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Surgeons' preferences in the management of recurrence after laparoscopic inguinal hernia repair: A nationwide survey

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ABSTRACT

Objective: This study aimed to evaluate contemporary surgical approaches and decision-making patterns of general surgeons in the management of recurrent inguinal hernia following laparoscopic inguinal hernia repair (LIHR), with particular emphasis on recurrence timing, surgeon experience, and annual laparoscopic case volume.

Material and Methods: The questionnaire consisted of 26 items, including both multiple-choice and short-answer questions, and was designed to assess demographic characteristics, surgical experience, preferred surgical techniques, preoperative evaluation strategies, and management approaches for recurrent inguinal hernia following LIHR. Recurrences were classified as early (≤2 years) or late (>2 years) based on the postoperative time interval.

Results: A total of 179 surgeons participated in the survey. Most respondents were male and had ≤10 years of surgical experience. Surgeons with higher annual laparoscopic hernia repair volumes were significantly more likely to prefer re-laparoscopic posterior approaches for both early and late recurrences, whereas surgeons with lower case volumes predominantly favored open anterior repair techniques ($p<0.05$). Surgical preferences also varied in female patients and according to the initial repair technique (transabdominal preperitoneal or total extraperitoneal). Nearly two-thirds of participants reported insufficient or only partially sufficient training in recurrent hernia repair, while the majority strongly agreed on the need for national or international clinical guidelines.

Conclusion: Surgeon experience and annual laparoscopic case volume significantly influence the management of recurrent inguinal hernia following LIHR. As laparoscopic expertise increases, re-laparoscopic approaches are more frequently adopted. These findings highlight the need for standardized training programs and evidence-based guidelines to optimize the management of recurrent inguinal hernia after laparoscopic repair.

Keywords: Laparoscopic, hernia, recurrence, surgeon decision

INTRODUCTION

Inguinal hernia is among the most prevalent surgical conditions in general surgery, particularly in the older population. It constitutes a substantial health issue in both developed and developing nations (1). Numerous approaches for open and laparoscopic inguinal hernia repair (LIHR) have been documented for its management. The open surgical approaches include Lichtenstein, Shouldice, anterior preperitoneal, Kugel, and Rives-Stoppa methods; the predominant laparoscopic techniques are total extraperitoneal (TEP), transabdominal preperitoneal (TAPP), and extended TEP (e-TEP) repairs (2,3).

Laparoscopic hernia repair has gained popularity in recent years owing to its benefits, including less postoperative pain, abbreviated hospital stays, expedited resumption of normal activities, and superior cosmetic results. etheless, despite the numerous benefits of minimally invasive approaches, studies indicate that recurrence rates following laparoscopic repairs are comparable to those observed after open surgical procedures (4,5).

The selection of surgical method for recurrent inguinal hernias primarily hinges on the original repair technique employed. Traditionally, posterior approaches (laparoscopic or Rives-Stoppa) are advised for recurrences of anterior open repairs, whereas anterior open surgical techniques are suggested for recurrences of LIHR (6,7). Advancements in laparoscopic and robotic technologies, enhanced surgeon expertise, and the introduction of novel mesh materials have redefined surgical techniques for recurring patients (8). Recent investigations indicate that laparoscopic

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repair is both feasible and safe for recurring instances following first laparoscopic surgery, contingent upon suitable patient selection (9,10). Given these advances, it is essential to evaluate surgeons' contemporary trends and methodologies in the therapy of recurrent inguinal hernias.

In this study, we sought to assess the contemporary surgical techniques employed by general surgeons in instances of recurrence after LIHR. We hypothesize that the frequency of re-laparoscopic operations has risen in recent years following recurrence after laparoscopic repair.

MATERIAL and METHODS

Study Design and Ethical Approval

This study was designed as a cross-sectional, questionnaire-based descriptive research. Ethical approval was obtained from the Local Ethics Committee of Kahramanmaraş Sütçü İmam University on September 22, 2025 (approval no: 24 following approval, the survey was conducted between October 1 and October 15, 2025). Informed consent was obtained from patients.

