PREVALENCE OF FEMUR FRACTURE AND ITS ASSOCIATED FACTORS IN TIKUR ANBESSA SPECIALIZED HOSPITAL ORTHOPAEDIC CENTER, ADDIS ABABA, ETHIOPIA

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Prevalence of femur fracture and its associated factors in Tikur Anbessa Specialized Hospital Orthopaedics center, Addis Ababa Ethiopia.

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List of acronyms

AAU:	Addis Ababa University
AFF:	Atypical Femoral Fracture
BMI:	Body Mass Index
EDHS:	Ethiopian Demographic and Health Survey
DRERC:	Department of Research and Ethics Review Committee
HMIS:	Health Management Information Systems
MRN:	Medical Record Number
MTA:	Motor Traffic Accident
OTA:	Orthopedic Trauma Association
ODK:	Open Data Kit (application)
RTA:	Road Traffic Accident
WBDI:	World Bank Development Indicators.
WHO:	World Health Organization
TASH:	Tikur Anbessa Specialized Hospital
SPSS:	Statistical Package for the Social Sciences (software)
SRS:	Simple Random Sampling
USA:	United States of America

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Abstract

Background: Femur is the strongest and principal load-bearing bone in the lower extremity, it can support up to 30 times the weight of an adult. Globally, femoral fracture is a common condition associated with high morbidity and mortality. Globally, it is estimated that 1.0 to 2.9 million people per year suffer from femoral fractures. Despite the fact that femoral fracture is a significant public health concern, little attention has been given to it in many countries, including Ethiopia.

Objective: to assess the prevalence of femur fracture and its associated factors in Tikur Anbessa Specialized Hospital (TASH) Orthopedics Center, Addis Ababa Ethiopia.

Methods: A 2-year retrospective Hospital-based cross-sectional study design was employed. The study was conducted in TASH Orthopedic center from January 1 to 25 /2021. A total of 392 randomly selected fracture patient records kept in TASH from June 2018 to June 2020 were studied. Data were collected by using a checklist through Open Data Kit (ODK) and analyzed using SPSS version 25 software package. To identify factors associated with femoral fracture sites, Bivariable and Multivariable binary logistic regression analyses were done. Statistical significance was considered at level of significance of 5%, and adjusted odds ratio (AOR) with 95% confidence interval (CI) was used to present the estimates of the strength of the association.

Result: The prevalence of femoral fracture was 28.6% (95% CI:24.1-31.1) among fractured patients admitted in the orthopedic surgery and traumatology department of TASH. The majority (77.7%) of the cases were males. In younger patients, femoral shaft was the commonest fracture site (57.5%) and road traffic accidents were the commonest cause of injury (58.8%). In older patients' proximal femoral fracture was the commonest fractured site (68.8%) and low energy falls were the commonest cause (73.3%). The identified associated factor for proximal femoral fracture and femoral shaft was age >40 year with [AOR= 5.11; 95% CI: 1.58 – 16.58] and [AOR= 0.09; 95% CI: 0.024 – 0.32] respectively. Fall [AOR= 0.03; 95% CI: 0.10-0.89 and bullet injury [AOR= 0.03; 95% CI: 0.01-0.81] were associated factors for femoral shaft fracture as compared to RTA.

Conclusion: The Prevalence of femoral fracture was high compared to reported literatures. The risk of proximal femoral fractures increases with ageing in contrast to that of shaft fracture. The risk of femoral shaft fracture is lower in fall down accident and bullate injury as compared to RTA.

Key words: Femur; Fracture; Prevalence; Patterns; Risk factors; TASH, Ethiopia

1. Introduction
1.1. Background

Femur is the longest, heaviest, strongest, and principal load-bearing bone in the lower extremity, it can support up to 30 times the weight of an adult, bony features of this long bone incorporate the femoral head and neck, greater and lesser trochanters at the proximal end, the femoral shaft, and the femoral condyles distally (1,2). Fracture is a disruption in the continuity of cortical and/or cancellous bone (3). A fracture can occur in any ranges of the femur. As the strongest, largest, and heaviest tubular bone in the human body, it requires a considerable amount of physical force(4000Newton) to fractur a femur (4).

Globally, femoral fracture is a common condition associated with high morbidity and mortality. It is estimated that 1.0 to 2.9 million people globally suffer from a femoral fracture per year (5). In 1990 1.3 million proximal femoral fractures occurred. This number is anticipated to rise to 2.6 million by 2025 and 4.5 million by 2050 (6). The annual incidence of femoral shaft fracture is approximately 10 per 100,000 person-year (7). Distal femoral fracture accounts for 3-6% of femoral fractures and 0.4% of all fractures (8).

The pattern and clinical outcome of femoral fracture varied with the patient's age, cause, the severity of the injury, fractured site, and type of treatment on time (7). In young persons, femoral fracture is generally caused by high-energy forces such as road traffic accident (RTA), gunshot wounds, falls from heights, assaults, and injuries from high-speed sports. And often associated with multisystem injury, and mid-shaft is commonly injured. In the elderly population, femoral fracture is typically caused by a low energy mechanism such as ground-level falls, and the proximal femur, especially the neck, is commonly injured. Road traffic crashes remain a principal cause for femoral fracture in most series (4, 9, 10).

Factors influencing femoral fracture are interrelated and varied with the site of fracture. For instance, Proximal femoral fractures are influenced by modifiable and non-modifiable factors. The non-modifiable risk factors are increasing age, female sex, positive family history fractures, low energy mechanisms of injury, the morphology of femur, and ethnic origin. And the Modifiable risk factors are BMI, low sunlight exposure, low physical activity, smoking, and alcohol use. Besides, underlying chronic diseases also generally tend to increase proximal femur fracture risk.

Whereas young age, male sex, and high energy mechanism of injuries are the risk factors for femoral shaft fracture (4, 6, 10-12).

1.2 Statement of the problem

According to the World health organization (WHO) report, more than 10 million people suffer from non-fatal injuries that require treatment, and 5 million people die each year as a result of injuries. This accounts for 9% of the world's deaths, nearly 1.7 times the number of fatalities that result from HIV/AIDS, tuberculosis, and malaria combined. A large proportion of people surviving their injuries incurs temporary or permanent disabilities (13).

Femoral fracture is one of the injuries that affect 1.0 to 2.9 million people globally per year (4). Especially proximal femoral fracture possesses some of the poorest outcomes in Orthopedics Surgery. Studies estimate that 2% to 14% of patients die during hospital admission, and 14% to 36% die within a year of their index surgery. Of those who survive, 58% continue to have difficulty ambulating without an assistive device at 1 year after their surgery (14).

The magnitude of femoral fracture is relatively higher in developing countries as compared to developed. For instance, in the USA, the magnitude of femoral fracture is reported as 1-1.33 fractures per 10,000 population. This burden varied with age in individuals younger than 25 years, and those older than 65 years, the rate of femoral fracture reaches 3 fractures per 10,000 population annually (15). Whereas, in developing countries, the magnitude reaches about 57.1 in women and 43.7 in men cases per 100,000 population (16).

The burden also varies in different part of the world. In Pakistan, femoral fracture constituted 39% of the total patients admitted to the Orthopedics Department (9). Whereas, in Africa, for instance, a study done in Nigeria shows that 0.12% were admitted to the Orthopedics department with the diagnosis of femoral fracture. Most of the cases (62.8%) occurred because of road traffic accidents (RTAs), and the mid-shaft was the most common site to fracture (26.5%) (16). Another study done in South Nigeria found that the proportion of femoral fracture treated at the trauma center was 10.9% (10).

Ethiopia is one of the second populous nations in Africa (18). The burden of traumatic injury is high in the country. For instance, in the 2013 – 2014 Ethiopian Fiscal Year, trauma, including fracture of the extremities was the fourth leading cause of admission in Ethiopian hospitals. Road

traffic accident was the major cause of such injuries in most cases (19). A study done in Addis Ababa Government hospitals in 2017 shows that femoral fracture accounted for 20.2% of fractures (20). Another similar study, which was conducted in Tikur Anbessa specialized hospital (TASH) in 2018, shows that the femur was most fractured bone accounted for 23.7% of fractures (21). These studies indicate that the magnitude of femoral fracture in Ethiopia is significantly higher than in other countries. Besides, it remains a growing problem from time to time (10, 17, 20, 21).

Despite the fact that, femoral fracture is a significant public health concern, little attention has been given in many countries, including Ethiopia. Although the occurrence and prevention of fracture have been the subject of some publications, the epidemiology of specific fractured bone-such as femoral fracture has not been studied extensively in Ethiopia. Moreover, although some risk factors for femoral fractures have been reported previously, there is little quantitative information in the literature regarding the independent contribution of the risk factors to the burden of femoral fractures. This study will give valuable information on the prevalence, patterns, and associated factors of femoral fracture.

1.3 Significance of the study

Femoral fracture is a common injury seen in the emergency room. It is a public health problem that affects many people all over the world. Identifying the prevalence of femoral fracture and its associated factors and their impact on the overall life of the patients may contribute in reducing morbidity and mortality.

The findings from this study would serve as an input data for policymakers in planning and implementing of mitigation activities of femoral fracture. Especially, the data would also help influence on the allocation of resources to facilitate the management of femoral fractured patients. Moreover, the findings of this study could serve as baseline data for further research in this area as the study is the first of its kind in our set up.

2. Literature Review

2.1. Magnitude of femoral fracture

2.1.1 Globally

According to the 2014 World health organization (WHO) report, more than 10 million of people suffer from injuries that lead to hospitalization, emergency department or general practitioner treatment, or treatment that does not involve formal medical care pre year. Of those who sustained injuries, more than 5 million people die each year. This means that more than 14,000 lives are cut short as a result of an injury every day. This accounts for 9% of the world's deaths (13).

