CONSERVATIVE MANAGEMENT OF TRAUMATIC BRAIN INJURY

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ABSTRACT

BACKGROUND

Traumatic brain injuries are a major cause of morbidity and mortality in modern times and it is a huge health sector burden.[1] Understanding the mechanism of traumatic brain injury leads to the development of guidelines for the management of traumatic brain injury.

This study aims at evaluating the conservative management of traumatic brain injury.

MATERIALS AND METHODS

It is a retrospective and descriptive study conducted from January 2015 to December 2016 in the surgical department of our tertiary care hospital. 185 non-operated cases of traumatic brain injury were enrolled in the study.

RESULTS

The mean age was 29.84 years. The sex ratio was 6.4. Road traffic accidents were responsible for injury in 82.16% of the cases. 48.65% of patients had a moderate brain injury (GCS 9 - 12), while 10.81% had a severe brain injury (GCS 3 - 8). Radiological evaluation demonstrated the brain contusion in 48.65% of the cases. Prevention of post-traumatic seizure was done with the use of phenytoin. Mannitol was used for its osmotic properties to reduce cerebral oedema. Favourable outcome was noted in 56.75% of the cases. Common complications were lower respiratory tract complications, chronic neurological sequelae, urinary infection and hyponatremia. Mortality was recorded at 15.13%.

CONCLUSION

Conservative management of traumatic brain injury involves use of the ventilatory assistance in all severe traumatic brain injuries, treatment of infectious complications and prevention of electrolyte imbalance.

KEY WORDS

Conservative Management.

HOW TO CITE THIS ARTICLE: Jadhav NS, Avinash SK. Conservative management of traumatic brain injury. J. Evolution Med. Dent. Sci. 2018;7(36):3946-3949, DOI: 10.14260/jemds/2018/882

BACKGROUND

Traumatic brain injuries are a major cause of morbidity and mortality in modern times and it is a huge health sector burden.[1] Understanding the mechanism of traumatic brain injury lead to the development of guidelines for the management of traumatic brain injury.[2] The guidelines are in terms of both surgical and non-surgical management.

50 - 60% of patients with Glasgow Coma Scale score of lesser or equal to 8 have one or more other organ systems injured.[3] 25% have surgical lesions. There is 4 - 5% incidence of associated spine fractures with significant head injury (mostly C1 to C3).

Brain Injury from Trauma Results from Two Distinct Processes-

1. **Primary Brain Injury:** Occurs at the time of trauma (Cortical contusions, lacerations, bone fragmentation, diffuse axonal injury and brain stem contusion).
2. **Secondary Brain Injury:** Develops subsequent to the initial injury. Includes injury from intracranial haematomas, oedema, hypoxemia, ischaemia (primarily due to elevated intracranial pressure and/or shock)

The routine use of sedatives and paralytics in neurotrauma patients may lead to a higher incidence of pneumonia, longer ICU stays and possibly sepsis.[4] These agents also impair neurological assessment.[5,6] Use, therefore should be reserved for cases with clinical evidence of intracranial hypertension, for intubation or where use is necessary for transport or to permit the evaluation of patient (eg: to get a combative patient to hold still for a CT scan).[7]

Indications for Intubation in Traumatic Head Injury-

1. Depressed level of consciousness: usually GCS less or equal to 7.
2. Need for hyperventilation.
3. Severe maxillofacial trauma.
4. Need for pharmacological paralysis for evaluation or management.

Cautions Regarding Intubation-

a. If a basal skull fracture through cribriform plate is possible, avoid nasotracheal intubation (to avoid intracranial entry of tube). In such cases use orotracheal intubation.
b. Prevents assessment of patient's ability to verbalise,[6] e.g. for determining Glasgow coma scale score. This

'Financial or Other Competing Interest': None.
Submission 09-08-2018, Peer Review 25-08-2018,
Acceptance 27-08-2018, Published 03-09-2018.
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DOI: 10.14260/jemds/2018/882

ability should be noted (none, unintelligible, inappropriate, confused or oriented) prior to intubation.
c. Risk of lower respiratory tract infection.

