FACTORS ASSOCIATED WITH EARLY CLINICAL OUTCOMES OF SEPTIC ARTHRITIS TREATED AT THE ADULT UNIVERSITY TEACHING HOSPITAL, LUSAKA

by

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A dissertation submitted to the University of Zambia in partial fulfilment of the requirements for the Master of Medicine in Orthopaedic and Trauma Surgery

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DECLARATION

I, **Mwamba Josephine Chiteba Mulenga**, now declare that this dissertation herein presented for the degree of Master of Medicine (Orthopaedic and Trauma Surgery) has not been previously submitted wholly or in part for any other degree at this or any other university nor is it being currently submitted for any other degree.

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APPROVAL

This dissertation of **Dr Mwamba Josephine Chiteba Mulenga** is approved as fulfilling part of the requirements for the award of the degree of Master of Medicine in Orthopaedic and Trauma Surgery by the University of Zambia, subject to the examiner's report

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ABSTRACT

Septic arthritis refers to an infection involving the joint. Management of these patients involves prompt diagnosis, surgical treatment and antibiotics. Delay in treatment could result in poor functional outcome and severe cases fatality. Antibiotic treatment requires knowledge of the local microbiological profile of this disease. Furthermore, outcomes of this disease vary and may depend on different demographic and clinical characteristics of patients presenting with septic arthritis. This set out to determine local microbiological profile as well as the early functional outcome following septic arthritis at the University Teaching Hospital, Lusaka, Zambia.

A prospective cross-sectional study was conducted at the University Teaching Hospital, Lusaka, Zambia from July 2019 to March 2020. A total of 33 patients with septic arthritis of all age groups were recruited. Demographic characteristics, clinical presentation and laboratory findings including microbiological profile were elicited. Participants had joint range of motion and weight-bearing assessed at six and twelve weeks.

The patients' age ranged from 5 to 72 years, with a median age of 23 and the majority, 75.8% (n=25) were males. Most patients came from high density areas 57.6% (n=19), did not go beyond primary level of education 78.8% (n=26) and were from moderately poor background 66.7% (n=22). Trauma was commonest predisposing factor 33.3% (n=11), and the knee was commonest joint affected 45.4% (n=15). The median duration of symptoms reported was nine days. Cultures were positive in 63.6% (21), and *S aureus* accounted for 85.6% (n=18), of which 50% were MRSA. Most patients were full weight-bearing at 12-week follow up 75.8% (n=25). Elbow and shoulder joints had marked a reduced range of motion. Age was the only variable that had a significant association with the functional outcome of multivariable logistic regression.

Septic arthritis had debilitating outcome in all age groups with a high prevalence of MRSA at our institution. Septic arthritis of the shoulder and elbow joints were associated with significant loss of range of motion. Older age was associated with delayed return to function of the affected limb.

Keywords: *Septic arthritis, Methicillin-resistant Staphylococcus aureus, range of motion, weight-bearing*

DEDICATION

I dedicate this work to my late mother, Josephine Chibale Bwalya, who encouraged me always and believed I could achieve great heights.

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ABBREVIATIONS

UTH-	University teaching hospital
WBC-	White blood cell
HB-	Haemoglobin
ESR-	Erythrocyte sedimentation rate
S aureus -	*Staphylococcus aureus*
Sp -	Specie(s)
Hib-	*Haemophilus influenza* type B
MRSA-	Methicillin-resistant *Staphylococcus aureus*
MSSA-	Methicillin-susceptible *Staphylococcus aureus*
ROM-	Range of motion
AVN-	Avascular necrosis

DEFINITIONS

Septic arthritis:	Septic arthritis is the bacterial invasion of the joint space and the subsequent inflammatory response.
Osteoarticular:	Refers to bone and joint.
Arthrotomy:	Creation of an opening in a joint.
Antibiogram:	Collection of data summarising bacteria isolated and susceptibility pattern.
Range of motion:	The movement through which a joint moves expressed in degrees.
Weight-bearing:	The amount of weight a person puts on an injured body part

CHAPTER ONE: INTRODUCTION

1.1 Background

Septic arthritis refers to bacterial invasion of the joint space and the subsequent inflammatory response (Frank et al., 2005). Septic arthritis is commonly spread via the haematogenous route (Smith and Piercy, 1995). Other methods of spread include direct inoculation from penetrating trauma to the joint and direct extension from adjacent infection, in particular, osteomyelitis (Frank et al., 2005). The major consequence of the bacterial invasion of the joint is damage to the articular cartilage (Mathews et al., 2010). This damage could be due to the particular organism's pathological properties, such as the chondrocyte proteases of *Staphylococcus aureus*, as well as to the host's polymorphonuclear leukocytes response (Mathews et al., 2010). The cells stimulate cytokine synthesis and other inflammatory products, resulting in the hydrolysis of essential collagen and proteoglycans (Mathews et al., 2010). The virulence of the infecting organism and the resistance of the host determine whether the inflammatory process and suppuration result in the synovial joint (Shirtliff and Mader, 2002).

Patients with septic arthritis may present with several symptoms that include fever, swelling of the joint, irritability (in children) and inability to weight bear (Frank et al., 2005). Several risk factors may predispose to septic arthritis (Mathews and Coakley, 2008). These include pre-existing joint disease, malnutrition and trauma to affected joint, including penetrating trauma (Mathews et al., 2010). Diagnosis of septic arthritis is clinical with the aid of laboratory investigations (Mathews and Coakley, 2008). This is aided by the use of Kocher's criteria which has four parameters. These are WBC count> 12000/mm^3, ESR > 40mm/hour, temperature>

38.5^0C and inability to weight bear. If all four features are present, there is a likelihood of septic arthritis of 99.6%, three features 93.1%, two features 40%, one feature 3% and 0.2% for no features present (Kocher et al., 2004). However, while such models correctly classify the majority of individuals, they are by no means the only method to rely on for diagnosis. Such models are more reliable in excluding, than including septic arthritis, and therefore a clinician's acumen remains important in identifying septic arthritis in those individuals with a single abnormal variable (Singhal et al., 2018). The disease may be insidious, affecting any joint in the body, and immunosuppression or recent use of antibiotics can alter the clinical and laboratory appearance of a septic joint (Mathews et al., 2010).

Septic arthritis is not a common condition, and its incidence varies in different parts of the world, as evidenced among several studies (Mathews et al., 2010). It occurs in all age groups but commonly in children, particularly below the age of 3 years (Russell et al., 2015). The epidemiology has continued to change over the past years due to factors such as vaccines, the pattern of the causative organism, health-seeking behaviour and improving health care provision in developing countries (Peltola et al., 1998). Six years before 1982 and ten years after starting routine *Hib* vaccinations, there has been a significant change in the pattern of septic arthritis (Peltola et al., 1998). From 1982 to 1988, 53% of cases were caused by *S aureus*, 36% by *Hib* and 11% by other bacteria. Since 1988, *Hib* infection has disappeared, and one-third of cases of childhood septic arthritis have been eliminated. This change has allowed us to reduce initial antimicrobial therapy for such children to cover only Gram-positive cocci. This limited treatment is safer, reduces cost, and simplifies treatment (Peltola et al., 1998).

In all age groups, approximately 75% to 80% of cases involve joints of the lower extremities, with the knee and the hip joints being most commonly affected (Frank et al., 2005). Other commonly affected joints include the ankles, wrists, elbows and shoulders. Small, distal joints are less likely to be involved (Lieber et al., 2018). Polyarticular joint involvement occurs in less than 10% of patients (Lieber et al., 2018).

Septic arthritis is an orthopaedic emergency that requires prompt diagnosis and treatment (Nunn et al., 2007). Failure of which would result in significant morbidity, and in severe cases, mortality (Li et al., 2016). Mortality is usually as a result of overwhelming Sepsis causing multi-organ dysfunction syndrome following septic arthritis (Omoke and Obasi, 2017). If clinical suspicion of septic arthritis is high, then it is correct to treat as SA in the absence of bacterial proof (Gupta et al., 2003).

Globally, the accepted treatment is surgical drainage and appropriate antibiotic therapy (Mathews and Coakley, 2008). Other than this, it is advocated to collect a specimen for culture and sensitivity to target the causative organism accordingly (Mathews and Coakley, 2008). It is vital to take note that antibiotics are started immediately as soon as the clinical diagnosis is made and not until cultures are collected (Nunn et al., 2007). This early commencement of antibiotics is essential to slow damage to cartilage by infection as early as possible. It is for this reason that the local pattern of infection in any particular demographic is known to give antibiotics accordingly (Nunn et al., 2007). In most health facilities around the world, the first-line choice of antibiotic is a first-generation cephalosporin, and if unavailable a second-generation (Shirtliff and Mader, 2002). The antibiotic choice is based on *S. aureus* local resistance patterns (Pääkkönen, 2017; Shirtliff and Mader, 2002). In The United Kingdom, 1st line for typical organisms causing SA include flucloxacillin,

clindamycin and second or third-generation cephalosporin (Mathews and Coakley, 2008). Other antibiotics are given for other species such as streptococcus and MRSA once culture and sensitivity testing are done (Mathews and Coakley, 2008). At UTH, the first-line choice of antibiotic is ciprofloxacin based on a previous study on the microbiological profile of chronic osteomyelitis at UTH (Mulenga, 2017).

The follow up of patients with septic arthritis requires antibiotic treatment for a few weeks (Mathews and Coakley, 2008). Different studies have disputed the duration of antibiotic treatment (Mathews and Coakley, 2008). Most recommend a minimum of 3 to 4 weeks (Pääkkönen, 2017). Locally, the duration of antibiotic treatment is six weeks. For uncomplicated septic arthritis, patients are given intravenous antibiotics in the acute phase, followed by oral antibiotics. Upon discharge, a first review is for wound inspection. Follow up reviews are mainly to monitor for function and any early and late complications. These reviews would include monitoring time to weight-bearing, joint mobility, joint subluxations or dislocation and osteomyelitis. Some joints are more susceptible to damage than others. For example, increased pressure within the hip can interrupt blood flow and lead to avascular necrosis of the femoral head. Prompt recognition and aggressive management are critical (Alhaji et al., 2016).

A clear understanding of the epidemiology and clinical history of septic arthritis should shape clinical decision making in septic arthritis (Andrews S and Sharon, 2017).

Septic arthritis is a disease of significant morbidity and mortality, as earlier stated. Understanding the local demographic pattern of septic arthritis would aid in its treatment and prevention or reduction of these problems. Therefore, this study was

set out to determine the causative organism in septic arthritis and drug sensitivity pattern at UTH to aid the appropriate treatment of the condition. Furthermore, this study looked at early outcomes of this disease and determined any predisposing factors to any poor outcomes as well as the disease. Participants were followed up for early outcomes. Early defined as a period of three (3) months (Gavet et al., 2005)

1.2 Statement of the Problem

Although the standard surgical procedure and use of antibiotics are adhered to in the treatment of septic arthritis at UTH, we see poor outcomes in our outpatient clinic. Such poor outcomes are reflected by the increase in the number of patients with poor joint function.

Therefore, it is essential to know what factors are associated with these poor outcomes in the treatment of septic arthritis despite standard treatment guidelines.

Poor outcomes can affect the quality of life and functionality, thus leading to increased morbidity and mortality.

1.3 Significance of the Study

Knowing the factors associated with poor outcomes such as joint stiffness will assist the clinician to recognise patients at risk of developing complications, therefore, instituting additional treatment to the routine treatment of septic arthritis. This early recognition of patients at risk will reduce complications and result in a reduced hospital stay for the patient, thus reduced cost on the patient and the hospital. Overall, this will reduce morbidity and mortality.

1.4 Research Question

What are the factors associated with short term clinical outcomes of septic arthritis treated at the Adult hospital of the UTHs?

1.5 Objectives

1.5.1 Main Objective

To explore the factors associated with short term outcome of septic arthritis treated at the Adult hospital of the UTHs.

1.5.2 Specific Objectives

1. To describe the demographic characteristics of patients treated with septic arthritis at the Adult UTH.
2. To determine clinical characteristics and haematological parameters of patients treated with septic arthritis at the Adult UTH.
3. To determine the causative organism and drug susceptibility pattern in patients treated with septic arthritis at the Adult UTH.
4. To establish the joint range of motion and time to weight-bearing in patients treated with septic arthritis at the Adult UTH.

CHAPTER TWO: LITERATURE REVIEW

Several studies in different parts of the world show some common patterns such as predilection of septic arthritis in the paediatric age group and those below the age of three years in particular. But varying statistics in the pattern of the disease such as the incidence, sex distribution, joint involvement, causative organism, sensitivity pattern, and follow up care exist.

2.1 INCIDENCE

Acute septic arthritis is not a common condition, and the incidence varies in different parts of the world. A retrospective case series of children with bone and joint infection from Northern Australia revealed the incidence of septic arthritis was 12 per 100,000 overall; 30 per 100,000 for indigenous, and 5 per 100,000 for nonindigenous children (Brischetto et al., 2016). In the United States, the incidence is 7.8 per 100000 person-years and 3.28 per 100000 children in the year 2012 (Okubo et al., 2017). In Western Europe, it is estimated at 4-10 per 100000 patient-years. In the United Kingdom, there has been a 43% increase in the reported incidence of septic arthritis, with rates rising from 5.5/100 000 in 1998 to 7.8/100 000 in 2013. The rate increased most rapidly in those >75 years of age (15/100 000 in 1998 and 31/100 000 in 2013) (Rutherford et al., 2016).

