ADDIS ABABA UNIVERSITY SCHOOL OF MEDICINE

DEPARTMENT OF EMERGENCY AND CRITICAL CARE MEDICINE

RETROSPECTIVE STUDY OF CLINICAL TRENDS OF PATIENTS WITH MILD HEAD INJURY PRESENTED TO TIKURANBESA SPECIALIZED HOSPITAL EMERGENCY ROOM

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The full title of the research project	**Retrospective study of the clinical trend of Patients with Mild Head Injury Presented to Tikur anbesa Specialized Hospital Emergency Room**
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Contents

Acronyms And Abbreviation

AAU- Addis Ababa university

CCHR- Canadian CT Head rule

CT - computed tomography

GCS- Glasgow coma scale

ICU- Intensive care unit

JUSH- Jimma university specialized hospital

MHI- mild head injury

NOC- New Orleans criteria

PR- pulse rate

RR- respiratory rate

SBP- systolic blood pressure

SCI-spinal cord injury

TASH- Tikur Anbessa specialized hospital

TBI- traumatic brain injury

Abstract

Background-Clinical information collected at baseline can be useful in knowing the clinical trends of mild head injury. One of the constraints of managing mild head injury patients is the availability and proper use of computed tomography scans. This clinical trend can be used to identify patients who need imaging after mild head injury. As a sub analysis, we compared the Canadian head computed tomography rule with the New Orleans criteria to select patients who need computed tomography scans for Ethiopian mild head injury patients.

Objective- The objective of this study is to see the clinical trends and computed tomography scan findings of mild head injury patients.

Method- A retrospective observational study of adult mild head injury patients who were seen at the Tikur anbesa specialized hospital. emergency room from December 2018 to July 2021. The study population was adult mild head injury patients who got head computed tomography scans after evaluation at the Tikur anbesa specialized hospital emergency room. The data will be collected from patients' charts using a structured checklist prepared by the investigator. SPSS software version 26 was used. Bivariate and multivariable logistic regression analyses were performed to identify factors associated with abnormal CT scan findings. P-value < 0.05 was used to declare statistical significance.

Result- patients met the criteria for this study and analyzed**.** The highest frequency of head injury occurred in the 20 to 29 age group (49.2%). The incidence of mild head injury was higher in males 166(86%). mild head injury patient tends to come slightly more at night shift (51%). the most common referral source was self-referral (39.9%). The number of abnormal CT scan findings seen was 58(30.1%). The most common CT scan finding was skull fracture 44(75.8%). sensitivity of CCHR and NOC rule is 100% and CCHR has higher specificity than NOC rule. Being male, regional referral source, tachycardia, and falling down mechanism of injury were found to be a predictor of abnormal CT scan findings.

Conclusion: The clinical trends of MHI patient is very important to determine the eligibility of mild head injury patients for CT scan.

Keywords: mild head injury, clinical trends, computed tomography

Dissemination of result

The findings of this study will be disseminated to the federal ministry of health, federal ministry of education, Addis Ababa University, department of emergency medicine and critical care, Ethiopian road authority, and other responsible stakeholders and policymakers. They will be communicated about the results and recommendations. The results will also be disseminated throughout the scientific community after publication.

CHAPTER 1- INTRODUCTION

1.1 Background

A mild head injury is a major public health problem worldwide. Especially in developing countries like Ethiopia, it bears upon a great deal of impact on the country's economic, social and political aspects. Even though the impact is evident worldwide, Head injury data are difficult to compare internationally for multiple reasons. This is because there are inconsistencies and complexities of diagnostic coding, inclusion criteria, case definition, and so on (1). Despite this according to World Health Organization In 2019 worldwide 5.2 million people died because of trauma, from this 90% of deaths occurred in developing countries. In 2020 trauma was the sixth most common cause of death worldwide (2). Amongst humans, the young male population is more affected than the female counterpart. It is also a major cause of morbidity and mortality. According to WHO's report Trauma-related mortality is more than the sum of death caused by HIV, malaria, and TB in Africa (2). These reports demonstrate the extent of the impact of mild head injury.

Head injury can occur through numerous mechanisms. One of the major mechanisms that cause mild head injury is RTA. This is consistent throughout the world. The incidence of RTA is increasing in Ethiopia because of economic growth and industrialization. But it is not getting the focus it needs to get. Other mechanisms of injury include fall-down accidents, fighting injuries, motor vehicles accident, blast injuries, sport-related accidents (3).

CT scan is a major investigative modality in detecting brain injuries. CT scan is a safe and reliable investigative modality, but it is expensive and the radiation exposure is harmful to the patient. Using CT scan we can diagnose skull fracture, brain contusion, brain edema, midline shift, intracerebral, and extracerebral bleeding, and so on. Because it is very important for the decision of surgical intervention There is no question regarding the appropriateness of CT scans for moderate and severe head injury patients. When it comes to mild head injury it is controversial. Most CT scan results in MHI cases tend to be normal. So, ordering a CT scan for such patients is arguable. That is why there are lots of well-validated criteria to get a head CT

for a mild head injury patient (4,5,6,7,9,11,14-16,18-20,22-24,27). The most commonly used and well-validated rules are CCHR and NOC rules. The role of all these guidelines is to decrease the cost and radiation exposure of patients. Like other studies, in this study, the used CT scan technique is skull base to vertex sequential axial slice 10 mm apart. The results were read by a radiologist.

Most MHI patients are managed conservatively. Merely some of the patients need surgical intervention. More often than not, Treatment of head injury in Ethiopia encounters a lot of obstacles that need to be surmounted. For instance, pre-hospital care is poor. The government transport system is not well established and trained manpower in pre-hospital care is few. The private sector transport system is expensive and lacks the requisite qualities or resources to meet a task. The in-hospital care for head injury is unsatisfactory, because the emergency department is understaffed and no adequate infrastructure, no adequate OR tables, and ICU care to carry the burden of head injury. post-discharge rehabilitation centers are also not adequate (9). unless we come up with a solution these deep-rooted problems will continue to cause the loss of a young and oil-bearing part of the population. This will in turn impinge the economic, social, and political aspects of the country.

1.2 Statement Of Problem

Trauma care for head injury patients has a significant difference between high-income countries and low-income countries like Ethiopia and most Ethiopian hospitals do not have CT scans. So patients are sent to get a head CT scan at private centers which is costly and in some cases it is unnecessary. TASH has two CT scans and one of the CT scans is used for emergency and the other one for outpatient care. Once or twice a year the CT scan will encounter damage from overutilization and it cease functioning. the patient will be sent outside to private diagnostic centers. There are no criteria that are well suited to order ct scan for mild head injury patient in our setup. It solely depends on the clinical judgment of the clinician. The clinician's judgment is highly affected by fear of medicolegal litigation. This affects the care given to our patients.

1.3 Significance of The Study

The identification of clinical trends and their association with unnatural CT scan findings of head injury patients seen in the emergency room will help in the prioritization and appropriate use of scarce resources. This research will help in finding The determinants of positive CT scan findings for Ethiopian patients who will be subjected to further intervention. It will also contribute to the literature provision of CT scans used in head injury patients in Addis Ababa. It also compares our patient's clinical presentation and ct scan finding with the Canadian head ct rule and new Orleans criteria for ordering head ct scan. it will help in the development of criteria for ordering CT scans in low socioeconomic status countries like Ethiopia as there is no research done in Ethiopia that tried to see eligibility of mild head injury patients for CT Scan. It will be a helpful source to come up with new or modified criteria that are suited for our population and situation.

