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A Study Of Severe Traumatic Brain Injury At A Tertiary Care Center

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Abstract

Background: Traumatic brain injurycauses headaches, memory loss, and mood changes due to external influences. Global incidence rates fluctuate, making it a major public health issue. Traumatic brain injuryseverity affects prognosis for closed and penetrating head injuries. Life-threatening severe traumatic brain injuryis more common in low- and middle-income nations and has enduring physical, cognitive, emotional, and social effects on patients and carers.
Aims and objectives: The objective of this study was to conduct an analysis of outcomes and identify potential areas for improvement in the management of severe traumatic brain injury in a Tertiary care centre.
Method: This study, conducted from February 2023 to September 2023 at Teerthanker Mahaveer hospital& Research Center, Moradabad, focused on traumatic brain injury (TBI). Assessed patient's through glasgow coma scale (GCS),Inclusion criteria covered traumatic brain injury patients with 15-45 years age.
Result: The study declare predictors of 2-week mortality in severe traumatic brain injury patients. Age, GCS, and pupillary response significantly influence outcomes. The study involved 80 patients with severe traumatic brain injuries (TBIs), analyzing demographics, treatments, and mortality outcomes. Most patients were males (85%) aged 25-40 (47.5%). Common causes included road accidents (70%) and assaults (18.75%). Medical interventions varied, with 27.5% needing ventilator support, 20% receiving anti-seizure medication, and 30% treated for brain swelling. Surgery was conducted in 26.25% of cases, challenging current intracranial pressure monitoring standards. Mortality was significant, with a 2-week mortality rate of 37.5%, highlighting the challenges in treating severe traumatic brain injury. Age and time until treatment were identified as significant predictors of mortality.
Conclusion: Countries have greater fatality rates for severe Traumatic brain injurydue to fewer resources. Pre-hospital, education, and collaboration can improve care for traumatic brain injurypatients.

Keywords: "Traumatic brain injury (TBI)", Glasgow Coma Scale (GCS),Headaches, Memory loss, and mood changes.

Introduction

"Traumatic brain injury (TBI)" is the outcome of external forces causing harm to the brain, and it may arise from diverse incidents like falls, motor vehicle accidents, sports-related injuries, or physical assaults.The severity of traumatic brain injury varies, spanning from mild to severe, dependent upon the degree of brain damage. Manifestations enclose symptoms like headaches, dizziness, confusion, memory impairment, concentration difficulties, mood fluctuations, and even instances of damage of awareness [1].
"Traumatic brain injury (TBI)" is an important public health concern, mainly among young individuals, serving as the leading cause of hospitalization and disability.Traumatic brain injury can result from various incidents like falls, accidents, assaults, and sports injuries, leading to severe complications, including seizures, dementia, cranial nerve damage, and psychiatric disorders. However, only about 25% of traumatic brain injury survivors reach long-term useful individuality.[2]
"Traumatic brain injury (TBI)" is a widespread issue with a notable global presence. It is valued that the annual frequency of traumatic brain injury global is around 295 cases per 100,000 persons. However, it is vital to underscore that the burden of TBI differs across various regions and demographic groups. For instance, "Latin America and Sub-Saharan Africa" experience higher traumatic brain injury incidence rates compared to the global average [3,4].
"Traumatic brain injuries (TBI)" enclose several distinct types. Closed Head Injuries, the most common, occur when the brain collides with the skull due to sudden impacts, potentially causing concussions, contusions, or diffuse axonal injuries. Penetrating Head Injuries involve objects penetrating the skull, often requiring surgery. "Diffuse Axonal Injuries (DAI)" result from severe rotational forces, such as those in car accidents, leading to widespread brain damage. Concussions, categorized as mild TBIs, cause temporary brain function changes, while contusions manifest as localized brain bruises, leading to swelling, bleeding, and neurological deficits. [1,5].

"Traumatic brain injury (TBI)"enclose a spectrum of severity, categorized using the "Glasgow Coma Scale (GCS)". Mild TBI, often known as a concussion, involves brief confusion or unconsciousness with symptoms resolving within weeks. Moderate TBI results in extended unconsciousness and persistent cognitive issues. Severe TBI, the most critical, leads to prolonged unconsciousness, severe cognitive and physical impairments, and increased risk of long-term complications. TBI severity significantly impacts prognosis, rehabilitation needs, and overall quality of life. [1].