A study done in Iceland between 1990 and 2002 reported that the incidence of septic arthritis increased from 4.2 cases per 100 000 in 1990 to 11.0 cases per 100 000 in 2002. This rise in septic arthritis was primarily observed in adults in whom the incidence rose by 0.61 cases per 100 000 per year ($p<0.001$). The annual number of arthroscopies increased from 430 in 1990–1994 to 2303 in 1998–2002 ($p<0.001$) and there was a correlation between the total usage of intra-articular drugs in Iceland

and the incidence of septic arthritis($p<0.01$). The frequency of post-arthroscopy septic arthritis was 0.14%, and post-arthrocentesis septic arthritis 0.037% (Geirsson et al., 2008). In Israel, between the period 1988 to 1993, the annual incidence of septic arthritis was 37.1 per 100,000 in children less than 2years (Yagupsky et al., 1995). There is no specific data on the incidence of septic arthritis in developing countries, particularly in Africa.

Some studies have shown that septic arthritis is more common in males than females (de Souza Miyahara et al., 2014) and some have even distribution between both sexes. The studies that showed septic arthritis more common in males attributed it to the likelihood of males sustaining trauma more than females. A prospective study of pyogenic sepsis of the hip in childhood at a South African Regional hospital revealed male to female ratio of 3:1 (Nunn et al., 2007).

2.2 RISK FACTORS

Presence of bacteria in a joint does not necessarily cause septic arthritis. Many patients have persistent bacteraemia but will not go to develop septic arthritis. Other factors predispose patients to develop septic arthritis. These include trauma, pre-existing joint disease and malnutrition. Trauma has been reported as one of the most prevalent risk factors with reports as high as 45% of cases of septic arthritis in children with a history of trauma (Sanabria-Báez et al., 2017).

Another factor associated with septic arthritis is a poor socio-economic status. A study done at a United States hospital revealed that most cases admitted with septic arthritis were from low and very low socioeconomic status (Okubo et al., 2017).

Another factor reported to contribute to the risk of developing septic arthritis is iatrogenic infection. This is seen in cases of procedures such as arthroscopy and arthrocentesis (Geirsson et al., 2008).

In the adult population, septic arthritis is also seen among patients with pre-existing joint disease, particularly osteoarthritis and rheumatoid arthritis with as high as 34% of the cases of septic arthritis (Cooper and Cawley, 1986). In a prospective study in adult patients presenting with septic arthritis in central Scotland between August 1997 and July 1999, 61% had the underlying joint disease (Gupta et al., 2001).

Advanced age of 80 years and above has also been reported as a risk factor for septic arthritis and a poor outcome as well (Gavet et al., 2005*)*.

Septic arthritis is an uncommon condition, particularly in neonates and is challenging to diagnose in this particular population. Poor outcomes have been reported, which include dislocations, chronic osteomyelitis and growth disturbance at a later stage. Some of the risk factors for developing septic arthritis in the neonate include prematurity, respiratory distress syndrome, umbilical artery catheterisation and perinatal asphyxia (Frederiksen et al., 1992).

A prospective and retrospective study of 87 patients with septic arthritis seen at Kenyatta National Hospital Nairobi between July 1980 and July 1985, revealed evidence of trauma in 24.1% of the patients studied. Furthermore, 4.5% of patients had a focus of infection in the bone, 2.2% patients had sickle cell disease, 1.1% patients suffered from diabetes mellitus and malignant renal tumour (Nyakinda, 1985). In another prospective study of musculoskeletal complications in adults with sickle cell disease at a Central Hospital in Yaounde revealed 7% of these

complications were as a result of septic arthritis (Bahebeck et al., 2004). This finding is an important risk factor to consider in sub-Saharan Africa.

The pattern of joint involvement in septic arthritis varies but common joints reported are the knee, hip and ankle (Pääkkönen, 2017). Osteoarticular infections caused by *Streptococcus pneumonia* in Children in eight United States Children's hospitals showed the most commonly involved joints in septic arthritis were hip 48.6%, knee 20.8%, elbow 11.1%, ankle 9.7%, shoulder 6.9%, wrist and sternoclavicular 1.4% (Olarte et al., 2017).

A Study done at a children's hospital in India between June 2013 and August 2015, a total of 88 joints were involved in 70 infants. Multiple joint involvements were seen in 17 (24.2%) neonates and 76% had single joint involvement. The hip joint was involved in 40% cases, followed by the shoulder (15.7%) and knee (15.7%). Infants had bilateral hip joint involvement in 12.8% of cases (Devi et al., 2017). In contrast, a study in Malawi in children aged 12 years and below between January 1979 and April 1980, the commonest joint involved was found to be the knee which accounted for 51%, followed by the shoulder accounting for 28%. The unusually high percentage of the shoulder joint was postulated to be due to repeated minor trauma to the joint when a child is lifted by one arm by the mother onto her back (Molyneux and French, 1982). In another similar study in Mukinge, Zambia involving children less than 3years of age, the commonest joint involved was the shoulder, accounting for 73% and also citing possible cause due to repeated trauma due to the African habit of swinging child by the arm onto mother's back (Lavy et al., 2016).

2.3 MICROBIOLOGY

Staphylococcus aureus has been implicated as the most common causative organism in bacterial arthritis in all age groups (Andrews S and Sharon, 2017). Other organisms have been isolated from septic joints. *Haemophilus influenza* which used to be a common organism in septic arthritis in infants has now become rare due to the vaccination against *Hib* which starts as early as six weeks of age (Castellazzi et al., 2016). A retrospective review of 68 episodes of septic arthritis in children less than five years of age with septic arthritis at a tertiary children's hospital in Auckland, New Zealand between 2005 and 2014 revealed 57 (83.8%) occurred in those less than 24 months. Among infants less than three months of age, *Streptococcus agalactiae* was predominant (45.5%), followed by *S aureus* (36.4%). The most common pathogen in those aged 3–12 months was *Streptococcus pneumoniae* (38.5%), followed by *Kingella kingae* (15.4%). In children aged 12–24 months, *Kingella kingae* was most prevalent, identified in 10 of 33 (30.3%). In those aged 24–60 months, *S aureus* was the only pathogen identified (Boom et al., 2016).

Similarly, from 1972 to 1981, there were 95 children with a presumed diagnosis of acute septic arthritis at the Royal Hospital for Sick Children, Glasgow that were reviewed. Blood culture was positive in only 41%, but joint fluid obtained by aspiration and arthrotomy yielded positive cultures in 80% and 71% of cases, respectively. The most prevalent pathogen identified was *S aureus.* The *Haemophilus sp* was the next most frequent, being found in 11 of the 16 children under two years of age from whom a causative organism was isolated. There were only two cases of *Haemophilus* infections in children over two years old (Wilson and Di Paola, 1986).

Despite being an essential tool for the effective management of septic arthritis, cultures of joint pus do not always yield organisms. From September 2004 to December 2005, a prospective study of all cases of sepsis of the hip in childhood at a South African regional hospital was carried out. Bacteriological cultures revealed growth in 28 hips (70%) most with *S aureus*. Other organisms included *E. coli* in a neonate with a septic focus from an umbilical catheter, *Serratia sp* (14-year-old child), *Klebsiella sp* (five-year-old) and *Streptococcus pneumoniae* (one-year-old). Of the 12 hips (30%) in which culture showed no growth, nine had received antibiotics previously, and this was thought to be the cause of the high rate of negative cultures (Nunn et al., 2007).

Other than *S aureus*, *Salmonella sp* is a frequent cause of acute osteoarticular infection in developing countries and in patients with sickle cell disease (Castellazzi et al., 2016). In a prospective study of 61 children in Malawi with septic arthritis of the shoulder, there was a positive culture in 72% of patients. Of these, non-typhoid *Salmonella sp*, *Salmonella enteritidis* and *Salmonella typhimurium*, made up 86% (19/22) of positive cultures in the aspiration group and 73% (16/22) in the arthrotomy group. Other organisms included S aureus, *Hib*, *Strep Pneumonia* and *Klebsiella* (Lavy et al., 2005). Thirty-four children under the age of 3 years with septic arthritis presented to Mukinge Hospital in Zambia between 1 January 1992 and 31 March 1993, 76% (26) of comprised *Salmonella sp*, four gram-negative *bacilli* and four had no growth (Lavy et al., 2016). The reason for the high prevalence of *Salmonella* in septic arthritis was thought to be because it is the single most prevalent organism found in the blood of sub-Saharan children, which is in turn, secondary to the poor nutritional status of the children in this part of Africa.

This finding made a strong argument, if not compelling, that *Salmonella* septic arthritis in sub-Saharan children is a disease of poverty (Lavy, 2007).

2.4 COMPLICATIONS

Postoperative follow up of septic arthritis is very important so as to prevent and recognise complications early. Early functional complications such as restricted ROM, subluxations and dislocations have been reported. Neonates with septic arthritis at a children's hospital in India were assessed by retrospective case sheet. Prospective data collection of clinical and radiological outcomes was done during follow-up visits. Of the 70 infants, the mean age of the 52 infants (74.2%) who came for follow-up was 15.3 months. The follow-up group had an average of 2 follow-up visits. On clinical examination, they found that 19 infants (36.5%) had poor clinical outcomes; limb-length discrepancy (15.3%) and restricted range of movements (30.7%). They also found that 22 (42.3%) infants had poor radiological outcomes-small epiphysis (21.1%), no epiphyseal ossification (7.6%), dislocation (1.9%), a subluxation (3.8%), metaphyseal widening (5.7%), and chronic osteomyelitis (1.9%). Seven (13.4%) infants had abnormal outcomes on X-rays but were normal clinically (Devi et al., 2017).

Most complications of septic arthritis are related to delay in treatment which could be as a result of delayed presentation to a health facility or delayed diagnosis. At a local hospital in Taiwan, a septic arthritis study done on children under 18years revealed the mean duration from onset of symptoms to surgical intervention was significantly longer (mean 13 days) in the unsatisfactory outcome group. Chronic osteomyelitis was the most common complication in this study, followed by dislocation, ankylosis, leg length discrepancy, and developmental dysplasia of the hip. Delayed treatment

and increased Neutrophil count were significantly associated with increased risk of sequelae (Yuan et al., 2006).

In a study in Scotland, the case records of 95 children treated at the Royal Hospital for Sick Children, Glasgow, for acute septic arthritis during the ten years from 1972 were examined. In a group of 21 older children with hip infection, there were six failures. After a mean follow-up of 65 months, four had necrosis of the femoral head and two had coxa magna. The poor outcome could not be related to the age or sex of the patient, the organism involved or moderate delay in antibiotic therapy, but all six had suffered a delay in surgical intervention. None had an arthrotomy within five days though one hip had been aspirated four days after the onset of symptoms (Wilson and Di Paola, 1986).

Reduced range of motion is a common complication of septic arthritis. This finding may present as joint stiffness, fixed flexion deformity or ankylosis. A total of 36 patients (23 males and 13 females) with septic arthritis involving 48 joints were studied at a tertiary hospital in Nigeria, and patient's age ranged from 3 months to 60 years. The outcome of septic arthritis in this series was not satisfactory as 31% had joint stiffness, 19% had fixed flexion deformity, whereas only 42% had a complete recovery. The mean duration of symptoms before presentation was two weeks. This finding could be the reason for the joint stiffness and deformity that were recorded in this study.

Furthermore, about 8.3% of patients were lost to follow- up making it challenging to assess their outcome (Alhaji et al., 2016). This finding is a study with one of the highest complication rates. In comparison to another study, at a rehabilitation hospital in Nigeria which had 5.7% with joint stiffness, 8.8% with pain and stiffness,

5.7% with bony ankylosis and 2.9% with limb shortening. The complications were attributed to delay in treatment, underlying systemic illness and virulent organisms (Mue et al., 2013).

The rate of Avascular necrosis of the femoral head following hip septic arthritis varies from 10% to as high as 29% (Nunn et al., 2007). This risk of AVN can be as high as 50% with five days' delay and is increased exponentially with a longer delay (Munting et al., 2018).

Mortality is another serious complication of septic arthritis. Different regions have reported different mortality rates. Some studies have reported a mortality rate as high as 11% (Gupta et al., 2001).

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Study design

The cross-sectional study conducted on patients with septic arthritis.

3.2 Study Site

The Department of Surgery at the Adult University Teaching Hospital, which is the largest tertiary hospital, located in the Zambian capital city Lusaka.

3.3 Target Population

The study was done on patients presenting with a clinical diagnosis of septic arthritis.

3.4 Study Population

The study was done on patients who presented with septic arthritis at the Adult University Teaching Hospital and met the inclusion criteria.

3.5 Study duration

The study took place for nine (9) months period.

3.6 Inclusion and exclusion criteria

3.6.1 Inclusion criteria

All participants:

- Had pus drained from the joint
- Were diagnosed clinically with septic arthritis
- Had informed consent and / or assent to participate in the study
- Underwent routine surgery and antibiotics for the treatment of septic arthritis

3.6.2 Exclusion criteria

- Patients who had Tuberculous Arthritis
- Patients who had a joint prosthesis

3.7 Sample size

- The sample size was 33 patients, which was calculated using the Yamane formula;

$$n = \frac{N}{1 + N(e)^2}$$

- Population (N) of 36, which was according to UTH theatre records for the period of one year from January 2016 to December 2016.
- 95% confidence interval and precision (e) of 0.05

3.8 Sampling strategy

All patients meeting the inclusion criteria were conveniently sampled**.**

3.9 Procedure

Patients were identified from the casualty unit and surgical wards once the admitting unit made the diagnosis of septic arthritis. Patients were then considered for enrolment once resuscitation was done and the patient stabilised by the attending unit. Information concerning the study was given to potential participants and/or their guardian if aged less than 18 as per information sheet.

