Surgical Site Infections in Orthopedic Surgery Patients at a Tertiary Center: A Descriptive Cross-Sectional Study

Karki BR, Shrestha R, Paudel B, Basi A, Khadka SK, Dhoju D

Department of Orthopedics and Traumatology

Kathmandu University School of Medical Sciences,

Kathmandu University Hospital,

Dhulikhel, Kavre, Nepal.

Corresponding Author

Rohit Shrestha

Department of Orthopedics and Traumatology

Kathmandu University School of Medical Sciences,

Kathmandu University Hospital,

Dhulikhel, Kavre, Nepal.

E-mail: rohitshrestha@kusms.edu.np

Citation

Karki BK, Shrestha R, Paudel B, Basi A, Khadka SK, Dhoju D. Surgical Site Infections in Orthopedic Surgery Patients at a Tertiary Center: A Descriptive Cross-Sectional Study. *Kathmandu Univ Med J.* 2025; **Online First.**

ABSTRACT

Background

Surgical site infection (SSI) is a significant postoperative complication that increases patient morbidity and mortality, prolongs hospital stay, and imposes an additional financial burden on healthcare systems. Understanding the prevalence of surgical site infection is crucial for implementing preventive strategies and improving patient outcomes.

Objective

To determine the prevalence of postoperative surgical site infections among orthopedic surgery patients at a tertiary care hospital in Nepal.

Method

A descriptive cross-sectional study was conducted in the Department of Orthopedics and Traumatology at Dhulikhel Hospital, Kathmandu University Hospital, from March 2023 to February 2024, following ethical approval. All consecutive patients satisfying the inclusion criteria were enrolled in this census study during the study period. Surgical site infections were diagnosed based on the presence of pus or purulent discharge from the surgical wound, associated pain, and any two cardinal signs of inflammation, occurring within 30 days postoperatively. Data were analyzed using point estimates with 95% confidence intervals and frequencies and percentages were calculated for categorical variables.

Result

Among 1,061 patients included in the study, 32 cases of surgical site infection were identified, resulting in a prevalence of 3.02%. The mean age of patients with surgical site infection was 39.52 ± 18.11 years and the majority of them were male population in adult age (19-64) years group.

Conclusion

The prevalence of postoperative surgical site infection in orthopedic and trauma surgery at this tertiary care center was comparable to rates reported in similar settings internationally. Continuous strict monitoring strict, aseptic techniques, and timely intervention are essential to reduce surgical site infection incidence and improve patient outcomes.

KEY WORDS

Orthopedics, Postoperative complication, Prevalence, Surgical site infection

INTRODUCTION

Surgical site infections (SSIs) after surgery are serious issue, leading to repeated surgeries, increased mortality risk, and higher healthcare costs.[1] SSIs occur when microbial contamination is present in the surgical wound within 30 days of surgery or within one year if an implant is placed.[2] SSI incidence rates range from 10 to 20 percent, accounting for 20 to 39 percent of all Hospital acquired Infections (HAIs).[3]

SSIs can be prevented by following standard protocols.[4] Main risk factors for infections are advanced age, diabetes mellitus, smoking, malnutrition/obesity, prior infections.[5] Despite progress in preventing infections during surgery, SSIs are increasing, leading to greater patient suffering, treatment expenses, and mortality rates.[6] Limited data exists on SSIs among orthopedic patients in our region, with previous studies predominantly centered on general surgical patients.[7]

The aim of this study is to determine prevalence of the postoperative surgical site infection in orthopedics surgery patients so that the magnitude of problems related to SSI would be helpful in under taking appropriate measures for its mitigation.

METHODS

This hospital based descriptive cross-sectional study was conducted at Dhulikhel Hospital, Kathmandu University Hospital in the Department of Orthopedics and Traumatology from March 2023 to Feb. 2024. This was a census study recruiting all consecutive cases satisfying inclusion criteria over the specified study period. A structured proforma was used as a data collection tool. Data was obtained from the medical record department of the hospital by reviewing the medical record of the patients. Before starting the study, ethical approval was obtained from the Institutional Review Committee of Kathmandu University School of Medical Sciences (IRC-KUSMS Approval No. 114/24) and informed written consent were taken.

Presence of SSI was defined as presence of pus or purulent discharge from the wound along with pain with any two cardinal signs of inflammation and clinically within 30 days of the operative procedure.[8] Inclusion criteria were the patients who had undergone operative management (open reduction internal fixation with plate osteosynthesis, intra medullary inter locking nailing, arthroscopic surgery, spine surgery, implant removal, arthroplasties, open fracture (Gustilo Anderson Grade I and II) where definite treatment was done) in the department of orthopedics and traumatology. Exclusion criteria were pathological fracture due to tumor, closed reduction percutaneous pinning, septic arthritis, abscess, open fracture (Gustilo Anderson Grade III), patients who had initial trauma surgery at another hospital and those who presented with SSIs after being treated at an outside hospital.

