INCIDENCE, PATTERN AND MANAGEMENT OUTCOME OF CHRONIC OSTEOMYELITIS AT JIMMA UNIVERSITY MEDICAL CENTER

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FEBRUARY, 2017

JIMMA ETHIOPIA

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ABSTRACT

BACKGROUND:-The end stage of delayed or poorly treated AHO is chronic osteomyelitis (COM). Here, a chronic infection of the involved bone is perpetuated by the presence of a sequestrum. The sequestrum is surrounded by the involucrum. Indolent, recurrent, chronic infection is associated with sinus formation, pain and prolonged disability. Under treatment or delayed treatment of AHO is associated with significant complications, the most significant being chronic osteomyelitis(17). However with early treatment only 3% of patients will have long-term sequel. Chronic osteomyelitis is difficult to eradicate completely.

OBJECTIVE:-This study was conducted to determine the incidence, causes and management outcome of chronic osteomyelitis in JUSH. It was stated the socio-demographic characteristics, the presenting sign and symptoms, method of diagnosis, treatment and outcome so as to come up with important recommendations and it can also be used as baseline for further studies.

METHODS:-A retrospective study done on all admit cases with a diagnosis of COM from 2014-2017, by using data from patients' charts. A cross-sectional study was conducted. There was no sampling technique that used. A structured check list was used to collect data. Data was analyzed by SPSS version 23.0 computer software. Data was analyzed and presented with tables, pie charts and bar graphs, association tables between variables was done and the significance of the association was tested by use of P-value and chi-square tests conclusion and recommendation was put in the final paper.

RESULT:-In retrospective analysis of the three years from September1, 2014 to August 30, 2017 in JUSH, 108 operated patients with a diagnosis of chronic osteomyelitis were studied. In this study 76.9% were males and 23.1% were females which shows males are more affected than females. Most groups fall in the age range of 11-20 years of age accounting for 51.99 %. And most patients came from rular area accounting for 86.1% and 13.9% were from urban area. The most affected groups were late adolescent and adult age, male sex was most predominant & most common cause of COM was non trauma related. The most common presenting symptom and signs are swelling and discharging sinus.

CONCLUSION AND RECOMMENDATION :- Awareness about COM symptom and signs for the public is recommended.

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List of abbreviations and acronyms

JUMC=jimma university medical center

COM =chronic osteomyelitis

PVD =peripheral vascular disease

Gp =General practitioner

AAU =Addis AbebaUniversity

AHO =Acute hematogenousosteomelytis

MRSA =methicillin-resistance s. aureus

MSSA=methocillin-susceptible s. aureus

IV =Intravenous

KCMC = Kilimanjaro Christian Medical Centre

OPAT =outpatient parenteral antimicrobial therapy

PRP =penicillinase-resistant penicillin

OR =odds ratios

RR = relative risk

CI= confidence intervals

SRP=student research project office

CHAPTER ONE INTRODUCTION

1.1 BACKGROUND

The incidence of osteomyelitis especially chronic osteomyelitis is still prevalent among children and young adult inmany parts of Africa as a result of the persistent prevalence of the predisposing factors such diabetes, vasculardiseases and sickle cell anaemia. The increasing rate of antibiotic resistance to many pathogenic bacteria in this partof the world further complicates this problem. Osteomyelitis is generally classified as acute or chronic based oneither histopathologic findings or duration of infection. It can also be categorized based on the presumed mechanism of infection (haematogenuous or direct inoculation into the bone from contagious soft tissue infection or infectedopen wounds) (1-3). The causative organism usually varies but *staphylococcus aureus s*till remains the commoncausative organism of osteomyelitis in both adult and children. Other organisms includes but not limited to*streptococcus pneumonia, Salmonella spp, Pseudomonas aureginosa*and to a lesser extent *E. coli* and*mycobacyterium(*4, 5) In younger patients the condition is more common because the metaphyseal regions of the bones are highly vascularand thus very susceptible to trauma. Children will often present with fever and irritability, local erythema, swellingand tenderness over the affected area within two weeks of the disease onset in the case of acute osteomyelitis (1-3).Chronic osteomyelitis is usually secondary to open wound and fractures, bacterimia or contagious soft tissuesinfections.

Physical examination should focus on the integrity of the skin and soft tissue, determine areas of tenderness, assess bone stability, and evaluate the neurovascular status of the limb. Laboratory studies generally are nonspecific and give no indication of the severity of the infection. Erythrocyte sedimentation rate and C-reactive protein are elevated in most patients, but the white blood cell count is elevated in only 35%.(28)

Anatomical criteria consist of four types. Type I, a medullary lesion, is characterized by endosteal disease. In type II, superficial osteomyelitis is limited to the surface of the bone, and infection is secondary to a coverage defect. Type III is a localized infection involving a stable,

well-demarcated lesion characterized by full-thickness cortical sequestration and cavitation (inthis type, complete débridement of the area would not lead to instability). Type IV is a diffuse osteomyelitic lesion that creates mechanical instability, either at presentation or after appropriate treatment.(28)

The diagnosis of chronic osteomyelitis is based on clinical, laboratory, and imaging studies. The "gold standard" is to obtain a biopsy specimen for histological and microbiological evaluation of the infected bone.(28)

In chronic osteomyelitis, secondary infections are common, and sinus track cultures usually do not correlate with cultures obtained at bone biopsy. Multiple organisms may grow from cultures taken from sinus tracks and from open biopsy specimens of surrounding soft tissue and bone.(28)

The "gold standard" in the diagnosis of osteomyelitis is a biopsy with culture and sensitivity. A biopsy is not only useful in establishing a diagnosis, but also is helpful in determining the proper antibiotic regimen. Typically, staphylococcal species are identified, especially in posttraumatic infections. Anaerobes and gram-negative bacilli are commonly isolated. In 2002, Holtom et al. described 10 patients with vancomycin-resistant enterococcal osteomyelitis. It is likely that these kinds of infections will be encountered more frequently in the future.(28)

The treatment of COM is multifaceted and complex. It involves: 1. the excision of all necrotic bone, 2. if necessary stabilization of the limb, 3.the application of appropriate, prolonged antibiotics, and 4.the obliteration of dead space through the closure and reconstruction of the soft tissue defect.(20)

1.2 Statement of the problem

Because of their relative rarity, as compared to other types of more typical infections, musculoskeletal infections can prove to be extremely difficult to diagnose and treat. Unrecognized infections can be limb threatening and even potentially fatal if not recognized and treated. The most important aspect of caring for patients with a musculoskeletal infection is to come to a timely diagnosis. When a timely diagnosis is made, most musculoskeletal infections can be effectively treated and the morbidity minimized. Open fractures are an extremely common occurrence in orthopedics, and specific attention is given to this topic. In general, appropriately treated open fractures can typically prevent the establishment of any type of chronic musculoskeletal infection or osteomyelitis**.**(29)

Chronic osteomyelitis is difficult to eradicate completely. Systemic symptoms may subside, but one or more foci in the bone may contain purulent material, infected granulation tissue, or a sequestrum. Intermittent acute exacerbations may occur for years and often respond to rest and antibiotics. The hallmark of chronic osteomyelitis is infected dead bone within a compromised soft-tissue envelope. The infected foci within the bone are surrounded by sclerotic, relatively avascular bone covered by a thickened periosteum and scarred muscle and subcutaneous tissue. This avascular envelope of scar tissue leaves systemic antibiotics essentially ineffective.(28)

The diagnosis of COM is usually fairly obvious with a prior history of recurrent infections, disability and deformity arising after an initial event. However, Museru has stressed the necessity of distinguishing COM from bony neoplasms and, in this regard, bone biopsy is again the gold standard.(18) All the standard imaging techniques have been used to assess the extent of COM and to plan treatment. Sinogram is a simple technique, which can give information on the extent of disease. Bacteriologic diagnosis is important and can only be made with culture of bone.(19)

