JIMMA UNIVERSITY INSTITUTE OF HEALTH FACULTY OF MEDICAL SCIENCE DEPARTMENT OF PEDIATRICS AND CHILD HEALTH

Etiology, risk factors, antimicrobial susceptibility pattern and treatment outcomes of musculoskeletal infections in children admitted to Jimma Medical Center (JUMC), South West Ethiopia, 2021

By Sophia Mohammednur (MD, Pediatrics Resident)

A RESEARCH THESIS TO BE SUBMITTED TO THE DEPARTMENT OF PEDIATRICS AND CHILD HEALTH IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE SPECIALTY CERTIFICATE IN PEDIATRICS AND CHILD HEALTH

DECEMBER, 2021

JIMMA, ETHIOPIA

Etiology, risk factors, antimicrobial susceptibility pattern and treatment outcomes of musculoskeletal infections in children admitted to Jimma Medical Center (JMC),

By Sophia Mohammednur (MD, Pediatrics Resident)

ADVISORS:

1) **Dr. Tsion Tilahun (MD, assistant professor pediatrics and child health)**
2) **Mr Teshome Kabeta (MPH, Assistant professor)**

NOVEMBER, 2021

JIMMA, ETHIOPIA

ABSTRACT

***Background**: Pediatric musculoskeletal infections are common disorders that can result in significant disability. Because the understanding, diagnosis, and treatment of infections of the bones, joints, and soft tissues have continued to improve over time, it is important to have an understanding of the etiology and antimicrobial susceptibility pattern of the commonest microorganisms, in order to achieve successful outcomes. Although each infectious process is unique, certain treatment principles like prevention, a prompt and accurate diagnosis, and timely medical and/or surgical intervention apply to all pediatric musculoskeletal infections. Continued evaluations are mandatory to assure good long-term outcomes. Because the effects of infection may last beyond the acute episode in pediatric patients, long-term follow-up is needed to assess for late sequelae such as angular deformities and limb-length inequalities.*

***Objective:** To identify the etiology and asses risk factors, drug susceptibility pattern and treatment outcome of musculoskeletal infections in children admitted to Jimma medical center.*

***Methods:** Institution based prospective longitudinal study was conducted to identify the etiologies, drug susceptibility pattern and treatment outcome of musculoskeletal infections in children at JUMC. A consecutive sampling technique was used to select the study participants. Data was collected using structured questioner. Descriptive statistics was used to present the finding like percentage, tables and graphs. Chi-square test was applied to investigate an association between the types of diagnosis with the predictor variables.*

***Results:** A total of sixty-three children (63) were enrolled in this study. The mean age of the study participants was 7.12 ± 5.8 years. The most presenting symptoms of the disease was swelling and limping (pain) which was 56 (88.9%) and 27 (42.9%) respectively. Pyomyositis was diagnosed on 49 (77.7%) of children admitted with musculoskeletal infections in the study setting. Gram stain was done for 26 (41.3%) children with musculoskeletal infections. Culture was done for all patients to identify the etiology of the disease of which 24 (38.1%) them was reported as having bacterial growth. Among grown bacteria: the most predominant growth bacteria were S.aures and S.poygen.*

***Conclusion and recommendation:** most of them were diagnosed with pyomyositis, staph aureus being the commonest etiology identified and is susceptible to different drugs. emperic treatment with the sensitive drug may improve the outcome.*

Acknowledgment

First of all, I would like to thank the Almighty God for helping me to reach today,

I would like to thank my advisors Dr. Tsion Tilahun and Mr Teshome Kabeta for their assistance and valuable comments in developing the research proposal and the thesis. In addition, I would also like to pass my deepest gratitude for the research office of Jimma University. I would like to thank the Department of pediatrics and child health for allowing me to conduct this research.

Contents

List of tables

List of figures

Acronyms and abbreviation

CA-MRSA- Community-Acquired Methicillin-Resistant S. Aureus

CRP-C-Reactive protein

ESR-Erythrocyte Sedimentation Rate

JMC – Jimma Medical Center

MSSA- Methicillin Sensitive Staphylococcus Aureus

MRSA-Methicillin Resistant Staphylococcus Aureus

PI-Principal Investigator

Spp-Species

Yr-Year

CHAPTER 1 INTRODUCTION

1.1. Background

Musculoskeletal infection which includes spectrum of illnesses from Osteomyelitis (infection/inflammation of bones), Septic arthritis (bacterial infection of joints) and pyomyositis (suppurative infection of the muscles) is a major cause of short and long term morbidity in children and adolescents. These different forms of infections could occur as separate disease entities, as a continuation of one another or even as a component of systemic/distant illnesses or as a focus for systemic/distant illnesses. Hence, besides the acute morbidity and possible contributors of mortality in children and adolescents, they are also significant contributors of long term morbidities especially when the infections involve the bones and/or the joints since the deformities and/or disabilities resulting from such infections significantly affect the quality of life of the growing children(1).

The median age of children with musculoskeletal infections is approximately 6 yr. Bone infections are more common in boys than girls; the behavior of boys might predispose them to traumatic events. (2).

Septic arthritis is more common in young children, with Reported incidence of bacterial arthritis ranging from 1-37 cases per 100,000. Half of all cases occur by 2 years of age and three fourths of all cases occur by 5 year of age. Boys are affected more often than girls with a ratio of 1.2 to 2:1. (3)

Septic arthritis is frequently associated with adjacent infections including osteomyelitis and sub periosteal and intramuscular abscesses. (4). Most infections in otherwise healthy children arise hematogenously. Less commonly, infection of joints can follow penetrating injuries or surgical procedures like arthroscopy, prosthetic joint surgery, and intraarticular steroid injection.

In the case of osteomyelitis, the incidence ranges from 1 in 5000 to 7700 children in developed countries and 1 in 500 to 2300 children in developing countries (5). Cases in previously healthy children are hematogenous. Minor closed trauma is a common preceding event in cases of osteomyelitis, occurring in approximately 30% of patients. (2)

Osteomyelitis can be classified as acute and chronic based on the duration of the illness. Acute osteomyelitis typically presents two weeks after bone infection, characterized by inflammatory

bone changes. By contrast chronic osteomyelitis typically presents six or more weeks after bone infection and is characterized by the presence of bone destruction and formation of sequestra. subacute osteomyelitis is a chronic low-grade infection of bone characterized by a lack of systemic manifestations. The onset is insidious. pain is the most common symptom, and has usually been present for several months before initial evaluation.(6)

Pyomyositis is a purulent infection of skeletal muscle that arises from hematogenous spread, usually with abscess formation(7). It's classically an infection of the tropics, even though it has been recognized in temperate climate. Tropical pyomyositis occurs in two age groups (ages 2-5) and (ages 20-45),(8)

Pyomyositis may be presented with fever and pain on the lower extremities mostly, in which the last stage is characterized by systemic toxicity and complications of s. aureus bacteremia like such as septic shock, septic arthritis, pneumonia, pericarditis, and septic emboli can occur (9). Definitive management require both incision and drainage and antibiotics.

Pyomyositis is diagnosed with imaging. If available MRI is the optimal imaging technique, defining the site of infection and ruling out other entities. Bacteriologic diagnosis can be made by caltures of drainage specimens and / or blood.(7)

Staphylococcus aureus is the most common infecting organism in septic arthritis, osteomyelitis and pyomyositis. Other common etiologies are Group A streptococcus and Streptococcus pneumoniae which historically causes 10–20%. Kingella kingae is recognized as a relatively common etiology with improved culture and polymerase chain reaction (PCR) methods. In sexually active adolescents, gonococcus is a common cause of septic arthritis and tenosynovitis, usually of small joints or as a monoarticular infection of a large joint (knee).Other common etiologies include: pseudomonas aeruginosa,,Bartonella henselae , Kingella kingae, atypical mycobacteria, and sometimes fungal infections.(2)

Acute phase reactants may be useful as monitors. The serum CRP typically decreases below 2mg/dL within 7-10 days after starting treatment, whereas the ESR typically rises for 5-7 days and then falls slowly, dropping sharply after 10-14 days. Recurrence of disease and development of chronic infection after treatment occur in <10% of patients (10)

1.2. Statement of the problem

Musculoskeletal infections in children are relatively common. Accurate and early etiologic diagnosis of musculoskeletal infections is very important in order to provide the appropriate treatment and minimize possible associated complications. Delayed diagnosis or missed diagnosis and inappropriate treatment of musculoskeletal infections in children can result in sepsis, joint cartilage destruction, disruption of longitudinal bone growth, pathological dislocation of joints, deformity, fracture, persistent chronic infection and contracture.

Diagnosis of musculoskeletal infections can be made by the combination of clinical findings, imaging, laboratory analysis and microbiology even if microbiology is crucial in identifying the exact etiology and administering the appropriate therapy. But early and accurate diagnosis of these infections in many of the developing countries including ours is a problem because of the limited resources and lack of advanced investigation modalities. Hence, most often, the treatment of such infections is empiric, just based on the data from other settings which could lead to ineffective treatments and possible sequalae from inadequate and timely treatment.

