



Comparative Study of Open versus Laparoscopic Inguinal Hernia Repair (TAPP/TEP): A Prospective Observational Study at a Tertiary Care Centre in Jamshedpur

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Abstract

Background:

This study compared perioperative and postoperative outcomes of open Lichtenstein mesh repair with laparoscopic inguinal hernia repair using transabdominal preperitoneal (TAPP) or totally extraperitoneal (TEP) techniques.

Methods:

This prospective observational study included 100 patients with primary inguinal hernia treated at a tertiary care centre in Jamshedpur. Fifty patients underwent open Lichtenstein mesh repair and 50 underwent laparoscopic repair (tapp/tep). Demographic characteristics, operative duration, postoperative pain, hospital stay, complications, return to normal activity, and recurrence were assessed.

Results:

The mean age was 48.84 ± 13.26 years in the open group and 46.52 ± 12.71 years in the laparoscopic group. Males predominated in both groups (96% vs. 98%). The mean operative time was significantly longer with laparoscopic repair (76.34 ± 14.28 vs. 59.16 ± 12.41 minutes; $p < 0.001$). Postoperative pain was significantly lower (2.84 ± 0.92 vs. 4.96 ± 1.12 ; $p < 0.001$), hospital stay was shorter (2.12 ± 0.76 vs. 3.68 ± 1.08 days; $p < 0.001$), and return to normal activity was earlier (12.8 ± 3.4 vs. 19.7 ± 4.2 days; $p < 0.001$) with laparoscopic repair. Postoperative complications occurred in 20% versus 44% of patients ($p = 0.010$). Recurrence was comparable (2% vs. 4%; $p = 0.558$).

Conclusion:

Laparoscopic repair was associated with better postoperative recovery despite longer operative time.

Recommendation:

Laparoscopic repair may be considered in appropriately selected patients where appropriate expertise and infrastructure are available.

Keywords: Inguinal hernia; open mesh repair; Lichtenstein repair; laparoscopic hernia repair; transabdominal preperitoneal; totally extraperitoneal; postoperative pain.

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Introduction

Inguinal hernia is one of the most common surgical disorders worldwide and constitutes a major proportion of elective procedures performed in general surgery [1]. The lifetime risk of developing an inguinal hernia is

approximately 27% in men and 3% in women [2]. Owing to its high prevalence and associated morbidity, inguinal hernia repair remains one of the most frequently performed operations globally [3].

The condition results from protrusion of abdominal contents through a weakened area of the inguinal canal. Ageing,

increased intra-abdominal pressure, smoking, obesity, chronic cough, and abnormalities in collagen metabolism have been implicated in its pathogenesis [4,5].

The introduction of tension-free mesh repair by Lichtenstein represented a major advancement in hernia surgery and became the standard treatment because of its simplicity, reproducibility, and low recurrence rates [6]. With the advent of minimally invasive surgery, laparoscopic techniques such as transabdominal preperitoneal (tAPP) and totally extraperitoneal (TEP) repair were developed, providing an alternative approach with mesh placement in the preperitoneal space [7].

Laparoscopic repair has been associated with reduced postoperative pain, shorter hospital stay, earlier return to normal activity, and improved cosmetic outcomes [8]. In addition, bilateral and recurrent hernias can be managed through the same access without additional incisions [9]. However, concerns regarding longer operative duration, technical complexity, learning curve, and higher costs continue to limit its widespread adoption [10].

Several randomized trials and meta-analyses have demonstrated that laparoscopic repair offers superior short-term postoperative outcomes, although recurrence rates are comparable to those of open repair [11,12]. Current international guidelines recommend that the choice of surgical technique should be individualized according to patient characteristics, surgeon expertise, and available resources [13].

Despite the increasing popularity of minimally invasive procedures, the relative advantages of open and laparoscopic inguinal hernia repair remain a subject of ongoing debate. Furthermore, data from Eastern India are limited. Therefore, the present study was undertaken to compare the clinical outcomes of open mesh repair and laparoscopic inguinal hernia repair (tapp/tep) among patients treated at a tertiary care centre in Jamshedpur.

