ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCES, SCHOOL OF MEDICINE, DEPARTMENT OF, ORAL AND MAXILLOFACIAL SURGERY

INCIDENCE AND PATTERNS OF MANDIBULAR FRACTURES IN ADDIS ABABA UNIVERSITY AFFLIATED HOSPITALS (YEKATIT 12 HOSPITAL MEDICAL COLLEGE AND ST.PETER SPECIALIZED HOSPITAL), FROM JANUARY, 2017 TO DECEMBER, 2019, ADDIS ABABA, ETHIOPIA

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This is to certify that, the thesis prepared by **Assefa Abera** entitled **'Incidence and pattern of mandible fractures in AAU affiliated hospitals (Yekatit 12 HMC and St.Peter's specialized Hospital) in Addis Ababa, Ethiopia over a retrospective period of 3 years from January 2017 to December 2019'** and submitted in partial fulfillment of the requirements for the **specialty certificate in Oral and Maxillofacial Surgery** complies with the regulations of the university and meets the accepted standards with respect to originality and quality.

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Abstract

Objectives: The objective of this study was to assess the incidence and pattern of mandible fractures in AAU affiliated hospitals in Addis Ababa, Ethiopia over a retrospective period of 3 years from January 2017 to December 2019 G C.

Methodology: Retrospective review of patient's records was conducted among those patients who visited AAU affiliated hospitals having mandibular fractures. The study was conducted from November, 2019 to August, 2020. The patients chart with incomplete information and those which are absent from shelf were excluded from the study. The data was entered, cleaned and analyzed using Epi info data version 7.0 Software. Descriptive analysis was computed as frequency of fractures, distribution of age, gender, etiology, diagnosis, and anatomical sites of mandibular fractures.

Results: A total of 247 patients who were retrospectively evaluated at Yekatit 12 HMC and St.Peter's specialized hospital between January 2017 and December 2019 sustained 343 mandibular fractures (mean of 1.4, range 1-3). The incidence of mandibular fracture was higher in male patients (83%) than in females (17%) (Male: Female ratio 5:1), and the peak incidence was during the third decade for both genders. The most common site of fracture was the body (26.53%), followed by the angle (23.9%), and parasymphysis (19.82%). Overall, interpersonal violence (46.15%) was the most common cause followed by RTA (27.53%). In male patients, the most common cause was interpersonal violence (50%); in females it was a RTA (34.14%). The anatomical sites of fracture reflected their cause. A total of (n=76, 30.76%) patients sustained other non-maxillofacial injuries of which head injury (n=58, 23.48%) is the most common.

Conclusions: The most common cause of mandibular fracture was interpersonal violence. Mandibular fractures were more common in males than females with most patients aged 21-30 years. The most common fracture site was body of the mandible. The predominant treatment modality was open reduction and internal fixation (ORIF).

Key words: Mandibular fractures, Body, Etiology, Interpersonal violence (IPV), ORIF.

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Acronyms

AAU - Addis Ababa University

CA - Car Accident

CHS - College of Health sciences

HMC - Hospital Medical College

IMF - Intermaxillary fixation

IPV- Interpersonal Violence

MMF-Maxillomandibular fixation

MVA - Motor Vehicle Accident

NOE - Naso-Orbitoethmoid Complex

OMF - Oral and maxillofacial

ORIF - Open reduction and internal fixation

RTA - Road Traffic Accident

SPSS - Statistical package for social sciences

WHO - World Health Organization

Yrs. - Years

ZMC # - Zygomaticomaxillary complex fracture

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CHAPTER-1

1. INTRODUCTION

1.1 Background Information

The maxillofacial region is one of the most fractured sites of the body. The management of these fractures is a challenge requiring skill and experience. In repair of maxillofacial trauma, functional and aesthetic reconstruction is a prime concern. Oral and maxillofacial injuries can vary in severity ranging from minor soft tissue injuries to major fractures of the entire facial skeleton (1).

The mandible is more prone for maxillofacial trauma and fractures due to its unique mobility, shape, and chin prominence in the facial skeleton. It is the second most frequent of the facial bones affected by traumatic injuries of all facial fractures. The mandible can be fractured alone or in combination with a fracture of other bones in the maxillofacial region (2). A fractured lower jaw is accompanied by pain, malocclusion and loss of masticatory function, speech impairment, and esthetic disfigurement with psychological effects. It can result in severe pain which prevents patient from feeding and airway obstruction (2)

Etiology of fracture is multifactorial and based variably on socioeconomic status, culture, technology, demography, and economic factors. The etiology of mandibular fractures could be caused by road traffic accidents (RTAs), accidental falls, assaults, industrial mishaps, sports injuries and firearm injuries (3). RTA is the leading cause of mandibular fracture in developing countries owing to poor enforcement of law and ensuring the abidance by the existing traffic and speed limit regulations, while interpersonal violence is leading cause in developed countries (3). Regarding with the management of mandibular fractures, the most widely applied treatment modality is closed reduction with maxillomandibular fixation especially in developing countries where advanced services are not widely available. In developed countries having advanced setups, open reduction with internal fixation using plates and lag screws is the most practiced modality of treatment (3).The most common complications related with closed reduction is TMJ ankylosis, weight loss, poor oral hygiene related infections whereas ORIF has risk of nerve injury, surgical scars, foreign body (plates and wires) related infections (3).

1.2 Statements of the problem

Mandibular fractures are the second, most-frequent facial injuries treated at a trauma center in Switzerland. According to several studies, they account for 15.5% to 59% of all facial fractures. The epidemiological data for facial and mandibular fractures varies among countries and changes over time. The etiology of maxillofacial injuries is multi-factorial, mostly depending on socio-economic, demographic, cultural, technological and environmental factors. Interpersonal violence is the most common cause for mandibular fractures in North-American countries, North European countries, Australia and New Zealand. In newly industrializing and less developed countries such as Jordan or Nigeria, motor vehicle accidents are the most common cause for mandibular fractures (4).

Maxillofacial bone fractures particularly mandibular fracture is one of the common problems affecting the population worldwide. Globally the incidence of maxillofacial bone fractures as a whole as well as mandibular bone fracture specifically is increasing with different figures represented at different geographical location that mainly corresponding to cultures and socioeconomics of the societies (5).

The majority of affected patients in Uttar prudish state, India were in the 2nd and 3rd decades. A definitive relationship existed between RTA and the incidence of mandibular fractures. The frequency further increased with consumption of social intoxicants. The most commonly fractured site was Para symphysis either isolated or associated with other fractures in the mandible (5).

The etiology and pattern of mandibular fracture vary considerably among different study populations. Despite many reports about the incidence, diagnosis and treatment of mandibular fracture there is limited knowledge about the specific pattern of mandibular fractures in South Asian countries (6).

The sheer pace of modern life with high-speed travel as well as an increasingly violent and intolerant society has made facial trauma a form of social disease from which no one is immune. There are changes in patterns of facial injuries, extent, clinical features, and so forth resulting in mild-to-massive disfigurement of maxillofacial skeleton along with functional loss.

