TRAUMATIC HEAD INJURY AND ASSOCIATED FACTORS AMONG PATIENTS WITH MAXILLOFACIAL TRAUMA IN JIMMA UNIVERSITY MEDICAL CENTER FROM MARCH 2020 TO FEBRUARY 2022: A TWO YEAR RETRSOPECTIVE STUDY

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A RESEARCH PAPER TO BE SUBMITTED TO SCHOOL OF GRADUATE STUDY JIMMA UNIVERSITY; DEPARTEMENT OF ORAL AND MAXILLOFACIAL SURGERY, SCHOOL OF DENTISTRY, INSTITUITE OF HEALTH SCIENCE; IN PARTIAL FUILLMENT OF THE REQUIREMENTS FOR SPECIALITY CERTIFICATE IN ORAL AND MAXILLOFACIAL SURGERY

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ABSTRACT

Background: Traumatic brain injury is a physical head injury that leads to loss of consciousness and/or post-traumatic amnesia. Whereas, a maxillofacial trauma refers to injuries of the oro-facial soft tissues, facial skeleton, and teeth. Understanding potential co-presence of traumatic head injury among maxillofacial trauma patient improves overall patient outcomes. However, despite high prevalence co-presence of this clinical scenario in Ethiopia, there is no single published data available in Ethiopia and this study is under taken to establish base line data on this particular clinical scenario.

Objective: This study was aimed to assess the prevalence of traumatic head injury (THI) and associated factors among patients with maxillofacial trauma at Jimma University Medical Center from March 2020 to February 2022.

Methods: Institution based cross-sectional study was conducted from July 7, 2022 to July 21, 2022. Data was collected from 325 (out of a total of 360) medical records of maxillofacial trauma patient cards by using extraction checklist. The data was analyzed by using SPSS version 23 for windows. Multivariate logistic regression analysis was performed identify factors associated with traumatic head injury. Adjusted odds ratio (AOR) with 95% confidence intervals (CI) and p-value of 0.05 were used for significant association.

Results: The results showed that the prevalence of traumatic head injury among maxillofacial trauma patient was 41.52% (135/325). The socio-demographic factors such as being male (OR=3.991, P<0.00), age less than 24 years (OR=4.058, P<0.00), and 25-29 years (OR=3.506, P<0.00) were found positively associated with traumatic head injury. Similarly, the odds of traumatic head injury was nearly six-fold higher in patients who sustained motor bike (OR=6.424, P<0.00), and motor car accidents (OR=5.666, P<0.00).

Conclusion: The results suggested that the prevalence of traumatic head injury among maxillofacial patients was considerably high. Moreover, the results identified that gender (being male) and younger age sustaining road traffic accidents associated with traumatic head injury that varies across facial anatomical location of the injuries.

Keywords: “Traumatic head injury”, “Maxillofacial fractures”, “Ethiopia”.

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LIST OF ABBREVIATIONS AND ACRONYMS

- BP: Blood Pressure
- CSF-R: Cerebrospinal fluid Rhinorrhea
- CSF-O: Cerebrospinal fluid Ottonorrhea
- DAI: Diffuse axonal injury
- Dx: Diagnosis
- DMD: Doctor of Dental Medicine
- ED: Emergency department
- EDH: Epidural Hematoma
- GCS: Glasgow coma scale
- IMF: Inter Maxillary Fixation
- JMC: Jimma medical center
- Mnx: Management
- MCA: Motor Cycle Accident
- MFF: Maxillofacial Fracture
- MVA: Motor Vehicle Accident
- OMFS: Oral and Maxillofacial Surgery
- ORIF: Open Reduction Internal Fixation
- PR: Pulse Rate
- RR: Respiratory rate
- RTA: Road Traffic Accident
- SAH: Subarachnoid Hemorrhage
- S02: Saturation
- SDH: Subdural Hemorrhage
- STI: Soft Tissue Injury
- STR: Soft Tissue Repair
- TBI: Traumatic Brain Injury
- VS: Vital Sign
- US: United states
- UK: United Kingdom
- WHO: World Health Organization.

1. CHAPTER ONE: INTRODUCTION

1.1. BACKGROUND

Traumatic brain injury (TBI) is defined as evidence of loss of consciousness and/or post-traumatic amnesia in a patient with a non-penetrating head injury. Centers for Disease Control and Prevention defined TBI as any head injury caused by perforating or penetrating impairing normal function of our brain. Injury involving head can be classified as skull fracture: depressed compound skull fracture, linear skull open fracture, intracranial injury including diffuse axonal injury, cerebral contusions, epidural hematoma, subdural hematoma, and subarachnoid hemorrhage(1–3). Maxillofacial fractures are defined as any hard or soft tissue injury extending from the frontal to mandible region including dentoalveolar trauma(4,5).

Type of facial fractures are upper face fracture which involve frontal bone and its sinus fracture, midface fracture like zygomaticomaxillary complex fracture (ZMC), Nasorbitoethmoid fracture (NOE), orbital rim fractures, nasal fractures and lower face mandibular fractures (symphysis, parasymphysis, body, angle, ramus, condylar and coronoid fractures). The facial skeleton includes the bones of the maxilla, zygoma, and the bony walls of the nasal cavity, paranasal sinuses, and orbit and the mandible. It is one of the most complex arrangements of curving bony structures in the body and it is commonly involved with head injury. Fractures of the midface are common in head injured patients and CT is invaluable in their assessment(4,6).

Road traffic accidents (RTAs) are responsible for both head and maxillofacial region trauma in a significant proportion of cases. Accidents involving motorcyclists are the most prevalent, affecting male adolescents aged from 15 to 19 years, resulting in a high frequency of head and face injuries. Head injuries occurred more frequently in children aged 0–4 years and unintentional injuries are the leading causes of morbidity and mortality in children and juvenile age patient. Individuals at this age of life are motivated for new references and experiences, leading to risky behavior and exposure to certain injuries(7,8).

Head injury patient may manifest light headiness, abnormal body movement, seizure, confusion, sleepy state, focal weakness, hemiparesis and inability to concentrate. Maxillofacial trauma

patient may show clinical feature of malocclusion (open bite, cross bite), asymmetric face, abnormal gait on mouth opening or closing, difficulty opening and closing the mouth, floor of mouth hematoma, facial height lengthening and widening of facial width, step deformity, crepitation and facial weakness in injury that involve cranial nerve seven. Facial trauma involving nose may have clinical feature of deviated nose including septal deviation and obstructed nasal orifice, septal hematoma, nasal cartilage laceration. Maxillofacial trauma associated with skull base fracture shows clinical sign of raccoon ayes, battle sign, hem tympanum, CSF rhinorrhea and otonorrhea (9,10).

Traumatic head injury (THI) patient may be treated bur hole and craniotomy to evacuate intracranial hematoma that decrease intracranial pressure (ICP) to normal to prevent brain tissue herniation and functional impairment of important center that may include respiratory function, managing post traumatic epilepsy; and elevation of depressed skull fracture, Dural repair, scalp repair to avoid complication from cerebrospinal fluid (CSF) leakage. Most of maxillofacial injuries are treated with open reduction and internal fixation(ORIF) to fix fractured segment anatomically while using occlusion as guidance, inter maxillary fixation(IMF), soft tissue repair(STR), arch bar wire or wire only splinting, bridle wire, eyelet wire, suspension wiring, gunning splint(2,4).

Complication from traumatic head injury include acute complication which is most of the time death, infection from intracranial pressure monitoring devices, amnesia, impaired concentration, hemiparesis and hemiplegia. From a literature review, it appears that the most common complication in maxillofacial trauma is infection or osteomyelitis, malunion, fibrous union and nonunion(2,9,10).

The predictors of outcome in associated traumatic head injury (THI) with maxillofacial trauma have been studied the least. Haug et al. found a 76% incidence of neurologic injury associated with facial fractures. Haug et al. stressed that in case of a trauma to the midface, energy will be directly transmitted to the cranium, causing damage to the brain. In contrast to this theory, many authors have the opinion that no association exists between maxillofacial trauma and brain injury(1,7). Despite the significance of this clinical scenario, there are no published reports on the association of traumatic head injury (THI) and maxillofacial fracture in Ethiopia.

1.2. STATEMENT OF THE PROBLEM

Maxillofacial fracture is often associated with multiple injuries to the cranium, especially following high energy trauma. Facial fractures and concomitant craniocerebral injuries carry the significant potential for mortality and neurological morbidity mainly in young adults and making traumatic head injuries (THI) in patient with maxillofacial trauma (MFT) the major public health concern globally(2,11,12).

There is controversy in available literature regarding the magnitude of THI patient associated with MFT with different authors have dissimilar finding in their report and many literature has questioned if their association is present in real clinical practice(1). The literature reviewed till to date have different report on the magnitude of THI in patient with MFT such that finding in one author reports the percentage of associated THI in MFT patient ranged from 5.4 up to 45.5%, while in other studies the percentage can reach up to 86% or above in more serious MFT case studied (13). The association between THI and MFT is yet to be established firmly in the literature(2). Many of the patients suffering mild brain injuries are oriented by the time they are first assessed and therefore score at the top of the Glasgow scale, which only recognizes patients with mild traumatic brain injury as those with a GCS score of thirteen to fifteen. Usually, conscious patients with a Glasgow Coma Scale (GCS) score of 15 with no clinical neurological abnormalities are not expected to have an intracranial pathology. However, high velocity impact can result in intracranial hemorrhage and 2.8 percent of patient with normal neurologically suffer from intracranial hemorrhage. This poses a problem in developing countries, where usually Glasgow Coma Scale is highly relied on in assessing the severity of brain injury, and as a result, patients with milder forms of brain injury are often times left undetected. Early diagnosis of these intracranial hemorrhage leads to prompt treatment which is essential to improve the outcome of these patients and such events are usually diagnosed late after the patients are refereed for definitive facial fracture management(14,15). Any patient with maxillofacial injury irrespective of whether it is associated with fractures or not is always at risk of traumatic brain injury. Hence, all the patients with maxillofacial injuries should be under neurosurgical observation and regular follow up (2,16). In literature there is a high rate of RTA related MFT seen in Asian, Middle Eastern region, African, and South American countries and also in

countries such as India, Japan, the United Arab Emirates, Pakistan, Turkey, and Brazil show that 36% to 75% of maxillofacial trauma (MFT) were related to RTA. The underlying reasons for that high rate include absence or defects of road traffic regulations and its application, lack of legislation regarding compulsory seat belts and helmet, risky driving, bad road quality, less safety of the vehicles, and increased usage of motor vehicles and cycles(2). The impact of this disease is too much greater in low and middle income countries such as Sudan in which there is a higher risk for it and where health systems are inadequately prepared to address the associated health outcomes(1,12,16). Data comparing gender difference shows most of the time male patients are most commonly seen in THI patient with maxillofacial trauma patients(2).

