Original Article

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Quick Response Code:

Website: www.herniasurgeryjournal.org

DOI: 10.4103/ijawhs.ijawhs_93_24

Outcomes of treatment for recurrent inguinal hernia: A retrospective cohort study

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Abstract

CONTEXT: Inguinal hernia is a common surgical condition, with over 20 million repairs worldwide annually. Recurrent inguinal hernias occur in 14% of men and 7% of women, with recurrence rates three times higher than primary cases. Recommendations for the surgical approach to recurrent hernias lack strong evidence.

AIMS: This study examines the outcomes of recurrent inguinal hernia surgeries and the patient factors influencing the choice of surgical technique.

METHODS: We conducted a retrospective cohort study at Pirogov City Clinical Hospital (2017–2023). Patient data were collected from medical records and surveys on short-term outcomes. The focus was on recurrence rates and chronic pain syndrome (CPS). Follow-up included physical exams and ultrasound.

STATISTICAL ANALYSIS USED: Data were analyzed using MS Excel and Jamovi 2.3.21. Categorical data are shown as counts and percentages, and continuous data as median (Me) and interquartile range (Q1–Q3). Statistical tests included the Student *t* test, Mann–Whitney test, Pearson's chi-square, and the log-rank test for recurrence rates. A *P*-value < 0.05 was considered significant.

RESULTS: A total of 187 patients had TAPP (n = 130) or Lichtenstein (n = 57) repairs. TAPP was preferred for prior mesh or non-mesh repairs, and Lichtenstein for prior TAPP. Our assessment of surgical trends showed a preference for open mesh repair in older patients (P = 0.04), those presenting with extensive hernias (P < 0.01), indirect inguinal hernias (P = 0.016), and individuals with a prior diagnosis of prostatic disorders (P < 0.01). Nevertheless, this sample of patients demonstrated a statistically significant increase in postoperative sensory disturbances (10.64%, P = 0.05). Seven recurrences (6.6%) occurred in the TAPP group, though not significantly different. Long-term outcomes were similar between groups.

CONCLUSION: The optimal surgical approach for recurrent inguinal hernia remains unclear. Patient characteristics play a significant role in surgical decision-making.

Keywords:

Inguinal hernia, Lichtenstein procedure, long-term outcome, recurrence, short-term outcome, TAPP

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Submitted: 22-Nov-2024
Revised: 06-Mar-2025
Accepted: 12-Mar-2025
Published: 23-Jun-2025

Introduction

Inguinal hernias account for 39.9–80% of all anterior abdominal wall hernias.[1,2] According to the literature, approximately 200,000 inguinal hernia surgeries are performed annually in Russia and Germany, more than 700,000 in the USA, 80,000 in the UK, and 100,000 in France,[3] with approximately 20 million patients undergoing inguinal hernia surgery annually worldwide.[4,5] These figures underscore the significant socio-economic burden of this condition, as most of these patients are young and physically active.[6]

How to cite this article: Sazhin AV, Ivakhov GB, Loban KM, Andriyashkin AV, Timurzieva MZ. Outcomes of treatment for recurrent inguinal hernia: A retrospective cohort study. Int J Abdom Wall Hernia Surg 2025;8:67-75.

The proportion of patients undergoing surgery for recurrent inguinal hernia is 11.3–14.3% in men and 7.0–7.4% in women. The recurrence rate following early open and laparoscopic inguinal hernia repair ranges from 1.2 to 3%, and the rate of secondary recurrence in re-operated patients ranges from 2.9 to 9.2%.[7]

Despite the availability of various inguinal hernia repair techniques, including prosthetic and minimally invasive methods, the choice of the optimal surgical approach for treating recurrent inguinal hernias remains an important issue and warrants further investigation.[8] According to current national and international clinical guidelines, laparoscopic repair for recurrent inguinal hernia is recommended in cases of recurrence following anterior wall repair of the inguinal canal (or Lichtenstein mesh repair). Anterior wall hernia repair is recommended if posterior wall repair fails.[4] However, this recommendation is not universally applied and lacks a high level of evidence.[9-11]

The aim of this study is to compare the short and long-term outcomes of groups of patients with recurrent inguinal hernias after Lichtenstein and laparoscopic hernia repair and to determine which patient characteristics influence the surgeon's choice of surgical approach.

Materials and Methods

A retrospective cohort study was conducted to analyze patients who underwent routine surgery for recurrent inguinal hernia from 2017 to 2023 at Pirogov City Clinical Hospital No 1, the clinical base of the Faculty Surgery Department 1, Pirogov Russian National Research Medical University. Surgical procedures, including transabdominal preperitoneal repair (TAPP) and Lichtenstein procedure, were performed using standard techniques with a 10 cm × 15 cm mesh implant as the prosthetic material. The decision to fix the mesh during laparoscopic procedures was left to the discretion of the operating surgeon. The type of anesthesia was selected based on the specific surgical procedure and the patient's comorbid status. Patient and procedural data were obtained from electronic medical records through the institution's medical information systems.

For the purpose of this study, hernia repairs were divided into subgroups based on prior surgery that was the cause of primary recurrence as a key influencing surgical decision-making factor in current clinical guidelines.[9,10]

Figure 1 illustrates a flowchart showing the patients included in the study and their hernias, categorized into subgroups based on the type of prior hernia repair preceding the recurrence.

Inclusion criteria for the study were patients aged over 18 years with recurrent inguinal hernias.

Exclusion criteria included primary, incarcerated, or femoral hernias, as well as cases of early recurrence (defined as occurring within one month after the initial operation). Additionally, 1 patient who underwent a nonstandard treatment approach (open preperitoneal mesh repair) and 11 patients who underwent surgery for bilateral recurrent inguinal hernias were excluded from the analysis.