1.3. Significance of the study

Musculoskeletal infections with its different spectrums, is a major cause of short and long term morbidity in children and adolescents. Besides the acute morbidity and possible contributors of mortality in children and adolescents, they are also significant contributors of long term morbidities especially when the infections involve the bones and/or the joints since the deformities and/or disabilities resulting from such infections significantly affect the quality of life of the growing children. These include prevention, a prompt and accurate diagnosis, and timely medical and/or surgical intervention. Because of the effects of infection may last beyond the acute episode in pediatric patients, long-term follow-up is needed to assess for late sequelae such as angular deformities and limb-length inequalities.

Identifying underlying risk factors will help us in early suspicion of the diseases and prompt treatment. With the newly emerging of MRSA and other different bacterial etiologies, sending cultures from the blood and the specimen will help us in identifying the exact microorganism and in initiation of appropriate antibiotics which will decrease the long term sequalae significantly.

Thus, this research aims to have better understanding of distribution of specific musculoskeletal infections in pediatric population, identifying the causative organisms and determining the drug susceptibility patterns of the organisms, which will in turn lead to improvement in the treatment as well us treatment outcomes of musculoskeletal infections.

Chapter Two

2.1. Literature review

Musculoskeletal infections (Osteomyelitis (infection/inflammation of bones), Septic arthritis (bacterial infection of joints) and pyomyositis (suppurative infection of the muscles) are major causes morbidity and mortality in children and adolescents.

The literature on musculoskeletal infections has expanded in recent years. Physicians should understand the most recent advances in the field of musculoskeletal infection and be aware of evidence-based approaches to the identification and management of pediatric musculoskeletal infections.

Septic arthritis in children is an orthopedic emergency that has serious consequences if not diagnosed promptly and treated effectively. The presenting symptoms include pain, non-weight bearing and fever. Inflammatory markers are raised and ultra-sonography demonstrates a joint effusion.

Boys are more commonly affected by septic arthritis than girls. There is no obvious reason for this gender difference, but it may be that boys are more likely to be involved in activities that lead to repetitive minor joint trauma (11).

The incidence of septic arthritis in a district of Malawi has been estimated as 1 in 5000 per year in those aged under five and 1 in 13 000 in those aged between five and 15 years (12). A recent survey of the orthopedic needs of children in Rwanda suggested that 3% were suffering from a musculoskeletal impairment due to infection (13). Another prospective African study reported an incidence of 1 in 20 000 (14)

Studies performed over two different decades in (15)Dallas demonstrated an unchanging incidence of 1 in 100000. In Israel, an incidence of 37 in 100 000 has been noted (16)

Children who are HIV positive have an increased risk of septic arthritis (17), and anemic, malnourished, underweight children in sub-Saharan Africa are also at high risk (18).

Jackson and Nelson reviewed 514 infected joints in 471 Western children and found the knee to be the most commonly affected with 41%, followed by the hip with 23%, the ankle with 14%, the elbow 12% and the wrist and shoulder 4% each(19). In Gillespie's series of 102 children the shoulder only represented 3%(20). Molyneux's series from Malawi in 1982 reported the shoulder

as being involved in 28% of cases, second only to the knee with 51% [16]. In the author's own series from Zambia the shoulder was involved in 19 out of the 34 prospectively studied cases, representing 56% of all infected joints(18).

Septic arthritis may be caused by a wide spectrum of bacteria, but there is a definite age relation to the common pattern. In neonates less than 2 months old infected in the community the common organisms are group B Streptococci, followed by Staphylococcus aureus and gram-negative rods. If the infection was acquired in the hospital situation, then Staphylococcus is more common and is reported as being the cause in up to 62% of cases(21)

Regarding Microbiological culture, The rate of positive identification of pathogens from blood and synovial fluid culture ranges from 34% to 82% in the current literature.(4) Synovial fluid Gram stains may only be positive in 30% of aspirates. (3)

Chronic osteomyelitis places a significant burden on the health services available in developing countries. In a review of paediatric surgical services at the main government referral hospital in Banjul, Gambia, osteomyelitis accounted for 7.8% of pediatric surgical admissions and 15.4% of total in-patient days.(22)

In children, an acute bone infection is most often hematogenous in origin. In high-income countries, acute osteomyelitis occurs in about 8 of 100,000 children per year, but it is considerably more common in low-income countries.(17).

An audit of surgical activity in Malawi revealed that, nationally, 3% of all procedures were related to osteomyelitis(23). A study investigating the healthcare burden in Uganda reported that 3.5% of surgical procedures were for osteomyelitis, and 60% of these procedures were a sequestrectomy (24). A retrospective study from a specialist orthopaedic hospital in Malawi reported that 6.7% of all orthopaedic procedures in children were for chronic osteomyelitis, the majority being a sequestrectomy. Approximately 16% of children required a reconstructive procedure(23)

There were four retrospective studies of children with osteomyelitis, one is a retrospective study of 167 children treated at an orthopaedic tertiary referral hospital in Malawi. In this study, 73% of children were successfully treated in a single admission with a median length of stay of 18 days; 16% required a second admission for further surgery to control infection and 16% required surgical reconstruction.(25)

In a study done, on the prevalence of osteomyelitis in UK, of the 275 cases, 148 infections (54%) were on the right and 122 on the left; five were multifocal. The patients included 37 (1 3.5%) aged one year or less. The median duration of symptoms before presentation was four days. For patients with Staphylococcus aureus infection the median duration of symptoms was three days (0 to 365) compared with a median of six days (0 to 155) for those in whom no organism was cultured ($p < 0.001$). (26)

Of those with subacute infection and a cultured organism, 67% had Staphylococcus aureus, compared with 90% of those with acute infection total of 159 patients (58%) had an organism isolated from either blood cultures or specimens obtained at surgery: the number of such isolates is recorded in. An organism was found in 62% of 129 patients, with infection in long bones as against 45% of the 30 with infection at other sites ($p < 0.01$). Infection due to an organism other than Staphylococcus aureus was recorded in 31% of those in their first year, as against only 8% in children older than one year. (6)

A prospective study was done at Finland, with the aim of to compare the clinical value of the erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and white blood cell (WBC) count in diagnosis and follow-up of acute hematogenous osteomyelitis in children. And Forty-four children aged 2 weeks to 14 years with bacteriologically confirmed acute hematogenous osteomyelitis were examined. Staphylococcus aureus was responsible in 39 cases (89%), Haemophilus influenzae type b in 3 cases (7%), pneumococcus in 1 case (2%), and a microaerophilic streptococcus in 1 case (2%). And the result was, ESR was elevated (20 mm/h) initially in 92% of the cases. CRP was elevated (>19 mg/L) at the time of admission in 98% of the cases, the mean value being 71 mg/L. CRP increased and especially decreased significantly faster than ESR, reflecting the effectiveness of the therapy given and predicting recovery more sensitively than ESR or WBC count (27).

Treatment of acute osteomyelitis is almost always instituted empirically before the causative agent and its resistance pattern are known. they must have an acceptable side-effect profile when administered orally because the doses are unusually large (3).

Clindamycin and first-generation cephalosporin fulfill these requirements. Their efficacy monotherapy for osteomyelitis has been documented, and large doses usually have an acceptable

side-effect profile. Treatment with antistaphylococcal penicillins has also been shown to be effective and safe, albeit in non-comparative or small prospective trials (28).

Most MRSA strains remain susceptible to clindamycin, but it (as well as vancomycin) should not be used against K. kingae. Beta-lactams are the drugs of choice for cases of osteomyelitis due to K. kingae, as well as for those due to S. pyogenes or S. pneumonia (28)

For patients in unstable condition, and in areas where resistance to clindamycin is widespread, vancomycin should be chosen as a first-line agent, The adequacy of bone penetration is a concern when vancomycin is used, and measurement of trough levels is warranted to guarantee sufficient dosing.(29)

A recent study out of Thailand found complications in 29% following pediatric osteoarticular infections. Complications included avascular necrosis, limb-length discrepancy, and pathologic fractures. The authors identified symptoms more than 1 week at presentation, neonatal age at presentation, infection of the hip joint, MRSA infection, and more than 3 days' delay to appropriate antibiotics as predictors of complications. (14)

