. Outcome of head trauma. *The Indian Journal of Pediatrics*. 2009. 76: 929 https://doi.org/10.1007/s12098-009-0143-9