

Comparison of Lichtenstein and TEP techniques in inguinal hernia repair: Impact of surgical experience on outcomes

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ABSTRACT

Introduction: Inguinal hernia repair is among the most frequently performed surgical procedures worldwide. Although both anterior open mesh repair (Lichtenstein) and posterior laparoscopic repair (TEP) are widely used, the impact of surgical experience and setting on perioperative outcomes remains inadequately studied. The objective is to compare the clinical outcomes of Lichtenstein and TEP techniques in inguinal hernia repair and assess the influence of surgical experience in training versus routine settings.

Materials and Methods: This retrospective cohort study included 361 patients who underwent elective inguinal hernia repair between January 2015 and June 2019. Patients were grouped based on the setting: training (residents under supervision, n=78) and routine (attending surgeons, n=283). Surgical techniques (Lichtenstein vs TEP) were compared regarding operation time, complication rates, length of hospital stay, and recurrence. Statistical analyses were performed using SPSS version 23.0 with a significance level of $p<0.05$.

Results: The mean patient age was 52.6 ± 16.1 years, with males comprising 94.7% of the cohort. Lichtenstein repair was performed in 202 patients (56%) and TEP in 159 patients (44%). Operative time was significantly longer in the training group than in the routine group (74.3 ± 37.5 vs 58.0 ± 38.5 min, $p=0.001$). Complication rates were also higher in the training group ($p<0.05$). Bilateral hernia repair significantly increased operative time in both techniques. No significant differences were observed in hospital stay duration. Early and late recurrence occurred in 1.4% and 4.4% of patients, respectively, without technique-specific differences.

Conclusion: Both Lichtenstein and TEP techniques are safe and effective for inguinal hernia repair. However, outcomes are significantly influenced by the surgeon's experience and the procedural context. Structured training and careful supervision are essential to minimize complications and standardize results in surgical education environments.

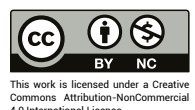
Keywords: Complication, inguinal hernia, laparoscopic surgery, Lichtenstein repair, operative time, recurrence, surgical training, TEP



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Introduction

Inguinal hernia is one of the most prevalent surgical conditions worldwide, with an estimated lifetime risk of 27% in men and 3% in women.^[1] Surgical intervention remains the definitive treatment for inguinal hernia, aiming to relieve symptoms and prevent complications such as incarceration and strangulation.^[2] Over the years, a wide array of surgical techniques has been developed, ranging from traditional open repairs to minimally invasive laparoscopic approaches.^[3]

The Lichtenstein tension-free mesh repair, introduced in the 1980s, has since become a widely accepted standard due to its simplicity, reproducibility, and relatively low recurrence rates.^[4] However, the posterior approach via totally extraperitoneal (TEP) laparoscopic repair has gained popularity in recent decades, especially among specialized centers, offering advantages in terms of postoperative pain, return to daily activity, and cosmetic outcomes.^[5,6]

Despite the growing body of literature, the choice between anterior and posterior approaches remains controversial, particularly when it comes to training environments versus routine surgical practice.^[7] One key challenge is that laparoscopic repairs, while offering potential benefits, are technically more demanding and associated with a steeper learning curve.^[8] Therefore, surgical outcomes may vary significantly depending on the experience of the surgeon and the context in which the procedure is performed.^[9]

In training hospitals, less experienced surgeons or residents often perform hernia repairs under supervision, which may influence both operative time and complication rates.^[10] On the other hand, procedures carried out in routine practice by experienced surgeons may yield more consistent outcomes.^[11]

Numerous studies have investigated the comparative effectiveness of Lichtenstein and TEP repairs in terms of operative time, postoperative pain, recurrence rates, and complication profiles.^[12,13] However, few have directly compared these two techniques across educational versus routine practice settings, which is critical for understanding the translational applicability of surgical techniques in real-world environments.^[14]

Moreover, there is limited data regarding how factors such as hernia laterality (unilateral vs bilateral), patient age,

and gender may influence outcomes differently based on the chosen surgical technique and context.^[15] Identifying these relationships is crucial for optimizing patient selection and guiding surgical decision-making.^[16]

