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Outcome and Prognosticators of Head Injury - Our Experience

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Abstract: ***Background: Management of patients with head injury is a difficult and challenging job and the outcome depends on various clinical and metabolic factors. Protocols followed for management, purposively same, may vary between institutions. Material and Methods: In this report, we present our experience with head injury patients in age group above 12 years and among the patients treated both conservatively and operatively from May 2021 to December 2021. Patients were assessed clinically with Glasgow Coma Scale (GCS), pupillary size and reaction and NCCT head. Patients requiring surgery were operated upon after stabilization of their hemodynamic and metabolic parameters. All patients were analyzed prospectively by evaluating their hospital clinical, laboratory and radiological data. Patients outcome were measured using Glasgow outcome score (GOS). Results and observation: Out of total 367 patients who were taken for the study males outnumber females. Poor prognosis was seen in patients with increasing age, male age group, poor GCS and pupillary inequality at admission, poor metabolic parameters and positive CT scan findings. There was an overall mortality of 16.6% (n=60). Of the survivors who were followed up, about 80% achieved a favorable functional outcome. An aggressive approach aimed at early evaluation and adequate treatment protocols resulted in survival in a significant proportion of patients who would have otherwise died. However use of protective gear like helmets has a great influence in the severity of injury. In the long - term follow - up, the surviving patients showed significant improvement in GOS.***

Keywords: Glasgow coma scale, pupillary inequality, hemodynamic and metabolic parameters

1. Introduction

A patient with head injury is a nightmare for the public in general and the neurosurgeon in particular due to its high rate of mortality and morbidity. It is a huge financial loss to the family as well as the country in terms of treatment or death in productive age group. With a population of above 30 million and the ever increasing traffic, Assam also has its burden of head injury. This study is a prospective one conducted to analyze the clinical status, laboratory data, radiological presentation, their management pattern and assess the outcome of treatment in cases of head injury in a tertiary hospital in Assam, India.

2. Materials and Method

This study was carried out in Department of Neurosurgery, Gauhati Medical College & Hospital, Guwahati, Assam between May 2021 and December 2021. All traumatic brain injury patients coming to admit in Gauhati Medical College were included in the study. Pediatric head injury (Age less than 12 years), 4/6 wheeler injury, assault, scalp swelling/injury, fracture mastoid bone and faciomaxillary injury were excluded from the study. Basic demographic data, clinical presentation, laboratory/radiological findings, treatment provided were recorded. Diagnosis was by complete neurological, hematological, biochemical, radiological investigation mainly NCCT head. The functional outcome was assessed by GOS. Patient chart were reviewed by one of the authors and pertinent chart data was recorded in computerized database (Microsoft excel). Surgical outcome were scored at1 /2/3 month interval and then at the mean follow up period.

3. Results

In our study, patients were of the age group between 13 - 82 years. Highest presentation was found in the third decade (35%). Of the total numbers of 1921 cases of accidents (2/4/6 wheeler, train accidents), 1521 (79.17%) were due to two wheelers.52 patients were diabetic and 38 were hypertensive. Among them 337 (22.2%) admitted cases were with demonstrable head injury.34 patients had only Extradural Hemorrhage (EDH). Amongst these, 9 were frontal EDH, 10 were parietal EDH, 9 was temporal EDH and 6 were front oparietal EDH. Associated calvarial fracture was found in 22 of these patients. Subdural Hemorrhage (SDH) was found in 26 patients. Traumatic Subarachnoid Hemorrhage (SAH) was found in 40 patients. Intracerebral Hemorrhage (ICH) was found in 138 cases. Of these, Frontal ICH was found in 52 patients, parietal ICH was found in 12 patients, temporal ICH was found in 7 patients, cerebellar ICH was found in 4 patients, contusions were found in 63 patients. Only calvarial fracture was found in 38 patients.30 patients were admitted without any demonstrable finding on NCCT head.

Patients with poor GCS at presentation with demonstrable findings in NCCT head were planned for surgery. Other cases were conservatively followed up with repeated GCS monitoring and repeat CT head and converted to operative treatment if patient deteriorated. Conservatively patients were treated with fluid, osmotic diuretics, anti - epileptic drugs, ryles tube feeding and intubated and ventilated as required. Craniotomy with primary replacement of the bone flap after adequate decompression and loose duroplasty was done in all the operated cases without re - exploration in any cases. All 34 cases of EDH were operated. Of the 26 patients of acute SDH, 22 were operated. Depressed fractures were elevated and debridement done for 32 cases. ICH evacuation

done in 27 cases. We found a mortality rate of 16.6% (60) amongst all the cases in the study. Higher mortality was observed with the patients who had a poor GCS at presentation and those who had a longer duration in transit to reach the hospital. Patients with moderate head injury (GCS=9 - 13) had a moderate to good outcome on the GOS (GOS=1/2) while patients with mild head injury had generally good outcome (GOS=1).

