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Feasibility and safety of clip versus bipolar vessel-sealing device closure of peritoneal tears in TEP inguinal hernia repair: a retrospective comparative study

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ABSTRACT

Introduction: Peritoneal tears are the most common intraoperative event during totally extraperitoneal (TEP) inguinal hernia repair and are the leading cause of conversion. Several closure techniques have been described, but clip closure has never been directly compared with closure using an energy-based sealing device. This study compared the feasibility and safety of 5-mm titanium clips and a bipolar vessel-sealing device for the closure of peritoneal tears during TEP repair.

Materials and Methods: Patients who underwent elective TEP inguinal hernia repair between January 2023 and May 2025 at a single center were retrospectively reviewed. Of 295 procedures, a peritoneal tear occurred in 74 patients (25.1%); after excluding 7 patients managed using other techniques and 6 lost to follow-up, 61 patients were analyzed (27 clip, 34 vessel-sealing device). Outcomes included the need for Veress needle decompression, conversion, operative time, complications, and recurrence. An additional analysis was performed after excluding inguinoscrotal hernias.

Results: Operative time did not differ between the clip and vessel-sealing device groups (45.9±7.3 vs 46.2±8.7 minutes; p=0.855), nor did the need for Veress needle decompression (3.7% vs 11.8%; p=0.371), early postoperative complications (14.8% vs 11.8%; p=1.000), or recurrence (7.4% vs 5.9%; p=1.000). Conversion occurred in one patient (1.6%). Inguinoscrotal hernias were more frequent in the vessel-sealing device group (29.4% vs 3.7%; p=0.016); excluding these patients did not alter any findings. No bowel obstruction occurred over a median follow-up of 26.3 months.

Conclusions: Both techniques appear feasible and safe, with no differences detected between them. As clip closure is not slower, device choice may be guided by availability and cost. These exploratory findings require confirmation in adequately powered studies.

Keywords: Inguinal hernia, peritoneal tear, titanium clip, totally extraperitoneal repair, vessel-sealing device

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Introduction

Inguinal hernia repair is among the most frequently performed operations worldwide, with more than 20 million procedures carried out annually.[1] Since its introduction by McKernan and Laws, the totally extraperitoneal (TEP) approach has become one of the two established laparo-endoscopic techniques.[2] Current international guidelines recommend laparo-endoscopic repair for primary unilateral inguinal hernia when the necessary expertise and resources are available.[3] By avoiding entry into the peritoneal cavity, TEP limits the risk of visceral injury and adhesion formation; however, it confines the surgeon to a narrow preperitoneal working space that depends on the integrity of the peritoneum.

Peritoneal tears are the most common intraoperative event associated with the TEP approach, with a reported incidence ranging from 11% to 67%.[4–6] Their principal consequence is immediate: carbon dioxide escapes into the peritoneal cavity, the resulting pneumoperitoneum compresses the extraperitoneal space, and the working area available for dissection and mesh placement progressively diminishes. Loss of working space is the leading cause of conversion during TEP repair, and a large peritoneal tear increases the risk of conversion approximately sixfold.[7] A less frequent but more serious concern arises later, because an unclosed peritoneal defect may allow the bowel to herniate into the preperitoneal space or adhere to the prosthetic mesh, potentially resulting in bowel obstruction.[8]

Whether peritoneal tears should be routinely closed and which technique should be used remain unresolved. Some authors leave small tears open and report no attributable sequelae,[9] while others close all but the smallest defects.[4] Neither the international guidelines for groin hernia management[1] nor their recent update[3] offers a recommendation on this issue. Among the techniques described—endoloop ligation, intracorporeal suturing, clip application, and sealing with energy devices—comparative data are scarce, and no study has directly compared clip closure with closure using an energy-based sealing device.

The aim of this study was therefore to compare the feasibility and safety of 5-mm titanium clips and a bipolar vessel-sealing device for the closure of peritoneal tears occurring during TEP inguinal hernia repair, with respect to preservation of the extraperitoneal working space, operative time, and early and late postoperative outcomes.