Multiple imaging studies are available to evaluate chronic osteomyelitis; however, no technique can absolutely confirm or exclude the presence of osteomyelitis. Imaging studies should be done to aid in confirmation of the diagnosis and to prepare for surgical treatment.(28)

The treatment of COM is multifaceted and complex. Eradication of chronic osteomyelitis generally requires aggressive surgical excision combined with effective antibiotic treatment.(28)Exsicion is not the only management, so a team approach has been associated with improved results.(21) The role of reconstructive efforts to improve local blood supply is important.(22) Soft tissue coverage of the post excision defect is necessary to cover the bone and bring new blood supply to the region.(27)Ziran et al. reported a significantly higher success rate when a dedicated orthopaedic–reconstructive-infectious disease team, rather than the on-call infectious disease consultant, managed the antibiotic regimen.(28)

The other challenge of management of COM is instability after multiple debridment. When debridement results in instability of the limb temporary stabilization is achieved through immobilization in plaster, external fixation and even intramedullary nailing. Because the periosteum has been damaged, bony defects may have to be repaired through bone transfer (23) or the Ilizarov technique.(24-26)

The duration of postoperative antibiotics is controversial. Traditionally, a 6-week course of intravenous antibiotics is prescribed after surgical débridement of chronic osteomyelitis. Swiontkowski et al. reported a 91% success rate with only 1 week of intravenous postoperative antibiotics followed by a 6-week course of oral therapy. Fluoroquinolone antibiotics are known to have equivalent serum concentrations whether given orally or intravenously.(28)

Amputation is one of the management of COM but it is performed infrequently. In certain patients, this form of treatment may be preferable, however, to multiple operations that are unlikely to eradicate the infection. The prevalence of malignancy arising from chronic osteomyelitis has been reported to be 0.2% to 1.6% of cases. Most of these are squamous cell carcinoma arising from a sinus track, but reticulum cell carcinoma, fibrosarcoma, and other malignancies have been reported. Amputation is the most reliable means of treating cases of osteomyelitis associated with malignant

change. Arterial insufficiency, major nerve paralysis, or joint contractures and stiffness that make alimb nonfunctional are indications for amputation.(28)

CHAPTER TWO LITRATURE REVIEW

2.1 Literature Review

A Retrospective research done on Clinical Characteristics and Treatment of Extremity Chronic Osteomyelitis in Southern China; 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 42years for all. The most frequent type was traumatic osteomyelitis (262cases, 66.50%), which was mainly caused by open injury (166 cases,63.36%) and during a road accident (91 cases, 34.73%). Single-siteinfection 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, erythrocyte sedimentation rate,C-reactive protein, procalcitonin, interleukin-6, and tumor necrosis factor alpha 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%.In this representative Chinese cohort, extremity chronic osteomyelitis was mostly caused by open injury and during a road accident,predominated in males and favored the tibia. S. aureus was the most frequent pathogenic organism. Preoperative elevated levels of serum IL-6, TNF- a, and ESR may be helpful diagnostic indicators of the disease. Most patients achieved a favorable clinical efficacy after appropriate treatment.(15)

Retrospective research done at greater Tacoma, Washington area, ~1300 patients identified as having osteomyelitis were reviewed. A total of 454 patients was identified who met all inclusion criteria. The great majority (90.8%) of these patients had contiguous osteomyelitis associated with a soft tissue wound or recent surgery. A foreign body was present in 69 (15.2%) and removed in 24 patients during therapy.

Nearly half (45%) of the patients were hospitalized before OPAT. The others were started directly in the outpatient clinic.The mean duration of OPAT for the antibiotics used was not

significantly different (PRP, 34 days; ceftriaxone,30 days; cefazolin, 30 days; vancomycin, 34 days). Locations of infection included foot in 236 (52%), leg in 86 (19%), hand in 45 (10%) and spine in 27 (6%). Co morbid conditions included diabetes in 173 (38%) and vascular disease in 54 (12%). The relative risk of recurrence for diabetes without vascular disease was 4.9 (95% CI 2.5–9.5; $P \leq 0.001$) and for vascular disease without diabetes 1.9 (95% CI 1.2–3; $P = 0.011$). Of the 454 patients, 315 (69.4%) were apparently cured at the time outcomes were measured and 139 (30.6%)had had a recurrence. Of the recurrences, 22 were considered relapses and 23 re-infections. Whether the recurrence was a relapse or re-infection could not be determined in 94 patients for whom repeat culture results could not be obtained. There were 13 deaths (2.9%) and 27 amputations (5.9%) recorded. The 454 patients were followed for a mean of 27.5 months, with the longest follow-up being 128 months. The incidence of recurrence peaked at 3 months at >6%. In fact, about half (56%) of the recurrences occurred by this time. Relapses occurred earlier than re-infections. Amputations or bone excisions were carried out in 27cases. Of these procedures, 93% (25/27) were on the legs or feet, 88% (24/27) were carried out in patients who were diabetic and 33% (9/27) in those with peripheral vascular disease(PVD). Amputations that occurred were most common(66.6%) within 3 months of the completion of OPAT, with81.5% of amputations carried out within 6 months and 100% within 1 year.The risk of recurrence, as specifically related to the initially recovered pathogen, was also investigated. For the purposes of the analyses presented here, methicillin-susceptible*S. aureus*(MSSA) and methicillin-resistant *S. aureus*(MRSA) were combined, since MRSA cases were few innumber and all patients with MRSA infections were appropriately treated with vancomycin. Using a Cox regression model, the relative hazard of recurrence by bacterial pathogen was analysed after simultaneous adjustment for diabetes, PVD and age >70 years. When *P. aeruginosa* was the initially recovered pathogen, the risk of recurrences was more than twice that of *S. aureus* infections(RR 2.5; 95% CI 1.3–4.7; $P = 0.005$). Conversely,infections caused initially by non-group D streptococci had a somewhat lower risk of recurrence compared with those initially caused by *S. aureus*(RR 0.6; 95% CI 0.3–1.1; $P = 0.11$). In a univariate analysis, *P. aeruginosa* infections had an approximately three-fold greater risk of recurrence (OR 2.9; 95% CI 1.2–7.2; $P = 0.024$) when compared with the other types of infections studied. There was also a strong correlation between *P. aeruginosa* and amputations. With regard to this

risk, there of the 20 (15%) patients from whom *P. aeruginosa* was initially cultured eventually required amputation. When non-group D streptococci were the initial pathogens, four of 62 (6.5%) eventually required amputation. With *S. aureus*, the corresponding figures were 11 of 246 (4.5%) and with coagulase negative staphylococci, two of 63 (3.2%).Outcomes for osteomyelitis caused by *S. aureus*, which was the most common pathogen isolated initially, were also compared according to the antibiotic used. Oxacillin (46cases), methicillin (nine cases) and nafcillin(one case) were considered equivalent and together formed the standard for therapy,28 with a recurrence rate of 28.6%. Ceftriaxone had a recurrence rate of 27.3%. Recurrence appeared to be more likely for subjects treated with cefazolin (34.8%), vancomycin (53%) and 'other' antibiotics (35.3%). Indeed, when compared with infections treated by PRPs (OR 1.0) or ceftriaxone (OR 0.94), vancomycin-treated infections were nearly three times more likely to recur (OR 2.8; 95% CI 0.99–7.2;*P*= 0.058). The difference between cefazolin and PRPs did not reach statistical significance (OR 1.3; 95% CI 0.58–3.1;*P* = 0.53).In a Cox regression model, also restricted to patients in whom *S. aureus* was the initial pathogen, the primary antibiotic used to treat the infection was again shown to affect the risk of recurrence, even after simultaneous adjustment for diabetes, PVD and age >70 years. In this model,patients initially treated with cefazolin or ceftriaxone were at comparable risk of recurrence when compared with patients treated with a PRP. However, patients treated with vancomycin had a risk of recurrence more than two times higher than patients treated with a PRP (RR 2.5; 95% CI 1.1–5.7;*P* = 0.03).(13)

Bacteriological profile of chronic osteomyelitis in a tertiary care hospital in South India were analyze,In all, 184 patients with chronic osteomyelitis were documented during the study period. There was a male preponderance (163 / 184, 88.5%) with majority, in the age group of 10-20years.

