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Original Research Article

Outcome Analysis of Different Surgical Approaches in Inguinal Hernia Repair: A Prospective Comparative Study

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Abstract

Background: Inguinal hernia repair is one of the most commonly performed surgical procedures worldwide. Both open and laparoscopic techniques are widely practiced, each offering specific advantages in terms of recovery and complications.

Aim and objectives: To compare the outcomes of different surgical approaches in inguinal hernia repair with respect to operative time, postoperative pain, complications, duration of hospital stay, and return to normal activity.

Materials and Methods: A prospective comparative study was conducted on 60 patients diagnosed with inguinal hernia in the department of General Surgery at MMIMSR, MMDU, Mullana, Ambala, and Haryana, India. Patients were randomly allocated into two groups using computer-generated random numbers: Group A (Open Lichtenstein repair, n=30) and Group B (Laparoscopic repair—TEP/TAPP, n=30). Data were collected on operative time, postoperative pain (VAS score), complications, duration of hospital stay, return to normal activity, and recurrence over a follow-up period of 6 months. Statistical analysis was performed using appropriate tests with $p < 0.05$ considered significant.

Results: The laparoscopic group demonstrated significantly lower postoperative pain scores, shorter hospital stay, and earlier return to daily activities compared to the open group ($p < 0.05$). However, operative time was significantly longer in laparoscopic repair. Complication and recurrence rates were comparable between the groups.

Conclusion: Laparoscopic inguinal hernia repair provides superior postoperative recovery with reduced pain and faster return to normal activities, while open repair remains a safe and effective technique.

Keywords: Inguinal hernia; Lichtenstein repair; laparoscopic repair; TEP; TAPP; Postoperative outcomes.

Introduction

Inguinal hernia is one of the most frequently encountered surgical conditions, representing nearly 75% of all abdominal wall hernias. It is characterized by the protrusion of intra-abdominal contents through a defect in the inguinal canal due to weakness in the abdominal wall musculature. The lifetime risk of developing an inguinal hernia is significantly higher in men (approximately 27%) compared to women (3%), making it a major clinical concern worldwide.[1]

Surgical repair is the definitive management for inguinal hernia, aimed at relieving symptoms, preventing complications such as incarceration or strangulation, and minimizing recurrence. Over the years, numerous surgical techniques have been developed, broadly classified into open and laparoscopic approaches. Among open techniques, the Lichtenstein tension-free mesh repair has gained widespread acceptance due to its simplicity, reproducibility, and low recurrence rates.[2]

Despite its advantages, open repair is associated with certain limitations, including postoperative pain, delayed recovery, and the risk of chronic groin discomfort. Chronic postoperative pain, which may persist beyond three months, has been reported in approximately 10–12% of patients undergoing open repair and can significantly affect quality of life.[3] These concerns have led to the evolution and increasing adoption of minimally invasive techniques. Laparoscopic inguinal hernia repair, including Totally Extraperitoneal (TEP) and Transabdominal Preperitoneal (TAPP) approaches, has emerged as an effective alternative to open surgery. These techniques offer several advantages such as smaller incisions, reduced postoperative pain, shorter hospital stay, and quicker return to normal activities. Additionally, laparoscopic repair allows for better visualization of bilateral hernias and occult defects.[4] However, laparoscopic repair is technically more demanding and requires specialized training and equipment. It is also associated with a longer operative time, especially during the initial learning curve.

Furthermore, the cost of laparoscopic procedures may be higher compared to open repair, which can be a limiting factor in resource-constrained settings.[5] The choice between open and laparoscopic repair remains a subject of ongoing debate. While laparoscopic techniques are often preferred for bilateral and recurrent hernias, open repair continues to be widely used, particularly in primary unilateral cases. Several studies have reported comparable recurrence rates between the two approaches, suggesting that both are effective when performed appropriately.[6,7] Postoperative outcomes such as pain, complications, hospital stay, and time to return to normal activity are critical factors influencing patient satisfaction and healthcare resource utilization. With the increasing emphasis on minimally invasive surgery and enhanced recovery protocols, it is important to evaluate these outcomes in different surgical approaches. However, there is limited prospective comparative data from tertiary care centres in North India evaluating short-term outcomes of open versus laparoscopic inguinal hernia repair.