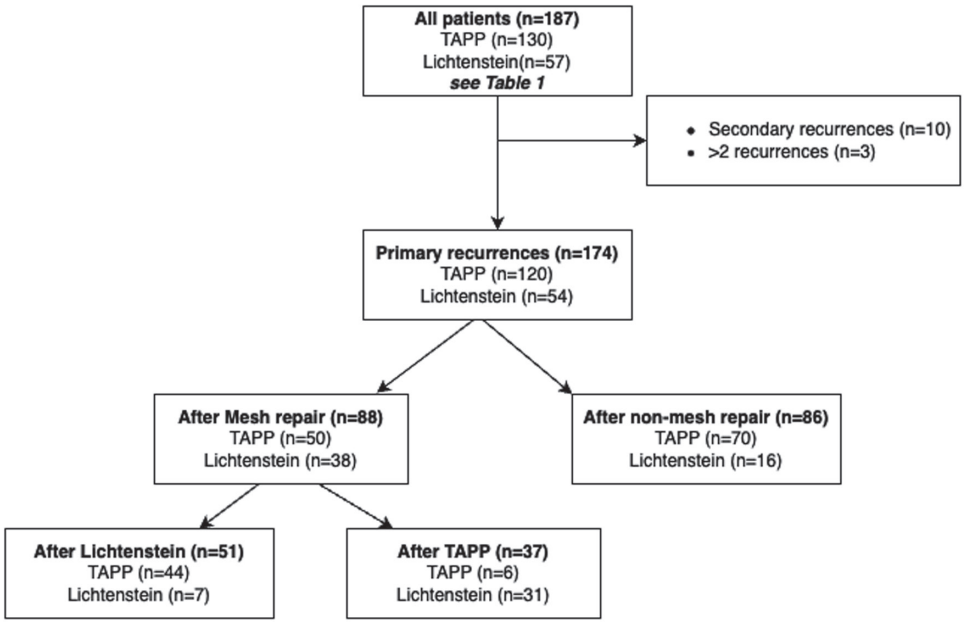

Figure 1: Flowchart of Patient Cohorts Based on Hernia Recurrence and Type of Previous Hernia Repair (Mesh vs. Non-Mesh). Notes: The number of hernias is given in brackets. TAPP—transabdominal preperitoneal hernia repair

Certain patient characteristics were assessed including demographics, hernia characteristics according to EHS classification, history of previous hernia repair and laparotomy, comorbidities, and American Society of Anesthesiologists (ASA) score.

The short-term outcomes of treatment for recurrent inguinal hernia were assessed using data from medical records, consultations, and examinations by outpatient surgeons through an electronic medical information and analytical system, as well as patient responses obtained via telephone interviews.

The long-term outcomes were assessed based on responses to a follow-up telephone survey conducted in 2024. The survey inquired about the presence of pain, paresthesia in the operated area, or recurrence of the hernia.

Subsequently, all patients in the retrospective cohort who completed the telephone questionnaire were invited for a follow-up physical examination and ultrasound imaging of the inguinal region to objectively confirm or discard the recurrence.

The following criteria were used to make the diagnosis of recurrent inguinal hernia: the presence of objective symptoms of herniation in the operated inguinal area, confirmed by ultrasound/CT data or intraoperative findings at reoperation.

The statistical analysis was performed using Microsoft Excel (Microsoft Corporation) and Jamovi 2.3.21 (The Jamovi Project). Categorical data are presented as absolute and relative frequencies, while continuous data (due to their non-normal distribution) are expressed as the median (Me) and interquartile range (IQR, Q1–Q3). The statistical significance of comparisons between normally distributed quantitative data was assessed using the Student *t* test. For non-normally distributed data, the Mann–Whitney *U* test was used and Pearson's Chi-square test was applied for qualitative data. The log-rank test was used to compare recurrence rates, accounting for the date of recurrence with a precision of one month. A < 0.05 *P*-value was considered statistically significant

Results

A total of 187 patients, ranging from 20 to 87 years, were included in this retrospective cohort study. Of these, 130 patients (69.5%) underwent laparoscopic hernia repair, while 57 patients (30.5%) underwent Lichtenstein mesh repair.

Surgery was performed for primary recurrence in 174 cases (93.05%), for secondary recurrence in 10 cases (5.35%), and for tertiary or higher recurrence in 3 cases (1.6%). The characteristics of all patients included in the study and the hernias treated are summarized in Tables 1 and 2.

Table 1: Patient and hernia characteristics in recurrent inguinal hernia repair

Features		TAPP (*n* = 130)	Lichtenstein (*n* = 57)	*P*-value
Number of patients		130	57	
Number of hernias		130	57	
Gender	Male (N, %)	122 (93.85%)	54 (94.74%)	1
	Female (N, %)	8 (6.15%)	3 (5.26%)	
Age (Me, IRR)		62 (52.0-68.8)	65 (68.8-76.0)	0.045
EHS classification of hernias:				
Location (N, %)	L (indirect)	62 (47.69%)	38 (66.6%)	0.016
	M (direct)	66 (50.77%)	16 (28.1%)	0.003
	Combined	2 (1.54%)	3 (5.3%)	0.325
Size (N, %)	1 (0–1.5 cm)	40 (31.25%)	9 (16.67%)	0.031
	2 (1.5–2.5 cm)	74 (57.81%)	25 (46.3%)	0.099
	3 (> 2.5 cm)	14 (10.94%)	20 (37.04%)	<0.0001
History of laparotomy		31 (23.85%)	20 (35.09%)	0.1124
Significant comorbidities				
CHD without PICS		12 (9.23%)	8 (14.04%)	0.4708
PICS		3 (2.31%)	5 (8.77%)	0.05
BPH		13 (10%)	6 (10.53%)	0.8875
PC		3 (2.31%)	8 (14.04%)	0.0037
PE		2 (1.54%)	8 (14.04%)	0.001

Note: TAPP = Transabdominal preperitoneal hernioplasty, Me = Median, ICR = Interquartile range, EHS = European Hernia Society, CHD = Coronary heart disease, PICS = Postinfarction cardiosclerosis, BPH = Benign prostatic hyperplasia, PC = Prostate cancer, PE = Prostatectomy. Statistically significant differences are indicated in gray.

Table 2: Complications in patients with recurrent inguinal hernia: Short-term and long-term outcomes

Complications		TAPP (*n* = 130)	Lichtenstein (n = 57)	*P*-value
Short-term complications				
Wounds		15 (11.54%)	13 (22.81%)	0.077
Hematoma		11 (8.46%)	7 (12.28%)	0.583
Seroma		4 (3.08%)	4 (7.02%)	0.249
SSI		0	2 (3.51%)	0.09
Long-term complications				
Telephone survey	Patients (N)	106	47	
	Hernias (N)	106	47	
A follow-up examination and US:	Patients (N)	63	19	
	Hernias (N)	63	19	
Recurrences	Re-operated	2 (1.89%)	0	0.338
	Confirmed by US	2 (1.89%)	0	0.349
	Noted subjectively	3 (2.83%)	0	0.384
	Objectively relapsed	4 (3.77%)	0	0.184
	Total recurrences	7 (6.6%)	0	0.085
	Median recurrence time	5 (3–18)	0	
CPS		16 (15.09%)	6 (12.77%)	0.920
Sensory disturbance		3 (2.83%)	5 (10.64%)	0.05

Note: SSI = Surgical site infection, US = Ultrasound examination, CPS = Chronic pain syndrome. Statistically significant differences are indicated in gray

Patients undergoing Lichtenstein mesh repair were statistically older compared to those receiving laparoscopic repair ($P = 0.045$). No significant differences were between the groups in terms of body mass index ($P = 0.25$) or the degree of operative and anesthetic risk, as assessed by the ASA classification ($P = 0.82$).