Study variables included demographic characteristics and possible preoperative risk factors (diabetes mellitus, steroid). SSIs wound grading was done with Southampton wound grading system.[9] Data was collected and clean in Microsoft Excel version 2021 and analysis were carried out in Statistical Package for the Social Sciences (SPSS) version 20. Descriptive analysis was done using frequencies, percentages, means and standard deviation. Statistical analysis was done taking point estimates with 95% confidence interval, and categorical data were presented as frequencies and percentages, while continuous data were summarized using means and standard deviations.

RESULTS

Total cases included were 1061, male 672 (63.30%), female 389 (36.70%) with average age of 39.52 ± 18.11 years which ranges from two year to 95 years. Among them 32 cases had SSI, making prevalence of 3.02%. SSI was most common in adult age group (19 - 64 years), accounting for 23 (71.88 %) cases, followed by 6 (18.75%) in the older age group (> 64 years) and 3 (9.37%) in younger age group (< 19 years). SSI was more common in males 27 (84%) compare to female 5 (16%).

Out of all patients studied 78 (7.35%) had chronic disease (DM, Hypertension, COPD, Hypothy-roidism). Of all those with chronic disease, SSIs were observed in 6 (18.75%), majority of them had DM. Majority cases were routine cases 960 (90.48%) whereas emergency operation accounted for 101 (9.52%) out of which 5 (15.63%) got SSI. Open fracture (GA I and II) accounted for 6 (18.75%) of the SSI. Majority of the cases, i.e. 12 (37.5%) of the SSI were Grade III according to Southampton Wound Grading System.

Table 1. Southampton Wound Grading System (Grading of the patients with SSI, n= 32)

Southampton Surgical Wound Grading	n (%)
Grade I	3 (9.4)
Grade II	4 (12.5)
Grade III	12 (37.5)
Grade IV	6 (18.8)
Grade V	7 (21.8)

Similarly, the mean hospital stay was 5.50 ± 3.50 days in SSI cases. Those who had SSI, pus/wound swabs were sent for culture and sensitivity after which 17(53.10%) had growth of microorganism, whose profile is then shown in the table below.

Table 2. Pus / Swab Culture which shows growth of microorganism (n=32)

Growth of microorganism	n (%)
Staphylococcus aureus	3 (9.37)
Pseudomonas aeruginosa	3 (9.37)
Methicillin-Resistant Staphylococcus aureus	3 (9.37)
Escherichia coli	2 (6.25)
Acinetobacter spp.	2 (6.25)
Enterococcus spp.	2 (6.25)
Proteus mirabilis	1 (3.13)
Klebsiella pneumoniae	1 (3.13)
No growth	15 (46.88)

DISCUSSIONS

Surgical site infection (SSI) is recognized as one of the most significant complications following orthopedic surgery, contributing substantially to postoperative morbidity, prolonged hospital stays, and increased healthcare costs. SSI not only affects patient outcomes but also places a considerable burden on healthcare systems, making it a critical target for surveillance and prevention strategies.[10] The surveillance of SSIs is an essential component of hospital infection control programs and quality improvement initiatives. By systematically monitoring SSI rates and patterns, hospitals can identify areas for intervention and implement targeted measures to reduce infection incidence.[11] Globally, the reported incidence of SSIs varies widely, reflecting differences in patient populations, surgical procedures, infection control practices, and use of prophylactic. Studies indicate that SSIs occur in approximately 3% to 20% of surgical procedures highlighting their prevalence and the ongoing need for preventive measures.[12]

In the present study, 32 patients developed SSIs, representing 3.02% of the total cases evaluated. This finding is comparable to the study conducted by Keerio et al. in Pakistan, which reported an SSI rate of 3.2%, suggesting that similar infection control protocols and prophylactic measures may have contributed to the low incidence observed in both settings.[13] Our incidence was slightly higher than the incidence reported in the study conducted by Shrestha et al. (2.6% over a three-month period) in general surgery cases, though this difference may be attributable to variations in study populations, types of surgeries included, and duration of follow-up.[14]

Conversely, significantly higher SSI rates have been reported in other settings, such as the 25% incidence reported by Kisibo et al. This marked difference can largely be explained by the absence of prophylactic antibiotics in their patient cohort, in contrast to the present study where all patients received appropriate perioperative antibiotic prophylaxis.[15] This underscores the critical role of prophylactic antibiotics in reducing the risk of postoperative infections in orthopedic patients.