2.1. CONCEPTUAL FRAMEWORK

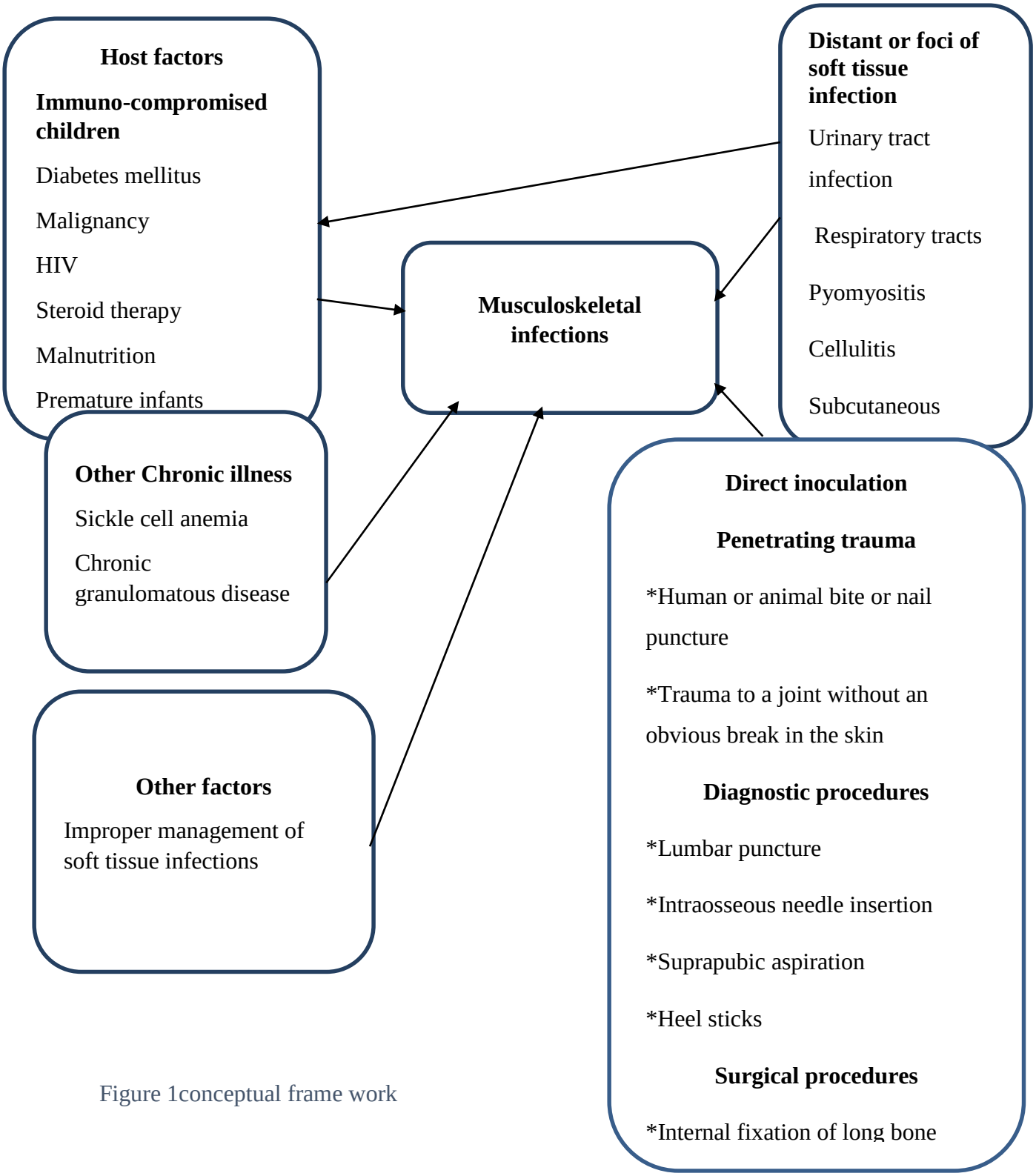

Figure 1conceptual frame work

CHAPTER THREE- OBJECTIVES

3.1. GENERAL OBJECTIVES

- ✓ To identify the aetiologies, drug susceptibility pattern and treatment outcome of musculoskeletal infections, in children at JMC

3.2. SPECIFIC OBJECTIVES

- ✓ To determine the magnitude of musculoskeletal infections in children admitted to JMC
- ✓ To asses risk factors associated with musculoskeletal infections in children admitted to JMC
- ✓ To identify the etiologies and drug susceptibility patterns of the isolates of musculoskeletal infections in children admitted to JMC
- ✓ To assess discharge outcome of musculoskeletal infections in children admitted to JUMC

CHAPTER FOUR- METHODOLOGIES

4.1. Study area

The study will be conducted at Jimma Medical Center (JMC). JMC is geographically located in Oromia Regional State, Southwest Ethiopia and 352 kilometers away from the capital Addis Ababa. JUMC provides services for approximately 15,000 inpatients and 160,000 Outpatients/year from the catchment of about 15 million populations. It has over 1600 staff and over 800 beds. The study was conducted from April 2020 to April 2021.

4.2. Study design

The study design was conducted institution based prospective longitudinal study.

4.3. POPULATION

4.3.1. Source population

All pediatric patients who visited JMC during the study period were the source population.

4.3.2. Study population

All children from birth to 18 years admitted to pediatrics ward of JMC and surgical orthopedics ward with the diagnosis of musculoskeletal infections and who fulfills the inclusion criteria was selected.

4.4. Eligibility criteria

4.4.1. Inclusion criteria

All children less than 18 years of age admitted to pediatrics ward and surgical orthopedics ward of JMC with the diagnosis of musculoskeletal infection (osteomyelitis, septic arthritis, pyomyositis) were included.

4.4.2. Exclusion criteria

- ✓ Parents not willing to participate in the study

4.5. Sampling procedure and sample size estimation

4.5.1. Sampling technique

Consecutive sampling technique was used

4.5.2. Sample size determination

The sample size was calculated based on single population proportion formula. The Value of proportion of success (P) taken as 0.05 with 95% confidence interval, 5% margin of error and 50% proportion, formulas follows:

= 1.962*0.5*(1-0.22)/0.052 =384

Where

n = Sample size

α = level of significance

z = at 95% confidence interval Z value (α = 0.05) =>Z α/2 = 1.96

p = Proportion of occurrence of the event to be studied 50% (0.50)

d = Margin of error at 5% (0.05)

After adding 10% for non-response rate the sample size will be 422

4.6. DATA COLLECTION TOOLS

4.6.1. Data collection methods

A face-to-face interview and review of record of patients using structured questionnaire was employed to collect data on socio-demographic characteristics of the patients and clinical information. Once the diagnosis of musculoskeletal infection is made patients were undergo necessary investigations such as blood culture, ESR, CRP, X-ray, gram stain and culture from the site of infection. Structured case recording formats were used to collect the data. And at discharge outcome was documented from the chart of the patient.

4.6.2. Microbiological Laboratory diagnosis

Culture and sensitivity tests were done on the relevant specimen (blood, synovia fluid, drained/aspirated pus or biopsy tissue) following the standard protocol. The bottle was labeled with unique sample number; date and time of collection; then within 2 hours of collection delivered to microbiology laboratory or if delay happen was transported with amines transport media with charcoal and further microbiological investigations was done. The samples were inoculated onto

blood agar, Chocolate agar and MacConkey agar and incubated at 37°c for 24 hours aerobically in candle jar.

4.6.3. Isolation and identification of pathogen

Identification of bacterial isolates was made based on their characteristic appearance on the respective media, Gram-staining, and biochemical reactions such as indole production, urease production, citrate utilization, H2S production and motility will be done. Gram negative rods were identified by the following laboratory tests: urease, citrate utilization and hydrogen sulfide generation; and motility, lactose fermentation, glucose fermentation and indole test. If the isolate are gram positive cocci, catalase, coagulase, optochin, disk bacitracin disk, novobiocin disk and oxidase test was done to identify the species.

4.6.4. Antimicrobial Susceptibility Test

Antimicrobial susceptibility test was carried out using disk diffusion method on Mueller Hinton Agar (MHA) according to the recommendation of Clinical and Laboratory Standard Institute (CLSI). Three to five similar colonies was picked up with wooden applicator stick and dipped into normal saline to make direct colony suspension of the isolates and inoculum was adjusted at 0.5 McFarland standard by using densitometer. After few minutes, the suspension was streaked onto MHA plates. The antibiotic susceptibility testing was done for Ampicillin (10µg), Amikacin (30µg), Ampicillin-sulbactum (10/10µg), Gentamicin (10µg), Ceftriaxone(30µg), Ciprofloxacin(5µg), Trimethoprim-Sulphamethoxazole(1.25/23.75µg), Ceftazidime (30 µg), Clindamycin, Cefepime (30 µg), Amoxicillin-Clavulanic acid (10µg), Meropenem (10 µg), Vancomycin, Cloxacililin, Cephalexin and Chloramphenicol. The plates were incubated at 37 °c for 24 hours under aerobic condition and diameter of zones of inhibition will be measured using ruler and was compared with the standard set by CLSI. Quality control E. coliATCC-25922, S.auresA TCC-25923 and P. aeruginosa 700603 was used as reference strain.

4.7. Study variables

4.7.1. Independent variables

- ✓ Sociodemographic characteristics
- ✓ Trauma
- ✓ COMORBIDITIES
- ✓ Type of pathogens

- ✓ Markers of musculoskeletal infections

4.7.2. Dependent variables

- ✓ Antimicrobial susceptibility pattern of bacterial isolate
- ✓ Treatment outcome of musculoskeletal infection

4.8. Plan for data Dissemination

The findings of the study will be presented to Jimma University Scientific community and submitted to department of Pediatrics and Child Health, faculty of medical sciences and institute of health, Jimma University. Recommendations will be forwarded to hospital staffs and other stakeholders based on the findings of the study. Efforts will be made to publish the findings on national and international scientific journals.

CHAPTER FIVE RESULTS

5.1. Socio cultural characteristics of the study participants

During the study period there were a total of admission of 4400 Of pediatrics patients out of this musculoskeletal infection contributed to 63 (1.5%) of admissions in pediatrics and orthopedics ward. The mean and standard deviation of the patients age was 7.12 ± 5.8 years, with minimum and maximum age of 27 days and 18 years respectively. Thirty-four (54.0%) of study participants were found within 7 years and the rest were above 7 years old. Regarding to sex distribution nearly two-third 41 (65.1%) of the participants were males. More than half 36 (57.1%) the study participants were from out of Jimma town. Similarly, 25 (39.7%), 12 (19.0%) and 30 (41.3%) of study participant's family income was having less than 2000 ETB, 2001-3000 ETB and greater than 3001 ETB respectively.

