International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675

Frequency: Bi-Monthly

Available online on: https://ijmpr.in/

Original Article

Surgical Site Infection in Fatal Postoperative Cases: An Autopsy-Based Observational Study from Eastern India

Kallol Roy[1], Swarnali Mukherjee[2], Satrajit Roy[3]

[1,2] Assistant Professor, Department of FMT, Barasat Govt. Medical College & Hospital, WB

[3] Senior Resident, Department of FMT, Barasat Govt. Medical College & Hospital, WB

OPEN ACCESS

Corresponding Author:

Dr. Kallol Roy

Assistant Professor, Department of FMT, Barasat Govt. Medical College & Hospital, WB.

Received: 17-04-2026

Accepted: 25-05-2026

Available online: 15-06-2026

ABSTRACT

Background: Surgical site infection (SSI) is among the most common healthcare-associated infections and remains a major contributor to postoperative morbidity, prolonged hospitalization, increased healthcare costs, and mortality.[1–3] Although numerous clinical studies have evaluated SSI in surgical patients, autopsy-based evidence examining the contribution of SSI to fatal postoperative outcomes remains limited.

Aim: To determine the prevalence and pattern of surgical site infection in fatal postoperative cases, evaluate its association with surgical wound classification, and explore its implications for perioperative infection control and antimicrobial stewardship.

Materials and Methods: A retrospective observational study was conducted on 75 postoperative deaths subjected to medicolegal autopsy in an anonymized tertiary care teaching institution in Eastern India from January 2025 to December 2025. Clinical records, operative notes, laboratory investigations, and autopsy findings were reviewed. Surgical wounds were classified as clean, clean-contaminated, contaminated, and dirty. Surgical site infections were categorized as superficial incisional, deep incisional, and organ/space infections according to the Centers for Disease Control and Prevention (CDC) criteria. The association between wound classification and SSI was analyzed using the Chi-square test, with $p<0.05$ considered statistically significant.

Results: Evidence of SSI was identified in 29 (38.7%) of the 75 fatal postoperative cases. Contaminated wounds constituted the largest group (49.3%). SSI occurred in 24% of clean wounds, none of the clean-contaminated wounds, 54% of contaminated wounds, and 75% of dirty wounds. Organ/space SSI was the predominant pattern of infection, accounting for 72.4% of all infected cases. A statistically significant association was observed between wound classification and the occurrence of SSI ($\chi^2=13.862$; df=3; $p=0.0031$).

Conclusion: Surgical site infection contributed substantially to fatal postoperative outcomes and was significantly associated with increasing wound contamination. The predominance of organ/space infections highlights the importance of meticulous perioperative infection control practices, antimicrobial stewardship, and early recognition of deep-seated infections to reduce preventable postoperative mortality.

Keywords: *Surgical site infection; postoperative mortality; autopsy; wound classification; antimicrobial stewardship; sepsis.*

INTRODUCTION

Surgical site infections remain a major challenge in modern surgical practice despite advances in aseptic techniques, antimicrobial therapy, and perioperative care. According to the Centers for Disease Control and Prevention (CDC), SSI is defined as an infection occurring within 30 days after surgery or within one year in patients with implants, involving the incision or deeper tissues manipulated during the operative procedure.[4] SSIs constitute one of the most common healthcare-associated infections worldwide and account for a substantial proportion of preventable postoperative complications.

