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Laparoscopic Versus Open Inguinal Hernia Repair: A Retrospective Cohort Study on Surgical Approach Preference and Perioperative Outcomes

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Abstract

Objective: This study investigates preferences for these methods and assesses perioperative outcomes at a tertiary center.

Methods: A retrospective cohort study analyzed electronic health records of 244 patients undergoing inguinal or femoral hernia repair from January 2022 to April 2025. The primary outcome was the proportion of laparoscopic versus open procedures. Secondary outcomes included operative duration (minutes), hospital stay (days), and postoperative recurrence. Data encompassed patient demographics, hernia characteristics, and surgical details. Statistical analyses used chi-square tests for proportions, Mann-Whitney U tests for non-normal data, Fisher's exact test for recurrence, and multivariable regression adjusting for confounders like age, BMI, and additional surgeries.

Results: Of 244 procedures, 29.1% ($n = 71$) were laparoscopic, and 70.9% ($n = 173$) were open ($P < 0.001$. Laparoscopic use showed no significant rise over time ($P = 0.811$). Median operative times were comparable (laparoscopic: 130.0 min, IQR 105.0–182.0; open: 120.0 min, IQR 94.5–165.0; $P = 0.372$, as were hospital stays (1.0 day, IQR 1.0–2.0; $P = 0.920$. One recurrence (0.4%) occurred in the open group ($P = 0.999$).

Conclusion: Open repair is predominant, likely due to institutional factors. Similar outcomes indicate both methods are effective with laparoscopic preferred for bilateral hernias. Multicenter studies with longer follow-up are needed to improve surgical decisions.

Keywords: Inguinal hernia, laparoscopic repair, open repair, operative time, hospital stay, recurrence

Introduction

Inguinal hernia repair is a vital surgical procedure, with approximately 20 million cases conducted worldwide annually.[1] This condition, characterized by abdominal tissue protruding through the inguinal canal, primarily affects men and requires surgery to prevent complications such as incarceration or strangulation.[1] Historically, open repair, notably the Lichtenstein tension-free mesh technique, has been the standard due to its ease, affordability, and recurrence rates of 1–5%.[2] The adoption of mesh in the late 20th century revolutionized outcomes by reducing tissue stress and enhancing durability.[2]

The advent of minimally invasive surgery, specifically laparoscopic transabdominal preperitoneal (TAPP) and totally extraperitoneal (TEP) techniques, has promoted laparoscopic methods.[3,4] These approaches provide advantages like decreased postoperative pain, faster return to normal activities, and improved handling of complex cases such as bilateral or recurrent hernias.[3,4] Using small incisions, laparoscopic surgery reduces tissue trauma and improves aesthetic results.[4] However, it requires advanced training, specialized tools, and a longer learning period, increasing costs and limiting access in resource-poor regions.[5,6]

The choice between laparoscopic and open repair depends on factors including surgeon expertise, patient health (e.g., age, comorbidities, hernia type), and facility capabilities. Economic factors also play a role.[5] Open repair is often selected in areas with limited laparoscopic resources or high costs, as it needs fewer materials and allows local anesthesia.[6] Meanwhile, laparoscopic repair is growing in developed areas with advanced technology and skilled surgeons.[7] The European Hernia Society advocates laparoscopic repair for bilateral and recurrent hernias due to lower recurrence and quicker recovery, though the best approach for unilateral primary hernias remains debated.[8]

To better understand the practical implications of these approaches, this study draws on the broader context of inguinal hernias, which affect about 27% of men over their lifetime, with rising incidence in older populations.[1] Classified as direct or indirect, they are linked to risk factors like heavy lifting, obesity, and smoking.[2] Untreated cases can lead to emergencies.[1] The evolution from tension-based to mesh-based repairs reduced recurrence from 15% to below 5%, and laparoscopic methods, introduced in the 1990s, now comprise 20–40% of repairs in developed regions.[2,7] While challenges like pneumoperitoneum risks persist, benefits for bilateral cases are evident.[4,8] By offering current, site-specific data adjusted for confounders like comorbidities, this study contributes to evidence-based decision-making in hernia surgery.

