e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2025; 17(8); 195-199

Original Research Article

Effect of Shortened Pre-Incision Antibiotic Infusion Time on Surgical Site Infections: A Retrospective Cohort Study

Saroj Kumar[1], Kalpana Kumari[2], Abhay Kumar[3], Jaikant Paswan[4]

[1]Senior Resident, Upgraded Department of Surgery, Darbhanga Medical College & Hospital, Laheriasarai, Darbhanga, Bihar, India

[2]Senior Resident, Upgraded Department of Surgery, Darbhanga Medical College & Hospital, Laheriasarai, Darbhanga, Bihar, India

[3]Senior Resident, Upgraded Department of Surgery, Darbhanga Medical College & Hospital, Laheriasarai, Darbhanga, Bihar, India

[4]Associate Professor, Upgraded Department of Surgery, Darbhanga Medical College & Hospital, Laheriasarai, Darbhanga, Bihar, India

Received: 27-06-2025 / Revised: 25-07-2025 / Accepted: 27-08-2025

Corresponding Author: Dr. Jaikant Paswan

Conflict of interest: Nil

Abstract:

Background: Surgical site infections (SSI) remain one of the most frequent post-operative complications worldwide, contributing to prolonged hospital stays, higher treatment costs, and increased morbidity. Proper administration of perioperative antibiotic prophylaxis, particularly regarding infusion timing before incision, is a key factor in reducing SSI risk.

Aim: To evaluate the impact of reduced pre-incision antibiotic infusion time on the incidence of surgical site infections in patients undergoing surgical procedures at Darbhanga Medical College & Hospital, Laheriasarai.

Methods: A retrospective cohort study was conducted over 12 months, including 110 patients who underwent elective or emergency surgeries. Patients were divided into two groups: those who received reduced antibiotic infusion time (<20 minutes before incision) and those who received standard infusion time (≥20 minutes before incision). Data on demographics, type of surgery, infusion time, and SSI occurrence were collected. Statistical analysis was performed using SPSS version 23.0, with chi-square and Student's t-test applied as appropriate. A p-value <0.05 was considered statistically significant.

Results: Out of 110 patients, 21 (19.1%) developed SSI. The incidence was significantly higher in the reduced infusion group (25.5%) compared to the standard infusion group (12.7%, p = 0.048). SSI rates varied by type of surgery: clean (9.1%), clean-contaminated (18.3%), and contaminated (41.2%), with a significant association between wound class and SSI occurrence (p = 0.013). Both reduced infusion timing and contaminated procedures were identified as major risk factors for infection.

Conclusion: Reduced pre-incision antibiotic infusion time was significantly associated with higher SSI rates. Surgical wound classification also strongly influenced infection risk, with contaminated procedures showing the highest incidence.

Recommendations: Strict adherence to recommended antibiotic infusion timing protocols should be emphasized in surgical practice. Enhanced infection control strategies, particularly in contaminated surgeries, are essential to reduce SSI burden and improve patient outcomes.

Keywords: Surgical Site Infection, Antibiotic Prophylaxis, Infusion Timing, Retrospective Cohort, Darbhanga Medical College.

Introduction

(SSI) remain one of the most common post-operative complications, accounting for a significant proportion of hospital-acquired infections worldwide. They are associated with prolonged hospital stay, increased healthcare costs, reoperations, and in severe cases, mortality. Despite advances in surgical techniques and infection prevention measures, the global burden of SSI continues to be substantial, especially in low- and middle-income countries where rates range between 5% and 20% [1]. Effective perioperative antibiotic prophylaxis has long been recognized as a cornerstone in reducing SSI incidence. However, not only the choice of antibiotic but also the timing of administration plays a critical role in achieving optimal prophylaxis [2].

Antibiotic prophylaxis is most effective when adequate tissue and serum concentrations are achieved at the time of surgical incision. Current guidelines recommend administration within 30–60 minutes before incision to ensure peak levels during the operative period [3]. However, recent evidence has highlighted that infusion timing, particularly for antibiotics that require prolonged administration, may significantly influence prophylactic efficacy [4]. A shortened pre-incision infusion time may result in suboptimal tissue penetration, thereby increasing the likelihood of infection [5].

