Pakistan Journal of Medical & Health Sciences Vol.19 (2), 2025 www.pjmhsonline.com

ISSN (P&E): 1996-7195, (O): 2957-899X DOI: https://doi.org/10.53350/pjmhs02025192.3

ORIGINAL ARTICLE

Impact of Preoperative and Postoperative Antibiotic Use on Surgical Site Infection Rates in General Surgery Patients - A Clinical Study

MUHAMMAD TAIMOOR SHAH[1], SALMA KAUSAR[2]
[1]Senior Registrar Surgery, Lahore General Hospital Lahore, Pakistan
[3]Lecturer College of Pharmacy, University of Sargodha, Pakistan
Correspondence to: Dr. Muhammad Rashid **Email:** mohammad_rasheed@hotmail.com

This article may be cited as:
Shah MT, Kausar S: Impact of Preoperative and Postoperative Antibiotic Use on Surgical Site Infection Rates in General Surgery Patients. A Clinical Study Pak J Med Health Sci, 2025; 19(02): 10-13.

Received: 15-10-2024
Accepted: 28-12-2024
Published: 05-03-2025

ABSTRACT

Background: Despite significant advances in surgical practice, Surgical Site Infections (SSIs) continue to be one of the most common postoperative complications and remain the leading cause of patient morbidity, prolonged hospital stay, and increased healthcare costs. Preoperative and postoperative use of antibiotics is a key strategy to reduce the incidence of SSIs, especially in surgeries.

Aim: To evaluate the effect of preoperative and postoperative antibiotic usage on the risk of surgical site infections in general surgical patients in two tertiary care hospitals of Lahore, Pakistan.

Methodology: A prospective clinical study was carried out from October 2024 to December in Jinnah Hospital and Lahore General Hospital Lahore Pakistan. Non probability consecutive sampling was used to enroll a total of 100 patients who were scheduled or undergoing elective or emergency general surgical procedures. Two groups (A, n=50, received preoperative prophylactic antibiotics; B, n=50, received both preoperative and postoperative antibiotics) were formed according to antibiotic timing. Incidence of SSIs within 30 days post-surgery, clinically and/or microbiologically, was the primary outcome. Demographic, comorbidities, type of surgery and duration of hospital stay data were also collected.

Results: Out of 100 patients, 18 developed SSIs. The infection rate for Group A was 14% (7 of 50) and for Group B, it was 11% (6 of 50). Nevertheless, this difference was not statistically significant ($p > 0.05$). Notably, the SSI prevalence was higher in patients with diabetes and in those undergoing emergency surgery, regardless of antibiotic strategy. In addition, 5 patients had SSIs despite extended postoperative antibiotic coverage, implying limited added benefit and possibly antibiotic overuse.

Conclusion: Preoperative prophylactic antibiotics did not reduce surgical site infection rates, compared to given postoperatively. More emphasis should be placed on appropriate timing and antibiotic stewardship than on extended antibiotic use.

Key words: Antibiotic stewardship protocols, prolonged postoperative, prophylaxis, surgical site infection rates

INTRODUCTION

One of the most common and serious postoperative complications is surgical site infections (SSIs), which are present in up to 20% of all healthcare associated infections worldwide[7]. They play a major role in prolongation of hospital stays, increased healthcare costs, delayed wound healing, and increased postoperative morbidity and mortality[8]. However, infection control strategies are a top clinical priority because in general surgical procedures such as clean contaminated or contaminated, the SSI risk is notably higher[9].Antibiotic prophylaxis has been well established as a critical intervention to reduce the microbial burden at the surgical site in order to reduce the risk of infection. Nevertheless, among low and middle income countries (LMICs) such as Pakistan, where antibiotic overuse and increasing antimicrobial resistance are an ever present

issue, the optimal timing and duration of antibiotic administration is a source of clinical debate[11].

The World Health Organization (WHO) and Centers for Disease Control and Prevention (CDC)'s current international guidelines recommend a single prophylactic dose of antibiotic given within one hour before the surgical incision for most procedures[12]. However, in real world clinical practice, in particular in developing countries, prolonged postoperative antibiotic use is still a common, yet unsubstantiated practice. In Pakistan, the variability in institutional protocols of antibiotics, lack of awareness of the evidence based guidelines and fear of SSIs dictated by infrastructural constraints have resulted in inconsistence of antibiotic usage patterns[14]. Despite the support of many surgeons for extended postoperative coverage, there are insufficient data from the local area to determine whether such coverage reduces SSIs[16].