Beside RTA and violence, direct/indirect trauma may also occur due to sport activities, falls, and firearms. Occasionally, it may also be secondary to certain disease entities like cystic lesion, neoplasms, and metabolic diseases (7).

Mandible is the only mobile bone of facial skeleton and there has been a significant increase in number of cases in recent years. It is embryologically a membrane bone and is more commonly fractured than the other bones of face. Mandibular fractures occur twice as often as midfacial fractures. The energy required to fracture it being of the order of 44.6–74.4 kg/m, which is about the same as the zygoma and about half that for the frontal bone. It is four times as much force is required to fracture maxilla (7).

The mandible is fractured more frequently than any other facial bone, likely because it is exposed and protruding. The etiology of these fractures is multifactorial, with the type and frequency of fracture dependent on socioeconomic status, culture, technology, demography, and economic factors. Despite these all major concerns, there is no recent comprehensive study has assessed patterns of mandibular fracture in African countries (8).

1.3 Significance of the study

The facial area is one of the most common sites of injury. The mandible is fractured more frequently than any other facial bone, because it is exposed and protruding. In addition to functional loss, a mandibular fracture can result in mild to moderate impairment or defect.

Maxillofacial bone fractures in general and mandibular fractures in particular not only cause morbidity and mortality but also has significant impact on facial cosmetics and psychosocial concerns demanding considerable attention. So it can cause great economic and psychosocial on the individuals, families and community as whole.

In worldwide, there is significant increase in number of mandibular fractures most commonly affecting young male in productive age groups with the highest peak age ranging in 21–30 years that has gross socioeconomic effect. The sheer pace of modern life with high speed travel has increased its effects. Despite all these problems, there are few studies done in Africa and other developing world regarding with incidence and patterns of mandibular fractures.

There are no previous study findings concerning incidence and patterns of mandibular fractures in our country Ethiopia. Hence, this study assess incidence and patterns of mandibular fractures based on etiology, gender, anatomic locations and treatment modalities used as this plays an important role in the quality assurance of the health care process and the quality of life for trauma patients.

Furthermore, in developing countries like Ethiopia where the number of road traffic accidents is dramatically increasing with time, determining the frequency of mandibular fractures and their patterns of occurrence can enhance early diagnosis and treatment, thereby reducing morbidity and mortality associated with these fractures.

In addition, it is believed that, this study contributes much as base line data for the descriptive epidemiologic study of maxillofacial fractures in general and mandibular fractures in particular, intended treatment guidelines and policy making for future in the country.

CHAPTER-2

2.1. LITERATURE REVIEW

A total of 13,142 patients with mandibular fractures from participating trauma centers in USA from 2001 to 2005 were included in the study of which 80% of patients were male. Fracture occurring most frequently at 18 to 54 years of age. Mechanism of injury differed by gender, with men most often sustaining mandibular fracture from assault (49.1%), followed by motor vehicle accidents (MVAs; 25.4%) and falls (12.8%). Women most commonly sustained mandibular fracture from MVAs (53.7%), followed by assault (14.5%) and falls (23.7%). Falls were a significantly more common mechanism in patients who were at least 65 years old (9).

A retrospective study of 246 patients treated for mandibular fracture at the Toronto General Hospital over a 5.5 years period (from 1995 to 2000) shows men those who aged 21 to 30 years sustained the most mandibular fractures. The ratio of males to females was 5:1. Most fractures were caused by violent assault (53.5%), followed by falls (21.5%) and sports activities (12.2%). Alcohol was a contributing factor at the time of injury in 20.6% of fractures for which this information was available. Nearly half of all cases were treated by open reduction (49.1%). Complications occurred in 5.3% of patients (10).

A retrospective medical records review of a total of 181 patients with maxillofacial injury was done in Montreal General Hospital, Canada between 1998 and 2003 and 307 mandibular fractures were identified. About 52% of the fractures occurred in individuals 21 to 40 years of age, 78% of patients were male, and there was wide ethnic diversity. About 60% of patients had multiple mandibular fractures; 29% were symphysis fractures, 25% were condylar fractures and 23% were angle fractures. Assault was the most common mechanism of injury, with 29% of fractures involving alcohol or illegal drug use. About 30% of patients had an associated facial fracture, and more than one-third had another major injury (11).

The study done in Canada, Finland and Kuwait during the 1990–2000 at Institute of Dentistry, University of Oulu and Oulu University Hospital, Oulu, Finland on a total of 596 patients having 818 mandibular fractures in Kuwait, 317 fractures on 228 patients in Canada and 417 fractures on 268 patients in Finland. The mean age of the patients in Kuwait, Canada and Finland were

26.2, 31.7, and 30.7 years, respectively. Condylar fractures were more common in Finnish patients (41%) than Canadian (35%) or Kuwaiti patients (21%). Condylar fractures caused by falls were about 3.4 times more common in Kuwait and Finland compared to Canada. In Finland the risk of road traffic accidents caused by condylar fracture was about 4 times higher than those caused by other causes. In Canada male was about 2 times higher for the condylar fracture than females. Female patients often had more multiple injuries than men in all three countries and multiple fractures were observed especially in traumas caused by falling (12).

A retrospective review done at London teaching hospital between June 2005 and May 2010 on a total of 1261 patients who sustained 1994 mandibular fractures shows the incidence of mandibular fracture was higher in male patients (87%) than in females (13%) (Male: female ratio 6.6:1). The peak incidence was during the third decade for both genders. The most common site of fracture was the angle (30%), followed by the parasymphysis (27%), and condyle (27%). Overall, interpersonal violence was the most common causes (72%) followed by falls (18%). In male patients, the most common cause was interpersonal violence (77%); in females it was a fall (46%). Interpersonal violence typically resulted in fractures of the angle (36%) while road traffic accidents and falls resulted in condylar fractures (28% and 53%, respectively). About 49.1% were treated by open reduction and internal fixation (ORIF) while 29.4% were treated by IMF and 21.5% were treated conservatively (8).

According to the retrospective study conducted in Portugal in the year period 1993 to 2002, on 521 patients with 681 mandibular fractures showed, motor-vehicle accident (MVA) was the most common (53.9% patients) cause of fracture. Almost half of the patients (48.8%) were in the oldest age group (16 to 18 years old). The condyle of the mandible was involved in 31.0% of the fractures. Maxillomandibular (MMF) fixation was used in 534 (78.4%) fractures. Overall mortality in this series was 0.6% (3 patients); mortality was caused by multiple traumas, mainly head trauma (13).

The retrospective study conducted between January, 2000 and December, 2007 at the University hospital of Bern, Switzerland's largest Craniomaxillofacial surgery center in central Switzerland on 420 patients with 707 mandibular fractures showed the two most common causes of injury were road traffic accidents (28%) and various types of sports injuries (21%).

A total of 13% of the patients were under the influence of alcohol or drugs at admission. Fractures were predominantly situated in the condyle/sub condyle (43%) and in the symphysis/parasymphysis region (35%). Occurrences of fractures in the angle and in the body were low, at 12% and 7% respectively (4).

