Clinical characteristics and outcomes of traumatic brain injury patients admitted to tertiary level surgical intensive care unit of Kashmir, India

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Abstract---Background: Traumatic brain injury (TBI) is a leading cause of mortality, morbidity, disability, and socioeconomic losses in the Indian subcontinent. For policy making, there is a lack of reliable and larger data regarding traumatic brain injuries in our setting. Aim: In our study an attempt was made to analyze and assess the clinical characteristics of patients with traumatic brain injuries admitted in Surgical Intensive Care Unit of SMHS hospital Srinagar. Materials and Methods: In this observational study, 89 patients of TBI admitted in SICU during study period were enrolled, after obtaining ethical clearance from institutional ethical clearance committee. All the study patients were followed up in SICU on daily basis. All the data required for study was recorded from the patient’s clinical notes as per study protocol. Outcome of patients was assessed in terms of survival at discharge from SICU. Results: Majority of the TBI patients requiring
ICU admission had Severe TBI (64%). All the patients required CT Brain on arrival to hospital and brain contusions (65.2%) were the most common findings on CT brain. Check CT brain was required in 53.9% of patients. There was need for neurosurgical intervention in 49.4% of patients and 21.3% required blood transfusions. 98.9% of patients required invasemecanical ventilation, with median 9 days of ventilation (Range = 1-42 days). 32.6% of patients required tracheostomy during stay in SICU. 93.3% of study population developed some form of SSIs with hyperthermia (76.4%) being the most common. 57.3% of patients developed complication(s) during stay in SICU, nosocomial infections (38.2%) being the most common one. The median of days stay in ICU were 10 days with a range of 1-48 days. 51.7% of our study population survived, with 30.4% of patients having residual neuro deficit on discharge from SICU. The statistically significant factors affecting survival in our observation were age, post resuscitation GCS, presence of comorbidity and pupillary reaction to light. Conclusions: There is an urgent need to improve access to pre-hospital care in TBI patients with improvement in Ambulance transportation facilities for injured patients. Strict implementation of traffic safety norms like wearing of seat belts, use of helmets, use of footpaths by pedestrians and driving within prescribed speed limits will help to decrease the overall burden of RTAs and in turn TBIs.

Keywords---traumatic brain injury, mortality, outcome, surgical intensive care unit.

Introduction

Traumatic Brain Injury (TBI) is considered as one of the most complex and chronic conditions due to its highly heterogeneous profile in terms of pathophysiology, clinical presentation and outcome. [1] TBI is frequently referred to as a “silent epidemic” because the complications from TBI, such as changes affecting thinking, sensation, language, or emotions, may not be readily apparent. In addition, society is largely unaware of the magnitude of this problem. [2] With an estimated 3 million people affected annually by TBI, the burden of mortality and morbidity that this condition imposes on society, makes TBI a pressing public health and medical problem. [3] According to the World Health Organization’s (WHO) predictions, in 2030, road traffic accidents will be the leading cause of morbidity and mortality of young people worldwide. [4] This is largely related to the frequency and severity of the brain lesions caused by the accidents. Brain trauma is considered to be the leading cause of death following a traffic accident. The international incidence of TBI (of any severity) is reported to be 349 (95% CI 96 – 1266) per 100,000 person-years. [5]

TBI is a leading cause of mortality, morbidity, disability, and socioeconomic losses in India as well. It is estimated that nearly 1.5–2 million people are injured, and 1 million die every year in India. [6] There are large gaps in research on TBI in countries with its highest burden and India is no exception to this. Furthermore, global research on neuro trauma must be performed in this context because the
transfer of evidence based guidelines from a high income setting do not apply to the injuries experienced in low and middle income countries (LMICs). [7]

**Material and Methods**

The study was conducted at Surgical Intensive Care Unit (SICU) of SMHS hospital, an associated hospital of Government Medical College Srinagar. The SICU is a fourteen bedded multidisciplinary unit catering to patients of all specialties. TBI patients are admitted under Neurosurgery department and care of these patients in SICU is coordinated by consultants in the hospital’s Department of Anesthesiology and Critical Care. The study was conducted for a period of fourteen months after obtaining ethical clearance from the Institutional Ethical Committee.