Two of the three leading causes of injury deaths – road traffic injuries and falls – are predicted to rise in rank compared to other causes of death. Road traffic injuries are predicted to become the 7th leading cause of death by 2030, with falls rising to become the 17th leading cause of death (13).

A certain study on the global incidence of femur fracture revealed that a femoral fracture is a common injury that occurs in approximately one in ten road traffic (RT) injuries. Worldwide annual femur fracture incidence is estimated between 1.0 and 2.9 million. Most femur fractures occurred between ages 15 - 44 years (34%), 5 and 14 years (29%), and in those older than 60 (21%) (5).

The proximal part is the most common site to fracture, and also it remains the most common reason for elders to be admitted to the orthopedic ward. An estimated 1.3 million proximal fractures occurred worldwide in 1990. Assuming there is no age-specific increase, this number is predicted to rise to 2.6 million by 2025 and 4.5 million by 2050. Estimations that include an age-specific increase give predicted values of between 7.3 and 21.3 million by 2050. The lifetime risk of sustaining a proximal femoral fracture is high and lies within the range of 40% to 50% in women and 13% to 22% in men (6).

A study conducted in Aalborg University Hospital, Denmark on Distal femoral fractures shows that the overall incidence of distal femur fracture between 2005 and 2010 was 8.7/100,000/year. The overall incidences for males and females were 5.9/100,000/year and 11.5/ 100,000/year, respectively. The incidence by age group was nearly constant (below 7.0/100,000/year) in the first six decades of life for both genders. After the age of 60 years, a rapid, continuous increase in the

incidence of distal femoral fractures was observed for both genders, with a large female predominance reaching a peak incidence of 213/100,000/year (22).

A study conducted in the USA shows that the magnitude of femoral fracture is 1-1.33 fractures per 10,000 population. The burden varied with age in individuals younger than 25 years, and those older than 65 years, the rate of femoral fractures is 3 fractures per 10,000 population annually (14). In another study done in Germany on Femoral fracture, rates show that of 1.2 million people aged 65 years and more, 44,000 femoral fractures were recorded during the observation period (23).

A cross-sectional study conducted in Pakistan, reveal that femoral fracture constituted 39% of the total patients admitted to the Orthopedic surgery and traumatology department. It was the largest admission load and longest stay. The frequency of mid-shaft fracture was considerably large in the male gender of the pediatric and young adult group (less than 40 years). Fractures of proximal femur like pertrochanteric and neck of femur fractures were commonest in elderly patients (more than 40 years), both male and female gender (9).

2.1.2 Africa

A few studies are available in Africa concerning femoral fracture. An institution-based retrospective cross-sectional study conducted in Nigeria, on the Pattern of femoral fracture and associated injuries revealed that femoral fracture magnitude accounts for 12% of the cases. The majority (62.8%) of the cases occurred as a result of RTAs, and the mid-shaft was the most common site to fracture (26.5%), followed by the intracapsular neck of the femur (16.0%) and the least site of femur involved was the head (0.9%). The majority (34.6%) were in the age group of 11 to 40 years, and 31.1% of patients were over 60 years of age, showing a bimodal trend in both male and female patients (17).

Another similar retrospective study done in South Nigeria revealed that femoral fractured patients treated at the trauma center were 10.9%. All age groups were affected, the majority of cases seen in the age group 21 to 30 years, followed by ≤ 10 years of age accounts for 30.8% and 16.6%, respectively. The majority of the fractures (72.7%) resulted from road traffic crashes, of which most are from motor vehicular crashes (48.7%). Other causes were gunshot injuries (17.7%) and falls (6.5%). Ground-level falls were the commonest cause (2.8%) in elderly persons, particularly

in females (1.7%). Most of the fractures were closed (21%), involving the shaft of the femur (56.1%), proximal and distal femur account for 16.5% and 25.4%, respectively (10).

A retrospective descriptive study Conducted in Kilimanjaro Christian Medical Centre (KCMC) Tanzania, which revealed that 65% were male and 35% were female; giving a male to female ratio of 1.8:1. Patients with femoral fractures ranged from 1 to 96 years old with a mean age of 39.2 years. The magnitude of femoral fracture accounts (39.9%). Across all age groups, 49% of femoral fractures were caused by MTA's and 42% by falls. Falls were the most common cause of femoral fracture in the 51-100 age group. In both males and females, the mid-shaft femoral fracture was a common site; 33% in males and 25% in females. The second most common fracture was distal third (n=30), followed by proximal third and neck of femur (both n=16) (24).

2.1.3 Ethiopia

In a certain institution-based retrospective cross-sectional study on Road Traffic Accident Victims Visiting Governmental Hospitals, the most common site of fracture was the lower limb accounts for (55.6%). Of those femoral fracture accounts for 20.2% (25).

In a study done in TASH on adult, limb fracture revealed that the highest age group most affected was between 21-30y (36.5%). The main causes of fracture were Road traffic accidents (47.9%) followed by fall down accident (29.9 %). The highest frequency of fracture occurred on the femur (15%) (21).

2.2 Factors associated to femoral fracture

Different risk assessment studies show that the factors influencing femoral fracture are interrelated and also varied with the site of fracture. For instance, Proximal femoral fractures are influenced by modifiable and non-modifiable factors. The non-modifiable risk factors are increasing age, female sex, positive family history fractures, low energy mechanisms of injury, the morphology of femur, and ethnic origin. And the Modifiable risk factors are BMI, low sunlight exposure, low physical activity, smoking, and alcohol use. Besides, underlying chronic diseases also generally tend to increase proximal femur fracture risk. Whereas young age, male sex, and high energy mechanism of injuries are the risk factors for femoral shaft fracture (4, 6, 10) these factors have an impact on the occurrence of femoral fracture as well as the site of fracture.

In a cross-sectional study conducted on the influence of ageing on the incidence and site of trauma of femoral fractures in Chang Gung Memorial Hospital, Taiwan 2019 G.C. Reported that 15.2 % had femoral fracture. Older age positively predicts the occurrence of trochanteric fracture (OR [95%CI]: 1.03 [1.03–1.04], $p < 0.001$) and neck fractures (1.02 [1.01–1.02], $p < 0.001$), and negatively predict the occurrence of head fracture (0.96 [0.94–0.98], $p < 0.001$), shaft (0.95 [0.95–0.96], $p < 0.001$), and distal fractures (0.98 [0.98–0.99], $p < 0.001$) (26)

Increasing age is associated with osteoporotic bone changes, which are believed to increase the rate of femoral fracture; falls occur more frequently in the elderly (27) But, traffic-related fractures caused by motorcycle or bicycle accidents occur more often in younger adults, and the rate of its occurrence differs between genders (28).

In a certain study on proximal femoral fractures revealed that Women have more bone loss and fall than men, their incidence of proximal femoral fractures is about twice that seen in men at any age in the USA and Europe. Furthermore, women live longer than men so that more than three-quarters of all proximal femoral fractures occur in women (29).

Chronic or underlying disease, in general, tends to increase fracture risk, and consideration of relevant comorbidities may influence treatment choice, particularly in younger patients. Renal failure, rheumatoid arthritis, and endocrine disorders all of which are associated with decreased bone mineral density in younger patients which increases fracture risk (30).

A meta-analysis on the association between alcohol consumption and both osteoporotic fracture and bone density revealed that heavy alcohol consumption is widely considered as a risk factor for osteoporotic fractures and low bone density. Compared with abstainers, persons consuming from more than 0.5 to1.0 drinks per day had lower hip fracture risk (relative risk=0.80 [95% confidence interval, 0.71-0.91]), and persons consuming more than 2 drinks per day had a higher risk (relative risk=1.39 [95% confidence interval, 1.08-1.79]) (31).

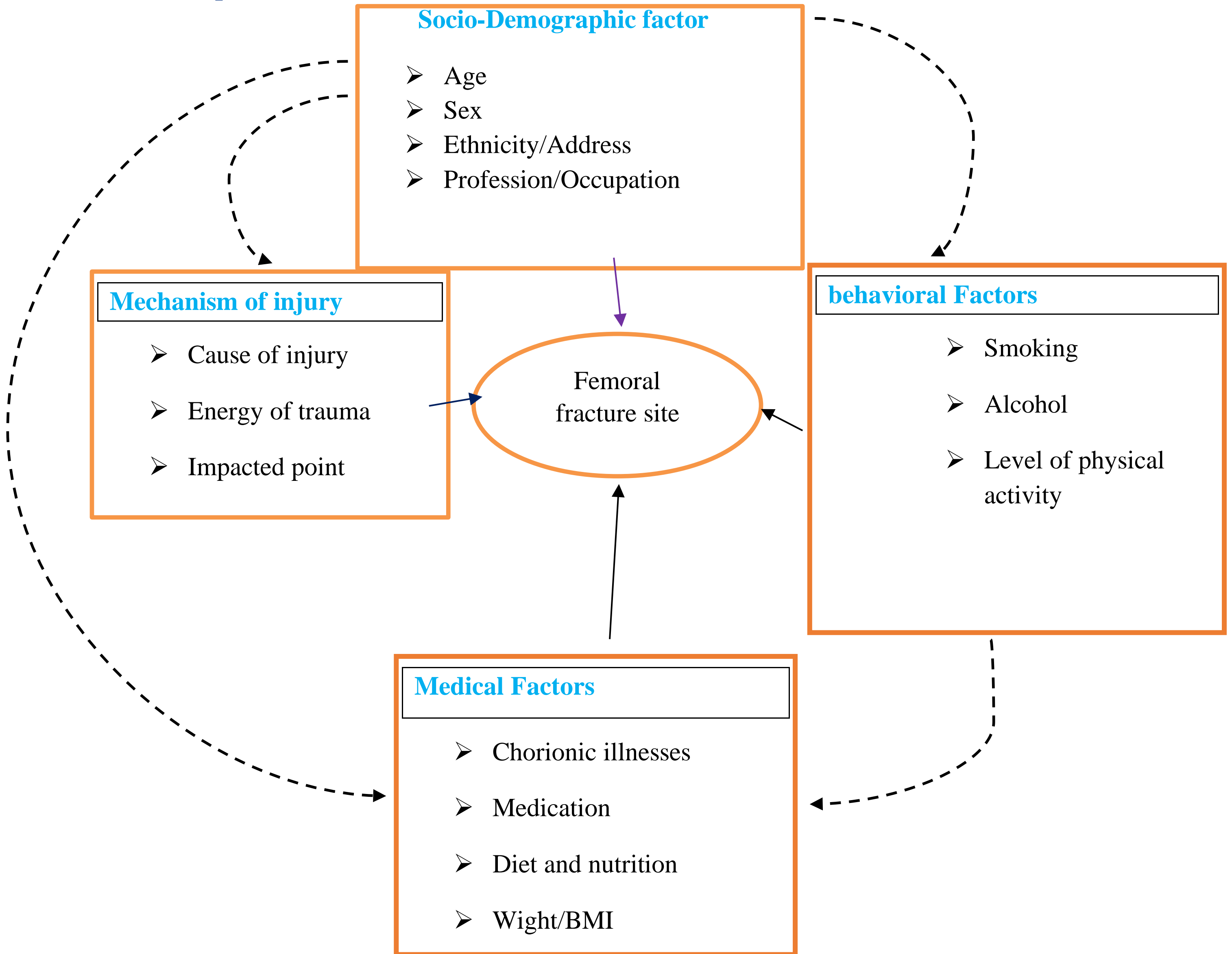
2.3 Anatomy of femur and classification of femoral fracture