The burden of SSI is particularly significant in low- and middle-income countries, where limitations in healthcare infrastructure, overcrowding, delayed diagnosis, and inconsistent adherence to infection prevention protocols contribute to higher infection rates. The World Health Organization (WHO) has emphasized that SSI not only increases morbidity and mortality but also prolongs hospitalization, increases antimicrobial consumption, and imposes a considerable financial burden on healthcare systems and patients.[3,8–10]

The development of SSI is influenced by multiple factors including patient characteristics, type and duration of surgery, wound classification, perioperative antimicrobial prophylaxis, and postoperative care. Surgical wounds are traditionally categorized as clean, clean-contaminated, contaminated, and dirty. This classification remains a valuable predictor of postoperative infection risk and guides preventive strategies.[5]

While several surveillance studies have documented SSI incidence among postoperative survivors, relatively few investigations have focused on fatal postoperative cases. Autopsy-based studies offer a unique opportunity to objectively identify infectious complications that may remain clinically unrecognized during life. Such studies provide valuable insights into the actual contribution of SSI to postoperative mortality and facilitate the development of strategies aimed at reducing preventable deaths.[11,12]

The present study was therefore undertaken to evaluate the occurrence and extent of SSI among fatal postoperative cases subjected to medicolegal autopsy and to determine the relationship between wound classification and surgical site infection in an Eastern Indian setting.

MATERIALS AND METHODS

This retrospective observational study was conducted in the Department of Forensic Medicine of an anonymized tertiary care teaching institution in Eastern India. The study included all postoperative deaths subjected to medicolegal autopsy between January 2025 and December 2025.

A total of 75 postoperative deaths fulfilling the inclusion criteria were analyzed. Cases with a history of surgical intervention prior to death and adequate clinical documentation were included. Cases with incomplete records preventing wound classification were excluded.

Data were obtained from hospital records, operative notes, laboratory investigations, and autopsy findings. Detailed autopsy examination was performed in each case to identify evidence of infection and establish the cause of death.
SSI was classified according to CDC criteria into superficial incisional SSI, deep incisional SSI, and organ/space SSI.[4] Surgical wounds were categorized into clean, clean-contaminated, contaminated, and dirty wounds.[5] based on standard definitions.

Statistical analysis was performed using the Chi-square test to evaluate the association between wound classification and SSI occurrence. A p-value less than 0.05 was considered statistically significant.

Inclusion criteria

- All postoperative deaths subjected to medicolegal autopsy during the study period.
- Availability of operative and clinical records.

Exclusion criteria

- Incomplete documentation.
- Advanced decomposition preventing assessment.

RESULTS

Among the 75 postoperative deaths, SSI was identified in 29 cases, yielding an overall prevalence of 38.7%.
Contaminated wounds constituted the largest category (37 cases; 49.3%), followed by clean wounds (25 cases; 33.3%), clean-contaminated wounds (9 cases; 12.0%), and dirty wounds (4 cases; 5.4%).
SSI was observed in six clean wounds (24%), none of the clean-contaminated wounds, 20 contaminated wounds (54%), and three dirty wounds (75%).

Organ/space SSI represented the predominant infection pattern, accounting for 21 of the 29 infected cases (72.4%). Deep incisional SSI occurred in seven cases (24.1%), while superficial SSI was observed in only one case (3.5%).

Chi-square analysis demonstrated a statistically significant association between wound classification and SSI occurrence ($\chi^2=13.862$; df=3; p=0.0031), indicating an increasing probability of infection with increasing wound contamination.

Of the 29 infected cases, organ/space SSI accounted for the majority (72.4%), followed by deep incisional SSI (24.1%) and superficial SSI (3.5%). This distribution indicates that fatal postoperative outcomes were more frequently associated with deeper infections rather than superficial wound involvement.

Table 1. Distribution of Fatal Postoperative Cases According to Surgical Wound Classification

Wound Classification	Frequency	Percentage
Clean	25	33.3
Clean-contaminated	9	12.0
Contaminated	37	49.3
Dirty	4	5.4
Total	75	100

Table 2. Relationship Between Surgical Wound Classification and Occurrence of SSI

Wound Classification	SSI Present	SSI Absent
Clean	6	19
Clean-contaminated	0	9
Contaminated	20	17
Dirty	3	1

Chi-square=13.862; df=3; p=0.0031.

