ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCE

DEPARTMENT OF ANESTHESIOLOGY, CRITICAL CARE AND PAIN MEDICINE

MAGNITUDE OF ADMISSION, OUTCOMES AND ASSOCIATED FACTORS OF NEUROSURGICAL PATIENTS AT TIKUR ANBESSA HOSPITAL SURGICAL INTENSIVE CARE UNIT, ADDIS ABABA A RETROSPECTIVE OBSERVATIONAL STUDY FROM JANUARY 01, 2024 - JANUARY 01, 2025.

THE THESIS IS TO BE SUBMITTED TO ADDIS ABABA UNIVERSITY, DEPARTMENT OF ANESTHESIOLOGY, CRITICAL CARE AND PAIN MEDICINE FOR THE PARTIAL FULFILLMENT OF THE REQUIREMENTS OF A SPECIALTY CERTIFICATE IN ANESTHESIOLOGY, CRITICAL CARE AND PAIN MEDICINE.

BY: DR. ABSERA GEBRIEL, FINAL YEAR ACCPM RESIDENT

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ADISS ABABA, ETHIOPIA

APPROVAL SHEET

Addis Ababa University College of Health Sciences School of Medicine Department of anesthesiology, critical care and pain medicine I, the undersigned anesthesiology, critical care and pain medicine resident , declare that I have submitted my original work titled " MAGNITUDE OF ADMISSION, OUTCOMES AND ASSOCIATED FACTORS OF NEUROSURGICAL PATIENTS AT TIKUR ANBESSA HOSPITAL SURGICAL INTENSIVE CARE UNIT, ADDIS ABABA A RETROSPECTIVE OBSERVATIONAL STUDY FROM JANUARY 01, 2024 - JANUARY 01, 2025".

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Abstract

Background: Neurosurgical care is resource demanding which require advanced technology in terms of managing and monitoring of patients. Tikur Anbessa Specialized Hospital is the leading territory referral center in Ethiopia providing advanced care for critically ill patients. Neurosurgical patients constitute majority of the patients admitted at the surgical intensive care unit at these hospital patients usually admitted are for postoperative follow up after a neurosurgical procedure or for management of their underlying neurological illness.

Objective: Assessment of the Magnitude of admission and outcomes of neurosurgical patients admitted at Tikur Anbessa hospital surgical intensive care unit from January 01, 2024- January 01, 2025.

Methods and Materials: A retrospective observational study of Neurosurgical patients admitted at Tikur Anbessa Specialized surgical ICU from a period of January 01, 2024 – January 01 2025G.C. A consecutive sampling technique was used and analysis was done by using SPSS 27. Logistic regression was used to identify associated factors and a p-value < 0.05 at 95% confidence intervals was considered as statistical significance.

Result: This study revealed the magnitude of Neurosurgical patients were n=150 (31.5%) out of n=476 Surgical Intensive care unit admission. From these patients n=140 met the inclusion criteria, among those 51.4% were male and 48.6% were female. The most common indication for admission at 72.1% were patients admitted for post operative Neurosurgical monitoring, among the admissions 54% require MV and 12.9% of the patients ended up on tracheostomy. The mortality rate was n=32 (23%), Emergency surgery, ICU complication and indication for ICU admission were associate with the outcome of Neurosurgical patients in ICU.

Conclusion and Recommendation: The magnitude of ICU admission of neurosurgical patient was 31.5%,mortality was high at 23% ,which strongly suggest the need to establish a dedicated Neurosurgical Unit, using blood conservative therapies and minimizing blood loss intraoperatively and manage ICU complication by implementing on daily ICU care bundles and infection control and finally develop local guidelines to support timely tracheostomy in patients requiring prolonged MV.

1 Introduction

1.1 Background

Globally, the need for specialized medical care is changing the face of Intensive Care units (1-1). As many neurosurgical patients require ICU during their hospital care, treatment of neurosurgical patients in a specialized neurosurgical intensive care unit has proven to be of benefit, including management and outcome (3-5).

An intensive care unit is a specialized inpatient unit that provides continuous monitoring and cares for those patients who are critically ill and need sophisticated materials and multidisciplinary human resources. These units are extremely expensive in terms of manpower and equipment utilization. In developed nations like the United States, this unit consumes 15–40% of the entire hospital cost (6-7).

Neurosurgical (NS) intensive care populations include patients with central nervous system (CNS) trauma, tumors, postoperative complications, or stroke. Systemic effects associated with neurological illness predispose patients to a variety of complications including altered drug metabolism (8-9).

A considerable number of intensive care unit (ICU) admissions involve patients with neurosurgical conditions, such as traumatic brain injury (TBI), spontaneous brain hemorrhages, ischemic strokes, subarachnoid hemorrhages (SAH), and those undergoing planned neurosurgical procedures. Postoperative care in these cases typically prioritizes optimizing cerebral perfusion by maintaining adequate cerebral perfusion pressure (CPP) and ensuring the brain receives sufficient oxygen. (10-11).

Criteria for ICU admission may encompass the need for close monitoring after a surgical procedure, impaired consciousness warranting advanced clinical or multimodal surveillance, reliance on mechanical ventilation (MV) to maintain airway protection, or the development of postoperative complications such as seizures, infections, or pulmonary embolism. (12).

