



St. Paul's Hospital

Millennium Medical College

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Title

Neurologic Outcome Of Traumatic Intracranial Epidural Hematoma After Neurosurgical Intervention at Addis Ababa Burn, Emergency and Trauma (AABET) Hospital

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Abstract

Background: Epidural hematoma (EDH) is one of the most life threatening lesions in patients with cranio-cerebral trauma. Traumatic EDH is a neurosurgical emergency and timely surgical intervention for significant EDH is the gold standard.(1)

Objective: the primary aim of this study is to evaluate the short-term outcomes of traumatic epidural hematoma cases post-neurosurgical intervention at Addis Ababa Burn Emergency and Trauma (AaBET) Hospital in Addis Ababa, Ethiopia.

Methodology: this research was employed an institutional-based cross-sectional design. The study is focused on patients admitted with epidural hematoma who have undergone neurosurgical intervention and meet the inclusion criteria, in from GC January 1, 2020, to December 31, 2022.

Result: Over a 2-year period, a total of seventy patients were managed, comprising 63 males and 7 females, reflecting a male-to-female ratio of 9:1. The mean age of the patients was 41.8 years (± 24.9), with the age distribution indicating a concentration of 38.6% of patients in the 29-38 age group. Assault was the leading mechanism of injury (MOI) among studied population, accounting for 61%, followed by motor vehicle accidents (MVA) at 20%, fall from height at 14.3%, and gunshots representing the least common MOI. Our investigation has pinpointed several factors that significantly influence patient outcomes. Specifically, the presence of abnormal pupillary reaction (Anisocoric), a midline shift exceeding 5 mm, an epidural hematoma (EDH) volume surpassing >30 ml, and ICU admission were all associated with a marked negative impact on patient recovery and overall outcome, with corresponding p-values of 0.015, 0.032, 0.03, and 0.013 respectively.

Conclusion: This study revealed good surgical outcome in EDH patients. The key determinant of surgical outcome using GOS in patients with acute EDH is the presence of new focal neurologic deficit, abnormal pupillary reaction, and ICU admission. The duration of injury to surgery showed no net effect on the surgical outcomes of patients.

Key words: epidural hematoma, outcome, neurosurgical, intervention

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Acronyms and Abbreviations

AaBet.....	Addis Ababa Burn, Emergency and Trauma Hospital
CNS.....	Central Nervous System
ED.....	Emergency Department
EDH.....	Epidural Hematoma
EP	Emergency physician
GCS.....	Glasgow Coma Scale
GOS.....	Glasgow Outcome Scale
HAIs.....	Hospital Acquired Infections
ICH.....	Intra Cerebral Hemorrhage
ICP.....	Intra Cranial Pressure
ICU.....	Intensive Care Unit
IQR.....	Inter-quartile Range
MOI.....	Mechanism Of Injury
MOF.....	Multi Organ Failure
MVA.....	Motor Vehicle Accident
No....	Number
PR.....	Pulse Rate
RR.....	Respiratory Rate
SBP.....	Systolic Blood Pressure
SDH.....	Subdural Hematoma
SPO ₂	Oxygen Saturation
tSAH.....	traumatic SubArachnoid Hemorrhage
tDAI.....	traumatic Diffuse Axonal Injury

1 Introduction

1.1 Background

Traumatic epidural haematoma (EDH) is the collection of blood in the potential space between the dura mater and endocranium and is usually a neurosurgical emergency that may cause an acute rise in intracranial pressure. (3)

EDH commonly results from traumatic brain injury and accounts for 2.7%–4% of all intracranial haemorrhage, making it one of the leading causes of death in the age group 16–40 years with an overall mortality of 9.4%–33%. They are more commonly observed in young males involved in traffic accidents and fall from a height. The outcome may be influenced by preoperative Glasgow Coma Scale (GCS), time between injury and surgery, associated intracranial injuries, anisocoria, and haematoma volume. (4)

EDHs are generally visible on computed tomography performed immediately after the injury. However, in 30% of the cases, they may be discovered at a later CT. In such cases, they are termed delayed EDHs. (5)

1.2 Problem Statement

The significance of the time interval between injury and surgical intervention in cases of Epidural Hematoma (EDH) cannot be overstated. Notably, a shorter time interval has been associated with superior outcomes, indicating better functional recovery for affected patients. Additionally, the preoperative Glasgow Coma Scale (GCS) emerges as a crucial predictor of outcomes. Statistical analyses have shown that patients with mild and moderate Traumatic Brain Injury (TBI) exhibit favorable surgical outcomes, with a Glasgow Outcome Scale (GOS) of 5, while those with severe traumatic brain injuries experience poorer surgical outcomes (3).

In our specific setting, we face a unique challenge. Delayed patient presentation, stemming from inadequate pre-hospital care, coupled with delays in surgical intervention during in-hospital care,

poses a potential threat to the overall outcome of EDH cases. Recognizing the impact of these factors is pivotal, as they may adversely influence the trajectory of recovery.

Addressing the issue at hand involves a dual focus on improving both pre-hospital and in-hospital care. By rectifying delays in patient presentation and refining the timing of surgical interventions, we anticipate a positive shift in the functional outcomes of EDH cases. This emphasis on timely care delivery, particularly for cases presented earlier to the hospital, has the potential to significantly enhance the overall prognosis of patients with Epidural Hematoma.

1.3 Significance of the Study

This study holds paramount importance in ~~clarifying~~ the short-term outcomes of traumatic epidural hematoma in patients undergoing neurosurgical intervention at AaBET Hospital. By elucidating these outcomes, the research aims to contribute significantly to the field by identifying key areas for improvement in the healthcare system.

The findings of this study are anticipated to play a pivotal role in preventing delays in surgical management. Recognizing the short-term outcomes will empower healthcare professionals to streamline interventions promptly, potentially averting complications associated with delayed surgical procedures. This proactive approach is crucial for optimizing patient care and minimizing the impact of traumatic epidural hematoma.

Moreover, the study delves into the causes of deaths and the factors associated with unfavorable neurologic outcomes in Acute Epidural Hematoma (AEDH). Identifying these factors provides a valuable opportunity for AaBET Hospital to implement preventive measures promptly, aiming to reduce both patient mortality and morbidity following traumatic injuries.