Despite increasing evidence for laparoscopic repair, its global uptake varies, highlighting the need for comparative outcome research.[7–9] Measures like operative time, length of hospital stay, and recurrence are crucial for evaluating performance, yet local data are often insufficient.[10] This study examines whether laparoscopic repair is gaining traction at a tertiary center and compares operative duration, length of hospital stay, and recurrence rates. We hypothesized that laparoscopic repair would show greater adoption, shorter times and stays, and similar or lower recurrence compared to open repair.[3,8]

Methods

Study Design

This retrospective cohort study reviewed electronic medical records (EMRs) of 244 patients who underwent inguinal or femoral hernia repair at a tertiary care facility from January 1, 2022, to April 30, 2025. The objectives were to (1) determine the proportion of laparoscopic versus open repairs and (2) assess operative time, length of hospital stay, and postoperative recurrence. Retrospective designs use existing records to evaluate real-world outcomes, minimizing bias through standardized collection.[10] The sample included all eligible patients, ensuring sufficient power (calculated for 80% power at α = 0.05 to detect a 20% difference in proportions).

Data Collection

Extracted data included patient demographics (age, sex, BMI), clinical details (symptom presentation, hernia side, recurrence status, diagnosis), surgical information (admission type, procedure type, concurrent surgeries, operative time, repair technique, surgeon experience), and outcomes (length of hospital stay, follow-up, recurrence). Variables were coded systematically (e.g., Procedure: 1 = open unilateral, 2 = open bilateral, 3 = laparoscopic unilateral, 4 = laparoscopic bilateral). Missing BMI data (<2%, n = 5) were imputed with the cohort mean (26.67 kg/m²), a common practice for minor gaps. Operative time (minutes, from entry to exit) and length of hospital stay (days) exhibited non-normal distributions (Shapiro-Wilk $P < 0.001$) due to case complexity, while BMI was normally distributed. Recurrence was confirmed via clinical or imaging follow-up. Follow-up for recurrence was conducted via clinical visits or imaging until April 30, 2025, with a median duration of 18 months (range: 4–40 months). The choice of surgical approach was at the discretion of the operating surgeon, influenced by patient characteristics (e.g., bilateral hernias were more likely to be selected for laparoscopic TAPP or TEP repair), surgeon expertise, and institutional resources such as equipment availability. Data accuracy was verified through subset double-entry checks, with anonymity preserved.

Inclusion and Exclusion Criteria

Eligible patients underwent elective or urgent inguinal or femoral hernia repair. Records lacking surgical approach or outcome data were excluded. All 244 records met the inclusion criteria.

Variables

The primary exposure was surgical approach: laparoscopic (transabdominal preperitoneal [TAPP] or totally extraperitoneal [TEP], unilateral or bilateral) or open (Lichtenstein or other mesh-based repairs). The primary outcome was the proportion of laparoscopic versus open procedures. Secondary outcomes included operative time (continuous, minutes), length of hospital stay (continuous, days), and recurrence (binary). Covariates included demographics (age, sex, BMI), clinical factors (hernia side, recurrence status, diagnosis), and surgical variables (admission type, concurrent surgery, surgeon seniority), adjusted to address confounding.

Statistical Analysis

Analyses were performed using R (version 4.3.2). Continuous variables were reported as means ± standard deviations (SD) or medians with interquartile ranges (IQR) based on normality; categorical variables as frequencies and percentages. Missing BMI data were imputed with the mean. Proportions were tested with chi-square tests, and annual trends were analyzed from 2022 to 2025. Non-normal operative time (skewness = 1.85, kurtosis = 5.67) and length of hospital stay (skewness = 3.12) were evaluated with Mann-Whitney U tests, using rank-biserial correlations for effect size. Recurrence was assessed with Fisher's exact test due to its low frequency. Multivariable linear regression adjusted for age, BMI, concurrent surgery, and admission type for time and stay; logistic regression was used for recurrence. Significance was set at $P < 0.05$, with effect sizes and 95% confidence intervals reported. Assumptions (e.g., linearity, no multicollinearity via VIF<5) were validated, and sensitivity analyses were conducted for complete-case BMI. Surgeon experience was not included in the regression models as it did not differ significantly between groups ($P = 0.735$) and showed no univariate association with operative time ($P = 0.412$), length of hospital stay ($P = 0.876$), or recurrence ($P = 0.999$). To address potential selection bias from surgeon preference and case selection, multivariable regression adjusted for key confounders including hernia side and concurrent surgeries.

Ethical Considerations

The study received institutional review board approval, with data anonymized to ensure compliance with privacy standards.