There was a statistically significant trend favoring Lichtenstein mesh repair as the hernia defect size increased [Table 2]. Additionally, a statistically significant difference was observed between the groups with respect to hernia location: indirect recurrent inguinal hernias were predominantly treated with Lichtenstein mesh repair, while direct hernias were more commonly managed with the TAPP technique ($P = 0.016$ and $P = 0.003$, respectively).

Mesh fixation during TAPP was most commonly performed by the operating surgeon using a tack in 88 (67.69%) of cases. Less frequently with sutures in 3 (2.31%) cases, and in 39 (30%) patients, no fixation was employed. The mean duration of laparoscopic procedures was 75 min IQR [60–100], while the mean duration of open mesh repair was 80 min IQR [65–110], with no statistically significant difference between the two groups ($P = 0.175$).

Additionally, we observed that significant comorbidities influenced the selection of surgical approach. For instance, surgeons showed a preference for the Lichtenstein repair technique in patients with malignant prostate neoplasms or those who had undergone early prostatectomy, although this preference did not reach statistical significance ($P > 0.05$).

The short and long-term outcomes of patients who underwent surgery for recurrent inguinal hernia are presented in Table 2.

To evaluate the short-term outcomes of treatment, we identified the most common wound complications, including seroma or hematoma formation and surgical site infections. Notably, there were no statistically significant differences between the two groups with respect to these complications.

Long-term outcomes were assessed through telephone interviews, with data obtained from 153 (81.82%) of the 187 patients. The remaining patients either declined the interview (10 patients, 5.35%) or could not be contacted using the contact information provided in the medical records (24 patients, 12.83%). Among the 153 patients who were interviewed, 22 (14.38%) reported the development of CPS and paresthesia at the site of the surgical procedure. Furthermore, there was a difference approaching statistical significance between the two groups regarding the presence of paresthesia at the surgical site; this symptom was more common in patients who underwent the Lichtenstein procedure ($P = 0.05$).

Among the patients surveyed, two (1.89%) had been treated at other hospitals for recurrent hernias, while six patients reported symptoms of a possible recurrence. Of these, two (1.89%) had the recurrence confirmed by ultrasound of the inguinal region. One patient (0.94%) had a suspected recurrence that could not be detected by palpation, but further examination revealed a lipoma in the inguinal area instead. The remaining three patients (2.83%) who reported symptoms of recurrence were later

diagnosed through clinical examination by outpatient surgeons.

Thus, according to the telephone interview, clinical examination, and ultrasound (US) of the inguinal region, 7 recurrences of inguinal hernia were identified, resulting in a recurrence rate of 6.6%. Notably, all recurrences occurred in the TAPP group; however, this difference was not statistically significant ($P > 0.05$).

The recurrence-free and cumulative recurrence risk curves are depicted in Figures 2 and 3.

The maximum follow-up period was 76 months, with a median follow-up of 28 months. Notably, no new recurrences were detected after 36 months. According to Kaplan–Meier analysis, the recurrence-free survival rate was 96.48% (95% CI: 91.74–98.53%) at 12 months, 95.28% (95% CI: 89.53–97.91%) at 24 months, and 93.79% (95% CI: 86.85–97.13%) at 36 months. The cumulative recurrence risk was 3.52% (95% CI: 1.47–8.26%) at 12 months, 4.72% (95% CI: 2.09–10.47%) at 24 months, and 6.21% (95% CI: 2.87–13.15%) at 36 months.

When patients were stratified by previous treatment, the following patterns emerged:

Among patients who had previously undergone hernia repair with mesh implants, the groups were comparable in terms of age, hernia location (direct or indirect), and history of prostatectomy and/or prostate cancer. However, there remained a statistically significant difference in hernia defect size, as well as in the long-term outcome of sensory impairment in the groin area. Further details can be found in Tables S1 and S2 in the Supplementary File.

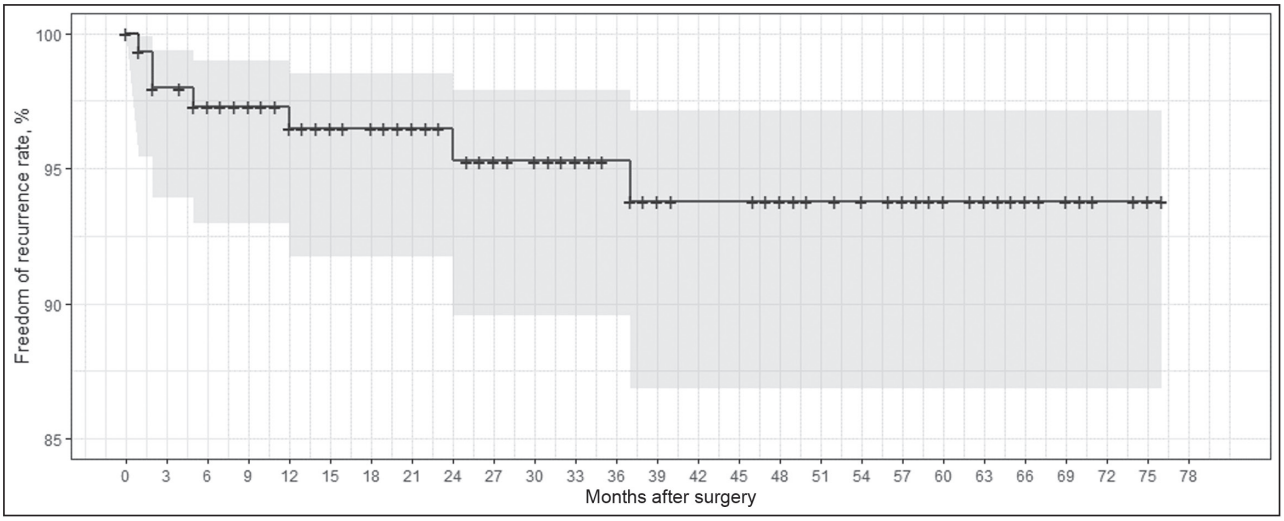

Figure 2: Recurrence-Free Curve for Patients Undergoing Laparoscopic (TAPP) and Open (Lichtenstein) Repair for Recurrent Inguinal Hernias