Importantly, the absence of a similar study within our institute underscores the novelty and significance of this research. Serving as a baseline, the study sets the stage for future investigations, providing a comprehensive foundation upon which subsequent research endeavors at AaBET Hospital can build. Ultimately, the outcomes of this study have the potential not only to inform current practices but also to shape the trajectory of future studies in our institution.

2. LITRETURE REVIEW

Study done in Seoul, Korea, from January 2018 to June 2021, 1,122 patients with an initial GCS score ≤ 8 were retrospectively enrolled in the Korean Neuro-Trauma Data Bank System, 79 surgically treated patients with EDH were compared between the unfavorable (scores of 1–3 on the Glasgow Outcome Scale [GOS]) and favorable (score of 4–5 on the GOS) outcome groups. The overall mortality rate was 13.9%, and 60.8% of the patients had good outcomes at six months post-trauma. In the univariate analysis, increasing age ($p=0.010$), lower initial GCS score ($p=0.001$), higher Rotterdam computed tomography (CT) score ($p=0.012$), craniotomy rather than craniectomy ($p=0.032$), larger EDH volume ($p=0.007$), and loss of pupillary reactivity (unilateral unreactive pupil, $p=0.026$; bilateral unreactive pupils, $p<0.001$), were significantly correlated with unfavorable outcomes. Of these factors, increasing age ($p=0.011$) and bilateral unreactive pupils ($p=0.002$) were the most significant risk factors in the multivariate logistic regression analysis. The interval from admission to the brain CT scan was not correlated with the outcome; however, it was significantly longer in the unfavorable outcome group. (10)

A study done in Indonesia, the Emergency Department (ED) of Dr. Soetomo General Hospital, an Airlangga University in Surabaya during January 2009–May 2012. A chart review of 268 patients had complete data admitted to the emergency department with EDH diagnosed by CT scan and surgically treated between January 2009 and May 2012, mean of 15.41 patients per month. Seventy (77%) patients were male, with a mean age of 27.1 years. Sixty (73.86%) patients were from road traffic crashes, 40 (14.92%) sustained falls, 7 (2.61%) had direct head trauma. On admission, 81 (30%) patients were GCS 14–15, 116 (43%) GCS 9–13 and 71 (27%) GCS 3–8. Overall, 79 patients (29%) had anisocoric pupils. Thirty-one patients (11.56%) died after neurosurgical operation. (9)

Study done in Abuja, Nigeria, retrospective study was conducted at the trauma center of NHA, the largest neurotrauma center in North Central Nigeria from January 2015 to December 2019 were retrieved and reviewed. Seventy-one patients were managed over a 5-year period the severity of traumatic brain injury using the Glasgow Coma Scale score (chi-square test, $P = 0.033$) had a statistically significant relationship with the outcome. The patients' age, gender, and total length of time until surgical intervention ($P > 0.05$) were of no statistical significance in

relation to the outcome. The mortality rate of patients presenting at our center is 16.9%. Overall, after surgery, 47 of 71 with epidural hematoma had good recovery (GOS 5). Twelve of 71 patients had GOS of 2–4. Twelve patients died. The median duration from injury to presentation was 15 hours with an interquartile range of 15hours. (11)

Study done in Tanzania, 156 participants were enrolled; 149 (95.5 %) were males. The mean age of the participants was 35.33 (SD 15.37) years. The mean arrival GCS was 11.76 ± 3.59 . Most participants had mild, followed by severe then moderate (55.8 %, 24.4 %, and 19.9 % respectively) TBI. 118 (75.6 %) participants had good outcomes and the overall in-hospital mortality was 18.6 %. 109 (69.9 %) had epidural hematomas mostly (21 %) in the parietal lobe. 30 (19.2 %) had brain herniation syndromes. Poor outcomes were associated with age above 50 years, severe TBI, motor response <4, abnormal pupil size, other injuries, ICU admission, SDH, midline shift >10 mm, cerebral edema, and brain herniation syndromes. Surgical site infection and hemostasis by packing were associated with a long length of hospital stay. (9)

According to prospective cross-sectional study design was conducted in Jimma University Medical Center, Jimma, Ethiopia from June to December 2020, A total of 91 neurosurgery eligible patients were recruited during the study period with a mean age of 34 years. The majority of neurosurgery patients were males 73 (80.2%) and more common in reproductive age groups (62.6%), from rural areas (50.5%). About 93.4% of patients reported a history of trauma and road traffic accidents & fighting account for 63.8% of the trauma cases. Sixty-five percent of patients arrive in the hospital within 24 hours. Upon presentation, loss of consciousness(48.4%), convulsion(11%), aspiration (9.9%) and increased ICP (12%).

The majority (49.5%) of the patients had a mild head injury. The focal neurologic deficits were hemiparesis (29.7%) and hemiplegia (5.5%). Acute epidural hematoma (68.1%) was a common finding followed by sub-acute subdural hematoma. Of the total study participants, 11% of the patients were died. All the surviving patients were accessed after one month of discharge and re-assessed, 66 patients had good neurologic (62 upper and 4 lower good recovery), 11 patients had some disability (7 lower and 4 upper-moderate disabilities), two patients had a severe disability and two patients (those among severe disability) had died. (12)

3. OBJECTIVE

3.1 Research Question

What is the neurological outcome of patient's with traumatic Epidural Hematoma (EDH) following neurosurgical intervention?

3.2 General Objective

The aim goal of this study is to assess the short-term outcomes of traumatic EDH after neurosurgical intervention at Addis Ababa Burn, Emergency, and Trauma (AaBET) Hospital, situated in Addis Ababa, Ethiopia.

3.3 Specific Objectives

- To identify the risk factors associated with the outcomes of epidural hematoma
- To ascertain the predictors of neurological outcomes in patients with Epidural Hematoma after undergoing neurosurgical intervention, offering valuable insights into prognostic indicators.
- To determine the incidence of complications, such as infections, ischemia in patients with Epidural Hematoma following neurosurgical intervention. This objective aims to quantify and understand potential complications that may arise during the course of recovery.