Maxillofacial trauma presented in patient with THI are tends to be complicated since it may distract clinician attention from managing the worst hidden injuries threatening patient's life and vice versa and cause compromising of one injury while treating the other alone that will have unwanted consequential outcome. Very concerning is that in patient with maxillofacial trauma; the presence of many important sensory systems (example: visual, auditory, somatic sensory & olfactory), glandular structures and facial esthetic units of the face that needs early intervention if injured. And delay of intervention in such trauma will result in permanent morbidity leading to physical and psychological trauma which affects patient quality of life(2,3).

Managing MFT having THI at the same time are difficult emergency surgical scenario, which need organized prioritization management protocol in place for immediate treatment of such trauma since timely intervention will result in good outcome in both MF trauma and THI, considering ICP monitoring in THI patient and securing airways are among urgent issue affecting the definitive management(17).

In view of high incidence of closed head injury in maxillofacial fracture population, as well as the potential for mortality and neurological morbidity; therefore the best approach for managing such clinical problems need a good professional communication among different discipline to improve overall patient outcomes(1,12). Despite this wide gap in literature globally and the significance of this clinical scenario on patient outcome, there are no published reports on the association of THI and MFT in our country Ethiopia. This study is designed to the analyze

pattern of maxillofacial trauma associated with head injury visited Jimma Medical Center, Jimma, Ethiopia.

1.3. SIGNIFICANCE OF THE STUDY

This study provided basic information on the patterns of associated head injury in patients with maxillofacial trauma and their clinical relation and management approach in patients visited JUMC which will have a valuable contribution for the academic community, service providers, and health care professionals in improving the practice of team working in managing such poly trauma patient by establishing persistent well organized trauma team that involve every specialty early on patient management process.

Thus, the study provides a basic clue for the prevention and early detection this particular trauma cases which would lower the morbidity and mortality due to this life threatening and manageable emergency trauma and can be used as base line data for further study on this topic.

2. CHAPTER TWO LITRATURE REVIEW

2.1. MAGNITUDE

Current literature has controversial views over the relation of facial fractures and head trauma with some authors states that facial skeleton act as the cushions of brain while others claim facial fractures is indicators for head injuries(18).

The percentage of THI accompanied with maxillofacial trauma (MFT) ranged from 4.4% to 87% and noted to be significantly different among various demo-graphical population communities within different countries. This wide range difference among studies might be due to that different authors may use different in inclusion and exclusion criteria, time interval, the number of patients included, the habitual, socioeconomic, cultural differences in the studied populations as well as the differences in the etiology and methodological criteria applied in various studies(2,19). Mulligan et al reported in their study of the association of THI among MFT patients that nearly 67.9% of patients with MF trauma had THI among which 29.5% had skull fractures followed by intracranial hemorrhage in 28.6%, brain contusion/laceration in 16.9%, and concussion with loss of consciousness in 11.2%(2).

A report from one study done in UK shows only 14% association of facial trauma with cranial and/or brain injury, and this figure is nearly the same with report from emergency department (ED) of a Turkish hospital. On the other hand, a higher percentage of maxillofacial trauma (MFT) having head injuries at 55.8% reported from a study in Nigeria. Most importantly a study from a low-income country from Burkina Faso, shares similar finding to that from the UK, in prevalence of THI injury among maxillofacial trauma (MFT) patients at 9.9%. Aldwasari et al showed that there was a high prevalence of THI among patients with MFT (69.98%) which is one of the highest percentages reported worldwide(20). Yasir et al evaluated the prevalence of facial trauma in patients with head injuries in Pakistan found that 76% of patients had facial trauma associated with THI (2,20,21).

Author; Davidoff et al found facial fractures to be strongly associated with traumatic brain injury, whereas Haug et al. found a 76% incidence of neurological injury associated with facial fractures(1) Salantin et al showed that 8.1% of the surgically treated maxillofacial trauma patients needed neurosurgical intervention during the same hospital stay(22). Among polytrauma case presentation; maxillofacial fractures have 1.5 times greater chance of presenting with TBI

relative to other anatomical site fracture group. This is clinically important as it shows; in severely injured patients with facial fractures, early neurosurgical intervention is mandatory and emergency CT Scan should be performed without delay to prevent the morbidity associated with TBI from prepossessing(3).

2.2. GENDER AND AGE

Yasir et al evaluated the prevalence of facial trauma in patients with head injuries that male were the most common suspected cases (74%) compared to females (26%) with the most affected age range between 15 to 30 years. Jeannoh, K.K et al reported that male gender is the most dominant (97.8%) compared to the female (2.2%) and in other study results; Abul Hasnat et al reported that, majority of the head and concomitant facial injuries were experienced by males, constituted 88.3% and females constituted only 11.7% of the total victims(23). The male to female ratio was 7.57:1. These results are similar in a study from India, where 89% of subjects were males and 11% were females, giving a male to female ratio, 8.09:1(23).

Alessandro Leite Cavalcanti et al reported that accidents involving motorcyclists are the most prevalent, affecting male adolescents aged from 15 to 19 years sustaining THI(8). He suggested that the high prevalence of head injuries with maxillofacial trauma (MFT) in this age group may be related to economic and social behavior of this age group such as driving motor vehicles rushly and increased violence among them. Data comparing gender difference shows most of the time male patients are most commonly seen in THI patient with maxillofacial trauma patients. The young adult males in the age group of 20–39 years were the most sustained THI associated with MFF fracture presented in patient with THI may potentially result in structural and functional disability as well as compromising important esthetic unit of the face(2). Samuel Udeabor et al determined in his study on maxillofacial (MF) injuries associated head injury that patient age group from 20-29 years age group was mostly affected (44.6%) accounting for 47.2% neurological injuries found in the study. In their study patients less than 12 years and more than 60 years were less frequently affected in our series(19).

2.3. ETIOLOGY

The increasing use of transportation technology, high speed travel, growing frequency of violence, war crowded society, road traffic accident (RTA), sports injuries, and industrial trauma, etc., have made maxillofacial trauma (MFT) an inevitable form of social disease. The main causes of MFT worldwide vary from one country to another and also in the same country. This large variability may be due to a variety of contributing factors such as cultural, environmental, and socioeconomic factors. Yasir et al reported that RTA including motor car accident(MCA), motor bike accident (MBA), and pedestrian was the leading cause of MFT associated with THI (39%) followed by fall (26%)(2). In literature there is a high rate of RTA related MFT seen in Asian, Middle Eastern region, African, and South American countries and also in countries such as India, Japan, the United Arab Emirates, Pakistan, Turkey, and Brazil show that 36%to 75% of MFT were related to RTA(1,12,15).

The underlying reasons for that high rate include absence or defects of road traffic regulations and its application, lack of legislation regarding compulsory seat belts and helmet, risky driving, bad road quality, less safety of the vehicles, and increased usage of motor bike or cycles(14). The burden of this disease is significantly greater in low- and middle-income countries such as Sudan in which there is a higher risk for it and where health systems are inadequately prepared to address the associated health outcomes(1,12,16). Road traffic accidents (RTAs) are responsible for both head and maxillofacial region trauma which involved in a significant proportion of cases. Traumatic injury involving motorcycle rider are the most commonly prevalent and affecting male adolescents group from 15 to 19 years of age, leading in a high frequency of head and facial injuries(7,8). Anjaneya Dube et al reported that the main cause of THI associated with maxillofacial (MF) injury was motorcycle accident (53.6%). Orawan Chansanti et al reported that the most common cause of injury was motorcycle accident, accounting for 65.9% (n = 566) followed by car accident 10.9% (n = 566) (11,19).

Head injuries occurred more frequently in children from 0 to 4 years of age and unintentional injuries are the leading causes of morbidity and mortality in children and adolescents. Individuals of this age group have tendency of looking for new references and experiences which lead them in risky behavior and exposure to injuries(7,8). The predominant etiological factor is assault in developed countries, and road traffic accidents in developing countries(3,22). The impact of

Covid-19 corona virus have on public transportation system facilitates one type of etiology to occur frequently than the other; particularly the use of motor bike were significantly increased during that time when public gathering was prohibited people started using motorcycle as only chance for transportation service(24). Yasin J. Yasin et al reported that traffic volume dropped sharply during the COVID-19 pandemic which was associated with significant drop in road traffic car accident (RTCs) globally and a reduction of road traffic deaths in 32 out of 36 countries in April 2020 compared with April 2019, with a decrease of 50% or more in 12 countries, 25 to 49% in 14 countries, and by less than 25% in six countries. Similarly, there was a decrease in annual road death in 33 out of 42 countries in 2020 compared with 2019, with a reduction of 25% or more in 5 countries, 15–24% in 13 countries, and by less than 15% in 15 countries(24).

2.4. CLASSIFICATION

Types of brain injuries includes; subdural hematoma, epidural hematoma, contusion, concussion, diffuse axonal injury(DAI) which may or may not lead death, and Shaken baby syndromes(3). Type of facial fractures are upper face fracture which involve frontal bone and its sinus fracture, midface fracture like zygomaticomaxillary complex fracture(ZMC), Nasorbitoethmoid fracture(NOE), orbital rim fractures, nasal fractures and lower face mandibular fractures(symphysis, parasymphysis, body, angle, ramus, condylar and coronoid fractures)(4).

