

A comparative prospective study of preoperative antibiotic prophylaxis in the prevention of surgical site infections

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ABSTRACT:

Background: The present study was conducted for assessing efficacy of preoperative antibiotic prophylaxis in the prevention of surgical site infections. **Materials & methods:** This study involved 100 surgical patients randomized into two groups: one receiving a single preoperative dose of ceftriaxone and the other undergoing surgery without prophylaxis. Both cohorts were matched for risk factors and managed under stringent aseptic and perioperative protocols, with 30-day postoperative surveillance for SSIs. Outcomes were assessed using SPSS software, and statistical analysis was conducted via the Chi-square test to determine the efficacy of antibiotic prophylaxis. **Results:** The study involved two groups of 100 patients each, with comparable demographic and clinical profiles. Group 1, which received preoperative ceftriaxone, showed no surgical site infections (SSIs), whereas Group 2, without prophylaxis, had infection rates of 6% in clean and 24% in clean-contaminated surgeries. These findings highlight the efficacy of prophylactic antibiotics in minimizing SSIs, especially in higher-risk procedures. **Conclusion:** In surgical interventions classified as clean, the administration of prophylactic antimicrobials does not confer a statistically meaningful reduction in postoperative wound infections. Conversely, in clean-contaminated procedures, antimicrobial prophylaxis is indicated due to its demonstrable efficacy in significantly minimizing the incidence of surgical site infections.

Key words: Surgical site infection, Antibiotics

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INTRODUCTION

Surgical site infections (SSIs) remain one of the most common and serious complications following operative procedures, significantly impacting patient recovery, prolonging hospital stays, and increasing healthcare costs. These infections are a major cause of postoperative morbidity and mortality and pose a considerable burden on both patients and healthcare systems. The likelihood of developing an SSI is influenced by a complex interplay of factors, including microbial characteristics (such as bacterial virulence and resistance), patient-related elements (such as age, comorbidities, immune status, and nutritional condition), and procedural variables (such as duration of surgery, type of procedure, and adherence to sterile technique).^{1, 2} Effective prevention of SSIs requires a multidisciplinary approach aimed at modifying risk factors wherever possible. Patient optimization strategies may include glycemic control, smoking cessation, decolonization protocols, and nutritional supplementation. Intraoperatively, the use of standardized protocols, including proper hand hygiene, antiseptic preparation of the surgical site, and maintenance of normothermia, is essential. Among these, antimicrobial prophylaxis remains a cornerstone in the prevention of SSIs. When administered appropriately—considering drug choice, timing, and dosage—it significantly lowers the incidence of infections in clean-contaminated and

high-risk clean procedures.^{3- 5} As medical knowledge advances and the complexity of surgical care increases, guidelines for SSI prevention have evolved to reflect the latest evidence-based practices. These protocols now incorporate nuanced recommendations tailored to specific patient populations and surgical procedures. Moreover, adherence to SSI prevention measures has become a key performance metric in evaluating surgical care quality. Outcomes related to SSIs are increasingly linked to institutional reputation, healthcare reimbursements, and public reporting systems. Consequently, continuous improvement in SSI prevention has become not just a clinical priority, but also a vital aspect of healthcare accountability and system-wide quality improvement.^{6- 8} Hence; the present study was conducted for assessing efficacy of preoperative antibiotic prophylaxis in the prevention of surgical site infections

MATERIALS & METHODS

The current research included 100 surgical patients, and were randomly stratified into two equal cohorts: Group 1 received a single preoperative intravenous dose of ceftriaxone, while Group 2 underwent identical procedures without antibiotic prophylaxis. Patient stratification ensured homogeneity across both groups in terms of surgical type, age, comorbidities, and risk factors for surgical site infections (SSIs). All patients underwent procedures under strict aseptic

conditions, and thorough documentation of diagnosis, laboratory findings, and perioperative preparation was maintained. Subjects were categorized as clean or clean-contaminated based on clinical presentation and intraoperative findings. Preoperative optimization included glycemic control in diabetics, treatment of remote infections, and skin decontamination with povidone-iodine. Intraoperative protocols included restricted operating room movement, minimized electrocautery use, and closed suction drainage when necessary. Postoperatively, wound surveillance continued for 30 days, with early inspection in cases of dressing soakage or malodor. SSI diagnosis was confirmed by microbial culture, and empirical antibiotics were modified based on sensitivity reports. Outcomes were recorded on standardized forms, and intergroup comparisons were performed to evaluate the prophylactic efficacy of ceftriaxone. All the results were recorded and analysed using SPSS software. Chi-square test was used for evaluation of level of significance.

