Journal of Surgery
2023; 11(2): 31-40
http://www.sciencepublishinggroup.com/j/js
doi: 10.11648/j.js.20231102.12
ISSN: 2330-0914 (Print); ISSN: 2330-0930 (Online)

A Retrospective Study on Assessment of Prevalence and Treatment Outcome of Acute and Chronic Osteomyelitis at Surgical Ward in HFUSH from 2018-2021

Bethel Tesfaye Bizuneh[1], Tewodros Kassahun Tarekegn[2], Frewengel Melake Weldeslassie[3], Sosina Abebaw Tsehay[4], Teame Kiflom Gaim[3], Salem Sium Mesfin[3], Rediet Abebe Mekonnen[5], Rediet Habtu Lebelo[6], Feven Wondimu Gezahagne[2], Solomon Endale Dagnachew[2]

[1]Department of Medicine, Haramaya University College of Health and Medical Science, Hararghe, Ethiopia

[2]Department of Medicine, Hayat Medical College, Addis Ababa, Ethiopia

[3]Department of Nursing, Asmara College of Health Sciences, Asmara, Eritrea

[4]Department of Medicine, Bahir Dar University College of Medicine and Health Science, Amhara, Ethiopia

[5]Department of Public Health, Kea Med Medical College, Addis Ababa, Ethiopia

[6]Department of Medicine, Mekelle University, College of Health and Medical Science, Mekelle, Ethiopia

Email address:

tesfayebethel8@gmail.com (Bethel Tesfaye Bizuneh), tedikas19@gmail.com (Tewodros Kassahun Tarekegn)

To cite this article:

Bethel Tesfaye Bizuneh, Tewodros Kassahun Tarekegn, Frewengel Melake Weldeslassie, Sosina Abebaw Tsehay, Teame Kiflom Gaim, Salem Sium Mesfin, Rediet Abebe Mekonnen, Rediet Habtu Lebelo, Feven Wondimu Gezahagne, Solomon Endale Dagnachew. A Retrospective Study on Assessment of Prevalence and Treatment Outcome of Acute and Chronic Osteomyelitis at Surgical Ward in HFUSH from 2018-2021. *Journal of Surgery*. Vol. 11, No. 2, 2023, pp. 31-40. doi: 10.11648/j.js.20231102.12

Received: January 3, 2023; **Accepted**: April 7, 2023; **Published**: April 27, 2023

Abstract: *Background*: As everyone has access to the streets of cities of Ethiopia, osteomyelitis is becoming a major burden in Ethiopia and causes disability in many cases. Osteomyelitis is an infection of the bone caused by various microorganisms, most frequently S. aureus, which can enter the bone directly or through the bloodstream. The femur, tibia and humerus are bones most typically infected, but every bone can be affected. Early intravenous antibiotics treatment is the mainstays of treatment, followed by surgical treatment if no improvement. *Objectives*: The objective of the study is to assess the prevalence and the treatment outcome of osteomyelitis among the patients admitted to surgical ward in HFSUH from January 2018 to February 2021. *Methodology:* This Hospital based retrospective descriptive cross-sectional study was conducted by retrieving secondary data using structured data collection sheet on all surgical patients in HFSUH from January 2018 to February 2021. *Result*: total admitted cases in surgical ward between Jan 2018 and Jan 2021 were 1035. From this 211,343,339 & 142 at 2018, 2019, 2020 and 2021: years respectively. Out of a total of 41 clinical records, 30 (73.2%) were reviewed. The remaining 11 (26.8%) was omitted since the card was missing and was short of relevant information and could not fulfill the inclusion criteria. The prevalence of osteomyelitis was 30/1035x100=2.89% in HFSUH, in surgical ward from January 2018- February 2021. *Conclusion*: Osteomyelitis is a common, persistent and serious problem, and attention should be given to the preventable forms. There should be a proper documentation. Osteomyelitis cannot be treated effectively with IV antibiotics alone. *Recommendation*: Health education, building better infrastructure capacity and additional prevention method by the governmental side and routinely investigation and documentation of patient history and early referral of open fracture by the health professionals should be implemented for better prevention of osteomyelitis.

Keywords: Prevalence, Treatment, Outcome, Acute, Chronic Osteomyelitis

1. Introduction

1.1. Background

Bone infection is called osteomyelitis. It is an acute or chronic inflammatory process involving the bone and its structures secondary to infection with pyogenic organisms, including bacteria, fungi, and mycobacteria. Interestingly, archeological finds showed animal fossils with evidence of bone infection, making this a relatively old disease. Various terms were used to describe infected bone over the years until Nelaton came up with the term osteomyelitis in 1844. Before the introduction of penicillin in the 1940s, management of osteomyelitis was mainly surgically consisting of extensive debridement, saucerization, and wound packing following which the affected area is left to heal by secondary intention resulting in high mortality from sepsis. Since the availability of antibiotics, mortality rates from osteomyelitis, including staphylococcal osteomyelitis, has improved significantly. [1]

Osteomyelitis is a gradual, progressive, inflammatory process involving the bone cortex and its marrow. Negligence or suboptimal management evolve and progress to chronic and long-term disease. Eventually the primary bone will undergo necrosis and form a sequestrum whereas the newly formed, reactive bone is called an involucrum. [2, 3] Chronic osteomyelitis is defined as bone infection lasting 6weeks or more with radiological evidences. [4] The last several decades witnessed a substantial rise in osteomyelitis rate despite advanced diagnostic and treatment modalities; this rise was associated with major shifting in causes and risk factors of osteomyelitis where posttraumatic osteomyelitis was predominated highly marked. [5] Almost 7 decades ago osteomyelitis was considered as a lethal condition and the patients who survived had severe comorbidities. The significant decline in osteomyelitis mortality and morbidity was attributed to optimal use of antibiotic therapy and advanced surgical techniques. [6] COM not only causes long term disability, it can on occasion cause other malignant conditions, notably squamous cell carcinoma (Marjolin's ulcer), arising from the long-standing sinus drainage and chronic inflammation with a progression to metaplasia, dysplasia, and neoplastic over time [7, 8]. The USA witnessed an exponential rise of osteomyelitis in the elderly population from 1969 to 2009 attributed to the dramatic rise in diabetes mellitus [9]. COM can present in various types from well localized to diffuse. The early course of the disease is marked by its acute and sub-acute phases. Timely and optimal management in this early phase of disease prevent progression to COM with the attendant morbidity and unproductivity for long periods. Misdiagnosis was identified as the main medical challenge at primary health facilities keeping COM on its rise in resource constrained settings, whereas ignorance and financial problems rank on the top of socio-economic factors [10].

