

Compound head injury in 46 pediatric patients

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Abstract: The purpose of the present retrospective study was to analyze the pediatric patients with compound head injury (CHI), and evaluate the incidence of complication in our setup, and to assess the various factors responsible for the ultimate outcome. During the 17-year-period (1990 to 2007), 46 pediatric patients under the age of 20 years with CHI were managed in two departments. The detailed clinical profile and radiological finding of these children were noted. Male to female ratio was 4.7:1. Mean age was 12.3 years. Major mode of trauma was road traffic accident; other causes included assault, fall from the height and missile injuries etc. Out of total 46 patients, 29 patients (64%) were treated surgically and 17 (36%) were managed conservatively. Complications were observed in 13 patients (29%). Meningitis was the most common, diagnosed in 6 cases (12%). Good recovery was observed in 20 cases (43%). Six children (13%) were moderately disabled, twelve (26%) were severely disabled and eight (17%) died. CHI has the risk of complications i.e. meningitis, seizure, CSF leak etc. Dural tear, free bone fragments and late presentation (more than 8 hours after trauma) were the important risk factors. Early surgery and adequate debridement with antibiotic cover play an important role in reducing the complication rate in children with compound head injury.

Keywords: compound head injury, post traumatic meningitis, surgery, outcome.

INTRODUCTION

A skull fracture is considered depressed, when any portion of the outer table of the fracture line lies below the normal anatomical position of the inner table. It results when impact energy is applied over a relatively small contact area.

Surgical intervention is required in 32% of head trauma patients, 50% of which have depressed skull fractures¹. A fracture is considered open compound when a scalp laceration overlies the fracture² while the fracture is considered as closed compound when there is no scalp laceration or oozing brain tissue and usually seen in the cases of skull base injury. Compound head injuries (CHI) are associated with a high risk of infection, injury to underlying brain and post traumatic seizures^{3,4}. In 85% cases fractures are of the compound in nature. This retrospective study on CHI was carried out in pediatric cases to analyze the rate of complications in compound head injury and outcome of CHI cases. The various factors responsible for the ultimate outcome were also

studied. We discussed our experience in the light of the published reports in the literature.

MATERIAL AND METHODS

This study spread over a period of 17 years, from January 1990 through December 2007, and was conducted in the department of neurosurgery of All India Institute of Medical Sciences, New Delhi (1990-1993) and Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow (1993-2007). It was a retrospectively study in children under 20 years with compound head injury. Follow-up was maintained by two senior authors. All patients with compound head injury received initial treatment in emergency department. After initial resuscitation, X-ray and CT scan was carried out, if not

Table 1: Complications in thirteen cases

S.No	Complications	No	Percentage
1	Meningitis	6	12
2	Systemic (Chest & Renal)	2	5
3	Wound	2	5
4	Post treatment CSF leak	1	2.5
5	Septicemia	1	2.5
6.	Seizures	1	2.5
	Total	13	29.5

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done earlier. The details of history, physical, local examination and CT finding of the head of each case were recorded. The degree of contamination, site of compounding, the neurological status and associated injuries, elsewhere on the body were recorded. The type, site of fracture, and associated brain parenchymal injuries were documented. The cases having indication for surgery that is brain herniation, pneumocephalous, venous sinus injury, hematomas with mass effect,

Foreign body or bony chips inside the brain parenchyma (29 patients) were operated as soon as possible, following their admission. Antibiotics were given before during and after the surgery. The cases fulfilling the criteria had undergone surgery under general anesthesia. Foreign bodies and free bone pieces were removed; depressed and attached bone pieces were elevated. The lacerated brain and hematoma if any, was evacuated depending on indication in particular case. The dura was primarily repaired in those cases where it was possible, otherwise duraplasty was done. Postoperative antibiotics were prescribed for a period of 3 to 6 weeks, depending on the degree of contamination of the wound. The patients were followed up at the end of 1 month, 6 months and one year after discharge. Outcome was assessed as per the Glasgow outcome score. The cases having follow up less than 6 weeks were not included in this study. The mean follow up was 6 months.

RESULTS

A total of 46 patients with CHI were managed. Age of these patients ranged from 1 year to 20 years (mean 12.3 years). Male to female ratio was 4.7:1. The mode of injury was road traffic accident in 20 patients, followed by fall from height in 9 cases, assault in 8 and in 9 injuries were due to domestic mishaps, blast or sport injuries (Table-3).

