Section: General Surgery

Original Research Article

CLINICO-RADIOLOGICAL CORRELATION IN MODERATE TO SEVERE HEAD INJURIES

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Received : *08/02/2024*
Received in revised form : *03/04/2024*
Accepted : *19/04/2024*

Keywords:
Caregiver's burden, psychiatric illness, schizophrenia, depression, bipolar, and anxiety disorders.

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DOI: 10.47009/jamp.2024.6.2.265

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (2); 1328-1331

Abstract

Background: Traumatic brain injuries (TBI) are common and come with a large cost to both society and the individual. The diagnosis of traumatic brain injury is a clinical decision, however, imaging, particularly CT, plays a key role in diagnostic work-up, classification, prognostication and follow-up. Traumatic brain injuries are more common in young patients, and men account for the majority (75%) of cases. Although sport is a common cause of relatively mild repeated head injury potentially eventually leading to chronic traumatic encephalopathy, more severe injuries are most often due to motor vehicle accidents and assault. The study sought to observe the severity of the injury that can be assessed with GCS: mild traumatic brain injury (TBI): GCS 14-15, moderate TBI: GCS 9-13 and severe TBI: GCS 3-8.
Materials and Methods: This prospective study observes all indoor patients with moderate to severe head injuries admitted to the hospital during the study period of 15 to 18 months at Department of GENERAL SURGERY, GS Medical College and Hospital, Pilkhuwa, U.P. Patients who gave consent, with moderate head injury i.e. patients having GCS in the range of 9-12 and with severe head injury i.e. patients having GCS in the range of 3-8 were included in the study. Patients of minor head injury having GCS 13-15, those who were lost to follow-up or went LAMA were excluded. **Result:** Mortality was found to increase with fall in GCS. Patients with GCS 9-12 had 6.98% mortality rate while patients with GCS 3-8 had 58.98% mortality rate. Thus mortality correlates with GCS. **Conclusion:** Moderate to severe head injury is most common in 21-40 years of age groups (50%). Incidence of moderate head injury is 12.95%, while that of severe head injury is 11.75%. Mortality was 100% in age group more than 60 years, 65% in 41-60 age group, 26.31% in 0-20 age group and 14.64% in 21-40 age group.

INTRODUCTION

Traumatic brain injury is a common injury sustained through military service, sports involvement, falls, or other accidents. As a leading cause of death and disability in individuals aged <45 years, it is a significant public health problem associated with both acute and long-term disabilities. Sixty-nine million individuals are estimated to suffer TBI from all causes each year. TBI can have a range of effects that depend on the type of injury, how severe the injury is, and what part of the brain is injured. According to the Centers for Disease Control and Prevention, these health effects can sometimes remain for a long time or even be permanent.

Clinical presentation

- Patients typically present with a combination of reduced Glasgow Coma Scale (GCS), nausea/vomiting and/or amnesia. The severity of the injury can be assessed with GCS: mild traumatic brain injury (TBI): GCS 14-15, moderate TBI: GCS 9-13 and severe TBI: GCS 3-8
- This scale has limitations as there are other causes for reduced GCS in trauma (alcohol, drugs, seizure, etc.).
- The term concussion refers to a clinical diagnosis which has overlap with the mild end of the spectrum of traumatic brain injury, and usually is used in reference to a transient brain injury.

Imaging indications

The decision to perform imaging in the setting of head trauma will depend on multiple factors, including local department guidelines and access to imaging. Various clinical tools exist which help to screen for patients who require acute neuro-imaging, including: the Canadian Head CT Rule, the National Emergency X-Radiography Utilization study II (NEXUS-II) criteria, and the American College of Radiology Appropriateness Criteria for head trauma. Potential indications for performing CT in the acute setting for patients with concussion (to exclude more serious forms of traumatic brain injury such as intracranial hemorrhage) may include the following: loss of consciousness, post-traumatic amnesia, persistent altered mental status, focal neurology, signs of skull fractures or evidence of clinical deterioration.