Table 3. Distribution of Types of Surgical Site Infection Among Fatal Postoperative Cases

Wound Class	Superficial	Deep	Organ/Space	Total SSI
Clean	1	2	3	6
Clean-contaminated	0	0	0	0
Contaminated	0	3	17	20
Dirty	0	2	1	3
Total	1	7	21	29

Figure Legends

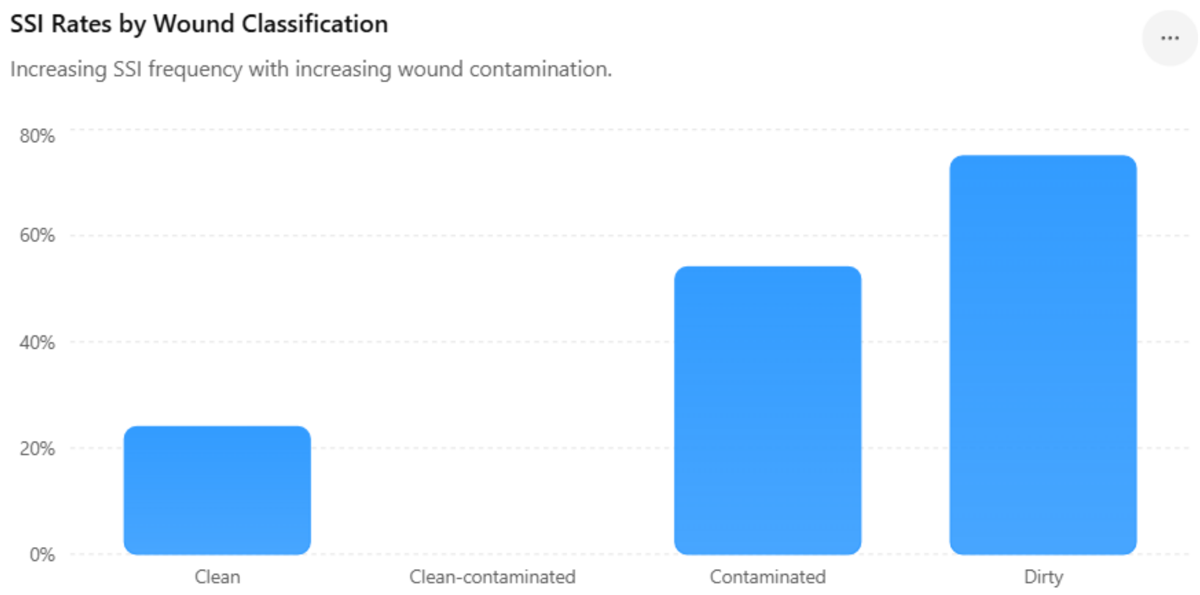

Figure 1:

Bar chart showing SSI rates according to wound classification. Infection rates increased progressively from clean wounds (24%) to contaminated wounds (54%) and dirty wounds (75%).

