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Research

Our Institutional Experience in Laparoscopic Inguinal Hernia Surgery: Is There a Difference Between Right and Left-Sided Procedures? A Retrospective Analysis of 192 Cases

Laparoskopik İnguinal Herni Cerrahisinde Kurum Deneyimimiz: Sağ ve Sol Taraf Cerrahisi Arasında Fark Var mı? 192 Hastalık Retrospektif Değerlendirme

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ABSTRACT

Objective: This study aimed to compare surgical duration, mesh placement time, complication and recurrence rates among adult patients undergoing right-sided, left-sided, or bilateral laparoscopic inguinal hernia repair.

Methods: Data from 192 patients who underwent laparoscopic transabdominal preperitoneal hernia repair at a single institution were retrospectively reviewed. Patients were grouped by the side of hernia repair (right, left, or bilateral), and surgical parameters were compared statistically. We used a standard large 3D mesh (10.3x15.7 cm) for hernia repair in all patients.

Results: Surgical duration in patients undergoing bilateral procedures was significantly longer than in patients undergoing single-sided surgeries ($p<0.05$). Although left-sided surgeries lasted an average of three minutes longer than right-sided ones, the difference was not statistically significant ($p=0.512$). Similarly, the mesh placement time was longer for left-sided hernias, but the difference was not statistically significant ($p=0.239$). However, in bilateral procedures, the duration of left-sided mesh placement was significantly longer than that of the right side ($p<0.05$). Complication rates were low (6.7%), and recurrence was detected in six patients.

Conclusion: Laparoscopic inguinal hernia repair is a safe and effective procedure; bilateral repairs requiring a significantly longer operative time. Although left-sided surgeries tend to take slightly longer than right-sided ones, this difference is not statistically significant. These parameters should be considered in surgical planning and patient counseling.

Keywords: Inguinal hernia, laparoscopy, mesh, repair, complication

ÖZ

Amaç: Bu çalışmada, erişkin hastalarda laparoskopik inguinal herni onarımı uygulanan sağ, sol ve bilateral cerrahilerin ameliyat süresi, mesh yerleştirme süresi, komplikasyon oranı ve nüks açısından karşılaştırılması amaçlanmıştır.

Gereç ve Yöntem: Tek bir merkezde laparoskopik transabdominal preperitoneal fıtık onarımı uygulanan 192 hastanın verileri retrospektif olarak incelendi. Hastalar fıtık onarımının yapıldığı tarafa (sağ, sol, bilateral) göre gruplandırıldı ve cerrahi parametreler istatistiksel olarak karşılaştırıldı. Tüm hastalarda fıtık onarımı için büyük 3D mesh (10,3x15,7 cm) kullanıldı.

Bulgular: Bilateral cerrahi uygulanan hastalarda ameliyat süresi, sağ ve sol cerrahilere göre istatistiksel olarak anlamlı şekilde daha uzundu ($p<0,05$). Sağ ve sol inguinal herni onarımı karşılaştırıldığında, sol taraf cerrahisinin süresi sağdan ortalama 3 dakika daha uzun olmasına rağmen fark istatistiksel olarak anlamlı değildi ($p=0,512$). Benzer şekilde mesh yerleştirme süresi de sol tarafta daha uzun olmasına rağmen istatistiksel olarak anlamlı bulunmadı ($p=0,239$). Ancak bilateral cerrahi grubunda aynı hastada sağ ve sol mesh yerleştirme süreleri karşılaştırıldığında, sol taraf süresi anlamlı derecede daha uzundu ($p<0,05$). Komplikasyon oranları düşüktü (%6,7). Altı hastada nüks tespit edildi.

Sonuç: Laparoskopik inguinal herni onarımı güvenli ve etkili bir yöntem olup, bilateral cerrahilerde süre belirgin olarak uzamaktadır. Sağ ve sol herni onarımı karşılaştırıldığında sol taraf cerrahisinde süreler daha uzun eğilim göstermekle birlikte farklar istatistiksel olarak anlamlı değildir. Cerrahi planlama ve hasta bilgilendirmelerinde bu parametreler göz önünde bulundurulmalıdır.

