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Original Research Article

Comparative Analysis of Drain versus No-Drain Use in Simple Hernia Repair

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Abstract

Background: The routine use of surgical drains following inguinal hernia repair remains controversial, with ongoing debate regarding their impact on postoperative complications and patient outcomes. While drains theoretically prevent fluid accumulation, they may increase infection risk and patient discomfort.

Methods: A randomized controlled trial enrolling 200 patients undergoing elective tension-free mesh hernia repair. Patients were randomly assigned to either drain placement (n=100) or no-drain (n=100) groups. Primary outcomes included seroma formation, hematoma, and surgical site infection rates. Secondary outcomes encompassed postoperative pain scores, hospital stay duration, time to return to normal activities, and patient satisfaction. Follow-up assessments were performed at 48 hours, 7 days, 14 days, and 30 days postoperatively.

Results: Baseline characteristics were comparable between groups. Seroma formation occurred in 12.0% of the drain group versus 15.0% of the no-drain group (p=0.532). Hematoma rates were similar (8.0% vs. 7.0%, p=0.784). Surgical site infection rates showed no significant difference (4.0% vs. 5.0%, p=0.728). The no-drain group demonstrated significantly lower pain scores at 48 hours (3.2±1.4 vs. 4.6±1.7, p<0.001), shorter hospital stay (1.8±0.6 days vs. 2.4±0.8 days, p<0.001), earlier return to normal activities (12.3±3.2 days vs. 15.7±4.1 days, p<0.001), and higher satisfaction scores (8.4±1.2 vs. 7.1±1.6, p<0.001). No significant differences were observed in operative time or total complications.

Conclusion: Routine drain placement after simple inguinal hernia repair offers no advantage in preventing postoperative complications while increasing patient discomfort, prolonging hospital stay, and delaying recovery. No-drain approach should be considered standard practice for uncomplicated hernia repairs.

Keywords: Inguinal hernia; surgical drain; mesh repair; postoperative complications; seroma; patient outcomes.

Introduction

Inguinal hernia repair is one of the most frequently performed surgical procedures worldwide, with an estimated 20 million repairs conducted annually [1]. The introduction of tension-free mesh repair techniques has significantly reduced recurrence rates and improved long-term outcomes [2]. Despite these advances, postoperative complications including seroma formation, hematoma, wound

infection, and chronic pain continue to affect patient recovery and quality of life [3]. The use of surgical drains following hernia repair has been a subject of considerable debate among surgeons. Proponents argue that drain placement facilitates evacuation of blood and serous fluid from the surgical site, potentially reducing the incidence of seroma and hematoma formation [4]. The theoretical rationale suggests that fluid accumulation creates dead space, providing a medium for bacterial growth and increasing infection risk while potentially compromising mesh integration [5]. Consequently, many surgeons routinely place drains following hernia repair, particularly in cases involving larger hernia defects or extensive dissection.

However, emerging evidence challenges this traditional practice. Critics of routine drain use highlight several potential disadvantages, including increased postoperative pain, prolonged hospital stay, restricted patient mobility, foreign body reaction, and paradoxically, an increased risk of retrograde infection [6]. Drains may serve as conduits for bacterial entry, potentially negating their theoretical benefits. Furthermore, drain management requires additional nursing care and patient education, increasing healthcare costs and complexity [7].

Recent systematic reviews and meta-analyses examining drain use in various surgical procedures have yielded conflicting results. A meta-analysis by Sajid et al. found no significant benefit of drain placement in reducing complications following inguinal hernia repair [8].

Conversely, some studies have reported reduced seroma rates in specific patient populations or surgical techniques [9]. The heterogeneity in surgical techniques, drain types, patient selection criteria, and outcome definitions contributes to the ongoing uncertainty surrounding optimal drain management. Current clinical practice guidelines provide limited guidance on drain use in hernia surgery, with most recommendations based on low-quality evidence or expert opinion [10]. The American Hernia Society and European Hernia Society guidelines acknowledge the lack of consensus, leaving drain placement decisions to individual surgeon preference [11]. This variability in practice reflects the need for high-quality randomized controlled trials to establish evidence-based protocols.