2.5. CLINICAL PATTERN

Sara Taha, Yousif.I. Eltohami stated that neurological manifestations are commonly associated with maxillofacial trauma, and that these injuries remain un diagnosed. This study reported most commonly; traumatic injuries associated with loss of consciousness include of mandibular body and para symphysis fractures; followed by zygomatic complex fractures. The only patient with anterograde amnesia following trauma was 1.3 percent, while 18.7 percent of patients experienced retrograde amnesia. Time period of retrograde amnesia in this particular study was from 15 minutes to several days and in average it was 15 hours. Several studies demonstrated that amnesia of any type even for a few minutes after traumatic head injury indicate diffuse brain injury or diffuse axonal injury(15). Report on other THI symptoms mild to moderate or severe headache account 18.7 percent, while dizziness was the next common symptom with 14.7 percent presentation, other symptom include 8 percent of blurred vision and with least experienced was nausea and vomiting accounting for 2.7% of head injury symptom. From

finding in this study there was 1 patient who developed anosmia and another patient reported left eye visual deterioration and impaired hearing ability and 56 percent of patients did not experience any of these symptoms(16). Computed tomography (CT) is now a days performed routinely for patients with impaired consciousness or neurological signs such as vomiting, nausea, and seizures(4,21) A study by Kanno et al demonstrated that a 2.8 percent of patient with facial fracture were found conscious with a Glasgow Coma Scale (GCS) score of 15 but having accompanying intracranial hematoma(25)(26). And that many author revealed that simple trauma causing mild fractures of the maxilla, zygoma, or even the maxillary alveolar fracture could cause an intracranial hemorrhage(21,27) Joshi et al found that the risk of head injury increased significantly as the GCS score decreased and with an increase in the number of facial fractures(18). Although the majority of patients sustained mild head injuries with GCS score 13-15, the chance of THI should still be strongly suspected in those patients independent of normal GCS score finding(13).

Chansanti. et al showed that patients with mild traumatic head injury were associated with coronoid process fracture, Le fort fracture type II and type III, moderate to severe traumatic head injury(11). In contradiction to this finding, Woriax et al in 2018 found that severe midface fractures are associated with lower rates of hemorrhagic brain juries, spine fractures, pneumothorax, abdominal, and pelvic injuries(18). Deceleration effect was considered one potential mechanism where midface impact dissipates the energy from the trauma resulting in decreased brain, neck, and torso traumatic injury(18). Historically it was reported that, the facial architecture has been perceived to be a cushion against impact, protecting the neurocranium from severe injury(1). Another researcher also states that maxillofacial fracture (MFF), especially in the case of maxillary and midfacial bony fractures, act as a shock absorber for the high impact energy of the trauma, guarding the brain, especially in the case of intracranial hemorrhage from trauma. Study demonstrated by Lee et al reported that facial fractures are not associated with an increased risk of traumatic brain injury, while theorizing that facial bones act as a protective cushion for the human brain. And this was shared by Chang et al who stated that the maxilla and the surrounding midfacial bones act as an absorption barrier against high impact energy from trauma, thus guarding the brain from damage. Because of these fewer brain injuries are expected to occur in patient with facial trauma(1)**.** However, other researchers suggest the reverse that

high velocity impacts with sufficient force to cause maxillofacial fracture(MFF) may also transmit to the brain and cause traumatic head injury (THI) such as intracranial hemorrhage(2). And also, some literature shows recent investigation findings have suggested that the face may transmit forces directly to the neurocranium, which lead to more serious brain injuries. In the search for this controversial literature finding; Keenan et al in 1999 studied this question on 3388 bicyclists to examine the association between facial fractures and traumatic brain injuries. This study demonstrated no evidence that facial fractures help prevent traumatic brain injury and their data suggested facial fractures as markers for increased risk of brain injury(18).

Review of the literature indicate very distinct idea regarding the effect of maxillofacial fracture(MFF) on the incidence and occurrence of THI as anatomically the brain is an adjacent position to those maxillofacial fracture(MFF). Elbaih et al showed that most of patients with moderate TBI had upper face fractures (66.6%) and the majority of patients who had severe THI had mid face fractures (52.4%) which was statistically significant relation(3).

Head injury patient may manifest light headiness, abnormal body movement, seizure, confusion, sleepy state, focal weakness, hemiparesis and impaired concentration and amnesia(10).

Maxillofacial trauma patient may show clinical feature of malocclusion (open bite, cross bite), asymmetric face, abnormal gait on mouth opening or closing, difficulty opening and closing the mouth, floor of mouth hematoma, facial height lengthening and widening of facial width, step deformity, crepitation and facial weakness in injury that involve cranial nerve seven the facial nerve. Facial trauma involving nose may have clinical feature of deviated nose including septal deviation and obstructed nasal orifice, septal hematoma, nasal cartilage laceration or avulsion injury. Orbital trauma patient may present with, subconjunctival hemorrhage, periorbital edema and ecchymosis, orbital volume widening, diplopia (binocular or monocular), traumatic telecanthus, narrowing of the palpebral fissure, epiphora, nasolacrimal duct disturbance, medial orbital ligament detachment, impaired vision and ruptured globe. Maxillofacial trauma associated with skull base fracture shows clinical sign of raccoon ayes, battle sign, hemotympanum, CSF rhinorrhea and otonorrhea(6,27).

Different imaging modality for maxillofacial patient with traumatic head injury like computed tomography scan (CT scan) and magnetic resonance imaging (MRI). Patient with isolated

maxillofacial trauma may be diagnosed with plain X-ray like panoramic radiography, lateral oblique view, poster anterior view(PA), submentovertex (SMV) view, waters view, reverse Towne's projection, lateral cephalic views and Caldwell's lateral oblique(6).

Yadav et al stated the traditional surgical management of complex craniofacial trauma is usually performed in 3 phases where immediate craniotomy is followed by orbitofacial repair in 7 to 10 days period and finally cranioplasty is done after 6 to 12 months. Traumatic head injury (THI) patient may be treated bur hole and craniotomy to evacuate intracranial hematoma that decrease intracranial pressure (ICP) to normal, managing post traumatic epilepsy, elevation of depressed skull fracture, dural repair, scalp repair and avoiding complication from intracranial pressure which may include brain tissue herniation and functional impairment of important center that may include respiratory function. Most of maxillofacial injuries are treated with open reduction and internal fixation(ORIF) to fix fractured segment anatomically while using occlusion as guidance, inter maxillary fixation (IMF), soft tissue repair(STR), arch bar or wire only splinting, bridle wire, eyelet wire, suspension wiring, gunning splint, establishing pretraumatic occlusion and function with acceptable aesthetics as the main goal of treatment including observation and follow up and reconstruction of traumatic avulsed facial esthetic sub unit(2,4,27).

Complication from traumatic head injury include acute complication which is most of the time death, infection with intracranial pressure monitoring devices and late complications including post traumatic seizures, communicating hydrocephalus with incidence~3.9 percent of severe head injuries, post traumatic syndrome (or post concussive syndrome)(16).

From a literature review, it appears that the most common complication in maxillofacial trauma is infection or osteomyelitis. Other complication includes malunion, fibrous union, nonunion, ankyloses, facial deformity, temporary or permanent facial palsy. Contributing factors seem to be preoperative, perioperative, and postoperative oral hygiene, presence of teeth in the line of fracture, alcoholic or metabolic disturbances, prolonged time before treatment, patient poor compliance or noncompliance, displacement of fracture fragments, and probably iatrogenic causes via open fixation procedures and lack of early intervention for esthetic facial sub unit and functionally important structures like facial nerves. Edwards et al have found a strong relationship between the severity of the mandibular fracture and the complication rate(2,27).

As conclusion; maxillofacial trauma with head injuries needs special attention as airway compromise is invariably present and another critical issue is the importance of surgical intervention needed simultaneously with craniocerebral and maxillofacial surgeries at the same time. Treatment of craniofacial trauma involve special response from well-organized trauma team which my decrease the incidence of mortality and morbidity(4). Hohlrieder et al. reported that Le Fort-II and III, orbit, nose, zygoma and maxillary fractures were associated with a 2-to 4-fold risk of intracranial hemorrhage, while mandibular fracture did not significantly increase the chance of intracranial hemorrhage. Fracture of the mid-face was found to be most commonly associated with head injury (3). And also similarly Sigaroudi et al reported that all of the midface fractures had a relationship with a brain injury and they reported that midface fractures increased the risk of brain injuries (13). Maher M. Abosadegh et al reported that zygoma fracture was observed to have the strongest impact to sustained THI with odds ratio of 3.34 followed by mandible, NOE, maxilla, and supraorbital bone with odds ratios of 2.46, 1.67, 1.36, and 1.15, respectively and THI should be suspected whenever orbital, zygoma, and maxillary bone fractures are presented (2).; And Kloss et al. reported the zygoma and orbit to be the most common fractured bones in a group of conscious patients with intracranial hemorrhage and concomitant facial fractures(3).

2.6. CONCEPTUAL FRAMEWORK

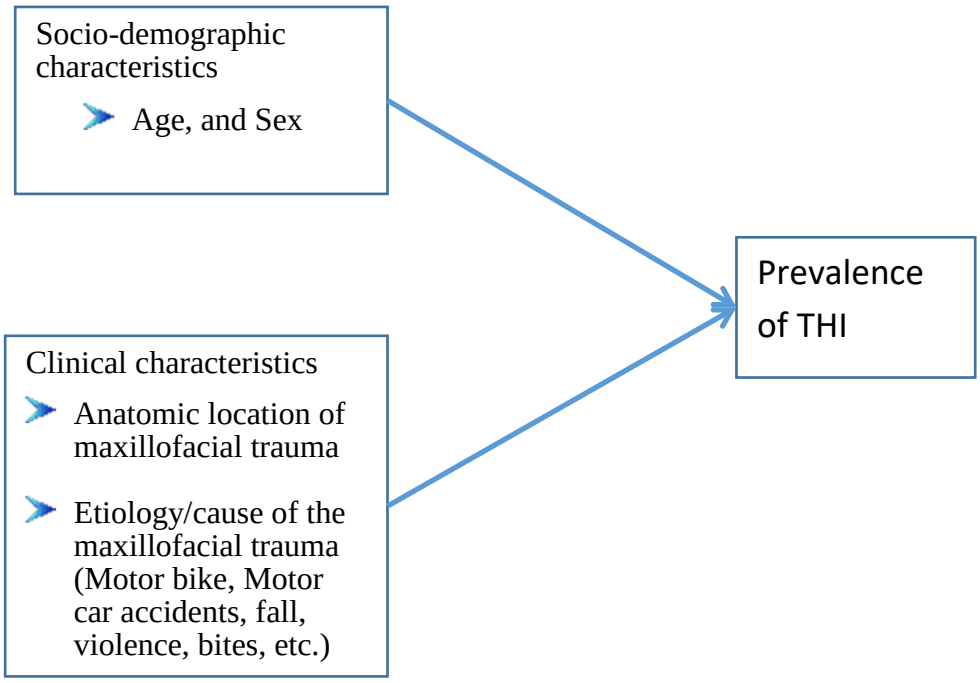

Figure 1: Conceptual Framework for prevalence of traumatic head injury and associated among patients with maxillofacial trauma at Jimma Medical Center, from March, 2020 to February, 2022, Jimma zone, Oromia region, Ethiopia.

