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Assessment of Neurological Outcomes of Patients Following Emergency Neurosurgical Interventions for Intra-Cranial Hematomas in Traumatic Brain Injury at Yekatit 12 Hospital Medical College

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Abstract

Background: *Traumatic Brain Injury (TBI) is the primary cause of death and disability in individuals under 40 globally. Resource constraints exist across the care spectrum, and neurosurgical outcomes remain poorly understood.*

Objective: *The study aims to evaluate the short-term neurological outcomes of patients who underwent surgery for traumatic intracranial hemorrhage at Yekatit 12 Hospital Medical College.*

Patients and Methods: *A longitudinal study design was used. Data were analyzed using SPSS version 27 and binary logistic regression was used to see factors associated with outcomes. P value ≤0.05 was considered significant*

Result: *Total of 34 patients were studied male outnumbered female and mean was age 34.5 ± 12.8. Road traffic accident was the common cause of traumatic brain injury. Acute epidural hematoma accounted the highest proportion (46%) traumatic brain injury. Postoperative mortality rate was 17.6 % and 83.3% was secondary to acute subdural hematoma. On post-operative follow up 64.7% patients have favorable 3 month Glasgow outcome score. The initial pupillary reaction (P: 0.02 COR 0.02(0.002-0.205), postoperative complications (P: <0.01 COR 21(2.099-210.136) and length of hospital stay (P: 0.04 COR0.054(0.07-0.395) showed statically significant association with 03 month Glasgow outcome score.*

Conclusion: *Young male populations are predominately affected from traumatic brain injury. Initial pupillary reactions and postoperative complications significantly affect the neurologic outcome.*

Keywords: Traumatic brain injury, Glasgow outcome score. Postoperative complication

Acronyms and Abbreviations

AEDH	Acute epidural Hematoma
A CI	Confidence Interval
CSDH	Chronic subdural Hematoma
EC	Ethiopian Calendar
GC	Gregorian Calendar
GCS	Glasgow Coma Scale
GOS	Glasgow outcome score
ICU	Intensive Care Unit
AOR	Adjusted Odds Ration
OR	Operation Room
MOT	Multiple Organ Trauma
RTA	Road Traffic Accident
SD	Standard Deviation
STBI	Severe Traumatic Brain Injury
SPSS	Stastical package for Social Science
SDH	Acute Subdural Hematoma
t-ICH	Traumatic Intra Cranial Hematoma
TBI	Traumatic Brain Injury
WHO	World Health Organization
Y12HMC	Yekatit 12 Hospital Medical College

Introduction

Traumatic head injury (TBI) is any alteration in mental or physical functioning related to a blow to the head which is among the most common causes of morbidity and mortality in the world. It can be mild, moderate, or severe based on GCS, with GCS 14-15, 9-13 and ≤8 respectively [1]. In

USA, in 2010, about 2.5 million emergency department (ED) visits, hospitalizations, or deaths were associated with TBI-either alone or in combination with other injuries, and it has contributed to the death of more than 50,000 people [2].

According to the WHO, TBI will surpass many diseases as the major cause of death and disability by the year 2020. Worldwide, it is estimated that 10 million people are affected annually by TBI which imposes a significant burden of mortality and morbidity on society. This makes TBI a pressing public health and medical problem [2]. Traumatic intracranial hemorrhage (t-ICH) is a collection of blood that forms inside the skull following TBI and remain the leading cause of death and disability of among patients with TBI [3] .

The worldwide incidence of TBI is estimated at 106 cases per 100,000 individuals, with a higher prevalence noted in Low and Middle Income Countries (LMICs). Sub-Saharan African countries are among the most heavily impacted by TBI, with an estimated incidence rate ranging from 150 to 170 cases per 100,000 people. Unfortunately, many of these countries lack a sufficiently equipped healthcare system to effectively manage the health repercussions linked to TBI [2].

Although Ethiopia is one of the Sub-Saharan African countries where TBI is notably prevalent, primarily attributed to RTA, there remains a lack of comprehensive studies examining the outcomes of emergency neurosurgical interventions. This study was aimed to assess the short-term neurosurgical outcomes of patients undergoing surgery for t-ICH at Yekatit 12 Hospital Medical College.

