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Original Research Article

Role of prophylactic antibiotics in preventing postoperative wound infection in clean surgeries: a comparative study

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ABSTRACT

Background: The role of prophylactic antibiotics in clean surgeries remains controversial in the pediatric population. Despite guidelines discouraging routine use, many surgeons prescribe them due to concerns regarding surgical site infections (SSIs). This study evaluated whether perioperative prophylactic antibiotics reduce postoperative wound infection in pediatric clean surgeries and assessed their cost implications.
Methods: This prospective, comparative interventional study was conducted at Bangladesh Shishu Hospital and Institute (Formar Dhaka Shishu Hospital) from March 2021 to September 2023. A total of 130 pediatric patients undergoing clean surgical procedures were randomly allocated into two groups: Group A (n=65) received a single-dose prophylactic antibiotic, and Group B (n=65) did not. Patients were followed up on the 3rd, 7th, and 30th postoperative days for signs of infection. Statistical analyses were performed using SPSS version 23.0, with a p value <0.05 considered significant.
Results: The mean age was 35.01±32.925 months in group A and 39.70±32.42 months in group B. The mean treatment cost was slightly higher in the antibiotic group (8526.25±900.10 BDT) than in the non-antibiotic group (8335.75±700.20 BDT). On the 7th postoperative day, one patient (1.5%) in the antibiotic group developed wound redness, swelling, serous discharge, and tenderness. No infection was recorded in the non-antibiotic group. By the 30th postoperative day, all the patients were healthy.
Conclusion: Prophylactic antibiotics are unnecessary in pediatric clean surgeries and do not reduce postoperative wound infections. Avoiding their use may reduce healthcare costs and support antimicrobial stewardship, without compromising patient outcomes.

Keywords: Prophylactic antibiotics, Clean surgery, Surgical site infection

INTRODUCTION

Surgical site infections (SSIs) remain a major concern in postoperative care, even though clean surgical procedures are associated with the lowest risk of infection. Clean surgeries are defined as procedures in which no inflammation is present, the respiratory, alimentary, or genitourinary tracts are not entered, and wounds are closed primarily under sterile conditions.[1] Despite a relatively low reported infection rate, ranging from 1–5% in clean surgeries, the consequences of SSIs in pediatric patients can be profound, contributing to delayed recovery, extended hospital stay, and additional financial burden.[2] Prophylactic antibiotics have long been prescribed in surgical practice as a preventive strategy, with well-established benefit in clean-contaminated, contaminated, and dirty operations.[3] However, their role in clean surgeries is controversial. Several guidelines, including those of the Centers for Disease Control and

Prevention (CDC), state that antibiotics are not routinely indicated in clean procedures unless prosthetic devices are implanted.[4] Nonetheless, in many low- and middle-income countries, prophylactic antibiotics continue to be used even in routine pediatric clean operations, primarily due to the fear of SSIs, concerns about sterility of the operative environment, and variability in perioperative care.[5] Overuse of antibiotics in such cases has broader implications. Indiscriminate antibiotic prescribing contributes to antimicrobial resistance (AMR), an urgent global health crisis with rising mortality and morbidity.[6] In addition, unnecessary prophylaxis increases healthcare costs, exposes patients to adverse drug reactions, and contributes to disruption of the patient's microbiome.[7] Pediatric populations are particularly vulnerable because of developmental differences in pharmacokinetics and immune responses.[8] Thus, the question of whether prophylactic antibiotics are truly warranted in pediatric clean surgeries deserves focused attention.

Several studies have explored this issue in both adults and children. Knight et al reported that prophylactic antibiotics did not reduce infection rates in clean general surgeries.[9] Similarly, Joda found no significant difference in SSI outcomes in children undergoing herniotomy with or without prophylactic coverage.[10] A systematic review also highlighted that compliance with existing guidelines significantly reduces unnecessary antibiotic use without increasing postoperative complications.[11] Despite such evidence, the routine use of prophylaxis in pediatric clean surgeries persists, reflecting a gap between evidence-based practice and clinical behavior.

In resource-constrained countries such as Bangladesh, where surgical volumes are high and hospital infrastructure is often stretched, evaluating the necessity of antibiotics in low-risk procedures is crucial. Avoiding unnecessary use would not only reduce cost but also mitigate nosocomial spread of resistant organisms.[12] The present study was designed to compare the incidence of postoperative wound infection in children undergoing clean surgical procedures with and without prophylactic antibiotics. Additionally, the study assessed the cost implications of prophylactic antibiotic use, aiming to provide context-specific evidence to guide rational prescribing in pediatric surgical practice.