3. CHAPTER THREE-OBJECTIVES

3.1. GENERAL OBJECTIVE

To assess the prevalence of traumatic head injury (THI) and associated factors among patients treated with maxillofacial facial trauma in Jimma University Medical Center from March, 2020 to February, 2022, Ethiopia.

3.2. SPECIFIC OBJECTIVE

- To study the socio-demographic characteristics of THI among maxillofacial trauma patient treated in Jimma University Medical center from March, 2020 to February,2022
- To determine the prevalence of THI among patients treated with maxillofacial facial trauma in Jimma University Medical Center from March, 2020 to February,2022
- To examine the relationship between THI in patients treated with maxillofacial facial trauma in Jimma University Medical Center from March, 2020 to February,2022
- To identify factors associated with THI among patients treated in Jimma University Medical center from March, 2020 to February, 2022
- To investigate etiology and pattern of maxillofacial trauma associated with THI in patient treated at Jimma University Medical Center from March, 2020 to February,2022

4. CHAPTER FOUR-METHODOLOGY

4.1. STUDY LOCATION AND PERIOD

This study was carried out at Jimma university medical center oral and maxillofacial surgery unit, Jimma, south west Ethiopia from from March, 2020 to February, 2022 G.C.

JUMC is located in Jimma town in south west of Ethiopia and 357km from Addis Ababa. It is the only government health facility providing specialized orthopedic and trauma management in the western and south western part of Ethiopia. It has a population (catchment area) of about 20 million and receives referred patients from western, south-western Ethiopia and even South Sudan. There are three maxillofacial surgeons and with Oral and Maxillofacial surgery residents. The Oral and Maxillofacial surgery unit ward has 15 beds and the unit holds a follow-up clinic every day each week and operation are conducted on three days of a week. Neurosurgical patient uses the emergency surgical ward with other trauma case.

4.2. STUDY DESIGN

A cross sectional study design was employed.

4.3. POPULATION

4.3.1. SOURCE OF POPULATION

Sources population includes all maxillofacial trauma patient who visited JUMC maxillofacial surgery during the study period from March, 2020 to February, 2022 Jimma zone, Oromia region, Ethiopia.

4.3.2. STUDY POPULATION

All maxillofacial (MF) trauma patients with associated THI treated at JUMC Oral and maxillofacial surgery unit during the study period from March, 2020 to February, 2022 Jimma zone, Oromia region, Ethiopia.

4.4. ELIGIBILITY CRITERIA

4.5. INCLUSION CRITERIA

- All MF trauma patients during the study period.

4.6. EXCLUSION CRITERIA

- Patients with Incomplete medical records,

4.7. SAMPLE SIZE AND SAMPLING TECHNIQUE

Sample size includes all patients treated with maxillofacial trauma over the period of two years (i.e., from March 2020 to February 2022) in JUMC, Jimma, Oromia regional state, Ethiopia. The total study population identified in medical records over the two years period was 360. Thus, since the total population of the patients was considerably small, this study used census to include all the medical records with complete patients' information and medical diagnosis required for the current study. Accordingly, total of 325 complete medical records were included in the current study. Patients' information for the sample was first accessed from the oral and maxillofacial surgery department medical records logbook. The list of patients' card number was recorded before selecting the patients' folders from the medical archives of the hospital. Finally, the selected patients' cards were reviewed based on the pretested data extraction format.

5. STUDY VARIABLES

5.1. DEPENDENT VARIABLE

- Prevalence of THI among maxillofacial trauma patients
-

5.1.1. INDEPENDENT VARIABLE

- Some socio-demographic characteristics: age, sex
- Clinical conditions: anatomical location of maxillofacial trauma, GCS, level of consciousness, vomiting, severity of THI.
- Etiology: Motor bike accidents, Motor car accidents, violence (knife, gunshot), falls

5.2. DATA COLLECTION TOOLS AND PROCEDURES

Data were collected using a semi-structured extraction checklist that covers socio-demographic factors (age, sex), clinical conditions (GCS, level of consciousness, vomiting, severity of THI), Etiology (Motor bike accidents, Motor car accidents, violence, falls). Data on dependent variables such as various diagnostic outcomes of types of maxillofacial trauma, THI and its characteristics were also extracted. The extraction checklist was prepared and used in English, the language used in documenting medical diagnosis and information. Data were collected by trained maxillofacial residents.

5.2.1. DATA QUALITY CONTROL MEASURES

The quality of the data was ensured by using a pretested data extraction checklist that was done on 5% of the medical records (18/360). The data were collected by dental health professionals (maxillofacial facial residents) who attend half day training. Moreover, a continuous supervision during data collection was done by principal investigator. All completed data extraction checklists were examined for completeness and consistency.

5.2.2. DATA PROCESSING AND ANALYSIS

The data were coded, entered using statistical software for social sciences (SPSS) version 23 for Windows. Descriptive statistical methods and multiple logistic regression were used to summarize data on socio-demographic and clinical characteristics. The results were presented using tables and figures. The multiple logistic regression modeling was performed to identify factors associated with the dependent variable (i.e. THI). The chi-square analysis was employed as bivariate analysis method to recruit and qualify variables for multiple logistic regression modeling. Odds ratios (OR) with 95% confidence intervals (CI) or P-value <5% were considered to infer significant association.

5.3. ETHICAL CONSIDERATION

Ethical clearance was obtained from Institutional Review Board (IRB), Institute of Health Science, Jimma University. The name of the patient was not entered into the questioners by using individually assigned number and all information obtained was kept confidential.

5.4. DISSEMINATION PLAN

This study was ethically approved by Jimma University, Institute of review board. Formal letter was submitted Research and publication office, Library catalog. It will be disseminated to local authorities after the approval of the department and effort will be made to publish the results in relevant peer-reviewed journals.

5.5. OPERATIONAL DEFINITION

- Upper face fracture: Frontal sinus fracture
- Mid face fracture: ZMC#, zygomatic arch#, NOE#, Le fort# (I, II, III), Orbital rim#, Palatal#, Nasal#
- Lower face fracture: Mandibular# (Symphysis#, parasymphasis #, body#, angle#, ramus#, condylar#, coronoid#)
- Skull fracture: Fracture involving occipital, temporal, parietal and frontal bone
- Basal skull fractures: are extensions of fractures through the cranial vault. Skull base fractures may involve the anterior, middle, or posterior fossa(2,27).
- Battle's sign: postauricular ecchymoses and is sign of basal skull fracture.

6. CHEPTER FIVE-RESULTS

Socio-Demographic Characteristics

A total of 325 medical records were reviewed. The total study population identified in medical records over the two years period was 360 which makes number of ineligible cards 35. During the study period, the results showed that a among total of 325 cases who sustained maxillofacial trauma, an 88.31% (287/325) were males and 11.31% (38/325) were females (table 1). Age and gender-based frequency distribution of maxillofacial trauma etiology was presented in the following (Table 1). In our study the male and female ratio was 13:1. It was revealed that; the age of the studied patients ranged from 12 to 85 years with majority of study participant below 24 years and lowest participant age group was age 30-35 years old. A mean age of participant involved in this study was 33.06 years.

Prevalence of THI

This study identified a significant association of maxillofacial trauma with head injury was seen in the present study; accounting for 41.52% of THI case in our study. The present study, showed that majority of the THI and concomitant facial injuries were experienced by males, accounting for 40.31% (N=325) and females are only 1.23%. Young age group less than 24 years (22.2%), and 25-29 years (6.5%) were found positively associated with THI. Figure 4 showing age group category of THI patient in the study subjects. Similarly, the results showed that key road traffic accidents related etiologies such as motor bike accident; (34.2%), motor car accidents; (5.2%) were linked to the higher occurrence of THI among patients presenting with maxillofacial traumas. Table 4 showing different etiology of different types of THI as found from this study result.

THI related maxillofacial trauma clinical sign was found in the study subjects including bleeding from ear (5.52%), raccoon eyes (5.82%), battle sign (3.7%).

Table 1: Sociodemographic characteristics of the study population (N=325)

S.N	Variables	Frequency	Percentage
1	Gender		
	Male	287	88.31
	Female	38	11.7
2	Age		
	<24 years	135	41.52
	25-29 Years	38	11.7
	30-34 years	36	11.1
	35+	116	35.7

Etiologies of Maxillofacial trauma

The majority of the study participant had motor bike accident (54.20%), while motor car accident was the second mechanism of trauma (16.62%), blunt assault (16%) was the third mechanism (Table 2) is presenting specific maxillofacial trauma type associated with different cause of injury.

Table 2: Distribution of etiology of maxillofacial trauma in the study subjects in JUMC.

Etiology	Gender				Age			
	Femae		Male		0-24	25-29	30-34	35+
	Count	%	Count	%	Count	Count	Count	Count
Blunt assault	8	2.5	44	13.54	24	3	2	23
GSI	0	0.00	12	3.70	0	1	6	5
Knife	1	0.31	2	0.62	2	0	0	1
MCA	7	2.2	47	14.50	14	3	4	33
MBA	7	2.2	169	52.00	89	31	24	32
Fall H	0	0.00	3	0.92	3	0	0	0
Fall G	15	4.62	10	3.1	3	0	0	22

Table 3: The etiology of trauma related to specific maxillofacial trauma.