Study Population

The study population consisted of 300 general surgeons working in 25 healthcare centers across different regions of Türkiye. Participation was entirely voluntary, and no incentives were offered. The inclusion criterion was being a general surgeon who had completed specialty training in general surgery and was actively performing hernia repair surgery.

Data Collection Tool

Data were collected using a structured electronic questionnaire developed via Google forms (Google LLC, California, USA). The questionnaire link was distributed to participants through WhatsApp communication groups of general surgeons. Each participant could complete the survey only once, as the form was configured to prevent duplicate responses.

Before accessing the questionnaire, participants read an informed consent form outlining the study's aim, data confidentiality, and voluntariness. Clicking the participation link and submitting the form indicated consent to participate. No personal identifiers other than initials and e-mail address (for consent verification only) were collected, ensuring full anonymity.

Questionnaire Structure

The questionnaire consisted of 26 items, including both multiple-choice and short-answer questions. It was designed to evaluate surgeons' demographic characteristics, professional experience, preferred surgical techniques, and management approaches in recurrent inguinal hernia cases following laparoscopic repair.

The content of the questionnaire was structured under four main sections:

1. Demographic and professional information — gender, age, surgical experience, preferred repair technique, and annual number of laparoscopic repairs performed.

2. Decision-making and clinical practice — factors influencing the choice of surgical approach, preoperative evaluations, and perceived intraoperative challenges.

3. Surgical management of recurrent Hernia — approach selection based on recurrence type (early vs. late), previous technique (TAPP vs. TEP), and patient factors such as gender and prior abdominal surgery.

4. Education and guideline needs — surgeons' self-assessment of training sufficiency and opinions regarding the necessity of national/international guidelines.

In the questionnaire, recurrence was presented as a standardized clinical scenario rather than a confirmed patient diagnosis. The survey aimed to evaluate surgeons' decision-making preferences; therefore, no specific diagnostic modality (clinical examination, imaging, or patient-reported symptoms) was imposed. Participants were asked to consider a clinically established recurrence after previous LIHR. Unless otherwise specified, the scenario referred to ipsilateral recurrence at the previously repaired side.

Recurrence timing was categorized as early or late based on the postoperative interval. Early recurrence was defined as recurrence occurring within 2 years after the initial LIHR, whereas late recurrence was defined as recurrence occurring beyond 2 years. This cut-off was selected in accordance with previous studies demonstrating that most recurrences following LIHR occur within the first 1-2 years postoperatively and are more likely related to technical or procedure-dependent factors, while later recurrences may reflect patient-related or progressive tissue factors (11,12).

Statistical Analysis

Descriptive statistics are presented with frequency, percentage, mean, standard deviation, minimum, and maximum values. In the analysis of categorical data, Fisher's-Freeman-Halton test (for nXn tables) was used if the percentage of cells with an expected value less than 5 was greater than 20%, and Pearson's chi-square test was used if it was less than 20%. Analyses were performed using the SPSS 23.0 programmed. $P<0.05$ was considered statistically significant.

RESULTS

A total of 179 surgeons engaged in the survey. The majority were male, and most possessed between 0 and 10 years of surgical experience. TAPPP (TEP) repair was the predominant procedure employed in routine surgery, succeeded by open anterior repair and TAPP repair. About fifty percent of the participants

conducted over 50 LIHRs each year. The majority of surgeons indicated that they actively address recurrent inguinal hernia patients in their clinical practice, but a lesser percentage opted to operate just on specific cases (Table 1). Regarding preoperative assessment, physical examination and ultrasonography were routinely used by most respondents. Computed tomography was applied selectively, while magnetic resonance imaging was rarely preferred in routine evaluation (Table 2).

Because participants were allowed to select more than one surgical difficulty, separate binary variables (present/absent) were created for each reported difficulty, and their associations with annual laparoscopic hernia repair volume groups were analyzed. The reporting rate of "distortion of anatomical planes" decreased with increasing case volume (<10: 90.9%; 10-50: 89.4%; 51-100: 78%; >100: 61.9%), with a statistically significant difference between groups (p=0.012).

