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Study of incidence of postoperative wound infection in orthopaedic surgery: A retrospective observational study.

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Abstract
Background
Postoperative wound infection, or surgical site infection (SSI), is an important complication following orthopaedic surgery and may result in delayed wound healing, prolonged hospitalization, and additional treatment. This study evaluated the incidence of postoperative wound infection and associated demographic, clinical, and surgical factors.

Objective
To determine the incidence of postoperative wound infection among patients undergoing orthopaedic surgery and evaluate associated risk factors.

Materials and Methods
A retrospective observational study was conducted in the Department of Orthopaedics, Katihar Medical College, Katihar, Bihar, India. Hospital records of patients who underwent orthopaedic surgery between February 2024 and February 2025 were reviewed. A total of 100 eligible patients with complete perioperative records were included. Demographic characteristics, comorbidities, surgical characteristics, wound classification, implant use, microbiological findings, treatment, and clinical outcomes were evaluated.

Results
Postoperative wound infection occurred in 12 of 100 patients, giving an overall incidence of **12.0%**. Infection was more frequent among patients with diabetes mellitus, prolonged operative duration, open fractures, implant-related procedures, and contaminated wounds. *Staphylococcus aureus* was the most commonly isolated microorganism. Most infections were successfully managed with culture-directed antibiotic therapy, while a smaller proportion required surgical wound debridement.

Conclusion
Postoperative wound infection remains an important complication following orthopaedic surgery, with an incidence of 12.0% in this study. Early identification of high-risk patients and appropriate perioperative infection-prevention measures are important for reducing SSI.

Recommendation
Strict adherence to aseptic surgical techniques, appropriate perioperative antibiotic prophylaxis, and meticulous postoperative wound care are recommended to reduce postoperative wound infection and improve patient outcomes.

Keywords: *postoperative wound infection, surgical site infection, orthopaedic surgery, incidence, risk factors, retrospective study, infection control.*
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Introduction

Postoperative wound infection, commonly classified as a surgical site infection (SSI), continues to represent a significant cause of postoperative morbidity following orthopaedic procedures despite substantial improvements in surgical techniques, sterilization methods, perioperative antibiotic prophylaxis, and infection prevention strategies. Surgical site infections adversely affect wound healing, prolong hospitalization, increase healthcare costs, delay rehabilitation, and may ultimately compromise functional recovery. In orthopaedic surgery, postoperative wound infections are particularly concerning because of the frequent use of metallic implants and prosthetic devices that facilitate bacterial adherence and biofilm formation, making eradication of infection considerably more challenging.[1–3]

The World Health Organization (WHO) recognizes surgical site infection as one of the most common healthcare-associated infections worldwide, particularly in low- and middle-income countries. Orthopaedic procedures are associated with varying infection rates depending on the type of surgery performed, ranging from less than 2% in clean elective procedures to more than 20% in contaminated trauma surgeries. Numerous patient-related and procedure-related factors contribute to infection risk, including advanced age, diabetes mellitus, obesity, smoking, malnutrition, anaemia, immunosuppression, prolonged operative duration, emergency surgery, open fractures, excessive blood loss, and inappropriate perioperative antimicrobial prophylaxis.[4–7]

The pathogenesis of postoperative wound infection involves microbial contamination of the surgical incision during or shortly after surgery. Although host immune mechanisms and prophylactic antibiotics eliminate most contaminating organisms, infection develops when bacterial virulence exceeds host defence mechanisms. Gram-positive cocci, particularly *Staphylococcus aureus* and coagulase-negative staphylococci, remain the predominant causative organisms in orthopaedic surgical site infections. Gram-negative bacilli, including *Escherichia coli*, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa*, are increasingly encountered, especially among trauma patients, prolonged hospitalizations, and patients requiring repeated surgical procedures.[8–11]

Orthopaedic implant-associated infections present unique clinical challenges because microorganisms can produce biofilms on implant surfaces, rendering them highly resistant to antimicrobial therapy and host immune responses. These infections frequently necessitate prolonged antibiotic therapy, repeated surgical debridement, implant retention or removal, staged revision surgery, and extended rehabilitation. Consequently, postoperative wound infections significantly increase healthcare expenditure while reducing patients' quality of life and delaying return to normal functional activity.[12–14]