4. Methodology

4.1 Study Area and Period

This study was conducted at AaBET Hospital in Addis Ababa, the capital city of Ethiopia. Addis Ababa boasts 12 public hospitals as of 2023, with AaBET Hospital serving as the singular trauma center, equipped with a total of 130 beds. The hospital is instrumental in providing specialized training in emergency and critical care for physicians, neurosurgeons, and emergency and critical care nurses. The study was conducted from January 1, 2020 GC, to December 31, 2022.

4.2 Study Design

A cross-sectional study design was employed to assess the outcomes of traumatic Epidural Hematoma (EDH) after neurosurgical intervention at AaBET Hospital.

4.3 Source Population

All patients with epidural hematoma who underwent neurosurgical intervention and admitted to AaBET Hospital were included.

4.4 Inclusion and Exclusion Criteria

4.4.1 Inclusion Criteria:

- Patients with a confirmed diagnosis of EDH.
- Patients who underwent neurosurgical intervention for EDH.
- Patients with complete medical records, including neurologic status at admission and discharge.

4.4.2 Exclusion Criteria:

- Patients with epidural hematoma who did not undergo neurosurgical intervention.
- Patients with spontaneous epidural hematoma.
- Polytrauma patients (ISS > 16).
- Age below 18 years

4.5 Sample Size and Sampling Technique

4.5.1 Sample size

Taking the population proportion of neurosurgical patients reported to have an overall complication rate (morbidity) to be 7% taken from the previous study done in Nigeria (8)

$$n = \frac{z^2 p(1-p)}{e^2}$$

n = the required sample size

p = proportion of neurosurgical patients reported to have postoperative morbidity – 7 A%

$Z_{\alpha/2}$ = the critical value at 95% confidence level = 1.96

e = precision (margin of error) = 5%

Accordingly,

$$n = \frac{(1.96)^2 * 0.07(1 - 0.07)}{0.05^2}$$

$$n = \frac{(1.96)^2 * 0.07(0.93)}{0.05^2}$$

$$n = 70$$

Hence, adding 10% of the calculated sample size for contingency that might happen due lost charts or incomplete reports, the final sample size became 70. Therefore, as the total number of EDH patients admitted following neurosurgical procedure during the study period is estimated to be close to the minimum calculated sample size, the researcher decided to include all medical records of postoperative EDH patients who were admitted to the hospital of the study unit during the specified study period.

4.5.2 Sampling Technique:

Non-probability sampling was done. Card numbers of eligible cases were selected from AaBET Hospital's registration log book using non-random technique.

4.6 Data Collection Procedures

Structured questionnaires were used to collect data from eligible epidural hematoma charts. Information was extracted from various sources, including AaBET Hospital's registration log book, patient charts, daily 24 reports, Health Management Information System (HMIS), , and death reports. Data collection was covered demographic characteristics, clinical presentation, imaging findings, surgical treatment, postoperative complications, and neurologic status at admission, discharge, and follow-up. The questionnaire was prepared based on literature review articles and guidelines on traumatic brain injury scoring, in English, and filled out by residents.

4.7 Study Variables

4.7.1 Dependent Variable:

- Short term outcome of epidural hematoma after neurosurgical intervention.

4.7.2 Independent Variables:

- | | |
|---|--|
| - Age | - Time of injury to surgery |
| - Sex | - Brain CT scan findings |
| - Vital signs on admission | - Presence of other TBI |
| - GCS at presentation and after surgery | - Length of hospital stay |
| - Presence of motor preference | - Complications related to hospital stay |
| - Pupillary reaction | - GOS upon discharge |

4.8 Operational Definitions of Variables

- ❖ Epidural Hematoma (EDH): One of the most life-threatening lesions in patients with cranio-cerebral trauma.
- ❖ Glasgow Outcome Score (GOS): A scale assessing the objective degree of recovery in patients with brain injuries.
- ❖ Short term outcome: three months Neurosurgery OPD follow up of the patient after discharging from hospital.

Table 4.1 Classification of Glasgow Outcome Scale (GOS) B	
1. Death	Severe injury or death without recovery of consciousness
2. Persistent vegetative state	Severe damage with prolonged state of unresponsiveness and a lack of higher mental functions
3. Severe disability	Severe injury with permanent need for help with daily living
4. Moderate disability	No need for assistance in everyday life, employment is possible but may require special equipment.
5. Low disability	Light damage with minor neurological and psychological deficits.

Glasgow Outcome Scale interpretation 1-3 poor outcome, 4-5 good outcomes

4.9 Data analysis procedure

The data analysis process commenced with a manual check for completeness, followed by coding and entry into SPSS version 25. Prior to analysis, continuous variables was categorized, and each dataset undergone rigorous quality checks using frequency and cross-tabulation. Descriptive statistics and frequencies were employed for initial insights.

To assess the model's fitness, the Hosmer and Lemeshow test was utilized. Multicollinearity was examined through variance inflation factor (VIF) and tolerance. Variables demonstrating collinearity was excluded. Both bivariable logistic regression analysis (COR) and multivariable logistic regression (AOR) was executed to explore the association between dependent and independent variables. A P-value less than 0.2 in bivariable analysis was qualified a variable for multivariable logistic regression. The final model was constructed, with variables having a p-value <0.05 deemed significant for the cause of MFF. Odds ratios were presented with confidence intervals (CIs), and the results was presented using tables and textual summaries.

4.10 Data Quality Management

Prior to actual data collection, the assessment tool had undergone a pretest on 5% of the sample size within the hospital, excluding them from the main study. This ensured data availability and allowed for refining the tool. Before and during data collection, data was cross-checked for completeness and consistency, by using Cronbach's alpha for validity.

4.11 Ethical Consideration

Approval from the Institutional Review Board of St. Pauli Millennium Medical College will precede the study. The study's objectives were communicated to hospital administrators, the medical director, and card room staff. Patient confidentiality was ensured through the use of code numbers instead of patient identification names, and questionnaires were securely stored.