Annually, approximately 7.3 million children die globally, and out of these 50% of children's deaths occur in just five countries – Nigeria, Democratic Republic Congo, Ethiopia, Tanzania, and Uganda. The common cause of death for these children is an infection, of which osteoarticular infection is one. [11] It is estimated that 0.1–30% of pediatric populations are affected by osteoarticular infections worldwide and the estimated cost for treatment of these infections is $17,000 to $150,000 per patient. [12]

1.2. Problem Statement

Incidence of osteomyelitis is approximately 13 per 100,000 in children and approximately 90 per 100,000 in adults. Hematogenous osteomyelitis occurs predominantly in children and elderly patients while osteomyelitis due to contiguous infection is most common in adults. Osteomyelitis is more common in males but equally affects each race. The disease is more common in developing countries. [14]

The prevalence of osteomyelitis has decreased throughout the years due to greater control of the spread of infection in hospitals as well as a better understanding of osteomyelitis treatment approaches. This enables the infection, in many cases, to be caught within 48 hours and prevented from becoming a chronic recurrence. Incidence of osteomyelitis varies widely between countries. The range has been reported to be 1.94-200 new cases per 100,000 people [15] A 2015 USA study reported that the incidence of osteomyelitis increased between 1969 and 2009, reasons being unclear but could comprise a variety of factors, including changes in diagnosing patterns or increases in the prevalence of risk factors (e.g., diabetes) in this population. The incidence between 1969 and 2009 and remained relatively stable among children and young adults but almost tripled among individuals older than sixty years; this was partly driven by a significant increase in diabetes-related osteomyelitis (from 2.3 cases per 100,000 person-years in the period from 1969 to 1979 to 7.6 cases per 100,000 person-years in the period from 2000 to 2009). Forty-four percent of cases involved Staphylococcus aureus infections. [16] The incidence of osteomyelitis in children has decreased to 47/10,000 in 1990 from 87/10,000 in 1970. [17] The estimated incidence of Vertebral Osteomyelitis (VO) increased from 5.3/100 000 population per year in 2007 to 7.4/100 000 population per year in 2010 (a Japanese national figure data base). They stated that "The high mortality suggests that VO remains a life-threatening disease despite advances in medical practice and should be regarded as a fatal systemic disorder rather than just a localized vertebral disorder" [18].

Chronic osteomyelitis continues to be prevalent in SSA, more recently, a shift from hematogenous to exogenous osteomyelitis has been observed, likely secondary to the prevalence of vehicular trauma and fracture treatment utilizing open reduction and internal fixation utilizing osteostynthetic material use. Very limited data of high quality on COM in SSA currently exist, reporting its epidemiology and socio-economic burden it poses. And in Hiwot Fana specialized university hospital, there is no published available data concerning about the prevalence and outcome of osteomyelitis. So, this study highlights common risk factors, incidences, and management in this hospital, it will

be used as reference to this Hospital.

1.3. Significance of the Study

The goal of this study is to provide information on the prevalence and treatment outcomes of acute and chronic osteomyelitis at the surgical ward in the HFSUH. It will also encourage efforts to improve early diagnosis of such cases and to reduce the delay in the initiation of therapy to similar cases by health officials. The study also aims to inform the public about the seriousness of OM and its complications and to encourage physicians and other clinicians to strengthen early referral system for compound fractures and prophylactic antibiotic use.

This study finding will help Harar health bureau (HHB) and HFSUH to design and develop locally appropriate plan and implementation strategy. There is a hope that data obtained from this study will be used to improve the quality of health care to the patients. Finally, the finding of this study may be used as base line data for those who have an interest of caring out further research.

1.4. Literature Review

A 5year retrospective study reviewed patients who were diagnosed and treated for extremity chronic osteomyelitis at a tertiary care hospital at Shillong in North East India from January 1 2013-December 31 2017, included 131 patients of whom 96 (73.28%) were males and 35 (26.72%) females giving a gender ratio of 2.74 for a male predilection. The median age on first diagnosis was 17 years while the mean age was approximately 21 years. The top three age groups involved were the periods from 1 to 20 years (59.5%), 21 to 40 years (27.5%), and 41 to 60 years (12.2%) respectively. Gender ratios differed statistically among the types of infections ($p<0.001$) ranging from 2.4 (hematogenous osteomyelitis) to 3.2 (traumatic osteomyelitis). According to the Wald Vogel classification, 68 (51.9%) cases of the total 131 cases were of hematogenous origin, the highest percentage 83.8% of which were in the 1 to 20 years age group. 63 (48.1%) cases were of post traumatic origin of which 44.4% of these patients were in the 21 to 40 years age group ($p<0.001$). [13] The oldest patient in this study was 66 years old male with traumatic osteomyelitis. All the patients had a single infection site, the right side accounted for 48.1% (63) of the total infection sites, and the left side accounted for 51.9% (68).

None of the patients had bilateral involvement. 120 (91.6%) cases had a lesion in a lower limb while 11 (8.4%) cases involved the upper limb. The most frequent single site of infection was the femur (57 cases, 43.5%) followed by the tibia (51 cases, 38.9%), the calcaneus and the humerus (5 cases each, 32.2%), and metatarsals (4 cases, 12.9%). In addition, the tibia was the most common site in traumatic osteomyelitis while the femur was the most common site for hematogenous osteomyelitis. [19]

The laboratory cut-off values for the various serum inflammatory markers used in this study were, ESR: 20mm/1h and CRP: 5mg/l. A preoperative comparison of the values of these 3 markers among the different types of osteomyelitis did not reveal any differences. While the mean WBC and CRP levels were found to be marginally elevated in the hematogenous type of osteomyelitis. In contrast, mean ESR levels were found to be elevated in traumatic infections. The overall positive rates for these three serum inflammatory markers showed that ESR was the highest (86.3%, 113/131) followed by CRP (65.6%, 86/131). Positive rates of WBC were the lowest (26%, 34/131). The positive rates for all three inflammatory markers were higher among the hematogenous osteomyelitis group than among the posttraumatic osteomyelitis group Variables [20].

