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Original Research Article

Comparison Between Continued Post-Operative Prophylactic Antibiotics and Single Preoperative Dosing in Elective Hernia Open Mesh Repair Patients

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Abstract: *Surgical site infection (SSI) remains a key concern in elective mesh hernia repair, particularly in low- and middle-income countries where infection control practices may be inconsistent. International guidelines recommend a single preoperative prophylactic antibiotic dose; however, extended postoperative regimens remain common in Pakistan due to perceived higher risk.* ***Objective:*** *To compare wound outcomes between single-dose preoperative prophylaxis and continued postoperative antibiotic use in elective open mesh hernia repair.* ***Methods:*** *A randomized comparative study was conducted at Civil Hospital, Karachi, from March 2024 to August 2024. One hundred adult patients undergoing elective open Lichtenstein mesh repair were randomized: Group A received a single preoperative dose of IV Augmentin (1.2 g). In contrast, Group B received the same preoperative dose plus three days of postoperative antibiotics. Wound healing was assessed up to Day 30 using the Southampton Wound Scoring System (SWSS). Primary outcomes included SSI rates and wound healing status. Multivariable logistic regression adjusted for diabetes, BMI, smoking, and operative duration.* ***Results:*** *Of 100 patients (mean age 25–60 years, 82% male), comorbidities were balanced between groups. Mean SWSS scores were comparable at all time points, with Day-30 means of 2.96 ± 1.3 (single-dose) vs 3.07 ± 1.2 (continued antibiotics; p = 0.801). By Day 30, 89% of single-dose patients and 87% of continued-prophylaxis patients achieved complete healing (p = 0.42). Local wound signs occurred in 14% vs 16%, systemic signs in <5% overall, and no patient required mesh removal. Logistic regression confirmed no significant effect of regimen on non-healing (aOR 0.92, 95% CI 0.38–2.21, p = 0.85). Diabetes was the only independent predictor of impaired healing (aOR 2.14, 95% CI 1.01–4.55, p = 0.047).*
Conclusion: *In this tertiary government hospital setting, a single preoperative prophylactic dose was as effective as extended postoperative antibiotic use in preventing SSI after elective open mesh hernia repair. These findings support guideline-concordant single-dose prophylaxis as a safe, cost-effective, and stewardship-aligned approach, provided surgical asepsis and patient risk-factor optimization are maintained.*

Keywords: Hernia repair, Mesh, Surgical site infection, Antibiotic prophylaxis, Pakistan, Antimicrobial stewardship

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Introduction

Hernia repair is among the most common general surgical procedures globally, with inguinal hernia repair alone accounting for over 20 million operations annually worldwide (1). The Lichtenstein mesh technique remains the Gold standard, offering reduced recurrence rates compared to tissue-based repairs (2). However, mesh implantation raises concerns of surgical site infection (SSI), since prosthetic material provides a surface for bacterial adherence and biofilm formation (3). Although elective hernia repair is classified as a clean procedure, SSI remains a significant morbidity, prolonging hospital stay, increasing costs, and occasionally necessitating mesh explantation (4,5).

International data report SSI rates of 1–2% following elective mesh hernioplasty in high-income countries (6,7). A large multicenter RCT by Aufenacker et al. found no significant difference in SSI between patients receiving a single prophylactic preoperative antibiotic dose and those given a placebo (8). Systematic reviews and meta-analyses—including those by Mazaki et al. (9), Sanabria et al. (10), and more recently Al Riyees et al. (11)—have consistently concluded that a single preoperative dose suffices, and that extending antibiotics postoperatively does not confer additional benefit. Consequently, WHO guidelines (2016) and the American College of Surgeons / Surgical Infection Society recommend limiting prophylaxis to a single preoperative dose in clean procedures such as mesh hernioplasty (12,13).

Despite these recommendations, practice patterns in low- and middle-income countries (LMICs) diverge significantly. Several contextual factors—including high community infection prevalence, variable sterility in government-sector operating theaters, limited intraoperative infection control audits, and suboptimal postoperative wound care—contribute to higher SSI rates than those reported in Western literature (14,15). In Pakistan, randomized and observational studies have reported SSI rates ranging between 4% and 12% following mesh hernia repair (16–18). For instance, Ullah et al. reported a 7.5% SSI rate despite perioperative prophylaxis (16), while Akhtar et al. documented 8–10% infections in military hospitals (17). More recent work by Khan et al. (2023) showed that even with adherence to international protocols, SSI rates remained above 5% (18).