Several international organizations, including the Centers for Disease Control and Prevention (CDC), the World Health Organization (WHO), and professional orthopaedic societies, have established comprehensive guidelines for preventing surgical site infections. Recommended preventive measures include preoperative patient optimization, appropriate hair removal techniques, timely administration of prophylactic antibiotics, maintenance of perioperative normothermia, strict aseptic surgical technique, meticulous haemostasis, adequate tissue handling, glycaemic control, and standardized postoperative wound care. Continuous surveillance of postoperative wound infection rates is considered an essential quality indicator for evaluating surgical performance and institutional infection control programmes.[15–18]

Despite considerable advances in infection prevention, postoperative wound infection remains an important clinical problem in developing countries because of increasing surgical volume, trauma burden, antimicrobial resistance, resource limitations, and variations in infection control practices. Understanding the local incidence and associated risk factors is essential for developing targeted preventive strategies and improving perioperative patient care. However, published data regarding postoperative wound infection in tertiary care hospitals in eastern India remain relatively limited.

Therefore, the present retrospective observational study was undertaken to determine the incidence of postoperative wound infection among patients undergoing orthopaedic surgery at Katihar Medical College and to evaluate the demographic, clinical, microbiological, and surgical factors associated with postoperative surgical site infection.

Materials and methods

Study design

This was a retrospective cross-sectional observational study conducted to determine the occurrence of postoperative wound infection among patients undergoing orthopaedic surgery and to evaluate associated demographic, clinical, and surgical factors. Patient information was retrospectively obtained from hospital medical records for patients who underwent orthopaedic surgery during the study period.

Study Setting

The study was conducted in the Department of Orthopaedics, Katihar Medical College, Katihar, Bihar,

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India. The study was based on patients undergoing orthopaedic surgical procedures at the institution between February 2024 and February 2025. Relevant demographic, clinical, surgical, microbiological, treatment, and postoperative outcome information was obtained from hospital medical records.

Study Population and Sample

The study included patients who underwent orthopaedic surgery during the study period. A total of **100 eligible patients** with complete perioperative records were included in the analysis.

Data Collection

Data were retrospectively extracted from hospital medical records using predefined study variables. The collected information included demographic characteristics, comorbidities, type of orthopaedic surgery, wound classification, duration of surgery, implant use, occurrence of postoperative wound infection, microbiological findings, treatment received, and clinical outcomes.

Postoperative wound infection was identified from documented postoperative clinical findings and microbiological records available in the patients' hospital records.

Bias and Measures to Minimize Bias

Potential sources of selection and information bias were considered because of the retrospective nature of the study. Selection bias was minimized by applying predefined eligibility criteria and including patients with complete perioperative records during the specified study period. Information bias was minimized by extracting data from documented hospital records using predefined variables. Records with incomplete or insufficient perioperative information were excluded from the analysis. Data were reviewed systematically to ensure consistency in the extraction of demographic, clinical, surgical, microbiological, and postoperative information. However, because this was a retrospective study based on existing medical records and did not involve random allocation, the possibility of residual selection bias, information bias, and confounding cannot be completely excluded.

Statistical Analysis

Data were analysed using appropriate statistical methods. Categorical variables were analysed using the Chi-square test and Fisher's exact test, as appropriate. Continuous variables were analysed using the independent-samples t test and Mann–Whitney U test, as appropriate. Continuous variables were summarized using mean ± standard deviation, while categorical variables were presented as frequencies and percentages. A two-sided p value $< .05$ was considered statistically significant.

Ethical Considerations

The study was conducted in accordance with the ethical requirements of the institution. Ethical approval was obtained from the relevant Institutional Ethics/Review Committee before the study was conducted and the medical records were reviewed. Patient information was treated confidentially and used solely for research purposes.

Results

A total of **100 patients** who underwent orthopaedic surgery between **February 2024 and February 2025** were included in the final analysis. Postoperative wound infection developed in **12 patients**, giving an overall incidence of **12.0%**, while the remaining **88 patients (88.0%)** had an uncomplicated postoperative course.

The baseline demographic and clinical characteristics are presented in **Table 1**. The mean age of the study population was **44.9 ± 15.8 years** (range: 18–82 years). Male patients constituted **68.0%** of the study population. Diabetes mellitus, smoking, and anaemia were significantly more common among patients who developed postoperative wound infection ($p<0.05$).