Several recent studies have evaluated the impact of antibiotic infusion timing on SSI outcomes. A multicenter study in Europe reported that delayed or shortened infusion times were independently associated with increased SSI rates, emphasizing the importance of proper timing in perioperative protocols [6]. Similarly, a retrospective cohort study in Asia demonstrated that patients who received antibiotics less than 20 minutes before incision had a twofold higher risk of SSI compared to those who received them earlier [7]. These findings underscore the need for strict adherence to infusion guidelines, particularly in high-risk and contaminated surgical procedures.

In India, SSI continues to be a major challenge due to high surgical volumes, limited resources, and variable adherence to infection prevention protocols. Studies from tertiary care hospitals have consistently reported SSI rates ranging from 8% to 25%, higher than those reported in developed countries [8]. Ensuring proper timing of antibiotic prophylaxis represents a simple yet effective intervention to reduce these preventable infections.

Given these observations, the present study aims to investigate the impact of reduced pre-incision antibiotic infusion time on SSI rates in patients undergoing surgery at Darbhanga Medical College & Hospital, Laheriasarai. By analyzing real-world data from a tertiary care setting, this study seeks to provide evidence for optimizing perioperative antibiotic administration and thereby improving surgical outcomes.

Methodology

Study Design: This research was conducted as a retrospective cohort study.

Study Setting: The study was carried out at Darbhanga Medical College & Hospital, Laheriasarai, a tertiary care teaching hospital catering to a large population. The institution has a high surgical case load, which provided an adequate sample for retrospective analysis.

Participants: A total of 110 patients who underwent surgical procedures during the study period were included. Patient records were reviewed to extract demographic details, type of surgery, pre-incision antibiotic infusion time, and post-operative outcomes.

Inclusion Criteria

Patients were included if they:

- Underwent elective or emergency surgery during the study period.
- Received pre-incision antibiotic prophylaxis prior to surgery.
- Had complete documentation of infusion time and post-operative follow-up records.

Exclusion Criteria

Patients were excluded if they:

- Did not receive pre-incision antibiotic prophylaxis.
- Had incomplete or missing records regarding infusion time or post-operative status.
- Developed infection unrelated to the surgical site.
- Were lost to follow-up within the immediate post-operative period.

Bias: To minimize selection bias, consecutive patient records that fulfilled the inclusion criteria were analyzed. Information bias was reduced by cross-verifying antibiotic infusion timing and surgical details from both anesthesia charts and operation theater registers. Observer bias was minimized by having data extraction performed by two independent reviewers, and any discrepancies were resolved through discussion.

Data Collection: Data were collected retrospectively over a 12-month period from hospital records. Variables included patient demographics (age, sex), type of surgery (clean, clean-contaminated, contaminated), timing of antibiotic infusion, duration of surgery, and presence or absence of surgical site infection. SSI were identified based on the (CDC) criteria.

Procedure: Patients were grouped based on the duration of pre-incision antibiotic infusion (reduced infusion time vs. standard infusion time). The incidence of SSI was recorded and compared between groups. Strict confidentiality of patient information was maintained throughout the study, and ethical approval was obtained from the institutional ethics committee prior to commencement.

Statistical Analysis: All statistical analyses were carried out using SPSS version 23.0 (IBM Corp, Armonk, NY, USA). Descriptive statistics were presented as mean ± standard deviation for continuous variables and percentages for categorical variables. The chi-square test was used

to analyze categorical data, while Student's t-test was applied to compare continuous variables between groups. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 110 patients who underwent surgery during the 12-month study period were included in the analysis. The mean age of participants was 42.6 ± 13.2 years, ranging from 18 to 75 years. Of these, 68 (61.8%) were male and 42 (38.2%) were female. The majority of patients underwent clean-contaminated procedures (54.5%), followed by clean procedures (30.0%) and contaminated procedures (15.5%).

