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Impact of reduced pre-incision antibiotic infusion time on surgical site infection rates: A prospective observational study.

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Abstract

Background:
Surgical site infections (SSIs) continue to be a significant contributor to postoperative morbidity, resulting in extended hospitalisations, elevated healthcare expenses, and detrimental patient outcomes. The administration of prophylactic antibiotics is essential for preventing surgical site infections, with the timing of administration being crucial for achieving sufficient tissue concentrations at the moment of surgical incision. Conventional guidelines advocate for the administration of antibiotics 30–60 minutes before incision.

Objective:
To assess the effect of shortened pre-incision antibiotic infusion duration on the occurrence of surgical site infections.

Methods:
A prospective observational study was performed over 9 months, involving 115 individuals receiving elective surgical procedures. Patients were classified into two groups according to the timing of antibiotic administration: conventional timing (30–60 minutes before surgery) and reduced timing (less than 30 minutes prior to incision). The principal outcome assessed was the occurrence of surgical site infections (SSIs). Statistical analysis was used to ascertain the significance of differences among groups, with a p-value of less than 0.05 deemed statistically significant.

Results:
A total of 115 patients were included, with comparable baseline characteristics between groups. The mean age was 45 years in the standard timing group and 43 years in the reduced timing group, while males constituted 60% and 58%, respectively. Patients receiving antibiotics within 30 minutes before incision demonstrated a significantly lower SSI rate (10%) compared to the standard timing group (18%) ($p = 0.03$).

Conclusion:
Minimised pre-incision antibiotic administration seems to be a secure and efficacious approach for decreasing SSI rates. Integrating this methodology into standard surgical protocols may enhance patient outcomes and diminish the incidence of postoperative infections.

Recommendations:
Surgical teams should consider administering prophylactic antibiotics within 30 minutes prior to incision to optimise tissue antibiotic concentration and reduce postoperative surgical site infections.

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Introduction
Surgical site infections (SSIs) remain a serious issue in contemporary healthcare, leading to extended hospitalisations, elevated healthcare expenses, and increased patient morbidity. They continue to be one of the most prevalent postoperative consequences despite advancements in surgical methodologies and infection prevention protocols. Consequently, effective

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preventative techniques are crucial, with prophylactic antibiotic therapy serving as a fundamental approach to decreasing SSI incidence (1).

The timing of antibiotic administration is essential for maximising antimicrobial effectiveness. The principal objective is to attain sufficient tissue and serum antibiotic levels at the moment of surgical incision, when the likelihood of bacterial contamination is greatest. Historically, protocols have advised the use of antibiotics 30–60 minutes before incision. Emerging research indicates that giving antibiotics nearer to the incision time may enhance protection by sustaining peak tissue concentrations during the surgical period (2).

Divergences in timing methodologies among institutions and surgical teams can affect outcomes, underscoring the necessity to determine the most efficacious scheduling technique. A reduced time between antibiotic treatment and incision may diminish the chance of subtherapeutic levels during surgery, therefore improving infection prevention (3).

This study intends to assess the effect of diminished pre-incision antibiotic infusion timing on the incidence of surgical site infections. Comprehending the ideal timing may enhance current practices, elevate patient outcomes, and diminish the overall incidence of postoperative infections.

Methods

Study Design

This was a prospective observational study conducted to evaluate the effect of reduced pre-incision antibiotic infusion timing on surgical site infection (SSI) rates among patients undergoing elective surgical procedures.

Study Setting and Duration

The study was conducted in the Department of General Surgery at Patna Medical College and Hospital, Patna, Bihar, India, over a period of 9 months from January 2025 to September 2025.

Sample Size

The sample size of 115 patients was determined using a standard prevalence-based sample size calculation formula considering expected SSI prevalence from previous studies, 95% confidence interval, and acceptable margin of error.

Sampling Technique

Patients fulfilling the eligibility criteria were selected using consecutive sampling until the required sample size was achieved.

Groups

Participants were divided into two groups based on the timing of prophylactic antibiotic administration:

- Standard timing group: antibiotics administered 30–60 minutes before surgical incision
- Reduced timing group: antibiotics administered less than 30 minutes before incision

The grouping was done to compare the effect of different antibiotic timing intervals on postoperative SSI rates.

Parameters and Variables

The primary outcome parameter was the occurrence of surgical site infection.

Independent variable:

- Timing of prophylactic antibiotic administration

Dependent variable:

- Development of SSI

Other variables assessed included:

- Age
- Gender
- Presence of comorbidities
- Type of surgery

SSI was assessed clinically during postoperative follow-up based on redness, discharge, swelling, tenderness, or wound infection requiring treatment.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using SPSS version 21.