A retrospective analysis was conducted in the patients who had sought medical attention from January 2010 to April 2015 for extremity chronic osteomyelitis in Nanfang Hospital in Southern China. Clinical data were collected and analyzed. A total of 394 patients (307 males and 87 females) were included, giving a gender ratio of 3.53. The median age at first diagnosis was 42 years for all. The most frequent type was traumatic osteomyelitis (262 cases, 66.50%), which was mainly caused by open injury (166 cases, 63.36%) and during a road accident (91 cases, 34.73%). Single-site infection accounted for 81.98% (323 cases), with tibia (126 cases), femur (79 cases), calcaneus (37 cases), and toes (37 cases) as the top sites. The positive rate of intraoperative culture was 70.63% (214/303), 78.97% (169/214) of which was monomicrobial infection. *Staphylococcus aureus* (59 cases) was the most frequent bacteria for monomicrobial infection, followed by *Pseudomonas aeruginosa* (29 cases) and *Escherichia coli* (11 cases). The positive ratios of preoperative serum white blood cell (WBC), erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), procalcitonin (PCT), interleukin-6 (IL-6), and tumor necrosis factor alpha (TNF-α) were 21.63%, 64.92%, 53.27%, 42.25%, 72.82%, and 66.67%, respectively. The most frequently used intravenous antibiotic was cephalosporins. The overall cure rate was 77.74%, with a total amputation rate of 16.75%. All 131 patients had records of organism cultures in our study. The positive rate for all was 57.25% (75 cases). A significant difference was identified regarding the positive rate of culture for the two different types of osteomyelitis ($p<0.001$). The most common bacteria to account for both hematogenous and traumatic infections was Staphylococcus aureus (44 cases, 33.58%), 9 of which were of MRSA strain. Other bacteria detected in more than five patients was Escherichia coli (9 cases, 6.87%) [9]

A three-year prospective study of chronic OM from 2005-2007 at the orthopedic ward in Tikur Anbesa Hospital, A total of 442 consecutive patients with chronic osteomyelitis (COM) were included. Males accounted for 336 (76%) of the cases. The mean age at the initial presentation was 18 years with a range of 1month to 84 years. The majority (68%) of patients came from rural areas. Discharging sinus was the commonest clinical presentation observed (411, 93%) followed by swelling

(260, 59%), pain (240, 54%), limping (188, 42%), and limitation of movement (131, 30%). Squamous cell carcinoma was present in four patients. The disease started spontaneously in 70% (312) and it followed trauma in 27% (118). Tuberculosis osteitis was proven in three of the suspected patients and the disease occurred post operatively in eleven patients Compound fracture accounted for 93 (79%) of the post traumatic onset and the osteomyelitis followed simple fractures in 12 (10%) of the patients. More than half (230, 52%) of the patients visited bone setters in the course of their illness and "difficulties" at Hospitals were one of the main reasons (41, 18%), Only 21 (4.8%) of the patients did not take any antibiotic in the course of their illness and majority of those who took antibiotics had taken them for more than a month. Seventy-five (81%) of the patients with compound fractures initially visited a hospital but were referred elsewhere due to lack of beds for admission. The commonest radiological finding seen was a sequestrum (189, 58%) and involucrum formation (174, 53.5%) followed by joint space narrowing (67, 20.6%). A quarter (117, 26.5%) of the patients were not initially x-rayed when referred to our hospital and 296 (67%) of them had no any laboratory investigations. ESR was more than 30mm/hr. in 86% of the patients, there was Leukocytosis in 38% of the patient and 43% of the patients were anemic (Hematocrit<30%). The commonest anatomical type noticed using Cierny-Mader's classification was type III (273, 63%) followed by type IV (82, 19%). Thirteen patients were difficult to classify. More than half, (58.6%) of the patients came to the Hospital two years after the onset of illness. Lower limb bones were the commonest affected (Tibia, 36%, fibula 22% and femur 21%). Nine of the patients had multiple bones affected and three of these patients agreed to HIV screening, all were positive. Swab culture was done in only half of the patients. The main isolate was Staph. Aureus and most of the organisms were resistant to the common antibiotics. Most of the patients (304, 69%) were waiting for surgery. Sequestrectomy had been done only in 73 (16.5%) of the patients and the discharge stopped in 38 (52%). (22)

1.5. Objectives

1.5.1. General Objectives

To assess prevalence and treatment outcome of acute and chronic osteomyelitis at HFSUH in the year of 2018-2021G.C.

1.5.2. Specific Objectives

1) To determine prevalence of acute osteomyelitis at HFSUH, Surgical ward in the year 2018-2021 G.C.
2) To determine the prevalence of chronic osteomyelitis at HFSUH, Surgical ward in the year 2018-2021 G.C.
3) To assess treatment outcome of acute osteomyelitis at HFSUH, Surgical ward in the year 2018-2021 G.C.
4) To assess treatment outcome of chronic osteomyelitis at HFSUH, Surgical ward in the year 2018-2021 G.C.

2. Methodology

2.1. Study Area and Study Period

2.1.1. Study Area

Harar is a city located in Eastern Ethiopia, 526kms from Addis Ababa. There are 19 kebele in the city as a whole, while there are 17 farmer organizations and two towns in the countryside of the State, notably Harar and Hamaresa (Central statistics agency of Ethiopia, 2018). There are a total of 7 hospitals: 4 governmental hospitals, 2 private hospitals and 1 Fistula hospital established by NGO and 7 Health centers, 29 private clinics and 26 Health posts. HFSUH is one of the oldest health institutions in Eastern part of Ethiopia. The hospital has been transferred to Haramaya University to serve as, a teaching, community serving, referral and research hospital.

The hospital is expected to serve about 5,000,000 populations like other referral teaching hospitals according to the Federal MOH hospital structure guideline. It is very clear to understand the enormous responsibility that hospital shoulders to give advanced health care to such a huge number of populations.

