Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/zjwxv681

ASSESSMENT OF PROPHYLACTIC ANTIBIOTIC USE IN OPEN INGUINAL HERNIA SURGERY: A STUDY AT A TERTIARY CARE CENTRE

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ABSTRACT

Introduction: While the use of prophylactic antibiotics in clean-contaminated, contaminated, and dirty wounds is well-established, their role in clean surgeries, such as Lichtenstein mesh hernioplasty, remains controversial. The unnecessary use of antibiotics is discouraged due to potential complications. As inguinal hernia repair is a common procedure performed worldwide, limiting the indiscriminate use of antibiotics could have significant benefits in terms of cost-effectiveness, reducing the emergence of drug-resistant bacteria, and minimizing the risk of antibiotic-related toxic or allergic reactions **(1).** This case-control study, conducted at Rajarajeswari Medical College and Hospital in Bangalore from August 2022 to August 2024, aimed to evaluate whether systemic antibiotic prophylaxis prevents wound infections in Lichtenstein inguinal hernioplasty.

Aims & Objectives:

1. To establish clear guidelines regarding the necessity of prophylactic antibiotics in patients undergoing open inguinal hernia surgery.
2. To identify the risk factors contributing to surgical site infections.

Methods: The study, conducted over a two-year period with follow-up, included 100 patients randomized into two groups. The first group received a third-generation cephalosporin, while the second group received no antibiotics prior to surgery.

Observation & Results: A total of 100 patients were included in the study. The age distribution between both groups was comparable, with the majority of patients being male. The age group most commonly represented was 41-50 years, accounting for 26% of cases. The overall complication rate was 5%, with 3 complications in the antibiotic group (Group A) and 2 in the non-antibiotic group (Group B).

Conclusion: Based on our findings, it can be concluded that routine antibiotic prophylaxis is not necessary for low-risk patients undergoing hernioplasty.

Keywords: Inguinal hernia, prophylactic antibiotics, preoperative, hernia complications, surgical site infection, SSIs

Introduction

A hernia is defined as the protrusion of an organ or tissue through an abnormal opening in the wall of the cavity that contains it.[2] The incidence of hernia is significant, with over one million hernia repairs performed annually in both the United States and Europe.[3] This number is mirrored in India, where hernia surgeries are similarly common. Among various hernia types, inguinal hernia repair is one of the most frequent procedures, and since 1975[4], mesh repair has become the standard approach for its management, especially in the Western world.

The use of mesh in inguinal hernia repair, first introduced for recurrent hernias [5], has been extended to primary cases as well. Within the open mesh repair techniques, the Lichtenstein method is the most frequently used[6]. Despite its widespread adoption and proven efficacy, complications such as incision site infections[7] and mesh rejection due to deep surgical site infections (SSIs) remain a significant concern. It is well-documented that the presence of infection following mesh repair leads to a fourfold increase in the risk of hernia recurrence.

In this context, the question arises whether antibiotic prophylaxis is necessary for all hernia surgeries, particularly given the low infection rate in many cases even with the use of foreign bodies like mesh[8].

Yerdel et al.[9] reported 9% infection in the control group and 1% in the antibiotic group. Celdrán et al.[10] found 8% and 2%, respectively. Aufenacker et al.[6] observed 1.8% and 1.6%, concluding antibiotics didn't prevent SSIs. Perez et al.[11] had 3.3% and 1.7%, with no benefit from antibiotics. Tzovaras et al.[12] found 4.7% and 2.6%, drawing similar conclusions. Higher SSI rates suggested some benefit, but not in studies with lower rates

Unnecessary antibiotic use is discouraged due to potential complications. Routine prophylaxis in inguinal hernia mesh repair can lead to antibiotic resistance and higher hospital costs. Limiting its use can reduce costs, prevent drug resistance, and minimize adverse effects. This case-control study, conducted at a Tertiary Care Hospital, Bangalore, from August 2022 to August 2024, aims to assess whether systemic antibiotics prevent wound infections in Lichtenstein inguinal hernioplasty