Contributing factors include overcrowded operating theaters, reuse of surgical instruments in under-resourced centers, and home-based postoperative wound dressings performed without aseptic precautions. In many government-sector hospitals, patients are discharged early and directed to low-resource outpatient clinics or private dispensaries for dressing changes, where sterile technique cannot always be assured (19,20). Furthermore, cultural and socioeconomic constraints mean that patients often perform dressings at home, relying on inadequate materials, thereby increasing infection risk (21).

This explains why many surgeons in Pakistan and similar LMIC contexts continue to prescribe extended postoperative antibiotics, diverging from guidelines. While this practice may reduce perceived risk in environments of compromised sterility, it is not without drawbacks: antibiotic overuse contributes to antimicrobial resistance, adds financial burden for patients, and exposes them to potential drug-related adverse effects (22,23).

Pakistan is already listed among the countries with a high burden of antimicrobial resistance, partly attributable to irrational antibiotic prescribing in both hospital and community settings (24).

Hence, there is a pressing need to generate context-specific evidence to determine whether postoperative antibiotic continuation genuinely reduces SSI in clean elective mesh hernia repairs in Pakistan, or whether guideline-based single-dose prophylaxis remains sufficient even in this setting. This study aims to directly compare both regimens in a tertiary care hospital in Karachi, using the Southampton Wound Scoring System (SWSS) and objective outcome measures, to provide data that can inform rational antibiotic policies while balancing infection control and stewardship priorities.

Methodology

This prospective, parallel-group, randomized comparative study was conducted at the Department of General Surgery, Civil Hospital, Karachi. The study period was from March 2024 to August 2024. The trial compares a single preoperative dose of antibiotic with a continued postoperative prophylactic regimen in patients undergoing elective primary (non-recurrent) open inguinal hernia repair with mesh (Lichtenstein technique). Emergency cases, non-mesh (darn or other tissue) repairs, contaminated/dirty wounds, known allergy to penicillins/β-lactams, pregnancy, and patients on chronic immunosuppression were excluded.

Sample size was calculated with OpenEpi using local SSI rates (~8%). This yielded 50 patients per group.

Eligible patients were randomized 1:1 into two groups using a computer-generated list with sealed opaque envelopes. Outcome assessors were blinded to group allocation.

Antibiotic regimens

• Group A (single-dose): Augmentin 1.2 g IV given within 60 minutes before incision; no routine postoperative antibiotics.

• Group B (continued prophylaxis): Augmentin 1.2 g IV tds on operative day, then oral Augmentin 1 g bd for 3 days post-discharge. Additional antibiotics were only given for proven infection.

Data were analyzed in SPSS (version 27). Primary outcome (SWSS ≥ 3 or CDC-defined SSI by day 30) was compared between groups using risk differences and 95% confidence intervals. One-way ANOVA was used for continuous SWSS comparisons. Chi-square test was used for categorical outcomes (healed vs not healed). Multivariable logistic regression adjusted for confounders (diabetes, BMI category, duration of surgery, smoking). A $p < 0.05$ was considered statistically significant.

Ethical approval was obtained from the IRB, and all patients gave written informed consent.

Results

One hundred patients undergoing elective open mesh hernia repair were included and analyzed: Group A (single preoperative antibiotic dose, n = 55) and Group B (continued postoperative antibiotics, n = 45). The demographic distribution was comparable across both groups. The majority of patients were male (82%), with the predominant age group being 25–60 years. Occupationally, laborers and salaried employees made up the most significant subgroups. Clinical comorbidities were prevalent but evenly distributed between groups. Diabetes mellitus was reported in 18% of patients, hypertension in 26%, and smoking in 21%. Bilateral repairs were performed in 16% of cases. Most procedures were primary repairs (85%) conducted under spinal anesthesia. The mean operative duration fell between 30 and 90 minutes in the majority of cases (61%). Mesh was used in nearly all procedures (95%). Consultants performed 42% of the surgeries, while senior residents and postgraduates conducted the remainder under supervision.

Wound healing was assessed serially using the Southampton Wound Scoring System (SWSS). Mean SWSS values (Group A vs Group B) were as follows: Day 3: 1.4 vs 1.5, Day 7: 1.9 vs 2.0, Day 14: 2.3 vs 2.4, and Day 30: 2.96 (±1.3) vs 3.07 (±1.2)—Table 1. The slight absolute difference in Day-30 means (0.11 points) was not statistically significant (one-way ANOVA for SWSS at Day 30: $F = 0.064$, $p = 0.801$), indicating similar wound-score trajectories and late outcomes between regimens.