Methods and Materials

Study area and Period

The study was conducted from September 1, 2022, to March 30, 2023, at Yekatit 12 Hospital Medical College situated in Addis Ababa, Ethiopia. The institution currently offers patient care services and serves as a training center for medical students, residents, and other postgraduate programs.

Study Design

Health facility based longitudinal study design was conducted to assess the neurological outcomes of patients operated for t-ICH at Y12HMC.

Source and study Population

All patients who was seen at Y12HMC both at the emergency and neuro-surgery ward with the diagnosis of TBI was used as source population and all patients who was operated for t-ICH both from the emergency and neurosurgery ward during the study period with the following inclusion and exclusion criteria were included in the study.

Inclusion and exclusion criteria

Inclusion criteria: all patients with settled diagnosis of t-ICH and admitted to the surgical ward within the study period was included.

Exclusion criteria: TBI patients without Brain CT-scan and patients who didn't want to participate in the study and patients who didn't come for follow up were excluded.

Sampling technique and Sample size

All patients operated for t-ICH with in the study period who fulfills the inclusion criteria's were included in the study.

Study Variables

Outcome of patients with traumatic ICH was dependent variable, socio-demographic factor; pre-operative patient characteristics and post operative factors were considered as independent variable.

Data Collection Methods and Control

Data were collected using structured questioner from electronic medical records and these questionaries' were designed from literature reviews after pre-test was done on patients. Data collectors were trained neurosurgery attaching residents. The principal investigator supervised the data collection process, completeness and consistency on weekly bases.

Data analysis and Presentation

Data entry done by EPI info version 7.1 software and analyzed using SPSS version-27 computer system. Binary logistic regression was used to see the association and significance was considered for P-value <0.05.

Result

Socio-demographic characteristics

During the study period 37 Patients were operated for t-ICH and 3 patients were excluded from the study due to lost from follow up resulting response rate of 91%. So only 34 Patients were enrolled to the study. From a total of 34 patients, 30 (88.2%) were men with male to female ratio of 7.5 to 1. The mean and median age of patients was 34.5± 12.8 and 33.5years respectively. The majority of patients, 26 (76.5%) were younger than 45 years. Rod traffic accident was the most cause of injury 14 (41.2%) followed by assaults (stone, stick) which is in 9 (26.5%); falling down accidents 9 (26.5%), and 2 patients sustained axe and bullet injury (Figure 1).

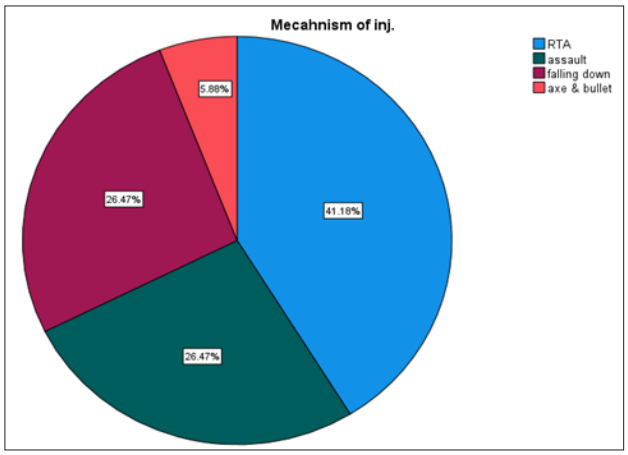

Figure 1: Shows distributions of mechanism of injury for t-ICH operated patients at Y12HMC from September 1/2022 to March 30/2023 G.C.

Duration of time	Frequency	Percent
<4hrs	18	52.9
4-12hrs	6	17.6
>12hrs	10	29.4
Total	34	100.0

Table 1: Shows distribution of arrival time to the hospital for patients with t-ICH operated patients at Y12HMC from September 1/2022 to March 30/2023 G.C.

Majority of the patient arrived to the hospital within 4 hours of the injury 18 (52.9%), whereas about 6 (17.6%) patient arrived 4-12 hrs of the injury and 12 (29.4%) arrived after 12 hours after their injury (Table 2). Majority of the patient transported to the hospital with ambulance 23 (67.6%), the others 9 (67.6%) used taxi and only 2 (5.9%) used private transportation.