Several studies have specifically focused on the use of prophylactic antibiotics in inguinal hernia repairs, particularly those involving mesh. The study by Yerdel et al.[9] reported a 9% infection rate in the control group compared to 1% in the antibiotic group. Similarly, Celdrán et al.[10] found a reduction in infection rates from 8% to 2% with the use of prophylactic antibiotics. However, Aufenacker et al.[6] found no significant difference, with SSI rates of 1.8% in the control group versus 1.6% in the antibiotic group, leading the authors to conclude that prophylactic antibiotics did not significantly reduce the incidence of SSIs in open mesh repair of inguinal hernias.

Perez et al.[11] and Tzovaras et al.[12] similarly found minimal benefits to the routine use of prophylactic antibiotics, reporting SSI rates of 3.3% and 1.7% in the control and antibiotic groups, and 4.7% and 2.6% respectively in their studies. In studies with lower SSI rates, no clear benefit of antibiotics was observed, while studies reporting higher infection rates found some benefit in antibiotic use.[19] Single dose antibiotic among patients undergoing open mesh repair for inguinal hernia is preferred option to prevent postoperative infection and it is cost effective too.[18] Durai et al.[20] found that the postoperative wound related infection rate after a single dose of antibiotic parenterally at the induction of anaesthesia is favourable compared with that of multiple dose antibiotics.[21,22]

The decision to use antibiotics prophylactically should consider the risk of unnecessary antibiotic use, which can lead to antibiotic resistance, increased hospital costs, and potential allergic or toxic reactions. Given the low rates of SSI in many studies, there is growing concern about the indiscriminatie use of antibiotics.

Infection rates in hernioplasty are 1-2% and are linked to higher recurrence rates. Understanding mesh infection is key to prevention. Pathophysiology of prosthetic infections in Hernioplasty[24] are as follows:

- **Bacterial Entry**: Bacteria enter the wound from the air, surgical team, improper draping, or perforated gloves.
- **Bacterial Binding**: Bacteria produce adhesive substances that allow them to bind to prosthetic surfaces. They form a protective "polysaccharide film" that shields them from antibiotics and body defenses.
- **Bacterial Survival**: Bacteria, like *Staphylococcus epidermidis*, can become aggressive on prosthetics. If bacteria colonize first, infection occurs; if healthy tissue colonizes, infection is unlikely. Proper aseptic techniques, theatre safety, and preoperative antibiotics are vital to preventing infection.

Surgical Site Infections (SSIs) occur at the surgical site and are classified as **incisional** (superficial or deep) or **organ/space-related** (internal infections). Wounds are categorized as **clean** (low infection risk), **clean-contaminated** (moderate risk), **contaminated** (higher risk), or **dirty/infected** (existing infection or contamination).

SSIs can result from **endogenous** (patient's own bacteria) or **exogenous** (external sources) contamination. Preventing SSIs involves sterile techniques, antibiotics, and proper post-op care.

SSIs lead to longer hospital stays, complications, and increased costs, with organ/space-related infections having higher mortality.

This study aims to provide clarity on the necessity of systemic antibiotic prophylaxis in open inguinal hernia surgeries. Specifically, we aim to:

1. Establish guidelines regarding the need for prophylactic antibiotics in patients undergoing open inguinal hernia surgeries.

Identify risk factors associated with surgical site infections (SSIs) in patients undergoing the Lichtenstein inguinal hernioplasty technique..

METHODS

100 patients with inguinal hernia requiring mesh hernioplasty at Rajarajeswari Medical College and Hospital, Bangalore are studied from August 2022 to July 2024

Sample Size Calculation:

$$\text{Sample Size} = 1 + \frac{z^2 x\, p(1-p)}{e^2 N}$$

The study design is Case control study done with inclusion criteria of patients diagnosed with Inguinal hernia admitted to General Surgery department. Complicated/ strangulated hernia, skin infecions, diabetes, recent antibiotic use, pediatric group, recurrent or bilateral hernias are excluded from the study

Patients presented with groin swelling/pain and were diagnosed with uncomplicated inguinal hernia. A full clinical history and examination were performed, along with tests to assess surgery fitness and exclude comorbidities(Refer Table 2), including blood tests, urine tests, ECG, chest X-ray, abdominal/pelvic ultrasound, and cardiac evaluation.

