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EVALUATION OF HEAD INJURY OUTCOMES BASED ON GLASGOW COMA SCALE ASSESSMENT: A CLINICAL STUDY

General Surgery

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ABSTRACT

Background: Traumatic Brain Injury (TBI) is a major public health concern, contributing significantly to morbidity and mortality worldwide. The Glasgow Coma Scale (GCS) is widely used to assess TBI severity and predict outcomes. This study evaluates head injury outcomes based on GCS at admission and its correlation with radiological findings and clinical progression. **Methods:** This prospective comparative study was conducted at MGM Medical College and Hospital, Navi Mumbai, from May 2022 to 2024. A total of 60 patients aged 18–60 years with mild to severe TBI were included. Patients with penetrating trauma, polytrauma, or prior neurological disorders were excluded. Clinical data, including demographics, mode of injury, GCS, and imaging findings (CT, MRI), were recorded. Patients were managed either conservatively or surgically, and outcomes were assessed using the Glasgow Outcome Scale (GOS) at 3 months. Statistical analysis was performed using SPSS Version 26.0, with chi-square and t-tests used for comparisons ($p < 0.05$ considered significant). **Results:** The majority of patients were young adults (15–30 years: 50.0%), with road traffic accidents (42.2%) being the leading cause of TBI. A significant association was observed between low GCS scores and poor outcomes ($p < 0.001$). Intracerebral hemorrhage (ICH) ($p = 0.015$)**Dr Anjoom Hyder AliSenior house officer in trauma at NHS, UK.** and diffuse axonal injury (DAI) ($p = 0.02$) were significantly linked to higher mortality. **Conclusion:** GCS at admission is a reliable predictor of TBI prognosis. Patients with ICH and DAI had the worst outcomes, emphasizing the need for early neuroimaging and timely interventions.

KEYWORDS

Glasgow Coma Scale, Head Injury, Intracerebral Hemorrhage, Outcome Assessment, Traumatic Brain Injury

INTRODUCTION

Traumatic Brain Injury (TBI) is a significant public health concern and a leading cause of morbidity and mortality worldwide. It is defined as brain damage resulting from external forces, including direct impact, acceleration-deceleration forces, penetrating injuries, or blast waves [1]. TBI predominantly affects individuals under 40 years old, with an increasing incidence due to rapid motorization and industrialization [2]. Road traffic accidents (RTA) remain the most common cause, followed by falls and assaults, with alcohol consumption being a major contributing factor [3].

The severity of TBI is commonly classified based on the level of consciousness using the Glasgow Coma Scale (GCS), which evaluates motor, verbal, and eye-opening responses. It provides a standardized method to grade TBI severity into mild, moderate, or severe categories [4]. GCS serves as a crucial tool for triaging patients, predicting outcomes, and guiding clinical decisions [5]. Additionally, computed tomography (CT) scanning is the preferred imaging modality for diagnosing skull fractures, intracranial hemorrhages, and contusions, facilitating prompt and appropriate management [6].

Advancements in neurosurgical techniques, such as decompressive craniotomy, intracranial pressure monitoring, and intensive care support, have significantly reduced mortality rates in severe TBI cases. Improved pre-hospital care, early detection, and optimized neurocritical management have further enhanced patient survival [7].

This study aims to evaluate the clinical profile of head injury patients admitted to our hospital, assess their outcomes using GCS, and correlate findings with advanced radiological techniques (CT, MRI). The results will help identify prognostic factors influencing morbidity and mortality in TBI patients, aiding in better treatment strategies.

METHODOLOGY

This prospective comparative study was conducted at MGM Medical College and Hospital, Navi Mumbai, from May 2022 to 2024, aiming to evaluate the clinical profile and outcomes of head injury patients using the Glasgow Coma Scale (GCS). A total of 60 patients aged 18 to 60 years with mild to severe traumatic brain injury (TBI) were included through simple random sampling. Patients with complicated head injuries, including penetrating trauma, polytrauma, and prior neurological disorders, were excluded. Ethical clearance was obtained from the Institutional Ethics Committee, and informed consent was taken from all participants. The mode of injury, time of presentation, Glasgow Coma Score, and status of inebriation were documented. A detailed clinical assessment was performed, and all patients underwent imaging studies (CT and MRI) to classify the severity of the injury. Management was categorized into conservative and surgical interventions, depending on the clinical presentation and radiological findings.

