

## Role of Laparoscopic Surgery in Repairing Inguinal Hernia: Comparative Study

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### Abstract

**Objective:** To compare the outcomes of laparoscopic (LR) and open repair (OR) for inguinal hernias in terms of postoperative pain, complications, hospital stay, recurrence rates, and quality of life.

**Methods:** This single-center cohort study included 200 patients undergoing inguinal hernia repair, with 100 patients in each group (LR and OR). The primary outcome was postoperative pain measured on a visual analog scale at 24 hours, 72 hours, and 1 week postoperatively. Secondary outcomes included early and late complications, hospital stay duration, recurrence rates at 1-year follow-up, and quality of life assessed using the Short Form-36 (SF-36) questionnaire at 3 months postoperatively.

**Results:** Postoperative pain scores were significantly lower in the LR group compared to the OR group at all time points ( $p < 0.001$ ). Early complications occurred in 8% of the LR group and 18% of the OR group ( $p = 0.03$ ), while late complications did not differ significantly between the two groups (5% vs. 7%,  $p = 0.49$ ). The LR group had a significantly shorter hospital stay duration ( $1.5 \pm 0.7$  days vs.  $2.8 \pm 1.2$  days,  $p < 0.001$ ) and a comparable recurrence rate at 1-year follow-up (4% vs. 5%,  $p = 0.71$ ). Quality of life, as assessed by the SF-36 questionnaire, was significantly better in the LR group at 3 months postoperatively.

**Conclusion:** Laparoscopic repair of inguinal hernias is associated with reduced postoperative pain, shorter hospital stays, and a lower risk of early complications compared to open repair, without compromising the durability of the repair. The improved quality of life in the LR group at 3 months postoperatively highlights the potential benefits of laparoscopic surgery in terms of patient satisfaction and faster return to normal activities.

**Keywords:** Inguinal hernia, Laparoscopic repair, Open repair, Postoperative pain, Complications, Recurrence, Quality of life, Hospital stay, Surgical outcomes.

### Introduction

With an estimated lifetime risk of 27% for males and 3% for women, inguinal hernias are among the most prevalent types of hernias. Pain and discomfort ensue from them when the intestines or fatty tissue protrude through a weak spot in the lower abdominal wall [1]. Inguinal hernias can result in life-threatening consequences such as intestinal blockage and strangulation if left untreated [2]. Inguinal hernias have traditionally been treated using open repair methods, such as the Shouldice and Lichtenstein tension-free mesh repairs. These procedures entail creating a groyne incision, then inserting a mesh to strengthen the fragile abdominal wall [3].

Despite their effectiveness, open repair procedures are linked to prolonged hospital stays, substantial postoperative discomfort, and a higher risk of sequelae, such as infection and persistent pain [4]. The therapy of inguinal hernias has undergone a paradigm shift as a result of the advent of laparoscopic surgery for hernia repair in

the 1990s. Small incisions must be made in the belly to introduce a laparoscope and other specialised devices needed for the procedure using laparoscopic procedures, such as the transabdominal preperitoneal (TAPP) and completely extraperitoneal (TEP) approaches [5]. Laparoscopic surgery has a number of advantages over open repair, such as less postoperative discomfort, shorter hospital stays, and speedier recovery times. Laparoscopic surgery may have benefits, but experts are divided on how well it works to repair inguinal hernias [6].

According to some studies, laparoscopic surgery is associated with a lower risk of complications and recurrence, whereas open repair is associated with rates of recurrence that are comparable to or even greater [7]. The study's main research question is: How safe, effective, and successful is laparoscopic surgery compared to open repair for inguinal hernia patients? Examining the possible benefits and downsides of laparoscopic surgery for inguinal hernia repair

in comparison to conventional open repair methods has attracted attention [8]. Less postoperative discomfort, shorter hospital stays, and quicker recovery times are a few of the documented advantages of laparoscopic surgery [9].

Due to lessened tissue stress, laparoscopic surgery may also produce superior cosmetic results, a lower risk of wound infection, and a lower prevalence of persistent discomfort [10]. Despite these benefits, laparoscopic hernia repair acceptance has been delayed in some settings, in part because of worries about the learning curve, the length of the procedure, and the cost of specialized equipment. Additionally, the method calls very extensive surgical abilities, and patient results are greatly influenced by the surgeon's expertise. Laparoscopic versus open inguinal hernia repair outcomes have been evaluated in a number of meta-analyses and randomised controlled trials. Laparoscopic repair was discovered to be connected to reduced postoperative discomfort, a quicker return to daily activities, and a lower risk of complications [11].

