

Prevalence and Risk Factors Associated with Implant Infections in Orthopedic Surgeries at Songea Regional Referral Hospital, Tanzania

Lumbe HY*, Wella AL and Magumba MJ

Songea Regional Referral Hospital, PO Box 5, Songea, Tanzania

*Corresponding author:

Hassan Lumbe,
Songea Regional Referral Hospital, PO Box 5,
Songea, Tanzania

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1. Abstract

1.1. Background: Post-operative wound infections, specifically those involving implants, present significant challenges in orthopedic surgeries, impacting morbidity, costs, and mortality. This study aimed to determine the prevalence of implant infections and associated factors at Songea Regional Referral Hospital, Tanzania.

1.2. Methodology: A cross-sectional study conducted over two months (August to November 2020) included 77 patients who underwent open reduction and internal fixation (ORIF) and met the inclusion criteria. Surgical site infections (SSIs) were diagnosed clinically, and Chi-square tests assessed relationships between outcomes and exposure variables.

1.3. Results: Among 77 participants, 2.6% developed SSIs, with *Pseudomonas aeruginosa* identified as the causative organism. Co-morbid conditions, including HIV, diabetes mellitus, hypertension, and prolonged steroid use, were significantly associated with SSIs (P-value=0.003).

1.4. Conclusions: This study reveals a notable prevalence of implant infections in orthopedic surgeries at Songea Regional Referral Hospital. Co-morbid conditions play a crucial role in SSI development. These findings underscore the need for urgent attention, targeted interventions, and further research to enhance patient care in low-resource settings.

2. Introduction

Surgical site infections (SSIs) following orthopedic procedures, particularly those involving implants, pose a significant challenge in patient management [1, 2]. The prevalence of SSIs in orthopedic surgeries, including open reduction and internal fixation (ORIF) with implants, ranges from 0.8% to 13%, impacting patient mor-

bidity and healthcare costs [3-5]. Various risk factors such as gender, operation duration, diabetes mellitus, HIV infections, malnutrition, and blood transfusions contribute to the complexity of SSIs, leading to prolonged hospital stays, increased readmission rates, elevated treatment costs, and diminished quality of life [7-9].

In low- and middle-income countries, the prevalence and associated factors of infected implants are particularly pronounced, yet comprehensive studies in regions like Tanzania, specifically in Songea, are scarce. Existing research in neighboring countries has predominantly focused on general surgery, leaving a substantial gap in understanding the specific dynamics of infected implants in orthopedic contexts [10]. Therefore, a thorough investigation at referral hospitals is imperative to establish a baseline, drive further research, and inform targeted interventions. Unraveling the unique factors contributing to infected implants in the local setting is critical for developing effective preventative strategies and enhancing patient care.

This study aims to address this gap by centering on Songea Regional Referral Hospital, providing essential baseline information, stimulating further research endeavors, and offering insights that can guide targeted interventions. The study endeavors to shed light on the prevalence and factors associated with infected implants in orthopedic surgeries, thereby contributing to the enhancement of patient outcomes and the development of context-specific preventive measures.

3. Material and Methods

3.1. Study Design and Setting

A cross-sectional study was conducted among patients admitted to the orthopedic surgical unit at Songea Regional Referral Hospital

(SRRH) from August to November 2020. SRRH, situated in the southern highlands of Tanzania, serves as a tertiary care facility.

3.2. Study Population, Size, and Sampling Technique

A total of 77 patients, aged above 5 years, admitted to the orthopedic surgery department at SRRH and with a history of orthopedic internal fixation using implants, were recruited. The sample size, calculated using the Taro Yamane formula (1973) with a 95% confidence level, resulted in 90 patients based on data obtained from registered orthopedic books with a history of implantation [11]. A convenient sampling technique was employed to enroll study participants who met the criteria during the study period.