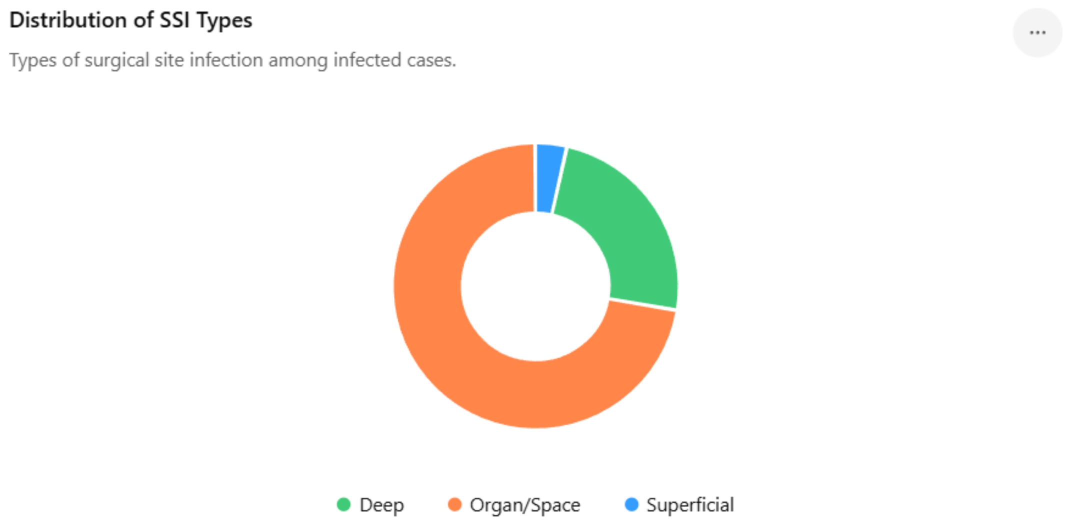

Figure 2:

Pie chart demonstrating the distribution of SSI types among infected cases. Organ/space SSI constituted 72.4% of all infections, followed by deep incisional SSI (24.1%) and superficial SSI (3.5%).

DISCUSSION

The present study demonstrated that more than one-third of fatal postoperative cases exhibited evidence of SSI. The prevalence observed was considerably higher than that reported in routine surgical surveillance studies.[6,9] However, this finding reflects the unique study population comprising exclusively fatal postoperative cases and underscores the potential contribution of SSI to adverse outcomes. The study population represented fatal cases only, which explains the markedly higher prevalence compared with routine surveillance studies.

A progressive increase in SSI rates was observed with increasing wound contamination. This finding is consistent with the classical observations of Cruse and Foord, who reported increasing infection rates with higher wound contamination categories. Although absolute rates differed, the overall trend supports the continuing relevance of wound classification as a predictor of postoperative infection risk.[5]

A noteworthy finding was the predominance of organ/space SSI. These infections are frequently associated with delayed diagnosis, progression to systemic sepsis, and increased mortality. The higher frequency of organ/space infections in this study likely contributed substantially to fatal outcomes.[6,10]

Autopsy remains the gold standard for establishing pathological causes of death and provides objective evidence regarding infectious complications that may be clinically underestimated. This represents an important strength of the present study and distinguishes it from conventional clinical surveillance investigations.[11,12]

The findings emphasize the importance of strict adherence to infection prevention protocols, appropriate timing and selection of antimicrobial prophylaxis, early postoperative surveillance, and prompt intervention when deep-seated infections are suspected.[2,7,14]

Clinical and Pharmaceutical Implications

The study findings highlight the need for effective antimicrobial stewardship programs involving surgeons, microbiologists, pharmacists, and infection control teams. Rational antimicrobial prophylaxis, appropriate antibiotic selection, optimization of dosing schedules, and regular audit of prescribing practices may reduce SSI-related morbidity and mortality while limiting the emergence of antimicrobial resistance. Pharmacists can play a critical role in monitoring antimicrobial utilization, promoting guideline adherence, and facilitating multidisciplinary infection prevention initiatives.[2,7,14,16]

Limitations

The present study has certain limitations. It was a single-centre retrospective study involving only fatal postoperative cases subjected to medicolegal autopsy, thereby limiting generalizability to the broader surgical population. The absence of a control group comprising postoperative survivors prevented the assessment of independent predictors of mortality. Certain perioperative variables, including detailed antimicrobial prophylaxis practices and postoperative management protocols, were not uniformly available. In addition, referral bias cannot be excluded, as medicolegal autopsies often represent more complex or unexpected clinical scenarios. Nevertheless, the study provides valuable autopsy-based evidence regarding the burden and pattern of SSI in fatal postoperative cases.

The autopsy-based design represents a major strength of the present study by enabling objective identification and characterization of SSI in fatal postoperative cases. The integration of clinical, laboratory, operative, and autopsy findings enhanced diagnostic accuracy and provided valuable insight into the contribution of SSI to postoperative mortality.

