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Research Article

Surgical Site Infection in Post-Orthopedic Fracture Surgeries at Omdurman Teaching Hospital

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Abstract

Background: Surgical site infection (SSI) is defined as microbial contamination of a surgical wound occurring within 30 days' post-operation, or within one year if an implant is placed. SSIs are serious complications that significantly affect patient outcomes and place a substantial burden on healthcare systems.

Aim: To determine the prevalence of surgical site infections following orthopedic fracture surgeries.

Methods: A cross-sectional study was conducted over three months, including 150 patients in the Orthopedics Department. The study included all clean cases of implant surgeries referred to the department. Data were analyzed using SPSS version 27.0.

Results: Surgical site infections were observed in 42 out of 150 patients (28%). Advanced age, smoking, prolonged surgery, and uncontrolled diabetes were identified as significant risk factors for SSIs.

Conclusion: Strengthening infection-control measures, optimizing patient health - especially glycemic control -and minimizing operative time are essential to reducing SSI and improving outcomes.

Keywords: surgical site infection; fracture surgeries; orthopedic

Introduction

Surgical site infection (SSI) is defined as a microbiological infection occurring within 30 days following a surgical procedure, or up to one year in cases where an implant is inserted. Previously termed postoperative wound infection, SSI is categorized into two primary types: superficial infections affecting the skin and subcutaneous tissue, and deep infections that extend to deeper structures, organs, or implanted materials. Typical clinical manifestations include pain or tenderness, erythema, and localized swelling. [2]

Infection refers broadly to the invasion and abnormal proliferation of microorganisms—such as bacteria, viruses, or parasites—within body tissues. Hospital-acquired (nosocomial) infections develop inside healthcare facilities and are frequently attributed to antibiotic-resistant organisms, often emerging within 72 hours of hospital admission. [3] Among the most significant causative agents are methicillin-resistant Staphylococcus aureus (MRSA) and vancomycin-resistant Enterococcus (VRE). [4]

SSI remains a major complication in orthopedic surgery, particularly when associated with implanted devices. It imposes a substantial burden on patients, their families, and the healthcare system, limiting physical activity and compromising quality of life. SSIs constitute a considerable portion of nosocomial infections—approximately 38%—with an estimated incidence of 2–5% among the more than 30 million surgical procedures conducted annually. [2] Reported rates can be even higher in certain settings, ranging between 8–23%. [2]

Despite the possibility of SSI occurring even after clean orthopedic operations, it continues to be a leading cause of postoperative morbidity, mortality, and increased healthcare expenditure. The condition presents a persistent challenge for both surgeons and patients due to its negative impact on functional outcomes and treatment costs. However, research on SSI risk factors in orthopedic practice in Sudan remains scarce. Therefore, this study aims to determine the prevalence of SSI following orthopedic fracture surgeries at Omdurman Teaching Hospital, contributing to enhanced surgical outcomes and improved patient quality of life.

Methods

An observational, descriptive, hospital-based cross-sectional study was conducted at Omdurman Teaching Hospital over a three-month period. As one of the largest healthcare and teaching institutions in Khartoum, Sudan, the hospital hosts a well-established orthopedic department staffed by specialists across multiple subspecialties and equipped with high-standard operating theaters capable of accommodating a wide range of orthopedic surgical procedures.

The study population comprised all patients undergoing open reduction and internal fixation (ORIF), closed reduction with internal fixation, or external fixation. Accordingly, all clean orthopedic cases that required implant-based surgical intervention were included. Exclusion criteria encompassed any patient presenting with an active infectious focus—including respiratory tract infections, urinary tract infections, or any other septic condition—as well as patients undergoing non-implant surgeries or revision procedures. A convenience sampling technique was employed, resulting in a total sample size of 150 participants.

Data collection was conducted using a pretested, structured questionnaire designed to obtain sociodemographic information (age, sex), comorbidities (diabetes mellitus, hypertension), smoking status, antibiotic use, duration of hospital stay, fracture site and type, surgical procedure details, classification of surgical site infection, and follow-up assessment items. Data analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 27.0. Categorical variables were summarized using frequencies and percentages, while analytical statistics were conducted using the chi-square test. Ethical approval was obtained from Omdurman Teaching Hospital, and written informed consent was secured from all participants. Confidentiality and anonymity of patient data were rigorously maintained throughout the study.