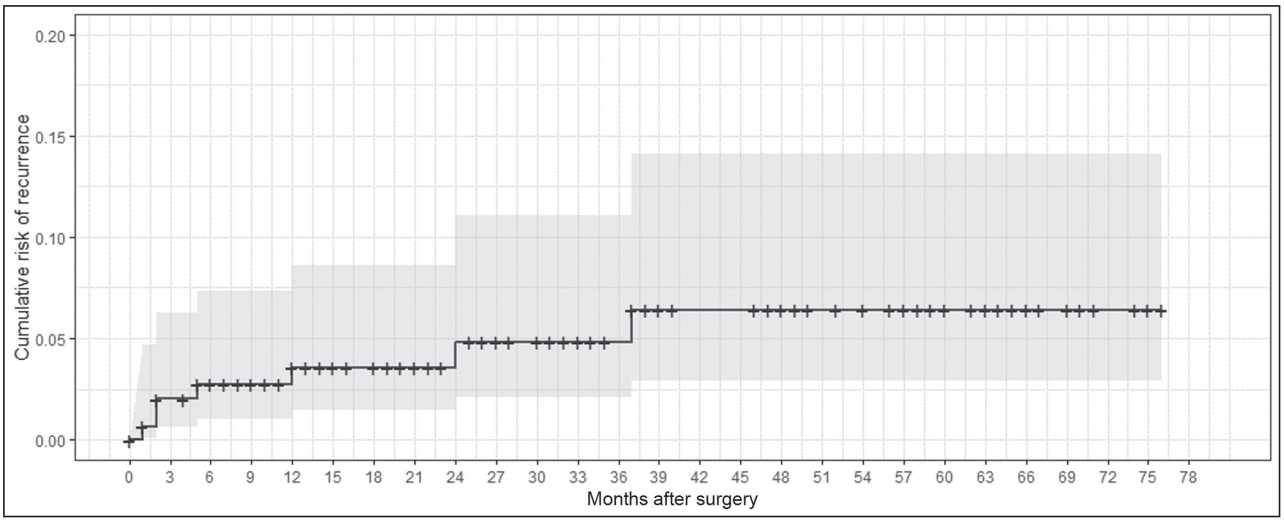

Figure 3: Cumulative Risk of Recurrence in Patients Undergoing Laparoscopic (TAPP) and Open (Lichtenstein) Repair for Recurrent Inguinal Hernias

Upon further stratification of the subgroup of patients who had previously undergone a Lichtenstein repair, non-comparability was observed only in terms of hernia defect size. Further details can be found in Tables S3 and S4 in the Supplementary File. In contrast, no statistically significant differences were found in the subgroup of patients who had undergone laparoscopic preperitoneal mesh repair. Further details can be found in Tables S5 and S6 in the Supplementary File.

In patients who had previously undergone repair without mesh, statistically significant differences between the groups were more evident for age ($P < 0.001$), hernia location ($P = 0.04$ and $P = 0.052$), and hernia size ($P = 0.041$ and $P < 0.001$). Additionally, a significant difference was found in the history of prior laparotomy ($P < 0.001$), with these patients being recommended for laparoscopic surgery by their surgeons later. Statistically significant differences were also noted for the presence of prostatectomy ($P = 0.042$) and a history of prostate cancer ($P = 0.02$). Furthermore, patients with benign prostatic hyperplasia (BPH) were more likely to have undergone the Lichtenstein procedure, though this difference was not statistically significant ($P = 0.58$).

There were also significant differences in the incidence of wound complications in this subgroup ($P = 0.007$), with hematomas being more common after Lichtenstein repair (37.5% vs. 8.57%). No other significant differences in short or long-term outcomes were observed in the subcohort of patients with a history of local tissue grafting. Further details can be found in Tables S7 and S8 in the Supplementary File.

Discussion

Recurrence after hernia repair for recurrent inguinal hernia in our study occurred only after TAPP, with an incidence of 6.21% (95% CI: 2.87–13.15%) at 36 months of follow-up. This rate was not statistically significantly higher than that observed after Lichtenstein repair. The absence of recurrence after Lichtenstein may be due to the limited sample size, rather than the advantages of this technique in managing recurrent inguinal hernia. Similar findings have been reported in both retrospective and prospective studies in the literature.[6] For instance, a large randomized controlled trial (RCT) by Neumayer *et al*., with a follow-up of up to 2 years, found a higher rate of recurrent hernia in the TAPP group compared with Lichtenstein group (10.1% vs. 4.9%, OR = 2.2; 95% CI: 1.5–3.2).[12] Additionally, an RCT by Eklund *et al*. reported a recurrence rate at 5 years of 19% (12 cases) after TAPP and 18% (12 cases) after Lichtenstein mesh repair. Recurrence rates varied widely between individual surgeons, ranging from 0 to 43% in the Lichtenstein group and from 0 to 67% in the TAPP group.[13] However, these studies were performed at the inception of the era of inguinal laparoscopic hernia repair, when the surgeons of the world were not yet so perfectly skilled in these techniques. A retrospective cohort study by G. Ramsay *et al*. also demonstrated a statistically significant difference between the TAPP and Lichtenstein groups in terms of recurrence: the risk of recurrence was higher in the laparoscopic group (OR = 1.83, 95% CI: 1.61–2.08) compared to the open repair group (OR = 0.87, 95% CI: 0.82–0.92; $P < 0.001$).[14]

In a study by Ramjist *et al*., based on data from the Canadian Hernia Registry, it was observed that patients undergoing laparoscopic hernia repair shown a significantly higher risk of recurrence compared to those who received open repair. This consistency was particularly pronounced among surgical practitioners who performed 25 or fewer procedures annually.[15]

Moreover, Roos *et al*. found out that the recurrence of hernias is close linked to the anatomical location of the hernia defect, revealing that direct inguinal hernias are associated with a markedly elevated rate of reoperation relative to indirect hernias.[16,17] Additionally, a RCT led by Demetrashvili *et al*. reported no events of early recurrence either in the TAPP or the Lichtenstein repair groups, suggesting the efficacy of these techniques in mitigating early recurrence rates.[18]

A meta-analysis by Pisanu *et al*., including 647 patients, found that the final recurrence rate was higher in patients who underwent the Lichtenstein procedure compared to those who received laparoscopic hernia repair (11.6% vs. 8.3%; $P = 0.16$).[19]

Based on the large studies, it remains clear that determining the optimal surgical approach for patients with recurrent inguinal hernias is still a relevant issue. A critical and unresolved aspect of clinical management of patients with recurrent inguinal hernia is the selection of a technique that minimizes the risk of recurrence.