The femur or thigh bone is the longest bone in the body.it is the most proximal (closest to the hip joint) bone of the leg. The femur consists of a head, greater and lesser trochanter, shaft, and lateral and medial condyles with the patellar surface in between. The head of the femur articulates with the acetabulum in the pelvic bone forming the hip joint while the distal part of the femur articulates with the tibia and kneecap forming the knee joint (30).

By most measures, the femur is the strongest bone in the body, the femur can support 30x body weight, the ultimate compressive strength for human femur bone is measured to be 205 **MPa** (205 million Pascals) under compression along its length. The ultimate tensile strength of femur bone under tension along its length is 135 **MP** (2).

The site of femoral fracture can be categorized according to the OTA (orthopedic trauma association) by coding femur as 3 and proximal part as 31(31type A: trochanteric; 31 type B: neck; and 31type C: head) shaft 32 and distal 33 (33)

2.4 Conceptual Framework



-------> The broken line indicates the association between the explanatory variables.

⟶ The solid line indicates the association between the outcome variable and explanatory variables.

Figure 1. Conceptual framework of factors associated with femoral fracture site.

3. Objective

3.1. General objective

- To assess the prevalence of femoral fracture and its associated factors in Tikur Anbessa Specialized Hospital Orthopedic center, June2018-June2020

3.2. Specific objectives

- To assess the prevalence of femoral fracture among fractured patients
- To determine associated factors with femoral fracture sites
- To describe the pattern of femoral fracture

4. Method and Materials

4.1. Study area and period

The study was conducted in Tikur Anbessa specialized hospital Orthopedic surgery and traumatology department from January 1 to 25/2021. Tikur Anbessa Specialized Hospital (TASH) is the largest referral hospital in the country. It was established in 1964. It provides specialty, subspecialty, and super-specialty health care services along with teaching and research activities. It is also an institution where specialized clinical services are given that are not available in other public or private institutions. Currently, it offers medical services for approximately 370,000-400,000 patients per year in all wards (34). TASH orthopedic surgery and traumatology department is one of the departments in the institution established in 1987. Currently, the department has 75 beds, staffed with 20 consultant orthopedic surgeons and 75 residents are in training. It provides specialized care and rehabilitation services for patients with serious traumatic injuries and undertakes academic activities (35).

4.2. Study design

- A 2-year hospital based retrospective cross-sectional study was carried out.

4.3. Population

4.3.1. Source population

- All fractured patients visited orthopedic center of Tikur Anbessa specialized hospital.

4.3.2. Study population

- Fractured patients visited orthopedic center of Tikur Anbessa specialized hospital from June 1, 2018– June 1, 2020.

4.4. Eligibility

4.4.1 Inclusion

- All patients record with a diagnosis of fracture during the period of June 1 2018- June1, 2020 were included in the study.

4.4.2 Exclusion criteria

- Patients with incomplete record (>10% of the variable) and lost card
- Patients with readmissions for the same fracture were excluded.

4.5. Sample size determination and sampling technique

4.5.1. Sample size determination

Sample size was determined using single population proportion formula considering confidence level of 95%, marginal error of 5%, and proportion of 50% because there was no study conducted regarding prevalence of femoral fracture in our setup. The final sample size was determined 422.

Where: n = sample size P = proportion of femoral fracture q = 1-p d = desired degree of precision (5%) Z= is the standard normal value at 95% confidence level

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

$$n = \frac{(1.96)^2 \times 0.5\,(1-0.5)}{0.05^2} = 384.16 \longrightarrow 384 + 10\% = 422$$

4.5.2. Sampling technique and procedure

The medical record number (MRN) of all patients with a diagnosis of fracture was collected from the health management information system (HMIS) registration book of the hospital within the study period. HMIS record of the hospital was used as a sampling frame and then, a simple random sampling technique using a computer-generated method was used to select the 422 study participants (Figure 2)

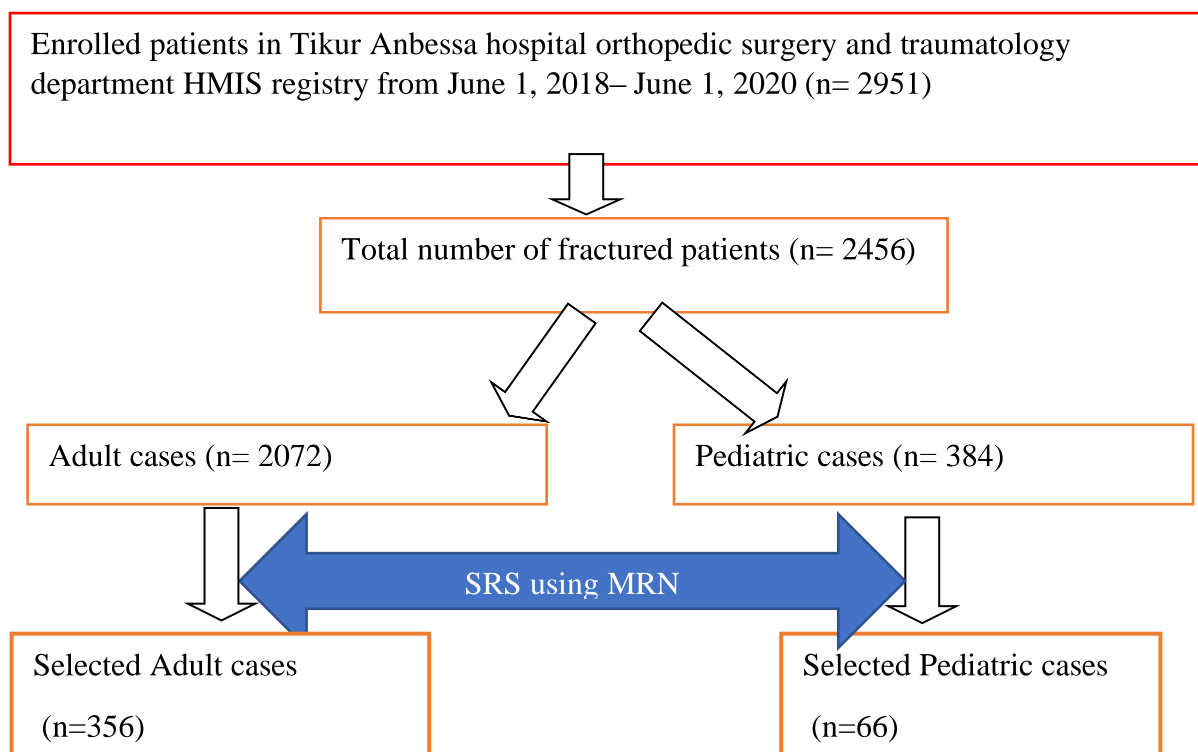


Figure 2. Schematic presentation of sampling procedure in Tikur Anbessa Specialized Hospital Orthopedic center, June2018-June2020.

4.6 Data Collection Tool and Procedures

After selecting the study cases, four BSc nurses were recruited to collect the data. Structured Checklist and WHO fracture risk assessment tool were used that encompasses Socio-demography, mechanism of injury, associated injury, medical risk factors, length of hospital stay, and radiologic features. ODK version 1.25.2 software was used to collect the data along with the KoboToolbox server to store the collected data.

4.7 Data Quality control and management

To ensure the quality of data, the data collectors and supervisor were trained for two days on basic data collection skills and ODK application. The Structured checklists were tested on 5% of the sample. All data collectors and supervisor were participated in pre-testing and standardization of the checklists. Problems highlighted during the pre-test were corrected before the start of the data collection. Each question was properly coded; continuous supervision was done both during the pre-test and data collection period by the principal investigator and supervisor. The collected data were checked for completeness and consistency on each day of data collection.

4.8. Variables

4.8.1 Outcome variable

- Femoral Fracture

4.8.2 Explanatory variables

- Socio demography
    - Age, sex, region, occupation
- Mechanism of injury
- Associated injury/other system involvement.
- Medical risk factors
    - Chorionic illnesses, Medication, Diet and nutrition, and Wight/BMI
- Behavioral factors
    - Smoking status, alcohol intake, and Level of physical activity
- Length of hospital stay.
- Radiologic report
    - Nature of fracture, site of fracture, affected side, line of fracture.