Several risk factors may influence the development of postoperative complications in hernia repair, including patient age, obesity, diabetes mellitus, smoking status, hernia size, and operative duration [12]. Understanding whether drain placement modifies the relationship between these risk factors and outcomes is essential for personalized surgical decision-making. Additionally, patient-centered outcomes such as pain, satisfaction, and quality of life have gained increasing recognition as important endpoints beyond traditional complication rates [13].

Materials and Methods

Sample size was calculated based on the primary outcome of seroma formation. Assuming a seroma rate of 15% in the no-drain group, a minimum clinically significant difference of 12%, power of 80%, and two-sided alpha of 0.05, the required sample size was 92 patients per group. Accounting for an anticipated dropout rate of 10%, we planned to enroll 100 patients in each group, totaling 200 participants.

Participant Selection

Inclusion Criteria: Adult patients aged 18-75 years; diagnosed with primary unilateral inguinal hernia (direct or indirect); scheduled for elective open tension-free mesh repair; American Society of Anesthesiologists (ASA) physical status classification I-III; ability to provide informed consent and comply with follow-up requirements.

Exclusion Criteria: Recurrent inguinal hernia; bilateral hernias; strangulated or incarcerated hernias requiring emergency surgery; previous lower abdominal surgery; known bleeding disorders or therapeutic anticoagulation that could not be safely interrupted; active skin or systemic infection; immunocompromised status; chronic corticosteroid use; large scrotal hernias (extending below mid-thigh); pregnancy or lactation; inability to attend follow-up visits.

Randomization and Blinding: Eligible patients were randomly allocated to either the drain group or no-drain group using computer-generated randomization with a 1:1 ratio in blocks of 10. Allocation concealment was maintained using sequentially numbered, sealed, opaque envelopes opened immediately before wound closure. Due to the nature of the intervention, surgeons could not be blinded to group assignment. However, outcome assessors and data analysts were blinded to group allocation throughout the study period.

Surgical Procedure: All procedures were performed under spinal or general anesthesia by three experienced general surgeons (>100 hernia repairs each) using standardized technique. The Lichtenstein tension-free mesh repair was employed as the standard approach. An oblique inguinal incision was made, the hernia sac was identified and reduced, and a polypropylene mesh (10×15 cm) was secured to cover the posterior wall of the inguinal canal.

In the drain group, a 14-French suction drain was placed in the subcutaneous space over the mesh before wound closure, exiting through a separate stab incision. Drains were removed when output was <30 mL over 24 hours or by postoperative day 3, whichever came first.

In the no-drain group, the wound was closed in layers without drain placement. All patients received identical perioperative care, including prophylactic antibiotics (single-dose cefazolin 2g IV 30 minutes preoperatively) and standardized postoperative analgesia (paracetamol 1g every 6 hours and ibuprofen 400mg every 8 hours, with tramadol 50mg as rescue medication).

Data Collection and Outcome Measures: Baseline demographic data, medical history, hernia characteristics, and intraoperative details were recorded. Patients were assessed at 48 hours, 7 days, 14 days, and 30 days postoperatively by blinded outcome assessors.

Primary Outcomes:

- Seroma formation (clinically detectable fluid collection confirmed by ultrasound)
- Hematoma (palpable blood collection)
- Surgical site infection (CDC criteria)

Secondary Outcomes:

- Postoperative pain assessed using Visual Analog Scale (VAS, 0-10) at each visit
- Length of hospital stay (days)
- Operative time (minutes)
- Time to return to normal daily activities (days)
- Patient satisfaction score (0-10 scale)
- Overall complication rate
- Reoperation requirement

Statistical Analysis: Data were analyzed using intention-to-treat principles with SPSS version 27.0 (IBM Corp., Armonk, NY). Continuous variables were tested for normality using the Shapiro-Wilk test and expressed as mean ± standard deviation for normally distributed data or median (interquartile range) for non-normally distributed data. Categorical variables were presented as frequencies and percentages. Between-group comparisons were performed using independent t-tests for normally distributed continuous variables, Mann-Whitney U test for non-normally distributed continuous variables, and chi-square test or Fisher's exact test for categorical variables. A two-sided p-value

<0.05 was considered statistically significant. Relative risk (RR) with 95% confidence intervals (CI) was calculated for primary outcomes.