This was a prospective observational study on patients admitted for TBI in SICU of SMHS hospital. Waiver of consent was requested from the Institutional Ethical committee as the data required for study was collected from clinical notes and treatment charts of the patients which was freely accessible, and its use implied no risk to the well-being of the population studied. All the data required for the study was obtained from the patient’s clinical notes with multiple contributors. On admission to SICU, following parameters were recorded:

1. Socio-demographic parameters [Age (completed years), gender, occupation].
2. Mechanism of injury (Road Traffic Accident, fall, aggressions, etc).
3. Time interval between trauma and reporting to hospital.
4. Other associated injuries (Chest, Abdomen, limbs).
5. Presence of co-morbidities (HTN, DM, etc).
7. Glasgow coma scale (GCS). Clinically injury severity was based on postresuscitation GCS score and defined as mild TBI (GCS 13-15); moderate TBI (GCS 9-12); or severe TBI (GCS 3-8).
8. Convulsions.
9. Presence of shock (SBP < 90 mmHg or MAP < 65 mmHg).
11. CT Brain results.

During stay in SICU, all the patients of TBI were managed as per institutional treatment protocol / guidelines, which are same as are being followed in apical institutes of the country, and following parameters were recorded for our study:

1. Need for mechanical ventilation.
2. Days of mechanical ventilation.
3. Need for tracheostomy.
4. Need for check CT brain.
5. Development of secondary systemic insults:
6. Development of complications during stay in SICU.
7. Total number of days of stay in SICU.
Outcome of patients was assessed in terms of survival at discharge from SICU. In case of survival, presence of residual neurodeficit if any was assessed. In case of death, date and time of death were recorded.

**Statistical Methods**

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel). Categorical data was summarized as frequency and percentage. Continuous variables were summarized as mean and standard deviation (or median and interquartile range if data was not normally distributed). The association of mortality with different clinical characteristics was analyzed using chi-square test (or Fischer’s exact test if the expected numbers were small). A p-value < 0.05 was considered statistically significant. Data analysis was done using SPSS (SPSS Inc. Chicago, Illinois, USA).

**Results**

Our prospective observational study, “Clinical characteristics and outcomes of Traumatic Brain Injury patients admitted to tertiary level Surgical Intensive Care Unit of Kashmir, India” was conducted in Postgraduate Department of Anaesthesiology and Critical care, Government Medical College Srinagar. Data for the study was collected from September 2020 to October 2021 (fourteen months). During this period, 89 patients of TBI were admitted in SICU, enrolled for the study and observed for various study parameters as per protocol. The mean age of study patients admitted in SICU was 33.9 ± 19.91 with range of 1 – 80 years. Maximum number of patients (22.5%) in our study belonged to age group 21-30 years followed by age group 41-50 years (21.3%) (Table 1). 73% (n = 65) of the study population were males and 27% (n=24) were females.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-10</td>
<td>16</td>
<td>18.0</td>
</tr>
<tr>
<td>11-22</td>
<td>7</td>
<td>7.9</td>
</tr>
<tr>
<td>21-30</td>
<td>30</td>
<td>22.5</td>
</tr>
<tr>
<td>31-40</td>
<td>11</td>
<td>12.4</td>
</tr>
<tr>
<td>41-50</td>
<td>19</td>
<td>21.3</td>
</tr>
<tr>
<td>51-60</td>
<td>7</td>
<td>7.9</td>
</tr>
<tr>
<td>&gt;60</td>
<td>9</td>
<td>10.1</td>
</tr>
<tr>
<td>Total</td>
<td>89</td>
<td>100</td>
</tr>
</tbody>
</table>

Mean±SD=33.9±19.91

Majority (68.5%) of patients of TBI who needed SICU admission had isolated head injury (Table 2).
Table 2: Type of injury among the study population

<table>
<thead>
<tr>
<th>Type of injury</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polytrauma</td>
<td>28</td>
<td>31.5</td>
</tr>
<tr>
<td>Isolated head injury</td>
<td>61</td>
<td>68.5</td>
</tr>
<tr>
<td>Total</td>
<td>89</td>
<td>100</td>
</tr>
</tbody>
</table>

70.8% (n=63) patients of TBI admitted in SICU failed to reach hospital within one hour (Golden hour) of trauma. The median pre hospital time interval in our study was 80 mins. with a range of 10-810 mins. (Table 3).

Table 3: Pre hospital time in study population

<table>
<thead>
<tr>
<th>Time (Minutes)</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;60</td>
<td>26</td>
<td>29.2</td>
</tr>
<tr>
<td>60-120</td>
<td>34</td>
<td>38.2</td>
</tr>
<tr>
<td>120-180</td>
<td>12</td>
<td>13.5</td>
</tr>
<tr>
<td>180-240</td>
<td>10</td>
<td>11.2</td>
</tr>
<tr>
<td>≥240</td>
<td>7</td>
<td>7.9</td>
</tr>
<tr>
<td>Total</td>
<td>89</td>
<td>100</td>
</tr>
</tbody>
</table>

Among the study population, 49.4% needed surgical intervention, 21.3% needed blood transfusion, and 98.9% needed mechanical ventilation. Tracheostomy was done in 32.6% of patients and 53.9% of study patients required check CT brain (fig 1).