The duration of surgery is a practical outcome measure, not only reflecting the efficiency of the technique but also influencing the risk of perioperative complications and the overall cost-effectiveness of treatment.^[17] Likewise, length of hospital stay serves as an indirect indicator of recovery, complication management, and institutional resource utilization.^[18]

Postoperative complications, encompassing both early events such as hematoma and infection, and late outcomes including recurrence and chronic pain, constitute critical parameters in the assessment of the safety, efficacy, and long-term durability of hernia repair techniques.^[19] These outcomes are particularly important when comparing surgeries performed by residents in training versus experienced surgeons.^[20]

This study aims to evaluate and compare the Lichtenstein and TEP inguinal hernia repair techniques in terms of operative time, hospital stay, complication rates, and recurrence, specifically contrasting outcomes between training and routine surgical practice. Furthermore, it seeks to identify demographic and procedural variables that may influence these outcomes.

By conducting a comprehensive analysis of these parameters, this study intends to provide valuable insights for optimizing surgical training and enhancing the overall quality of inguinal hernia management in diverse clinical settings.

Materials and Methods

Study Design and Setting

This retrospective cohort study was conducted at the General Surgery Department of a tertiary-care institution, between January 2015 and June 2019. The study protocol was approved by the Kutahya University of Health Sciences Ethics Committee prior to data collection (Approval no: 2019/9-17 Date: 28.08.2019) and conducted according to Helsinki Declaration.

Patient Selection

A total of 459 patients who underwent elective inguinal hernia repair during the study period were initially eval-

uated. Patients with incomplete medical records, missing operative data, or follow-up loss were excluded from the study. After exclusion of 98 cases due to missing or erroneous data, 361 patients were included in the final analysis.

Patients were stratified into two groups based on the surgical setting:

Training Group: Procedures performed by surgical residents under supervision (n=78).

Routine Group: Procedures performed by experienced attending surgeons (n=283).

Surgical Techniques

Two surgical techniques were evaluated:

Lichtenstein Repair: A conventional open anterior mesh repair technique using a polypropylene mesh placed over the posterior wall of the inguinal canal.

Totally Extraperitoneal Procedure (TEP): A laparoscopic posterior approach involving the placement of mesh in the preperitoneal space without breaching the peritoneum.

The choice of technique was made based on surgeon preference, anatomical considerations, and availability of laparoscopic equipment.

Data Collection

Demographic data (age, gender), hernia characteristics (laterality: Unilateral vs bilateral), surgical technique, operation time (in minutes), length of hospital stay (in days), intraoperative and postoperative complications, and recurrence (early and late) were extracted from electronic medical records and operative notes.

Complications were classified as:

Intraoperative: Including bleeding, visceral injury.

Early postoperative (within 30 days): Hematoma, seroma, wound infection.

Late complications: Chronic pain, mesh-related issues, and recurrence.

Recurrence was defined as the presence of a clinically or radiologically confirmed inguinal hernia in the previously repaired site.

Outcome Measures

The primary outcomes of the study were:

Operative time (min)

Postoperative complications (yes/no)

Length of hospital stay (days)

Early recurrence (within 30 days)

Late recurrence (after 30 days)

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics version 23.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean $\pm$ standard deviation (SD) and range, while categorical variables were presented as frequency and percentage.

The Shapiro-Wilk test was used to assess normality.

Student's t-test or Mann-Whitney U test was applied to compare continuous variables, depending on distribution.

Chi-square or Fisher's exact test was used for categorical comparisons.

Pearson correlation analysis was conducted to examine associations between variables such as operative technique, operation time, complications, and recurrence.

A p-value <0.05 was considered statistically significant.

Results

A total of 459 patients who underwent inguinal hernia repair between January 2015 and June 2019 were initially reviewed. After excluding 98 patients due to data inaccuracies or missing information, 361 patients were included in the final analysis (Fig. 1).

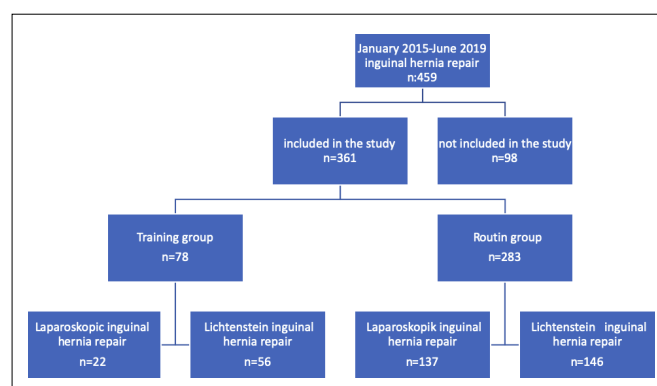


Figure 1. Number of records included in the study and analysis.