However, they also noted that laparoscopic surgeries took longer to complete. Laparoscopic repair had a lower postoperative pain score, shorter hospital stays, and a quicker return to work, but was linked to a higher risk of uncommon but serious consequences, like intestinal injury [12,13]. Further clinical research is necessary in light of the contradictory information about the safety and efficacy of laparoscopic versus open inguinal hernia repair [14, 15]. This study's objective is to assess and contrast the results of patients who had laparoscopic and open inguinal hernia repairs, with a focus on postoperative discomfort, complications, length of hospital stay, recurrence rates, and quality of life.

## Materials and Methods

### Study Design

This prospective cohort study compares the results of laparoscopic versus open repair procedures for people with inguinal hernias. The institutional review board gave its blessing to the study, which was carried out in accordance with the Helsinki Declaration.

### Patient Population

The study included patients with unilateral or bilateral primary inguinal hernias who were 18 years of age or older. Prior inguinal hernia repairs, urgent procedures, conditions that exclude the use of general anaesthesia, and patients who are incapable of giving informed consent were among the exclusion criteria. Based on the surgical method used-laparoscopic repair (LR) and open repair-patients were split into two groups (OR).

### Interventions

According to the surgeon's desire and skill level, patients in the LR group either had transabdominal preperitoneal (TAPP) or completely extraperitoneal (TEP) laparoscopic repair. Depending on the surgeon's preference and the patient's clinical presentation, either a Shouldice repair or a Lichtenstein tension-free mesh repair was performed on the OR group.

## Outcome Measures

Postoperative discomfort, complications, length of hospital stay, and recurrence rates were the main outcome indicators. The Visual Analogue Scale (VAS) was used to measure postoperative pain at 24, 72, and 1 week after surgery. According to the Clavien-Dindo classification, complications were defined as early (within 30 days) or late (after 30 days). Days were used to represent the length of the hospital stay, and a year later recurrence rates were evaluated. At three months after surgery, the Short Form 36 (SF-36) questionnaire was used to gauge quality of life.

### Sample Size Calculation

The sample size was calculated using a power analysis based on the primary outcome of postoperative pain. A previous study reported a mean difference of 1.5 points on the visual analog scale (VAS) between laparoscopic and open hernia repair. Assuming a standard deviation of 2.5 points for both groups, a sample size of 86 patients per group was required to detect a statistically significant difference with a power of 80% and a two-tailed alpha of 0.05. To account for potential dropouts and loss to follow-up, we enrolled 100 patients per group.

2.6 Subgroup Analysis we performed a subgroup analysis to compare the outcomes of patients with unilateral and bilateral inguinal hernias. Patients were stratified into two subgroups: those with unilateral hernias (n=160) and those with bilateral hernias (n=40). Outcomes were compared between the LR and OR groups within each subgroup.

### Follow-up

Patients were followed up at 1 week, 1 month, 3 months, and 1 year postoperatively. During the follow-up visits, patients were evaluated for hernia recurrence, complications, and postoperative pain. The recurrence of hernias was assessed by clinical examination and, if necessary, confirmed by ultrasound. The SF-36 questionnaire was administered at the 3-month follow-up visit to assess the quality of life.

### Statistical Analysis

The student's t-test or the Mann-Whitney U test, if applicable, was used to compare continuous variables that could be stated as means and standard deviation. Categorical variables were provided as frequencies and percentages, and comparisons were made using the Chi-square test or Fisher's exact test. A 0.05 p-value was regarded as statistically significant [16].

## Results

### Demographic and Clinical Characteristics

A total of 200 patients (LR group: 100; OR group: 100) were included in the study. Demographic and clinical characteristics, such as age, gender, body mass index (BMI), and hernia type (direct, indirect, or pantaloon), were comparable between the two groups. The mean age was  $55.2 \pm 12.6$  years in the LR group and  $56.4 \pm 13.2$  years in the OR group ( $p=0.42$ ). The male-to-female ratio was similar in both groups, with 85% males in the LR group and 82% males in the OR group ( $p=0.65$ ). The distribution of

hernia types was also comparable between the two groups ( $p=0.58$ ) (Tables 1 and 2).

