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### RESEARCH PAPER

# An epidemiological study of traumatic brain injury cases in a tertiary health care facility in Guwahati

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### ABSTRACT

**Background and aims:** Trauma meets the disease categorization requirements for a global pandemic. Despite efforts to mitigate its impact, it is a recurring and significant source of morbidity and mortality across time and continents. **Objectives:** The purpose of this study was to provide a more complete and descriptive review of traumatic brain injury cases in a high-volume centre like GMCH. **Materials and methods:** This prospective observational study included 1000 patients admitted to the surgery department at Gauhati Medical College and Hospital (GMCH) with traumatic brain injury (TBI). We have completed the data capture form for each patient, including all case details such as patient profile, prehospital care, type of injury, CT scan findings, clinical examination, neurological findings, and management details. We have analyzed the data to determine the critical variables and their impact on the final result. **Results:** The male-to-female ratio in our study was 2.91:1. According to the findings, sex distribution did not affect the prognosis of TBI patients. Patients ranged in age from 2 to 85 years. The majority (23.9%) of patients were between the ages of 22 and 31, with an average age of 33.5 years. Road traffic accidents were the most common cause of TBI (71.7%). In 77.4 % of cases, trained personnel administered first aid. Arriving at the hospital on time aids in giving fast management and a positive outcome. The current study observed excellent outcomes in 84.25 % mild, 80.14 % moderate, and 39.79 % severe TBI cases. Hemorrhagic Contusion was found in 58.79 % of CT scans. **Conclusion:** TBI primarily affects men in their third and fourth decades, most of which are preventable. Early transportation to the hospital and first aid by doctors or competent paramedics resulted in a favourable prognosis. Because mortality increases with TBI severity and accompanying injuries, a multimodality strategy in polytrauma is required.

**Keywords:** Clinical epidemiology; Glasgow outcome score; multimodality approach; neurosurgery; tertiary care facility.

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### INTRODUCTION

Every day, approximately 15,000 people die prematurely due to an injury. Trauma meets the disease categorization requirements for a global pandemic, as it is a recurring and significant source of morbidity and mortality across time and continents, despite efforts to mitigate its impact. Every year, over 5.8 million individuals worldwide die from injury.<sup>1</sup> Road accidents are the leading cause of death from trauma globally, accounting for more than 90% of all

fatalities in low and middle-income nations. According to the WHO, 1.3 million people die, and 50 million are wounded on roads yearly.<sup>2</sup> Over the next 20 years, traffic-related deaths are forecast to rise by 66%, with China seeing a 92% increase and India seeing a 147% increase. The United Nations has designated 2011-2020 as the decade of action for road safety, with a global focus on the road safety.<sup>3</sup>

One of the most devastating types is traumatic brain injury (TBI). It affects people of all ages, although most road traffic injuries (RTI) occur in young adults of productive age. According to the Ministry of Road Transport, Government of India (2017), there were 4,64,910 road accidents in 2017, with 1,47,913 people dead and 4,70,975 injured. As a result, India ranks first in the world regarding road deaths. TBI is also linked to huge socioeconomic losses in India and other developing countries.<sup>4,5</sup> Similarly, non-communicable disease, including accidents, is becoming a prominent cause of mortality and morbidity in many low- and medium-income countries (LMIC). LMICs have a higher prevalence of TBI risk factors but typically lack the efficient health care capacity to deal with the accompanying health effects.<sup>6</sup> The significant disabilities associated with TBI significantly strain these countries' health care systems; consequently, understanding the epidemiological profile of TBI and developing preventive methods to lessen this burden is critical, particularly in low-resource settings. Prehospital and emergency department care quality is a significant predictor of outcomes in trauma patients. Trauma causes various injuries and difficulties, requiring prompt examinations, discussions, improvisation, and interventions to preserve lives and prevent lifelong disability. In India and other developing nations, data gathering registries are lacking. Still, a large European Trauma Registry has been used to enable descriptions of demography, mechanism/pattern of injury, and death from polytrauma. The study's goal was to provide a complete descriptive overview of TBI cases in a high-volume centre like GMCH in a developing nation with a nearly nonexistent trauma registry system.

