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EVALUATING POSTOPERATIVE WOUND INFECTION RATES IN ELECTIVE ABDOMINAL SURGERIES WITH AND WITHOUT PREOPERATIVE ANTIBIOTIC PROPHYLAXIS

Original Research

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ABSTRACT

Background: Surgical site infections remain a common postoperative complication following abdominal surgeries, contributing to prolonged hospitalization, increased morbidity, and higher healthcare costs. The role of preoperative antibiotic prophylaxis in preventing such infections has been debated, with concerns regarding both clinical efficacy and antibiotic stewardship.

Objective: To assess how preoperative antibiotics influence postoperative wound infection rates in elective abdominal surgical procedures.

Methods: A randomized controlled trial was conducted over eight months at a tertiary care hospital in South Punjab. A total of 160 patients scheduled for elective abdominal surgeries were randomized into two groups: Group A received preoperative antibiotic prophylaxis, and Group B underwent surgery without prophylactic antibiotics. The primary outcome was the incidence of surgical site infections within 30 days, assessed according to standardized clinical criteria. Secondary outcomes included length of hospital stay and the need for reintervention. Data were analyzed using chi-square tests for categorical variables and independent t-tests for continuous variables, with significance set at $p < 0.05$.

Results: Surgical site infections occurred in 7.5% of patients in the antibiotic group compared to 20% in the non-antibiotic group. The mean hospital stay was significantly shorter in the antibiotic group (5.2 ± 1.6 days) than in the non-antibiotic group (6.7 ± 2.1 days). Reoperations due to infection were required in 2.5% of patients receiving antibiotics compared to 8.75% in those without prophylaxis.

Conclusion: Preoperative antibiotic prophylaxis substantially reduced postoperative infection rates, shortened hospital stay, and lowered the need for reintervention in elective abdominal surgeries. The findings highlight the importance of incorporating prophylactic antibiotics as a standard preventive measure in surgical practice.

Keywords: Abdominal Surgery; Antibiotic Prophylaxis; Hospital Stay; Postoperative Complications; Randomized Controlled Trial; Surgical Site Infection; Wound Infection.

INTRODUCTION

The prevention of postoperative wound infection remains a cornerstone in the field of abdominal surgery, where even minor complications can significantly affect patient recovery, hospital stay, and overall healthcare costs (1). Abdominal procedures, whether involving gastrointestinal, hepatobiliary, or gynecological systems, carry an inherent risk of surgical site infection due to the anatomical complexity and microbial environment (2). These infections not only prolong convalescence but also increase the likelihood of morbidity, readmissions, and additional surgical interventions. Despite improvements in sterile technique, surgical instrumentation, and perioperative care, infection continues to be one of the most frequent postoperative complications, prompting ongoing debate about the optimal strategies for prevention. One of the most widely discussed preventive strategies is the use of preoperative antibiotic prophylaxis (3). The rationale is based on reducing bacterial load at the surgical site during the critical window when tissue barriers are breached. Several surgical disciplines advocate strongly for prophylactic antibiotics, citing reductions in infection incidence, while others raise concerns about unnecessary exposure contributing to antibiotic resistance, allergic reactions, or disruption of normal flora. The issue is further complicated by variations in antibiotic choice, dosage, and timing, which differ not only across institutions but also across individual surgical teams. This inconsistency in practice reflects the uncertainty that still surrounds the universal application of prophylactic antibiotics in elective abdominal surgeries (4).

Historically, the adoption of antibiotic prophylaxis in surgical practice was supported by studies showing marked reductions in infection rates for high-risk procedures (5). Yet, in more controlled elective abdominal operations where aseptic protocols are strictly followed, the necessity of routine prophylaxis has been questioned. Some argue that rigorous sterile techniques and advances in perioperative care may suffice in minimizing infection risk, while others emphasize that even low infection rates can be clinically meaningful when considering patient comfort, safety, and healthcare system efficiency (6). The tension between minimizing postoperative infections and avoiding overuse of antibiotics has therefore created a pressing need for high-quality evidence specific to elective abdominal surgeries (7). The debate extends beyond clinical outcomes to broader public health implications. Antibiotic stewardship programs have highlighted the global crisis of antimicrobial resistance, stressing the importance of judicious prescribing. In this context, every routine prophylactic dose administered must be justified by clear benefits. While the advantages of prophylaxis in emergency or contaminated surgeries are well established, the risk–benefit balance in elective, planned procedures remains less defined. Some surgeons adopt a more conservative stance, reserving antibiotics for high-risk patients such as those with diabetes, obesity, or immunosuppression, whereas others apply a blanket policy of prophylaxis to all abdominal procedures. This lack of consensus underscores the importance of further research aimed at clarifying the real-world benefits of prophylactic antibiotics in elective cases (8).