Components of Glasgow coma scale	Score
Eye Responses	
Spontaneous	4
To sound	3
To pain	2
Never	1
Motor Responses	
Obeys command	6
Localizes pain	5
Normal flexion	4
Abnormal flexion	3
Extension	2
Nil	1
Verbal responses	
Oriented	5
Confused conversation	4
Inappropriate words	3
Incomprehensive sounds	2
None	1

Radiographic features of the following will be considered: Skull fracture, extradural hematoma, subdural hematoma (SDH), subdural hygroma, traumatic SAH, intraventricular hemorrhage, brain contusion, axonal injury, diffuse cerebral edema, vascular injuries, second brain injuries and herniation.

CT is the workhorse of imaging in TBI, especially in the acute setting, and is able to identify the majority of injuries at the time of presentation. Benefits of CT in the acute setting over MRI include increased sensitive for detection of fracture, vascular injury, CSF leak, and not needing to assess for MRI safety (particular in the setting of penetrating injury). CT can also be used to formally classify the degree of injury using a formal scale (e.g. Marshall classification or Rotterdam CT score).

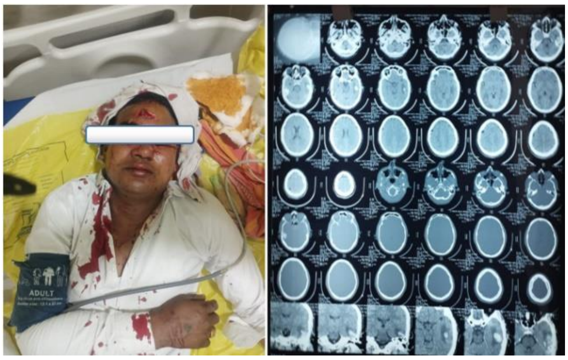

Figure 1: Picture and NCCT head of the patient who suffered moderate head injury

Aim and Objectives of Study

To study clinico-radiological correlation in moderate to severe head injuries. To study the clinical parameters in moderate to severe head injury using Glasgow coma scale (GCS). To study the radiological changes in moderate to severe head injuries. To correlate clinical and radiological changes to study the outcome in moderate to severe head injury.

MATERIALS AND METHODS

Duration of Study: 15-18 months (from October 2022 to march 2024)

Sample Size: All the patients of head injuries coming to this hospital during the study period. A sample size of 82 was taken.

Conflict of Interest: Nil

Financial Burden: Nil

RESULTS

Road traffic accident was the predominant mode of trauma found in 60.98% of moderate to severe head injury patients, followed by fall from height (24.39%), physical assault (10.98%) and fire arm injury (3.66%). Males are more prone to moderate to severe head injury than females (male female ratio is 2.4:1). Incidence is 70.73% in males and 29.27% in females.

In road traffic accident group, male to female ratio was 4:1, but when the cause was fall from height then male to female ratio is 1.5:1. In fire arm injury male to female ratio is 2:1 while in physical assault ratio is 0.8:1.Road traffic accident is the most common cause of moderate to severe head injury (70.73%) in age group 20-40 years; while fall from height is the most common cause of moderate to severe head injury (47.36%) in age group 0-20, but most of the cases (71.43%) were between 0-10 years of age.

Moderate to severe head injury is most common in 21-40 years of age groups (50%). Incidence of moderate head injury is 12.95%, while that of severe head injury is 11.75%. History of unconsciousness (68.3%) was the most common clinical presentation in patients with moderate to severe head injury followed by vomiting (47.56%), headache (34.15%),

ISSN (O): 2687-5365; ISSN (P): 2753-6556

ENT bleed/ discharge (28.05%) and convulsions (9.76%), shock (4.88%), respiratory distress (3.66%), abdominal distension (2.44%).

46.34% patients had bilaterally normal size normally reacting pupils, 28.05% patients had unilaterally reacting pupils and 25.61% patients had bilaterally non- reacting pupils. Long bone or pelvic bone fracture is the commonest associate injury (13.42%) in patients of moderate to severe head injury, followed by maxillary or mandibular fracture (10.97%), major chest injury (4.87%), abdominal visceral injury (3.66%), spinal injury (2.44%). Predominant cause of long bone or pelvic bone fracture associated with moderate to severe head injury is road traffic accidents (72.73%).