After clearance, patients were randomly assigned to two groups of 50. Group 1 (control) received Cefoperazone 60 minutes before surgery, while Group 2 received no antibiotics. Surgical prep included povidone-iodine application, sterile draping, and spinal anesthesia.

Statistical Methods:

Descriptive and inferential statistical analyses were performed in this study. Continuous data are presented as Mean ± SD (Min-Max), while categorical data are presented as Number (%). Significance was assessed at the 5% level. The following assumptions were made:

1. Dependent variables should be normally distributed.
2. Samples must be randomly drawn.
3. Cases must be independent.

The Student's t-test (two-tailed, independent) was used for inter-group analysis of continuous variables. For categorical variables, the Chi-square or Fisher Exact test was used. Fisher's Exact test was applied when sample sizes were small.

Significance Levels:

- Suggestive significance (P value: $0.05 < P < 0.10$)
- Moderately significant (P value: $0.01 < P \leq 0.05$)

** Strongly significant (P value: $P \leq 0.01$)

Statistical Software:

Data analysis was performed using SPSS 18.0 and R version 3.2.2. Microsoft Word and Excel were used for generating tables and graphs.

DISCUSSION

Inguinal hernia is the most common abdominal surgery in adults, with Lichtenstein hernioplasty being the standard treatment due to its low recurrence rate. However, wound infections remain a common complication, with rates ranging from 1-14% in various studies (Refer Figure 1).While antibiotic prophylaxis is often used in surgery, its necessity in hernioplasty is debated, given the low infection rates and ease of managing infections when they occur. Nonetheless, infections can increase recurrence rates, highlighting the importance of prevention.

Several risk factors for surgical site infections (SSIs) include diabetes, obesity, smoking, steroid use, and surgical factors like technique, operating room conditions, and mesh type. Intrinsic factors are beyond control, but extrinsic factors can be managed. Studies show that infection rates are higher with absorbable meshes than with permanent meshes. In our study, the overall infection rate was 3%, with 4% in the antibiotic group and 2% in the control group, similar to other studies. For example, Yerdel et al. found a 4.64% infection rate, with lower rates in the antibiotic group. Other studies, like those by Amit et al. and Lovellen et al., had mixed results on the benefit of antibiotics.

Complications like seromas and chronic pain are common with mesh insertion. One study found ischemic orchitis in the antibiotic group, leading to testicular atrophy, though its connection to infection was unclear. Comparing studies on antibiotic use, Yerdel et al. showed a significant reduction in infections with antibiotics, while Sanabria et al. and Jian-Fang Li[8] also found benefits. However, Amit et al.[9] and Raja Najam-ul-Haq found no increased infection risk with mesh implants, suggesting that antibiotics may not be necessary if aseptic techniques are followed.

In our study, no significant difference was found between the antibiotic and placebo groups ($p = 0.362$), with a 5% infection rate overall. No mesh removals were needed, and cultures showed no bacterial growth. This suggests that prophylactic antibiotics may not be necessary for low-risk patients with proper aseptic measures. These findings are consistent with larger studies like Aufenacker et al.[6], which found no benefit to antibiotics in low-risk cases.

In conclusion, while antibiotics may reduce infections in high-risk patients, they may not be necessary for low-risk patients with appropriate surgical technique. Further studies are needed to refine guidelines for antibiotic use in inguinal hernia repair.

