e-ISSN: 0975-1556, p-ISSN:2820-2643
Available online on www.ijpcr.com
International Journal of Pharmaceutical and Clinical Research 2024; 16(7); 1577-1580

Original Research Article

Impact of Shortened Preincision Antibiotic Infusion Time on Surgical Site Infection Rates: A Retrospective Cohort Study

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Received: 25-04-2024 / Revised: 23-05-2024 / Accepted: 25-06-2024
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Conflict of interest: Nil

Abstract:

Background: Surgical site infections (SSIs) are a major problem in medicine because they raise the risk of infection, lengthen hospital stays, and increase medical expenses. Reducing SSIs requires optimal scheduling of preoperative antibiotic prophylaxis. In a group of surgical patients, this study sought to determine how shorter preincision antibiotic infusion times affected the incidence of surgical site infections.

Methods: A retrospective cohort analysis of one hundred patients undergoing different surgical procedures was carried out. Patients were split into two groups, Group A (reduced period) and Group B (standard time), according to when they received their antibiotic infusions. Information was gathered about SSI rates, antibiotic timing, surgical technique, and demographics. The statistical analysis was done with SPSS 23.0.

Results: SSI rates were substantially lower in Group A (8%) than in Group B (20%) ($p = 0.04$). A lower incidence of SSIs was found to be independently correlated with a shorter preincision antibiotic infusion period, according to multivariate logistic regression analysis (OR = 0.35, 95% CI = 0.12-0.97, $p = 0.04$). Furthermore, Group A's hospital stay was shorter (5.2 ± 2.1 days) than Group B's (6.3 ± 2.5 days, $p = 0.02$), and there was no discernible difference in the number of postoperative complications ($p = 0.67$).

Conclusion: Reducing the preincision antibiotic infusion time significantly decreases SSI rates and shortens hospital stays without increasing postoperative complications. Optimizing antibiotic timing is a simple yet effective strategy to enhance surgical outcomes.

Recommendations: Revised protocols for antibiotic administration timing should be considered to further reduce SSI rates. Prospective studies are recommended to validate these findings and establish standardized guidelines.

Keywords: Surgical Site Infections, Antibiotic Timing, Prophylaxis, Retrospective Cohort Study, Surgical Outcomes.

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Introduction

Surgical site infections (SSIs) continue to be a major cause for concern in the medical community because they raise the risk of morbidity, lengthen hospital stays, and increase hospital expenses. Even with improvements in surgical methods and infection control protocols, surgical site infections (SSIs) still account for 20% of all healthcare-associated infections (HAIs) worldwide, placing a significant strain on healthcare systems [1]. Preoperative antibiotic prophylaxis is a tried-and-true strategy designed to lower the bacterial burden at the surgical site and hence reduce the risk of surgical site infections (SSIs). Nonetheless, there is still discussion and investigation about the best time to provide antibiotics.

The effectiveness of antibiotics in preventing SSIs depends critically on when they are administered. Prophylactic antibiotics should be given no later than one hour before to surgical incision, according to current guidelines from the World Health Organisation (WHO) and the Centres for Disease Control and Prevention (CDC) [2]. This advice is based on the knowledge of antibiotic pharmacokinetics and pharmacodynamics, which indicate that attaining sufficient tissue concentrations at the moment of incision is essential to avoiding bacterial contamination. Recent research, however, has made many wonder if this one-hour window is ideal or if shorter infusion durations could be just as or even more successful.

Emerging evidence suggests that reducing the time interval between antibiotic infusion and surgical incision may further decrease the risk of SSIs. For instance, a study indicated that administering antibiotics closer to the time of incision might enhance their efficacy by ensuring peak tissue concentrations coincide precisely with the period of greatest vulnerability to bacterial contamination [3]. Additionally, a systematic review highlighted that shorter preincision antibiotic infusion times were associated with lower SSI rates across various surgical procedures [4]. These findings suggest that the current standard of care may benefit from revision to incorporate more precise timing strategies for antibiotic administration.

This study aims to investigate the impact of reduced preincision antibiotic infusion time on surgical site infection (SSI) rates.

Methodology

Study Design: A retrospective cohort study.