Table 1. Baseline Demographic and Clinical Characteristics

Variable	Wound Infection (n=12)	No Infection (n=88)	p-value
Age (years), Mean ± SD	52.8 ± 13.7	43.8 ± 15.6	0.041*
Male	9 (75.0%)	59 (67.0%)	0.57
Female	3 (25.0%)	29 (33.0%)	
BMI (kg/m²), Mean ± SD	27.4 ± 3.2	24.8 ± 3.8	0.029*

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Variable	Wound Infection (n=12)	No Infection (n=88)	p-value
Diabetes mellitus	7 (58.3%)	18 (20.5%)	0.008*
Hypertension	4 (33.3%)	21 (23.9%)	0.49
Smoking	6 (50.0%)	18 (20.5%)	0.030*
Anaemia	5 (41.7%)	14 (15.9%)	0.041*

The distribution of operative characteristics is shown in **Table 2**. Implant-related procedures, emergency surgeries, open fractures, contaminated wounds, and prolonged operative duration were significantly associated with postoperative wound infection.

Table 2. Operative Characteristics

Variable	Wound Infection (n=12)	No Infection (n=88)	p-value
Elective surgery	4 (33.3%)	58 (65.9%)	0.031*
Emergency surgery	8 (66.7%)	30 (34.1%)	
Implant surgery	9 (75.0%)	42 (47.7%)	0.048*
Open fracture	6 (50.0%)	14 (15.9%)	0.009*
Contaminated wound	5 (41.7%)	10 (11.4%)	0.006*
Duration of surgery (minutes), Mean ± SD	118.4 ± 22.7	91.6 ± 18.5	<0.001*

Microbiological analysis of infected wounds is summarized in **Table 3**. *Staphylococcus aureus* was the most frequently isolated pathogen (41.7%), followed by *Escherichia coli* and *Klebsiella pneumoniae*.

Table 3. Microbiological Profile of Surgical Site Infections (n=12)

Organism	Number (%)
Staphylococcus aureus	5 (41.7%)
Escherichia coli	3 (25.0%)
Klebsiella pneumoniae	2 (16.7%)
Pseudomonas aeruginosa	1 (8.3%)
Mixed bacterial growth	1 (8.3%)

Postoperative management and clinical outcomes are shown in **Table 4**. Culture-directed antibiotic therapy was administered to all infected patients. Surgical wound debridement was required in four patients, while implant removal was necessary in one patient because of persistent deep infection.

Table 4. Clinical Management and Outcomes of Patients with Wound Infection (n=12)

Variable	Number (%)
Intravenous antibiotics	12 (100.0%)
Surgical wound debridement	4 (33.3%)
Implant removal	1 (8.3%)
Reoperation	2 (16.7%)
Complete recovery	11 (91.7%)
Persistent infection at discharge	1 (8.3%)

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Hospital stay was significantly longer among patients with postoperative wound infection (**Table 5**). The mean duration of hospitalization was **15.6 ± 4.3 days** in infected patients compared with **7.8 ± 2.6 days** in patients without infection (**p<0.001**).

Table 5. Hospital Stay

Variable	Wound Infection	No Infection	p-value
Hospital stay (days), Mean ± SD	15.6 ± 4.3	7.8 ± 2.6	<0.001*

Multivariable logistic regression analysis identified diabetes mellitus, prolonged operative duration (>120 minutes), contaminated wounds, and open fractures as independent predictors of postoperative wound infection (**Table 6**).

Table 6. Multivariable Logistic Regression Analysis for Predictors of Postoperative Wound Infection

Variable	Adjusted OR	95% CI	p-value
Diabetes mellitus	3.68	1.22–11.09	0.021*
Operative duration >120 min	4.11	1.43–11.82	0.008*
Open fracture	3.24	1.09–9.64	0.034*
Contaminated wound	4.79	1.54–14.92	0.006*
Implant surgery	1.82	0.61–5.41	0.281

These results demonstrate an overall **12.0% incidence of postoperative wound infection**, with diabetes mellitus, prolonged surgery, open fractures, and contaminated wounds emerging as the most important independent risk factors. The majority of infections responded successfully to culture-guided antimicrobial therapy, although a small proportion required additional surgical intervention.

DISCUSSION

The present retrospective observational study evaluated postoperative wound infection among patients undergoing orthopaedic surgery at Katihar Medical College over one year and assessed associated demographic, clinical, and surgical factors. A total of 100 patients were included, of whom 12 developed postoperative wound infection, corresponding to a proportion of **12.0%**. The demographic and clinical characteristics of the study population are presented in the Results section. The occurrence of postoperative wound infection was greater among patients with diabetes mellitus, prolonged operative duration, contaminated wounds, and open fractures. *Staphylococcus aureus* was the predominant microorganism isolated from infected wounds, and most affected patients recovered following culture-directed antibiotic therapy with or without surgical wound debridement.

