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Original Research Article

Early outcomes after TAPP vs. Lichtenstein repair: a prospective cohort from a resource limited surgical unit in South India

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ABSTRACT

Background: Inguinal hernia repair is a globally prevalent surgical procedure. Despite declining age-standardized prevalence, the absolute global burden is increasing, necessitating optimized surgical strategies. Open Lichtenstein and laparoscopic (TAPP/TEP) mesh repairs represent the two dominant surgical approaches, each with distinct perioperative profiles and patient outcomes. This study prospectively compared these techniques to provide evidence-based guidance for surgical decision-making in resource-constrained healthcare settings.

Methods: A prospective observational comparative study was conducted at a tertiary care teaching hospital in Chennai, India, between July 2022 to December 2023. Sixty eligible patients (59 male, 1 female; mean age ~45 years) with inguinal hernias were allocated to Lichtenstein open repair (n=30) or TAPP laparoscopic repair (n=30) based on clinical suitability patient factors, and surgeon discretion. Primary outcomes included operative time, postoperative pain (Visual Analog Scale-VAS at 12, 24, 48 hours), length of hospital stay, and time to return to work. Secondary outcomes were complications (infection, seroma, hematoma). Statistical analysis employed independent t-tests and chi-square/Fisher's exact tests ($p<0.05$ significant).

Results: Operative time was significantly longer for TAPP (113.33±12.41 minutes) compared to Lichtenstein (61.50±11.23 minutes; $p<0.001$). However, the TAPP group demonstrated significantly lower VAS pain scores at 12 hours (4.83±0.70 vs. 7.60±0.77), 24 hours (2.97±0.72 vs. 5.03±0.85), and 48 hours (1.73±0.45 vs. 3.40±0.93; all $p<0.001$). Hospital stay was shorter for TAPP (4.97±0.85 days vs. 6.70±1.75 days; $p<0.001$), and return to work was faster (10.30±1.54 days vs. 18.50±2.80 days; $p<0.001$). Complication rates (infection, seroma, hematoma) were low and comparable between groups (infection: $p=0.492$; overall complications <5%). Direct hernias were more frequently repaired laparoscopically ($p=0.042$).

Conclusion: While laparoscopic (TAPP) inguinal hernia repair requires significantly longer operative time and expertise, it offers substantial advantages in the early postoperative recovery, including reduced pain, shorter hospital stay, and faster return to normal activities, with equivalent safety profile compared to open Lichtenstein repair. These benefits support the role of laparoscopic repair, particularly in younger patients and when rapid functional recovery is prioritized, despite its technical demands.

Keywords: Inguinal hernia, Herniorrhaphy, Laparoscopic repair, TAPP, Lichtenstein repair, Open surgical repair, Minimally invasive surgery, Comparative study

INTRODUCTION

Inguinal hernia repair remains one of the most commonly performed general surgical procedures worldwide, with over 20 million repairs performed annually globally. The Global Burden of Disease (GBD) 2019 report reveals a significant 36% increase in global hernia cases from 1990 to 2019, despite a 16.46% decline in age-standardized

prevalence rates.[1] This epidemiological paradox reflects population growth and aging, with the condition showing particular predilection for male gender, older age, smoking, and strenuous physical activity. Specifically, in the Indian context, hernia cases increased from 3.99 million to 4.10 million during the same period, accompanied by a 43% reduction in age-standardized prevalence rates but rising incidence in both genders. These findings underscore the growing global burden requiring optimized surgical management strategies.[2]

The condition, characterized by protrusion of abdominal contents through the inguinal canal, has undergone significant evolution in surgical approaches.[3] Modern techniques predominantly utilize mesh reinforcement, reducing recurrence rates from 10-15% with traditional repairs to under 5% currently.[4] Contemporary surgical practice presents surgeons with two principal evidence-based options: open tension-free mesh repair (Lichtenstein technique) and minimally invasive laparoscopic approaches including TEP and TAPP techniques. While both demonstrate excellent efficacy and low recurrence rates, they differ substantially in perioperative characteristics, recovery profiles, resource requirements, and learning curves.[5,6]