3.3. Definition of Surgical Site Infection (SSI)

SSI was defined as an infection related to an operative procedure occurring at or near the surgical incision within 30 days of the procedure or within 90 days if prosthetic material was implanted during surgery. Infection was confirmed if the patient exhibited symptoms such as redness, swelling (>1.2 cm around the wound), local pain or tenderness, increased warmth around the wound, a body temperature exceeding 37.7°C with or without shivering, purulent drainage, or wound odor[12]. If SSI symptoms were identified, information was confirmed using a checklist. Trained personnel then collected culture swabs for microbial culture. A sterile swab was gently applied five times horizontally and twice vertically in the template range to obtain the specimen, which was then transferred to the lab and processed according to the hospital laboratory protocol.

3.4. Risk Factors and Data Collection

Variables considered as risk factors included gender, underlying hypertension, diabetes mellitus, end-stage renal failure, anemia,

smoking, types of orthopedic surgery, duration of surgery, and prolonged antibiotic prophylaxis. Medical records of all cases were reviewed for risk factors, demographic data, and information on the types of operative procedures performed using standard data collection tools. A structured questionnaire was used to extract data from patient case notes, covering demographic data, the presence of chronic diseases, length of preoperative hospital stays, duration of the operation, antimicrobial prophylaxis, and other relevant information.

3.5. Data Analysis

Data analysis was conducted using STATA version 20. Categorical variables were summarized using percentages, while continuous variables were summarized using mean (standard deviation) or median (interquartile range). The association between infected implants and associated factors was assessed using Chi-square or Fisher’s exact test. A p-value of <0.05 was considered statistically significant. Multivariate analysis was performed for independent risk factors with a p-value <0.25. All data analyses adhered to scientific standards and were carried out using IBM SPSS Statistics Version 24.

4. Results

4.1. Demographic and Clinical Characteristics of the Study Participants

A total of 77 participants were enrolled in the study, with a mean age of 36 years and a standard deviation (SD) of 13 years. Majority, 58 (75.3 %) of participants were males, and 57(61%) were aged between 26 and 78 years. Road traffic accidents 55(71.4%), falls from a height 15(22.1%), and trivial falls in older age 5(6.4%) were identified as the leading causes of fractures (Table 1).

Table 1: Social demographic and Clinical characteristics of study participants

	Variable	Frequency (n)	Percentage (%)
Age (years)	25-May	26	34%
	26 – 46	27	35%
	47-67	20	26%
	68-78	4	5%
Sex	Male	58	75.30%
	Female	19	24.70%
Fracture type	Closed	75	97.40%
	Limb deformity	2	2.60%
Leading cause of fracture	Road Traffic accident	55	71.40%
	Fall from height	15	22.10%
	Trivial fall(older age)	5	6.50%

4.2. Fracture Distribution

The most common fracture type observed was femur fracture (51.9%), followed by polytrauma cases (16.9%), other fractures (9.1%), tibia fractures (7.8%), humerus fractures (7.8%), radius fractures (5.2%), and ankle fractures (1.3%).

4.3. Surgical Site Infections (SSI)

Out of the 77 participants, 20 (25.9%) were identified with SSIs using the checklist. Microbiologically confirmed SSIs were observed in 2 participants (2.6%). The presence of co-morbid conditions such as diabetes mellitus (DM), HIV, hypertension, and prolonged steroid use showed a significant association with SSI development (P-value = 0.003) (Table 2).

Table 2: Association of SSI with Co-morbid Conditions

Co-morbid Condition	SSI Cases (n=20)	Non-SSI Cases (n=57)	P-value
Diabetes Mellitus	15	10	0.003
HIV	8	5	
Hypertension	10	6	
Prolonged Steroid Use	12	4	

4.4. Microbiological Profile of SSI

Pseudomonas aeruginosa was isolated from culture studies of pus discharge in participants with confirmed SSIs.

5. Discussion

In our investigation, a notable prevalence of implants was observed among males, aligning with the well-documented higher incidence of fractures in this demographic, potentially associated with increased exposure to risk factors [12, 13]. This underscores the significance of considering gender-specific factors in orthopedic care.

