



SAINT PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE

DEPARTMENT OF EMERGENCY AND CRITICAL CARE MEDICINE

**PATTERN AND OUTCOME OF TRAUMATIC BRAIN INJURY AT ADDIS ABEBA
BURN, EMERGENCY AND TRAUMA HOSPITAL: CROSS SECTIONAL STUDY**

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LIST OF ACRONOMYS AND ABBREVIATIONS

AaBET	Addis Ababa Burn, Emergency and Trauma Hospital
BSF	Basal Skull Fracture
CNS	Central Nervous System
CT	Computed Tomography
CXR	Chest X-Ray
ED	Emergency Department
EDH	Epidural Hematoma
FDA	Falling Dawn Accident
GCS	Glasgow Coma Scale
HAI	Hospital Acquired Infection
HAP	Hospital Acquired Pneumonia
ICU	Intensive Care Unit
IRB	Institutional Review Board
LMIC	Low and Middle Income Countries
MVA	Motor Vehicle Accident
RTA	Road Traffic Accident
SDH	Subdural Hematoma
SPHMMC	Saint Paul`s Hospital Millennium Medical College
TBI	Traumatic Brain Injury
TASH	Addis Ababa Specialized Hospital
USD	United States Dollar

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ABSTRACT

Background- Traumatic brain injury (TBI) is a major cause of mortality and morbidity. TBI according to world health organization TBI will surpass many diseases as a major cause of death and disability in 2030. Injuries in general, and road traffic injuries in particular are a growing national concern in Ethiopia(1).

Objectives: To determine pattern and Outcome of Traumatic Brain Injury in Addis Ababa Burn Emergency And Trauma Hospital from February 01/2021 to July30/2021,Addis Ababa Ethiopia

Methods: Hospital based cross-sectional survey was conducted at AaBET hospital. Patients who were admitted with TBI in the study period and fulfill inclusion criteria were included in the Study. Data was collected using structured questionnaires, trauma registry and patient chart. Data was collected by Emergency medicine and critical care residents. The collected data was entered, cleaned, edited and analyzed using spss version 25.0 statistical software.

Results: From the total of 300 patients who full filled the inclusion criteria, Two hundred fourteen (81.3%) of them were males and the mean age of participants was 29.4 ± 17.4 with the range of 8 years-80 years .One hundred thirty-one (43.7%) of study subjects were between 16-30 years old. One hundred fourteen (38.0%) of patients had RTA, 56(18.7%) of them had FDA, 104 (34.7%) of them had interpersonal violence and 26 (8.7%) of had other causes of injury. Out of a total of 114 cases of RTA, 99 (86.8%) of study subjects had motor vehicle type of RTA from the total of patients who had brain CT abnormality, skull fracture (linear DSF& BSF) was the most common 137(33.0%) followed by intracerebral lesion (DAI, contusion & ICH) which accounted for 138(33.2%). In final multivariable logistic regression analysis; GCS was associated with poor outcome. Patients with low GCS were more likely to develop adverse outcome than those who had higher GCS (AOR=0.029; 95% CI 0.002, 0.379)

Conclusion and Recommendations: In this study,the commonst cause of traumatic brain injury was road traffic accident and young males are the commonest victims. In addition, low Glasgow coma scale was highly associated with unfavorable outcome of patients. Since most of the TBI cases are due to road traffic crashes, there is a need for appropriate preventive measures to help reduce the frequency of head injury in our population.

Keywords: Traumatic brain injury, Road traffic accident, violence,

1. INTRODUCTION

1:1. Background

The centers for disease control and prevention defines traumatic brain injury (TBI) as a disruption in the normal function of the brain that can be caused by a bump, blow, or jolt to the head, or a penetrating head injury(2). Traumatic brain injury (TBI) is the leading cause death and disability worldwide(2–5). TBI, according to World Health Organization (WHO) will surpass many diseases as a major cause of death and disability by the year 2030. It is estimated that TBI affects over 10 million people annually leading to either mortality or hospitalization(6). Annually more than 4.7 million deaths and approximately 40-50 million disabilities occur after injury(7). Yet TBI incidence and distribution across regions and socioeconomic divides remain unknown(8). In both less and more developed countries motor vehicles are the major causes of death and disability in the young. Falls are the major causes of death and disability in people older than 65 year(9). Each year approximately 69 million individuals suffer TBI. The vast majority of this burden affects populations in LMICS, in which adequate health care resources are often either inaccessible or nonexistent (10). Injuries in general, and road traffic injuries in particular are a growing national concern in Ethiopia. There were 15,086 road traffic crashes in the year 2014/15 alone which caused an estimated economic loss of 7.3 million USD. The fatality rate compiled from Addis Ababa, Adama and Hawassa city road data was 156/10,000 vehicles the same year. A year later (2016) the road traffic mortality rate per 100,000 population for Ethiopia was 26.7. One year later, (the year 2016) the road traffic mortality rate per 100,000 population for Ethiopia was 26.7(1). The odds of mortality in patients with TBI in low and middle income countries, including sub-Saharan Africa, are more than twice as high as patients in high-income countries. The effect of TBI are not limited to an individual's health but are also a cause of increased socioeconomic burden(11). Traumatic brain injury is graded as mild, moderate and severe on the basis of the level of consciousness (Glasgow coma scale). Traumatic brain injury can also be classified as primary injury which occurs at the time of impact and evolves into (secondary brain injury). Primary injury immediately sets in motion a cascade of secondary inflammatory, oxidative stress, mitochondrial, metabolic and vascular mechanisms that further initiate and perpetuate cellular injury. Secondary brain injury is maintained and worsened by intracranial and extra cranial insults, the combined effects of which are multiplicative rather than additive. Hypoxia and

