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Research Article

Clinical Profile, Management and Outcomes of Head-Injured Patients Admitted to the Intensive Care Unit of Ekiti State University Teaching Hospital, Ado-Ekiti, Nigeria: A Four-Year Retrospective Study

OA Dada[1,2*], AI Okunlola[3,4], MO Adetoye[5] and JM Afolayan[6,7]

[1]*Department of Surgery, Ekiti State University, Nigeria*

[2]*Neurosurgery Unit, Department of Surgery, Ekiti State University Teaching Hospital, Nigeria*

[3]*Department of Surgery, Federal Teaching Hospital, Nigeria*

[4]*Department of Surgery, Afe Babalola University, Nigeria*

[5]*Department of Surgery, Ekiti State University Teaching Hospital, Nigeria*

[6]*Department of Anesthesia, Ekiti State University, Nigeria*

[7]*Department of Anesthesia, Ekiti State University Teaching Hospital, Nigeria*

***Corresponding author:** OA Dada, Department of Surgery, Faculty of Clinical Sciences, Neurosurgery Unit, College of Medicine, Ekiti State University Teaching Hospital, Ekiti State University, Ado-Ekiti, Ekiti State, Nigeria.

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Abstract

Background: Traumatic brain injury remains an important cause of intensive care admission and mortality, particularly in resource-limited settings. This study assessed the clinical characteristics, management and outcomes of head-injured patients admitted to the Intensive Care Unit (ICU) of a Nigerian tertiary hospital.

Methods: A retrospective review was conducted among 121 patients admitted to the ICU of Ekiti State University Teaching Hospital, Ado-Ekiti, between July 2022 and June 2026. Sociodemographic, injury-related, clinical, radiological, management and outcome data were analysed. Factors associated with hospital mortality were assessed using bivariate analysis and multivariable logistic regression.

Results: The mean age was 34.8±19.6 years, and 75.2% were male. Road traffic crashes accounted for 63.6% of injuries. Severe head injury occurred in 70.2% of patients, while 79.3% required mechanical ventilation and 60.3% underwent neurosurgical intervention. Hospital mortality was 28.9%. Severe head injury (AOR 5.72; 95% CI 1.76-18.55), bilateral fixed pupils (AOR 4.39; 95% CI 1.55-12.41), midline shift >5mm (AOR 2.84; 95% CI 1.08-7.42) and acute kidney injury (AOR 3.26; 95% CI 1.04-10.18) independently predicted mortality.

Conclusion: Head-injured ICU patients were predominantly young males with severe injuries. Mortality remained substantial, with neurological severity and adverse systemic and radiological features independently associated with death.

Keywords: Traumatic brain injury, Head injury, Intensive care unit, Neurocritical care, Mortality

Introduction

Traumatic Brain Injury (TBI) remains a major cause of death and long-term disability worldwide, with a disproportionate burden in low- and middle-income countries where road traffic injuries, limited emergency care capacity and restricted access to specialist neurotrauma services contribute substantially to adverse outcomes [1,2]. In Nigeria, road traffic trauma remains an important cause of head injury, particularly among young adults, and severe neurological injury continues to account for considerable morbidity and mortality [3]. Patients with severe TBI frequently require intensive care because of impaired consciousness, loss of airway protective reflexes, respiratory failure, intracranial hypertension and the risk of secondary cerebral injury [4,5]. Appropriate early assessment, airway and ventilatory support, hemodynamic optimization, timely neuroimaging and definitive neurosurgical treatment are therefore central to the management of critically injured patients [5,6]. However, the availability and quality of neurocritical care vary considerably across low-resource settings. Studies from Uganda and Tanzania have demonstrated substantial delays in care, limited critical care resources and variable adherence to evidence-based recommendations, factors that may contribute to preventable mortality [7,8]. The clinical severity of TBI at presentation remains an important determinant of outcome. Admission Glasgow Coma Scale (GCS) score, pupillary abnormalities and important computed tomography findings, particularly intracranial haemorrhage and midline shift, have been consistently associated with prognosis [9-11]. Systemic complications occurring during intensive care, including ventilator-associated pneumonia, sepsis, electrolyte disturbances and acute kidney injury, may further worsen outcomes and prolong hospitalization [12-14]. Despite the substantial burden of traumatic head injury in Nigeria, institution-specific data describing the clinical profile, intensive care requirements, complications and outcomes of patients severe enough to require ICU admission remain limited. Local data are particularly important because patterns of injury, referral pathways, resource availability and access to neurosurgical care differ between institutions. This study therefore assessed the clinical characteristics, management, complications and outcomes of head-injured patients admitted to the ICU of Ekiti State University Teaching Hospital, Ado-Ekiti, Nigeria, and examined factors independently associated with hospital mortality.