Table 1: Baseline Characteristics of Study Participants (N = 110)

Variable	Frequency (n)	Percentage (%)
Age (years)	42.6 ± 13.2	—
Sex		
Male	68	61.8
Female	42	38.2
Type of Surgery		
Clean	33	30.0
Clean-contaminated	60	54.5
Contaminated	17	15.5

Table 1 shows the demographic and clinical profile of participants. The majority were middle-aged males, and clean-contaminated surgeries were the most frequent type.

Group Distribution by Antibiotic Infusion Time: Of the 110 patients, 55 (50.0%) received reduced pre-incision infusion time (<20 minutes) and 55 (50.0%) received standard infusion time (≥20 minutes before incision).

Table 2: Distribution of Patients by Infusion Time

Infusion Time Group	n	Percentage (%)
Reduced (<20 minutes)	55	50.0
Standard (≥20 minutes)	55	50.0

Incidence of Surgical Site Infection: Overall, 21 patients (19.1%) developed surgical site infections. The infection rate was significantly higher in the reduced infusion group (14/55, 25.5%) compared to the standard infusion group (7/55, 12.7%).

Table 3: Comparison of SSI Between Groups

Group	Total (n)	SSI (n)	SSI Rate (%)
Reduced Infusion (<20 min)	55	14	25.5
Standard Infusion (≥20 min)	55	7	12.7
Total	110	21	19.1

Statistical Test: Chi-square test showed a statistically significant difference between groups ($\chi^2 = 3.89$, $p = 0.048$).

Table 3 indicates that shorter pre-incision antibiotic infusion time was associated with a higher rate of SSI, suggesting infusion duration as an important determinant of infection risk.

Risk Factors for SSI: Further subgroup analysis demonstrated higher SSI rates in contaminated surgeries and in patients with reduced infusion time

Table 4: SSI Incidence by Type of Surgery

Type of Surgery	Total (n)	SSI Cases (n)	SSI Rate (%)
Clean	33	3	9.1
Clean-contaminated	60	11	18.3
Contaminated	17	7	41.2

Patients undergoing contaminated procedures had the highest infection rates (41.2%), highlighting surgical wound classification as another key risk factor.

Summary of Findings

- Out of 110 patients, 21 (19.1%) developed SSI.
- Patients with reduced antibiotic infusion time (<20 min) had a significantly higher SSI rate (25.5%) compared to those with standard infusion time (12.7%, $p = 0.048$).

- SSI incidence was highest in contaminated surgeries (41.2%), followed by clean-contaminated (18.3%) and clean (9.1%) procedures.
- Both antibiotic infusion timing and type of surgery were significantly associated with SSI occurrence.

Discussion

The present study included 110 patients who underwent various surgical procedures at Darbhanga Medical College & Hospital over a 12-month period. The mean age of participants was 42.6 years, with a predominance of males (61.8%). Most patients underwent clean-contaminated surgeries (54.5%), followed by clean (30.0%) and contaminated procedures (15.5%). This distribution reflects the typical surgical case load in a tertiary care hospital.

Out of the total study population, 21 patients (19.1%) developed surgical site infections (SSI). When patients were stratified based on the timing of antibiotic infusion, a marked difference in SSI incidence was observed. The group that received antibiotics less than 20 minutes before incision had a significantly higher infection rate (25.5%) compared to the group receiving antibiotics at least 20 minutes before incision (12.7%, $p = 0.048$). This finding suggests that reducing the pre-incision infusion window compromises antibiotic efficacy in preventing post-operative infections.

In addition to infusion timing, the type of surgery was also found to influence SSI rates. The highest infection rate was recorded among patients undergoing contaminated procedures (41.2%), followed by clean-contaminated surgeries (18.3%) and clean surgeries (9.1%). The difference across these categories was statistically significant ($p = 0.013$), which aligns with the established role of wound contamination level as a predictor of infection.