1.2 Statement of the problem

Neurosurgical conditions often require intensive postoperative care due to the complexity and critical nature of the procedures involved. Despite the increasing demand for neurosurgical services, there is limited data on the magnitude and outcomes of patients admitted to the surgical ICU. Understanding these is crucial for resource allocation, improving patient management, and reducing morbidity and mortality rates (8, 10, 12).

The absence of comprehensive data on patient characteristics, admission trends, and outcomes at surgical ICU limits the ability of healthcare providers to optimize care for this high-risk population. Furthermore, no existing studies have adequately described the clinical outcomes of neurosurgical patients' availability (11). The study aims to explore the magnitude of neurosurgical admissions, and factors influencing patient outcomes. The aim of this study will be firstly to describe the current magnitude of neurosurgical admissions in ICU, and secondly, it aims to investigate the outcome in neurosurgery. By identifying these factors, the study seeks to inform better practices for resource management, improve patient outcomes, for neurosurgical care at Tikur Anbessa Hospital.

1.3 Significance of the study

Magnitude of admission and outcomes of neurosurgical patients in the surgical Intensive Care Unit at Tikur Anbessa Specialized Hospital is of critical importance, this study will provide valuable data that can guide the development of targeted care protocols in the ICU. This will help healthcare providers to better manage the unique needs of neurosurgical patients, ultimately improving patient care and outcomes.

Understanding the trends and factors affecting patient outcomes will assist hospital administrators in optimizing resource allocation. Neurosurgical cases often require specialized equipment, intensive monitoring, and prolonged ICU stays. Data from this study can inform staffing levels, resource distribution, and the need for specialized training, ensuring that ICU resources are used efficiently and effectively.

The study will provide insights into the factors that contribute to patient mortality and post-surgical complications in the ICU. In Ethiopia, there is a growing need to improve the healthcare system's capacity to handle complex neurosurgical cases. The findings of this study will serve as a foundation for evidence-based policy development at Tikur Anbessa Specialized Hospital. It can also help inform national strategies for improving neurosurgical care and ICU management.

2 Literature review

A Retrospective cohort study analyzing national Hospital Episode Statistics (HES) data in England from 2013 to 2018, focusing on the incidence and outcomes of neurosurgical procedures. The study utilized a retrospective cohort design to analyze HES data over a five-year period. Patient characteristics, comorbidities, and incidence rates of neurosurgical procedures were examined. The evaluation included post-operative outcomes such as length of stay, need for additional procedures, discharge destination, and in-hospital mortality rates for both elective and non-elective neurosurgical patients.

The study analyzed 371,418 neurosurgery admissions in England, with 77.3% involving neurosurgical procedures. Among these, 45% were cranial surgeries, while 37% were spinal surgeries. Mortality rates for elective neurosurgical procedures were notably low, at 0.5% for cranial surgeries and 0.1% for spinal surgeries. However, mortality rates were significantly higher for non-elective procedures, at 7.4% for cranial surgery and 1.3% for spinal surgery. Additionally, approximately 25% of patients required additional procedures following non-elective cranial surgery. (14)

A retrospective study was conducted, including all neurosurgical patients admitted to the level III mixed medical-surgical intensive care unit of a tertiary teaching hospital in Nepal between April 13, 2017, and April 13, 2018 (1st Baisakh 2074 to 30th Chaitra 2074).

A total of 813 patients were admitted in ICU over a period of one year (2074 B.S.) of which 199 (24.48 %) were neurosurgical cases. Among these 170 (85.42%) cases were post-surgical, with 29 (14.58%) being pre-operative patients. One hundred forty-nine patients (74.9%) were on mechanical ventilation. One hundred and thirty-two (66.3%) patients improved and were transferred to a step downward. Forty-three (22.5%) died in the intensive care unit, 14 (7.03%) left the hospital against medical advice and 9 (4.5%) patients expired after withdrawal of life support. (22)

A retrospective study conducted at the surgical ICU of Aga Khan University Hospital, focusing on the clinical data of neurosurgical patients admitted between January 2020 and June 2022.

Among the 321 patients admitted to the SICU, 197 met the inclusion criteria. Of these, 168 patients (85.3%) required surgical intervention, with 101 (60%) undergoing elective surgery and 67 (40%) requiring emergency surgery. The mortality rate during the ICU or hospital stay was 6.6%, with 13 patients dying. The median length of stay in the ICU was 4 days, and the median hospital stay was 11 days. Tracheostomy was performed in 77 patients (39%), with a median timing of 4 days post-admission. The APACHE-II scores, deceased patients exhibited significantly longer durations of ICU stay and overall hospital stay. (23)

A retrospective analysis was conducted on all patients admitted to the general ICU at the University of Nigeria Teaching Hospital, Enugu, from 2008 to 2012. During this period, 766 patients were admitted, comprising 501 males (65.4%) and 265 females (34.6%), with ages ranging from 1 day to 89 years and a mean age of 38.2 ± 18.2 years.