METHODS

This prospective, comparative interventional study was conducted in the Department of Pediatric Surgery, Bangladesh Shishu Hospital & Institute (Formar Dhaka Shishu Hospital), Dhaka, Bangladesh. The study period extended from March 2021 to September 2023. A total of 130 pediatric patients undergoing clean surgical procedures were included. Patients were divided into two groups: Group A (n=65) received single-dose prophylactic antibiotics, while Group B (n=65) underwent surgery without perioperative antibiotics.

Inclusion criteria

Pediatric patients undergoing clean surgical operations (inguinal hernia, hydrocele, undescended testis, lipoma, umbilical hernia, paraumbilical hernia). Elective surgical procedures lasting less than two hours. Patients with no prior infection at the surgical site.

Exclusion criteria

Patients with acute conditions. Children with comorbidities (jaundice, uremia, malignancy, cardiac or renal disease, anemia). Malnourished or immunosuppressed patients. Cases with intraoperative breaks in aseptic technique. Patients with known allergy to cephalosporins or perioperative blood transfusion. Patients with active infection elsewhere in the body.

Data collection and study procedure

Data were collected using a predesigned case record form. After enrolment, preoperative evaluation included clinical assessment, ultrasonography (for undescended testis or lipoma), and baseline hematological investigations (complete blood count, bleeding time, clotting time, and serum creatinine). Group A received a single intravenous dose of cephradine (12.5 mg/kg) half an hour before incision. Group B did not receive any perioperative antibiotic. All surgeries were performed under standardized operating theater conditions with uniform surgical technique, meticulous hemostasis, and intradermal closure using absorbable sutures. Postoperatively, patients were monitored for pain, fever, and wound complications. Follow-up visits were scheduled on the 3rd, 7th, and 30th postoperative days.

Ethical considerations

Informed written consent was obtained from parents or guardians. Confidentiality of patient information was strictly maintained. Participants retained the right to withdraw at any time. The study protocol received approval from the institutional ethical review committee of Dhaka Shishu Hospital.

Statistical analysis

Data were entered and analyzed using SPSS version 23.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean±standard deviation and compared using unpaired t-tests. Categorical variables were presented as frequencies and percentages, with Chi-square test applied for group comparisons. A p value <0.05 was considered statistically significant.

RESULTS

Table 1 shows that majority of patients belonged to age group ≤12 months in both group A and group B, 21 (32.3%) and 17 (26.2%), respectively. The mean age was

35.01±32.925 months in group A and 39.70±32.42 months in group B. Table 2 shows that male patients were predominant in both groups, which was 58(89.2%) in group A and 49 (75.4%) in group B. Table 3 shows that the mean cost of treatment was found to be 8526.25±900.10 Tk in group A and 8335.75±700.20 Tk in group B. The difference was not statistically significant (p>0.05) between the two groups. Total cost of treatment = Admission fee + bed charge + OT charge + drug cost + antibiotic cost for group A.

Table 4 shows that at the 2nd follow-up (7th postoperative day), 1 (1.5%) patient of group A developed redness, swelling, serous discharge and tenderness around the wound. No patient developed a wound infection in group B. At the 3rd follow-up, after 1 month from the day of operation, all patients were healthy in both groups.

Table 1: Distribution of the study patients by age (n=130).

Age group (in months)	Group A (n=65)		Group B (n=65)	
	N	%	N	%
≤12	21	32.3	17	26.2
13-24	17	26.2	11	16.9
25-36	5	7.7	9	13.8
37-48	5	7.7	7	10.8
49-60	6	9.2	8	12.3
>60	11	16.9	13	20
Mean± SD	35.01±32.96		39.70±32.42	

Table 2: Distribution of the study patients by sex (n=130).

Sex	Group A (n=65)		Group B (n=65)	
	N	%	N	%
Male	58	89.2	49	75.4
Female	7	10.8	16	24.6

Table 3: Distribution of the study patients by total cost of treatment (n=130).

Cost of treatment	Group A (n=65)	Group B (n=65)	P value
	Mean± SD	Mean± SD	
Cost of treatment (TK)	8526.25±900.10	8335.75±700.20	0.18

Table 4: Distribution of the study patients by condition of patient after discharge (n=130).

Condition of patient after discharge		Group A (n=65)	Group B (n=65)	P value
		N (%)	N (%)	
1st follow up (3rd postoperative day)	Fever	0 (0.0)	0 (0.0)	-
2nd follow up (7th postoperative day)	Redness	1 (1.5)	0 (0.0)	0.5
	Swelling around the wound	1 (1.5)	0 (0.0)	0.5
	Serus discharge	1 (1.5)	0 (0.0)	0.5
	Tenderness around wound	1 (1.5)	0 (0.0)	0.5
	Fever	0 (0.0)	0 (0.0)	-
3rd follow up (30th postoperative day)	Redness	0 (0.0)	0 (0.0)	-
	Swelling around the wound	0 (0.0)	0 (0.0)	-
	Serus discharge	0 (0.0)	0 (0.0)	-
	Wound dehiscence	0 (0.0)	0 (0.0)	-
	Fever	0 (0.0)	0 (0.0)	0