Demographic and Clinical Characteristics

The mean age of the patients was 52.6 ± 16.1 years (range: 18–88), with 77.6% of the cohort aged below 65 years. Male patients constituted 94.7% of the study population, while female patients accounted for only 5.3%. The majority of procedures were unilateral (71.7%), and bilateral repairs comprised 28.3% of cases. Regarding surgical techniques, 56% of patients underwent anterior mesh repair using the Lichtenstein technique, while 44% were treated via posterior laparoscopic repair (TEP). The mean duration of surgery was 61.5 ± 38.8 minutes (range: 20–215), and the average length of hospital stay was 1.9 ± 1.2 days (range: 1–10). Postoperative complications occurred in 4.7% of patients, with early recurrence observed in 1.4% and late recurrence in 4.4% (Table 1).

Distribution of Surgical Techniques

A significant difference was observed in the distribution of surgical techniques between the training and routine groups. In the training group, Lichtenstein repairs were performed in 56 cases, while TEP was applied in 22 cases. In contrast, the routine group included 146 Lichtenstein and 137 TEP procedures. This distribution is visually represented in Figure 2.

Operation Time

The mean operation time was significantly longer in the training group compared to the routine group (74.3 ± 37.5

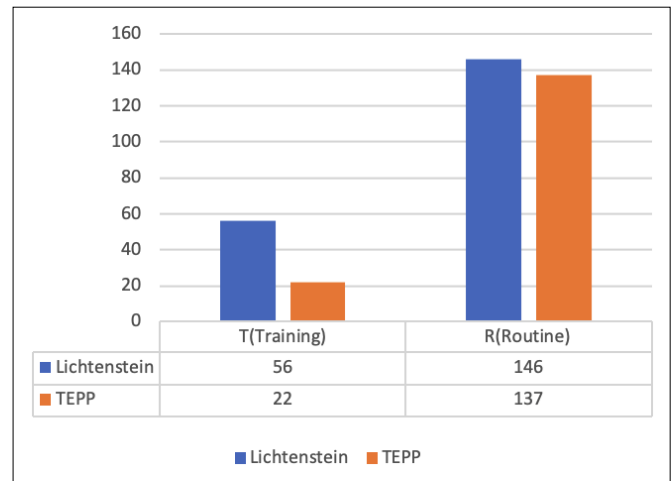


Figure 2. Graphical representation of the numerical distribution of inguinal hernia repair techniques used in the study sample.

min vs. 58.0 ± 38.5 min, $p=0.001$). Among the surgical techniques, TEP was associated with a longer operative time than Lichtenstein repair across both groups (Fig. 3; Table 2). Additionally, bilateral hernia repairs had significantly longer operation durations than unilateral repairs (Lichtenstein: 112.2 vs. 58.5 min; TEP: 94.7 vs. 43.8 min; $p<0.05$ for both comparisons).

Hospital Stay

The mean length of hospital stay did not significantly differ between surgical techniques or between the training and routine groups ($p>0.05$). The average duration was approximately 1.9 days for both techniques and groups. Furthermore, the type of hernia (unilateral or bilateral) had no significant impact on the length of hospital stay (Fig. 4).

Complication Rates

Postoperative complications occurred in 17 patients (4.7%). The frequency of complications did not significantly differ based on gender or age group. However,

Table 1. General demographic and surgical characteristics in the study sample

Variable	Value
Age (years)	52.6 ± 16.1 [18–88]
<65	280 (77.6%)
65–79	67 (18.6%)
>80	14 (3.9%)
Female / Male	19 / 342 (5.3% / 94.7%)
Elective / Emergency	78 / 283 (21.6% / 78.4%)
Unilateral / Bilateral	259 / 102 (71.7% / 28.3%)
Lichtenstein / TEPP	202 / 159 (56% / 44%)
Operation time (minutes)	61.5 ± 38.8 [20–215]
Length of hospital stay (days)	1.9 ± 1.2 [1–10]
Complication	17 (4.7%)
Early recurrence	5 (1.4%)
Late recurrence	16 (4.4%)

Table 2. Comparison of the usage rates of Lichtenstein and TEPP techniques in inguinal hernia repair in study and routine groups*

	Training group	Routine	p
Operation times	74.3 ± 37.5	58.0 ± 38.5	0.001
*Mann Whitney U test/student t test, $p<0.05$.			