CHAPTER 2-LITERATURE REVIEW

2.1 Globally

A head injury can be defined as any alteration in the mental or physical functioning of the brain or skull related to a blow to the head. Globally head injury accounts for one of the major reasons to visit emergency units, hospital admission, or death in combination with other injuries or alone (7). a clinically important brain lesion is defined as an acute traumatic lesion found on CT that would normally require admission to hospital and need neurological follow-up unless the patient is neurologically intact & has one of these lesions on CT scan. solitary contusion less than 5 mm in diameter, localized subarachnoid blood less than 1 mm thick smear, subdural hematoma less than 4mm thick, isolated pneumocephalus, or closed depressed skull fracture, not through the inner table (14).

According to many studies done in the USA and UK, the most commonly affected part of the population is young males. The most common mechanism of injury is a road traffic accident. (7,9,11,14-16,18-20,22-24,27). But in Norway, the most common mechanism of injury is fall-down accidents according to one study. (20) CT scan has shown to be a very important investigative modality in head injury patients. the benefit of CT scan is undeniable for

moderate and severe head injury patients. the line is blurred when it comes to a mild head injury (8). The place of guidelines in ordering head CT scan in the head trauma patient is one of the measures on which we need to base our management (2). Since the past two decades use of CT scan for head injury patient is increasing in the United States of America (18). different researches used different guidelines to assess the benefit of ordering CT scans in MHI as most of the controversies emanate from this. A study done in the USA by Linda papa et al compared the sensitivity and specificity of CCHR with NOC and they found that both have extremely high sensitivity for detecting clinically significant brain injuries. But the specificity is higher for CCHR than NOC in detecting significant head injury and the need for neurosurgical intervention (7,9,11,14-16). the reason why we need guidelines for ordering CT scans is to decrease unnecessary exposure of a patient to the CT scan (1). approximately 1 in 3 CT scans performed for head injury may be avoidable (11). The positivity of CT scan is different from institution to institution. according to a study done in Netherland, CT yield is 20% (16). A study done in the USA by Mahren kisat showed a CT yield of 29.2% (23), the study was done by Linda et al USA which showed a 7% CT yield (11). The study done by brain J Yun showed a 7.4 % positive CT yield. (27) almost all literature agrees not to use CT scans of the head for low-risk mild head injury patients (7,9,11,14-16). There was a study done in the USA by Mahren et al which showed predictors of positive head CT scan. these include old age, young male, history of fall, mechanism of injury. (23).

Lots of initiatives are ongoing to decrease CT scan use in mild head injury patients without a clear clinical indication (7,9,11,14-16,18-20,22-24,27). Most of the research which stated the importance of head CT scan in mild head injury wanted to know which criteria is the best so the ordering physician will have no problem in practicing targeted head CT use (6). Choosing wisely campaign was one of the currently advocated protocols that aimed at decreasing unnecessary head CT use. (8). another study that supports the use of CCHR was done in the USA by Adam et al. they showed the use of CCHR has decreased unnecessary use of CT scans (11,19). Another study compared using clinical parameters and skull x-ray with CT scan imaging based on the NICE guideline. (14) It showed there is no significant change in sensitivity between them. despite this guideline CT use has increased in the emergency department. this was not cost-effective (7). in most hospitals in developed countries number of CT scans ordered is a lot. despite the implementation of guidelines, 84.5 % of patients who

sustained mild head injury got CT scans according to a study done in Netherland. Most head Ct scan in mild head injury is normal (16). There is a gap in adherence of ED providers in ordering head CT scan following head CT rules or guidelines (8). Another study also showed Head CT use along with diagnostic yield has remained stable from 2012 to 2013 among pts presenting to the ED for injury-related visits (18). This study also advocates the use of validated decision rule in guiding physicians ordering head CT scan for mild head injury patient so that it will be based on indications and evidence (7,9,11,14-16,18-20,22-24,27).

In general, the best way to order a CT scan is to combine the clinical manifestation of a patient with the clinical judgment of a physician. It is also important for the patient to know the danger signs and have a follow-up. (11)

2.2 Africa

Most researches done in Africa showed the commonest clinical manifestation to be a headache (10). Other clinical manifestations seen include loss of consciousness, amnesia, seizure, scalp laceration, epistaxis, and so on.

Globally, road traffic accidents are a major cause of death and disability. The developing countries bear a disproportionately large share of the RTAs which account for about 85% of the deaths. Most of these RTAs result in head injury, which globally, most scholars and medical practitioners consider a significant economic, social and medical problem. In Mulago National referral hospital, RTA is the leading cause of surgical admission (10).

A retrospective study done in South Africa by Chuma Singita et al from 2012 to 2014 tried to show whether computed tomography of the head vindicated in patients with MHI presenting with GCS of 15/15 or not. (21) the radiology department at Groote Schuur Hospital (GSH) in the Western Cape of South Africa undertakes several such scans annually. Of these scans, many are undertaken for post-trauma patients with MHI. This research was done to add evidence to the controversy regarding sending CT scans. from 460(100%) patients who got CT scans 320(69.6%) were normal and 140(30.4%) were abnormal. From these 140 abnormal CT scans findings, 107(23.3%) was clinically insignificant. 33(7.2%) images were clinically significant of which 22(4.8%) were brain contusions and 11(2.4%) were skull fractures. None of them got the urgent neurosurgical intervention. They concluded that CT head scanning in

patients with MHI and GCS scores of 15/15 can safely be delayed for 8 h. the aim was to ensure that this scarce resource is used cost-beneficially for all head-injured patients. (21)

Another retrospective study done in Uganda by Geoffrey Erem et al in 2017 studied clinical and cranial computed tomography scan findings in adults following road traffic accidents in Kampala, Uganda. The prevalence of abnormal CT scans in mild head injury is 13.9% (10). Their objective was to see CT scan findings in a patient who sustained a head injury because of RTA. The study was done on 178 patients. They studied their Sociodemography, clinical manifestations, and CT scan finding. Their finding was that the young population is more affected and 52% of patients sustained open head injury. The commonest CT scan finding was extra-cerebral hemorrhage their conclusion was public health interventions like advocacy and education of the population on safe and responsible road usage should be emphasized to reduce on RTAs. (10)

Another prospective study done in Nigeria by Samuel c. Ohaegbulam et al studied CT finding in head injury patients in Enugu teaching hospital in Nigeria from Jan 2009 to April 2010. The choice of radiological investigations in head trauma in Africa is influenced by factors such as cost. Some patients who require computed tomography (CT) scans elsewhere are either managed blindly or do not present for it at the appropriate time. The article evaluated 204 CT scan imaging(171 new and 33 follow-up cases. Most are moderate to severe head injury patients. Adult males are the most to be affected.80.1% of CT findings were abnormal.in 7% of cases, CT diagnosis and indication were un-matching and 13% had more than one finding. The most common finding was SDH. 64 % of them required neurosurgical intervention. The overall mortality rate was 11.1 % and the mortality rate of abnormal CT findings was 13.9%. Their conclusion was the high yield and diversity of CT scan findings in head trauma patients support the indication for the appropriate use of CT in the diagnosis and management of head trauma even in developing countries. (4)

Another one-year prospective study done in Nigeria by AA Adeyekun et al showed computerized tomographic patterns in patients with a head injury at the University of Benin teaching hospital (36) head injuries rank high among morbidities due to trauma. Computerized tomography is an important modality in the investigation of these cases. The study was done on 100 patients. Their finding showed Young male patients are the most commonly to be affected, intracerebral hemorrhage was the commonest finding. Their

conclusion was CT plays a very significant role in the management of head injuries, as demonstrated in this study, by making such diagnoses that guided eventual patient management. So Regular use of CT in moderate to severe cases of head injury is advocated. (13)

2.3Ethiopia

There are some studies done in our country which focused on epidemiology, etiology, mechanism of injury, CT scan finding, and outcome of head injury patients. But there is a gap in ordering CT scans to a specific type of patients like mild head injury patients. The other crack seen in our health system is not having a guideline in ordering CT scans for MHI. There is no external validation of the Canadian head CT rule, and New Orleans criteria, or other criteria for that matter. There is also a gap in awareness and use of CT scans among physicians in using CT scans for mild head injury patients.