In contrast, the reporting rate of "mesh migration" increased with higher case volume (<10: 18.2%; 10-50: 18.2%; 51-100: 40.7%; >100: 38.1%), and the difference between groups was statistically significant (p=0.011). Difficulty in accessing the previously placed mesh also differed significantly across volume groups (p=0.015). However, the reporting rates of "dense fibrosis" were similar among volume groups (p=0.376) (Figure 1).

Although a proportion of surgeons considered their training in recurrent hernia repair to be adequate, nearly half reported only partial adequacy, and a notable minority indicated insufficient training. In contrast, there was a strong consensus regarding the need for national or international clinical guidelines for the management of recurrences following LIHR (Table 3).

Table 1. Demographic characteristics of the physicians participating in the study

	Frequency (n)	Percentage (%)
Gender		
Male	152	84.9
Female	27	15.1
Surgical experience		
0-5 years	64	35.7
6-10 years	67	37.4
11-20 years >20 years	36 12	20.1 6.7
Which surgical technique do you most frequently use in your practice?		
TEP	78	43.6
TAPP	44	24.6
Lichnestein open repair technique	54	30.2
e-TEP	3	1.7
How many laparoscopic hernia repairs do you perform per year?		
<10	33	18.4
10-50	66	36.9
51-100	59	33
>100	21	11.7
Do you prefer to take on recurrent inguinal hernia cases in your surgical practice?		
Yes, I actively follow up and operate on them	128	72.7
Yes, but only in selected cases	45	25.6
No, I refer such cases to another surgeon	3	1.7

TEP: Total extraperitoneal, TAPP: Transabdominal preperitoneal, e-TEP: Extended TEP.

Table 2. Routine assessments routinely performed on patients prior to recurrence repair

Which assessments do you routinely perform on the patient before recurrence repair?	Frequency (n)	Percentage (%)
Physical examination		
No	16	8.9
Yes	163	91.1
Ultrasonography		
No	36	20.1
Yes	143	79.9
CT scan		
No	120	67
Yes	59	33
MRI		
No	171	95.5
Yes	8	4.5

Because this question allows selecting multiple options, the sum of the percentages can exceed 100.
CT: Computed tomography, MRI: Magnetic resonance imaging.

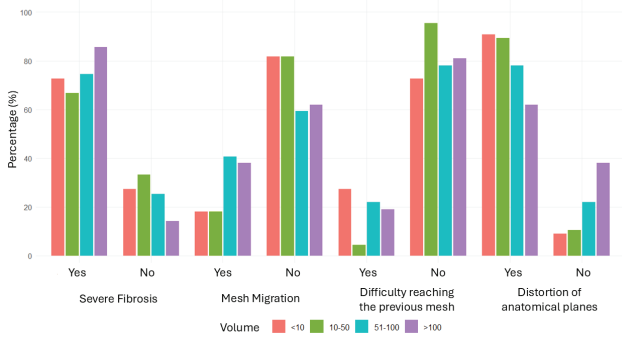

Figure 1. The most common surgical challenges in recurrent cases.

Table 3. Opinions regarding training adequacy and guideline requirements for recurrent hernia repair		
Do you think you have received sufficient training on hernia recurrence repair?	**Frequency (n)**	**Percentage (%)**
Yes	61	34.1
Partially	89	49.7
No	29	16.2
Do you think there is a need for a national/international surgical guideline on the management of recurrence after laparoscopic inguinal hernia repair?		
I definitely agree	54	30.2
I agree	99	55.3
I am undecided	15	8.4
I disagree	11	6.1

Annual laparoscopic hernia repair volume was significantly associated with surgical preferences in after laparoscopic recurrent cases. In early recurrences (≤2 years), surgeons with higher annual case volumes were more likely to prefer advanced laparoscopic approaches, whereas those with lower volumes more frequently opted for open anterior repair techniques. A similar pattern was observed in late recurrences (>2 years), with high-volume surgeons predominantly favoring laparoscopic strategies.