Trauma was the major risk factor for osteomyelitis (95/ 184,51.6%). The lower limb bones were more commonly affected of which femur (166/184, 90.2%) was the predominant bone involved.Culture was positive in 104/184 (56.6%), with the Gram positive organisms most predominant. MRSA was the predominant organism isolated in 28/104 (27%) cases. Among Gram negative bacilli, Escherichia coli was most common organism isolated in 11/104 (10.4%).

Other organisms isolated included Pseudomonas aeruginosa, Klebsiella pneumonia, Acinetobacterbaumanii, Proteus mirabilis, Enterobacter cloacae, Morganellamorgagnii and showeda high level of antibiotic resistance. In this study no anaerobic organisms were isolated. One patient had a mixed infection with Mycobacterium tuberculosis and A.baumannii. Majority of the patients (85/184, 46%) were managed conservatively with wound care and antibiotics. No mortality was recorded.(10)

Research done on Surgical interventions in chronic osteomyelitis at kathmandu university, Nepal showed:-Ninety children (60 boys, 30 girls) were included inthis study. Mean age at first surgical intervention was 2 years (range: 1 year – 16 years). 83% (75) of the patients with chronic osteomyelitis came from the rural community, while 17% (15) came from urban or semi-urban area. Regarding the site of infection,femur was the commonest site involved (50%)followed by tibia (45%). Other bones involved were radius, humerus, and scapula, in the upper extremity and fibula and tarsal bones in the lower extremity.A total of 112 surgical procedures were carried out in 90 patients. There were 8 modalities of surgical intervention as shown. The commonest intervention was Sequestrectomy (59.8%) followed by Ilizarov external fixator application (13.4%) and saucerization (10.7%).Decompression procedures (Sequestrectomy and saucerization) were necessary for most of the cases. In 28 patients (31%) some other procedure, (combined with a decompression procedure or without it) was necessary to achieve union or leg length symmetry or both. In 62 cases,decompression procedure (79 procedures) was theonly surgical intervention necessary.(9)

A prospective study was performed on 28 consecutive patients with long-bone chronic osteomyelitis treated at a tertiary-level tumor, sepsis, and reconstruction units in South Africa. Twenty six of the 28 enrolled patients were available for follow-up at a minimum of 12 months. The median patient age was36.5 years (range 18–72 years). Fourteen patients (54%) were managed palliative care, and 11 patients (42 %) were managed through the implementation of a curative treatment strategy. One patient required alternative treatment in the form of an amputation. The overall success rate was 96.2 % (95 % CI 80.4–99.9 %) at a minimum of12-months follow-up. Remission was achieved in all [11/11] patients treated

curatively (one-sided 95 % CI73.5–100.0 %). Palliative treatment was successful in92.9 % [13/14] of cases (95 % CI 66.1–99.9 %). In patients with lower limb involvement, there was a statistically significant improvement of 28.3 (95 % CI21.0–35.7; SD 17.0) in the AAOS Lower Limb Outcomes Instrument score (p value\ 0.001).(14)

A research done in Nigeria, Fifty-three patients with chronic pyogenic osteomyelitis of 57 long bones with com were studied. This consisted of 30 males (56.6%) and 27 females (43.4%) giving a male-to-female ratio of 1.1:1.The age range was 3 – 60 years (mean 20.34±13.48). Poorly-treated or neglected acute haematogenous osteomyelitis was the predominamt cause of chronic osteomyelitis (n=40, 70.2%). The involved bones include tibia (n=29, 50.9%), femur (n=11, 19.3%), humerus (n=9, 15.8%). Staphylococcus aureus was the most common offending organism isolated (n=13, 52%). Sequestrectomy and curettage (n=51, 96.2%) was the main surgical procedure carried out.(8)

A study done at Ghanaian Specialist Hospital, a total of 43 cases of oesteomyelitis was recorded over the period under review of which, 28 (65.1%) were males and 15 (44.9%) were females with a male to female ratio of 1.9:1. Out of the total, 8 (18.6%) patients had infected implants following open reduction and internal fixation (ORIF) and 1(2.3%) was due to septic gunshot wounds with fractures. Removal of the septic implants and pellets were done in addition to total sequestrectomy, curettage, wound and tract debridement and lavage. All patients recovered fully without further complications. The mean age of the patients was 24.88 ± 16.97 years. The highest incidence of chronic osteomyelitis (37.2%, n=16) was recorded in the age group of 11-20 years. Over 70% of the patients were ≤ 40 years of age (72.1%, n=31). Only one patient reported with multiple bone infection, involving the tibia and fibula. The bone types that were affected by the disease are tibia (65.1%) and femur (18.6%) the most frequently affected bones. The most frequently isolated organisms were *Staphylococcus aureus* (48.8%, n=21) and *Pseudomonas aureginosa*(25.6%, n=1).(16)

Study done in Tanzania, 63 patients were identified of whom notes were available for 55 (40 males, 15 females, mean age of 11 years; range 6 months to 18 years). Of the 55 patients, 24

patients (44%) were direct admissions to KCMC and 31 patients (56%) had previously been admitted to a district general hospital with osteomyelitis and referred to KCMC for further management. Six patients had a history of trauma coinciding with symptom onset (1 open fracture and 5 closed fractures).The most common bones affected were the tibia (22 patients, 40%) and femur (13 patients, 24%), with other sites including the skull, foot, humerus, hand, ulna and vertebrae. At the time of presentation to KCMC, 8 cases (15%) were categorized as acute, 5 cases (9%) as acute with X-ray changes, 40 cases (73%) as chronic localized and 2 cases (4%) as chronic systemic [Figure 2]. The median time from symptom onset to presentation for all patients was 7 months (range: 0-72 months), for patients admitted directly to KCMC was 11 months, and for patients referred from a district hospital was 6 months. The median duration of stay at KCMC was 6 days (range: 0-48 days). A total of 11 patients (20%) were treated with antibiotics only, 11 patients (20%) with incision and drainage and 30 patients (55%) with surgical debridement (sequestrectomy or saucerisation). One patient required a below knee amputation, one was transferred to another hospital and one was admitted for removal of a tibial pin. Seven patients had previously been admitted to KCMC for the treatment of osteomyelitis prior to the study period, 5 for incision and drainage and 2 for sequestrectomy.The antibiotic therapy (intravenous) used included cloxacillin alone (8 patients, 15%), cloxacillin and gentamicin (30 patients, 55%), another single or combination of antibiotics (16 patients, 29%) and in a single case no antibiotics were used. Bacterial cultures (taken from pus ± bone fragments at the time of operation) were available in 11 cases: Staphylococcus aureus 7, coliforms 1, proteus 1 and no growth 2. All S. aureus tested were gentamicin-sensitive, but at least one patient had S. aureus resistant to cloxacillin, erythromycin, co-trimoxazole, tetracycline or a combination of these. 29 (53%) out of 55 patients attended for follow-up at KCMC. Of the 29 patients, 20 patients made a full clinical recovery and 9 patients developed recurrence of infection. Three patients died while in hospital (two from meningitis and one from severe hydrocephalus). The median duration of follow-up for those attending was 5 months, and no patients subsequently required reconstructive surgery. Eight out of nine patients presenting with recurrence of infection had a duration from symptom onset to presentation at KCMC of >3 months. Twelve out of 13 patients with duration from symptom onset to presentation of <2 months did not present again with recurrence of infection.(11)