Results

Patient Characteristics

The cohort comprised 244 patients (93.4% male, mean age 54.60 ± 16.20 years, mean BMI 26.70 ± 4.60 kg/m²). Unilateral hernias were predominant (83.6%, n = 204), followed by bilateral (14.8%, n = 36) and femoral (1.6%, n = 4). Laparoscopic repairs accounted for 29.1% (n = 71; 51 unilateral, 20 bilateral), while open repairs constituted 70.9% (n = 173; 153 unilateral, 16 bilateral). Elective procedures made up 98.4% (n = 240), with mesh used in 99.6% (n = 243). Concurrent surgeries occurred in 11.5% (n = 28; 19 minor, 7 moderate, 2 major). Baseline characteristics were similar, except laparoscopic repairs were more frequent for bilateral hernias ($P < 0.001$) (Table 1).

Proportion of Laparoscopic vs. Open Repairs

Of 244 procedures, 71 (29.1%) were laparoscopic, and 173 (70.9%) were open (chi-square = 41.2, $P < 0.001$, OR = 0.41, 95% CI: 0.28–0.60), indicating a preference for open repair. Annual proportions from 2022 to 2025 showed no significant increase in laparoscopic use (chi-square = 0.96, $P = 0.811$) (Table 2).

Operative Time and Length of Hospital Stay

Median operative time was 130.0 minutes (IQR: 105.0–182.0) for laparoscopic and 120.0 minutes (IQR: 94.5–165.0) for

Table 1. **Baseline characteristics by surgical approach**

Variables	Laparoscopic ($n = 71$)	Open ($n = 173$)	*P*-value
Age (years, mean ± SD)	53.10 ± 15.30	55.20 ± 16.60	0.374*
Sex (Male, *n* [%])	68 (95.8%)	160 (92.5%)	0.369†
BMI (kg/m^2, mean ± SD)	26.40 ± 3.80	26.80 ± 4.90	0.532*
Symptomatic side (Bilateral, *n* [%])	20 (28.2%)	16 (9.2%)	<0.001†
Recurrence status (Yes, *n* [%])	2 (2.8%)	4 (2.3%)	0.999†
Type of admission (Elective, *n* [%])	71 (100.0%)	169 (97.7%)	0.333†
Concomitant surgery (Any, *n* [%])	9 (12.7%)	19 (11.0%)	0.708†
Surgeon seniority (>20 years, *n* [%])	34 (47.9%)	87 (50.3%)	0.735†

*Independent *t*-test; †Chi-square test or Fisher's exact test as appropriate.

Table 2. **Annual proportions of laparoscopic and open repairs (2022–2025)**

Year	Laparoscopic (*n* [%])	Open (*n* [%])	Total (*n*)
2022	15 (25.0%)	45 (75.0%)	60
2023	20 (28.6%)	50 (71.4%)	70
2024	21 (30.4%)	48 (69.6%)	69
2025 (partial)	15 (33.3%)	30 (66.7%)	45

*Chi-square test for trend: $P = 0.811$.

open repairs (Mann-Whitney U = 6490, $P = 0.372$, rank-biserial correlation = 0.05, 95% CI: –0.06–0.16). Median length of hospital stay was 1.0 day (IQR: 1.0–2.0) for both groups (Mann-Whitney U = 6145, $P = 0.920$, rank-biserial correlation = 0.01, 95% CI: –0.10–0.12). Regression analyses identified concurrent surgery ($\beta = 85.2$, $P < 0.001$) and bilateral hernias ($\beta = 32.4$, $P = 0.002$) as predictors of longer operative time, and concurrent surgery ($\beta = 1.2$, $P = 0.003$) and urgent admission ($\beta = 1.8$, $P = 0.042$) as predictors of extended length of hospital stay.

Post-Operative Recurrence

One recurrence (0.4%) occurred in the open group (unilateral repair), with none in the laparoscopic group (Fisher's exact test, $P = 0.999$, OR = 0.00, 95% CI: 0.00–∞). Given the low event rate ($n = 1$), this outcome should be interpreted with caution, as it limits statistical power and generalizability.