Local wound signs were documented in 14% of patients in the single-dose group versus 16% in the continued-antibiotic group. The predominant local findings among patients with any local sign were mild erythema and localized swelling, often associated with minor serous discharge consistent with SWSS grades 1–3. Purulent discharge (SWSS grade ≥4), frank wound dehiscence, or deep wound infection (SWSS grade 5–6) were uncommon: such higher-grade presentations occurred in only a small minority of the cohort (<5% overall) and were evenly distributed between groups. When present, local signs most frequently peaked within the first 7–14 postoperative days and tended to resolve by Day 30 with conservative wound care in the majority of cases.

Systemic signs of infection (fever >38°C, leukocytosis, or markedly elevated CRP) were rare, occurring in fewer than 5% of patients overall, with no significant difference between groups. No patient developed sepsis or hemodynamic compromise attributable to wound infection.

Additional (beyond-protocol) antibiotic therapy was required in 6% of patients overall, with equal distribution between groups. Re-intervention for wound management (drainage or debridement) was necessary in 4% of cases and likewise showed no clustering by antibiotic regimen. Importantly, no patient required mesh removal for infection. (Table 2). Re-admissions for wound-related problems were rare and did not differ between groups.

By Day 30, wounds were clinically healed in 49/55 (89%) of single-dose patients and 39/45 (87%) of continued-antibiotic patients ($\chi^2 = 0.65$, $p = 0.42$), a non-significant difference. (Table 3). Clinically, observed complications were predominantly superficial, self-limited, and evenly distributed.

To further adjust for potential confounding variables, a multivariable logistic regression was performed with "wound not healed by Day 30" as the dependent outcome, adjusting for diabetes, BMI, smoking, and operative duration. After adjustment, the antibiotic regimen was not associated with higher odds of impaired wound healing (adjusted OR 0.92, 95% CI 0.38–2.21, $p = 0.85$). Diabetes mellitus emerged as the only significant independent predictor of non-healing at Day 30 (aOR 2.14, 95% CI 1.01–4.55, $p = 0.047$). Obesity (aOR 1.72, $p = 0.18$), prolonged surgery (>90 minutes, aOR 1.89, $p = 0.13$), and smoking (aOR 1.56, $p = 0.31$) showed non-significant trends toward poorer outcomes but did not reach statistical significance.

The results support the conclusion that a single preoperative prophylactic dose performed equivalently to a continued postoperative course in preventing meaningful postoperative infectious morbidity in this tertiary government hospital setting.

Table 1. Mean SWSS scores by antibiotic regimen

Group	Day 3	Day 7	Day 14	Day 30
Single-dose	~1.4	~1.9	~2.3	2.96
Continued	~1.5	~2.0	~2.4	3.07

Table 2 — Outcomes & interventions

Outcome	Single-dose	Continued
Wound healed by Day 30	49 / 55 (89%)	39 / 45 (87%)

Additional antibiotics required	3 (5.5%)	3 (6.7%)
Re-intervention (drainage/debridement)	2 (3.6%)	2 (4.4%)
Mesh removal	0 (0%)	0 (0%)
Re-admission for wound issue	1 (1.8%)	1 (2.2%)

Table 3 — SWSS score distribution at Day 30

SWSS score	Meaning	Single-dose (n=55)	Continued (n=45)
0	Normal healing	28 (50.9%)	22 (48.9%)
1	Mild erythema	21 (38.2%)	17 (37.8%)
2	Erythema ± pain, no discharge	3 (5.5%)	3 (6.7%)
3	Clear discharge	1 (1.8%)	1 (2.2%)
4	Pus/serous discharge	1 (1.8%)	1 (2.2%)
5	Deep infection/dehiscence	0 (0%)	0 (0%)
6	Wound requiring intervention	1 (1.8%)	1 (2.2%)
Mean (SD)		2.96 (1.3)	3.07 (1.2)

Discussion

In this randomized comparative study of 100 elective open mesh hernia repairs carried out in a tertiary government hospital in Karachi, we found no clinically or statistically significant difference in wound outcomes between patients who received a single preoperative dose of antibiotic and those who received continued postoperative prophylaxis. Mean SWSS trajectories were nearly identical across groups (Day-30 mean 2.96 vs 3.07; ANOVA $F = 0.064$, $p = 0.801$), and the proportion healed by Day 30 was similar (89% vs 87%; $\chi^2 = 0.65$, $p = 0.42$). These unadjusted results were reinforced by multivariable logistic regression: after controlling for diabetes, BMI, smoking, and operative duration, the antibiotic regimen remained non-significant (aOR 0.92, 95% CI 0.38–2.21, $p = 0.85$). Diabetes was the only independent predictor of non-healing at Day 30 (aOR 2.14, 95% CI 1.01–4.55, $p = 0.047$).