Materials and methods

Study design

This was a prospective observational comparative study conducted to compare perioperative and postoperative outcomes between open Lichtenstein tension-free mesh repair and laparoscopic inguinal hernia repair using the transabdominal preperitoneal (TAPP) or totally extraperitoneal (TEP) approach.

Study setting

The study was conducted in the Department of General Surgery at Jamshedpur, Jharkhand, India. The centre is a

tertiary-care teaching hospital providing comprehensive surgical services, including elective and emergency general surgical care and minimally invasive laparoscopic procedures. The Department of General Surgery provides diagnostic, operative, postoperative, and follow-up care for patients with abdominal wall and other general surgical conditions.

Study duration

The study was conducted over a period of one year.

Sample size

A total of **100 patients** with inguinal hernia were included in the study. Fifty patients underwent open Lichtenstein mesh repair and 50 underwent laparoscopic repair using the TAPP or TEP approach.

Sampling method

Consecutive sampling was used. All eligible patients presenting during the study period who met the predefined inclusion and exclusion criteria were considered for enrolment until the planned sample size was reached.

Inclusion criteria

Patients were eligible if they were aged >18 years, had a primary unilateral or bilateral inguinal hernia, were scheduled for elective repair, and were willing to participate in the study.

Exclusion criteria

Patients with complicated hernias, recurrent hernias, severe cardiopulmonary disease, previous lower abdominal surgery, or those considered unfit for general anaesthesia were excluded.

Surgical procedures

Patients in group A underwent open Lichtenstein tension-free mesh repair. Patients in group B underwent laparoscopic inguinal hernia repair using either the TAPP or TEP approach. The surgical technique was selected according to the patient's clinical characteristics, surgeon expertise, and availability of the appropriate laparoscopic facilities.

Variables studied

The primary independent variable was the type of surgical procedure: open Lichtenstein repair or laparoscopic repair. The postoperative and perioperative outcomes assessed included operative time, postoperative pain measured using

the visual analogue scale (VAS), duration of hospital stay, postoperative complications, time to return to normal activities, and hernia recurrence.

Statistical analysis

Data were entered into Microsoft Excel and analysed using the Statistical Package for the Social Sciences (SPSS), version 26.0. Continuous variables were expressed as mean $\pm$ standard deviation (SD), whereas categorical variables were expressed as frequencies and percentages. Continuous variables were compared using the independent-samples Student's t-test, while categorical variables were compared using the chi-square test. A p-value < 0.05 was considered statistically significant.

Measures to minimize bias

As this was a prospective observational study, treatment allocation was not randomized. To minimize potential selection and information bias, consecutive sampling was used for patient recruitment, predefined inclusion and exclusion criteria were applied consistently, and the same outcome variables and assessment methods were used for both treatment groups. Data were recorded prospectively using a standardized data-collection format. Wherever possible, postoperative outcomes were assessed using

predefined clinical criteria and standardized measures such as the VAS for pain and the documented duration of hospital stay.

Informed consent

Written informed consent was obtained from all participants before their inclusion in the study. Participants were informed about the purpose and nature of the study, the surgical procedures, potential benefits and risks, confidentiality of their information, and their right to decline participation without affecting their clinical care.

Results

A total of 100 patients with inguinal hernia were included in the study. Among them, 50 patients underwent open Lichtenstein mesh repair (group a), and 50 patients underwent laparoscopic repair (tapp/tep) (group b).

Baseline characteristics

The mean age of patients in the open repair group was 48.84 ± 13.26 years, whereas that in the laparoscopic group was 46.52 ± 12.71 years. Males constituted the majority of patients in both groups. No significant difference was observed regarding age, sex, body mass index, or comorbidities between the groups ($p > 0.05$), indicating comparable baseline characteristics (Table 1).