Maxillofacial Trauma	Etiology									
	Blunt assault trauma		Gunshot		RTA MCA		RTA MBA		Fall on the Ground	
	N	%	N	%	N	%	N	%	N	%
Frontal Sinus Fracture	2	0.6	0	0	3	0.9	11	3.4	0	0
Facial Frontal Fracture	5	1.5	0	0	2	0.6	14	4.3	0	0
Soft Tissue Injury	22	6.8	8	2.5	10	3.1	55	16.9	10	3.1
Zygomatic Arch Fracture	4	1.2	0	0	5	1.5	13	4.0	20	6.2
Zygomatic Complex Fracture	6	1.8	0	0	19	5.8	43	13.2	2	0.6
NOE Fracture	0	0	0	0	8	2.5	34	10.5	0	0
Orbital Rim Fracture	0	0	0	0	14	4.3	20	6.2	2	0.6
Palatal Fracture	0	0	0	0	1	0.3	9	2.8	0	0
Nasal Bone Fracture	11	3.4	0	0	0	0	29	8.9	24	7.4
Le Fort I fracture	2	0.6	0	0	1	0.3	9	2.8	0	0
Le Fort II fracture	0	0	0	0	3	0.9	43	13.2	0	0
Le Fort III fracture	2	0.6	0	0	5	1.5	23	7.1	0	0
Mandibular angle fracture	30	9.2	5	1.5	23	7.1	63	1.4	8	2.5
Mandibular body fracture	13	4.0	5	1.5	12	3.7	22	6.8	9	2.8
Mandibular para-symphysis fracture	6	1.8	2	0.6	3	0.9	25	7.8	6	1.8
Mandibular symphysis fracture	2	0.6	4	1.2	7	2.2	29	8.9	6	1.8
Mandibular condyle fracture	5	1.5	4	1.2	6	1.8	33	10.2	5	1.5

RTA: Road traffic accident, MCA: Motor car accident, MBA: Motor bike accident

Motor bike accidents were the most common etiology in all types of facial fracture and there was no patient sustain palatal fracture, NOE fracture and orbital rim fracture other than for RTA as cause of trauma.

This study revealed that patients suffering from multiple episodes of vomiting and variable duration of loss of conscious and found to show abnormal body movement as neurologic manifestation was presented in (Figure 1). Loss of consciousness was the most common neurologic manifestation (52.31%) followed by vomiting (23.10%) in patient with maxillofacial trauma which may insight traumatic head injury. The least common neurologic manifestation was abnormal body movements (2.8%).

Other clinical sign was epistaxis (8.9%), bleeding from ear (5.54%), hemotympanum, raccoon eyes, battle sign, paresthesia (3.1%) around infraorbital nerve distribution. This clinical feature recorded from study subject on presentation demonstrated on Figure 2.

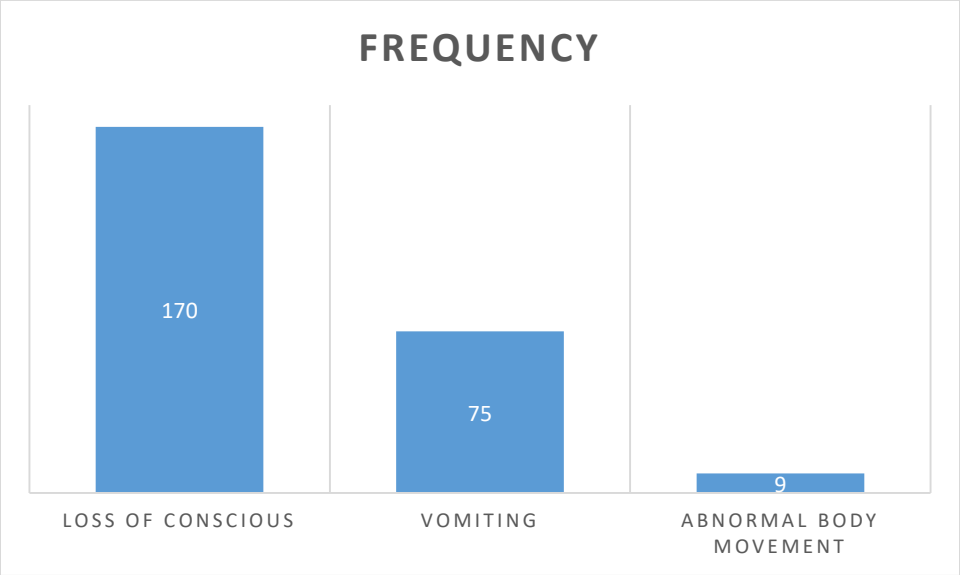

Figure 1: Frequency of neurologic manifestation of study subjects.

Among clinical sign recorded on presentation raccoon eyes (5.8%) and bleeding from the ear (5.5%) was the major clinical feature recorded in the study subjects while battle sign (3.7%) was the lowest found to be recorded (Figure 2).

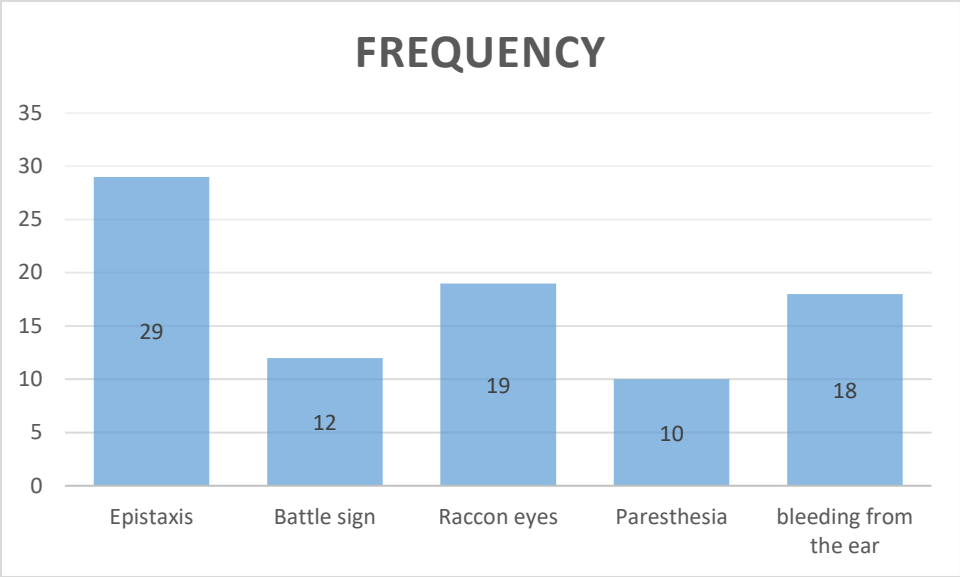

Figure 2: Clinical sign identified on study subjects

In our present study mandibular angle was the most commonly fractured facial bone in general accounting 133 cases (40.9% n=325) and followed by zygomaticomaxillary complex fracture (21.52%) and Le fort fracture (21.23%) and palatal fracture was the lowest found (3.4%). Types of maxillofacial fracture found in our study was demonstrated in Figure 3. Soft tissue injury (32.62%, N=325) was found to occur with facial fracture in our study.

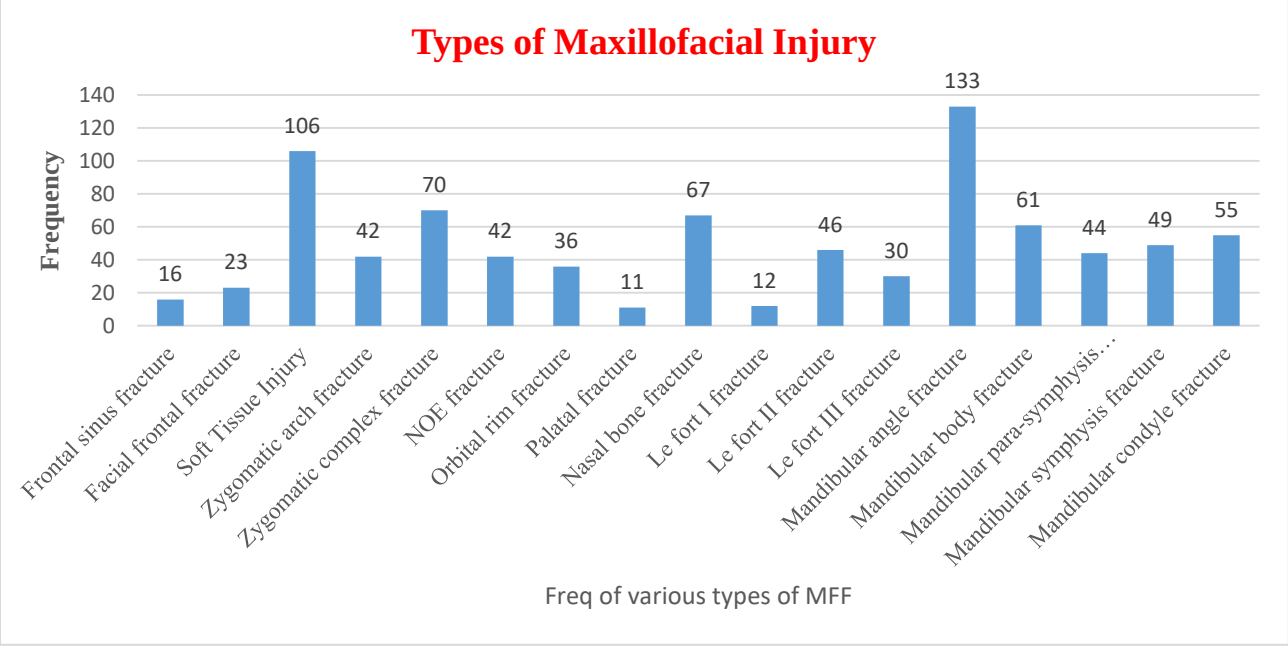

Figure 3. Types of maxillofacial trauma found in the study subject (n=325).