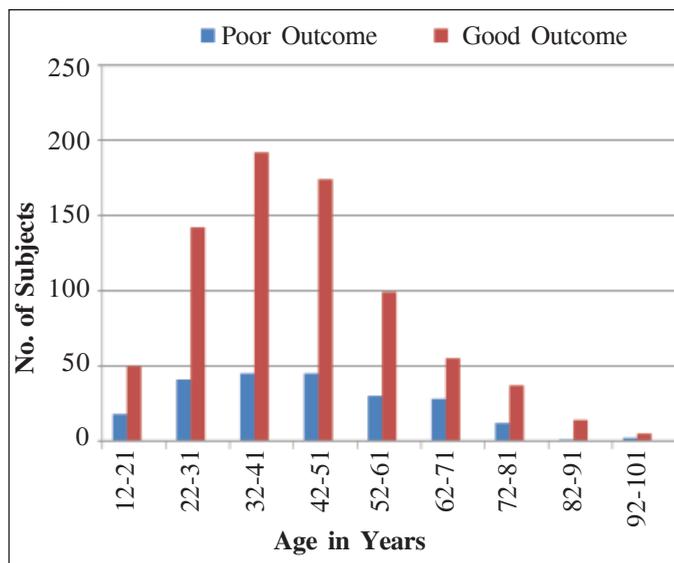
**MATERIAL AND METHODS**

This prospective observational study included 1000 patients admitted to Gauhati Medical College and Hospital's Department of Surgery with traumatic brain injuries. The study comprised trauma patients with clinical/radiological evidence of brain injury alone or in conjunction with other injuries from October 2017 to October 2018. A data capture form was completed for each patient, including all case details such as the patient profile, prehospital treatment, kind of injury, CT scan findings, clinical examination, neurological findings, and management details. The severity of the TBI was determined using the GCS. We have done a CT scan of the brain as soon as possible. These data were entered into the computer using an MS Office Excel spreadsheet. All the author has continuously reviewed the study's progress every week. The neurology examination documented their progress, follow-up, and final conclusion. GCS was used for patients older than five years, and the Pediatric Coma Scale (developed by Simpson and Reilly) was used for instances younger than five years. TBI cases were classified as mild (13-15), moderate (9-12), or severe

(8) based on GCS. The Glasgow Outcome Scale was utilized to determine the final result. A complete assessment was performed and recorded after six months from the date of injury to investigate the end outcome. Data Analysis — Collected data was analyzed using MS Excel and Epi info (CDC Atlanta and WHO software for statistical analysis).

**RESULTS**

A total of 1000 patients were investigated. After six months of initial injury, the Glasgow outcome scale (GOS) assessed the overall outcome. For analysis, the outcome was separated into three primary groups: group 1 (dead patients), group 2 (good outcome) (GOS-4 and 5) and group 3 (poor outcome) (GOS-2 and 3). Patients ranged in age from 2 to 85 years. The majority (23.94%) of cases were 22-31 years old; the second highest (22.12%) were 32-41 years old, followed by 18.48 % instances of 21-21 years and 13.03% cases of 42-51 years. There were 746(74.6%) males and 254(25.4%) females, with an average age of 33.5 years. Most of the patients were from low socioeconomic backgrounds (47.07%). The rural population accounted for (89.09%) of this study. The younger the patient's age, the better the recovery (**Figure 1**).



**Figure 1** Age-related outcome

The predominant mode of TBI was Road traffic Accidents (71.72%). Only 9.5% of cases of assault-related TBI (**Table 1**).

**Table 1** Mode of injury

MODE OF INJURY	Count
Animal attack	23
Electric shock	13
Fall from height	72
Fall of a heavy object	28
Physical assault	99
Road traffic accident	712
Self-fall	53
Total	1000

43.2% of TBI cases had consumed alcohol or other psychoactive substances before sustaining the injury (P-value = 0.0015) (Figure 2).

