

Comparative analysis of different surgical approaches for recurrent inguinal hernia: a single-center observational study

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Purpose: Managing recurrent inguinal hernias is complex, and choosing the right surgical approach (laparoscopic vs. open) is vital for patient outcomes. This study compared the outcomes of using the same vs. different surgical approaches for initial and subsequent hernia repairs.

Methods: We retrospectively analyzed patients who underwent recurrent inguinal hernia repair at Seoul National University Bundang Hospital between January 2014 and May 2023. Patients were divided into the "concordant" and "discordant" groups, comprising patients who underwent same and different approaches in both surgeries, respectively. Preoperative baseline characteristics, index surgery data, postoperative outcomes, and recurrence rates were analyzed and compared.

Results: In total, 131 patients were enrolled; the concordant and discordant groups comprised 31 (open, n = 19; laparoscopic, n = 12) and 100 patients (open to laparoscopic, n = 68; laparoscopic to open, n = 32), respectively. No significant differences were observed in the mean operation time (50.5 ± 21.7 minutes vs. 50.2 ± 20.0 minutes, P = 0.979), complication rates (6.5% vs. 14.0%, P = 0.356), or 36-month cumulative recurrence rates (9.8% vs. 9.8%; P = 0.865). The mean postoperative hospital stay was significantly shorter in the discordant than in the concordant group (1.8 ± 0.7 vs. 1.4 ± 0.6, P = 0.003).

Conclusion: Most recurrent inguinal hernia repairs were performed using the discordant surgical approach. Overall, concordance in the surgical approach did not significantly affect postoperative outcomes. Therefore, the selection of the surgical approach based on the patient's condition and surgeon's preference may be advisable.

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Key Words: Hernia, Herniorrhaphy, Inguinal hernia, Laparoscopy, Minimally invasive surgical procedures

INTRODUCTION

Approximately 20 million cases of inguinal hernia are surgically repaired every year worldwide, with recurrence

occurring in approximately 15% of cases [1,2]. Although advances in surgical techniques and equipment have allowed radical cure of many diseases, the recurrence rate of inguinal hernias remains high, with little reduction compared to past

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years [3]. Recurrence not only causes discomfort to patients but also increases healthcare costs [4]. Moreover, the probability of re-recurrence significantly increases in cases of recurrent inguinal hernia [5]. Hence, it is imperative to adopt a meticulous approach in treating patients with hernias to effectively resolve the initial condition and prevent complications and recurrence.

With increased interest in minimally invasive surgery, laparoscopy has become commonplace across the entire surgical field. Regarding hernias, both laparoscopic and open surgeries are routinely performed. The outcomes of laparoscopic versus open surgery for recurrent hernias have been studied [6-10]; however, no clear consensus has yet been reached. The current International Guidelines for Hernia Management recommend adopting a different surgical approach for recurrence than that used in prior surgery [11]; i.e., a laparoscopic approach could be suggested for recurrence if the initial surgery was open, and vice versa.

Nonetheless, there are cases in which these guidelines are not followed due to a variety of factors, including the surgeon's preference or the patient's condition. One study estimated that only 38.5% of surgeons who perform open surgery as the index surgery adhere to these guidelines [12]. Additionally, in the 2023 revision of the groin hernia management guidelines, post-prostatic surgery, pelvic radiation, and indications for local anesthesia were designated as relative contraindications for laparoscopy [13].

In situations where choosing surgical methods that deviate from the guidelines is inevitable, it is uncertain whether these methods are clinically as safe as adhering to the guidelines. It remains challenging to find studies analyzing postoperative outcomes based on compliance with guidelines. Therefore, this study aimed to analyze the degree of guideline adherence in actual clinical practice. We retrospectively analyzed the clinical outcomes of groups that adhered to the guidelines and those that did not to determine whether guideline adherence affects recurrence rates.

METHODS

Ethics statement

This study was approved by the Institutional Review Board (IRB) of Seoul National University Bundang Hospital (No. B-2312-869-103). The need for informed consent was waived in accordance with the policy of our IRB.

