

Effect of Single-Dose Antibiotic Prophylaxis on Surgical Site Infections Following Clean Paediatric Inguinal Surgery

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Abstract

Background: In clean surgery, the argument for antibiotic prophylaxis may not be valid, especially for procedures that do not use prosthetic material. The infection rate in such cases is very low. Guidelines specify that the rate of wound infection in clean surgery should not exceed 4%.

Objective: To determine the incidence of surgical-site infection and assess its association with documented single-dose antibiotic prophylaxis among children undergoing clean elective inguinal surgery.

Methods: A prospective cohort study was conducted at the Department of Paediatric Surgery, Shaikh Zayed Medical Complex, Lahore. Consecutive eligible children undergoing clean elective inguinal surgery were enrolled before surgery and followed prospectively for 30 days. Participants were categorized according to whether a single preoperative dose of antibiotic prophylaxis was documented or not as part of routine clinical care. During the one-year study period, 70 eligible children (35 in each group) were enrolled and followed prospectively.

Results: Thirty-five children received a documented single preoperative dose of intravenous cephadrine, while 35 did not receive prophylactic antibiotics. Antibiotic-exposed cohort received a single pre-operative dose of intravenous cephadrine (50 mg/kg/day), whereas antibiotic-unexposed cohort received no prophylactic antibiotic. There were no statistically significant differences between the antibiotic and no-antibiotic groups. At the 30th postoperative day, 68 (97.2%) patients had grade 0 wounds, with 34 patients in each study group. One surgical-site infection occurred in each cohort.

Conclusion: The use of prophylactic antibiotics in clean paediatric inguinal surgery does not confer any additional benefit for favourable wound outcomes or the prevention of surgical wound infection.

Key words: Surgical Wound Infection, antibiotic prophylaxis, hernia, inguinal surgery, hydrocele, orchiopex, child.

Introduction

Surgical-site infection has been defined by the Centers for Disease Control and Prevention (CDC) as the growth of pathogens at the surgical

site, involving the skin, deeper tissue layers, or an internal organ or cavity, within 30 days of surgical intervention.¹ Surgical site infections (SSIs) have been a significant contributor to health care costs, morbidity, and mortality, and are accountable for a large number of nosocomial infections.²

When the surgery is clean, contaminated, or dirty, the risk-to-benefit ratio favors antibiotics. This has led to the universal acceptance of antibiotic prophylaxis in surgery. However, in clean surgery, a similar prophylaxis argument may not be valid, especially when no prosthesis is used, as the infection rate in such cases is very low.³

Several studies and clinical evidence support the concept that prophylactic antibiotics in clean surgery are not mandatory, but are overemphasized out of fear of infection, which perpetuates the old practice. Recent meta-analyses

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Authors Contribution

MAS conceptualized the project. AI did the data collection. AI* & SHK performed the statistical analysis. AI* & AI** did the literature search. Drafting, revision & writing of manuscript were done by AI & MAS. AA, AA* & TIM did the proof reading.

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of similar studies either dismiss or discourage the use of perioperative prophylactic antibiotics.⁴ Various studies conducted in both general and teaching hospitals show inappropriate use of antibiotics in 52% of inpatients and 28% of outpatients in general hospitals, and 60.36% of patients in teaching hospitals.⁵

Currently, limited local data are available to determine outcomes of postoperative surgical SSI in clean inguinal surgery, with patients either taking a single-dose antibiotic or no antibiotic. The rationale for the study is to provide local evidence and reduce unnecessary antibiotic use in the paediatric population undergoing clean surgery to prevent the development of resistance and allergic reactions, as well as to minimize health care costs. Therefore, aim of this study is to determine the incidence of surgical-site infection and assess its association with documented single-dose antibiotic prophylaxis among children undergoing clean elective inguinal surgery.

Methods

A prospective, single-centre, observational cohort study was conducted in the Department of Paediatric Surgery, Shaikh Zayed Medical Complex, Lahore, from July 2022 to June 2023. Children were enrolled before elective surgery and followed prospectively for 30 days after the procedure. The study included all eligible participants available during the predefined one-year recruitment period. Because this was a single-centre observational cohort, The sample size was calculated using the Raosoft online sample size calculator, with a 95% confidence level, a 5% margin of error, and a response distribution of 50%, against a total eligible population of 84 patients presenting during the one-year study period. The minimum recommended sample size was 70.