In our study, there was no statistically significant difference in the incidence of chronic pain syndrome (CPS) between patients who underwent early laparoscopic surgery and those who underwent the Lichtenstein procedure ($P = 0.920$). CPS occurred in 15.1% of patients in the TAPP group and in 12.8% for the Lichtenstein group. The data we present are consistent with the results of a number of studies,[20,21] but in some respects they contradict the conclusions of other authors.[19] Miller *et al*. report that the ilioinguinal, iliohypogastric, and genitofemoral nerves are among the most commonly affected during open inguinal hernia repairs, both with and without mesh, leading to potential complications associated with chronic pain.[22]

The literature on CPS prevalence following hernia repair demonstrates greater heterogeneity compared to data on recurrence rates. According to various studies, CPS develops in approximately 8%–15% of patients; however, some reports cite rates as high as 40%, with long-term disability from CPS (pain persisting beyond three months) affecting 10%–12% of patients.[23,24] This variation may reflect differences in CPS severity definition and assessment criteria as well as timing of assessments. Currently, there is not standard method exists for CPS assessment. Some studies have employed the Carolinas Comfort Scale,[25] while others used the visual analog scale,[13,26] or omitted specific scales altogether.[27]

The incidence of early postoperative complications, including seroma, hematoma, and infection at the surgical site, is reported to be as high as 21.9%, according to the literature.[28] This is consistent with the findings in our study, where wound complications were notably more prevalent in the Lichtenstein hernia repair group. Comparable results were reported in RCTs by Dedemadi *et al*.,[29] Kumar *et al*.,[30] Eklund *et al*.,[13] Sagar *et al*.[31] However, in the RCT conducted by Neumayer *et al*., which included 1696 patients undergoing surgery for primary and recurrent inguinal hernias, the incidence of early complications was significantly higher in the group undergoing laparoscopic mesh repair (39.0% vs. 33.4%; OR 1.3; 95% CI: 1.1–1.6) when comparing short-term postoperative outcomes.[12]

In a study by Demetrashvili *et al*., involving 52 patients who underwent surgery for recurrent inguinal hernias using the standard TAPP and Lichtenstein techniques, wound complications were more frequent in the TAPP group (8 vs. 4, $P = 0.19$).[18]

The approach to surgical management of recurrent inguinal hernia is influenced by the type of previous repair. According to current international and national clinical guidelines, laparoscopic repair is recommended for recurrent inguinal hernia following failed anterior inguinal wall repairs or Lichtenstein procedures. Conversely, Lichtenstein repair is typically recommended for recurrence after posterior inguinal wall repairs.[4] Adherence to these guidelines varies from surgeon to surgeon, so alternative strategies may be used in clinical practice.

In our study, the majority of specialists were adhering to the current surgical guidelines; however, there were notable exceptions. Specifically, in six cases (16.22%), patients underwent repeat transabdominal preperitoneal mesh repair (reTAPP) following a previous TAPP procedure, and in seven cases (13.73%), repeat Lichtenstein repair was performed after an initial Lichtenstein procedure. Probably, both hernia defect size and prior surgical intervention influenced the decision to reoperate in the second cohort, because the subgroups were not completely comparable on these variables. This surgical decision-making approach is not entirely new, as it has been described in previous studies by several authors.[9-11]

A retrospective study by Fernández-Alberti *et al*. included 46 patients who experienced recurrence after a previous primary TAPP hernia repair. In 28 (61%) cases, the surgeons performed reTAPP, while the remaining 18 (39%) cases were managed with the Lichtenstein procedure according to current guidelines. As a result, 24 (86%) patients had a successful outcome, while 4 cases required conversion from laparoscopy to the Lichtenstein procedure due to severe adhesions. In the laparoscopic group, one recurrence occurred and was resolved by reTAPP. Similarly, one recurrence was observed in the Lichtenstein group, which was managed by repeating the Lichtenstein procedure. The study concluded that reTAPP for recurrence after a prior TAPP procedure is safe and associated with a shorter hospital stay.[9]

A similar retrospective study in the Russian-language literature by D.Y. Bogdanov *et al*. reviewed 137 patients with recurrent inguinal hernia who underwent primary TAPP. Of these, 64 patients (46.72%) underwent repeat TAPP, while 73 patients (53.28%) underwent Lichtenstein mesh repair. No significant intra- or postoperative complications were reported in either group.[10]

The cohort study by S. Öberg *et al*., based on the Danish Hernia Med database, included 4344 patients with primary inguinal hernia recurrence. These patients were divided into four groups according to the surgical approach used during their most recent hospitalization: Lichtenstein–Lichtenstein, Lichtenstein–Laparoscopy, Laparoscopy–Laparoscopy, and Laparoscopy–Lichtenstein. The study found no significant differences in reoperation rates after primary laparoscopic surgery, regardless of the type of reoperation performed. However, the Lichtenstein–Lichtenstein group had a significantly higher reoperation rate compared to the Lichtenstein–Laparoscopy group (8.7% vs. 3.1%, $P < 0.0005$). Further analysis revealed that this increased reoperation rate in the Lichtenstein–Lichtenstein group was primarily observed in patients with a direct inguinal hernia.[11]

In our study, a notable proportion of operations (49.43%) was performed for recurrent inguinal hernia after previous non-mesh repair. This proportion is higher than was reported in the studies above. In this subgroup, several key patient characteristics showed significant differences between groups limitis the ability of direct comparisons. These characteristics include age, hernia

size and location, history of laparotomy, history of prostatectomy and/or prostate cancer, and the presence of BPH. It can be hypothesized that the choice of hernia repair method in our cohort was influenced not only by the presence of previous surgical history but also by the factors listed above.

To date, few studies have specifically addressed the management strategies following hernia repair using local tissue. for example, in the study by B.A. Mizaushev *et al*., 286 patients (69.9%) underwent open non-mesh repair for primary hernia recurrence. 68 patients (23.8%) experienced a second recurrence. However, the recurrence rate was reduced by a factor of 6.7 with the use of non-tension repair techniques.[32]

The RCT by Demetrashvili *et al*. was the only study recommend TAPP repair for recurrent inguinal hernia after non-mesh repair, particularly in young, physically active patients without obesity.[19]

The limitations of our study include the relatively small sample size, the use of telephone interview as the primary method for detecting complications, and the retrospective study design. Additionally, a review of the medical records of the patients included in our study revealed that not all patients underwent a follow-up ultrasound examination in the early postoperative period, as recommended by their treating physicians.

