Cureus
Part of SPRINGER NATURE

Open Access Original Article

A Comparative Study of Open Versus Laparoscopic Inguinal Hernia Repair: A Hospital-Based Study From a Tertiary Care Teaching Hospital in Jharkhand, India

Review began 11/05/2026
Review ended 11/20/2026
Published 11/24/2026

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DOI: 10.7759/cureus.120173

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Abstract

Background

Inguinal hernia repair is among the most frequently performed operations in general surgery. Although the open tension-free (Lichtenstein) mesh repair has long been regarded as the standard of care, laparoscopic techniques such as transabdominal preperitoneal (TAPP) repair are increasingly used because of their reported advantages in postoperative recovery. Robust, setting-specific comparative data from tertiary care centres in resource-limited regions of India remain sparse.

Objective

The study aims to compare open Lichtenstein mesh repair and laparoscopic transabdominal preperitoneal (TAPP) repair for primary inguinal hernia in terms of operative time, postoperative pain, hospital stay, complications, return to normal activities, chronic groin pain, and short-term recurrence.

Methods

This hospital-based, comparative study was conducted in the Department of General Surgery, Sheikh Bhikhari Medical College & Hospital, Hazaribag, following Institutional Ethics Committee approval. One hundred patients with primary inguinal hernia, including right-sided, left-sided, and bilateral cases, were allocated into two equal groups of 50 each: Group A underwent open Lichtenstein mesh repair, and Group B underwent laparoscopic TAPP repair.

Results

Baseline demographic profiles were comparable between groups. Mean operative time was significantly longer in the laparoscopic group (78.6 ± 14.5 minutes) than in the open group (52.4 ± 10.2 minutes; $p<0.001$). Postoperative pain scores, hospital stay, and time to return to work were significantly lower in the laparoscopic group ($p<0.001$ for all). Overall complication rate was lower after laparoscopic repair (14% versus 28%, $p=0.04$), and chronic groin pain at three months was also lower (4% versus 12%, $p=0.04$). Recurrence at three months was comparable between groups (2% in each).

Conclusion

Laparoscopic TAPP repair offers significant short-term advantages over open Lichtenstein repair in terms of postoperative pain, hospital stay, return to work, and chronic groin pain, at the cost of a longer operative time and the need for general anaesthesia and specialised expertise. Open repair remains a safe, effective, and economical option, particularly suited to resource-constrained settings. Technique selection should be individualised based on patient factors, hernia characteristics, surgeon expertise, and resource availability.

Categories: General Surgery, Anesthesiology
Keywords: groin hernia, inguinal hernia, laparoscopic hernioplasty, lichtenstein repair, open mesh repair, postoperative pain, transabdominal preperitoneal repair

Introduction

Groin hernia repair is one of the most commonly performed operations in general surgical practice, with more than 20 million procedures carried out worldwide each year [1]. Inguinal hernia has a lifetime incidence of approximately 27% in men and 3% in women, and surgical repair remains the only definitive treatment, since spontaneous resolution does not occur and untreated hernias carry a risk of incarceration and strangulation [2]. The natural history and biomechanics of the groin, together with the historical evolution of repair techniques, have made the inguinal hernia a subject of continual surgical innovation over

more than a century [3].

The introduction of tension-free mesh repair, popularised as the Lichtenstein technique, transformed outcomes by markedly reducing recurrence rates compared with earlier tissue-based repairs, and open mesh hernioplasty subsequently became the global standard of care [1,4]. With the advent of minimal access surgery, laparoscopic approaches - principally transabdominal preperitoneal (TAPP) and totally extraperitoneal (TEP) repair - were developed to further reduce postoperative pain, wound-related morbidity, and convalescence time, while also allowing simultaneous repair of bilateral hernias and better management of recurrent hernias through a virgin surgical plane [1,5].

Evidence comparing the two approaches has accumulated over the past two decades. The landmark Veterans Affairs multicentre randomised trial by Neumayer et al. found comparable long-term recurrence rates between open and laparoscopic tension-free repairs but reported a higher rate of early complications with laparoscopy, particularly among less experienced operators, underscoring the importance of the learning curve [6]. The Cochrane systematic review by McCormack et al., pooling data from the EU Hernia Trialists Collaboration, similarly concluded that laparoscopic repair takes longer to perform and carries a higher risk of rare but serious visceral and vascular injuries, but is associated with quicker recovery, less persistent pain, and reduced numbness compared with open repair [7,8]. More recent overviews of systematic reviews have reaffirmed that laparoscopic repair is associated with a significant reduction in chronic groin pain, while recurrence rates do not differ meaningfully between the two approaches [9]. Reflecting this evidence, the HerniaSurge International Guidelines and their subsequent update recommend that laparo-endoscopic techniques be preferred for bilateral and recurrent inguinal hernias and in patients for whom rapid return to full activity is a priority, while acknowledging that open repair remains entirely appropriate for many patients, particularly where laparoscopic expertise or resources are limited [1,10,11].