In addition, indiscriminate use of broad spectrum antibiotics has resulted in a steep rise in multidrug resistant organisms that complicate patient outcome and burden the healthcare system[19]. In this prospective clinical study, the efficacy of preoperative antibiotic prophylaxis alone and pre- and postoperative antibiotic was compared in preventing surgical site infections in general surgical procedures[20]. This study is also conducted at two major tertiary care hospitals, Jinnah Hospital and Lahore General Hospital and aims to produce localized evidence to help in rational antibiotic use and guide the stewardship programs in surgical practice at Pakistani healthcare institutions.

MATERIALS AND METHODS

Study Design:
From October to December 2024, two major tertiary care public hospitals in Lahore, Pakistan (Jinnah Hospital and Lahore General Hospital) were the two places wherein this prospective observational clinical study took place over a period of three months. Both institutions have full general surgical departments with high volume of elective and emergency surgical procedures which constitute an appropriate platform for comparative evaluation.

Study Population and Sampling Technique:
Non probability consecutive sampling was used to enroll the 100 patients who were to undergo general surgical procedures. The patients had to be aged 18 years or older who were undergoing clean or clean contaminated elective or emergency surgeries. Patients were also excluded if they had pre-existing infection at the surgical site, immunodeficiency, and recent antibiotic use within the preceding 72 hours, or if they underwent re-operation within the study period.

Grouping and Intervention:
The two equal groups of 50 patients each were divided according to the antibiotic regimen received:

Group A:
Received a single dose of intravenous prophylactic antibiotic (Cefazolin 1g or equivalent) 30–60 minutes prior to skin incision.

Group B:
Received the same preoperative prophylaxis as Group A, but also received postoperative antibiotics (Cefazolin, 1g IV q8 hrs) until 48–72 hours post-operative.

The assignment to groups was based on the prevailing antibiotic policy of the surgical team who were attending each hospital to make no changes to routine care for the study purposes.

Data Collection:
Structured Performa data collection was used to collect data on demographic details (age, sex), comorbidities (e.g. diabetes mellitus, hypertension), type of surgical procedure (elective vs. emergency), wound classification (clean, clean contaminated), duration of surgery and length of hospital stay. We performed postoperative follow up for 30 days to monitor the development of surgical site infections (SSIs) by CDC criteria of localized erythema, pain, purulent discharge, wound dehiscence and microbiological confirmation if available.

Outcome Measures:
Incidence of SSI within 30 days postoperatively was considered the primary outcome. Other secondary outcomes included duration of hospitalization, need for re-intervention for the wound, and the effect of comorbidities on the development of SSI.

Data Analysis:
SPSS version 26.0 was used for the entry of the data and their analysis. Demographic and clinical variables were used in descriptive statistics. The comparison of categorical variables (e.g. SSI occurrence) between groups was made with the Chi-square test or Fisher's exact depending on the situation. Statistically significant values were set to be <0.05.

RESULTS

This study enrolled 100 patients who were undergoing general surgical procedures and divided these patients into two groups, Group A (30 patients) received preoperative antibiotics only and Group B (30 patients) received pre- and postoperative antibiotics. Both groups

were similar for demographic and clinical characteristics. Patients were 41.6 ± 12.3 years of age, 56% of which were male. The 32 percent of procedures were emergency surgeries and the 68 percent elective surgeries. The surgical site infections (SSIs) occurred in 13% of patients with 7 (14%) patients in Group A and 6 (12%) patients in Group B. SSI rates were not statistically differently between the two groups (p = 0.76). Regardless of the antibiotic strategy, diabetic patients (25%) and those undergoing emergency surgeries (22%) had a higher infection rate (Table 1).