4.12 Dissemination of Results

Upon completion, the results will be presented in the Emergency and Critical Care resident department as part of a defense. After approval of the adviser and the department, copies of the final results will be submitted to St. Pauli Millennium Medical College and distributed to the library, postgraduate office, AaBET's administration office, and the Federal Ministry of Health. Furthermore, the findings will be shared in workshops, seminars, and submitted for publication in international journals.

4.13. Data Analysis

The data, coded and analyzed using SPSS version 25.0, employed mean $\pm$ standard deviation for numerical variables and frequencies/percentages for categorical variables such as gender, time between injury and surgery, and GCS and GOS scores. Stratification was performed for age, gender, and time from injury to surgery.

The time from injury to surgery was categorized into time before presentation and the reaction time (time from presentation to surgical intervention). The chi-square test assessed relationships between various variables and surgical outcomes, with statistical significance set at $P < 0.05$.

5. Result

5.1 Patient's demography and clinical status

Over a 2-year period, a total of seventy patients were managed, comprising 63 males and 7 females, reflecting a male-to-female ratio of 9:1. The mean age of the patients was 41.8 years (± 24.9), with the age distribution indicating a concentration of 38.6% of patients in the 29-38 age-group. The majority of admissions, specifically 81.1%, originated from the Oromia region. Statistical analysis revealed that age and gender had no significant impact on the patient outcomes, as evidenced by p-values of 0.87 and .999, respectively.

Upon admission, 81% of patients exhibited normal blood pressure, with 7.1% in the hypertensive range and only 2.9% in the hypotensive range. Regarding heart rate, 85% of patients had a normal rate, while 28.6% and 4.3% were in the tachycardic and bradycardic ranges, respectively.

Assault was the leading mechanism of injury (MOI) among studied population, accounting for 61%, followed by motor vehicle accidents (MVA) at 20%, fall from height at 14.3%, and gunshots representing the least common MOI.

The median duration from injury to presentation was 34.27 hours, ranging from 1 hour to 5 days. The majority of patients, 41.4%, presented within 1-3 days of injury.

The average total delay from injury to surgery was 43.31 hours (± 32.8 hours), with 41.4% receiving surgical intervention between 1 and 3 days of injury. Surgical interventions occurred within the first 24 hours for 34.3% of patients, while 24.2% underwent surgery from 4 to 7 days post-injury. Notably, no patients underwent surgery after a week of injury. The time from injury to surgical intervention demonstrated no statistical effect, with a p-value of 0.87.

Table 5.2 Time of injury to surgery * GOS Cross tabulation				
Count				
		GOS		Total
		5-4(Good outcome)	3-1 (Poor outcome)	
Time of injury to surgery	<24 hrs	18	6	24
	1-3 days	24	5	29
	4-7 days	15	2	17
Total		57	13	70

Among the 70 patients assessed GCS at presentation, 44.3% (31 of 70) with a Glasgow Coma Scale (GCS) score of 13–8, 37.1% (26 of 70) the group with GCS scores of 15–14, 18.6% (13 of 70) had GCS scores of <8. There was no statistically significant relationship of GCS at presentation and the outcome of the patient with the evidence of p value of 0.998.

At the initial assessment, a majority of patients 55.7%, (39 of 70) exhibited no motor preference, while 38.6% (27 of 70) presented with motor deficits. Documentation for the remaining cases was incomplete.

Those with new focal neurologic deficit at presentation 33.3% (9 out of 27) patients their GOS were 3 and below which corresponds poor neurologic outcome compared to those who had no motor preference, only 5% (2 out of 39) had poor neurologic outcome, thus this donates that there is a significant relationship between the presence of new onset focal neurologic deficit and the GOS with the evidence of both bivariate and multivariate logistic regression, P value = .034. [Refer to Table 5.9, 5.10]

Pupillary reactions were normal in 46 of the 70 patients, with 13, 10 displaying anisocoria, bilaterally dilated non-reactive respectively. Crosschecking with its correlation to the patient outcome, 38.4% (5 out of 13) patients whose anisocoric and 40% (4 out of 10) with bilaterally fixed and dilated pupil had poor outcome, compared to those who had normal pupillary reaction at presentation only 8.6% (4 out of 46) had poor outcome after surgery, this correlation is evidenced by p value of 0.01. [Refer to Table 5.3, 5.9, 5.10]

5.2 Brain CT scan findings

The frontal and fronto-parietal areas emerged as the most commonly affected sites in epidural hematoma (EDH), each accounting for 22.9%, while the occipital area experienced the least incidence at 1.4% (1 out of 71 cases) [refer to Table 5.3].

In terms of volume, 34 out of 70 patients (48.6%) exhibited a hematoma volume exceeding 30 ml, whereas 14 out of 71 patients (20%) had a volume below 30 ml. Notably, a majority of patients, 59 out of 70, presented with an associated skull fracture [refer to Table 5.4].

Table 5.3 Presence of focal neurologic deficit and pupillary exam * GOS Cross tabulation				
Count				
		GOS		Total
		5-4(Good outcome)	3-1(Poor outcome)	
Presence of focal neurologic deficit	No	37	2	39
	Yes	18	9	27
	Not documented	2	2	4
Pupillary reaction at ED presentation	Normal	42	4	46
	Anisocoric	8	5	13
	Bilaterally fixed non-reactive	6	4	10
	Bilaterally dilated non-reactive	1	0	1

Table 5.4 Site of EDH				
SITE	Frequency	Percent	Valid Percent	Cumulative Percent
Parietal	5	7.1	7.1	7.1
Temporal	1	1.4	1.4	8.6
Frontal	16	22.9	22.9	31.4
Occipital	1	1.4	1.4	32.9
Fronto-Parieto-Tempro-Occipital	11	15.7	15.7	48.6
Fronto-Parietal	16	22.9	22.9	71.4
Parieto-Temporal	14	20.0	20.0	91.4
Temporo-Occipital	6	8.6	8.6	100.0
Total	70	100.0	100.0	

5.3 Outcome Measurement

The necessity for ICU admission was fulfilled in only 18.6% of cases (13 out of 70), while patients with a Glasgow Outcome Scale (GOS) score of 4 and above were directed to the Neuroward, ultimately being discharged home from there.