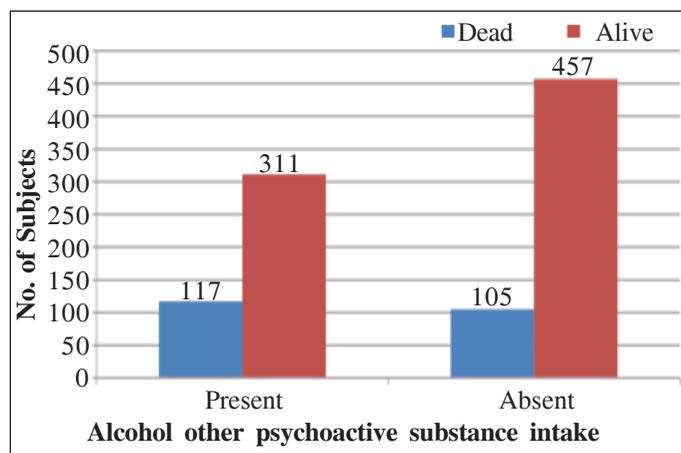


Figure 2 Alcohol or other psychoactive substance intake and outcome

In the event of a road traffic accident, a large number of two-wheeler users are injured (59.7%). In 77.37% of instances, trained personnel (doctors/paramedics) provided first aid; in the remaining 22.63% of cases, first aid was supplied by members of the general public/police officers who had no formal training to attend trauma cases, with a P-value of <0.0001 (Figure 4).

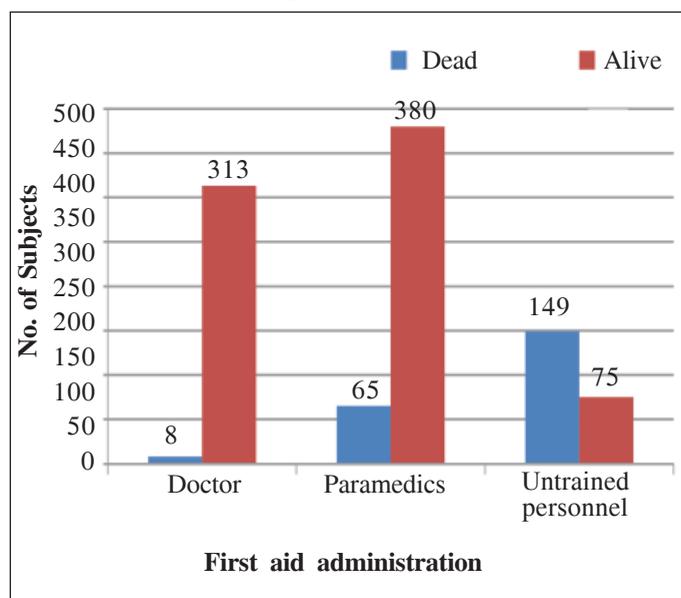


Figure 4 First aid administration and outcome

Only 21.72% of cases were reached within 24 hours of injury, with the majority coming from outside the Guwahati region or being admitted to small private hospitals. Patients receiving tertiary care within 6 hours of injury improved their outcomes dramatically. After 24 hours of damage, 21.7% of cases were reached. (P-value<0.0001) (Figure 5)

