Article published online: 2024-06-10

Original Article

Demographic Profile, Clinical Features, Imaging, and Outcomes in Patients with Traumatic Brain Injury Presenting in Garhwal Himalayas in Tertiary Care Hospital

Ritish Garg[1] Pankaj Arora[2] Vibhu Shankar[2]

[1] Department of Neurosurgery, Shri Guru Ram Rai Institute of Medical and Health Sciences, Dehradun, Uttarakhand, India
[2] Department of Neurosurgery, Shri Guru Ram Rai Institute of Medical and Health Sciences, Dehradun, Uttarakhand, India

Address for correspondence Ritish Garg, MS, Department of Neurosurgery, Shri Guru Ram Rai Institute of Medical and Health Sciences, Resident Hostel, Room No. A9, Dehradun 248001, Uttarakhand, India (e-mail: drritish1993@gmail.com).

Indian J Neurotrauma

Abstract

Introduction Traumatic brain injury (TBI) poses a significant global health challenge, accounting for over 50% of trauma-related deaths and emerging as a leading cause of mortality and disability.

Objective This article studies the demographic characteristics, clinical features, imaging findings, and outcomes of TBI patients.

Materials and Methods This was a retrospective observational study conducted on 490 patients with TBI. Data regarding age, gender, socioeconomic status, and residential location were extracted from medical records. Neuroimaging reports, including computed tomography (CT) scans results, were analyzed for structural and functional insights.

Results The majority of TBI cases involved individuals aged 21 to 40, with a higher incidence in males. Road traffic accidents were identified as the most common mode of injury, followed by falls. Most of the patients had moderate Glasgow Coma Scale scores at admission. CT scans indicated skull fractures, cerebral edema, and subdural hematomas as common findings. Most patients did not require ventilator support, and the majority had a hospital stay of less than 10 days. At discharge, 89.8% exhibited favorable outcomes, while 4.3% experienced mortality during treatment. Follow-up data demonstrated an overall mortality rate of 8.8%, with 89.2% achieving complete recovery within a month.

Conclusion The study underscores the importance of understanding the multifaceted aspects of TBI, emphasizing the need for integrated approaches in tertiary medical care to optimize patient outcomes and contribute to effective public health strategies.

Keywords
- traumatic brain injury
- demographic profile
- clinical profile
- outcome

DOI https://doi.org/10.1055/s-0044-1787699.
ISSN 0973-0508.

© 2024. The Author(s).
This is an open access article published by Thieme under the terms of the Creative Commons Attribution License, permitting unrestricted use, distribution, and reproduction so long as the original work is properly cited. (https://creativecommons.org/licenses/by/4.0/)

Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

Introduction

Traumatic brain injury (TBI) is a pervasive clinical issue that places a substantial financial burden on health care resources.[1] More than 50% of trauma-related deaths result from head trauma, making it a major public health problem worldwide. Predictions indicate TBI is expected to surpass many diseases as a leading cause of death and disability.[2,3] In India alone, an alarming 1.5 to 2 million individuals sustain injuries annually, with over a million succumbing to death. Road traffic accidents (RTAs) are the predominant cause of TBIs, accounting for 60% of cases, followed by falls (20–25%) and violence (10%). Alcohol involvement is identified as a confounding factor in 15 to 20% of TBI cases at the time of injury.[4,5]

TBI is not only a significant health concern but also results in substantial socioeconomic losses in India and other developing nations. The majority of TBI cases (60%) are attributed to road traffic injuries, underscoring the urgent need for comprehensive strategies to address road safety.[5]

Demographically, TBI exhibits a diverse profile influenced by age, gender, socioeconomic factors, and geographical location. Considering the demographic shift toward an aging population, it is anticipated that specific population patterns will emerge. These may include a rise in the incidence of TBIs resulting from falls among the elderly. Additionally, within the TBI patient demographic, an upward trend is expected in the utilization of antiplatelet and anticoagulation medications.[6]

Similarly, TBI presents a diverse range of clinical manifestations, from mild concussions to severe injuries, necessitating thorough evaluation of symptoms, neurological deficits, and comorbidities. Imaging techniques, including computed tomography (CT) scans and magnetic resonance imaging, are crucial for diagnosis and ongoing management, offering insights into structural and functional changes. Patient outcomes, spanning short-term recovery to long-term quality of life, require identification of predictive factors to tailor rehabilitation strategies. This concise overview highlights the multidimensional aspects of TBI, emphasizing the need for an integrated approach in tertiary medical care.