Materials and Methods

Study Design and Patient Selection

This retrospective, single-center study was conducted at a tertiary training and research hospital in Istanbul, Türkiye, between January 2023 and May 2025. During the study period, 295 consecutive patients underwent elective laparoscopic totally extraperitoneal (TEP) inguinal hernia repair. An intraoperative peritoneal tear occurred in 74 patients (25.1%). Seven patients in whom the tear was managed using another technique (intracorporeal suturing in 4 and endoloop ligation in 3) were excluded, and a further 6 patients were lost to follow-up (2 in the clip group and 4 in the vessel-sealing device group), leaving 61 patients who constituted the study population (Fig. 1). Patients who underwent transabdominal preperitoneal (TAPP) or open repair as the primary approach, those operated on under emergency conditions for incarcerated or strangulated hernia, those who underwent a concomitant intra-abdominal procedure, and those with incomplete operative or follow-up records were also excluded. The study was approved by the institutional ethics committee of Şehit Prof. Dr. İlhan Varank Hospital (approval number: E-46059653-050.04-31934084, date: 29.06.2026), and the requirement for informed consent was waived owing to the retrospective design. All procedures were performed in accordance with the Declaration of Helsinki.

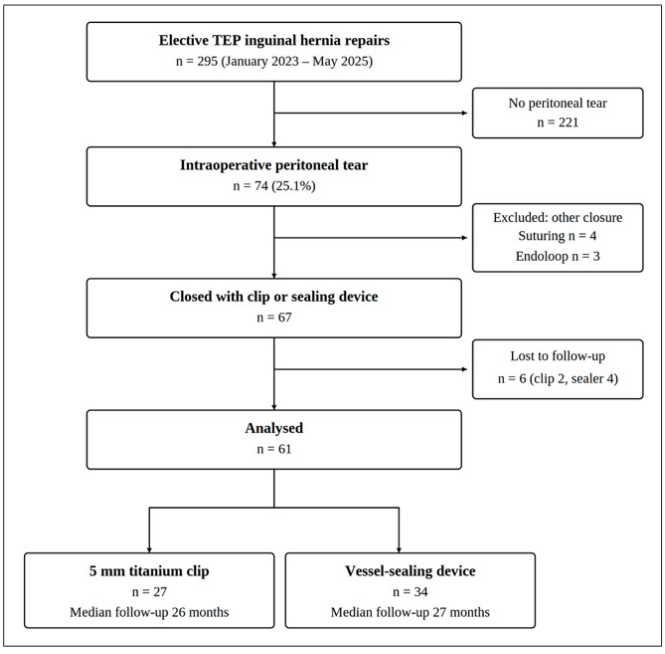

Figure 1. Flow diagram of patient selection.

Surgical Technique

All procedures were performed under general anesthesia with the patient in the supine position by surgeons experienced in laparoscopic inguinal hernia repair who had completed the learning curve. A first-generation cephalosporin (1 g) was administered intravenously as antibiotic prophylaxis. Operative time was defined as the time from skin incision to closure of the last port site. A 10-mm infraumbilical incision was made, and a balloon trocar was used to create the preperitoneal space. Insufflation was established at 12 mmHg. Two additional 5-mm ports were placed in the midline: the first 7 cm above the symphysis pubis and the second 5 cm above the first port. The preperitoneal space was dissected, and the hernia sac was reduced. A 10×15 cm polypropylene mesh was placed to cover the myopectineal orifice and secured with a single absorbable tack to Cooper's ligament. In large medial (M3) hernias, according to the European Hernia Society classification, fixation was increased to two absorbable tacks at Cooper's ligament and one at the rectus muscle.

A peritoneal tear was defined as any full-thickness disruption of the peritoneum occurring during creation of the preperitoneal space or dissection of the hernia sac, resulting in carbon dioxide leakage into the peritoneal cavity. Tear size was estimated intraoperatively by reference to the jaws of an open endoscopic grasper, which measure approximately 20 mm when fully opened. In accordance with departmental practice, tears measuring approximately 20–25 mm or smaller were closed before mesh placement, either with 5-mm titanium clips or with a bipolar vessel-sealing device (LigaSure™, Medtronic, Minneapolis, MN, USA); larger tears were managed by intracorporeal suturing or endoloop ligation, and these patients were excluded from the analysis. Titanium clips from various manufacturers were used according to availability; no single brand was standardized. The choice between clips and the vessel-sealing device was not protocolized and was determined by surgeon preference and device availability. In patients with inguinoscrotal hernias, the vessel-sealing device was frequently already in use for dissection of the hernia sac and was therefore the more readily accessible instrument when a tear occurred. When the extraperitoneal working space remained compromised despite closure of the tear, the pneumoperitoneum was decompressed using a Veress needle inserted in the left upper quadrant. Conversion to transabdominal preperitoneal (TAPP) or open repair was performed when adequate working space could not be restored.

