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Original Research Article

Intraoperative and postoperative complications in transabdominal preperitoneal versus totally extraperitoneal laparoscopic inguinal hernia repair: a prospective randomized controlled trial

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ABSTRACT

Background: Laparoscopic inguinal hernia repair has gained widespread acceptance due to reduced postoperative pain, improved recovery, and favorable cosmetic outcomes. Among laparoscopic approaches, transabdominal preperitoneal (TAPP) and totally extraperitoneal (TEP) repair are the most commonly employed techniques. However, comparative evidence regarding intraoperative and postoperative complication profiles remains variable.
Methods: This prospective randomized controlled trial was conducted in the Department of General Surgery at Mahatma Gandhi Medical College and Hospital from April 2024 to September 2025. Sixty patients with inguinal hernia were randomized into TAPP (n=30) and TEP (n=30) groups. Postoperative pain was assessed using the visual analogue scale (VAS), and patients were followed for six months.
Results: The mean operative time was significantly shorter in the TAPP group (60.97±11.41 minutes) compared to the TEP group (69.37±11.25 minutes; p=0.006). Early postoperative pain at 6 and 12 hours was significantly lower in the TEP group ($p<0.05$). Incidence of edema, urinary retention, hematoma, chronic pain, and recovery outcomes were comparable.
Conclusions: Both TAPP and TEP are safe and effective laparoscopic techniques with comparable complication profiles. TAPP offers shorter operative time, whereas TEP provides reduced immediate postoperative pain. Long-term outcomes are equivalent.

Keywords: Laparoscopic inguinal hernia repair, TAPP, TEP, Complication

INTRODUCTION

Inguinal hernia is one of the most frequently encountered conditions in general surgery and accounts for the majority of abdominal wall hernias. The lifetime risk is estimated at 27% in men and 3% in women, making hernia repair one of the most commonly performed surgical procedures worldwide.[1] The introduction of tension-free mesh repair revolutionized outcomes by reducing recurrence rates. Subsequently, laparoscopic approaches emerged with advantages including reduced postoperative pain, earlier ambulation, and faster return to work.[2,3] Two principal laparoscopic techniques are widely practiced: transabdominal preperitoneal (TAPP) repair and totally extraperitoneal (TEP) repair. Both involve placement of mesh in the preperitoneal space but differ in anatomical access. TAPP involves entry into the peritoneal cavity, whereas TEP avoids intraperitoneal access.[4] International guidelines recognize both approaches as effective, with technique selection often based on surgeon expertise and patient characteristics.[5] Although recurrence rates are comparable, differences in

complication profiles and recovery parameters remain an area of ongoing investigation.[6] The present prospective randomized controlled trial was conducted to compare intraoperative and postoperative complications associated with TAPP and TEP repair.

METHODS

A prospective randomized controlled trial was conducted at Mahatma Gandhi Medical College and Hospital over a period of 18 months (April 2024-September 2025). Institutional ethical approval was obtained prior to initiation of the study, and written informed consent was secured from all participants. All consecutive adult patients presenting with inguinal hernia were screened for eligibility. Patients aged 18–75 years with unilateral or bilateral inguinal hernia who were fit for general anesthesia and provided informed consent were included. Patients with incarcerated or strangulated hernia, those unfit for general anesthesia, cases of ventral or incisional hernia, and patients requiring conversion to open surgery were excluded.

The sample size was calculated using a standard statistical formula assuming a 95% confidence level and 5% precision, resulting in a total of 60 participants, consistent with comparable randomized studies.[7] Eligible patients were randomized into two groups: the transabdominal preperitoneal (TAPP) group (n=30) and the totally extraperitoneal (TEP) group (n=30).[8] The primary outcome measures included intraoperative and postoperative complications. Secondary outcomes assessed were operative time, postoperative pain, analgesic requirement, duration of hospital stay, and cosmetic outcome. Patients were followed up according to the study protocol to evaluate these parameters.