Fig 1. Need for surgical intervention, blood transfusion, mechanical ventilation, tracheostomy and check CT brain

Among the study population, the median days of mechanical ventilation were 9 days with a range of 1-42 days. Majority (47.2%) of patients needed mechanical ventilation between 1-7 days (fig 2).
The observed survival rate in the study population was 51.7% (Fig 3).

The median duration of stay of study population in SICU was 10 days with a range of 1-48 days. Majority of these patients (40.4%) stayed between 1-7 days, followed by those who stayed 8-14 days (22.5%). Patients with 15-21 days and >21 days stays accounted for 18% and 19.1% respectively.

**Discussion**

Traumatic Brain Injury is one of the major health issues throughout the world, with highest burden in developing countries including India. The importance of the problem of TBI is always underestimated because high quality
research on TBI is essentially lacking in India and Kashmir is no exception. [7,8,9] Our study was aimed to bridge the gaps in research on TBI in Kashmir.

The mean age of study patients was 33.9 ± 19.91 years with a range of 1 – 80 completed years. Maximum number (22.5%) of patients in our study belonged to age group of 21-30 years. Age of patient was found to be one of the statistically significant parameter affecting survival in our study (p-value = 0.015). We observed male preponderance in our study. 73% of the study population were males and 27% were females. Maximum number of the patients in our study were students. The studies conducted by TobiKU et al,[10]Chelly H et al,[11]Wabule A et al.,[12]Gao G et al [13] and Para RA et al [9] too had young male dominance of TBI patients which is in synchronicity with our study. TBI is more common in young males, one of the reason being that the mobility of male population is higher than their female counterpart and they are exposed to more accidental risk factors at various places. The age profile of our study population is different to the study conducted by KokkinouM et al. [1] The mean age in their study was 45.72 ±21.64 years which is among the highest of all previously reported studies.

In our study, 68.5% of patients had isolated TBI, while TBI was associated with polytrauma in 31.5% of patients. Among polytrauma patients, chest injuries were the most common associated injuries. The results are similar to study conducted by Kamal VK et al.[8] In their study, TBI was associated with polytrauma in 24.30% patients, whereas study conducted by Chelly H et al.[11] have found TBI associated with polytrauma in 65% of patients admitted in ICU. The increased incidence of polytrauma associated with TBI was attributed to severity of trauma due to road traffic accidents.

In our study 22.5% of TBI patients had received pre-hospital care before being shifted to our hospital. On the contrary the study done by Gururaj G et al[14] shows pre-hospital care was received by 22.1% of TBI patients from rural areas and 80.3% of patients from urban areas of Bangalore. Our findings are in contrast to the study conducted by Shekhar C et al.[15] in which 61% of TBI patients had received prehospital care. Prehospital care for TBI focuses on preventing secondary brain injury by on-scene stabilization, to triage those with mass lesions and impending cerebral herniation, and rapid transportation to an appropriate hospital. Organized traumasystems with defined protocols for field resuscitation, modes of transport, and trauma facility destination ensure reproducible high-quality prehospital care. Various studies suggest that the availability, accessibility, affordability and utilization of prehospital and emergency care are major determinants for survival and outcome in TBIs.[16,17,18] These findings reflect that availability and quality of prehospital and emergency care services are extremely poor and deficient in Kashmir.

The median time interval from trauma to reporting to hospital in our study population is 80 mins. [Range = 10-810 mins.]. 70.8% of the study population failed to reach to the hospital within one hour (Golden Hour) of trauma. Although longer prehospital time is not associated with increased risk of 30 day mortality in trauma patients overall, a survival benefit exists in patients arriving earlier to hospital after severe head injury. [19] Longer prehospital time is detrimental to functional outcome in TBI. Every 10-minute delay in total
prehospital time has been associated with a 6% increase in the odds of a poor functional outcome. Establishment of prehospital care in developing countries has been shown to reduce mortality. Our findings reflect the need to improve transportation and thus reduce the prehospital time in TBI patients for improved survival and functional outcome.