In female patients with recurrent hernia, surgical preference also varied according to annual laparoscopic volume. Surgeons with lower case volumes more commonly preferred open techniques specifically addressing the femoral canal, whereas surgeons with moderate to high volumes more frequently opted for repeat laparoscopic approaches or individualized decision-making strategies (Table 4).

When recurrence occurred after an initial TAPP or TEP repair, surgical volume remained a significant determinant of the chosen strategy. High-volume surgeons were more likely to adopt repeat laparoscopic repair or to base their decision on additional imaging, while lower-volume surgeons predominantly favored open anterior repair techniques. All observed associations between annual surgical volume and treatment preference were statistically significant (Table 5).

A statistically significant relationship was found between the annual volume of laparoscopic hernia repairs and the most commonly used surgical technique in practice (p<0.001) (Table 6).

Due to the small number of observations, the e-TEP category was excluded from the analysis, and TEP and TAPP were combined and defined as the "relaparoscopic" category (1), whereas Lichtenstein open repair was defined as (0). In the multivariable

Table 4. Comparison of the annual rates of laparoscopic hernia repairs performed according to surgical preferences in early-stage, late-stage, and female patients with laparoscopic recurrence					
	Early-stage recurrent (≤2 years)				
Number of laparoscopic hernia repairs performed annually	**TEP n (%)**	**TAPP n (%)**	**Open ant repair tech. n (%)**	**e-TEP n (%)**	**p**
<10	6 (18.8)	12 (27.3)	15 (15.6)	0 (0)	0.006
10-50	12 (37.5)	13 (29.5)	41 (42.7)	0 (0)	
51-100	7 (21.9)	16 (36.4)	33 (34.4)	3 (42.9)	
>100	7 (21.9)	3 (6.8)	7 (7.3)	4 (57.1)	
	Late-stage recurrent (>2 years)				
	TEP n (%)	**TAPP n (%)**	**Open ant. repair tech. n (%)**	**e-TEP n (%)**	**p**
<10	3 (12)	9 (21.4)	21 (19.4)	0 (0)	<0.001
10-50	12 (48)	7 (16.7)	47 (43.5)	0 (0)	
51-100	7 (28)	19 (45.2)	33 (30.6)	0 (0)	
>100	3 (12)	7 (16.7)	7 (6.5)	4 (100)	
	Female				
	Open ant. repair tech. n (%)	**It depends on the situation n (%)**	**Open repair n (%)**	**Again TAP n (%)**	**p**
<10	12 (11.5)	9 (23.7)	9 (60)	3 (13.6)	0.001
10-50	44 (42.3)	9 (23.7)	6 (40)	7 (31.8)	
51-100	34 (32.7)	16 (42.1)	0 (0)	9 (40.9)	
>100	14 (13.5)	4 (10.5)	0 (0)	3 (13.6)	

The column totals are provided. Fisher's-Freeman-Halton test was used for all of them.
TEP: Total extraperitoneal, TAPP: Transabdominal preperitoneal, e-TEP: Extended TEP.

Table 5. Comparison of the rates of annual laparoscopic hernia repair according to surgical preferences in recurrences repaired with TAPP and TEP

	Surgical preference when recurrence develops in a patient repaired with TAPP				
Number of laparoscopic hernia repairs performed annually	**Lichnestein repair n (%)**	**TEP n (%)**	**Again TAPP n (%)**	**Decide based on the outcome n (%)**	**p**
<10	33 (20.6)	0 (0)	0 (0)	0 (0)	<0.001
10-50	63 (39.4)	3 (50)	0 (0)	0 (0)	
51-100	47 (29.4)	3 (50)	6 (100)	3 (42.9)	
>100	17 (10.6)	0 (0)	0 (0)	4 (57.1)	
	Lichnestein repair n (%)	**TAPP n (%)**	**Again TEP n (%)**	**Decide based on the outcome n (%)**	
<10	18 (14.1)	9 (28.1)	6 (40)	0 (0)	<0.001
10-50	60 (46.9)	6 (18.8)	0 (0)	0 (0)	
51-100	40 (31.3)	10 (31.3)	9 (60)	0 (0)	
>100	10 (7.8)	7 (21.9)	0 (0)	4 (100)	

The column totals are provided. Fisher's-Freeman-Halton test was used for all of them.
TEP: Total extraperitoneal, TAPP: Transabdominal preperitoneal, e-TEP: Extended TE preperitoneal.