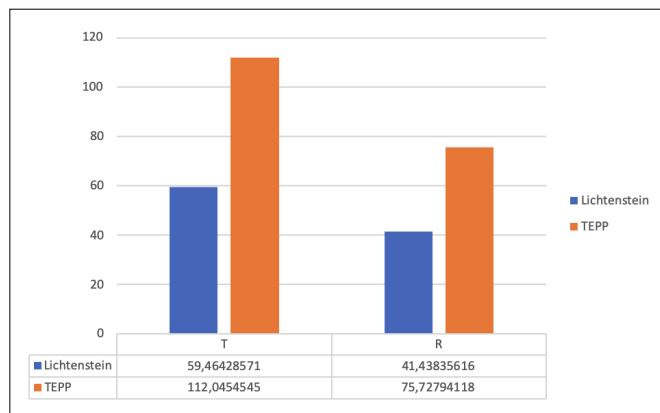


Figure 3. Graphical representation of the comparison of operative times of inguinal hernia repair techniques in study group.

complications were more frequent in bilateral repairs compared to unilateral ones, irrespective of the surgical technique ($p < 0.05$). Complication rates were also significantly higher in the training group compared to the routine group ($p < 0.05$).

Recurrence Rates

Early recurrence was observed in 5 cases (1.4%), while late recurrence was seen in 16 cases (4.4%). There were no statistically significant differences in recurrence rates based on gender, age group, or surgical technique. Similarly, unilateral and bilateral repairs did not demonstrate significant differences in recurrence frequencies. However, early recurrence was significantly associated with the presence of complications ($p < 0.05$), and late recurrence was associated with both complications and early recurrence ($p < 0.05$).

Correlation Analyses

Pearson correlation analyses revealed that operation type (Lichtenstein vs. TEP) was significantly associated with gender, age, hernia laterality (unilateral or bilateral), and group type (training or routine) ($p < 0.05$). Operation time showed a significant correlation with patient age, laterality, surgical technique, and group type ($p < 0.05$). However, hospital stay was not significantly associated with any of the examined variables. Complication rates were significantly correlated with sex, group type, and operation duration, but not with age or technique. Finally, early and late recurrence were both significantly correlated with the presence of complications ($p < 0.05$).

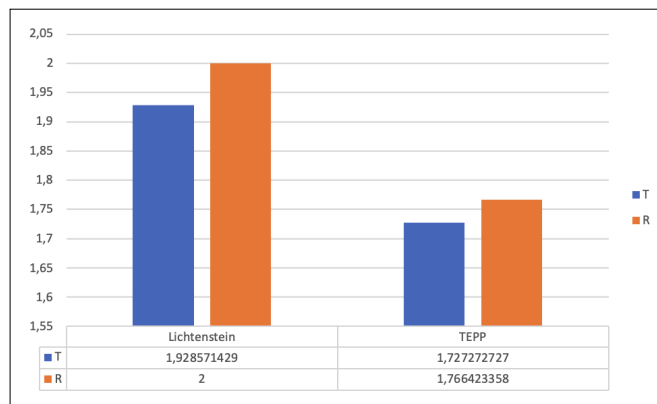


Figure 4. Graphical representation of the mean length of hospital stay after inguinal hernia repair in the study sample.

Discussion

The present study aimed to compare the outcomes of anterior (Lichtenstein) and posterior laparoscopic (TEP) inguinal hernia repair techniques in both training and routine surgical practice settings. Our findings reveal several important differences in operative time, complication rates, and recurrence, all of which have implications for surgical training and clinical decision-making.