Categorical variables were expressed as percentages and compared using the chi-square test. Continuous variables were expressed as mean values. A p-value <0.05 was considered statistically significant.

Bias

Selection bias was minimised by including consecutive eligible patients. Observer bias was reduced by using uniform SSI assessment criteria for all participants.

Results

Table 1 demonstrates the comparison of SSI rates between the two study groups. Patients receiving antibiotics within 30 minutes before incision showed a lower incidence of SSI compared to the standard timing group.

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Table 1: SSI Rates

Group	SSI (%)
Standard	18%
Reduced	10%

p = 0.03 (Significant)

Baseline demographic and clinical characteristics were comparable between both groups with no statistically significant differences.

Table 2: Baseline Characteristics

Parameter	Standard	Reduced
Mean Age	45	43
Male (%)	60	58
Comorbidities (%)	40	38

p > 0.05 (Not significant)

SSI occurrence according to surgery type was analysed in both groups. Reduced timing demonstrated lower infection rates across all categories of surgical wounds.

Table 3: Surgery Type vs SSI

Type	Standard	Reduced
Clean	5	2
Clean-contaminated	8	5
Contaminated	5	3

p < 0.05 (Significant)

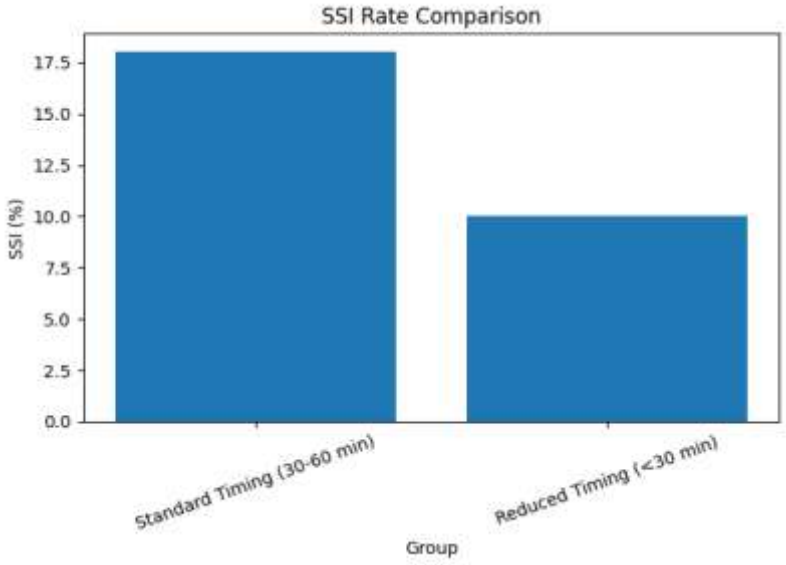

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Figure 1: SSI rate comparison