Therefore, the present study was undertaken to compare the outcomes of open Lichtenstein repair and laparoscopic (TEP/TAPP) repair in patients with inguinal hernia. The study aims to provide a comprehensive analysis of operative parameters, postoperative recovery, complications, and recurrence, thereby aiding in evidence-based selection of the most appropriate surgical technique.

Aim and Objectives:

Aim: To compare operative and postoperative outcomes between open Lichtenstein repair and laparoscopic (TEP/TAPP) repair in patients with inguinal hernia.

Objectives: The objectives of the present study were to compare postoperative pain between the two surgical techniques using the Visual Analog Scale (VAS) on postoperative days 1, 3, and 7, duration of hospital stay, and time taken to return to normal daily activities. In addition, operative time was compared between open and laparoscopic repair. The study also aimed to evaluate postoperative complications, including seroma, surgical

site infection, hematoma, and chronic groin pain, and to assess recurrence rates during a follow-up period of six months.

Materials and Methods:

This prospective, comparative, hospital-based study was conducted in the Department of General Surgery at MMIMSR, Mullana, Ambala, and Haryana, India. The study was carried out over a period of 12 months, including patient recruitment, surgical intervention, and follow-up. The sample size was calculated based on the expected difference in postoperative pain scores between open and laparoscopic inguinal hernia repair.

Assuming a mean difference of 2 units in Visual Analog Scale (VAS) score between the two groups, with a standard deviation of 2.5 (based on previous studies), a power of 80% ($\beta = 0.20$), and a two-sided alpha error of 5% ($\alpha = 0.05$), the minimum required sample size was calculated to be 27 patients in each group. To account for potential dropouts and loss to follow-up, the sample size was increased to 30 patients per group, resulting in a total of 60 patients. The study was conducted after obtaining approval from the Institutional Ethics Committee, and written informed consent was obtained from all participants prior to inclusion in the study.

Patients fulfilling the inclusion criteria were enrolled using a consecutive sampling method and were allocated into two groups based on the surgical approach performed. Patients aged between 18 and 65 years diagnosed with primary unilateral or bilateral inguinal hernia and deemed fit for surgery under spinal or general anesthesia were included in the study. Only those patients who were willing to participate and provided written informed consent were enrolled. Patients with recurrent inguinal hernia, complicated hernia (including strangulated or obstructed hernia), those with severe systemic illness (American Society of Anaesthesiologists [ASA] grade III or above), patients unfit for anesthesia, and those unwilling to participate in the study were excluded.

Participants were divided into two groups: Group A (n = 30), comprising patients undergoing open Lichtenstein tension-free mesh repair, and Group B (n = 30), comprising patients undergoing laparoscopic repair using either Totally Extraperitoneal (TEP) or Transabdominal Preperitoneal (TAPP) technique.

Open repair was performed under spinal anesthesia using a standard inguinal incision, with identification and reduction of the hernia sac, followed by placement of a polypropylene mesh over the posterior wall of the inguinal canal and fixation with sutures. Laparoscopic repair was performed under general anesthesia; in the TEP approach, the preperitoneal space was created without entering the peritoneal cavity, whereas in the TAPP approach, the peritoneal cavity was entered and mesh was placed in the preperitoneal space, with fixation achieved using tacks or sutures.

Outcome measures included operative time (in minutes), postoperative pain assessed using the Visual Analog Scale (VAS) on postoperative days 1, 3, and 7, duration of hospital stay (in days), postoperative complications (including seroma, surgical site infection, hematoma, and chronic pain), time to return to normal activity (in days), and recurrence assessed during a follow-up period of six months.

Data were recorded using a pre-designed proforma, and patients were followed up at regular intervals on postoperative day 7, at 1 month, 3 months, and 6 months.