Data on demographics, clinical parameters, imaging results, intraoperative and postoperative outcomes, and hospital stay were recorded. Patients were followed up for complications, morbidity, and mortality. Statistical analysis was conducted using SPSS Version 26.0, with descriptive statistics for categorical and continuous variables. Chi-square tests were used for comparing categorical data, while Student's t-tests analyzed continuous variables. A p-value of <0.05 was considered statistically significant. The findings were correlated with patient outcomes to determine the effectiveness of GCS in predicting prognosis and guiding treatment strategies.

RESULTS

The study population predominantly consists of young adults (15–30 years, 50.0%), followed by the 31–45 years group (25.0%), with fewer cases in older age groups. Interestingly, females (82.0%) outnumber males (18.0%), indicating a higher incidence of head injuries among women in this sample (Figure 1).

Figure 1. Distribution of study subjects according to Age and gender

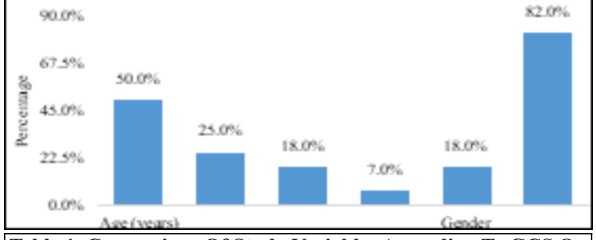

Table 1. Comparison Of Study Variables According To GCS On Admission

Variable		GCS on admission			Chi-square	p-value
		3-8	9-12	13-15		
		n (%)	n (%)	n (%)		
Age (years)	15-30	16 (53.3%)	11 (35.5%)	23 (59.0%)	4.059	0.669

	31-45	7 (23.3%)	10 (32.3%)	8 (20.5%)		
	46-60	5 (16.7%)	7 (22.6%)	6 (15.4%)		
	>60	2 (6.7%)	3 (9.7%)	2 (5.1%)		
Gender	Male	4 (13.3%)	7 (22.6%)	7 (17.9%)	0.883	0.643
	Female	26 (86.7%)	24 (77.4%)	32 (82.1%)		
LOC	Present	30 (100%)	31 (100%)	0 (0.0%)	100.0	<.001
	Absent	0 (0.0%)	0 (0.0%)	39 (100%)		
Alcohol	Present	6 (20.0%)	6 (19.4%)	5 (12.8%)	0.796	0.672
	Absent	24 (80.0%)	25 (80.0%)	34 (87.2%)		
Mode of injury	RTA	19 (42.2%)	13 (28.9%)	13 (28.9%)	9.413	0.052
	Fall	10 (22.7%)	12 (27.3%)	22 (50.0%)		
	Assault	1 (9.1%)	6 (54.5%)	4 (36.4%)		
Cerebral Odema		1 (12.5%)	2 (25.0%)	5 (62.5%)	–	–
EDH		8 (30.8%)	8 (30.8%)	10 (38.5%)	--	–
SDH		18 (60.0%)	10 (33.3%)	2 (6.7%)	24.421	<.001
SAH		9 (30.0%)	9 (30.0%)	12 (40.0%)	--	–
ICH		9 (75.0%)	2 (16.7%)	1 (8.3%)	13.397	<.001
DAI		3 (100%)	0 (0.0%)	0 (0.0%)	7.216	0.027
Contusion		7 (43.8%)	4 (25.0%)	5 (31.2%)	1.715	0.424
Skull Fracture		7 (23.3%)	12 (40.0%)	10 (34.5%)	2.101	0.35

The analysis of study variables across different Glasgow Coma Scale (GCS) categories (3–8, 9–12, and 13–15) provides insights into the demographic distribution, clinical presentation, mode of injury, and radiological findings among head injury patients. (Table 1) The 15–30 years age group had the highest proportion of cases across all GCS categories, particularly in severe (53.3%) and mild (59.0%) head injuries. However, the association between age and GCS was not statistically significant ($p = 0.669$). Gender distribution also showed no significant difference ($p = 0.643$), with females (86.7%) predominating across all GCS categories.