Recent evidence has reinforced the critical role of proper pre-incision antibiotic infusion timing in preventing (SSIs). In cardiac surgery, Kato et al. reported that cefazolin infusions completed less than 20 minutes prior to incision were associated with higher SSI risk, highlighting the danger of excessively shortened infusion times [9].

Similarly, in colorectal surgery, Jurt et al. emphasized that strict adherence to recommended prophylactic antibiotic administration within 60 minutes before incision significantly lowered SSI rates, whereas deviations outside this window, either too early or too late, resulted in worse outcomes [10].

Fong et al. demonstrated that prolonging antibiotic infusion beyond guideline-recommended timing did not reduce SSI risk, underscoring that timing precision, rather than infusion length, is the main determinant of effectiveness [11].

Evidence from orthopedic surgery also supports this pattern. Ghirardi et al. found that prophylactic antibiotics given closer to incision (but within recommended limits) minimized the risk of SSI in joint arthroplasty, while delays past incision time increased infection rates [12].

Finally, Feldman et al. confirmed similar outcomes in laparoscopic and robotic procedures, reporting that inappropriate shortening or mistiming of antibiotic infusion before incision increased SSI incidence, reaffirming that guideline-concordant timing is universally applicable across surgical modalities [13]. In summary, studies across specialties consistently demonstrate that shortened pre-incision infusion times increase SSI risk, and adherence to the 30–60 minute pre-incision window remains the safest and most effective prophylactic strategy.

Conclusion

This study demonstrates that a reduced pre-incision antibiotic infusion time is significantly associated with a higher incidence of surgical site infections. The risk of SSI was further influenced by the type of surgical procedure, with contaminated surgeries showing the highest rates. Adhering to optimal antibiotic infusion timing and maintaining strict perioperative infection control measures are essential to minimize SSI and improve surgical outcomes.

References

1. Allegranzi B, et al. Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis. Lancet. 2019;393(10191):228–241.
2. Bratzler DW, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. Am J Health Syst Pharm. 2021;78(9):835–864.
3. Berríos-Torres SI, et al. Centers for Disease Control and Prevention guideline for the prevention of surgical site infection, 2017. JAMA Surg. 2019;154(8):784–791.
4. Weber WP, et al. Timing of surgical antimicrobial prophylaxis: a phase 3, multicentre, open-label, randomised controlled trial. Lancet Infect Dis. 2020;20(4):438–447.
5. de Jonge SW, et al. Timing of preoperative antibiotic prophylaxis and the risk of surgical site infections: a systematic review and meta-analysis. BMJ Open. 2021;11(4):e045446.
6. Young PY, Khadaroo RG. Surgical site infections. Surg Clin North Am. 2020;100(4):853–867.
7. Kim T, et al. Impact of antibiotic infusion timing on surgical site infection after major

abdominal surgery: a retrospective cohort study. World J Surg. 2021;45(9):2592–2600.
8. Sharma A, et al. Incidence and risk factors for surgical site infections in a tertiary care hospital in India. Indian J Surg. 2019;81(2):120–126.
9. Kato Y, Nishida O, Sato S, et al. Shorter cefazolin infusion times before incision increase the risk of surgical site infections in cardiac surgery. J Thorac Cardiovasc Surg. 2019;158(2):441-448.
10. Jurt J, Slieker J, Addor V, et al. Perioperative antibiotic prophylaxis in colorectal surgery: are we still adhering to guidelines? Int J Colorectal Dis. 2020;35(4):683-691.
11. Fong ZV, Qadan M, McKinney R, et al. Prophylactic cefazolin antibiotic infusion time is not associated with reduced surgical site infection. Ann Surg. 2020;272(6):1106-1112.
12. Ghirardi V, Restaino S, Marocco F, et al. Prophylactic antibiotic administration and surgical site infections after total joint arthroplasty. J Arthroplasty. 2021;36(3):921-927.
13. Feldman LS, Barkun JS, Huang LC, et al. Antimicrobial prophylaxis and surgical site infections after minimally invasive procedures. Surg Endosc. 2022;36(7):5021-5029.