Methodology

Study Design and Setting

This was a retrospective descriptive and analytical study conducted at the Intensive Care Unit (ICU) of Ekiti State University Teaching Hospital (EKSUTH), Ado-Ekiti, Nigeria. EKSUTH is a tertiary healthcare institution that provides specialist and subspecialist services, including neurosurgical and critical care services, to patients from Ekiti State and neighbouring areas.

Study Population

The study included children and adults with traumatic head injury who were admitted to the ICU and managed during the four-year period from July 2022 to June 2026. A total sampling approach was used, and all patients who met the eligibility criteria during the study period were considered for inclusion. Eligibility criteria: Patients of all ages with documented traumatic head injury who required ICU admission during the study period were included. Patients whose records contained insufficient information regarding their ICU admission or outcome were excluded from the analysis. Patients admitted to the ICU for non-traumatic neurological conditions were also excluded.

Data Collection

Relevant information was retrospectively extracted from patients' medical records, ICU admission and monitoring charts, neurosurgical records, theatre registers, nursing documentation, laboratory results and radiological reports using a structured data-collection proforma. The variables included age, sex, mechanism of injury, referral status, clinical presentation, admission Glasgow Coma Scale (GCS), pupillary findings, associated injuries, computed tomography findings, ICU interventions, neurosurgical procedures, complications, duration of ICU and hospital admission, and clinical outcomes. Head injury severity was classified using the admission GCS as mild (13-15), moderate (9-12) or severe (3-8). Radiological variables included the presence of intracranial haemorrhage, cerebral contusion, cerebral ooedema, midline shift, skull fracture and other documented traumatic abnormalities. ICU management variables included mechanical ventilation, vasopressor support, enteral feeding, tracheostomy and neurosurgical intervention.

Outcome Measures

The primary outcome was in-hospital mortality. Secondary outcomes included ICU mortality, Glasgow Outcome Scale (GOS) at hospital discharge, duration of ICU stay, duration of hospitalisation and documented ICU complications. For analysis of functional outcome among survivors, among survivors, GOS scores of 2-3 was classified as poor functional outcomes, while scores of 4-5 represented favorable outcomes.

Statistical Analysis

Data was analysed using the Statistical Package for the Social Sciences (SPSS). Categorical variables were summarised using frequencies and percentages, while continuous variables were expressed as means with standard deviations or medians with interquartile ranges, as appropriate. Associations between categorical variables and mortality were assessed using the chi-square test or Fisher's exact test where appropriate. Continuous variables were compared using the independent-samples t-test or Mann-Whitney U test according to data distribution. Variables demonstrating an association with mortality on bivariate analysis, together with clinically relevant variables, were considered for multivariable logistic regression. Adjusted Odds Ratios (AORs) with 95% Confidence Intervals (CIs) were reported. Statistical significance was set at $P < 0.05$. Model adequacy was assessed using the Hosmer-Lemeshow goodness-of-fit test.

Ethical Considerations

Ethical approval was obtained from the Research and Ethics Committee of EKSUTH before commencement of data extraction. As this was a retrospective study involving review of existing records, no direct patient intervention was undertaken. Patient identifiers were removed from the analytical dataset, and confidentiality maintained throughout data collection, analysis and reporting.

Results

Sociodemographic and Injury Characteristics

A total of 121 patients with head injury were admitted and managed in the ICU during the four-year study period from July 2022 to June 2026. The mean age of the patients was 34.8 ± 19.6 years. Patients aged 18-39 years constituted the largest age group (45.5%), followed by those younger than 18 years (23.1%). Males predominated, accounting for 91 patients (75.2%), giving a male-to-female ratio of approximately 3:1 (Table 1). Road traffic crashes were the predominant mechanism of injury, accounting for 77 cases (63.6%). Falls were responsible for 21 cases (17.4%), while assault accounted for 13 (10.7%). Four patients (3.3%) sustained gunshot injuries and six (5.0%) had other mechanisms of injury. Most patients, 82 (67.8%), were referred from other health facilities, while 39 (32.2%) presented directly to EKSUTH (Table 1).

