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Head Injury in Children: A Tertiary Care Centre Study

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ABSTRACT

Aim and objective: To investigate various prognostic factors associated and their effect on the neurological outcome among children with a head injury on the basis of mode of injury, GCS at time of admission, pupillary response, hypoxia, CT scan findings and time of surgical intervention.
Methods: This was a prospective observational study of thirty-four children (age<15 years) with a head injury, managed in the P.G. Department of surgery, S.R.N. Hospital associated with M.L.N Medical college, Allahabad from September 2015 to August 2016 a period of 12 months. The factors affecting the outcome were analyzed.
Results: Out of the 34 children, there were 7 children less than 5 years and 27 were above 5 years of age. Poor outcome was seen in 42.8% children below 5 years, 35.7% in 6-10 years group, 15.3% in 11-15 years group. Male: female ratio was approximately 1:2. There were 4 patients in GCS of 3-8, of which 3 (75%) had a poor outcome; while out of 12 patients of GCS 9-12, 7 (58.3%) had poor outcome. Out of 18 patients in GCS 13-15, no patient had poor outcome. Twelve patients had abnormality of pupillary size and reaction, poor outcome was seen in 58.33% in contrast to only 13.6% with normal pupillary response. There were 12 patients with acute subdural hematoma, 5 patients had contusion, extradural hematoma in 11 patients, subarachnoid haemorrhage in 1 patient and multiple brain injuries in 5 patients. Poor outcome was noticed in 80% patients with multiple brain injuries, 20% with contusion, 18.18% with acute subdural hematoma and 16.6% with extradural hematoma. Poor outcome noticed in 63.6% patients with midline shift > 5mm. Non-operated patients had poor outcome (45.4%) than operated patients (21.7%). Poor outcome was noticed in 23.5% patients operated after 24 hour and 16.6% patients operated within 24 hour (Table 3). Overall poor outcome was seen in 10 (29.4%) of 34 children with head injury.
Conclusion: The unfavorable prognostic factors for traumatic intracranial hematoma are RTA, low GCS (3-8), nonresponsive pupil to light, presence of multiple lesion on CT scan, midline shift > 5 mm, nonoperative lesions, the time elapsed from trauma to surgery > 24 hours.

Keywords: Head injury; Glasgow coma scale; Intracranial hematoma; Glasgow outcome scale

INTRODUCTION

Severe head injury in children is a significant cause of morbidity and mortality worldwide[1]. The most common type of injury is fall from height, followed by motor vehicle related accidents[2] and child abuse remains a major cause of head injury in children under 2 years of age. Infants and young children are more vulnerable to abuse due of their dependency on adults[3]. Head injury is classified as mild (Glasgow Coma Scale GCS 13–15), moderate (GCS 9–12), or severe (GCS 3–8)[4]. CT Scan head provides all essential information necessary to make a decision regarding the presence or absence of significant intracranial injury and emergency operative intervention is required or not[5,6]. Several studies have highlighted the importance of age and clinical factors such as GCS (post

resuscitation) score, ocular movements, pupillary size, etc. in the prediction of outcome of head injury in children[7,8]. The present study was done to view the outcome and analyze factors affecting the outcome in children with head injury.

MATERIAL & METHOD

Thirty four children with head injury, fifteen years or less in age were managed in the P.G. Department of surgery, S.R.N. Hospital associated with M.L.N Medical College, Allahabad from September 2015 to August 2016 a period of 12 months.

All variables were categorized which might have been related to the functional recovery and mortality into three groups:

1. Clinical variables; gender, age, mechanism of injury, GCS scores (Table 1), pupillary abnormalities, hypoxia at admission.
2. CT variables; type of hematoma, midline shift.
3. Management variables; operated, non-operated, time elapsed from trauma to surgery.

The patients were divided in 4 age groups; 0-2 years, 3-5 years,6-10 years, 11-15 years. The GCS score was determined on admission and all patients were divided into three groups; GCS scores of 3 to 8, 9 to 12 and 13 to 15. On the basis of pupillary response patients divided in three groups: responsive, anisocoric, nonresponsive.