In the city of Sao Paulo, Brazilian level I complex public trauma hospital ;one study done between January and December, 2001 on a total of 91 patients having mandibular fractures reveals motorcycle accident (22%) was the major cause of mandibular fractures followed by physical aggression (15%) and height fall(11%). The mandibular anatomical sites of higher fracture incidence were: symphysis (36.3%), body (34%) and condyle (6.6%). The most commonly performed treatment modes were conservative approach or open reduction and intraosseous fixation. The most predominantly affected age groups were 21-30 year-old males (29.7%). Out of 91 patients, 18 (19.7%) had complication; 12 had infection (66%), malocclusion was (2 cases; 10%). Trismus, lack of union, mobility and salivary fistula had 1 case each (14).

In Medina region King Fahad Hospital, Saudi Arabia: Oral Maxillofacial Surgery Department, a retrospective study was done on a total of 197 patients with fracture of the mandible who were admitted in the period of 3 years from 2013 to 2016 of which 165 were male and 32 female patients. The ages ranged from 3 to 86 years with a mean of 24 yrs. A total of 260 fractures of Mandible were documented. The largest number (113) of patients was found in the age group between 16 and 30 years. Trauma caused by RTAs was the main etiology of the fractures followed by falls and assault. The majority of the patients were in the role of vehicle drivers. The condylar fracture was most frequently affected constituting the largest number (103) of fractures followed by the angle (51), Parasymphysis (45), and then by the body (23) of the mandible. Dentoalveolar fractures were present in 22 cases. Very less number of coronoid fractures (7), followed by those of the ramus (5), and least number at the symphysis (4) were found (15).

The 5 years retrospective study conducted in Taleghani Hospital of Iran, from the beginning of 2013 until the end of 2017 on the total of 708 patients with maxillofacial fractures; most cases were men (85.2%) and in the second and third decades of life (53.8%). The majority of the fractures were in the mandible with the incidence rate of 64.7% (16).

According to a retrospective study done on an incidence and pattern of mandibular fracture in Rohilkhand region, Uttar Pradesh state of India; the patient records and radiographs for 144 patients treated for mandibular fractures were reviewed between January 2012 to December 2013 and maximum incidence of fractures was observed among the individuals in 3rd decade (35.4%) followed by 2nd and 4th decades, which exhibited 32 and 30 cases (22.2% and 20.8%), respectively. Male to female ratio was (4:1) portraying a male predominance. Road traffic accidents (RTAs) were observed to be the predominant etiological factor accounting for 79.2% of the total injuries followed by assaults (11.8%) and falls (9%). Parasymphysis exhibited the highest incidence (32.63%) amongst the anatomic sites, followed by body (18.75%), angle (16.66%), condyle (15.27%), symphysis (12.50%), ramus (2.77%) and coronoid (1.38%) (5).

A 3 years (October 2010 to October 2013) retrospective analysis done in central India on a total of 464 patients out of which (343) 79% were male and (91) 21% were female having mandibular fractures with age ranging from 7 to 89 years showed the highest incidence (37.5%) of mandibular fractures was in the age group of 21–30 years. The main cause was road traffic accidents (RTAs, 68.8%) followed by falls (16.8%), assaults (11%) and other reasons (3.8%). Parasymphyseal fractures were the most frequent 331 (41.1%), followed by condyle (135) and angle (124) fractures in occurrence. Mandibular angle fractures were found mostly to be associated with assault victims (6).

According to the Study conducted between 2012 t0 2015 on Pattern and Incidence of Mandibular Fractures in Department of Oral and Maxillofacial Surgery, Career Post Graduate Institute of Dental Sciences, Lucknow, India on of 66 patients of which 37 had a unilateral mandibular fracture while 29 had bilateral fractures with maximum number of subjects were in the age group 21–30 years (28.8%) followed by 11–20 (25.8%), 31–40 (21.2%), <10 (13.6%), 41–50 (6.1%), and 60 years and above (4.5%). Around three-fourth (75.76%) of patients were in the age range 11 to 40 years. More than four-fifth (81.8%) of patients were males. Only 12 (18.2%) patients were female. The male to female ratio of the patients was 4.5: 1. Road traffic accident (68.2%) was the cause of mandibular fractures in majority of subjects, followed by fall from height (30.3%) and hit against object (1.5%). In 37.9% of cases, the mandible fracture was associated with other injuries while in majority (62.1%) no such associated injury was observed.

Fracture of parasymphysis (31.4%), body (24.5%), sub condyle (20.6%), and angle (13.7%) were the most common sites while fracture condyle (1%), coronoid (1.0%), dentoalveolar (1.0%), and ramus (1.0%) were the least common fracture sites (7).

According to one study done in Department of Oral Medicine and Radiology, Faculty of Dental Sciences, King George's Medical University, Lucknow, Uttar Pradesh, North India on Prevalence of mandibular fracture in patients visiting a tertiary dental care hospital; the study population consists of 1015 individuals aged between 7 and 68 years with the mean age of 33.49 ± 11.79 years and majority of the patients were between 18 and 35 years of age. Males (78.6%) dominated the study population than females (21.4%). The most common anatomic site for mandibular fracture was parasymphysis region (40.3%) followed by angle (28.8%), condyle (27.6%), and symphysis (12.5%) of mandible. The coronoid process of mandible (44, 4.3%) was least involved in mandibular fracture. Males (42.4%) suffered more parasymphyseal injury than females (32.7%). The mandibular angle fracture is more common in females (47.9%) than males (23.6%) (17).

A 3 years retrospective study of maxillofacial injury cases was carried out at the newly created B.P.S Government Medical College for Women, Khanpur Kalan, Sonepat, in India from September 2011 to February 2013 on a total number of 474 patients with 86 mandibular fractures was registered, males outnumbering female patients by a ratio of 2.9:1. Age of patients ranged between 9 months and 72 years, maximum incidence occurring in the 18-34 year group of age. Most injuries were caused by road traffic accidents (48.83%), followed by assaults (26.74%) and sporting activities (13.95%). The most prominent site of mandibular fracture was parasymphysis (27.90%), followed by angle (24.41%) and body (18.60%) regions. 30.23% of the patients with mandible fractures were having multiple fracture sites. Also, 10% of the patients with mandible fracture had associated mid-facial fractures. Closed reduction was done in 13.6% of patients, open reduction and internal fixation was performed in 46.4% of cases, while 18.1% of them were treated conservatively. The mean duration of hospitalization was 10.12 ± 6.24 days (18).

According to a retrospective descriptive study done on a total of 35 patients with mandibular fractures in Department of Oral and Maxillofacial Surgery, Sinhgad Dental College and Hospital, Pune, Maharashtra, India on the prevalence of mandibular fractures during the period of February 2008 to September 2009, Out of 35 patients, thirty one were males (88.57%) and four

were females (11.43%) with a male: female ratio of 8:1. The peak occurrence is in young adults, aged 21-30 years (n = 15, 42.86%). In case of etiologic of fracture, road traffic accidents (RTAs) was the most common (n = 25, 71.43%) and condyle was most frequently involved site (n = 19, 38.78%). In most (n = 16, 45.71%) of the patients, an open reduction and rigid internal fixation using bone plate and screws was done (19).