The optimal surgical approach for recurrent inguinal hernia remains unclear. We found that previous intervention is important but not the only factor determining the surgical strategy. It is very important that new studies about recurrent inguinal hernia surgery are needed that take into account the patient's previous intervention.

Author contribution

We certify that we have participated sufficiently in the intellectual content, conception and design of this work or the analysis and interpretation of the data (when applicable), as well as the writing of the manuscript, to take public responsibility for it and have agreed to have our name listed as a contributor.

Ethical policy and Institutional Review board statement

The study protocol was approved by Ethical Committee of Pirogov Russian National Research Medical University (No. 246, dated on December 16, 2024). The design and concept of the study does not conflict with the Declaration of Helsinki.

Declaration of patient consent

By permission of the ethical committee, consent was taken only from patients evaluated face-to-face.

Data Availability statement

The data set used in the current study is available on request from Loban K.M. doctor.loban@gmail.ru.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Kirienko AI, Shevtsov YN, Nikishkov AS, Seliverstov EI, Andriyashkin AV, Tatarintsev AM, *et al*. Incidence of abdominal wall hernias: the results of population study. Pirogov Russian J Sur 2016;8:61-6.
2. Timerbulatov VM, Iamalov RA, Faiazov RR, Kunafin MS, Trukhanov OG. Experience with hernioplasty after Lichtenstein in inguinal hernias. Vestn Khir Im I I Grek 2011;170:93-5.
3. Palermo M, Acquafresca PA, Bruno M, Tarsitano F. Hernioplasty with and without mesh: analysis of the immediate complications in a randomized controlled clinical trial. Arq Bras Cir Dig 2015;28:157-60.
4. HerniaSurgeGroup. International guidelines for groin hernia management. Hernia 2018;22:1-165.
5. Bittner R, Schwarz J. Inguinal hernia repair: current surgical techniques. Langenbecks Arch Surg 2012;397:271-82.
6. Ostrovskiĭ VK, Filimonov IE. Risk factors for recurrent inguinal hernia. Khirurgiia (Mosk) 2010:45-8.
7. Köckerling F, Krüger C, Gagarkin I, Kuthe A, Adolf D, Stechemesser B, *et al*. What is the outcome of re-recurrent vs recurrent inguinal hernia repairs? An analysis of 16,206 patients from the Herniamed Registry. Hernia 2020;24:811-9.
8. Aliev SA. Evolution of the methods of surgical treatment of inguinal hernias. Vestn Khir Im I I Grek 2010;169:109-13.
9. Fernandez-Alberti J, Iriarte F, Croceri RE, Medina P, Porto EA, Pirchi DE. Laparoscopic treatment (reTAPP) for recurrence after laparoscopic inguinal hernia repair. Hernia 2021;25:1301-7.
10. Bogdanov DY, Rutenburg GM, Navid MN, Ramazanov RB, Guseinov II. Comparison of traditional and laparoscopic procedures for recurrent inguinal hernia after laparoscopic repair. Endoscopic Surgery 2024;30:20-5.
11. Öberg S, Andresen K, Rosenberg J. Surgical approach for recurrent inguinal hernias: a Nationwide Cohort Study. Hernia 2016;20:777-82.
12. Neumayer L, Giobbie-Hurder A, Jonasson O, Fitzgibbons R, Jr, Dunlop D, Gibbs J, *et al*; Veterans Affairs Cooperative Studies Program 456 Investigators. Open mesh versus laparoscopic mesh repair of inguinal hernia. N Engl J Med 2004;350:1819-27.
13. Eklund A, Rudberg C, Leijonmarck CE, Rasmussen I, Spangen L, Wickbom G, *et al*. Recurrent inguinal hernia: Randomized multicenter trial comparing laparoscopic and Lichtenstein repair. Surg Endosc 2007;21:634-40.
14. Ramsay G, Scott NW, Jansen JO. A 19-year population-based cohort study analysing reoperation for recurrence following laparoscopic and open inguinal hernia repairs. Hernia 2020;24:793-800.
15. Ramjist JK, Dossa F, Stukel TA, Urbach DR, Fu L, Baxter NN. Reoperation for inguinal hernia recurrence in Ontario: a population-based study. Hernia 2019;23:647-54.
16. Roos MM, van Hessen CV, Verleisdonk EJMM, Clevers GJ, Davids PHP, Voorbrood CEH, *et al*. An 11-year analysis of reoperated groins after endoscopic totally extraperitoneal (TEP) inguinal hernia repair in a high-volume hernia center. Hernia 2019;23:655-62.