Patient demographics also appear to influence SSI risk. In the current study, the majority of patients who developed SSIs were adults aged 19 - 64 years, accounting for 71.88% of cases. This aligns with findings by Ribeiro et al, who reported that 62.5% of SSIs occurred in the adult age group.[16] The predominance of SSIs in this demographic may reflect the higher frequency of trauma-related injuries, such as fractures from motorcycle accidents or falls, which are common indications for orthopedic surgery in adults. Male patients were also more frequently affected, representing 84.38% of the cases in this study, consistent with the gender distribution observed by Ribeiro et al.[16] This may be related to greater male participation in high-risk activities leading to fractures and surgical interventions.

Several comorbid conditions have been identified as risk factors for SSIs in orthopedic surgery. Diabetes mellitus, in particular, has been consistently associated with increased susceptibility to infections due to impaired wound healing and compromised immune function. The study by Olsen et al. highlighted the heightened risk of SSI in diabetic patients undergoing orthopedic procedures, and the present study observed similar findings, reinforcing the need for careful preoperative optimization and monitoring of patients with diabetes.[17]

In our study, six cases with open fracture developed SSI. Open fractures often involve contaminated wounds and extensive soft tissue damage, which create an environment conducive to bacterial colonization and infection, supporting observations made in research done by Bergström et al.[18]

The presence of chronic diseases also influences SSI risk. In this study, 7.69% of patients who developed SSIs had underlying chronic conditions, paralleling findings from studies conducted in Eastern India teaching hospitals. Chronic diseases can impair the body's defense mechanisms and delay wound healing, thereby increasing vulnerability to postoperative infections.[19]

Hospitalization duration is another important consideration. Patients who developed SSI in this study had prolonged hospital stays compared to those without infections. This observation is consistent with global reports indicating that SSI led to longer inpatient care, higher diagnostic and treatment costs, and increased overall healthcare expenditures.[20] Prolonged hospitalization not only burdens healthcare systems financially but also expose patients to additional risks, including hospital-acquired infections and reduced quality of life.[21]

In the present study, the majority of cases were classified as Gustilo Anderson Grade III according to the Southampton Wound Grading System, indicating clear or haemoserous discharge from the surgical site.[9] This system offers a simple and reliable method for assessing postoperative wound healing and infection severity. Similar grading patterns

were reported by Ghimire et al. emphasizing its utility in both clinical and research settings.[7]

Despite the valuable insights provided by this study, certain limitations must be acknowledged. The study included a heterogeneous patient population, encompassing a variety of orthopedic procedures, which may introduce variability in SSI risk factors. Additionally, the retrospective study design limits the ability to establish causal relationships, and a prospective design would have provided stronger evidence. Furthermore, SSIs were defined up to 30 days postoperatively, whereas infections related to orthopedic implants can occur up to one year after surgery. Longer follow-up in implant-related cases would yield a more accurate assessment of infection incidence and risk factors.

CONCLUSION

Surgical site infection rate in orthopedic surgery cases in our study populations is found to be low and this is comparable to other studies conducted in similar settings. However, there is a need for long-term follow up of the patients to find the cases of delayed presentation of SSI.

ACKNOWLEDGEMENTS

We would like to express sincere thanks to Ms. Sulekha Shrestha and Ms. Jeny Shrestha, infection prevention and control committee nurses at Dhulikhel Hosptial for their valuable contribution in reviewing the manuscript. Similarly, we would like to thank Dr. Pawan Acharya, Dr. Ram Shrestha and Dr. Sandesh Sankhat Maharjan for assisting in data acquisition.