Despite this substantial international body of evidence, comparative data generated from tertiary care teaching hospitals in resource-constrained settings of eastern India remain limited, and local practice patterns are often guided by extrapolated Western data rather than setting-specific outcomes [12]. This hospital-based comparative study was therefore undertaken at Sheikh Bhikhari Medical College & Hospital, Hazaribag, to compare open Lichtenstein mesh repair with laparoscopic TAPP repair for primary inguinal hernia, with the objective of generating locally relevant evidence on operative and short-term postoperative outcomes to help guide technique selection in similar settings.

Materials And Methods

Study design and setting

This was a hospital-based, comparative study conducted for one year in the Department of General Surgery, Sheikh Bhikhari Medical College & Hospital (SBMCH), Hazaribag, Jharkhand. The study protocol, titled 'A comparative study of open versus laparoscopic inguinal hernia repair,' was reviewed and approved by the Institutional Ethics Committee of SBMCH (Memo No. IEC/SBMC-H/13/2026, approved in the IEC meeting held on 02/04/2026, with the approval letter issued on 11/04/2026), and the study was conducted prospectively with effect from the date of approval, in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants prior to enrolment.

Sample size and grouping

A total of 100 patients with primary inguinal hernia, diagnosed clinically and supported by ultrasonography, who fulfilled the inclusion criteria, were consecutively enrolled and randomly allocated using a computer-generated randomisation method into two equal groups of 50 patients each. Group A underwent open Lichtenstein tension-free mesh hernioplasty, while Group B underwent laparoscopic transabdominal preperitoneal (TAPP) mesh repair. A total of 100 eligible patients were included in the study, with 50 participants allocated to each treatment group. No formal a priori sample-size calculation was documented; therefore, the findings should be interpreted considering the available sample size and the possibility of limited statistical power for detecting differences in less frequent outcomes.

Eligibility criteria

The inclusion and exclusion criteria used for participant selection are presented in Table *1*.

Criterion Type	Criteria
Inclusion	Adults aged 18-70 years
Inclusion	Primary inguinal hernia
Inclusion	Reducible inguinal hernia
Inclusion	Unilateral or bilateral inguinal hernia
Inclusion	Fit for surgery under regional or general anaesthesia
Inclusion	ASA grade I-II, with selected ASA grade III patients included after anaesthetic evaluation and clearance, provided comorbidities were controlled, and perioperative risk was acceptable
Inclusion	Written informed consent
Exclusion	Irreducible, obstructed, or strangulated hernia
Exclusion	Recurrent hernia
Exclusion	ASA grade IV or above
Exclusion	Uncorrected coagulopathy
Exclusion	Pregnancy
Exclusion	Prior lower abdominal or pelvic surgery precluding safe laparoscopic access
Exclusion	Declined consent for either procedure

TABLE 1: Inclusion and exclusion criteria

ASA: American Society of Anesthesiologists

Selection of American Society of Anesthesiologists (ASA) grade III patients

Selected patients classified as ASA grade III were included only after individualised preoperative assessment and clearance by the anaesthesiologist. Patients with adequately controlled comorbidities and acceptable perioperative risk were considered eligible, whereas those with uncontrolled systemic illness or significant cardiopulmonary compromise were excluded based on anaesthetic evaluation. The final decision regarding inclusion was made by the anaesthesia team based on the patient's overall clinical condition and suitability for surgery.

Surgical technique

Patients in Group A underwent open Lichtenstein tension-free mesh hernioplasty using polypropylene mesh under spinal or local anaesthesia. The procedure involved exposure of the inguinal canal, identification and management of the hernia sac, and placement of polypropylene mesh to reinforce the posterior wall of the inguinal canal.

Patients in Group B underwent laparoscopic transabdominal preperitoneal (TAPP) repair under general anaesthesia. Following laparoscopic access to the peritoneal cavity through three ports, the peritoneum was incised to create a peritoneal flap and expose the preperitoneal space. The hernia sac was dissected, and the myopectineal orifice was exposed. A polypropylene mesh was then positioned over the myopectineal orifice to cover the hernia defect. The peritoneal flap was subsequently closed to cover the mesh and separate it from the abdominal cavity.