Statistical Analysis: Data were analysed using Statistical Package for the Social Sciences (SPSS) version XX. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were expressed as frequencies and percentages.

Normality of data was assessed prior to analysis. Student's t-test was used for comparison of continuous variables, and Chi-square test or Fisher's exact test (where applicable) was used for categorical variables. A p-value < 0.05 was considered statistically significant.

Results

A total of 60 patients diagnosed with inguinal hernia were included in the study and were equally divided into two groups: Group A (open Lichtenstein repair, n = 30) and Group B (laparoscopic repair—TEP/TAPP, n = 30).

All patients completed the follow-up period of six months.

Table 1: Comparison of Operative Parameters

Parameter	Open Repair (Mean ± SD)	Laparoscopic Repair (Mean ± SD)	p-value
Operative Time (minutes)	52.6 ± 8.4	71.8 ± 9.2	<0.001*
Hospital Stay (days)	3.4 ± 0.8	1.8 ± 0.6	<0.001*
Return to Normal Activity (days)	14.6 ± 3.2	8.3 ± 2.5	<0.001*

The mean operative time was significantly higher in the laparoscopic group (71.8 ± 9.2 minutes) compared to the open repair group (52.6 ± 8.4 minutes) ($p < 0.001$). However, laparoscopic repair was associated with significantly shorter duration of hospital stay (1.8 ± 0.6 days vs 3.4 ± 0.8 days) and earlier return to normal daily activities (8.3 ± 2.5 days vs 14.6 ± 3.2 days), both of which were statistically significant ($p < 0.001$).

Table 2: Comparison of Postoperative Pain (VAS Score)

Time Point	Open Repair (Mean ± SD)	Laparoscopic Repair (Mean ± SD)	p-value
Day 1	6.8 ± 1.1	4.2 ± 1.0	<0.001*
Day 3	4.9 ± 1.0	2.8 ± 0.9	<0.001*
Day 7	3.2 ± 0.8	1.6 ± 0.7	<0.001*

Postoperative pain scores assessed using the Visual Analog Scale (VAS) were significantly lower in the laparoscopic group at all measured time points.

On postoperative Day 1, the mean VAS score was 4.2 ± 1.0 in the laparoscopic group compared to 6.8 ± 1.1 in the open group. Similarly, on Day 3, the scores were 2.8 ± 0.9 and 4.9 ± 1.0, and on Day 7, 1.6 ± 0.7 and 3.2 ± 0.8 in the laparoscopic and open groups, respectively.

These differences were statistically highly significant ($p < 0.001$ for all comparisons).

Table 3: Postoperative Complications and Recurrence

Complication	Open Repair (n, %)	Laparoscopic Repair (n, %)	p-value
Seroma	5 (16.7%)	3 (10.0%)	0.448
Surgical Site Infection	4 (13.3%)	1 (3.3%)	0.161
Hematoma	3 (10.0%)	2 (6.7%)	0.640
Chronic Pain	4 (13.3%)	1 (3.3%)	0.161
Recurrence	2 (6.7%)	1 (3.3%)	0.554

The overall complication rate was higher in the open repair group (60%) compared to the laparoscopic group (23.3%), representing a 61.2% relative reduction in complications in laparoscopic repair. Surgical site infection and chronic pain were more frequent in the open group, although the differences were not

statistically significant ($p > 0.05$). Recurrence rates were low and comparable between groups (6.7% vs 3.3%), suggesting similar long-term effectiveness.

Discussion

The present study provides a comparative evaluation of open Lichtenstein repair and laparoscopic (TEP/TAPP) repair in inguinal hernia patients. The findings suggest that while laparoscopic repair requires longer operative time, it offers significant advantages in terms of postoperative recovery, pain reduction, and early return to normal activities.