293 patients (80%) were not wearing any helmets at the time of the accident. Majority of these patients were under the influence of alcohol (70%).

It was observed that patients with a single lesion on NCCT head had a better prognosis as compared to those with multiple lesions or those with diffuse axonal injury. Single lesion survival with GCS<5 was 35% and with GCS 5 - 8 was 91%. However multiple lesion survival with GCS<5 was 15% and with GCS 5 - 8 (50%). Midline shift survival <3mm was 50% and those with >3mm (0%). Those with an admitting GCS>8 had 86% survival.

On assessment of the GOS at 4weeks, 8 weeks and 6 months we found a good outcome (GOS=1) in 293 patients (79.83%), moderate outcome (GOS=2) in 4 patients (1.08%), severe/vegetative outcome (GOS=3/4) in 10 patients (2.72%) while expired patients (GOS=1) amounted to 60 (16.3%).

The most important subset for the cause of mortality found by us was the pre hospital care before the patient reached our hospital, seizure, hypoxia or aspiration during the transport and during hospital stay.

Table 1: Patients' characteristics

Categories	
Sex	
Male	317 (86.37%)
Female	50 (13.63%)
Mean Age	29±12.7 years
Comorbidities	
DM	52 (14.16%)
HTN	38 (10.35%)
Presenting GCS	
Mild (14 - 15)	140 (38.14%)
Moderate (9 - 13)	101 (27.52%)
Severe (less than 8)	126 (34.33%)
Anisocoria	82 (22.34%)
NCCT findings	
EDH	34 (9.26%)
Frontal	9
Parietal	10
Temporal	9
Frontoparietal	6
Associated calvarial fracture	22
SDH	26 (7.08%)
SAH	40 (10.89%)
ICH	138 (37.60%)
Frontal	52
Parietal	12
Temporal	7
Cerebellar	4
Associated contusions	63
Calvarial fractures	38 (10.38%)
Diffuse Axonal Injury	30 (8.17%)

Table 2: Outcome

Glasgow Outcome Score	Number
GOS1	293
GOS2	4
GOS3	4
GOS4	6
GOS5	60

4. Discussion

In the setting of acute head injury, priority should be given to the immediate assessment and stabilization of the airway and circulation. Despite the fact that prehospital intubation has become common, at least one study has reported a higher rate of mortality in patients intubated in the field than in those intubated in the hospital setting. In this study, however, more critically ill patients required in - field intubation.[1]

Following stabilization, attention should be directed to prevention of secondary injury. Mean arterial pressures should be kept above 90 mm Hg; arterial saturations should be greater than 90%. Urgent CT scan is a priority.

Next, attention should be focused on reducing intracranial pressure, since elevated intracranial pressure is an independent predictor of poor outcome. If the intracranial pressure rises above 20 - 25 mm Hg, intravenous mannitol, CSF drainage, and hyperventilation can be used. Hypertonic saline has also been used in lieu of mannitol to lower intracranial pressure, but more definitive studies are needed.[2]If the intracranial pressure does not respond to these conventional treatments, high - dose barbiturate therapy is permissible.[3]

An approach used by some clinicians is to focus primarily on improving cerebral perfusion pressure (CPP) as opposed to intracranial pressure (ICP) in isolation. One study reported that 80% of patients with severe head injuries experienced recoveries with no or little disability after volume expansion, mannitol, CSF drainage, and vasopressors were used to maintain a cerebral perfusion pressure of at least 70 mm Hg.[4] Other studies have found higher perfusion pressures were associated with more complications and have recommended maintaining a cerebral perfusion pressure of 50 - 70 mm Hg.[5]

The question whether saline or albumin fluid resuscitation would maximize cerebral perfusion pressure and lead to improve outcomes lead to a large, double - blind, randomized controlled study of 460 patients with Glasgow Coma Scale scores < 13 who also had abnormal head CT scan results. A post - hoc 2 - year follow - up demonstrated increased mortality in those receiving albumin as opposed to saline.[6]