The hospital is located in this cross-sectional retrospective study, which was carried out at the Hiwot Fana specialized university in Harar, Ethiopia's Harare region.

2.1.2. Study Period

The research was done from 1/1/2018-30/1/2021 in GC in HFSUH.

2.2. Study Design

The study design was hospital-based retrospective descriptive cross-sectional study for patients admitted to surgical and orthopedic ward.

2.3. Population

2.3.1. Source Population

The all-orthopedic patients who visited HFSUH during the study period make up the source population.

2.3.2. Study Population

The study population is patients with acute and chronic OM who visited HFSUH in the years.

Jan 2010 – Jan 2013 E.C fulfilling the inclusion criteria.

2.4. Inclusion and Exclusion Criteria

2.4.1. Inclusion Criteria

All patients who are admitted and diagnosed with acute and chronic OM in surgical and orthopedic ward, in HFSUH during the reference period and whose cards contain complete information will be included in the study.

2.4.2. Exclusion Criteria

A patient with incomplete chart records.

2.5. Sample Size Determination and Sampling Technique

2.5.1. Sample Size Determination

The number of a sample included in the study was calculated based on the following formula

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

Where: N= maximum sample size to represent large population.

z= is the standard normal value corresponding to the desired level of confidence 95% (Zα/2=1.96).

D= error of precision (margin of error) (5%).

p= 50% (28) d= 0.05.

$$n = \frac{(1.96)^2 0.5(1-0.5)}{0.05^2} = \frac{3.8416 \times 0.25}{0.0025} = 384$$

For incomplete data and loss of charts the PI use 10% of contingency =422. (38 +384)

Since the study population is <10000 we use correction formula which is

$$Na = n / (1+n/N)$$

$$Na = 141$$

2.5.2. Sampling Techniques

A systematic random sampling method using the formula K=N/n =1035/141= 7.

2.6. Data Collection Instruments and Techniques

Data was collected using structured data collecting format. All patients with diagnosis of acute and chronic osteomyelitis during the study period was selected from registration book. From this, card numbers of cases were recorded. Using these card numbers, charts of the patient was retrieved from card room.

Age, gender, clinical and laboratory findings, diagnosis, and treatment information on the patients were gleaned from their medical records.

2.7. Data Quality Control Method

Data input forms created for this purpose were used to gather pertinent information on age, sex, clinical presentation, laboratory and radiologic results, risk factors, and treatment outcomes. Daily checks were made to ensure the accuracy, completeness, and accurate identification of the needed document in the questions.

2.8. Data Processing and Analysis

Data was retrieved from the medical charts and entered into a checklist. Then it was organized and analyzed using SPSS version 21 statistical software. It was collected using structured data collecting format (check list) which is adapted from different literatures and with reviewing patient cards. Data is summarized and presented in tables and graphs. Result of data analysis is reviewed and documented in tables, charts and discussion.

2.9. Variables

2.9.1. Dependent Variable

1) Infected site;
2) Fever;
3) bone pain;
4) Duration of IV antibiotics use;
5) WBC count;
6) ESR;
7) Outcome of Acute and chronic osteomyelitis after treatment.

2.9.2. Independent Variable

1) Age;
2) Sex;
3) Address.

2.10. Ethical Consideration

The Ethical Review Board of the School of Medicine, HU, and HFSUH Ethics Review Committee gave their permission and ethical clearance for the study protocols. A copy of the letter will then be given to the hospital administration and any relevant organizations, and the study's purpose will be conveyed to those parties. The patient's name or card number was never used in any way during the research because data collectors were strictly trained about patient confidentiality. After obtaining permission from the responsible bodies, medical follow-up clinic log books and patient charts were accessed using the patients' card numbers.

3. Result

The total admitted cases in surgical ward between January 2018 and January 2021 were 1035 patients. From these 211, 343, 339 & 142 at 2018, 2019, 2020 & 2021 GC years respectively. Out of a total of 41 clinical records of Osteomyelitis, 30 (73%) were reviewed. The remaining 11 (26.8%) was omitted since the card was incomplete and having lack of relevant information and could not fulfill the inclusion criteria. The prevalence of osteomyelitis was 30/1035x100=2.89% in HFSUH, in surgical ward from January 2018-January 2021 GC.

3.1. Socio-Demographic Distribution of the Study Population

Table 1. *Socio-demographic distribution of the study population on osteomyelitis patients admitted to HFSUH, surgical ward in the Year 2018-2021.*

Age (years)		Frequency	Percent%
	0-5	4	13.3
	6-15	14	46.7
	16-30	2	6.7
	31-45	4	13.3
	>/=46	6	20
Sex	Male	25	82.1
	Female	5	17.9
	Rural region	26	85.7
Address	Urban region	4	14.3
			100

The mean age of patients was 14 years, ranging from 2-60 years. Majority (46.7%) of the participants were between the ages of 6-15 years. Out of all patients, 82.1% of them were male and the rest 17.9% were Females. And 85.7% of the study subjects were from rural area and the remaining 14.3% were from urban area.

3.2. Symptoms of Patients Presenting with Osteomyelitis Patients Admitted to HFSUH, Surgical Ward in the Year 2018-2021GC

The presenting compliant in all the study subjects were swelling which accounted for 25 (83.3%), among the study subjects 27 (90.0%) had bone pain, 14 (46.7%) had fever, 27 (90.0%) complains limitation of movement, 10 (33.3%) had warmth and about 28 (93.3%) had pussy discharge.

3.3. Common Risk Factors Among Osteomyelitis Patients Admitted to HFSUH Surgical Ward in January 2018-January 2021 GC

From the 30 patients who was admitted with diagnosis of osteomyelitis, the common risk factors were assessed. The result shows 16 (53.3%) had history of trauma, 4 (13.3%) had hematogenous spread, 5 (16.7%) had a local spread from a contiguous site, 2 (6.7%) were known Type 2 DM patients not existing bone diseases and 3 (10.0%) had no identified risk factor.