Objective

The objective is to analyze the demographic characteristics, clinical features, imaging findings, and outcomes of patients with TBI presenting in Garhwal Himalayas at a tertiary care hospital.

Material and Methods

Study design: This study employed a combined retrospective and prospective observational design to analyze demographic profiles, clinical features, imaging findings, and outcomes in patients with TBI presenting in Garhwal Himalayas at a tertiary care hospital.

Study setting: The study was conducted at Shri Guru Ram Rai Institute of Medical and Health Sciences, Dehradun, Uttarakhand, India renowned for its specialized neurotrauma services.

Study period: The study was conducted between September 2022 and August 2023.

Sample size and sampling method: The study included a total of 490 patients diagnosed with TBI who presented to the emergency department of Shri Guru Ram Rai Institute of Medical and Health Sciences. The sample size was determined based on a systematic random sampling approach, ensuring a representative selection of cases during the specified timeframe.

Inclusion Criteria

1. Patients of all ages presenting to the emergency department with a confirmed diagnosis of TBI.
2. Cases with complete demographic, clinical, and imaging data available for analysis.

Exclusion Criteria

1. Patients with incomplete or insufficient medical records.
2. Individuals with preexisting neurological conditions affecting the interpretation of TBI outcomes.

Data Collection

Demographic characteristics: Data on age, gender, socioeconomic status, and residential location were extracted from medical records.

Clinical features: Clinical manifestations, mode of injury, and comorbidities were documented.

Glasgow Coma Scale (GCS) score was noted at time of admission of patient.

Imaging findings: Neuroimaging reports, including CT scans results, were analyzed for structural and functional insights.

Outcomes: Short-term recovery, long-term functional status, and quality of life outcomes were assessed using standardized outcome measures. Glasgow Outcome Scale (GOS) is used to measure outcome.

Statistical analysis: Descriptive statistics were used to summarize demographic characteristics, clinical features, and imaging findings. Data analysis was performed using statistical software.

Results

A total of 490 patients with TBI were included in the study. Majority of the patients were in the age group of 21 to 40 years (30%). Males were more inflicted with TBI as compared with females. Majority of the participants did not have past history of any other disease and 70% of them did not have history of alcohol intake (►**Table 1**).

On investigating the mode of injury in patients presenting with TBI, RTAs were found to be the most common mode of injury followed by fall. Other modes of injury included getting hit be heavy objects or physical assault. The most common presenting symptom was vomiting followed by bleeding from any site like nose, ear, or oral bleed. Central nervous system (CNS) symptoms like seizures or weakness in

Table 1 Baseline characteristics of patients presenting with TBI

	Frequency (*n*)	Percentage (%)
Age group (y)		
0–20	109	22.2
21–40	147	30.0
41–60	138	28.2
61–80	79	16.1
81–100	17	3.5
Gender		
Male	371	75.7
Female	119	24.3
Past history[a]		
None	401	81.8
Hypertension	61	12.4
Diabetes mellitus	29	5.9
CAD	14	2.9
Others	26	5.3
History of alcohol habituation		
Yes	147	30.0
No	343	70.0

Abbreviations: CAD, coronary artery disease; TBI, traumatic brain injury.
[a]Multiple response.

upper or lower limbs were observed in 63 patients at the time of presentation to the hospital (►**Table 2**).

At the time of presentation, maximum number of patients had moderate GCS score, that is, between 9 and 12. CT scan was done for all the 490 study participants. On CT, the most common finding was fracture of the skull bones (64.5%) followed by cerebral edema (26.9%) and subdural hemorrhage/hematoma (23.9%). Extradural hemorrhage/

Table 2 Mode of injury and clinical presentation of patients with TBI

	Frequency (*n*)	Percentage (%)
Mode of injury		
Fall	199	40.6
Road traffic accidents	215	43.9
Other	76	15.5
Symptoms at presentation[a]		
Headache	121	24.7
Vomiting	203	41.4
Loss of consciousness	167	34.1
Bleeding from any site	184	37.6
Seizures	17	3.5
Motor deficit	46	9.4

Abbreviation: TBI, traumatic brain injury.
[a]Multiple response.