Consecutive sampling was used. All children presenting during the study period who met the eligibility criteria were invited to participate. Participants were not assigned to receive or not receive antibiotics by the research team. Antibiotic exposure was recorded according to the perioperative treatment documented by the treating surgical team. The exposure of interest was receipt of a single preoperative dose of intravenous cephadrine at induction. Children with documented receipt of cephadrine were classified as the antibiotic-exposed cohort, whereas those with no documented prophylactic antibiotic were classified as the antibiotic-unexposed cohort. The decision to administer prophylaxis was made as part of routine perioperative care and was not determined by the

investigators. Neither cohort received routine postoperative prophylactic antibiotics.

Written informed consent was obtained from the parent/legal guardian of each participating child prior to inclusion in the study and verbal assent of children was taken where applicable. Patients aged 2 to 14 years undergoing elective inguinal surgery with a normal complete blood count were included in the study. Patients were excluded if they had an obstructed inguinal hernia, systemic diseases, prolonged surgical duration, prior surgeries, rashes in the genital area, congenital genitourinary malformations on examination, known bleeding disorders, or were immune compromised. Additionally, children with any documented systemic condition affecting wound healing or those requiring antibiotics for any other reason were also excluded. Besides wound status, other variables, such as weight, socioeconomic status, diagnosis, and operative time, were also recorded.

In both cohorts, patients were shifted to post-operative wards and discharged on the first post-operative day. Wound dressing was removed after 24 hours in both groups. Patients were advised to shower and maintain routine hygiene. Wound was assessed at the 7th and 30th postoperative day using "The Southampton Wound Scoring System". Parents were informed in detail about the signs and symptoms of wound infection (redness, fever, and pus oozing from the wound) and advised to seek prompt consultation and follow-up. Patients who developed wound infection were admitted and managed with daily dressings and antibiotics if needed. The wound swabs from these patients were sent for culture and sensitivity testing, and they were treated accordingly. The underlying cause of infection was also noted. Wound infection was defined as the presence of redness, pain, warmth, swelling, or purulent discharge at the surgical wound. Wounds were assessed on the 7th and 30th postoperative days using the Southampton Wound Scoring System, where Grade 0 indicates normal healing, Grades I–III represent increasing degrees of bruising, erythema, inflammation, or serous discharge, and Grades IV–V indicate purulent or deep/severe wound infection. Participants who did not complete the 30-day assessment were documented as lost to follow-up, and their last known wound status and reason for non-attendance were recorded.

Data were entered and analyzed using SPSS version 26.0. Categorical variables, including gender, socioeconomic status, diagnosis, and wound grade, were presented as frequencies and percentages, whereas quantitative variables, including age, weight, operative duration, and

hemoglobin level, were presented as mean±standard deviation. The normality of quantitative variables was assessed using the Shapiro–Wilk test. The Chi-square test was used to assess associations between categorical variables and study groups, while the independent-samples t-test was used to compare mean age, weight, operative duration, and hemoglobin levels between the two groups. A p -value ≤ 0.05 was considered statistically significant.

Results

During the study period, 70 patients met the eligibility criteria. The majority were male (62; 88.6%), with only 8 female patients (11.4%). The mean age was 4.46 ± 3.05 years, and the average weight was 18.33 ± 9.86 kg.

There were no significant differences between the two cohorts in terms of age, gender distribution, body weight, or socioeconomic background ($p > 0.05$ for all comparisons).

Inguinal hernia was the most common diagnosis, observed in 46 patients (65.7%), followed by undescended testis in 15 (21.4%) and hydrocele in 9 (12.9%). Diagnosis distribution did not differ significantly between groups ($p = 0.589$). The Comparison of Baseline and Clinical Characteristics Between cohorts is shown in Table-1.

On the 7th postoperative day, wound assessment showed that 68 patients (97.1%) had healthy wounds with no signs of infection (Southampton Grade 0). Two patients (2.9%), one from each group, developed a wound infection, graded as Grade 4b according to the Southampton Wound Grading. Both were managed with appropriate surgical care and antibiotics. Cultures in both cases grew *Staphylococcus aureus*, which was pansensitive. By the 30th postoperative day,

complete wound healing was observed in all the patients.

No significant associations were found between wound infection and the use of preoperative antibiotics ($p = 0.368$), socioeconomic status ($p = 0.334$), or operative time ($p = 0.229$). The mean operative time was 38.5 ± 10.95 minutes. Operative duration was also comparable between groups ($p = 0.229$). Association of Wound Infection at 30th Postoperative Day with Study Variables is shown in Table-2.