Table 5.5 Complications related hospital stay * Admission to ICU Cross tabulation				
Count				
		Admission to ICU		Total
		No	Yes	
Complications related neurosurgical intervention	Ischemia	1	1	2
	HAP	1	3	4
	VTE	1	2	3
	CNS infection , ischemia and HAP	0	2	2
	Ischemia and HAP	0	1	1
	None	54	4	58
Total		57	13	70

Table 5.6 Admission to ICU * GOS Cross tabulation				
Count				
		GOS		Total
		5-4 (Good outcome)	3-1 (Poor outcome)	
Admission to ICU	No	52	5	57
	Yes	5	8	13
Total		57	13	70

Sixty-one percent (8 out of 13) patients who admitted to ICU had poor outcome after surgery, comparing to those not admitted to ICU, 8.9% (5 out of 57) with the evidence of p-value of 0.013 [refer to Table 5.6, 5.10].

Table 5.7 Associated TBI injuries			
	Frequency	Percent	Cumulative Percent
Traumatic DAI	1	1.4	1.4
SDH	3	4.3	5.7
Traumatic SAH	3	4.3	10.0
Contusion	4	5.7	15.7
Skull fracture	37	52.9	68.6
DAI, contusion and skull fracture	2	2.9	71.4
ICH with skull fracture	3	4.3	75.7
Contusion with skull fracture	7	10.0	85.7
Contusion, ICH and skull fracture	6	8.6	94.3
None	4	5.7	100.0
Total	70	100.0	

GCS level post-surgical intervention, 80% (56 out of 70) maintained a GCS level of 15-14, 8.6% (6 out of 70) GCS levels of 13-8 and <8 observed 1.4% (8 out of 70), respectively. Notably, the Glasgow Coma Scale (GCS) level after surgical intervention significantly influenced the patient's recovery.

Eighty-seven percent (7 out of 8) patients who had GCS of <8 after surgery had poor outcome, comparing to 33.3% (2 out of 6), and 7.1% (4 out of 56), GCS (13-8), (15-14), respectively.. This is strongly evidenced by a p-value of 0.003 and a confidence interval (CI) ranging from 9.4 to 7880 [refer to Table 5.6, 5.10].

Out of the 70 patients studied, 58 experienced an uncomplicated hospital stay, while 6 developed Hospital-Acquired Pneumonia (HAP), 3 experienced Venous Thromboembolism (VTE), 3 suffered from brain ischemia, and 2 encountered Central Nervous System (CNS) infections.

Table 5.8 Level of GCS after surgical intervention * GOS Cross tabulation				
Count				
		GOS		Total
		5-4 (Good outcome)	3-1 (Poor outcome)	
Level of GCS after surgical intervention	15-14	52	4	56
	13-8	4	2	6
	<8	1	7	8
Total		57	13	70

In the postoperative phase, 46 out of 70 patients with Epidural Hematoma (EDH) achieved a favorable recovery, attaining a Glasgow Outcome Scale (GOS) score of 5. Seventeen patients achieved a GOS score of 2–4, and unfortunately, 7 patients did not survive (refer to Figure 4.3).

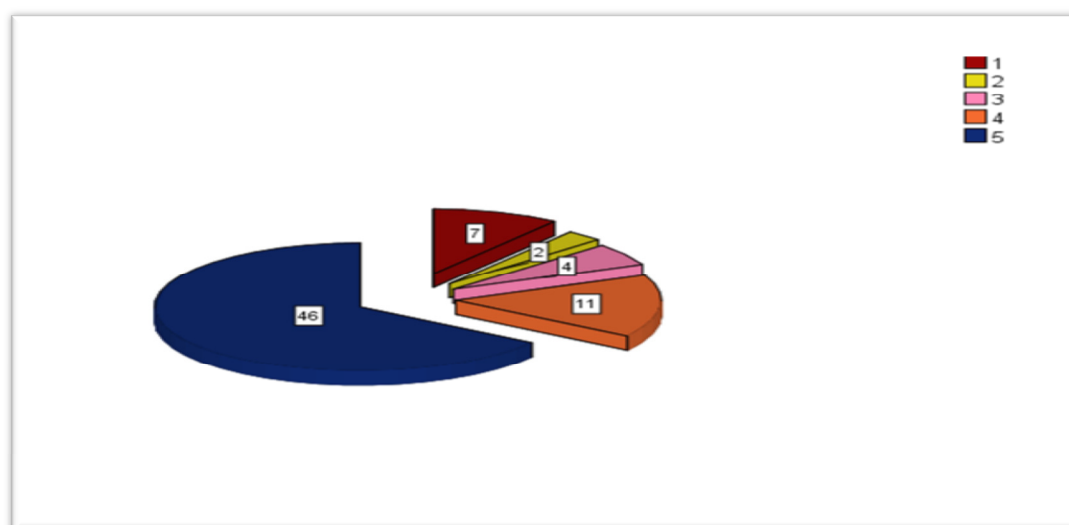


Figure 4.3 Proportions of patients and their respective Glasgow Outcome Score

In terms of the length of hospital stay, 74% of patients (52 out of 70) were discharged in less than 10 days, while 8.57% (6 out of 70) had an extended hospitalization period exceeding 30 days (refer to Figure 4.4).