Most admissions were neurosurgical cases, totaling 316 (41.2%), of which 224 (70.9%) were attributed to severe traumatic brain injury (TBI). Among all ICU patients, 128 (16.7%) required invasive mechanical ventilation, yet only 15% of severe TBI cases received this intervention. The overall mortality rate was 34.6%, with severe TBI accounting for 45.7% of all ICU deaths. (15)

A study conducted at AaBET Hospital identified trauma as the leading cause of ICU admission, accounting for 163 cases (53.4%), followed by non-traumatic neurosurgical conditions, which constituted 22 cases (8.2%). Among trauma cases, traumatic brain injury (TBI) represented the majority, with 146 cases (82.5%). Post-procedural ICU admissions were primarily due to respiratory failure (50%), while patient intubation for a low Glasgow Coma Scale (GCS) score of 7 accounted for 31.8% of cases. Severe TBI and tetanus were associated with the longest median ICU stays and an in-ICU mortality rate of 71.1%. Factors significantly linked to mortality included a GCS score of 3–8, admission category, pre-referral care (encompassing stabilization and transportation of critically ill patients), and patient age. (21).

Conceptual framework

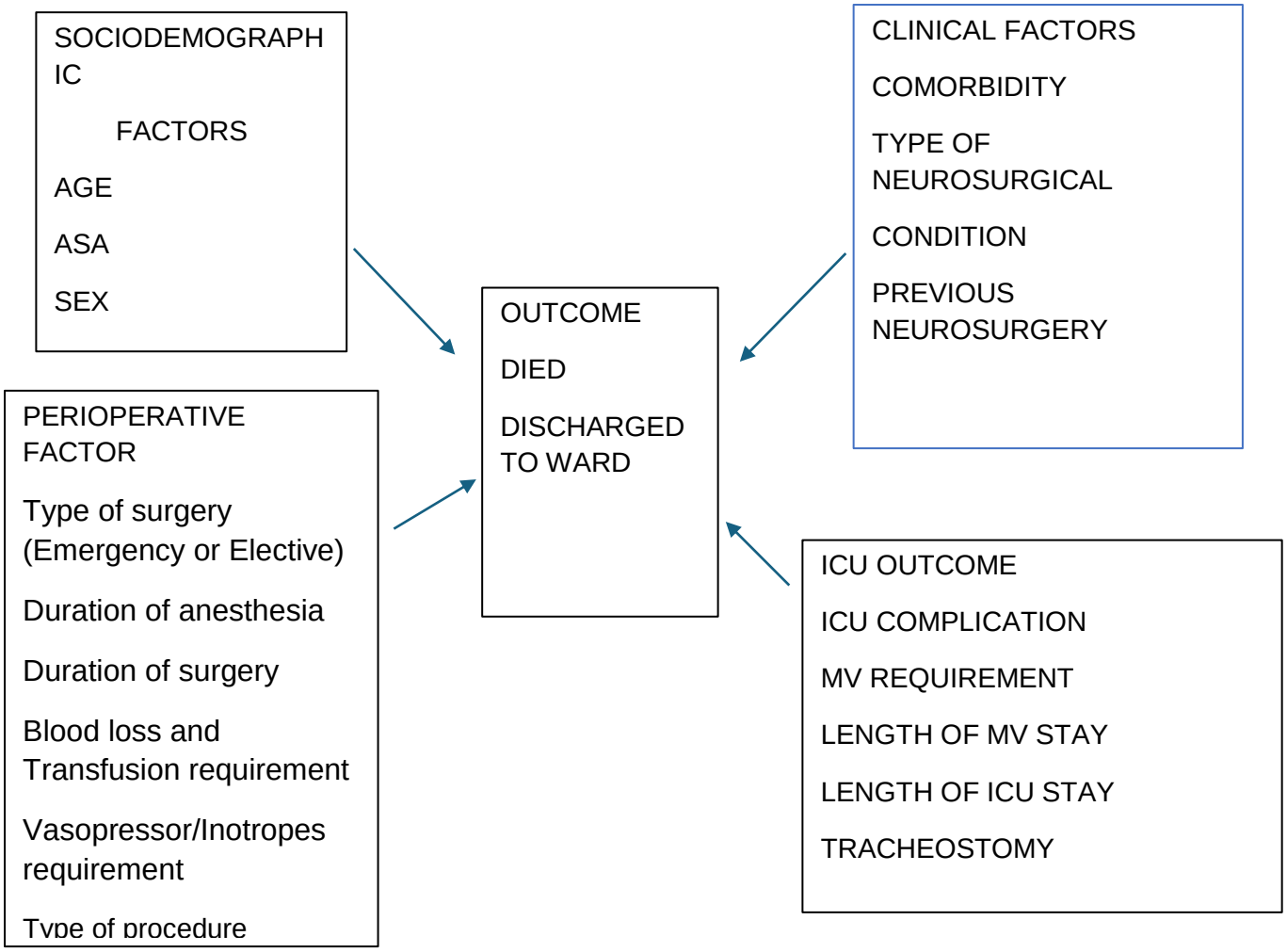

Figure 1: Conceptual framework

3 Objectives

3.1 General Objective

Assessment of the Magnitude of admission, outcomes and associated factors of neurosurgical patients at Tikur Anbessa hospital SICU Adiss Ababa Ethiopia from January 01, 2024 – January 01, 2025.

3.2 Specific objectives

1. To assess length of stay in hospital after discharge from ICU of Neurosurgical patients admitted at TASH SICU Adiss Ababa Ethiopia.
2. To assess the leading cause of mortality among Neurosurgical patients admitted at TASH SICU Adiss Ababa Ethiopia.

4 Methods and materials

4.1 Study design and period

A retrospective observational study was conducted of Neurosurgical patients admitted at Tikur Anbessa Specialized Hospital surgical ICU from the period of January 01, 2024 – January 01 2025G.C.