A 4-month prospective study was done in Jimma, Ethiopia by Isabel Aenderl from March-June 2010 on analysis of Head injuries at Jimma University Specialized Hospital, Ethiopia (15). According to this research Trauma, especially head trauma, is an expanding major public health problem and the leading cause of death of the young and productive part of the Jimma towns population. This study intended to analyze head injury in a context where a majority of patients in low- and middle-income countries receive treatment, a referral hospital with general but no neurosurgical service like Jimma University Specialized Hospital. They include all adult head trauma patients who presented within the specified time and their epidemiology clinical manifestation and management were studied. This study evaluated 52 patients of which half of the patients sustained a mild head injury, 47 were male and the median age was 20, most common mechanism of injury was fighting injury. The initial GCS has a significant association with the outcome. overall mortality rate was 21.1%, and 76.9% of them managed conservatively. They concluded that Prevention of road traffic accidents and improvement of conservative care were identified as major methods to reduce the burden of head injury in a set-up similar to Jimma. This tells us the importance of Further studies on head injury patients in low-income countries. (17)

Another prospective study done in TASH Ethiopia Addis Abeba in TASH emergency room by Megan lands et al studied Epidemiology, clinical characteristics, and outcomes of head-

injured patients in an Ethiopian emergency center (6). They characterized the epidemiology and outcomes of a head injury at an Ethiopian emergency center. They evaluated 204 patients with head injury patients and followed them until discharge or death or transfer or 7-day hospital stay. They have found 51% of patients are <30 yrs old, males are predominantly affected, RTA's most common cause of injury. The severity, morbidity, and mortality indicators of head injury found were age>60, One or more abnormal vital signs, RTS <6, polytrauma, GCS < 9, hypoxia, fixed bilateral pupil size. They Concluded Head injury represents a significant risk for morbidity and mortality in Ethiopia, of which RTA's increase injury severity. Targeted approaches to improving the care of the injured may improve outcomes. (6)

Another prospective study was done in TASH, Addis Abeba Ethiopia by Tequam Debebe et al. from March 2016 to August 2016 showed CT scan patterns and correlation between imaging findings and mechanism of injury in Traumatic Head Injury patients. They included all head injury patients that are seen in that specified time. The result of this article showed most common to be affected are young males, RTA is the most common mechanism of injury, and skull fracture is the most common finding. They concluded Appropriate clinical information is crucial for planning evaluation. The study reinforces the necessity of expanding CT service and concerted effort to reduce RTA (3).

CHAPTER 3- OBJECTIVES OF THE STUDY

3.1 general objective

To assess clinical trends and head CT scan findings of mild head injury patient

3.2 Specific objectives

To identify clinical presentation of mild head injury patients.

To identify CT scan findings of mild head injury patients.

To compare the Canadian head ct rule and the new Orleans criteria

CHAPTER 4- METHODS

4.1 study area and period

Addis Ababa is the capital and largest city of Ethiopia. The city is divided into 11 sub-cities and 116 weredas. The annual growth rate from 2019 was a 4.4% increase. currently, there are 30 general hospitals in the city out of which 8 have government ownership and only half of them have a functional CT scan. The remaining 22 are under private and nongovernmental organization properties. There is an increasing number of private imaging diagnostic centers where the head CT scan without contrast costs from 1500 ETH Birr to 2500 Eth Br. In TASH the cost of a CT scan is 500 birrs only.

The study hospital is one of the government hospitals in Ethiopia known as Tikur Anbesa specialized hospital. It was established in 1972 G.C. it is the largest referral hospital in the country with 700 beds and a teaching hospital for fellowships, residents, and undergraduate medical students. it has a total of more than 500,000 visits per year. The emergency room framework is triaging area, front where patients are clerked, waiting area, green, yellow, and red. the emergency has its laboratory and imaging center nearby which are dedicated only for emergency patients. It has one CT scan. The surgical unit has one emergency OR table, one neurosurgery table. The ED staff composes ED physicians, nurses, ER residents, interns, medical students, nursing master's students, and consultants from other departments. The study will be conducted on patient medical records that are seen from December 2018 to July 2021.

4.2 Study design

A retrospective study will be conducted to identify the clinical trend and CT Scan findings of mild head injury patients in TASH in Addis Ababa.

4.3 Population

4.3.1 Source population

All patients who sustained a head injury and were seen at TASH emergency room from December 2018 to July 2021 G.C.

4.3.2 Sample Size Determination

Using the proportion of 20% for prevalence of abnormal ct scan finding in MHI from an observational study done at a clinical emergency unit of a TASH in Ethiopia,

Where;

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

Zα/2 = critical value for normal distribution at 95% confidence interval= 1.96 (α = 0.05).

P = Proportion = 20%

d = margin of error= 5%

n = required sample size

So, n = $\frac{(1.96)^2*(0.2)\ (1-0.2)}{(0.05)^2}$ =246

Therefore, the total required sample size is 246. using sample reduction formula, the sample size was determined based on a study population as follows:

nf=n/(1+n/N)

where nf= sample size included in the reviews

N= study population.

With an incomplete chart expected as 5%, the final sample size will be 193.

4.4 study variables

4.4.1 independent variables

- socio-demographic characteristics of a patient
- triaging time
- referral mode and place
- NEWS score
- chronic medical illness
- mechanism of injury
- length of stay in ER
- clinical presentation
- physical examination findings
- distracting injuries
- trauma score

4.4.2Dependent variables

- CT Scan findings
- Meeting the CCHR rule
- Meeting the NOC rule

4.5 ELIGIBILITY CRITERIA

4.5.1 Inclusion criteria

All adult mild head trauma patients who had head CT scan

4.5.3 Exclusion criteria

Mild head injury Patients with significant(more than 20%) incomplete medical record

Mild head injury Patients who don't have a ct scan

Mild head injury patients who have disappeared before disposition plan

4.6 DATA ANALYSIS

Descriptive statistics, including counts (percentages), means (standard deviations), medians ranges, and 95% confidence intervals (CIs) are reported as appropriate. Comparisons between

groups were performed using the Chi-Square for proportions and Student's T-test for continuous variables, as appropriate to the distribution of the data. Independent variables with a p-value <0.05 will be Chosen to be run through binary logistic regression analysis to dig out the variable associated with the outcome of interest. In the final multivariate analysis, Two-sided p-values < 0.05 were considered significant.