hypotension occur commonly before the patient reaches hospital and significantly increases the secondary brain injury and the likelihood of poor outcome(10–13). Within the skull cavity, raised intracranial pressure from cerebral edema or an expanding space-occupying lesion are the major contributors to continuing the secondary injury cascade. Metabolic (hypo- and hyperglycemia) and electrolyte abnormalities are also implicated in worsening secondary injury. Hyperglycemia contributes to secondary brain injury by worsening intracellular acidosis as it provides a substrate for continued anaerobic metabolism. The injured brain is particularly vulnerable to hypotension because cerebral auto regulation is frequently disturbed(14). Patients with TBI are at risk of airway obstruction, aspiration and consequent hypoxia. Therefore endotracheal intubation at the scene of injury would intuitively seem to be an effective method of preventing hypoxia and consequent brain energy failure. Rapid sequence intubation (RSI) is thought to be the technique of choice for the pre-hospital intubation of TBI patients as it does not increase intracranial pressure and reduces the risk of aspiration. TBI is an economically, socially and personally devastating condition, which clearly epitomizes the adage that ‘prevention is better than cure. For the foreseeable future, improved patient outcomes will depend on organized trauma response systems, particularly to prevent the potentially reversible effects of secondary brain injury(12).

1.2 Statement of the problem

TBI is a significant public health problem worldwide and is predicted to surpass many diseases as a major cause of death and disability by the year 2030(6). The significant disability associated with TBI also places a considerable burden on health systems in these countries and therefore knowledge of the epidemiological profile of TBI and the development of preventive measures to alleviate this burden is vital, particularly in limited resources setting. The effects of TBI are not limited to an individual's health but are also a cause of increased socioeconomic burden. . The attenuation of TBI-related morbidity and mortality is critical to reduce the global impact of trauma(7). Concerning road traffic accidents in Ethiopia, the situation is already alarming. The country has one of the highest number of fatalities per vehicle worldwide. The study identified the young male part of the population as a major group sustaining head injury. the injury or death of young male members of the population causes social and economic difficulties because they are often the breadwinners of the whole family(15).

1.3 Significance of the study

TBI is now a days a major public health threat in all age groups in the world's populations including Ethiopia. As a country, Ethiopia is one of the countries with significant amount of RTA incidence which result a significant amount of TBIs and its complications like huge amount of medical expense, morbidity and mortality(16). Injuries in general, and road traffic injuries in particular are a growing national concern in Ethiopia. Despite this the country in general and AaBET hospital in particular, don't have an adequate studies done regarding to this specific topic and there is no well formulated protocol to fight this burden. So this research can serve as an input in increasing hospital-based management protocol concerning to the conservative and surgical management of patients diagnosed with TBI. Even though this study is pattern and outcome of traumatic brain injury at a single hospital, it can still serve to initiate further researches regarding this issue in other hospitals and the country as a whole.

2. LITERATURE REVIEW

Traumatic brain injury (TBI) is an important global public health problem. At least 10 million TBIs serious enough to result in death or hospitalization occur annually(8).

Prospective population based study conducted in Norway, Oslo to present the incidence of hospital treated TBI and to describe the severity of brain injuries and outcome of the patients acute medical care from May 2005 to May 2006 on 445 patients identified represent an annual incidence of of 83.3/100,000 and the median age was 29 years. Based on this study, elderly males and the youngest children were more commonly affected. The most common cause of TBI was falls (51%) and transport accidents (29.7%). Intracranial lesions were common in the elderly. The case fatality rate was 2.0/100 hospitalized patients and was highest in the elderly(15).

According to prospective study conducted in England and wales on epidemiology, complications and standardized mortality on traumatic brain injury from April 2014 and June 2015 on 15,820 patients, road traffic collisions and assaults are more common in younger patients while with increasing age, there is a concurrent increase in the proportion of patients injured following falls under 2 m. Ambulance was the common mode of transport to hospital (74% overall). Helicopter was another mode of transport in around (7%) but it increase to 19% in patients with severe TBI. Definitive airway (defined as endotracheal intubation, tracheostomy or cricothyroidotomy) was secured pre hospital or in the ED in 86% of patients with severe TBI(4).

Another retrospective study conducted from May 2001 to July 2010 on a total of 1870 patients who met the inclusion criteria on causes and patterns of adult traumatic head injury in Saudi Arabia from May 2001 to July 2010, most injuries were secondary to motor vehicle collisions (MVC; 69.4%) followed by pedestrian injuries were second (16.8%) and had 40% risk of mortality. Most patients (56.7%) had a severe TBI (GCS< 8)in this study, the overall mortality rate was 30%& mortality was significantly associated with older age , lower GCS and a higher injury severity score (17).

There was a study conducted in in India in 2015, in this study mild, moderate & severe grade of TBI was seen in 62%, 22% &16% cases respectively. Radiological examination of other body parts revealed injuries in 11% cases. Only 11% cases required surgical management, rest was managed conservatively. Good outcome noted in 80% cases and 20% cases expired. Average

duration of hospital stay was 5 days. According to multivariate analysis, the factors which correlated with poor prognosis are presence of radiological injuries to other body parts, GCS, abnormal cranial nerve examination, abnormal plantar and abnormal pupillary reflex(18).

In one study conducted in Pakistan 2014, the most commonly affected age group was 21 to 30 years (34.1%) with male to female ratio of 3.3:1. The predominant causes of injuries were road traffic accident (62.6%), followed by fall (31.7%) and assault (5.5%). The most common CT scan finding was brain contusion (14.1%); others included traumatic sub-arachnoid hemorrhage (7.1%), subdural hematoma (7.6%), extra-Dural hematoma (5.8%) and depressed skull fracture(19).