Results

Of the 150 patients included in the study, 110 were males (73.3%). The majority were middle-aged (21–40 years), representing 65 individuals (43.3%), and 94 patients (62.7%) reported no comorbidities. Among diabetic patients, 16 (57.1%) had well-controlled disease. Additionally, 94 patients (62.7%) were non-smokers. [Table-1]

The prevalence of surgical site infection (SSI) was 42 cases (28%). [Table-2] Analysis of associated risk factors demonstrated that advanced age, smoking, prolonged operative duration, and uncontrolled diabetes mellitus were statistically significant predictors of SSI. Although lower limb fractures appeared clinically more severe than upper limb fractures, this association did not reach statistical significance. [Table-3]

Furthermore, SSI was found to have a significant negative impact on postoperative function and quality of life, as evidenced by a statistically significant reduction in limb use among affected patients. [Table-4]

Discussion

The present study explored the demographic characteristics, risk factors, incidence, and consequences of surgical site infection (SSI) among orthopedic trauma patients. The findings revealed that male patients predominated, which aligns with global trauma patterns where males are more frequently involved in high-risk activities leading to fractures. The majority of patients were middle-aged, reflecting the typical age group with the highest exposure to outdoor and occupational injuries. [5,6]

Most patients did not report comorbidities, and among those with diabetes mellitus, more than half had controlled disease. This supports the assumption that the sample largely represents relatively healthy trauma patients, although a considerable portion had chronic illnesses that may influence wound healing. [7] Moreover, two-thirds of the patients were non-smokers, which is favorable considering the known negative impact of smoking on tissue perfusion and postoperative recovery. [8]

The overall incidence of SSI is higher than the rates reported in many international studies (typically 2%–15%). [9] This elevated incidence may reflect differences in surgical conditions, sterility standards, patient health status, or postoperative care. High SSI rates have also been documented in several low- and middle-income settings, suggesting a multifactorial etiology that includes overcrowded hospitals, limited sterilization capacity, and delayed wound assessment. [10]

When evaluating risk factors, the study found that advanced age, smoking, prolonged operation time, and uncontrolled diabetes mellitus were significantly associated with SSI. These results are consistent with the established literature. Older patients often have reduced physiological reserve and impaired immune responses, making them more susceptible to infection. [11] Smoking is known to reduce tissue oxygenation and impede wound healing. [12] Prolonged surgeries increase tissue exposure and bacterial contamination risk. [13] Poor glycemic control compromises leukocyte function and microvascular circulation, both of which are critical for wound healing. [14]

Although lower limb fractures appeared to have more severe outcomes compared to upper limb fractures, the association was not statistically significant. This finding may still hold clinical relevance, as lower limb surgeries typically involve greater soft tissue disruption, higher contamination risk, and longer recovery periods. [15] Larger sample sizes or more stratified analyses might reveal significant differences in future studies.

Regarding postoperative outcomes, the study demonstrated that SSI has a significant negative impact on limb function and quality of life, with infected patients showing markedly reduced limb use. This finding underscores the importance of SSI prevention, as limited mobility not only affects recovery but may also lead to long-term disability, prolonged hospitalization, delayed rehabilitation, and increased economic burden. [16]

The overall interpretations are that findings collectively highlight the need for enhanced infection prevention protocols, especially for high-risk individuals, rigorous glycemic control among diabetic patients before and after surgery, minimizing operative time when feasible without compromising surgical quality, targeted counseling for smokers and smoking cessation strategies, and closer monitoring of elderly patients due to their elevated vulnerability.

Conclusion

This study found a high rate of surgical site infections among orthopedic trauma patients, with advanced age, smoking, prolonged surgery, and uncontrolled diabetes identified as significant risk factors. SSI had a clear negative impact on postoperative function and quality of life. Strengthening infection-control measures, optimizing patient health—especially glycemic control—and minimizing operative time are essential to reducing SSI and improving outcomes.

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