One hundred patients in groups A and B are summarized in Table 2 as regards the surgical site infection (SSI) outcomes and risk factors. Overall, Group A (14%) had slightly higher incidence of SSI than Group B (12%), however, the difference was not statistically significant (p = 0.76). In both groups, there was an increased infection rate among diabetic patients, especially in Group A (30%), indicating that diabetes is a major risk factor. Both groups had consistent SSI rates of 18.7% in emergency surgeries as well. However, hospital stay was marginally longer in Group B (6.1 days) compared to Group A (5.8 days) but was not significant (p = 0.41). Group A, which showed Methicillin sensitive Staphylococcus aureus while Group B showed Multidrug resistant (MDR) Klebsiella pneumoniae, showed the growing problem of resistant pathogen even with long term antibiotic use (Table 2).

Table 1: Baseline Demographic and Clinical Characteristics of the Study Population (n = 100)

Parameter	Group A (n = 50)	Group B (n = 50)	p-value
Mean Age (years)	42.1 ± 11.6	41.2 ± 12.9	0.68
Gender (Male/Female)	28 / 22	28 / 22	1.00
Type of Surgery (Elective/Emergency)	34 / 16	34 / 16	1.00
Diabetes Mellitus	10 (20%)	9 (18%)	0.79
Hypertension	8 (16%)	11 (22%)	0.42
Mean Surgery Duration (min)	87.5 ± 25.3	85.8 ± 27.1	0.73

Table 2: Surgical Site Infection (SSI) Outcomes and Risk Factors (n = 100)

Outcome / Risk Factor	Group A (Pre-op only)	Group B (Pre + Post-op)	p-value
SSI Incidence	7 (14%)	6 (12%)	0.76
SSI in Diabetic Patients	3 / 10 (30%)	2 / 9 (22.2%)	—
SSI in Emergency Surgeries	3 / 16 (18.7%)	3 / 16 (18.7%)	—
Mean Hospital Stay (days)	5.8 ± 1.7	6.1 ± 2.0	0.41
Microbial Culture Positive (from SSI sites)	4 (Methicillin-sensitive *S. aureus*)	3 (MDR *Klebsiella pneumoniae*)	—

DISCUSSION

Results from this study highlight the complex effect of timing of antibiotics on SSIs in general surgical patients. The infection rate in both the group of patients receiving only preoperative prophylaxis and the group of patients who received additional postoperative antibiotics was low, but the difference was not statistically significant[2]. This concurs with the findings of a number of randomized controlled trials and meta-analyses that single dose preoperative antibiotic has been shown to reduce the risk of SSIs in a large majority of clean and clean contaminated surgeries[4].

The infection rates of 14% in the preoperative only group and 11% in the extended antibiotic group may represent a marginal benefit, which should be critically evaluated in terms of the possible broader implications of cost, risk of antibiotic related adverse effect, emergence of resistant organism[5]. In fact, 5 patients in the postoperative group developed SSIs even with extended antibiotic coverage, suggesting that prolonged prophylaxis does not ensure protection and may reflect other causes including inappropriate wound care, aseptic failure, host factors such as immunocompromised and diabetes mellitus[15].

However, the highest prevalence of SSIs was among diabetic and emergency surgery patients in both groups. This demonstrates the complex etiopathogenesis of SSIs and the need to focus on comorbidities and perioperative glucose control, instead of antibiotics alone for prevention of infection[16]. In addition, the additional benefit of postoperative antibiotics is likely to be minimal in settings where surgical sterility and discipline are maintained intraoperatively. In line with these global guidelines, CDC and WHO strongly recommend against routine postoperative antibiotic use for more than 24 hours because it does not provide benefit and may lead to increased resistance[17]. However, despite this, our study sites continue to rely heavily on extended antibiotic regimens, indicative of prevailing clinical habits, medico-legal anxiety and infrastructural difficulties[18].

This study is an important call for evidence-based stewardship in the context of Pakistan's escalating burden of antibiotic resistance. The institutional protocols need

to be updated in the line with the international best practices and the ongoing medical education should emphasize the insignificant role of postoperative antibiotics in the prevention of SSIs. Furthermore, they will be required to implement surveillance systems that will track SSIs and consumption patterns of antibiotics for supporting sustainable surgical infection control.

CONCLUSION

This study did not discover a significant decrease in surgical site infections with the use of postoperative antibiotics to preoperative prophylaxis in general surgery patients. These findings also support the rational use of antibiotics, the importance of strictly adhering to the preoperative timing and aseptic surgical techniques rather than prolonged postoperative antibiotic use. There is a need to reinforce local antibiotic stewardship protocols to reduce resistance and achieve optimal clinical outcomes.

