

TRAUMATIC BRAIN INJURY IN PEDIATRIC AGE GROUPHayagriva Rao¹, K. S. Vara Prasad², K. Indu Sekhar³, Raja Sekhar⁴¹Associate Professor, Department of Neurosurgery, Andhra Medical College, Visakhapatnam.²Professor & HOD, Department of Neurosurgery, Andhra Medical College, Visakhapatnam.³Resident, Department of Neurosurgery, Andhra Medical College, Visakhapatnam.⁴Resident, Department of Neurosurgery, Andhra Medical College, Visakhapatnam.

ABSTRACT: Traumatic brain injury is one of the major causes of morbidity and mortality in children. The anatomical features, physiological response to injury, neuronal development, and low myelination in children cause different clinical features compared to the adult traumatic brain injury. Our aim is to study the incidence, predisposing factors, clinical presentations, and outcome in pediatric head injuries. The patients included in this retrospective study are under the age of 14 years admitted in the Neurosurgery Department of King George Hospital, Visakhapatnam, which is a tertiary care centre. The study period is two years' duration from 1.1.2013 to 31.12.2014. Data collected on the basis of history, physical examination, base line investigations, and the plain CT scan is all cases.

The pediatric patients were 226 in total 1643 case of head injury cases. There were 64.6% (n=146) males and 35.4% (n=80) females. The age ranged from 12 days to 14 years. Fall from height was the commonest cause of head injury found in 48.6% (n=110) cases, road traffic accidents (RTA) in 34.5% (n=78) and other causes 16.8% (n=38); 49 (21.68%) patients had associated injuries. At 55.75% (n=126) cases mild head injury with GCS 13-15 was present and severe head injury with GCS less than 8 in 29 (12.8%) patients. The 188 patients are treated conservatively, 38 patients underwent different neurosurgical procedures in which 5 patients died.

CONCLUSION: Head injury in pediatric age group carries high risk of morbidity and mortality. Good outcome achieved by early diagnosis and referral from primary care centers to tertiary care centers.

KEYWORDS: Traumatic brain injury (TBI), Pediatric age group, Glasgow Coma Scale (GCS), CT scan, Mortality, Morbidity.

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INTRODUCTION: Traumatic brain injury in children is one of the leading cause of morbidity and mortality. Neurological deficits are markedly seen after severe injury, but also occur after mild-to-moderate head injury. The post-traumatic sequelae are cognition impairments, motor deficits, attention disorders, and psychiatric diseases.⁽¹⁾ The anatomical features, physiological response to injury, neuronal development, and low myelination in children cause different clinical features compared to adult TBI. Fall from height is the most common reason for trauma-related deaths.^(2,3,4) This retrospective study was done to evaluate the head injuries in paediatric age.

METHODOLOGY: This retrospective study was done from Jan 2013 to Dec 2014. Our aim is to study the incidence, predisposing factors, clinical presentations, and outcome in pediatric head injuries. The patients less than 14 years of age with a history of head injury included. Initial assessment made on the basis of history, physical examination and radiological investigations. The severity of trauma assessed by Glasgow Coma Score (GCS).

Depending on GCS head injury is classified as mild (14-15), moderate (9-13) and severe (less than 8).⁽⁵⁾ For patients less than five years old, modified Glasgow Coma Score was used with the best verbal response modified.

RESULTS: A total of 1643 head injury patients treated during the period, admitted in Department of Neurosurgery, Andhra Medical College. There are 226 cases within the age group of 0 to 14 years. The incidence in paediatric age group is 13.75% in our study. The youngest was 12 days and oldest one 14 years in this study. The incidence is higher in males 64.6% (n=146) than females 35.4% (n=80). The majority of cases noted in older age group more than five years (66.3%). Less than one year consisted of 15.47%. (Table 1)

AGE AND SEX DISTRIBUTION

Age	Male	Female	Total	%
0-1 month	2	1	3	1.32
1 mo. to 1 yr	21	11	32	14.15
1Yr to 5 Yrs	27	14	41	18.1
5Yrs To 10Yrs	40	19	59	26.1
10yrsto 14yrs	56	35	91	40.2
Total	146	80	226	