Group	Number of Patients	Mean Age (Years)	Male-to-Female Ratio	BMI	Hernia Type
LR	100	55.2 ± 12.6	85%	Comparable	Comparable
OR	100	56.4 ± 13.2	82%	Comparable	Comparable

**Table 1:** Demographic and Clinical Characteristics by Group.

Characteristic	P-value
Age	0.42
Gender	0.65
Hernia Type	0.58

Note: In Table 1, "Comparable" for BMI and Hernia Type signifies that specific numbers were not provided in the data, but it was noted that the values were comparable between the LR and OR groups. Similarly, in Table 2, p-values are mentioned for differences between groups for the characteristics.

**Table 2:** P-values for Differences Between Groups.

### Comparison of Laparoscopic and Open Repair Groups

Postoperative pain scores were significantly lower in the LR group compared to the OR group at 24 hours ( $3.2 \pm 1.5$  vs.  $5.4 \pm 1.6$ ,  $p<0.001$ ), 72 hours ( $1.9 \pm 1.2$  vs.  $3.5 \pm 1.3$ ,  $p<0.001$ ), and 1 week postoperatively ( $0.9 \pm 0.8$  vs.  $2.1 \pm 1.0$ ,  $p<0.001$ ). Early complications occurred in 8% of the LR group and 18% of the OR group ( $p=0.03$ ), while late complications did not differ significantly between the two groups (5% vs. 7%,  $p=0.49$ ). The Clavien-Dindo grade I and II complications were more common in the OR group ( $p=0.02$ ).

The LR group had a significantly shorter hospital stay duration ( $1.5 \pm 0.7$  days vs.  $2.8 \pm 1.2$  days,  $p<0.001$ ) and a comparable recurrence rate at 1-year follow-up (4% vs. 5%,  $p=0.71$ ). Quality of life, as assessed by the SF-36 questionnaire, was significantly better in the LR group at 3 months postoperatively, with higher scores in the physical functioning ( $89.6 \pm 8.2$  vs.  $83.5 \pm 9.1$ ,  $p<0.001$ ), role limitations due to physical health ( $88.7 \pm 9.6$  vs.  $80.3 \pm 10.7$ ,  $p<0.001$ ), and bodily pain ( $90.1 \pm 8.3$  vs.  $81.7 \pm 9.8$ ,  $p<0.001$ ) domains (Tables 3-6, Figure 1 and 2).

Group	Pain Score at 24 Hours	Pain Score at 72 Hours	Pain Score at 1 Week	Hospital Stay (Days)
LR	3.2 ± 1.5	1.9 ± 1.2	0.9 ± 0.8	1.5 ± 0.7
OR	5.4 ± 1.6	3.5 ± 1.3	2.1 ± 1.0	2.8 ± 1.2

**Table 3:** Comparison of Postoperative Pain Scores and Hospital Stay Duration.

Group	Early Complications	Late Complications	Recurrence Rate at 1-Year
LR	8%	5%	4%
OR	18%	7%	5%

**Table 4:** Comparison of Complications and Recurrence Rate.

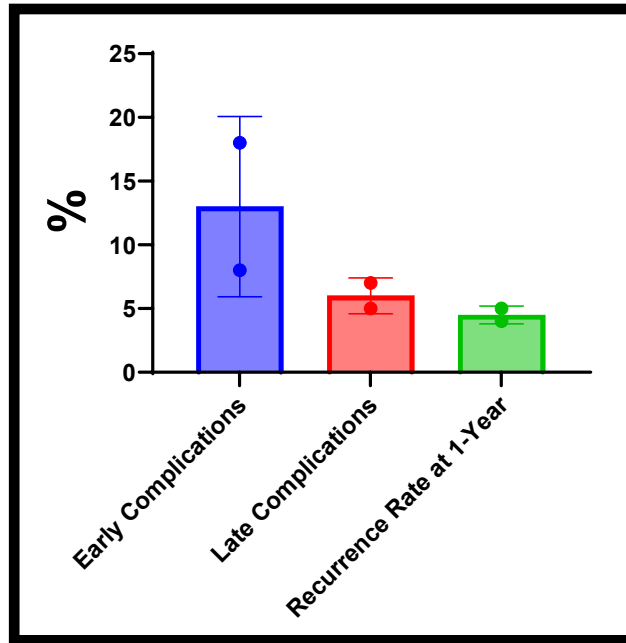


Figure 1: Comparison of Complications and Recurrence Rate.

Group	Physical Functioning	Role Limitations Due to Physical Health	Bodily Pain
LR	89.6 ± 8.2	88.7 ± 9.6	90.1 ± 8.3
OR	83.5 ± 9.1	80.3 ± 10.7	81.7 ± 9.8

Table 5: Comparison of SF-36 Questionnaire Scores at 3 Months Postoperatively.