A 5 years retrospective review of Incidence and pattern of mandibular fractures in rural population in Loni, Maharashtra, India during the period from January 2003 to December 2007 conducted on 324 patients reveals 486 mandibular fractures were identified; males formed 80.9% and females 19.1% of the studied population, with peak incidence occurring in the 21–30 years age group. The most common fractures site was parasymphysis (39.3%). The cause of mandibular fractures was RTAs (42.9%), followed by falls (25.9%), assaults and interpersonal violence (20.7%), and animal injuries (10.5%). The results exhibit that road traffic accidents remain the major cause of mandibular trauma and animal injuries being found exclusively in rural population (20).

The study carried out on 138 patients diagnosed with mandibular fractures in 2015 included 108 men (78.3%) and 30 women (21.7%), at the departments of oral and maxillofacial surgery of three hospitals in Peshawar, Pakistan: Sardar Begum Dental College and Hospital, Rehman Medical Institute, and Northwest General Hospital shows Most patients (56%) were aged 15-25 years, followed by those aged 26-35 years (26%). The most frequent cause of fractures was RTAs; 59.42%), followed by falls (18.8%). RTAs were predominant in men (89%); whereas, falls were predominant in women (80%). In patients with unilateral fractures, the most common fracture site was the parasymphysis (24.6%) followed by the symphysis (10.1%). In patients with bilateral fractures, the most common fracture sites were the parasymphysis and condyle (11.6%), followed by the parasymphysis and angle (8.0%) (21).

A retrospective analysis of patients suffering from facial fractures and treated in 8 hospitals in Kuwait during the years 1992-1997, shows there were 586 patients with facial fractures with a male: female ratio of 5.4: 1. The age of the patients ranged from 8 months to 87 years, with a mean of 27 and a median of 25 years. The majority (55.5%) were due to road traffic accidents. Only mandibular fractures were suffered by 49%, only midfacial fractures by 36.7% and combined mandibular and midfacial fractures by 14.3% of the patients. Altogether there were

923 fractures. The most frequent fractures were of zygomatico-maxillary complex (15%], followed by mandibular molar-premolar area (14.7%). Serious concomitant injuries were found in 141 patients (24%), of which 22 (3.8%) died as a results. 278 patients (47.4%) were treated by open reduction, 247 (42.1%) of them using titanium miniplates. Conservative treatment (closed reduction and/or maxillo-mandibular fixation) was performed in 180 patients (30.7%), while 128 patients (21.9%) were only observed (22).

The descriptive cross sectional retrospective study was undertaken on 435 patients with mandibular fracture during the year 2014-2015 to determine the epidemiological and clinical profile of patients presented with fractures of mandible and their different methods of treatment modalities in Bangladesh College of Physicians and Surgeons reveals higher prevalence in male (3.9:1), with occurrence peak between 21-30 years. The principal causes of fracture in this study were RTA representing 54.02% followed by physical assault 17.24%, fall, Sports injury, Blow by heavy objects, Tube well injury & others which includes Tire blast injury, Gunshot injury, Iatrogenic cause, Pathological fracture, Boat handle injury, Penetrating injury by metal etc. The most injured sites were in parasymphysis (26.31%) followed by angle of mandible 17.89% then symphysis, condyle, body of mandible, dentoalveolar, ramus, coronoid process of mandible. Most patients (70.11%) of mandible fractures were treated by closed reduction (arch bar, arch bars with intermaxillary fixation, eyelet wiring & lateral compression plate) and 21.83% of patients were treated with open reduction (miniplates fixation. 3D plate fixation). Only 8.05% patients were managed by conservative approach (23).

According to the a 10-year retrospective analysis of 685 mandibular fracture cases treated in Charles-Nicolle Hospital, Tunis, Tunisia during the time period of 1995 and 2004, the prevalence of mandibular fractures was higher in male patients (sex ratio 6:1). Road traffic accidents were the main cause of this trauma (45%), followed by assault (22%). Angle fractures were the most common (24.8%) followed by parasymphyseal fractures (22.2%). The most frequent treatment was closed reduction with MMF in 388 patients (56.6%). Trans osseous wiring was the most commonly used method in open reductions. Tooth loss and neurological sensitive deficiency were the most common sequels (24).

A review on incidence and patterns of maxillofacial fractures at Muhimbili National hospital, Dar es Salaam, Tanzania from January 2003 to June 2009 on 118 patients having maxillofacial fractures shows the males are more affected with (M: F ratio = 3.7:1). Peak incidence was in the 21-30 years age group that accounted for 53 (46.3 %) of the cases, followed by the 11 to 20 years age group which comprised of 25 (accounting for 21.3%) of the cases. Majority, 110 (85.9%) fractures, were occurred in the mandible, while 16 (13.6%) occurred in the maxilla and 2 (1.6%) in the zygoma. The most frequent cause was violence (social altercation, domestic violence and assaults), which accounted for 64 (54.2%) of all fractures causes, followed by motor traffic accidents with 41 (34.7%) (25).

Another study done at Muhimbili National Hospital in Dar es Salaam, Tanzania, 1998–2003 on a total of 314 patient records of 261 (83.1%) males and 53 (16.9%) females were retrieved (ratio m:f = 5:1), age range 2–70 years, with most (41.4%) in the 20–29 year age group. Most of the fractures occurred in the mandible 222 (70.7%). Most fractures were caused by assault 181 (57.6%) followed by falls 62 (19.7%), motor traffic accidents 43 (13.7%) and sports 25 (8%). Most of the mandibular (98.2%) and zygomatic arch fractures (62.5%) were managed by closed reduction, compared with alveolar bone fractures that were predominantly managed by open reduction. Complications occurred in 17 (5.4%) patients and were mostly infections (26).

A 1 year retrospective study on incidence of facial fractures made on a total of 390 patients with facial fractures at Khartoum teaching dental hospital; Sudan, during the period of January, 2010 to January 2011 indicates 14.1 % (55) of them were children below 16 years of age. Most facial fractures 47 % were in the age group 12–16 years, followed by 29.1 % in the age group 7–11 years, while the least number of fractures were seen in 23.6 % in the age group below 6 years. Most maxillofacial were caused by RTA 56.4 %, followed by daily activities 21.8 %, assault 16.4 %, and others 5.5 %. Most of the facial fractures occurred in the mandible 76.8 %, followed by mid-face fractures; zygomatic complex fractures 13.5 %, Le Forte 6.7 % and NOE 1.3 %. Intervention was in the form of conservative management in 49.1 % of the patients, 34.5 % closed reduction (e.g. simple wire, lingual splints) and 16.4 % open reduction (open reduction and internal fixation) (27).