Prospective study was done at AAU, Ethiopia. A total of 442 consecutive patients with chronic osteomyelitis (COM) were included**.**There were 336 males, accounting for 76%. The mean age at the initial presentation was18 years The youngest patient was aged one month and the oldest was 84 years.. The majority (68%)of patients came from rural areas. Discharging sinus was the commonest clinical presentation observed in 93%. Squamous cell carcinoma was present in four patients. The disease followed trauma in 27%. Tuberculosis osteotitis was proven in three of the suspected patients. Compound fracture accounted for 93 (79%) of the post traumatic onset. More than half (52%) of the patients had visited bone setters in the course of their illness. The commonest anatomical type noticed using CiernyMader's classification was type III (273, 63%) followed by type IV (82, 19%). Lower limb bones were the commonest affected. Nine of the patients had multiple bones affected and three of these patients agreed to HIV screening were all 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. Sequestrectomy had been done only in 73 (16.5%) of the patients.(12)

2.2 The significance of the Study

Chronic osteomyelitis is one of the common problems in orthopedic ward that cause major disability& limb loss if acute osteomyelitis is not managed early and appropriately. In our nation Ethiopia, where early diagnosis and intervention is not equally performed at all setups due to lack of human resources, diagnostic facilities, inadequate transportation facilities, low awareness of community to seek health care early, which might contribute to difficulty of managements and increased risk of postoperative complications and poor out comes; it is important to know the magnitudes, common causes and outcome of COM. This will help to develop practice on how to approach patients presenting with COM and prevention of complications.

This study will have advantage by providing baseline information about the incidence and causes of COM and its management outcome in our country for minimizing morbidity and mortality of patients by early prediction and detection acute osteomyelitis for early initiation of antibiotic and definitive management on time before complications occurs because operating patients after complication occur has poor prognosis. It will also have significant advantage for health professionals and other concerned body in that it will add useful information about COM.

The result of this study will also add epidemiological and clinical information that will serve as an essential input for policy makers to design proper strategies and also helps as references for those who want to undertake further researches on COM since there was no adequate study conducted in our country which deals about it.

CHAPTER THREE OBJECTIVES OF THE STUDY

3.1 General objective

- To determine the incidence, causes and management outcome of chronic osteomyelitis

3.2 Specific objectives

- ✓ To determine the incidence of chronic osteomyelitis
- ✓ To identify common causes of chronic osteomyelitis
- ✓ To assess type and the number of procedure done for chronic osteomyelitis
- ✓ To assess the socio-demographic characteristic of chronic osteomyelitis
- ✓ To assess the common bacteria
- ✓ To assess the bacterial sensitivity to commonly available drugs in the setup
- ✓ To assess management outcome of chronic osteomyelitis
- ✓ To identify the common post operation complications and outcome.

CHAPTER FOUR METHODS & MATERIALS

4.1. Study area and period

This study was conducted inJUMC from September, 2014 to August 30, 2017.The data collection period was taken place for one month.

4.2. Study design

A retrospective descriptive study design was employed.

4.3. *Population*

4.3.1. Source population

- The source populations were all patients admitted to orthopedic ward

4.3.2. Study population

- All Patientsadmitted withdiagnosis of chronic osteomyelitis from September, 2014 to August , 2017.

4.4. Inclusion and Exclusion criteria

Inclusion criteria

- patients who were clinically diagnosed as COM
- Operated cases of patients for COM
- Patients who died by confirmed diagnosis of COM

Exclusion Criteria

- Incompletely documented charts with important information
- Patients whose charts were lost

4.5. Sample size determination

All patients admitted to Orthopedic ward of with the diagnosis of chronic osteomyelitis and treated from September 1,2014 to Augest 30, 2017 was included without sampling.

4.6. Measurements and study variables

4.6.1. Data Collection instrument

The check list were developed by English language for collection of important information such as age, sex, admission diagnosis, intraoperative finding, intraoperative procedure done, duration of presentation,causesof COM, postoperative complications and management outcome of patients.

4.6.2 Study variables

4.6.2.1 Dependent variables:

- Chronic osteomyelitis
- Management outcome(post-operative complication, Final outcome after hospital stay)

4.6.2.2 Independent variables:

- Age, Sex,Residence,
- Duration of illness
- Pre operative antibiotic use
- Causes of COM
- Complication before operation
- Methods of patient management
- Operative Procedure done
- Postoperative antibiotics
- Duration of hospital stay

4.7. Data collection methods

4.7.1 Data collectors and supervisor: For data collection two general practitioner wererecruited. The Principal investigator gave training for data collectors on how to fill the prepared checklist, the importance of

data quality and the relevance of the study. Two surgical residentwere supervise the daily activity, consistency and completeness of the checklist and gave appropriate support during the data collection process. The Principal Investigator checked the daily activities of data collectors and supervisor.

4.7.2Data collection techniques: Patients that were admitted to orthopedic wardwith the diagnosis of COM and treated were initially identified from admission log book and operation log book from which card number of patients were obtained. Then cards of the patients was identified, collected from record keeping roomand used to collect important information about patients admitted with the diagnosis of COM.

4.8. Data processing, analysis, interpretation and presentation

After data collection, it was coded, entered and cleaned using computer software SPSS windows version 20 to be analyzed by using descriptive statistics like Percentages, mean and standard for elementary data analysis. Data was presented by frequency tables and figures. Association between dependent and independent variables was checked by using binary and multivariate logistic regression. On binary logistic regression a p-value ≤ 0.25 was used as a candidate for multivariate logistic regression analysis. Statistical significant association was tested at a p-valueof < 0.05.

4.9 Data quality management

- Before data collection: The prepared checklists in English was assessed and commented by research advisors. The facilitators and Supervisor was trained for two days.

- During data collection:In order to avoid the interpersonal variation between data collectors, data was collected by the same data collectors throughout the data collection..Regular daily supervision was done for checking the consistency and completeness of the filled out checklists by the principal investigator.The completed checklistswas checked for their completeness and consistency at every step of data collection.
- After data collection: Before starting data analysis completeness was rechecked again.

4.10 Ethical consideration

Ethical approval of the research proposal was obtained from the ethical review committee of Jimma University. A formal letter was written from surgical department. The Hospital medical director was permitted us to conduct the study. The data was collected by review of the registration books using structured checklists. The filled checklists was destroyed, some years after the study has finished. Until that it kept carefully in the hand of principal investigator.

4.11 Dissemination of results

After finishing this research it wasdisseminated toJimma University SRP office then college of public health & medical science and also to department of surgery. It was also be disseminated to the Jimma University specialized hospital and might also be published on peer reviewed journals.

4.12 Limitation of the Study

Budget constraints and other limitations of the secondary data since the data was collected from patients chart and registration books. There were laboratory biofilms inadequacy to stratify the specific bacterial species.

4.13 Operational definitions

Sequestreum- a necrotic piece of bone devascularized by the pathologic process of COM

Sequestrectomy- excision of dead bone

Involucrum-new bone formed by the periosteum

Favoral outcome- outcome without any complication like contracture, amputation, limb instability, other complication

Unfavorable outcome – outcome with above complication including death.

CHAPTER FIVE RESULTS

Socio Demographic characteristics

During the study period from 108 COM cases 83(76.9%) were males and 25(23.1%) were females. Most groups fall in the age range of 11-20 years of age accounting for 51.99 %(Table 1). And most patients came from rular area accounting for 86.1% and 13.9% were from urban area.