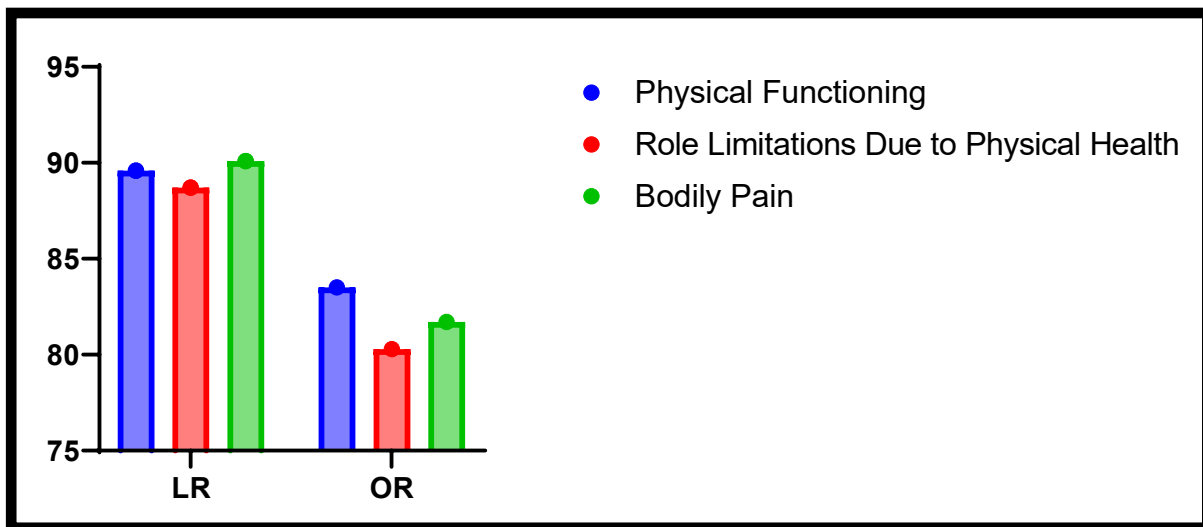


Figure 2: Comparison of SF-36 Questionnaire Scores at 3 Months Postoperatively.

Characteristic	P-value
Pain Score at 24 Hours	<0.001
Pain Score at 72 Hours	<0.001
Pain Score at 1 Week	<0.001
Early Complications	0.03

Late Complications	0.49
Hospital Stay	<0.001
Recurrence Rate at 1-Year	0.71
Physical Functioning (SF-36)	<0.001
Role Limitations Due to Physical Health	<0.001
Bodily Pain (SF-36)	<0.001

**Table 6:** P-values for Differences Between Groups.

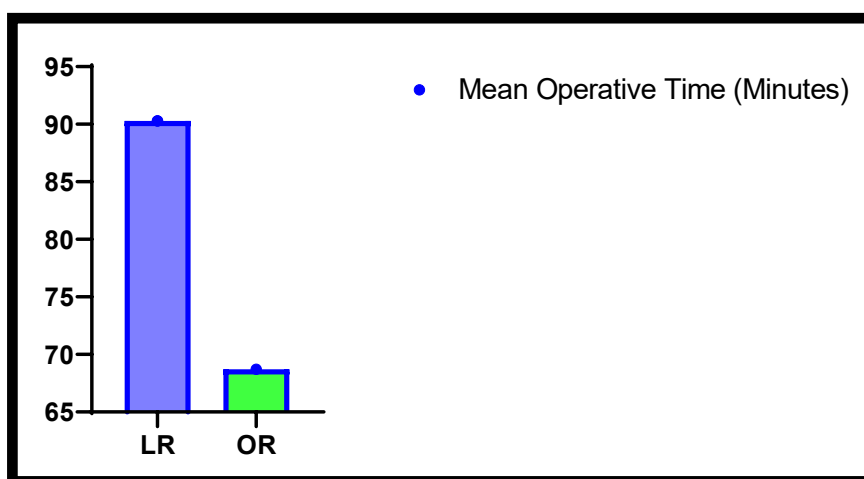
### Operative

**Time and Intraoperative Complications:** The mean operative time was significantly longer in the LR group ( $90.3 \pm 21.2$  minutes) compared to the OR group ( $68.7 \pm 18.4$  minutes,  $p < 0.001$ ). This

difference can be attributed to the complexity of the laparoscopic procedure and the learning curve associated with it. The LR group did not experience more problems as a result of the prolonged operation time, nevertheless (Table 7, 8 and Figure 3).