A retrospective study made on Occurrence and pattern of mandibular fractures at Kisii District Hospital, Kenya: hospital records revealed that 39 cases of mandibular fractures presented at Kisii District hospital during a two-year period. 27 cases were due to interpersonal violence while road traffic accidents and accidental falls accounted for 9 and 3 of the cases respectively. The male ratio was 2.9:1. Majority (26 cases) of the patients were aged between 20 and 39 years. The commonly involved fracture site was the left body of the mandible accounting for 20 of the fractures (28).

A research done during 2-year period, September 2013–August 2015, in university of Gondar, northern Ethiopia shows, 326 patients of maxillofacial trauma were treated of which 80% were males with male to female ratio of 4.02:1. The mean age was 29.12 (± 8.62) with age range of 11–75 years. Majority of the study participants (47.2%) were within the age group of 21–30 years. Interpersonal violence (75.8%) and Road traffic accident (21.5%) were the leading causes. There was an associated injury in 79 (24.2%) patients in head and neck area, thoracic, abdominal and extremities. Half of the patients were managed conservatively (49.7%) with debridement and suture, while 45.7% of the patients were closed reduction and 4.6% were surgical open reduction. There were 25 post procedure complications especially in mandibular fractures (29).

CHAPTER-3

3. OBJECTIVES

3.1 General Objective

- To assess the incidence and pattern of mandible fractures in AAU affiliated hospitals in Addis Ababa, Ethiopia over a retrospective period of 3 years; January 2017 to December 2019.

3.2 Specific objectives

- ✓ To determine sociodemographic distribution of mandibular fractures in AAU affiliated hospitals (Yekatit 12 HMC and St. Peter Specialized Hospital).
- ✓ To identify etiologies and frequency of mandibular fractures in the study population.
- ✓ To assess patterns of mandibular fracture in AAU affiliated hospitals in Addis Ababa.
- ✓ To determine incidence of mandibular fracture and the treatment modality given for diagnosed cases in the study population.

CHAPTER-4

4. METHODS AND MATERIALS

4.1 Study area and period

The study was carried out among those patients with mandibular fractures who visited Addis Ababa University affiliated hospitals (Yekatit 12HMC and St. Peter Specialized hospital) during the study period. AAU is one of the renowned higher learning institutions in Ethiopia and it is located in the capital city of the country, Addis Ababa. It provides health care service with 600 full time faculty staff members and 700 beds serving almost all the entire population as the only tertiary level health care center. It contains of many departments such as Surgery, Dentistry, Gynecology, Internal medicine, Ophthalmology, Pediatrics, Pharmacy, Pathology, laboratory and other public health departments. It is the only tertiary level teaching center in the country until recently. The College currently offers eight undergraduate and over 70 postgraduate programs. Tikur Anbessa specialized hospital (TASH) is the teaching hospital of the College. In line with the mission and vision of AAU, the CHS exercises unique roles in training highly skilled health professionals at MSc, PhD, specialty and subspecialty levels. This allows it to contribute to the expansion of quality health care, education and research in the country. The study was conducted from November, 2019 to August, 2020 G C.

4.2 Study design

A retrospective secondary data like patient's chart, admission and operation room log books review were used.

4.3 Population

4.3.1 Source population

All patients who were treated at AAU affiliated hospitals (Yekatit 12 HMC and St. peter specialized Hospital), Oral and maxillofacial department from January 2017 to December 2019.

4.3.2 Study population

All patients who had mandibular fractures and treated at AAU affiliated hospitals; maxillofacial surgery department from January 2017 to December 2019 were taken as study population.

4.4 Sample size and sampling technique

4.4.1 Sample size Determination

All patients who came to AAU affiliated hospitals, oral and maxillofacial surgery department and those diagnosed with mandibular fractures from January 2017 to December 2019 G.C were taken as the study samples from the mentioned charts. All the patients with fully recorded charts in the given time with given diagnosis were taken as valid study sample size.

4.4.2 Sampling technique

From log/registration books the list of all patients seen during January 2017 to December 2019 and diagnosed with mandibular fractures together with their chart number were gathered. Using chart numbers, their charts were regained from card room for data collection.

4.4.3 Inclusion criteria

All patients who were treated for confirmed mandibular fracture at oral and maxillofacial surgery department in the study period with completed record were included in the study.

4.4.4 Exclusion criteria

Those patient charts absent from shelf and incomplete charts were excluded from study sample when it was found not quite enough to fill this specific data collection instruments.

4.5 Variables

4.5.1 Independent variables

-Age

-Sex

-Address

-Etiologies

4.5.2 Dependent Variables

-Pattern of mandibular fractures

-Treatment modalities

4.6 Data collection procedures

Data collection was undertaken in June, 2020 in Yekatit 12 HMC and St. Peter Specialized hospital. Data was collected through medical record reviews of patients using a prepared data extraction format to collect information on, socio-demographic, patient details, investigations, comorbidities and diagnosis.

4.6.1 Disease Identification

Identification of disease was done by using typical clinical or radiographic features documented in patient chart and the treatment delivered.

4.6.2 Disease Classification and Categorization

Disease classification and categorization was according to the standard text book of (Peterson's principles of oral and maxillofacial surgery) based on anatomical sites.

4.7 Operational definitions and Terms

Mandibular fracture:–is a break through the mandibular bone usually because of trauma and some time as a result of pathologic conditions.

Polytrauma:–is the condition of a person who has been subjected to multiple traumatic injuries to various part of the body.

Comorbidities:-any significant disease which coexists with mandibular fractures in trauma patients.

Incidence:–the occurrence, rate or frequency of a disease or other undesirable things.

Patterns:–is the type of fracture weather complete or incomplete, displaced or non-displaced, linear or comminuted depending on the severity of injuries.

4.8 Data quality assurance

4.8.1 Pre-test

For consistency purposes, prior to data collection the data collection format was pretested on selected patient's chart those who were not included in the final study, so that the data collecting instruments were tested and based on the finding appropriate correction was taken including estimation of the time needed for data collection, data collector ability to understand it.

4.8.2 Data collectors training and supervision

The data collectors were trained on how to collect the data in an orientation session on study requirements including objectives of the study, definitions and the documentation processes, prior to data collection. The data collection process was rigorous patient chart review. The patient's card number was used, to check validity and completeness of the information. The data collectors were strictly supervised daily and the principal investigator has reviewed all filled format so that any suggestion and corrections were given.

4.9 Data analysis

Completeness of the data was checked every day and was entered and cleaned using Epi-info data version 7.0 and analyzed by the principal investigator. Descriptive analysis was computed as frequency, percentages, cross tabulation of different variables were determined. Finally the out puts of processed data were presented using tables and figures accordingly.

4.10 Ethical Consideration

Ethical clearance letter was obtained from Addis Ababa city government public health research and emergency management directorate and St. Peter`s specialized hospital ethical review committee office (ERCO).

4.11 Result Dissemination

Results of the study is disseminated to Addis Ababa University College Health Sciences ,Addis Ababa city government public health research and emergency management directorate and St. Peter`s specialized hospital ethical review committee office (ERCO).