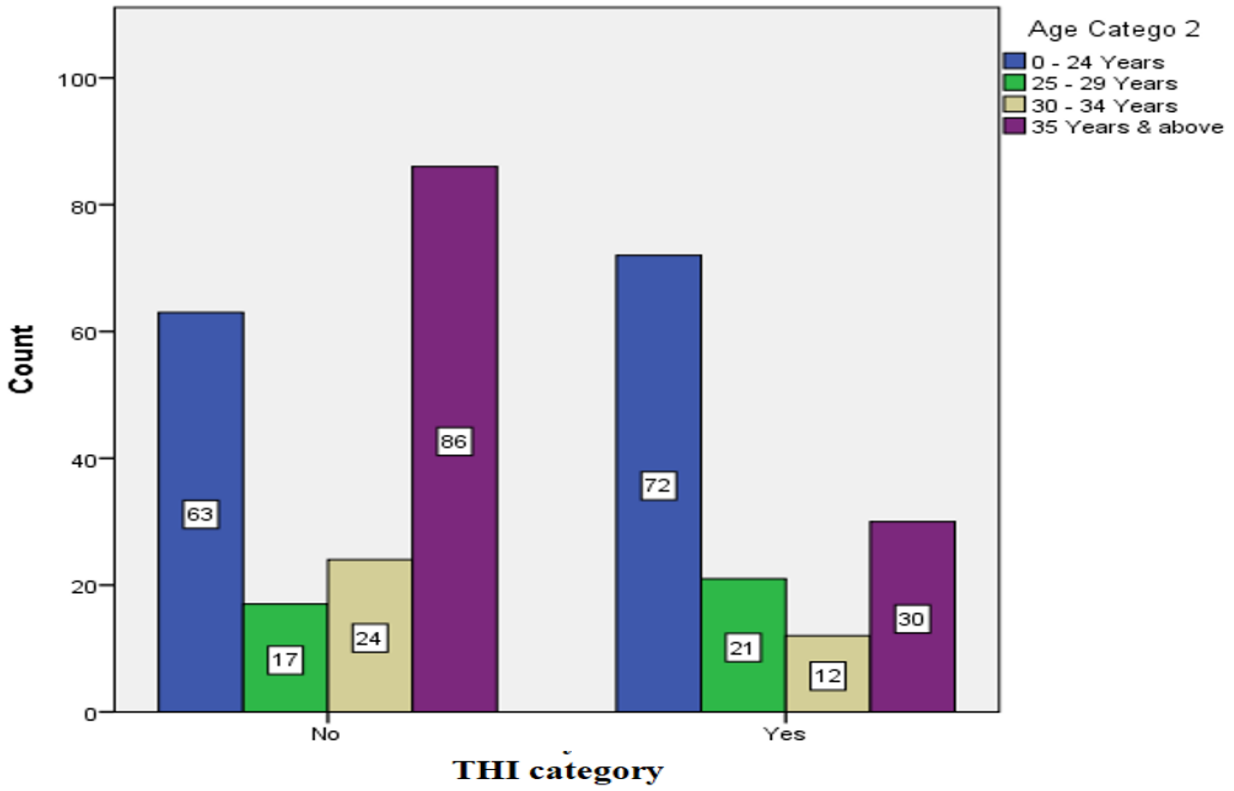

Figure 4: Age category of THI patient in the study subjects.

Among age category; age group from 0 to 24 years are the most common sustaining traumatic head injury and age group 30 to 34 is the lowest presented with traumatic head injury (Figure 4). Majority of the injuries with THI were seen in mid-face region followed by upper third of the face. Zygomaticomaxillary fracture (13.5%) was the most common facial fracture associated with THI followed by mandibular angle fracture 11.7% and Le fort II fracture 8.9%. Specific types of maxillofacial fracture combined with THI was presented in Figure 5.

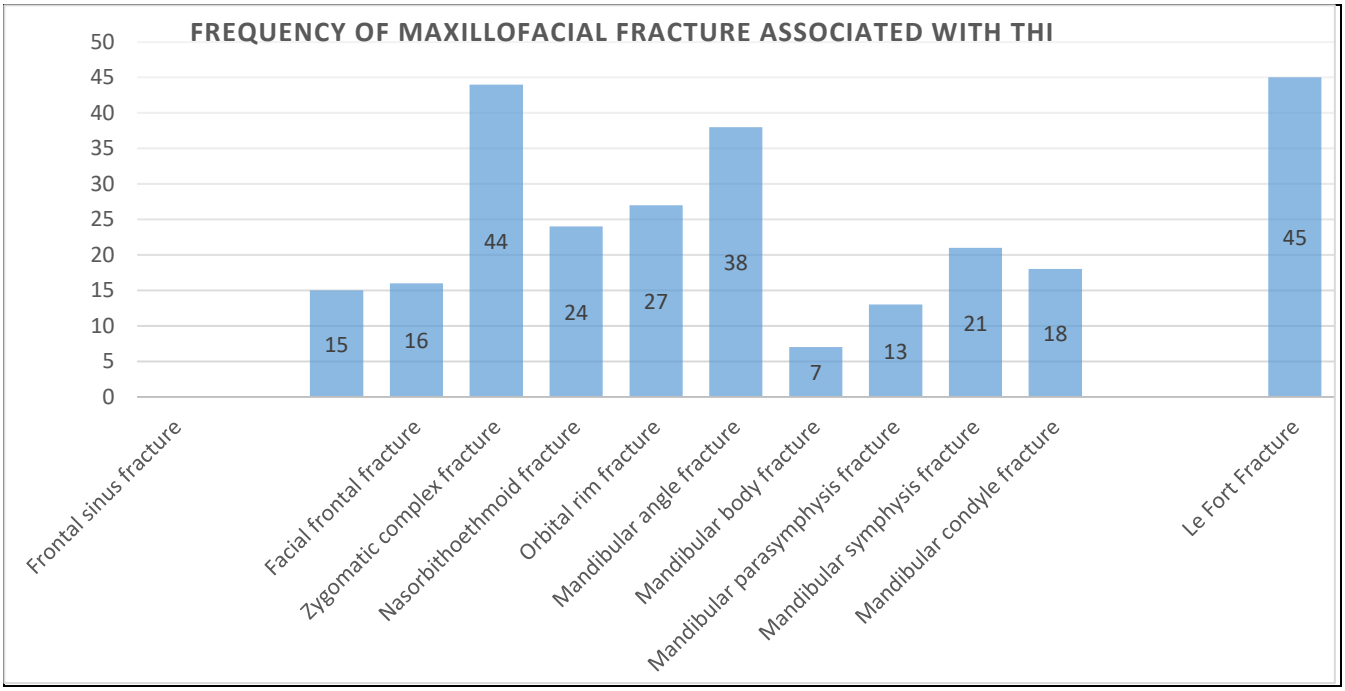

Figure 5: The frequency distribution of types of maxillofacial fracture with THI in patient visited JUMC.

Among head injury case seen in our study; the most common types of THI was epidural hematoma (12.9%; n=325) followed by brain contusion (12.31%). The least common THI type was intracranial laceration (0.92%). Among depressed skull fracture; closed depressed skull fracture (13.8%) was the most common found. The least common skull fracture is skull base fracture (7.1%) as seen on Graph 6. Graph 6 presenting types of THI seen in our study subject (n=325).

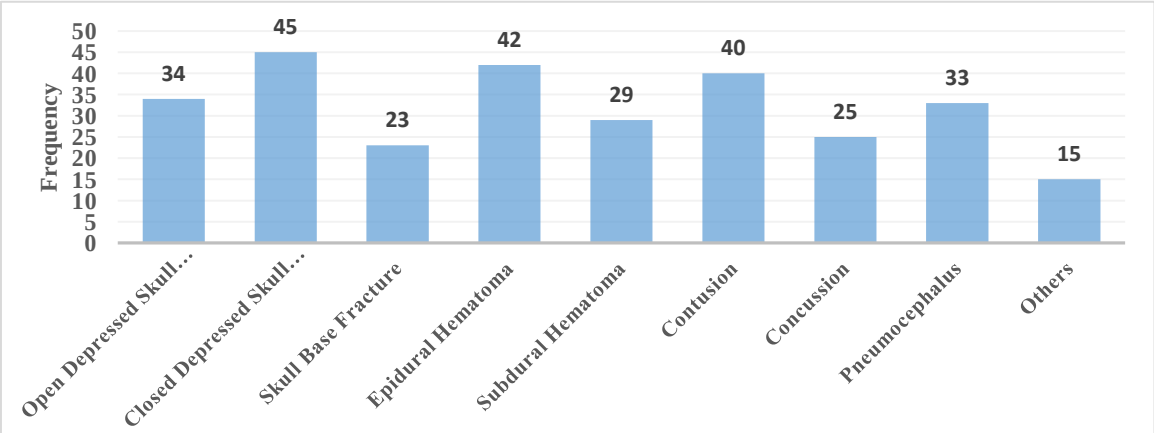

Figure 6: Types Of Traumatic Head Injury

Closed depressed skull fracture was found to be the most common skull fracture in this study. Among skull fracture location in THI patients; frontal skull fracture was the most common found in the study result. Graph 7 showing location of skull fracture in THI patient in this study subjects.