In this study from the total participants of 63 about 21 (60.0%) of the participants were in primary school, followed by 6 (17.1%) of them were in preschools. Regarding to family size slightly more than two-third 43 (68.3%) of the study participants had more than five household members live together in the household (table 1).

Table 1: Socio demographic characteristics of Children with musculoskeletal infection admitted to JMC Southwest Ethiopia, 2021 (N=63).

Variables	Categories	Frequency	Percent
Age (years)	≤ 1 month	4	6.3
	>1 mon-12months	9	14.3
	>12mon-60mon	14	22.2
	>60 mon-120mon	14	22.2
	>120 mon	22	**34.9**
Sex	Male	41	65.1
	Female	22	34.9
Place of Residence	Jimma	27	42.9
	Out of Jimma	36	52.1
Average family income	<2000 ETB	25	39.7
	2001-3000 ETB	12	19.0
	>3001 ETB	26	41.3
Level of education(child) (n=35)	Preschools	6	17.1
	Kindergarten	5	14.3
	Primary (1-8)	21	60.0
	Secondary (9-10)	2	5.7
	Preparatory	1	2.9
Father educational status (child age<15 years n= 56)	Cannot read and write	10	17.9
	Read and write	14	25.0
	Primary (1-8)	8	14.3
	Secondary (9-10)	4	7.1
	Preparatory (11-12)	4	7.1
	TVET	5	8.9
	University/ collage	11	19.6
Mother educational	Cannot read and write	17	30.4
	Can read and write	10	17.9

status (child age<15 years n= 56)	Primary	7	12.5
	Secondary	6	10.7
	Preparatory	8	14.3
	TVET	5	8.9
	University/ collage	3	5.4
Mother occupation (child age<15 years n= 56)	Unemployed	16	28.6
	Gov't employee	5	8.9
	Merchant	6	10.7
	Farmer	25	44.6
	NGO	1	1.8
	Others[1]	3	5.4
Family size	<5	20	31.7
	≥5	43	68.3

Key Others[1] includes housewife and private employee

5.2. General clinical characteristics of the respondents

In this study regarding to the duration of illness the majority of the respondents started their illness for 12 days before arrival to hospital. The mean and standard deviation of duration of illness before arrival to the hospital was 12.4±20 days with minimum and maximum of 1 day to 99 days respectively. According to this study about slightly more than one-third 23 (36.5%) of the study participants were had trauma prior to trauma to onset of illness. Similarly, 12 (19.0%) of the study participants were also reported as having skin lesion at the site prior to onset of illness. Only 3(4.8%) of individuals were undergone prior surgical procedure at the site. None of them had comorbid diseases like HIV and DM.

This study revealed that 37 (58.7%) of children with musculoskeletal infection admitted to JUMC visited other health facility for their illness before coming to this hospital. Among those who had visited health facility prior to coming to this facility slightly more than half 20 (54.1%) of individuals visited health center. (Table 2).

Table 2: General clinical characteristics of the study participants

Variables	Categories	Frequency	Percent
Having trauma to the site prior to illness	Yes	23	36.5
	No	40	63.5
Had skin lesion	Yes	12	19.0
	No	51	81.0
Did undergone surgical procedure at the site	Yes	3	4.8
	No	60	95.6
Have any diagnostic procedure	Yes	1	1.6
	No	62	98.4
Did the patient visited other health facility	Yes	37	58.7
	No	26	41.3

Regarding to the presenting symptoms of the disease, the vast majority 56 (88.9%) of individuals were having swelling followed by limping (pain) 27 (42.9%) (Figure 1).

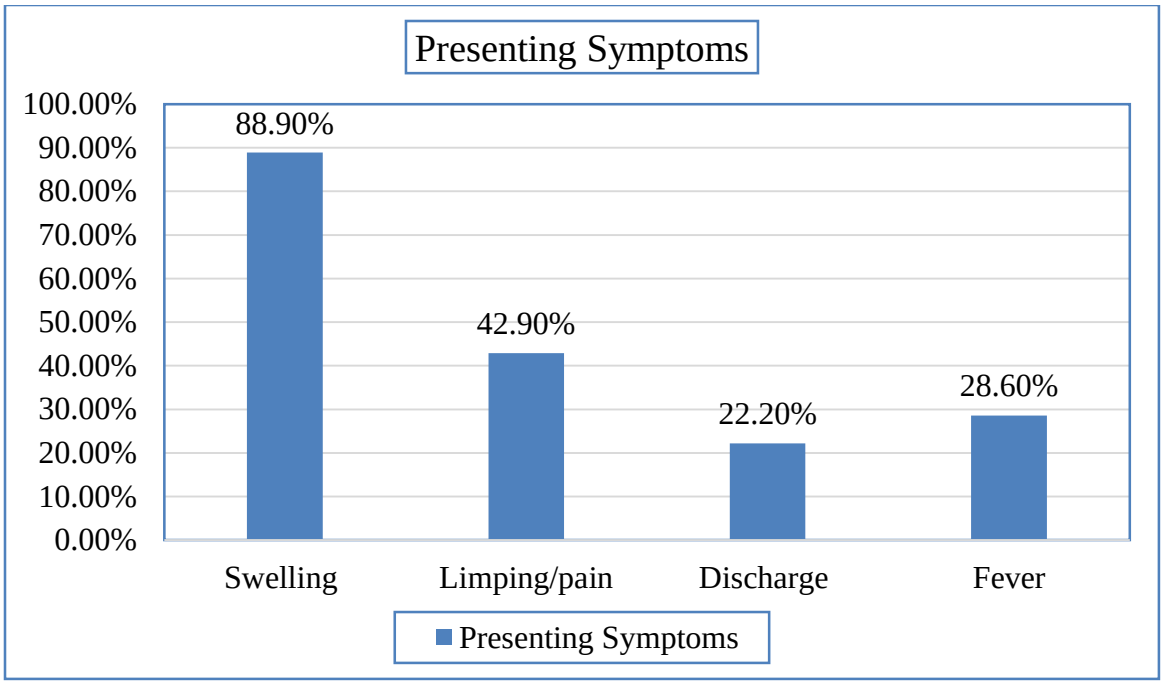

Figure 2: The presenting symptoms of the disease among patients admitted to pediatric ward, JUMC, 2021.

Similarly, regarding to nutritional status of the patient, almost half of the study participants were normal by using WFH indices. Around 8.0% of participants were diagnosed with severe acute malnutrition,

Regarding to the anatomical location of the illness about 26 (41.3%) of respondents were having musculoskeletal infection at the bone site of which 9 (14.3%) occurred at femur and tibia equally. And 19 (30.2%) patients with musculoskeletal infection at joint site.

5.2.1. Diagnosis of the patient

In this study 49 (77.8%) of children admitted with musculoskeletal infections at JUMC was diagnosis with Pyomyositis. Similarly, 19 (30.2%), 7(11.1%) and 11 (17.5%) of patients admitted to JUMC with musculoskeletal system infection there was having a diagnosis of septic arthritis, chronic osteomyelitis and acute osteomyelitis respectively (Figure 2).

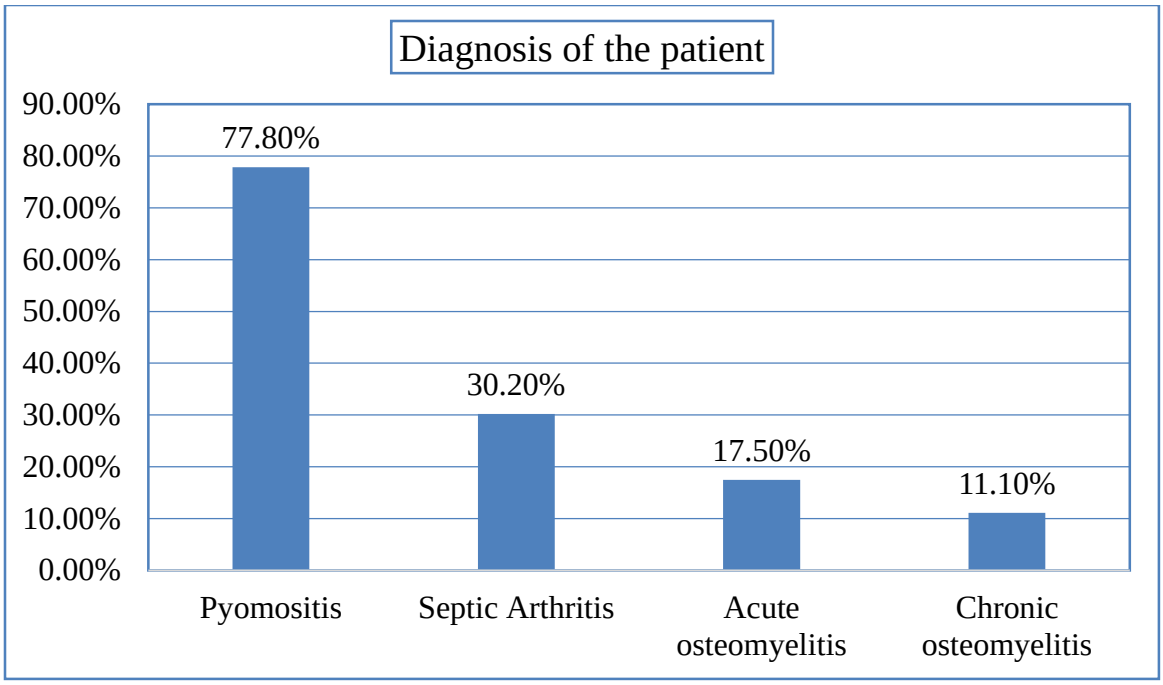

Figure 3 Specific diagnosis of the patient admitted to pediatric ward with musculoskeletal infections, JUMC, 2021.