Table 1. Socio demography of patients with COM at JUSH from September, 2014 to August 30, 2017

Variables		Frequency	Percentage
Sex	Male	83	76.9
	Female	25	23.1
Age	1-10	30	27.8
	11-20	56	51.9
	21-30	9	8.3
	31-40	0	0
	41-50	2	2
	51-60	7	7
	61-70	4	4
Residence	Rular	93	86.1
	Urban	15	13.9

Condition of a patient

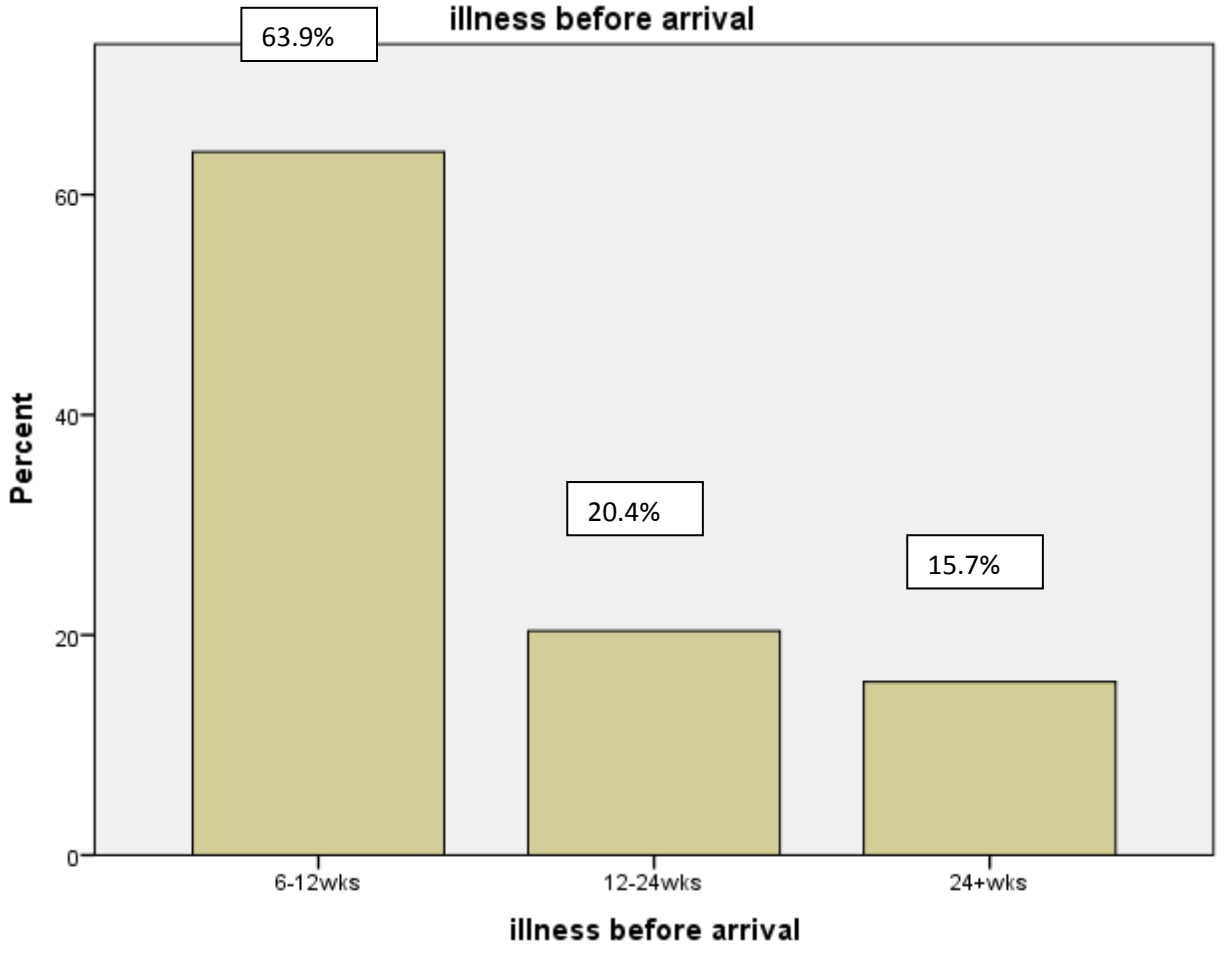
Most patients in the study period came after 6-12wks of illness accounting for 69(63.9%), the rest came after 12-24 wks of illness & 17(15.7%) of them came after 24wks of illness (figure 1). From the study population 7 of them had previous surgery for the same complaint out of them 5(4.6%) were operated in the last 6month before their presentation. There were 6(5.6 %) patients who developed preoperative complications like anemia 3(2.8%), fracture 2(1.9%) & other 1(0.9%).

The major patient presenting complaint was swelling 83(76.9%), followed by discharging sinus 20(18.5%). Around 103 patients had single bone involvement, only 5(4.6%) of the patients presented with multiple bone involvement. Tibia 38(35.2%) was the most frequently encountered bone followed by femur 36(33.2%)&humerus 9(8.3%) (table 2). There were 31(28.7%) patients who took antibiotic before arrival and cloxacillin 18(16.7%) and chloramphenicol 9(8.3%) were the commonest antibiotics used. Around 18(16.7%) of patients took for a period of 1wk, 12(11.1%) took for a period of 2wk and only 1 patient took for 4 wks period.

Table 2 Frequency of involved bone of patients with COM at JUSH from September 2014-August 2017

Bone	Frequency	Percentage
Femur	36	33.3
Tibia	38	35.2
Fibula	5	4.6
Humerus	9	8.3
Radius	7	6.5
Ulna	5	4.6
Others	8	7.4
Total	108	100

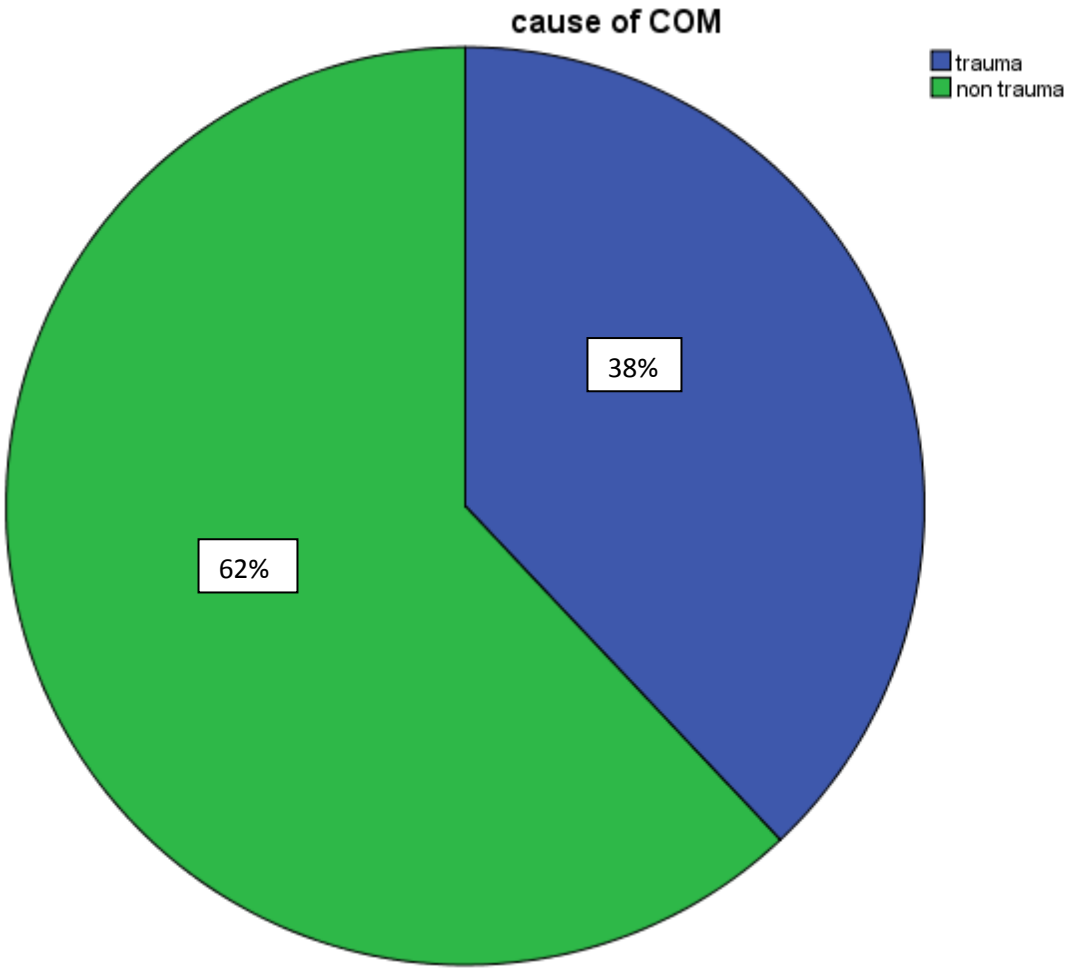
Figure 1 duration of illness before arrival of patients with COM at JUSH from September 2014-August 2017



Causes of chronic osteomyelitis

From the study period the most common causes of chronic osteomyelitis was non- trauma related causes 67(62%) and trauma related causes of chronic osteomyelits accounts for 41(38%)(figure 2).