Although hypothermic therapy initially appeared promising, and despite the fact that hypothermia decreases intracranial pressure, a large randomized study of 392 patients with head injuries recently demonstrated that hypothermic therapy does not improve outcomes. In addition, a post - hoc analysis found that the rewarming of patients with head injury who arrived in the emergency department already

hypothermic was likely detrimental.[7] Furthermore, a current review of 23 randomized, controlled trials concluded that this therapy was of no benefit.[8]

Acute hypothermic treatment has been found to worsen outcomes in patients with diffuse head injuries but to improve outcomes in patients with surgically - evacuated hematomas. This indicates a potential benefit in this subgroup; however, further prospective studies are needed.[9] Head injury induces a hyper metabolic state and early nutritional interventions may be as critical as cerebral perfusion pressure. Parental or enteral feedings reduced mortality by at least 50% in one study when given early in the course of severe head injury.[10]

As mentioned previously, head injury may alter coagulation parameters, and this can raise the risk of deep venous thrombosis to as much as 15% if no pharmacologic prophylaxis is given within the first 48 hours.[11] The risk of extension of intracranial bleeding needs to be balanced with the benefits of thromboembolic prevention. A retrospective review suggested that early prophylaxis is safe because there was no difference between intracranial hemorrhage progressions in patients with head injury who received enoxaparin or heparin within the first 3 days versus later in the course of their hospitalization.[12]

Anticonvulsant therapy, if used, should be discontinued after 1 - 2 weeks unless further seizures supervene.[13]

Traditionally, the prompt surgical evacuation of subdural hematomas in less than 4 hours was believed to be a major determinant of an optimal outcome. Indeed, a recent publication found a delay in surgery for acute subdural hematomas of over 5 hours was associated with increased mortality.[14] Nevertheless, other recent investigations have emphasized that the extent of the original intracranial injury and the generated intracranial pressures may be more important than the timing of surgery. For example, 70% of 83 patients with GCS scores of 11 - 15 who had subdural hematomas less than 1 cm in width and no cisternal effacement on neuroimaging or focal neurological deficits were successfully managed non - operatively with only 6% eventually requiring surgery.[15] Another study of 462 patients with head injuries with CT - imaged intracranial hematomas who were treated non - operatively found that only approximately 10% progressed clinically and eventually required surgery. Frontal parenchymal hematomas were more likely to require eventual surgery.[16]

Decompressive craniectomy issometimes advocated for patients with increased intracranial pressure refractory to conventional medical treatment. DECRA trial concluded that in adults with severe diffuse traumatic brain injury and refractory intracranial hypertension, early bifronto - temporo - parietal decompressive craniectomy decreased intracranial pressure and the length of stay in the ICU but was associated with more unfavorable outcomes.[17]

The operative and non - operative management of intracranial injuries is an ever - evolving area of study and, at present, more a matter of neurosurgical judgment than hard and fast decision rules.

A prognostic tree is a visually informative way to look at the prognosis of head injury patient. However considering the number of cases in the subgroups it is difficult to obtain precise estimates of the predictive accuracy in these subgroups.

Data using decision tree analysis support hypotension and papillary response response to light as a major predictor of poor outcome. Maintenance of normal BP is an important treatment in head injury. CPP is more important than ICP.[18] However “neuro worsening” is dependent on increasing ICP and not on CPP.[23, 24.]

Since pathology after head injury is complex, multilevel therapy will best suit the patient. Further study at ICP oriented therapy probably will be more appropriate so as to identify subgroups. Certain insults (hypotension/ tachycardia/ bradycardia) may be due to clinical/ pharmacological intervention to maintain/regulate BP. We have not taken medical/nursing intervention that may increase BP (suctioning, physiotherapy). Also GCS, pupil recording may be abnormal if patient is under the influence of alcohol/drugs or he may be sedated for intubation/ transportation if he is restless.

Patients referred from periphery without proper ABC may have episodes of hypotension/hypoxia which affect the outcome along with the time lag between the site of accident and hospital. Pyrexia is associated with increased CMRO2 and excitatory neurotransmitter and exacerbating the injury process [24]. Seizure may have a generalized effect on the environment leading to poor prognosis. It has been found that in patient with minor injury hypotension/seizure/pyrexia are associated with poor outcome. We conclude that handling of BP and ICP is extremely important in the analysis of head injury data.

5. Conclusion

With the present day sophistication in daily life head injury is likely to increase, predominantly due to lack of awareness regarding road safety or blunt refusal to adhere to it. A loss of life in productive year is a loss not only to the family but the country as a whole. Strict application of road safety measures and public awareness to it is a key to reduce road traffic accidents.

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