Laparoscopic techniques, introduced in the early 1990s, offer theoretical and practical advantages including smaller incisions, reduced tissue trauma, and enhanced posterior anatomy visualization.[7] However, they require specialized equipment, advanced laparoscopic skills, and expertise that may limit universal adoption, particularly in resource-constrained settings. Multiple systematic reviews and meta-analyses demonstrate laparoscopic approaches provide reduced postoperative pain and 2-3 day faster recovery, but with 15-30 minute longer operative times and unique risks including port-site complications and potential for major vascular or visceral injury during trocar insertion.[8,9] Conversely, open repair maintains technical simplicity and universal applicability but is associated with higher rates of chronic groin pain (10-15%) that can significantly impact quality of life.[10]

The optimal surgical approach for inguinal hernia repair remains debated, particularly in developing countries where healthcare resources are limited and patient populations may have different socioeconomic profiles affecting recovery patterns. The surgical management of this condition presents a significant challenge, especially among the economically active population in low- and middle-income countries such as India. Current data from the GBD study underscore a steady increase in incidence rates, set against a backdrop of limited healthcare infrastructure and resources.

Given the paucity of comparative data from Indian healthcare settings and the unique challenges of resource allocation in developing countries, we aimed to prospectively compare the clinical outcomes and resource utilization of open mesh technique and laparoscopic repair for inguinal hernia repair. The primary objective was to compare operative time, postoperative pain, length of hospital stays, return to normal activities and associated complications between these two approaches. By evaluating these critical parameters in our specific healthcare context, the study aims to guide evidence-based and context-sensitive clinical decisions that reflect both patient characteristics and system-level limitations. The results are anticipated to enhance the existing evidence base, contributing to more informed surgical strategies in settings characterized by resource constraints and rising case volumes.

METHODS

Study design and setting

This prospective, observational, comparative study was conducted in the Department of General Surgery at a tertiary care teaching hospital in Chennai serving a large urban and rural population. The study was conducted between July 2022 to December 2023 and received approval from the Institutional Ethics Committee. The objective was to evaluate and compare perioperative and postoperative outcomes between Lichtenstein open mesh repair and laparoscopic hernia repair techniques among patients presenting with inguinal hernia.

Study population

Male and female patients aged between 12 and 80 years presenting with inguinal hernia were eligible for inclusion. Additional inclusion criteria were incomplete or recurrent inguinal hernias, and written informed consent for surgical intervention. Patients were excluded if they were younger than 12 or older than 80 years, pregnant, presented with incarcerated, scrotal hernias, or obstructed hernia, or were medically unfit for surgery due to uncontrolled chronic asthma, severe chronic obstructive pulmonary disease (COPD), or significant cardiac disease precluding general anesthesia.

Sample size and group allocation

Out of 60 patients enrolled, a total of 50 eligible patients were included and allocated into two equal groups of 25 each. Group A underwent open Lichtenstein mesh repair, while Group B underwent laparoscopic hernia repair (TAPP approach exclusively for standardization), based on patient suitability, patient preference after informed discussion, and surgeon discretion.

Study procedure

All patients underwent comprehensive preoperative evaluation, including a detailed history, physical examination, and baseline investigations: complete blood count with erythrocyte sedimentation rate (ESR), fasting blood sugar and postprandial glucose levels, renal and liver function tests, electrocardiogram (ECG), chest X-

ray, HIV 1 & 2 screening, hepatitis B surface antigen, and abdominal ultrasonography. Patients with significant comorbidities underwent additional cardiac or pulmonary evaluation as clinically indicated. Patients were optimized for surgery and detailed informed consent was obtained including discussion of risks, benefits, and alternatives for both surgical approaches.

All patients received standardized perioperative care including a single preoperative antibiotic dose of cefazolin 1g intravenously 30 minutes before skin incision and continued for three days postoperatively as per institution protocol. Surgical procedures were carried out under spinal anesthesia or general anesthesia using standard techniques. Open mesh repairs were performed by the Lichtenstein method using polypropylene mesh with appropriate overlap and fixation. Laparoscopic hernia repairs followed the TAPP approach exclusively, performed by surgeons with >50 prior laparoscopic hernia repairs to minimize learning curve effects.

Detailed operative notes were maintained including hernia size, type (direct/indirect), mesh size used, fixation method, and any intraoperative complications. Postoperatively, patients were assessed for pain using the VAS scored from 0 (no pain) to 10 (worst possible pain) and monitored for complications such as wound infection, seroma, hematoma, and bleeding.

Pain assessment was performed by nursing staff blinded to the surgical technique at standardized time points. Recovery metrics included duration of surgery (in minutes), length of hospital stay (in days), and time to return to routine activity (in days). Return to work was defined as resumption of pre-operative occupational activities without restrictions. Pain levels were recorded on the VAS and classified according to the standardized pain intensity scale (0-3: mild, 4-6: moderate, 7-10: severe).