Anahtar Kelimeler: İnguinal herni, laparoskopi, mesh, onarım, komplikasyon

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INTRODUCTION

Abdominal wall hernias are among the most common surgical conditions, with inguinal hernias accounting for approximately 75% of cases. The lifetime risk is estimated at 27% for men and 3% for women (1). Over recent decades, significant progress has been made in their management. Although conventional open repairs, both mesh and non-mesh, were once predominant, laparoscopic mesh repairs have become increasingly preferred. This shift has been largely driven by comparative studies demonstrating advantages over open techniques (2).

Multiple studies have confirmed that minimally invasive approaches to inguinal hernia repair are associated with less postoperative pain, fewer wound complications, faster return to normal activities, and lower rates of chronic groin pain (2,3). Although recurrence rates appear similar between laparoscopic and open repairs, the overall benefits of laparoscopy have established it as a preferred approach (3).

The two principal laparoscopic techniques are transabdominal preperitoneal repair (TAPP) and totally extraperitoneal repair (TEP). TAPP provides a wider operative field but carries a greater risk of intra-abdominal injury, whereas TEP avoids peritoneal entry and thus reduces the risk of visceral injury. However, TEP is technically more demanding due to limited working space and restricted visualization (4,5).

A wide range of synthetic meshes is available for laparoscopic repair. Recently, anatomically contoured and three-dimensional (3D) meshes have been developed to overcome limitations such as folding or migration associated with flat polypropylene meshes (6). This evolution has contributed to the growing adoption of 3D mesh designs (6).

With the increasing use of laparoscopy for inguinal hernia repair, studies comparing open, laparoscopic, and robotic-assisted approaches have become more prevalent, further highlighting the advantages of minimally invasive surgery (1,3,7-10).

In the present study, we report our single-center experience with 192 patients who underwent laparoscopic TAPP repair.

METHODS

Between June 2021 and June 2025, the medical records of 303 patients who underwent surgery for inguinal hernia at the Department of General Surgery, İstanbul Aydın University Faculty of Medicine, were retrospectively reviewed. Fifty-nine patients treated with open repair were excluded. Surgical videos were available for 244 patients; however, 52 were excluded due to incomplete or missing video data. The remaining 192 patients, all of whom underwent laparoscopic TAPP repair, constituted the study cohort.

Polypropylene mesh was used in 6 patients, whereas 3D anatomically contoured mesh was used in the remaining 186 patients. All operations were performed by the same surgical team. Operative times were measured by reviewing surgical videos and operative notes: the interval from the insertion of the first trocar to the end of the procedure was defined as the total operative time, and the interval from the insertion of the mesh into the abdominal cavity to peritoneal closure was defined as the mesh placement time.

Postoperative outcomes assessed included hospital length of stay, drain duration (if applicable), early perioperative complications, and recurrence rates.

Statistical Analysis

Statistical analyses were performed using SPSS Statistics for Windows, version 15.0 (SPSS Inc., Armonk, NY, USA). Descriptive statistics were presented as mean±standard deviation for continuous variables and as percentages for categorical variables. The normality of data distribution was assessed using the Kolmogorov-Smirnov test. For categorical variables, either the chi-square test or Fisher's exact test was applied, as appropriate. For continuous variables, comparisons between groups were made using the Student's t-test or the Mann-Whitney U test, depending on data distribution. A two-tailed p-value <0.05 was considered statistically significant.

Artificial Intelligence-Assisted Figure Generation

Visualizations, including operative times and mesh-placement durations, were generated using the artificial intelligence tool ChatGPT (GPT-5; OpenAI; August 2025 version). Aggregated and anonymized data were provided to the system without any patient-identifiable information. The prompts specified figure types (e.g., bar charts, grouped comparisons), axis labeling, and legend formatting. All generated figures were carefully reviewed and cross-checked by the authors to ensure accuracy and consistency with the study data.