In another retrospective study conducted from January 2009 to July 2012 in tamale teaching hospital in Ghana commonest cause of TBI was RTA occurring in 90% of the patients, followed by fall from height with 3.43% and assault (2.4%) and gunshot accounted for 2.09% of the causes of TBI with game related and other causes of injury occurring in 0.30% and 0.75% of the patients respectively. The study revealed that TBI mostly affects young unemployed males between the ages of 21-30 years with a mean age of 28 ± 17 years with a male to female ratio of 5:1. The second highest affected age group was patients age 20 years and below constituting about 20% of the overall study population(20).

Another retrospective observational study conducted at Muhimbili Orthopedic Institute in Dar es Salaam capital city of Tanzania between January 2014 and June 2014 on a total of 627 traumatic brain injury (TBI) patients, 86% were males. Majority (73%) were between 15 - 45 years age group. Most of them sustained mild TBI (64%) followed by moderate (18.2%) and severe TBI (17.8%) road traffic crashes were the leading cause of injury (59.3%). All mild TBI patients had good recovery. Among patients with moderate and severe TBI; 19.1% had good recovery, 50.2% recovered with disabilities and 30.7% died. Severe TBI and systolic blood pressure at referring hospital of more than 90mmHg were independent factors associated with mortality(21).

According to a study conducted in Uganda, motorcycle road traffic accident was the leading mechanism of injury, and male's ages 15–29 years comprised the predominant demographic (42.5% of patients). Initial GCS, change in GCS score during hospital stay, and the presence of hematoma were strongest predictors of outcome(22) .

A study was conducted on patients admitted to a surgical ward and ICU of Ayder referral hospital with record review of a total of 750 records. In this study, the causes of head injury were fall down accident in 41.9%, interpersonal violence in 24.8%, and road traffic accident (RTA) in 24.8%. Of the 187 RTA cases 102 were pedestrians and 84 were vehicle occupants. The distribution is 598 males to 152 females, making the male to female ratio 4:1. The most common affected age group was from 6-25 years. A total of 422(56.3%) of the head injury patients came from urban area.

In this study, patient age >60 years, time interval from injury to treatment, low GCS, conservative management, pupil's abnormality were associated with unfavorable outcome. Out of 378 cases 95 (25.1%) were discharged with unfavorable outcome of which 37(9.8%) were neurologic deficits and 58 were deaths giving overall mortality rate of 15.3%(23).

Among 204 head injured patients enrolled in another prospective cohort study in Tikur Anbessa specialized hospital emergency Centre (TASH-EC) in Addis Ababa, Ethiopia from May to October 2012, the majority were <30 years old (51.0%) and male (86.8%). Forty-one percent of injuries occurred from road traffic accidents (RTAs). A significant number of patients had at least one indicator of severe injury on presentation: 51 (25.0%) had a GCS < 9, 53 (26.0%) had multi-system trauma, 95 (46.6%) had ≥ 1 abnormal vital sign and of the 133 patients with data available, 37 (27.8%) had a revised trauma score (RTA) < 6. Patients injured by RTA were more likely to have indicators of severe injury than other mechanisms, including multi-system injury, GCS < 9,

≥ 1 abnormal vital sign or an RTS score <6. In general, 149 (73.0%) patients were discharged from hospital, 34 (16.7%) were transferred to another hospital, and 21 patients died (10.3%). In multivariable analysis, death was highly associated with age over 60 years, GCS < 9, fixed bilateral pupils and hypoxia (oxygen saturation <90%)(24).

3. Objectives

3.1 General objectives

-To assess pattern and outcome of traumatic brain injuries in Addis Ababa Burn, Emergency And Trauma/AaBET/Hospital From May 01/2021 To July 30/2021

3.2 Specific objectives

- To describe the socio-demographic characteristics of traumatic brain injury .
- To describe the common causes of traumatic brain injury
- To determine the outcome of traumatic brain injury.

4. METHODS AND MATERIALS

4.1 Study area

This study was conducted at Addis Ababa Burn, Emergency and Trauma/AaBET/ Hospital. AaBET Hospital is part of Saint Paul's hospital millennium medical college which was established in 2015 which is found in Addis Ababa, Ethiopia. As there is no well-organized

functional Emergency and trauma center hospital in Ethiopia, AaBET Hospital leads a way for the Hospitals probably to build as emergency and trauma centers and in fact it is contributing a significant role for the growth of the Emergency and critical care department as well.

The Hospital contains well-structured emergency department with more than 50 beds and organized to red, yellow & green areas, intensive care unit (ICU) with equipped 11 beds including 02 semi-ICU beds, and 130 beds at inpatient departments of orthopedics, neurosurgery, general surgery and burn unit. In AaBET hospital, more than 30,000 patients are being seen per year. Out of these more than 70% are trauma cases. The hospital provides comprehensive Emergency care in 24 hours per day and 7 days per week in Emergency medicine and critical care, orthopedics, neurosurgery, general surgery and burn. It also provides compressive laboratory and imaging services like x-ray, ultrasound and CT scan.

4.2. Study period &duration of study

This study was done in Addis Ababa Burn Emergency and Trauma /AaBET/Hospital from February 01/2021 to July 30/2021 and the duration was from February 01/2021 to September 30/2021.

4.3. Study design

Hospital based cross-sectional study was conducted in Addis Ababa Burn, emergency and trauma/AaBET/hospital

4.4 Population

4.4.1 Source Population

The source populations were all trauma patients who were seen in Addis Ababa Burn, emergency and trauma/AaBET/hospital in the study period.

4.4.2 Study population

The study population were all TBI patients seen in Addis Ababa Burn, Emergency and Trauma/AaBET/hospital in the study period.

4.5 Eligibility criteria

4.5.1 Inclusion criteria's

All TBI patients who were seen in AaBET hospital during data collection period.