For participants who agreed to take part in the study, informed consent was then administered while the patient was on the surgical ward. Informed parental consent as well as assent was obtained for children aged 7 to 17 years and only informed parental consent was obtained for those less than seven years.

Collection of demographic and clinical data at the first point of contact from a participant who agreed to take part in the study was done.

Blood investigations were collected for FBC and ESR by trained medical personnel as routine in the management of patients with septic arthritis.

Patients were taken to theatre as part of the routine management of septic arthritis to drain the affected joint (arthrotomy). Pus swabs were collected from the joint at the time of arthrotomy in theatre by qualified medical personnel as routinely done in managing such patients. Pus swab was then taken for microscopy, culture and sensitivity to the lab. The lab used was the same for all samples collected to ensure standardisation. Data of the results of blood tests and pus swabs were entered into the data collection sheet.

HIV testing and counselling was done voluntarily by trained counsellors and under strict conditions of privacy while on the ward or on an outpatient basis at follow up if was preferred by the patient. This test is done as a standard hospital policy for patients being attended with unknown HIV status.

Patients underwent routine management for septic arthritis on the ward by attending doctors.

The next point of contact with the participant was at six weeks which coincided with scheduled follow-up in the clinic by attending surgeons. At this point, the range of

motion using a goniometer was assessed and also the subjective assessment of weight-bearing, whether non-, partial or full weight bearing of the participant was done. Weight-bearing of the upper limb was assessed as non-weight bearing referring to no use of an affected limb, partial weight-bearing as partial function in that limb and full weight-bearing as full function in that limb. This function was referred to as that during the pre-morbid state. The data collection sheet was then updated.

The next review was at 12 weeks that coincided with scheduled follow-up in the clinic by attending surgeons and again assessment of the range of motion using a goniometer and weight-bearing, whether non-, partial or full weight bearing was done. The data collection sheet was updated with the findings.

3.10 Variables

3.10.1 Independent Variables

- Age
- Sex
- Clinical presentation
- Duration of symptoms
- History of trauma, HIV status, Diabetes Mellitus, sickle cell disease, pre-existing joint disease
- Residence
- Level of education
- Poverty level ("LCMS 2015 Summary Report.pdf," n.d.)
- Haematology parameters
- Causative organism
- Sensitivity pattern

3.10.2 Dependent Variables:

- Range of motion
- Time to weight-bearing

3.11 Data Analysis

- Data collected was transferred to excel spreadsheet.
- Data was exported to STATA statistical software version 13 (STATA Corporation, Texas, USA).
- The categorical variable comparison was done using chi-square.
- To test for normal distribution of continuous variables, the Shapiro-Wilk test was used.
- Continuous variables with normal distribution such as haemoglobin concentration were reported as means and standard deviation.
- Data that were not normally distributed were reported as medians and interquartile range such as age, duration of symptoms, duration of hospital stay, WBC and ESR.
- Categorical variables such as sex, residence, level of education, poverty level, predisposing factors, joint involved and culture results were analysed to determine their frequencies.
- Associations between categorical variables were analysed using contingency tables and the Chi-square test.
- To rule out confounders and to determine predictors of culture-positive septic arthritis and predictors of weight-bearing at twelve weeks, multivariate multiple regression was used. The analysis was done at the 95% confidence interval and significance considered if the p-value was less than 0.05.

3.12 Ethical Consideration

Benefits

There were no financial benefits for the participants. The participants did not receive any special treatment and did not receive any financial benefits for participating in the study. All procedures, investigations, and follow up were as per standard routine management.

Risks

There was no direct risk to participants as the study was not interventional.

Confidentiality

High level of confidentiality was maintained at all times. Participant's names were not used, but instead, numbers were used for identification. The data collection sheets were kept under lock and key, and only the researcher had access to the key. Information was entered into a computer, which was password protected and was only known to the researcher.

Voluntarism

Participation in this research was voluntary, and no coercion was used. Patients were free to withdraw at any time, for no given reason, and this did not have any implications on their management.

Written Consent

Written informed consent and/or assent were obtained from each patient before their enrolment into the study. Permission to carry out the study at the Adult hospital of

The University Teaching Hospitals was obtained from The Hospital Management and The Department of Surgery.

Ethical clearance and approval was obtained from ERES CONVERGE IRB.

Injury clause

In the event of injury to the patient while undergoing the study, participants were advised to notify the principal investigator or the Chairperson of ERES CONVERGE IRB at the given address.

CHAPTER FOUR: RESULTS

4.1 Demographic Characteristics

There were 33 participants in this study which was in keeping with calculated sample size. The age range of patients in this study was from 5 to 72 years, with a median age of 23(IQR, 10-39) years. Participants were predominantly male 25(75.8%). The majority came from high-density areas, accounting for 19(57.6%), 26 (78.8%) did not go beyond primary level of education, and 22(66.7%) fell in the moderately poor bracket as shown in Table 4.1 below.

Table 4.1; Demographic characteristics of study participants

Variable	**Median**	**IQR**
Age	23	10-39
	Category	**Frequency (%)**
Sex	Male	25 (75.8)
	Female	8 (24.2)
Residence	Low density	1 (3.0)
	Medium-density	13 (39.4)
	High density	19 (57.6)
Level of education	Primary	26 (78.8)
	Secondary	7 (21.2)
	Tertiary	0
Poverty level	Extremely poor	6 (18.2)
	Moderately poor	22 (66.7)
	Non-poor	5 (15.1)

IQR- interquartile range

4.2 Clinical characteristics of study participants

There was a history of trauma to the affected joint in 10(30.3%), 4(12.1%) were HIV positive, 2(6.1%) had sickle cell disease, 1 (3.0%) had a preexisting joint disease, 1(3.0%) had diabetes mellitus, and 1 (3.0%) had both HIV and preexisting joint disease. One participant (3.0%) had both infective endocarditis as well as a history of trauma. A total of 13(39.4%) participants had no known predisposing factor for septic arthritis, as shown in Table 4.2.1 below. Of those that were HIV positive, all five were on retroviral therapy, but one was poorly compliant.

Table 4.2.1 Predisposing factors of study participants

Predisposing factors of study participants	**Frequency**	**Percentage (%)**
Trauma	10	30.3
HIV	4	12.2
Pre-existing joint disease	1	3.0
Diabetes mellitus	1	3.0
Sickle cell disease	2	6.1
HIV and Pre-existing joint disease	1	3.0
Infective endocarditis and trauma	1	3.0
No known predisposing factor	13	39.4

The commonest joint affected was the knee joint 15(45.4%), followed by the hip 9(27.3%), then the ankle joint 4(12.1%) and then 2(6.1%) and 1(3.0%) participants had shoulder and elbow involvement respectively. Participants who had both knee and ankle involvement were 2(6.1%) as shown in table 4.2.2 below.

Participants who had involvement of the right joint were 19(57.6%), 13(39.4%) involved the left and 1(3.0%) had bilateral joint involvement. Details are shown in Table 4.2.3 below.

Table 4.2.2 Joint involved

Joint	**Frequency**	**Percentage (%)**
Hip	9	27.3
Knee	15	45.4
Shoulder	2	6.1
Ankle	4	12.1
Elbow	1	3.0
Knee and ankle	2	6.1

Table 4.2.3 Joint side affected

Side	**Frequency**	**Percentage (%)**
Right	19	57.6
Left	13	39.4
Bilateral	1	3.0

The median duration of symptoms before patient presentation to hospital was nine days (IQR, 6.0- 12.0) and the median duration of hospital stay was six days (IQR, 5-9) as shown below in Table 4.2.4.

Table 4.2.4 Duration of symptoms and hospital stay

Variable	**Median (days)**
Duration of symptoms	9.0 (IQR, 6.0 - 12.0)
Duration of hospital stay	6.0 (IQR, 5.0 - 9.0)

IQR- interquartile range

4.3 Laboratory parameters of study participants

The median for the white blood cell count was 10.7 x 10^9/L (IQR, 7.3- 23.7), the mean haemoglobin concentration was 10.2g/dL (SD, $\pm$ 2.8g/dL) and the median ESR was 17mm/hr (IQR, 5.0- 34.0) as shown in table 4.3.1 below.

Table 4.3.1 Haematological parameters of study participants

Variable	**Mean**	**Median**
White blood cell count (x 10^9/L)		10.7 (IQR, 7.3- 23.7)
Haemoglobin (g/dL)	10.2 (SD, $\pm$ 2.8)	
Erythrocyte Sedimentation Rate (mm/hr)		17 (IQR, 5.0- 34.0)

IQR- Interquartile range, SD- Standard deviation

Out of the 33 participants, 21(63.6%) had positive culture results (Table 4.3.2), 18 (85.6%) of these yielded *Staphylococcus aureus* and 1(4.8%) each yielded *Klebsiella pneumoniae, Pseudomonas aeruginosa* and *Streptococcus species* as shown in Table 4.3.3 below.

Table 4.3.2 Culture results of study participants

Culture	**Frequency**	**Proportion (%)**
Positive	21	63.6
Negative	12	36.4

Table 4.3.3 Microbiological profile of study participants

Micro-organism	**Frequency**	**Proportion (%)**
Staphylococcus aureus	18	85.6
Klebsiella Pneumoniae	1	4.8
Pseudomonas aeruginosa	1	4.8
Streptococcus species	1	4.8

For cultures that yielded *Staphylococcus aureus*, the drug sensitivity pattern revealed nine were susceptible, one was intermediate, and eight were resistant to Cefoxitin/ oxacillin screen. It also revealed 13 were susceptible to ciprofloxacin and 16 were resistant to penicillin. The one case of *Klebsiella pneumoniae* was resistant to Ciprofloxacin, Gentamicin, Chloramphenicol, Ceftazidime and Co-amoxiclav. It was susceptible to Ampicillin. Details are shown in Table 4.3.4 below.

Table 4.3.4 Susceptibility pattern of study participants

Organism	Antibiotic															
	Cefoxitin screen			**Gentamicin**			**Ciprofloxacin**			**Erythromycin**			**Azithromycin**		**Clindamycin**	
	S	*I*	*R*	*S*	*I*	*R*	*S*	*I*	*R*	*S*	*I*	*R*	*S*	*R*	*S*	*R*
S. aureus	9	1	8	8	1	4	13	2	1	6	4	4	8	2	6	1
K. pneumoniae						1			1							
P. aeruginosa							1									
Streptococcus species				1			1					1				

Organism	Antibiotic											
	Penicillin		**Ampicillin**		**Chloramphenicol**		**Tetracycline**		**Tobramycin**		**Co-amoxiclav**	
	S	*R*	*S*	*R*	*S*	*R*	*S*	*R*	*S*		*S*	*R*
S. aureus	1	16			2	1	1	1	1		2	
K. pneumoniae			1			1						1
P. aeruginosa				1					1			
Streptococcus species		1										

Organism	Antibiotic					
	Ceftazidime	**Cefotaxime**		**Ceftriaxone**	**Cefapime**	**Piperacillin**	**Imipenem**
	R	*S*	*R*	*S*	*S*	*I*	*S*
S. aureus		1	1				2
K. pneumoniae	1						
P. aeruginosa		1		1			
Streptococcus species							

S- susceptible, I- intermediate, R- resistant

4.4 Clinical outcomes of study participants

At six weeks, 51.5% of participants were full weight-bearing, followed by 42.4% partial weight-bearing and 6.1% were non-weight bearing. At twelve weeks, 75.8% were full weight-bearing, 21.2% partial weight-bearing and 3.1% non-weight bearing. See Table 4.4.1 below.

The means and standard deviation of the range of motion in joints at six weeks and at 12 weeks and estimated normal range of motion are shown in Table 4.4.2 below. The normal range of motion was referenced from (Norkin and White, 2016; Soucie et al., 2011; Boone and Azen, 1979).