4.9. Operational Definition

Proximal segment: - is defined by line passing transversely through the lower edge of the lesser trochanter.

Femoral Shaft fracture: -is a fracture of the femoral diaphysis occurring between 5 cm distal to the lesser trochanter and 5 cm proximal to the adductor tubercle.

High-energy mechanisms: - fall from >2m, road traffic collision, assault, Gun shot and penetrating.

Low-energy mechanisms: - fall from<2m.

Pathological fracture: - is a bone fracture which occurs without adequate trauma and is caused by a preexistent pathological bone lesion.

Atypical femoral fractures (AFF): - are stress or ‘insufficiency’ fractures, often complicated by the use of bisphosphonates or other bone turnover inhibitors.

Pattern of femoral fracture: - site, gender and age-based, distribution and variation of femoral fracture.

4.10. Data processing and Analysis

After data collection by ODK version 1.25.2, each completed forms were checked for completeness and exported to SPSS version 25 for analysis. Mean, median, mode and standard deviation were used to describe Continuous data; and frequency and percentage were used to describe categorical data. Bivariable and Multivariable binary logistic regression analyses were done. Statistical significance was considered at level of significance of 5%, and adjusted odds ratio (AOR) with 95% confidence interval (CI) was used to present the estimates of the strength of the association. Finally, the results were presented using text, table, and charts.

4.11. Ethical consideration

Ethical clearance was obtained from the Department of Research and Ethical Review Committee (DRERC)of Anatomy Department. Then an official letter of support and ethical clearance was submitted to the Orthopedics department and Cardroom. Confidentiality was maintained at all levels of the study, besides only the MRN number of study participants were used without mentioning the name and the collected information was kept in a secured place.

4.12. Dissemination and utilization of results

The result of the study will be submitted to Addis Ababa University, College of Health Sciences, School of medicine, Department of Anatomy for the requirement of partial fulfillment of Master ‘s degree. The finding of the study will also be shared to the orthopedic surgery and traumatology department and other concerned bodies. Furthermore, the manuscript will be published on peer reviewed journals.

5.Results

5.1 Socio-demographic Characteristics

In the study period, 2456 fractured patients were admitted to TASH orthopedic surgery and traumatology department. Of these, medical records of 422 cases were taken from which 392(92.9%) charts were complete for analysis. Among the 392 cases, 298 (76%) were male and 94 (24 %) were female resulting in a male-to-female ratio of 3:1. The median (Q1, Q3) age of fractured patients was 31.2 (20, 42) years. More than half (203 (51.8%)) of the patients were between the age group of 19 to 40 followed by (103 (23.7 %)) were > 40 years and (86 (21.9%)) patients were less than 19 years. Most (162 (41.8 %)) of the patients were from Addis Ababa (the capital city). The number of cases from Oromia, Amhara region and from other regions of Ethiopia were 130 (33.5%), 56(14.3%) and 40(10.3%), respectively. A quarter of the study cases (100 (26 %)) were student whereas 59 (15%) were daily labors and 47(12%) were farmers. The socio-demographic characteristics of the study population is shown in *table 1*.

Table 1: Socio-demographic characteristics of fractured patients visited orthopedic surgery and traumatology department of TASH Addis Ababa, Ethiopia, June2018-June2020

Variables		Frequency	Percent %
Sex	Male	298	76 %
	Female	94	24 %
	Total	**392**	**100** %
Age	1-18	86	21.9 %
	19-40	203	51.8 %
	>40	103	26.3 %
	Total	**392**	**100.0** %
Region	Addis Ababa	163	41.5 %
	Oromia	131	33.4 %
	Amahara	57	14.5 %
	Other	41	10.6 %
	Total	**392**	**100.0** %
Profession	Student	100	26 %
	Daily labor	59	15 %
	Farmer	47	12 %
	Government/Private employee	38	10 %
	Driver	37	9 %
	Other (HW, no job, Merchant, Police, Unknown)	111	29 %
	Total	**392**	**100 %**

5.2 Prevalence of femoral fracture

In this study, concerning the prevalence of fractured cases admitted in the orthopedic surgery and traumatology department of TASH during the study period. Femoral fracture constituted 112(28.6%; 95% CI: 24.1-31.1), followed by tibiofibular 80(20.4%), and Humeral 58(14.8%) fracture (Table 2).

Table 2: The prevalence of fractured bone in patients visited orthopedic surgery and traumatology department of TASH Addis Ababa, Ethiopia, June2018-June2020

Fractured bone	Frequency	Percent %
Femur	112	28.57%
TF (tibia and fibula)	80	20.41%
Humerus	58	14.80%
Pelvic and acetabular fracture	55	14.03%
Tibia	27	6.89%
RU (Radius and ulna)	23	5.87%
Radius	13	3.32%
Multiple bone	8	2.04%
Patella	7	1.79%
Ulna	5	1.28%
Clavicle	2	0.51%
2,3&4 Metacarpal	1	0.26%
Mandible	1	0.26%
Total	**392**	**100** %

"*" spinal fractured cases are managed in other hospital (Alert hospital)

Regarding the site of fracture, femoral shaft was the preponderant site (51(45.5%)) of fracture, followed by proximal femur (47 (42.0 %)) and distal (14 (12.5%)) (Fig 3). Less than half of femoral fracture cases (53 (47.3%)) were in the age group of 19 to 40 years followed by age group of >40 years (32(28.5 %)) and age group of < 19 years ((27(24.1%)). In both the age group <19 year and 19 to 40 years, femoral shaft was the predominant site to be fractured as opposed to the age group >40 years where the proximal region of femur was predominant (Fig 3).

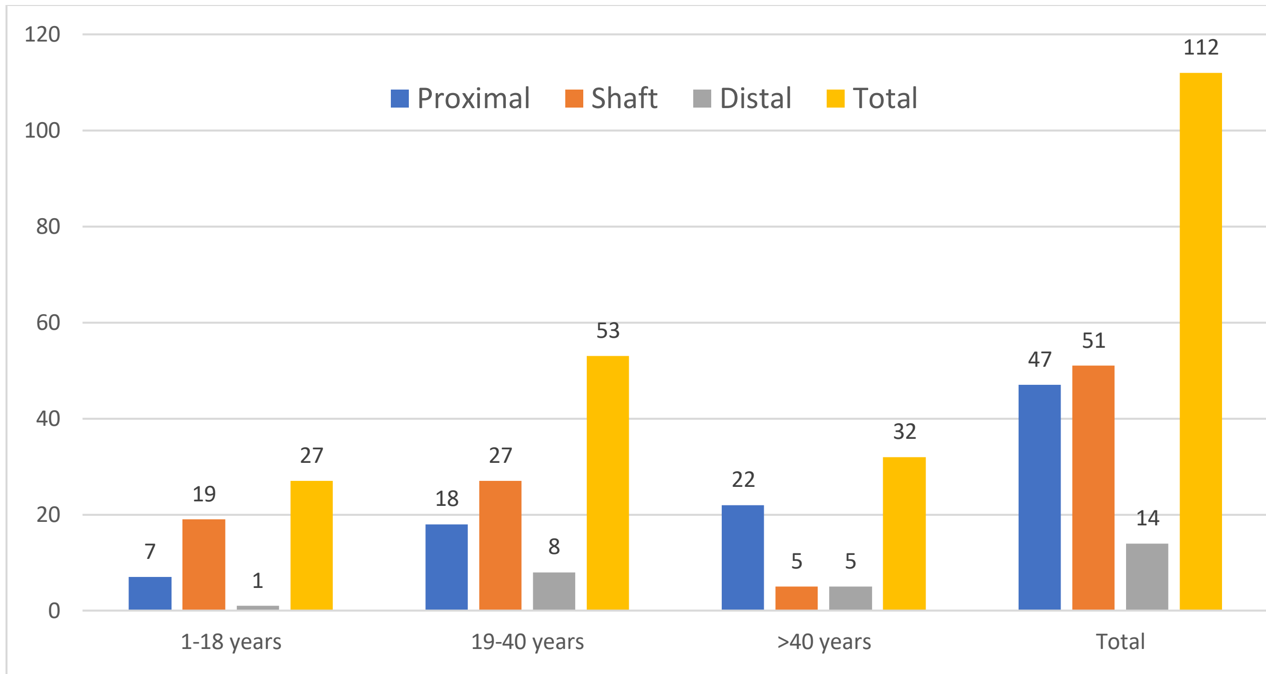


Figure 3. Distribution of femoral fracture site's by age in patients visited orthopedic surgery and traumatology department of TASH Addis Ababa, Ethiopia, June2018-June2020

