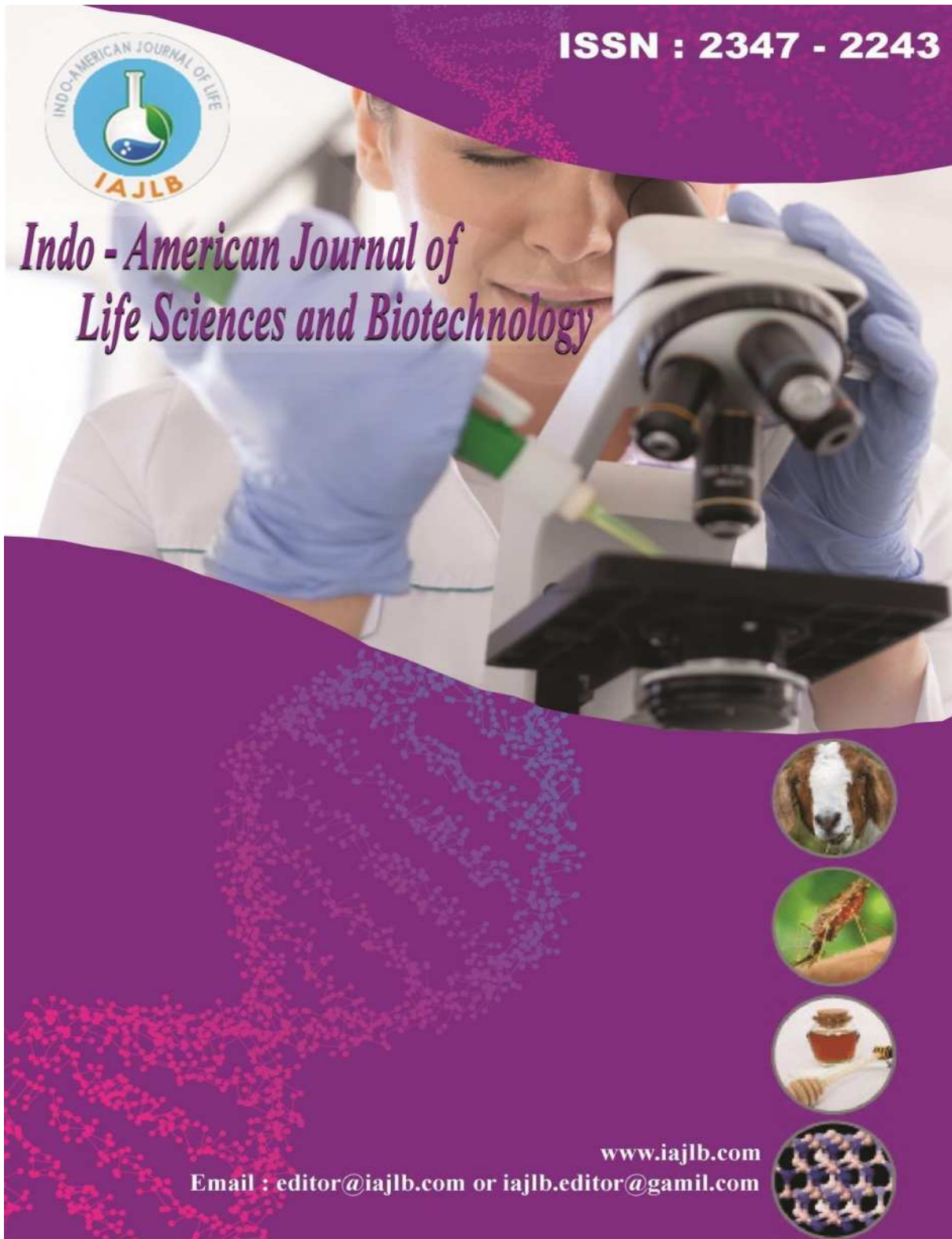




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Comparative Evaluation of Laparoscopic and Open Mesh Repair in Inguinal Hernia: Postoperative Pain, Complications, and Early Recurrence

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ABSTRACT

Introduction: A comparative clinical-study was designed with 180 adults, equally split between approaches. At 24 hrs and day 7, pain was measured on an 11-point numerical scale. Operative duration, hospital stay, return to usual activity, 30-day complications, and clinically assessed recurrence at six months were specified as outcomes.

Methods: This single-center, non-randomized study analyzed outcomes of laparoscopic total extraperitoneal (TEP) versus open Lichtenstein inguinal hernia repair using 180 constructed records of adults aged 18 to 75. The analytical sample included 90 records per group meeting strict criteria for elective, primary, unilateral, reducible hernia repairs while excluding complicated, recurrent, or emergency cases..