Table 4.4.1 Weight-bearing assessment in study participants

	6 WEEKS		**12 WEEKS**	
WEIGHT-BEARING	**Estimate (%)**	**95% CI**	**Estimate (%)**	**95%CI**
Non-weight bearing	2 (6.1)	1.4 – 22.6	1 (3.1)	0.3 – 20.3
Partial weight bearing	14 (42.4)	26.2 – 60.4	7 (21.2)	10.0 – 39.4
Full weight bearing	17 (51.5)	34.1 – 68.6	25 (75.8)	57.4 – 87.9

Table 4.4.2 Range of motion of affected joints of participants

	RANGE OF MOTION		
MOVEMENT	**6 weeks** (degrees)	**12 weeks** (degrees)	**Normal** (degrees)
Hip flexion	111.3 ± 10.8	116.9 ± 8.3	122.3 ± 6.1
Hip extension	24.9 ± 7.9	28.0 ± 5.6	9.8 ± 6.8
Hip abduction	43.2 ± 8.2	47.4 ± 5.5	45.9 ± 9.3
Hip adduction	23.1 ± 5.2	25.9 ± 4.7	26.9 ± 4.1
Hip internal rotation	39.3 ± 6.2	40.4 ± 5.1	47.3 ± 6.0
Hip external rotation	39.1 ± 6.0	42.2 ± 3.9	47.2 ± 6.3
Knee flexion	114.1 ± 18.8	119.8 ± 16.0	142.5 ± 5.4
Knee extension	2.7 ± 2.3	2.7 ± 2.3	1.6 ± 2.7
Shoulder flexion	67.0 ± 18.4	75.0 ± 21.2	166.7 ± 4.7
Shoulder extension	35.0 ± 7.1	45.0 ± 21.2	45.4 ± 6.2
Shoulder abduction	80.0 ± 28.3	100.0 ± 14.1	184.0 ± 7.0
Shoulder adduction	17.5 ± 17.7	17.5 ± 17.7	
Shoulder internal rotation	37.5 ± 10.6	39.5 ± 7.8	68.8 ± 4.6
Shoulder external rotation	50.5 ± 14.1	54.5 ± 8.5	103.7 ± 8.5
Ankle plantar flexion	30.8 ± 13.6	38.3 ± 13.7	56.2 ± 6.1
Ankle dorsiflexion	15.0 ± 7.7	17.7 ± 7.1	12.6 ± 4.4
Elbow flexion*	90.0	110.0	142.9 ± 5.6
Elbow extension*	-10.0	-10.0	0.6 ± 3.1

4.5 Association between demographic characteristics and laboratory data

The association between age and culture results was not statistically significant (p=0.379). More patients in the younger age groups had culture-positive compared to older age groups, as shown in Figure 4.5.1 below.

There was no significant relationship between culture result and duration of symptoms (p=0.823) as shown in table 4.5.2 below. No significant association was also noted between each of Haemoglobin concentration (p=0.637), WBC (p=0.624) and ESR (p=0.613) with culture as shown below in Figures 4.5.3, 4.5.4 and 4.5.5 respectively.

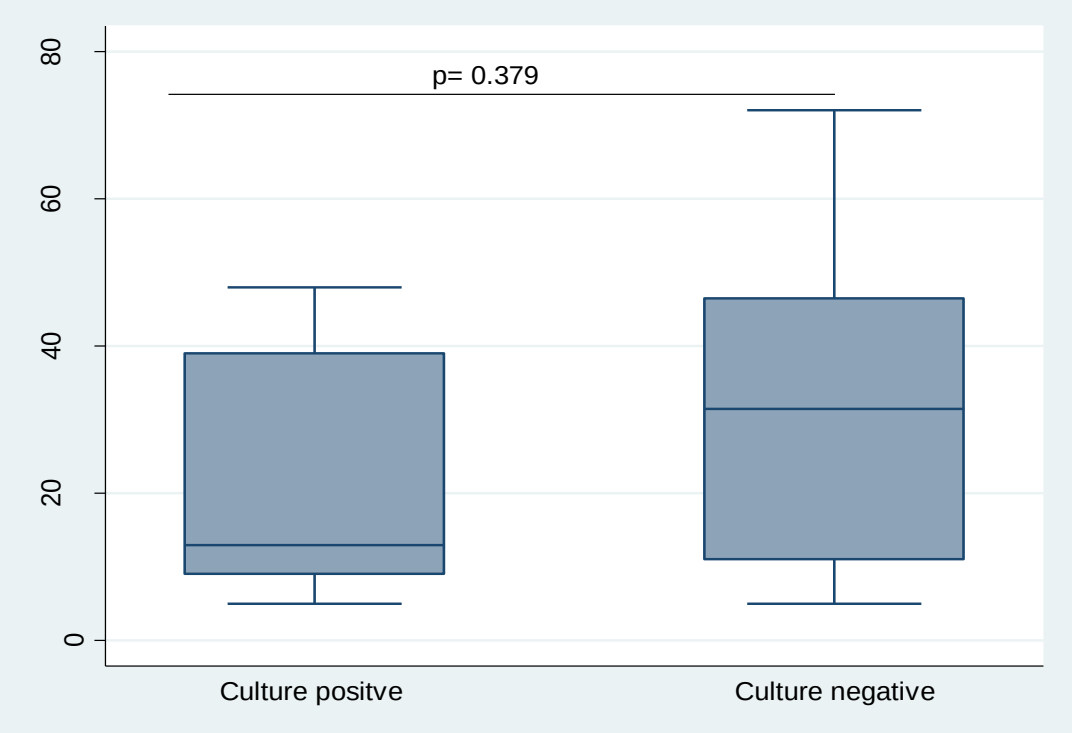

Figure 4.5.1 Relationship between culture results and age

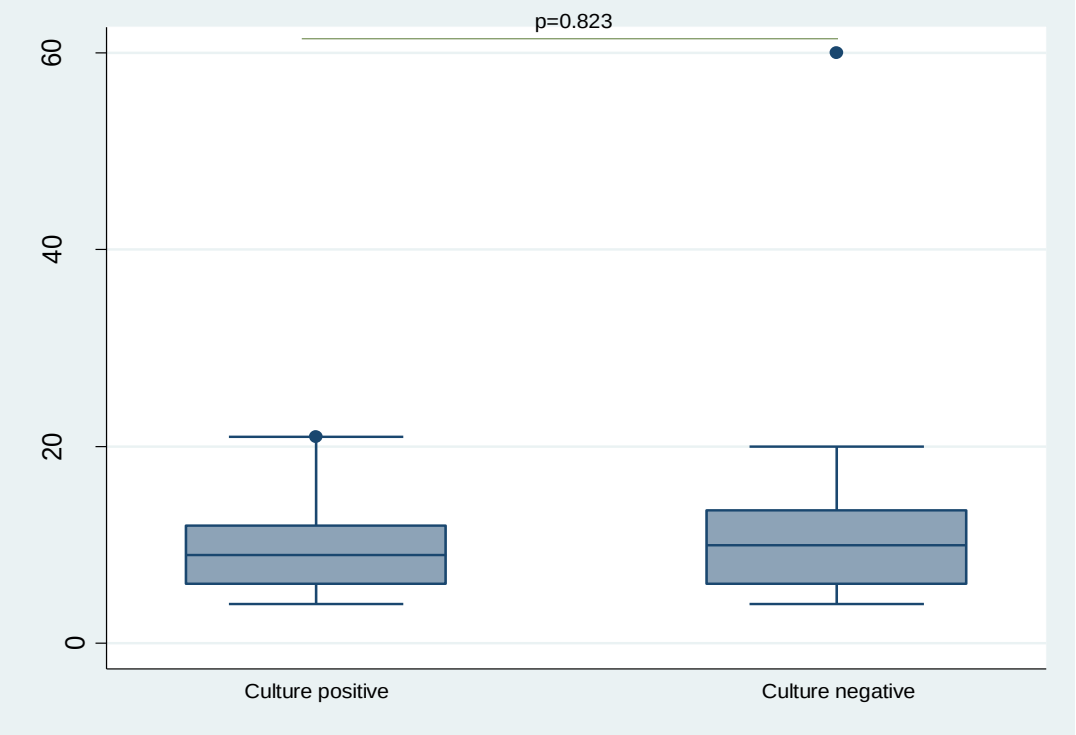

Figure 4.5.2 Relationship between culture results and duration of symptoms

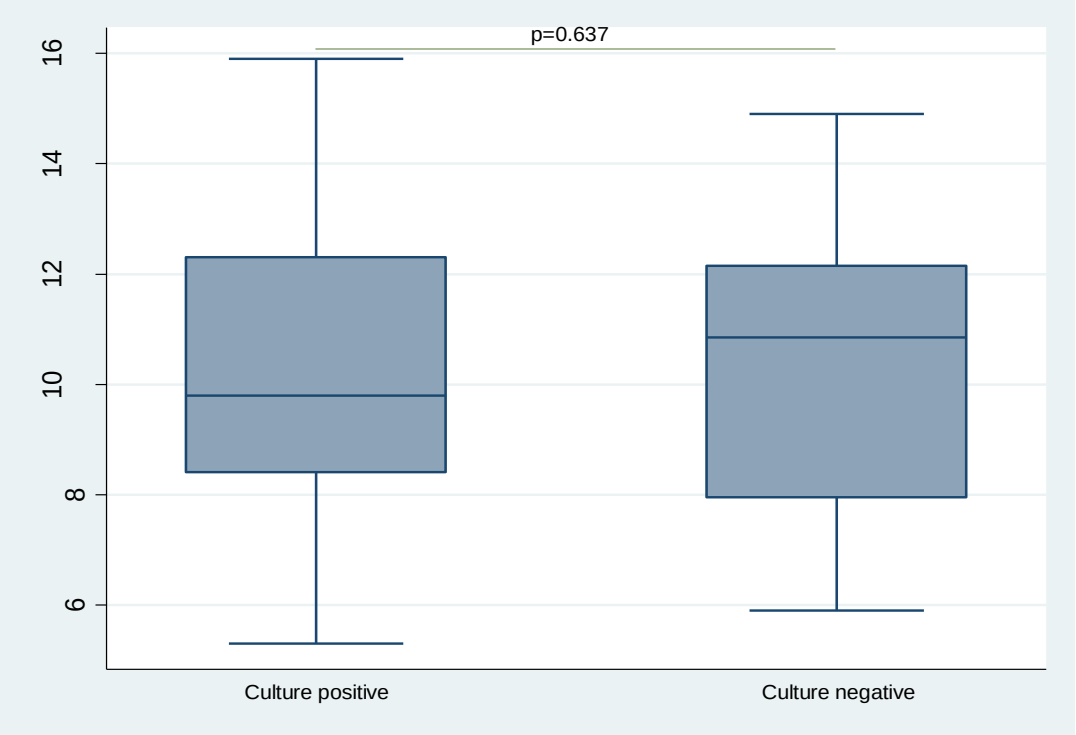

Figure 4.5.3 Relationship between culture results and Haemoglobin concentration

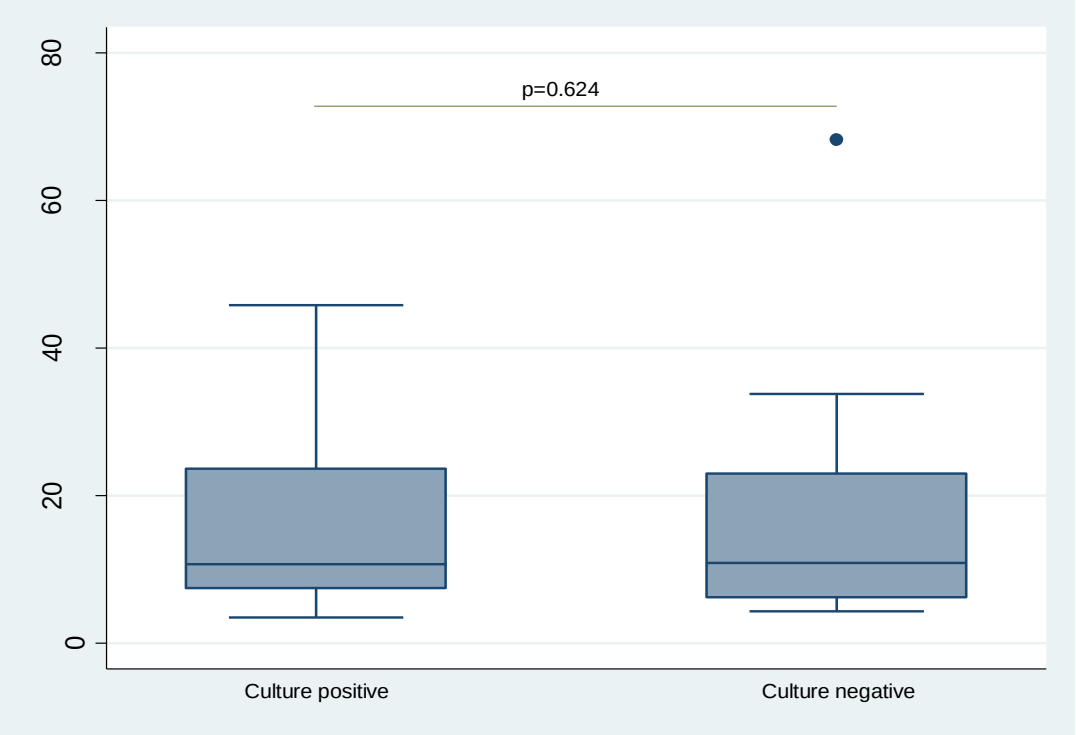

Figure 4.5.4 Relationship between culture results and white blood cell count (WBC)

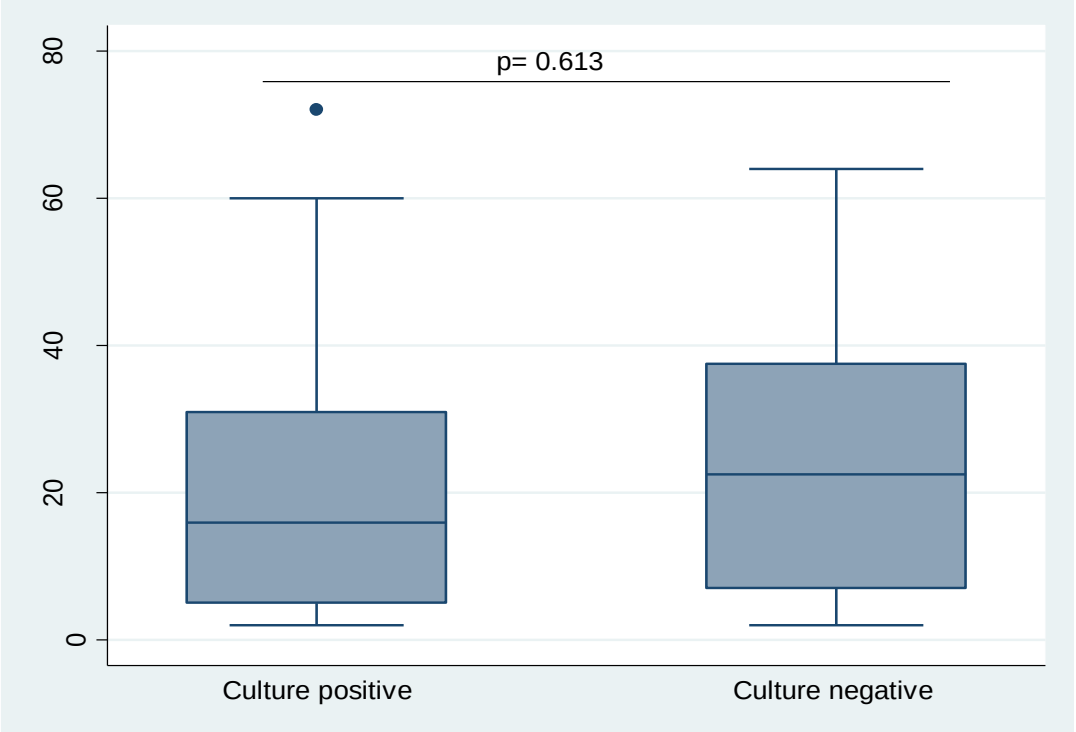

Figure 4.5.5 Relationship between culture results and erythrocyte sedimentation rate

There was a significant association between use of antibiotics and culture results (p=0.024). It was observed that 85.7% of with no history of use of antibiotics were culture positive and 14.3% were culture negative. Those that had a history of antibiotic use had 47.4% positive cultures and 52.6% negative cultures. Details are shown in Table 4.5.1 below.