Ethical Approval

This retrospective study was conducted in accordance with the ethical standards of the institutional and national research committees and with the 1964 Declaration of Helsinki and its later amendments. The study protocol was approved by the İstanbul Aydın University Non-Interventional Clinical Research Ethics Committee (approval no: 164/2025, date: 06.08.2025). No interventions or changes were made to patient care as part of this research. As the study had a retrospective design, informed consent was not required from the patients.

RESULTS

Of the 192 patients included, 180 were male (93.8%) and 12 were female (6.3%). The mean age was 53.7±15.1 years (range, 21-83). Bilateral inguinal hernia repair was performed in 84 patients (43.8%), right-sided repair in 51 patients (26.6%), and left-sided repair in 57 patients (29.7%).

Drains were not placed in 168 patients (87.5%), whereas the surgical team inserted drains in 24 patients (12.5%). The mean length of hospital stay was 1.3 days overall. Patients with drains had a significantly longer hospital stay than those without drains (mean 1.79 vs. 1.29 days; p<0.05).

Complications were observed in 13 patients: seven were early perioperative complications and six were recurrences. Among early complications, four patients developed postoperative hematomas, one developed a bladder hematoma, and two sustained intraoperative bowel injuries; all bowel injuries were managed laparoscopically with drain placement. No drains were placed in patients with hematomas.

The mean operative time was 33.0±11.8 minutes (median 32.0) for right-sided repairs, minutes (median 35.0) for left-sided repairs, and 54.4±24.7 minutes (median 50.0) for bilateral repairs. Bilateral repairs were significantly longer than unilateral repairs (p<0.05; Figure 1). Although left-sided repairs averaged approximately 3 minutes longer than right-sided repairs, this difference was not statistically significant (p=0.512).

Mesh placement times were 6.7±3.3 minutes (median 6.0) for right-sided repairs and minutes (median 7.0) for left-sided repairs; the difference was not statistically significant (p=0.239; Figure 2). In bilateral procedures, no significant difference was found between the right and left sides in operative duration (26.6±13.6 min vs. 27.3±12.9 min, respectively; p>0.05). However, mesh placement time was significantly longer on the left side (6.6±3.1 min vs. 6.3±3.8 min; p<0.05) (Figure 3).

Recurrence was detected in 6 patients (3.1%) with a minimum follow-up of 6 months. This rate approached the upper limit reported in the literature (0.5-3%). When the 52 patients who had been excluded for lack of surgical video data were included in the denominator, the overall recurrence rate was 2.4%, consistent with previously published series.

Among patients with recurrence, 2 were repaired with polypropylene mesh and 4 patients with 3D mesh (p<0.05). Four recurrences occurred after bilateral repairs and two after left-sided repairs. No recurrences were observed in patients with right-sided unilateral repair. In the bilateral group, two recurrences occurred on the left and two on the right. In total, 6 recurrences occurred on the left side and 2 on the right (Table 1).

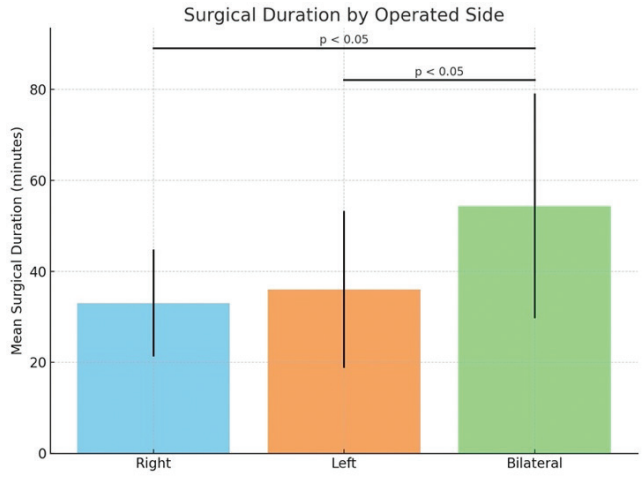

Figure 1. Mean surgical duration according to operated side (right, left, bilateral). Error bars indicate standard deviation. Significant differences are marked (p<0.05)