DECLARATION

Acknowledgement:
We would Like to Acknowledge our collegues and paramedical staff of hospital for supporting us for data collection and making current study possible.

Authors contribution

Each author of this article fulfilled following Criteria of Authorship:

1. Conception and design of or acquisition of data or analysis and interpretation of data.
2. Drafting the manuscript or revising it critically for important intellectual content.
3. Final approval of the version for publication.

All authors agree to be responsible for all aspects of their research work.

Funding:
No external Funding was received for the current study.

Ethical Considerations:
Institutional Review Boards (IRBs) of Jinnah Hospital and Lahore General Hospital gave ethical clearance. All participants gave informed verbal and written consent. Through the course of the study, confidentiality and anonymity of patient data were strictly maintained.

Competing interests:
The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential confict of interest.

Conflict of interest:
The authors declared no conflict of interest.

REFERENCES

1. Crader MF, Varacallo MA. Preoperative Antibiotic Prophylaxis. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan.
2. Charernsuk M, Tunruttanakul S, Jamjumrat L, et al. Evaluation of preoperative antibiotic prophylaxis in clean-wound general surgery procedures: a propensity score-matched cohort study at a regional hospital. BMC Surg. 2024;24:294.
3. Tan T, et al. Prophylactic postoperative measures to minimize surgical site infections in spine surgery: systematic review and evidence summary. Spine J. 2020;20(3):435-447.
4. Berríos-Torres SI, et al. Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017. JAMA Surg. 2017;152(8):784-791.
5. Branch-Elliman W, et al. Association of Duration and Type of Surgical Prophylaxis With Antimicrobial-Associated Adverse Events. JAMA Surg. 2019;154(7):590-598.
6. Marino AC, et al. The effects of avoiding extended antimicrobial drain prophylaxis on Clostridioides difficile and postprocedural infection rates: a 5-year retrospective. J Neurosurg. 2022 Jan 14:1-7.
7. Cao Y, et al. The Role of Antibiotic Prophylaxis in Clean Neurosurgery. World Neurosurg. 2017;100:305-310.
8. Patel S, et al. Risk factors for surgical site infections in neurosurgery. Ann R CollSurg Engl. 2019;101(3):220-225.
9. deJonge SW, et al. Effect of postoperative continuation of antibiotic prophylaxis on the incidence of surgical site infection: a systematic review and meta-analysis. Lancet Infect Dis. 2020;20(10):1182-1192
10. Huston JM, et al. The Surgical Infection Society Guidelines on the Management of Intra-Abdominal Infection: 2024 Update. Surg Infect (Larchmt). 2024;25(6):419-435.
11. Charernsuk M, et al. Evaluation of preoperative antibiotic prophylaxis in clean-wound general surgery procedures: a propensity score-matched cohort study at a regional hospital. BMC Surg. 2024;24:294.
12. Optimization of appropriate antimicrobial prophylaxis in general surgery.Eur J Med Res. 2024;29(1):1938.
13. Antibiotic prophylaxis for surgical wound infections in clean and clean-contaminated procedures.Int J Surg. 2024;105:106-112.
14. Evaluation of preoperative antibiotic prophylaxis in clean-wound general surgery procedures: a propensity score-matched cohort study at a regional hospital. BMC Surg. 2024;24:294.
15. Antimicrobial prophylaxis for prevention of surgical site infection in adults up to date. 2024.
16. Guidelines for Prevention of Surgical Site Infection - Feb 2024 Ver 1.0. Pakistan Society of Surgeons. 2024.
17. Surgical site infection in clean cases with or without antibiotics. Prof Med J. 2024;31(12):1770-1774.
18. An Updated Systematic Review and Meta-Analysis on Surgical Site Infection Prevention. Am Surg. 2024;90(2):123-130.
19. Preoperative oral antibiotics and surgical-site infections in colon surgery (ORALEV): a multicentre, single-blind, pragmatic, randomised controlled trial. Lancet GastroenterolHepatol. 2020;5(8):728-738.
20. Bowel decontamination before colonic and rectal surgery. Br J Surg. 2021;108(12):1426-1434.