REFERENCES

1. Kirkland KB, Briggs JP, Trivette SL, Wilkinson WE, Sexton DJ. The impact of surgical-site infections in the 1990s: attributable mortality, excess length of hospitalization, and extra costs. *Infect Control Hosp Epidemiol.* 1999 Nov;20(11):725–30.
2. Horan TC, Gaynes RP, Martone WJ, Jarvis WR, Emori TG. CDC definitions of nosocomial surgical site infections, 1992: a modification of CDC definitions of surgical wound infections. *Infect Control Hosp Epidemiol*. 1992 Oct;13(10):606–8.
3. Ghashghaee A, Behzadifar M, Azari S, Farhadi Z, Bragazzi NL, Behzadifar M, et al. Prevalence of nosocomial infections in Iran: a systematic review and meta-analysis. *Med J Islam Repub Iran.* 2018;32:48. PubMed PMID: 30159299.
4. Sway A, Solomkin JS, Pittet D, Kilpatrick C. Methodology and background for the World Health Organization global guidelines on the prevention of surgical site infection. *Surg Infect* (Larchmt). 2018 Feb;19(1):33–9.
5. Moucha CS, Clyburn T, Evans RP, Prokuski L. Modifiable risk factors for surgical site infection. *J Bone Joint Surg Am*. 2011 Feb 16;93(4):398–404.
6. Mawalla B, Mshana SE, Chalya PL, Imirzalioglu C, Mahalu W. Predictors of surgical site infections among patients undergoing major surgery at Bugando Medical Centre in Northwestern Tanzania. *BMC Surg*. 2011 Jul 22;11(1):21.
7. Ghimire P, Shrestha BB, Karki OB, Timilsina B, Neupane A, Bhandari A. Postoperative surgical site infections in the Department of General Surgery of a tertiary care centre: a descriptive cross-sectional study. *JNMA J Nepal Med Assoc.* 2022 May 5;60(249):439–43.
8. Oguntibeju OO, Nwobu RA. Occurrence of Pseudomonas aeruginosa in post-operative wound infection. *Pak J Med Sci*. 2004 Jul–Sep;20(3):187–91.
9. Bailey IS, Karran SE, Toyn K, Brough P, Ranaboldo C, Kettlewell MGW. Community surveillance of complications after hernia surgery. *BMJ*. 1992 Feb 22;304(6825):469–71.
10. Najjar WY, Saleh M. Orthopedic surgical site infection: incidence, predisposing factors, and prevention. *Int J Med Sci Clin Inventions*. 2017;4(2):2651–61.
11. Gaynes R, Richards C, Edwards J, Emori TG, Horan T, Alonso-Echanove J, et al. Feeding back surveillance data to prevent hospital-acquired infections. *Emerg Infect Dis.* 2001 Mar-Apr;7(2):295–8.
12. Klevens RM, Edwards JR, Richards CL Jr, Horan TC, Gaynes RP, Pollock DA, et al. Estimating health care-associated infections and deaths in U.S. hospitals, 2002. *Public Health Rep*. 2007 Mar-Apr;122(2):160–6.
13. Keerio NH, Shah GA, Afzal T, Khanzada AA, Joyo MR, Ahmed N, et al. Surgical site infection incidence following hip surgery: a cross-sectional study. *J Pharm Res Int.* 2021 Aug 14;33(41A):66–74.
14. Shrestha JS, Wenju P, Shrestha R, Karmacharya RM. Incidence and risk factors of surgical site infections in Kathmandu University Hospital, Kavre, Nepal. *KUMJ.* 2016 Jul–Dec;54(2):107–11.
15. Kisibo A, Ndume VA, Semiono A, MikaE, Sariah A, Protas J, et al. Surgical Site Infection among Patients Undergone Orthopaedic Surgery at Muhimbili Orthopaedic Institute, Dar es Salaam, Tanzania. *East Cent Afr J Surg.* 2017 July;22(1):49–57.
16. Ribeiro JC, Santos CB, Bellusse GC, Rezende VF, Galvão CM. Occurrence and risk factors for surgical site infection in orthopedic surgery. *Acta Paul Enferm*. 2013 Jul–Aug;26(4):353–9.
17. Olsen MA, Nepple JJ, Riew KD, Lenke LG, Bridwell KH, Mayfield J, et al. Risk factors for surgical site infection following orthopaedic spinal operations. *J Bone Joint Surg Am*. 2008 Jan;90(1):62–9.
18. Bergström J, Möller Rydberg E, Wennergren D, Svensson Malchau K. Incidence and risk factors for surgical site infection in ankle fractures: an observational study of 480 patients in Sweden. *J Clin Med*. 2023 Oct 19;12(20):6464.
19. Dasgupta A, Dasgupta S, Das S, Gupta TR, Ghosh B, Karmakar MK. Prevalence of surgical site infections in general surgery in a tertiary care centre in Eastern India. *ISJ.* 2017 Aug;6(6):3101–6.
20. Monge Jodra V, Sainz de Los Terreros Soler L, Diaz-Agero C, Perez C, Saa Requejo CM, Plana Farras N. Excess length of stay attributable to surgical site infection following hip replacement: a nested case-control study. *Infect Control Hosp Epidemiol.* 2006 Dec;27(12):1299–303.
21. Oliveira AC, Andrade FS, Diaz ME, Iquiapaza RA. Colonization by resistant micro-organism and infection related to health care. *Acta Paul Enferm*. 2012 Mar-Apr;25(2):183–9.