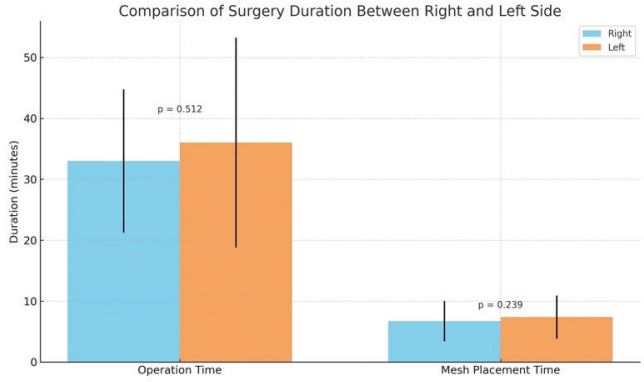

Figure 2. Comparison of operative time and mesh placement time between right- and left-sided inguinal hernia repairs. Error bars indicate standard deviation

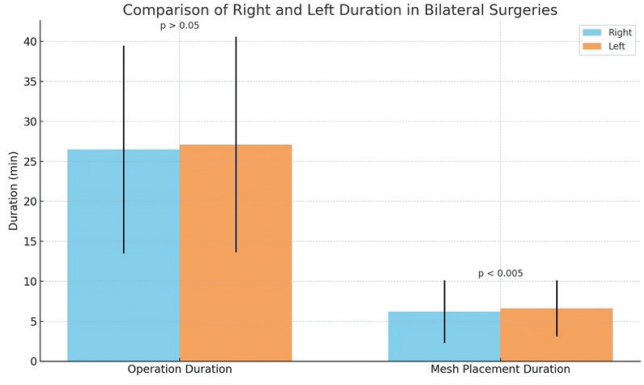

Figure 3. Comparison of operative time and mesh placement duration in bilateral surgeries (right and left sides). Error bars indicate standard deviation. Significant differences are marked (p<0.05)

Table 1. Clinical and demographic characteristics

Parameter	Value
Total number of patients	192
Gender (male/female)	180 (93.75%)/12 (6.25%)
Mean age (years)	**53.65±15.05 (21-83)**
Surgical side (right/left/bilateral)	51 (26.56%)/57 (29.69%)/84 (43.75%)
Patients with drain	24 (12.5%)
Mean hospital stay (days)	1.3
Hospital stay with/without drain	**1.79/1.29 (p<0.05)**
Number of complications (total)	13
Recurrence	6
Hematoma (early period)	4
Bladder hematoma	1
Intraoperative bowel injury	2
Operative time (right/left/bilateral)	33.02/36.02/54.37 min
Mesh placement time (right/left)	6.73/7.39 min
Mesh placement time in bilateral surgeries (right/left)	**6.31/6.63 min (p<0.05)**
Recurrence rate	6 patients (3.12 %)
Type of mesh in recurrences (prolene/3D)	2/4 (p<0.05)
Side of recurrence (right/left)	2/4

DISCUSSION

Laparoscopic approaches to inguinal hernia repair have increasingly replaced conventional open techniques and are now widely adopted (11). Nonetheless, utilization rates vary considerably, with reports of 38% in the United States (12) and 23% in the United Kingdom (13). Several studies have also suggested that laparoscopy is more commonly employed in bilateral hernia cases (14). In our series, 80.5% of inguinal hernia repairs over a four-year period were performed laparoscopically, and 43.8% of patients underwent bilateral repair. These rates are notably higher than global averages. Remarkably, in the past two years, open surgery was avoided altogether except in elderly patients deemed unsuitable for general anesthesia. This trend reflects an increasing preference for laparoscopic repair as experience accumulates.

Although recurrence rates after laparoscopic and open repair are generally comparable, rates of acute and chronic pain are significantly lower after laparoscopic repair (3,15). These advantages have driven wider adoption and training in laparoscopic techniques. In our cohort, the recurrence rate was 2.4%, consistent with published data and comparable to open repair (16,17).

Among laparoscopic techniques, debate continues between TAPP and TEP. While some studies have found equivalent outcomes, others favor one approach over the other. In our practice, the TAPP procedure is preferred because it provides wider exposure and facilitates more straightforward mesh placement, which is particularly useful during the learning phase (18-20).