A significant association ($p < 0.001$) was observed between loss of consciousness (LOC) and GCS at admission, as all patients in the severe (GCS 3–8) and moderate (GCS 9–12) groups experienced LOC, while none in the mild injury group (GCS 13–15) reported it. Regarding the mode of injury, road traffic accidents (RTAs) were the most frequent cause in severe head injuries (42.2%), whereas falls were more common in mild cases (50.0%), showing a borderline significance ($p = 0.052$). These findings suggest that high-impact injuries like RTAs contribute more to severe TBI, while falls are associated with milder presentations.

Radiological findings revealed significant correlations with GCS severity. Subdural hematoma (SDH) ($p < 0.001$) and intracerebral hemorrhage (ICH) ($p < 0.001$) were more prevalent in severe cases (60.0% and 75.0%, respectively). Additionally, diffuse axonal injury (DAI) ($p = 0.027$) was exclusively seen in patients with severe TBI (GCS 3–8). Other injuries like epidural hematoma (EDH), skull fractures, and contusions were distributed across all GCS groups without a significant association.

Table 2. Comparison of study variables according to GOS at 3 months

GOS at 3 months		1	2	3	4	5	Chi-square	p-value
Age (years)	15-30	5 (10.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	5.941	0.115
	31-45	8 (32.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	17 (68.0%)		
	46-60	3 (16.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	15 (83.3%)		
	>60	1 (14.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	6 (85.7%)		
Gender	Female	4 (22.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	14 (77.8%)	0.424	0.515
	Male	13 (15.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	69 (84.1%)		
Mode of injury	RTA	7 (15.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	38 (84.4%)	3.342	0.188
	Fall	10 (22.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	34 (77.3%)		
	Assault	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	11 (100%)		
Cerebral Odema		2 (25.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	6 (75.0%)	0.349	0.53
EDH		3 (11.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	23 (88.5%)	0.743	0.389
SDH		6 (20.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	24 (80.0%)	0.273	0.601
SAH		5 (16.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	25 (83.3%)	0.003	0.954
ICH		5 (41.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	7 (58.3%)	5.88	0.015
DAI		2 (66.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (33.3%)	5.407	0.02
Contusion		1 (6.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	15 (93.8%)	1.56	0.212
Skull Fracture		4 (13.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	25 (86.2%)	0.298	0.585
Midline shift		4 (13.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	26 (86.7%)	--	–
Management	Operated	4 (13.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	26 (86.7%)	0.408	0.523

	Conservative	13 (18.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	57 (81.4%)		

The Glasgow Outcome Scale (GOS) at 3 months was analyzed in relation to various demographic, clinical, and radiological variables to assess factors influencing recovery in head injury patients. Age distribution showed that the majority of patients in the 31–45 years (68.0%), 46–60 years (83.3%), and >60 years (85.7%) groups had a good recovery (GOS 5), while the 15–30 years group had the highest mortality rate (10.0%). However, the association between age and GOS was not statistically significant ($p = 0.115$). Similarly, gender distribution was not significantly associated with GOS ($p = 0.515$), though males (84.1%) had slightly better recovery rates than females (77.8%).

The mode of injury showed that assault cases had a 100% good recovery rate (GOS 5), while RTAs (84.4%) and falls (77.3%) had slightly lower recovery rates, but the differences were not statistically significant ($p = 0.188$). Among radiological findings, intracerebral hemorrhage (ICH) ($p = 0.015$) and diffuse axonal injury (DAI) ($p = 0.02$) were significantly associated with poorer outcomes, with 41.7% of ICH and 66.7% of DAI cases resulting in mortality (GOS 1). Other injuries such as subdural hematoma (SDH), epidural hematoma (EDH), cerebral edema, skull fractures, and contusions did not show statistically significant associations with GOS outcomes.