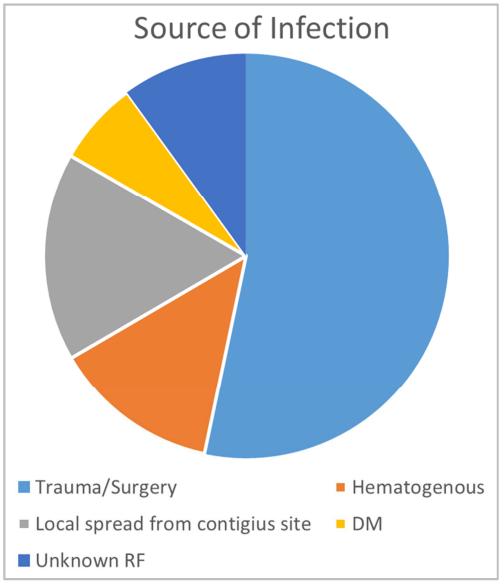

Figure 1. *Source of infection among osteomyelitis patients admitted to HFSUH surgical ward in January 2018-January 2021 GC.*

3.4. Common Site of Infection in Osteomyelitis Patients Admitted to HFSUH Surgical Ward in January 2018-January 2021GC

The most popular singles source of infection was the Tibia (13 cases, 43.3%) followed by the Femur (8 cases, 26.7%), the Humerus, Ulna & Fibula (each 2cases, 6.7%), the Radius & Calcaneus (each 1 cases, 3.3%) and others account for 1 (3.3%) (Table 2).

Table 2. *Sites of infection among osteomyelitis patients admitted to HFSUH surgical ward in January 2018-January 2021GC.*

Site	N (%)
Humerus	2 (6.7%)
Ulna	2 (6.7%)
Radius	1 (3.3%)
Femur	8 (26.7%)
Tibia	13 (43.3%)
Fibula	2 (6.7%)
Calcaneus	1 (3.3%)
Others	1.(3.3%)

3.5. Laboratorial Findings in Osteomyelitis Patients Admitted to HFSUH Surgical Ward in January 2018-January 2021 GC

Concerning the laboratorial findings among the study subjects 21 (70.0%) patients WBC were between 4000-11000/mm^3, 9 (30.0%) were > 11000/mm^3, 14 (46.7%) patients ESR were >20mm/hr., 4 (13.3%) were between 0-20mm/hr. and 12 (40.0%) patients had no ESR done. 1 patient (3.3%) had C-reactive protein value done, only 3 (10.0%) of patients had microbiologic culture done and shows 66.7% causative agent was S. aureus & the rest 33.3% show Gram –VE bacilli, 22 (73.3%) had bone x-ray and was confirmatory for 94% of them. 3 cases (10.0%) had an ultrasound done and 1 patient (3.3%) had an MRI done & both were confirmatory, none of the cases had a Bone scan examination.

Table 3. *Laboratorial and Radiologic findings in osteomyelitis patients admitted to HFSUH surgical ward in January 2010- January 2013EC.*

Laboratory result		Frequency	percent%
1. WBC count	A.<4,000	0	0
	B.4,000-11,000	21	70.0
	C.>11.000	9	30.0
	D. Not done	0	0
2. ESR	A.0-20 mm/h	4	13.3
	B.>20 mm/h	14	46.7
	C. Not done	12	40.0
3. CRP	A. Done	1	3.3
	B. Not done	29	96.7
4. Microbiologic culture	A. Done	3	10.0
Radiologic investigation			
5. Bone x-ray	A. Done	22	73.3
6. Ultrasound	A. Done	3	10.0
7. MRI	A. Done	1	3.3
8. Bone scan	A. Done	0	0

3.6. Treatment and Outcome of Osteomyelitis Patients Who Were Admitted to HFSUH Surgical Ward in January 2018- January 2021 GC

Based on this study 28 (93.3%) of the cases had received a combination of Anti-microbial & surgical treatment, and only 2 (6.7%) of the patients had received Anti-microbial treatment alone and 12 (40.0%) were given IV antibiotic < 2 weeks, 16 (53.3%) took for duration of 2-4 weeks, 2 (6.7%) cases took for >4 weeks. 3rd generation cephalosporin antibiotics were given for 18 (60.0%) of patients, 10 (30.0%) took penicillin-based antibiotics, 1 (3.0%) took carbapenem and 7 (23.3%) of these patients took a combination of antibiotics.

Of the 28 patients who had surgical intervention done, 16 (57.1%) had Sequestrectomy, 5 (17.9)% had surgical debridement, and 4 (14.3%) had Limb amputation 3 (10.7%) had other surgical intervention.

Out of 30 patients, 27 (90.0%) were discharged from the ward with improvement, 1 (3.3%) case was referred to a better facility for better workup and management, 1 (3.3%) patient had deteriorated, 1 (3.3%) had no documentation about any death and complication.

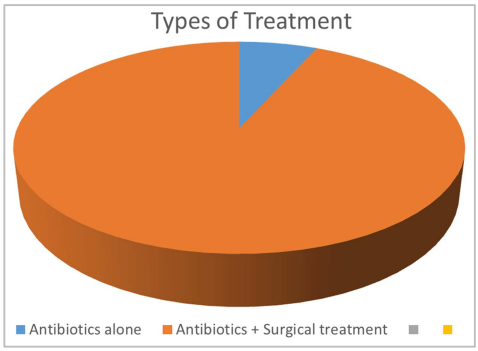

Figure 2. *Type of treatment given among osteomyelitis patients admitted to HFSUH surgical ward in January 2018-January 2021 GC.*

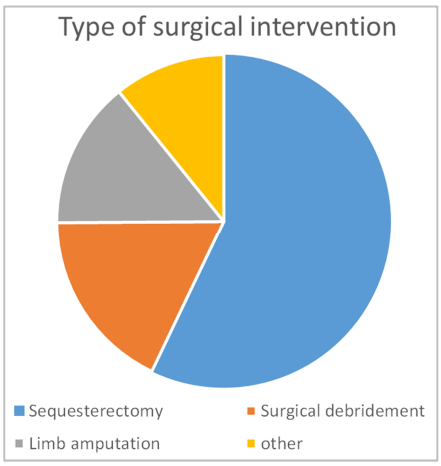

Figure 3. *Type of surgical interventions done for osteomyelitis patients admitted to HFSUH surgical ward in January 2018-January 2021 GC.*