Table 1. Glasgow Coma Scale

Eye opening	Best verbal response	Best motor response
		6: obeys command
	5: oriented	5: localise pain
4: spontaneous	4: confused but converse	4: withdraws
3: to speech	3: inappropriate words	3: abnormal flexion
2: to pain	2:incomprehensible sounds	2: extension
1: none	1: none	1: none
Total GCS score : 3 - 15		

Standard treatment guidelines were followed as per requirement. Outcome evaluation was done using the Glasgow Outcome Scale (GOS) score at time of discharge and divided into good (normal, moderate disability) and poor (severe, vegetative, dead) outcome(Table 2).

Table 2. Glasgow Outcome Scale

Good recovery (able to return to work or school)	5
Moderate disability (able to live independently, unable to work or school)	4
Severe disability (able to follow commands / unable to live independently)	3
Vegetative state	2
Death	1

RESULTS

Out of the 34children, there were 7 children less than 5 years and 27were above 5 years of age (Table 3). Poor outcome was seen in 42.8% children below 5 years, 35.7% in 6-10 years group, 15.3% in 11-15 years group. Thus children less than 5 years of age had a relatively worse outcome. Fall from height was most common mode of head injury (79.4%). Male: female ratio was approximately 1:2 but no difference in outcome. (Table 3). The best GCS response after resuscitation was considered and GCS was found to be a good indicator of outcome (Table 3). There were 4 patients in GCS of 3-8, of which 3 (75%) had a poor outcome; while out of 12 patients of GCS 9-12, 7 (58.3%) had poor outcome. Out of 18 patients in GCS 13-15, no patient had poor outcome. Pupillary size and reaction was found to be a good indicator of outcome (Table 3). Twelve patients had abnormality of pupillary size and reaction, poor outcome was seen in 58.33% in contrast to only 13.6% with normal pupillary response. There were 12 patients with acute subdural hematoma; 5patients had contusion, extradural hematoma in 11 patients, subarachnoid haemorrhage in 1 patient and multiple brain injuries 5 patients. Outcome

was found to be different in these groups. Poor outcome was noticed in 80% patients with multiple brain injuries, 20% with contusion, 18.18% with acute subdural hematoma and 16.6% with extradural hematoma. Poor outcome noticed in 63.6% patients with midline shift >5mm. Non operated patients had poor outcome (45.4%) than operated patients (21.7%). Poor outcome was noticed in 23.5% patients operated after 24 hour and 16.6% patients operated within 24 hour (Table 3). Overall poor outcome was seen in 10 (29.4%) of 34 children with head injury.

Table 3: Factors Related to Outcome

Variables	No. of Patients	Outcome	
		Good (GOS 5 & 4)	Poor (GOS 3-1)
Age Distribution			
0-5	7	4	3
6-10	14	9	5
11-15	13	11	2
Sex Distribution			
Male	21	15	6
Female	13	9	4
Mechanism of Injury			
RTA	5	1	4
Fall form height	27	21	6
assault	2	2	0
GCS at admission			
13-15	18	18	0
9-12	12	5	7
3 - 8	4	1	3
Pupillary response			
Normal	22	19	3
Abnormal/ no response	12	5	7
Type of haematoma			
Contusion	5	4	1
EDH	12	10	2
SDH	11	9	2
SAH	1	0	1
Multiple brain injuries	5	1	4
Mid line shift (>5 mm)			
Present	11	4	7
absent	23	20	3
Management			
Operated	23	18	5
Non-operated	11	6	5
Time of surgery			
< 24 hr	6	5	1
> 24 hr	17	13	4

DISCUSSION

In this study factors predicting the outcome of head injuries in children were analysed. Outcome measured as good (GOS 5 & 4) and poor (GOS 3-1). The following factors are significantly related to outcome.

There are discrepancies in the literature in defining the age point for good or poor outcome. For example, there has been disagreement regarding the pediatric age group. One group of reports has indicated that outcome tends to be better in children under 10 years of age[9,10] while others report that children under five have a higher mortality rate[11]. In our study poor outcome was seen in 42.8% children below 5 years, 35.7% in 6-10 years group, 15.3% in 11-15 years group. Thus, children less than 5 years of age had a relatively worse outcome, but it was not however statistically significant (p = 0.74). There was no significant difference in term of outcome between gender (p = 0.084). However the number of patients was small, which may not give an accurate statistical result.