Statistical analysis

Quantitative variables were expressed as mean±SD. Independent t-test and chi-square test were used. A p value <0.05 was considered statistically significant. Analysis was performed using SPSS v26.0 and Microsoft Excel, following CONSORT principles for randomized trials.[9]

RESULTS

Demographics

Sixty patients were equally distributed between groups. Age distribution, gender, hernia laterality, and hernia type were comparable across both groups (p>0.05). Male predominance reflected established epidemiological patterns. Demographic data are presented in Table 1.

Operative outcomes

Mean operative time was significantly shorter in the TAPP group (60.97±11.41 minutes) compared to the TEP group (69.37±11.25 minutes; p=0.006). Hospital stay, analgesic duration, and cosmetic satisfaction scores were comparable between groups. These findings align with previous comparative analyses demonstrating technical efficiency of TAPP. Results are presented in Table 2.

Table 1: Baseline characteristics of study groups.

Variable	TAPP (n=30)	TEP (n=30)	P value
Mean age (years)	46.3±12.1	44.8±11.5	0.62
Male gender (%)	93.3	90.0	0.64
Unilateral hernia (%)	80.0	83.3	0.74
Bilateral hernia (%)	20.0	16.7	0.74
Direct hernia (%)	56.7	60.0	0.79
Indirect hernia (%)	43.3	40.0	0.79

Table 2: Operative outcomes.

Outcome	TAPP	TEP	P value
Operative time (minutes)	60.97±11.41	69.37±11.25	0.006
Hospital stays (days)	1.7±0.7	1.8±0.8	0.27
Analgesic duration (days)	3.7±1.2	3.6±1.3	0.43
Cosmetic satisfaction score	4.5±0.6	4.6±0.5	0.55

Postoperative pain

Early postoperative pain assessed by VAS was significantly lower in the TEP group at 6 hours (p<0.001) and 12 hours (p=0.021). No significant differences were observed from postoperative day 1 onwards. This finding supports evidence that avoidance of peritoneal incision reduces the early nociceptive response. Pain scores at all time points are presented in Table 3.

Postoperative complications

Edema occurred transiently in both groups without significant difference (20.0% TAPP vs 16.7% TEP; p=0.74). Urinary retention and hematoma each occurred

in 6.7% of patients in both groups (p=1.00). Postoperative numbness persisted in 10% of patients in each group at six months. Chronic pain occurred in 3.3% of patients in each group. There was no recurrence in either group. These rates are consistent with previously reported laparoscopic hernia outcomes. Complication data are presented in Table 4.

Recovery outcomes

Analgesic requirement was comparable between groups (p=0.434). Hospital stay was similar (p=0.270). Cosmetic satisfaction was high in both groups (p=0.55). Overall complication rates and recovery profiles were equivalent.

Table 3: Postoperative pain comparison (visual analog scale).

Time interval	TAPP (VAS)	TEP (VAS)	P value
6 h	5.20±0.92	4.23±0.86	<0.001
12 h	4.30±0.88	3.77±0.77	0.021
Day 1	3.10±0.74	3.05±0.71	0.78
Day 3	2.20±0.60	2.10±0.55	0.49
1 week	1.40±0.50	1.30±0.48	0.41
1 month	0.60±0.30	0.55±0.25	0.48

Table 4: Postoperative complications.

Complication	TAPP (%)	TEP (%)	P value
Edema	20.0	16.7	0.74
Urinary retention	6.7	6.7	1.00
Hematoma	6.7	6.7	1.00
Numbness at 6 months	10.0	10.0	1.00
Chronic pain	3.3	3.3	1.00
Recurrence	0	0	—

DISCUSSION

This prospective randomized controlled trial demonstrates that both TAPP and TEP laparoscopic inguinal hernia repair are safe and effective techniques with equivalent overall complication and recovery profiles across a six-month follow-up period.