17. Bisgaard T, Bay-Nielsen M, Kehlet H. Re-recurrence after operation for recurrent inguinal hernia. A nationwide 8-year follow-up study on the role of type of repair. Ann Surg 2008;247: 707-11.
18. Demetrashvili Z, Qerqadze V, Kamkamidze G, Topchishvili G, Lagvilava L, Chartholani T, *et al*. Comparison of Lichtenstein and laparoscopic transabdominal preperitoneal repair of recurrent inguinal hernias. Int Surg 2011;96:233-8.
19. Pisanu A, Podda M, Saba A, Porceddu G, Uccheddu A. Meta-analysis and review of prospective randomized trials comparing laparoscopic and Lichtenstein techniques in recurrent inguinal hernia repair. Hernia 2015;19:355-66.
20. Bignell M, Partridge G, Mahon D, Rhodes M. Prospective randomized trial of laparoscopic (transabdominal preperitoneal-TAPP) versus open (mesh) repair for bilateral and recurrent inguinal hernia: incidence of chronic groin pain and impact on quality of life: Results of 10-year follow-up. Hernia 2012;16:635-40.
21. Polynsky AA, Kozlovskaya AV, Krechenko AS. Quality of life and long-term results of treatment of patients with recurrent inguinal hernia//Journal of GrSMU, 2015.
22. Miller HJ. Inguinal Hernia: Mastering the Anatomy. Surg Clin North Am 2018;98:607-21.
23. Bittner R, Gmähle E, Gmähle B, Schwarz J, Aasvang E, Kehlet H. Lightweight mesh and noninvasive fixation: an effective concept for prevention of chronic pain with laparoscopic hernia repair (TAPP). Surg Endosc 2010;24:2958-64.
24. Lau H, Patil NG, Yuen WK, Lee F. Prevalence and severity of chronic groin pain after endoscopic totally extraperitoneal inguinal hernioplasty. Surg Endosc 2003;17:1620-3.
25. Haggerty S, Forester B, Hall T, Kuchta K, Linn J, Denham W, *et al*. Laparoscopic repair of recurrent inguinal hernia offers similar outcomes and quality of life to primary laparoscopic repair. Hernia 2021;25:165-72.
26. van den Heuvel B, Dwars BJ. Repeated laparoscopic treatment of recurrent inguinal hernias after previous posterior repair. Surg Endosc 2013;27:795-800.
27. Tuuliranta M, Antikainen T, Heiskanen T, Mecklin JP, Aarnio MT. Recurrent groin hernia surgery after primary open inguinal procedures: a reappraisal of the open preperitoneal (Ugahary) technique. Hernia 2019;23:671-5.
28. Schumpelick V. Hernias. 4th ed. Stuttgart, New York: Georg Thieme Verlag; 2000.
29. Dedemadi G, Sgourakis G, Karaliotas C, Christofides T, Kouraklis G, Karaliotas C. Comparison of laparoscopic and open tension-free repair of recurrent inguinal hernias: a prospective randomized study. Surg Endosc 2006;20: 1099-104.
30. Kumar S, Nixon SJ, MacIntyre IM. Laparoscopic or Lichtenstein repair for recurrent inguinal hernia: one unit's experience. J R Coll Surg Edinb 1999;44:301-2.
31. Sagar SMIU, Hossain MA, Yusuf MA, Sultana R, Azad MAK. Comparison of open lichtenstein repair and laparoscopic transabdominal preperitoneal repair of inguinal hernia: A pragmatic randomized control trial in Bangladesh. J Curr Adv Med Res 2023;10:35-40.
32. Mizaushev BA, Kumyshev AN. Surgical treatment of recurrent inguinal hernias// Bulletin of RUDN, Medicine Series, 2011. Available from elibrary website.

Supplementary File

Table S1: Characteristics of patients operated on for recurrent inguinal hernias (after previous mesh repair)

Features		TAPP (*n* = 50)	Lichtenstein (*n* = 38)	*P*-value
Number of patients		50	38	
Number of hernias		50	38	
Gender	Male (N, %)	46(92%)	35(92.11%)	1
	Female (N, %)	4(8%)	3(7.89%)	
Age (Me, IRR)		61.5 (53.0–68.8)	60.5 (53.5–68.0)	0.884
EHS classification of hernias:				
Location (N, %)	L (indirect)	25(50%)	23(60.53%)	0.3271
	M (direct)	23(46%)	12(31.58%)	0.1714
	combined	2(4%)	3(7.89%)	0.6482
Size (N, %)	1 (0–1.5 cm)	21(43.75%)	6(17.14%)	0.008
	2 (1.5–2.5 cm)	21(43.75%)	17(48.57%)	0.7913
	3 (> 2.5 cm)	6(12.5%)	12(34.29%)	0.04
History of laparotomy		14(28%)	7(18.42%)	0.4273
Significant comorbidities				
CHD without PICS		5(10%)	3(7.89%)	1
PICS		1(2%)	1(2.63%)	1
BPH		8(16%)	4(10.53%)	0.6713
PC		0	4(10.53%)	0.031
PE		0	4(10.53%)	0.031

Note: TAPP = Transabdominal preperitoneal hernioplasty, Me = Median, ICR = Interquartile range, EHS = European Hernia Society, CHD = Coronary heart disease, PICS = Postinfarction cardiosclerosis, BPH = Benign prostatic hyperplasia, PC = Prostate cancer, PE = Prostatectomy. Statistically significant differences are indicated in gray

Table S2: Immediate and long-term results of treatment of patients operated on for recurrent inguinal hernias (after previous mesh repair)

Features		TAPP (*n* = 50)	Lichtenstein (*n* = 38)	*P*-value
Short-term complications				
Wounds:		6(12%)	7(18.42%)	0.59
Hematoma		3(6%)	2(5.26%)	1
Seroma		3(6%)	3(7.89%)	1
SSI		0	2(5.26%)	0.183
Long-term complications				
Telephone survey	Patients (N)	40	32	
	Hernias (N)	40	32	
A follow-up examination and US	Patients (N)	30	14	
Recurrences	Reoperated	1(2.5%)	0	1
	Confirmed by US	2(5%)	0	0.499
	Noted subjectively	0	0	1
	Objectively relapsed	3(7.5%)	0	0.248
	Total recurrences	3(7.5%)	0	0.248
CPS		7(17.5%)	5(15.63%)	0.92
Sensory disturbance		0	5(15.63%)	0.014

Note: SSI = Surgical site infection, US = Ultrasound examination, CPS = Chronic pain syndrome. Statistically significant differences are indicated in gray

Table S3: Characteristics of patients operated on for recurrent inguinal hernias (after previous Lichtenstein repair)

Features		TAPP (*n* = 44)	Lichtenstein (*n* = 7)	*P*-value
Number of patients		44	7	
Number of hernias		44	7	
Gender	Male (N, %)	40 (90.91%)	7 (100%)	1
	Female (N, %)	4(9.09%)	0	
Age (Me, IRR)		60.0 (52.5-69.4)	65.0 (60.0-89.5)	0.166
EHS classification of hernias:				
Location (N, %)	L (indirect)	20 (45.45%)	4(57.14%)	0.6931
	M (direct)	22 (50%)	3(42.86%)	1
	Combined	2(4.55%)	0	1
Size (N, %)	1 (0–1.5 cm)	20(47.62%)	0	0.059
	2 (1.5–2.5 cm)	19(45.24%)	3(42.86%)	1
	3 (> 2.5 cm)	3(7.14%)	4(57.14%)	0.004
History of laparotomy		11(25%)	1(14.29%)	0.671
Significant comorbidities				
CHD without PICS		5(11.36%)	2(28.57%)	0.242
PICS		1(2.27%)	1(14.29%)	0.258
BPH		7(15.91%)	2(28.57%)	0.592
PC		0	0	1
PE		0	0	1

Note: TAPP = Transabdominal preperitoneal hernioplasty, Me = Median, ICR = Interquartile range, EHS = European Hernia Society, CHD = Coronary heart disease, PICS = Postinfarction cardiosclerosis, BPH = Benign prostatic hyperplasia, PC = Prostate cancer, PE = Prostatectomy. Statistically significant differences are indicated in gray

Table S4: Immediate and long-term results of treatment of patients operated on for recurrent inguinal hernias (after previous Lichtenstein repair)