4.7 Operational Terms And Definitions

ADULT- a person whose age is greater than 13 yrs. old.

FALL DOWN ACCIDENT- is the action of a person losing their footing and ending up on the lower level or the ground which is nonfatal.

HEAD CT SCAN is a medical imaging technique that uses computer-processed combinations of multiple X-ray measurements taken from different angles to produce a cross-sectional image of the head.

HEAD INJURY-any alteration of brain or skull related to a blow to the head.

GLASSGO COMA SCALE- is a clinical scale that is used to assess a patient's level of consciousness after a head injury. It is graded out of 15. There are 3 classes. Mild (13-15), moderate (9-12), severe (3-8).

MIDLINE SHIFT-it is a shift of the brain past its centerline that is evident on ct scan.

ROAD TRAFFIC ACCIDENT- is an accident involving at least one vehicle on a road open to public traffic in which at least one person is injured or killed.

SKULL FRACTURE- is a break in one or more of the eight bones that form the cranial portion of the skull, usually occurring as a result of blunt force trauma that is seen on ct scan.

4.8 Ethical consideration

After submission of this research proposal and getting a written paper from the AAU School of Medicine Ethics Review Committee for informed consent, it will be given to the hospitals` heads, heads of emergency medicine department, and other responsible bodies. After permission is granted, the data collection process is completed. Since the card includes the

name of the patients; confidentiality will be maintained by excluding any identification found on the card.

CHAPTER 5- RESULT

Of the 205 patients originally included in the study 12 patients did not meet the inclusion criteria on reassessment and were excluded from further analysis. They had significant missing data on history and neurological examination. So, the total number of patients analyzed was 193 patients.

5.1 Demographic Characteristics

The mean age of the entire series was 31.62 with a standard deviation of 12.69. the median age was 27. the modal age was 22. the age range was from 15 yrs. old to 80 yrs. old. The highest frequency of head injury occurred in the 20 to 29 age group (49.2%) followed by the age group 30-39 yrs. Old (20.7%), 40-49 years old (9.3%), 15-19 yrs. old (8.3%) and the least incidence was observed in patients whose age is 60 and above (5.2%). (figure 1).

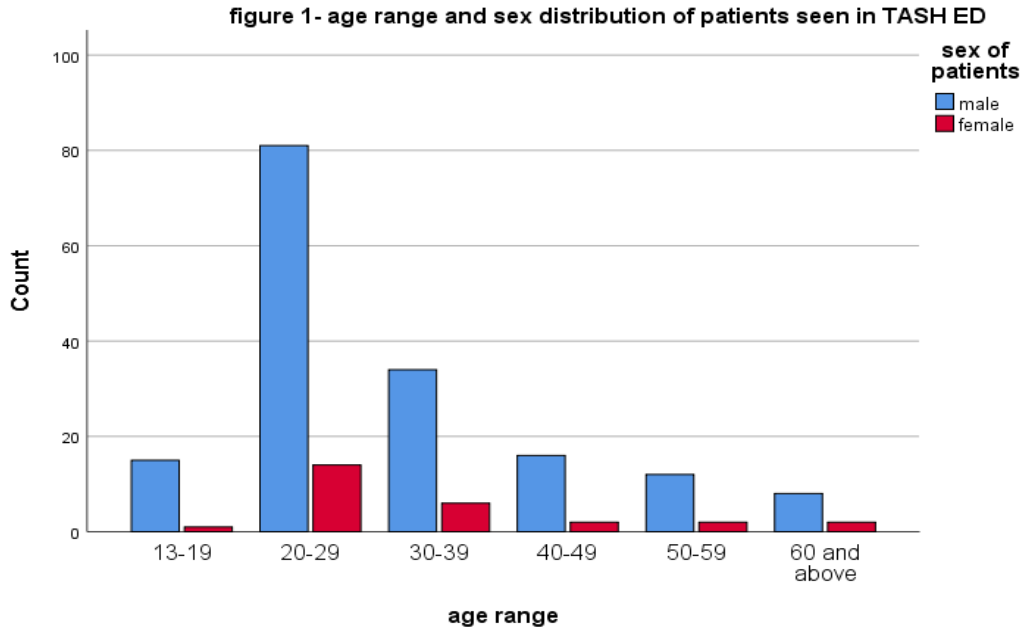

Figure 1 age range and sex distribution of patients seen in TASH ER

The incidence of mild head injury was higher in males 166(86%) than in females 27(14%). The overall male to female ratio was 6.1:1. (figure 2)

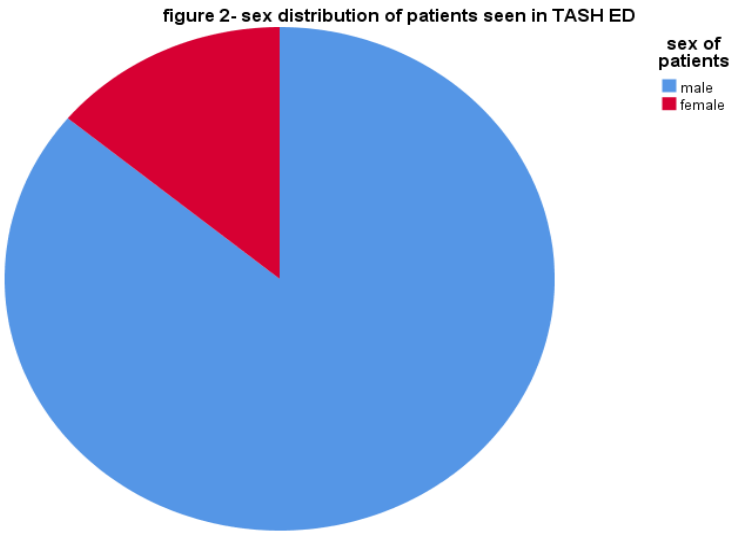

Figure 2 Sex distribution of patients seen in TASH ER

Mild head injury patient tends to come slightly more at night shift which ranges from 6 pm to 8:00 am accounting for 51.3% than day shift 46.1% and undocumented time 2.6% (Figure 3). The most common referral source was found to be self-referral (39.9%) where the patient come without any referral paper, followed by regional hospital referral (32.6%), from Addis Ababa city health centers (11.4%), a government hospital in Addis Ababa (8.3%), brought by police (6.7%) and the least was a referral from private centers (1%). Regarding mode of arrival, most patients come to the hospital on a taxi (46.6%), followed by ambulance (31.6%), walking (8.3%), by a police car (7.3%), undocumented mode of arrival (6.2%).

