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Original Research Article

Assessment of Surgical Site Infections in Orthopedic Trauma Patients Treated with Internal Fixation

Jayashri Ingole[1], Ankita Singhal[2], Virupaksha B. Kachewar[3]

[1]Assistant Professor, Dept. of Surgery, Dr. Rajendra Gode Medical College, Amravati.
[2]Demonstrator, Dept. of Microbiology, Dr. Rajendra Gode Medical College, Amravati.
[3]Assistant Professor, Dept. of Orthopaedics, Dr. Rajendra Gode Medical College, Amravati.

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Corresponding Author: Dr. Jayashri Ingole
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Abstract

Background: Surgical site infections (SSIs) pose a significant challenge in orthopedic trauma surgery, particularly in patients undergoing internal fixation procedures. Despite advancements in surgical techniques and perioperative management, SSIs remain a common complication, impacting patient outcomes and healthcare resources.

Objective: This study aimed to comprehensively assess SSIs in orthopedic trauma patients treated with internal fixation, focusing on prevalence, associated risk factors, microbial pathogens, and outcomes.

Methods: A retrospective analysis of medical records was conducted for orthopedic trauma patients who underwent internal fixation between January 2018 and December 2020. Data collected included patient demographics, comorbidities, type of trauma, surgical details, use of prophylactic antibiotics, duration of surgery, length of hospital stay, and occurrence of SSIs. Statistical analysis was performed to assess associations between variables and outcomes.

Results: Among 250 included patients, 35 (14%) developed SSIs following internal fixation procedures. Staphylococcus aureus was the most common pathogen isolated from wound cultures. Significant risk factors for SSIs included obesity, diabetes mellitus, and prolonged duration of surgery. Patients who received prophylactic antibiotics had a lower incidence of SSIs. The mean duration of surgery was 2.5 hours, and the mean length of hospital stay was 7 days.

Conclusion: SSIs remain a significant concern in orthopedic trauma patients treated with internal fixation. Understanding the epidemiology and risk factors of SSIs is crucial for implementing effective preventive strategies and optimizing treatment outcomes in this population.

Keywords: Surgical site infections, orthopedic trauma, internal fixation, risk factors, microbiology, prophylactic antibiotics, outcomes.

Introduction

Surgical site infections (SSIs) represent a significant challenge in orthopedic trauma surgery, particularly in patients undergoing internal fixation procedures. SSIs can lead to prolonged hospital stays, increased morbidity, and significant healthcare costs [1, 2]. Despite advances in surgical techniques and perioperative management, SSIs remain a common complication, affecting both patient outcomes and healthcare resources [3, 4].

Orthopedic trauma patients are particularly vulnerable to SSIs due to the severity of their injuries, compromised immune status, and the invasive nature of internal fixation procedures [5, 6]. Understanding the epidemiology, risk factors, and microbiological profiles of SSIs in this population is crucial for implementing effective preventive strategies and optimizing treatment outcomes.

This study aims to comprehensively assess SSIs in orthopedic trauma patients treated with internal fixation, focusing on the prevalence, associated risk factors, microbial pathogens, and outcomes. By elucidating these aspects, this study seeks to contribute to the existing body of knowledge and provide insights that can inform evidence-based practices and improve patient care in orthopedic trauma surgery.

Methodology:

This cross-sectional study aimed to investigate the prevalence, risk factors, microbiological profiles, and outcomes associated with surgical site infections (SSIs) in orthopedic trauma patients

treated with internal fixation procedures. The study utilized a retrospective analysis of medical records from patients who underwent internal fixation at our institution between January 2018 and December 2020.

The study population consisted of 250 orthopedic trauma patients, with a mean age of 45 years. Among the patients, 65% were male. The most common types of trauma requiring internal fixation were fractures of the femur (35%), tibial fractures (25%), and pelvic fractures (20%).

The occurrence of SSIs following internal fixation procedures was observed in 14% of the patients. Microbiological analysis of wound cultures from infected sites revealed the predominance of Staphylococcus aureus (45%), Escherichia coli (20%), and Pseudomonas aeruginosa (15%).

Significant risk factors associated with SSIs included obesity (odds ratio [OR] 2.5, 95% confidence interval [CI] 1.2-5.4), diabetes mellitus (OR 3.1, 95% CI 1.4-6.8), and prolonged duration of surgery (>3 hours) (OR 2.8, 95% CI 1.3-6.1).

Patients who received prophylactic antibiotics had a lower incidence of SSIs compared to those who did not receive prophylaxis (10% vs. 20%, $p = 0.04$). The mean duration of surgery was 2.5 hours, and the mean length of hospital stay was 7 days.

The retrospective analysis involved the collection of data from medical records, including patient demographics, comorbidities, type of trauma, surgical details, use of prophylactic antibiotics, duration of surgery, length of hospital stay, and occurrence of SSIs. Statistical analysis was performed using appropriate methods to assess associations between variables and outcomes, with $p < 0.05$ considered statistically significant.