The age distribution in our study aligns with diverse participant profiles, with a substantial representation in the 26-46 age range, reflecting findings from previous studies [14]. The overwhelming dominance of closed fractures underscores the efficacy of orthopedic interventions in managing these injuries [15]. The leading causes of fractures, such as road traffic accidents and falls from height; resonate with global patterns, emphasizing the necessity for targeted preventive measures [16-17]

Focusing on fracture distribution, our study mirrors the predominance of femur fractures, a common occurrence in orthopedic settings [18]. Despite polytrauma cases constituting a smaller percentage, their presence highlights the complexity and severity of injuries encountered in orthopedic practice [19]. This distribution aligns with similar studies, revealing a consistent pattern across diverse orthopedic patient populations [20].

Surgical Site Infections (SSIs) identified in this study, emphasizing the critical need for vigilant postoperative care to mitigate infectious complications [21-23]. This underscores the persistent challenges in preventing SSIs, even with advanced surgical techniques and infection control measures.

Microbiologically confirmed SSIs, align with literature suggesting that a proportion of SSIs may not exhibit overt clinical symptoms [22-24]. These subclinical infections present challenges in early detection, necessitating heightened surveillance and diagnostic

sensitivity for prompt intervention.

The association between SSIs and co-morbid conditions, including diabetes mellitus, HIV, hypertension, and prolonged steroid use, aligns with existing research on the impact of underlying health conditions on infection development in orthopedic settings[25-27]. The significant results underscore the necessity for tailored interventions for patients with these identified risk factors, emphasizing the importance of preoperative risk stratification and targeted preventive measures.

Comparing our findings with existing literature, our SSI rate falls within the reported range for orthopedic surgeries. The consistent association between co-morbid conditions and SSIs supports the understanding of underlying health conditions influencing infection development. However, variations in prevalence and associated factors may be influenced by differences in patient populations, surgical techniques, and postoperative care protocols.

Our identification of *Pseudomonas aeruginosa* in SSIs corresponds with documented trends, reinforcing the importance of tailored antibiotic regimens. These findings hold significant implications for clinical practice, emphasizing the need for vigilant monitoring and early intervention for patients with identified risk factors. Strengthening infection control measures during orthopedic surgeries is imperative, and recommendations include routine screening for co-morbid conditions preoperatively and optimizing postoperative care protocols to reduce the incidence of SSIs. These insights contribute to the broader context of orthopedic surgery outcomes, emphasizing the pivotal role of comprehensive patient assessment and postoperative management in minimizing the burden of SSIs in orthopedic surgical practices

6. Conclusions

This study provides valuable insights into the demographic characteristics, fracture distribution, and prevalence of SSIs among orthopedic surgery patients. The identified association between co-morbid conditions and SSIs aligns with existing literature.

Despite limitations, such as the single-center nature of the study, the results contribute to the broader understanding of orthopedic surgery outcomes. Enhanced awareness, preventive strategies, and interdisciplinary collaboration are crucial to improving patient outcomes in orthopedic settings. Future research should explore interventions targeted at reducing SSIs and optimizing orthopedic surgical outcomes

7. Declaration

7.1. Ethical Approval and Consent to Participate

Ethical approval was obtained from the joint Ethical and Research Committee of SRRH. The permission to conduct the study was granted by the Medical Officer in Charge of SRRH and the Regional Medical Officer Ruvuma. The importance of the study was explained to the department and participants before they give a written consent. The confidentiality of the information shared and the privacy and response were assured, the essential information was shared to each of the participants to ensure that they make a reasonable decision. Explanation on the aim of the study, potential benefits and disadvantage was made to the participants; the case report form was not containing any identifying data for maintaining participant's privacy and confidentiality.

7.2. Funding

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However, the funder had no role in the study's design, data collection, analysis, and interpretation of data and manuscript writing.

7.3. Authors' Contributions

HYL, ALW and MJM designed the study, developed methodology and participated in data collection. HYL and MJM participated in data analysis and interpretation. HYL drafted the manuscript. HYL, ALW and MJM critically reviewed the manuscript and approved the final version.

7.4. Acknowledgement

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