Table 1. Baseline demographic and clinical characteristics

Variable	Open repair (n=50)	Laparoscopic repair (n=50)	P-value
Age (years), mean $\pm$ SD	48.84 ± 13.26	46.52 ± 12.71	0.372
Male sex	48 (96%)	49 (98%)	0.558
Bmi (kg/m ²), mean $\pm$ sd	24.7 ± 3.4	25.1 ± 3.1	0.541
Diabetes mellitus	12 (24%)	10 (20%)	0.629
Hypertension	15 (30%)	14 (28%)	0.826

Hernia characteristics

Indirect inguinal hernia was the predominant type in both groups. There was no statistically significant difference regarding type or laterality of hernia between the groups (Table 2).

Table 2. Distribution of hernia characteristics

Variable	Open repair (n=50)	Laparoscopic repair (n=50)	P-value
Indirect hernia	32 (64%)	35 (70%)	0.519
Direct hernia	18 (36%)	15 (30%)	
Right-sided	28 (56%)	26 (52%)	0.688
Left-sided	19 (38%)	20 (40%)	
Bilateral	3 (6%)	4 (8%)	

Operative and early postoperative outcomes

The mean operative time was significantly longer in the laparoscopic group (76.34 ± 14.28 minutes) compared with the open repair group (59.16 ± 12.41 minutes) ($t=6.42$, $p < 0.001$). Conversely, postoperative pain scores and duration of hospital stay

were significantly lower in patients undergoing laparoscopic repair ($p < 0.001$ for both). These findings are summarized in Table 3.

Table 3. Comparison of operative and postoperative parameters

Parameter	Open repair (n=50)	Laparoscopic repair (n=50)	P-value
Operative time (minutes)	59.16 ± 12.41	76.34 ± 14.28	<0.001
VAS pain score at 24 hours	4.96 ± 1.12	2.84 ± 0.92	<0.001
Hospital stay (days)	3.68 ± 1.08	2.12 ± 0.76	<0.001
Return to normal activity (days)	19.7 ± 4.2	12.8 ± 3.4	<0.001

The comparison of operative duration and postoperative recovery parameters is illustrated in Figure 1.

Figure 1. Comparison of Operative and Postoperative Outcomes Between Open and Laparoscopic Repair Groups