Table 1: Sociodemographic and Injury Characteristics of ICU Head Injury Patients (N = 121).

Variable	Category	Frequency (n)	Percentage (%)
Age group	<18	28	23.1
	18-39	55	45.5
	40-59	26	21.5
	≥60	12	9.9
Sex	Male	91	75.2
	Female	30	24.8
Mechanism of injury	Road traffic crash	77	63.6
	Fall	21	17.4
	Assault	13	10.7
	Gunshot injury	4	3.3
	Others	6	5.0
Referral status	Direct	39	32.2
	Referred	82	67.8

Clinical and Radiological Characteristics

Severe head injury was the predominant clinical presentation. On admission, 85 patients (70.2%) had a GCS of 3-8, while 27 (22.3%) had moderate head injury and only nine (7.4%) had mild head injury (Table 2). Bilaterally reactive pupils were documented in 71 patients (58.7%), whereas 27 (22.3%) had unilateral fixed or dilated pupils and 23 (19.0%) had bilaterally fixed pupils. Acute subdural hematoma was the most frequently documented CT abnormality, occurring in 46 patients (38.0%), followed by midline shift greater than 5 mm in 44 (36.4%) and cerebral contusion in 41 (33.9%). Diffuse cerebral oedema was present in 33 patients (27.3%), while extradural hematoma and traumatic subarachnoid haemorrhage were identified in 25 (20.7%) and 22 (18.2%), respectively. Depressed skull fractures were reported in 18 patients (14.9%). Several patients had more than one radiological abnormality (Table 2).

Table 2: Clinical and Radiological Characteristics (N = 121).

Variable	Category	Frequency (n)	Percentage (%)
Admission GCS	Mild (13-15)	9	7.4
	Moderate (9-12)	27	22.3
	Severe (3-8)	85	70.2
Pupils	Bilaterally reactive	71	58.7
	Unilaterally fixed	27	22.3
	Bilaterally fixed	23	19.0

CT findings	Acute SDH	46	38.0
	Acute EDH	25	20.7
	Cerebral contusion	41	33.9
	Diffuse cerebral edema	33	27.3
	Midline shift >5mm	44	36.4
	Traumatic SAH	22	18.2
	Depressed skull fracture	18	14.9

Note*: GCS = Glasgow Coma Scale; CT = computed tomography; SDH = subdural hematoma; EDH = extradural hematoma; SAH = subarachnoid haemorrhage. CT findings were not mutually exclusive; individual patients could have more than one radiological abnormality. Percentages are based on N = 121.

ICU Management and Complications

Mechanical ventilation was required in 96 patients (79.3%), while 73 (60.3%) underwent neurosurgical intervention during their hospitalization (Table 3). Vasopressor support was required in 22 patients (18.2%), and 18 (14.9%) underwent tracheostomy. Enteral feeding was commenced within 48 hours in 88 patients (72.7%). Electrolyte abnormalities were the most frequently documented ICU complication, occurring in 28 patients (23.1%). Ventilator-associated pneumonia occurred in 19 patients (15.7%), while post-traumatic seizures and sepsis were documented in 15 (12.4%) and 13 (10.7%), respectively. Acute kidney injury occurred in eight patients (6.6%), pressure sores in six (5.0%), and deep vein thrombosis in three (2.5%) (Table 3).

Table 3: ICU Management and Complications (N = 121).

Variable	Category	Frequency (n)	Percentage (%)
Mode of management	Mechanical ventilation	96	79.3
	Neurosurgical operation	73	60.3
	Tracheostomy	18	14.9
	Vasopressor use	22	18.2
	Enteral feeding (<48 hrs)	88	72.7
Complications	Ventilator-associated pneumonia	19	15.7
	Sepsis	13	10.7
	Electrolyte abnormalities	28	23.1
	Seizures	15	12.4
	Acute kidney injury	8	6.6
	Pressure sores	6	5.0
	Deep vein thrombosis	3	2.5

Note*: Management interventions and complications were not mutually exclusive; individual patients could receive multiple interventions or develop multiple complications. Percentages are based on N = 121.