4.5.2 Exclusion criteria

- Patients with TBI who were categorized as death on arrival or dead body on arrival are excluded in the study

- All TBI patients who came to AaBET hospital and referred to other hospitals before having the necessary investigations.
- All TBI patients who came to AaBET hospital but went home against medical advice without having the necessary investigations.

4.6 Sampling technique and sample size

Systematic random sampling Was used which included all TBI patients who were seen in AaBET hospital from February 01 /2021 to July 30/2021 and who fulfilled the inclusion criteria.

But the minimum sample size for the study was determined using population proportion formula because the proportion of TBI was not known and there was no similar study done previously.

$$n = \frac{(Z_{\alpha/2})^2 P(1 - P)}{d^2}$$

Where

- n =required sample size
- $z_{\alpha/2}$ =critical value =1.96(normal standard deviation usually set at 1.96 which corresponds to the 95% confidence interval)
- d =precision (marginal error) =0.05
- p-is taken as 50% from a similar study done in a tertiary hospital, Nnewi , Nigeria, as the proportion of TBI in AaBET hospital is unknown.

$$n = \frac{(1.96)^2 0.5(0.5)}{0.05^2} = 384$$

Since the source of population was 3,000, which is below 10,000, population correction formula was used to determine adjusted minimum sample size

Where;

$$n_f = \frac{n}{1 + \frac{n}{N}} = \frac{384}{1 + \frac{384}{3000}} = 344$$

n = initial sample size (384)

N = Total number of source of population (3000)

n_f = minimum sample size

Then adding 10% drop out= $344 \times 10/100=378$. Therefore, the final sample size for this study was 378.

4.7. Study variables

4.7.1 Independent Variables

Age	Brain CT finding
Sex	Intubation
Mechanism of Injury	Time of neurosurgical operation
Co-Morbidity	Type of Neurosurgery
Mode of transport	Length of Stay at the ED
Triage category	GCS
Pupillary abnormality	

4.7.2 Dependent variables

Traumatic brain injury (Death /Discharge)

4.8 Operational Definition

- ✓ Glasgow coma scale-is the most common scoring system used to describe the level of consciousness in a person sustained an accident associated with TBI
- ✓ traumatic brain injury-any injury to the head associated with any loss of consciousness or confusion/alter sensation and/or documented clear neuropathology (e.g. hemorrhage or fracture seen on CT)
- ✓ mild TBI-patients with TBI with GCS of 13-15
- ✓ moderate TBI –patients with TBI with GCS of 9-12
- ✓ Sever TBI-patients with TBI with GCS of less than or equal to 8.
- ✓ Intensive care unit-is a special department of a tertiary hospital for patients with the most severe and life threatening conditions which will often require constant and close monitoring, support from special equipment and medications in order to maintain normal physiological functions.
- ✓ Dead body on arrival-TBI patients who arrived to hospital without clinical sign of life or dead at the field or on the way to hospital.
- ✓ Death on arrival-TBI patients who arrived to hospital with clinical sign of life but died within one hour of hospital arrival.

4.9. Data collection

A structured questionnaire in English language, which was taken from a study done in TASH, modified and prepared was used to collect the data. The necessary data were collected using the questionnaire from emergency department trauma registry and from patients chart.

4.10. Data quality control

The questionnaire was pretested in 5% of the total sample two week ahead of starting the data collection. The purpose and significance of the study, explanation of the questionnaire and procedure of the data collection was done by the principal investigator to the data collectors before the data collection begins to avoid any source of error. The investigator supervised the data collection process so that the data collectors can forward any issue during the data collection.

4.11. Data analysis

The collected data was entered, cleaned, edited and analyzed by using spss25.0 version statistical software. Descriptive analysis of categorical variables were reported as numbers, and percentages and continuous variables with means and standard deviations. Multiple logistic regression analysis was done to assess the relation of the independent variables with TBIs outcome. The type of injury and outcome of injury was analyzed by Pearson x2 test.

Finally, variables with p-value <0.05 after controlling confounders will be retained as independent factors.

4.14. Ethical clearance

The hospital admission was informed about the purpose of the study, anticipated benefits, selection criteria, and data collection procedures and a written legal ethical clearance regarding the study was obtained from St. Paul's hospital millennium medical college IRB. Confidentiality of participants was kept during the study and during dissemination of the result.

5. RESULTS

5.1. Socio-demographic characteristics of study participants

A total of 402 Traumatic Brain Injury patients were participated in this study. Fifty two of them had incomplete chart, 44 of the charts were not available, 3 were dead body on arrival and another 3 were dead on arrival. From the total of 300 patients who full filled the inclusion criteria, Two hundred fourteen (81.3%) of them were males and the mean and median age of participants were 29.4 ± 17.4 and 27 years respectively. Within the range of 8 -80 years. One hundred thirty-one (43.7%) of study subjects were between 16-30 years old. One hundred seventy six (58.7%) of study participants came from Oromia regional state. [Table 1](#)

Table 1: Socio-demographic characteristics of Traumatic Brain Injury

Variables	Category	Frequency	Percent
Sex	Male	244	81.3
	Female	56	18.7
age	<16	45	15.0
	16-30	131	43.7
	31-45	68	22.7
	46-60	35	11.7
	>60	21	7.0
Address	Addis Ababa	90	30.0
	Oromia	176	58.7
	Amhara	25	8.3
	SNNP	6	2.0
	Other	3	1.0

Other indicates Afar, Dire Dawa, Somali and Sidama

5.2. Pattern and Mechanism of Traumatic Brain Injury

As illustrated in Table 2, One hundred fourteen (38.0%) of patients had RTA, 56(18.7%) of them had FDA, 104 (34.7%) of them had interpersonal violence and 26 (8.7%) of had other causes of injury. Out of a total of 114 cases of RTA, Ninety-nine (86.8%) of study subjects had motor vehicle type of RTA.