Initially, large polypropylene meshes, typically used in open surgery, were employed to reduce costs. However, this practice was quickly abandoned due to longer operative times. In the present series, six patients received polypropylene mesh; two (33.3%) experienced recurrence. By contrast, among the 186 patients treated with 3D meshes, only four recurrences were observed (2.1%). Despite the small number of polypropylene cases, operative and mesh placement times were longer and recurrence rates were higher compared with 3D mesh; these differences were statistically significant (p<0.05). Prior reports have also indicated that 3D meshes reduce operative time, complication rates, and postoperative analgesia requirements; however, higher costs remain a limiting factor in some regions (21). Our findings support the clinical advantages of 3D mesh, despite the increased expense.

The learning curve for laparoscopic inguinal hernia repair has been extensively studied. A meta-analysis estimated that proficiency is achieved after approximately 32 cases; however, this threshold has decreased over the past 15 years owing to earlier training, improvements in laparoscopic equipment, and increased case exposure (2).

In our cohort, 13 complications occurred (6 recurrences, 4 hematomas, 2 bowel injuries, 1 bladder hematoma); nine of these complications occurred within the first 100 cases. As experience increased, complication rates declined significantly, underscoring the effect of cumulative surgical expertise.

Although the anatomy of the right and left inguinal regions is symmetrical, subtle technical challenges may still arise. In our study, left-sided repairs averaged three minutes longer than right-sided repairs, although this difference was not statistically significant (p=0.512). Similarly, mesh placement times were slightly longer on the left, although this difference was not statistically significant (p=0.213). Among bilateral cases, operative times were comparable between sides, but mesh placement times were significantly longer on the left ($p<0.05$). Interestingly, four of the six recurrences occurred on the left side, suggesting technical difficulty related to surgeons' right-hand dominance. Dissection and mesh deployment may be less intuitive on the left side, a phenomenon that deserves further investigation. Given the relatively large proportion of bilateral cases in our series, future studies with larger sample sizes may help confirm these observations. To our knowledge, this is the first study to examine side-specific outcomes in such detail, making it a unique contribution to the literature.

Study Limitations

This study has several limitations that should be considered. First, its retrospective design may have introduced selection bias, as data were derived from existing medical records rather than prospective collection. Second, although our series includes 192 cases, the sample size may be insufficient to detect subtle differences between right- and left-sided procedures with strong statistical power particularly regarding rare outcomes such as recurrence patterns. Lastly, the lack of long-term follow-up beyond the early postoperative period limits our ability to assess late complications, chronic pain, or recurrence rates. Future prospective, multicenter cohort studies with standardized protocols and extended follow-up are needed to validate and expand upon our findings.

CONCLUSION

Laparoscopic techniques for inguinal hernia repair are sometimes still perceived as technically demanding, even among experienced surgeons. However, growing surgical expertise consistently leads to reductions in operative time and complication rates. Although laparoscopic equipment and the use of advanced mesh types may increase overall costs, the advantages for patient outcomes, faster recovery, and surgeon comfort are indisputable. Moreover, our findings suggest that left-sided repairs may be associated with slightly longer operative and mesh placement times, potentially reflecting the predominance of right-handed surgeons. While these differences did not reach statistical significance, they raise an important technical consideration. To validate these observations and provide stronger evidence-based guidance, further randomized controlled trials with larger patient cohorts are warranted.

ETHICS

Ethics Committee Approval: The study protocol was approved by the İstanbul Aydın University Non-Interventional Clinical Research Ethics Committee (approval no: 164/2025, date: 06.08.2025).

Informed Consent: Retrospective study.

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FOOTNOTES

Authorship Contributions

Surgical and Medical Practices: S.B., Y.E.A., B.K., E.E., C.E., Concept: S.B., Y.E.A., B.K., E.E., C.E., Design: S.B., Y.E.A., B.K., Data Collection or Processing: S.B., E.E., C.E., Analysis or Interpretation: S.B., Y.E.A., B.K., E.E., Literature Search: S.B., Y.E.A., C.E., Writing: S.B., C.E.

Conflict of Interest: No conflict of interest was declared by the authors.

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