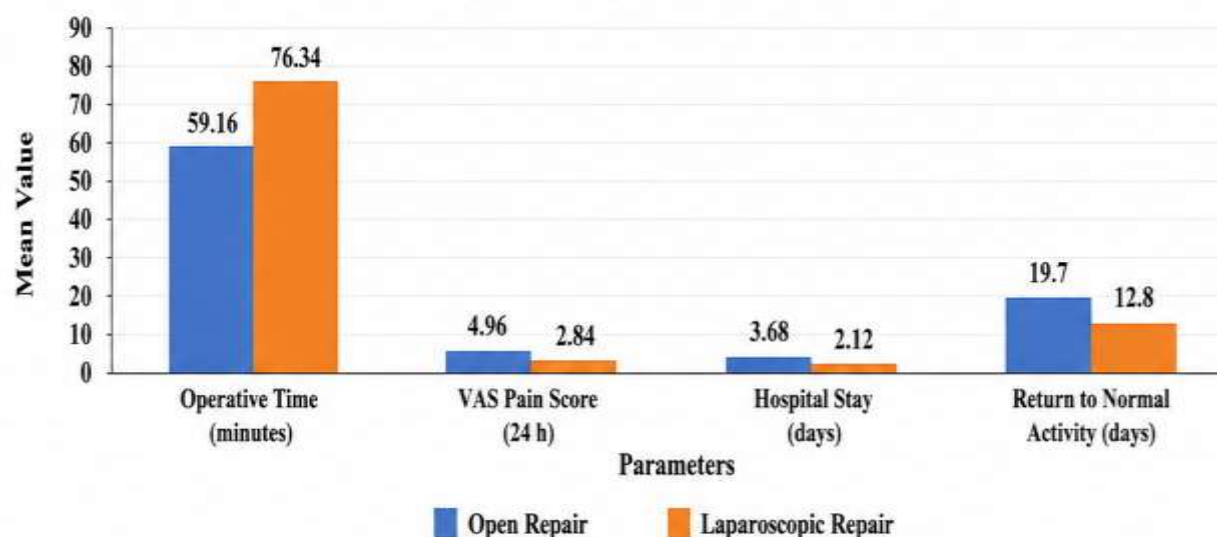


Figure 1. Comparison of operative and recovery outcomes between groups

Postoperative complications

Postoperative complications were observed in 22 patients (44%) in the open repair group and 10 patients (20%) in the laparoscopic group. Seroma formation was the most common complication in both groups. Wound infection and chronic groin pain were more frequently encountered after open repair. The overall difference in complication rates was statistically significant ($\chi^2 = 6.59$, $p = 0.010$) (Table 4).

Table 4. Postoperative complications

Complication	Open repair (n=50)	Laparoscopic repair (n=50)
Seroma	6 (12%)	4 (8%)



Hematoma	4 (8%)	2 (4%)
Wound infection	5 (10%)	1 (2%)
Urinary retention	3 (6%)	2 (4%)
Chronic groin pain	4 (8%)	1 (2%)
Total complications	22 (44%)	10 (20%)

The distribution of postoperative complications is depicted in Figure 2.

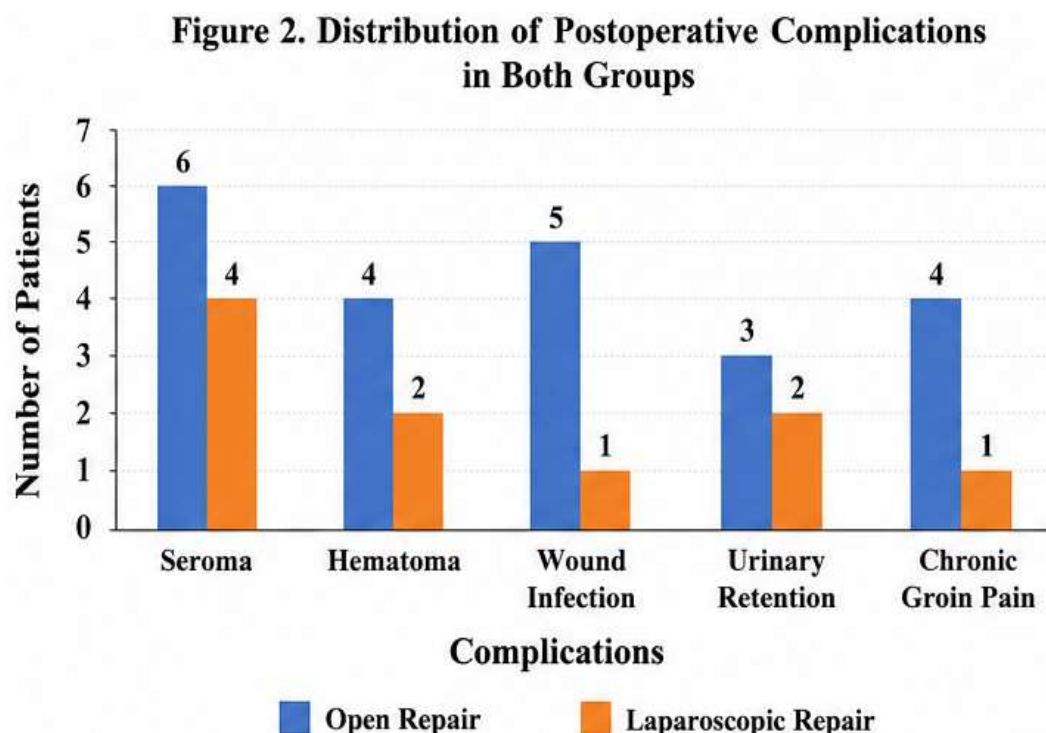


Figure 2. Distribution of postoperative complications in both groups

Recurrence

During follow-up, recurrence was observed in two patients (4%) in the open repair group and one patient (2%) in the laparoscopic group. The difference was statistically insignificant ($p=0.558$), indicating comparable recurrence rates between the two procedures (Table 5).