CHAPTER-5

RESULTS

In between January, 2017 and December, 2019, the chart review of 247 patients identified 343 mandibular fractures (mean 1.4, range 1-3). A slightly increasing number of patients were reported in each year of the study; 71 patients in 2017, 84 and 92 patients in 2018 and 2019 respectively.

Patient demographic details

The majority of the patients were males (n=206, 83%), while the rest (n=41, 17%) were females with the male to female ratio of 5:1. The age of patients ranged between 3 and 67 years, with the mean of 27.70 years and median of 26.0 years. The maximum incidence occurred in 21-30 years age group in both genders; 98 males and 17 females (Table 1). Most of the patients were from Addis Ababa (n=131, 53.04%) and Oromia (n=72, 29.15%) region whereas only (n=2, 0.8%) patients came from Harari region (Figure 1).

Aetiology of mandibular fractures

Interpersonal violence (n=114, 46.15%) was the leading mechanism of injury and RTA (n=68, 27.53%) was the second most common cause. In males, the most frequent cause of mandibular fracture was interpersonal violence (n = 103, 50%), followed by RTA (n = 54, 26.21%). In females, the most common cause overall was RTA (n = 14, 34.14%), followed by interpersonal violence (n = 11, 26.82% (Table 2). In children less than 10 years of age, falling was the most frequent cause of mandibular fracture and for each of the 10- year intervals between 20 and 69 years, the most common cause was interpersonal violence but, for the age interval of 11- 20 years, the most common mechanism was road traffic accidents (Table 3).

Site of mandibular fractures

Of the total 343 mandibular fractures reported, the most common site of fracture was body (n = 91, 26.53%), followed by the angle (n=82, 23.90%) and parasymphysis (n=68, 19.82%). The least involved site was dentoalveolar and ramus region (Table 4). About 37.65% of patients had multiple mandibular fractures; 26.53% were body fractures, 23.90% were angular fractures and 19.82% were parasymphysis fractures. Multiple mandibular fracture was most commonly caused by interpersonal violence (n= 42, 45.16%) followed by road traffic accidents (n=29, 31.18%) and falling (n=11, 11.83%) (Table5).

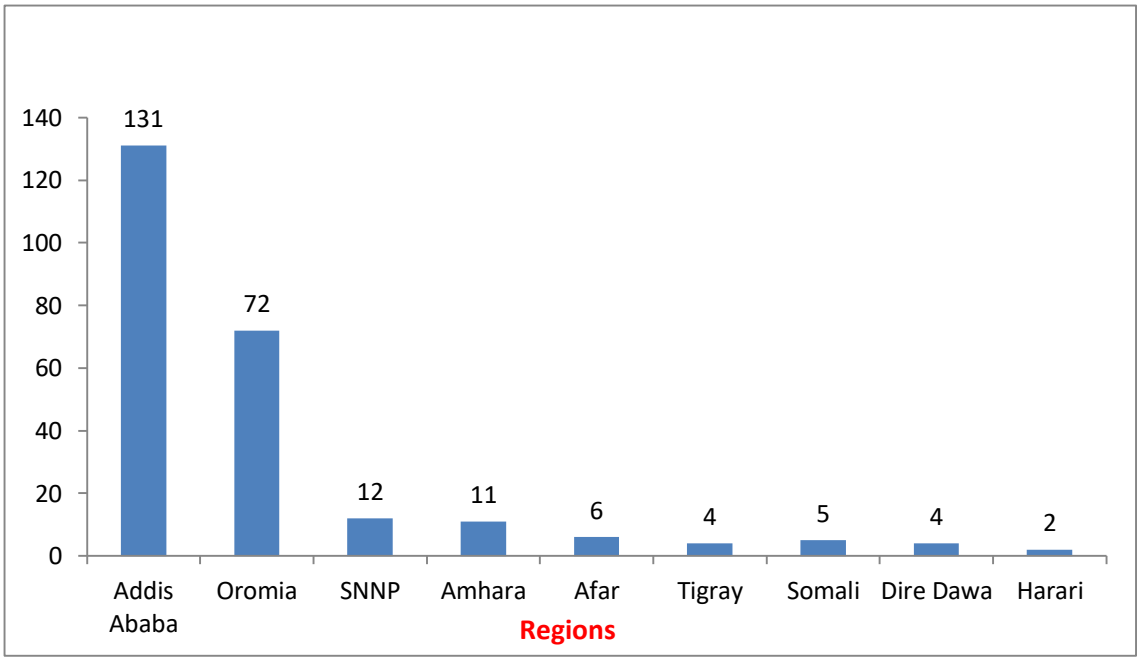

Figure 2 Distribution of 247 patients according to their geographic locations.

Table 1 Age and gender distribution of 247 patients.

Age groups	Females	Males	TOTAL
1 - 10	2	13	15
11 - 20	8	33	41
21 - 30	17	98	115
31 - 40	8	43	51
41 - 50	2	13	15
51 - 60	2	5	7
61 - 70	2	1	3
TOTAL	**41**	**206**	**247**

Table 2 Distributions of 247 patients according to aetiology and gender.

Etiology	Females	Males	TOTAL
IPV	11	103	114
Falling	10	32	42
Gun shot	1	8	9
RTA	14	54	68
Sport related	0	4	4
Works related	4	3	7
Others	1	2	3
TOTAL	**41**	**206**	**247**

Table 3 Distributions of 247 patients according to age groups and aetiology of fractures.

Age groups	IPV	Falling	Gunshot	Works	RTA	Sports	Others	TOTAL
1 - 10	0	10	2	0	2	0	1	15
11 - 20	9	12	3	0	17	0	0	41
21 – 30	68	12	0	4	27	4	0	115
31 - 40	24	3	2	3	19	0	0	51
41 – 50	8	2	2	0	3	0	0	15
51 - 60	3	2	0	0	0	0	2	7
61 - 70	2	1	0	0	0	0	0	3
TOTAL	**114**	**42**	**9**	**7**	**68**	**4**	**3**	**247**

Table 4 Distributions of mandibular fractures according to anatomical sites and gender.

Patterns of fracture	Females	Males	TOTAL
Angle	8	74	82
Body	12	79	91
Condyle	12	34	46
Dentoalveolar	3	3	6
Symphysis	7	36	43
Parasymphysis	10	58	68
Ramus	1	6	7
TOTAL	**53**	**290**	**343**

Table 5 Distributions of mandibular fractures according to anatomical sites and aetiology.

Patterns of fractures	IPV	Falling	Gunshot	Works	RTA	Sports	Others	TOTAL
Angle	20	4	2	0	5	1	0	32
Body	26	4	1	1	10	1	0	43
Condyle	7	6	0	2	6	1	0	22
Dentoalveolar	2	4	0	0	0	0	0	6
Multiple fractures	42	11	6	2	29	1	2	93
Parasymphysis	10	8	0	1	11	0	0	30
Ramus	2	0	0	1	3	0	0	6
Symphyisis	5	5	0	0	4	0	1	15
TOTAL	**114**	**42**	**9**	**7**	**68**	**4**	**3**	**247**

Role of patients and associated injuries

Among patients injured by RTA, the largest number were pedestrians (n=37, 43.02%) followed by motorcycle drivers (n=19, 22.09%). The majority of males were involved in motorcycle + vehicle driving (n=30) while more females were pedestrians (n=14). About 76 patients had other associated injuries, of which head injury contributed larger number (n=58) followed by cervical spine injury (n=10) and few patients had chest and abdominal injuries (n=8).