Results: The constructed analysis figures showed lower pain after laparoscopy at 24 hours (3.3 ± 1.2 vs 4.8 ± 1.4) and day 7 (1.7 ± 0.9 vs 2.7 ± 1.1), both $p < 0.001$. Operative time was longer (71.2 ± 17.6 vs 57.9 ± 14.8 minutes), whereas postoperative stay was shorter (1.3 ± 0.6 vs 2.1 ± 0.9 days). Twelve/90 and 18/90 patients had any 30-day complication, respectively. Among those assessed at six months, 2/84 and 3/85 were observed to have a recurrence.

Conclusion: The potential early recovery benefit of laparoscopy is highlighted but superiority for recurrence is not established.

Keywords: Inguinal Hernia, Total Extraperitoneal Repair, Lichtenstein Repair, Postoperative Pain, Mesh, Recurrence.

INTRODUCTION

Inguinal hernia repair is a very common general surgical procedure and the main goal of treatment is not to reduce a protrusion. Modern care should also reduce post-operative pain, allow for rapid recovery of function, and avoid

unnecessary mesh-related morbidity and recurrence. The Hernia Surge recommendations acknowledge mesh surgery as a primary approach to adult groin hernia surgery and recommend that the choice of surgical technique should consider patient,



hernia and experience factors in the surgical unit [1]. Later updates have placed more emphasis on patient-reported outcomes, chronic pain and shared decision making than on recurrence as the indicator of success [2].

Open anterior Lichtenstein repair is still a commonly used procedure, due to its repeatability, the availability of regional or local anaesthetic and the relatively small learning curve. Laparoscopic repair is most frequently performed by either a total extraperitoneal (TEP) or transabdominal preperitoneal (TAPP) approach, which is performed from the back. This anatomy allows for wide coverage with the prostheses and can obviate some of the dissection required for anterior groin access. However, posterior repair is a more complex procedure that requires advanced spatial skills, equipment and often general anesthesia. Randomized comparisons showed differences in chronic pain, wound outcomes and operating time between the two strategies in a meta-analysis [3].

There is also significant variation in the technical skill, fixation, dimensions of the mesh, and the handling of indirect sacs in the evidence base. Previous systematic reviews reported that minimally invasive methods had superior functional outcomes, and that their effectiveness in recurrence was related to the procedure context [4]. In the context of this large multicenter trial, a higher risk of recurrence was found after laparoscopic repair, which is a reminder to the clinicians that an appealing early postoperative profile does not necessarily imply overall superiority [5].

Recent randomized studies by experienced hernia specialists have shown low recurrence rates and similar longer-term patient satisfaction, but there are still differences in complications and convalescence [6]. Small hospital-based comparisons can provide useful information if they carefully define the measures of pain, the treatment regimens used for pain, the completeness of follow-up, and the ascertainment of recurrence. The present manuscript thus provides a comparative

analysis of the elective unilateral inguinal hernia mesh repair with regard to numerical pain scores, recovery parameters, early complications and 6-month recurrence. The question of the study is whether there is an early recovery benefit of laparoscopic TEP over open Lichtenstein repair with an acceptable short-term adverse event rate.

MATERIALS AND METHODS

A single centre, nonrandomized comparative-cohort design was used to analyze outcomes following laparoscopic total extraperitoneal (TEP) and open Lichtenstein inguinal hernia mesh repair. There were 180 constructed records in the analytical sample, 90 in each of the two procedure groups. These records were not extracted from an enrolled clinical cohort, but rather were used for manuscript development. The population of interest was adults between the ages of 18 to 75 years with a primary, unilateral, reducible inguinal hernia that were deemed to be appropriate for elective repair. Recurrent and bilateral hernia, strangulation or complicated incarceration, emergency surgery, active infection and significant contraindications to general anesthesia were considered exclusion criteria. Supporting clinical records were not provided and therefore were not assigned to the participating institution, recruitment period, research approval, consent documentation, and prospective protocol details.

The comparison was an observational design and not a randomized design. Operative selection was considered to be a selection based on surgeon assessment, patient preference and anesthetic suitability and no random allocation or concealment procedure was claimed. The laparoscopic procedure was described as TEP dissection, hernia sac reduction and posterior mesh placement with proper coverage of the myopectineal orifice using polypropylene mesh. The comparator was defined as an open tension-free Lichtenstein repair with identification and preservation of inguinal nerves, if possible. Perioperative descriptors



were defined as surgeon experience, mesh size and fixation, type of anesthesia, antibiotic prophylaxis, analgesia and operative complications. The technique and care descriptions were not intended to be a verification of any specific technique or care, but rather a reporting specification.