Table 6. Relationship between surgical preference and annual laparoscopic preference

	Surgical preference			
	Lichnestein n (%)	**Relaparoscopic n (%)**	**Total n (%)**	**p**
How many laparoscopic hernia repairs do you perform per year?				
<10	24 (44.4)	9 (7.4)	33 (18.8)	<0.001
Between 10 and 50	30 (55.6)	36 (29.5)	66 (37.5)	
Between 51 and 100	0 (0)	56 (45.9)	56 (31.8)	
>100	0 (0)	21 (17.2)	21 (11.9)	
Total	54 (100)	122 (100)	176 (100)	

The Pearson chi-square test was applied.

logistic regression analysis, the presence of prior laparoscopic experience was independently associated with a relaparoscopic preference (p=0.021). Surgeons with such experience were 2.69 times more likely to prefer a relaparoscopic approach than those without experience.

Availability of information regarding the previous operation type and details was inversely associated with relaparoscopic preference (p=0.002). When prior operative information was available, the likelihood of choosing a relaparoscopic (TEP/TAPP) approach was 74% lower compared with cases in which such information was unavailable (1-0.260).

Years of surgical experience were not independently significant in the multivariable model (p=0.380). When annual laparoscopic repair volume was entered into the model, the absence of open repair choices in certain volume categories resulted in unstable coefficient estimates in standard logistic regression. Therefore, this variable was not included in the final multivariable model (Table 7).

DISCUSSION

The emergence of novel surgical techniques has continuously reshaped the management of recurrences following LIHR. While conventional open repair approaches have traditionally been favored in revision surgery, recent studies demonstrate an increasing preference for posterior repair using a re-laparoscopic

Table 7. Multivariate logistic regression analysis for laparoscopic preference

	B	**S.E.**	**Wald**	**p**	**Exp(B)**	**95% CI for Exp(B)**	
						Lower	**Upper**
Surgical experience			1.934	0.38			
0-5 years vs. 11-20 years	-0.568	0.453	1.576	0.209	0.567	0.233	1.376
6-10 years vs. 11-20 years	-0.103	0.441	0.055	0.815	0.902	0.38	2.139
Previous surgery type and details (Present vs. Absent)	-1.346	0.434	9.636	0.002	0.26	0.111	0.609
The surgeon's previous experience (Yes vs. No)	0.993	0.431	5.319	0.021	2.699	1.161	6.276
Constant	0.64	0.41	2.436	0.119	1.896		

-2LL=205,184; Hosmer Lemeshow p=0.194; Nagelkerke R^2=0.092, S.E.: Standard error, CI: Confidence interval.

approach (13). With growing surgical experience, complications encountered during LIHR can also be effectively managed under laparoscopic guidance (14).

Our findings indicate that increasing laparoscopic expertise among surgeons is associated with a greater tendency to perform repeat laparoscopic posterior repairs in cases of recurrence following LIHR. At the same time, there is a prevailing perception among surgeons in our country that current surgical training provides insufficient preparation for the management of recurrent hernias after LIHR. Accordingly, the vast majority of respondents emphasized the need for national and international guidelines to standardize the management of such recurrences.

In recurrent cases following LIHR, the traditional anterior approach appears to be increasingly replaced by laparoscopic posterior repair techniques (15). Van den Heuvel and Dwars (16) demonstrated that the TAPP approach is a safe and effective option for the treatment of recurrences after LIHR. Similarly, Ertem et al. (17) reported that a re-laparoscopic approach represents a safe and feasible strategy in recurrent cases following LIHR. Moreover, the safety and applicability of re-laparoscopic repair have also been demonstrated in pediatric populations (18).