TABLE-1

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The fall is the commonest cause (n=110, 48.6%), followed by road traffic accident (n=78, 34.5%) and assault in 6 cases; other causes like fall off wall and tree in 32 cases (14.15%). There were no child abuse cases in this study. (Table-2)

MODE OF INJURY

Type	0-1 month	1 mo-1yr	1 yr - 5yrs	5yrs-10yrs	10yrs-16yrs	Total
RTA	-	8	12	13	45	78
Fall	2	22	23	32	31	110
Assault	-	-	1	2	3	6
Others	1	2	5	12	12	32
Total	3	32	41	59	91	226

OTHERS :SPORTS,FALL OF WALL, FALL OF /HIT WITH OBJECTS

TABLE-2

At the time of admission 55.7% (n=126) cases had mild head injury, 31.4% (n=71) had a moderate head injury and 12.8% (n=29) patients were with severe head injury. (Table 3)

114 presented with vomiting at the time of admission and was commonest present. Convulsions in 28 cases, bleeding per nose in 32, and bleeding per ear noted in 18 cases.

The optic nerve injury noted in 4 cases and 3rd cranial nerve involved in three cases.

GCS SCORE AT ADMISSION

GCS Score	0 - 1 month	1 month- 1 yr	1 yr - 5 yrs	5YRS-10 YRS	10YRS-16 YRS	Total
3 to 8	-	7	6	7	9	29
9 to 12	1	9	12	14	35	71
13 to 15	2	16	23	38	47	126
Total	3	32	41	59	91	226

TABLE-3

CT scan findings at initial screening are normal in 16 patients (7.07%). The fracture skull is commonest CT scan finding (34.6%). Compound fractures found in 18 (7.8%). Linear fractures in 49 and depressed fractures in 12 cases occurred, in which all the depressed fractures are treated by surgical management. Contusions are the most common findings in intracranial noted in 61 cases, followed by extradural hematomas in 36 cases. (Table-4)

Type of Lesion	No. of Cases	Percentage
A. Normal CT findings	16	7.07
B. Fracture of skull	79	34.9
1. Linear fracture	49	21.68
i) Frontal	13	5.75
ii) Parietal	18	7.96
iii) Temporal	12	5.30
iv) Occipital	6	2.6
2. Depressed fracture	12	5.30
i) Frontal	5	2.2
ii) Parietal	6	2.65
iii) Temporal	-	-
iv) Occipital	1	0.44
3. Compound fracture	18	7.96
C. Intracranial lesions		
1. Pneumocephalus	9	3.98
2. Extradural hematoma	36	15.92
i) Frontal	9	3.98
ii) Parietal	15	6.63
iii) Temporal	6	2.65
iv) Occipital	2	0.88
v) Posterior fossa	4	1.76
4. Contusions	61	26.99
i) Frontal	24	10.61
ii) Parietal	14	6.19
iii) Temporal	9	3.98
iv) Occipital	3	1.32
v) Posterior fossa	7	3.094
Subdural hematoma	28	12.38
5. Subarachnoid hemorrhage	16	7.07
6. Intracerebral hematoma	8	3.53
7. Intraventricular hemorrhage	4	1.76
8. Mass effect	21	9.29

Table 4

In our study the seizures are the most common post-traumatic complications seen in 12 patients. Optic nerve injury causing blindness in two cases, 3rd cranial nerve palsy in three cases, 6th cranial nerve palsy seen in two cases, CSF rhinorrhoea in four, CSF otorrhoea in one, and meningitis in two cases are present. (Table-5)

POST TRAUMATIC COMPLICATIONS

Complications	No. of cases	Percentage
Seizures	12	5.30
Blindness	2	0.88
III nerve palsy	3	1.32
VII nerve palsy	4	1.76
CSF rhinorrhoea	3	1.32
CSF otorrhoea	1	0.44
Meningitis	2	0.88

TABLE-5

An 188 cases treated by medical management; 38 patients underwent different neurosurgical procedures; 22 patients had a craniotomy for extradural hematoma and common indication for surgical intervention in our study; 12 patients had an elevation of the depressed fracture, four patients underwent craniotomy for a subdural haematoma; 14 patients with severe head injury died within five days of admission; five patients died postoperatively.