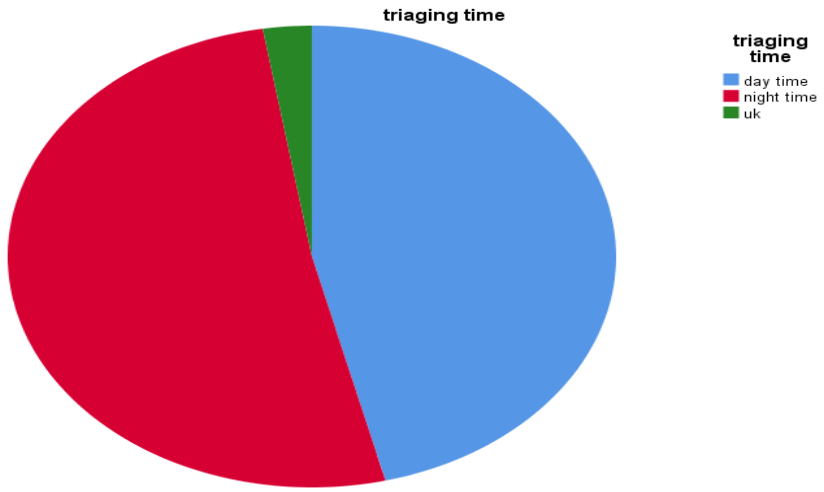

Figure 3 triaging time of MHI patients

The mean Early warning score for mild head injury patients was 3.55 with a standard deviation of 1.65. the median early warning score was 2 and the mode was 3. The minimum NEWS Score was 1 and the maximum was 8. Higher NEWS SCORE observed in a patient with associated distracting injuries. Most patients were kept in the yellow zone (45.6%), followed by orange (26.9%), green (25.4%), red (2.1%). The average length of stay in the emergency room for mild head injury was 2.06 days with a standard deviation of 1.925 days. The median length of stay was 2 days and the mode was 1 day. the minimum length of stay is 8hrs and the maximum length of stay was 10 days. The reason behind these was delayed imaging with CT scan, a delayed consultation, and a delayed neurosurgical decision, associated distracting injuries resulting in uncoordinated multidisciplinary teamwork, and some patients had to go a long distance to go to their town.

5.2 mechanism of injury

The commonest cause of mild head injury was a road traffic accident (45.1%), followed by fight injury (37.8%) and fall accident (14.1%). From the road traffic accident, most of the victims were pedestrians (48.3%) followed by passengers in the car (26.4%) and the driver itself (25.3%)

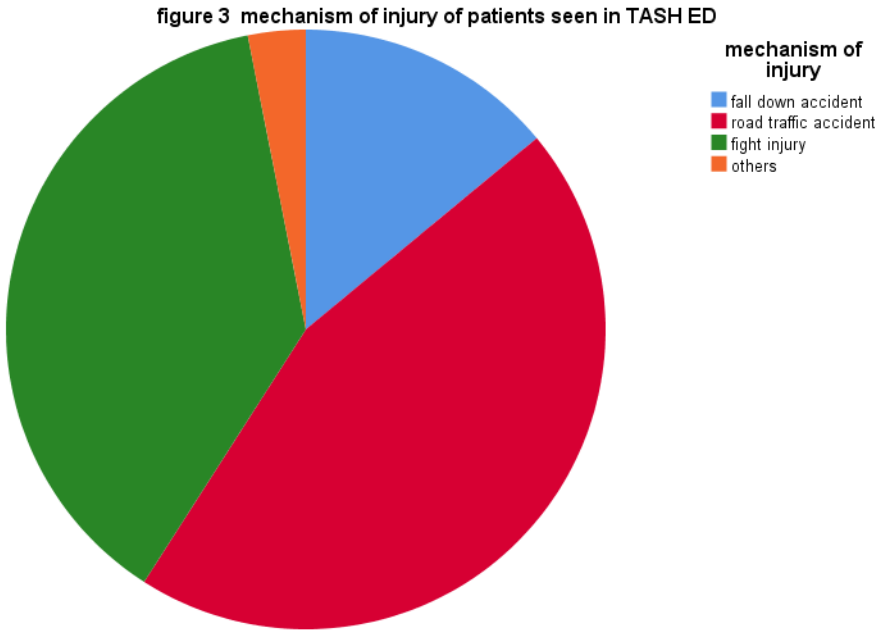

Figure 4: mechanism of injury of patients seen in TASH ED

5.3 clinical manifestation

The most common symptom seen in this study was headache observed in 136 patients (70.5%), followed by scalp laceration 119(61.7%), history of loss of consciousness 108(56%), nausea and vomiting 29(15%), epistaxis 17(8.8%), otorrhea 12(6.2%), rhinorrhea 1(0.5%), fecal incontinence 6(3.1%), urine incontinence 6(3.1%), change in behavior 7(3.6%), amnesia 5(2.6%), neck pain 4(2.1%), abnormal body movement 3(1.6%). (See table 1). mild head injury patients who were intoxicated with alcohol accounted for 26(13%). Most mild head injury patients do not have comorbidities (93.8%), commonest comorbidity seen was hypertension (3.6%) 0f the patients followed by the unspecified psychiatric patient (1.6%), diabetes Meletus (0.5%).

Table 1: clinical presentation of MHI patients

Clinical presentation	Count	Percentage
Headache	136	70.5(AOR=1.73, P-VALUE=0.041)
Vomiting	29	15
Fecal incontinence	6	3.1
Urine incontinence	6	3.1
Scalp laceration	119	61.7
Loss of consciousness	108	56
Seizure	2	1
Otorrhea	12	6.2
Rhinorrhea	1	0.5
Amnesia	5	2.6
Change in behavior	4	2.1
Epistaxis	17	8.8
Neck pain	4	2.1
Alcohol intoxication	26	13

5.4 physical examination

On physical examination, the mean pulse rate was 90.2 beats per minute with a standard deviation of 17.756. tachycardia was observed in (28%), bradycardia in (4.1%), and normal heart rate in (67.9%) of patients. The mean respiratory rate was 20.25 breaths per minute with a standard deviation of 3.8 breaths per minute. Tachypnea was seen in (65.3%), normal in (34.7%). The mean systolic blood pressure was 124 with a standard deviation of 1.699. increased systolic blood pressure > 130mmhg was observed in (35.2%), normal systolic blood pressure in (63.7%) and decreased systolic blood pressure < 90 mmHg in (1%). The mean diastolic pressure is 75.26 mmHg with a standard deviation of 12.698 mmHg. Elevated diastolic blood pressure > 90 was observed in 20(10.4%), normal diastolic blood pressure in 161 (83.4%), and decreased blood pressure in 12(6.2%). The mean oxygen saturation was 93.8% with a standard deviation of 2.74 %. Hypoxia was seen in 17(8.8%) especially in those who have associated chest injury. Normal oxygen saturation was observed in 176(91.2%). The patient who has a normal temperature was 190(98.4%) and only 3(1.6%) of patients were febrile (table 2). A total of 19(9.8%) patients had localized motor weakness,12 (6.2%) had a sensory deficit, 3(1.6%) had a pupillary abnormality. Cranial nerve abnormality was seen in 3(1.6%) of patients, and neck tenderness was observed in 19(9.8%) of patients. The majority of patients presented with a normal GCS score of 15 177(91.7%), followed by 12(6.2%) GCS of 14 and 4(2.1%) GCS of 13. Most patients had a trauma score of 12 accounting for 186(96.3%) followed by a score of 11 accounting for 7(3.7%).