Cerebral oedema is the most common CT scan finding (63.42%) in moderate to severe head injury followed by skull fracture (62.19%) and hemorrhagic contusions (46.34%). In moderate to severe head injury patients 19.51% cases had acute subdural hematoma. Subarachnoid hemorrhage was seen in 29.29% patients, midline shift in 24.39% patients, pneumocranium in 12.19% patients and intraventricular hemorrhage in 10.97% patients. Skull fracture was common in frontal region (49.02%) followed by temporal or temporo-pariental region (33.33%) followed by parieto-occipital region (17.64%). Pneumocranium was most common is frontal region (60.0%) followed by temporal or temporo-parietal region (30.0%) followed by parieto-occipital region (10.0%). Extradural hematoma was maximally present in temporo-parietal region (48.0%) cases followed by frontal region (32.0%) cases; parieto-occipital (20%). Hemorrhagic contusion was maximally present in frontal regions (52.63%), followed by temporo-parietal region (26.31%), and parieto-occipital (21.05%). At all sites coup injuries were greater than contre-coup injuries.

Mortality was 100% in age group more than 60 years, 65% in 41-60 age group, 26.31% in 0-20 age group and 14.64% in 21-40 age group. Mortality was found to increase with fall in GCS. Patients with GCS 9-12 had 6.98% mortality rate while patients with GCS 3-8 had 58.98% mortality rate. Thus mortality correlates with GCS. Mortality also correlates with change in GCS at 48 hours. In 26 expired patients none of the patient showed improved GCS at 48 hours while 71.43% patients out of 35 fully recovered patients showed improved GCS at 48 hours. Out of 21 patients with bilaterally non-reacting pupils 90.48% patients expired. Out of 23 patients with unilaterally reacting pupils 26.09% patients expired while out of 38 patients with bilaterally reacting pupils only one patient (2.63%) expired. Among various CT findings, maximum mortality seen in intraventricular hemorrhage (77.78%), subarachnoid hemorrhage (79.17%), subdural hematoma (75.0%) followed by cerebral hematoma (50%) and generalized cerebral oedema (50%). Mortality in extradural hematoma was seen in 24% patients.

Out of 82 patients with moderate to severe head injury 33 patients (40.24%) required ventilatory support. 17 patients (65.38%) on ventilatory support expired while 10 patients (71.43%) had residual neurologic disability. Only 2 patients (5.72%) out of 35 patients who recovered fully required ventilatory support.

Neurosurgical intervention was done in 29 patients (35.37%) out of which 19 patients (65.52%) fully recovered, 4 patients (13.79%) had residual disability and 6 patients (20.69%) expired. Out of 53 patients (64.64%) in who, surgical intervention was not done 20 (37.74%) patients expired, full recovery was seen in 16 (30.19%) patients and 10 patients (18.87%) had residual deformity.

Study showed that systemic injury in moderate to severe head injury is associated with increased mortality. Out of 29 patients (35.37%) having systemic injury, 44.83% survived and 55.17% patients expired. Mortality was higher in major chest injury (75.0%) followed by abdominal visceral injury (66.67%), long bone or pelvic fracture (63.64%), spinal injury (50.0%) and maxillary or mandibular fracture (33.33%).

DISCUSSION

1. Outcomes compared with age group

In the present study incidence of mortality increase as age increases. In the 0-20 age group incidence of mortality is 26.31% in 21-40 age group mortality was seen in 14.64% patients. 65.0% patients expired in 41-60 age group and incidence mortality almost reaches to 100% above 60 year. Incidence of mortality in 0-20 age group is slightly higher than 21-40 age group as associated head injury was more severe in 0-20 age group.

Dr. Gupta R (1993) in his study of factors affecting outcome in severe age injury showed that for the same GCS score mortality increases as the age increases.

Hakkelhoven W. et al (2003) in his study showed that age is one of the factors that affects the outcome after head injury and outcome is decreasing with increasing age group.