Variable		GOS			p-value
		Favorable	Un-favorable	COR,95%CI	
Pupillary reaction	normal	18	1	0.02(0.002-0.205)	0.02
	abnormal	4	11	1	
Post-op complications	yes	1	6	21(2.099-210.136)	0.01
	no	21	6	1	
Length of hospital stay	<= 5days	16	3	0.054(0.07-0.395)	
	5-10days	4	2	0.14(0.14-1.44)	0.04
	10days	2	7	1	

Table 2: Factors associated with 03 month GOS for patients operated for t-ICH at Y12HMC from September 1/2022-march30/2023 G.C.

Peri-operative patient characteristics

The mean GCS of patient was 10.8 ± (SD 3.5). A total of 13 (38.2%) patients presented with an initial GCS of 3-8, 9 (26.5%) had an initial GCS of 9-13, and 12 (35.3%) had an initial GCS of 14-15 (see Figure 2).

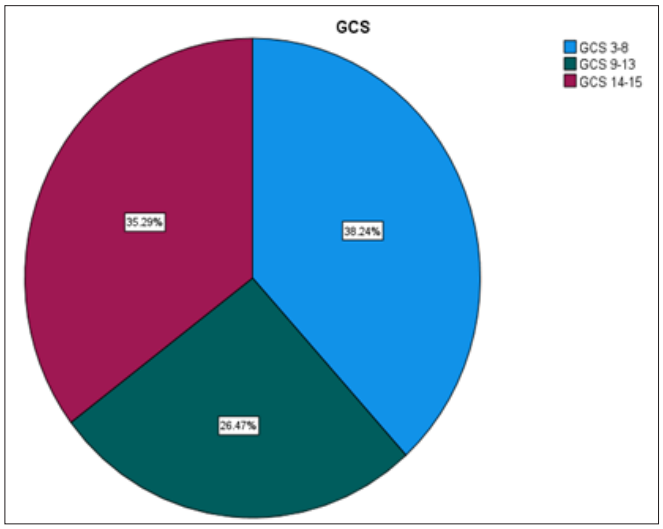

Figure 2: Shows distribution of GCS for patients with t-ICH operated patients at Y12HMC from September 1/2022 to March 30/2023 G.C.

Among the patients who underwent surgery, 15 (44.1%) exhibited abnormal pupillary reactions. Of those with abnormal pupillary reactions, 10 (29.4%) had unilaterally dilated pupils, 5 (14.4%) had bilaterally dilated pupils, and 2 (4%) had constricted pupils. The majority of patients experienced isolated TBI (30, 88.2%), while only 4 (11.7%) had additional injuries. Among these additional injuries, two were chest injuries, one was abdominal, and one involved extremity injuries.

Among all patients with t-ICH who underwent surgery, brain CT-scans revealed 18 (52.9%) acute epidural hematomas (AEDH), 13 (38.2%) acute subdural hematomas (ASDH), 2 (5.9%) intraparenchymal hematomas (IPH), and 1 mixed t-ICH (see Figure 3). The mean hematoma volume among operated patients was 49.7 ± 17.9, with 21 (61.8%) patients estimated to have ICH volumes above 40ml, while 13 (38.9%) had volumes below 40ml. These hematomas were distributed across various brain lobes: 6 (17.9%) in the parietal lobe, 6 (17.9%) in the temporal lobe and 4 (11.8%) in the frontal lobe, with the majority of patients having t-ICH occurring across multiple lobes (see Figure 4).

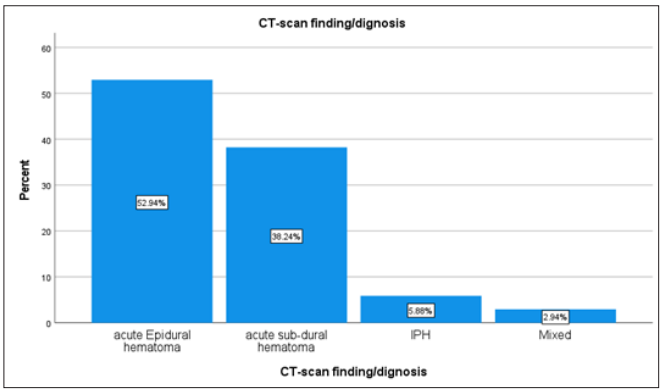

Figure 3: Shows distribution of admission diagnosis for t-ICH operated patients at Y12HMC from September 1/2022 to March 30/2023 G.C.