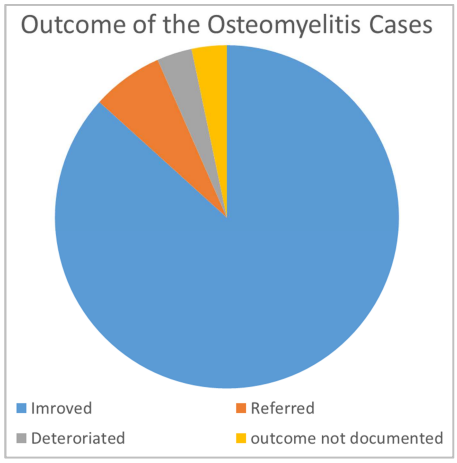

Figure 4. *Outcome of osteomyelitis patients admitted to HFSUH surgical ward in January 2018-January 2021 GC.*

4. Discussion

Osteomyelitis has been linked to a considerable amount of morbidity globally and causes major morbidity and mortality.

This study's objective was to evaluate the incidence and prognosis of osteomyelitis among patients admitted to the surgical ward at HFSUH between January 2018 and January 2021 GC.

According to this particular retrospective study the overall prevalence of osteomyelitis among patients admitted to HFSUH surgical ward in 2018-2021 GC is 30 (2.89%) Compare to a study done among residents of Olmsted County, Minnesota, the study population comprised 760 incident cases of osteomyelitis first diagnosed between January 1, 1969, and December 31, 2009, the overall age and sex-adjusted annual incidence of osteomyelitis was 21.8 cases per 100,000 person-years. The annual incidence was higher for men than for women and increased with age ($p < 0.001$). Rates increased with the calendar year ($p < 0.001$) from 11.4 cases per 100,000 person-years in the period from 1969 to 1979 to 24.4 per 100,000 person-years in the period from 2000 to 2009. The incidence remained relatively stable among children and young adults but almost tripled among individuals older than sixty years; this was partly driven by a significant increase in diabetes-related osteomyelitis from 2.3 cases per 100,000 person-years in the period from 1969 to 1979 to 7.6 cases per 100,000 person-years in the period from 2000 to 2009 ($p < 0.001$) [9].

The result of the socio demographic assessment of the study subjects shows that males are 25 (82.1%) and females 5 (17.9%) while 4 (13.3%) were in the age range 0-5 years 14 (46.7%) were in the age range of 6-15 years, 2 (6.7%) were in the range of 16-30years and 4 (13.3%) 31-45 years age group, the rest 6 (20%) was more than 46 years. The mean age of this study is 14 years, Majority of the study population (85.7%) in this study were from rural region. Similar to our study, the study done at Tikur Anbesa Hospital retrospective study total of 442 patients with osteomyelitis were 336 (76%) males. The mean age of initial presentation was 18 years with ranges 1 month-84 years, (68%) of the patients come from rural areas. [20] Same as our study a systematic review was written according to the PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions of 1173 patients from Africa (Kenya, Malawi, Nigeria, Congo, Uganda, Ethiopia) and Asia (Nepal, India). All patients were diagnosed with chronic osteomyelitis. The age of the patients ranged from 1 month to 84 years with a mean age of 15 years and a male/female ratio of 714/333; the sex of 153 patients is not specified [21] and A study done in Rwanda from January 2015 to December 2016 in 55 cases of chronic OM the majority of cases (56%) were pediatric cases under 15 years of age, and most of them were from the rural and low-income families. Poor hygiene and poor nutrition were possibly among the risk factors this patient population. [22]

The presenting compliant in all the study subjects about 28 (93.3%) had pussy discharge, among the study subjects 27

(90.0%) had bone pain and limitation of movement, 25 (83.3%) had swelling and 14 (46.7%) had fever, 10 (33.3%) of them had warmth over the affected area. Compare to our study it is somehow comparative to the study done at Tikur Anbesa Hospital retrospective study. Their study shows, discharge sinus was the most clinical presentation observed (411, 93%) followed by swelling (260, 59%), pain (240, 54%), limping and limitation of movement (188, 42%). [9]

In this study the commonest risk factor is trauma 16 (53.3%) and 3 (10%) had no identified risk factor, likely a prospective multi-center study done in Chronic osteomyelitis patients from two different university medical centers in the Netherlands, 69 % of all cases of had a post-traumatic origin, where 18 % was due direct post-operative inoculation, 12 % was infected due a hematogenous spread of bacteria, and 1 % remained of unknown origin. [23] In contrast to the retrospective study done at Tikur Anbesa Hospital the disease started spontaneously in 70% (312), followed by trauma in 27% (118) this is might due to the reason for late presentation to the institution in black lion and short period study in our hospital. [20].

Based on this study concerning the laboratorial findings among the study subjects 21 (70.0%) patient's WBC results were between 4000-11000/mm^3, 9 (30.0%) were > 11000/mm^3, 14 (46.7%) patients had raised ESR (>20mm/hr), 4 (13.3%) had ESR 0-20mm/hr., 22 (73.3%) had bone x-ray. Relative to the study done in Ethiopia, Tikur Anbesa Hospital ESR was more than 30mm/hr in 86% of the patients. [20]

12 (40%) of the patients were given IV antibiotic < 2 weeks, 16 (53.3%) 2-4 weeks, 2 (6.7%) took for >4wks, 28 (93.3%) had surgical intervention along with Antibiotics. Out of 30 patients, 27 (90.0%) discharged from the ward after improvement, 1 (3.3%) was referred to a better facility for better workup and management, 1 (3.3%) patient had deteriorated, 1 (3.3%) had no documentation about any death and complication. In correspondence to this study, Tikur Anbesa Hospital had only 21 (48%) patients who has not taken any antibiotics in the course their illness and majority of those who took antibiotic had taken more than a month. 75 (81%) of the patients with compound fracture initially visited this Hospital but referred elsewhere due to lack of bed for admission. Sequestrectomy had been done only in 73 (16.5%) of the patients and discharged in 238 (52%). [20] Complementary to this research, A research done in Rwanda from January 2015 to December 2016, 55 cases of COM were enrolled and were followed up for 12 months. Of the 55 cases of COM treated with locally made bone cement, 3 cases (5%) developed complications. Fifty-two cases (95%) improved without any complications after 12 months of follow-up. Of the 3 cases with complications, 1 case of COM of the right femur developed an early foreign body rejection reaction against the bone cement; this patient underwent additional surgery to remove the bone cement pellets on the fifth postoperative day. [22] Contrarily to this study, A prospective study was performed on 28 consecutive patients with long-bone chronic osteomyelitis treated at a tertiary-level tumor, sepsis, and reconstruction unit, after a minimum of 12-month follow-up, we achieved an overall success rate of 96.2%, with 100% remission in the curative group and 92.8% suppression (or better) in the palliative group. [24]