Statistical analysis

Data were entered into Microsoft Excel and analyzed using IBM SPSS version (X). Continuous variables, including duration of surgery, VAS pain scores, hospital stay, and time to return to daily activity, were expressed as means±standard deviation and compared using independent sample t-tests. Categorical variables, including the presence of wound infection, seroma, hematoma, and postoperative bleeding, were expressed as frequencies and proportions and compared between groups using the chi-square test or Fisher's exact test, as appropriate. A p value of <0.05 was considered statistically significant.

RESULTS

A total of 60 patients were enrolled in the study, comprising 59 males (98.3%) and 1 female (1.7%) (Table 1). The mean age was 44.7±11.2 years (range: 18-75 years). The majority presented with right-sided inguinal hernia (56.7%), followed by left-sided (40%) and bilateral hernias (3.3%). Direct hernias were slightly more common (53.3%) than indirect hernias (46.7%). Baseline characteristics were comparable between groups except for age, with the Lichtenstein group being significantly older (48.50±11.11 vs. 40.93±10.45 years, p=0.009).

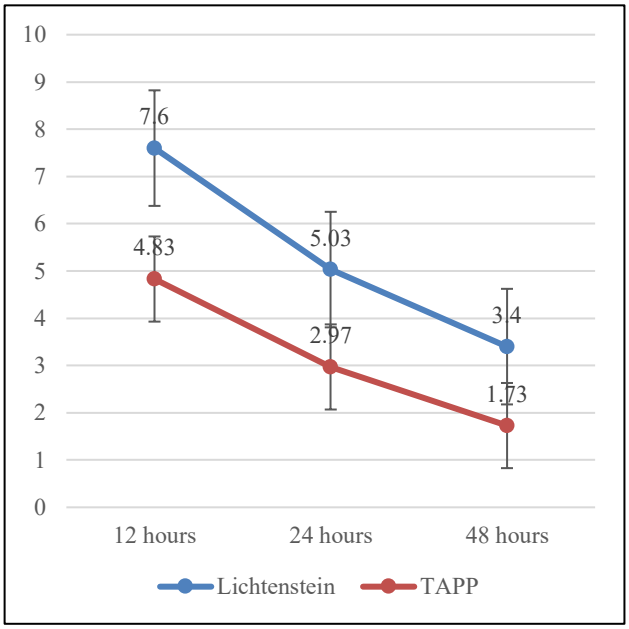

Figure 1: VAS pain scores over time. Lower scores indicate less pain. TAPP consistently shows lower pain scores across all time points.

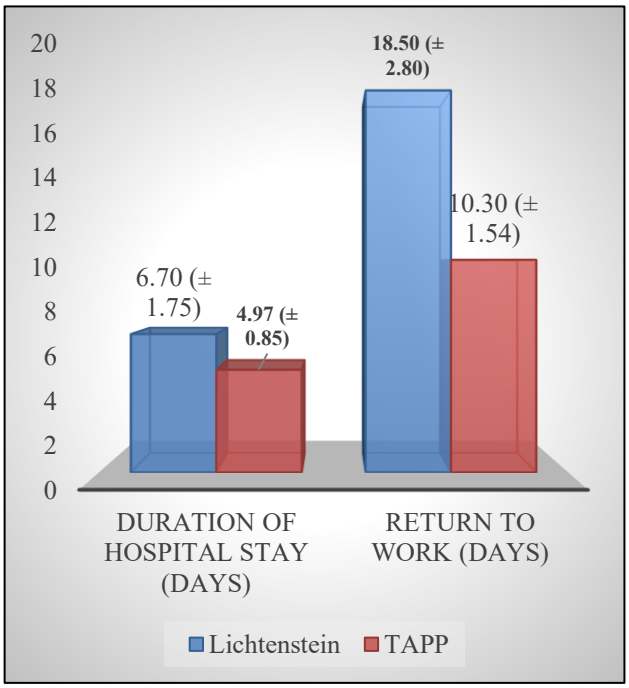

Figure 2: Recovery timeline comparison: TAPP shows significantly shorter hospital stay and faster return to work compared to Lichtenstein repair.