Table 5. Comparison of recurrence rate

Outcome	Open repair (n=50)	Laparoscopic repair (n=50)	P-value
Recurrence present	2 (4%)	1 (2%)	0.558
No recurrence	48 (96%)	49 (98%)	

The recurrence rates in both groups are shown in Figure 3.

Figure 3. Comparison of Recurrence Rates Between Groups

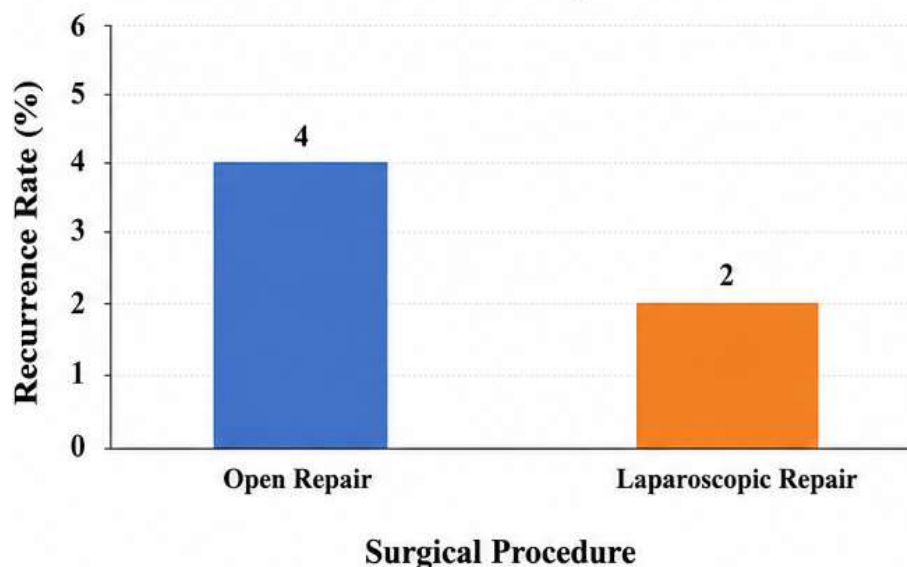


Figure 3. Comparison of recurrence rates between groups

Overall outcome

Overall, laparoscopic repair was associated with significantly lower postoperative pain, shorter hospital stay, fewer complications, and earlier return to normal activity, although operative duration was significantly longer. Recurrence rates were comparable between the two procedures.

Discussion

The present prospective observational study compared the perioperative and postoperative outcomes of open Lichtenstein mesh repair and laparoscopic inguinal hernia repair using the transabdominal preperitoneal (TAPP) or totally extraperitoneal (TEP) approach in 100 patients. The principal findings were that laparoscopic repair was associated with significantly lower postoperative pain, shorter hospital stay, fewer postoperative complications, and earlier return to normal activities, although it required a significantly longer operative time. Recurrence rates were low and comparable between the two groups.

The mean age of patients was comparable between the open and laparoscopic groups (48.84 ± 13.26 vs. 46.52 ± 12.71 years; $p = 0.372$). Male patients predominated in both

groups, accounting for **48 (96%)** patients in the open repair group and **49 (98%)** in the laparoscopic group ($p = 0.558$). In addition, no significant differences were observed between the groups with respect to body mass index, diabetes mellitus, or hypertension ($p > 0.05$). These findings indicate that the two groups had broadly comparable baseline demographic and clinical characteristics. The predominance of middle-aged men is consistent with previous reports by Primatesta and Goldacre [2], Kingsnorth and Leblanc [3], and Neumayer et al. [14], which described inguinal hernia as predominantly affecting men.