As you can see from the above study, our study has comparative result in recovered cases but no complicated/died cases documented in our study this is might be due to improper documentation and short period of study.

5. Conclusion

OM mainly affects patients with risk factors related to the presence of vascular diseases. Antibiotic treatment must be guided by susceptibility patterns of individual microorganisms, although it must be performed together with surgery in most of the cases.

Osteomyelitis (OM) is an inflammatory condition that results in bone loss and is brought on by an infectious microorganism. Because of its heterogeneity, pathophysiology, clinical presentation, and management, it is an infectious disease that is challenging to diagnose and has a complicated course of treatment.

There are several ways to classify OM. The two major classification schemes are those described by Lew and Wald Vogel and Cierny et al.The Cierny-Mader OM classification combines both anatomic factors (medullar, superficial, localized, or diffuse OM) and physiological classes (healthy host, systemic and/or local compromise, and treatment worse than the disease).This classification applies well to long and massive bones and it is not very useful for the digits, minor bones, or the skull.

Chronic OM is defined as long-standing infection that evolves over months or even years, characterized by the persistence of microorganisms, low-grade inflammation, and the presence of dead bone (sequestrum) and fistulous tracts.

Necrotic bone development and chronic OM are linked to clinical signs that last longer than 10 days. Chronic OM may also present as a recurrent or intermittent disease, with periods of quiescence of variable duration.

The prevalence of diabetes and peripheral vascular disease has increased due to the general population's aging process, predisposing and complicating OM, which, if not properly managed, may result in amputation, sepsis, or death. For diabetic patients, the timing of their diagnosis and treatment is essential to preventing amputation in the future. The various forms of OM frequently call for a variety of therapies, including prolonged antibiotic therapy and/or surgical debridement or resection. The cornerstone of effective management of OM is early diagnosis and aggressive treatment with thorough debridement and culture-directed antibiotic therapy. In order to acquire precise pathogen identification, the treating surgeon should take suitable tissue samples. The gold standard for OM diagnosis consists of a biopsy specimen and its culture in order to identify the infecting organism. In chronic OM, the antibiotic choice should be based on sensitivity data: a short course of intravenous

antibiotics, followed by a prolonged course of oral antibiotics is the usual therapy. Staphylococcus aureus represents the most common isolated microorganism in most types of OM, affecting 66% of cases. Other microorganisms commonly found in cases of OM include aerobic Gram-negative bacilli and anaerobes, these latter ones are often isolated as part of mixed infections.

6. Recommendations

1) For Government

a) Additional emphasis on prevention and control of osteomyelitis should be implemented.
b) Health education and awareness creation of the patients on possible risk factors of osteomyelitis.
c) Infrastructure capacity building to equip the health system with necessary baseline laboratories and adequate management of Osteomyelitis.

2) For Clinicians and Hospital Staffs

a) Patients should be routinely investigated with ESR, CRP, x-ray, PIHCT, RBS.
b) Patients' full clinical history should be documented on their clinical record.
c) Patients should be educated on the possible risk factor avoidance and complications of the disease.
d) Referrals of open fractures should be given serious attention and prophylactic antibiotics should be given if at all such patients are referred.

3) Further Research

Finally, further prospective study is recommended to overcome the limitations of retrospective cross-sectional study and use of secondary data from clinical records with the existing clinical record keeping condition.

7. Strength and Limitations

1) Strength

The study tried to assess largely unexplored and neglected area of the research in Ethiopia, namely, assessment of the Prevalence and outcome of acute and chronic osteomyelitis among patients admitted to HFSUH, surgical ward. This study, which is the first of its kind in this field of research, paves the way for future research and is anticipated to produce reliable baseline data for future assessments.

Second, the results of this study will help epidemiologists better understand the root causes of this unfortunate disease that is prevalent in the study area, which will make it easier to address the issue and produce data for the particular institution.

The study also tried to avoid bias for which the data collection was done by the principal investigator.

With all the limitations, it has tried to assess the prevalence, treatment and outcome of osteomyelitis. It has also tried to identify risk factors associated with osteomyelitis in our set up. It can be used as a preliminary study to undertake subsequent prospective investigations.

2) Limitations

In this study, secondary data from a single hospital were used in a retrospective survey. As it is done at one institution, the outcome might not be indicative of the situation on a national or regional level. The diagnosis was accepted exactly as it appeared in the clinical notes. The clinical records frequently lacked crucial socio-demographic, clinical, and laboratory information. It was difficult to locate the patients' complete medical histories or any information to pinpoint risk factors.

Abbreviations and Acronyms

OM: Osteomyelitis, *S. aureus:* Staphylococcus aureus, *MSSA:* Methicillin Sensitive Staphylococcus Aureus, *MRSA:* Methicillin Resistant Staphylococcus Aureus, *CRP:* C-reactive protein (CRP), *ESR:* Erythrocyte Sedimentation Rate, *WBC:* White Blood Cell, *MRI:* Magnetic Resonance Imaging, *HFSUH:* Hiwot Fana Specialized University Hospital.

References

[1] Schmitt SK. Osteomyelitis. Infect Dis Clin North Am. 2017 Jun; 31 (2): 325-338. [PubMed].

[2] Jorge LS, Chueire AG, Rossit AR (2010) Osteomyelitis: a current challenge. Braz J Infect Dis 14: 310-315. [Crossref].