Combinations of mandibular fracture

The most common combinations were body + angle (n=23, 24.73%) and Parasymphysis + angle (n = 14, 15.05%) fractures while the least was symphysis + ramus (n=1, 1.07%). Of the total 93 combined fractures almost all were treated by ORIF (n=89, 95.69%). Most of the fractures were combinations of two while only three patients had combination of three fractures.

Treatment modalities

The majority patients were treated by ORIF (n=202, 81.78%) while the rest were treated by; IMF (n=31, 12.55%), conservative managements (n=9, 3.64%) and splinting (n=5, 2.02%) (Figure2). ORIF was the dominant treatment modality followed by IMF while splinting was the least treatment done in both genders (Figure 3). Among the isolated mandibular fractures, angle fracture was the common site treated by ORIF while condyle fracture was the common site managed by IMF (Table 6).

Table 6 Distributions of 247 patients according to anatomical sites and treatment modalities.

Patterns of fracture	Conservative	IMF	ORIF	Splinting	TOTAL
Angle	0	1	31	0	32
Body	3	10	30	0	43
Condyle	1	10	11	0	22
Dentoalveolar	1	0	0	5	6
Multiple fractures	0	4	89	0	93
Parasymphysis	3	0	27	0	30
Ramus	0	3	3	0	6
Symphyisis	1	3	11	0	15
TOTAL	**9**	**31**	**202**	**5**	**247**

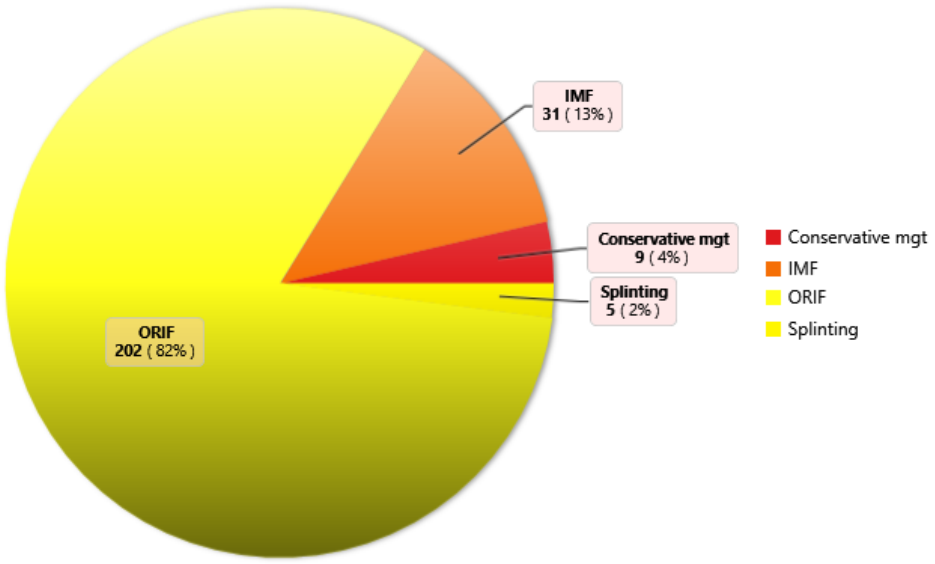

Figure 2 Distributions of mandibular fractures according to treatment modalities.

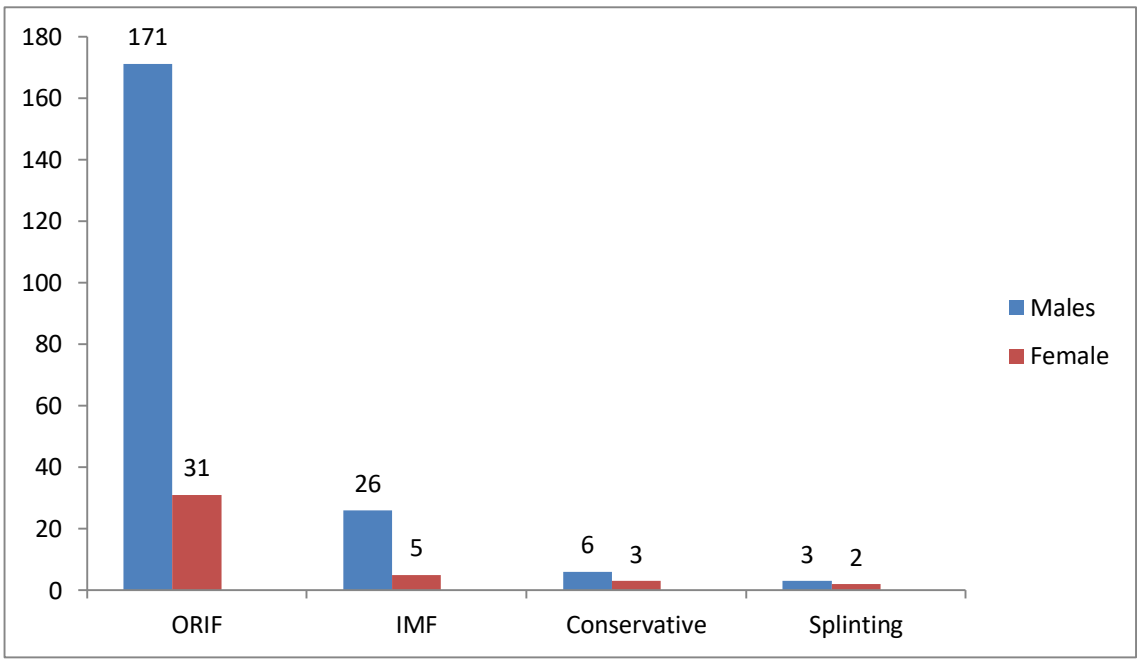

Figure 3 Distribution of 247 patients according to treatment modalities and gender.

CHAPTER-6
DISCUSSIONS

Sociodemographic and Incidence

Socioeconomic, geographical, and cultural factors have been shown to influence the patterns of mandibular fracture in a given population (5, 8, 10, 29). Most of the patients were from Addis Ababa (53.04%) and Oromia region (29.15%) whereas only (0.8%) of patients came from Harari region. This predominance could be explained by the fact that, Oromia region and Addis Ababa city government are geographically close to the study area while other regions are on far distance; they might also have maxillofacial surgery services in their respective more closer areas. In line with other study, a comparable proportion of patients sustained mandibular fractures at one site (44.9%) and 2 sites (52.4%) with mean of 1.4 fractures/mandible (8). The overall 3 years incidence was almost similar which showed a little increments that showed similarities with some other studies (11, 12).