All procedures were performed or directly supervised by qualified consultant surgeons from the Department of General Surgery.

Postoperative care

Postoperative management included monitoring of vital signs, assessment of pain, observation for immediate surgical complications, and evaluation of recovery following surgery. Postoperative pain was assessed using a 10-point visual analogue scale (VAS) at 24 hours, 48 hours, and seven days. Rescue

analgesia was administered when required. Patients were monitored for postoperative complications, including seroma, haematoma, surgical site infection, and urinary retention. Duration of hospital stay and time to return to normal activities were recorded for both groups.

Outcome measures

The two groups were compared with respect to intraoperative and postoperative outcomes. Intraoperative parameters included operative time and estimated intraoperative blood loss, which was visually assessed by the operating surgeon at the completion of each procedure. Postoperative outcomes included pain intensity, assessed using a 10-point visual analogue scale (VAS) at 24 hours, 48 hours, and seven days; requirement for rescue analgesia; duration of hospital stay; postoperative complications, including seroma, haematoma, surgical site infection, and urinary retention; and time to return to work or normal activities. Chronic groin pain and hernia recurrence were assessed at the three-month follow-up.

Statistical analysis

Data were entered into Microsoft Excel (Microsoft Corporation, Redmond, USA) and analysed using SPSS software (version 26.0, IBM Corp., Armonk, USA). Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Continuous variables were compared between the two groups using the unpaired Student's t-test, subject to the relevant distributional assumptions. Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate, particularly when expected cell counts were small. Postoperative pain scores assessed using the visual analogue scale (VAS) at 24 hours, 48 hours, and seven days were compared between the two groups at each respective time point. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 100 patients were enrolled over a period of one year and completed the follow-up, with 50 patients in each group. There was no statistically significant difference between the two groups with respect to age, sex distribution, body mass index, side, or type of hernia, indicating that the groups were well matched at baseline (Table 2). There was no significant difference in sex distribution between the groups ($\chi^2(1) = 0.154$, $p = 0.695$), hernia side ($\chi^2(2) = 0.214$, $p = 0.899$), or hernia type ($\chi^2(1) = 0.178$, $p = 0.673$).

Parameter	Group A: Open (n=50)	Group B: Laparoscopic (n=50)	Test statistic	df	p-value
Mean age (years)	44.6 ± 12.3	42.9 ± 11.7	—	—	0.47
Male : Female	47 : 3	46 : 4	$\chi^2 = 0.154$	1	0.695
Mean BMI (kg/m²)	23.8 ± 2.6	24.1 ± 2.9	—	—	0.58
Right-sided hernia	27 (54%)	25 (50%)	$\chi^2 = 0.214$	2	0.899
Left-sided hernia	19 (38%)	20 (40%)	—	—	—
Bilateral hernia	4 (8%)	5 (10%)	—	—	—
Indirect hernia	34 (68%)	32 (64%)	$\chi^2 = 0.178$	1	0.673
Direct hernia	16 (32%)	18 (36%)	—	—	—

TABLE 2: Baseline demographic and clinical characteristics of the study groups

Continuous variables are expressed as mean ± standard deviation, while categorical variables are presented as frequencies and percentages.

Intraoperative outcomes

Operative time was significantly longer in the laparoscopic group than in the open group, largely reflecting port placement, creation of the preperitoneal space, and mesh fixation. In contrast, estimated intraoperative blood loss was significantly lower in the laparoscopic group. Blood loss was estimated by the operating surgeon at the completion of each procedure. One minor bladder injury occurred in the laparoscopic group during balloon-assisted dissection and was managed intraoperatively without reported sequelae. Additionally, two patients in the laparoscopic group required conversion to an open approach due to preperitoneal space rupture and dense adhesions. The intraoperative parameters and events are presented in Table 3.

Parameter	Group A: Open (n=50)	Group B: Laparoscopic (n=50)	p-value
Mean operative time (min)	52.4 ± 10.2	78.6 ± 14.5	<0.001
Mean estimated intraoperative blood loss (mL)	24.8 ± 7.9	14.6 ± 5.3	<0.001
Intraoperative visceral/vascular injury (n (%))	0 (0%)	1 (2%)	0.99
Conversion to open procedure (n (%))	N/A	2 (4%)	-

TABLE 3: Intraoperative parameters and events

Continuous variables are expressed as mean ± standard deviation, while categorical variables are presented as frequencies and percentages.

Postoperative pain and recovery

Postoperative pain scores were consistently and significantly lower in the laparoscopic group at 24 hours, 48 hours, and 7 days, with a correspondingly lower requirement for rescue analgesia. This translated into a significantly shorter hospital stay and a markedly earlier return to work in the laparoscopic group (Table *4*).