Indications of Mannitol in Traumatic Head Injury Patients-

1. Evidence of intracranial hypertension.
   a. Pupillary dilatation (Unilateral or bilateral).
   b. Asymmetric pupillary reaction to light.
   c. Decerebrate or decorticate posturing (Usually contralateral to fixed and dilated pupil).
   d. Progressive deterioration of the neurologic exam, not attributable to extracranial factors.
2. Evidence of mass effect (Focal deficit, e.g. hemiparesis).
3. Sudden deterioration prior to CT (Including papillary dilatation).
4. After CT, if a lesion is associated with increased ICP is identified.
5. To assess salvageability: In patients with no evidence of brainstem function, look for return of brainstem reflexes.

Contraindications to Mannitol Use-

a. Prophylactic administration is not recommended due to its volume depleting effect. So it should be used only in appropriate indications.
b. Hypotension or Hypovolaemia: Hypotension can negatively influence outcome.[7] Therefore, when intracranial hypertension is present, first utilise sedation and/ or paralysis, and CSF drainage. If further measures are needed, fluid resuscitate the patient before administering mannitol. Use hyperventilation in hypovolaemic patients until mannitol can be given.
c. Relative contraindication: Mannitol may slightly impede normal coagulation.
d. Congestive Heart Failure: Before causing diuresis, mannitol transiently increases intravascular volume. So, use with caution in congestive heart failure may need to pre-treat with furosemide.

Routine use of Prophylactic Antiepileptic Drugs in Traumatic Brain Injury is Ineffective in preventing the Late Development of Post-traumatic Seizures and has been shown to be useful only in certain Circumstances.[8,9]

1. Acute subdural, epidural or intracerebral haematoma.
2. Open depressed skull fracture with parenchymal injury.
3. Seizure within the first 24 hrs. after injury.
4. Glasgow coma scale score < 10.
5. Penetrating brain injury.
6. History of significant alcohol abuse.
7. Haemorrhagic contusion on CT.

Management of severe traumatic brain injury involves mechanical intubation, ventilator support and radiological assistance. Management of primary and secondary lesions require a multidisciplinary team made of anaesthetist, radiologist and neurosurgeons, nursing staff and physiotherapist.[10]

MATERIALS AND METHODS

This study is a retrospective descriptive study conducted from January 2015 to December 2016 at our tertiary care centre. 185 non-operated cases of traumatic brain injury were enrolled in the study.

Inclusion Criteria

Patients with traumatic brain injury admitted in our hospital were included in the study.

Exclusion Criteria

1. Cases in which the radiological data were absent were excluded from the study.
2. Multiple trauma cases that were operated for an associated lesion other than head trauma.

Clinical parameters, diagnosis, management and outcome of the management are evaluated. Data was collected from hospital register.

RESULTS

Age and Sex

The mean age was 28.76 years with extreme ranging from 3 to 85 years. There were total 160 men and 25 women and the sex ratio was 6.4.

Clinical Aspects

Predisposing Factors-

1.	Alcoholics	50 (27.03)
2.	Diabetes	10 (05.40)
3.	Hypertension	15 (08.11)

Among the predisposing factors, alcohol was the most common factor.

Mode of Injury

1.	Road traffic accident	152 (82.16)
2.	Assaults, falls	33 (17.84)

Road traffic accident is by far the most common mode of injury.

Neurological Examination

Glasgow Coma Scale (GCS): Average GCS score was 11

a.	3 - 8	20 (10.81)
b.	9 - 12	90 (48.65)
c.	13 - 15	75 (40.54)

Seizures	11 (05.94)
Neurological deficit	21 (13.51)

Related Injuries

1.	Thoracic	15 (08.11)
2.	Cervical spine	12 (06.48)
3.	Orthopaedic	21 (11.35)

Delay in admission- CT scan Average = 5 days (30 minutes to 8 days).

Radiological Technique	Number of Patients	Percentage
X-ray cervical spine	90	48.64
X-ray chest	72	38.92
X-ray base of skull	7	3.78
CT brain plain	165	89.19
MRI brain plain	20	10.81

Table 1. Radiological and Diagnostic aspects on Admission

Findings	Number	Percentage
Haemorrhagic Contusions	90	48.64
Subarachnoid Haemorrhage	33	17.84
Normal CT scan	30	16.22
Acute Subdural Haematoma	20	10.81
Pneumocephalus	15	08.11
Extradural Haematoma	10	05.41
Diffuse Cerebral Oedema	06	03.24

Table 2. Findings on CT and MRI are as Follows

When the CT scan was done, haemorrhagic contusion was the most common finding.