Figure 2causes of COM of patients at JUSH from September 2014-August 2017

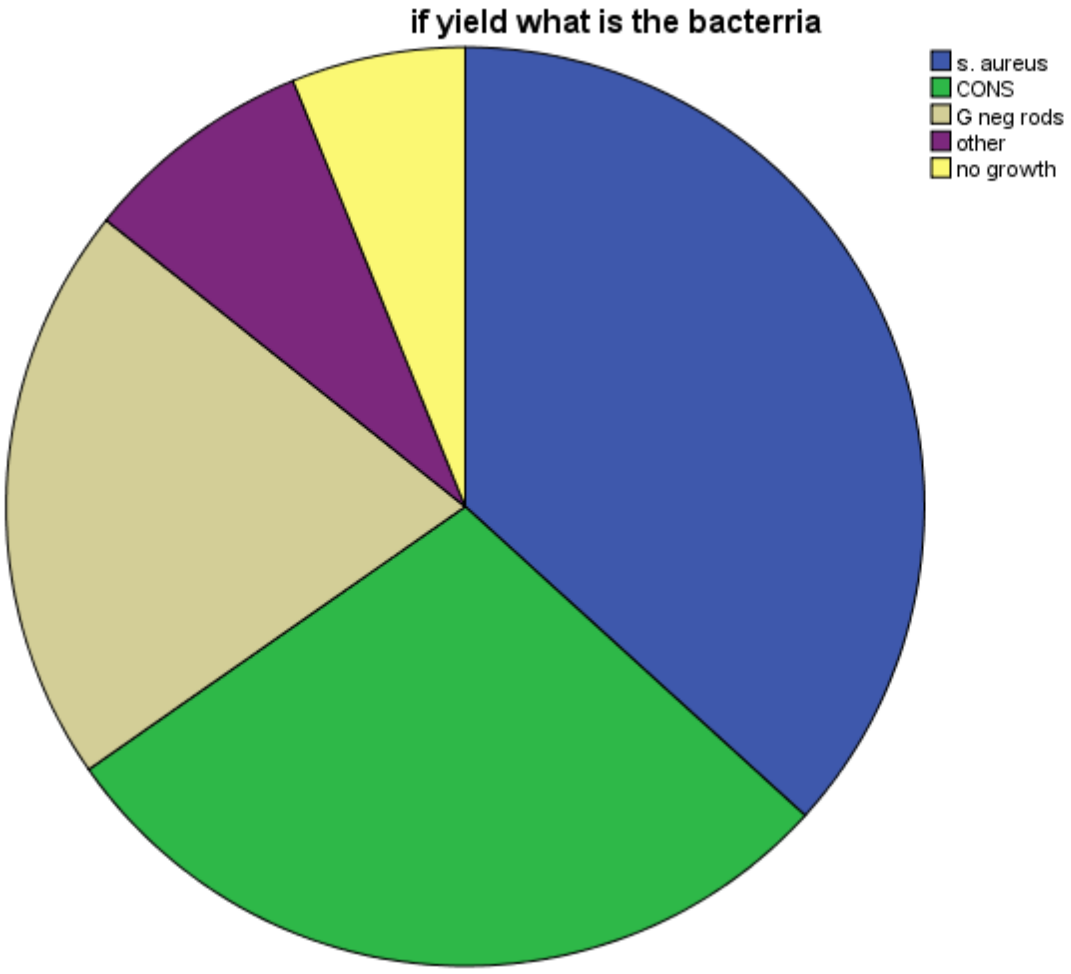


Patients who have comobidities like diabetes and peripheral vascular disease are prone to develop lower extremity cronic osteomyelitis. From the study population 9(8.3%) of patients had associated comorbidities and PVD accounts for 4(3.7%) of the comorbidities.

Identifying causative bacteria is important in the management of COM. In order to do so culture and sensitivity is the best diagnostic tool. In the study population culture and sensitivity done for 49(45.4%)

of the patients and about 46(42.6%) of the culture had bacterial yield. From the bacteria's staphylococcus holds the largest proportion around 18(16.7%) and the second bacteria was coagulase negative staphylococcus holding 14(13%), gram negative rods accounting for 10(9.3%) holds the third position there were 2 hemophilus influenzae, 1 streptococcus pyogenes and 1 pseudomonas aeruginosa summed up to hold 3.7% of the specific bacteria. From the culture which was done 2.8% had no growth on the 48 hrs stay in the laboratory.

Figure 3 Bacterial species as cause of COM of patients at JUSH from September 2014-August 2017



About 23(21.3%) of the bacterial yield are sensitive for the third generation cephalosporin ceftriaxone followed by ciprofloxacillin 9(8.3%) which is a locally available fluroquinolol (table 3).

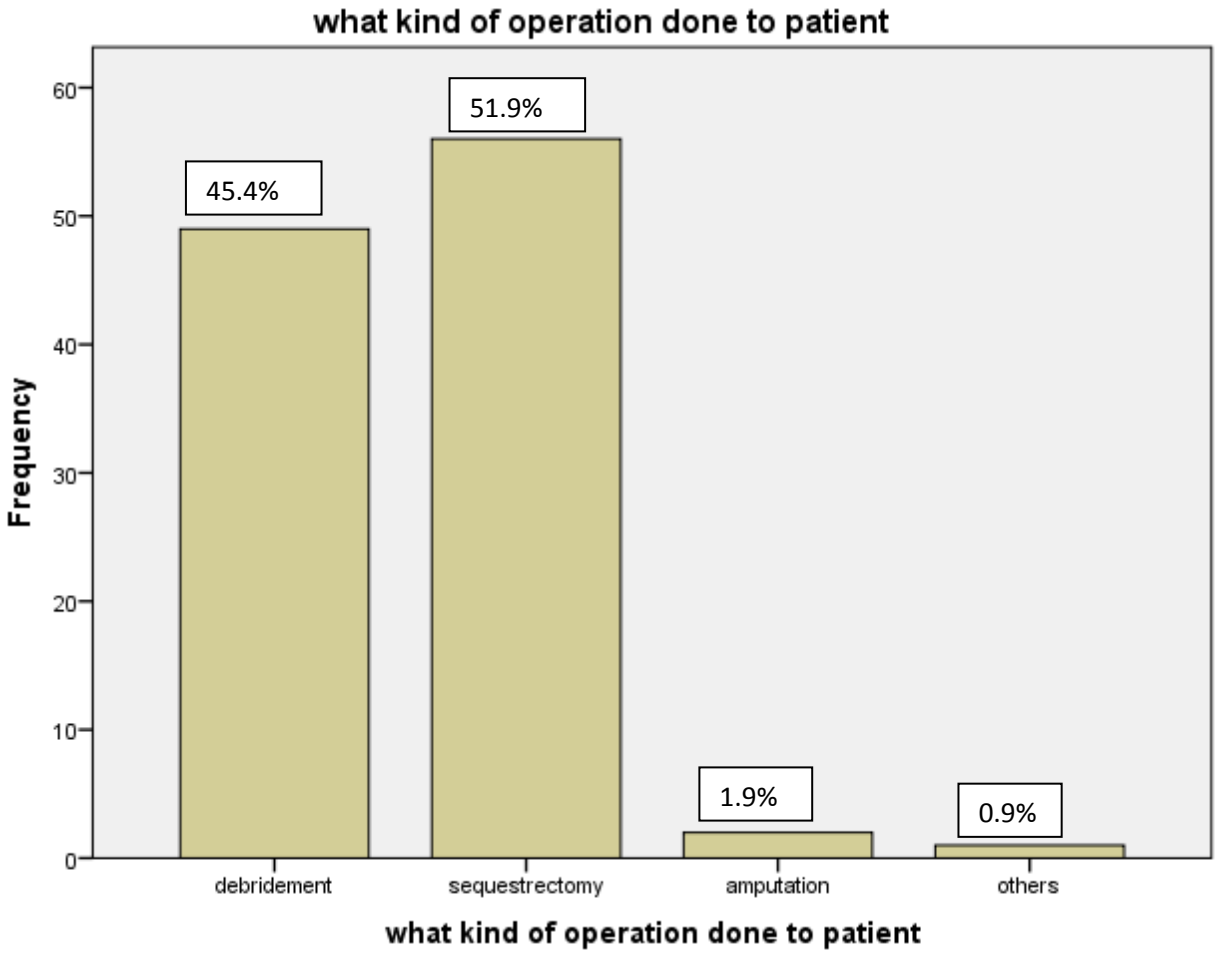
Table 3 Frequency of sensitive locally available drugs for patients with COM at JUSH from September 2014-August 2017