Regarding management approaches, both surgically treated and conservatively managed patients had similar recovery patterns ($p = 0.523$), suggesting that surgical intervention was performed in more severe cases, but did not necessarily guarantee a better prognosis. Overall, ICH and DAI were the strongest predictors of poor outcomes, reinforcing the need for early detection and aggressive management in such cases.

DISCUSSION

The findings of this study highlight the crucial role of the Glasgow Coma Scale (GCS) in assessing the severity and predicting outcomes in patients with traumatic brain injury (TBI). The majority of patients in this study were young adults, with road traffic accidents (RTA) being the leading cause of head injury, consistent with global trends [1,2]. Alcohol consumption was a notable contributing factor in many cases, emphasizing the need for stricter road safety regulations and public awareness campaigns. The correlation between GCS scores and imaging findings (CT/MRI) provided valuable insights into injury severity, guiding clinical decision-making. Patients with lower GCS scores were more likely to require surgical intervention, while those with mild to moderate TBI were successfully managed conservatively.

The study also found that operation time, hospital stay, and postoperative complications varied significantly based on the severity of head injury and management approach. Patients with severe TBI had a higher risk of intracranial hemorrhage, prolonged ICU stay, and poorer neurological outcomes, similar to findings in previous studies [8,9]. Despite advancements in neurosurgical techniques, mortality and long-term disability remain significant concerns in severe cases. However, improved prehospital care, early neuroimaging, and intensive care support have significantly reduced TBI-related mortality compared to past decades [10].

CONCLUSION

The study concluded that Glasgow Coma Scale (GCS) at the time of admission plays a significant role in predicting the prognosis of patients with traumatic brain injury (TBI). Factors such as intracerebral hemorrhage (ICH) and diffuse axonal injury (DAI) were found to be strongly associated with poorer outcomes. Despite various factors influencing recovery, early neuroimaging and appropriate management remain crucial for improving patient outcomes.

Conflict Of Interest:

The authors declare that there is no conflict of interest.

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REFERENCES

1. Maas AIR, Menon DK, Adelson PD, Andelic N, Bell MJ, Belli A, et al. Traumatic brain injury: integrated approaches to improve prevention, clinical care, and research. Lancet Neurol. 2017;16:987–1048.
2. Roozenbeek B, Maas AIR, Menon DK. Changing patterns in the epidemiology of traumatic brain injury. Nat. Rev. Neurol. 2013;9:231–6.
3. Pavan Kumar B, Vidya Devi V, Kumar Bandyopadhyay T, Hussaini SM. Factors influencing road traffic accidents causing maxillofacial injuries in Nalgonda District: prospective survey of 366 cases. J. Inj. Violence Res. 2023;15:27–32.
4. Jain S, Iverson LM. Glasgow Coma Scale [Internet]. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2025 Mar 16]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK513298/
5. Chou R, Totten AM, Pappas M, Carney N, Dandy S, Grusing S, et al. Executive Summary [Internet]. In: Glasgow Coma Scale for Field Triage of Trauma: A Systematic Review [Internet]. Agency for Healthcare Research and Quality (US); 2017 [cited 2025 Mar 16]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK410021/
6. Mutch CA, Talbott JF, Gean A. Imaging Evaluation of Acute Traumatic Brain Injury. Neurosurg. Clin. N. Am. 2016;27:409–39.
7. Sahuquillo J, Dennis JA. Decompressive craniectomy for the treatment of high intracranial pressure in closed traumatic brain injury. Cochrane Database Syst. Rev. 2019;2019:CD003983.
8. Stocchetti N, Zanier ER. Chronic impact of traumatic brain injury on outcome and quality of life: a narrative review. Crit. Care 2016;20:148.
9. Hawryluk GWJ, Rubiano AM, Totten AM, O'Reilly C, Ullman JS, Bratton SL, et al. Guidelines for the Management of Severe Traumatic Brain Injury: 2020 Update of the Decompressive Craniectomy Recommendations. Neurosurgery 2020;87:427–34.
10. Wilson JT, Pettigrew LE, Teasdale GM. Structured interviews for the Glasgow Outcome Scale and the extended Glasgow Outcome Scale: guidelines for their use. J. Neurotrauma 1998;15:573–85.