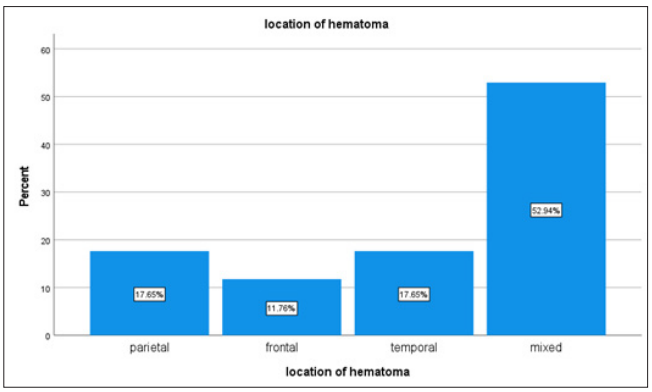

Figure 4: Shows distribution of location of hematoma on brain CT-scan for t-ICH operated patients at Y12HMC from September 1/2022 to March 30/2023 G.C.

Following surgery, 7 (20.6%) patients developed post-operative complications, and among the complications observed, 5 (14.7%) patients developed pneumonia, and 3 (8.8%) patients developed pressure sores. The mean hospital stay for operated patients was 7± (SD 5.2) days. Nineteen patients (55.9%) were discharged within 5 days, 6 patients (17.6%) were discharged between 5-10 days, and 9 patients (26.5%) required a stay exceeding 10 days.

Factors associated with GOS outcomes

Patients were followed for three months and 12 (35.3%) of patients had shown unfavorable outcome and the GOS was 1 for 17.6 patients, 2 for 5.9% patients, 3 for 11.8% patients, 4 for 8.8% and 5 for 55.9% patients (see Figure 5).

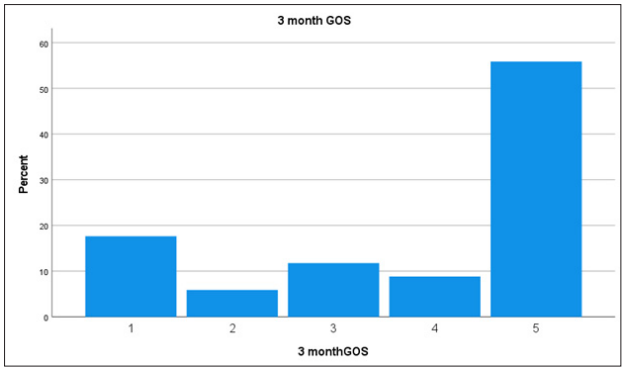

Figure 5: Shows distributions of 03month GOSfor t-ICH operated patients at Y12HMC from September 1/2022 to March 30/2023 G.C.

The initial pupillary reaction (p-value: 0.02; COR: 0.02; 95% CI: 0.002-0.205), postoperative complications (p-value: <0.01; COR: 21; 95% CI: 2.099-210.136), and length of hospital stay (p-value: 0.04; COR: 0.14; 95% CI: 0.14-1.44) exhibit statistically significant associations with the 3-month Glasgow Outcome Scale (GOS) in univariate logistic regression analysis. However, they did not demonstrate significant associations in multivariate logistic regression analysis (See Table-2).

Factors associated with mortality

Among patients who underwent surgery for traumatic intracerebral hemorrhage (t-ICH), 6 (17.6%) patients died. Although GCS, papillary reaction and ICH of TBI patients condition upon admission did not show significance association with mortality all patients who died due to TBI had GSC of less than 8 and abnormal papillary as well as 83.3% of mortality account for SDH collection. The length of hospital stay displayed a significant association with postoperative mortality of t-ICH (p-value: 0.03; COR: 0.06; 95% CI: 0.006-0.769). Furthermore, postoperative complications were also significantly associated with death (p-value: 0.008; COR: 16.667; 95% CI: 2.08-133). However, neither variable demonstrated a significant association in multivariate logistic regression with the mortality of operated t-ICH patients (Table 3).