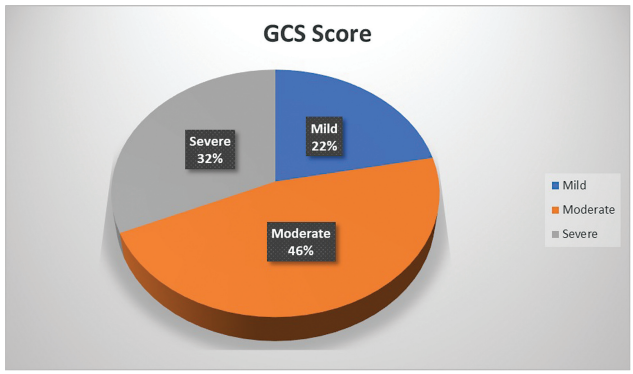

Fig. 1 Glasgow Coma Scale (GCS) score at the time of presentation in patients presenting with traumatic brain injury (TBI).

hematoma was observed only in 1.4% patients (►**Fig. 1**, ►**Table 3**).

In the present study, 311 patients (63.5%) were managed conservatively while 179 patients (36.5) were managed by surgery either with burr hole surgery, craniotomy, or decompressive craniectomy. Majority of our patients (79.6%) did not require any ventilator support during their stay in the hospital. Most of the patients stayed in the hospital for < 10 days (87.6%) with a median stay of 5 days. At the time of discharge, majority of the patients were conscious and active with GOS score of favorable outcome (89.8%), while 21 patients (4.3%) had mortality during the treatment. Among the patients with severe TBI, the mortality rate was 9% and only 67.1% patients had good recovery (►**Table 4**).

Note that 456 patients with TBI who were discharged were followed up till 1 month after discharge from the hospital. Seventeen patients were lost to follow-up during the study. Of the remaining patients, 407 patients (92.7%) had complete recovery, 7 patients (1.6%) had partial recovery, 2 patients (0.5%) were readmitted, and 2 patients (0.5%) had no recovery. Of the total patients who were followed up, 22 patients (5%) had mortality during the follow up period. Hence, the overall mortality rate in our study was 8.8%.

Table 3 Findings in CT scan of patients presenting with TBI

CT finding	Frequency (*n*)[a]	Percentage (%)
Bone fracture	316	64.5
Cerebral edema	132	26.9
Contusion	94	19.2
Subdural hemorrhage/ hematoma	117	23.9
Subarachnoid hemorrhage	54	11.0
Extradural hemorrhage/ hematoma	7	1.4
Pneumocephalus	3	0.6

Abbreviations: CT, computed tomography; TBI, traumatic brain injury.
[a]Multiple response.

 © 2024. The Author(s).

Table 4 Course of patients with TBI during their hospital stay and status at the time of discharge

	Frequency (*n*)	Percentage (%)
Treatment[a]		
Conservative	311	63.5
Surgical	179	36.5
Burr hole surgery	30	16.75
Craniotomy	116	64.8
Decompressive craniectomy	119	17.8
Ventilator support		
Yes	100	20.4
No	390	79.6
Duration of stay in the hospital (d)		
0–10	429	87.6
11–20	43	8.8
21–30	12	2.4
> 30	6	1.2
Status at discharge (GOS) (of all patients)		
Death	21	4.3
Vegetative state	7	1.4
Severe disability	9	1.8
Moderate disability	41	8.36
Good recovery	399	81.4
LAMA	13	2.7
Status at discharge (GOS) of patients with severe TBI ($n = 155$)		
Death	14	9.0
Vegetative state	4	2.6
Severe disability	6	3.9
Moderate disability	23	14.8
Good recovery	104	67.1
LAMA	4	2.6

Abbreviations: GOS, Glasgow Outcome Scale; LAMA, Leave Against Medical Advice; TBI, traumatic brain injury.
[a]Multiple response.

Discussion

Our study comprised 490 TBI patients, predominantly aged 21 to 40, with a higher incidence observed in males compared with females (3.1:1). Whereas in the study conducted by Sachan et al[7] most of the patients affected were in the range of 21 to 30 years with a sex ratio of 2.2:1.

In our study, among TBI patients, RTAs (43.9%) were the most common mode of injury, followed by falls (40.6%) and other causes like being hit by heavy objects or physical assault. Whereas in a study conducted by Chaitanya et al,[8] RTA (40.8%) was the most common mode of injury followed by fall from height (30.2%) and slippage in and around home (26.4%).

The prevalent presenting symptoms were vomiting, bleeding from various sites, and CNS symptoms such as seizures or limb weakness in 63 patients upon hospital presentation.

Clinical evaluation revealed loss of consciousness in 167 (34.1%) patients, vomiting in 203 (41.4%) patients, headache in 121 (24.7%) patients, bleeding from any site 37.6%, seizure in 17 (3.5%) patients, and motor deficit in 46 (9.4%) patients.