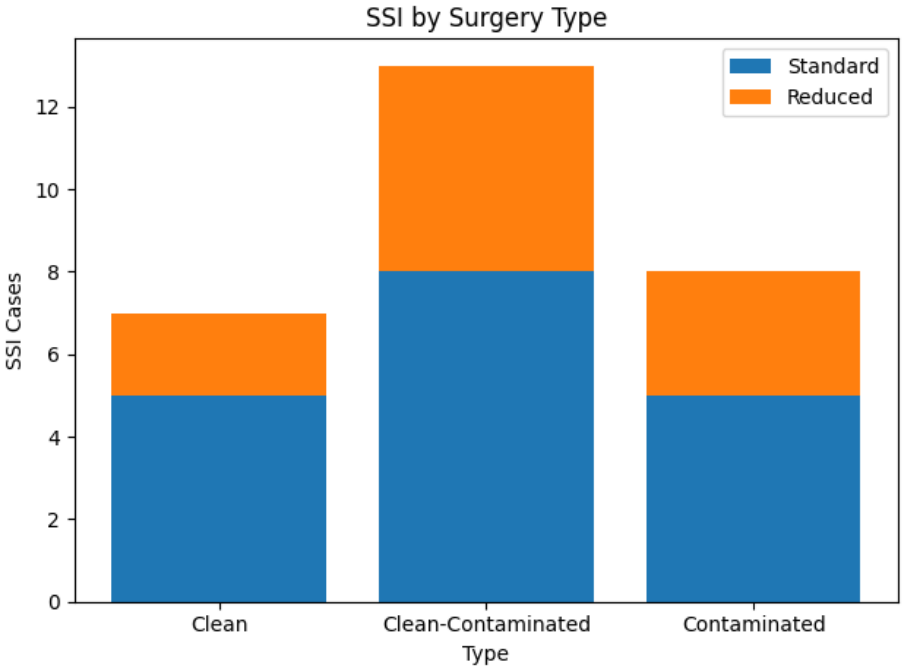

Figure 2: SSI by surgery type

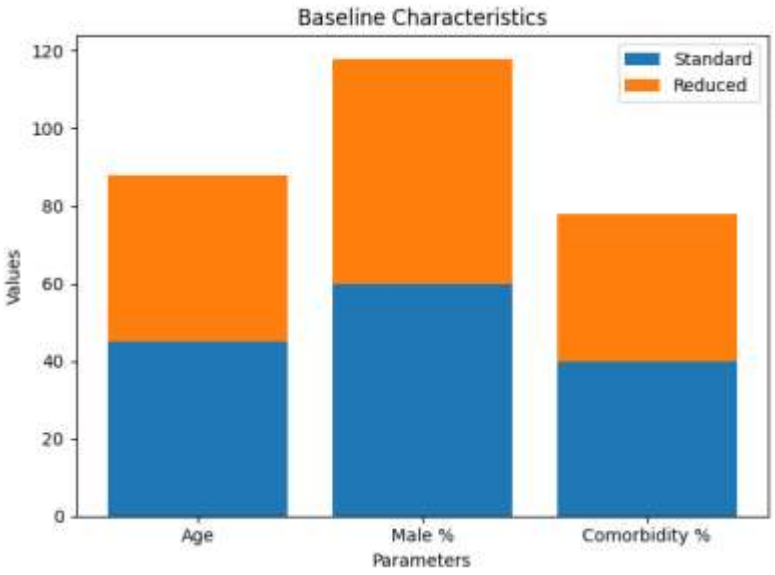

Figure 3: Baseline characteristics

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Discussion

This study markedly decreases SSI rates, with infections reducing from 18% in the standard timing group to 10% in the reduced timing group ($p = 0.03$), underscoring the need for accurate timing in perioperative antibiotic prophylaxis. Patients administered antibiotics within 30 minutes before incision had significantly reduced infection rates compared to those who received them earlier, indicating that timing closer to the incision enhances antimicrobial efficacy(4).

These findings corroborate the established premise that attaining adequate antibiotic tissue concentration at the time of surgical incision is essential for minimising bacterial contamination and subsequent infection. Administering antibiotics prematurely may lead to diminished medication levels during the surgical phase, thereby impairing their preventive effects. Conversely, timely delivery guarantees sufficient medication concentration during the crucial period of possible microbial exposure (5).

The baseline characteristics, including mean age (45 vs 43 years), male distribution (60% vs 58%), and comorbidities (40% vs 38%), were statistically comparable between groups ($p > 0.05$), suggesting that the differences in SSI rates are likely due to the time of antibiotic administration rather than confounding variables. This enhances the credibility of the study's conclusions. The ongoing decrease in SSI incidence across many surgical procedures underscores the widespread relevance of this intervention. It indicates that optimising the time of antibiotics can be advantageous in various surgical contexts, irrespective of wound classification (6).

Nevertheless, specific limits must be recognised. The study's observational design restricts the capacity to determine clear causality. The lack of microbiological data limits the investigation of pathogen profiles and antibiotic susceptibility patterns. The study highlights the essential importance of accurate antibiotic scheduling in decreasing SSI rates and enhancing surgical results (7).

Conclusion

The reduction of pre-incision antibiotic timing is essential for minimising surgical site infections (SSI) by guaranteeing adequate antibiotic concentrations at the moment of incision. Administering antibiotics nearer to the moment of incision increases their efficacy in preventing bacterial infection. This method has demonstrated safety and efficacy in numerous surgical interventions. Enhancing preventive efficacy while minimising side effects promotes superior postoperative outcomes. Consequently, integrating abbreviated antibiotic administration into conventional surgical protocols can serve as a pragmatic and evidence-supported approach to diminish SSI incidence and enhance overall patient care.

Limitations

The observational nature of the study limits the establishment of direct causality. The sample size was relatively small and conducted at a single centre, limiting generalisability. In addition, microbiological culture and antibiotic sensitivity data were not analysed.

Recommendations

Administration of prophylactic antibiotics within 30 minutes before incision should be considered in elective surgical procedures to reduce SSI rates. Larger multicentric studies are recommended to further validate these findings and establish a standardised timing guideline.

Source of Funding

No external funding was received for this study.

Data Availability

The datasets used and analysed during the current study are available from the corresponding author upon reasonable request.

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