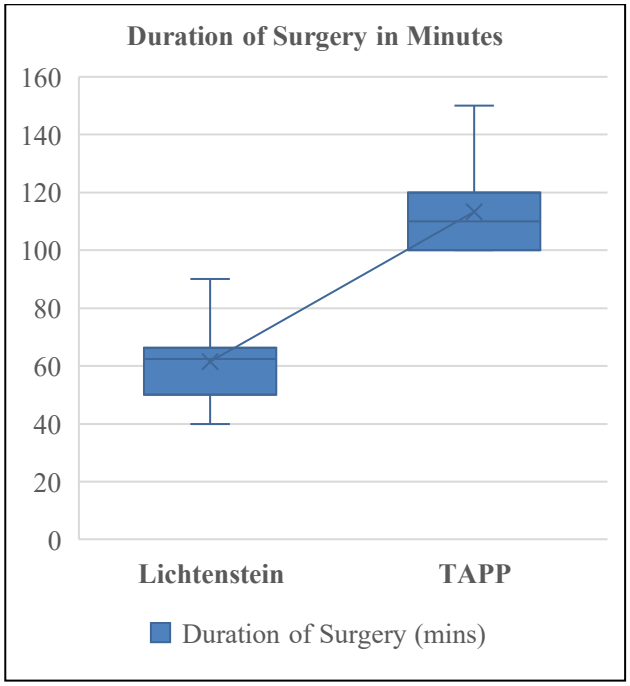

Figure 3: Operative time comparison-TAPP requires longer operative time (nearly double) compared to Lichtenstein repair.

Comparison between the two surgical techniques revealed several statistically significant differences (Table 2). The mean operative time was significantly longer for TAPP (113.33±12.41 minutes) compared to the Lichtenstein procedure (61.50±11.23 minutes, p<0.001). However, patients in the TAPP group experienced significantly lower postoperative pain scores at 12, 24, and 48 hours (all p<0.001), a shorter duration of hospital stay (4.97±0.85 vs. 6.70±1.75 days, p<0.001), and an earlier return to work (10.30±1.54 vs. 18.50 ± 2.80 days, p<0.001).

A statistically significant association was observed between the type of hernia and the surgical procedure used (p=0.042), with direct hernias more frequently managed by TAPP (62.5% vs. 37.5% for Lichtenstein) (Table 3). Postoperative complications, including infection, seroma, and hematoma, were infrequent and comparable between the groups with no statistically significant differences (p>0.05 for all comparisons).

Overall complication rate was 5% (3/60), with 2 infections in the Lichtenstein group and 1 seroma in the TAPP group. No major complications such as vascular injury, bowel injury, or mesh infection occurred in either group.

Table 1: Demographic and clinical profile of study population (n=60).

Variable	Subgroup	Frequency (N)	Proportion (%)
Gender	Male	59	98.3
	Female	1	1.7
Side of hernia	Right	34	56.7
	Left	24	40
	Bilateral	2	3.3
Type of hernia	Direct	32	53.3
	Indirect	28	46.7
Infection	Present	2	3.3
	Absent	58	96.7
Seroma	Present	1	1.7
	Absent	59	98.3
Hematoma	Present	1	1.7
	Absent	59	98.3

Table 2: Comparison of operative and postoperative parameters between Lichtenstein and TAPP groups.

Variable	Lichtenstein (Mean±SD)	TAPP (Mean±SD)	P value
Age (in years)	48.50±11.11	40.93±10.45	0.009*
Duration of surgery (min)	61.50±11.23	113.33±12.41	<0.001*
VAS pain score-12 hours	7.60±0.77	4.83±0.70	<0.001*
VAS pain score–24 hours	5.03±0.85	2.97±0.72	<0.001*
VAS pain score–48 hours	3.40±0.93	1.73±0.45	<0.001*
Duration of hospital stay (days)	6.70±1.75	4.97±0.85	<0.001*
Return to work (days)	18.50±2.80	10.30±1.54	<0.001*

*Statistically significant at p < 0.05.

Table 3: Association between surgical approach and patient characteristics.

Variable	Subgroup	Lichtenstein (N, %)	TAPP (N, %)	P value
Gender	Male	30 (50.8%)	29 (49.2%)	0.9
	Female	0 (0.0%)	1 (100.0%)	
Side of hernia	Right	19 (55.9%)	15 (44.1%)	0.566
	Left	10 (41.7%)	14 (58.3%)	
	Bilateral	1 (50.0%)	1 (50.0%)	
Infection	Present	2 (100.0%)	0 (0.0%)	0.492
	Absent	28 (48.3%)	30 (51.7%)	
Type of hernia	Direct	12 (37.5%)	20 (62.5%)	0.042*
	Indirect	18 (64.3%)	10 (35.7%)	

*Statistically significant at $p<0.05$.