Discussion

Extensive unnecessary antibiotic use has been associated with the emergence of antibiotic resistance, thereby reducing their effectiveness and increasing the cost of treatment.⁶ Presently, prospective cohort provides local observational data on SSI occurrence among children undergoing clean inguinal surgery, according to whether perioperative antibiotic prophylaxis was documented.

Antibiotic prophylaxis has been considered to decrease infection-related costs and post-operative morbidity, and to reduce hospital stay, but its use is also associated with potential risks of allergic reactions, antibiotic side effects, drug interactions, and thrombophlebitis. Excessive use of antibiotics has also been associated with community-acquired Methicillin-resistant *Staphylococcus aureus* infections.⁷ The patients in both the cohorts in at present had hospital stays within the standard duration, and there were no significant postoperative complications in either group. Developing hospital protocols for antibiotics and improving hygiene conditions can help reduce bacterial resistance.⁸ In this study, special consideration was given to following proper aseptic surgical techniques.

Table 1: Baseline and clinical characteristics of both study groups. (n=70)

Variables	Category	Antibiotic n (%)	No Antibiotic n (%)	Total	Chi-square	p-value
Age (years)	≤ 3	20 (52.6)	18 (47.4)	38	0.230	0.631
	> 3	15 (46.9)	17 (53.1)	32		
Gender	Male	29 (46.8)	33 (53.2)	62	2.258	0.133
	Female	6 (75.0)	2 (25.0)	8		
Socioeconomic status	Lower	10 (43.5)	13 (56.5)	23	2.191	0.334
	Middle	21 (50.0)	21 (50.0)	42		
	Upper	4 (80.0)	1 (20.0)	5		
Diagnosis	Inguinal hernia	25 (54.3)	21 (45.7)	46	1.060	0.589
	Undescended testis	6 (40.0)	9 (60.0)	15		
	Hydrocele	4 (44.4)	5 (55.6)	9		
Operative duration (minutes)	≤ 35	13 (41.9)	18 (58.1)	31	1.447	0.229
	> 35	22 (56.4)	17 (43.6)	39		
Weight (Kg)	≤ 15	20 (51.3)	19 (48.7)	39	0.058	0.810
	> 15	15 (48.4)	16 (51.6)	31		

Table 2: Association of wound infection at 30th postoperative day. (n=70)

Variable	Category	No Wound Infection n (%)	Wound Infection n (%)	Pearson χ^2	Exact p-value
Preoperative antibiotic use	Antibiotic	34 (97.1)	1 (2.9)	0.000	1.000
	No antibiotic	34 (97.1)	1 (2.9)		
Socioeconomic status	Lower	22 (95.7)	1 (4.3)	0.366	1.000
	Middle	41 (97.6)	1 (2.4)		
	Upper	5 (100.0)	0 (0.0)		
Age	≤3 years	37 (97.4)	1 (2.6)	0.015	1.000
	>3 years	31 (96.9)	1 (3.1)		
Gender	Male	60 (96.8)	2 (3.2)	0.266	1.000
	Female	8 (100.0)	0 (0.0)		
Diagnosis	Inguinal hernia	45 (97.8)	1 (2.2)	1.126	0.571
	Undescended testis	14 (93.3)	1 (6.7)		
	Hydrocele	9 (100.0)	0 (0.0)		
Operative time	≤35 min	31 (100.0)	0 (0.0)	1.637	0.499
	>35 min	37 (94.9)	2 (5.1)		
Weight	≤15 kg	38 (97.4)	1 (2.6)	0.027	1.000
	>15 kg	30 (96.8)	1 (3.2)		

A randomized, prospective study was conducted by Vaze et al., which included a total of 251 patients. Patients in Group A (Control Group) were given a standard protocol: a single dose of intravenous antibiotic at the time of induction and 3-4 days of oral antibiotics thereafter. Whereas patients in Group B (Case Group) underwent a similar surgical procedure without pre-induction or post-operative antibiotics. The frequency of surgical site infection in the case group was 3.73%, and in the control group, 2.22%. The detected difference in the frequency of surgical site infection was statistically inconsequential (p value =0.7027). The general infection frequency in both the case and control groups was 2.89%. A local study done at AIMS Muzaffarabad, Pakistan, concluded that antibiotic prophylaxis in clean surgery is not significantly associated with a lower incidence of wound infection postoperatively.⁹ Currently, the patient population was divided into two cohorts and the antibiotic of choice for prophylaxis was Cephadrine at a dose of 50mg/kg/day. The surgical procedures were sterilized and disinfected before and after the procedures in both groups, and similar post-discharge care was provided to each patient.