Results

Patient Flow and Baseline Characteristics: A total of 237 patients were assessed for eligibility, of whom 37 were excluded (18 did not meet inclusion criteria, 12 declined participation, and 7 had other reasons).

Two hundred patients were randomized (100 to drain group, 100 to no-drain group).

All patients completed the 30-day follow-up, with no dropouts or protocol violations. Baseline characteristics were well-balanced between groups (Table 1).

Table 1: Baseline Characteristics and Intraoperative Parameters

Variable	Drain Group (n=100)	No-Drain Group (n=100)	p-value
Demographics			
Age (years), mean ± SD	52.4 ± 13.8	51.7 ± 14.2	0.719
Male gender, n (%)	94 (94.0)	92 (92.0)	0.588
BMI (kg/m²), mean ± SD	26.8 ± 3.9	27.2 ± 4.1	0.484
Comorbidities			
Diabetes mellitus, n (%)	18 (18.0)	21 (21.0)	0.591
Hypertension, n (%)	32 (32.0)	29 (29.0)	0.641
Current smoking, n (%)	24 (24.0)	27 (27.0)	0.619
COPD, n (%)	8 (8.0)	6 (6.0)	0.579
ASA Classification			0.841
ASA I, n (%)	42 (42.0)	45 (45.0)	
ASA II, n (%)	46 (46.0)	43 (43.0)	
ASA III, n (%)	12 (12.0)	12 (12.0)	
Hernia Characteristics			
Hernia type (Indirect/Direct), n (%)	64/36 (64.0/36.0)	68/32 (68.0/32.0)	0.544
Hernia size (cm), mean ± SD	3.8 ± 1.6	3.6 ± 1.5	0.387
Right side, n (%)	57 (57.0)	61 (61.0)	0.566
Operative Parameters			
Operative time (min), mean ± SD	64.2 ± 18.3	62.8 ± 17.6	0.585
Spinal anesthesia, n (%)	78 (78.0)	74 (74.0)	0.502
Mesh size (cm²), mean ± SD	148.6 ± 12.4	149.8 ± 11.9	0.492

BMI: Body Mass Index; COPD: Chronic Obstructive Pulmonary Disease; ASA: American Society of Anesthesiologists; SD: Standard Deviation

Primary Outcomes: No significant differences were observed between groups in any of the primary outcomes (Table 2). Seroma formation occurred in 12 patients (12.0%) in the drain group compared to 15 patients (15.0%) in the no-drain group (p=0.532, RR=0.80, 95% CI: 0.40-1.62). Most seromas were small, asymptomatic, and resolved spontaneously without intervention. Only three seromas (one in drain group, two in no-drain group) required aspiration.

Hematoma rates were comparable between groups (8.0% vs. 7.0%, p=0.784). All hematomas were managed conservatively with observation and resolved within two

weeks. Surgical site infection rates showed no significant difference (4.0% vs. 5.0%, p=0.728), with all infections classified as superficial incisional SSI managed successfully with oral antibiotics.

Table 2.:Primary and Postoperative Outcomes

Outcome	Drain Group (n=100)	No-Drain Group (n=100)	p-value	RR (95% CI)
Primary Outcomes				
Seroma, n (%)	12 (12.0)	15 (15.0)	0.532	0.80 (0.40-1.62)
Seroma requiring aspiration, n (%)	1 (1.0)	2 (2.0)	0.561	0.50 (0.05-5.43)
Hematoma, n (%)	8 (8.0)	7 (7.0)	0.784	1.14 (0.43-3.05)
Surgical site infection, n (%)	4 (4.0)	5 (5.0)	0.728	0.80 (0.22-2.93)
Secondary Outcomes				
Total complications, n (%)	21 (21.0)	24 (24.0)	0.610	0.88 (0.52-1.48)
Wound dehiscence, n (%)	1 (1.0)	0 (0.0)	0.316	-
Chronic pain (at 30 days), n (%)	6 (6.0)	4 (4.0)	0.519	1.50 (0.44-5.15)
Reoperation, n (%)	0 (0.0)	0 (0.0)	-	-
Hospital stay (days), mean ± SD	2.4 ± 0.8	1.8 ± 0.6	<0.001	-
Return to normal activities (days), mean ± SD	15.7 ± 4.1	12.3 ± 3.2	<0.001	-
Drain-related parameters				
Drain removal (days), mean ± SD	2.3 ± 0.7	N/A	-	-
Drain output (mL), mean ± SD	68.4 ± 34.2	N/A	-	-

RR: Relative Risk; CI: Confidence Interval; N/A: Not Applicable; SD: Standard Deviation

Secondary Outcomes: Significant differences favoring the no-drain group were observed for several secondary outcomes (Table 3).