DISCUSSION

This prospective comparative study aimed to evaluate and compare outcomes between laparoscopic (TAPP) and open (Lichtenstein) inguinal hernia repair techniques, focusing on operative time, postoperative pain, recovery parameters and perioperative complications. The findings demonstrate that while laparoscopic repair is associated with significantly longer operative time, it offers clinically meaningful advantages in terms of postoperative pain reduction and recovery acceleration, with equivalent safety profiles.

The demographic profile of patients in our study is consistent with global data on inguinal hernia incidence. Inguinal hernias predominantly affect males, with the prevalence rising sharply with age. Previous epidemiological data report cumulative prevalence rates increasing from 5% among males aged 25–34 years to 45% in those aged ≥75 years.11 Inguinal hernias are eight times more frequent in men than in women, accounting for nearly 90% of all hernia repairs.12 Our study population reflected this pattern with a strong male predominance (98.3%) and a mean age of 44.7 years, demonstrating representativeness of the typical hernia population in our geographic region.

The age difference between groups (48.5 vs. 40.9 years, p=0.009) represents a potential confounding factor that warrants discussion. This difference likely reflects selection bias, where younger patients may have been preferentially offered laparoscopic repair due to perceived benefits in terms of faster recovery and return to work. However, the clinical significance of this 7.6-year difference may be limited, and our primary outcomes remained statistically significant even when considering this age disparity. Operative duration was significantly longer in the laparoscopic group with our findings closely aligning with existing literature. Our mean operating time for TAPP was 113.33 minutes, compared to 61.50 minutes for the open technique. This aligns with findings from multiple randomized trials and meta-analyses. Pulikkal et al reported similar findings, with mean duration for open surgery in cases of bilateral direct inguinal hernia repair being 58.75±6.8 minutes. In comparison, laparoscopic procedures required significantly more time, averaging 107.42±8.9 minutes. For bilateral indirect hernia repairs, the duration of surgery was 61.21±3.87 minutes. These findings indicate that laparoscopic repair takes considerably longer than open mesh surgery when managing bilateral inguinal hernias.[13] The MRC trial group reported comparable durations of 58.4 minutes for laparoscopic versus 43.3 minutes for open repair.[14]

The prolonged operative time in laparoscopic repair can be attributed to several factors: the technical complexity of creating pneumoperitoneum, trocar placement, extensive dissection of the preperitoneal space, mesh positioning, and secure fixation. Additionally, the learning curve associated with laparoscopic techniques may contribute to longer operative times, particularly in the early phases of adoption. However, this increased operative time must be weighed against the subsequent benefits in postoperative recovery.

Postoperative pain is a critical outcome when comparing surgical techniques. Chronic pain, defined as pain persisting beyond three years, affects approximately 18% of patients after open repair and 6% after laparoscopic procedures.[15] This is attributed to factors such as nerve irritation by sutures or mesh, scarring, and reduced abdominal wall compliance.[16] Our study found that patients undergoing laparoscopic repair experienced significantly lower pain scores at 48 hours postoperatively (mean: 1.73) compared to the open group (mean: 3.40), indicating a potential early postoperative benefit of the minimally invasive approach.

The study demonstrated statistically and clinically significant reductions in postoperative pain across all measured time points. The TAPP group showed 36% lower pain scores at 12 hours, 41% lower at 24 hours, and 49% lower at 48 hours compared to the Lichtenstein group. These indicate not just statistical significance but clinically meaningful differences that would impact patient experience and satisfaction. While some meta-analyses, including the European Hernia Society (EHS) 2014 guidelines, suggest variable findings regarding chronic pain differences between TEP and Lichtenstein

techniques, larger cohort studies provide more robust evidence. A large-scale cohort study of 17,388 patients showed a higher risk of exertional pain in the open group (OR: 1.420; CI: 1.264-1.596).[17] The reduced acute postoperative pain observed in our laparoscopic group likely reflects the minimally invasive nature of the approach, with smaller incisions, reduced tissue trauma, and avoidance of the "triangle of pain" where the lateral femoral cutaneous nerve is located.