Drug	Frequency	Percentage
Ceftriaxone	23	21.3
Ciprofloxacillin	9	8.3
Chloramphenicol	1	0.9
Gentamycin	3	2.8
Erythromycin	4	3.7
Others	6	5.6
Total	46	42.6

Management of COM

The major operative procedure done in the study period was sequestrectomy which accounts for 56(51.9%) followed by debridement and irrigation holding 49(45.4%) of the procedures and amputation holding 1.9% of the procedure(figure 3). There are patients who undergo additional procedure 20(18.5%) inorder to cover the bone and soft tissue like muscle flap 8(7.4%) and others 12(11.1%) like skin graft.

Figure 4 Operative procedure done for patientswith COM at JUSH from September 2014-August 2017



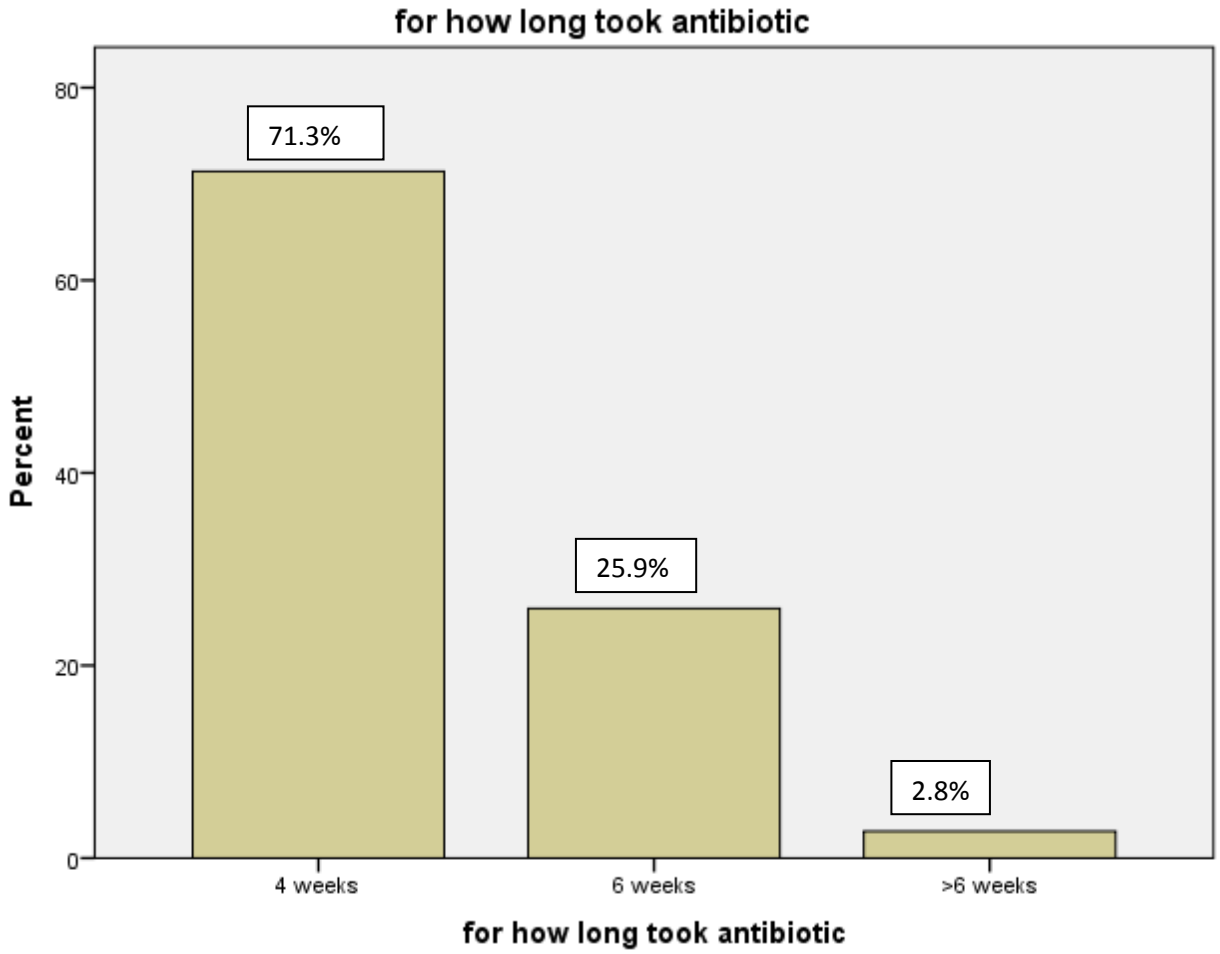
According to the culture and sensitivity patients were put on intravenous and then peroral antibiotics. In the study period chloramphenicol and cloxacillin were frequently used postoperative antibiotics with 49(45.4%) and 15(13.9%) respectively (table 4).

Table 4 Frequency of postoperative antibiotics used for patients with COM at JUSH from September 2014-August 2017

Postoperative antibiotic	Frequency	Percentage
Chloramphenicole	49	45.4
Cloxacillin	15	13.9
Ciprofloxacillin	12	11.1
Cephalexin	12	11.1
Augmentin	9	8.3
Ampicillin	5	4.6
Other	6	5.6
Total	108	100

In this study most patients took antibiotic only for 4 weeks 77(71.3%) and only 3(2.8%) of patients took for greater than 6 weeks (figure 5).

Figure 5 Postoperative antibiotic uses for patientswith COM at JUSH from Setember 2014-August 2017



Post-operative complication and outcome

From 108 patients 9(8.3%%) of them developed post-operative complications and the commonest of the complication was wound infection which accounted for 4.6% followed by anemia that accounted for 3.7%(Table 5)

Table 5. Frequency of post op complication in operated patients with COM at JUSH from January 1, 2012 to January 1, 2013

Post op complication	No. (%)
Wound infection	5(4.6)
Anemia	4(3.7)
Total	9(8.3)

During the study period all patients were discharged improved with the longest hospital stay 102 days and the shortest was 7 days with a mean of 32.3 days.