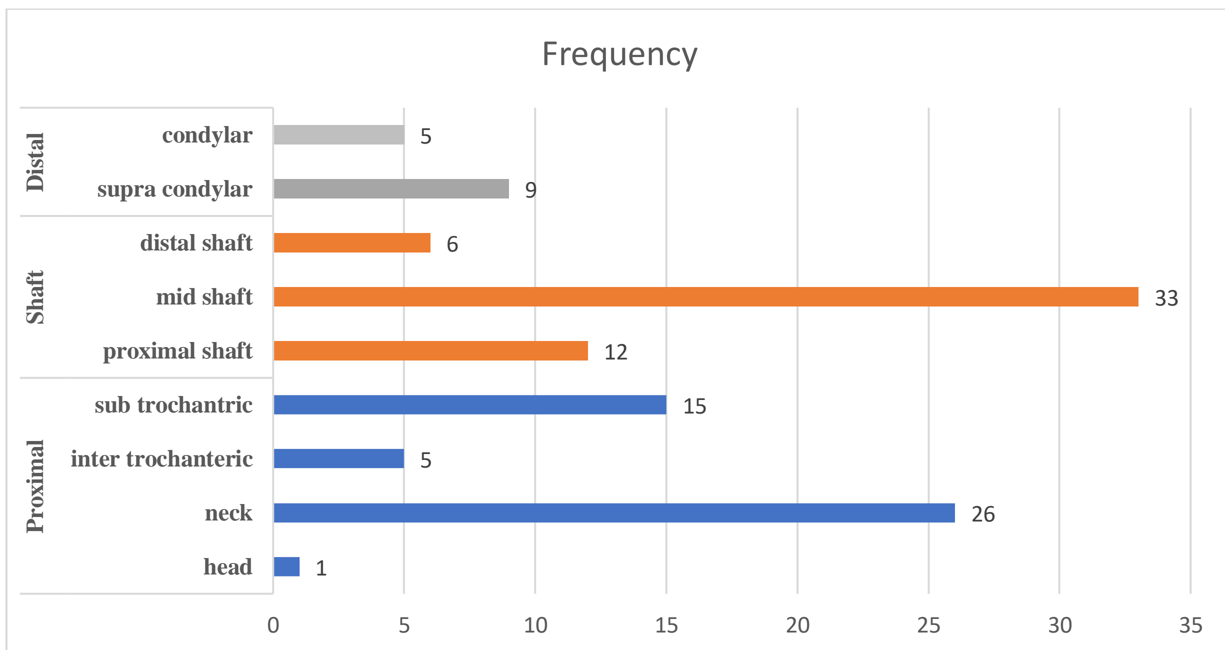


Figure 4. Distribution of femoral fracture specific site's in patients visited orthopedic surgery and traumatology department of TASH Addis Ababa, Ethiopia, June2018-June2020

Among the femoral fracture cases, there was male predominance (87 (77.7%)). The femoral shaft and proximal femur were commonest site in males (41(47.1%)) and females (12 (34.2%)), respectively (Fig 5). There was a unimodal trend in both male and female patients pick at age group of 21 to 30 (Fig 6).

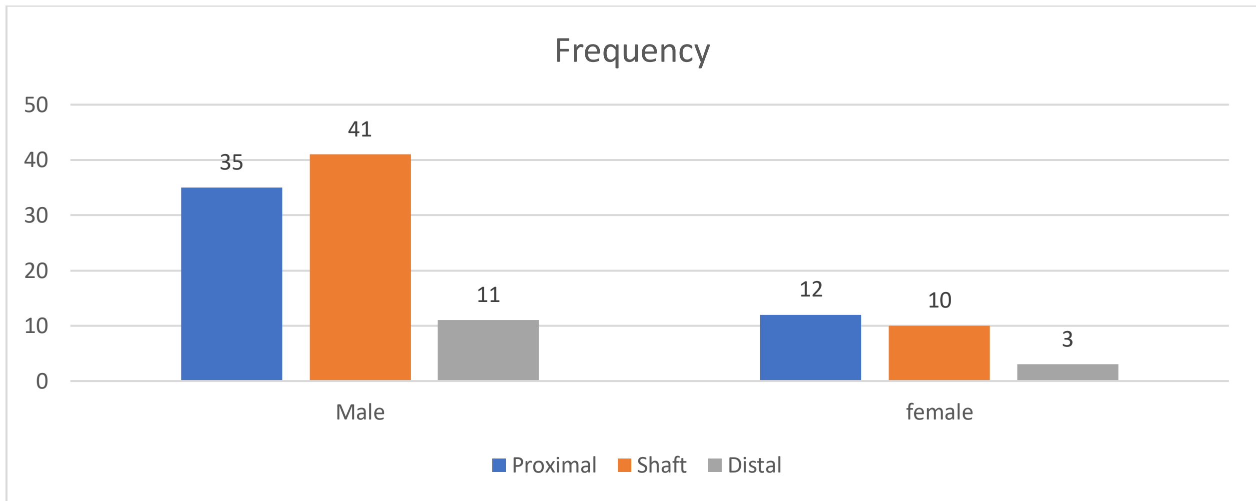


Figure 5. Distribution of femoral fractur by sex in patients visited orthopedic surgery and traumatology department of TASH Addis Ababa, Ethiopia, June2018-June2020

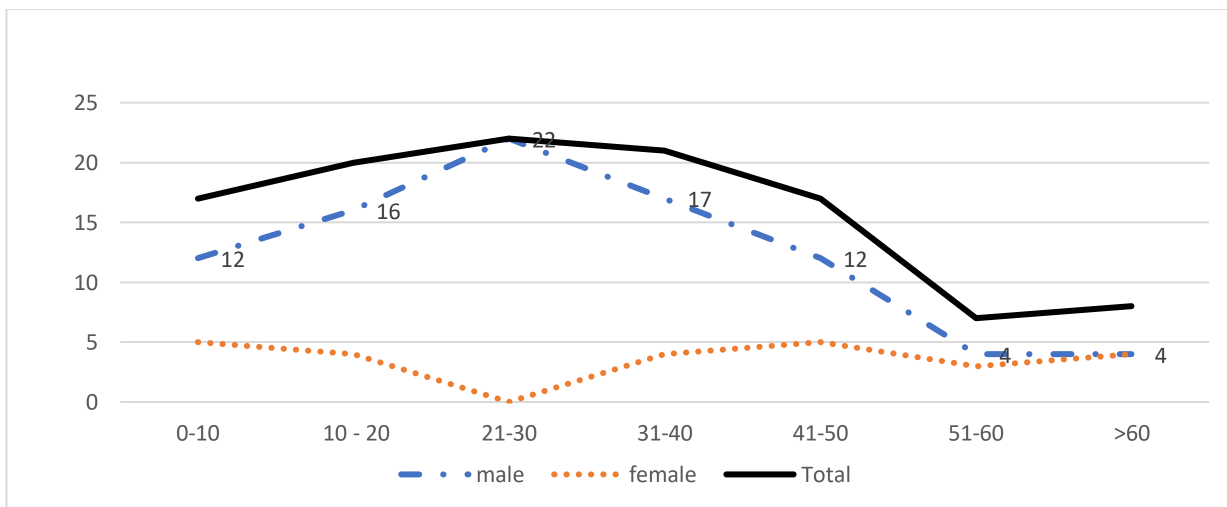


Figure 6. Distribution of femoral fractur by age and sex in patients visited orthopedic surgery and traumatology department of TASH Addis Ababa, Ethiopia, June2018-June2020

The magnitude of proximal femur fracture is bimodal with an initial peak around 15 years of age and second higher peak around 40 years (Fig 7). The magnitude of Proximal femur fracture was very low in children (age group of ≤10 years) but shows sharp increase after 25 years of age with peak around 45 years (Fig 7). The magnitude of femoral shaft fracture was highest in children (age group of ≤10 years) which sharply decreases till 40 years and then tapers down gradually (Fig 8). Average stay in hospital of patients with proximal femur fractures was 18 ±11 days that of shaft was 14 ± 9 days and distal femur was 25 ±22 days.

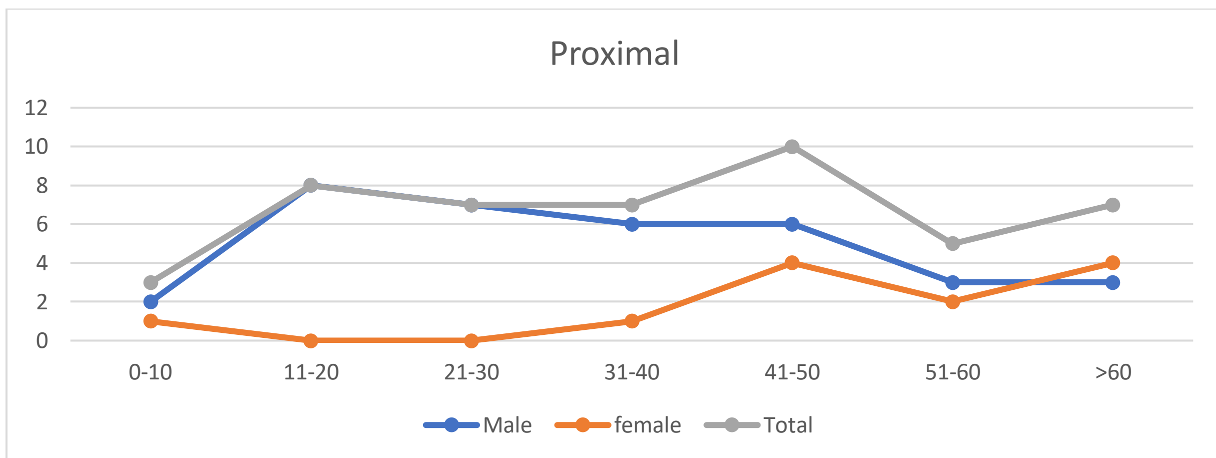


Figure 7. Age and gender specific trend of proximal femoral fractures in patients visited orthopedic surgery and traumatology department of TASH Addis Ababa, Ethiopia, June2018-June2020

