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Clinical profile, injury spectrum, and outcomes of head Injury Patients in a Major S. D Singh Medical College

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Abstract
Background: Head injury remains a major cause of morbidity and mortality worldwide, particularly in developing nations where road traffic accidents and falls are prevalent. Timely diagnosis, severity assessment, and appropriate neurosurgical or supportive interventions are essential for improving patient outcomes.
Objective: To evaluate the demographic profile, injury mechanisms, clinical patterns, severity, and outcomes of patients presenting with head injury at a tertiary care surgical center
Methods: This retrospective observational study was conducted in the Department of General Surgery, Major S. D. Singh Medical College, Farrukhabad, Uttar Pradesh, India. A total of 200 cases of head injury admitted between January 2013 and December 2013 were analyzed. Data were collected on age, gender, mode of injury, Glasgow Coma Scale (GCS) score at admission, radiological findings, management strategy, and final outcome. Patients were categorized based on head injury severity, and outcomes were assessed using Glasgow Outcome Scale (GOS) at discharge.
Results: The majority of patients were males (78%) and in the age group of 21–40 years. Road traffic accidents (64%) were the most common cause, followed by falls (22%) and assaults (14%). Mild head injury accounted for 58%, moderate for 24%, and severe injuries for 18%. CT findings revealed contusions in 32%, subdural hematomas in 21%, extradural hematomas in 16%, and diffuse brain edema in 9% of cases. Surgical intervention was required in 27% of patients. Overall mortality was 11%, predominantly among patients with severe head injury. Favorable outcomes (GOS 4–5) were observed in 72% of cases.
Conclusion: Young adult males are the most commonly affected group in head injury cases, with road traffic accidents being the leading cause. Early assessment of injury severity using GCS and prompt intervention significantly influence the outcome. Strengthening preventive strategies and early referral systems can help reduce head injury–related morbidity and mortality.

Keywords: Head injury; traumatic brain injury; Glasgow Coma Scale; road traffic accidents; surgical outcome; CT findings; tertiary care; India

Introduction

Head injury, encompassing all traumatic injuries to the scalp, skull, or brain, represents a critical subset of trauma-related emergencies globally. Traumatic brain injury (TBI), in particular, is a major cause of hospitalization, long-term disability, and mortality across all age groups [1]. According to global estimates by the World Health Organization (WHO), head injury contributes to more than 10 million hospitalizations annually and is projected to become one of the top three causes of global disease burden. This burden is disproportionately higher in low- and middle-income countries due to rapid urbanization, poor road safety enforcement, occupational risks, and limited pre-hospital care systems [2].

India, with its expanding population and burgeoning motor vehicle usage, faces a particularly high incidence of head trauma. Road traffic accidents (RTAs) remain the most common cause, followed by falls, assaults, and industrial mishaps [3]. Young adult males, often engaged in outdoor labor or two-wheeler travel, form the most affected demographic. The outcomes of head injury vary widely depending on the severity of trauma, timely access to care, radiological findings, and the quality of clinical and surgical intervention [4].

Head injuries are commonly classified as mild, moderate, or severe based on the Glasgow Coma Scale (GCS) at presentation. GCS remains a widely used and validated clinical tool that aids in stratifying patients and guiding immediate management decisions [5]. Radiological imaging, especially non-contrast computed tomography (CT), is indispensable in identifying intracranial hemorrhages, contusions, depressed fractures, cerebral edema, and midline shift. These findings influence the choice between conservative treatment and surgical intervention

Several Indian studies have reported epidemiological and clinical patterns of head injury, but regional variability exists due to differences in trauma patterns, emergency response systems, and referral logistics [7]. Tertiary care centers in semi-urban and rural India often handle both primary and referred trauma cases, and insights from such centers are essential to understanding ground-level challenges. Furthermore, while neurosurgical centers may offer dedicated intervention, general surgery units often manage a significant volume of head injury cases due to infrastructural constraints and referral delays [8].

This retrospective observational study was conducted at the Department of General Surgery, Major S. D. Singh Medical College, Farrukhabad, Uttar Pradesh, India, catering to a large rural and semi-urban population. The objective was to analyze the demographic profile, modes of injury, clinical presentation, CT findings, severity grading, and treatment outcomes of head injury cases admitted over a one-year period from January 2013 to December 2013.

A total of 200 patients who presented with head trauma and were admitted for evaluation and management during the study period were included. This sample size reflects the typical patient load for a busy surgical unit in a semi-urban tertiary center over three years and allows meaningful evaluation of injury trends and outcomes. The findings aim to contribute to the regional trauma database, improve understanding of local head injury patterns, and support strategies for effective trauma care delivery and prevention in similar healthcare settings.