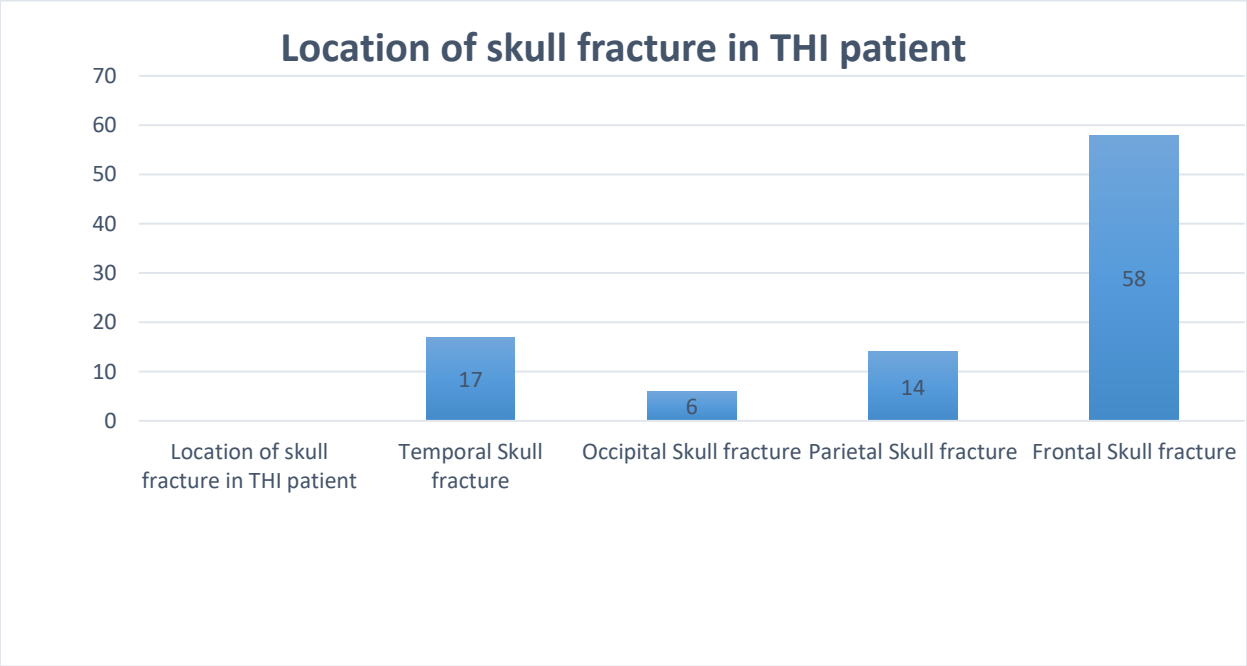

Figure 7: Location of the skull fracture in THI study subjects.

Among various location of skull fracture in our study the frontal skull fracture is the most commonly involved area in THI patient and the least common is occipital skull fracture.

Bivariate analysis: Chi-square test

The chi-square test result shows that; being male were shown to be more likely to sustain THI in maxillofacial patients (X^2=17.02; P-value=0.000). Young age group below 29 years was significantly associated with the occurrence of THI in maxillofacial trauma patients (X^2=23.42; P-value=0.000). Motor bike accident was significantly associated with the occurrence of THI in maxillofacial trauma patients (X^2=73.277; P-value=0.000). Table 4: The chi-square test for statistical significance.

Table 4: The chi-square test for statistical significance.

Variables	THI		Chi-square values	P-value
	Yes (%)	No (%)		
Gender				
Female	4 (1.2)	34 (10.5)	17.04	0.000
Male	131 (40.3)	156 (48)		
Age categorized				
<24 years	72 (22.2)	63 (19.4)	23.42	0.000
25-29 years	21 (6.5)	17 (5.2)		
30-34 years	12 (3.7)	24 (7.4)		
>35 years	30 (9.2)	86 (26.5)		
Motor car accident				
Yes	17(5.2)	37(11.4)	2.697[a]	0.101
No	118(36.3)	153(47.1)		
Motor bike accident				
Yes	111(34.2)	65(20.00)	73.277[a]	0.000
No	24(7.4)	125(38.5)		
Fall the ground				
Yes	2(0.60)	23(7.1)	12.545[a]	0.000
No	133(40.9)	167(51.4)		
Mandibular angle fracture				
Yes	38(11.7)	95(29.2)	15.588[a]	0.000
No	97(29.8)	95(29.2)		
Zygomatic complex fracture				
Yes	44(13.5)	26(8.0)	16.697[a]	0.000
No	91(28)	164(50.4)		
Le Fort Fracture				
Yes	45(13.8)	24(7.4)	20.225[a]	0.000
No	90(27.7)	166(51.1)		

Independent predictors of THI

The multiple regression modeling identified the sociodemographic characteristics, etiology and specific types of maxillofacial fractures as factors significantly affecting the THI. The sociodemographic factors being male (OR=3.991, 95% CI: 1.164, 13.687), age less than 24 years (OR=4.058, 95% CI: 1.847, 8.918), and 25-29 years (OR=3.506, 95% CI: 3.506) were found positively associated with THI. This implies males who are in the young age group (compared age >35 years) who were treated with maxillofacial trauma were more likely to experiences THI. Similarly, the results showed that key road traffic accidents related etiologies such as motor bike accident; (OR=6.424, 95% CI: 5.238, 11.662), motor car accidents; (OR=5.666, 95% CI: 1.769, 18.162) were linked to the higher occurrence of THI among patients presenting with maxillofacial traumas. According to the results, the odds of THI was nearly six-fold higher in individuals who sustained motor bike and motor car accidents.

Furthermore, the analysis identified specific types of maxillofacial traumas such as Zygomaticomaxillary complex fracture, ((OR=3.055, 95% CI: 1.440, 6.482), and mandibular angle fractures, (OR=0.340, 95% CI: 0.187, 0.617) significantly associated with THI. The results implied that the odds of THI in patients having the Zygomaticomaxillary complex patents was three-fold, while the mandibular angle fractures preventive for THI occurrence for 66% of the patients. Table 5 shows multiple logistic regression modeling parameters for the independent predictors THI among maxillofacial patients.

Table 5: Multiple logistic regression modeling parameters for the independent predictors THI among maxillofacial patients at JUMC (N=325)

Predictors	THI		Beta	AOR	95% CI	P-value
	Yes (%)	No (%)				
Gender						
Female	4 (1.2)	34 (10.5)	Ref	Ref	Ref	Ref
Male	131 (40.3)	156 (48)	1.384	3.991	[1.164, 13.687]	0.028
Age categorized						
<24 years	72 (22.2)	63 (19.4)	1.401	4.058	[1.847, 8.918]	0.000
25-29 years	21 (6.5)	17 (5.2)	1.255	3.506	[1.288, 9.918]	0.014
30-34 years	12 (3.7)	24 (7.4)	-.080	.923	0.333, 2.561]	0.878
>35 years	30 (9.2)	86 (26.5)	Ref	Ref	Ref	Ref
Motor car accident						
Yes	17(5.2)	37(11.4)	1.735	5.669	[1.769, 18.162]	0.003
No	118(36.3)	153(47.1)	Ref	Ref	Ref	Ref
Motor bike accident						
Yes	111(34.2)	65(20.00)	2.669	6.424	[5.238, 11.662]	0.000
No	24(7.4)	125(38.5)	Ref	Ref	Ref	Ref
Fall the ground						
Yes	2(0.60)	23(7.1)	.997	2.710	[0.416, 17.650]	0.297
No	133(40.9)	167(51.4)	Ref	Ref	Ref	Ref
Zygomatic complex fracture						
Yes	44(13.5)	26(8.0)	1.117	3.055	[1.440, 6.482]	0.004
No	91(28)	164(50.4)	Ref	Ref	Ref	Ref
Mandibular angle fracture						
Yes	38(11.7)	95(29.2)	-1.079	.340	[0.187, 0.617]	0.000
No	97(29.8)	95(29.2)	Ref	Ref	Ref	Ref
Le Fort Fracture						
Yes	45(13.8)	24(7.4)	.584	1.793	[0.899, 3.579]	0.098
No	90(27.7)	166(51.1)	Ref	Ref	Ref	Ref

7. CHEPTER SEVEN-Discussion

In our study, we identified that the prevalence of THI among patients with maxillofacial trauma was found to be 41.52%. Other literature also reported that percentage of THI accompanied with maxillofacial trauma ranged from 4.4% to 87% and noted to be significantly different among various demo-graphical population communities within different countries(2,19). Similarly other study reported variable result, as seen in a report from one study done in UK shows only 14% association of facial trauma with cranial and/or brain injury, and this figure is nearly the same with report from emergency department (ED) of a Turkish hospital. On the other hand, a higher percentages of MF trauma having head injuries at 55.8% reported from a study in Nigeria. Most importantly a study from a low-income country from Burkina Faso, shares similar finding to that from the UK, in prevalence of THI injury among MF trauma patients at 9.9%. Aldwasari et al showed that there was a high prevalence of THI among patients with MFF (69.98%) which is one of the highest percentages reported worldwide(20). Yasir et al evaluated the prevalence of facial trauma in patients with head injuries in Pakistan found that 76% of patients had facial trauma associated with THI (2,20,21). The reason behind a little lower figure in our study from other study reported may be related to; our study period that was coincided with the time when public transportation was restricted by officially declared state of emergency due to Covid-19 pandemic stay home period in our country Ethiopia which may be related to overall decrease in road traffic accidents. Since road traffic accident is a major cause of trauma all over the world including Ethiopia, the slightly lower figure in our study may be related to overall decrease in trauma admission; which was also similarly seen in other study done during Covid-19 lockdown period; as Heather X. Rhodes et al reported that the restricted travel mandates have had significant impacts on motor vehicle collisions (MVC). Trauma centers located in Florida, New York, and Massachusetts have reported a significant downward trend in MVCs. After reviewing trauma admissions from 2017 to 2020, February to April, a New Hampshire Level II trauma center reported an 80.5% reduction in MVCs(28). Yasin J. Yasin et al reported that traffic volume dropped sharply during the COVID-19 pandemic which was associated with significant drop in road traffic car accident (RTCs) globally and a reduction of road deaths in 32 out of 36 countries in April 2020 compared with April 2019, with a decrease of 50% or more in 12 countries, 25 to 49% in 14 countries, and by less than 25% in six countries(24). Similarly, there

was a decrease in annual road death in 33 out of 42 countries in 2020 compared with 2019, with a reduction of 25% or more in 5 countries, 15–24% in 13 countries, and by less than 15% in 15 countries(24). The other reason behind this wide range difference among studies was attributed to the inclusion and exclusion criteria, time interval, the number of patients included, and the applied methodology(2,29).