Table 2: physical finding of MHI patients

Physical Finding	Unit Of Measurement	Count	Percentage	AOR	p-value
Pulse rate	Beats per minute				
	Normal (60-100)	131	67.9		
	Bradycardia (<60)	8	4.1		
	Tachycardia (>100)	54	28.0	1.67	o.oo1
Respiratory rate	Breath per minute				
	Normal (12-18)	67	34.7		
	Tachypnea (>18)	126	65.3		
Systolic blood pressure	In mmHg				
	Normal (60-130)	123	63.7		
	Elevated (> 130)	68	35.2		
	Low (< 60)	2	1		
Diastolic blood pressure	In mmHg				
	Normal (60-90)	161	83.4		
	Elevated (>90)	20	10.4		
	Low (<60)	12	6.2		
Oxygen saturation	In percent				
	Normal (90 and above)	176	91.2		
	Hypoxic (<90)	17	8.8		
temperature	Degree silicious				
	Normal (35.5-37.5)	190	98.4		
	Febrile (>37.5)	3	1.6		
Glasgow coma scale					
	15	177	91.7		
	14	12	6.2		
	13	4	2.1		
Pupillary reflex	abnormal	3	1.6		
Motor examination	Abnormal	19	9.8		
Sensory examination	abnormal	12	6.2		
Cranial nerve examination	Abnormal	3	1.6		
Neck tenderness	abnormal	19	9.8		

5.5 distracting injuries

Distracting injuries that occurred with mild head injury patients accounted for 69(35.8%). From this, the most common was lower limb and pelvic fracture 33(17.1%), followed by chest trauma 22(11.4%), upper limb fracture 16(8.3%) abdominal trauma 7(3.6%), facial bone

fracture 4(2.1%). Polytrauma was seen in 16(8.3%) .spinal cord injury accounted for 14(7.25%). The most common was lumbar spinal cord injury seen in 7(3.6%) patients, followed by cervical spine injury 6(3.1%), thoracic spine injury 1(0.5%). All of them were referred to another hospital for vertebral bone fixation.

Table 3: distracting injuries in MHI patients

Distracting Injuries		Count	Percent	AOR	P-Value
Overall incidence		69	35.8		
Lower extremity fractures		33	17		
Upper extremity fractures		16	8.3		
Chest trauma		22	11.4		
Abdominal trauma		7			
Polytrauma		16	3.6		
Spinal cord injury		14	7.2		
	Cervical spine	6	3.1		
	Thoracic spine	1	0.5		
	Lumbar spine	7	3.6		
Facial bone fracture		4	2.1		

5.5 CT scan finding

The number of abnormal CT scan findings seen were 58(30.1%) and normal CT scan finding were seen in 135 patients (69.9%). The highest proportion of abnormal CT scan findings was seen in a patient with a GCS of 13 and 14. From abnormal CT scan findings, the most common CT scan finding was skull fracture 44(75.8%), followed by pneumocephalus 26(44.8%), cerebral contusion 23(39.65%), basal skull fracture 22(37.9%), epidural hematoma 10(17.2%), intracerebral hemorrhage 6(10.3%), subdural hematoma 5(8.6%), subarachnoid hemorrhage 1(1.7%). Midline shift was seen in 2(1%). Both of these patients had a subdural hematoma.

The sensitivity of the Canadian head CT rule and New Orleans rule was 100% for detecting abnormal CT scan findings. The sensitivity for CT scan findings that need neurosurgical

intervention is also 100%. The negative predictive value is also 100% for both rules. The specificity for neurosurgical intervention and neurocranial traumatic CT findings was low for the NOC decision rule (55.2%). But higher for the CCHR decision rule (58.8%). The positive predictive value for CCHR is 29.5% and for NOC is 19.8%. If the CCHR decision rule have been used (29.5%) patients would not get the CT scan and if the NOC decision was used, (19.8%) of patients would not get the CT scan.

Table 4: CT scan finding of MHI patients

Ct Scan Finding		**Count**	**Percent**	**Aor**	**P-Value**
Overall ct scan finding	N=193				
	abnormal	58	30.1		
	Normal	135	69.9		
Abnormal ct scan finding(n=58)					
Skull fracture		44	75.8		
Basal skull fracture		22	37.9		
Pneumocephalus		26	44.8		
Subdural hematoma		5	8.6		
Epidural hematoma		10	17.2		
Intracerebral hematoma		6	10.3		
Contusion		23	39.6		
SAH		1			
Meeting CCHR rule (n=136)	Normal ct scan	79	58.1		
	Abnormal ct scan	58	41.9		
Do not meet CCHR rule(n=56)	Normal ct scan	56	100		
Meet NOC rule (n=158)	Normal ct scan	100	63.7		
	Abnormal ct scan	58	36.3		
Do not meet NOC rule (n=36)	Normal ct scan	36	100		

5.7 Outcome

Regarding the disposition of the patient after CT scan finding the most common disposition was discharging the patient 132(68.4%), followed by Neurosurgical intervention 25(13%). 20(10.4%) of the patients were admitted to the neurosurgical ward for observation, 7.8% of patients were referred to another hospital for vertebral bone fixation and 1(0.5%) patient left the hospital against medical advice.

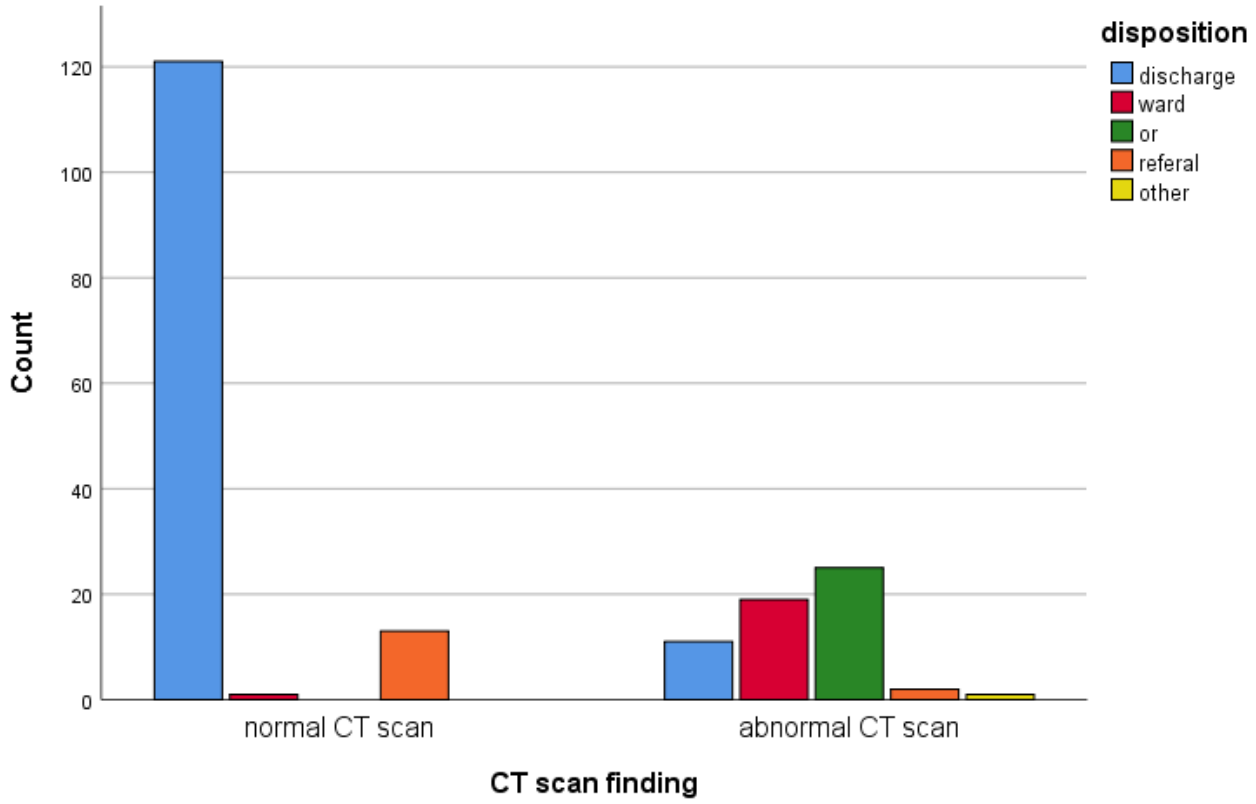

Figure 5: cross-tabulation of CT scan finding and neurosurgical decision

Male tends to have more preponderance to have a positive CT scan finding (AOR=2.03, P-value=0.021,95% CI=O.O1-0.595). Falling accidents showed to be a predictor of abnormal CT scan findings (AOR=4.12, P-Value=0.038). This could be because most fall down accident patients fell from height > 3 meters. Patients who have headache tends to have an abnormal CT scan finding (AOR=1.73, P-Value=0.041).