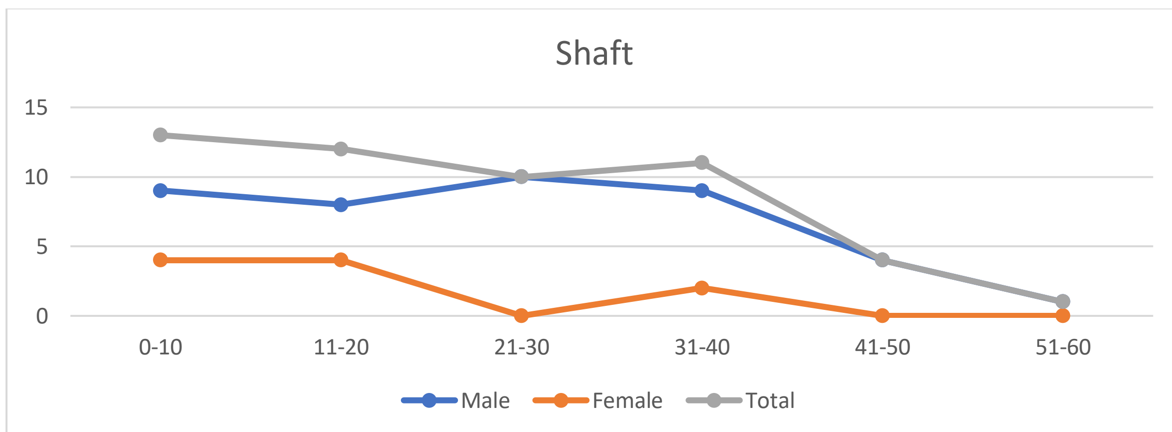


Figure 8. Age and gender specific trend of femoral Shaft fractures in patients visited orthopedic surgery and traumatology department of TASH Addis Ababa, Ethiopia, June2018-June2020

5.3 Injury related characteristics

Regarding the causes of injury, most of the fractures (179 (45.6%)) resulted from RTA of which majority were from motor vehicular crashes (122 (68.2%)). The other causes were falls (162 (41.3%)), gunshot injuries (24(6.12%)), and assaults (27(6.89%)) (Table 3). RTA was the common cause of injury among fracture cases, particularly in the age group of 19- 40 years. Falling down accidents was also common in all age group but it was preponderant in age group <19 years & >40 years. More than half (222(57.4%)) of the patients had not associated injuries that involved other systems while (165(42.6%)) patients had an associated injury that involved other systems.

Table 3 Cause of fracture in patients visited orthopedic surgery and traumatology department of TASH Addis Ababa, Ethiopia, June2018-June2020

Cause	Frequency	%	Males	%	Females	%
Road traffic injury	**179**	**45.66**	**137**	**34.95**	**42**	**10.71**
Motor vehicle crash	122	31.12	90	22.96	31	7.91
Motorcycle crash	52	13.27	44	11.22	8	2.04
Non-Motorized crash	3	0.77	2	0.51	1	0.26
Falls	**162**	**41.33**	**115**	**29.34**	**47**	**11.99**
Falls from height	55	14.03	47	11.99	8	2.04
Ground level falls	107	27.30	68	17.35	39	9.95
Gunshot wounds	**24**	**6.12**	**21**	**5.36**	**3**	**0.77**
Assaults	**27**	**6.89**	**24**	**6.12**	**3**	**0.77**
Total	**392**	**100%**	**297**	**75.77%**	**95**	**24.23%**

In case of femoral fracture sites and the cause of injury, RTA (30 (58.8%)) was the major cause for femoral shaft fractures whereas fall down accident (30(63.3%)) was the major cause for proximal femur fracture and bullet injury for the distal region (Fig 9).

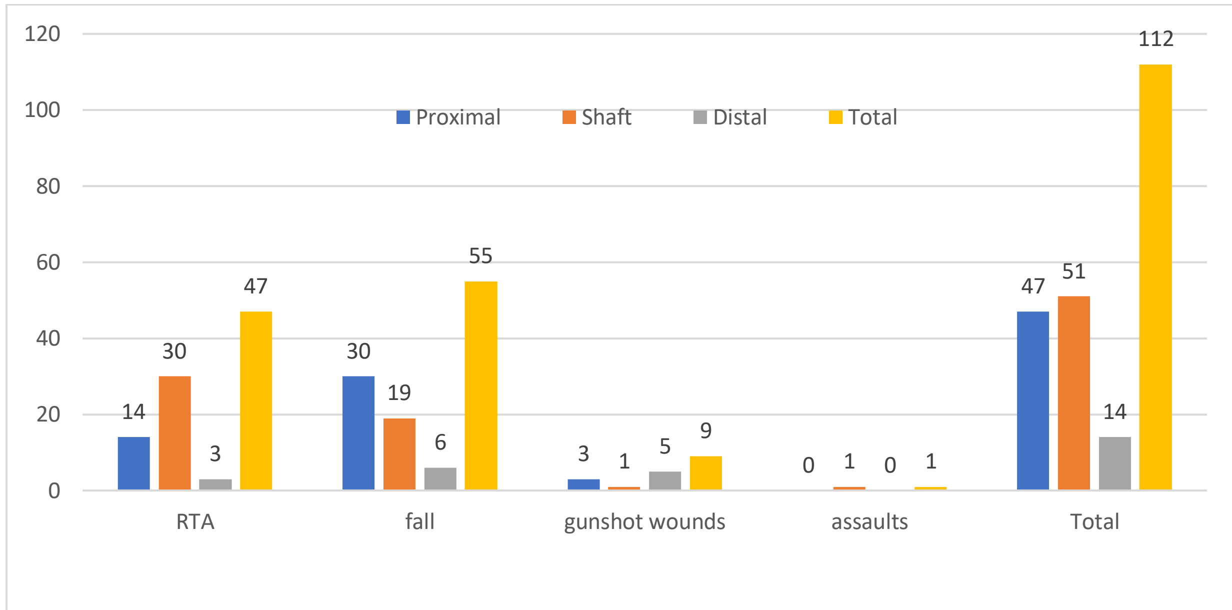


Figure 9. Distribution of femoral fracture sites by cause in patients visited orthopedic surgery and traumatology department of TASH Addis Ababa, Ethiopia, June2018-June2020

Regarding the nature of fracture, among the 392 fracture cases the majority of fractures were simple (closed) type (294(75.9%)) followed by compound (open) type (97(24.1%)) (Fig 10). In case of femoral fracture majority of the fracture cases were closed (95 (84.8%)), while (17(15.2%)) of the fractures were open fractures with Gustilo-Anderson's grade III A open fracture contributing (8 (7.1%)) of the cases while grade III C open fractures were (4 (3.6%)) (illustrated in Fig 8 and 9).

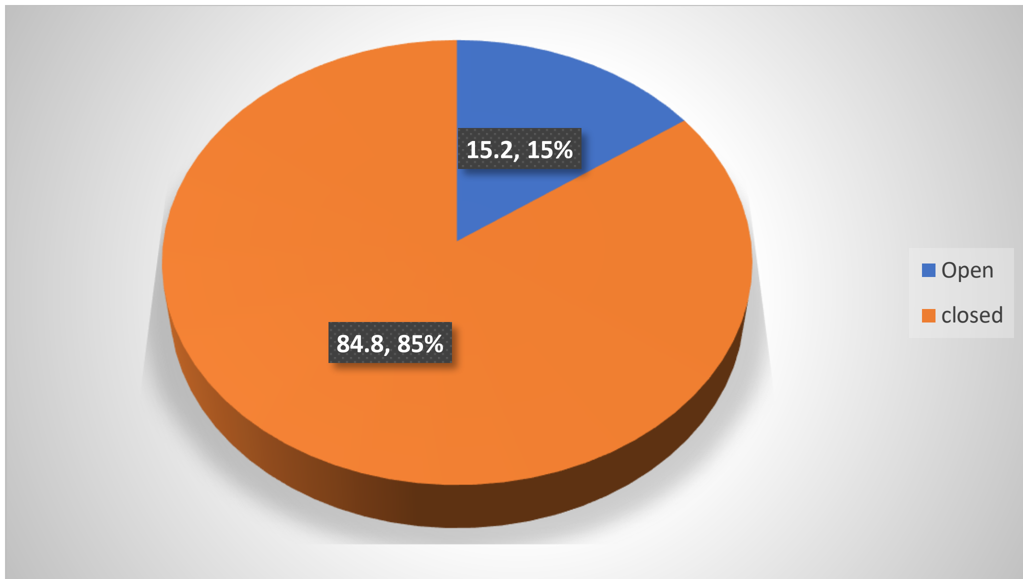


Figure 10 Nature of femoral fracture in patients visited orthopedic surgery and traumatology department of TASH Addis Ababa, Ethiopia, June2018-June2020

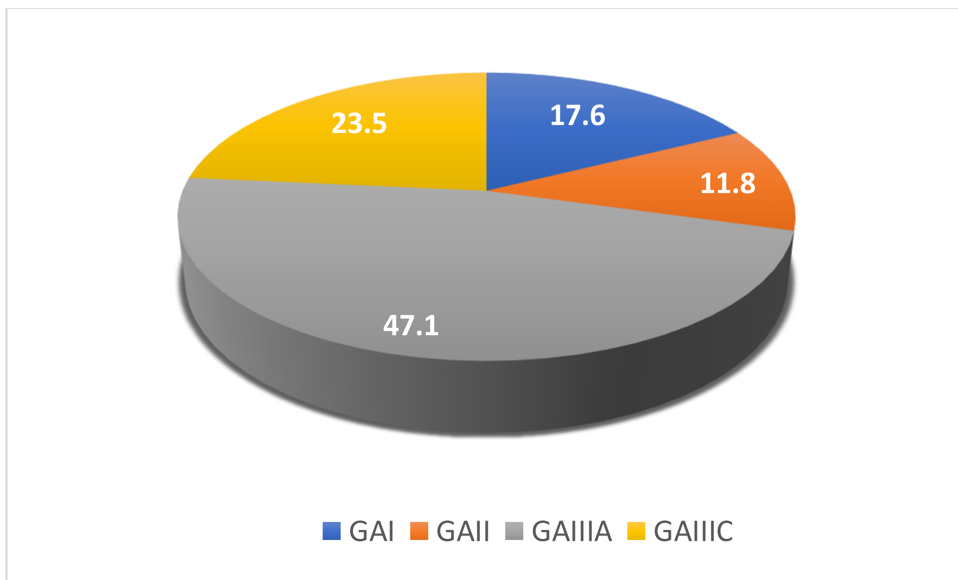


Figure 11. Types of open femoral fracture in patients visited orthopedic surgery and traumatology department of TASH Addis Ababa, Ethiopia, June2018-June2020

This study also revealed that there was no significant difference in the distribution of the fractures between the right and the left sides of femur (55(49.1%)) and (52(46.4%)) respectively. Regarding specific pattern of femoral fracture, the common type of patterns of fracture were Transverse (42(37.5%)) followed by oblique, Comminuted and spiral which comprised for (37 (33.0%)), (22 (19.6%)), and (11 (9.8%)) respectively (Illustrated in figure 10).

