

Prevalence and Glasgow Outcome Scale score of severe head injury in Mbarara regional referral hospital: A retrospective study

Erick Odwar (✉ odwar31@gmail.com)

Lacor Hospital <https://orcid.org/0000-0001-5532-0739>

Ronald Okidi

Lacor Hospital

Florence Kayanga

Bethany Women and Family Hospital

David Kitya

Mbarara University of Science and Technology

Stephen Ttendo

Mbarara University of Science and Technology

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Abstract

Background: Traumatic brain injury (TBI) is a common cause of death in the Intensive care units and emergency departments with an estimated annual global mortality of 1.5 million people as a result of severe TBI. The prevalence of TBI varies according to regions. Despite this, there is limited data on the outcomes of patients following severe traumatic brain injury in southwestern Uganda. Herein, we studied the prevalence and outcome of severe traumatic brain injury at Mbarara Regional Referral Hospital (MRRH) at discharge.

Methods: A retrospective chart review of all TBI over six months (August 2016 - February 2017). The primary outcome was the Glasgow Outcome Scale (GOS) score at discharge. A favorable outcome was either good recovery or moderate disability while unfavorable outcome was severe disability, persistent vegetative state or death. Bivariate and multivariate logistic regression analyses were used to determine the factors associated with GOS score at discharge. Data were analyzed using STATA v13.0.

Results: A total of 196 hospital records of TBI patients were reviewed, 80 (40.8%) patients had severe TBI, with the average length of hospital stay at 4.3 ± 2.9 days. The mean patients' age was 35 ± 14 years with the most affected age group being 18 - 34 years (58.8%). The GOS score at discharge were; death (42.5%), persistent vegetative state (0%), severe disability (1.3%), moderate disability (3.8%) and good recovery (52.5%).

Pupil size and response had a dose-response relationship with unfavorable outcome when both pupils were dilated and non-reactive to light and had a higher odd ratio (OR=6.05) and strongly associated with unfavorable outcome ($p=0.011$). However, surgery and seizure prophylaxis were significantly associated with favorable outcome ($p=0.033$), ($p=0.016$) and a lesser odd ratio (OR=0.29),(OR=0.31) of having unfavorable outcome respectively.

Conclusion: Mbarara regional referral hospital, the prevalence of STBI is still high. Both surgery and seizure prophylaxis were associated with favorable outcome at discharge. However, unfavorable outcome was mainly seen amongst patients who develop a complication.

Introduction

Traumatic brain injury (TBI) is a common cause of death in Intensive Care Units and Emergency ward primarily caused by RTA (Road Traffic Accidents), followed by falls and assaults with severe traumatic brain injury (STBI) ($GCS \leq 8$) estimated as a significant cause of neurological morbidity and mortality accounting for 1.5 million deaths annually (1–4). According to different studies done in Uganda, TBI accounted for most of the neurosurgical admissions at 87.0% and mortality rate of 13.0% (5) while the prevalence of STBI was at 9.0% (6). In Tanzania, the prevalence of STBI was higher at 33.0% (7) and in Malawi and Burkina Faso, the prevalence of STBI was 33.0% and 14.0% respectively (8,9). In developed countries, the prevalence of STBI was at 44.0% (10).

Outcomes of STBI are associated with many factors like age, co-morbidities, alcohol abuse, low socioeconomic status, educational status and cause of injury (1). Primary and secondary central nervous system complications were the cause of mortality in 70% of patients admitted within 24 hours of the injury (11). The secondary injury to the brain may be due to brain herniation syndrome as a result of Pressure-induced prolapse of part of the brain into adjacent spaces, which occurs when the brain is under high intracranial pressure (12,13). The outcomes following TBI is measured by GOS scores that predict the long-term course of rehabilitation to return to work and everyday life (14).