Table 2: Pattern and Mechanism of Traumatic Brain Injury of Patients

Variables	Category	Frequency	Percent
Cause of trauma	RTA	114	37.9
	FDA	56	18.7
	Interpersonal violence	104	34.7
	Other	26	8.7
Type of RTA	Motor vehicle	99	86.8
	motor cycle	14	12.3
	Bajaj	1	0.9
Circumstance of trauma	Pedestrian	80	69.6
	Passenger	26	22.6
	Driver	9	7.8

Other indicates that Gunshot and hit by a falling objects.

5.3. Clinical characteristics of study participants

As demonstrated in Table 3, severity of trauma was assessed using vital sign abnormality, GCS and revised trauma score. Around 224 (74.7%) of study participants had mild TBI, 54 (18%) of them had moderate and 22(7.3%) had sever TBI. Two hundred eighty-one (93.7%) of study subjects had revised trauma score greater than six. Regarding pupillary abnormality, 277(92.3 %) of patients had a normal pupillary reaction to light which was followed by 18(6.6%) of study subjects had anisocoric pupils.

Table 3: Clinical characteristics of study participants

Variable	Category	Frequency	Percent
Glasgow coma scale	13-15	224	74.7
	9-12	54	18.0
	<9	22	7.3
Pupillary Abnormality	normal	277	92.3
	Anisocoric	18	6.0
	Bilaterally nonreactive	2	0.7
	Other	3	1.0
Revised trauma score	<4	1	0.3
	4-6	18	6.0
	>6	281	93.7

5.4. Mode of arrival and duration of presentation to Emergency Department

As demonstrated in the Table; as high as 178 (59.3%) of the patients arrived to AaBET by ambulance and the rest were by public transport, private car and other mode of transport. Most, 246 (82.0%) of study subjects came with referral. Of the referred patients, 33(12.7%) of them came with communication. Among the referred patients, 180 (72.9%) of them were from government hospitals followed by health centers which accounted for 51 (20.6%). Concerning duration of arrival to Emergency Department, study participants were arrived with a mean time 1.45 day and SD of 2.06 day.

Table 4: Mode of arrival and duration of presentation to Emergency Department

Variables	Response	Frequency	Percent
Mode of transport	Ambulance	178	59.3
	Contract taxi	25	8.3
	Private care	33	11.0
	Other	64	21.3
Referred	Yes	246	82.0
	No	54	18.0
Referred with communication	Yes	33	12.7
	No	227	87.3
Referred From	Health center	51	20.6
	Government hospital	180	72.9
	Private Hospital	16	6.5
Duration of arrival	Mean $\pm$ SD	1.45 $\pm$ 2.06	

Other indicates on foot, public transport and brought by police

5.5. Brain CT findings and course of management of Traumatic Brain Injury

In this study 226 (75.3%) of patients had Brain CT abnormality. As illustrated on figure 1, from the total of patients who had brain CT abnormality, skull fracture (linear DSF& BSF) was the most common 137(33.0%) followed by intracerebral lesion (DAI, contusion & ICH) which accounted for 138(33.2%). Sixty-nine (23.0%) of study subjects were intubated. Out of the intubated patients, 48(69.6%) of them were intubated for airway protection and 21(30.4%) of them were intubated for respiratory failure. The rest were not intubating due to the absence of indication which accounted for 228(98.7%) and 3(1.3%) of them were deferred due to poor prognosis.

(Table 5).

Table 5: Brain CT findings and course of management of Traumatic Brain Injury

Variable	Response	Frequency	Percent
Brain CT abnormality	Yes	226	75.3
	No	74	24.7
Patient intubated	Yes	69	23.0
	No	231	77.0
Indication for intubation	Airway protection	48	69.6
	Respiratory failure	21	30.4
	Has no indication	228	98.7
Reason not intubate	Deferred	3	1.3
	Antibiotics	2	0.7
Treatment	Phenytoin	114	38.0
	Multiple treatment	114	38.0
	Analgesics	70	23.3

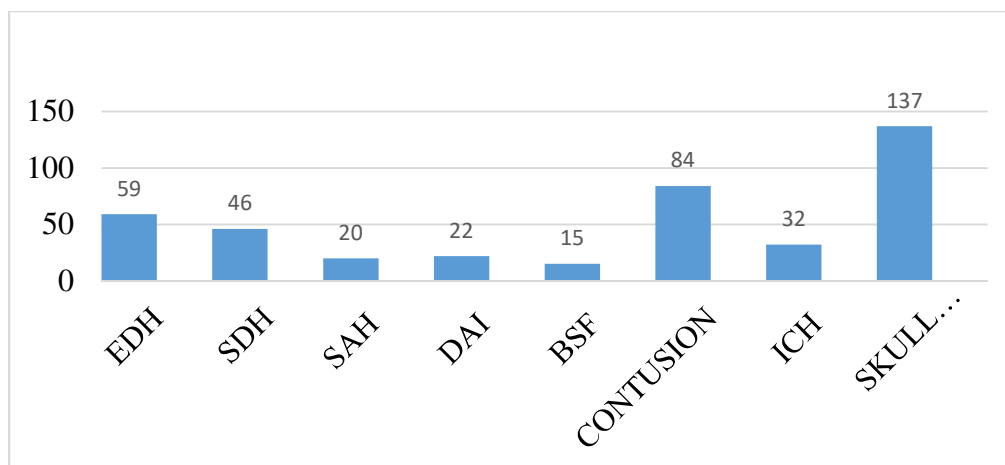


Figure 1: BRAIN Computed Tomography findings

5.6. Multisystem Injury of Study participants

In this study 9(26.5%) of patients had Spinal, 9(26.5%) polytrauma and 9(26.5%) of study participants had chest injury. Similarly, upper and lower extremity injuries were 3(8.8%) each. The rest had abdominal injury (2.9%) (Figure 2).