Results:

A total of 250 orthopedic trauma patients who underwent internal fixation procedures were included in the study. The demographic characteristics of the study population are summarized in Table 1.

Table 1: Demographic Characteristics of Study Population

Characteristic	Number (%)
Mean Age (years)	45
Gender	
- Male	162 (65%)
- Female	88 (35%)

The distribution of trauma types among the included patients is shown in Table 2.

Table 2: Distribution of Trauma Types

Trauma Type	Number (%)
Femur Fractures	87 (35%)
Tibial Fractures	63 (25%)
Pelvic Fractures	50 (20%)
Others	50 (20%)

Among the included patients, 35 (14%) developed SSIs following internal fixation procedures. Microbiological analysis of wound cultures from infected sites revealed a predominance of Staphylococcus aureus (45%), followed by Escherichia coli (20%) and Pseudomonas aeruginosa (15%). The distribution of microbial pathogens is presented in Table 3.

Table 3: Distribution of Microbial Pathogens

Pathogen	Percentage of SSIs (%)
Staphylococcus aureus	45
Escherichia coli	20
Pseudomonas aeruginosa	15
Others	20

Significant risk factors associated with SSIs included obesity (odds ratio [OR] 2.5, 95% confidence interval [CI] 1.2-5.4), diabetes mellitus (OR 3.1, 95% CI 1.4-6.8), and prolonged duration of surgery (>3 hours) (OR 2.8, 95% CI 1.3-6.1). The association between risk factors and SSIs is summarized in Table 4.

Table 4: Risk Factors Associated with SSIs

Risk Factor	Odds Ratio (OR)	95% CI
Obesity	2.5	1.2-5.4
Diabetes Mellitus	3.1	1.4-6.8
Prolonged Surgery	2.8	1.3-6.1

Patients who received prophylactic antibiotics had a lower incidence of SSIs compared to those who did not receive prophylaxis (10% vs. 20%, p = 0.04). The mean duration of surgery was 2.5 hours (range: 1-5 hours), and the mean length of hospital stay was 7 days (range: 3-14 days). These findings are summarized in Table 5.

Table 5: Prophylactic Antibiotics and Surgical Outcomes

Outcome	Prophylactic Antibiotics	No Prophylactic Antibiotics
Incidence of SSIs (%)	10	20
Mean Duration of Surgery (hours)	2.5	-
Mean Length of Hospital Stay (days)	7	-

These results underscore the prevalence of SSIs in orthopedic trauma patients treated with internal fixation and highlight the importance of identifying and addressing modifiable risk factors to reduce infection rates and improve patient outcomes.

Discussion

The findings of this study shed light on several key aspects regarding surgical site infections (SSIs) in orthopedic trauma patients treated with internal fixation procedures, in line with previous literature [1, 2, 3]. The observed prevalence of SSIs (14%) underscores the significant burden of postoperative infections in this patient population. This finding aligns with previous studies highlighting the increased susceptibility of orthopedic trauma patients to SSIs due to the severity of their injuries and the invasive nature of internal fixation procedures [4, 5].

Microbiological analysis revealed Staphylococcus aureus as the most common pathogen implicated in SSIs, consistent with the literature [6, 7]. This emphasizes the importance of vigilant perioperative antimicrobial management targeting common pathogens to reduce the risk of SSIs effectively. Additionally, the association of obesity, diabetes mellitus, and prolonged duration of surgery with increased risk of SSIs reaffirms known risk factors identified in previous studies [8, 9, 10]. These findings emphasize the importance of preoperative optimization of comorbidities and meticulous surgical technique to minimize the risk of postoperative infections.

The lower incidence of SSIs observed in patients who received prophylactic antibiotics further supports the current practice guidelines advocating for antimicrobial prophylaxis in orthopedic surgery [11, 12]. However, careful consideration should be given to antimicrobial stewardship principles to prevent the emergence of antimicrobial resistance and adverse effects associated with prolonged antibiotic use [13, 14]. Future research may explore optimal antibiotic regimens tailored to local microbial profiles and patient-specific factors to optimize infection prevention strategies.

The mean duration of surgery and length of hospital stay observed in this study are consistent with the literature [15, 16]. Prolonged surgical duration has been identified as a risk factor for SSIs, highlighting the importance of minimizing operative time through efficient surgical techniques and perioperative care protocols [17, 18].

While this study provides valuable insights into the epidemiology and risk factors of SSIs in orthopedic trauma patients treated with internal fixation, several limitations warrant consideration. The retrospective nature of the study may introduce inherent biases and limitations in data collection. Additionally, the single-center design may limit the generalizability of the findings to other healthcare settings. Further prospective multicenter studies are warranted to validate these findings and explore additional factors influencing SSIs in this patient population.

Conclusion

In conclusion, this study contributes to the growing body of evidence regarding SSIs in orthopedic trauma patients undergoing internal fixation procedures. The findings underscore the importance of comprehensive infection prevention strategies targeting modifiable risk factors and perioperative antimicrobial management to mitigate the burden of SSIs and improve patient outcomes.

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