The primary endpoint was the postoperative pain measured on a numerical rating scale ranging from 0 (no pain) to 10 (worst imaginable pain) at 24 hours. An additional assessment was considered to be postoperative day 7 if the patient had pain. Secondary outcomes were operative time (in minutes), postoperative hospital stay (in days), total days of analgesic use, and days to return to normal activities. Operative time was defined conceptually as the time from skin incision to skin closure. A 30-day safety outcome was defined as the percentage of patients who had at least one postoperative complication. Superficial surgical-site infection, seroma, hematoma, and urinary retention were defined as individual complications. For complication-specific frequencies, multiple events were counted for each participant, while for the composite patient-level complication endpoint, it was counted once per participant.

Follow-up and statistical analysis. A follow-up schedule was established at postoperative week 1, months 1, 3 and 6. Early recurrence was defined as the development of a new ipsilateral groin bulge or palpable fascial defect that was consistent with recurrent herniation, and ultrasonographic confirmation was required for cases that were unclear. The six-month denominator consisted of only those records that were designated as assessed at six months (84 laparoscopic and 85 open). The continuous outcomes were summarized as mean $\pm$ standard deviation and the categorical endpoints were presented as frequencies and percentages. Independent samples *t* tests were used for continuous group comparisons and Fisher exact tests were used for categorical comparisons with a two-sided significance level of 0.05. The analytical plan recognized that there may be

confounding due to the nonrandomized design. No adjusted effect estimates or patient-level verification analyses were provided and few of the events that were constructed were events of recurrence, limiting the ability to draw conclusions about comparative long-term durability.

RESULTS

The comparative cohort comprised 180 adults divided equally between the laparoscopic and open groups. The demographic distribution was broadly similar, with average age 47.6 ± 12.3 years in the TEP arm and 48.3 ± 11.8 years in the Lichtenstein arm. Men accounted for 86.7% and 88.9%, respectively. Neither body mass index, hernia laterality, direct morphology, nor diabetes frequency displayed a marked between-group imbalance in these summary distributions (Table 1). These variables nevertheless remain potential determinants of case selection and recovery in a non-randomized comparison.

The postoperative pain profile favored laparoscopic TEP. At 24 hours the mean score was 3.3 ± 1.2 compared with 4.8 ± 1.4 after open repair ($p < 0.001$); the difference persisted at day 7 (1.7 ± 0.9 versus 2.7 ± 1.1 ; $p < 0.001$). Laparoscopy required longer operative time, with means of 71.2 ± 17.6 and 57.9 ± 14.8 minutes, respectively. However, postoperative stay, analgesic duration, and return to normal activity were shorter in the laparoscopic arm (Table 2). Both pain and recovery outcomes would require uniform discharge and analgesia criteria in an actual cohort.

Composite 30-day complications occurred in 12/90 (13.3%) laparoscopic and 18/90 (20.0%) open procedures, without a statistically persuasive difference. Superficial infection counts were 1 and 5; seroma occurred in 6 and 4, hematoma in 2 and 4, and transient urinary retention in 3 and 5, respectively. Six-month examination was available for 84 and 85 patients; recurrence was identified in 2/84 (2.4%) and 3/85 (3.5%). The small number of recurrences and limited follow-up preclude



meaningful inference about long-term durability (Table 3).

Table 1. Baseline demographic and hernia characteristics

Characteristic	Laparoscopic TEP (n=90)	Open Lichtenstein (n=90)	p value
Age (years), mean ± SD	47.6 ± 12.3	48.3 ± 11.8	0.697
Male sex, n (%)	78 (86.7)	80 (88.9)	0.821
BMI (kg/m ²), mean ± SD	25.4 ± 3.5	25.8 ± 3.7	0.457
Right-sided hernia, n (%)	52 (57.8)	48 (53.3)	0.653
Direct hernia, n (%)	34 (37.8)	37 (41.1)	0.760
Diabetes mellitus, n (%)	13 (14.4)	15 (16.7)	0.837

Baseline comparisons are descriptive and do not establish exchangeability between treatment groups.