Table 4.5.1 Relationship between the use of antibiotics and culture results

Use of antibiotics	**Culture**		**Total**	**P-value**
	Positive	Negative		
Yes	9 (47.4)	10 (52.6)	19 (100)	0.024
No	12 (85.7)	2 (14.3)	14 (100)	
	21 (63.6)	12 (36.4)	33 (100)	

4.6 Multivariable logistic regression analysis for prediction of culture-positive septic arthritis

Some independent variables were selected, and multivariable logistic regression was used to determine the association, odds ratio (OR) with 95% confidence interval (CI) of having culture-positive septic arthritis.

For every unit increase in age (per year), there was 3% less likelihood of having culture positive septic arthritis (aOR = 0.97, 95% CI: 0.94 – 1.01, p-value = 0.17). Furthermore, males were 113% more likely of having culture positive septic arthritis

than females (aOR = 2.13, 95% CI: 0.42 – 10.75, p-value = 0.36). The results also showed those living in high density areas 140% of having culture positive septic arthritis (aOR = 2.40, 95% CI: 0.54 – 10.70, p-value = 0.25). Those who had not gone beyond primary level of education were 200% more likely of having culture positive septic arthritis (aOR = 3.00, 95% CI: 0.54 – 16.64, p-value = 0.21). Participants who had come from poor socio-economic status were 17% more likely to have positive cultures (aOR = 1.17, 95% CI: 0.16 – 8.52, p-value = 0.88). For every unit increase in duration of symptoms (days), there was 4% less likelihood of having culture positive septic arthritis (aOR = 0.96, 95% CI: 0.87 – 1.04, p-value = 0.32). For participants that had no history of antibiotic use, there was a 567% chance of culture positive septic arthritis (aOR = 6.67, 95% CI: 1.16 – 38.24, p-value = 0.03). For every unit increase in WBC (x109/L), there was 1% less likelihood of positive culture (aOR = 0.99, 95% CI: 0.94 – 1.04, p-value = 0.78) and for every unit increase in HB, there was 4% less likelihood of positive culture (aOR = 0.96, 95% CI: 0.74 – 1.24, p-value = 0.75). Lastly, for every unit increase in ESR (mm/hr), there was a 1% less likelihood of culture positive septic arthritis.

In this multivariate logistic regression, history of antibiotic use was an only significant variable which was the main predictor for culture-positive septic arthritis. Details are shown in Table 4.6 below.

Table 4.6 Multivariable logistic regression for determination of predictors of culture-positive septic arthritis

Variable	aOR	95% CI	P-value
Age	0.97	0.94 - 1.01	0.17
Sex	2.13	0.42 – 10.75	0.36
Residence	2.40	0.54 – 10.70	0.25
Education	3.00	0.54 – 16.64	0.21
Poverty	1.17	0.16 – 8.52	0.88
Duration of symptoms	0.96	0.87 – 1.04	0.32
History of antibiotic use	6.67	1.16 - 38.24	0.03
WBC	0.99	0.94 – 1.04	0.78
HB	0.96	0.74 – 1.24	0.75
ESR	0.99	0.96 – 1.02	0.67

aOR – adjusted odds ratio *CI – confidence interval*

4.7 Association between demographic data and clinical outcomes

There was an association between age and time to weight-bearing at six weeks (p=0.011) and twelve weeks (p=0.024), as shown below in figures 4.7.1 and 4.7.2, respectively. Younger patients had a shorter time to weight-bearing both at six and twelve weeks compared to older patients.

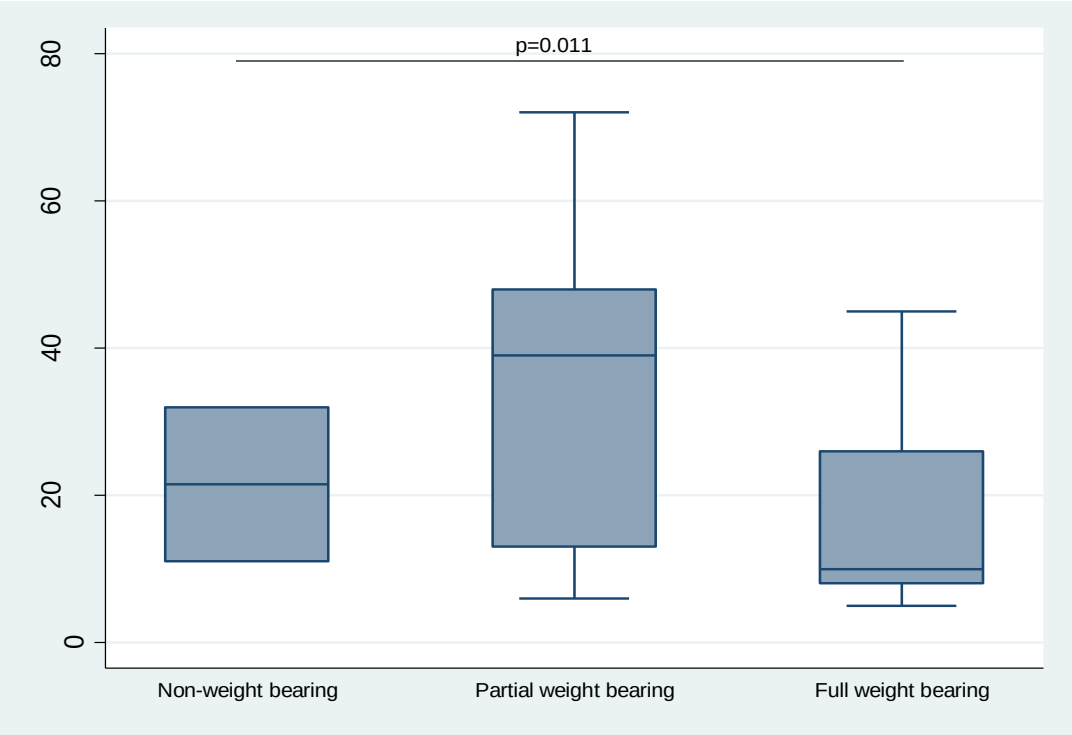

Figure 4.7.1 Relationship between age and weight-bearing at six weeks

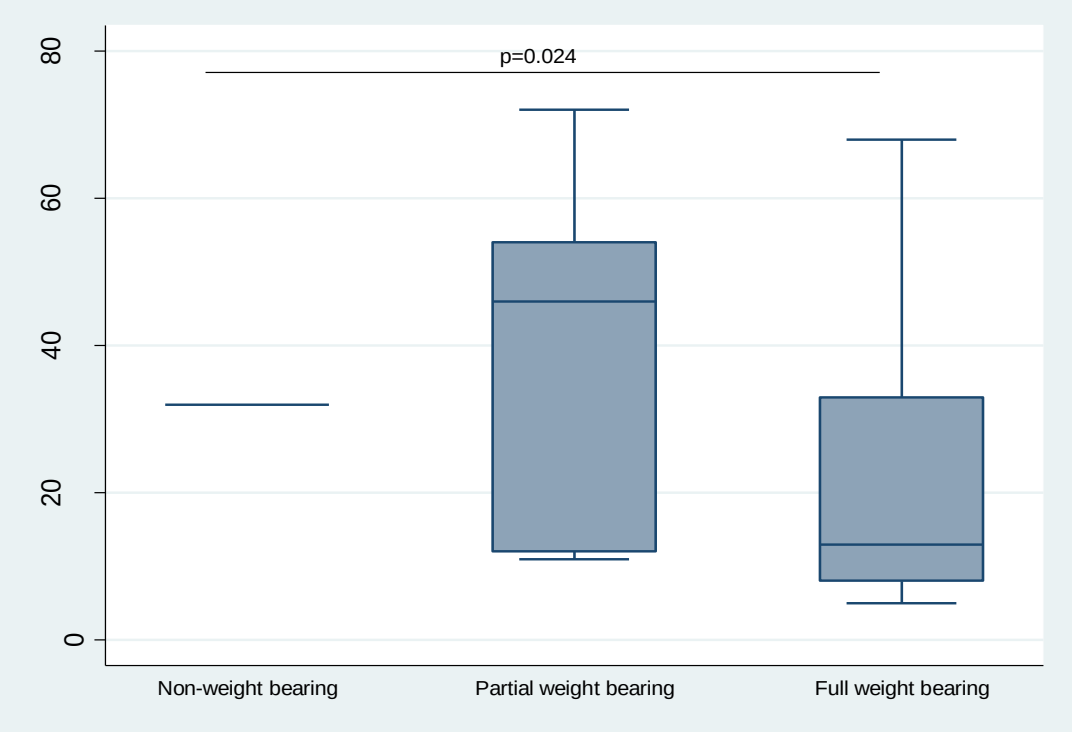

Figure 4.7.2 Relationship between age and weight-bearing twelve weeks

4.8 Association between laboratory data and clinical outcomes

There was no significant relationship between culture results and weight-bearing at six weeks (p=0.680) and twelve weeks (p=0.149). Details are shown in tables 4.8.1 and 4.8.2, respectively. There was an overall improvement in weight-bearing in both culture-positive and negative participants at twelve weeks. Furthermore, there was no significant relationship between duration of symptoms and culture results at six weeks (p=0.114) and at twelve weeks (p=0.180) as shown below in Figures 4.8.1 and 4.8.2, respectively.

Table 4.8.1 Relationship between culture results and weight-bearing at six weeks

Weight-bearing	**Culture**		**Total**	**P-value**
	Positive	**Negative**		
Non-weight bearing	1 (50)	1 (50)	2 (100)	
Partial weight bearing	8 (57.1)	6 (42.9)	14 (100)	0.680
Full weight bearing	12 (70.6)	5 (29.4)	17 (100)	
Total	21 (63.6)	12 (36.4)	33 (100)	

Table 4.8.2 Relationship between culture results and weight-bearing at twelve weeks

Weight-bearing	**Culture**		**Total**	**P-value**
	Positive	**Negative**		
Non-weight bearing	0 (0)	1 (100.0)	1 (100)	
Partial weight bearing	3 (42.9)	4 (57.1)	7 (100)	0.149
Full weight bearing	18 (72.0)	7 (28.0)	25 (100)	
Total	21 (63.6)	12 (36.4)	33 (100)	

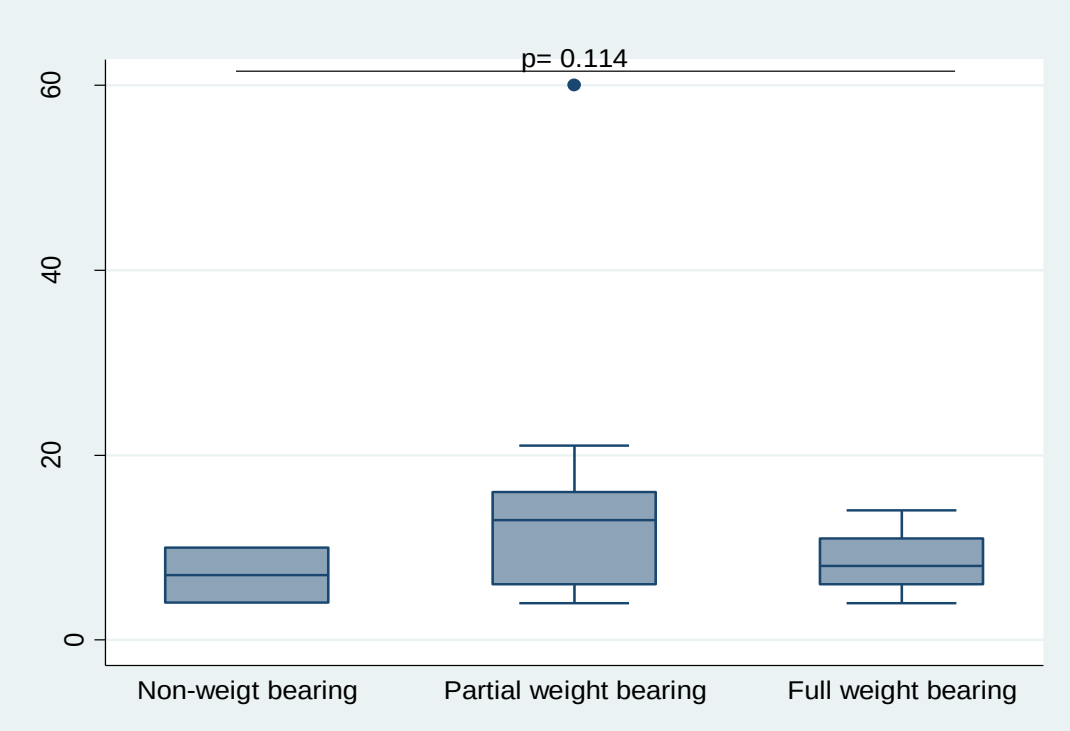

Figure 4.8.1 Relationship between duration of symptoms and weight-bearing at six weeks