4.2 Study area

The study was conducted at Tikur Anbessa Specialized Hospital, located in Addis Ababa, the capital city of Ethiopia. TASH is the largest tertiary referral and teaching hospital in the country and serves as a major center for advanced medical care, clinical teaching, and research. It is affiliated with Addis Ababa University, College of Health Sciences.

TASH comprises various departments, including the Department of Anesthesiology, which plays a key role in perioperative patient care, critical care, and pain management. The SICU constitutes of 12 beds.

4.3 Population

4.3.1 Source population

All patients admitted to surgical ICU at TASH over 1 year period from January 1, 2024, to January 01, 2025.

4.3.2 Study population

All Neurosurgical patients admitted at SICU TASH over 1 year period from January 01, 2024 – January 01, 2025.

4.3.3 Sampling technique

A consecutive sampling technique was used as the study aimed to include all eligible patients meeting the criteria during specified time frame.

4.4 Eligibility criteria

4.4.1 Inclusion criteria

All Neurosurgical patients admitted at TASH Surgical ICU admitted from January 01, 2024, to January 01, 2025.

4.4.2 Exclusion criteria

All patients with lost chart and incomplete documentation are excluded from the data.

4.5 Study variable

4.5.1 Dependent variables

Patterns of neurosurgical patient ICU admission and Outcome of neurosurgical patient from ICU.

4.5.2 Independent variable

Socio-demographic factors: Age, Sex, ASA

Clinical factors: Comorbidity, Type of Neurosurgical Condition Previous neurosurgery

Perioperative factors: Duration of anesthesia or surgery, Type of surgery (Elective vs Emergency), Blood loss, Blood transfusion and Inotropic or Vasopressor requirement.

ICU factors: ICU complication, MV requirement Tracheostomy, GCS at admission Length of stay.

4.6 Operational definition

ASA (American society of Anesthesiologists) - is a physical status classification used to assess and communicate a patient's pre-operative health status ranging from ASA I to ASA VI. This classification helps to determine the patient's overall health risk for undergoing anesthesia and surgery.

Readmission - Reentry of patients within the study period after prior discharge only data from the most recent admission was included in the data.

Post operative Neurosurgical monitoring: Admission to the surgical ICU for Neurological monitoring it includes patients who are mechanically ventilated postoperatively for routine observation, hemodynamic monitoring or delayed emergence, but not due to a primary indication of airway protection such as low GCS or brainstem involvement.

Airway protection: ICU admission due to risk of airway compromise caused by low GCS, brainstem compression, or surgery affecting airway reflexes.

4.7 Data collection, tools, and procedure

Patients medical record number was identified from TASH ICU logbooks the source of data was collected from patient's medical record and charts. Patients chart was evaluated by physician capable of recording different variables. Socio-demographic data like the patient's age, sex, and ASA physical status, duration of anesthesia and surgery, was taken from the patient chart and anesthesia follow up sheet. Pattern and outcome of the neurosurgical ICU patients of the participants was measured from admission until its outcome.

4.8 Data processing and analysis

All responses to the questionnaires were coded, entered, and analyzed using SPSS Version 27. Binary logistic regression was employed for each independent variable, with those having a P value < 0.25 entered a multivariable logistic regression. A P value < 0.05 at 95% confidence intervals was considered as statistically significant.

4.9 Ethical consideration

The research was conducted after obtaining ethical clearance and approval from the Department of Anesthesiology, Critical Care, and Pain Medicine. An official support letter was written to TASH and permission for data collection was sought from the hospital authorities

5 Result

5.1 Sociodemographic characteristics of the study participants

The study included a total of 140 individuals. Nearly half of the participants (47.9%) were between the ages of 31 and 45 years, with the overall mean age reported as 38.3 years (SD = 11.88). Participants aged 15 to 30 years comprised 27.9% of the sample, while those aged 46 to 55 years and 55 years or older accounted for 16.4% and 7.9%, respectively.

Regarding sex, 51.4% of the participants were male and 48.6% were female. A total of 25.7% of participants reported having at least one preexisting medical condition. Among these, the most frequently identified conditions were hypertension (50%), diabetes mellitus (16.7%), and seizure disorders (8.3%). Additionally, 30.7% of participants reported a previous history of neurosurgical intervention. In terms of ASA physical status classification, the majority (78.6%) were categorized as ASA II, followed by ASA I (14.3%), and ASA III–IV (7.1%). (See Table 1)

Variable	Frequency	Percent
Age in years		
15-30	39	27.9
31-45	67	47.9
46-55	23	16.4
>55	11	7.9
Sex		
Male	72	51.4
Female	68	48.6

ASA classification		
ASAI	20	14.3
ASA II	110	78.6
ASAIII & IV	10	7.1
Comorbid disease		
Yes	36	25.7
No	104	74.3
Types of comorbid disease (n=36)		
Hypertension	18	50
HTN + DM	4	11.1
DM	6	16.7
RVI + HTN	1	2.8
Epilepsy	3	8.3
RVI	2	5.6
HTN + Epilepsy	2	5.6
Previous history of neurosurgery		
Yes	43	30.7
No	97	69.3

Table 1. Sociodemographic characteristics of the study participants among neurosurgical patients at Tikur Anbessa hospital surgical intensive care unit, Addis Ababa, 2024/5.