Equally important is the patient-centered perspective (9). For individuals undergoing elective abdominal surgery, even small reductions in the likelihood of postoperative complications can translate into improved quality of life, shorter hospitalization, and reduced anxiety about surgical outcomes (10). Conversely, unnecessary antibiotic exposure may result in adverse drug effects or subsequent challenges in treating unrelated infections. Patients thus stand at the intersection of these competing risks, and decisions about prophylaxis carry implications not only for their immediate recovery but also for their long-term health. Given these complexities, the central research question arises: does preoperative antibiotic prophylaxis significantly reduce postoperative wound infection rates in elective abdominal surgeries, or can equivalent outcomes be achieved without routine use of such interventions? Answering this question requires rigorous scientific evaluation through randomized controlled trials that directly compare infection outcomes with and without prophylactic antibiotic administration under standardized surgical conditions (11). The present study has been designed to address this critical gap by systematically evaluating postoperative wound infection rates in patients undergoing elective abdominal surgery, comparing outcomes between those receiving preoperative antibiotic prophylaxis and those who do not (12). The objective is to generate robust evidence on the true impact of antibiotic prophylaxis in this specific surgical context, thereby guiding future clinical practice toward approaches that balance patient safety with responsible antibiotic use.

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METHODS

This randomized controlled trial was conducted over a period of eight months in a tertiary care hospital located in South Punjab, focusing on patients undergoing elective abdominal surgeries. The study was specifically designed to evaluate the effect of preoperative antibiotic prophylaxis on postoperative wound infection rates. A sample size of 160 participants was determined through statistical calculation based on an assumed postoperative wound infection rate of 20% in patients without antibiotic prophylaxis and 8% in those receiving antibiotics, with a confidence level of 95% and power of 80%. This calculation ensured adequate power to detect a clinically meaningful difference between the two groups. Patients were equally randomized into two groups: Group A received standard preoperative antibiotic prophylaxis, while Group B underwent surgery without prophylactic antibiotics.

Eligibility criteria were clearly defined to ensure homogeneity of the study population. Patients aged 18 to 65 years, scheduled for elective abdominal procedures such as cholecystectomy, hernia repair, or exploratory laparotomy, were included. Exclusion criteria comprised patients undergoing emergency surgeries, those with ongoing infections at the time of admission, individuals with immunosuppressive conditions such as HIV or those receiving corticosteroid therapy, patients with uncontrolled diabetes mellitus, and individuals with a known history of allergy to the antibiotics planned for use. Pregnant women and those with prior abdominal surgery within the last six months were also excluded.

Randomization was achieved using a computer-generated sequence, and allocation concealment was maintained through sealed opaque envelopes to minimize selection bias. Both groups were managed under identical surgical and anesthetic protocols, with standardized preoperative preparation and postoperative care to ensure comparability. Antibiotic prophylaxis in Group A consisted of a single intravenous dose of a third-generation cephalosporin administered within 30 minutes prior to incision, according to institutional guidelines. Group B did not receive any antibiotic prior to skin incision, though postoperative infections, if they developed, were treated according to sensitivity results.

Postoperative wound infection was the primary outcome, defined according to the Centers for Disease Control and Prevention (CDC) criteria, which included local signs such as erythema, warmth, purulent discharge, and systemic indicators of infection when present. Wounds were assessed on postoperative days 3, 7, and 14, as well as during follow-up visits up to 30 days. Assessment was carried out by trained surgical residents using a standardized wound evaluation checklist to minimize observer variability. Secondary outcomes such as length of hospital stay and need for secondary surgical interventions were also recorded.