Severe "traumatic brain injury (TBI)" constitutes a grave and often life-threatening condition stemming from a traumatic incident, such as a motor vehicle accident, fall, or physical assault. It is characterized by a "Glasgow Coma Scale (GCS)" score ranging from 3 to 8, signaling a profound impairment of consciousness. Severe traumatic brain injury can precipitate a spectrum of complexities, encompassing intracranial hemorrhage, cerebral edema, and harm to vital brain tissue.Timely medical intervention and specialized,customized care are paramount in the management of severe traumatic brain injury, serving to reduce enduring disabilities and protracted complications, and ultimately enhancing the prospects for recovery [1,5].

The occurrence of severe "traumatic brain injury (TBI)" varies by population and region. Research indicates an annual rate of about 73 severe TBI cases per 100,000 people. However, it's crucial to recognize that this frequency is influenced by factors such as age, socioeconomic status, and geographic location. Notably, the burden of severe TBI is more pronounced in "Low And Middle Income Countries" compared to "High-Income Countries ", underscoring the complex interplay of demographic and economic factors in determining traumatic brain injury prevalence [6].

Severe "traumatic brain injury (TBI)" has a profound and lasting impact, affecting individuals physically, cognitively, emotionally, and socially. Physical challenges include paralysis, coordination issues, and sensory impairments. Cognitive and emotional struggles range from memory and attention deficits to mood swings and disorders like depression and anxiety. It can lead to social isolation and strained relationships. Financially, it may result in unemployment and reliance on others. Caregivers often bear significant physical, emotional, and financial burdens while providing essential support to individuals with severe traumatic brain injury [7-12].

Method

Research Design

This study was conducted at Teerthanker Mahaveer hospital& Research Center, Moradabadfrom February 2023 to September 2023.Assessed patients through Glasgow Coma Scale. Data was collected with our ethics committee and board permission. All patient datawere registered within 24 hours of arrival and tracked throughout their hospitalisation until the 14th day.

Inclusion and exclusion criteria

Inclusion

- Patients hospitalised at our Teerthanker Mahaveer hospital& Research Center, Moradabadhospital with traumatic brain injury.
- Patients with GCS 3 to 8
- Patients with 15-45 years of age.
- Patients with TBI who were assessed and documented within 24 hours after hospital arrival.
- Patients with complete and relevant registry data on TBI management and outcomes.
- Patients with TBI who survived hospitalisation.

Exclusion

- Patients with “traumatic brain injuries” who were proclaimed dead upon arrival or for whom no medical records could be located for the registry.
- Patients without enough data to assess TBI therapy and outcomes.
- Patients with Non- Traumatic brain injury diagnoses who were hospitalised and found to have Traumatic brain injury.

Statistical analysis

This data analysis used SPSS 25 software to examine data distribution and create summary statistics for categorical and continuous variables. Frequencies and sizes were considered for categorical data, whereas income, “standard deviations”, middles, and “interquartile ranges” were considered for constant variables. Age, gender, admission “Glasgow Coma Scale (GCS)” mark, pupillary reaction, “hypotension”, number of days between wound and hospitalisation.A substantial outcome connection was found in the univariate analysis.Then included these significant univariate variables in a multivariable logistic regression model. To maintain results integrity, regression analysis removed patients with missing covariate data. All statistical tests used a two-sided approach, with a significance level of $p < 0.05$.

Ethical approval

The patients' permission had been obtained. The ethics board had given its clearance of approval to the study's

Result

Table 1 outlines the baseline and demographic features of the patients in the study. The majority of participants were between the ages of 25 and 40, constituting 47.5% of the sample, while those aged 15-25 and 40-45 years, represented 12.5% and 40%, respectively. The gender distribution was predominantly male (85%). Accidental wounding on the road was the leading cause of injury (70%), followed by assault (18.75%), fall (5%), and blunt injury (6.25%). The " Glasgow Coma Scale " upon admission showed that 77.5% of patients had a score in the range of 6–8. Most patients (68.75%) were admitted to the acute care unit within 1 day of injury. Pupillary reaction examination indicated that 52.5% had a normal reaction, 18.75% had an abnormal reaction, 15% had unilateral reactions, and 12.5% had bilateral reactions. Following resuscitation, the majority of patients (93.75%) had hypotension with a blood pressure of ≥90 mm Hg. These baseline characteristics provide a comprehensive overview of the study population, essential for understanding the context of the subsequent analyses and findings.