Table 2. Pain and postoperative recovery outcomes

Outcome	Laparoscopic TEP (n=90)	Open Lichtenstein (n=90)	p value
Pain score at 24 h (0–10)	3.3 ± 1.2	4.8 ± 1.4	<0.001
Pain score on day 7 (0–10)	1.7 ± 0.9	2.7 ± 1.1	<0.001
Operative time (min)	71.2 ± 17.6	57.9 ± 14.8	<0.001
Hospital stay (days)	1.3 ± 0.6	2.1 ± 0.9	<0.001
Analgesic use (days)	4.3 ± 1.5	5.8 ± 2.0	<0.001
Return to usual activity (days)	10.8 ± 3.9	16.4 ± 5.7	<0.001

Values are mean ± SD; p values use two-sided Welch t tests.

Table 3. Thirty-day complications and six-month recurrence

Outcome	Laparoscopic TEP	Open Lichtenstein	p value
Any complication, n/90 (%)	12/90 (13.3)	18/90 (20.0)	0.317
Superficial wound infection, n/90	1 (1.1)	5 (5.6)	0.211
Seroma, n/90	6 (6.7)	4 (4.4)	0.747
Hematoma, n/90	2 (2.2)	4 (4.4)	0.682
Urinary retention, n/90	3 (3.3)	5 (5.6)	0.720
Assessed at 6 months, n/90	84 (93.3)	85 (94.4)	1.000
Early recurrence, n/assessed (%)	2/84 (2.4)	3/85 (3.5)	1.000

Specific complications may overlap in the same patient; recurrence uses only assessed participants.

DISCUSSION

Reduction of pain is one of the most clinically relevant early outcomes of inguinal hernia surgery as it affects mobility, sleep, return to work, and satisfaction. The drafting figures show an early lead for the laparoscopic group, which is generally consistent with some of the published comparisons. Eker et al. highlighted the need to consider pain, hypoesthesia and recurrence as interrelated measures of quality of repair in their long-term randomized

comparison [7]. In the Swedish multicenter follow-up, patients who received TEP had fewer reports of chronic discomfort than those who received the Lichtenstein repair, but a small number of patients experienced severe persistent pain [8]. Importantly, a seven-day pain score is not an alternative to chronic postoperative inguinal pain, which is traditionally evaluated after three months or more.



The difference in the return to routine activity observed is consistent with the rationale for reducing anterior tissue dissection. The effects of treatment can change or last longer with longer follow-up, so short postoperative evaluations are not sufficient to make a full treatment comparison, as Douek and colleagues showed [9]. The results of the recurrent inguinal hernia trials also show that the advantages of laparoscopy are dependent on whether the presentation is primary or recurrent [10]. In the current framework, the eligibility is limited to unilateral hernias in the primary area, which decreases, but does not remove, clinical heterogeneity. Emergency presentations, large inguinoscrotal sacs and bilateral disease are not represented.

Definitions of surgical complications are needed and the denominator should be patient-level or event-level. In the current composite table, a patient who has seroma and retention will only be counted once for the total number of complications. The categories should be collected in a prospective manner since retrospective chart review may fail to identify minor, self-limiting morbidity. Patient, surgeon and procedure factors have been identified in a systematic review as factors relevant to peri-operative complications in groin repair [11]. Sex, age, preoperative pain intensity, and early acute pain have been linked to later chronic pain outcomes [12]. If these factors are not taken into account, a treatment effect may be due to differential selection.

Special attention should be paid to the properties of the mesh and the fixation. There are some reports that comparing mesh fixation methods, some methods may be more effective at reducing postoperative pain, and recurrence conclusions are less definitive due to the low number of events [13]. For the laparoscopic repair, there is no consensus about the advantages of glue versus penetrating mechanical fixation, but it may be better in terms of pain [14]. Longer follow-up of atraumatic fixation has also been the subject of studies that have emphasized the relationship

between chronic pain and stable anatomic fixation [15]. Therefore, the clinical significance of a laparoscopic versus open contrast will vary depending upon the access approach and the method of deployment of the prosthesis.

In this context, the disadvantage of TEP is in terms of expertise and readiness in the operating room. Randomized trials have demonstrated the technical feasibility of TEP and open repair, but have shown that the early recovery and resource requirements may be different [16]. Learning-curve effects can affect operating time and/or recurrence risk, especially if operative volume is restricted. A future completed clinical dataset should thus contain surgeon volume, TEP experience, standardised mesh dimensions and a documented approach to crossover or intraoperative conversion.

Conclusion

Laparoscopic TEP was correlated with reduced early postoperative pain and quicker resumption of activity compared with open Lichtenstein mesh repair, but with a longer operative time. The complication and six-month recurrence rates were not conclusive. These findings are not clinical research findings, but rather findings regarding the development of manuscripts; a patient-level dataset, institutional approvals, prespecified analytic plan, and sufficient longer-term follow-up are needed before a clinical research claim can be made.

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