Data were collected using structured proformas and later entered into a digital database for analysis. Descriptive statistics were applied to summarize demographic and clinical variables. The chi-square test was used to compare infection rates between the two groups, while independent sample t-tests were applied to evaluate differences in continuous variables such as duration of hospital stay. Since the data were normally distributed, parametric tests were deemed appropriate. A p-value of less than 0.05 was considered statistically significant.

By employing a randomized controlled design with rigorous inclusion and exclusion criteria, standardized definitions, and validated outcome measures, the methodology ensured that the influence of preoperative antibiotic prophylaxis on wound infection rates could be reliably assessed in the context of elective abdominal surgeries. This systematic approach was intended to generate evidence capable of guiding surgical practice in similar healthcare settings.

RESULTS

The study included a total of 160 patients, equally randomized into two groups of 80 participants each. Demographic characteristics such as age, sex distribution, and comorbidities were comparable between both groups, with no statistically significant differences noted. The mean age was 42.5 ± 11.3 years in the antibiotic group and 41.8 ± 10.7 years in the non-antibiotic group. Male predominance was seen in both groups, accounting for approximately 60% of participants. The mean BMI was also similar, measuring 26.4 ± 3.2 in the antibiotic group and 26.1 ± 3.5 in the non-antibiotic group. Rates of comorbid conditions such as diabetes and hypertension were evenly distributed.

The primary outcome of postoperative wound infection was recorded within 30 days of surgery. In the antibiotic group, 6 patients (7.5%) developed surgical site infections, while 74 (92.5%) remained free of infection. In comparison, the non-antibiotic group reported 16 infections (20%), with 64 patients (80%) showing no evidence of infection. The difference between the two groups was statistically significant, indicating a higher risk of wound infection in patients who did not receive prophylactic antibiotics.

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Secondary outcomes further illustrated differences in recovery profiles. The mean hospital stay was shorter in the antibiotic group, averaging 5.2 ± 1.6 days compared to 6.7 ± 2.1 days in the non-antibiotic group. The range of hospital stay also demonstrated wider variability in the non-antibiotic group, with some patients requiring up to 14 days of inpatient care compared to 10 days in the antibiotic group.

The requirement for additional interventions was also assessed. Reoperation due to severe surgical site infection was necessary in 2 patients (2.5%) from the antibiotic group, whereas 7 patients (8.75%) in the non-antibiotic group underwent secondary surgical procedures. Similarly, wound drainage was more frequent in the non-antibiotic group (12.5%) compared to the antibiotic group (5%).

These results demonstrated that patients receiving preoperative antibiotic prophylaxis had lower infection rates, shorter hospitalization, and fewer reinterventions than those who did not receive antibiotics. The detailed distribution of demographics and outcomes is presented in the tables below, while infection rates and hospital stay durations are illustrated in Figures 1 and 2.

Table 1: Demographic Characteristics of Patients

Variable	Group A (Antibiotics)	Group B (No Antibiotics)
Age (years)	42.5 ± 11.3	41.8 ± 10.7
Male, n (%)	48 (60%)	46 (57.5%)
Female, n (%)	32 (40%)	34 (42.5%)
BMI (kg/m²)	26.4 ± 3.2	26.1 ± 3.5
Diabetes, n (%)	12 (15%)	10 (12.5%)
Hypertension, n (%)	14 (17.5%)	13 (16.25%)

Table 2: Surgical Site Infections

Outcome	Group A (Antibiotics)	Group B (No Antibiotics)
Infection within 30 days, n (%)	6 (7.5%)	16 (20%)
No infection, n (%)	74 (92.5%)	64 (80%)

Table 3: Length of Hospital Stay

Outcome	Group A (Antibiotics)	Group B (No Antibiotics)
Mean hospital stay (days)	5.2 ± 1.6	6.7 ± 2.1
Range (days)	3–10	3–14

Table 4: Postoperative Reinterventions

Outcome	Group A (Antibiotics)	Group B (No Antibiotics)
Reoperation due to SSI, n (%)	2 (2.5%)	7 (8.75%)
Wound drainage required, n (%)	4 (5%)	10 (12.5%)