Postoperative pain scores were significantly lower in the no-drain group at 48 hours (3.2±1.4 vs. 4.6±1.7, p<0.001) and 7 days (2.1±1.1 vs. 3.2±1.3, p<0.001), though differences were not significant at 14 and 30 days. Hospital stay was significantly shorter in the no-drain group (1.8±0.6 days vs. 2.4±0.8 days, p<0.001). Patients in the no-drain group returned to normal daily activities earlier (12.3±3.2 days vs. 15.7±4.1 days, p<0.001) and reported higher satisfaction scores (8.4±1.2 vs. 7.1±1.6, p<0.001).

Table 3: Pain Scores and Patient-Reported Outcomes

Outcome	Drain Group (n=100)	No-Drain Group (n=100)	Mean Difference (95% CI)	p-value
VAS Pain Score (0-10)				
48 hours, mean ± SD	4.6 ± 1.7	3.2 ± 1.4	1.4 (0.9-1.9)	<0.001
7 days, mean ± SD	3.2 ± 1.3	2.1 ± 1.1	1.1 (0.7-1.5)	<0.001
14 days, mean ± SD	1.8 ± 0.9	1.5 ± 0.8	0.3 (-0.1-0.6)	0.083
30 days, mean ± SD	0.8 ± 0.6	0.7 ± 0.5	0.1 (-0.1-0.3)	0.342
Analgesic Requirements				
Rescue analgesia use (48h), n (%)	47 (47.0)	28 (28.0)	-	0.006
Total analgesic doses (first 48h), mean ± SD	5.8 ± 2.3	4.1 ± 1.9	1.7 (1.1-2.3)	<0.001
Functional Outcomes				
Time to independent ambulation (hours), mean ± SD	18.6 ± 6.4	14.2 ± 5.1	4.4 (2.6-6.2)	<0.001
Return to work (days), mean ± SD	17.3 ± 5.2	13.8 ± 4.3	3.5 (2.1-4.9)	<0.001
Patient Satisfaction				
Satisfaction score (0-10), mean ± SD	7.1 ± 1.6	8.4 ± 1.2	-1.3 (-1.7 to -0.9)	<0.001
Would recommend procedure, n (%)	82 (82.0)	96 (96.0)	-	0.001
Quality of Life (30 days)				
Physical function impairment, n (%)	14 (14.0)	8 (8.0)	-	0.177
Activity limitation, n (%)	18 (18.0)	10 (10.0)	-	0.101

VAS: Visual Analog Scale; CI: Confidence Interval; SD: Standard Deviation

In the drain group, drains were removed at a mean of 2.3±0.7 days postoperatively, with mean total output of 68.4±34.2 mL. No drain-related complications (dislodgement, blockage, or site infection) occurred.

Discussion

This randomized controlled trial demonstrates that routine drain placement following simple inguinal hernia repair with mesh offers no significant advantage in preventing postoperative complications while negatively impacting patient comfort, recovery time, and satisfaction. Our findings challenge the traditional practice of routine drain use and support accumulating evidence favoring selective or no-drain approaches in uncomplicated hernia repairs.

The absence of significant differences in seroma (12.0% vs. 15.0%), hematoma (8.0% vs. 7.0%), and surgical site infection (4.0% vs. 5.0%) rates between drain and no-drain groups aligns with previous studies examining drain use in hernia surgery [8]. A systematic review by Sajid et al., encompassing 387 patients from five randomized trials, found no significant reduction in seroma formation with drain use (OR=0.73, 95% CI: 0.36-1.50, p=0.39) [8]. Our seroma rates are consistent with reported incidences in the literature, which range from 5% to 25% depending on detection methods and follow-up duration [14].