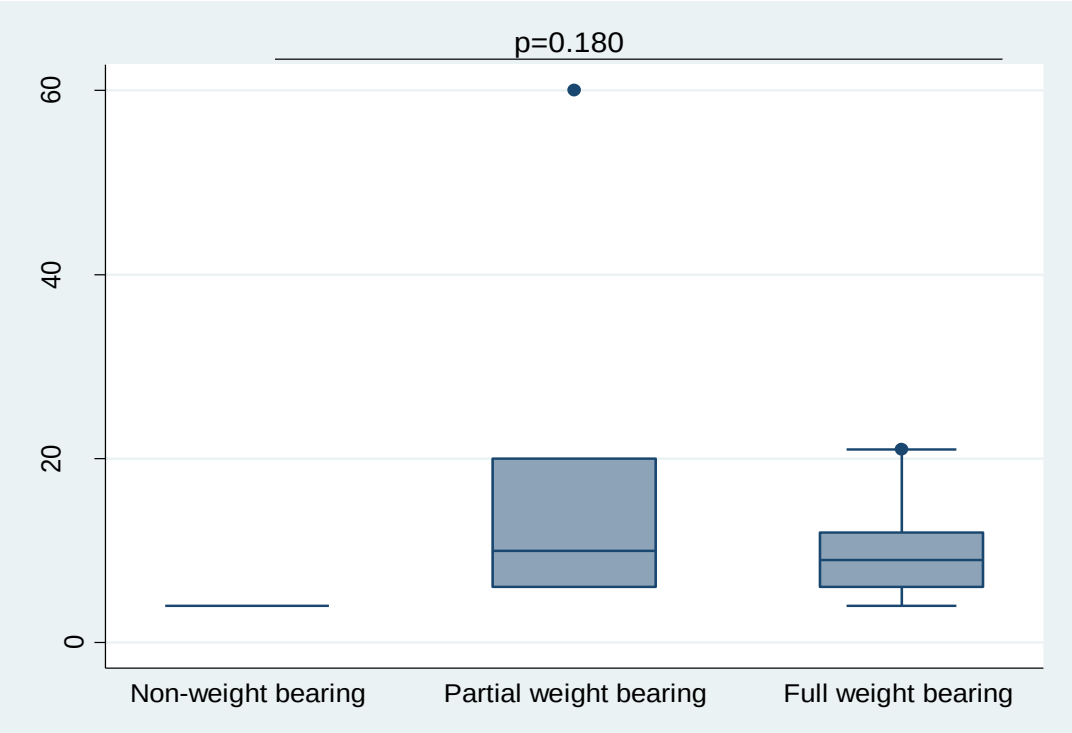

Figure 4.8.2 Relationship between duration of symptoms and weight-bearing at twelve weeks

4.9 Multivariable logistic regression analysis for prediction of full weight-bearing at twelve weeks

Some independent variables were selected, and multivariate logistic regression was used to determine the association, odds ratio (OR) with 95% confidence interval (CI) of full weight-bearing at twelve weeks.

For every unit increase in age (per year), there was 5% less likelihood of being full weight-bearing at twelve weeks (aOR = 0.9, 95% CI: 0.91 – 1.0, p-value = 0.04). Furthermore, females were 58% less likely of being. For every unit increase in the duration of symptoms (days), there was 6% less likelihood of being full weight-bearing at twelve weeks (aOR = 0.94, 95% CI: 0.84 – 1.03, p-value = 0.21). For

every unit increase in WBC (x109/L), there was 4% less likelihood of being full weight-bearing (aOR = 0.96, 95% CI: 0.91 – 1.02, p-value = 0.17) and for every unit increase in HB, there was 4% less likelihood of being full weight-bearing (aOR = 0.96, 95% CI: 0.72 – 1.28, p-value = 0.76). Also, for every unit increase in ESR (mm/hr), there was a 3% less likelihood of being full weight-bearing. Lastly, for those who had positive cultures, there was a 77% less likelihood of being full weight-bearing at twelve weeks.

In this multivariate logistic regression, age was the only significant variable which was the main predictor for being full weight-bearing at twelve weeks. Details are shown in Table 4.9 below.

Table 4.9 Multivariable logistic regression for determination of predictors of full weight-bearing at twelve weeks

Variable	**aOR**	**95% CI**	**P-value**
Age	0.95	0.91 - 1.00	0.04
Sex	0.42	0.07 – 2.36	0.32
Duration of symptoms	0.94	0.84 – 1.03	0.21
WBC	0.96	0.91 – 1.02	0.17
HB	0.96	0.72 – 1.28	0.76
ESR	0.97	0.93 – 1.01	0.14
Culture	0.23	0.44 – 1.25	0.09

aOR – adjusted odds ratio CI – confidence interval

CHAPTER FIVE: DISCUSSION

5.1 Overview

This study had a majority of males affected than females and a median age of 23. The majority of participants lived in high-density areas and were from moderately poor socio-economic status. One-third of participants had trauma as a predisposing factor for developing septic arthritis. The knee was the commonest joint affected, followed by the hip joint. Most participants were also noted to have delayed presentation to our hospital. Two-thirds of joint fluid culture were positive with the majority yielding *S aureus.* Half of these that yielded *S aureus* were *MRSA.*

Poor joint functional outcome was noted in 8% of participants and significantly impaired range of motion in septic arthritis involving the shoulder and elbow.

5.2 Socio-demographic data

In this study, septic arthritis had a median age of 23, affecting both paediatric and adult age groups with similar frequency. This finding is different from many studies that have reported septic arthritis more common in the paediatric age group. In a study done at a tertiary hospital in Nigeria, the most prevalent age group was pre-adolescent which accounted for 50% of all participants with an overall median age of 4.5 years (Alhaji et al., 2016). More males than females were affected with a ratio of 3:1, which is in keeping with several other studies that also showed more male predominance. In this study, the higher male incidence could be attributed to the fact that most males tend to be exposed to traumatic events due to activities undertaken in comparison to females, such as contact sports. Trauma was found to be the commonest predisposing factor in this study. A study in central Nigeria found a male to female ratio of 1.5: (Mue et al., 2013) with similar findings in a study done in

Iceland which found a ratio of 1.7:1 (Geirsson et al., 2008). Some studies though have found equal sex predilection. A Scotland study found a higher incidence in females with a ratio of 3:1 (Gupta et al., 2001). This finding was attributed to pre-existing joint disease such as rheumatoid arthritis and osteoarthritis being the commonest predisposing factor to developing septic arthritis. It has been documented that these diseases have female predominance (Sangha, 2000).

Most patients in this study resided in high-density areas and did not go beyond primary school education. Furthermore, most fell in moderately poor class followed by extremely poor. Some studies have shown most patients with septic arthritis come from low income and in particular in developing world (Molyneux and French, 1982; Smith et al., 2002; Okubo et al., 2017). Furthermore, this patient demographic with septic arthritis was a reflection of patients presenting to our institution.

5.3 Clinical presentation

Trauma was found to be the most prevalent predisposing factor accounting for one-third of all patients, followed by HIV, with other factors such as sickle cell disease, diabetes mellitus and pre-existing joint disease in few patients. Of note, only two patients had a pre-existing joint disease, one of whom also had HIV. These findings were similar to a Paraguayan study that reported a history of trauma in 45% of patients with septic arthritis (Sanabria-Báez et al., 2017). Penetrating and blunt trauma was recognised as predisposing factors for septic arthritis in many studies, but the pre-existing joint disease was documented as the commonest in these studies. A multicentre study done in Scotland revealed that 68% of patients had a pre-existing joint disease, the majority of which was rheumatoid arthritis (Gupta et al., 2003). This difference with our study could be a difference in the prevalence of joint

diseases in our environment and Scotland though the local prevalence is unknown. In contrast, a study done at a University Hospital in Iceland, the iatrogenic cause was a risk noted in septic arthritis in 30.4%. This finding included arthroscopic procedures, intraarticular injections and open joint surgeries. The study found trauma to be the second most common risk factor accounting for 24% of patients followed by osteoarthritis in 19%.

Our study revealed HIV as the second commonest predisposing factor for septic arthritis. The number of participants with HIV was similar to the prevalence in Zambia, which is 11.3% (UNAIDS, 2018). A study in Rwanda found that patients with septic arthritis were more likely to be infected with HIV-1 though the prevalence of septic arthritis in seropositive and seronegative individuals was not statistically significantly different (Saraux et al., 1997). This finding was in a country with a high HIV-1 seroprevalence reaching as high as 30% at that time but has significantly declined since (Kayirangwa et al., 2006).

All patients were on retroviral therapy, but one was noted to be poorly compliant to medication. Though, details of whether these participants were virally suppressed were not obtained.

Of note, we had one paediatric patient who was diagnosed with infective endocarditis a few days after being admitted to hospital for septic arthritis. This patient was aged 11 years with a history of trauma and had developed septic arthritis of knee and ankle. Culture revealed MSSA and was admitted for 38 days. Septic arthritis following infective endocarditis has been reported in a few cases with polyarticular involvement in most instances (Soor et al., 2017). A high index of suspicion is

required for a patient presenting with septic arthritis and a cardiac murmur (Hoyer and Silberbach, 2005).

The commonest joint involved in septic arthritis in this study was the knee. These findings were similar to findings in a study of epidemiology and outcome of septic arthritis in a central Nigeria hospital (Mue et al., 2013). This finding was attributed to the joints of the lower limb being more frequently affected in trauma than the upper limb. This finding would be highly probable in our study as we had trauma as the most prevalent predisposing factor in our participants. The commonest joint side involved was the right for a reason unknown. Different studies have demonstrated no predisposition of the joint side involved in septic arthritis.

In this study, patients showed a delayed presentation to our hospital with a median of 9 days. These delays could be attributed to a lack of transport funds to reach our health facility as most patients fell in moderately and extremely poor categories. Furthermore, most patients will pass through local clinics before being referred to our institution, which could have contributed to delayed presentation. The median duration of hospital stay was within a normal length of stay as patients are put on intravenous antibiotics for 5 to 7 days on an in-patient basis at our institution.

5.4 Laboratory parameters

The median white blood cell count and the erythrocyte sedimentation rate in this study were within a normal range. WBC count in many infectious processes does tend to be raised above normal in most instances, but a normal count does not exclude infectious process such as septic arthritis. ESR, an inflammatory marker also tends to be raised in infectious processes, but normal values do not exclude infection.

Some studies have shown peripheral WBC count and ESR to have poor sensitivity for detecting septic arthritis (Li et al., 2007). The mean haemoglobin concentration was slightly below normal which could not be directly related to the disease process as Zambia has had anaemia prevalence as high as 39% in 1998 (Luo et al., 1999).

The culture-positive results of joint effusion in our study were similar to a prospective comparative study in Scotland of patients with culture-proven and high suspicion of adult-onset septic arthritis in which 68% were culture-positive (Gupta et al., 2003). Some other studies have found lower culture-positive rates as low as 40% (Arshi et al., 2019). Culture negative results in the presence of overt infection are possible. They may be due to a history of antibiotic use before sample collections as was noted in our study, which found there was a significant association between use of antibiotics and culture. Most of our patients that had negative cultures had a prior history of use of antibiotics. Also, negative cultures have been attributed to the presence of less virulent organism as well as reduced disease burden (Spyridakis et al., 2019). Furthermore, non-availability or inadequate anaerobic cultures also could contribute to the high percentage of negative cultures (Agarwal and Aggarwal, 2016).

Our study also revealed that those in the younger age group had more positive cultures compared to the older age group though this was not statistically significant. This finding may be attributed to the possibility of an older age group self-medicating on antibiotics compared with younger age groups.

For those that had positive cultures, *Staphylococcus aureus* was the most prevalent organism cultured, which was similar to most other studies that reported it as commonest in all age groups. A study in a tertiary care hospital in India revealed *S.*

aureus in 72% of culture-positive joint aspirate. Furthermore, a retrospective study in a teaching hospital in Nigeria revealed *S. aureus* as the commonest organism in septic arthritis (Alhaji et al., 2016).

Locally, a study done at Mukinge mission hospital in rural northwestern province found *Salmonella species* as the most prevalent organism in septic arthritis (Lavy et al., 2016). This difference may have been attributed to the fact that this study involved children less than three years of age which our study did not have as the youngest was five years old.