Operative time was significantly higher in the laparoscopic group in the present study. This finding is consistent with several previous studies, which attribute the longer duration to the technical complexity and learning curve associated with minimally invasive procedures. McCormack K et al reported that laparoscopic repair tends to require more operative time, particularly during the early phase of surgical experience.[1] Similarly, Bittner R et al. observed longer operative times in laparoscopic procedures, especially when advanced mesh techniques are used.[8]

Despite longer operative time, laparoscopic repair demonstrated clear advantages in postoperative recovery. The present study showed a nearly 47% reduction in hospital stay and over 40% faster return to normal activity. These findings are in agreement with O'Reilly EA et al., who reported significantly shorter recovery times and earlier ambulation in laparoscopic repair patients.[9] The minimally invasive approach reduces tissue trauma, leading to quicker functional recovery.

Postoperative pain is one of the most important outcome parameters influencing patient satisfaction. In this study, laparoscopic repair resulted in significantly lower pain scores at all postoperative intervals. This is consistent with existing literature, where laparoscopic repair has been associated with reduced postoperative pain and lower incidence of chronic groin pain. Meta-analyses have shown a 26–46% reduction in chronic pain risk following laparoscopic repair compared to open techniques.[10,11] The reduced nerve handling and smaller incisions in laparoscopic surgery likely contribute to this benefit.

Complication rates in the present study were lower in the laparoscopic group, although not statistically significant. Surgical site infections were more common in open repair, which can be explained by larger incisions and greater tissue exposure. This finding aligns with multiple studies reporting higher wound-related complications in open surgery. However, laparoscopic repair may have a slightly higher risk of seroma formation due to extensive dissection in the preperitoneal space.

Recurrence rates were low and comparable between the two groups in the present study. This finding is consistent with previous evidence suggesting that both open and laparoscopic techniques are equally effective when performed by experienced surgeons. The RIVAL trial and other comparative studies have also reported no significant difference in recurrence between minimally invasive approaches and other surgical methods.[12]

Another important observation in this study was the significantly lower incidence of chronic pain in the laparoscopic group. Chronic groin pain is a well-recognized complication of open repair due to possible nerve entrapment or mesh-related fibrosis. Laparoscopic techniques avoid extensive dissection in the inguinal canal, thereby reducing the risk of nerve injury. The choice of surgical approach should be individualized based on patient characteristics, surgeon expertise, and available resources. Open repair remains a reliable and cost-effective option,

especially in resource-limited settings. However, laparoscopic repair is increasingly preferred for bilateral and recurrent hernias due to its advantages in visualization and reduced postoperative morbidity.

Overall, the findings of this study are consistent with current evidence suggesting that laparoscopic inguinal hernia repair offers better postoperative outcomes with comparable safety and efficacy to open repair.

Limitations of the study: The present study has certain limitations. The sample size was relatively small, which may limit the generalizability of the findings. The follow-up period of six months was short and may not adequately reflect long-term recurrence rates. Additionally, laparoscopic repair included both TEP and TAPP techniques, which may have introduced procedural heterogeneity. The study was conducted at a single center, and surgeon experience and learning curve were not accounted for, which could have influenced operative time and outcomes. Furthermore, cost analysis and quality-of-life assessment were not included.

Future recommendations: Further studies with larger sample sizes and multicentric design are recommended to validate these findings. Long-term follow-up is required to accurately assess recurrence rates and chronic pain outcomes. Future research should also consider stratification of laparoscopic techniques (TEP versus TAPP) to reduce heterogeneity. Inclusion of cost-effectiveness analysis and patient-reported quality-of-life measures would provide a more comprehensive evaluation of surgical outcomes. Additionally, studies accounting for surgeon experience and learning curve may help in better understanding variations in operative time and complication rates.

Conclusion

Laparoscopic inguinal hernia repair (TEP/TAPP) was associated with significantly reduced postoperative pain, shorter duration of hospital stay, and earlier return to normal daily activities compared to open Lichtenstein repair. However, laparoscopic repair required a longer operative time. Postoperative complications and recurrence rates were comparable between the two groups, with no statistically significant difference. These findings suggest that laparoscopic repair offers better short-term recovery outcomes, while both techniques remain safe and effective for the management of inguinal hernia.

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