ICU and Hospital Outcomes

Of the 121 patients, 87 (71.9%) were stepped down from the ICU to the ward, while 31 (25.6%) died in the ICU (Table 4). Two patients (1.7%) were referred elsewhere and one (0.8%) left against medical advice. Overall, 35 patients (28.9%) died before hospital discharge, while 86 (71.1%) survived to discharge. Among the survivors, 41 (47.7%) achieved good recovery, 25 (29.1%) had moderate disability, 18 (20.9%) had severe disability and two (2.3%) remained in a persistent vegetative state. The median ICU stay was 7 days (IQR 4-12), while the median hospital stay was 15 days (IQR 10-24).

Bivariate Analysis of Factors Associated with Mortality

Several variables demonstrated significant associations with hospital mortality on bivariate analysis. Patients aged 60 years or older had significantly higher mortality compared with younger patients (P = 0.005) as shown in Table 5. Severe head injury at admission was strongly associated with death, with 32 of the 35 patients who died having a GCS of 3-8 compared with 53 of 86 survivors (P < 0.001). Pupillary abnormalities were also significantly associated with mortality. Bilaterally fixed pupils were present in 15 (42.9%) of those who died compared with eight (9.3%) survivors (P < 0.001). Similarly, a midline shifts greater than 5 mm was significantly more frequent among patients who died than among survivors (60.0% versus 26.7%; P = 0.001). Mechanical ventilation, neurosurgical intervention, ventilator-associated pneumonia and acute kidney injury were also significantly associated with mortality on bivariate analysis (P < 0.05 for each). Male sex was not significantly associated with mortality (P = 0.435) (Table 5).

Table 4: Clinical Outcomes (N = 121)

Variable	Category	Frequency (n)	Percentage (%)
ICU outcome	Stepped down	87	71.9
	Died in ICU	31	25.6
	Referred	2	1.7
	Left against medical advise	1	0.8
Hospital outcome	Alive	86	71.1
	Dead	35	28.9
Glasgow Outcome Score (survivors)	Good recovery	41	47.7
	Moderate disability	25	29.1
	Severe disability	18	20.9
	Vegetative state	2	2.3

Note*: Glasgow Outcome Score categories are reported among hospital survivors (n = 86), and their percentages therefore use 86 as the denominator.

Table 5: Bivariate Analysis of Factors Associated with Hospital Mortality.

Variable	Survivors (n = 86)	Deaths (n = 35)	χ^2/t	P value
Age ≥60 years	4	8	7.76	0.005
Male sex	63	28	0.61	0.435
Severe GCS (3–8)	53	32	11.89	<0.001
Bilateral fixed pupils	8	15	18.26	<0.001
Midline shift >5 mm	23	21	11.44	0.001
Mechanical ventilation	64	32	4.37	0.037
Neurosurgical operation	58	15	6.26	0.012
Ventilator-associated pneumonia	9	10	5.98	0.014
Sepsis	6	7	4.69	0.03
Acute kidney injury	2	6	8.52	0.004

Note*: GCS = Glasgow Coma Scale. Values are frequencies among survivors and deaths. χ^2 = chi-square statistic. P < 0.05 was considered statistically significant.

Multivariable Analysis of Predictors of Mortality

Variables demonstrating significant associations with mortality on bivariate analysis were considered for multivariable logistic regression. After adjustment for potential confounding, severe head injury, bilateral fixed pupils, midline shift greater than 5 mm and acute kidney injury remained independent predictors of hospital mortality. Patients with severe head injury had approximately six-fold higher odds of death compared with those without severe injury (AOR 5.72, 95% CI 1.76-18.55; P = 0.004) (Table 6). Bilaterally fixed pupils were independently associated with mortality (AOR 4.39, 95% CI 1.55-12.41; P = 0.005). A midline shifts greater than 5 mm was associated with nearly three-fold increased odds of death (AOR 2.84, 95% CI 1.08-7.42; P = 0.034), while patients who developed acute kidney injury had increased odds of mortality (AOR 3.26, 95% CI 1.04-10.18; P = 0.043). The regression model demonstrated acceptable calibration, with a Hosmer-Lemeshow goodness-of-fit P value of 0.61, a Nagelkerke R^2 of 0.41 and an overall classification accuracy of 82.6% (Table 6).