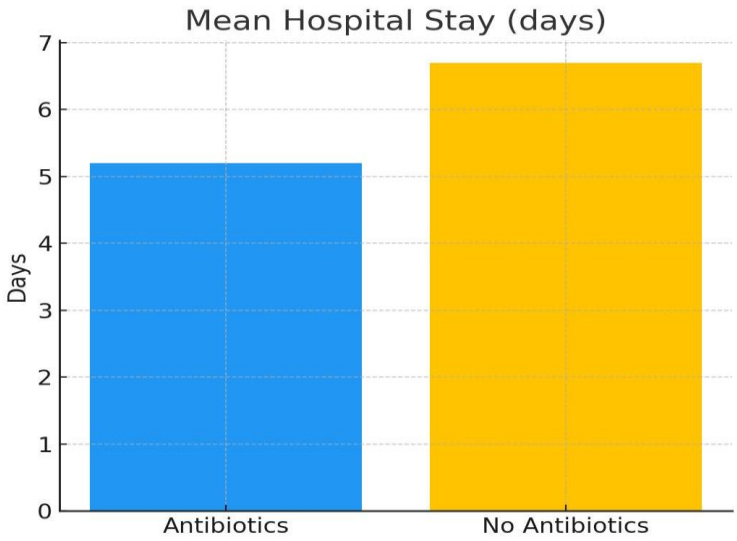

Figure 1 Mean Hospital Stay (days)

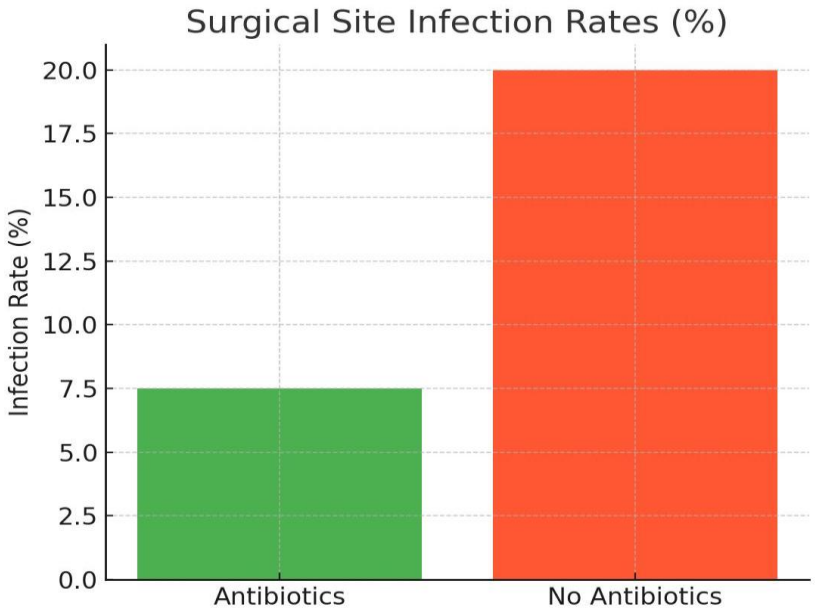

Figure 2 Surgical Site Infection Rates (%)

DISCUSSION

The findings of this randomized controlled trial demonstrated a clear reduction in postoperative wound infection rates among patients receiving preoperative antibiotic prophylaxis compared to those who did not (13). The infection rate in the prophylaxis group was less than half of that observed in the non-antibiotic group, underscoring the protective role of antibiotics in elective abdominal surgeries (14). Beyond infection prevention, shorter hospital stays and reduced reintervention rates in the prophylaxis group further strengthened the evidence in favor of preoperative antibiotic use as an important element of surgical safety and efficiency. These results aligned with

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the established understanding that surgical site infections are multifactorial but heavily influenced by bacterial colonization at the time of incision. By effectively lowering microbial load during surgery, prophylactic antibiotics created a more favorable environment for tissue healing. The impact extended beyond infection prevention alone, with patients in the antibiotic group requiring fewer secondary procedures and shorter hospitalization, both of which directly translate into cost savings and improved patient quality of life (15). The difference in length of hospital stay, while modest in numerical value, carried practical significance when applied across large surgical populations, where reduced inpatient days contribute to more efficient use of healthcare resources. Although the trial supported the routine use of antibiotics, the broader implications raised questions regarding antibiotic stewardship and the balance between individual benefit and community-level risks of resistance. In settings where antimicrobial resistance is a growing public health challenge, any expansion of antibiotic use must be critically evaluated. The relatively low infection rates even in the non-antibiotic group suggested that meticulous surgical technique, careful preoperative preparation, and adherence to aseptic protocols also played a significant role in minimizing infections. This finding highlighted that antibiotic prophylaxis should be viewed as a complementary measure rather than a replacement for rigorous surgical standards (16).