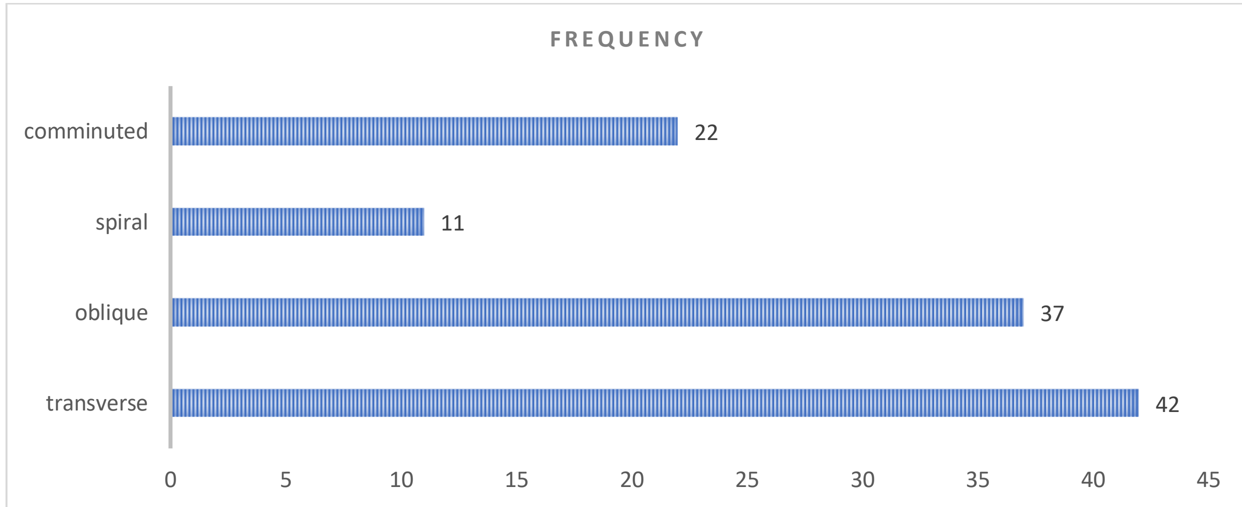


Figure 12. Specific patterns of femoral fracture in patients visited orthopedic surgery and traumatology department of TASH Addis Ababa, Ethiopia, June2018-June2020

5.4 Medical and behavioral characteristics

In this study, the majority (376(95.4%)) of fractured patients, had no previous history of fracture, and 384(98%) of patients had no family history of fracture. While 90.6% of the patients reported that they had no history of smoking, nearly 86.2% of patients reported that they had no history of alcohol use. Regarding the use of steroids, only 3.8% reported that they had a history of using a steroid. Among the fractured cases, 40(10.2%) had a history of chronic illness, and only 6(1.5%) of the case had Rheumatoid arthritis. The details are shown in table 4.

Table 4. Life style and behavioral factors of participants visited orthopedic surgery and traumatology department of TASH Addis Ababa, Ethiopia, June2018-June2020

Variable		Frequency	Percent %
History of fracture	Yes	14	3.6%
	No	378	96.4%
	Total	**392**	**100 %**
Family history of fractured hip	Yes	4	1%
	No	388	99%
	Total	**392**	**100 %**
Current smoking	Yes	37	9.4%
	No	355	90.6%
	Total	**392**	**100 %**
Alcohol in take	Yes	54	13.8%
	No	338	86.2%
	Total	**392**	**100 %**
Steroids use	Yes	15	3.8%
	No	377	96.2%
	Total	**392**	**100 %**
Rheumatoid arthritis	Yes	6	1.5%
	No	386	98.5%
	Total	**392**	**100 %**
Presence of underling chronic illness	Yes	40	10.2%
	No	352	89.8%
	Total	**392**	**100 %**

5.5 Factors associated with femoral fracture sites

In this study, explanatory variables such as: - age, sex, profession, cause of injury, previous history of fracture, family history of hip fracture, smoking status, alcohol intake, Steroids use, history of rheumatoid arthritis and presence of chronic medical illness were analyzed first by bivariable analysis. Based on the p-value of the bivariable analysis, six variables were identified as candidate variables for the multivariable analysis for proximal femoral fracture these are: - age, profession, Cause of injury, Mechanism of injury, Smoking status, Alcohol use and CMI. Whereas two variables were identified for femoral shaft these are: - age and cause of injury. In cases of distal femoral fracture only age of fractured patients was significant for multivariable analysis.

The result of the multivariable analysis revealed that age group >40 years and cause of injury are independent determinants of proximal femoral fracture and femoral shaft fracture. (Table 7)

The odds of proximal femoral fracture were 5 times higher in age group >40 years as compared to age group less than 18 [AOR= 5.11; 95% CI: 1.58 – 16.58]. Whereas the odds of femoral shaft fracture were 99.1% times lower in age group >40 years as compared to Age group (1-18) [AOR= 0.09; 95% CI: 0.024 – 0.32]

The odds of femoral shaft fracture were 72.2% times lower in age group 19-40 as comparted to Age (1-18) [AOR= 0.27; 95% CI: 0.082 – 0.94]

The odds of femoral shaft fracture were 70% times lower in fall as compared to RTI [AOR= 0.03; 95% CI: 0.10-0.89]**.** The odds of femoral shaft fracture were 69% times lower in bullet injury as compared to RTI [AOR= 0.03; 95% CI: 0.01-0.81]

Table 5. Bivariable and Multivariable Logistic Regression analysis results of factors associated with proximal Femoral fracture at TASH Hospital, Addis Ababa, Ethiopia, 2020

Explanatory Variable		Proximal femur fracture		Bivariate analysis (COR)	Multivariate analysis (AOR)	P-value
		Yes	No			
Age	1-18	7	20	1	1	
	19-40	18	35	1.4(0.52-4.12)	1.7(0.48-6.05)	0.40
	>40	22	10	6.2(2.01-19.65)	5.11(1.57-16.58)	0.007*
Cause of injury	RTI	14	33	1	1	
	Fall	30	25	2.8(1.24-6.42)	2.17(0.58-8.15)	0.24
	Bullet	3	6	1.17(0.25-5.39)	0.77(0.13-4.30)	0.76
	Assaults	0	1	0.00		0.000
Mechanisms of injury	High energy	26	48	0.43(0.19-0.97)	0.90(0.22-3.29)	0.87
	Low energy	21	17	1	1	
Smoking status	Yes	8	3	4.23(1.06-16.95)	1.63(0.12-21.40)	0.7
	No	39	62	1	1	
Alcohol in take	Yes	11	3	6.31(1.65-24.14)	4.38(0.40-47.2)	0.22
	No	36	62	1	1	

Table 6. Bivariable and Multivariable Logistic Regression analysis results of factors associated with Femoral shaft fracture at TASH Hospital, Addis Ababa, Ethiopia, 2020

Explanatory Variable		**Femoral shaft**		**Bivariate analysis (COR)**	**Multivariate analysis (AOR)**	**P-value**
		Yes	No			
Age	1-18	19	8	1	1	
	19-40	27	26	0.44(0.16-1.17)	0.27(0.08-0.94)	0.04*
	>40	5	27	0.078(0.02-0.27)	0.09(0.02-0.32)	0.001*
Cause of injury	RTI	30	17	1	1	
	Fall	19	36	0.29(0.13-0.67)	0.3(0.10-0.88)	0.030*
	Bullet	1	8	0.07(0.01-0.61)	0.09(0.10-0.80)	0.031*
	Assaults	0	1	0.000		1.00

6. Discussion

This study was a retrospective hospital-based cross-sectional study, conducted in Tikur Anbessa specialized Hospital Orthopedic Surgery and Traumatology Department (OSTD) involving records of three hundred ninety-two fractured patients from June2018-June2020.

In this study, the prevalence of femoral fracture was found to be 28.6% among fractured patients admitted in the OSTD of TASH.

The prevalence of femoral fracture in the current study is higher compared to previous studies carried out in Addis Ababa on Road Traffic Accident Victims Visiting Governmental Hospitals, in 2017, which accounts for 20.2% (24). The prevalence was also higher compared that reported by a study conducted in TASH on adult limb fracture, in 2018, where prevalence of femoral fracture was 23.7% (20).

Moreover, the prevalence of femoral fracture was significantly higher when compared to the prevalence reported in south Nigeria regional trauma center, and also Taiwan Chang Gung Memorial Hospital, which reported 10.9%,12.0%, and 15.2% respectively (16,9,23). However, the prevalence in the present study was relatively lower than that of a study done in Kilimanjaro Christian Medical Centre (KCMC), Tanzania and in Benazir Bhutto Hospital Rawalpindi Medical College, Pakistan which accounted for 39% (23), and 39.9%, respectively (8).

The observed increased prevalence in this study compared to that reported by previous studies in Addis Ababa, Ethiopia may be due to increased population in recent years in Addis Ababa, increase in patient flow to TASH, the increasing number of specialized consultants, and advancement of the facility.

Differences in prevalence among other studies may be due to variations in the burden of RTA and fall down accident, type of population studied, the duration of the study conducted and increment of a patient referred to this hospital.