Operative duration was significantly longer in the training group compared to the routine group, a finding that corroborates with previous studies reporting prolonged operative times among residents and junior surgeons due to inexperience and learning curve dynamics.^[21] This is especially relevant in the context of laparoscopic hernia repair, which is known to require more advanced technical skills and spatial orientation than open repair techniques.^[22]

Notably, TEP repairs were associated with longer operative times compared to Lichtenstein repairs across both surgical settings. This finding supports prior literature indicating that laparoscopic repairs, despite offering faster recovery, tend to be more time-consuming during the early stages of surgeon adoption.^[23,24] The increased operative duration may also contribute to elevated complication rates in less experienced hands.^[25]

Interestingly, bilateral hernia repairs were associated with significantly longer operation times in both techniques, confirming previous studies suggesting that bilateral involvement substantially increases surgical complexity and resource utilization.^[26] However, this did not translate into significantly longer hospital stays, likely due to the application of enhanced recovery protocols.

The average hospital stay in our cohort was approximately 1.9 days, with no significant differences observed between techniques or practice settings. This aligns with enhanced recovery after surgery (ERAS) principles that have been widely adopted in elective hernia surgery to reduce length of stay and standardize discharge criteria.^[27]

Postoperative complications were observed in 4.7% of patients, a rate consistent with the literature, which generally reports complication rates between 3% and 8% for inguinal hernia repairs.^[28] Complication rates were higher in the training group, emphasizing the importance of experience and technical proficiency in minimizing intraoperative and early postoperative risks.^[29]

Among the complications observed, bilateral procedures were again associated with higher complication rates, a finding that may be attributed to greater tissue dissection, longer surgical duration, and larger mesh placement requirements.^[30] While gender and age did not significantly impact complication rates, previous studies have suggested that elderly patients, particularly those over 80, may have increased vulnerability to adverse outcomes due to comorbidities.^[31]

Early recurrence occurred in 1.4% of patients, while late recurrence was observed in 4.4%, both within the expected range reported in long-term follow-up studies.^[32] Importantly, recurrence rates did not significantly differ between Lichtenstein and TEP techniques, confirming the findings of recent meta-analyses that support the non-inferiority of both methods when executed with proper technique.^[33,34]

Complications were significantly associated with recurrence, especially in patients experiencing early postoperative issues such as hematoma or infection. This supports previous findings indicating that early postoperative events may compromise tissue healing and mesh integration, contributing to recurrence risk.^[35,36]

Our correlation analysis further demonstrated that the type of surgical technique selected is influenced not only by anatomical considerations but also by patient demographics (age, gender) and institutional context (training vs routine setting). These findings highlight the complex interplay between patient factors and surgeon decision-making.^[37]

Although TEP is increasingly being promoted for its favorable long-term outcomes and patient satisfaction scores,

its adoption remains limited in many institutions due to equipment costs, surgeon training demands, and operative time concerns.^[38] Some studies have advocated for a tailored approach, using TEP in young, active patients or those with bilateral hernias, while reserving Lichtenstein for elderly or comorbid individuals.^[39]

An important aspect of this study is its focus on educational implications. Given that complication and recurrence rates were higher in the training group, structured surgical mentorship and gradual progression from open to laparoscopic techniques are critical. Simulation-based training and supervised hands-on experience are essential to enhance competency in laparoscopic repairs.^[40,41]

Moreover, our results reinforce the notion that operative time should not be the sole parameter for evaluating surgical proficiency in training. Outcomes such as complication rates, recurrence, and postoperative recovery should also be integrated into surgical performance assessments.^[42]

This study contributes to the growing body of evidence supporting outcome-based evaluation of surgical training programs. Institutions should consider developing performance benchmarks and competency assessments to ensure that residents are adequately prepared for complex procedures like TEP before performing them independently.^[43]

While this study offers valuable insights, it is not without limitations. Its retrospective design and single-center nature may limit generalizability. Furthermore, the lack of patient-reported outcomes, such as postoperative pain, return to work, or chronic discomfort, is a notable gap that future studies should address.^[44]

Conclusion

Both Lichtenstein and TEP techniques are safe and effective options for inguinal hernia repair. However, their outcomes are significantly influenced by surgical experience and procedural context. Integrating these insights into clinical practice and surgical education is essential for optimizing patient outcomes and ensuring safe learning environments for surgical trainees.

Disclosures

Ethics Committee Approval: The study protocol was approved as a thesis by the Kutahya University of Health Sciences Ethics Committee prior to data collection (No: 2019/9-17, Date: 28/08/2019).

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

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