Indirect inguinal hernia was the most common type in both groups, occurring in **32 (64%)** patients in the open repair group and **35 (70%)** patients in the laparoscopic group. Direct hernia occurred in **18 (36%)** and **15 (30%)** patients, respectively, with no significant difference in the overall distribution of hernia type ($p = 0.519$). Similarly, the distribution of laterality was comparable between the groups ($p = 0.688$), with right-sided hernias observed in 56% and 52%, left-sided hernias in 38% and 40%, and bilateral hernias in 6% and 8% of the open and laparoscopic groups, respectively. These findings suggest that differences in postoperative outcomes were unlikely to be explained by



substantial differences in the baseline distribution of hernia type or laterality. The predominance of indirect hernias is consistent with findings reported by Bittner et al. [8] and the herniaSURGE group [13].

The mean operative time was significantly longer in the laparoscopic group than in the open repair group (**76.34 ± 14.28 vs. 59.16 ± 12.41 minutes; $p < 0.001$**). Thus, laparoscopic repair required approximately **17 minutes longer** on average. This finding is consistent with previous studies by McCormack et al. [11], Neumayer et al. [14], and Schmedt et al. [19]. The longer operative duration may be related to the technical complexity of laparoscopic repair, establishment of the preperitoneal working space, and the learning curve associated with TAPP and TEP procedures. Nevertheless, the longer operative time in the laparoscopic group was accompanied by better postoperative recovery.

A major finding of the present study was the significantly lower postoperative pain following laparoscopic repair. The mean VAS pain score at 24 hours was **2.84 ± 0.92** in the laparoscopic group compared with **4.96 ± 1.12** in the open repair group (**$p < 0.001$**). This represents a mean difference of **2.12 VAS points**, indicating substantially less early postoperative pain following laparoscopic surgery. The reduced pain may be related to less tissue dissection and reduced trauma to the abdominal wall and inguinal tissues. These findings are consistent with previous studies by Kuhry et al. [12], Eklund et al. [15], and Pisanu et al. [20], which reported lower postoperative pain following minimally invasive inguinal hernia repair.

The duration of hospital stay was also significantly shorter in the laparoscopic group. Patients undergoing laparoscopic repair had a mean hospital stay of **2.12 ± 0.76 days**, compared with **3.68 ± 1.08 days** in the open repair group (**$p < 0.001$**). This corresponds to an average reduction of approximately **1.56 days** in hospital stay. The shorter hospitalization observed in the laparoscopic group is consistent with previous comparative evidence reported by the EU Hernia Trialists Collaboration [21] and Karthikesalingam et al. [22]. Earlier discharge may reflect reduced postoperative pain and faster functional recovery following minimally invasive repair.

Postoperative complications were significantly more frequent following open repair. Complications occurred in **22 (44%)** patients in the open repair group compared with **10 (20%)** patients in the laparoscopic group (**$\chi^2 = 6.59$; $p = 0.010$**). Seroma was the most common complication in both groups, occurring in **6 (12%)** patients after open repair and **4 (8%)** after laparoscopic repair. Wound infection occurred in **5 (10%)** and **1 (2%)** patients, respectively, while chronic

groin pain occurred in **4 (8%)** and **1 (2%)** patients, respectively. The lower overall complication rate observed with laparoscopic repair suggests a postoperative morbidity advantage, particularly with respect to wound-related complications and chronic groin pain. These findings are consistent with previous reports by Phillips et al. [24] and Amid [25], which described differences in wound morbidity and chronic pain between open and laparoscopic approaches.

An additional important finding was the significantly earlier return to normal activities among patients undergoing laparoscopic repair. The mean time to return to normal activity was **12.8 ± 3.4 days** in the laparoscopic group compared with **19.7 ± 4.2 days** in the open repair group (**$p < 0.001$**), representing an average difference of approximately **6.9 days**. This finding supports the observation that reduced postoperative pain and shorter hospitalization following laparoscopic repair may translate into faster functional recovery. Similar findings have been reported by Wantz [26] and Ferzli et al. [27], who described earlier postoperative rehabilitation following laparoscopic approaches.