Materials and Methods

This retrospective observational study was conducted in the Department of General Surgery at Major S. D. Singh Medical College, Farrukhabad, Uttar Pradesh, India. The study aimed to analyze the demographic and clinical profile, injury characteristics, radiological findings, and outcomes of patients presenting with head injury over a defined period of one year

All patients with head injury admitted to the general surgery department between January 2013 and December 2013 were considered for inclusion in the study. A total of 200 patients were selected after applying the inclusion and exclusion criteria. Inclusion criteria comprised all patients of either sex and any age who presented with head trauma, confirmed by clinical examination and neuroimaging. Exclusion criteria included patients who were declared dead on arrival, those with isolated scalp injuries without intracranial involvement, and those referred directly to neurosurgical centers without complete evaluation at the study center.

Relevant clinical data were retrieved from hospital records, admission registers, and patient files. The variables collected included age, gender, mechanism of injury (such as road traffic accidents, falls, or assaults), time interval between injury and hospital arrival, presenting Glasgow Coma Scale (GCS) score, clinical signs of neurological deterioration, and associated systemic injuries.

All patients underwent a non-contrast computed tomography (CT) scan of the head as part of the initial evaluation. Radiological findings were categorized into skull fractures, epidural hematoma (EDH), subdural hematoma (SDH), cerebral contusion, diffuse axonal injury, and cerebral edema. Based on the GCS score at presentation, head injuries were classified into mild (GCS 13–15), moderate (GCS 9–12), and severe (GCS $\leq$ 8). This categorization facilitated correlation with CT findings and treatment outcomes.

Patients were managed either conservatively or surgically based on clinical status, CT findings, and available neurosurgical support. Conservative management included observation, medical therapy for intracranial pressure control, and supportive care. Surgical intervention was undertaken in cases of space-occupying hematomas, compound depressed fractures, or signs of raised intracranial pressure requiring decompression. Postoperative and non-operative patients were monitored in the surgical ICU or high-dependency unit as appropriate.

Outcomes were assessed at the time of hospital discharge using the Glasgow Outcome Scale (GOS), which categorizes patients as having good recovery, moderate disability, severe disability, persistent vegetative state, or death. For analytical purposes, outcomes were grouped as favorable (GOS 4–5) or unfavorable (GOS 1–3). The data were compiled in structured format and entered into Microsoft Excel for analysis.

Descriptive statistics were used to summarize demographic and clinical variables. Categorical data were presented as frequencies and percentages, and continuous variables were expressed as mean values. Comparative analysis between severity grades, imaging findings, and outcomes was performed using chi-square test or Fisher's exact test where applicable. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 200 patients with head injury were included in the study. Demographic data, mechanism of injury, clinical severity, radiological findings, management approach, and outcomes were analyzed in detail.

The age distribution of the patients is presented in Table 1. The majority were in the 21–40 years age group.

Table 1: Age Distribution of Patients (N = 200)

Age Group (years)	Number of Patients	Percentage (%)
0–10	12	6.0
11–20	28	14.0
21–30	56	28.0
31–40	38	19.0
41–50	32	16.0
51–60	22	11.0
>60	12	6.0
Total	200	100.0

Table 2 shows gender distribution, revealing a strong male predominance.

Table 2: Gender Distribution of Patients (N = 200)

Gender	Number of Patients	Percentage (%)
Male	156	78.0
Female	44	22.0
Total	200	100.0

Table 3 presents the mode of injury. Road traffic accidents were the leading cause.

Table 3: Mode of Injury

Mode of Injury	Number of Patients	Percentage (%)
Road traffic accident	128	64.0
Fall from height	44	22.0
Assault	28	14.0
Total	200	100.0

Table 4 displays the GCS-based severity of head injury.

Table 4: Head Injury Severity Based on GCS

GCS Category	Number of Patients	Percentage (%)
Mild (13–15)	116	58.0
Moderate (9–12)	48	24.0
Severe (≤8)	36	18.0
Total	200	100.0

Table 5 shows the CT findings among the patients.

Table 5: Radiological Findings on CT Scan

CT Finding	Number of Patients	Percentage (%)
Cerebral contusion	64	32.0
Subdural hematoma	42	21.0
Extradural hematoma	32	16.0
Skull fracture	26	13.0
Diffuse brain edema	18	9.0
Normal CT	18	9.0
Total	200	100.0

Table 6 presents the treatment modalities used.

Table 6: Management Approach

Treatment Modality	Number of Patients	Percentage (%)
Conservative	146	73.0
Surgical	54	27.0
Total	200	100.0

Table 7 shows the surgical indications among patients who underwent operative management.

Table 7: Indications for Surgical Intervention (n = 54)

Indication	Number of Patients	Percentage (%)
Extradural hematoma	20	37.0
Subdural hematoma	16	29.6
Depressed skull fracture	10	18.5
Raised ICP	8	14.9
Total	54	100.0

Table 8 outlines the outcomes based on the Glasgow Outcome Scale.