A study done in patients with STBI, GOS score was used to describe the outcome of the patients where 19.0% had good recovery, 43.0% had moderate disability and 38.0% had severe disability at discharge (15). In Kenya, 10.3% had good recovery, 8% had moderate disability, 8% had severe disability, 21.8% had persistent vegetative state and 54.0% died. The high mortality rate was related to the high frequency of multiple injuries and late presentation to the hospital (16). While in France, the highest GOS score was moderate disability followed severe disability and lastly good recovery with the global disability remaining high because of lack of rehabilitation center and follow up (15). To avoid the unfavorable outcome as a result of STBI, early Decompressive Craniectomy was required to improve intra cranial pressure and cerebral perfusion pressure hence better outcome (17)

Overall, there is limited published literature about outcomes of STBI amongst adult patients in low-middle income countries (LMICs) as well as patient and service-related factors associated with outcomes.

In Switzerland, the average length of hospital stay for STBI was relatively high which was attributable to the severity of the injury, extracranial complications and mechanical ventilation (18,19).

Methods

Study site

The study was conducted in Mbarara Regional Referral Hospital (MRRH), a university teaching hospital for Mbarara University of Science and Technology (MUST) and the neighboring health institutions located in southwestern Uganda. Amongst others, it offers brain computed – tomography scanning, neurosurgical care and intensive care services (Hospital Registry, 2016).

Study design

This was a retrospective review of medical documents from neurosurgical and Surgical Quality Assurance Database (SQUAD).

Study Population

The study participants comprised of adult patients admitted with TBI at MRRH from August 2016 to February 2017.

Inclusion criteria

All patients who were at least 18 years of age who sustained traumatic brain injury admitted at MRRH from August 2016 to February 2017.

Exclusion criteria

Patients with incomplete information within the study period.

Sample size calculation

A total of 196 completed patients data were extracted from the databases for this study.

Data Collection Tool

Case report forms for data collection were used to obtain patients' details from the databases. The data extracted included: Demographics, the time between injury and hospital arrival, cause of injury, length of hospital stay, pupil size and response, type of injury, surgery performed, Infection prophylaxis, Seizure prophylaxis, complications acquired during the hospital stay, airway compromise, Aspiration pneumonia, pressure sores, epilepsy and others.

The outcomes of interest were Glasgow outcome scale (GOS) scores characterized in five variables; death, persistent vegetative state, severe disability, moderate disability and good recovery. Favorable outcome was either moderate disability and good recovery while unfavorable outcome was death, persistent vegetative state, or severe disability on GOS score.

Statistical analysis

Data from the study were cleaned, sorted, entered into Microsoft excel and later exported into STATA version 13.0 for analysis. The proportions of STBI and the outcomes were calculated. Bivariate and multivariate logistic regressions analyses performed for outcome factors at discharge and presented in tables.

Results

Prevalence of severe traumatic brain injury

In this review, the overall mortality rate from TBI in Mbarara regional referral hospital was at 46.8%. However, mortality from severe traumatic, moderate and mild traumatic brain injuries was at 40.8%, 18.9% and 40.3% respectively. The average age of TBI patients was 35.0 ± 14.0 years with the most affected were between the age of 18 and 34 years who constituted 58.8% of the total TBI population. Traumatic brain injury affected majorly males (83.6%) and their mortality rate was at 43.3%. Among patients with STBI, 28.75% were motorcyclists (Boda-boda riders) and had a mortality rate of 52.2%.

Outcomes of Severe TBI at MRRH

Glasgow outcome scores at discharge

The most prevalent GOS score at discharge was good recovery (52.5%) followed by death (42.5%). Severe disability and moderate disability were at 1.3% and 3.8% respectively; meanwhile, none sustained persistent vegetative state.

Length of hospital stay

Majority of the study participants 70.0% spent the least number of days (0–7) while 2.5% spent > 41 days in the hospital. The rest of the patients spent between 8 and 41 days in the hospital before discharge. The average length of hospital stay was 4.3 ± 2.9 days.