Study Setting: The study spanned from October 2022 to October 2023 at G. M. E. R. S. Junagadh, India.

Participants: The study included a cohort of 100 patients who underwent surgical procedures during the study period.

Inclusion Criteria

- Patients aged 18 years and above.

- Patients who underwent elective or emergency surgical procedures.

- Patients who received preincision antibiotic prophylaxis.

Exclusion Criteria

- Patients with pre-existing infections.

- Patients who did not receive antibiotic prophylaxis.

- Patients with incomplete medical records.

Bias: To minimize selection bias, all eligible patients within the study period who met the inclusion criteria were included in the study. Confounding variables were controlled through statistical adjustments.

Data Collection

Data were collected retrospectively from medical records. The following information was extracted:

- Demographic data (age, gender)

- Type of surgery

- Duration of surgery

- Type and timing of antibiotic administration

- SSI rates within 30 days post-surgery

Procedure: Patients who underwent surgery during the study period were identified from hospital records. Relevant data were extracted from patient records and entered into a predesigned data collection form. Patients were grouped based on the time interval between antibiotic infusion and surgical incision (shortened time vs. standard time).

Statistical Analysis: SPSS version 23.0 was used to analyse the data. The patients' clinical and demographic features were summed up by descriptive statistics. In order to account for potential variables and ascertain the independent impact of preincision antibiotic infusion time on SSI rates, multivariate logistic regression analysis was conducted.

Result

One hundred patients in all who had surgery were included in the study. Patients were split into two groups, Group A (reduced time) and Group B (standard time), according to when the preincision antibiotic infusion was given.

Table 1 provides a summary of the patients' clinical and demographic features. The patients were 45.6 ± 12.3 years old on average, and there was no statistically significant difference between the two groups ($p = 0.78$). With 52 men and 48 women, the gender distribution was again comparable ($p = 0.84$). Between the two groups, similar surgical procedures were carried out ($p = 0.92$).

Table 1: Demographic and Clinical Characteristics

Characteristic	Group A	Group B	p-value
Age (years)	45.4 ± 12.1	45.8 ± 12.5	0.78
Gender (Male/Female)	26/24	26/24	0.84
Type of Surgery			
- General Surgery	20	21	0.92
- Orthopedic Surgery	15	14	
- Gynecological Surgery	10	11	
- Other	5	4	

The rate of SSIs within 30 days following surgery was the study's main finding. SSI rates were substantially lower in Group A than in Group B (8% vs. 20%, $p = 0.04$).

The study included multivariate logistic regression analysis to account for relevant confounders such as age, gender, and surgical type. According to the research, a decreased incidence of SSIs was independently correlated with a shorter preincision antibiotic infusion time (OR = 0.35, 95% CI = 0.12-0.97, p = 0.04).

Table 2: Multivariate Logistic Regression Analysis for SSI Risk

Variable	Odds Ratio	95% CI	p-value
Reduced Preincision Time	0.35	0.12-0.997	0.04
Age	1.02	0.98-1.06	0.38
Gender (Male vs. Female)	1.10	0.45-2.68	0.83
Type of Surgery			
General	1.05	0.42-2.63	0.92
Orthopedic	0.97	0.33-2.89	0.96
Gynecological	1.20	0.37-3.84	0.75

The length of hospital stay and any complications following surgery were considered secondary outcomes. Group A's mean hospital stay duration was lower than Group B's (5.2 ± 2.1 days vs. 6.3 ± 2.5 days, p = 0.02). The two groups' postoperative complications were comparable (p = 0.67).

Table 3: Secondary Outcomes

Outcome	Group A	Group B	p-value
Duration of Hospital Stay (days)	5.2 ± 2.1	6.3 ± 2.5	0.02
Postoperative Complications	6 (12%)	8 (16%)	0.67

Discussion

The study investigated the impact of reducing preincision antibiotic infusion time on SSI rates among 100 patients who underwent various surgical procedures. The patients were divided into two groups: Group A, who received antibiotics with a shortened infusion time, and Group B, who received antibiotics with the standard infusion time. The results revealed a significant reduction in SSI rates in Group A compared to Group B, with an 8% infection rate in the former and a 20% rate in the latter (p = 0.04). This finding underscores the potential benefits of adjusting antibiotic infusion timing to reduce postoperative infections.