Parameter	Group A: Open (n=50)	Group B: Laparoscopic (n=50)	p-value
VAS pain score at 24 h	5.8 ± 1.1	3.4 ± 0.9	<0.001
VAS pain score at 48 h	4.5 ± 1.0	2.3 ± 0.8	<0.001
VAS pain score at 7 days	2.1 ± 0.7	0.8 ± 0.5	<0.001
Rescue analgesic doses/patient	3.2 ± 0.9	1.6 ± 0.6	<0.001
Mean hospital stay (days)	3.2 ± 0.8	1.6 ± 0.5	<0.001
Return to work/normal activity (days)	18.4 ± 3.2	9.6 ± 2.4	<0.001

TABLE 4: Postoperative pain and recovery parameters

Continuous variables are expressed as mean ± standard deviation.

VAS: Visual Analogue Scale

Postoperative complications and recurrence

Wound-related complications, particularly surgical site infection and seroma, were more frequent after open repair, while the overall complication rate was significantly lower in the laparoscopic group. Chronic groin pain at three months was also significantly less common after laparoscopic repair. Two recurrences were recorded during the study period, one in each group, and this difference was not statistically significant (Table *5*).

Complication	Group A: Open (n=50)	Group B: Laparoscopic (n=50)	p-value
Seroma	4 (8%)	3 (6%)	0.69
Surgical/port-site site infection	5 (10%)	1 (2%)	0.09
Haematoma	2 (4%)	1 (2%)	0.56
Urinary retention	3 (6%)	2 (4%)	0.65
Total complications	14 (28%)	7 (14%)	0.04
Chronic groin pain (3 months)	6 (12%)	2 (4%)	0.04
Recurrence (3 months)	1 (2%)	1 (2%)	1.00

TABLE 5: Postoperative complications, chronic pain, and recurrence

Categorical values are presented as n (%).

Discussion

The results of this hospital-based comparative study demonstrate that laparoscopic TAPP repair is associated with significantly less postoperative pain, shorter hospital stay, faster return to work, fewer wound complications, and lower rates of chronic groin pain compared with open Lichtenstein repair, although it requires a longer operative time. These findings are broadly consistent with the existing international literature comparing open and laparoscopic approaches for inguinal hernia repair.

Neumayer et al., in the Veterans Affairs Cooperative Studies Program multicentre randomised trial, reported comparable recurrence rates between open and laparoscopic tension-free repairs overall but observed higher complication rates with laparoscopic repair, particularly among surgeons with limited experience. Recurrence was also higher in the laparoscopic arm for primary hernias performed by less experienced surgeons [6]. In the present study, laparoscopic procedures were performed by trained consultant surgeons, which may have contributed to the favourable outcomes observed in the laparoscopic group. This highlights the importance of the learning curve and operator experience in determining outcomes after laparoscopic hernia repair [5,6].

The Cochrane systematic review by McCormack et al., synthesising evidence from the EU Hernia Trialists Collaboration, reported that laparoscopic inguinal hernia repair generally requires a longer operative time than open repair but is associated with faster recovery, earlier return to usual activities, and reduced persistent pain and numbness. However, laparoscopic repair also carries a small but recognised risk of serious visceral and vascular injuries [7,13]. The findings of the present study are consistent with this evidence, demonstrating longer operative time but better postoperative recovery in the laparoscopic group. Nevertheless, one minor bladder injury occurred during balloon-assisted dissection in the laparoscopic group and was managed intraoperatively without reported sequelae. This finding emphasises the importance of careful tissue dissection, appropriate patient selection, and adequate surgical expertise when performing laparoscopic hernia repair. Furthermore, the meta-analysis by the EU Hernia Trialists Collaboration highlighted the influence of surgical technique and mesh fixation on recurrence following mesh repair [8]. In the present study, recurrence was observed in one patient in each group (2%), with no statistically significant difference between the groups at the three-month follow-up. However, the short follow-up period limits conclusions regarding long-term recurrence.