Study population

Patients who underwent recurrent hernia repair between January 2014 and May 2023 at Seoul National University Bundang Hospital were retrospectively enrolled. Patients younger than 19 years, and those who did not undergo follow-up after surgery were excluded. Patients who underwent

reoperation due to recurrence were categorized into 2 groups according to whether their surgical approach matched that of their previous surgery. The concordant group consisted of patients who underwent the same type of surgery for primary and recurrent inguinal hernias, whereas the discordant group included patients who underwent different surgical approaches.

Surgical intervention

In this study, we focused on 2 primary surgical techniques for inguinal hernia repair: the Lichtenstein method for open surgery and laparoscopic approaches including totally extraperitoneal (TEP) and transabdominal preperitoneal (TAPP) repair. The decision between open and laparoscopic or TAPP and TEP was based on surgeon preference. The surgeries were performed by a total of 4 surgeons.

Outcomes

Both intraoperative and postoperative outcomes, including operative time, hospital stay, and complications were assessed as short-term outcomes. The long-term outcomes of this study were the median time to re-recurrence and the 36-month cumulative re-recurrence rate.

Both short- and long-term outcomes were assessed based on retrospective analysis of the medical records. We reviewed the medical records of patients who visited our institution, regardless of specialty, to assess for any recurrences or complications. In cases without such records, it was assumed that there were no recurrences or complications.

Statistical analysis

Categorical variables were analyzed using the chi-square test or Fisher exact test as appropriate. For continuous variables, the Mann-Whitney U-test or t-test was utilized, depending on the data distribution, while the Kaplan-Meier method and the log-rank test were employed to examine time-dependent variables. All analyses were performed using the IBM SPSS Statistics for Windows, ver. 27.0 (IBM Corp.).

RESULTS

Demographics

A total of 2,867 patients underwent surgical treatment for inguinal hernias at our institution during the study period. Of these, 131 underwent surgery for recurrent hernias, and the medical records of this entire cohort were retrospectively analyzed. Of the 131 patients, 31 were classified into the concordant group (open to open, $n = 19$; laparoscopic to laparoscopic, $n = 12$) and 100 into the discordant group (open to laparoscopic, $n = 68$; laparoscopic to open, $n = 32$). The mean age of the patients was 68.7 ± 12.1 years, and the patients were predominantly male ($n = 123$, 93.9%). The median time

from initial surgery to recurrence was 36.0 months (interquartile range [IQR], 12.0–120.0 months) (Table 1). Similarly, there were no significant differences in perioperative characteristics between the concordant and discordant groups in any variable, including the proportion of open index surgery (61.3% vs. 71.0%, $P = 0.458$) and median time to recurrence (40.0 [IQR, 24.0–120.0] months vs. 36.0 [IQR, 11.0–120.0] months, $P = 0.231$) (Table 2).

Surgical trends

Examination of the surgical trends for recurrent inguinal hernia repair from 2014 to 2023, revealed that laparoscopy was consistently more commonly performed than open surgery. Moreover, the prevalence of laparoscopy, which accounted for 51.0% of cases in 2014–2015, was found to have sharply increased to 79.0% in 2022–2023 (Fig. 1).

Postoperative outcomes

The mean operation times showed no discernible difference

Table 1. Baseline characteristics of recurrent inguinal hernia patients

Characteristic	Value
No. of patients	131
Age (yr)	68.7 ± 12.1
Sex, male:female	123 (93.9):8 (6.1)
Recurrent site	
Right	66 (50.4)
Left	53 (40.5)
Bilateral	12 (9.2)
Time to recurrence (mo)	36.0 (12.0–120.0)

Values are presented as number only, mean ± standard deviation, number (%), or median (interquartile range).