RESULTS

The study comprised two patient cohorts—Group 1 and Group 2—each containing 100 subjects. Table 1 summarizes the demographic and clinical parameters of the two groups. The mean age was slightly higher in Group 1 (55.3 years) compared to Group 2 (52.7 years). Both groups had a higher proportion of male participants, with 61 males in Group 1 and 65 in Group 2. The prevalence of diabetes mellitus was comparable (8% in Group 1 vs 7% in Group 2), while hypertension was slightly more common in Group 2 (15%) than in Group 1 (13%). Table 2 presents data on surgical site infection (SSI) rates among clean and clean-contaminated surgical cases. Group 1, which received preoperative prophylactic antibiotics, showed no infections in either clean or clean-contaminated cases. In contrast, Group 2, which did not receive prophylaxis, demonstrated infection rates of 6% in clean surgeries and 24% in clean-contaminated cases. This finding underscores the protective role of preoperative antimicrobial prophylaxis, particularly in surgeries with increased risk of contamination.

Table 1: Demographic and clinical data

Variable	Group 1	Group 2
Mean age (years)	55.3	52.7
Males	61	65
Females	39	35
Diabetic	8	7
Hypertensive	13	15

Table 2: Surgical site Infection rates in all cases

Groups	Number of cases		Number of cases which got infected		Rate of infection	
	Clean	Clean contaminated	Clean	Clean contaminated	Clean	Clean contaminated
Group 1	75	25	-	-	-	-
Group 2	75	25	6	24	6%	24%

DISCUSSION

Surgical site infections (SSIs) are associated with serious postoperative complications, including extended hospital stays and increased mortality. Although all surgical wounds are exposed to some degree of microbial contamination during incision, several validated strategies are available to significantly reduce the risk of infection. Among these, strict adherence to evidence-based preventive protocols—especially regarding the timely and appropriate use of antimicrobial prophylaxis—has been shown to markedly lower SSI incidence. When infections do occur, prompt and aggressive surgical debridement combined with targeted antimicrobial therapy is essential to ensure optimal management and improve patient recovery outcomes.⁸⁻¹⁰ Hence; the present study was conducted for assessing efficacy of preoperative antibiotic prophylaxis in the prevention of surgical site infections.

The study involved two groups of 100 patients each, with comparable demographic and clinical profiles. Group 1, which received preoperative ceftriaxone,

showed no surgical site infections (SSIs), whereas Group 2, without prophylaxis, had infection rates of 6% in clean and 24% in clean-contaminated surgeries. These findings highlight the efficacy of prophylactic antibiotics in minimizing SSIs, especially in higher-risk procedures. Few investigations have definitively established a correlation between surgical attire and the incidence of surgical site infections (SSIs). Although surgical masks are routinely worn, multiple studies have questioned their effectiveness in reducing SSI risk. Similarly, the use of scrub suits, caps, and shoe covers has not been conclusively shown to prevent infections. Nonetheless, certain SSI outbreaks have been linked to organisms from hair or the scalp, regardless of head covering, and increased operating room foot traffic has been associated with elevated airborne microbial load and higher infection risk.⁹⁻¹³ Regarding preoperative antiseptic showering, a 2007 Cochrane review of six randomized controlled trials involving over 10,000 patients found no significant reduction in SSI rates with the use of chlorhexidine gluconate compared to bar soap or placebo. Only one

large study reported a benefit of chlorhexidine over no bathing. Additionally, a Swedish trial evaluating chlorhexidine vaginal cleansing before total abdominal hysterectomy also failed to demonstrate a reduction in postoperative infections. These findings suggest that while commonly practiced, some traditional preoperative hygiene measures may offer limited benefit in reducing SSIs.¹⁴⁻¹⁶ Chalkiadakis GE et al studied the pharmacokinetics of preincisional injection of 2 g ceftriaxone in 20 patients who have undergone abdominal surgery, with determination of serum, wound tissue, and wound fluid antibiotic concentrations. Preincisional injection of ceftriaxone resulted in high antibiotic concentrations in the wound tissue and wound fluid. The highest plasma concentrations were achieved at 1.50 hours (99.47 +/- 14.67 micrograms/mL). Plasma concentrations exceeded the minimal inhibitory concentrations of most aerobic gram-positive and gram-negative organisms with the exception of *Pseudomonas aeruginosa*, *Acinetobacter* species, and *Streptococcus faecalis* for 24 hours (10.42 +/- 4.12). No local or general complications arose in any of the patients. Their results suggested that preincisional administration of ceftriaxone for prophylaxis is very effective.¹⁷

CONCLUSION

In surgical interventions classified as clean, the administration of prophylactic antimicrobials does not confer a statistically meaningful reduction in postoperative wound infections. Conversely, in clean-contaminated procedures, antimicrobial prophylaxis is indicated due to its demonstrable efficacy in significantly minimizing the incidence of surgical site infections.

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