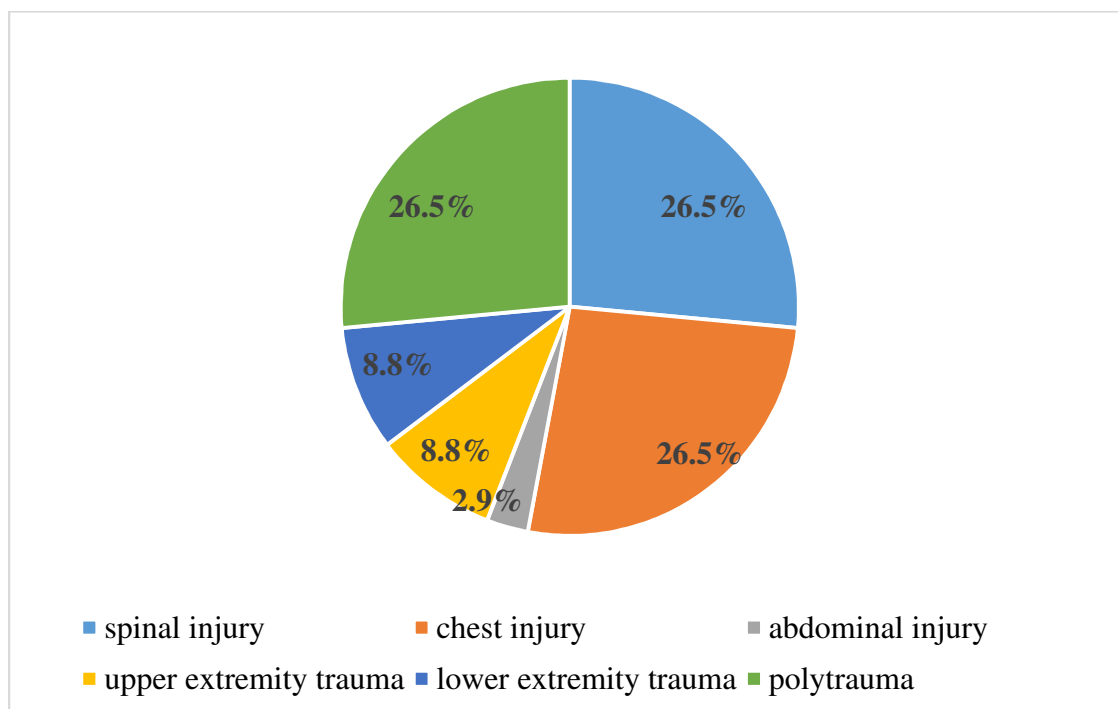


Figure 2: Multisystem Injury of Study participants

5.7. Severity of Trauma and Neurosurgical Intervention

As illustrated in Table 6, From the 93 patients who had neurosurgical intervention, based on severity, Among the operated cases, the higher number of cases were mild TBI (65.5%), followed by moderate TBI 22(22.5%) and sever TBI 11(12.0%). This finding also demonstrated that there is statistically significant association between severity of TBI and Neurosurgical Intervention ($\chi^2(2) = 6.771$; $P=0.034$).

Table 6: The association of severity of the trauma with neurosurgical intervention of TBI patients presented to AaBET hospital

		Glasgow coma scale			χ^2	DF	P-value
		13-15,	9-12,	<9,			
Neurosurgical intervention	Yes	61(65.6%)	21(22.6%)	11(11.8%)	6.771	2	0.034
	No	163(78.7)	33(15.9)	11(5.3)			

It was found that, 93(31%) of them had neurosurgical intervention; 39(41.9%) elevation, 32(34.4%) decompressive craniotomy & evacuation, 12(12.9%) burr hole, 10(10.8%) had evacuation, craniotomy & elevation. Other procedures like cranialization & duraplasty were also done for 54(21%) of patients. Neurosurgical intervention was done for 30(50.8%) of patients with EDH, 24(52.1%) of patients with SDH, and 67(48.9%) of patients with skull fracture cases. In general, from those who had neurosurgical intervention, the majority of them were males (n=84, 90.2%).

Table 7: Association of brain CT finding with severity of TBI

Brain CT finding	Glasgow coma scale		
	13-15	9-12	<9
EDH	46(78.0)	11(18.6)	2(3.4)
SDH	25(54.3)	7(15.2)	14(30.4)
SAH	5(25.0)	10(50.0)	5(25.0)
DAI	2(9.1)	10(45.5)	10(45.5)
BSF	15(100.0)	0(0.0)	0(0.0)
CONTUSION	53(63.1)	26(31.0)	5(6.0)
ICH	14(43.8)	14(43.8)	4(12.5)
Skull Bone Fractures	100(73.0)	29(21.2)	8(5.8)

After patients were kept in the ED, around 58.8% were disposed within 24 hours, another 22.6% were disposed within 24-72 hours, and others 17.9% were disposed after 72 hours of stay. From the total patients, 198(66.6%) of them were kept in the ED and discharged home despite the length of stay, 80 (26.7%) were admitted to neurosurgical ward, 15(5%) were admitted to AaBET ICU, 6(2%) were referred to another hospital and 1(0.3%) dead. see Figure 3. From the total of 300 patients, 10 (3.3%) of them died. The common causes were brain herniation 5(50%), multi-organ failure 3(30%), and 2 (20%) were due to other causes.