In the current study, multivariate regression analysis has different socio-demographic characteristics, etiologies of MFF and anatomical location of MFF. Key to socio-demographic characteristics, gender and age categories appeared factors positively and significantly associated with THI. In this study, being male (OR=3.991, 95% CI: 1.164, 13.687), age range below 24 years (OR=4.058, 95% CI: 1.847, 8.918) and 25-29 years (OR=3.506, 95% CI: 3.506) were factors that influenced the high prevalence of THI. The same reason can explain why most of the study participants were young male who were the only productive age group to the family in our society. The same may be the reason why Motor car accident (OR=5.666, 95% CI: 1.769, 18.162) and motor bike accident (OR=6.424, 95% CI: 5.238, 11.662) in our study participant was significantly associated with THI occurrence. In our study being male(131/135=97.1%) compared to females(2.96%). Similarly Jeannoh, K.K et al reported that male gender is the most dominant (97.8%) compared to the female (2.2%) and in other study results; and Abul Hasnat et al reported that, majority of the head and concomitant facial injuries were experienced by males, constituted 88.3% and females constituted only 11.7% of the total victims. The male to female ratio was 7.57:1. These results are similar in a study from India, where 89% of subjects were males and 11% were females, giving a male to female ratio, 8.09:1(23). In the present study many factors can affect gender distribution in a developing country like Ethiopia; including women's are less likely to participate in outdoor activity, while males involve in daily outdoor risky condition to continuously supply or support their family, it was almost all male population participate into risky transportation system on daily basis particularly riding motor cycle, the other factors may be violence, And our study finding showed significant association of male participant having THI during their maxillofacial trauma. In our study, age range below 24 years (OR=4.058, 95% CI: 1.847, 8.918) and 25-29 years (OR=3.506, 95% CI: 3.506) were factors that influenced the high prevalence of THI. This being young age groups more likely to have associated THI was similar with the study by Alessandro Leite Cavalcanti et al reported that most accidents affects male adolescents aged from 15 to 19 years sustaining THI(8)3). Samuel

Udeabor et al determined in his study on maxillofacial(MF) injuries associated head injury that patient age group from 20-29 years age group was mostly affected (44.6%) accounting for 47.2% neurological injuries found in the study(19).

In the present study, the results showed that key road traffic accidents related etiologies such as motor bike accident (X^2=73.277; P-value=0.000) and motor car accidents; were linked to the higher occurrence of THI among patients presenting with maxillofacial traumas. Similarly, multiple regression analysis results showed that key road traffic accidents related etiologies such as motor bike accident; (OR=6.424, 95% CI: 5.238, 11.662), motor car accidents; (OR=5.666, 95% CI: 1.769, 18.162) were linked to the higher occurrence of THI among patients presenting with maxillofacial traumas. According to the results, the odds of THI was nearly six-fold higher in individuals who sustained motor bike and motor car accidents (Table 9). Similar to our study results, Anjaneya Dube et al reported that the main cause of THI associated with maxillofacial (MF) injury was motorcycle accident (53.6%). Orawan Chansanti et al reported that the most common cause of injury was motorcycle accident, accounting for 65.9% (n = 566) followed by car accident 10.9% (n = 566) (11,19). This is consistent with the habit of children and adolescents using motorcycles in our today society which is quite common in developing country like our country Ethiopia. The reason of this high frequency of RTA accident may be from recklessness and negligence of the drivers, poor maintenance of vehicles, road defect, lack of helmet usage and seat belt, or in rural area where road facility were not available four wheel transportation system cannot serve the society which may persuade them to use motor cycle as alternative transportation leading to maxillofacial trauma severely enough to involve THI. The impact of Covid-19 corona virus have on public transportation system facilitates one type of etiology to occur frequently than the other; particularly the use of motor bike were significantly increased during that time when public gathering was prohibited people started using motorcycle as only chance for transportation service since motor cycle was the main individual transportation option by young age group of society in general(24). This is consistent with our study result that high rate of motor bike involvement was seen as the etiology of traumatic head injury in maxillofacial patient, which may be linked to that our study period which was conducted coincided with the period that public transportation was restricted as state of emergency due to novel Covid-19 or corona virus pandemic in our country Ethiopia which may

persuade many people to buy affordable vehicle like Motor bike and that can be used by one person to fit new traffic law of Covid-19 as an alternative transportation system to provide basic needs to the community and this was reported also in other study. And those people started using motorbike during pandemic may include people who were not qualified to ride motor bike in their life before increasing their risk of having accident which may positively affect the high occurrence of motor bike related injury in our study subjects during this period and this our study finding was supported from other study(24).

Furthermore, the analysis identified specific types of maxillofacial traumas such as zygomaticomaxillary complex fracture, ((OR=3.055, 95% CI: 1.440, 6.482), and mandibular angle fractures, (OR=0.340, 95% CI: 0.187, 0.617) significantly associated with THI. The results implied that the odds of THI in patients having the zygomaticomaxillary complex patents was three-fold, while the mandibular angle fractures preventive for THI occurrence for 66% of the patients. Similarly, Hohlrieder et al. reported that Le Fort-II and III orbit, nose, zygoma and maxillary fractures were associated with a 2-to 4-fold risk of intracranial hemorrhage, while mandibular fracture did not significantly increase the chance of intracranial hemorrhage. Fracture of the mid-face was found to be most commonly associated with head injury (3). And also similarly Sigaroudi et al reported that all of the midface fractures had a relationship with a brain injury and they reported that midface fractures increased the risk of brain injuries (13). Maher M. Abosadegh et al reported that zygoma fracture was observed to have the strongest impact to sustained THI with odds ratio of 3.34 followed by mandible, NOE, maxilla, and supraorbital bone with odds ratios of 2.46, 1.67, 1.36, and 1.15, respectively and THI should be suspected whenever orbital, zygoma, and maxillary bone fractures are presented (2).; And Kloss et al. reported the zygoma and orbit to be the most common fractured bones in a group of conscious patients with intracranial hemorrhage and concomitant facial fractures(3). In contradiction to this finding, Woriax et al in 2018 found that severe midface fractures are associated with lower rates of hemorrhagic brain juries**,** spine fractures, pneumothorax, abdominal, and pelvic injuries(18). Deceleration effect was considered one potential mechanism where midface impact dissipates the energy from the trauma or by acting as a shock absorber for the high impact energy of the trauma, guarding the brain, resulting in decreased brain**,** neck, and torso traumatic injury which proves its role of protecting the neurocranium from severe injury(1,18).

8. Conclusion

The results suggested that the prevalence of THI among maxillofacial trauma patients was considerably high implying the prevalence of strong connection between maxillofacial trauma and THI accounting for 41.52%.

Furthermore, the results identified that socio-demographics factors like gender (being male) and younger age groups (age <24 and 25-29 years) are factors influencing THI.

Among the etiological factors was also positively affected by RTAs (motor bike accident and motor car accident) and THI

Anatomical location of maxillofacial trauma site such as zygomaticomaxillary complex fracture are positively associated with the occurrence of THI among maxillofacial trauma patient.

9. Recommendation

In line with the results, we would like to recommend various bodies, institutions and individuals. Jimma University medical center (JUMC) should take initiatives to improve patients' outcomes by promoting case-sensitive medical care systems such as emergency medical responses, coordinating inter-disciplinary actions or team works.

The health professionals should be committed for team works, and patient-centered care and support for improved responses to emergency conditions.

Oral and maxillofacial surgeon and Neurosurgeons should participate at all level of planning and management for concomitant maxillofacial trauma and THI from emergency department to operation room.

We would like to recommend the JUMC emergency department to provide and prepare specialty specific emergency instrument and equipment ready at all time as stand by to respond early on to the devastating maxillofacial trauma that usually co-existed with other poly-trauma particularly THI.

As prevention is supposed to be better than cure and caring, Jimma Zone health offices and other concerned stakeholders such as road and transportation agencies and police departments should take preventive actions before the occurrence of the accidents by strictly sticking to traffic law and order and increasing community awareness about the impact road traffic accident and how to participate in decreasing traffic accident.

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9. ANNEX II

Check list for data extraction

Variables	Categories	Remark
MRN #……,.	Address:	
Age in complete years	Mention:____	
Gender:	1.Male 2. Female	
Etiology	1.Blunt trauma 5.RTA (MCA) 2. Gunshot….. 6. Falls from height…… 3.Knife 7. Falls on ground 4. RTA (MVA) 8. Bite (animal, human)	3: O. sharp…. 2:type….
Assessment		
VS:	1. PR…. 2. RR……3. BP…... 4. T….. 5. S02…	
Pupillary reflex	1.Normal 2.Dilated 3. constricted	R.….
GCS	1. EO ___ 2. VR: ___ 3. MR: ___	
Severity/degree	1. Mild 2.moderate 3. severe	
NM: Neurological M	1. LOC: ____ 2. ABM: ___ 4. ME: ___ 5. amnesia: a. ARG b. RG 3. Vomit: a. minute: ___ b. episode: ____	ME: 0.. 1...2…3…4..5…
Clinical findings	1.Asymmetry 2. CSF leak (CSF-R) 3. CSF leak (CSF-O) 4. Epistaxis 5. Hemotynpanium 6. Battle sign 7. Raccoon's eyes 8. Facial palsy 9. Paresthesia 10. Open bite 11. Cross bite 12. Trismus 13. Telecunthus, 14. Septal hematoma	R.……. Ant……
Imaging Dx	1. CT Scan….. 2. Plain X-ray…..	O. site trauma?
Type of skull #	1. Depressed-open 2. Depressed-closed 3. Linear-open 4.Linear-closed 5.skull base (cribriform plate)	IO. finding?
Location of skull #	1.Temporal 2.Occipital, 3. Parietal, 4.Frontal	R.….
THI Dx.	1.SAH, 2.EDH, 3.SDH, 4.DAI, 5.ICL, 6.Contusion, 7. Concusion, 8.Pneumocephalus	
OMF trauma location	1.Upper face 2.Midface 3.Lower face	R.….
OMF Dx	1.Frontal sinus# 2.frontal bone# 4. STI 5. ZMC# 6. NOE# 7.Orbital rim# 8. Palatal# 9. Nasal#, 10. Lefort# (I/II/II), 11. Impaired vision, 12. Globe rupture	IO. finding. **4**:FN/SG injury
Management	1.ORIF 2.IMF 3.a)STR b)Flaps 4.a)Frontal sinus Ant.T.E, b)S.lining remo & sinus & NFD obliteration, c)cranialization, 5. Craniotomy 6. H.evacuation, 7. dural repair, 8. Skull elevation, 9. craniotomy, **10**:TAT, 11;BT	
Mgt outcomes	1. Improved, 2. complicated**?** 3.died**?**	