Table 6: Multivariable Logistic Regression Analysis of Factors Independently Associated with Hospital Mortality.

Variable	Adjusted OR	95% CI	P value
Severe GCS (3–8)	5.72	1.76 – 18.55	0.004
Bilaterally fixed pupils	4.39	1.55 – 12.41	0.005
Midline shift >5 mm	2.84	1.08 – 7.42	0.034
Acute kidney injury	3.26	1.04 – 10.18	0.043

Note*: AOR = adjusted odds ratio; CI = confidence interval; GCS = Glasgow Coma Scale. Reference categories are the corresponding non-severe/non-exposed categories. Acute Kidney Injury was recorded during the hospital course; its association with mortality should therefore not be interpreted as a baseline prognostic effect or causal relationship. Model statistics: Hosmer–Lemeshow P = 0.61; Nagelkerke R^2 = 0.41; overall classification accuracy = 82.6%.

Factors Associated with Poor Functional Outcome

Among the 86 survivors, 66 achieved a favorable functional outcome (GOS 4-5), whereas 20 had a poor functional outcome (GOS 1-3) (Table 7). Older age was significantly associated with poor functional outcome, with patients aged 60 years or older being more likely to have an unfavorable outcome (P = 0.028). Severe head injury was significantly more common among patients with poor functional outcomes than among those with favorable outcomes (90.0% versus 53.0%; P = 0.006). Bilaterally fixed pupils and midline shift greater than 5 mm were also significantly associated with poor functional outcome (P = 0.022 and P = 0.013, respectively). Mechanical ventilation, ventilator-associated pneumonia and an ICU stay exceeding 10 days were similarly associated with poor functional outcome (Table 7).

Table 7: Bivariate Analysis of Factors Associated with Poor Functional Outcome among Hospital Survivors (n=86).

Variable	Good outcome (n = 66)	Poor outcome (n = 20)	χ^2	P value
Age ≥60 years	3	5	4.84	0.028
Severe GCS	35	18	7.66	0.006
Bilateral fixed pupils	4	4	5.23	0.022
Midline shift >5 mm	13	10	6.12	0.013
Mechanical ventilation	45	19	4.14	0.042
Ventilator-associated pneumonia	5	4	4.26	0.039
ICU stay >10 days	17	11	7.38	0.007

Discussion

Clinical and Demographic Profile

This study demonstrates that critically ill head-injured patients admitted to the ICU were predominantly young males, with a mean age of 34.8 years and approximately three-quarters being male. Road traffic crashes were the leading mechanism of injury, accounting for 63.6% of admissions. These findings are consistent with the epidemiological pattern of traumatic head injury reported in Nigeria and other sub-Saharan African settings, where road traffic trauma disproportionately affects young, economically productive males [3,7,8]. The predominance of road traffic crashes has important preventive implications. Adeleye and Ogun reported that road traffic trauma constituted a major source of head injury in Nigeria, with substantial neurological and extracranial morbidity [3]. Similarly, studies from Uganda and Tanzania have identified road traffic injuries as an important contributor to severe TBI and neurosurgical workload. [7,8]. The high proportion of patients referred from other healthcare facilities in the present study is also noteworthy. More than two-thirds of patients were transferred from other centers, suggesting that EKSUTH functions as an important referral destination for severe neurotrauma. Referral itself may introduce delays in definitive treatment, particularly when prehospital systems, interfacility communication and transport facilities are limited. Evidence from Uganda has similarly highlighted prolonged delays in TBI care as an important contributor to adverse outcomes [7].

Severity of Head Injury at ICU admission

Severe head injury predominated in this cohort, with 70.2% presenting with a GCS of 3-8. This finding is expected in an ICU-based population because patients with profound neurological impairment are more likely to require airway protection, mechanical ventilation and intensive monitoring. Nevertheless, the high proportion of severe injuries indicates that many patients reached definitive tertiary care only after substantial neurological compromise had already occurred. The relationship between neurological severity and outcome was particularly strong in this study. Severe TBI was associated with substantially increased mortality on both bivariate and multivariable analyses. After adjustment for other variables, patients with severe injury had more than five times the odds of hospital death. This finding is consistent with established prognostic evidence showing that admission neurological status remains one of the strongest predictors of outcome after TBI [9,10]. The GCS therefore remains a simple and clinically useful tool for early risk stratification, particularly in settings where sophisticated prognostic technologies may not be readily available. Bilateral fixed pupils were another factor independently associated with mortality. Bilateral pupillary unresponsiveness generally reflects severe cerebral dysfunction and may indicate raised intracranial pressure, herniation or extensive primary brain injury. Contemporary prognostic work has demonstrated that combining GCS with pupillary responses improves assessment of TBI severity and outcome prediction. 9 The present findings reinforce the importance of careful and repeated pupillary assessment during the early management of severely injured patients.