Table 8: Outcome at Discharge Based on Glasgow Outcome Scale (GOS)

GOS Category	Number of Patients	Percentage (%)
Good recovery (GOS 5)	98	49.0
Moderate disability (GOS 4)	46	23.0
Severe disability (GOS 3)	26	13.0
Persistent vegetative state (GOS 2)	8	4.0
Death (GOS 1)	22	11.0
Total	200	100.0

Table 9 presents the mortality distribution based on severity of head injury.

Table 9: Mortality by GCS-Based Severity

GCS Category	Total Patients	Deaths	Mortality Rate (%)
Mild (13–15)	116	2	1.7
Moderate (9–12)	48	6	12.5
Severe (≤8)	36	14	38.9
Total	200	22	11.0

Table 10 shows the outcome in relation to type of management.

Table 10: Outcome Comparison – Conservative vs Surgical Management

Outcome	Conservative (n = 146)	Surgical (n = 54)
Favorable (GOS 4–5)	118 (80.8%)	26 (48.1%)
Unfavorable (GOS 1–3)	28 (19.2%)	28 (51.9%)
Total	146	54

Discussion

Head injury continues to be one of the most significant causes of morbidity and mortality in trauma-related emergencies worldwide. The findings of the present study, based on 200 cases admitted over a one year period to a tertiary care surgical center in Farrukhabad, Uttar Pradesh, provide valuable insights into the demographic profile, patterns of injury, radiological features, and clinical outcomes of head trauma in a semi-urban Indian population.

In the current study, the majority of patients were young adult males aged 21–40 years, accounting for nearly 47 percent of cases. This trend reflects the demographic most involved in outdoor occupational activity and road travel, making them more susceptible to high-velocity injuries. The male-to-female ratio was 3.5:1, which is consistent with national and international literature on head trauma demographics, indicating a higher risk-taking behavior and outdoor exposure among males.

Road traffic accidents were identified as the most common cause of head injury, responsible for 64 percent of cases, followed by falls (22 percent) and assaults (14 percent). These findings underscore the ongoing epidemic of traffic-related injuries in India, where increasing motorization is not matched by adequate enforcement of traffic regulations, helmet usage, or pedestrian safety measures. Similar observations have been made in multiple studies across India, highlighting the need for preventive strategies.

In terms of injury severity, mild head injury (GCS 13–15) constituted 58 percent, while severe head injury (GCS ≤ 8) accounted for 18 percent. This distribution suggests that a significant proportion of head injury patients reach tertiary care facilities with relatively preserved neurological status, likely due to timely transportation in select cases or the limited referral of severely unstable patients. Importantly, mortality increased markedly with injury severity, ranging from 1.7 percent in mild to 38.9 percent in severe cases, highlighting the prognostic utility of initial GCS assessment.

Radiologically, cerebral contusions (32 percent), subdural hematomas (21 percent), and extradural hematomas (16 percent) were the most frequent findings on CT. These lesions often reflect focal damage secondary to direct impact or acceleration-deceleration forces. The observed proportion of diffuse cerebral edema (9 percent) and normal CT scans (9 percent) also emphasizes the variability in injury mechanisms and potential underestimation of axonal injury using standard imaging.

Surgical intervention was required in 27 percent of cases, primarily for mass-effect lesions like extradural and subdural hematomas, or for depressed fractures. Favorable outcomes (GOS 4–5) were achieved in 72 percent of all patients, while mortality was recorded in 11 percent, a figure that aligns well with other regional data. Notably, patients managed conservatively had better outcomes (80.8 percent favorable)

compared to those who underwent surgery (48.1 percent), although this may be due to the higher baseline severity of surgically managed cases.

The Glasgow Outcome Scale remains a reliable tool for outcome assessment in head injury, and its use in this study facilitated consistent evaluation across the severity spectrum. The correlation between GCS at presentation and GOS at discharge supports its continued utility in triage and prognostication.

While this study provides a comprehensive overview, certain limitations must be acknowledged. Being a retrospective single-center study, it is subject to inherent data limitations, lack of long-term follow-up, and potential selection bias. Additionally, the absence of neurosurgical intervention in some eligible cases due to referral constraints may have influenced outcomes.

Nonetheless, this study reinforces the urgent need for enhanced preventive measures, such as strict implementation of helmet laws, road safety awareness programs, and improved trauma system infrastructure, particularly in semi-urban and rural areas. It also underscores the importance of early GCS assessment, timely imaging, and appropriate triage, all of which are critical determinants of outcome in head injury.

Conclusion

Head injury predominantly affects young adult males and is most commonly caused by road traffic accidents. The severity of head trauma, as assessed by Glasgow Coma Scale at presentation, significantly correlates with clinical outcomes and mortality. Radiological evaluation plays a crucial role in identifying lesions requiring surgical intervention. In this study, the majority of cases were mild to moderate in severity and managed conservatively with favorable results, while mortality was significantly higher in patients with severe injuries. Strengthening pre-hospital care, enforcing traffic regulations, and ensuring timely referral and imaging can play a key role in reducing head injury–related morbidity and mortality, particularly in resource-limited tertiary care settings.

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