Thirty two patients were admitted within 24 hours of trauma and 3 patients were admitted between 24 hours and 48 hours. Nine patients were admitted after 2 days

of whom 2 patients were referred to us even after one month due to complications. There were 21 patients in GCS 13-15, 8 patients in GCS 9-12. Seventeen patients were in GCS 8 or below, 4 of these 17 had GCS 3. Locations of fractures were frontal in 23, parietal in 9, multiple in 8 and temporal in 4 patients. Two cases had isolated occipital bone fractures (Tables 2 & 3).

In twenty four cases (52%) laceration / contusion / hematomas were localized to one site without or with minimal mass effect. However, 8 (18%) patients had multiple contusion / hematoma. Twenty nine (64%) cases were treated by surgery, while 17 (36%) cases were managed conservatively. Debridement of wound, removal of foreign bodies, evacuation of lacerated brain/hematomas and dural repair were carried out in surgical cases depending on indication of individual case. Intraoperative and postoperative antibiotics were given for 3 to 6 weeks. Antiepileptic treatment was started in all cases. Thirty eight cases (83%) improved, eight (17%) died. Twenty (43%) cases had good outcome. Twelve of 17 cases (GCS below 8) had severe disability and six of eight (GCS between 9-12) (75%) were moderately disabled.

There were 27 cases with brain matter herniation through the defect, CSF leak, venous sinus injury, intracranial air and dural tear. Out of them there were 11 cases (41%) of brain matter leak, seven cases (26%) of CSF leak, two cases (6%) of venous sinus injury, and seven cases (27%) of intracranial air and dural tear respectively. Respiratory insufficiency at admission was found in 3 patients (8%) and shock with hypotension was present in 4 patients (9%). Three patients (6%) were intubated in casualty or brought with intubation before attending casualty. Complications were observed in 13 patients (29%). Meningitis was most common, to be diagnosed in 6 cases (12%). Wound infections were seen in 2 cases (5%). Two cases (5%) developed systemic complications such as chest infection or renal complications. Surprisingly, seizure was noticed in one case (2.5%) only. Septicemia and post treatment CSF

Table 2: Severity of Head Injury and outcome

GCS	No.	%	Recovered		Grade No.			Expired	
			No	%	Good (%)	Mod (%)	Severe (%)	No	%
3-8	17	37	12	70	1 (8%)	3 (25%)	8 (67%)	5	29
9-12	8	17	6	75	3 (50%)	2 (33%)	1 (17%)	2	25
13-15	21	46	20	95	16 (80%)	3 (15%)	1 (5%)	1	5
Total	46	100	38		20	8	10	8	59

Table 3: Associated variables of CHI

Variables	No of Patients	Percentage
Mode of Injury		
Road traffic accident	20	43
Fall	09	20
Site of compounding		
Frontal	23	50
Partial	09	20
Dural sinus injury		
Brain Matter leak + CSF	11	41
CSF leak	07	26
Localizing Sign		
Hemiparesis	12	54
Pupillary Asymmetry	05	25
Associated Injury		
Long bone	04	27
Clavicle small bone	03	08
Associated CT scan finding		
Localized Contusion / Hematome at one site	24	52
Contusion/hematoma involving at more than 1 site	08	18

leak occurred in one case. Twenty one cases (73%) and 12 cases (72%) has survived in surgical and conservative groups respectively. However, good recovery was seen in nine cases (67%) of conservative group in comparison of eleven cases (54%) of surgical group.

DISCUSSION

CHI is a common problem which has the risk of complications like CSF leak, meningitis and seizures etc. Because of the danger of CNS infections, it is a generally accepted practice to explore and elevate depressed skull fracture as soon as possible. It has more relevance in countries like India and developing countries, where infection rate is higher in comparison to developed countries.

The mean age in children's with CHI in this study, was 12.3 years, which was 6.1 years to 21.7 years in other studies^{2,5,6}.

Head injury mostly occurs in males. This study showed

that the male and female ratio was 4.7:1. It varies from series to series in 3.6:1⁷, 9:1⁸, 1.4:1⁹, 2.1⁵, 4.6:1² and 2.3:1¹⁰.

Forty three percent (20 cases) CHI of present study was caused by road traffic accident (RTA). The causes of accidents in India include a poor design and maintenance of roads, poorly maintained vehicle with no safety facilities, apathy by authorities, poorly trained drivers and most importantly public and children awareness of prevention of accidents etc. These factors play important role in road traffic accidents and head injuries including CHI. Eight cases (17%) had injury due to assault, other nine cases sustained (20%) injuries due to falls from height. Four patients (8%) sustained missile injuries. According to other studies, 60%⁷, 13.2%⁹, 32.14%², 42.14%⁴ patients with CHI had history of RTA. Some authors have reported incidence of fall in CHI in 50% - 65%^{2,9}. It is obvious that road traffic accident remains an important cause of CHI in pediatrics populations in our scenario as well, though the incidence of etiology of head injury varies from series to series.