In this study, there was an equal distribution of *MSSA* and *MRSA,* which is in keeping with recent studies that show MRSA incidence has been on the rise. These findings were similar to a California based cross-sectional retrospective study that revealed MRSA in 50% of S. aureus cultured (Frazee et al., 2009). Studies have shown a rise in MRSA in the past years. A retrospective study in Tennessee done between 1st January 2000 and 31st December 2004 revealed an increase in MRSA cases in 2003 and 2004 compared to previous years (Arnold et al., 2006). Locally, the prevalence of MRSA has been reported as 30.7% in a study done involving breast abscess patients at The University Teaching Hospital in 2010 (Kapatamoyo et al., 2010). A subsequent study done at UTH found a prevalence of 40.6% in 2014 (Mwamungule et al., 2015). This finding does show a rise in MRSA cases at our institution over the past ten years.

The MRSA could more likely be community-acquired which is more virulent and less resistant. The idea drug for coverage would be Vancomycin (Gupta et al., 2001; Raut et al., 2017). Vancomycin is not readily available locally. From the antibiogram, other alternatives such as Ciprofloxacin, which is currently our first-line

treatment for septic arthritis at our institution, has a higher sensitive proportion in vitro and is already known to have good bone penetration (Landersdorfer et al., 2009). However, the greatest challenge is it has inducible resistance while the patient is on treatment hence not recommended for treatment of MRSA (Raut et al., 2017). Clindamycin is a good and effective alternative (Martínez-Aguilar et al., 2003), despite not being available in Zambia and being expensive. It also carries a higher risk of antibiotic-related diarrhoea referred to as *C difficile* (Berild et al., 2003). The remaining alternatives, therefore, include drugs such as Trimethoprim-sulfamethoxazole, Doxycycline and Linezolid which are all readily available locally as long as there is no infective endocarditis as these are bacteriostatic drugs (Davis, 2005). Linezolid can be combined with Rifampicin to increase on the clinical outcomes of patients with MRSA septic arthritis (Coiffier et al., 2013). Though caution has to be taken considering 34% of the culture results in this study were negative which could be explained by *Mycobacteria tuberculosis* so patients may eventually be on two drugs with anti- tuberculous effect and for a shorter duration.

This study also cultured one of each *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *Streptococcus sp*. For *Pseudomonas* and *klebsiella*, these are usually hospital-acquired organisms but can exist in patients with a predisposition to them such as alcoholics and diabetics (Schelenz et al., 2007). More express beta-lactamases which confer resistance to penicillin and cephalosporins except for fourth-generation cephalosporins (Babic et al., 2006).

For streptococcus species, there was resistance to penicillin and macrolides, which could be explained by extended use of the two drugs for management of common community-acquired pneumonia for which the patient could have been treated in the recent past before presenting with septic arthritis (Baquero, 1999). The gentamycin

sensitive isolate would require synergy from penicillin (Ruppen et al., 2016) which would increase the entry of the drug into the organisms though this cannot be achieved due to resistance of the penicillin. The alternatives are third-generation cephalosporins and linezolid which were not tested for in the isolates submitted to the lab.

5.5 Clinical outcome

The mean range of motion for hip, knee and ankle joints was within the normal range at twelve weeks except for the shoulder and elbow joints which had significantly reduced range of motion. There was an improvement at twelve weeks compared with six weeks of assessments. Shoulder and hip septic arthritis have been reported to have a poor outcome compared to other joints. This finding was attributed to these joints having the epiphysis contained within the joint and possibly being more susceptible to infection and vascular compromise (Mue et al., 2013). Septic arthritis of the elbow is rare (Bowakim et al., 2010) and accounted for one patient in our study who had significant loss of range of motion. The elbow is prone to stiffness following any insult to it as there is a loss of soft tissue compliance (Evans et al., 2009). Furthermore, the elbow requires an early range of motion to prevent stiffness following most insults to it to prevent stiffness (Evans et al., 2009).

At the six-week review, half of our patients were full weight-bearing. This observation improved at twelve weeks review at which most were full weight-bearing. This observation showed an improvement in joint function over time. A quarter of the participants, though at twelve weeks, had poor joint function as they had not returned to full function. The younger age group were the majority that was full weight-bearing at six and twelve weeks compared with the adult age group. Our

results showed a significant association between age and weight-bearing. Older patients had a long period of return to full weight-bearing compared with younger patients. It has been documented that morbidity in septic arthritis does increase with patient age. The older age group are at higher risk of poor outcomes compared with the young (Momodu and Savaliya, 2020). This finding could be because, with advancing age, there is impairment in the immune system and risk of comorbidities compared with younger age groups. Furthermore, it could be that older patients are at a higher likelihood of underlying joint disease (Kaandorp et al., 1997) though only two of our participants reported underlying joint disease.

In our study, there was no significant relationship between duration of symptoms and time to weight-bearing, despite most patients having delayed presentation. Several studies have reported a delayed presentation as a poor outcome for septic arthritis (Mue et al., 2013). On multivariate logistic regression analysis, it was noted that patients with positive culture were less likely to be full weight-bearing at 12 weeks compared to those with negative cultures though the relationship was not statistically significant. Some studies have shown a relationship between culture-positive septic arthritis and poor joint outcomes and attributed this to the virulence of individual organisms (Shirtliff and Mader, 2002).

This study did not exhibit other risk factors for poor outcomes as other studies, possibly because most studies had long term follow up and some of the poor outcomes can only be picked at this time (Kaandorp et al., 1997).

No mortalities were reported at the time of final follow up of the study participants.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study revealed:

1. Septic arthritis was more in males and in those from low social, economic status and those who lived in high-density areas.
2. Trauma was the most prevalent predisposing factor for developing septic arthritis.
3. The knee was the commonest joint affected in septic arthritis.
4. Patients presenting with septic arthritis had a delayed presentation to our institution.
5. *S aureus* was the commonest causative organism in septic arthritis at UTH and MRSA accounted for half of these cases.
6. The elbow and shoulder joints were associated with early poor functional outcome.
7. Older age was associated with early poor functional outcome.

6.2 Recommendations

1. There is a need for more sensitive diagnostic tools for septic arthritis such as PCR to detect microorganisms that are not detected on the routine culture of joint fluid.
2. Revision of first-line antibiotics of patients presenting with septic arthritis taking into account the high prevalence of MRSA found in this study.
3. Older age groups require closer monitoring and rehabilitation following septic arthritis.

4. Septic arthritis involving shoulder and elbow joints require an early range of motion to reduce associated morbidity in these joints.

6.3 Study limitations

- This study had a small sample size which may increase the margin of error of our data. For instance, few patients had elbow and shoulder septic arthritis, and these were reported to have poor outcomes.
- Septic arthritis is well known to have long term sequelae, but this study had short term follow up, and so some patients may develop other poor outcomes associated with the disease at a later stage.
- This study was a single centre study which may not be a true reflection of other populations within the country.

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FACTORS ASSOCIATED WITH EARLY CLINICAL OUTCOMES OF SEPTIC ARTHRITIS TREATED AT THE ADULT UNIVERSITY TEACHING HOSPITAL LUSAKA

APPENDIX A

PARTICIPANT'S INFORMATION SHEET

I am Dr Mwamba J C Mulenga, a medical doctor pursuing a master's degree in Orthopaedic and Trauma Surgery at the University Teaching Hospital. As part of my academic qualification, I am conducting a study to determine predisposing factors, microbiological profile and short term clinical outcomes of septic arthritis at the Adult hospital of The University Teaching Hospitals, Lusaka.

What is a research study?

A research study is when people like me collect a lot of information about a certain thing to find out more about it. Before you decide if you want to be in this study, it is important for you to understand why we are doing this study and what is involved.

Please read this form carefully. You can discuss it with your parents or anyone else. If you have questions about this research, feel free to ask me.

Why are we doing this study?

We are doing this study to find out the type of germs present in infection of the joint and what medicines to use for their treatment. We also want to know if the infection in the joint causes any other problems.

Why are we talking to you about this study (if under 18years)?

We are inviting you to take part because our research involves young patients like you who are also affected.

What will happen if you are in this study?

If you agree to take part in the study and your parents give permission (if under 18 years), we will do the following:

1.) Several questions will be asked by me to find out more information about you.
2.) Trained and experienced medical personnel will collect blood samples in 2 bottles to take to the lab on the day we admit you. These blood samples will usually be collected from the veins in your arm using a needle and syringe. Trained medical personnel will tie a band called a tourniquet around your arm to make your veins more prominent. The site of the collection will be cleaned with methylated spirit solution and then less than 8ml of blood drawn with a needle and syringe and emptied into 2 bottles which will be taken to the lab by medical personnel.
3.) Collection of swabs to check if there are germs in the joint will be done at the time you are in theatre during the routine procedure performed to drain the pus from the joint.
4.) HIV testing is entirely voluntary and will be done by trained counsellors under conditions of complete privacy.

The information collected will be transferred to a data collection form.

Furthermore, you can skip any questions on the data collection sheet that you do not wish to answer, and this will have no bearing on your management.

If you don't want to be in the study, what can you do instead?

You have the right to refuse to participate in this study, and you will still be treated like any other patient who comes with infection in the joint at the University Teaching Hospitals.

Are there any benefits to being in the study?

There are no personal benefits as you will be taken care of like any other patient who presents with infection in the joint. Though for the benefit of others, we hope that the results of this research will improve the management of patients with infection in the joint at the University Teaching Hospitals.

Are there any risks or discomforts to being in the study?

There are very minimal risks associated with participating in the study. I will ensure methods undertaken during this study will be to reduce any risk as much as possible**.** The risks include reacting to the swabs, as well as mild pain when collecting blood samples. Furthermore, there is a risk of developing swelling or infection at the site of blood collection. Approved swabs will be used to collect samples to reduce the risk of reacting to swabs. Collection of blood samples will be by trained and experienced medical personnel to avoid multiple pricks, thus avoiding any swelling, pain or discomfort if you choose to participate. Collection of blood samples will be under the sterile condition to reduce the risk of infection at the blood collection site.

Who will know about your study participation?

Apart from yourself, your guardian (if under 18) and researcher, no one will know about your participation and the results as the information will be kept private. Group results, however, will be communicated to you and will get published in journals.

Will you get paid for being in the study?

You will not get paid for taking part in this study.

Do you have to be in the study?

No, you do not. Research is something you do on a voluntary basis. No one will be annoyed with you if you do not want to be in the study. And whether you decide to participate or not, will have no effect on the routine treatment you get at the University Teaching Hospitals.

Do you have any questions?

You can contact ERES CONVERGE IRB or myself if you have questions about the study, or if you decide you do not want to be in the study any more. You can talk to me, or your guardian (if under 18), or someone else at any time during the study.

If you decide to participate, and your guardian agrees (if under 18), we will give you a copy of this form to keep for future reference.

Dr Mwamba J.C. Mulenga
University Teaching Hospital,
Private Bag 1X RW,
LUSAKA.
Phone: +260977667173
Email: mwambachiteba@gmail.com
OR

The Chairperson
ERES CONVERGE IRB
33 Joseph Mwilwa Road
Rhodespark
LUSAKA
Tel: 0955155633/4
Email: eresconverge@yahoo.co.uk

FACTORS ASSOCIATED WITH EARLY CLINICAL OUTCOMES OF SEPTIC ARTHRITIS TREATED AT THE ADULT UNIVERSITY TEACHING HOSPITAL LUSAKA

APPENDIX B

ASSENT FORM

If you would like to be in this research study, please sign your name on the line below.

_____ _____

Child's Name/Signature or thumb print (*by child*) Date

_____ _____

Signature of Investigator/Person Obtaining Assent Date

_____ _____

Witness Date

FACTORS ASSOCIATED WITH EARLY CLINICAL OUTCOMES OF SEPTIC ARTHRITIS TREATED AT THE ADULT UNIVERSITY TEACHING HOSPITAL LUSAKA

APPENDIX C

CONSENT FORM

I_____ have read the above information sheet, or it has been read to me. I have had the opportunity to ask the questions concerning the study and these have been answered to my satisfaction. Furthermore, I understand I can skip any questions on the data collection sheet that I do not wish to answer and that I am free to withdraw from the study at any time and this will have no bearing on my management.

I consent voluntarily for _____ to participate in this study.

Name of participant_____

_____ Date: _____

Signature or thumb print of participant/ guardian

---------- Date: ----------

Signature of investigator

---------- Date: ----------

Witness

LOCAL LANGUAGE TRANSLATION: NYANJA

ZINTHU ZOKHUDZA ZOTSATITIRA ZACHIPATALA ZACHIDULE ZA ANTHU OLANDILA THANDIZO PAMATENDA A NYAMAKAZI PACHIPATALA CHOPHUNZITSIRA ZAUMOYO MUMUZINDA WA LUSAKA

Zamapeto Zoyamba (APPENDIX D)

Pepala la Chidziwitso kwa Odwala Otengako Mbali Kuphunziro

Dzina langa ndine Mwamba J.C. Mulenga dotolo ophunzira zaukaswili za anthu othyoka minyendo ndiponso opezeka mungozi. Ndikuphunzira pachipatala chopunnzitsira zaumoyo mumuzinda wa Lusaka. Mwazofunikira kuti ndithe maphunziro anga aukaswili ndikuchita kafukufuku kuti ndione mndandanda wa zilombo ndiponso zotsatira zachipatala zakanthawi pamatenda a nyamakazi muchipatala chathu.