The observed proportion of postoperative wound infection was comparable with rates reported from several tertiary care hospitals in developing countries, where reported rates generally range between 5% and 15%, depending on patient characteristics, surgical complexity, and infection surveillance methods.[17–19] Differences between studies may be explained by variations in hospital infrastructure, patient case mix, emergency surgical workload, adherence to infection-prevention protocols, antimicrobial prophylaxis, and local antimicrobial resistance patterns. The findings of the present study should therefore be interpreted within the context of the study population and institutional setting.

Diabetes mellitus was an important patient-related factor associated with postoperative wound infection in the present study. More than half of the infected patients had diabetes, and logistic regression analysis identified diabetes as an independent predictor of infection. This finding is clinically relevant to the study objective because it suggests that underlying patient characteristics may contribute substantially to postoperative infection risk. Poor glycaemic control can adversely affect immune function, collagen synthesis, angiogenesis, and tissue repair, thereby increasing susceptibility to bacterial infection and delayed wound healing. Similar associations between diabetes and orthopaedic surgical site infection have been reported in previous studies.[20–22]

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Operative duration was another important factor associated with postoperative wound infection. Patients who developed infection had significantly longer operative times than those without infection. Prolonged surgery may increase tissue manipulation, blood loss, exposure to the operating-room environment, and opportunities for bacterial contamination. Longer procedures may also reflect greater surgical complexity, which itself may contribute to postoperative infection risk. Previous studies have similarly reported an increased risk of surgical site infection with prolonged operative duration, particularly for procedures lasting more than two hours.[23,24]

The present study also demonstrated a greater occurrence of postoperative wound infection among patients with **open fractures** and **contaminated wounds**. Open fractures are frequently accompanied by soft-tissue injury, environmental contamination, devitalized tissue, and impaired local tissue viability, all of which can facilitate bacterial proliferation. Similarly, contaminated wounds have a greater microbial burden at the time of surgery and may therefore have a higher risk of subsequent infection. These findings are consistent with the clinical importance of wound classification and injury severity when assessing the risk of postoperative infection.[25,26]

Implant-related procedures showed a higher frequency of wound infection than non-implant procedures; however, implant use did not remain an independent predictor after multivariable analysis. This distinction is important when interpreting the results because the unadjusted association may partly reflect other patient or surgical characteristics. Orthopaedic implants can provide surfaces for bacterial adhesion and biofilm formation, which may make established infections more difficult to eradicate. Although only one patient in the present study required implant removal, implant-associated infection remains an important clinical concern because treatment may require prolonged antimicrobial therapy and additional surgical intervention.[27,28]

Microbiological findings provided further information regarding the nature of postoperative wound infections. *Staphylococcus aureus* was the most frequently isolated organism, accounting for approximately two-fifths of all infections. This finding is consistent with previous studies identifying *S. aureus* as an important pathogen in orthopaedic surgical site infections. Its ability to colonize skin and form biofilms may contribute to its clinical importance, particularly in implant-related infections. Other organisms, including *Escherichia coli*, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa*, were also isolated, demonstrating the range of microorganisms encountered among patients with postoperative wound infection.[29–31]

Patients who developed postoperative wound infection had a significantly longer hospital stay than those without infection. This finding has important clinical and healthcare implications because infection may require additional antibiotic treatment, repeated wound assessment, microbiological investigations, dressing changes, and, in some cases, surgical intervention. Prolonged hospitalization may consequently increase healthcare utilization and costs and may expose patients to additional hospital-acquired complications.[32,33] The association between infection and prolonged hospitalization therefore reinforces the importance of effective perioperative infection-prevention and early postoperative surveillance.

The clinical outcomes among infected patients were generally favourable. More than 90% of infected patients achieved complete recovery following appropriate management. Culture-directed antibiotic therapy was effective in the infected patients, while only a minority required wound debridement or implant removal. These findings highlight the importance of early recognition of postoperative wound infection, appropriate microbiological evaluation, and timely initiation of targeted antimicrobial treatment.[34]

Overall, the findings address the primary objective of the study by demonstrating that postoperative wound infection occurred in 12.0% of the study population and was associated with several patient- and procedure-related characteristics. Diabetes mellitus, prolonged operative duration, open fractures, and contaminated wounds were particularly important factors, while *S. aureus* was the predominant isolated pathogen. The results support the need for risk-based perioperative assessment, strict infection-prevention practices, appropriate antimicrobial prophylaxis, and close postoperative wound surveillance.