between the concordant and discordant groups (50.5 ± 21.7 minutes vs. 50.2 ± 20.0 minutes, $P = 0.979$). Likewise, no significant differences were observed in the complication rates (6.5% vs. 14.0%, $P = 0.356$). Surgical complications included scrotal pain, inguinal pain, incisional hernia, wound pain, wound problems, urinary retention, wound seroma, and scrotal edema. A significant difference was found in the mean hospital stay duration, with the concordant group exhibiting a longer duration than the discordant group (1.8 ± 0.7 days vs. 1.4 ± 0.6 days, $P = 0.003$) (Table 3). There were 12 cases of re-recurrence after recurrent inguinal hernia repair. Of these, in 9 cases, a different surgical method was selected following the guidelines compared to the initial surgery, while in the remaining 2 cases, the guidelines were not followed. In 1 case, re-recurrence was

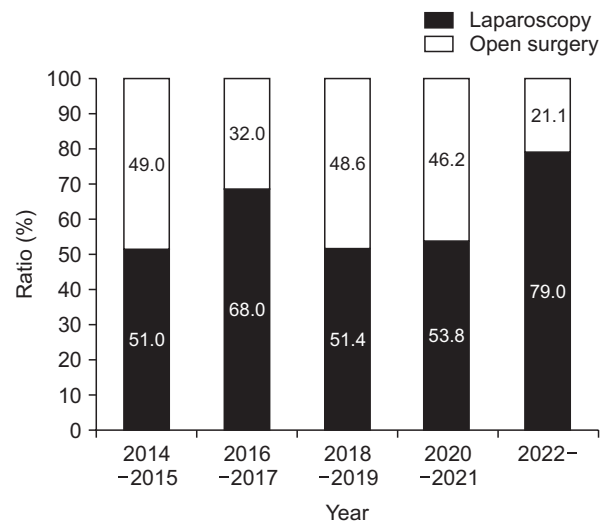


Fig. 1. Trends in surgical approach for recurrent inguinal hernia repair at our center in the last decade.

Table 2. Comparisons of perioperative characteristics between the concordant and discordant groups

Variable	Concordant group	Discordant group	P-value
No. of patients	31	100	
Age (yr)	68.2 ± 13.3	69.0 ± 11.8	0.795
Sex, male:female	28 (90.3):3 (9.7)	95 (95.0):5 (5.0)	0.393
Body mass index (kg/m ²)	22.5 ± 2.7	23.6 ± 2.7	0.073
Smoking	15 (57.7)	41 (56.2)	0.893
Index operation site			0.276
Right	9 (29.0)	42 (42.0)	
Left	12 (38.7)	38 (38.0)	
Bilateral	10 (32.3)	20 (20.0)	
Index operation type			0.458
Laparoscopy	12 (38.7)	29 (29.0)	
Open	19 (61.3)	71 (71.0)	
Time to recurrence (mo)	40.00 (24.0–120.0)	36.00 (11.0–120.0)	0.231

Values are presented as number only, mean ± standard deviation, number (%), or median (interquartile range).

Table 3. Comparisons of postoperative data between the concordant and discordant groups

Variable	Concordant group (n = 31)	Discordant group (n = 100)	P-value
Operation type			0.017
Laparoscopy	12 (38.7)	71 (71.0)	
Open	19 (61.3)	29 (29.0)	
Recurrent site			0.312
Right	17 (54.8)	49 (49.0)	
Left	13 (41.9)	40 (40.0)	
Bilateral	1 (3.2)	11 (11.0)	
Operation time (min)	50.5 ± 21.8	50.2 ± 20.0	0.979
Hospital stay (day)	1.8 ± 0.72	1.4 ± 0.6	0.003
Complication	2 (6.5)	14 (14.0)	0.356
Scrotal pain	1 (3.3)	1 (1.0)	
Scrotal edema	1 (3.3)	0 (0)	
Seroma	0 (0)	2 (2.0)	
Inguinal pain	0 (0)	2 (2.0)	
Wound problem	0 (0)	3 (3.0)	
Urinary retention	0 (0)	3 (3.0)	
Others	0 (0)	3 (3.0)	
Time to re-recurrence (mo)	14.0 (13.3–57.5)	12.0 (4.5–34.3)	0.268

Values are presented as number (%), mean ± standard deviation, or median (interquartile range).