Therapeutic Aspects

The 20 cases of severe traumatic brain injury are managed by orotracheal intubation and ventilator support with sedation using midazolam. NSAIDS were used for analgesia. No tracheostomy was performed after the orotracheal intubation. Anti-epileptic treatment was administered in 11 cases who had convulsions; agent used was phenytoin. Immediate treatment of convulsion was the administration of the bolus of diazepam. The prophylaxis of post-traumatic seizure was used in 75 patients (40.54%), the indications were cortical brain contusion, diffuse cerebral oedema, pneumocephalus, acute subdural haematoma, subarachnoid haemorrhage, extradural haematoma and GCS lesser or equal to 10. We used phenytoin. Mannitol 20% was administered in all patients with severe traumatic brain injury. Intravenous proton-pump inhibitor was administered.

Outcome

Favourable outcome was noted in 105 patients (56.75%) with a normal GCS, oral feeding and absence of neurological deficit. The average hospital stay for these patients was 6 days.

About 60 patients developed complications (32.43%).

Complications	Number	Percentage
Lower respiratory tract infection	29	48.33
Altered consciousness	15	25.00
Urinary tract infection	09	15.00
Hyponatremia	07	11.66
Total	**60**	**100**

Table 3. Types of Complications in our Study

The average hospital stay for these patients with complication was 17 days.

28 patients of the series died (15.13%) during the study period. Mortality was due to a complicated lower respiratory infection due to altered consciousness in 19 patients, 6 cases due to neurological problems, 3 cases due to electrolyte disturbance.

DISCUSSION

This was a retrospective study, so data collection was limited by difficulty in reaching patients who were discharged. In addition, there is influence of GCS in clinical evolution of patients. Alcohol is the most common predisposing factor and road traffic accident was the most common mode of injury. The management of severe brain trauma involves tracheal intubation and ventilatory support with continuous sedation.[10],[11] In our study, among the 20 patients admitted to intensive care, all were managed by intubation and ventilation. Sedation aims for cerebral protection and control of intracranial pressure and facilitation of care.[12,13] Prophylactic treatment of seizures was administered in 75 patients (40.54%); post-traumatic seizures are classified according to time of occurrence[14] as immediate (within 24 hours), early (within a week) and late (over a week). Frequency of post-traumatic seizures is estimated between 5% and 7%. It is related to the severity of the trauma (11%) and mode of injury [eg. more with sharp object injuries].[15,16] Phenytoin is the preferred anti-epileptic for prophylactic treatment of seizures. In our study, drug used was phenytoin. Mannitol[17] was used for its osmotic properties to reduce cerebral oedema. The recommended dose is 50 - 100 mg/kg over 25 minutes. It improves cerebral perfusion pressure and microcirculation. However, its use is preferable when the blood-brain barrier is intact and it may predispose to hypotension or hypovolaemia, because of its volume depleting effect and it has to be used with caution in patients with congestive heart failure. The effects of hypertonic saline[18,19] is comparable to mannitol, and it is more useful when haemorrhagic shock is associated with head injury. But it was not used in our study, because of lack of availability. Common complications were lower respiratory tract infections, more common with intubated patients.[20] Other common complications are electrolyte imbalance. Hyponatremia was the most common in our study (11.66%), and would be related to salt wasting syndrome or syndrome of inappropriate antidiuretic hormone secretion.[21] Hospital mortality in traumatic brain injury is variable, ranges from 8.5% to 38%.[22],[23],[24] In our study, the mortality of 15.13% for deaths occurred during the study period. It is linked to neurological and infectious complications.

CONCLUSION

Among traumatic brain injuries, most injuries can be managed conservatively. Among intracranial lesions, cerebral contusions are predominant. Conservative management of brain injury involves prevention of secondary insult to brain which is usually of systemic origin, which in our study is respiratory complications followed by infection and electrolyte disturbances. The management of severe head trauma involves ventilatory assistance, prevention of post-traumatic seizures and the use of osmotic diuretics.

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