Recurrence rates were low in both groups and did not differ significantly. Recurrence occurred in **2 (4%)** patients following open repair and **1 (2%)** patient following laparoscopic repair (**$p = 0.558$**). Although recurrence was numerically lower in the laparoscopic group, the difference was not statistically significant. This finding indicates that both procedures provided comparable short- to intermediate-term recurrence outcomes in the present study. Previous comparative and guideline-based literature has also reported comparable effectiveness of established open and laparoscopic techniques when appropriately performed [16–18,28,29]. The low number of recurrence events in the present study, however, limits the ability to draw firm conclusions regarding differences in long-term recurrence.

Overall, the present study demonstrates that laparoscopic inguinal hernia repair was associated with significantly better postoperative recovery than open Lichtenstein repair, as evidenced by lower postoperative pain (**$p < 0.001$**), shorter hospital stay (**$p < 0.001$**), fewer postoperative complications (**44% vs. 20%; $p = 0.010$**), and earlier return to normal activities (**$p < 0.001$**). These advantages were observed despite a significantly longer operative time (**76.34 vs. 59.16 minutes; $p < 0.001$**). Recurrence rates remained comparable between the two approaches (**4% vs. 2%; $p = 0.558$**). Therefore, laparoscopic repair may offer advantages in postoperative recovery for appropriately selected patients,



particularly when suitable surgical expertise and laparoscopic facilities are available.

Recommendation

Based on the findings of the present study, laparoscopic inguinal hernia repair may be considered a suitable approach for appropriately selected patients undergoing elective inguinal hernia repair, particularly when reduced postoperative pain, shorter hospital stay, and earlier return to normal activities are important considerations. However, the choice between open and laparoscopic repair should be individualized according to patient characteristics, hernia characteristics, surgeon expertise, availability of laparoscopic facilities, and institutional resources. Larger multicentre prospective studies with longer follow-up are recommended to further evaluate recurrence, chronic postoperative pain, quality of life, and cost-effectiveness.

Limitations

The present study was conducted at a single centre with a relatively small sample size and limited follow-up period. Larger multicentric studies with longer follow-up are required to assess long-term recurrence and quality-of-life outcomes.

Conclusion

The present prospective observational study demonstrated that both open Lichtenstein mesh repair and laparoscopic inguinal hernia repair (tapp/tep) are safe and effective techniques for the management of inguinal hernia, with comparable recurrence rates. However, laparoscopic repair was associated with significantly lower postoperative pain, shorter duration of hospital stay, fewer postoperative complications, and earlier return to normal activities, despite having a longer operative time.

Although open repair remains a reliable and cost-effective procedure, the advantages offered by laparoscopic repair in terms of postoperative recovery and patient comfort make it an attractive option. Therefore, laparoscopic inguinal hernia repair may be considered the preferred approach in appropriately selected patients when adequate surgical expertise and infrastructure are available.

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assistance in the management and follow-up of the study participants.

List of abbreviations

BMI – body mass index

SD – standard deviation

spss – statistical package for the social sciences

tapp – transabdominal preperitoneal

TEP – totally extraperitoneal

VAS – visual analogue scale

Source of funding

No external funding was received for this study.

Conflict of interest

The authors declare that they have no conflict of interest.

Data availability

The data generated and analysed during the present study are available from the corresponding author on reasonable request. The data may be provided in anonymized form, subject to institutional policies and applicable requirements for maintaining participant confidentiality.

Author contributions

Tushar Malua: Conceptualization, study design, clinical supervision, patient management, data collection, data interpretation, and manuscript preparation.

Khushboo Rani: Study design, clinical management, data collection, interpretation of findings, and critical revision of the manuscript.

Neha Khushboo: Literature review, data collection, data organization, interpretation of findings, and manuscript preparation.

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