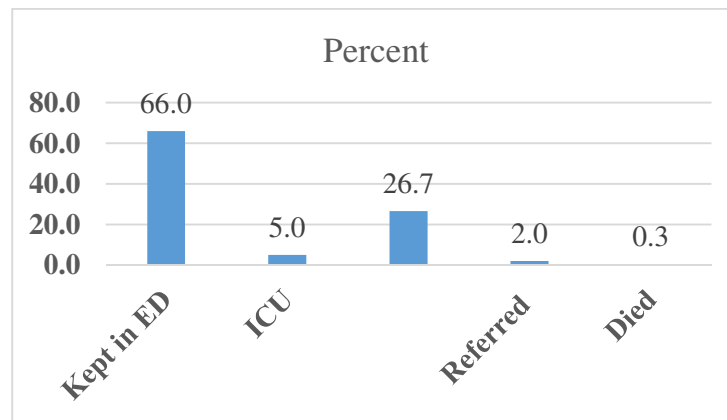


Figure 3:24 Hours Disposition of TBI patients at AaBET

5.8. Factors associated with outcome of traumatic brain injury

Using binary logistic regression, a few variables such as: triage category, GCS, revised trauma score, vital sign abnormality and pupillary abnormality were selected for multivariable analysis with p-value less than 0.25. As shown in table 8, in final multivariable logistic regression analysis; GCS was associated with poor outcome. Patients with low GCS were more likely to develop adverse outcome than those who had higher GCS (AOR=0.029; 95% CI 0.002, 0.379).

Table 8: Multivariable logistic regression of associated factors among TBI patients

Variables	Category	TBI		COR	95% C.I. for COR		AOR	95% C.I. for AOR		P-value
		Discharged	death		Lower	Upper		Lower	Upper	
Triage	Red	32(76.2)	10(23.8)	40.000	8.388	190.739	7.493	0.824	68.136	0.074
	Orange/Yellow/Green	256(99.2)	2(0.8)	1						
Glasgow coma scale	9-15	277(99.6)	1(0.4)	0.004	0.000	0.030	0.029	0.002	0.379	0.007
	<9	11(50.0)	11(50.0)	1						
Revised trauma score	≤6	11(57.9)	8(42.1)	50.364	13.148	192.918	4.576	0.711	29.440	0.109
	>6	277(98.6)	4(1.4)	1						
Pupillary abnormality	Normal	274(98.9)	3(1.1)	0.017	0.004	0.070	0.163	0.014	1.953	0.152
	Abnormal	14(60.9)	9(39.1)	1						
Vital Sign abnormality	Yes	106(93.0)	8(7.0)	3.434	1.010	11.677	0.174	0.014	2.218	0.178
	No	182(97.8)	4(2.2)	1						

1 indicates references

6. DISCUSSION

Traumatic brain injury (TBI) is a major cause of mortality and morbidity(12,21,24–26).In this study the mean age was 29.4 ± 17.4 years. This result is comparable with a study done in Ghana(28 ± 17)(20).In this study, young aged males were the most common victims of TBI with 81. % of cases being male ,making male to female ratio of 4.3:1.This result is similar with the study done in Ayder(4:1) (23). Around(43.6%) of participants were were found in the age group of 16-30 years but 22% were found in the age group of 31-45 years and age less than 16 years were 15.0%.This result is similar with the study in Uganda(42.5%)(22).This might be attributed to the existing culture that males are mainly engaged in outdoor activities including work & social gathering while women spend most of their time indoors, and may have limited outdoor activity. Males may travel more and show more aggressive behavior which leads them to be involved in fighting and road traffic accidents. The major cause of trauma was RTA (37.9%), of which 86.8% was MVA and majority were pedestrians, followed by interpersonal violence (34.6%) and FDA (18.6%). This is similar with the prospective cohort study in Tikur Anbessa specialized hospital emergency Centre (TASH-EC), the majority were <30 years old (51.0%) and male (86.8%)(24). Forty-one percent of injuries occurred from road traffic accidents (RTAs).This result is lower than studies done in Saudi Arabia, Pakistan and India but is higher than a study done in Norway(15,17–19,24). There are similar findings in similar studies done in England, Pakistan, Ghana, Tanzania and Uganda(4,19–21). The impact of RTAs on Africa has been noted to be related to a lack of road safety standards and regulation of elements such as helmets, which can lead to increased severity(24). The other explanation could be due to the absence of tight rules and regulations on acquiring driving license and also the absence of traffic light. The second most common cause for Traumatic brain injury in this study was found to be interpersonal violence (34.6%).Violence has been related to poverty, substance Abuse including alcohol & political condition of the country. This needs further study as it turns out to be another important cause of injury. In contrary to this result, the second most common cause was FDA in study done in Norway, Oslo(15) & Ayder hospital Mekelle (41.9%)(23).

Fifty-four (18.0%) of the cases were presented directly to AaBET ED without referral. Most of the patients (59.1%) presented to AaBET with ambulance, followed by private car (11%) & contract

taxi (8.3%), but the ambulance utility was lower than the study done in England & Wales which is 74%.

From the total 114(38%) had one or more vital sign abnormality, GCS < 22(7.3%), Multisystem injury 34(11.3%), revised trauma score < 6 19(6.3%) and pupillary abnormality 18(6.6%). This result is significantly lower than study done in TASH(24). The possible explanation for this could be, the referral of more severe cases to TASH.

Among all the cases, 224 (74.7%) of them had mild TBI, followed by 54(18%) moderate & 22(7.3%) severe TBIs, and 90% of severe TBI cases were males with less than half (41%) of them were caused by RTA. This result is similar with the studies done in Tanzania(21) & Ayder(23). While in the Saudi Arabian study, majority (56.6%) of the cases were severe TBIs(17). The intubation rate was 23% which is significantly lower than that of a study done in England(86%)(4). This could be due to limited number of ventilators in this hospital.