Radiological Characteristics and Prognostic Significance

Acute subdural hematoma was the most frequent CT abnormality, followed by cerebral contusion and midline shift greater than 5mm. The predominance of acute subdural hematoma is clinically relevant because this lesion is frequently associated with severe primary and secondary brain injury. Studies have demonstrated that subdural hematoma is an important determinant of short-term outcome following TBI. [15]. Midline shift greater than 5mm was independently associated with mortality in this study. A substantial midline shift is an indirect marker of mass effect and intracranial compartment disturbance and may indicate significant cerebral oedema or an expanding intracranial hematoma. Previous evidence has demonstrated an association between the degree of midline shift and mortality in patients with acute traumatic subdural hematoma. 11 The present finding therefore supports the continued importance of CT-based assessment in identifying patients at particularly high risk. The high prevalence of multiple CT abnormalities in individual patients further reflects the severity of the injuries managed in this ICU. Such patients may require rapid coordination between emergency physicians, anesthetists, intensivists and neurosurgeons. In resource-constrained environments, however, the ability to provide timely CT imaging, continuous monitoring and urgent operative intervention may be restricted. African studies have documented gaps in neurocritical care resources and variable implementation of evidence-based TBI management. [7,8,16].

Intensive Care Management

Mechanical ventilation was required in 79.3% of patients, while 60.3% underwent neurosurgical intervention. The high rate of ventilation is consistent with the predominance of severe TBI and reflects the need for airway protection and control of oxygenation and ventilation in patients with markedly impaired consciousness. Contemporary neurocritical care recommendations emphasize appropriate ventilatory management while avoiding both hypoxemia and inappropriate extremes of carbon dioxide tension [17]. The proportion undergoing neurosurgical intervention is also substantial. In a severe TBI population, timely evacuation of surgically significant intracranial hematomas and other appropriate procedures can be lifesaving. However, evidence from Uganda has shown that failure to receive indicated surgical intervention was strongly associated with mortality [7]. The relatively high operative rate in the present study may therefore reflect the availability of neurosurgical services at EKSUTH, although the retrospective design does not allow assessment of whether surgery was performed within recommended time intervals. Enteral feeding within 48 hours was achieved in 72.7% of patients. Early nutritional support is an important component of contemporary critical care because severe TBI is associated with a hypermetabolic and catabolic state. Evidence supports early enteral nutrition as part of comprehensive management of critically ill patients with TBI [18].

ICU Complications

Electrolyte abnormalities were the most frequently documented complication, followed by ventilator-associated pneumonia, seizures and sepsis. These complications highlight the fact that survival after severe TBI depends not only on control of the primary cerebral injury but also on prevention and prompt treatment of secondary systemic insults. Ventilator-associated pneumonia occurred in 15.7% of patients and was associated with mortality on bivariate analysis. TBI patients are particularly vulnerable to pulmonary complications because impaired consciousness, prolonged mechanical ventilation, aspiration risk and reduced cough effectiveness may compromise airway protection. A meta-analysis has demonstrated a significant burden of ventilator-associated pneumonia among patients with TBI and identified its association with adverse outcomes [13]. Acute kidney injury occurred in 6.6% of patients and emerged as a factor independently associated with hospital mortality. This association is clinically plausible because acute kidney injury may reflect systemic hypoperfusion, sepsis, nephrotoxic exposure or multisystem organ dysfunction. In a severely injured patient, renal dysfunction may also complicate fluid and electrolyte management and limit the ability to maintain physiological stability. The independent association observed in this study suggests that renal function deserves close attention in neurocritical care rather than being regarded as a secondary issue.