Kodi phunziro ndi ciani?

Kafufuzidwe ndi pamene anthu ngati ine amasonkhanitsa zambiri zokhudza chinthu china kuti mudziwe zambiri za izo. Musanayambe kusankha ngati mukufuna kukhala mu phunziro lino, nkofunika kuti mumvetse chifukwa chake tikuchita kafukufuku ndi zomwe zikukhudzani.

Chonde werengani fomuyi mosamalitsa. Mutha kukambirana ndi makolo anu kapena wina aliyense. Ngati muli ndi mafunso okhudza kafukufukuyu, omasuka kundifunsa

Nchifukwa chiyani tikuchita phunziroli?

Tikuchita phunziro ili kuti tiwone mtundu wa majeremusi omwe alipo pa matenda a mgwirizano ndi mankhwala omwe angagwiritsidwe ntchito kuti athe kuchiritsira. Timafunanso kudziwa ngati kachilombo koyambitsa matendawa kakuyambitsa mavuto ena mthupi la odwalayo.

Nchifukwa chiyani tikuyankhula nanu za phunziroli (ngati muli ndi zaka zochepekera khumi limodzi, chisanu ndi chitatu)?

Tikukulimbikitsani kutengako mbali chifukwa kafukufuku wathu akuphatikiza odwala omwe ali ngati inu pazaka zakubadwa.

Nchiyani chiti chichitike ngati muli mu phunziroli?

Ngati mukuvomera kukhala mu phunziro ndipo makolo anu amapereka chilolezo (ngati osakwana zaka 18), tidzachita izi:

1) Ndikufunsa mafunso angapo ndekha kuti ndiziwe zambiri zokhudza inu.

2) Akaswili azakutengani magazi ndikuika mutumabotolo tibili ndi kutipereka kumalo opimila. Izi zizachitika patsiku loyamba, pakapita mwezi umodzi ndiponso pakutha kwa miyezi itatu.

3) Akaswili azatenga mafina ochekela mumugwilizano pomwe muli kumalo owonetsera kulingana ndi chizolowedzi chathu. Mafina azapimidwa kuti tipeze

majeremusi omwe angapezekemo

4) Muli ndi ufulu kubovemekeza kapena kukana kupimiza magazi patulombo ta *HIV*.

Tizalowetsa zonse zosonkhanitsidwa mu fomu yosonkhanitsa deta.

Ndiponso, muli ndi ufulu kuthawa mafunso alionse amene simufuna kuyankha. Mukatelo muzalandilabe thandizo monga odwala aliyense muchipatala chathuchi.

Kodi kuli kupatsidwa mulandu ngati simufuna kutengako mbali?

Muli ndi ufulu wokana ngati simufana kutengako mbari ku phunziro ndipo musayope kuti mwina simuzalandira thandizo lachipatala. Ndikukutsimikizani kuti muzalandilabe thandizo.

Kodi ndizapata ciani potengako mbali?

Mukutengako mbali kuphunziro iri simupata ndalama kapena malipiro amtundu uli onse. Koma zotuluka muphunziro zithandizire achipatala pakuthandiza anthu odwala matenda anyamakazi obwera ndi zilombo m'mgwirizano.

Kodi ndingapezeke mungozi potengako mbali ku phunziro?

Kulibe ngozi ili yonse yomwe mungazekemo pakutengako mbali ku phunziro. Mankhwala oletsa kukalipa amapatsidwa potenga mafima mmgwirizano. Koma mwina mungathe kumva kuwawa pang'ono. Zonsezi zizachitidwa ndi akaswili.

Ndani azaziwa kuti mwatengako mbali?

Kutengako mbali ku phunziro ndichinsinsi chathu ndipo sitizaulutsa maina anu. Zotuluka muphunziro ziribe maina. Chonde palibe anthu ena omwe azapatsidwa mpata kuziwa za inu.

Kodi mukufuna kudziwa zina ndi zina zache?

Ngati muli ndi mafunso chonde mungathe kuniimbira lamya kapena kundilembera kalata.Mungathenso kuonana ndi akulu akabungwe koona kuti phunziro likuyenda bwino. Ngati mwabvomekeza kutengako mbali muzapatsidwa pepala ili kuti muziwengapo.

Dr Mwamba J.C. Mulenga
University Teaching Hospital,
Private Bag 1X RW,
LUSAKA.
Phone: +260977667173
Email: mwambachiteba@gmail.com

OR

The Chairperson
ERES CONVERGE IRB
33 Joseph Mwilwa Road
Rhodespark
LUSAKA
Tel: 0955155633/4
Email: eresconverge@yahoo.co.uk

ZINTHU ZOKHUDZA ZOTSATITIRA ZACHIPATALA ZACHIDULE ZA ANTHU OLANDILA THANDIZO PAMATENDA A NYAMAKAZI PACHIPATALA CHOPHUNZITSIRA ZAUMOYO MUMUZINDA WA LUSAKA

Zamapeto Zachiwiri (APPENDIX E)

Pepala lachibvomekezo Kwa Mwana

Ngati mwawerenga ndi kubvomekeza kutengako mbari ku phunziro, chonde mupemphedwa kusaina dzina lanu.

Dzina la mwana…… Kusaina/kufwatika……. Tsiku……

Dzina la mboni…….Kusaina/kufwatika…….Tsiku……..

Dzina la otenga chibvomekezo……. Kusaina……..Tsiku

ZINTHU ZOKHUDZA ZOTSATITIRA ZACHIPATALA ZACHIDULE ZA ANTHU OLANDILA THANDIZO PAMATENDA A NYAMAKAZI PACHIPATALA CHOPHUNZITSIRA ZAUMOYO MUMUZINDA WA LUSAKA

Zamapeto Zachitatu (APPENDIX F)

Pepala lachibvomekezo

Ine……. ndikukutsimikidzirani kuti ndawerenga kapena andiwerengera zonse zokhuza kutengako mbali ku phunziroli. Ndikutsimikidzanso kuti zonse zomwe zingandidetse nkhawa andimatsurira bwino ndipo ndine wokhutira. Anditsimikidzira kuti ndiri ndi ufulu osayankha mafunso omwe sakundikhuza popanda chiopsedzo. Mwa ichi ndikubvomekeza kuti…… atengeko mbali ku phunziroli.

Dzina la otengako mbali/kholo…… kusaina……Tsiku ……

Dzina la otenga chibvomekezo……Kusaina…….Tsiku…….

Dzina la opereka umboni……..Kusaina…….Tsiku……..

FACTORS ASSOCIATED WITH SHORT TERM CLINICAL OUTCOMES OF SEPTIC ARTHRITIS TREATED AT THE ADULT UNIVERSITY TEACHING HOSPITAL LUSAKA

APPENDIX G

DATA COLLECTION SHEET

PATIENT CODE: | |

PART A: DEMOGRAPHIC DATA

1. AGE

2. SEX

Male	Female

3. RESIDENCE

Low density	Medium density	High density

4. LEVEL OF EDUCATION

Primary	Secondary	Tertiary

5. POVERTY LEVEL

Extremely poor	Moderately poor	Non-poor

PART B: CLINICAL DATA

1. PREDISPOSING FACTORS

TRAUMA	HIV	MALNUTRITION	PRE-EXISTING JOINT DISEASE	DIABETES MELLITUS	OTHER (specify)

If HIV positive:

CD4 COUNT	VIRAL LOAD	ON TREATMENT (Y/S)	COMPLIANCE (Y/S)

2. JOINT INVOLVED

HIP	KNEE	SHOULDER	ANKLE	ELBOW	OTHER(specify)

3. DURATION OF SYMPTOMS

4. HISTORY OF ANTIBIOTICS

YES	NO

If yes, specify……

Duration ……

5. HAEMATOLOGY PARAMETERS

WBC	HB	ESR	

6. POSITIVE FOR CULTURE

YES	NO

If yes, specify……

7. SUSCEPTIBILITY

Susceptible	Intermediate	Resistant

8. DURATION OF HOSPITAL STAY POST OP

PART C: FOLLOW UP VISITS

1. AT 6 WEEKS

Range of motion:

Weight bearing

Non-weight bearing	Partial weight bearing	Full weight bearing

2. AT 12 WEEKS

Range of motion:

Weight bearing

Non-weight bearing	Partial weight bearing	Full weight bearing

Plot No. 1, Cnr Joseph Mwilwa & Great East Road
Rhodes Park, Lusaka - Zambia
Tel: +260 955 155 633
+260 955 155 634
Cell: +260 977 493220
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I.R.B. No. 00005948
E.W.A. No. 00011697

9th July, 2019

Ref. No. 2019-Mar-007

The Principal Investigators
Dr. Mwamba J. C. Mulenga
University Teaching Adult Hospital
Dept. of Surgery,
LUSAKA.

Dear Dr. Mulenga,

RE: FACTORS ASSOCIATED WITH SHORT TERM CLINICAL OUTCOMES OF SEPTIC ARTHRITIS TREATED AT THE ADULT HOSPITAL OF THE UNIVERSITY TEACHING HOSPITAL, LUSAKA.

Reference is made to your protocol dated 2nd July, 2019. The IRB resolved to approve this study and your participation as Principal Investigator for a period of one year.

Review Type	**Ordinary**	Approval No. **2019- Mar-007**
Approval and Expiry Date	Approval Date: 9th July, 2019	Expiry Date: 8th July, 2020
Protocol Version and Date	Version - Nil.	8th July, 2020
Information Sheet, Consent Forms and Dates	• English, Nyanja.	8th July, 2020
Consent form ID and Date	Version - Nil	8th July, 2020
Recruitment Materials	Nil	8th July, 2020
Other Study Documents	Data Collection Sheet.	8th July, 2020
Number of participants approved for study	33	8th July, 2020

Specific conditions will apply to this approval. As Principal Investigator it is your responsibility to ensure that the contents of this letter are adhered to. If these are not adhered to, the approval may be suspended. Should the study be suspended, study sponsors and other regulatory authorities will be informed.

Conditions of Approval

- No participant may be involved in any study procedure prior to the study approval or after the expiration date.
- All unanticipated or Serious Adverse Events (SAEs) must be reported to the IRB within 5 days.
- All protocol modifications must be IRB approved prior to implementation unless they are intended to reduce risk (but must still be reported for approval). Modifications will include any change of investigator/s or site address.
- All protocol deviations must be reported to the IRB within 5 working days.
- All recruitment materials must be approved by the IRB prior to being used.
- Principal investigators are responsible for initiating Continuing Review proceedings. Documents must be received by the IRB at least 30 days before the expiry date. This is for the purpose of facilitating the review process. Any documents received less than 30 days before expiry will be labelled "late submissions" and will incur a penalty.
- Every 6 (six) months a progress report form supplied by ERES IRB must be filled in and submitted to us.
- A reprint of this letter shall be done at a fee.

Should you have any questions regarding anything indicated in this letter, please do not hesitate to get in touch with us at the above indicated address.

On behalf of ERES Converge IRB, we would like to wish you all the success as you carry out your study.

Yours faithfully,
ERES CONVERGE IRB

Dr. Jason Mwanza
Dip. Clin. Med. Sc., BA., M.Soc., PhD
CHAIRPERSON

UNIVERSITY OF ZAMBIA
SCHOOL OF MEDICINE

Telephone : +260211252641
Telegram: UNZA, Lusaka
Telex: UNZALU ZA 44370
Email: assistantdeanpgmedicine@unza.zm

P.O Box 50110
Lusaka, Zambia

21 February 2019

Dr. Mwamba Josephine Chiteba Mulenga
Department of Surgery
University of Zambia
LUSAKA

Dear Dr. Mulenga

RE: GRADUATE PROPOSAL PRESENTATION FORUM

Following the presentation of your proposal entitled **"Factors Associated with Short Term Clinical Outcomes of Septic Arthritis at the Adult University Teaching Hospital"** your Supervisor has confirmed that the necessary corrections to your research proposal have been done.

You can proceed and present to the Rescarch Ethics.

Yours Sincerely

Dr. Lavina Prashar
Assistant Dean, Postgraduate

cc: HOD – Surgery

UNIVERSITY OF ZAMBIA
SCHOOL OF MEDICINE
21 FEB 2019
ASSISTANT DEAN (PG)
P.O. BOX 50110, LUSAKA.

Dr. Mwamba J.C. Mulenga
University of Zambia
School of Medicine
P.O. Box 50110
Lusaka, Zambia

19th February 2019

Senior Medical Superintendent
University Teaching Adult Hospital
P/Bag RW 1X
Lusaka, Zambia

UFS: Head of Department
Department of Surgery
University Teaching Adult Hospital
Lusaka

Dear Sir,

RE: APPLICATION FOR AUTHORISATION TO CONDUCT A RESEARCH FOR MMED DISSERTATION

The above subject refers.

I am an Orthopaedic and Trauma Surgery Registrar under the University of Zambia, School of Medicine, in the third year of study. As a requirement for the MMED degree award, I would like to conduct a research study entitled "**Factors associated with short term clinical outcomes of Septic Arthritis at The University Teaching Adult Hospital, Lusaka, Zambia.**" The study proposal has been approved by the Department of Surgery and Graduate Proposal Presentation Forum. The study is expected to run for twelve months in the Department of Surgery.

Your prompt response would be great appreciated.

Yours faithfully,

Dr. Mwamba J.C. Mulenga
MMED Orthopaedic and Trauma Surgery
University Teaching Adult Hospital
LUSAKA