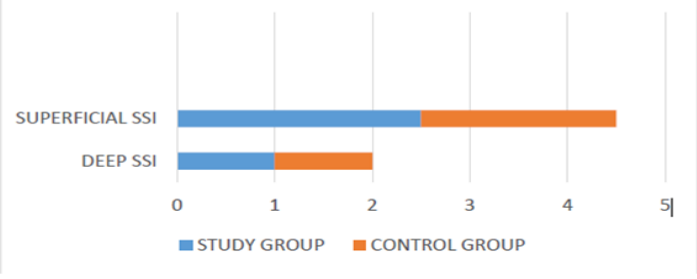

Figure 1 – Post Op Complications

Age in years	Study Group	Control Group	Total
<20	2(4%)	0(0%)	2(2%)
20-30	6(12%)	9(18%)	15(15%)
31-40	14(28%)	7(14%)	21(21%)
41-50	13(26%)	13(26%)	26(26%)
51-60	6(12%)	9(18%)	15(15%)
61-70	8(16%)	11(22%)	19(19%)
71-80	1(2%)	1(2%)	2(2%)
Total	50(100%)	50(100%)	100(100%)
Mean ± SD	45.14±14.65	47.78±14.45	46.46±14.54

Table 1 – Age group distribution

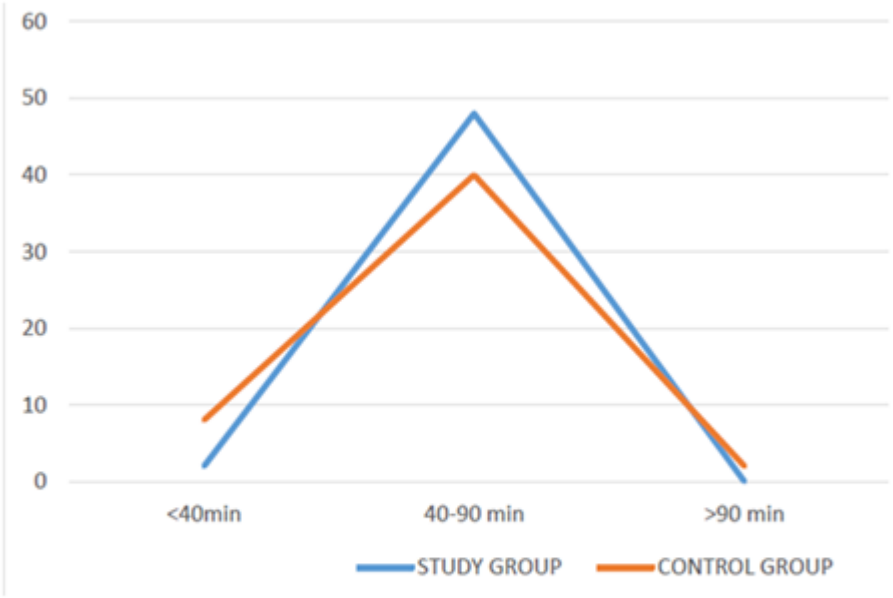

Figure 2- Duration of surgery

Comorbidities	Study Group (n=50)	Control Group (n=50)	Total (n=100)
None	46(92%)	39(78%)	85(85%)
Yes	4(8%)	11(22%)	15(15%)
• HTN	3(6%)	10(20%)	13(13%)
• Asthma	0(0%)	1(2%)	1(1%)
• IHD	1(2%)	0(0%)	1(1%)