DISCUSSION

This prospective, comparative interventional study was conducted at the Department of Pediatric Surgery of Dhaka Shishu (Children) Hospital, Dhaka. This study aimed to evaluate whether the use of perioperative prophylactic antibiotics affects postoperative wound infection in clean operations in our setup. In this study majority of 21 (32.3%) belonged to the age group ≤12 months in group A and 17 (26.2%) in group B. The mean age was 35.01±32.925 months in group A and 39.70±32.42 months in group B. The difference was not statistically significant (p>0.05) between the two groups. In a study by Joda (2016), the age range was one month to seven years, with a mean age of 26.14 months. In group B, the age range was one month to five years, with a mean age of 27.81 months. Khoshbin et al also observed that the mean age was 7.0±6.1 years in the given antibiotic prophylaxis group and 7.0±6.1 years in the no antibiotic prophylaxis group.[11]

In this study, male patients were predominant in both groups, 58 (89.2%) in group A and 49 (75.4%) in group B. The difference was not statistically significant (p>0.05) between the two groups. Joda (2016) observed that the majority of patients were male in both groups (92%); males constituted 93.3% in group A and 90.6% in group Khoshbin et al reported that males comprised 58.2% in the antibiotic prophylaxis group and 64.2% without antibiotic prophylaxis.[11] Females were found in 41.8% and 35.8% of the antibiotic prophylaxis and non-antibiotic prophylaxis groups, respectively. The difference was not statistically significant (p>0.05) between the two groups. Kumar et al. also found male 68% in group A and 62% in group B.[13] Bendre et al observed 39 males and 11 females in the case group and 45 males and 5 females in the control group.[14] Leuva et al, also found male predominance 15 (60.0%) in group A and 15 (60.0%) in group B.[15]

From the perspective of the cost of treatment, the mean cost of treatment was 8526.25±900.10 Tk in group A and 8335.75±700.20 Tk in group B. The difference was not statistically significant (p>0.05) between the two groups. This finding aligns with that of Bendre et al who reported that omitting postoperative antibiotics in clean general surgeries resulted in an 88% cost reduction without increasing SSI incidence.[14]

In the 2^{nd} follow-up (7^{th} postoperative day), we found that one (1.5%) patient in Group A developed redness, swelling, serous discharge, and tenderness around the wound. No patient in Group B developed a wound infection. Prasanna et al and Ranganath et al reported that 4% of cases were infected in both groups.[16] All four cases were categorized as superficial surgical site infections and were found on the first follow-up. The wound infection rate reported in the literature for clean wounds is between 1.5% and 4%.[2] Classen et al. showed that 3.8% of patients who received preoperative antibiotics developed wound infection.[17]

The implications of these findings are highly relevant for clinical practice in resource-limited countries. First, the negligible difference in wound outcomes between the two groups suggests that strict adherence to aseptic technique and proper postoperative monitoring may be sufficient to prevent infection in clean pediatric surgeries, without requiring routine antibiotic coverage. This aligns with current international recommendations and highlights an important opportunity for antibiotic stewardship in surgical practice. By reducing unnecessary antibiotic use, hospitals can help limit antimicrobial resistance, a growing public health threat in South Asia and worldwide. Moreover, omission of antibiotics can lower treatment costs and reduce the burden on families who often pay out-of-pocket for healthcare, while maintaining safety and quality of care.

In summary, this study reinforces the evidence that prophylactic antibiotics provide no additional benefit in preventing wound infection in clean surgeries when perioperative standards are maintained. Male predominance and young age distribution reflect the typical epidemiology of pediatric surgical conditions in Bangladesh. Wound outcomes were excellent in both groups, and the cost analysis further supports rational avoidance of unnecessary antibiotics. Taken together, these findings support adopting a selective, evidence-based approach to perioperative antibiotic use in pediatric clean surgeries, with implications for improving surgical safety, optimizing resource use, and advancing antimicrobial stewardship.

Limitations

This study was limited by its single-center design and relatively small sample size, which may affect the statistical power to detect rare infection events. Surgeons with varying levels of experience performed the procedures, which could have introduced performance-related variability. Follow-up was limited to 30 days, potentially missing late-onset complications. Additionally, microbiological evaluation of wounds was not systematically performed, limiting deeper insights into causative organisms.

CONCLUSION

The findings of this study suggest that prophylactic antibiotics do not reduce the incidence of postoperative wound infection in pediatric clean surgical procedures. The omission of antibiotics was not associated with higher infection rates and may reduce unnecessary costs and antimicrobial exposure. Rational prescribing, adherence to aseptic techniques, and optimized perioperative care should remain the cornerstones of infection prevention in pediatric clean surgeries.

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