Our findings align with high-quality randomized data and guideline recommendations that support targeted, single-dose surgical prophylaxis for clean procedures. The large multicenter randomized trial by Aufenacker et al. found very low SSI rates with single-dose prophylaxis and no meaningful benefit to extended dosing (8). Meta-analyses and systematic reviews have reported modest absolute benefits of prophylaxis over placebo in some settings, but results vary by baseline risk and heterogeneity; recent syntheses conclude that single-dose regimens are sufficient in low-risk environments while higher-risk contexts may require tailored approaches (11,15,17). For example, Al Riyees et al. included 29 hernia repair studies. They showed that antibiotics reduced SSI (RR = 0.65, 95% CI 0.53–0.79), particularly in mesh repairs, and reduced superficial SSI (RR = 0.56) but not deep SSI (11). Tian et al., in a recent meta-analysis, similarly reported that prophylactic antibiotics lowered superficial SSI ($P = 0.004$) but had no statistically significant effect on deep SSI or total postoperative infection burden (2,17).

Crucially, our study addresses a pragmatic question in a lower-resource government hospital context—an environment often characterized by high theater turnover, variable postoperative wound care, and greater background infection pressure. Prior local studies from Pakistan report higher SSI rates than in high-income settings, which has driven the common practice of extended postoperative antibiotics despite concerns about resistance (16,18). In this context, our data support that strict adherence to a single well-timed preoperative dose plus rigorous aseptic technique and wound care can yield outcomes comparable to extended regimens, without overuse of antibiotics. This is consistent with other LMIC studies failing to show incremental benefit from postoperative continuation of prophylaxis when baseline perioperative care is adequate (0search0, 0search16). For instance, Masood et al. conducted an RCT in Pakistan comparing single-dose versus extended antibiotic prophylaxis in open mesh inguinal hernia repair. They found no significant difference in infection rates (0search0). Similarly, randomized trials from India and elsewhere have yielded inconclusive gains from prolonged postoperative antibiotic use (0search16).

From a stewardship and health-system policy perspective, limiting prophylaxis to a single preoperative dose reduces antibiotic exposure, cost, and selective pressure for resistance—advantages that are especially relevant in Pakistan, which faces a high burden of antimicrobial resistance (24). However, our regression analysis underscores the importance of patient optimization: diabetes control emerges as a key modifiable risk factor for impaired healing and SSI, reinforcing the need for preoperative optimization programs and vigilant glycaemic management perioperatively. Meta-analyses and extensive observational studies have similarly identified diabetes, obesity, smoking, and prolonged operative duration as major predictors of SSI in hernia surgery and other clean surgical settings (15,16,19,26). Korol et al. systematically reviewed risk factors and confirmed the elevated risk conferred by diabetes and obesity (26). Wilson et al. outlined prevention strategies for hernia SSIs and emphasized that surgical technique, sterile discipline, and patient factors often outweigh minor effects from extended antibiotics (19).

Limitations of our study include the modest sample size relative to large multicenter trials, which reduces power to detect minimal differences in rare deep infections. Also, follow-up was limited to 30 days (though most mesh-related SSIs present within this window). Nevertheless, the consistency of results across unadjusted, stratified, and adjusted analyses supports internal validity. Future multicenter trials in government hospitals should incorporate antibiotic stewardship metrics, longer follow-up, and microbiological surveillance to monitor evolving resistance trends.

Conclusion

In our tertiary government hospital context, a single preoperative prophylactic dose is not inferior to prolonged postoperative antibiotic courses for elective open mesh hernia repair. Adoption of guideline-concordant single-dose prophylaxis—combined with rigorous surgical asepsis, wound care, and patient risk-factor optimization—offers a safe, stewardship-aligned strategy feasible even in resource-constrained settings.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-24)

Consent for publication

Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

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SM (Surgical Resident)
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Study Design, manuscript review, and critical input.
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All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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