Regarding the brain imaging, skull fracture (45.5%), brain contusion (27.9%), EDH (19.6%) and SDH (15.3%) were the most common findings. Around 11.3% of all the cases had other site injury which is similar to a study done in India but lower than similar studies in TASH(24). Thirty one percent (31%) of all the cases had neurosurgical intervention, which is comparable to the study done in Ayder (33.5%), but this is significantly higher than the study done in India(18) and TASH(24). Elevation for depressed skull fracture was the most common procedure done (41.9%), followed by hematoma evacuation and most of the patients had mild TBI on presentation which is similar to the study done in TASH(24).

Among all the cases, 66% discharged, 26.7% admitted to neurosurgery, 5% were admitted to ICU, 2% transferred to other hospital and 1% dead. This finding is lower than the study in TASH in which the discharge rate was (75%). From the study it's observed that, the majority of patients were discharged mainly from the ED, which may be resulted from our poor disposition protocol, which has a significant influence for the turnover of ED patients and the whole function of the system. The death rate in this study is (4%) which is lower than that of Ayder(23) & TASH(24). In the majority of the studies, young male pedestrians with RTAs were the common victims with death. According to multivariate analysis the factor which correlated with poor prognosis was lower GCS (AOR: 0.029; 95% CI: 0.002-0.0379). This result is similar with the study done in India, Tanzania, Uganda, Ayder and Tikur Anbessa (18,21–23).

7. Limitations

This study was carried out in a single referral center in Ethiopia, and therefore has limited generalizability of its findings. As cross-sectional study; cause and effect cannot be made between independent and dependent variables.

8. Conclusion

Road traffic accident is the most common cause of traumatic brain injury and young males are the commonest victims. In addition, low Glasgow coma scale was highly associated with unfavorable outcome of patients.

9. Recommendation

Since most of the TBI cases are due to road traffic crashes, there is a need for appropriate preventive measures to help reduce the frequency of head injury in our population. Public awareness campaigns concerning road traffic safety rules are needed to help reduce the occurrence of road traffic crashes as well as improvement of roads. I also recommend that future researchers conduct similar studies, which involves multiple health institutions.

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11 .ANNEX

ANNEX-I: DATA COLLECTION CHECK LIST FOR TBI CASES

1. MRN :_____
2. Sex: _____
3. Age _____
4. Address A. Addis B. Oromia C. Amhara D. SNNPR E. others, specify_____
5. duration of time to arrive ED after the trauma;
6. what is the cause of TBI;
 - A. RTA d. gunshot injury
 - B. FDA e. hit by falling object
 - C. Assault f. others, specify_____
7. if the answer for question number 6 is RTA, specify the type;
 - A. Motor vehicle b. motor bicycle c. railway d. cart
8. if the answer for question number 6 is RTA, how was the mechanism;
 - A. Pedestrian b. passenger c. driver
9. how was the mode of transport to ED;
 - A. ambulance d. public transport
 - B. contract taxi e. on foot
 - C. private car f. others, specify-----
10. how was the presentation;
 - A. direct without referral c. referred from government hospital
 - B. referred from health center d. referred from private health facility
- 11.If referred, was it communicated?
 11. triage category; a. red b. orange c. yellow d. green
12. vital sign at ED presentation;
BP =_____HR =_____RR =_____ spo₂ = _____
13. GCS at ED presentation;_____
14. calculated revised trauma score(RTAs) at ED presentation;_____

15. Pupils size and reactivity to light; a. right_____
- b. left_____
16. Was the patient intubated? If yes where?
- A. yes, at referring health facility c. yes, in ICU of AaBET hospital
- B. yes, at ED of AaBET hospital d. not intubated
17. If the answer is a-c for question number 16, what was the indication for intubation?
- A. for air way protection b. respiratory failure c. others, specify_____
18. If the answer is D for question number 16, what was the reason?
- A. has no indication b. there was no machine c. due to patient's poor prognosis
19. brain CT scan findings; more than one option is possible;
- A. normal f. linear skull fracture
- B. Epidural hematoma g. depressed skull fracture
- C. subdural hematoma h. basal skull fracture
- D. subarachnoid hemorrhage I. contusion
- E. Diffuse axonal injury j. mention if combined
20. other site injuries other than TBIs, more than one option is possible;
- A. spinal cord injuries, if yes specify_____
- B. chest injuries, if yes specify_____
- C. abdominal injuries if yes, specify_____
21. treatments given in ED; more than one option is possible;
- A. Mannitol F. PHENYTOIN FOR SEIZURE PROPHYLAXIS
- B. ANTIBIOTICS G. OTHER, SPECIFY_____
- C. TETANUS ANTI TOXOID(TAT)
22. length of stay in the ED before admission or referral;_____
23. How was the disposition of the patient from ED?
- A. admitted to ICU d. referred to private hospital

- B. admitted to neurosurgery ward e. went home against medical advise
C. referred to other government hospital f. kept in ED
24. additional medical diagnosis other than TBI; _____
25. Is the neurosurgical operation is done? a. yes b. no
26. if the answer is yes for question number 25, what was the type of surgery;
- A. epidural evacuation d. elevation of DSF
B. subdural evacuation e. others, specify-----
C. Decompressive craniotomy
27. if the answer is yes for question number 25, what was the duration after;
- A. Arrived to hospital b. the incidence
28. If the answer is no for question number 25, what was the reason?
- A. not indicated c. due to patient's poor prognosis
B. Due to lack of or instrument d. other, specify.....
29. how was the outcome of the patient;
- A. died
B. transferred to other hospital with GCS of _____
C. discharged home with GCS of _____
D. went home against medical advice with GCS of _____
30. If the answer for the question number 29 is a, what is the possible cause of death;
- A. increased ICP with brain herniation c. multiple organ failure
B. SEPTIC SHOCK D. OTHER, SPECIFY _____
31. How long was the total duration of stay?