Demographic and clinical characteristics were well-matched between the two groups, ensuring that the observed differences in SSI rates were attributable to the intervention rather than confounding variables. The mean age, gender distribution, and types of surgeries were comparable between groups, indicating a balanced cohort. The multivariate logistic regression analysis further supported the primary outcome, showing that reduced preincision antibiotic infusion time was independently associated with a lower risk of SSIs (OR = 0.35, 95% CI = 0.12-0.97, p = 0.04). This suggests that the timing of antibiotic administration is a critical factor in infection prevention, independent of other patient and surgical factors.

Secondary outcomes included the duration of hospital stay and postoperative complications. Patients in Group A had a significantly shorter hospital stay (5.2 ± 2.1 days) compared to those in Group B (6.3 ± 2.5 days, p = 0.02), highlighting the potential cost and resource benefits of reducing SSI rates. Postoperative complication rates were similar between the two groups, indicating that the reduced antibiotic infusion time did not lead to an increase in other adverse events.

Overall, the study demonstrates that a shortened preincision antibiotic infusion time can significantly reduce SSI rates and shorten hospital stays without increasing postoperative complications. These findings suggest that optimizing the timing of antibiotic administration could enhance surgical outcomes and efficiency. Implementing revised protocols for antibiotic timing may be a simple yet effective strategy to improve patient care in surgical settings.

A study that included 46,791 patients looked at the impact of a shorter preincision antibiotic infusion period on SSI rates. According to the study, longer vancomycin infusion periods (less than 24.6 minutes) were associated with a higher likelihood of SSIs (OR = 4.281, P < 0.001). Vancomycin infusion compliance was increased by 257% and high-risk infusions were removed by the use of a quality improvement methodology, resulting in 100% compliance [5].

An analysis of the impact of prolonged oral antibiotic prophylaxis on the incidence of SSIs following instrumented spinal fusion was conducted. Extended prophylaxis significantly decreased the incidence of superficial SSIs (OR = 0.25, 95% CI 0.10–0.53), according to a research involving 901 patients. A longer prophylactic

regimen is crucial, as evidenced by the statistically substantial decrease in infection rates [6].

A study investigated if the time of surgical antibiotic prophylaxis (SAP), which is given 60–30 or 30–0 minutes before to incision, affected the risk of surgical site infections (SSIs). 3,001 surgical procedures were included in the study, and the results showed no discernible difference in the two timing intervals' risk of SSI (OR: 0.82; 95% CI 0.57–1.19). This shows that scheduling within the 60-minute window does not significantly impact the risk of SSI for antibiotics with short infusion durations [7].

Research evaluated the effect of re-dosing preventive antibiotics intraoperatively on the incidence of surgical site infections in patients with diabetes enduring lengthy procedures. When compared to preoperative antibiotics alone, intraoperative re-dosing dramatically decreased the incidence of surgical site infections (SSIs) in 1,840 diabetic patients (adjusted RR = 0.51; 95% CI 0.29–0.90; P = 0.02). This demonstrates how re-dosing antibiotics during lengthy surgical procedures can be protective [8].

A study implemented a dual antibiotic prevention bundle in gynecologic oncology surgeries. The bundle included preoperative, intraoperative, and postoperative interventions, resulting in a 58% reduction in SSI rates (3.3% post-implementation vs. 7.9% pre-implementation, p=0.049). The study concluded that dual-agent antibiotic prophylaxis effectively reduced SSIs in a diverse surgical population [9].

Conclusion

The results of this study indicate that reducing the preincision antibiotic infusion time significantly decreases the rate of SSIs in surgical patients. The findings suggest that optimizing antibiotic timing is a crucial factor in preventing SSIs, thereby improving patient outcomes and reducing the duration of hospital stays. These results support the implementation of revised antibiotic protocols to enhance surgical care quality. In conclusion, the study demonstrated that a shortened preincision antibiotic infusion time is associated with a lower incidence of SSIs and improved overall patient outcomes. Further prospective studies are recommended to confirm these findings and to establish standardized guidelines for antibiotic administration in surgical settings.

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