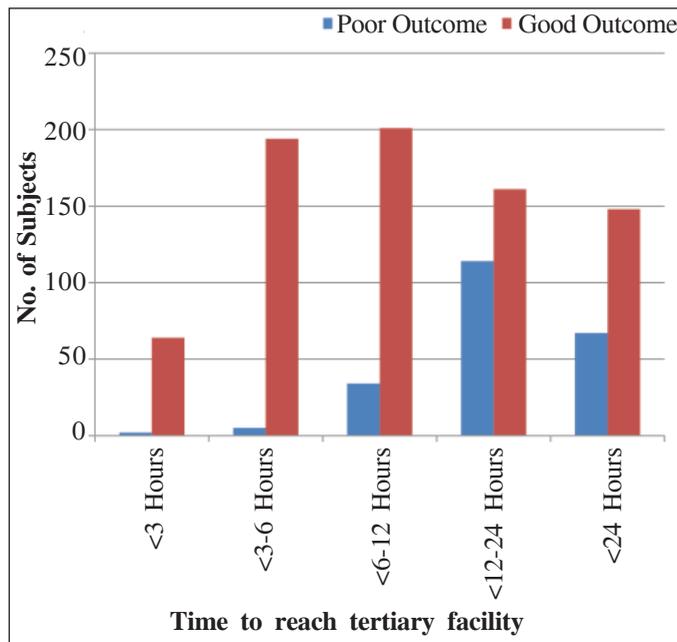


Figure 5 Time to reach tertiary facility and outcome

An episode of loss of consciousness (LOC) followed the injury in 56.57% of cases, vomiting in 82.42% of cases, and ENT bleeding following injury in 50.51% of cases. On arrival at the hospital, 59.9% of the patients who needed resuscitation (40.10% of overall admission) died. Cases were classified as mild, moderate, or severe based on GCS scores in 34.65%, 55.45%, and 9.9% of the cases. Among severe grades of TBI cases, 60.2% cases died. Radiological evaluation of various body parts was performed in suspected polytrauma cases, and evidence of injury was found in 46.87% of cases. Based on CT scan findings, 74.04% of patients were offered conservative therapy, while only 25.9% of cases were operated on. Most cases (69.39%) required a hospital stay of 2-7 days. Because they had lesser grades of TBI, 1.21% of individuals were discharged after 24 hours with essential follow-up counselling. (Table 2).

Table 2 Final outcome of the cases

Final outcome	
Death	152
Discharged	402
Lama	70
Referred to orthopaedics	376
Grand total	1000

According to univariate analysis, many variables such as per capita income, alcohol consumption, first aid provider, the time required to reach tertiary care, history of loc and ENT bleed, GCS during admission, surgical intervention, duration of stay, and final outcome (whether death or discharge) were all significantly related to outcome. (p<0.05).

## DISCUSSION

TBI remains a nightmare for the general population and neurosurgeons due to the high morbidity and mortality rates. Similar to earlier studies, most of our patients (73.7%) were men. There was no association found between the sex of the patient and the outcome (P-value 0.6067). According to the findings, sex distribution did not affect the prognosis of TBI patients, but it is worth noting that most TBI patients were men. It has also been correlated to severe socioeconomic losses in emerging countries such as India.<sup>7,8</sup> Road traffic injuries are a growing health concern worldwide, particularly in South-East Asia. In India, the incidence is primarily recorded from cities and is based on medicolegal records that may or may not be completely accurate.<sup>9,10</sup> Most writers indicate the highest prevalence of TBI in children aged 2 to 10 years.<sup>11</sup> Others have indicated that 69% of cases were among the ages of 15 and 35. According to a study from central India, the mean age of TBI cases was 32-64 years.<sup>12,13</sup>

Male:Female ratio was 2.91:1. Many other authors have made parallel observations about male predominance. The most likely explanation is that men leave their homes more frequently for employment. The current investigation found no link between sex and treatment outcome (P-value>0.6067). Our findings are consistent with those of other investigations. This is because the male population is more mobile than the female population and thus is exposed to more incidental risk factors in various places.<sup>14,15</sup> Lower and lower-middle-class cases made up 76.37 % of the total (P-value =0.0003). Though it does not affect the outcome, it is apparent that they cannot afford safe housing and transportation, making them more vulnerable to numerous sorts of damage, including TBI. Gabela B et al. identified TBI cases using a state surveillance system. The study found that rural areas had greater rates of severe TBI than urban areas. In our analysis, most cases (89.09%) came from rural areas, with the remaining 10.91% coming from urban areas. In rural locations, developing trauma treatment is difficult. The number and location of these facilities do not correspond to the number of injured patients.<sup>16,17</sup>

Alcohol-impaired 43.23% of TBI cases (P-value>0.0015) because it impairs patients' reflexes on the road, making them more prone to accidents. Alcohol-related injuries have recently grown due to a lack of enforcement of safety standards and relatively low prosecution rates in such cases. According to a study of the intent behind the injury, just 9.49% of instances were assaulted, while 71.72% were accidental injuries. Due to legal obstacles, every assault injury stays unreported in our system. The most prevalent cause of injury, according to most research, was motor vehicle accidents, followed by falls from great heights (16.46%) and assault instances. It emphasizes the importance of preventive measures to be taken by parents/family members, whereas adult falls are more typically associated