RTA (46.1%) followed by FFH (37.1%) are the most common modes of injury among study population in our study. Gao G et al [13] in their study on the clinical characteristics and outcomes in patients with TBI admitted in China found RTA (50%) as the major cause of injury followed by incidental fall (33%). The results of our study are also in accordance with the study conducted by Para RA et al [9] on the management and outcome of isolated TBI patients admitted in ICU in which the most common mode of injury was RTA (43.6%) followed by FFH (35.7%). In a study conducted by Tobi KU et al [10] on the outcome of TBI in the ICU, 89.6% of the cases of TBI were due to RTA. RTA as the most common mode of injury in our study may be because of poor traffic planning, bad road network & lesser use of safety measures like wearing seat belts or helmets.

All the patients of TBI admitted in SICU had undergone CT brain in emergency department. 53.90% of the patients needed check CT brain while admitted in SICU. 86.5% needed FAST/eFAST scans, 53.9% needed CT Chest and 27% needed CTA Abdomen. These investigations not only increase the burden on hospital resources but also increases the cost of treatment in TBI patients. Among all the patients of TBI admitted in SICU, 49.4% underwent various neurosurgical interventions. Study conducted by Kokkinou M et al [1] had neurosurgical intervention in 76.65% of patients, 33% of patients needed neurosurgical intervention in study conducted by Chelly H et al [11] while as in a study conducted by Para RA et al [9] neurosurgical intervention was done in 30% of patients.

In our study, 98.9% of patients of TBI admitted in SICU needed mechanical ventilation. The finding in our study is similar to the study conducted by Kokkinou M et al [1] in which 98.76% of TBI patients received mechanical ventilation. Similar finding was also reported by Chelly H et al. [11], in their study 97.6% of patients needed mechanical ventilation. Mechanical ventilation is fundamental to resuscitation of brain injured patients, facilitating tissue oxygen delivery, helping to modulate cerebral vascular reactivity, and ensuring protection of the airway. [22] There was a need for tracheostomy in 32.6% of patients in our study. The incidence of tracheostomy in our study is higher than in the study conducted by Wabule A et al [12] (19.64%). The higher incidence may be due to the fact that our centre practices early tracheostomy in severe TBI patients. Various studies demonstrate that early tracheostomy in severe TBI patients contributes to a lower exposure to secondary insults and nosocomial adverse events, increasing the opportunity of patient’s early ventilator weaning, rehabilitation and discharge. [9, 10, 14] Early and late tracheostomy are both recommended in literature.

In our study, 57.3% of patients developed some complication(s) during stay in SICU. Nosocomial infections (38.2%) followed by Pneumonia (22.5%) were the most common complications seen in our study. Septicaemia was seen in 13.5%
of patients. The results are almost similar to the study conducted by Chelly H et al. [11] In their study, nosocomial infections were seen in 47.3% of patients. Pneumonia in 38% and septicaemia in 13% of patients. Studies have shown that non-neurological complications are a common occurrence in neurotrauma ICU. These complications have significant bearing on ICU stay, disability, and ICU mortality. [23, 24, 25] The median duration of ICU stay in our study was 10 days with a range of 1-48 days. Majority of the patients (40.4%) had a stay between 1-7 days, while as 22.5% had a stay in ICU between 8-14 days. In a study conducted by Chelly H et al., [11] the mean stay of TBI patients in ICU was 16 ± 17.4 days. In a study conducted by Tobi KU et al. [10] 76.4% of patients had 1-7 days of stay in ICU, 11.5% had 8-14 days of stay and 8.8% had a stay of 15-21 days in ICU. The duration of stay in ICU has direct impact on overall morbidity, use of hospital resources and treatment cost. In our study, 51.7% of the patients survived on discharge from SICU. 30.4% of patients among those survived, had residual neurodeficit. Based on severity of TBI, 42.1% of severe TBI, 61.9% of moderate TBI and 81.8% of mild TBI survived on discharge from SICU. The survival rate based on severity of TBI was statistically significant (p-value = 0.031). The survival rate in our study is slightly better than that of Tobi KU et al., [10] who had a survival rate of 47.8% in their study. However, it is quite less than that of Gao G et al., [13] who had a survival rate of 95% in their study.

Thus, our study highlights the pattern of TBI among patients presenting to SICU of SMHS hospital, Srinagar, Kashmir. The results obtained from this study will help in enhancing the knowledge on burden of TBI in ICU, improving effective allocation and judicious use of ICU resources, and aid in formulating more effective preventive and management strategies. In addition, the study of factors affecting mortality as revealed in our study can be used in SICU to prognosticate outcomes in such patients.

Limitations

Limitation of the present study is that the outcome assessment was limited to outcome on discharge from SICU and no information on long term complications, quality of life and outcomes was collected. Also, the study was carried out during the lock down period due to corona virus pandemic otherwise the sample size of the study population could have been more to correlate and validate the more accurate data.

Conflict of Interest: Nil
Funding: Nil

References

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