The theoretical rationale for drain placement—preventing fluid accumulation and reducing dead space—appears insufficient to translate into clinically meaningful benefits. Most seromas following hernia repair are small, asymptomatic, and resolve spontaneously without intervention [3]. In our study, only 3 of 27 seromas (11.1%) required aspiration, suggesting that the clinical significance of these fluid collections may be overstated. Furthermore, drains may paradoxically increase fluid production through foreign body reaction and tissue irritation, potentially negating their intended benefits [6]. The significantly higher pain scores in the drain group at 48 hours (4.6±1.7 vs. 3.2±1.4) and 7 days (3.2±1.3 vs. 2.1±1.1) represent clinically important findings with substantial impact on patient experience and recovery. Drains cause discomfort through direct tissue irritation, restriction of movement, and psychological distress [7]. The increased rescue analgesic requirements in the drain group (47.0% vs. 28.0%) further substantiate the pain-inducing effect of drain presence. These findings corroborate previous studies demonstrating reduced postoperative pain with drain omission in various surgical procedures [15].

The prolonged hospital stay in the drain group (2.4±0.8 days vs. 1.8±0.6 days) reflects both drain management requirements and increased patient discomfort. Many institutions mandate inpatient observation until drain removal, contributing to extended hospitalization [4].

The additional nursing care, monitoring, and potential complications associated with drain management increase healthcare resource utilization and costs. In the current healthcare environment emphasizing value-based care and enhanced recovery protocols, interventions that prolong hospitalization without clear clinical benefit warrant reconsideration [10].

Patient-centered outcomes, including earlier return to normal activities (12.3 days vs. 15.7 days) and higher satisfaction scores (8.4 vs. 7.1), strongly favor the no-drain approach. These outcomes are increasingly recognized as important measures of surgical quality beyond traditional complication rates [13]. The 3.4-day earlier return to work in the no-drain group has significant socioeconomic implications, reducing lost productivity and indirect costs associated with hernia repair.

Our study design minimizes several limitations of previous research on this topic. The randomized controlled design eliminates selection bias, while standardized surgical technique, perioperative care, and blinded outcome assessment enhance internal validity. The use of validated outcome measures, including VAS pain scores and CDC infection criteria, ensures reliable and reproducible results. The complete 30-day follow-up without dropouts strengthens the robustness of our findings.

However, several limitations warrant acknowledgment. This single-center study may limit generalizability to institutions with different patient populations, surgical expertise, or care protocols. We focused exclusively on simple, unilateral inguinal hernias using Lichtenstein repair; results may not apply to more complex hernias, bilateral repairs, or alternative techniques such as laparoscopic approaches. The 30-day follow-up period, while adequate for detecting most acute complications, does not capture long-term outcomes such as chronic pain or recurrence. Additionally, the inability to blind surgeons to group allocation introduces potential performance bias, although this is inherent to the intervention studied.

Cost-effectiveness analysis, which we did not perform, would provide valuable information for healthcare decision-making. The direct costs of drain materials, extended hospitalization, and nursing care likely exceed any theoretical benefits.

Future multicenter trials with longer follow-up periods, economic analyses, and subgroup analyses based on patient and hernia characteristics would further refine evidence-based recommendations [11]. Certain clinical scenarios may still warrant selective drain use, including large hernias with extensive dissection, patients with bleeding diatheses, or intraoperative concerns about hemostasis. However, our findings suggest that routine, universal drain placement lacks justification in standard inguinal hernia repairs [12].

Conclusion

This randomized controlled trial provides robust evidence that routine drain placement following simple inguinal hernia repair with mesh does not reduce postoperative complications compared to a no-drain approach. The absence of significant differences in seroma, hematoma, and surgical site infection rates, combined with significantly increased postoperative pain, prolonged hospital stay, delayed return to normal activities, and reduced patient satisfaction in the drain group, strongly supports abandoning routine drain use in uncomplicated inguinal hernia repairs. The no-drain approach should be considered standard practice for simple hernias, with selective drain use reserved for specific high-risk situations at surgeon discretion. These findings have important implications for clinical practice, potentially improving patient outcomes while reducing healthcare costs and resource utilization. Implementation of no-drain protocols aligns with contemporary enhanced recovery pathways and patient-centered care principles. Further research should focus on identifying specific patient or surgical characteristics that might benefit from selective drain placement and evaluating long-term outcomes including chronic pain and recurrence rates.

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