Table1: Baseline and demographic features of the patients in this study

Parameters	N	%
Age		
15-25	10	12.5
25-40	38	47.5
40-45	32	40
Gender		
Male	68	85
Female	12	15
Injury's Cause and Effect		
Accidental wounding on the road	56	70
Fall	4	5
Assault	15	18.75
Blunt injury	5	6.25
"Glasgow Coma Scale" upon admission		
3–5	18	22.5
6–8	62	77.5
Acute care unit admission time in days		
< 1 day	55	68.75
≥ 1 day	25	31.25
The examination of pupillary reaction upon admission		
Normal	42	52.5
Abnormal	16	18.75
Unilateral	12	15.00
Bilateral	10	12.5
The occurrence of hypotension following resuscitation		
< 90 mm Hg	5	6.25
≥ 90 mm Hg	75	93.75

Some 27.5% needed ventilator support, and 20% were given medicine to prevent further seizure activity after their injuries. In addition, 30% were treated with hyperosmolar medicine for brain swelling. The fact that surgery was conducted in 26.25 % of instances indicates that a sizable percentage of patients required surgical intervention. Surprisingly, no one had a ventriculostomy for ICP monitor implanted, which calls into question current standards for ICP monitoring. The variety of diagnostic and therapeutic methods used to treat severe traumatic brain injuries is illuminated by these findings. Figure 1 shows the various medical managements given to the patients while Figure 2 presents the interventional managements provided to the patients.