CONCLUSION

Surgical site infection was present in more than one-third of fatal postoperative cases and was significantly associated with increasing wound contamination. Organ/space SSI emerged as the predominant infection pattern. These findings emphasize the importance of strengthening infection prevention practices, optimizing antimicrobial stewardship, and promoting early recognition of deep infections to reduce preventable postoperative mortality. Integration of robust infection prevention strategies, timely antimicrobial stewardship interventions, and multidisciplinary postoperative surveillance may substantially reduce SSI-related mortality.[11]

Conflict of Interest
The authors declare that they have no conflict of interest.
Funding
No funding was received for this study

REFERENCES

1. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection, 1999. Infect Control Hosp Epidemiol. 1999;20(4):250-278.
2. Berríos-Torres SI, Umscheid CA, Bratzler DW, Leas B, Stone EC, Kelz RR, et al. Centers for Disease Control and Prevention guideline for the prevention of surgical site infection, 2017. JAMA Surg. 2017;152(8):784-791.
3. World Health Organization. Global Guidelines for the Prevention of Surgical Site Infection. 2nd ed. Geneva: WHO; 2018.
4. Horan TC, Gaynes RP, Martone WJ, Jarvis WR, Emori TG. CDC definitions of nosocomial surgical site infections. Infect Control Hosp Epidemiol. 1992;13(10):606-608.
5. Cruse PJE, Foord R. The epidemiology of wound infection. Surg Clin North Am. 1980;60(1):27-40.
6. Owens CD, Stoessel K. Surgical site infections: epidemiology, microbiology and prevention. J Hosp Infect. 2008;70(Suppl 2):3-10.
7. Anderson DJ, Podgorny K, Berríos-Torres SI, et al. Strategies to prevent surgical site infections in acute care hospitals. Infect Control Hosp Epidemiol. 2014;35(6):605-627.
8. Allegranzi B, Bischoff P, de Jonge S, et al. WHO recommendations on SSI prevention. Lancet Infect Dis. 2016;16:e276-e287.
9. Kirkland KB, Briggs JP, Trivette SL, et al. Impact of surgical-site infections. Infect Control Hosp Epidemiol. 1999;20(11):725-730.
10. Badia JM, Casey AL, Petrosillo N, et al. Impact of SSI on healthcare costs and outcomes. J Hosp Infect. 2017;96(1):1-15.
11. Fecho K, Lunney AT, Boysen PG, Rock P, Norfleet EA. Postoperative mortality after inpatient surgery. Ther Clin Risk Manag. 2008;4(4):681-688.
12. Pearse RM, Moreno RP, Bauer P, et al. Mortality after surgery in Europe. Lancet. 2012;380:1059-1065.
13. Leaper DJ, Edmiston CE. WHO global guidelines commentary. J Hosp Infect. 2017;95:135-136.
14. Ban KA, Minei JP, Laronga C, et al. ACS and Surgical Infection Society guidelines. J Am Coll Surg. 2017;224(1):59-74.
15. Haley RW, Culver DH, White JW, et al. Efficacy of infection surveillance programs. Am J Epidemiol. 1985;121:182-205.
16. Broom A, Broom J, Kirby E, et al. Pharmacists as antibiotic stewards: a narrative review. Int J Clin Pharm. 2019;41:302-318.
17. Lilani SP, Jangale N, Chowdhary A, Daver GB. Surgical site infection in clean and clean-contaminated cases. *Indian J Med Microbiol.* 2005;23(4):249-252.
18. Patel SM, Patel MH, Patel SD, Soni ST, Kinariwala DM. Surgical site infections: incidence and risk factors in a tertiary care hospital. *National Journal of Community Medicine.* 2012;3(2):193-196.
19. Kownhar H, Shankar EM, Vignesh R, Sekar R, Velu V, Rao UA. High isolation rate of Staphylococcus aureus from surgical site infections in an Indian hospital. *J Antimicrob Chemother.* 2008;61(3):758-760.