5.2.2 Distribution of antibiotics given for the patient prior to conducted culture

The below table shows that the antibiotic distribution which the patient took before the culture was done. The vast majority 56 (88.9%) of the study participants took ceftriaxone before the culture was done followed by 18 (28.6%) of them also took Metronidazole. Note that the majority of the study participants took medication more than two type of medication due to this reason the total frequency might be greater than from the total sample size. In Nine (37.5%) of study participants' antibiotics were changed after culture result.

Variables	Category	Frequency	Percent (%)
Type of medication given prior to culture	Ceftriaxone	56	88.9
	Metronidazole	18	28.6
	Ampicillin	2	3.2
	Gentamycin	10	15.9
	Cloxacillin	12	19.4
Changed antibiotics after culture	Yes	9	37.5
	No	15	62.5

5.3. Lab investigations

In this study, 43 (68.3%) of study participants were examined for ESR at admission. About one third 13 (20.6%) and 10 (15.9%) of study participants were screened for CRP at admission and 7th day of admission respectively. Two-third 42 (66.7%) of the respondents were x-rayed. The X-ray result showed that soft tissue swelling was reported on 19 (46.3%) followed by 9 (22.0%), 8 (19.5%) and 5 (7.9%) was reported as having sequestrum, periosteal reaction and pathologic fracture respectively. Similarly, ultrasound was done for 30 (47.6%) study participants.

In this study gram stain was done for 26 (41.3%) study participants. The result of gram stain showed that 3 (11.5%) of participants were having for gram positive cocci bacteria (Table 3)

Table 3 Identified bacteria's on gram stain

Variables	Category	Frequency	Percent (%)
Name of organism identified by gram stain (n=26)	Gram + cocci	3	11.5
	Gram –ve Cocci	1	3.8
	S. aureus	2	7.7
	Gram –ve Roddi	1	3.8
	Coagulase negative staphylococcus	1	3.8
	Not identified	11	42.3
	Not growth	2	7.7
	Done not reported	6	23.0

Culture was done for all patients of the study participants. Among 63 samples sent to culture only 24 (38.1%) was reported as having bacterial growth in culture media. Among bacteria's who had grown on culture media; the most frequently grown and identified bacteria was S.aures (66.6(%) followed by S.poygen (12.5%) (Table 4).

Table 4 Lab result of culture among samples took from children with musculoskeletal infections, JUMC, 2021.

Variables	Categories	Frequency	Percent
Culture done from	Joint	12	19.0
	Muscle	43	68.3
	Bone aspiration	8	12.7
Was culture growth	Yes	24	38.1
	No	39	61.9
	E. coli	1	4.2
	S. aureus	16	66.6

Name of organism identified by culture (n=24)	S. pyogen	3	12.5
	Coagulase negative staphylococcus	1	4.2
	Entero bacter	1	4.2
	Klebsela ozane	2	8.2

5.4. Etiologies of the disease

This study revealed that S.aureus was the leading causes for pyomositis, septic arthritis, acute osteomyelitis and chronic osteomyelitis. Similarly, klebessella Ozale was reported on two individuals with pyomositis. This study also revealed that Enterobacter was the etiology for pyomositis and septic arthritis in one study participant. S. pyogen was only identified in participant with pyomositis (Table 6).

Table 5.Etiology of the disease among children admitted to JUMC, 2021

Types of diagnosis	Identified organism	Frequency
Pyomositis	S.aures	10
	coagulases negative staph	1
	E.coli	1
	Enetero bacter	1
	Klebesella Ozale	2
	S pyogens	3
Septic arthritis	Enetero bacter	1
	S.aures	4
	Klebesella Ozale	1
Acute osteomyelitis	Klebesella Ozale	1
	S.aures	3
Chronic osteomyelitis	S.aures	3

5.3.1. Sensitive drugs identified by culture examination

The below table showed that the distribution of bacteria with respect to their sensitive drugs after identified by culture and sensitivity test. In this study ciprofloxacin was the most frequently identified sensitive drug for S.Aureus. Similarly, clindamycin and gentamycin was drugs which are sensitive for this bacteria. According to this study gentamycin, CAF, Tazobactem and Meropeneum were the only identified drugs which are sensitive for E.coli bacteria. Clindamycin was sensitive drug for S.pyogen. Generally Clindamycin and Erythromycin drugs were sensitive for S.aurues, S.pyogens and Coagulas negative staphylococcus (Table 5).

Table 6 Lists of grown bacteria and sensitive drugs identified in culture and sensitivity tests

Name of grown bacteria	Sensitive drugs	Frequency
S.Aureus	Ceftriaxone	2
	Cotrimoxazole	8
	Pencillin	7
	Ciprofloxaciline	12
	Cephalexin	1
	Oxaciline	7
	Tetracycline	4
	Erythromycin	8
	Gentamycin	9
	Clindamycin	11
	Doxycycline	3
	Augmentin	2
	CAF	4
	Azithromycin	1
	Ceftazidine	3
	Cefoxitin	1
E.coli	Gentamycin	1
	CAF	1
	Tazobactem	1

	Meropeneum	1
S.pyogens	Vancomycin	1
	Clindamycin	3
	Erythromycin	2
	Ampicillin	1
	Piperacin	1
Coagulas negative staphylococcus	Ciprofloxacilline	1
	Clindamycin	1
	Cotrimoxazole	1
	Erythromycin	1
	Gentamycin	1
	Azithromycin	1
	Vancomycin	1
Entero bacter	Meropeneum	1
K. ozane	CAF	2
	Tazobactem	1
	Meropeneum	2
	Cotrimoxazole	1
	Imipenem	1

5.4 Complications of musculoskeletal infections

This study revealed that 18 (28.6%) of study participants developed complications of musculoskeletal infections. Among developed complications osteomyelitis were the most 10(55.6%) predominant complications identified by this study followed by anemia which was 6 (33.30%) and pathologic fracture was reported on 5 (27.8%) children. But none of the participants had DVT, nosocomial infections and avascular necrosis (Figure 4).

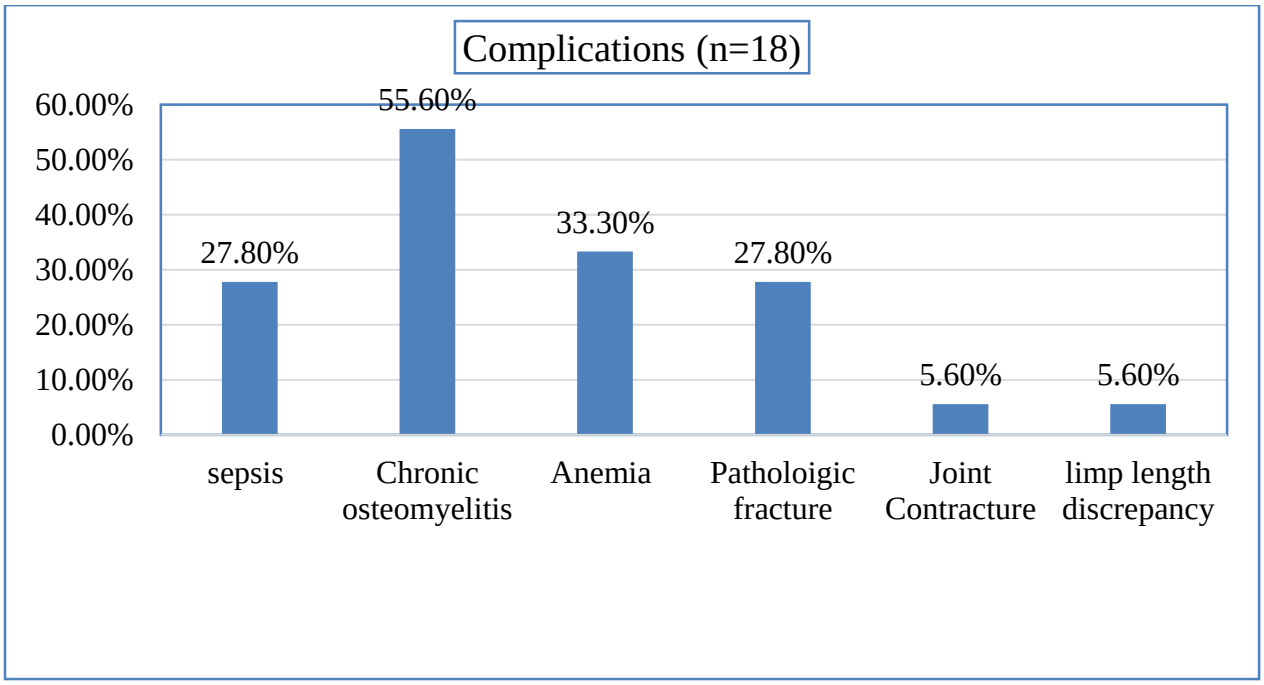

Figure 4 Complications of the disease among children with musculoskeletal infections admitted to pediatric ward, JUMC, 2021.