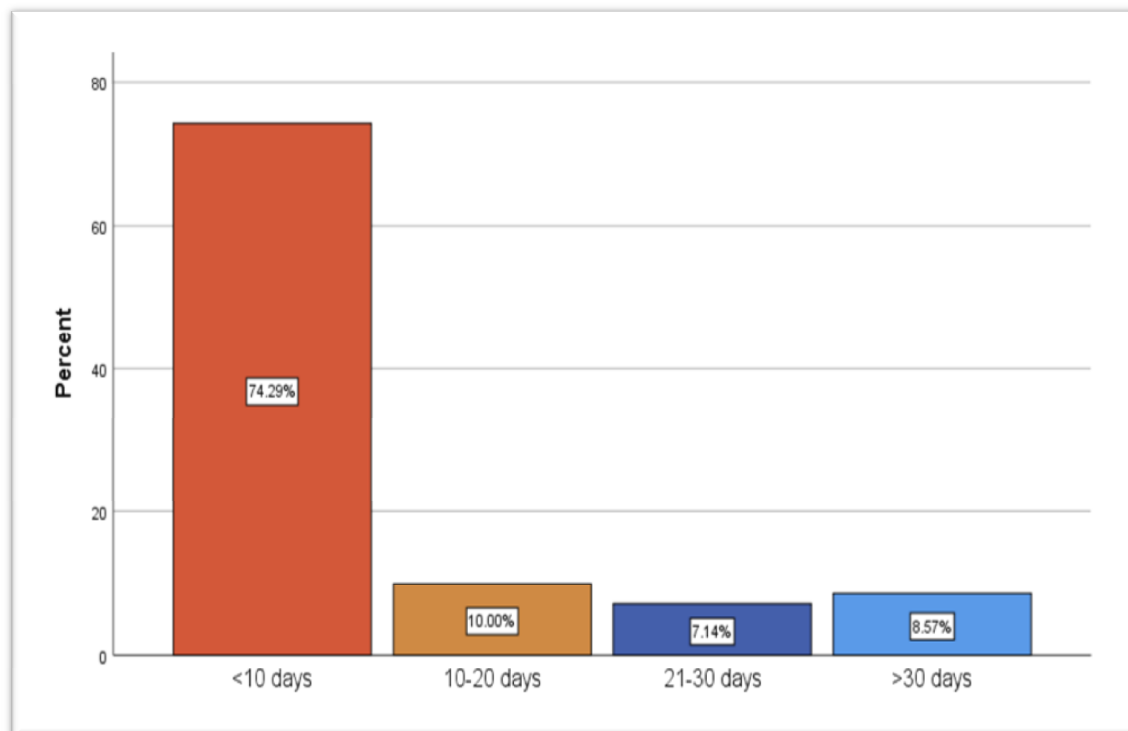


Figure 4.3 Length of hospital stay

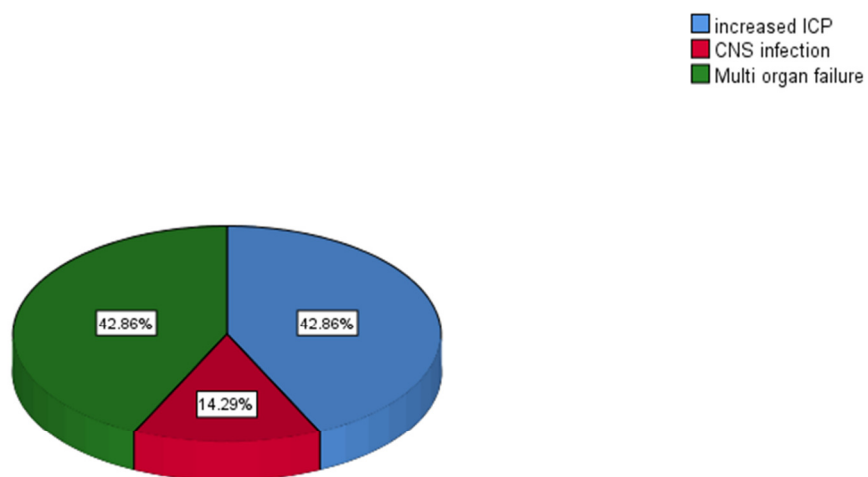


Figure 4.4 Cause of death

6. Discussion

Our investigation revealed a predominance of male victims in the prime of their lives, with a mean age of 41.8 years. This trend aligns with findings from similar studies conducted in Nigeria and Bangladesh, highlighting a consistent pattern of male predominance among individuals in their most active life period. Despite this alignment in gender and life stage, a notable disparity emerges in the average age. (2)

Studies done in Jimma, Ethiopia, Nigeria and Bangladesh reported an average age in the third decade, contrasting with our findings that indicate a shift to the fourth decade. This discrepancy invites further scrutiny into the demographic nuances contributing to variations in age distribution among victims across diverse geographical contexts. (11) (2)

Our study revealed that at presentation, 44.3% (31 out of 70) of patients had a Glasgow Coma Scale (GCS) score between 13 and 8, while 37.1% (26 out of 70) fell into the group with GCS scores of 15–14. Additionally, 18.6% (13 out of 70) had GCS scores below 8. Importantly, our analysis found no statistically significant relationship between the GCS at presentation and the patient's outcome, as evidenced by a p-value of 0.998.

To contextualize these findings, we compared our results with a study that investigated the clinical outcomes of patients diagnosed with traumatic intracranial epidural hematoma and severe brain injury (Glasgow Coma Scale ≤ 8) who underwent surgery. Surprisingly, despite the severity of the brain injury, the study demonstrated that more than half of the patients with epidural hematoma (EDH) had favorable outcomes after surgical treatment. These findings underscore the importance of a prompt diagnosis and advocate for an aggressive surgical approach in cases of severe brain injury with epidural hematoma. (12)

Our investigation has pinpointed several factors that significantly influence patient outcomes. Specifically, the presence of abnormal pupillary reaction (Anisocoric), a midline shift exceeding 5 mm, and an epidural hematoma (EDH) volume surpassing >30 ml, ICU admission were all associated with a marked negative impact on patient recovery and overall outcome, with corresponding p-values of 0.015, 0.032, 0.03, and 0.013 respectively.

In our multivariate logistic regression analysis, the presence of a midline shift greater than 5 mm emerged as the most significant risk factor among these variables. These findings resonate with other studies conducted in Seoul, Korea, Kilimanjaro, Tanzania, utilizing the Korean Neuro-Trauma Data Bank System. In this study, 79 surgically treated patients with EDH were categorized into unfavorable (scores of 1–3 on the Glasgow Outcome Scale [GOS]) and favorable (score of 4–5 on the GOS) outcome groups. The study observed that a larger EDH volume ($p=0.007$) and the loss of pupillary reactivity (unilateral unreactive pupil, $p=0.026$; bilateral unreactive pupils, $p<0.001$) were associated with unfavorable outcomes, reinforcing the significance of these factors in predicting patient prognosis. (9) (12)

In our resource-limited facility, ICU admission is warranted for patients presenting with several conditions. These include a low Glasgow Coma Scale (GCS), particularly those challenging to wean from ventilation during the immediate postoperative period. Additionally, patients who are thermodynamically unstable or meet other criteria for ICU admission are also considered for intensive care.