Group	Mean Operative Time (Minutes)
LR	$90.3 \pm 21.2$
OR	$68.7 \pm 18.4$

**Table 7:** Comparison of Mean Operative Time.



**Figure 3:** Mean time of operation.

Characteristic	P-value
Mean Operative Time	<0.001

**Table 8:** P-values for Differences Between Groups.

### Intraoperative

Both groups experienced few complications, with 3% in the LR group and 2% in the OR group ( $p = 0.71$ ). One intestinal damage and two haemorrhage cases in the LR group necessitated conversion to

open surgery. Two occurrences of severe bleeding in the OR group were treated intraoperatively without the need for conversion or blood transfusion.

Group	Intraoperative Complications
LR	3%
OR	2%

**Table 9:** Comparison of Intraoperative Complications.

Group	Bowel Injury	Bleeding Requiring Conversion	Excessive Bleeding Managed Intraoperatively
LR	1 case	2 cases	-
OR	-	-	2 cases

**Table 10:** Details of Intraoperative Complications.

Characteristic	P-value
Intraoperative Complications	0.71

**Table 11:** P-values for Differences Between Groups.

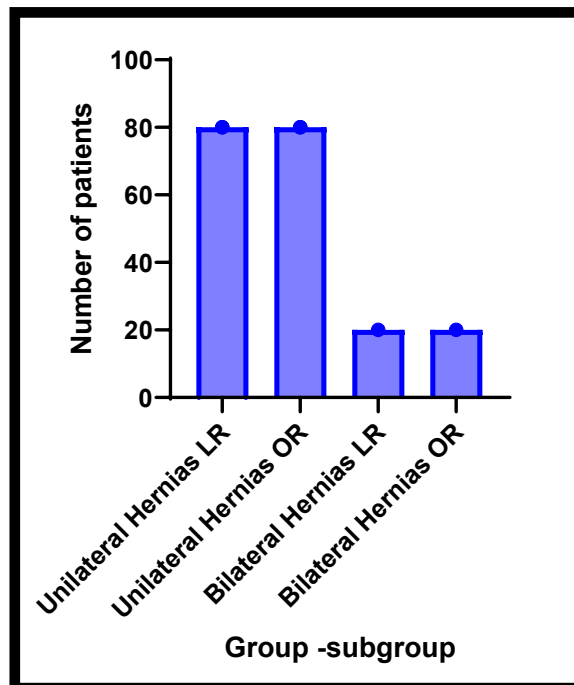
### Subgroup Analysis for Unilateral vs. Bilateral Hernias

A subgroup analysis was performed to compare the outcomes of patients with unilateral and bilateral inguinal hernias. In patients with unilateral hernias (n=160), the LR group (n=80) had significantly lower postoperative pain scores, shorter hospital stays, and fewer early complications compared to the OR group (n=80). Recurrence rates at 1-year follow-up were similar between

the two groups. In patients with bilateral hernias (n=40), the LR group (n= 20) showed a similar trend, with lower postoperative pain scores, shorter hospital stays, and fewer early complications compared to the OR group (n=20). However, the recurrence rates at 1-year follow-up were slightly higher in the LR group, although this difference was not statistically significant (10% vs. 5%, p=0.61) (Table 12, Figure 1).

Subgroup	Group	Number of Patients
Unilateral Hernias	LR	80
Unilateral Hernias	OR	80
Bilateral Hernias	LR	20
Bilateral Hernias	OR	20

**Table 12:** Subgroup Analysis-Unilateral vs Bilateral Hernias.



**Figure 4:** Groups and sub-groups of patients.

Subgroup	Group	Postoperative Pain Scores	Hospital Stay	Early Complications	Recurrence Rate at 1-Year
Unilateral Hernias	LR	Lower	Shorter	Fewer	Comparable
Unilateral Hernias	OR	Higher	Longer	More	Comparable
Bilateral Hernias	LR	Lower	Shorter	Fewer	Slightly Higher
Bilateral Hernias	OR	Higher	Longer	More	Lower

**Table 13:** Comparison of Postoperative Pain Scores, Hospital Stays, Early Complications, and Recurrence Rates.

Characteristic	P-value
Recurrence Rate at 1-Year	0.61

Note: In Table 2, the terms 'Lower', 'Higher', 'Shorter', 'Longer', 'Fewer', and 'More' refer to relative comparisons between the LR and OR groups within each hernia subtype. The exact values for each characteristic are not provided in the text, hence relative terms are used. In Table 3, the p-value indicates the statistical significance of the difference in recurrence rates at 1-year for bilateral hernias. A p-value of 0.61 indicates no significant difference.