Factors associated with GOS score at discharge

Patients in the age groups > 35 years had lesser odd (OR = 0.62) of unfavorable outcomes compared to the patients in the age group 18–35 years. The female gender though had a comparable odd (OR = 0.10) of unfavorable outcome compared to that of male gender and was not significantly associated with GOS score at discharge ($p = 0.10$). As concerned the cause of injury, fall had a higher odd (OR = 2.75) of unfavorable outcome compared to assault and RTA and it was not significantly associated with GOS score at discharge. Patients who arrived in the hospital > 24 hours after injury had higher odd (OR = 1.14) with insignificant unfavorable outcome ($p = 0.77$). Pupil size and response to light had a progressive increase in the odd of unfavorable outcome and patients with both pupils dilated and non-reactive had a significant association with unfavorable outcome. Injury type on CT (Computed tomography) Scan result showed that patients with normal CT scan results had lesser odd (OR = 1.00) of having unfavorable outcome as compared to patients with abnormal CT Scan results (OR = 2.04). The patients who spent in the hospital between 0–21 days had comparable odd of unfavorable outcome to patients that spent > 21 days in the hospital with no significance ($p = 0.80$) (Table 2).

Table 1
Socio-demographic characteristics of adult patients with
STBI

Characteristic	Alive n (%)	Died n(%)
Age (years)		
18–34	25(53.2)	22 (46.8)
35–51	12(60.0)	8 (40.0)
52–68	3(42.9)	4 (57.14)
69–84	6(100.0)	0 (0.0)
Gender		
Female	8(61.5)	5(38.5)
Male	38 (56.7)	29(43.3)
Occupation		
Motorcyclists (Boda rider)	11(47.8)	12(52.2)
Peasant	2(33.3)	4(66.7)
Student	1(50.0)	1(50.0)
Others	32(65.3)	17(34.69)

Table 2
Bivariate logistic regression analysis for factors associated with GOS score at discharge

Variable	GOS at discharge		Odds Ratio	95% CI	p-value
	Unfavorable	Favorable			
	n (%)	n (%)			
Age (years)					
18–35	24 (51.1)	23 (48.9)	1		
> 35	13 (39.4)	20 (60.6)	0.619	- 0.330–1.360	0.303
Gender					
Male	31 (46.3)	36 (53.7)	1		
Female	6 (46.2)	7 (53.8)	0.995	0.302–3.277	0.994
Cause of injury					
Assault	8 (42.1)	11 (57.9)	1		
Fall	6 (66.7)	3 (33.3)	2.75	0.523–14.439	0.232
RTA	23 (44.2)	29 (55.8)	1.09	0.376–3.155	0.873
The time between injury and hospital arrival					
≤ 24hrs	16 (44.4)	20 (55.6)	1		
> 24hrs	21 (47.7)	23 (52.3)	1.141	0.471–2.763	0.77
Pupil size & response					
PEARL	20 (37.7)	33 (62.3)	1		
Unilaterally dilated ± reactive	6 (46.2)	7 (53.8)	1.414	0.416–4.808	0.579
Both dilated ± non-reactive	11 (78.6)	3 (21.4)	6.05	1.504–24.343	0.011*

*Significant at 0.05 level, GOS-Glasgow Outcome Scale, RTA-Road Traffic Accident, PEARL-Pupils Equal and Reactive to light.

Variable	GOS at discharge		Odds Ratio	95% CI	p-value
	Unfavorable	Favorable			
Type of injury as on CT scan(n = 50)					
Normal	1 (25.0)	3 (75.0)	1		
Abnormal	16 (44.4)	20 (55.6)	2.044	-1.077–2.055	0.523
Length of hospital stay in days					
0–21	32 (45.7)	38 (54.3)	1		
≥ 21	5 (50.0)	5 (50.0)	0.957	- 0.574 - 0.445	0.799
Surgery performed					
No	32 (53.3)	28 (46.7)	1		
Yes	5 (25.0)	15(75.0)	0.292	0.094–0.905	0.003*
Seizure prophylaxis					
No	11 (68.8)	5 (31.2)	1		
Yes	26 (40.6)	38 (59.4)	0.311	0.097–1.001	0.050*
Complications					
No	24 (38.7)	38 (61.3)	1		
Yes	13 (72.2)	5 (27.8)	4.117	1.302–13.015	0.016*
*Significant at 0.05 level, GOS-Glasgow Outcome Scale, RTA-Road Traffic Accident, PEARL-Pupils Equal and Reactive to light.					