It is noteworthy that individuals admitted to the ICU tend to experience poorer outcomes compared to those not admitted. This trend is often attributed to the severity of their primary injury. Prolonged mechanical ventilation and extended stays in the ICU contribute to an increased susceptibility to acquiring Hospital-Acquired Infections (HAIs) and other complications associated with ICU care. Our frequency analysis of complications during hospital stays underscores this vulnerability.

In this study, we investigated the distribution of epidural hematoma (EDH) sites, revealing notable disparities when compared to existing literature. While prior studies predominantly identified the parieto-temporal region as the common site, our findings suggest a significant prevalence in the fronto-parietal area. This variation prompted an exploration into the potential correlation between the site of EDH and the mechanism of injury (MOI).

The association between the site of EDH and the MOI emerged as a crucial aspect of our study. Notably, our data revealed a correlation between the fronto-parietal location and incidents of violence and physical abuse. This nuanced insight suggests that the etiology of head injuries may

play a pivotal role in determining the specific site of EDH, challenging previous assumptions about injury patterns.

Our study revealed that there is association between ICU admission and the outcome of the patient. Sixty-one percent (8 out of 13) patients who admitted to ICU had poor outcome after surgery, comparing to those not admitted to ICU, 8.9% (5 out of 57) with the evidence of p-value of 0.013, this is parallel to study done in Tanzania which found out poor outcomes were associated with age above 50 years, severe TBI, motor response <4, abnormal pupil size, other injuries, ICU admission, SDH, midline shift >10 mm, cerebral edema, and brain herniation syndromes. Surgical site infection and hemostasis by packing were associated with a long length of hospital stay. (9)

A majority of the patients in our study achieved a favorable outcome, with 46 out of 70 showing a Glasgow Outcome Scale (GOS) score of 5. Interestingly, this aligns with a study conducted in Abuja, Nigeria, where post-surgical intervention resulted in good recovery for 47 out of 71 patients diagnosed with epidural hematoma (EDH), all indicating a GOS score of 5. These parallel findings highlight a consistent trend in positive patient outcomes across different geographical settings. (2)

7. Conclusion

This study revealed good surgical outcome in EDH patients. The key determinant of surgical outcome using GOS in patients with acute EDH is the presence of new focal neurologic deficit, abnormal pupillary reaction, and ICU admission. The duration of injury to surgery showed no net effect on the surgical outcomes of patients.

8. Recommendation

To Hospital Administrators and MOH

The alarming prevalence of assault as the predominant MOI, it is constituting 61% of cases among EDH patients in our hospital. This stresses the societal implications of violence-related EDH, necessitating immediate action and the implementation of preventive measures in the identified area. Motor vehicle accidents (MVA) and falls from height also contribute significantly, highlighting the diverse range of factors contributing to epidural hematoma. It is imperative that we take prompt action to curtail the escalation of these incidents and avert potential health catastrophes.

To Health Care Providers:

Our research has revealed a significant negative relationship between ICU admission and patient outcomes, among complicated patients half of them had HAIs in their hospital stay course and this is emphasizing the need for careful consideration and adherence of IPC all the area of the hospital and particularly ICU and implementing other ICU protocols in order to mitigate adverse outcomes associated with hospital and to enhance patient outcomes.

To Researchers:

I recommend that future studies on this topic focus on conducting multicenter research, with a primary emphasis on the association between emergency department (ED) interventions—such as endotracheal intubation, pharmacological interventions, and other management strategies for increased intracranial pressure (ICP) at the ED—and the outcomes of patients with epidural hematoma (EDH). A comprehensive investigation in this direction will provide valuable insights into optimizing emergency care for head injury patients and guide evidence-based interventions.

9. Limitations

For generalization of the study due small sample size and single center conducted study. . no pre-hospital management is included.

10. Reference

1. . Factors affecting the outcome of traumatic brain. Ayogu OM, Onobun DE,. Abuja : s.n., April 13, 2022,
2. Factors Affecting the Outcome of Traumatic Brain Injured Patients with. Kizito, Kenechukwu. Abuja : s.n., 2022.
3. Epidemiology, outcome and Dating of EDH and SDH. Aromatario, M and Torsella. Switzerland : medicino, February 5, 2021,
4. Clinical Outcome of Patients Diagnosed Traumatic Intracranial Epidural Hematoma With Severe Brain Injury (Glasgow Coma Scale ≤ 8) Who Undergo Surgery: A Report From the Korean Neuro-Trauma Data Bank System. Kim, Woo Kyung. Seoul, Korea : s.n., Oct, 2022.
5. Toward zero mortality in acute epidural hematoma. Bambang Priyantoa. Surabaya, Indonesia : s.n., 2019.
6. Outcomes of traumatic brain injury patients with acute epidural and . Sengua Koipapi a,b,* . Kilimanjaro, Tanzania : s.n., 2023.
7. A Prospective Study on Patterns and Management. Abafita, Mohammed. Jimma, Ethiopia : s.n., December, 2020.
8. Surgical Outcome of Extradural Hematoma. Reaz A. Howlader^{1*}, Asit C. Sarker². 2021, Open Journal of Modern Neurosurgery, p. 11.
9. Incidence, hospital costs and in-hospital mortality rates of epidural hematoma in the United States. Shyamal C. Bir, Tanmoy Kumar Maiti,. 2015, Vol. 138.
10. Factors affecting outcomes of surgically treated patients with cranial. Lafta, Ghazwan A. Baghdad, Iraq : s.n., 2015-2017.
11. Jennett, B and Bond, M (Mar 1, 1975). "Assessment of outcome after severe brain damage". Lancet.