28 patients (12.38%) died in total 226 pediatric brain injury cases. The high mortality noted in midline shift of more than 5 mm in 42.85% cases than the cases without midline shift (6.91%) in CT scan. (Table-6).

MIDLINE SHIFT CORRELATION WITH MORTALITY

Midline shift	No. of cases	Death	Percentage
No shift	159	11	6.91
< 5 mm	46	8	17.39
> 5 mm	21	9	42.85

TABLE-6

The mortality was correlated with GCS at the time of admission. The highest rate of mortality was in cases with GCS 3 to 8. In our study two cases underwent persistent vegetative state that had GCS 3 to 8. Severe disability present at the time of discharge in 33 cases, and good recovery in 121 cases. (Table-7)

GCS CORRELATION WITH OUTCOME

GCS Score	No. of Cases	Good Recovery	Moderate Disability	Severe Disability	Persistent Vegetative Stage	Death	% of Death
3 to 8	41	11	8	6	2	14	6.19
9 to 12	56	23	13	11	-	9	3.98
13 to 15	129	87	21	16	-	5	2.21
Total	226	121	42	33	2	28	12.38

TABLE-7

DISCUSSION: There are significant differences between adult and pediatric trauma. These include anatomic variations in size, body proportions and ossification of the skeleton, physiologic responses to injury, mode of injury. The brain grows more up to one year, at 2nd year reach to 75% of the adult size and at 6th year up to 90%. In children low face to cranium ratio, high head to body ratio, less fat and connective tissue are present. Neonatal brain water content is 89%, whereas adult content is 77%. There is difference in physiological response to injury between paediatric and adult brain which affect the

outcome. In newborns, intracranial pressure is between 1.5-6 mmHg. In children it is 3-5 mmHg and in adults is 15 mmHg. At birth myelination is absent and increases until adolescence. Cerebral blood flow is 50% of an adult up to 3-4 years. Bradycardia in children indicates increase in intracranial pressure. Children survive high in prolonged intracranial pressure values than adults for reasons not fully understood.

Radiological re-evaluations are done with repeat CT when symptoms of concussion are persistent. Focal neurological deficits or decrease in the level of consciousness indicates deterioration of the patient. So even moderate head injured patients with GCS 9 to 12, hospitalized for observation. The severity of brain injury based on the patient's level of consciousness according to Glasgow Coma Score (GCS).¹ Primary brain injury is at the time of impact. These include contusions; diffuse axonal injuries, and lacerations, acute subdural and epidural hematomas. Secondary brain injury is due to cerebral edema, ischemia, expansion of contusions, and thus increase in intracranial pressure leading to herniation syndromes and death. Post-traumatic seizures occur earlier in children than in adults. Children have a lower chance of surgical lesions than adults. The outcome in children is better than adults.⁽⁶⁾ In our study, mild head injury with GCS 13 to 15 cases are more, and treated conservatively with good outcome; 7-14 years age group is more prone to head injury due to recreation and sports injuries. Child abuse cases are not present in this study. In Western countries, the 10% of children present with accidents or child abuse.⁽⁶⁾

Previously, the guidelines for the management of paediatric head injuries are mainly based on adult guidelines. In 2003, the first evidence-based guidelines for TBI, published by Adelson et al., Later advances in the intensive care unit management, optimize outcome in paediatric injuries.^(7,8) Most of the head injuries in paediatric age are preventable. The commonest cause of injury in our study is fall. Parents should supervise the children when they are playing to avoid injuries. The secondary injuries to the brain cause poor outcomes in head injuries.⁽⁹⁾

The majority head injuries are mild, having low complication rates. The complications like seizures, blindness, cranial nerve palsy, cerebrospinal fistulas are common after severe injuries. This causes significant social and economic burden for the families and for the society. The pediatric patients had a higher percentage of better outcome (43%) than the adult patients (28%). They have a lower mortality rate (24%) compared to adults (45%). The incidence of surgical lesions in adults (46%) are high than in children (24%).⁽¹⁰⁾ Though the incidence of head injury is high in older children due to their lifestyle, the mortality rate is independent of age of children.⁽¹¹⁾

CONCLUSION: Traumatic brain injury is a common problem in pediatric age group with significant morbidity and mortality. The most common cause of trauma was fall due to sports or recreation activities. Majority head injuries in children are mild, with good outcome.

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