5.2 The magnitude of neurosurgical admission

In this study the magnitude of neurosurgical ICU admission from the total surgical ICU admission during the study period were 31.5% (n=150). From those of neurosurgical cases only 140 (93.3%) were included in the study.

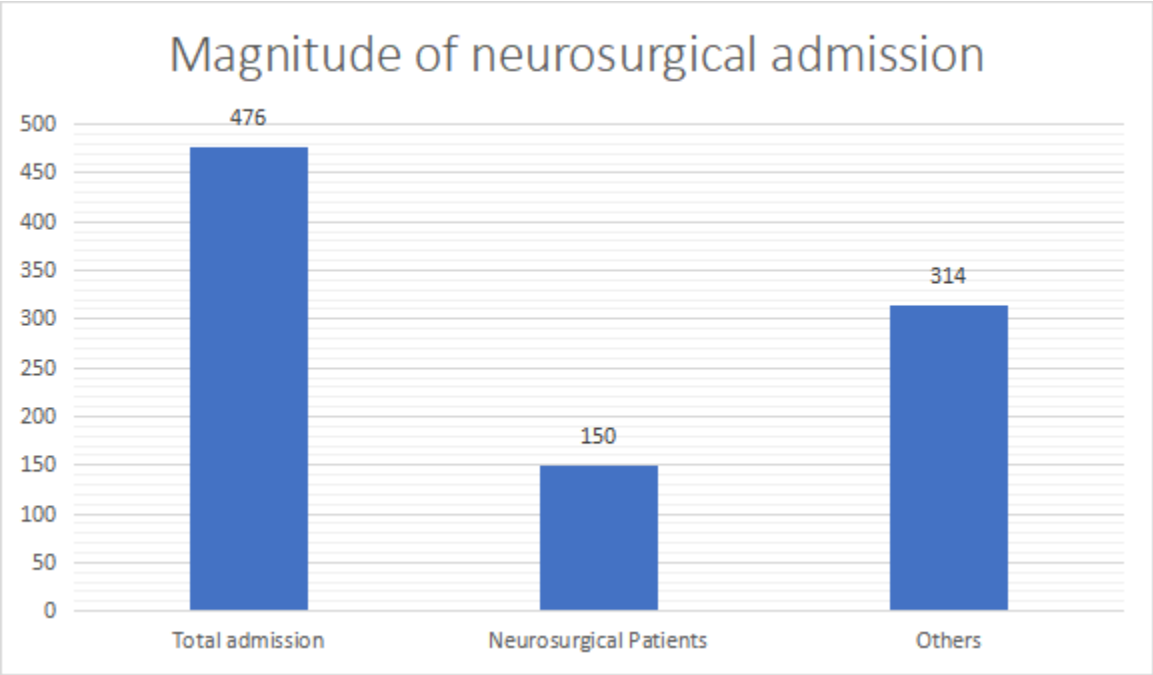

Figure 2. The magnitude neurosurgical admission among surgical ICU patients at TASH, 2024/5.

5.3 Primary Diagnosis at Hospital Admission

Seventy-two percent of the participants were admitted in hospital with the diagnosis of brain tumor and from those brain tumor, 64.3% them had supratentorial and 33.7% had infratentorial.

Variable	frequency	Percent
Hospital admission diagnosis		
Brain Tumor	101	72.1
Chronic subdural hematoma	1	0.7

Subarachnoid Hemorrhage	7	5.0
TBI	29	20.7
Trigeminal neuralgia	2	1.4
Grading of TBI(n=29)		
Mild	3	10.3
Moderate	16	55.2
Severe	10	34.4
Types of brain tumor (n=101)		
Supratentorial	67	66.3
Infratentorial	34	33.7

Table 2. Characteristics of the Primary Diagnosis at Hospital Admission

5.4 Intraoperative related characteristics of the study participants

Eighty-five percent of the surgical procedures were elective. Craniotomy and resection accounted for the largest proportion at 59.3%, followed by decompressive craniotomy and hematoma evacuation, which together comprised 15% of the procedures. Intraoperative blood loss between 500–1000 mL was observed in 58% of the study participants, and 12.9% required vasopressor support. Blood transfusion was administered to 24% of the participants, while 52.1% underwent surgeries lasting between 4 to 7 hours.

Variable	Frequency	Percent
Types of surgery		
Elective	119	85
Emergency	21	15
Types of procedure		

Craniotomy and resection	83	59.3
EVD/shunt placement	20	14.3
Decompressive Craniotomy& Hematoma evacuation	21	15
Elevation of deep skull fracture	2	1.4
Microvascular surgery	3	2.1
TSS	11	7.9
Intraoperative blood loss		
<500	20	14.3
500-1000	81	57.9
>1000	39	27.9
Requirement of vasopressor or Inotropes		
Yes	18	12.9
No	122	87.1
Blood transfusion		
Yes	34	24.3
No	106	75.7
Duration surgery in hours		
≤3	35	25.0
4-7	73	52.1
>7	32	22.9
Duration of anesthesia		
≤3	4	2.9

4-7	78	55.7
>7	58	41.4

Table 3. Intraoperative related characteristics of the study participants

5.5 Indication of admission in intensive care unit

Among the neurosurgical patients admitted to the ICU, the majority were admitted for postoperative neurosurgical monitoring, accounting for 72.1 (101 out of 140) of the total admissions. The remaining 26.9. were admitted for other critical indications, including airway protection, respiratory failure, sepsis and raised intracranial pressure.