In our study, the most common modes of head injury were fall 27 (79.4%) with good outcome in 21/27 (77.7%) patients, followed by RTAs 5 (14.7%) with good outcome only in 1/5 (20%), followed by assault in 2 (2.4%) with good outcome in 100%.

The GCS response after resuscitation was considered and GCS was found to be a good indicator of outcome (Table 3). There were 4 patients in GCS of 3-8, of which 3 (75%) had a poor outcome; while out of 12 patients of GCS 9-12, 7 (58.3%) had poor outcome. Out of 18 patients in GCS 13-15, no patient had poor outcome. Beca *et al*[12] and Kuday[13] found that the initial GCS score was the single most important factor affecting outcome ($P < 0.00001$). Astrand *et al* reported poor outcome in GCS 14–15 in 0%, in 9–13 as 6.2%, and < 8 had 22% poor outcome[14]. Aldrich *et al* reported that low GCS did not always accurately predict the outcome in the absence of hypoxia or ischemia[15]. In our series, we found a significant effect of GCS on outcome. The developing areas like ours have poorer outcome due to lack of late presentation to hospital and prehospital resuscitation.

Patients with normal pupils had better outcome as compared to those with anisocoric pupil & worst outcome was seen in patients with fixed dilated pupils[16,17].In our study 12 patients had abnormality of pupillary size and reaction, poor outcome was seen in 58.33% in contrast to only 13.6% with normal pupillary response. Francel et al[18] stated that papillary response is not a good predictor of outcome but In our study, we found abnormal pupillary response being a strong predictor of outcome.

The probability of associated intracranial hematoma with skull fracture in children is half of that of adults[19]. Extradural hematoma (EDH) is significantly less common in children than in adults and is even more rare in infants[20]. EDH can occur without fracture in children more commonly.14Unlike in other series we observed high incidence of EDH in children (35.2%) and good outcome was seen in 83.3% cases followed by children with SDH (81.8%) This has been seen in other studies as well[21]. Contusions were seen in 14.7% (n= 5) of cases. The outcome was unfavourable in patients with intracerebral hematomas and hemorrhagic contusions[21]. In our study 20% of the patients with contusion had poor outcome. Worst outcome was noticed in 80% patients with multiple brain injuries.

In this study, midline shift >5mm present in 12.22% (n=11) of patients. Poor outcome noticed in 63.6% (n= 7) patients with midline shift > 5mm.While patient with midline shift <5mm or no midline shift on CT scan only 13 % (n=3) patients had poor outcome. Quattrocchi et al reported that the presence of MLS was associated with a poor outcome in 50% of cases, whereas the absence of MLS was associated with a poor outcome in only 14% of cases ($P < 0.05$)[22]. Lobato *et al* stated that bad outcome can be predicted correctly as 68% when MLS >1.5 cm[23].

In this study, 11 patients (32.3%) were treated conservatively and 23 patients (67.6%) were treated surgically. The decision to operate on a head-injured patient is based on: premorbid state, the severity of initial injury, the onset and rapidity of neurological deterioration and patient assessment on arrival at the neurosurgical unit. Good outcome present in 78.2% (n=18) in operated patients and 54.5% (n= 6) in conservatively managed patients.

The time from the trauma until surgical decompression also affects the mortality. Some researchers have observed that the sooner surgery is performed in cases of acute head trauma, the better the final results. Seelig et al[24] in their study concluded that a delay from injury to operation was the factor of greatest therapeutic importance in traumatic SDH. But the relationship between time to surgery and outcome is still debatable. Stone et al[25] reported no difference in patients operated within 4 hours of injury compared with those operated later. Good outcome present in 5 out 6 (83.3%) patient which were operated within 24hr and 13 out of17 (76.4%) patients had favourable outcome which were operated after 24hr.

CONCLUSION

Fall from height was the most common cause of head trauma in children. GCS at admission was directly related to outcome of patients. The unfavourable prognostic factors for head injury in children were low GCS (3-8), nonresponsive pupil to light, presence of multiple lesions on CT scan, mid line shift > 5 mm, nonoperative lesions, time elapsed from trauma to surgery > 24 hours.

Conflict of interest: None
Disclosure: None to declare

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