Annex

Annex-I: Data collection Check list for EDH Cases

Section I: Demographic Data and clinical status of patient

1. MRN : _____
2. Sex : _____
3. Age:
A. 18-28 B. 29-38 C. 39-48 D. 49-58 E. >59
4. Address of the patient
A. Addis B. Oromia C. Amhara D. Others, specify _____
5. Time of arrival to ED after trauma;
A. < 2hrs B. 2-6 hrs. C. 6 - 12 hrs. D. 12 -24 hrs. E. > 24 hrs
6. Mechanism of injury:
A. MVA B. Fall from height C. Assault D. Gunshot injury E. Other, specify-----
7. Time of injury to ED presentation
A. <24 hrs B. 1-3 days C. 4-7 days
8. Systolic BP in mmHg at ED presentation:
A. <90 B. 90-120 C. 120-129 D. >130
9. Pulse Rate per minute at ED presentation
A. <60 B. 60-100 C. >100
10. Respiratory rate per minute at ED presentation:
A. <12 B. 12-20 C. >20
11. Oxygen saturation at ED presentation:
A. <92% B. >92%
12. GCS at ED presentation:
A. 15-14 B. 13-8 C. <8
13. Presence of new focal neurologic deficit:
A. Yes
B. No
C. Not documented

14. Pupillary reaction at ED presentation:

A. Normal

B. Anisocoric

C.. Bilatrally fixed non-reactive

D. Bilatrally dilated non-reactive

Section II: Brain CT scan findings

15. Site of EDH, you can select more than one

A. Parietal

B. Temporal

C. Frontal

D. Occipital

16. Presence of midline shift >5 mm:

A. Yes

B. No

C. Not documented

17. Volume of EDH:

A. <30 ml

B. >30 ml

C. Not documented

18. Associated TBI injuries, More than one option is possible;

A. ICH

B. SDH

C. tSAH

D. DAI

E. Contusion

F. Skull fracture

Section III: Outcome Measurements

19. Time of ED presentation to intervention:

- A. <6 hrs
- B. 6-12 hrs
- C. 13-24 hrs
- D. >24 hrs

20. Time of injury to surgical intervention:

- A. <24 hrs
- B. 1-3 days
- C. 4-7 days
- D. >7 days

21. GCS after surgical intervention:

- A. 15-14
- B. 13-8
- C. <8

22. Admission to the ICU:

- A. Yes
- B. No

23. Complication related neurosurgical intervention, more than one option is possible,

- A. CNS infections
- B. Ischemia
- C. HAP
- D. VTE

24. Length of hospital stay

- A. <10 days
- B. 10-20 days
- C. 21-30 days
- D. >30 days

25. Level of GOS:

A. 1

B. 2

C. 3

D. 4

E. 5

26. If the answer for the question number 19 is A, what was the possible cause of death, (You can select more than one option):

A. Increased ICP with brain Herniation

C. CNS infections

B. MOF

D. Other specify____

Annex II

Table 5.9 Presentation of Bivariate Binary Logistic Regression Analysis				
	Frequency	Percent	COR(95% CI)	P-value
Presence of new focal neurologic deficit				
No	39	55.7	9.250(1.808-47.325)	.008
Yes	27	38.6	18.500(1.642-208.462)	.018
Not documented	4	5.7	9.250	.000
Pupillary reaction at ED presentation				
Normal	46	65.7	6.563(1.373-29.906)	.046
Anisocoric	13	18.6	7.000(1.440-35.678)	.015
Bilaterally fixed non-reactive	10	14.3	.000	.019
Bilaterally dilated non reactive	1	1.4	6.563	1.000
Volume of EDH in ml				
<30	14	20.0	.648(.156-2.700)	.551
>30	34	48.6	.250(.039-1.605)	.144
Not documented	22	31.4	.400	.551
Presence of midline shift >5 mm				
No	15	21.4	.609(.155-2.388)	.477
Yes	30	42.9	.083(.009-.807)	.032
Not documented	25	35.7	35.7	
GCS after surgical intervention				
15-14	56	80.0		.064
13-8	6	8.6	6.500 (.899-47.018)	.000
<8	8	11.4	91.000 (8.862-934.405)	.000
ICU admission				
No	57	81.4	16.640(3.919-70.648)	.000
Yes	13	18.6	.096	.000
Length of hospital stay				
<10 days	52	74.3	2.000(.191-20.969)	.563
10-20 days	7	10.0	8.000(1.020-62.737)	.048

21-30 days	5	7.1	19380	.999
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Table 5.10 Multivariate Binary Logistic Regression Analysis					
	Frequency	Percent	COR(95% CI)	AOR (95% CI)	P-value
Presence of new focal neurologic deficit					
No	39	55.7	9.250(1.808-47.325)	11.057(10.905-61.268)	.336
Yes	27	38.6	18.500(1.642-208.462)	4.386(14.342-228.062)	.010
Not documented	4	5.7			
Pupillary reaction at ED presentation					
Normal	46	65.7	6.563(1.373-29.906)		
Anisocoric	13	18.6	7.000(1.440-35.678)	7.854(1.633-50.512)	.034
Bilaterally fixed non-reactive	10	14.3		6.065(1.150-43.994)	.089
Bilaterally dilated non-reactive	1	1.4		.000	1.000
GCS after surgical intervention					
15-14	56	80.0	6.500 (.899-47.018)		
13-8	6	8.6	91.000 (8.862-934.405)	4.380(9.438-7880.890)	.238
<8	8	11.4		53.333(1.526-588.018)	.003
ICU admission					
No	57	81.4			
Yes	13	18.6	16.640(3.919-70.648)	9.656(1.52-61.229)	.022

11. Assurance of Principal Investigator

I the undersigned agree to accept all responsibilities for the scientific and ethical conduct of the research project. I will provide timely progress report to my advisor and seek the necessary advice and approval from my primary advisors in the course of the research. I will communicate timely to my advisors all stakeholders involved in the study including any source of funding for this research.

Name of the student: Dr Rukia Abukar EMCCR

Signature: _____

Date: _____

Approval of the Primary Advisor

Name of the primary advisor: Dr. Feven (Assistant Professor of ECCM)

Signature: _____

Date: _____

Approval of the Co-Advisor

Name of the primary advisor: Dr. Biniam (Assistant Professor of ECCM)

Signature: _____

Date: _____