5.6 ICU admission related characteristic of the study participants

From those ICU admitted patients 9.3% were readmitted and 44.3% had a GCS score of 13-15 and 31.4% has RASS score of -2 and -3. Fifty-four percent of the participants required MV and from those 36% had 2-7 days length of stay.

Variable	Frequency	Percent
Postoperative Neurosurgical Monitoring		
Yes	101	72.1
No	39	26.9
ICU readmission		
Yes	13	9.3
No	127	90.7
GCS and RASS score		
RASS Score –2 & -3	44	31.4
<9	10	7.1
9-12	24	17.1
13-15	62	44.3

Tracheostomy done		
Yes	18	12.9
No	122	87.1
ICU complication(N=62)		
Yes	62	44.3
No	78	55.7
Types of complication		
PE	2	3.2
DVT	3	4.8
Arrythmia	4	6.4
AKI	25	40.3
Bed sore	25	40.3
Central DI	22	35.5
VAP	15	21.2
Septic shock	24	38.7
Meningitis	20	32.2
Electrolyte imbalance	52	83.9
Mechanical ventilator requirement		
Yes	75	53.6
No	65	46.4
Indication for MV (N=75)		
Prolonged prone position	10	13.3

Airway protection	27	36
Respiratory Failure	10	13.4
Delayed awakening	19	25.3
ICP	9	12
Length of stay in MV in days(n=75)		
≤1	27	36
2-7	27	36
>7	21	28

Table 4. ICU admission related characteristic of the study participants

5.7 The outcome related characteristics of the study participants

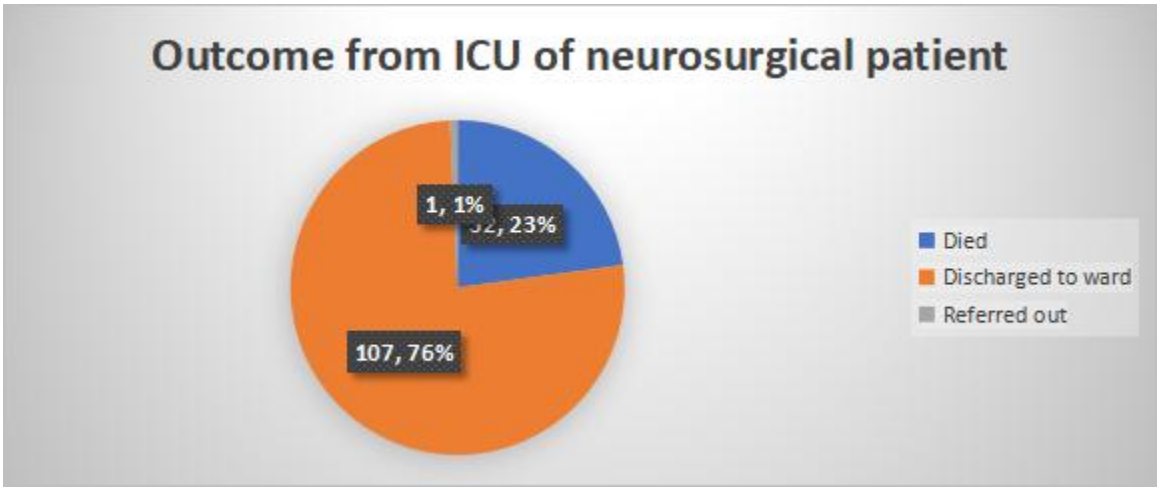

Figure 4. Intensive care unit outcome of neurosurgical patients.

Among the ICU complication (N=62) the most frequently observed complication was electrolyte imbalance with (83.9%) followed by AKI and Bed sore (40%), Central diabetes insipidus (DI) in 35.5% of the patients. Septic shock occurred in 32.2%, while ventilator-associated pneumonia (VAP) was reported in 38.7%. Other noted complications included meningitis (16.1%), arrhythmia (6.4%), deep vein thrombosis (DVT) (4.8%), and pulmonary embolism (PE) (3.2%).

Almost two-third of the case had ICU length of stay for ≤3days and (23%) had died (see figure above). from those outcomes, 65.6% were caused by MOF secondary to septic shock followed by cardiorespiratory arrest 2ndry to brain death (18.8%). From the patients discharged to ward (N=107) 64.5% were discharged from hospital within 3 days of discharge from the ICU.

Variable	frequency	Percent
Length of stay in days		
≤3	89	63.6
4-7	22	15.7
>7	29	20.7
Cause of death(N=32)		
Cardiorespiratory arrest 2ndry to Brain death	6	18.8
Hypovolemic shock	1	3.1
MOF 2ndry to Cardiogenic shock	1	3.1
MOF secondary to Septic shock	21	65.6
Obstructive shock	1	3.1
Refractory hypotension	1	3.1
Refractory ICP	1	3.1
If improved and discharged time of discharge in days		
≤3	69	64.5
>3	38	35.5

Table 5. The outcome related characteristics of the study participants

5.8 The determinants of death outcome in ICU of neurosurgical patients

Urgency of surgery, amount of blood loss, postoperative monitoring, tracheostomy, ICU admission and length of stay in ICU were an association with ICU outcome by bivariate logistic regression. The multivariate logistic regression revealed that the odds of emergency surgery were 7.4 times increase its death in ICU compared to those of elective surgery (AOR=7.4, 95%CI=1.26, 29.67) and Compared to patients admitted for postoperative neurosurgical monitoring, those admitted for other critical indications such as airway protection, respiratory failure, and sepsis experienced significantly worse outcomes and the odds are 3.5 times increase in mortality compared to those of its opposite compartment (AOR=3.5, 95%CI=1.93, 13.15). The odds ICU complication were 7.8 times increase its death in ICU compared its opposite compartment (AOR=3.5, 95%CI=1.92, 13.15).