Variables		Deaths		
		Yes	No	COR,95%CI
LOHS	<5days	1	18	0.06(0.006-0.769)
	5-10days	1	5	
	>10days	4	5	1
Postoperative complication	Yes	4	3	16.667(2.08-133)
	No	25	2	1

Table 3: Factors associated with mortality for patients operated for t-ICH at Y12HMC from September 1/2022- march30/2023 G.C

Discussion

Y12HMC is one of the few government hospitals which gives Emergency neurosurgical service. The expected number of head injuries are 150,000 per year in Ethiopia [4] however so small number of patients get the service in Y12HMC lack of awareness to the availability of the service may be the cause. According to Tsegaezeab Leake [5] study TBI is problem of young adults with mean ages of 29. Our study showed the mean age of the patients with TBI was 34.5 which is similar to the reports from TASTH. This is due to susceptibility of this age groups to risky behavior like fighting and involvements of work without safety precautions.

The study from Black lion hospital [6] shows male predominance of the of 95.6%. Our study shows male to account 88.5% of the group which has close range to the Cameroon report [7] (89.3%). High risk behaviors, like fighting using sticks and stones contribute for this high preponderance of young males. The reports from TASTH [6] and Gondar [8] showed assault as common causes of ICH 75.5% and 58.8% but in most of the setting RTA is commonest cause of TBI which showed similar trend in this study 41.2%. Our study Shows AEDH (52.9%) was commonest diagnosis that required surgery which has similar trend to the TASTH, Gondar and Cameron studies [7]. Intracerebral hematomas are usually treated conservatively unless they exceed 50 cc in size, hence, only two patients was operated for intracerebral hematoma.

According to Tsegaezeab Leake [5] study the overall mortality from TBI was 10.2%. Gondar study [8] reported death rate of 28.8%. TASH [6] report was 18.57over all mortality and 50% among sever TBI. Cameroon report [7] was 17.35 %

overall mortality. Our study shows 17.6% overall mortality and 54.5% of mortality from Sever TBI. The death rate for ASDH in this study is 41.6% which is similar with the report from Switzerland [9] 41% this my associated with significant mechanism of trauma, low initial GCS and underlying brain injury with ASDH.

Heiden et al [10] observed 91% of their patients with fixed pupils either died or were in persistent vegetative state. TASH study [6] shows all patients with fixed pupil expired. Our study shows all patients with dilated fixed pupil died or they have severe disability at 03 months assessment. German trauma society [11] reported only 8% of patients with fixed and unequal pupil were having good GOS which is similar to our study 11.7% of patient have good functional outcome among patients who have abnormal pupillary reaction. Which might be due to lack of proper post-operative ICU and coma care.

The china study [12] observed postoperative complications related with unfavorable long term outcomes of TBI patients. The study from Greece [13] also demonstrated postoperative infections in patients with TBI lead no unnecessary procedures and prolonged hospital stay. Similarly, our study shows TBI patients who develop postoperative complication have increased mortality and unfavorable GOS at 3 month follow up.

According to TBI studies from Kenya [14] 26.9% have unfavorable outcome. The result from TASH study [6] was 36.3% 3 month unfavorable outcome which comparable to our finding 35.3% 3 month unfavorable GOS. Netherlands study [9] shows 76% unfavorable GOS for Sever TBI patients and TASH report [6] was 73.3% outcome. Our result was higher than the two reports 90% unfavorable 3 month GOS for sever TBI patients. This might be related with poor post-operative ICU care and rehabilitation centers.

Conclusion

Traumatic brain injury predominantly affects young males who are victim of RTA. A low pre-operative GCS correlates with higher mortality rates compared to patients with higher GCS scores. The study showed ASDH is associated with the poorest outcome. Abnormal pupillary reactions, postoperative complications, and length of hospital stay impact the neurological outcomes and mortality of TBI patients. Despite this, the majority of patients experience good recovery and can resume their previous activities, underscoring the significant impact of neurosurgical interventions on outcomes.

Ethical Approval and Patient Consent

Ethical clearance was obtained from Y12HMC IRB committee (Reference number: 276/22, dated 08/08/2022). The information gained from the patient registry logbooks was kept confidential by using codes for each card throughout the study. The procedures followed were by the ethical standards of the Helsinki Declaration.

Informed Consent

We obtained documented and witnessed informed verbal consent for publication from the administration bodies otherwise informed consent from the subjects was not required.

Availability of Data and Materials

All data and materials are available to the corresponding author

Competing Interest

No conflict of interest

Acknowledgments

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