5.5. Length of hospital stay and outcome of the patient

Regarding to duration of stay in the hospital, the mean and standard deviation was 18.76±16.90 days with the minimum and maximum hospital days of 3 up to 90 days respectively. Similarly, regarding to the length of days in which IV Antibiotics took for the patient, the mean and standard deviation was 17.02 ± 12.73 days with minimum and maximum days of 3-64 days respectively. The vast majority 59 (93.7%) of patients were improved and discharged, while only 3 (4.8%) and 1 (1.6%) patients were disappeared and left against medical advice respectively.

5.6. The relationship between diagnoses of the patient with some explanatory variables

Specifically, the present study showed that there was an association between patients having pyomositis and having trauma to the site prior to the onset of illness (X^2 =7.01, P=0.008). Additionally, the present study has revealed that there was a significant association between patients having chronic osteomyelitis and respondents who had undergone surgical procedure to the site prior to come this facility (X^2 =9.84, P=0.030) (Table 6).

Table 7: The relationship between diagnosis of the patient and their general clinical characteristics among children with musculoskeletal infections admitted to pediatric ward, JUMC, 2021.

Variables	Categories	Had Pyomositis		X^2	P value
		Yes (%)	No (%)		
Having trauma to site prior to illness	Yes	21 (91.3)	2 (8.7)	7.01	0.008*
	No	24 (60.0)	16 (40.0)		
Had skin rash prior to illness	Yes	8 (91.7)	4 (8.3)	2.97	0.087
	No	37 (66.7)	17 (33.3)		
	No	32 (74.4)	11 (25.6)		
Variables	Categories	Had septic arthritis		X^2	P value
		Yes	No		
Having trauma to site prior to illness	Yes	5 (21.3)	18 (78.3)	0.50	0.47
	No	12 (30.0)	18 (70.0)		
Having skin lesion prior to illness	Yes	3 (25.0)	9 (75.0)	0.30	0.86
	No	14 (27.5)	37 (72.5)		
Variables	Categories	Had chronic osteomyelitis		X^2	P value
		Yes	No		
Undergone surgical procedure on the site	Yes	2 (66.7)	1 (33.7)	9.84	0.030*
	No	5 (8.3)	55 (91.7)		

Key *indicates variables associated with diagnosis of the patient among children with musculoskeletal infection at p <0.05 by X^2.

CHAPTER SIX DISCUSSION

In this study 49 (77.8%) of children admitted with musculoskeletal infections at JUMC were having the diagnosis of Pyomyositis. Similarly, 19 (30.2%), 7(11.1%) and 11 (17.5%) of patients were admitted with the diagnosis of septic arthritis, chronic osteomyelitis and acute osteomyelitis respectively.

Regarding to sex distribution nearly two-third 41 (65.1%) of the participants were males in this study similar studies demonstrated, Boys are more commonly affected by septic arthritis than girls(11). There is no obvious reason for this gender difference, but it could be due to boys are more likely to be involved in activities that lead to repetitive minor joint trauma

In this study regarding to the duration of illness the majority of the respondents were ill for 12 days before arrival to hospital. The mean and standard deviation of duration of illness before arrival to the hospital was 12.4±20 days with minimum and maximum of 1 day to 99 days respectively. Its known that delay in presentation is one of the risk factors which will affect the treatment outcome. In a study done in UK, the median duration of symptoms before presentation was four days. For patients with Staphylococcus aureus infection the median duration of symptoms was three days (0 to 365) compared with a median of six days (0 to 155) for those in whom no organism was cultured. (6)

According to this study about slightly more than one-third 23 (36.5%) of the study participants had trauma prior to onset of illness. Similarly, 12 (19.0%) of the study participants were also reported as having skin lesion at the site prior to onset of illness. Only 3(4.8%) of individuals were undergone for surgical procedure. Compared to other studies, trauma has been postulated as a predisposing factor for pyomyositis. About 25-50 % of patients report a history of trauma (8).

In contrast to other studies, in which being malnourished is one of the potential risk factors for acquiring musculoskeletal infection, only 6(%) of them were diagnosed to have severe acute malnutrition.

Regarding to type of procedure done for the patient more than two-third 45(71.0%) of the patient was done abscess drainage. Similarly, among the study participants 25 (39.7%), 10 (15.9%) and 4 (6.3%) of study participants were under gone to irrigation and drainage, Arthrotomy and bone window respectively. Similarly, as most patients present in advanced stage of pyomyositis,they require both antibiotics and drainage for definitive management(30). An audit of surgical activity in Malawi revealed that, nationally, 3% of all procedures were related to osteomyelitis (23) A study investigating the healthcare burden in Uganda reported that 3.5% of surgical procedures were for osteomyelitis, and 60% of these procedures were a sequestrectomy (24). Be Thomas et (25) retrospectively studied 36 children who developed chronic haematogenous osteomyelitis after acute disease. Infection control was achieved by debridement and sequestrectomy. Cancellous or corticocancellous bone grafting was required in 20 patients, four had a fibular strut graft and two a fibula-to-tibia in situ cancellous bone graft.

In this study, when we see antibiotic distribution of the patient who took before the culture the vast majority 56 (88.9%) of the study participants took ceftriaxone before the culture was done followed by 18 (28.6%) of them also took Metronidazole. In Nine (14.3%) of study subjects' antibiotic was changed after culture result. In this study gram stain was done for 26 (41.3%) study participants. The result of gram stain showed that 3 (11.5%) of participants were having for gram positive cocci

In this study, Culture was done for all patients to identify the etiology of the disease. Among 63 samples sent to culture only 24 (38.1%) was reported as having bacterial growth in culture media. Among bacteria's who had grown on culture media; the most frequently grown and identified bacteria was **S.aures** followed by S.pyogen , The rate of positive identification of pathogens from blood and synovial fluid culture ranges from 34% to 82% in the current literature. Synovial fluid Gram stains may only be positive in 30% of aspirates (14)

In this study ciprofloxacin was the most frequently identified sensitive drug for **S.Aureus**. Similarly, clindamycin and gentamycin was drugs which are sensitive for this bacteria. Moreover gentamycin, CAF, Tazobactem and Meropeneum were the only identified drugs which are sensitive for E.coli bacteria. Clindamycin was sensitive drug for S.pyogen.Generally Clindamycin and Erythromycin drugs were sensitive for S.aurues, S.pyogens and Coagulas negative staphylococcus

Blood cultures are positive in up to 10-35 percent of pyomyositis(31). Similarly, Staphylococcus aureus is the most common cause of pyomyositis; it causes up to 90 percent of tropical cases and up to 75 percent of temperate cases(8). Methicillin-resistant S. aureus (MRSA), including community-acquired strains, is also an increasingly important pathogen. (30)

Similarly, in a study done at Finland Staphylococcus aureus was responsible in 39 cases (89%), Haemophilus influenzae type b in 3 cases (7%), pneumococcus in 1 case (2%), and a microaerophilic streptococcus in 1 case (2%).(27)

In a study in UK, of those with subacute infection of the bone and a cultured organism, 67% had Staphylococcus aureus, compared with 90% of those with acute infection total of 159 patients (58%) had an organism isolated from either blood cultures or specimens obtained at surgery. An organism was found in 62% of 129 patients, with infection in long bones as against 45% of the 30 with infection at other sites ($p < 0.01$). Infection due to an organism other than Staphylococcus aureus was recorded in 31% of those in their first year, as against only 8% in children older than one year. (33)

Similarly, in a study done in Nigeria ,the sensitivity pattern of s.aureus was done and Ciprofloxacin was the most sensitivity drug identified, in around 78.9% (32).

Regarding complications, this study has revealed that 18 (28.6%) of study participants developed complications of musculoskeletal infections. Among developed complications chronic osteomyelitis were the most 10(55.6%) predominant complications identified by this study followed by anemia (33.3%), sepsis (27.80%) and pathologic fracture (22.2%). In contrast to our study, a study conducted in Thailand, found complications in 29% following pediatric osteoarticular infections. Complications included avascular necrosis, limb-length discrepancy, and pathologic fractures.

Regarding to duration of stay in the hospital, the mean and standard deviation was 18.76±16.90 days with the minimum and maximum hospital days of 3 up to 90 days respectively. Similarly, regarding to the length of days in which IV Antibiotics took for the patient, the mean and standard deviation was 17.02 ± 12.73 days with minimum and maximum days of 3-64 days respectively. The vast majority 59 (93.7%) of patients were improved and discharged, while only 3 (4.8%) and 1 (1.6%) patients were disappeared and leave against medical advice respectively. There were four

retrospective studies of children with osteomyelitis, one is a retrospective study of 167 children treated at an orthopedic tertiary referral hospital in Malawi(23).In this study, 73% of children were successfully treated in a single admission with a median length of stay of 18 days; 16% required a second admission for further surgery to control infection and 16% required surgical reconstruction.(23)

7. Strength and limitation of the study

7.1 Limitation

- ✓ Due to COVID 19 pandemic, flow of patients was limited.
- ✓ There was interruption in some laboratory investigations (CRP) and unavailability of blood culture
- ✓ The time of sample collection for culture is sometimes delayed.