Variable	Outcome of ICU		p-value	COR with 95%CI	P-value	AOR with 95%CI
	Death	discharge				
Age in years						
15-30	9	30	1		1	
31-45	11	56	0.400	0.66(0.24, 1.76)	0.037	0.19(0.04, 0.90)
46-55	7	16	0.524	1.5(0.46, 4.65)	0.883	0.89(0.18, 4.41)
>55	5	6	0.154	2.8(0.68, 11.28)	0.353	2.6(0.34, 19.93)
Comorbidity						
Yes	10	26	0.216	1.4(0.60, 3.45)	0.895	1.1(0.29, 4.01)
No	22	82	1		1	

Timing of surgery						
Elective	23	96	1		1	
Emergency	9	12	0.022	3.1(1.18, 8.31)	0.027	**7.4(1.26,43 .97)**
Amount of blood loss						
<500	2	18	1		1	
500-1000	16	65	0.318	2.2(0.47, 10.54)	0.090	9.1(0.71, 117.59)
>1000	14	25	0.048	5.0(1.02, 24.98)	0.044	**14.0(0.96, 65.29)**
Postoperative monitoring						
Yes	16	85	1		1	
No	16	23	0.002	3.7(1.61, 8.49)	0.044	**3.5(1.93, 13.15)**
Tracheostomy						
Yes	10	8	0.001	5.7(2.01, 16.04)	0.309	2.7(0.39, 18.90)
No	22	100	1		1	
ICU complication						
Yes	28	34	0.000	15.2(4.95, 46.86)	0.004	**7.8(1.92, 31.49)**
No	4	74	1		1	
Length of stay in ICU						
≤3	11	78	1		1	

4-7	5	17	0.222	2.1(0.64, 6.79)	0.681	0.74(0.17, 3.15)
>7	16	13	0.000	8.7(3.32, 22.94)	0.693	1.4(0.25, 8.14)

Table 6. The bivariate and multivariate association between independent variable ICU outcome neurosurgical patients 2024/5.

6. Discussion

In our study, neurosurgical patients accounted for 31.5% of all ICU admissions. This proportion is comparable to findings from TASH in 2014, where neurosurgical admissions were reported at 32%,(24) and aligns closely with the 37.9% observed at Aga Khan University Hospital in Pakistan.(23) The, AaBET Hospital in Addis Ababa, Ethiopia, reported the highest proportion of neurosurgical ICU admissions at 62.7%, reflecting its designation as a trauma and emergency center.(21) Similarly, the University of Nigeria Teaching Hospital reported 41.2%.(13) In contrast, Nepal reported a lower proportion of 24.5%(22). These variations can be attributed to differences in hospital specialization, patient demographics, and the nature of neurosurgical cases managed. For instance, AaBET and UNTH primarily admit trauma patients, while TASH sees a higher proportion of brain tumor cases, accounting for 72% of its neurosurgical ICU admissions.

The ICU mortality rate in our study was 23% (32/140), like AaBET (22.9%), (21) and Nepal study 22% (22), the University of Nigeria teaching hospital only reported death due to TBI which accounted for 45.7% (15%). In contrast, in the Pakistan study it was (6.6%; 13/197), (23) which reported much lower mortality rates, largely due to a higher proportion of elective surgical. In England, mortality for elective cranial surgery is as low as 0.5%, but increases to 7.4% for non-elective cranial procedures, emphasizing the global impact of surgical urgency and healthcare infrastructure on outcomes.

The factors that were independently associated with mortality in our study, were patients undergoing emergency surgery (AOR = 7.4; 95% CI: 1.26–29.67). These could be due to lack preparation severity of the underlying conditions mostly performed off regular hours and availability of senior staff might be limited. Similar trends have been noted in the Pakistan study, where emergency surgeries comprised 40% (67/168) (23) of procedures and were associated

with poorer outcomes, and in England, where mortality increases significantly in non-elective neurosurgical cases.

Presence of ICU complications was significantly associated with increased mortality (AOR = 7.8; 95% CI: 1.92–31.49). In our study, 44.3% (62/140) of patients experienced complications, with electrolyte imbalance (83.9%), acute kidney injury (40.3%), bed sores (40.3%), and septic shock (38.7%) being the most frequent. In AaBET, similar complications such as central diabetes insipidus, infections, and ventilator-associated pneumonia were linked to poor outcomes. In contrast, Pakistan reported fewer complications: AKI (7.1%), arrhythmias (2%), and vasopressor use (10.6%), possibly due to stronger ICU protocols and better resource availability.