TAPP demonstrated significantly shorter operative time (60.97±11.41 vs 69.37±11.25 minutes; p=0.006). This advantage is attributable to the direct intraperitoneal visualization offered by TAPP, which provides a wider operative field, clearer anatomical landmarks particularly in the myopectineal orifice region, and greater ease of mesh positioning. The peritoneal cavity serves as a natural working space that is immediately accessible without the need for balloon dissection of the preperitoneal plane. Chen et al, in their meta-analysis, similarly reported shorter operative times with TAPP, attributing this to the ease of peritoneal access and working space.[10]

TEP demonstrated significantly lower postoperative pain scores at 6 hours (VAS 4.23±0.86 vs 5.20±0.92; p<0.001) and 12 hours (VAS 3.77±0.77 vs 4.30±0.88; p=0.021). The avoidance of peritoneal incision and the consequent absence of peritoneal manipulation is the likely mechanism underlying this benefit. Visceral nociceptors within the peritoneum are not activated during TEP, and there is no peritoneal closure required, both of which contribute to reduced early inflammatory and pain signaling. Wei et al corroborated this finding in their meta-analysis of randomized trials, where TEP was associated with lower immediate postoperative pain intensity.[11] Pain scores beyond 24 hours were comparable, indicating that the difference is confined to the early postoperative window.

Postoperative complications including edema, urinary retention, hematoma, chronic groin pain, and postoperative numbness were equivalent across groups. Urinary retention occurred in 6.7% of each group, which is consistent with reported rates following laparoscopic hernia repair under general anesthesia, particularly in male patients with pre-existing lower urinary tract symptoms. Hematoma formation at 6.7% in both groups likely reflects the extent of preperitoneal dissection inherent to both techniques. Postoperative numbness persisting at six months in 10% of patients in each group is consistent with previously described rates of lateral femoral cutaneous nerve and genitofemoral nerve neuropraxia during mesh fixation or balloon dissection.[8] Chronic pain at 3.3% in both groups is within the reported range for laparoscopic repair in the literature and substantially lower than open tension-free repair.[12] The absence of recurrence in either group over six months reflects the adequacy of mesh coverage of the myopectineal orifice when both techniques are performed with standardized precision. Analgesic consumption, hospital stay, and cosmetic satisfaction scores were statistically equivalent across groups, reinforcing the guideline position that neither TAPP nor TEP has inherent superiority, and that technique selection should be guided primarily by surgeon expertise, training, and patient-specific anatomical factors.[5]

The findings from the present study align with those of multiple published meta-analyses and systematic reviews. Aiolfi et al in their trial sequential analysis reported equivalent safety and efficacy for TAPP and TEP with no significant difference in complication rates, recurrence, or chronic pain.[6] Köckerling et al, in a registry-based analysis of over 57,000 patients, similarly found no clinically significant difference in outcomes attributable to technique.[12] From an anatomical standpoint, both techniques address the preperitoneal space bounded by the transversalis fascia and the peritoneum, achieving the same mechanical principle: wide retroperitoneal mesh coverage of direct, indirect, and femoral hernia orifices in accordance with the anatomical territory described by Fruchaud as the myopectineal orifice. Skandalakis' Surgical Anatomy and Gray's Anatomy define the relevant landmarks — the inferior epigastric vessels, the Cooper's ligament, the iliopubic tract, and the femoral vessels — which must be identified and respected in both TAPP and TEP to avoid neurovascular injury. Technical precision in this anatomical corridor, rather than choice of approach, is the principal determinant of long-term outcome.[14]

Limitations

The limitations of this study include its single-center design, moderate sample size of 60 patients, and follow-up restricted to six months. Learning curve effects, while minimized by participation of senior surgeons with equivalent laparoscopic experience in both arms, cannot be entirely excluded. Long-term recurrence data beyond six months and formal quality-of-life assessments are warranted to supplement these findings.

CONCLUSION

TAPP and TEP laparoscopic inguinal hernia repairs demonstrate equivalent safety and long-term outcomes. TAPP offers shorter operative time while TEP provides lower immediate postoperative pain. Both techniques demonstrate comparable postoperative complication rates, analgesic requirements, hospital stay, and cosmetic outcomes. Surgical expertise and standardized anatomical technique remain the most important determinants of optimal results.

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