with alcohol usage.<sup>18</sup> The leading causes of these incidents were inadequate road maintenance, insufficient lighting, mixed traffic, and a congested vehicle population. A trained provider cared for 77.37% of patients. Only 6.67% of cases were taken to the hospital within three hours of injury. Prehospital treatment is critical for stabilizing trauma cases in terms of adequate airway protection, the prevention of excessive blood loss, and the prevention of further trauma during transportation to a proper hospital setup for definitive care. There is a necessity to raise public understanding about how to provide early care to a trauma patient, as well as the necessity for well-trained paramedics on ambulances stationed at various vital locations across the city for quick action. Mock et al. determined in their study that if a trauma victim receives effective life-saving care within a few minutes of damage, the outcome is favourable.<sup>19</sup>

The current study observed excellent outcomes in 84.25% mild, 80.14% moderate, and 39.79% severe TBI cases. As a result, based on GCS, there is a progressive decline in favourable outcomes as TBI severity grows. On CT scan, 58.79% of patients with TBI had a hemorrhagic contusion, 12.63% had a subdural hematoma (SDH), and 28.59% had an extradural haemorrhage.

In the present study, 74.04% of patients were managed conservatively, while the remaining 25.96% were managed surgically. Approximately one-third of patients with severe head injuries are eligible for craniotomy. As a result, most patients are handled conservatively to lower intracranial pressure. In their study, Bhole Anil et colleagues. Handled 81% of cases conservatively, with only 19% requiring surgical intervention, primarily for large cerebral hematomas and complicated fractures.<sup>13</sup> In the current study, 24.22% of cases had a favourable outcome following surgery. The lives of 71(31.98%) of the 257(25.96%) operated cases could not be spared. In our study, 768(76.8%) cases had a positive outcome (GOS-4&5), 10 cases (1%) had a negative outcome (GOS-2 & 3), and 222(22.2%) cases died (GOS-I). According to the duration of hospital stay, 45.95% of deaths occurred between 2 and 7 days. As a result, the first 48 hours are critical for TBI cases, and most severe cases die within this time. Later, due to various problems, the next crucial time is one week. Only one factor, radiological harm to other body parts, was significant in logistic regression analysis for numerous covariates with the dependent outcome. This indicates that other factors affect the outcome combined rather than individually.

## CONCLUSION

Predicting fate in patients with severe TBI is a problematic endeavour fraught with disagreement. Aside from clinical measures at the time of admission, periodic revisits and clinical re-assessment are required to detect early deterioration and take quick action with a multimodality strategy. TBI can be avoided through environmental

modifications and legislative changes. TBI is a significant public health issue that demands regional attention from academics and policymakers in the form of ongoing surveillance programmes and the deployment of effective evidence-based therapies. TBI in children and adolescents is a huge problem, and as survival rates improve, these people are more likely to have a physical disability and neurobehavioral issues. In India, injury patterns/modes differ from those in developed countries. We are in a rapid transitional phase of development, with a significant disparity between the poor and the wealthy.

The current health infrastructure is incapable of meeting the needs of the general public, which is exacerbated by the city's ever-growing slum population. Injury prevention and care is a complex field that necessitates cross-sectoral coordination for effective planning. In all relevant circumstances, prompt treatment of head injuries includes quick GCS, radiological examination, surgical intervention, and intensive care, as the initial few minutes are critical for the outcome. Surgeons should follow the overall management approach, including Resuscitation, Review, and Repair. The Advanced Trauma Life Support (ATLS) standards should be followed when treating suspected head injury cases. We will be able to build a better strategy to reduce the incidence of TBI and their prompt suitable multimodality therapies to achieve better outcomes for these cases within our limited resources if we improve our system with improved reporting and documenting of cases.

**Contribution of authors:** (1) The article is original with the author(s) and does not infringe any copyright or violate any other right of any third party. (2) The article has not been published (whole or in part) elsewhere and is not being considered for publication elsewhere in any form, except as provided herein. (3) All author(s) have contributed sufficiently to the article to take public responsibility for it, and (4) All author(s) have reviewed the final version of the above manuscript and approved it for publication.

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