7.2 Strength

- ✓ culture and drug susceptibility pattern was done for all patients
- ✓ complications of musculoskeletal infections were followed and documented on subsequent follow ups

8. Conclusion and recommendation

8. 1 Conclusion

- In conclusion, among musculoskeletal infections pyomyositis was found to be the most prevalent infection in pediatrics age group, with trauma being the commonest risk factor.
- Staph aureus is responsible etiology as indicated in this study and was susceptible frequently for ciprofloxacin. And while the vast majority 59 (93.7%) of patients were improved and discharged,

8.2 Recommendation

- Since most of the infections are hematogenously transmitted both blood and tissue culture should be done to increase the yield of microorganism.
- For our hospital, it would be helpful if blood culture bottle is supplied and culture is done routinely.
- For health service providers, antibiotics should be changed after culture and antibiotic susceptibility pattern is determined.
- Further studies might be needed with large sample size.

References

1. Help_Tachdjiansv3C34.Pdf.
2. Eric Robinette SSS. osteomylitis. In: Nelson textbook of pediatrics. 21st ed. 2021. p. 14160–78.
3. Hong DK GK. infectious and inflammatory arthritis.in: principles and practice of pediatric infectious disease,. In: Benjamin D. Welling, MD, Lee S. Haruno, BS, and Scott B. Rosenfeld M, editor. principle and practice of pediatric infectious disease. 5th ed. 2018.
4. Welling BD, Haruno LS, Rosenfeld SB. Validating an algorithm to predict adjacent musculoskeletal infections in pediatric patients with septic arthritis. Clin Orthop Relat Res. 2018;476(1):153–9.
5. Charles R Woods 1 JSB 2. Guideline on Diagnosis and Management of Acute Hematogenous Osteomyelitis in Pediatrics. Clin Pract Guidel by Pediatr Infect Dis Soc Infect Dis Soc Am. 2021;
6. Dartnell J, Ramachandran M, Katchburian M. Haematogenous acute and subacute paediatric osteomyelitis. J Bone Jt Surg - Ser B. 2012;94 B(5):584–95.
7. Stevens DL , Bisno AL chambers H. guidelines for the diagnosis and management of skin and soft tissue infections: Infect Dis Soc Am.
8. 1 NFC. Bacterial pyomyositis in the United States. 2004;
9. G F Falasca 1 AJR. The spectrum of myositis and rhabdomyolysis associated with bacterial infection.
10. Shah ERSS. septic arthritis. In: Neslson text book of pediatrics. 21st ed. philadelphia; 2021. p. 14180–9191.
11. S P Smith 1, M Thyoka, C B D Lavy AP. Septic arthritis of the shoulder in children in Malawi. A randomised, Prospect study aspiration versus arthrotomy washout.
12. Lavy CBD, Peek AC, Manjolo G. The incidence of septic arthritis in Malawian children. Int Orthop. 2005;29(3):195–6.
13. Atijosan O, Rischewski D, Simms V, Kuper H, Linganwa B, Nuhi A, et al. A national survey of musculoskeletal impairment in Rwanda: Prevalence, causes and service implications. PLoS One. 2008;3(7):1–7.
14. Nunn TR, Cheung WY, Rollinson PD. A prospective study of pyogenic sepsis of the hip in

childhood. J Bone Jt Surg - Ser B. 2007;89(1):100–6.

15. PanelElizabethMolyneuxGaryFrench. Salmonella joint infection in Malawian children.

16. Welkon CJ, Long SS, Fisher MC AP. Pyogenic arthritis in infants and children: In: Pediatr Infect Disease.

17. L O Hughes 1 JA. Skeletal infections in children.

18. Smith SP, Thyoka M, Lavy CBD, Pitani A. Septic arthritis of the shoulder in children in Malawi. J Bone Jt Surg - Ser B. 2002;84(8):1167–72.

19. Jackson MA NJ. Etiology and medical management of acute suppurative bone and joint infections in paediatric patients. J Pediatr oirthopedics 2008.

20. CH.B. GRMB. Septic Arthritis of Childhood.

21. Anthony J MATAN M. pediatric septic arthritis.

22. Bickler SW S-DB. Epidemiology of paediatric surgical admissions to a government referral hospital in the Gambia. Bull World Heal Organ. 2000;

23. Lavy C, Tindall A, Steinlechner C, Mkandawire N, Chimangeni S. Surgery in Malawi - A national survey of activity in rural and urban hospitals. Ann R Coll Surg Engl. 2007;89(7):722–4.

24. Christine M Stanley 1, George W Rutherford, Saam Morshed, R Richard Coughlin TB. Estimating the healthcare burden of osteomyelitis in Uganda. 2009;

25. Jones HW, Beckles VLL, Akinola B, Stevenson AJ, Harrison WJ. Chronic haematogenous osteomyelitis in children. J Bone Joint Surg Br. 2011;93-B(8):1005–10.

26. Dartnell J, Ramachandran M, Katchburian M. Haematogenous acute and subacute paediatric osteomyelitis. J Bone Jt Surg - Ser B. 2012;94 B(5):584–95.

27. Eskola MJTKHPJ. Serum C-Reactive Protein, Erythrocyte Sedimentation Rate, and White Blood Cell Count in Acute Hematogenous Osteomyelitis of Children Leila Unkila-Kallio; 93.

28. Peltola H, Pääkkönen M, Kallio P, Kallio MJT, Aalto K, Anttolainen I, et al. Clindamycin vs. first-generation cephalosporins for acute osteoarticular infections of childhood-a prospective quasi-randomized controlled trial. Clin Microbiol Infect. 2012;18(6):582–9.

29. Liu C, Bayer A, Cosgrove SE, Daum RS, Fridkin SK, Gorwitz RJ, et al. Clinical practice guidelines by the Infectious Diseases Society of America for the treatment of methicillin-resistant Staphylococcus aureus infections in adults and children. Clin Infect Dis. 2011;52(3).

30. R K Gibson, S J Rosenthal BPL. Pyomyositis. Increasing recognition in temperate climates.

31. (Daren A, Diiorio SR. subcutaneous and deep tissue infection. 2021.

32. Nwankwo EO, Nasiru MS. Antibiotic sensitivity pattern of Staphylococcus aureus from clinical isolates in a tertiary health institution in Kano, Northwestern Nigeria. Pan Afr Med J. 2011;8:4.

ANNEX

Information sheets

The purpose of this research study is to determine “Etiology, risk factor, antimicrobial susceptibility pattern and treatment outcomes of musculoskeletal infections in children admitted to Jimma Medical Center”. When your child is a research participant, the principal investigator and the study staff will follow the rules of the research study protocol. Your child is being asked to voluntarily take part in a research study. You do not have to allow your child to participate if you do not want your child to participate. Before deciding to allow your child to be a part of this study, you need to read this Information and Consent Form.

This form tells you what will happen during the study and the risks and benefits for your child if you choose to allow him/her to take part in this study. It explains the other choices your child has besides taking part in this study. The form also explains you and your child’s right to stop taking part in the study at any time. If you agree to allow your child to participate in this study, assent (agreement) will also be obtained from your child.

This consent form may contain words that you do not understand. Please ask the principal investigator or study staff to explain any words or information that you do not clearly understand. Your questions should be answered clearly and to your satisfaction. Before you make a decision to allow your child to participate, we want you to understand the information in this form.

Sometimes, during a study, we may learn of new information which may make a difference in whether you want your child to continue to participate. If we learn of any information, we will let you and your child know as soon as possible.

Potential benefits

Your child will not receive any direct benefit from participating in this study.

Voluntary participation and withdrawal from the research

Your child's participation is voluntary. You may refuse to allow your child to participate for any reason at any time, without penalty or loss of benefits to which your child is otherwise entitled. You may withdraw your child from the study by contacting the study staff.

Confidentiality

Your child's identity and your child's personal records will be kept confidential to the extent permitted by the applicable laws and/or regulations and will not be made publicly available. If results of this study are published or presented at a conference, you or your child's identity will not be revealed. Confidentiality will be maintained during and after your participation in this study

Gucaodeeffanno

KaayyoonqorannookanaawalittihidhaminsadhukkubootaqaamaaLafee, busaa, mashaa (qancaroo) /dhukkubootadaa'immanii fi ijoollotaumrii 14 gadikanta,anigiddugalayaalaajimmattisireequbteenikanjirren, rekkodhukubichaabarruffiiaddaabasuudha.

Yeroomucaankeessanqorannookeessattihirmaatu, dursaanqorannookanaa fi miseensotniqorannichaaseeraqorannoohordofuunkanhojjetanta'a.

Mucaankeessafedhiiisaatiinakkaqorannoo kana keessattihirmaatunigaafatama. Isinisyoomucaankeessanakkahirmaatuhinbarbaaddanta'eakkainnihirmaatueeyyamuudid uudandeessu.Dursamucaankeessanakkahirmaatueeyyamuundurayaadawaliigaltee kana fi odeeffannoo kana dubbisuutuisinirraaeegama.