In our study, at the time of presentation, maximum number of patients had moderate GCS score, that is, between 9 and 12. CT scan was done for all the 490 study participants. In the study by Sachan et al,[7] most patients (49.10) had a mild GCS score, 13 to 15.

On CT, the most common finding was fracture of the skull bones (64.5%) followed by cerebral edema (26.9%) and subdural hemorrhage/hematoma (23.9%). Extradural hemorrhage/hematoma was observed only in 1.4% patients.

Whereas in the study conducted by Sachan et al[7] subdural hemorrhage was seen in 32.7% cases.

In our study, 311 patients (63.5%) were treated conservatively, while 179 (36.5%) underwent surgery (burr hole surgery, craniotomy, or decompressive craniectomy).

Whereas in the study conducted by Sachan et al,[7] 69.78% were treated conservatively and 30.22% underwent surgery. In another study conducted by Kirankumar et al,[9] 79% were treated conservatively and only 21% were managed surgically.

The majority (79.6%) did not require ventilator support, and most stayed in the hospital for < 10 days (87.6%, median stay: 5 days). At discharge, the majority were conscious with favorable outcome (89.8%), and 4.3% experienced mortality during treatment. While in the study by Huijben et al[10] 313 of 758 patients from 52 European centers (41%) received at least one high therapy intensity level (TIL) treatment with significant variation between centers (median odds ratio $= 2.26$). Patients often transiently received high TIL therapies without escalation from lower tier treatments. Thirty-eight percent of patients with high TIL treatment had favorable outcomes (Glasgow Outcome Scale–Extended ≥ 5).

Conclusion

In this TBI study involving 490 patients, the 21 to 40 age group, predominantly males, faced a higher incidence. RTAs and falls were the primary injury modes. Common symptoms included vomiting and bleeding, with moderate GCS scores prevalent at admission. CT scans highlighted skull fractures (64.5%), cerebral edema (26.9%), and subdural/hemorrhage/hematoma (23.9%). Conservative management was employed in 63.5% of cases, while 36.5% underwent surgical interventions. Ventilator support was needed in 20.4% of cases. At discharge, 4.3% patients had mortality, and 92.7% achieved complete recovery within a month. The study emphasizes the significance of comprehending demographic, clinical, and imaging aspects for effective TBI management and prognostic evaluation.

Note

We, all authors approve the above said article and clarify that the article is our original contribution and has not been plagiarized/copied from any source/individual. It does not contravene on the rights of others and does not contain any libelous or unlawful statements and all references have been duly acknowledged at the appropriate places.

Conflict of Interest

None declared.

References

1 Rehabilitation of persons with traumatic brain injury. NIH Consens Statement 1998;16(01):1–41
2 Jennett B. Epidemiology of head injury. Arch Dis Child 1998;78 (05):403–406
3 Castillo M, Harris JH, Harris WH, Novelline AR. Skull and Brain: The Radiology of Emergency Medicine. 3rd ed. Baltimore: Williams and Wilkins; 1993
4 World Health Organization Projections of Mortality and Burden of Disease to 2030: Death by Income Group. 2002 Geneva World Health Organization; 2006
5 Gururaj G. Epidemiology of traumatic brain injuries: Indian scenario. Neurol Res 2002;24(01):24–28
6 Lee KK, Seow WT, Ng I. Demographical profiles of adult severe traumatic brain injury patients: implications for healthcare planning. Singapore Med J 2006;47(01):31–36
7 Sachan AS, Sachan P, Chandra S. Epidemiological, demographic and clinical profile of traumatic brain injury patients: a prospective analysis at a level one trauma centre in northern part of India. Rom Neurosurg 2021;35(03):370–375
8 Chaitanya K, Addanki A, Karambelkar R, Ranjan R. Traumatic brain injury in Indian children. Childs Nerv Syst 2018;34(06): 1119–1123
9 Kirankumar MR, Satri V, Satyanarayana V, Ramesh Chandra VV, Madhusudan M, Sowjanya J. Demographic profile, clinical features, imaging and outcomes in patients with traumatic brain injury presenting to emergency room. J Clin Sci Res 2019; 8:132–136
10 Huijben JA, Dixit A, Stocchetti N, et al; CENTER-TBI investigators and participants. Use and impact of high intensity treatments in patients with traumatic brain injury across Europe: a CENTER-TBI analysis. Crit Care 2021;25(01):78

 © 2024. The Author(s).