Table 2- Co morbidities

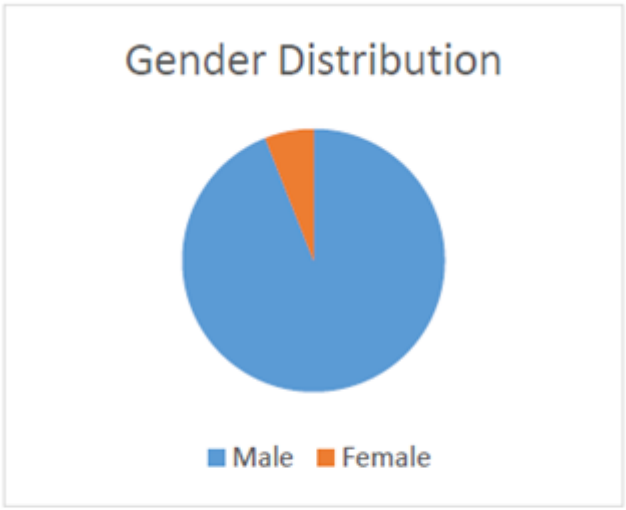

Figure 3- Gender distribution

Gender	Study Group	Control Group	Total
Female	3(6%)	0(0%)	3(3%)
Male	47(94%)	50(100%)	97(97%)
Total	50(100%)	50(100%)	100(100%)

Table 3- Gender distribution

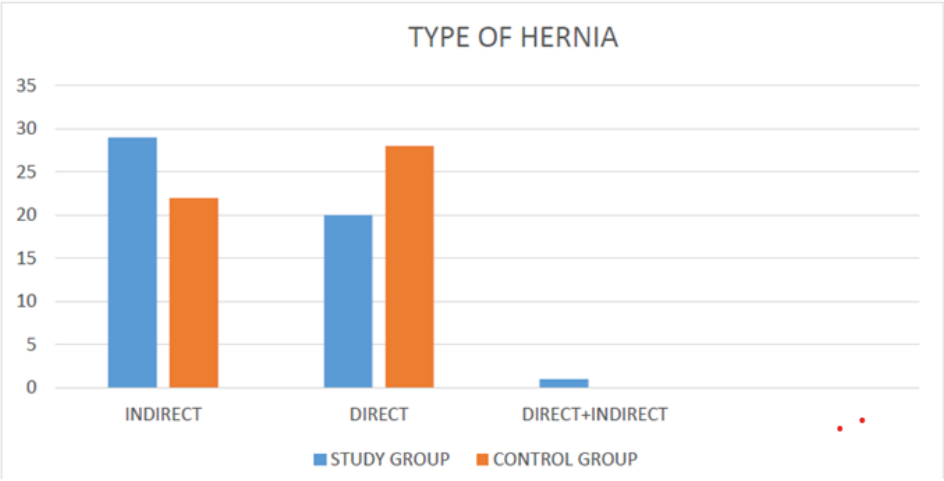

Figure 4- Types of Hernia

CONCLUSION

This case-control study examines the need for antibiotic prophylaxis in Lichtenstein inguinal hernioplasty. While some studies show a reduction in surgical site infections (SSIs) with antibiotics, others find no significant difference. The consensus is that the decision should depend on individual patient risk, surgical technique, and institutional protocols.[25]

Reducing unnecessary antibiotic use in hernia surgery lowers the risk of adverse effects, antibiotic resistance, and healthcare costs. Our study aims to clarify these issues and guide appropriate

antibiotic use in inguinal hernia repair. By identifying infection risk factors and assessing the benefit of antibiotics, we hope to inform clinical practices and guidelines.

Our findings suggest that prophylactic antibiotics offer no clear benefit in low-risk patients. The SSI rate in our study was similar to other research. Therefore, routine antibiotic prophylaxis is not necessary for low-risk hernioplasty patients. However, for surgeries with prolonged duration or complex dissection (e.g., congenital hernia sacs), postoperative antibiotics may be needed.

Post-operative wound infections were monitored in both groups, with statistical analysis showing a p-value of < 0.05 considered significant. The surgery duration ranged from 40 to 90 minutes, with a p-value of 0.032, indicating statistical significance. The overall post-operative infection rate was 5%. Two patients had deep SSIs, treated with drainage and antibiotics, while three had superficial SSIs, managed conservatively. The p-value for the infection rate between the two groups was 0.362, indicating no statistically significant difference.

The hospital stay ranged from 6 to 12 days for both groups, with longer stays for patients with 0post-operative complications. There was no significant difference in wound infection rates between the antibiotic and non-antibiotic groups. However, infections were more common in patients with longer surgery durations and prolonged hospital stays.

Source of Funding – NIL
Conflict of Interest - NIL

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