This study showed twenty three (50%) frontal fractures, nine (20%) in parietal region, four (8%) in temporal region, two in (5%) occipital region and eight (15%) fractures involved more than one region. Frontal fractures is reported in 3% to 75%^{2,4,10,11}, 58% to 75%^{2,4,11,12} fractures in parietal region, 10% to 11%^{2,4,11} fractures in temporal region, 5% to 11%^{2,4,12} fracture in occipital region, 7.1%² fractures in more than one region and 66.7%¹⁰ fracture in temporo-parietal region. Obviously the site of fracture depends on the site and type of injury. It may vary from series to series.

A primary concern with a compound depressed fracture is the potential for intracranial infections¹³. Dural tear, hematomas and brain contusions are considered to be very important factor for optimal recovery. Total twenty seven cases (59%) in the present study had evidence of brain matter leak, CSF leak, venous sinus injury and dural tear. These were detected clinically in twenty cases (74%) at the time of admission due to parenchymal, CSF leak or bleed. Localized contusion, contusions combined with sub-dural hematoma and epidural hematomas were documented in 24 cases (52%), eight cases (18%) and five cases (10%) respectively. The frequency of dural tear varied from 41% to 67% in various series^{2,3,4,6,11,15,19}. Brain contusion is reported in 25% to 50%^{2,11}, epidural hematoma in 6% to 14%^{2,10,11}

and associated sub-dural hematoma in 9.8%¹⁰. In this study, twenty nine cases (64%) were treated by surgery and seventeen cases (36%) were managed conservatively. In other series, 44% to 48%^{18,19} cases were treated surgically and 52% to 56%^{18,19} cases were managed conservatively. Relatively more cases in our set-up required surgery. It may be because of inadequate availability of treatment and referral biases from peripheral referral centers. It seems nearly half the cases with compound head injury have dural tear and other half have brain laceration. Nearly half of our cases (49%) had localizing sign and neurological deficit at the time of admission. It was 28% to 50%^{2,17} in other studies. All the above risk factors was considered as the consequence of the CHI and had an overall impact on the outcome, however association of risk factor to complication was not concluded statistically in our study.

GCS score is still the most important predictor of outcome in cases suffering from severe head injury. Twenty one cases (46%) were admitted mild injury (GCS 13-15), twenty cases (95%) survived and sixteen cases (82%) had good outcome. While eight cases (17%) were admitted with moderate injury, six cases (75%) survived, three (50%) had good outcome. Seventeen patients (37%) had severe injury among them, twelve (70%) survived, one (9%) had good outcome. It corresponds with the usual trends of head injury cases.

Twenty one cases (73%) and 12 cases (72%) had survived in surgical and conservative groups respectively. However, good recovery was seen in nine cases (67%) of conservative group in comparison to eleven cases (54%) of surgical group; the inclusion and exclusion criteria was different in both the groups hence both the groups are not comparable.

Twenty nine patients were operated in our study of which complications developed in 13 cases (29%). Meningitis, systemic, wound infection, post treatment CSF leak, septicemia and seizures occurred in six (12%), two (5%), two (5%), one (2.5%), one (2.5%) and one case (2.5%) respectively. Higher incidence of meningitis in this study was due to the fact that patients were referred late. In about half on the cases, meningitis was noticed on admission. The incidence of meningitis, wound infection and seizures are reported in 4% to 10%^{15,21,22}, 4% to 22.7%^{6,7,8,15,19,20}, 1% to 4%^{22,23} respectively.

All other patients received antibiotics; however the value in preventing infections remains to be further elucidated by studies treating such patients by randomizing those who receive antibiotics and those who do not.

CONCLUSION

Compound head injury is not uncommon in children and has a significant male's predilection. Road traffic accidents, assaults and falls from height were the common modes of trauma. Mild head injuries showed excellent outcome of 95% survival with a good outcome in 82% cases. Good outcome occurred in one case (8%) of GCS score 8 and below. Twenty seven cases (59%) of all compound head injuries had brain matter leak CSF leak, venous injury and dural tear. As much as 29% cases developed one or more complications. Meningitis was most common complication. Post-meningitis hydrocephalus and CSF leak were the avoidable complications. Surgery and conservative management offers similar result as far as the survival is concerned.

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