Mortality and Functional Outcome

Overall hospital mortality was 28.9%, while ICU mortality was 25.6%. This remains a substantial mortality burden. Comparisons between institutions should, however, be made cautiously because ICU populations differ considerably according to injury severity, referral patterns, availability of neurosurgical intervention and case-mix. The mortality observed in the present study is broadly compatible with the high burden of severe TBI reported from African tertiary centers. Studies from Uganda and Tanzania have documented significant mortality among patients with severe TBI and highlighted the influence of delays, resource limitations and adherence to evidence-based management [7,8]. In Tanzania, severe TBI was associated with challenges in implementation of recommended management strategies, while the Ugandan registry demonstrated substantial mortality and high ICU fatality among severely injured patients [7,8]. These observations underscore the importance of strengthening the entire continuum of trauma care rather than focusing exclusively on ICU treatment. Among survivors, 47.7% achieved good recovery, whereas the remainder had varying degrees of disability. Older age, severe admission GCS, bilateral fixed pupils, significant midline shift, mechanical ventilation, ventilator-associated pneumonia and prolonged ICU stay were associated with poor functional outcome. The relationship between age and outcome is consistent with evidence that older patients generally have poor recovery after significant TBI. [19]. The association between severe neurological injury, pupillary abnormalities and functional outcome is also consistent with established prognostic models for TBI [9,20].

Predictors of Mortality and Clinical Implications

The multivariable analysis identified four factors independently associated with hospital mortality: severe head injury, bilateral fixed pupils, midline shift greater than 5 mm and acute kidney injury. The findings are clinically coherent because they encompass both the severity of primary neurological injury and the development of systemic organ dysfunction. Importantly, the predictors identified in this study are readily assessable in routine clinical practice. GCS and pupillary responses can be obtained at the bedside, while CT evidence of midline shift is available from routine neuroimaging. Renal function can be monitored through standard laboratory investigations and urine output. Their accessibility makes these variables potentially useful for early risk stratification in resource-constrained settings. The findings also have implications for service development. Earlier recognition of severe TBI, efficient referral pathways, rapid access to CT imaging, timely neurosurgical consultation, appropriately staffed ICUs and systematic prevention of secondary complications could potentially improve outcomes. African studies have repeatedly identified limitations in critical care and neurosurgical capacity as important barriers to optimal trauma care [17,21]. Strengthening these components should therefore form part of a broader institutional strategy for improving neurotrauma outcomes.

Strengths and Limitations

A major strength of this study is that it provides institution-specific data covering a four-year period and includes demographic, clinical, radiological, management, complication and outcome variables. The use of multivariable analysis also allowed several clinically important predictors of mortality to be assessed simultaneously. The study nevertheless has limitations inherent in its retrospective design. The quality of the analysis depended on the completeness and accuracy of existing medical records, and some potentially relevant variables may not have been consistently documented. The study was conducted at a single tertiary institution, which may limit generalizability to other Nigerian hospitals. In addition, functional outcome was assessed at hospital discharge rather than at a longer-term follow-up point; therefore, subsequent neurological recovery or deterioration could not be evaluated. Finally, the observational design permits identification of associations but does not establish causality.

Conclusion and Implications

This study demonstrates that ICU-admitted head-injured patients at EKSUTH were predominantly young males with severe neurological injuries, most commonly resulting from road traffic crashes. Mortality remained substantial, and severe admission GCS, bilateral fixed pupils, significant midline shift and acute kidney injury independently predicted hospital death. The findings emphasize the importance of early neurological assessment, timely neuroimaging and neurosurgical intervention, meticulous neurocritical care and active prevention of systemic complications. Strengthening referral systems and critical care capacity, alongside broader road traffic injury prevention strategies, may contribute to improved outcomes for patients with severe head injury in this setting.

Declarations

Authors’ Contributions

All authors contributed to the conception and design of the study, interpretation of data, drafting of the manuscript, and approval of the final version.

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Ethical Approval Statement

Ethical approval was obtained from the Research and Ethics Committee of EKSUTH prior to the commencement of the study. The study was carried out in accordance with the ethical standards of the institutional research committee and the principles of the Declaration of Helsinki.

Conflict of Interest Statement

The authors declare that there are no conflicts of interest regarding the publication of this article.

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Data Availability Statement

The datasets generated and analyzed during the study are available from the corresponding author upon reasonable request.

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