CHAPTER SIX DISCUSSION

In retrospective analysis of three year from September1, 2014 to August 30, 2017 in JUSH, 108 operated patients with a diagnosis of chronic osteomyelitis were studied. In this study 76.9% were males and 23.1% were females which shows males are more affected than females. Most groups fall in the age range of 11-20 years of age accounting for 51.99 %. And most patients came from rular area accounting for 86.1% and 13.9% were from urban area. This finding is similar with statistics from other studies.Bacteriological profile of chronic osteomyelitis in a tertiary care hospital in South India were analyze,In all, 184 patients with chronic osteomyelitis were documented during the study period. There was a male preponderance (163 / 184, 88.5%) with majority, in the age group of 10-20years. And research done on Surgical interventions in chronic osteomyelitis at kathmandu university showed:- Ninety children (60 boys, 30 girls) were included inthis study. Mean age at first surgical intervention was 2 years (range: 1 year – 16 years). 83% (75) of the patients with chronic osteomyelitis came from the rural community, while 17% (15) came from urban orsemi-urban area.

Most patients in the study period came after 6-12wks of illness accounting for 63.9%, 20.4 % of them came after 12-24 wks of illness & 15.7% of them came after 24wks of illness, compared with other study, study done at Tanzania the median time from symptom onset to presentation for all patients was 7 months (range: 0-72 months), for patients admitted directly to KCMC was 11 months, and for patients referred from a district hospital was 6 months, our patients came early. The major patient presenting complaint was swelling 76.9%, followed by discharging sinus 18.5% which is different from AAU study mentioning discharging sinus was the commonest clinical presentation observed in 93%.

A study done at Ghanaian Specialist Hospital the bone types that were affected by the disease are tibia (65.1%) and femur (18.6%) are the most frequently affected bones which has similar result with this study stating that tibia 35.2% was the most frequently encountered bone followed by femur 33.2% &humerus 8.3% and also with the study done at Tanzania KCMC hospital the most common bones affected were the tibia (22 patients, 40%) and femur (13 patients, 24%), with other sites including the skull, foot, humerus, hand, ulna and vertebrae has similar result.

In this study period the most common causes of chronic osteomyelitis was non- trauma related causes 62% and trauma related causes of chronic osteomyelits accounts for 38% which contradict from other studies in the study at South India trauma was the major risk factor for osteomyelitis (95/ 184,51.6%) and also in the Chinese cohort study, extremity chronic osteomyelitis was mostly caused by open injury and during a road traffic accident.

Retrospective research done at greater Tacoma, Washington area, from ~1300 patients identified as having osteomyelitis %) co morbid conditions included diabetes in 173 (38%) and vascular disease in

54 (12%). The relative risk of recurrence for diabetes without vascular disease was 4.9 (95% CI 2.5–9.5; $P \leq 0.001$) and for vascular disease without diabetes 1.9 (95% CI 1.2–3; $P = 0.011$) and on this study population 9(8.3%) of patients had associated comorbidities and PVD accounts for 4(3.7%) of the comorbidities.

Major operative procedure done in this study period was sequestrectomy which accounts for 56(51.9%) followed by debridement and irrigation holding 49(45.4%) of the procedures (figure 3). There are patients who undergo additional procedure 20(18.5%) inorder to cover the bone and soft tissue like muscle flap 8(7.4%) and others 12(11.1%) like skin graft. Comparing with other studies a research done at Nepal total of 112 surgical procedures were carried out in 90 patients the commonest intervention was Sequestrectomy (59.8%) followed by Ilizarov external fixator application (13.4%) and saucerization (10.7%) and in study at Nigerian speciality hospital sequestrectomy and curettage (n=51, 96.2%) was the main surgical procedure carried out which is showing similarity.

According to the culture and sensitivity patients were put on intravenous and then peroral antibiotics. In this study chloramphenicol and cloxacillin were frequently used postoperative antibiotics with 49(45.4%) and 15(13.9%) respectively comparing with other studies the antibiotic therapy (intravenous) used in the Tanznians study include cloxacillin alone (8 patients, 15%), cloxacillin and gentamicin (30 patients, 55%), another single or combination of antibiotics (16 patients, 29%) and in a single case no antibiotics were used and in the Chinese cohort study the most frequently used intravenous antibiotic was cephalosporins.

CHAPTER SEVEN CONCLUSION AND RECOMMENDATION

Conclusion

In the pattern and management outcome of COM the most affected groups were late adolescent and adult age, male sex was most predominant. Most of patients presented within 6-12 weeks of beginning of symptoms. The predominant presenting symptoms are extremity swelling and discharging sinus tract. The leading cause of COM were nontrauma like hematogenous infection followed by poorly managed extremity trauma. The commonest causative organism identified from the culture and sensitivity was staphylococcus aureus and sensitive for third generation cephalosporins, ceftriaxone. The major operative procedures done were sequestrectomy and debridement. The commonest postoperative complication is wound infection and all patients have good outcome.

Recommendation

- Health centers and primary hospitals should manage soft tissue infections adequately and early referral if suspicious of bone involvement.
- Health professionals should have to give awareness about chronic osteomyelitis symptom and signs and increase public awareness about the illness.
- To JUSH health professionals to improve recording everything done for the patients starting from time of presentation to discharge.

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ANNEX 1: CHECKLISTS

Checklistsfor data collection on the retrospective cross sectional study of incidents, causes and management outcome of chronic osteomyelitis among orthopedic patients at JUMC.

CardNo. _____ ***Code:*** _____

PART I: Socio-demographic characteristics

No.	Questions	Categories
NO	QUESTIONS	
1	Age	1-10 11-20 21-30 31-40 41-50 51-60 61-70 >70Years
2	Sex	1.Male 2.Female
3	Residence	1.Rural 2.Urban 3.Not mentioned
4	Distance from hospital in Km	1.<5 2. 5-10 3. 10-15 4.>15

PART II: General Condition of the patient

No.	Questions	Categories
1	Duration of illness in weeks before arrival	1. 6- 12 wks 2. 12-24wks 3. 24+
2	Did the patient come with referral	1. Yes 2. No
3	Did the patent have previous history of operation for chronic osteomyelitis?	1.Yes 2 No
4	If question above is yes, A) how many times?	
	B) when was the last operation	1. < 6wks 2. 6wk – 6 month 3. > a year
5	Did the patient developed complication before operation?	1. Yes 2. No
	If the above question is yes, what was thecomplication?	1. Anemia 2. Contracture 3. Malignancy 4. Bone fracture 5. other
6.	Clinical condition History	
	Physical examination	
7.	Which bone is involved single/ multiple Which specific bone…..	
8.	Was the patient took antibiotic before	Yes/no

arrival	
If yes For how long and types of drug/s	

Part III: causes of COM and management

No	Question	Category
1	Causes of COM	1. trauma 2. non trauma
2	Is the patient has co-morbid	1. DM 2. PVD 3. other
2	Is culture and sensentity done	Yes/no/unknown
	If yes, how was the yield?	Have yield/ no yield
	If there is yield	What is the bacteria
	how is the sensitivity for locally available drugs	
4	What kind of operation done to the patient? How many types Is it on the same admission	1. Debridement 2. Sequestrectomy 3. Amputation 4. Other
5	Was patient has additional producer	1. Muscle flap 2. Antibiotics beeds 3. Other

6	Is the patient took antibiotics	Yes/no
	If yes, what kind of antibiotics	
	For how long	

Part IV:Outcome of the patient

No	Question	Category
1	Post op complication developed?	1.Yes 2.No
2	If question above is yes, what postoperative complication was developed?	1.Wound infection 2.aniemia 3.hospital acquired pneumonia 4.Others(specify)_____
3	Duration of patient stay in hospital in days	
4	Outcome of the patient	1.Improved and discharged (favorable outcome) 2.Died (unfavorable outcome)

ASSURANCE OF PRINCIPAL INVESTIGATOR

The undersigned agrees to accept responsibility for the scientific ethical and technical conduct of the research project and provision of required progress reports as per terms and conditions of the college of Public Health & Medical Sciences in effect at the time of grant is forwarded as the result of this application.

Name of the student: DrLidyaGemechu

Date:_____ Signature:_____

APPROVAL OF THE ADVISORS

Name of the first advisor: DrYonasYilma

Date:_____ Signature:_____

Name of the second advisor:Mr.EshetuAlemayehu

Date:_____ Signature:_____