Among the neurosurgical patients admitted to the ICU, the majority were admitted for postoperative neurosurgical monitoring, accounting for 72.1 (101 out of 140) of the total admissions the remaining 27.9 were admitted for other indications such as airway protection, respiratory failure, or sepsis had significantly higher odds of mortality (AOR = 3.5, 95% CI: 1.93–13.15). This suggests that the higher mortality in the non-monitoring group may be attributed to the underlying critical condition of the patients.

Regarding tracheostomy, our study reported a rate of 12.9% (18/140), higher than Nepal (5.5%; 11/199) but significantly lower than Pakistan (39%; 77/197), where early tracheostomy (median day 4) was a common practice. Tracheostomy is typically performed in cases requiring prolonged ventilation, and its early use may help reduce ICU stay and improve outcomes, especially in resource-limited settings.

In this study intraoperative blood loss >1000 mL was associated with increased in mortality compared to blood loss <500 mL (AOR = 14.0; 95% CI: 0.96–65.29). Although the confidence interval crossed 1 the odds ratio and p value suggest association. Excessive bleeding can lead to hemodynamic instability, transfusion-related complications, and organ dysfunction. While specific intraoperative blood loss data was not detailed in the other studies.

7. Conclusion

The magnitude of ICU admission of neurosurgical patient was 31.5%. Postoperative neurological monitoring and air way protection were the two main reason of ICU admission. Among those admitted in ICU, 53.6% them required mechanical ventilation and 44.3% were develop

complication. from those ICU admitted patients, 23% died and the 63.6% had ICU length of stay for less than three days. The determinant factors for ICU mortality were emergency surgery (AOR=7.4, 95%CI=1.26, 29.67), intraoperative blood loss >1000ml (AOR=14, 95%CI=0.96, 65.29), and develop complication in ICU (AOR=3.5, 95%CI=1.92, 13.15).

Strength and Limitations

As a pilot study it could help for further studies, it also clearly addressed its main objectives. Retrospective data makes it prone to data incompleteness documentation error. Limited sample size and short study period duration. Lack of complete documentation of 10 participant have introduced bias and reduced accuracy of findings. ICU acquired complications like VAP Septic shock and other infectious disease there was incomplete microbiological data in the chart review.

Recommendation

The Neurosurgical department at TASH is rapidly growing evidenced by current study findings, comparing the data reported over a decade ago the number of Neurosurgical ICU admission has tripled, this strongly suggest the need to establish a dedicated Neurosurgical Unit.

ICU mortality was high in this research so we can improve our intraoperative management using blood conservative therapies and minimizing blood loss prevent and manage ICU complication by implementing on daily ICU care bundles and infection control.

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Questionnaire

Demographic and Admission Information

1. Patient ID: _____

2. Age (in years): _____

3. Gender:

A. Male

B. Female

4. Pre-existing Conditions (Select all that apply):

A. Hypertension

B. Diabetes Mellitus

C. Coronary Artery Disease

D. Chronic Kidney Disease

E. Pulmonary Disease

F. Coagulopathy

H. Others specify

5. Previous Neurosurgery

A. Yes

B. No

Preoperative Characteristics

1. Primary Diagnosis at Hospital Admission:

A. Traumatic Brain Injury
B. Subarachnoid Hemorrhage
C. Intracerebral Hemorrhage
D. Brain Tumor
E. Spinal Cord Injury
F. Other (Specify): ____

Intraoperative Characteristics

1. Duration of Surgery (in minutes): _____

2. Duration of Anesthesia (in minutes): ____

3. Type of Procedure:

A. Tumor Resection
B. Decompressive Craniectomy
C. Clot Evacuation
D. Spinal Surgery
E. Other (Specify): __

4. Site of Surgery: ____

ICU Admission Information

1. ICU Admission Diagnosis: ____

2. GCS or RASS Level in ICU: _____

3. Mechanical Ventilation:

   A. Yes
   B. No

4. Length of MV _____

5. Length of ICU stay ----------

ICU Outcome

1. Complications Developed in SICU (Select all that apply):

   1.1 Infectious Complications

   A. Sepsis
   B. Pneumonia
   C. Meningitis
   D. Other Infections (Specify): ____

   1.2. Respiratory Complications

   A. Acute Respiratory Distress Syndrome (ARDS)
   B. Pulmonary Embolism
   C. Aspiration Pneumonitis
   D. Ventilator-Associated Pneumonia (VAP)
   E. Other Respiratory Issues (Specify): ____

1.3. Cardiovascular Complications

   A. Hypotension/Shock
   B. Arrhythmia
   C. Myocardial Infarction
   D. Deep Vein Thrombosis (DVT)
   E. Other Cardiovascular Issues (Specify): ____

1.4. Neurological Complications

A. Neurological Deterioration
B. Seizures
C. ICP
D. Other Neurological Issues (Specify): ____

1.5. Renal Complications

A. Acute Kidney Injury (AKI)
B. Electrolyte Imbalance (Specify type if known, e.g., hyperkalemia): ____
C. Other Renal Issues (Specify): ____

1.6. Hematological Complications

A. Coagulopathy
B. Thrombocytopenia
C. Anemia
D. Disseminated Intravascular Coagulation (DIC)
E. Other Hematologic Issues (Specify): ___

2. Bed sore

A. Yes

B. NO

3. Trachostomy

A. Yes
B. NO

3. Patient Outcomes upon SICU Discharge:

A. Discharge to ward

B. Deceased

4. Total length of hospital stay after discharge from ICU ------