The most important factor to determine surgical wound status was the Southampton grading. Most wounds were grade 0 on the 7th and 30th postoperative days, consistent with CDC criteria. There was one patient with wound grade 4b in the control group and one patient with wound grade 5 in the other group. The difference was because of poor hygiene of wounds in one patient, and the other patient was immunocompromised after getting infected with measles after surgery.

Overall, results showed no significant effect of antibiotic prophylaxis on wound infection.

A study conducted in Nigeria found that of the total 104 procedures, wound infection occurred in 5 cases, resulting in an infection rate of 4.8%. Of the total number of wound infections, three involved infants and children of preschool age who were 5 weeks, 7 weeks, and 1.5 years old, respectively 9. It is noteworthy that they all belonged to the group of children who were often in nappies. The remaining two wound infections happened in the collective school/adolescent-aged group. At present, a paediatric population aged more than 2 years, both genders, and all socio-economic statuses were included to overcome bias related to affordability, and were divided into two groups: a control group and a no-antibiotic group. In this study, age range of 2-14 years was considered to exclude factors such as inadequate hygiene and groin wound location, which are prone to contamination in young children wearing wet nappies, and may increase the risk of infection.¹⁰

Socioeconomic status, a leading factor in affordability, hygiene, nutrition, and patient care, can affect outcomes and was critically analyzed during the study period. There is multiple evidence supporting no need for cautionary use of antibiotics in clean surgery. The limitation of the available evidence is that the research is being conducted in developed countries where standard protocols are established and followed. The results of such studies cannot be replicated in the scenario of developing countries. Socio-economic status of the patients in this study was also noted. It was found that it had played no role with respect to wound infection or any other postoperative morbidities. In

developing countries, there is a constant fear of wound infections associated with poor hygiene, financial constraints, malnutrition, etc. In such situations, the potential chances of infections lead to surgeons' use of antibiotics without any rationale, even in cases of clean surgeries.¹¹

Wound healing is a complicated process, and nutrition plays an important role in the development of new tissue. In this study, weight was also analyzed to assess the patient's nutritional status. To determine if the weight/general nutritional status of the patient had any impact on the wound healing, as well as the requirement of surgical prophylaxis. Children with an average weight of 18 kg and all grades of wounds were included to assess the need for antibiotics. It is suggested that if the body's immunity is low, tissue repair will be sluggish. Overlooking the nutritional health of the individual might compromise all the wound management measurements taken entirely. It is well established that good nutritional status will improve healing.¹²

For this reason, hemoglobin levels of the patients in this research were recorded. Although no statistically significant outcomes were found, considering its effect on wound healing. There are numerous mechanisms by which iron deficiency may harm wound healing. Hypoxia plays an important role in impaired wound healing, according to the literature.¹³

A study suggested that the operative time was considered to be a substantial risk factor for SSIs. The longer the operative time, the higher the risk of infection.¹⁴ In present study, operative time of more than 60 minutes was excluded. The time taken to perform the procedures was less than or more than 35 minutes per procedure, and there was no significant effect of operative time on wound status.

Cheng et al. suggest that prolonged surgical time is a demonstrated hazard for surgical site infection in children. There were no significant differences, and, therefore, these were not the factors associated with SSI in this study. Moreover, the 57 stressors of varying extent and duration can significantly alter healing.¹⁵

The association of antibiotic use and wound infection based on gender was observed to be statistically insignificant. In clean paediatric surgical procedures, the risk of surgical site infections is exceedingly low. Unnecessary antibiotic use in children can lead to harmful side effects like increase risk of infection with community acquired Methicillin-resistant *Staphylococcus Aureus* and antimicrobial resistance.¹⁶ In a carefully selected paediatric population, administering antibiotic prophylaxis may provide no additional benefit.¹⁷

The main limitations of this study include its small sample size and single-center design, which may limit generalizability. The naturally low SSI rate in clean paediatric inguinal surgery may reduce the ability to detect significant differences.

Conclusion

Surgical-site infection was uncommon among children undergoing clean elective inguinal surgery in this single-centre prospective cohort. No statistically significant association was observed between documented single-dose preoperative antibiotic prophylaxis and SSI.