Table 3

Multivariate Logistic regression of factors associated with GOS score at discharge

Variables	Odds Ratio	95% CI	P-value
Pupil Size and response			
PEARL	1		
Unilaterally dilated and reactive	1.413	0.384–5.192	0.603
Both pupils dilated and non-reactive	3.548	0.813–15.473	0.092
Complication			
Absent	1		
Present	5.719	1.333–24.542	0.019*
Surgery is done			
Not done	1		
Done	0.179	0.043–0.750	0.019*

Having surgery done was associated with lesser odd (OR = 0.29) of unfavorable outcome, which was significant ($p = 0.033$) as compared to having no surgery done. Patients who received seizure prophylaxis had a much lesser odd (OR = 0.31) and a significance ($p = 0.050$) of having unfavorable outcome compared to patients who never received seizure prophylaxis. Patients who developed complications had higher odds (OR = 4.12) and are associated with unfavorable outcomes ($p = 0.016$) as compared to patients who had no complications.

Factors associated with GOS score at discharge

The pupil size and response had no significant association ($p > 0.05$) with a dose-response odd of having unfavorable outcome. Complication had a significant association with unfavorable outcome ($p = 0.019$) and a higher odd (OR = 5.72). Likewise, surgery done was significantly associated with favorable outcome ($p = 0.019$) and a lesser odd (OR = 0.18) (Table 2).

Discussion

Prevalence of severe traumatic brain injury

In this study, the prevalence of severe traumatic head injury was high and this could have been due to the increased urbanization, limited imposed traffic laws, increased traffic volume within the country and most importantly since MRRH is the only referral center for neurosurgical conditions in Southwestern Uganda with a wide catchment area hence the high prevalence. Compared to other studies, in Tanzania and

Malawi where the prevalence of STBI was slightly low at 33% (7,8) while in Switzerland, the prevalence of STBI was high at 44%(10).

The differences in the study findings may be due to differences in the study period, study design, study site and sensitization of the public on safety measures to prevent occurrences of STBI. Our study findings were different from the study conducted at MRRH except for the length of hospital stay, which was relatively comparable. The difference could have been due to the study duration and study age group (5)

Outcomes of Severe Traumatic Brain Injury

The primary outcome of this study was Glasgow outcome scale scores at discharge

Glasgow Outcome Scale Scores at discharge

In our study, we found a slightly high number of patients with GOS scores 5 followed by GOS score 1, GOS score 4 and finally, GOS score 3 at discharge comparable to a study in Greece with a relatively high number of patients with GOS score 5 followed by GOS score 1, GOS score 4, GOS score 3 and GOS score 2 [15] and slightly contrasted with a study on France with the global disability remaining high because of lack of rehabilitation center and follow up (15) and due to high frequency of multiple injuries and late presentation to the hospital(16). Hence, higher mortality from STBI was observed in the study probably attributed to age, the severity of the injury, inadequate resuscitation resources, inaccessible diagnostic equipment especially CT scan.

Length of hospital stay

This study showed a shorter average length of hospital stay and the majority of patients spent less than 7 days from admission time contrasting to a study in Switzerland which was relatively longer. However, this study is comparable to another conducted in the same setting though in paediatrics population(5). We postulate our shorter average length of hospital stay was probably influenced by untimely access to critical care services, hence early mortality.

Factors associated with GOS Scores at discharge

Our study found that female gender had a comparable odd of unfavorable outcome at discharge as a male gender with no level of significance. Though males were the most affected, and the majority being motorcyclists which is an occupation done mostly by men, therefore, making them prone to STBI hence global disability and unfavorable outcome which is similar to other studies conducted in Tanzania, Malawi and Switzerland (7,8,17).

In this study, younger patients (age group 18–35 years) had a higher odds of unfavorable outcome compared to patients > 35 years and most likely due to the severity of the injury or cause of the injury because in this age group (18–35 years), it comprised of individuals who are very active, energetic and are most likely to take on risky works such as motorcycling (Boda riding), being involved in physical fights which made them susceptible to STBI. Though there was no significant association ($p > 0.05$) of the age groups with GOS score, it is biologically known that the outcome of STBI is influenced by age.