Dr. K.G. Basvaraj et al (2005) in his study revealed that mortality increases as the age increases.[1-5]

2. Effect of GCS on the outcome of the patients

According to Marshall (1991) GCS provides simple grading of the arousal and functional capacity of the cerebral cortex. He found that as the GCS rises there is significant decline in mortality. In the present study there is 58.98% mortality among the patients having GCS 3-8 in comparison to 68.0% in the study of Marshall (1991). As the rises to 9-12 the mortality declines to 6.98% which too is similar to 4% in the study of Marshall (1991).[6-10]

3. Changes in GCS in first 48 hours correlated to outcome

Present study shows that improvement in GCS at 48 hours, improves survival in patients, 71.43% fully recovered patients showed GCS improvement at 48 hours while none of expired patient showed improved

ISSN (O): 2687-5365; ISSN (P): 2753-6556

GCS at 48 hours. Dr. K.G. Basvaraj et al (2005) in his study showed that patients with improved GCS had good outcome and patients with no change in GCS and deteriorating GCS had poor outcome.[11-13]

4. Outcome compared with pupillary changes

Present study showed that patients with bilaterally non reacting pupils had the worst outcome, (mortality 90.48%). Incidence of mortality in unilaterally reacting pupils is 26.09% while mortality seen in 2.63% patients with bilaterally reacting pupils. Classmann H et al (2001) in his study revealed that patients with normal pupils had better outcome as compared to those with anisocoria and worst outcome was seen in patients with fixed dilated pupils. Wani et al (2009), Dr. K.G. Basavaraj et al (2005) also showed that worst outcome was seen in fixed dilated pupil as compared to patients with unilaterally reacting pupils and outcome was best in patients with bilaterally reacting pupils.[14,15]

5. Outcome related to various CT scan findings in moderate to severe head injury

In the present study cute SDH was associated with mortality in 75% cases. Intracerebral hematoma was associated with mortality in 50% cases. Generalized cerebral edema was associated with mortality in 50%, EDH in 24% cases. Kishore et al (1987) reported that 53.0% cases of extracerebral hematoma has poor outcome and 57.0% cases of intracerebral hematoma had poor outcome. Zimmerman et al (1978) reported that mortality was related to acute hematoma in 31.0% cases, epidural hematoma had mortality in 2.0% cases while intracerebral hematoma had mortality in 2.0% cases while intracerebral hematoma had mortality in 33.3% cases and generalized cerebral swelling in 56.0% cases.[16]

6. Outcome compared with patient kept on ventilatory support

Present study showed that incidence of mortality was 65.38% in patients kept on ventilatory support and 34.62% patients who did not require ventilatory support. Increase in mortality and morbidity is due to the fact that most of the patients who need ventilatory support were of severe head injury. Also mechanical ventilation is associated with ventilator induced injury, barotrauma, ventilatory associated pneumonia and airway complications according to J.L.Y. Tsang N.D. Ferguson (2006). Arrival hypercapnoea and hypocapnoea are common and associated with worst outcome in intubated but not spontaneously breathing patients with traumatic brain injury, as shown by Davs DP et al (2006) in his study. Prehospital endotracheal intubation and advance life support is associated with increased mortality and morbidity as shown in various studies: Daniel P Davis (2008), Bozeman WP (2005), Bochicchio GV (2004) Want HE et al (2006).[17]

7. Neurosurgical intervention and outcome

In present study neurosurgical intervention was done in 29 patients (35.37%) out of which 19 patients (65.52%) fully recovered, for patients (13.79%) had residual deformity and 6 patients (20.69%) patients expired. It shows that outcome in patients in whom surgical intervention was not done. Clusmann H et al (2001) in his study showed that patients who underwent surgical intervention had better outcome than those who were managed conservatively. This was possible due to localized nature of lesion in surgical group leading to rapid reduction of ICP after surgery. While in patients managed conservatively injuries were diffuse hence only medical methods were used to reduce ICP.

8. Outcome in patients with head injury associated with systemic injury

Present study showed that associated systemic injury is associated with increased mortality (55.17%). Prasad B Rajendra et al (2009), Pradeep K Narotam et al (October 2009) in their study showed that systemic injury is associated with increased mortality due to major blood loss resulting in shock.

CONCLUSION

Moderate to severe head injury is most common in 21-40 years of age groups (50%). Incidence of moderate head injury is 12.95%, while that of severe head injury is 11.75%. Mortality was 100% in age group more than 60 years, 65% in 41-60 age group, 26.31% in 0-20 age group and 14.64% in 21-40 age group.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556