In the literature, most recurrences following LHIR occur within the early stage (19). In early-stage recurrences, reasons such as surgical insufficiency, mesh migration, and selection of inappropriate mesh size are typically attributed (17). In their series of 12 cases involving same-sided recurrences following Ferzli and Khoury (20) TEP, they reimplemented TEP and asserted that it was an effective technique. The TAPP treatment has been reported to be effectively executed by skilled surgeons in cases of recurrence following LIHR (21). Global agreement suggests that a relaparoscopic intervention for recurrences following LIHR should be conducted by skilled specialists (22).

Previous literature suggests that greater experience in LIHR is associated with improved perioperative outcomes, including lower complication and recurrence rates and reduced operative time (23,24). In line with this, our findings indicate that increasing laparoscopic case volume is associated with a higher tendency to adopt relaparoscopic strategies in recurrent cases. In multivariable analysis, LIHR experience emerged as the strongest independent predictor of relaparoscopic preference.

The literature indicates that recurrence rates following LIHR in women are minimal (25). Revealing the round ligament in the inguinal area is beneficial for managing other intra-abdominal conditions and facilitates the treatment of bilateral hernias (26,27). After recurrent inguinal hernias, a laparoscopic approach can be safe again with the current advantages.

Although re-laparoscopic approaches were generally preferred by high-volume surgeons, the adoption of advanced techniques such as e-TEP remained very limited. This finding likely reflects multiple factors. First, e-TEP requires a steeper learning curve and advanced laparoscopic expertise compared with conventional TEP or TAPP techniques. Second, the availability of appropriate equipment and institutional support may vary between centers. Finally, recurrent hernia surgery presents altered anatomy and dense adhesions, which may lead surgeons to favor more familiar or standardized techniques. Therefore, the low utilization of e-TEP in our survey probably represents a combination of training exposure, technical complexity, and case-related considerations rather than a single underlying cause.

Despite the existence of recommendations pertaining to LIHR, published in 2011 and revised in 2015 (22,28) a consensus on recurrent instances arising post-LIHR remains elusive, particularly with the advent of novel approaches. A renewed consensus and extensive studies are required to achieve a common approach.

Study Limitations

This study has several limitations. First, the sample frame was restricted to 300 surgeons invited from 25 centers, and participation was voluntary with a response rate of 59.7%; therefore, respondents may not fully represent the overall general surgical population in Türkiye. In addition, distribution of the survey through WhatsApp communication groups may have preferentially reached younger, digitally active, and more laparoscopically oriented surgeons, introducing potential selection bias and limiting generalizability.

Second, as this was a questionnaire-based survey, recurrence was evaluated as a standardized clinical scenario rather than a confirmed patient diagnosis, and no uniform diagnostic modality (clinical examination, imaging, or symptoms) was imposed. Accordingly, the findings reflect surgeons' decision-making preferences rather than actual clinical outcomes.

Finally, recurrence was categorized as early (≤2 years) and late (>2 years) to standardize responses; however, this represents a pragmatic classification rather than a strict biological distinction. Recurrent inguinal hernia is a heterogeneous condition, and technical and patient-related factors may overlap in individual cases. Therefore, this categorization should be interpreted cautiously.

CONCLUSION

This research is the inaugural investigation on surgeons' strategies for managing recurrence patients after LIHR in Türkiye. It illustrates that with increased surgical experience, the utilization of relaparoscopic techniques for LIHR recurrences rises. The utilization of minimally invasive techniques by proficient surgeons is expected to rise following the establishment of national and worldwide consensus guidelines.

Ethics

Ethics Committee Approval: This study was designed as a cross-sectional, questionnaire-based descriptive research. Ethical approval was obtained from the Local Ethics Committee of Kahramanmaraş Sütçü İmam University on September 22, 2025 (approval no: 24 following approval, the survey was conducted between October 1 and October 15, 2025).

Informed Consent: Informed consent was obtained from patients.

Footnotes

Author Contributions

Concept - Ö.Ç.; Design - Ö.Ç., R.C.Ç.; Data Collection or Processing - Ö.Ç., R.C.Ç.; Analysis or Interpretation - Ö.Ç., R.C.Ç.; Literature Search - Ö.Ç., R.C.Ç.; Writing - Ö.Ç., R.C.Ç.

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