Complications		TAPP (*n* = 44)	Lichtenstein (*n* = 7)	*P*-value
Short-term complications				
Wounds		5(11.36%)	2(28.57%)	0.242
Hematoma		2(4.55%)	0	1
Seroma		3(6.82%)	1(14.29%)	0.999
SSI		0	1(14.29%)	0.137
Long-term complications				
Telephone survey	Patients (N)	35	3	
	Hernias (N)	35	3	
A follow-up examination and US	Patients (N	28	3	
Recurrences	Reoperated	1(2.86%)	0	1
	Confirmed by US	2(5.71%)	0	1
	Noted subjectively	0	0	1
	Objectively relapsed	3(8.57%)	0	1
	Total recurrences	3(8.57%)	0	1
CPS		6(17.14%)	0	1
Sensory disturbance		0	1(33.33%)	0.078

Note: SSI = Surgical site infection, US = Ultrasound examination, CPS = Chronic pain syndrome. Statistically significant differences are indicated in gray

Table S5: Characteristics of patients operated on for recurrent inguinal hernias (after previous TAPP repair)

Features		TAPP (*n* = 6)	Lichtenstein (*n* = 31)	*P*-value
Number of patients		6	31	
Number of hernias		6	31	
Gender	Male (N, %)	6(100%)	28(90.32%)	1
	Female (N, %)	0	3(9.68%)	
Age (Me, IRR)		64.5 (59.0-67.9)	60.0 (53.0-67.5)	0.621
EHS classification of hernias:				
Location (N, %)	L (indirect)	5(83.33%)	19(61.29%)	0.394
	M (direct)	1(16.67%)	9(29.03%)	0.66
	Combined	0	3(9.68%)	1
Size (N, %)	1 (0–1.5 cm)	1(16.67%)	6(21.43%)	1
	2 (1.5–2.5 cm)	2(33.33%)	14(50%)	0.66
	3 (> 2.5 cm)	3(50%)	8(28.57%)	0.362
History of laparotomy		3(50%)	6(19.35%)	0.14
Significant comorbidities				
CHD without PICS		0	1(3.23%)	1
PICS		0	0	1
BPH		1(16.67%)	2(6.45%)	0.421
PC		0	4(12.9%)	0.591
PE		0	4(12.9%)	0.591

Note: TAPP = Transabdominal preperitoneal hernioplasty, Me = Median; ICR = Interquartile range, EHS = European Hernia Society, CHD = Coronary heart disease, PICS = Postinfarction cardiosclerosis, BPH = Benign prostatic hyperplasia, PC = Prostate cancer, PE = Prostatectomy. Statistically significant differences are indicated in gray

Table S6: Immediate and long-term results of treatment of patients operated on for recurrent inguinal hernias (after previous TAPP repair)

Complications		TAPP (*n* = 6)	Lichtenstein (*n* = 31)	*P*-value
Short-term complications				
Wounds		1(16.67%)	5(16.31%)	1
Hematoma		1(16.67%)	2(6.45%)	0.421
Seroma		0	2(6.45%)	1
SSI		0	1(3.23%)	1
Long-term complications				
Telephone survey	Patients (N)	5	29	
	Hernias (N)	5	29	
A follow-up examination and US	Patients (N	2	11	
Recurrences	Reoperated	0	0	1
	Confirmed by US	0	0	1
	Noted subjectively	0	0	1
	Objectively relapsed	0	0	1
	Total recurrences	0	0	1
CPS		1(20%)	5(17.24%)	1
Sensory disturbance		0	4(13.79%)	1

Note: SSI = Surgical site infection, US = Ultrasound examination, CPS = Chronic pain syndrome. Statistically significant differences are indicated in gray

Table S7: Characteristics of patients operated on for recurrent inguinal hernias (after previous non-mesh repair)

Features		TAPP (*n* = 70)	Lichtenstein (*n* = 16)	*P*-value
Number of patients		70	16	
Number of hernias		70	16	
Gender	Male (N, %)	66(94.29%)	16(100%)	0.587
	Female (N, %)	4(5.71%)	0	
Age (Me, IRR)		62.0 (50.3-71.0)	75.0 (69.0-79.0)	<0,001
EHS classification of hernias				
Location (N, %)	L (indirect)	30(42.86%)	12(75%)	0.04
	M (direct)	39(55.71%)	4(25%)	0.052
	combined	1(1.43%)	0	1
Size (N, %)	1 (0–1.5 cm)	14(20.29%)	2(12.5%)	0.521
	2 (1.5–2.5 cm)	51(73.91%)	7(43.75%)	0,041
	3 (> 2.5 cm)	4(5.8%)	7(43.75%)	<<0,001
History of laparotomy		15(21.43%)	11(68.75%)	<<0,001
Significant comorbidities				
CHD without PICS		6(8.57%)	5(31.25%)	0.027
PICS		2(2.86%)	3(18.75%)	0.042
BPH		4(5.71%)	2(12.5%)	0.588
PC		3(4.29%)	4(25%)	0.02
PE		2(2.86%)	3(18.75%)	0.042

Note: TAPP = Transabdominal preperitoneal hernioplasty, Me = Median, ICR = Interquartile range, EHS = European Hernia Society, CHD = Coronary heart disease, PICS = Postinfarction cardiosclerosis, BPH = Benign prostatic hyperplasia, PC = Prostate cancer, PE = Prostatectomy. Statistically significant differences are indicated in gray

Table S8: Immediate and long-term results of treatment of patients operated on for recurrent inguinal hernias (after previous non-mesh repair)

Complications		TAPP (*n* = 70)	Lichtenstein (*n* = 16)	*P*-value
Short-term complications				
Wounds		6(8.57%)	6(37.5%)	0.007
Hematoma		5(7.14%)	5(31.25%)	0.017
Seroma		1(1.43%)	1(6.25%)	0.339
SSI		0	0	1
Long-term complications				
Telephone survey	Patients (N)	58	12	
	Hernias (N)	58	12	
A follow-up examination and US	Patients (N	33	4	
Recurrences	Reoperated	0	0	1
	Confirmed by US	0	0	1
	Noted subjectively	3(5.17%)	0	1
	Objectively relapsed	0	0	1
	Total recurrences	3(5.17%)	0	1
CPS		9(15.52%)	0	0.204
Sensory disturbance		3(5.17%)	0	1

Note: SSI = Surgical site infection, US = Ultrasound examination, CPS = Chronic pain syndrome. Statistically significant differences are indicated in gray