In the present study, the most fractured site of femur was the shaft (45.5%) followed by proximal femur (42.0 %) and distal femur (12.5%). This finding is in agreement with findings of a study conducted in south Nigeria, in which most of the fractures involved the shaft of femur (58.1%) followed by proximal femur (16.5%) and the distal femur (25.4%) (9). Our findings were also similar with that of a study carried out in Rawalpindi, Pakistan, where femoral shaft fracture

accounted (45%) and femoral neck accounted (20 %) (8). Moreover, the results of the present study go in line with the data of an investigation conducted in Nigeria tertiary trauma center, which showed that mid shaft was the most common site to fracture (26.5%), followed by femoral neck (16%) (9). However, the findings of the current study were inconsistent with that reported by a study done in Black-Lion Hospital, Addis Ababa, Ethiopia, where proximal femur fracture was the most common site fracture (44.4%), followed by femoral shaft (41.1%) (33).

The possible reason for the inconsistencies in the results of the two studies may be due to variation in mechanism of injury and difference in age distribution. In a study conducted in Black lion hospital low energy fall were the common cause of fracture and elderly age group were commonly involved whereas in current study high-energy mechanism of injury were common cause and young age group was mostly involved.

Regarding cause of injury and age distribution, RTI was the commonest cause of injury to all age groups, but it was the most prominent cause in the age group between 19- 40 years old. The possible explanation is that the younger age group represented the most active age group physically, participating in higher levels of economic and high-risk activities. Falling down accident was also common in all age groups but it was the most common cause of injury in the age group less than 18 years old & >40. Which is consistent with a study done in Addis Ababa, Ethiopia (20).

Age >40 years was identified as one of the significant determinants of proximal femoral fracture and femoral shaft fracture. The odds of proximal femoral fracture were 5 times higher in the age group >40 compared to the age group less than 18 years. The odds of femoral shaft fracture were 99.2% times lower in the age group >40 compared to the age group between 1 and 18 years. This observation was in agreement with that reported in a cross-sectional study conducted in Taiwan in which older patients were at a higher risk of developing proximal femoral fractures, while a lower risk of developing femoral shaft fractures (23).

The association of older age with proximal femoral fracture can largely be explained by age-related factors, including a decrease in bone strength, and falling being the most common mechanism of trauma in older patients.

7. Limitations of the study

Due to incomplete registration of patient information and data management system in the study hospitals, some other variables that may affect femoral fracture were not included under the study (such as; nutritional status, BMI, sunlight exposure, physical activity).

8. Conclusion

The findings of this study showed that, the Prevalence of femoral fracture was high compared to that reported in the literature. Fall down accident and RTI were the commonest cause for femoral fracture. In younger patients (≤ 40 years of age) shaft of femur was the commonest region involved and road traffic accidents were the commonest cause of injury. In older patients (> 40 years of age) proximal femoral fracture was the commonest fracture and low energy falls were the commonest causes. Proximal femoral fracture is found to be a major health problem, especially in elderly populations. The fracture risk for developing proximal fractures increases with ageing in contrast to that of shaft fracture. The risk of femoral shaft fracture is lower in fall down accident and bullate injury compared to RTI.

9. Recommendations

Based on the findings of the study, the following recommendations are forwarded

- As the study showed fall down accident and RTI were the leading causes of femoral fracture, the responsible authorities/agencies should give due attention in recognition and prevention of RTI and fall down accident.
    - Government should consider the following:
        - Set appropriate road safety targets and establish national road safety plans.
        - Develop a multidisciplinary approach to road safety.
        - Allocate sufficient budget for preventive activities, hospital care and rehabilitation services.
        - Specifically, allocation of resources to facilitate the management of femoral fracture.
        - Opening of Orthopedic centers our side the Addis Ababa (capital city). Because number of cases were referred from Oromia and Amhara region
    - Health institution
        - Public education regarding RTI and Fall down accident prevention.
        - Strengthen pre-hospital and hospital care as well as rehabilitation services.
- Researchers should consider
    - conducting prospective studies to identify more factors that may affect femoral fracture.
    - Conducting a study on fall and RTl prevention

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Annex I: Checklists

MRN No………………

Part I Socio-demographic				
S. No	Question	Answer	Code	Remark
101	Age	______Years (age in completed years)		
102	Sex	1. Male	1	
		2. Female	2	
103	Occupation	1. Government or private employee	1	
		2. Daily labor	2	
		3. Athlete	3	
		4. Driver	4	
		5. Others	5	
104	Address/region	1. Addis Ababa	1	
		2. Oromiya	2	
		3. Amhara	3	
		4. SNNP	4	
		5. Diredawa	5	
		6. Afar	6	
		7. Benshangulgumz	7	
		8. Somale	8	
		9. Hareri	9	
		10. Tigray	10	

<table>
<tr><td></td><td></td><td colspan="3">11. Gambela</td><td>11</td><td></td></tr>
<tr><td></td><td></td><td colspan="3">12. Other</td><td>12</td><td></td></tr>
<tr><td colspan="7">Part II Injury related Characteristics</td></tr>
<tr><td>201</td><td>Affected bone</td><td colspan="3">______</td><td></td><td></td></tr>
<tr><td rowspan="8">202</td><td rowspan="8">Cause of the injury</td><td rowspan="3">1. Road traffic Crash</td><td colspan="2">1Motor vehicle crash</td><td>1</td><td></td></tr>
<tr><td colspan="2">2Motorcycle crash</td><td>2</td><td></td></tr>
<tr><td colspan="2">3Non-Motorized crash</td><td>3</td><td></td></tr>
<tr><td rowspan="2">2. Falls</td><td colspan="2">Falls from height</td><td>1</td><td></td></tr>
<tr><td colspan="2">Ground level falls</td><td>2</td><td></td></tr>
<tr><td colspan="3">3. Gunshot wounds</td><td></td><td></td></tr>
<tr><td colspan="3">4. Assaults</td><td></td><td></td></tr>
<tr><td colspan="3">5. Other</td><td></td><td></td></tr>
<tr><td rowspan="2">203</td><td rowspan="2">Mechanism of injury</td><td colspan="3">1.High-energy mechanisms</td><td>1</td><td></td></tr>
<tr><td colspan="3">2.Low-energy mechanisms</td><td>2</td><td></td></tr>
<tr><td rowspan="6">204</td><td rowspan="6">The nature of fracture</td><td rowspan="5">1. Open</td><td colspan="2">1.GA I</td><td rowspan="5">1</td><td rowspan="5"></td></tr>
<tr><td colspan="2">2. GA II</td></tr>
<tr><td rowspan="3">3. GA III</td><td>A</td></tr>
<tr><td>B</td></tr>
<tr><td>C</td></tr>
<tr><td colspan="3">2 Closed</td><td>2</td><td></td></tr>
<tr><td rowspan="2">205</td><td rowspan="2">Associated injury/other system involvement</td><td colspan="3">1 Yes</td><td>1</td><td></td></tr>
<tr><td colspan="3">2 No</td><td>2</td><td></td></tr>
<tr><td>206</td><td>If Yes for Q 204 specify</td><td colspan="3"></td><td></td><td></td></tr>
</table>

Part III Medical and behavioral characteristics				
301	Weight (Kg)	______Kg		
302	Hight(m)	______m		
303	Previous history of fracture	1.Yes	1	
		2.No	2	
304	Parent fractured hip	1.Yes	1	
		2.No	2	
305	Current smoking	1.Yes	1	
		2.No	2	
306	Alcohol 3 or more unite per day	1.Yes	1	
		2.No	2	
307	Steroids use	1.Yes	1	
		2.No	2	
308	long-term use of bisphosphonates	1.Yes	1	
		2.No	2	
308	Rheumatoid arthritis	1.Yes	1	
		2.No	2	
309	Presence of underling chronic illness	1.Yes	1	
		2.No	2	
310	If Yes for Q 309 specify			
311	Length of hospital stay	______in day		

Part IV femoral fracture related				
401	Affected side	1.Right	1	
		2.Left	2	
402	Site of fracture according to OA classification	1. 31Proximal Type A	1	
		2. 31Proximal Type B	2	
		3. 31Proximal Type C	3	
		4. 32Shaft	4	
		5. 33Distal	5	
403	Fracture line	1.Transvers	1	
		2.Oblique	2	
		3.Spiral	3	
		4 Comminuted	4	
		5.Other	5	
404	Site of fracture	1) Head	1	
		2) Neck	2	
		3) Inter trochanteric	3	
		4) Sub trochanteric	4	
		5) Proximal shaft	5	
		6) Mid shaft	6	
		7) distal shaft	7	
		8) Supra condylar	8	
		9) Condylar region	9	
		10) Other		

Annex II: Declaration form

This is to certify that the thesis prepared by Darba Samuel, entitled: Prevalence of femoral fracture and its associated factors in Tikur Anbessa Specialized Hospital Orthopaedics center, Addis Ababa Ethiopia, January, 2021 and submitted in partial fulfillment of the requirements for the Degree of Masters of Science in Human Anatomy complies with the regulations of the university and meets the accepted standards with respect to originality and quality. This thesis has not been presented for a degree in any other university, and that all sources of materials used for the thesis have been duly acknowledged.

ASSURANCE OF PRINCIPAL INVESTIGATORS

I, the undersigned, declare that this postgraduate degree thesis is my original work, has not been presented for a degree in any other university and that all sources of materials used for the thesis have been duly acknowledged.

1.Name of the student: ______________________________Signature_________ Date. _______

APPROVAL OF THE ADVISORS

This thesis has been submitted with my approval as university advisor.

APPROVAL OF ADVISOR

Name of the first advisor: ___________________________Signature _____ Date. ____________

Name of the second advisor: ________________________ Signature_____Date. ____________

Name of the Third advisor: __________________________ Signature_____Date. ____________

APPROVAL OF EXAMINER

Name: ____________________________

Signature __________________ Date. ____________________