The findings demonstrated significant advantages for the laparoscopic approach: the mean hospital stay was 35% shorter (4.97 vs. 6.70 days, $p<0.001$) and return to work was 44% faster (10.30 vs. 18.50 days, $p<0.001$) for the TAPP group. This represents a Cohen's d of 1.23 and 3.64 respectively, indicating large to very large effect sizes. This supports earlier findings by multiple studies including the VA hernia trial group, which noted shorter recovery periods with laparoscopic techniques, although some studies, such as Haladu et al did not report significant differences, likely reflecting differences in patient populations, healthcare systems, and outcome measurement methods.[18]

The reduced hospital stays and faster return to work have important economic implications, both for individual patients and healthcare systems. In resource-constrained settings like India, shorter hospital stays reduce costs and improve bed availability, while faster return to productive activities benefits patients economically and societally. A major strength of the study was the comprehensive assessment of perioperative complications between two commonly used surgical techniques in a real-world clinical setting. The inclusion of patients operated by trained surgeons helps reduce operator-dependent variability.

An interesting finding was the significant association between hernia type and surgical approach selection ($p=0.042$), with direct hernias more frequently managed laparoscopically (62.5% vs. 37.5%). This likely reflects surgeon preference based on the superior visualization of the posterior wall anatomy in laparoscopic repair, which may be particularly advantageous in direct hernias where the weakness is in the posterior wall of the inguinal canal. This finding suggests that surgical decision-making in our practice incorporates anatomical considerations beyond patient factors, which is consistent with evidence-based surgical principles. The ability to address bilateral hernias simultaneously through a single laparoscopic approach also represents an advantage in selected cases.

Several limitations of our study merit discussion and should inform interpretation of results. First, this was an observational study with non-randomized group allocation, which introduces potential selection bias as evidenced by the age difference between groups. Second, the modest sample size of 60 patients, while adequately powered for our primary outcomes, limits the statistical power for detecting differences in less common complications and generalizability to broader populations. Third, the lack of long-term follow-up beyond the immediate postoperative period precludes conclusions regarding chronic pain incidence and recurrence rates, which are critical long-term outcomes. Finally, while time to discharge was used as a proxy for recovery, a more nuanced assessment of return to work or daily function would provide better insight. The exclusive use of TAPP technique, while providing consistency, prevents conclusions about TEP repair outcomes. Furthermore, we did not perform formal cost-effectiveness analysis, which would be valuable for healthcare policy decisions in resource-constrained settings.

The findings reinforce existing evidence that laparoscopic hernia repair, although technically demanding and time-intensive, offers early postoperative advantages in terms of pain and recovery. These results are relevant for both patient counselling and surgical training. Future research should include larger randomized controlled trials with long-term follow-up to assess outcomes such as chronic pain, recurrence, and cost-effectiveness. Additionally, stratified analysis based on age, comorbidities, and hernia characteristics could better inform individualized treatment strategies.

The evidence presented reinforces existing guidelines that support laparoscopic repair for bilateral hernias, recurrent hernias, and in patients where rapid recovery is particularly important. However, open repair remains an excellent option, particularly for patients with contraindications to general anesthesia, in resource-limited settings, or when performed by surgeons without extensive laparoscopic experience.

CONCLUSION

This prospective comparative study provides valuable evidence for surgical decision-making in inguinal hernia repair within the context of Indian healthcare delivery. While laparoscopic (TAPP) inguinal hernia repair requires significantly longer operative time and specialized technical expertise, it offers substantial and clinically meaningful advantages in the postoperative period, including significantly reduced pain across all measured time points, shorter hospital stay, and faster return to normal activities, with equivalent safety profiles and low complication rates compared to open Lichtenstein repair.

The study contributes to the growing body of evidence supporting minimally invasive approaches in hernia surgery, while acknowledging the practical considerations of implementation in resource-constrained healthcare environments. The decision between surgical approaches should be individualized based on patient factors, surgeon expertise, institutional resources, and healthcare system considerations. Both techniques demonstrate excellent safety profiles when performed by

experienced surgeons with appropriate patient selection. Future research priorities should focus on long-term outcomes including chronic pain incidence, recurrence rates, cost-effectiveness analysis, and quality of life measures to further inform evidence-based surgical decision-making. Multi-centre randomized controlled trials with extended follow-up periods would strengthen the evidence base and better guide clinical practice guidelines for inguinal hernia repair in diverse healthcare settings.

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