CHAPTER 6 DISCUSSION

It is not a secret that Traumatic brain injury (TBI) ranks top as a cause of morbidity and mortality throughout the world and Mild TBI accounts for the vast majority of all TBIs (1-5,8-13,18-22,25-27). A similar impact of MHI was observed in this and other studies done in Ethiopia. Mild head injury is a major health burden especially when proper evaluation and management is not done. It imposes a substantial social, clinical, and economic burden on individuals and the health care system in the country. This study is the first to solely focus on and assess MHI patients' epidemiology, mechanism of injury, clinical presentation, and CT scan findings. It offers insight into acknowledging the breadth and depth of the existing TBI literature. In a study done in Jimma Fifty percent of all the head injury patients presented with a mild head injury in comparison to about 80% to 90% in high-income countries (11,14,16,19,22,23,27). This study finding (67%) is lower than high-income countries and higher than Jimma (17). A possible explanation is a difference in The health-seeking behavior threshold for mild head injury and the difference in socioeconomic status.

Annually, thousands of people worldwide suffer head injuries, especially young males (4). In this study, 86% of the patients were males (sex ratio=6.1:1=male: female). The predilection for young males aged 20-40 years as seen in this study had been previously reported by several authors (1-6,10,13,17,21,26). This high predisposition of young people is not unexpected, as they constitute an active and adventurous group that is more likely to be involved in accidents (1-6,10,13,17,21,26). However, it is important to note other studies that reported increasing involvement of children and adolescents in head injuries, presumably due to falls. This is a piece of bad news for a country like us as the injury or death of young members of the population causes social and economic difficulties because they are often the breadwinners of the whole family.

According to a study done by Tequam et al. as a review of emergency neurosurgical cases at TASH in 2010 showed a median time of three days to neurosurgical consultation for an emergency. This study showed the mean length of stay until a neurosurgical decision is 2 days. This difference could be explained by the study setup as this study's area is only emergency rooms while the previous study included ward and pediatric patients. The other reason could

be the number of residents of neurosurgery has increased significantly compared to 10 yrs. back and the availability of functional CT scans in the hospital could also be another factor.

The most common source of referral was found to be self-referral (39.9%) followed by regional hospital referral (32.6%). This could be explained by good health-seeking behavior in people who live in urban residences than rural areas which were seen in a study done at Debre Markos referral hospital. It also tells the importance of prehospital care in triaging patients before the patient directly comes to a tertiary level trauma center as it will contribute to unnecessary overcrowding. A study done by Adeleye et al. in Nigeria showed patients who are referred from other regional hospitals tend to have abnormal CT scans.

Most patients who come to TASH arrive in private cars and taxis (46.6%). A similar finding was reported by Tequam et al. study and it can be assumed that there is a huge gap in providing prehospital care in the last 10 yrs. A study was done in Jimma University Hospital also showed most patients reach the hospital by rented public minibusses, carried on a stretcher by attendants or on foot. This shows poor prehospital care and transportation due to lack of infrastructure and rescue service which impacted the care given to head injury patients.

Agreeing with the World Health Organization (WHO)estimates that the African region has the highest RTA-related mortality rate in the world (24.1 per 100,000 population vs. 10.3 per 100,000 in Europe). This study showed the two major causes of injury were road traffic accidents (45.1%) and interpersonal fights (37%). This finding was similar to other studies done in Addis Ababa, Kenya, Uganda, Nigeria, South Africa, Ghana, and India (1-6,10,13,17,21,26). the depicted reason to be related to a lack of road safety standards and regulation of elements such as speed reduction and the use of protective equipment such as helmets, which can lead to increased incidence of RTA. This finding signals an alarming indication of the RTA burden. but the most common cause of TBI is different in the study done in Jimma(17) and Debre Markos(4) where the most common cause is fight injury. This could be explained by the difference in the study area, the sociocultural variance, the number of vehicles in a given area, and the urbanization. Regarding fight injury, a study done in Jimma recommends teaching de-escalation skills as a cheap method to prevent injury in the region. This research can confirm the recommendation of Ayana et al. (17) with restriction.

In this research, patients who sustained a head injury from road traffic accidents had a relatively lower initial GCS compared to patients who sustained a head injury from an interpersonal fight. This finding was similar to the study done in Addis Ababa, Jimma, Nigeria, and India (1-6,10,13,17,21,26). This may be directly related to a relatively higher energy impact hitting the head. Thus, it appears that the focus on trauma prevention in countries like Ethiopia should mainly be on road traffic accidents. An interdisciplinary action embracing legislation and law enforcement, road users, and road planners is mandated to work on the prevention of road traffic accidents. Injury prevention is based on education, enforcement, and engineering.

As for Comorbidities in patients with MHI, only a few of them had comorbidities and this finding was similar to a study done in Addis Ababa (3,6), Jimma (17), and Canada (9,16). The commonest comorbidity seen in this study was hypertension (3.6%). But the sample size is too small to generalize.

Concerning Clinical presentation, in this study, the most common clinical presentation of MHI is a headache. this was observed in other studies done in Ethiopia, Nigeria, Tanzania. Initial GCS and pupillary reaction have been identified as valid abnormal CT predictors in this study like in many other studies (1-6,10,13,17,21,26).

In Ethiopia, studies have shown that Alcohol intoxication is one of the strongest predictors of TBI, and a substantial proportion of TBIs occur in intoxicated individuals. A small amount may worsen the effects of brain injury. It can cause unsteadiness and dizziness which may lead to a fall and further injury. This study result is similar to the finding of the Jimma study. This could be because of similarities in the socio-cultural aspect of the study area.

Destructing injuries have been shown to have an association with MHI. Fracture of the lower limb and pelvic area other than skull fractures were identified as the most common further injury in this and other studies from Benin (13) and turkey(12). For example, motor impairment of a limb caused by an inadequately treated fracture can lead to a disability and reduction of workforce affecting a whole family. Thus, a thorough physical examination and treatment of associated fractures are a relevant part of the management of head injury patients.

This study showed that, from 193 patients who had a mild traumatic head injury with a GCS score of 13 up to 15 at presentation, 58(30.1%) had clinically significant CT head scan findings. skull fracture was the most common significant positive findings in 44(75.8%)and other common findings were pneumocephalus, contusion, and basal skull fracture. These findings are similar to several previous studies. (3)

Eighty-seven percent of all the patients were managed conservatively. This finding was higher compared to a study done in Jimma(77%). One reason for this high percentage is that we focused only on MHI patients while other studies focus on head injury patients including moderate and severe head injuries. (17)

Ohaegbulam et al. found out that in their research on CT scan findings in head injury patients in a hospital in Nigeria, the frequent use of CT scan reduced mortality (16). But this research showed that this may not be always true for MHI pt. rather it showed one fourth to one-third of the patient didn't need to get a CT scan. So, this study strongly supports the use of internationally validated decision rules with some modifications.