Table 4. Surgical approaches used for cases of re-recurrence

	Index surgery	Second surgery	Third surgery
1	Open	Open	Laparoscopy
2	Open	Open	Laparoscopy
3	Laparoscopy	Open	Laparoscopy
4	Laparoscopy	Open	Laparoscopy
5	Laparoscopy	Open	Laparoscopy
6	Laparoscopy	Open	Laparoscopy
7	Laparoscopy	Open	Laparoscopy
8	Laparoscopy	Laparoscopy	Open
9	Open	Laparoscopy	Open
10	Open	Open	Open
11	Open	Laparoscopy	Laparoscopy
12	Laparoscopy	Laparoscopy	-

diagnosed, but the patient was lost to follow-up after diagnosis (Table 4).

Re-recurrence rate

To assess long-term outcomes, both groups had a median follow-up duration of 19.0 months (IQR, 4.0–59.0 months). The outcomes of the observation indicated no significant disparity in the 36-month cumulative re-recurrence rate between the 2 groups (concordant vs. discordant: 9.8% vs. 9.8%, P = 0.865) (Fig. 2).

DISCUSSION

To the best of our knowledge, this is the first study to

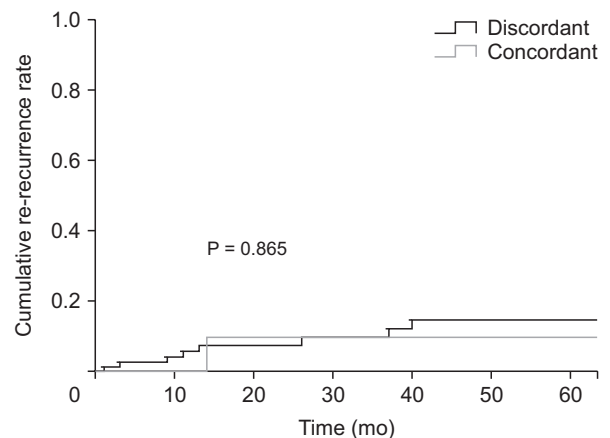


Fig. 2. Comparison of the 36-month cumulative re-recurrence rate in patients treated at our center.

investigate the comprehensive adherence to surgical guidelines for recurrent inguinal hernia repair and to assess the resulting clinical outcomes. In previous studies, obtaining data on the index surgery was found to be challenging. Moreover, even in studies with data on the index surgery, the surgeries were mostly open surgeries, making it difficult to reflect the recent trend of frequently using laparoscopy as the initial surgery [3,14-16]. For these reasons, it was difficult to compare clinical outcomes based on guideline adherence in previous studies. Therefore, in this study, we compared recurrence rates, a major concern in recurrent inguinal hernias, based on guideline adherence. We found that, overall, 76.3% of patients adhered to the guidelines, and there were no significant differences

between the concordant and discordant groups in most of the postoperative outcomes. Therefore, if the existing guidelines cannot be strictly adhered to, it is safe to suggest other surgical methods based on the patient's condition.

Given these findings, we believe that surgeons can reduce the burden associated with surgery for recurrent hernias by assessing surgeons' preferences and situations. One survey investigating surgeons' preferences for inguinal hernia repair revealed that 82% of the surgeons favored a patient-customized approach to hernia repair. They also expressed a preference for endoscopic surgery in cases of bilateral and recurrent hernias, while favoring open surgery in patients with hemodynamic abnormalities or emergencies [17]. Overall, surgeons do not adhere to a single approach but prefer to apply the most suitable surgical method depending on the specific case. Our results provide evidence supporting the validation and accommodation of surgeons' preferences in surgical decision-making.