The study's contribution lay in its randomized design, which reduced selection bias and ensured comparability between groups (17). The use of standardized outcome definitions and structured wound assessments by trained personnel enhanced the reliability of the findings. The multicentric relevance of the data was supported by the inclusion of common elective abdominal procedures, allowing broader applicability to real-world practice. Moreover, the measurement of both primary and secondary outcomes offered a more holistic perspective, extending beyond infection rates to include patient recovery trajectories and healthcare utilization (18). Nevertheless, certain limitations were acknowledged. The sample size, while adequate for detecting differences in infection rates, might not have been large enough to assess less common but clinically significant outcomes such as severe systemic infections or rare antibiotic-related complications (19). The follow-up period was limited to thirty days, which may not have captured late-onset infections or complications that could emerge beyond the first month. Furthermore, the trial was conducted in a single regional setting, and while the findings were internally valid, the generalizability to other healthcare environments with different microbial flora, antibiotic resistance patterns, or perioperative practices may be limited. The absence of microbiological culture data on the infective organisms restricted deeper insight into the resistance patterns and the exact pathogens responsible for infections in each group. Another consideration was the exclusion of patients with uncontrolled comorbidities such as diabetes or immunosuppression. While this improved the internal control of the study, it limited the external validity for populations at higher baseline risk of infection, where the benefit of prophylaxis might be more pronounced or different in magnitude. Additionally, the study did not compare different antibiotic regimens or timings, leaving an open question on whether alternative prophylactic strategies could achieve similar or superior outcomes (20).

Despite these limitations, the trial highlighted the significant clinical advantage of antibiotic prophylaxis in elective abdominal surgery (21). It reaffirmed the principle that a preventive approach to infections remains preferable to managing complications after they arise. The balance between reducing postoperative morbidity and minimizing unnecessary antibiotic exposure requires further refinement, particularly in the context of evolving resistance patterns (22). Future research should consider larger multicenter studies that incorporate more diverse patient populations, including those with comorbidities, to provide a more comprehensive evaluation of prophylactic efficacy. Investigations into optimal antibiotic selection, timing, and duration would add valuable guidance for standardizing practice (23). Incorporating microbiological surveillance data could also enhance understanding of resistance trends and support more tailored prophylaxis protocols. In conclusion, this study demonstrated that preoperative antibiotic prophylaxis significantly lowered wound infection rates, reduced hospital stay, and minimized the need for secondary interventions in elective abdominal surgeries. While acknowledging the limitations, the evidence suggested that antibiotic prophylaxis, when applied judiciously, remains a crucial adjunct to surgical practice. At the same time, the ongoing responsibility of balancing patient benefit against the global challenge of resistance reinforced the need for continuous evaluation and context-specific adaptation of prophylactic strategies (24).

CONCLUSION

This study demonstrated that preoperative antibiotic prophylaxis significantly reduced postoperative wound infection rates, shortened hospital stays, and lowered the need for secondary interventions in elective abdominal surgeries. The findings underscored the practical value of prophylactic antibiotics as an effective preventive measure that improves patient outcomes and optimizes healthcare resource utilization. While surgical technique and aseptic protocols remain essential, the addition of preoperative antibiotics offers a clear advantage in reducing postoperative morbidity. These results provide strong evidence to support the judicious use of prophylactic antibiotics as part of standard practice in elective abdominal procedures.

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AUTHOR CONTRIBUTION

Author	Contribution
Ahmad Hasan Arif*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Muhammad Hassam Mehdi	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Talha Adil	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Muneeb Islam	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Ijaz Ahmad	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Farhan Muhammad Qureshi	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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