[3] Walter G, Kemmerer M, Kappler C, Hoffmann R (2012) Treatment Algorithms for Chronic Osteomyelitis. Dtsch Arztebl Int 109: 257–64. [Crossref].

[4] Ikpeme IA, Ngim NE, Ikpeme AA (2010) Diagnosis and treatment of pyogenic bone infections. Afr Health Sci 10: 82-88. [Crossref].

[5] Jorge LS, Chueire AG, Fucuta PS, Machado MN, Oliveira MGL, et al. (2017) Predisposing factors for recurrence of chronic posttraumatic osteomyelitis: a retrospective observational cohort study from a tertiary referral center in Brazil. Patient Saf Surg 11: 17. [Crossref].

[6] Agaja SB, Ayorinde RO (2008) chronic osteomyelitis in Ilorin, Nigeria. S Afr J Surg 46: 116-118. [Crossref].

[7] Li Q, Cui H, Dong J, He Y, Zhou D, et al. (2015) Squamous cell carcinoma resulting from chronic osteomyelitis: a retrospective study of 8 cases. Int J Clin Exp Pathol 8: 10178–10184. [Crossref].

[8] Biruk WL, Wubshet K (2007) Chronic Osteomyelitis at Tikur Anbessa Hospital, Addis Ababa University, Ethiopia. East Cent Afr J Surg 12.

[9] Kremers HM, Nwojo ME, Ransom JE, Wood-Wentz CM, Melton LJ 3rd, et al. (2015) Trends in the epidemiology of osteomyelitis: a population-based study, 1969 to 2009. J Bone Joint Surg Am 97: 837-845. [Crossref].

[10] Onche II, Obiano SK (2004) Chronic osteomyelitis of long bones: reasons for delay in presentation. Niger J Med 13: 355-358. [Crossref].

[11] Afolabi BM. Sub-Sahara African neonates–ghosts to statistics. J Neonatal Biol. 2017; 6 (1): 2167–0897.1000246. doi: 10.4172/2167-0897.1000246 [CrossRef] [Google Scholar].

[12] Schwarz EM, Parvizi J, Gehrke T, et al. 2018 international consensus meeting on musculoskeletal infection: research priorities from the general assembly questions. J Orthop Res. 2019; 37 (5): 997–1006. doi: 10.1002/jor.24293 [PubMed] [CrossRef] [Google Scholar].

[13] C. Michael Gibson, M. S., M.D; Osteomyelitis epidemiology and demographics Editor-In-Chief: Associate Editor(s)-in-Chief: Nate Michalak, B. A., Seyedmahdi Pahlavani, M.D.

[14] Gigante A, Coppa V, Marinelli M, Giampaolini N, Falcioni D, Specchia N. Acute osteomyelitis and septic arthritis in children: a systematic review of systematic reviews. Eur Rev Med Pharmacol Sci. 2019 Apr; 23 (2 Suppl): 145-158.

[15] Kremers, H. M., Nwojo, M. E., Ransom, J. E., Wood-Wentz, C. M., Melton III, L. J. and Huddleston III, P. M., 2015. Trends in the epidemiology of osteomyelitis: a population-based study, 1969 to 2009. *The Journal of bone and joint surgery. American volume*, *97* (10), p. 837. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4642868/ (last accessed 5.10.19).

[16] Craigen MA, Watters J, Hackett JS. The changing epidemiology of osteomyelitis in children. J Bone Joint Surg 1992; 74B (4): 541-545.

[17] Akiyama T, Chikuda H, Yasunaga H, Horiguchi H, Fushimi K, Saita K. Incidence and risk factors for mortality of vertebral osteomyelitis: a retrospective analysis using the Japanese diagnosis procedure combination database. BMJ open. 2013 Jan 1; 3 (3): e002412. Available from: https://bmjopen.bmj.com/content/3/3/e002412 (last accessed 5.10.19).

[18] Tashi G. Khonglah, Bhaskar Borgohain, Wanlamkupar Khongwir, Kashif A. Ahmed, Extremity chronic osteomyelitis in a population of North East India: epidemiology, clinical characteristicsandmanagement, https://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20202680

[19] Jiang N, Ma YF, Jiang Y, Zhao XQ, Xie GP, Hu YJ, Qin CH, Yu B. Clinical Characteristics and Treatment of Extremity Chronic Osteomyelitis in Southern China: A Retrospective Analysis of 394 Consecutive Patients. Medicine (Baltimore). 2015 Oct; 94 (42): e1874. Doi: 10.1097/MD.0000000000001874. PMID: 26496345; PMCID: PMC4620766.

[20] W. L. Biruk and K. Wubshet. (2007). Chronic Osteomyelitis at Tikur Anbessa Hospital, Addis Ababa University, Ethiopia. East and Central African Journal of Surgery, Vol. 12, No. 1, pp. 33-41.

[21] J. Geurts, A. Hohnen, T. Vranken, P. Moh, Treatment strategies for chronic osteomyelitis in low- and middle-income countries: systematic review, First published: 30 June 2017 https://doi.org/10.1111/tmi.12921

[22] Tom Byamungu, Christian Ngarambe, Justin Bayisenga, Ahmed Kiswezi, Treatment of chronic osteomyelitis with locally made calcium sulfate bone cement pellets impregnated with antibiotics at University Teaching Hospital of Butare (CHUB), Rwanda Julien Gashegu.

[23] Van Vugt TAG, Heidotting J, Arts JJ, Ploegmakers JJW, Jutte PC, Geurts JAP. Mid-term clinical results of chronic cavitary long bone osteomyelitis treatment using S53P4 bioactive glass: a multi-center study. J Bone Jt Infect. 2021 Nov 12; 6 (9): 413-421. Doi: 10.5194/jbji-6-413-2021. PMID: 34804776; PMCID: PMC8600462.

[24] Marais LC, Ferreira N, Aldous C, Le Roux TL. The outcome of treatment of chronic osteomyelitis according to an integrated approach. Strategies Trauma Limb Reconstr. 2016 Aug; 11 (2): 135-42. Doi: 10.1007/s11751-016-0259-1. Epub 2016 Jul 1. PMID: 27369868; PMCID: PMC4960061.