Several concerns regarding the choice of concordant surgical methods have been raised. One primary concern of concordance is whether consecutive use of the same surgical method may be technically demanding for the surgeon given that repeated identical surgeries in the same area can lead to technical difficulties, such as adhesion of the abdominal wall. However, in our study, the complication rate was lower in the concordant group than in the discordant group (Table 3). Moreover, some previous studies have mentioned that continuously performing either open or laparoscopic surgery is sufficiently feasible [18,19]. This evidence alleviates concerns about the continued use of open surgery or laparoscopy in clinical practice.

Additionally, our research provides evidence not only from the surgeon's perspective but also from the grounds for making choices that consider the patient's situation and preferences. Laparoscopy may not be easily applicable in cases of incarcerated or large inguinoscrotal hernias, or in patients with contraindications for general anesthesia [20]. In such instances, performing open surgery as the initial surgery inevitably leads to a deviation from the guidelines. However, our findings offer medical justification for such deviations by tailoring the patient's condition. Furthermore, previous studies have shown that patients who undergo laparoscopic surgery return to their daily activities faster than those who undergo open surgery [14]. Hence, patients who desire a quicker return to normal may opt for laparoscopy. Our results support the feasibility of selecting the surgical methods that reflect these preferences.

The findings of our study have significant implications for surgical education, especially as the shift towards minimally invasive procedures, such as laparoscopy, changes the landscape of surgical training [21]. Nowadays, trainees are primarily exposed to laparoscopic techniques, which could limit their experience with open surgery methods (Fig. 1). This trend raises concerns about their ability to adhere to traditional

surgery techniques and the discomfort they may experience when switching between methods. To address this, we conducted a subgroup analysis comparing TAPP to TEP within laparoscopic surgery. Our findings revealed no significant differences in postoperative recurrence rates and perioperative outcomes between these 2 approaches, echoing the results of previous studies. This suggests that surgical outcomes are consistent regardless of the specific laparoscopic technique used, indicating that training programs could focus more on developing proficiency in minimally invasive techniques without compromising patient care. By enhancing familiarity and comfort across a broader spectrum of surgical methods, we can potentially ease the transition for surgeons between different techniques, benefiting both their education and patient outcomes.

Our study results can generally be extended in these ways. However, it should be noted that some small differences were found between the concordant and discordant groups: specifically, the length of the hospital stay was significantly shorter in the discordant group. Nonetheless, caution is needed before interpreting this as a significant superiority of the discordant group that adhered to the guidelines. It is important to note that factors other than the surgical method can influence the duration of the hospital stay. For example, this discrepancy may be due to both surgeon and patient factors. Some surgeons may recommend hospitalization to keep patients under close observation, whereas others may not. Moreover, patients taking aspirin or anticoagulants are at risk of bleeding and should be admitted to the hospital for appropriate monitoring before discharge. Factors such as insurance coverage may have also influenced the length of stay.

This retrospective study faces inherent biases, including the possible underreporting of postoperative complications. The lack of data from loss to follow-up might contribute to an underestimation of long-term complication rates. Moreover, for patients who received primary inguinal hernia repair at other hospitals, there were instances where detailed information about their initial surgery was not available in the medical records. Therefore, these factors necessitate caution in interpreting the results of our study. Additionally, this was a single-center study predominantly involving expert surgeons. Thus, the results may not fully apply to less experienced surgeons, underscoring a limitation in generalizability. The need for multicenter studies, like randomized controlled trials, is evident to validate these findings.

In our study, the adherence rate to the surgical guidelines for recurrent inguinal hernias was 76.3%, indicating a high compliance with the guidelines in clinical practice. However, whether the same surgical approach was used for both primary and recurrent inguinal hernias did not affect the postoperative outcomes, except for the length of hospital stay. Therefore, we

concluded that in cases where strict adherence to guidelines is not feasible due to surgeon or patient factors, it is advisable to consider alternative surgical methods for the repair of recurrent inguinal hernias.

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Conflicts of Interest

Duck-Woo Kim, serving as the Editor-in-Chief of *Annals of Surgical Treatment and Research*, did not participate in the review process of this article. No other potential conflicts of interest pertinent to this article were reported.

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