However, our mean age was comparable with other studies done for example in a study done in Tanzania and Malawi with mean age 32 ± 20.1 years and 28 ± 16.3 years (7,8)

The most common cause of STBI was RTA, followed by assaults and lastly falls. However, fall had higher odds of unfavorable outcome compared to assault and RTA. This higher odd could have been due to the age disparity (common in the elderly) with reduced physiological reserves that predisposes them to a poor outcome. RTA as the common cause of injury could have been due to increased urbanization and traffic volume within Uganda in conjunction with limited imposed traffic laws (4). Several studies found similar results that the most common cause of STBI was RTA ranging from 60.7%-65.2%. Therefore, our study finding was comparable to these studies (4,7,15).

Patients who arrived in the hospital > 24hours had higher odds of unfavorable outcome compared to < 24hours and the delay in the time of arrival after injury was most likely due to long-distance, inadequate transport means, limited financial resources and absence of paramedic pre-hospital care services at the scene of injuries. In our study, the time between injury and hospital arrival was not significantly associated with GOS score at discharge. However, critical to note that time between injury and hospital arrival influences the outcome of STBI (Acosta). In a trauma center, majority of deaths occurred within 24 hours of the injury and relatively high number of patients with STBI were admitted to hospital on the day of injury, which contrasted with our study (7,11).

Pupil size and the response had a progressive increase in the odds ratios of unfavorable outcome with patients who had both pupils dilated and non-reactive having the highest odd and significant association with unfavorable outcome. This may have been as a result of very severe injury with predetermined poor outcome as with other studies, abnormal pupil size and response were correlated with poor outcome in STBI patients (13).

Surgery when indicated, in patients with STBI was significantly associated with favorable outcome and lesser odd of unfavorable outcome. This relieves increased intracranial pressure caused by intracranial space-occupying lesions, thus improving cerebral blood flow and mitigating secondary injuries. Hence, favourable outcome. However, in this study, majority of the patients did not have surgery done and this could have been as a result of lack of diagnostic CT-Scan result, conservatively manageable injury, Unsalvageable condition and/or inadequate resuscitation equipment post-surgery. Craniotomy was the commonest surgical procedure, this was comparable to another surgical centre (7).

Patients who had seizure prophylaxis were at much lesser odds of having unfavorable outcome with a significant association to favorable outcome compared to the patients who did not have seizure prophylaxis (OR = 0.31, CI; 0.097–1.001, p = 0.050). This could have influenced the manifestation of seizures, which is associated with risks of hypoxia, aspiration pneumonitis and worsening morbidity hence predisposing to unfavorable outcome. Therefore, all patients with STBI should receive seizure prophylaxis as a standard measure.

Complication during management had a strong correlation with unfavorable outcome as portrayed by the higher odds and significant association shown above. However, some of the complications that were observed were aspiration pneumonia, surgical site wound swelling and airway compromise with most commonly observed complication being aspiration pneumonia. In other studies, the common complication was airway compromise and brain edema (8,19). The disparity in the results could be related to the geographical location and management resources.

Conclusion

The prevalence of STBI is high at MRRH with a reduced length of hospital stay. Administering seizure prophylaxis and having surgery done when indicated in STBI patients are associated with favorable outcome while patients who develop complications due to STBI have unfavorable outcome.

Abbreviations

CT-Scan Computed Tomography Scan

GCS Glasgow Coma Scale

GOS Glasgow Outcome Scale

LMIC Low Middle Income Country

MRRH Mbarara Regional Referral Hospital

MUST Mbarara University of Science and Technology

SQUAD Surgical Quality Assurance Database

STBI Severe Traumatic Brain Injury

TBI Traumatic brain injury

Declarations

Ethical approval and consent to participate:

This study approval was sought from the Faculty Research Committee and Research Ethics Committee of Mbarara University of Science and Technology and the need for individual consent was waived off since this was a respective data collection.

Competing interests:

All authors declare no competing interests

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Authors' contributions:

All authors actively participated in writing this research protocol, conducting the research, and writing the manuscript. All authors read and approved the manuscript.

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