The overall peak age group for mandibular fractures in this study for both gender was 21–30 years, which is similar to most studies in the literatures (6, 8, 10, 14, 20, 29). Mandibular fractures have been reported in all age groups ranging from 3-67 years, which is consistent to most of the studies (7, 17, 28, 29). The outcome of the study sample was predominantly male (83.4%) ;with male to female ratio of 5:1 which is almost similar to the study conducted in Canada ,Kuwait and Muhimbili National Hospital, Tanzania (10, 22, 26). These findings of the current study might be attributed to the fact that, people are more active during second and third decades of life than other decades, making them more vulnerable to trauma. Moreover, men participate in more outdoor activities than women.

Etiology

The most common cause of mandibular fracture in the study group was interpersonal violence (46.15%) followed by road traffic accidents (27.53%) and falling (17%) that coincided with the studies made in Muhimbili national hospital in Tanzania, Kisi district hospital in Kenya and Gondar university teaching hospital in Ethiopia (25, 28, 29). However, most of the literatures done in developing countries showed RTA as the leading cause of mandibular fractures (23, 24, 27).

The principal cause of mandibular fracture varies with gender in the study group; in males interpersonal violence (n=103, 50%) was most common cause followed by RTA (n= 54, 26.21%) whereas in females, the most common cause overall was RTA (n=14, 34.14%), followed by interpersonal violence (n= 11, 26.82%) which is supported with one study done in participating trauma centres of USA (9).

The majority of the patients injured by road traffic accidents (RTA) were motorcyclist + vehicle drivers (n=30) in males whereas pedestrians (n=14) in females which might be explained by the engagement of males in outdoor jobs like driving than females in Ethiopian culture. Over all, the high prevalence of RTA was observed in pedestrians in the present study, which may reflect the low level of community awareness on road traffic safety and road use. In addition, the absence of pedestrian's walkways in most of the roads in Addis Ababa, Ethiopia, may have contributed to the higher vulnerability of pedestrians to motorized vehicles.

In children less than 10 years of age, falling was the most frequent cause of mandibular fracture; for the age interval of 11- 20 years, the most common mechanism was road traffic accidents and for the rest interval of 10 year age groups the leading cause of mandibular fracture was interpersonal violence which is in line with one study conducted in London teaching hospital (8). This might be due to low standard of socioeconomic life of the societies, low tolerance habit in the community and frequent intertribal quarrelling in the country.

Pattern of fractures

The most common site of mandibular fracture was body (26.53%) followed by angle (23.9%) and the least site fractured was ascending ramus which is in line with some literatures (1, 28), however, some other studies showed condylar fracture predominance(13, 15, 19). The largest number of patients had multiple mandibular fractures (37.65%) out of which body + angle (24.73%) combined fracture comprised highest number while symphysis + ramus (1.04%) fracture was least number recorded which is supported by one study result conducted in Montreal General Hospital, Canada between 1998 and 2003 and 307 mandibular fractures (11). Out of the total number of study sample, about 30.76% patients had non-facial associated injuries. Head injury (23.48%) was the most common followed by cervical spine injury (4.05%) and these value coincided with few literatures (1, 11).

Treatment modalities

The dominant treatment modality was ORIF (81.78%) followed by IMF (12.55%), while the rest few patients were treated by splinting and conservative managements. Even though, open reduction and internal fixation was the most common treatment used in many literatures, the findings in this current study group showed higher value than those literatures (8, 10, 14, 19). This finding could be explained by the reason that, most of the fracture patterns identified in the study sample were multiple in natures and displaced. On the other hand, few literatures demonstrated higher values of intermaxillary fixation as compared to other treatment options (13, 23). Among the isolated single site mandibular fractures, angle fracture was the common site treated by ORIF while condyle fracture was the common site managed by IMF. This variation might be related to difficulty to achieve appropriate anatomic reduction while trying to treat angle fracture by intermaxillary fixation due to increased muscle pull effects than other sites.

Limitations of the study

- Some of the patient's charts were lost from the shelf while some others were incomplete charts that made them difficult to include in the study sample.
- The study was unable draw valid conclusion regarding the impacts of patients social history like their jobs and use of illicit substances on patterns of mandibular fracture as these were not well documented in the patient's charts.

CHAPTER-7

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The majority of the patients were from Addis Ababa and Oromia region. Most of the patients who experienced mandibular fractures were young males. The major etiological factor was interpersonal violence, followed by road traffic accidents (RTA) in all study age groups whereas falling was the most common cause of fracture in children less than 10 years old and older people above 60 years old. The most frequently fractured site was body of the mandible followed by the angle. The most common combined fracture was body + angle. The dominant treatment modality was open reduction and internal fixation (ORIF) especially for multiple site mandibular fractures.

RECOMMENDATIONS

- The high incidence of interpersonal violence in the study group suggests a need for government to prepare programs creating greater awareness on cultural, economic and social problems and improve tolerance among communities to minimize the role of violence in trauma.
- The significant role of RTA in causing mandibular fracture warns the government's body, transport office personnel, communities and other stake holders to work on road safety rules so as to minimize the injuries.
- The high prevalence of falling among children and old age groups indicates, taking special care in prevention of falling in these age groups is strongly recommended.
- Since the number/sites of fracture are influenced by the cause of trauma, the detailed history on mechanism of injury and physical examination should be taken.

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Annex II: Data collection Instruments

ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCES, SCHOOL OF MEDICINE, DEPARTMENT OF ORAL AND MAXILLOFACIAL SURGERY

This data collection format to be filled by data collector is designed for the purpose of data gathering to assess Incidence and Pattern of Mandibular Fractures in Addis Ababa University affiliated Hospitals (Yekatit 12 Hospital Medical College and St. Peter Specialized Hospital).

Instruction: - please read the information carefully and put ''√ ''mark in front of the information given or encircle the choices given if applicable. More than one choice is possible; if the check list is open ended, write the information on the space provided.

Date: - _____

Code number:-_____

DATA CALLECTION FORMAT

1. Demographic data:-

   Sex: Male ☐ Female ☐ Age ☐☐

2. Geographic location (Region): -

   a. Tigray
   b. Afar
   c. Amhara
   d. Oromia
   e. SNNP
   f. Somali
   g. Benishangul Gumuz
   h. Gambella
   i. Harari
   j. Addis Ababa
   k. Dire Dawa

3. Occupation or role of the patient:-
    a. Vehicle driver ☐
    b. Motor cyclist ☐
    c. Pedestrian ☐
    d. Others (specify) ----------
4. Causative factors:-
    a. RTA ☐
    b. Assault ☐
    c. Falling ☐
    d. Sport related ☐
    e. Work related ☐
    f. Others (Specify) ----------
5. Patterns of mandibular fracture:-
    a. Symphysis
    b. Body
    c. Ramus
    d. Coronoid
    e. Parasymphysis
    f. Angle
    g. Condyle
    h. Dentoalveolar
6. Associated injuries
    a. Head injury
    b. Cervical spine injury
    c. Chest and abdomen
    d. Others (specify)_____
7. Treatment modality
    a. ORIF (open reduction and internal fixation)
    b. IMF (Intermaxillary fixation)
    c. Conservative management