Discussion

This study shows that open repair remains the leading method for inguinal hernia surgery at this tertiary center, comprising 70.9% of 244 procedures compared to 29.1% laparoscopic, with no significant trend toward increased laparoscopic use from 2022 to 2025 ($P = 0.811$). Operative time, length of hospital stay, and recurrence rates were similar, challenging the hypothesis that laparoscopic repair provides superior perioperative outcomes.[11,12]

The predominance of open repair likely reflects institutional constraints, such as limited access to laparoscopic equipment, surgeon training, and higher costs, which are critical barriers in resource-limited settings[5,6] [repeated statements about equipment and training constraints]. Laparoscopic repair was more common for bilateral hernias (28.2% vs. 9.2%, $P < 0.001$), aligning with European Hernia Society guidelines recommending laparoscopic techniques for bilateral and recurrent cases due to reduced recurrence and faster recovery.[8]

Contrary to studies reporting shorter lengths of hospital stay with laparoscopic repair (0.5–1 day difference),[9,11–13] this study found no difference ($P = 0.920$), likely due to standardized postoperative care protocols that optimize discharge for both approaches. Operative times were also comparable ($P = 0.372$), despite expectations of longer laparoscopic procedures due to technical complexity.[14] This equivalence may stem from case selection (e.g., simpler cases assigned to open repair), surgeon learning curves plateauing with experience, or standardized operative protocols minimizing variability.[15] Concurrent surgeries and bilateral hernias significantly extended operative time, highlighting the impact of case complexity.[16]

The recurrence rate was low (0.4%, $n = 1$, open group), consistent with modern mesh repair outcomes of 1–5%.[2] The absence of recurrences in the laparoscopic group may reflect selection for lower-risk patients or the small sample size limiting event detection. Longer follow-up is needed, as recurrences typically emerge within 2–5 years.[17]

Recent literature supports these findings. Systematic reviews of randomized trials highlight laparoscopic benefits in controlled settings, yet real-world studies, like ours, often show equivalent outcomes.[18] Analyses in older patients suggest faster recovery with laparoscopic methods, but our age-adjusted results showed no difference.[19] Comparable lengths of hospital stay may reflect consistent care protocols across both approaches.[12] Retrospective studies and comprehensive reviews, including robotic approaches, reinforce these trends, suggesting hybrid models may emerge, though our study focused on conventional techniques.[9,20]

The preference for open repair reflects practical considerations like cost-effectiveness and accessibility, vital in settings with resource constraints.[5,6] For bilateral hernias, where laparoscopic repair was more frequent, targeted investments in training and equipment could align practice with guidelines.[8] Future policy should optimize resource allocation based on local capabilities and patient needs, while multicenter studies with extended follow-up and patient-centered outcomes (e.g., quality of life) are needed to refine clinical guidelines.[9,20]

Strengths

The study benefits from thorough data collection, robust statistical adjustments, and recent references,[18–20] enhancing its relevance to current practice. The single-center perspective provides detailed insights into local trends.

Limitations

The single-center design limits generalizability. Non-normal data distributions necessitated non-parametric tests, reducing statistical power. The low recurrence rate restricted deeper analysis. Missing BMI data (<2%) had minimal impact but could introduce slight bias. The 2025 dataset covers only a partial year (January–April), potentially limiting interpretation of annual trends. Unmeasured factors, such as surgeon laparoscopic expertise, may have influenced results.

Implications

Open repair remains a cost-effective, reliable option in similar settings.[5,18] Institutions should weigh laparoscopic training and equipment costs against benefits, particularly for bilateral hernias.[8] Future research should incorporate multicenter data, extended follow-up, and patient-centered outcomes to optimize surgical approaches.[20]

Conclusion

Open inguinal hernia repair remains the primary method at this center, with no significant shift toward laparoscopic techniques from 2022 to 2025. Similar operative times, lengths of hospital stay, and recurrence rates highlight the role of institutional factors in approach selection. Laparoscopic repair's suitability for bilateral cases supports targeted use, while open repair remains effective for most patients. Multicenter studies with extended follow-up are crucial to improve clinical guidelines.

Author Contributions

Yahya Almarhabi, MD, MPH, conceptualized and designed the study, collected and curated the data, and performed the statistical analyses. He drafted the initial manuscript, provided clinical expertise, critically revised the content for intellectual accuracy, and finalized the manuscript. The author reviewed and approved the final version of the manuscript for submission.

Data Access Statement

Data are accessible upon reasonable request, subject to institutional review board approval.

Conflict of Interest

The author declare no conflicts of interest.

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