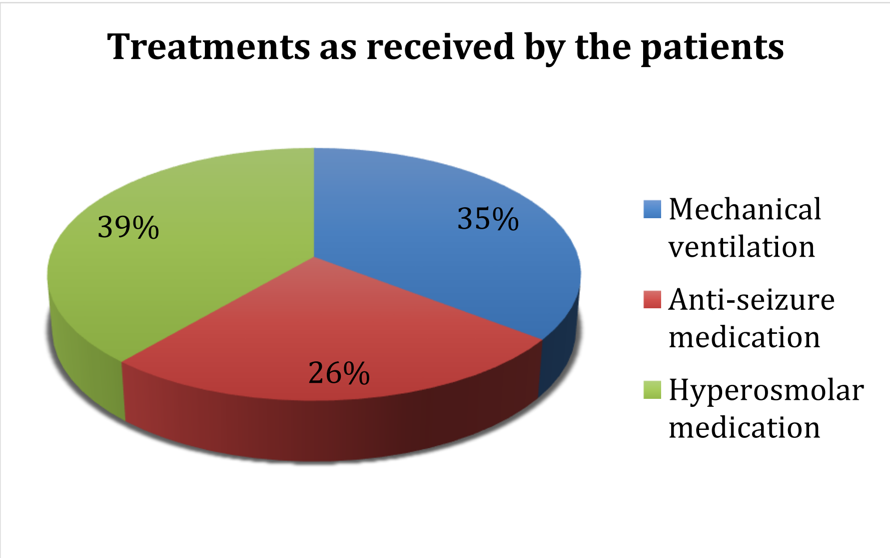

Figure 1: Types of Treatments received by the patients

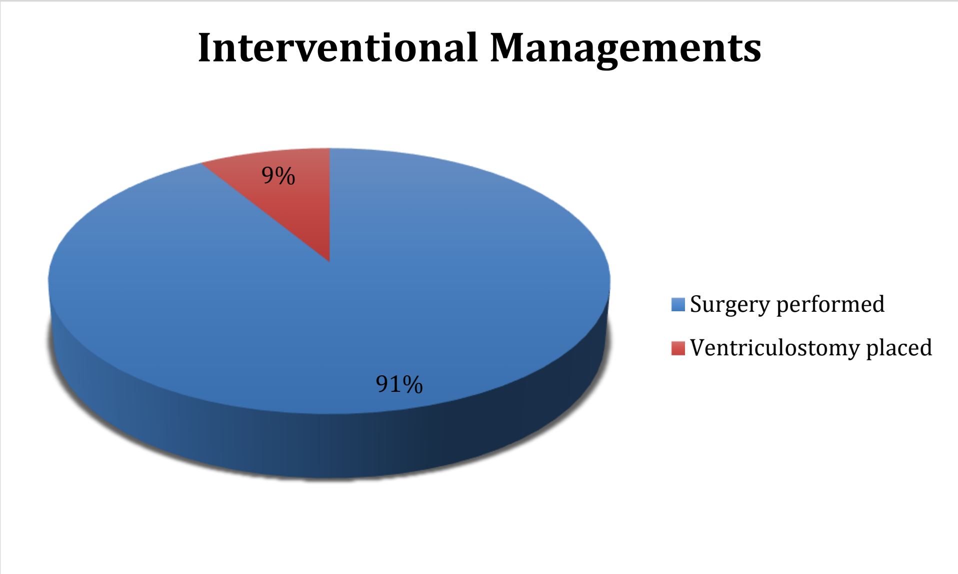

Figure 2: Interventional managements as received by the patients

Table 2 shows the findings regarding mortality in this study. The median hospital stay was 11 days, with an interquartile range (IQR) of 5 to 22 days, showing significant variance. The first-day survival rate was 93.75%, while the 24-hour death rate was 6.25%. At two weeks, 37.5% of patients died and 62.5% survived. The high mortality rate before discharge of 43.75% highlights the difficulties of treating severe traumatic brain injuries. These figures show how serious these injuries are and how they affect patient outcomes, emphasising the need for good treatment and care.

Table 2: Results from a study of 80 patients hospitalised with severe TBI

Parameters	**Median**	**IQR**
Length of Stay	11	5–22
24-hr Mortality		
Yes	5	6.25
No	75	93.75
2-week Mortality		
Yes	30	37.5
No	50	62.5
Mortality before discharge		
Yes	35	43 .75
No	45	56.25

Table 3 outlines risk factors associated with 2-week mortality in severe traumatic brain injury (TBI) cases. The demographic cohort analyzed is categorized by age groups (15-25, 25-40, and 40-45). Age shows that for each year increase, there is a 1.03 times higher odds of 2-week mortality, with a statistically significant p-value of 0.01. Specifically, the age group 25-40 and 40-45 has p-values of 0.02 and 0.002, respectively, suggesting a significant association with increased mortality compared to the reference group (<30). The time period between injury and acceptance for treatment also shows significance, with patients waiting ≥30 days having 3.31 times higher odds of 2-week mortality compared to those accepted in <30 days (p-value: 0.006). Gender, as well as anomalies detected on a computed tomography (CT) scan, do not appear to have a statistically significant impact on 2-week mortality. The Glasgow Coma Scale (GCS) admissions Class is associated with lower odds of mortality, with the 3-5 GCS class having higher odds (p-value: 0.01), but this association loses significance in the multivariate analysis (p-value: 0.2).Overall, the study suggests that age and time period until acceptance are notable predictors of 2-week mortality in severe traumatic Brain Inury cases.

Table 3: Risk factors for severe TBI 2-week mortality

Predictive Variable	2-week mortality N (%)	OR	Univariate 95% CI	P value 0.01	OR	Multivariate 95% CI	P value
Age (continuous)	39 (48.75)	1.03	1.01–1.05	**0.01**			
The demographic cohort under consideration is the age group.							
15-25	-						
25-40							**0.02**
40-45				**0.02**			**0.002**
Time period							
<30	12 (15.00)	reference	reference	reference			
≥30	26 (32.5)	3.31	1.41–8.01	**0.006**			
Gender							
Male	33 (41.25)	1.21	0.41–3.41	0.79			
Female	7 (8.75)	reference	reference	reference			
“GCS Admissions Class”	40 (50.00)	0.71	0.51–0.89	**0.003**			
“GCS Admissions Class”							
3–5	17 (21.25)	2.91	1.31–7.51	**0.01**	2.11	0.71–5.98	0.2
6–8	23 (28.75)	reference	reference	reference	reference	reference	reference

Discussion

In our comprehensive study on severe “traumatic brain injury (TBI)”, a crucial aspect of our analysis was the in-depth examination of the demographic characteristics of the patients included in our research cohort. This encompassed a thorough investigation of factors such as age, gender distribution, mechanisms of injury, and, in some cases, the patients' geographic backgrounds.

In Myburgh et al.'s (2008) extensive study of 635 patients from 16 medical centers, they examined the demographic and clinical aspects of severe “traumatic brain injury (TBI)”. The mean age of participants was 41.6 years, with a majority of men (74.2%). The main causes of severe TBI were vehicular trauma (61.4%) and falls in elderly patients (24.9%), and 57.2% had severe TBI (“Glasgow Coma Scale” ≤ 8). Secondary brain insults were recorded in 28.5% of cases. Despite the use of intracranial pressure monitoring in 44.5% of severe TBI cases, the 12-month mortality rate was 26.9% for all patients and 35.1% for severe TBI patients. Nevertheless, 58.8% of all patients and 48.5% of severe TBI patients achieved favorable outcomes, underscoring the potential for recovery in this patient population. [13].