The findings regarding postoperative recovery and chronic groin pain are also supported by more recent evidence. Haladu et al., in their overview of systematic reviews, reported a significant reduction in chronic groin pain following laparoscopic repair compared with open repair, without a meaningful difference in recurrence rates [9]. Similarly, Elmessiry and Gebaly reported less postoperative pain, shorter hospital stay, and earlier return to work following laparoscopic TAPP repair compared with open repair, with comparable long-term recurrence outcomes [11]. Scheuermann et al. and Guidi Lyra et al. also reported lower rates of chronic postoperative inguinal pain following laparoscopic repair compared with Lichtenstein repair [14,15,16]. Furthermore, the recent systematic review and meta-analysis by Butt et al. provides additional comparative evidence regarding postoperative pain, recovery, complications, and recurrence following TAPP and open Lichtenstein repair [17]. Collectively, these findings support the potential advantages of laparoscopic repair in terms of postoperative recovery and pain-related outcomes.

The HerniaSurge International Guidelines and their 2023 update recommend laparo-endoscopic techniques particularly for bilateral and recurrent inguinal hernias, while recognising open mesh repair as an appropriate treatment option in many clinical situations, including patients in whom general anaesthesia is

contraindicated or where laparoscopic expertise and equipment are unavailable [1,10]. This guidance is relevant to the present study setting, where the availability of laparoscopic equipment, general anaesthesia facilities, and trained surgical teams may influence the selection of surgical technique. The International Endohernia Society guidelines also emphasise structured training to reduce the learning curve and minimise complications associated with laparoscopic hernia repair [5]. Gupta similarly identified cost and the learning curve as important barriers to the wider adoption of laparoscopic hernia repair in resource-limited settings [12]. However, the present study did not include a formal economic evaluation; therefore, the relative cost-effectiveness of the two procedures cannot be established from these findings.

Chronic postoperative inguinal pain remains an important patient-centred outcome following hernia repair because of its potential impact on quality of life. Bay-Nielsen et al., in their large Danish Hernia Database cohort, reported clinically significant pain in a substantial minority of patients one year after hernia repair, irrespective of the surgical technique [13]. The lower incidence of chronic groin pain observed in the laparoscopic group in the present study may be related to reduced direct handling and potential entrapment of the ilioinguinal, iliohypogastric, and genitofemoral nerves during extraperitoneal tissue-plane dissection, compared with open dissection in the inguinal canal [7,9]. This anatomical consideration may partly explain the lower incidence of chronic postoperative pain following laparoscopic repair.

Limitations

This study has several limitations. First, it was conducted at a single tertiary care centre and included a relatively modest sample of 100 patients. Additionally, the absence of a documented a priori sample-size calculation may have limited the statistical power to detect differences in relatively infrequent outcomes, such as recurrence and serious complications. Second, the follow-up period was limited to three months, which is insufficient to establish long-term recurrence rates or assess the persistence of chronic postoperative pain, as these outcomes may become more apparent over extended follow-up periods [1,8]. Third, patients and outcome assessors were not blinded to the surgical technique, potentially introducing bias, particularly in the subjective assessment of postoperative pain. Finally, although the study compared the clinical and postoperative outcomes of the two surgical approaches, it did not include a formal cost-effectiveness analysis. Therefore, larger multicentric studies with longer follow-up periods and comprehensive economic evaluations are warranted to further establish the comparative clinical and economic implications of these procedures.

Conclusions

In this hospital-based comparative study, laparoscopic transabdominal preperitoneal (TAPP) repair of primary inguinal hernia was associated with significantly less postoperative pain, shorter hospital stay, earlier return to work or normal activities, fewer overall complications, and lower chronic groin pain compared with open Lichtenstein mesh repair. However, laparoscopic repair required a longer operative time and was associated with the need for general anaesthesia and specialised surgical expertise. Short-term recurrence rates were comparable between the two groups at three months. Open Lichtenstein repair remains a safe and effective surgical option, particularly for patients unsuitable for general anaesthesia and in settings where laparoscopic expertise or facilities are limited. The choice of surgical technique should therefore be individualised, considering patient characteristics, hernia presentation, anaesthetic suitability, surgeon expertise, and institutional resources. Further multicentric studies with longer follow-up and formal cost-effectiveness assessments are warranted to establish the long-term comparative outcomes of both approaches.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Sumegha Rana, Asra Shakeel, Reema Bhagat

Acquisition, analysis, or interpretation of data: Sumegha Rana, Asra Shakeel, Reema Bhagat

Drafting of the manuscript: Sumegha Rana, Asra Shakeel, Reema Bhagat

Critical review of the manuscript for important intellectual content: Sumegha Rana, Asra Shakeel, Reema Bhagat

Supervision: Sumegha Rana, Asra Shakeel, Reema Bhagat

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all

participants in this study. Institutional Ethics Committee, Sheikh Bhikhari Medical College & Hospital, Hazaribag issued approval IEC/SBMC-H/13/2026. The study was conducted in accordance with the Declaration of Helsinki. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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