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Availability of Data: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethical Approval: The Institutional Review Board of Shaikh Zayed Medical Complex, Lahore approved the study via letter no. 00118/2021 dated 01/10/2021.

Conflict of Interest: None declared.

References

1. Zabaglo M, Leslie SW, Sharman T. Postoperative wound infections. StatPearls . Treasure Island (FL): 2024. (Accessed on 20th September, 2026) /avaukavke from <https://www.ncbi.nlm.nih.gov/books/NBK560533/>
2. Rezaei AR, Zienkiewicz D, Rezaei AR. Surgical site infections: a comprehensive review. J Trauma Inj. 2025; 38(2): 71-81.
3. Vaze D, Samujh R, Narasimha Rao K. Risk of surgical site infection in paediatric herniotomies without any prophylactic antibiotics: A preliminary experience. Afr J Paediatr Surg 2014; 11(2): 158.
4. Taborda JCM, Guzmán JCM, Higuera-Gutiérrez LF. Understanding antibiotic knowledge, attitudes, and practices: a cross-sectional study in physicians from a Colombian region, 2023. BMC Med Educ 2024; 24(1): 380.
5. Shamsuddin AKM, Rahman MS, Sultana N, Islam MS, Shaha AK, Karim MR, et al. Current Trend of Antibiotic Practice in Paediatric Surgery in Bangladesh Current Trend of Antibiotic Practice in Paediatric Surgery in Bangladesh. IOSR-JDMS 2019; 18: 28-32.
6. Charani E, de Barra E, Rawson TM, Gill D, Gilchrist M, Naylor NR, et al. Antibiotic prescribing in general medical and surgical specialties: a prospective cohort study. Antimicrob Resist Infect Control 2019; 8(1): 151.
7. Orelia CC, van Hessen C, Sanchez-Manuel FJ, Aufenacker TJ, Scholten RJ. Antibiotic prophylaxis for prevention of postoperative wound infection in adults

- undergoing open elective inguinal or femoral hernia repair. *Cochrane Database Syst Rev* 2020; 4(4): CD003769.
8. Caniça M, Manageiro V, Abriouel H. Antibiotic resistance in foodborne bacteria. *Trends Food Sci Technol* 2019; 84: 41-4.
9. Fujii T, Kitadani Y, Tanaka A, Harada N, Katami H, Mikami F, et al. Minimal Impact of Prophylactic Antibiotics in Pediatric Inguinal Hernia Surgery: Evidence From Real-World Data. *J Pediatr Surg* 2025; 60(11): 162607.
10. Shah JN, Subedi N. Paediatric day care inguinal hernia surgery in a general hospital: a prospective study on change in practice. *J Nepal Paed Soc* 2010; 30(3): 128-31.
11. Gwilym BL, Maheswaran R, Edwards A, Thomas-Jones E, Michaels J, Bosanquet DC, et al. Income Deprivation and Groin Wound Surgical Site Infection: Cross-Sectional Analysis from the Groin Wound Infection after Vascular Exposure Multicenter Cohort Study. *Surg Infect* 2022; 23(1): 7383.
12. Ghaly P, Iliopoulos J, Ahmad M. The role of nutrition in wound healing: an overview. *Br J Nurs* 2021; 30(5): 38-42.
13. Boncheva I. Role of Iron in Epidermal Healing and Infection. *McGill Sci Undergrad Res J* 2023; 18(1): 6-9.
14. A Megahed H, Taki-Eldin A, A Mohamed AM, Kh El-Syed Ibrahim M, Abdel Aziz AA, A Megahed H, et al. Risk Factors for Surgical Site Infections in Elective and Emergency Surgeries: A Prospective Cohort Study. *Med J Islam Repub Iran* 2025; 39(1): 55.
15. Cheng H, Chen BP, Soleas IM, Ferko NC, Cameron CG, Hinoul P. Prolonged operative duration increases risk of surgical site infections: a systematic review. *Surg Infect* 2017; 18(6): 722-35.
16. Sheikh MA, Idrees A, Ahmad JAM, Fatima K, Riaz L, Ikram A. Community Acquired Methicillin Resistant *Staphylococcus Aureus* (CA-MRSA) Infection in Paediatric Subcutaneous Abscesses in Pakistan. *Proc SZMC* 2021; 35(3): 12-6.
17. Syed MK, Al Faqeeh AA, Othman A, Hussein AA, et al. Antimicrobial prophylaxis in clean paediatric surgical procedures: a necessity or redundancy? *Cureus* 2020 28; 12(9): e10701.