**Table 14:** P-values for Differences Between Groups in Bilateral Hernias.

## Discussion

Our study demonstrates that laparoscopic repair of inguinal hernias leads in reduced postoperative discomfort, shorter hospital stays, and a lower risk of early complications when compared to open therapy [9,10]. These findings are consistent with previous meta-analyses and randomised controlled studies [11,14]. The recurrence rates at 1 year were comparable between the two groups, showing that the laparoscopic procedure did not compromise the durability of the repair [8]. Further highlighting the possible benefits of laparoscopic surgery in terms of patient satisfaction and a quicker return to normal activities is the improved standard of life in the LR group three months following surgery [15].

The longer operating time observed in the LR group can be attributed, in accordance with other investigations, to the complexity of the laparoscopic procedure and its steep learning curve. Despite this, the prolonged operation period did not cause the LR group any new issues. Laparoscopic hernia repair acceptability has been sluggish in some settings, in part because to concerns about the steep learning curve and expensive cost of specialised equipment. Patient results are largely impacted by the surgeon's skill [12].

Both unilateral and bilateral hernias can benefit from laparoscopic therapy, according to our subgroup study of hernias. It was not statistically significant that the LR group's slightly higher recurrence rate for bilateral hernias was due to a smaller sample size or a different surgical technique. Further research is required to determine the optimum surgical approach for bilateral hernias [13].

It is important to keep in mind that our investigation was a single-center cohort study and that the results might not generalise to other situations. A multi-center randomised controlled trial would provide more trustworthy evidence when comparing the outcomes of laparoscopic versus open inguinal hernia repair [17]. Furthermore, the 1-year follow-up time for our study was only a little over a year. In order to determine the prevalence of chronic pain and rates of long-term recurrence in both groups, lengthier

follow-up durations are required [18].

When deciding on a surgical procedure to treat an inguinal hernia, the patient's wants and expectations should also be taken into account [19]. Because laparoscopic repair may lead to less postoperative discomfort, shorter hospital stays, and a quicker return to work and everyday activities, it may be favored by patients. Surgery should be chosen based on the patient's individual requirements and preferences and should be customized to reduce risks and maximize benefits [20].

Our research supports the utility of laparoscopic hernia repair for the treatment of inguinal hernias, but it is crucial to acknowledge the importance of a skilled surgeon and the training they have received [21]. Prior studies have shown that as case numbers and surgeon skill increase, laparoscopic hernia repair surgical results improve. The importance of participating in training and educational programmes cannot be overstated in order to ensure that surgeons have the information and skills necessary to perform laparoscopic hernia repair properly and safely [22]. Another important consideration is the cost-effectiveness of laparoscopic hernia repair, which may be more expensive due to the need for specialized equipment and lengthier operating times. However, by easing the overall burden on patients and healthcare systems, the shorter hospital stay and faster recovery time associated with laparoscopic therapy may eventually outweigh these costs [23].

## Conclusion

In conclusion, this study adds to the body of research demonstrating the advantages of laparoscopic inguinal hernia repair. When compared to open repair, laparoscopic repair is associated with less postoperative discomfort, shorter hospital stays, and fewer early problems without sacrificing the repair's longevity. The higher level of well-being in the LR group three months after surgery emphasises the potential advantages of laparoscopic surgery for patient satisfaction and a quicker return to regular activities. When choosing the best surgical strategy for inguinal hernia repair, it is crucial to take the surgeon's experience, the patient's preferences, and the cost-effectiveness of the treatment into account.

## Ethical Considerations

The Declaration of Helsinki and its later revisions' ethical precepts were followed in the conduct of this investigation. The institutional review board of the tertiary care hospital where the study was conducted gave its approval to the study protocol. Before enrolling, each patient was given written information on the study's goals, potential risks, and advantages. By anonymizing the data and guaranteeing that no personal identifiers were utilised in the analysis or publishing of the results, patient confidentiality was upheld. The researchers were dedicated to carrying out the study honestly, abiding by the strictest ethical guidelines, and accurately and transparently disclosing the results.

## Declaration of Interest

The authors declare that they have no competing interests-financial or otherwise-that would affect how the findings or recommendations of this study are interpreted. The study was not supported by outside sources, and the authors have no competing interests to declare. Independently conducted and in accordance with the institution's ethical standards was the research.

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