Gomez et al.'s (2014) 25-year study reveals a shift in the demographic and epidemiological profile of severe “traumatic brain injuries (TBI)”. The mean age of affected individuals increased from 35 to 43 years. While the overall frequency of severe TBI decreased by 13%, the gender distribution remained relatively constant. The nature of these injuries changed significantly, with a decline in traffic accidents, particularly 4-wheeled vehicle incidents, and a notable increase in falls, particularly among older women. Structural injuries like contusions and subdural hematomas became more prevalent. [14].

Myburgh et al. (2008) highlighted a significant gender disparity in their study on severe “traumatic brain injury (TBI)”, with 74.2% of patients being male, consistent with the broader trend of male predominance in severe TBI cases. Ziaeirad et al. (2018) delved into the intricacies of severe TBI in adults, revealing that a substantial 87.27% of the patient cohort were men. Road traffic accidents emerged as the primary cause, contributing to a staggering 79.40% of severe TBI cases. Beyond road accidents, the study unveiled a spectrum of causative factors, including falls, assaults, and sports-related injuries, providing valuable insights for injury prevention strategies and a comprehensive understanding of severe TBI in the adult population. [15].

In a parallel vein, Talving et al.'s (2009) investigation unearthed the prevailing mechanisms behind sport-related "traumatic brain injuries (TBI)". Notably, the primary causes were identified as football-related incidents involving kicks (38.1%) and falls during various sporting activities (20.3%). This insightful study illuminates the specific dynamics within the realm of sports-related TBI, providing a targeted perspective on the key factors contributing to these injuries [16].

Andriessen et al.'s (2011) multicenter study of 508 patients with moderate-to-severe traumatic brain injury (TBI) revealed diagnostic variations, with 15% of cases classified differently when considering accident scene "Glasgow Coma Scale (GCS)" scores. Patients diagnosed with severe TBI at both time points exhibited higher in-hospital mortality (44%) compared to those with moderate TBI at one or both time points (7-15%). Implementing a threshold of ≥6 hours of impaired consciousness led to diagnostic changes in 14% of cases, with lower mortality when impaired consciousness was shorter [17].

Brazinova et al.'s (2010) study on severe "traumatic brain injury (TBI)" in patients aged 65 and older identified several critical predictors of adverse outcomes, including higher "Injury Severity Score (ISS)", "Trauma and Injury Severity Score (TRISS)", and "Abbreviated Injury Scale (AIS)" scores for head injuries. These factors were associated with increased mortality rates [18]. In a prospective cohort study by Oliveira et al. (2022) involving individuals with severe TBI and focal lesions, it was found that significant functional recovery occurred in the first twelve months after the injury, with the most pronounced improvements observed within the initial three months. This underscores the potential for substantial long-term recovery in severe TBI patients [19].

Through a thorough examination of the current corpus of literature pertaining to long-term outcomes subsequent to severe "Traumatic brain injury (TBI)", the review uncovered a wide range of findings. Mortality rates within this context varied considerably, spanning from 18% to as high as 75%. Similarly, rates indicating unfavorable outcomes exhibited substantial variability, ranging from 29% to a striking 100%. These diverse outcomes underscore the complex and multifaceted nature of severe TBI [20].

Conclusion

This study concluded that severe "Traumatic Brain Injury (TBI)" patient mortality is twice as high as in high-income nations.The lack of ICU beds, specialised care, Neuroimaging, and monitoring technologies makes severe traumatic brain injury management difficult in this setting.Multifaceted solutions are needed to address traumatic brain injury care outcomes discrepancies. Pre-hospital care, Neuroimaging, ICU, and interdisciplinary care expertise should be prioritised. Healthcare advancement relies on education, information exchange, and educational institution relationships.The study emphasises intellectual growth and knowledge sharing. Clinical treatment routes, specialist recruiting, and surgical facility and equipment advancements can improve traumatic brain injury care. The findings of the study support the idea of allocating resources and promote teamwork in order to address the disparity in healthcare access, with the aim of delivering optimal treatment to individuals with traumatic brain injuries in places where resources are restricted.

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