Gucikunwantootayerooqorannoomudachuudanda'ankanibsudha.
Yerooqorannichaarakkooyknfaayidaanmucaakeessamudachuudanda'anilaaluunqoranni chattihirmaachuu fi dhiisuufilachuu dandeessu. Gama biraan gucikun filannoo mucaan keessan qabu sababa qorannicha keessatti hirmaatuun kanibsudha. Gama biraan mucaankeessani ykn isin qorannoo kana irratti hirmaachuu dhiisuuf mirga guutuu akka qabdan niibsa. Yoo mucaan keessan akkahirmaatuuf eeyyamamaa taatan, mucaakeessan irraa walii galuuisaaf eeyyamni isaanigaafatama. Gucikuntarii jechoota isin hubachuu hindandeenye yoo qabaate, dursaa qorannichaa ykn miseensota isaa soda tokko malee yoogaafattan isaan isiniifibsuu nidanda'u. Gaaffiinkeessanhangaisiniififata'uttideebiinquubsaata'eisiniifnikennama.

Mucaankeessanakkahirmaatumurteessuukeessanduraodeeffannoowwanasirrattibarraa' anisiniifgaluuisaabaruubarbaanna.waanjiruhundamucaankeessanii fi isinakkahubattannitaasifna.
Isinisisarrattihundaa'uunammasittifufuuyknimmooqorannichaaddakutuundhaabuunidandeessu.

Bu'aakallattii

Gama biraanfaayidaaleenisinyknmucaankeessankallattiinwaanqorannoo kana keessattihirmaateefargattanyknargatuhinjiru.Kanaafwantinutiisiniifwaadaagalluhinjiru.Sababniisaabu'aaqorannoo kana ammumairraaka'uuntilmaamuunhindanda'amu.

Filannoobiraa/ yaaliiwwan

Qorannoonkunfedhiiirrattikanhundaa'edha.
Yerookamilleemucaankeessanqorannichadhaabuuyknkeessaaakkabahugochuunidandeessu.

Fedhiinhirmaachuu fi ergajalqabaniigidduuttiqorannichakeessabahuu

Mucaankeessankanhirmaatufedhaisaatiini.
Jalqabumamucaankeessanakkahinhirmaannediduuykndhorkuunidandeessu. Yoo kana gootanwantiisinirrahauyknwantimucaankeessanargachuuqabugaruuwaanhirmaachuudi

ddaniifdhabutokkolleehinjiru.Kanaaf, yoojidduuttiaddakutuufeetan nutty himuunaddakutuunidandeessuakkasumasyeroobiraadeebitaniiakkaittihirmaatugichuunidandeessu.

Icciitiikeessanqabuuilaalchisee

Mucaakeessanilaalchiseeodeeffannoondhuunfaaisaa/ishiiiccittiidhaanqabama.Yeroobu' aanqorannookanaamaxxanfamuyknkoonfiraansileeaddaaddaairrattidhiyaatu, wantimucaakeessanibsutokkoilleehindhiyaatu.Kanaaficciitiinodeeffannoomucaakeessan irraaargamuhundiisaayerooqorannoosakkasumasqorannoo kana boodaicciitiidhaanqabama.

STATEMENT OF CONSENT

I have been informed about this study's purpose, procedures, possible benefits and risks, and the use and disclosure of my child's health care information from this research. I have read and understood this consent form, and have been given the opportunity to ask any questions I may have. All my questions have been answered to my satisfaction. I freely give my consent for my child to participate in this research study. I authorize the use and disclosure of my child's health information to the parties listed in the authorization section of this consent for the purposes described above. By signing this consent form I have not waived any of the legal rights to which my child is otherwise entitled.

You will be provided with a signed copy of this form.

CONSENT SIGNATURE

_____

Printed name of Child _____

Child's Date of Birth (dd-MMM-yyyy)

_____

Printed name of Parent/Legal Guardian _____

Relationship to Child _____

Signature of Parent/Legal Guardian _____ Date

PERSON OBTAINING CONSENT

I attest that the requirements for informed consent for this research project described in this form have been satisfied – that I have discussed the research project with the participant's parent or guardian and explained to him or her in nontechnical terms all of the information contained in this informed consent form, including any risks or adverse reactions that may reasonably be expected to occur. I certify that the information provided was given in a language that was understandable to the participant's parent or guardian. I further certify that I encouraged the parent or legal guardian to ask questions and that all questions asked were answered.

Printed name of Person Obtaining Consent

_____

Signature of Person Obtaining Consent

Yaada waliigaltee

Ani waa'ee qorannoo kanaa, adeemsa isaa, faayidaa fi miidhaa inni fiduu danda'u fi waa'ee itti fayyadama odeeffannoo fayyaa mucaakootii fi iccittiiisaa natty himameejira. Yaada waliigaltee kana dubbissee hubadheera, akkasumas wanta naaf hingalle akkan gaafadhuuf carraan naafkennamee jira. Asirratti gaaffiin ani qabu ture hundi karaa quubsaa ta'een naafdeebi'ee jira.Yaada waliigaltee qorannoo kana keessatti hirmaachuu kana yeroon kennu bilisa ta'ee osoo dhiibbaan tokko narra hinjiraatiini dha.Odeeffannoo fayyaa waa'ee mucaakootiif yaada waliigaltee sababa qorannoo armaan olitti ibsameef kennuu fi itti fayyadamuufani namasirrii dha. Uunkawaliigaltee kana mallatteessuu kootiin mirga mucaankoo qabu kananirra darbe hinqabu/hinjiru.

Uunkikun ergamallattaa'ee booda kopiintokko isiniif kennama.

Mallattoo waliigaltee

_____

Maqaa mucaa _____

Guyyaa, ji'a fi baradhalootamucichaa (dd-MM-yyyy)

_____

Maqaamaatii/guddistuu/saa _____

Walittidhufeenyamucaawaliinqaban

_____

Mallttoomaatii/guddistuu/saa _____ Guyyaa_____

Namawaliigalteefudhatu

Yaadniwaliigalteefudhachuuqorannookanaabarbaachisaaakkata'e fi as keessattiibsamequubsaa fi namootaqorannoo kana keessattihirmaatanii fi maatii/guddiftootaafkaraaifata'ee fi alphaattihubatamuunkanibsameta'uuibsuunbarbaada. Odeeffannoonyaadawaliigaltee kana keessattiibsamanhundiosoohinhafiinmiidhaadhufuudanda'udabalateehirmaattotayookaanmaatii/guddiftootaafsirriittiibsameejira.Odeeffannoonkennamanhundikaraaifata'eefi ifaanhirmaattotaayokaangudiftootaangaluunta'uuisaa nan mirkaneessa. Dabalataanismaatiinykngguddistootniseeraawantaisaaniififahintaaneakkagaafataniifisaanjajjabeesseenjiraakkasumasgaaffiiisaaniifdeebiibarbaachisaankennanee fi jira..

Maqaanamawaliigalteefudhatuu_____

Mallattoonamawaliigalteefudhatuu _____

Questionnaires

Questionnaires for data collection on etiology, antimicrobial susceptibility pattern and treatment outcomes of musculoskeletal infections in children admitted to Jimma University Medical Center (JUMC)

*CardNo.*_____ *Code:* _____

PART I: Socio-demographic characteristics

No.	Questions	Categories
NO	QUESTIONS	
1	Age	
2	Sex	1.Male 2.Female
3	Residence	1. Jimma 2.outside of Jimma
4	Income	

PART II: General Condition of the patient

No.	Questions	Categories
1	Duration of illness in weeks before arrival	
2	Did the patient visit other health facility	1. Yes 2. No
3	Did the patient receive antibiotics before coming here?	1. Yes 2. No
4	If yes, A) What is the drug?	

	B) Duration?	
5	Clinical condition	
	Chief complaint	1. Swelling 2.Limping(pain) 3.discharge 4. Fever 5.other
	Physical examination	1. Admission vital signs PR…… RR……. temperature…….. 2. Anthropometry Weight…… height…….. MUAC……. 3.Anatomic location of the disease Femur…….. Tibia……. Humerus……. Radius…… Ulna……other……..

Part III: Risk factor and management

No	Question	Category
1	Risk factor	1. trauma 2. skin lesion 3. surgical procedures 4.diagnostic procedures

2	Does the patient have co-morbid illnesses?	1. HIV 2. DM 3. Malignancy 4. Drugs (1. Chemo, 2.steroid) 5. Other	
3 In	Investigation results	1. CBC_____ 2. ESR_____ 3. CRP_____ 4. X RAY _____ 5. Ultrasound _____ 6. Blood culture _____ 7. Body fluid (pus, synovial fluid,..) _____ 8. Bone biopsy_____	
4	Is culture and sensitivity done from the body fluid?	Yes/no/unknown	
	If yes, how was the yield?	Have yield/ no yield	
	If there is yield	What is the bacteria	
	Which drugs are sensitive?		
5	What kind of procedure done to the patient?	1. Incision and drainage 2. Irrigation and Debridement 3. Arthrotomy 4. Bone window 5. Other	
6	Was the patient taking 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.Sepsis (Disseminated infection) 2. Nosocomial infection 3. Anemia 4.Fracture 5.contracture 6. DVT 7.COM 8.Leg discrepancy 9.Avascular necrosis
3	Duration of patient stay in hospital in week	
4	Outcome of the patient	1.Improved and discharged (favorable outcome) 2.Died (unfavorable outcome)