Generalizability

The findings may be most applicable to patients undergoing orthopaedic surgery in settings similar to the study institution and with comparable patient characteristics, surgical practices, infection-prevention protocols, and postoperative care. Because the study was conducted at a single institution and included 100 patients, the findings may not be directly generalizable to all orthopaedic populations or healthcare settings. Differences in surgical case mix, prevalence of comorbidities, antimicrobial prophylaxis, wound management practices, infection-control measures, and available healthcare resources may influence postoperative wound infection rates.

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Therefore, the observed 12.0% proportion should be interpreted within the context of the study population and institution rather than assumed to represent the rate in all orthopaedic surgical populations. Larger multicentre studies involving diverse patient populations and healthcare settings would improve the external validity of the findings.

Conclusion

The present retrospective study demonstrated that postoperative wound infection remains an important complication following orthopaedic surgery, with an overall incidence of 12% among patients treated at Katihar Medical College. Most infections were superficial and were successfully managed with appropriate wound care and culture-directed antibiotic therapy.

Advanced age, diabetes mellitus, smoking, implant-related procedures, and prolonged operative duration were identified as important factors associated with an increased risk of postoperative wound infection. *Staphylococcus aureus* remained the predominant causative organism. Patients who developed wound infections experienced significantly longer hospital stays, highlighting the substantial clinical and economic impact of this complication.

Limitations

The present study has several limitations. First, its retrospective design relied on information available in existing hospital medical records. Consequently, incomplete documentation or variability in record-keeping may have introduced information bias and affected the accuracy of some recorded variables. Second, the relatively small sample size of 100 patients may have resulted in imprecision in estimates and limited the ability to detect statistically significant associations between individual risk factors and postoperative wound infection.

Third, because the study was conducted at a single institution, selection bias may have occurred, and the findings may not be fully representative of patients treated at other hospitals. Differences in patient characteristics, surgical procedures, infection-prevention practices, antimicrobial prophylaxis, and postoperative care may influence the occurrence of wound infection.

Fourth, the retrospective observational design did not involve random allocation or prospective control of exposure variables. Therefore, potential confounding by patient-related or surgical factors cannot be completely excluded, and the observed associations should not be interpreted as proof of causality.

Finally, the study included only patients with complete perioperative records. Exclusion of records with incomplete information may have introduced selection bias if patients with incomplete records differed systematically from those included in the analysis. Larger prospective multicentre studies are therefore required to confirm these findings and provide more precise estimates of postoperative wound infection and its associated risk factors.

Recommendations

The findings of this study have important clinical implications for the prevention and management of postoperative wound infection following orthopaedic surgery. The observed 12.0% proportion of postoperative wound infection and the greater occurrence among patients with diabetes mellitus, prolonged operative duration, open fractures, implant-related procedures, and contaminated wounds highlight the importance of identifying high-risk patients and procedures before and after surgery.

Patients with recognized risk factors should receive appropriate perioperative assessment and closer postoperative wound surveillance. Strict adherence to aseptic surgical techniques, appropriate perioperative antimicrobial prophylaxis, adequate management of contaminated and open wounds, and meticulous postoperative wound care should be emphasized. Early recognition of signs of wound infection and timely microbiological investigation can facilitate appropriate culture-directed antimicrobial treatment. Where clinically indicated, early surgical intervention such as wound debridement should be considered.

Future studies should include larger sample sizes and multicentre prospective designs to improve the precision and generalizability of the findings. Further research should also evaluate independent risk factors for postoperative wound infection using multivariable analysis and assess the effectiveness of specific infection-prevention strategies. Long-term clinical outcomes, antimicrobial resistance patterns, and the economic burden associated with postoperative wound infection should also be investigated.

List of Abbreviations

SSI — Surgical Site Infection
DM — Diabetes Mellitus
BMI — Body Mass Index
SD — Standard Deviation
CDC — Centers for Disease Control and Prevention

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Conflict of Interest
The authors declare no conflict of interest.

Author Biography
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Author Contributions
All authors equally contributed to the manuscript

Data Availability
The data generated and/or analysed during the present study are not publicly available because they are derived from patient medical records and contain potentially identifiable clinical information. Data may be available from the corresponding author upon reasonable request, subject to institutional and ethical restrictions.

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The study received no external funding

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