The patients who fulfill these well-validated decision rules should profit from the limited resources to ensure effective allocation. This is only possible with knowing indicators to predict abnormal CT scan findings (23). These abnormal CT predictors are very useful when it comes to difficult decisions in the everyday work of a doctor in a similar set-up.

The Ministry of Health has a plan to establish CT scans in multiple hospitals in Ethiopia. This will surely improve the management of head injury patients even though financing and maintenance will be a challenge. At the same time, the development of decision rules is a very important aspect that needs attention. This will help the country regarding the economic impact.

The most frequent CT abnormality seen in a study done in Nigeria, by Ashaleye et al. was intracranial hemorrhage accounting for about 58% of abnormal cases. And the study was done in Addis Ababa and Jimma agrees with our study findings. The variations in findings by these authors can be ascribed to various factors such as patient selection, the severity of the injury, and the mechanism of injury.

A retrospective study done in South Africa by Chuma Singita et al from 2012 to 2014 tried to show whether computed tomography of the head justified in patients with minor head trauma presenting with Glasgow Coma Scale 15/15 or not (21). From 460(100%) patients who got CT scans 320(69.6%) were normal and 140(30.4%) were abnormal. This finding is almost equivalent to our study finding. To decrease unnecessary exposure to radiation they developed Kimberley Hospital Rule (KHR) for decision. This rule served them well for MHI patients in the Western Cape catchment area.

A study done in the USA by Linda papa et al compared the sensitivity and specificity of CCHR with NOC and they found that both have extremely high sensitivity for detecting clinically significant brain injuries. But the specificity is higher for CCHR than NOC in detecting significant head injury and the need for neurosurgical intervention (7,9,11,14-16). approximately 1 in 3 CT scans performed for head injury may be avoidable (11). A similar finding was seen in our study. This may show the external validity of this research. But further research is warranted.

There was a study done in the USA by Mahren et al which showed predictors of abnormal head CT scan. these include old age, young male, history of fall, mechanism of injury (23). Except for old age, this research also showed similar predictors of abnormal ct scans. This difference regarding old age could be explained by the small sample size of our study, the difference in the life expectancy, presence of comorbidities, use of anticoagulants in this specific age group.

Lots of initiatives are ongoing to decrease CT scan use in mild head injury patients without a clear clinical indication (7,9,11,14-16,18-20,22-24,27). This study also advocates the use of validated decision rule in guiding physicians ordering head CT scan for mild head injury patient so that it will be based on indications and evidence. In general, the best way to order a CT scan is to combine the clinical manifestation of a patient with the clinical judgment of a physician. It is also important for the patient to know the danger signs and have a follow-up. (11)

6.1 limitation

Variables such as length of LOC and other clinical presentation were not clearly mentioned and the mode of injury was not always documented. The sample size was smaller than many similar studies. different patient demographic and socioeconomic factors may play a major role in the different outcomes which makes it difficult to generalize to the greater population in Ethiopia. This study was confined to the CT scan reports of patients presenting to a single tertiary hospital. It is a retrospective study.

CHAPTER 7 RECOMMENDATION

Currently, patients presenting post-trauma with normal GCS scores to the emergency room at TASH are imaged urgently in the face of CT scan scarcity. In the light of the findings of this retrospective study where it showed unnecessary CT scans in 20-30% of MHI patients, we recommend a large prospective study. We also need to formulate a comprehensive policy and criteria for radiologic imaging of MHI patients as CT head decision rules have proved effective in other countries with reliable sensitivity and specificity.

Competing interests

The author declares that he has no financial or personal relationships which may have inappropriately influenced him in writing this paper.

Author contributions

Y.W was the primary author and was responsible for the research proposal protocol, literature review, data collection, and compilation of the research manuscript. T.B. and Y.F. were the supervisors and assisted with the project design, review, study analysis, and manuscript editing.

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ANNEX-QUESTIONER

1. Identification number----------
2. age ----------
3. sex
    - Male
    - Female
4. Triaging time
    - Day time (8 am-11:59 pm)
    - Nighttime(6pm-7:59am)
5. Referred from
    - Self-referral
    - Health center
    - From private centers
    - From regional hospital
    - Gov't hospital in Addis Abeba
    - Others(specify)----------
6. Mode of arrival
    - Walking
    - By ambulance
    - By taxi
    - Brought by police
    - Others----------
7. NEWS score----------
    - Black
    - Green
    - Yellow
    - Orange
    - Red
    - Others--------
8. Length of stay in ED----------
9. Chronic medical illness
    - Cardiac illness
    - Diabetic Mellitus
    - Stroke
    - hypertension
    - COPD
    - CKD

- OTHERS-SPECIFY----------
- none

10. Mechanism of injury
    - Fall down accident
        - Height----------
        - Ground-type----------
    - Road traffic accident
        - Velocity ----------
        - Car type----------
    - Fight injury
    - Accidental Struck by----------
    - Stab injury
    - Motor bicycle
    - OTHER-SPECIFY----------
11. Who is the patient if it is RTA?
    - The driver
    - Pedestrian
    - Passenger
    - Other----------
12. Clinical manifestation (can circle more than one choice)
    - Headache
    - change in behavior
    - nausea
    - vomiting
    - epistaxis
    - urine incontinence
    - fecal incontinence
    - neck pain
    - scalp laceration
    - Abnormal body movement
    - Loss of conscientious
    - Extremity motor weakness
    - Otorrhea
    - Bleeding from ear
    - Rhinorrhea
    - Amnesia for more than 30 min
    - Others----------
13. Alcohol use
    - Yes
    - no
14. Vital sign
    - pulse rate----------
    - respiratory rate----------
    - blood pressure----------
    - oxygen saturation----------
    - temperature----------
15. Physical examination
    - GCS----------
    - Pupil size ----------
    - Motor

- Normal
- abnormal

- Sensation
  - Normal
  - abnormal
- Cranial nerve
  - Normal
  - abnormal

- Neck tenderness
  - yes
  - no

16. Distracting injuries
    - NONE
    - Soft tissue injury
    - Upper extremity fracture
    - Lower extremity fracture
    - Chest trauma
    - Abdominal trauma
    - Polytrauma
    - SCI
    - Others-specify----------

17. do they meet the Canadian head CT scan rule(GCS<15,suspected open fx or dsf, s/s of bsf,vomiting > 2, age > 65, amnesia > 30,dangerous mechanism)
    - Yes
    - No

18. do they meet the New Orleans criteria(headache, vomiting, age>60, drug or alcohol intoxication, amnesia, visible trauma above clavicle, seizure)
    - Yes
    - No

19. Collar applied
    - Yes
    - No

20. Ct scan findings
    - NORMAL
    - Skull fracture
    - Basal skull fracture
    - Subdural hematoma
    - Epidural hematoma
    - Intracerebral hemorrhage
    - Contusion
    - Intraventricular hemorrhage
    - Cerebral edema
    - Midline shift
    - C-SPINE FX
    - Others----------

21Trauma score----------

22. Disposition (neurosurgical decision) ----------

- Home
- Ward
- OR
- Others----------