Data Collection and Outcome Measures

Patient demographics, comorbidities, hernia characteristics, operative details, and postoperative outcomes were retrospectively collected from the hospital electronic record system, patient files, and operative notes. Recorded variables included age, sex, body mass index (BMI), American Society of Anesthesiologists (ASA) score, comorbidities, history of previous lower abdominal surgery, hernia side, hernia type, primary or recurrent hernia, presence of an inguinoscrotal hernia, and anatomical location of the peritoneal tear. Seroma and hematoma were diagnosed by physical examination and confirmed by ultrasonography. Given the small number of expected events and the exploratory nature of the comparison, no single primary outcome was designated. Intraoperative outcomes included the need for Veress needle decompression of the pneumoperitoneum, conversion to TAPP or open repair, operative time, and intraoperative complications. Early postoperative complications were defined as those occurring within 30 days of surgery and were graded according to the Clavien–Dindo classification. Late outcomes assessed during follow-up comprised hernia recurrence, chronic groin pain defined as pain persisting beyond 3 months, and bowel obstruction.

Follow-up

Patients were followed up in the outpatient clinic on the 10th postoperative day and at 1, 6, and 12 months, and annually thereafter. Follow-up data were obtained during outpatient clinic visits or by structured telephone interview for patients who were unable to attend, during which patients were questioned regarding symptoms suggestive of hernia recurrence, chronic groin pain, and abdominal complaints. Patients reporting symptoms were invited for clinical examination, and suspected recurrences were confirmed by ultrasonography. All confirmed recurrences were subsequently repaired using the open Lichtenstein technique. The censoring date for follow-up was May 31, 2026.

Statistical Analysis

Statistical analysis was performed using Python version 3.12 with the SciPy library (SciPy 1.17, Python Software Foundation). The normality of continuous variables was assessed using the Shapiro–Wilk test. Operative time

was normally distributed in both groups (Shapiro–Wilk p=0.442 and p=0.202). Normally distributed continuous variables were expressed as mean±standard deviation and compared using the independent-samples t-test, whereas non-normally distributed variables were presented as median (range) and compared using the Mann–Whitney U test. Categorical variables were expressed as frequencies and percentages and compared using the chi-square test or Fisher's exact test, as appropriate. Differences between groups are presented with 95% confidence intervals; risk differences for categorical variables were calculated as the clip group minus the vessel-sealing device group.

No a priori sample size calculation was performed, as all eligible patients treated during the study period were included. Given the low number of events observed for several outcomes, no multivariable regression analysis was performed because the number of events per variable was insufficient to support a reliable model. An additional sensitivity analysis was performed after excluding patients with inguinoscrotal hernias to assess whether the observed baseline imbalance in the distribution of inguinoscrotal hernias between the groups influenced the results. A p value <0.05 was considered statistically significant. The study was not powered to detect differences in rare outcomes; post hoc, approximately 160 patients per group would be required to detect a difference in the rate of Veress needle decompression of the observed magnitude with 80% power. All comparisons should therefore be interpreted as exploratory.

Results

Patient Characteristics

During the study period, 295 patients underwent laparoscopic TEP inguinal hernia repair. An intraoperative peritoneal tear occurred in 74 patients (25.1%). Seven patients were excluded because the tear was managed using another technique (intracorporeal suturing in 4 and endoloop ligation in 3), and 6 were lost to follow-up (2 in the clip group and 4 in the vessel-sealing device group), leaving 61 patients for analysis. The tear was closed with 5-mm titanium clips in 27 patients (44.3%) and with a bipolar vessel-sealing device in 34 patients (55.7%). The majority of the study population was male (n=59, 96.7%), with a mean age of 46.5±12.1 years and a mean BMI of 26.9±2.4 kg/m². Most patients were classified as ASA II (n=53, 86.9%). Comorbidities included diabetes mellitus in 6 patients (9.8%), hypertension in 7 (11.5%), and other comorbidities in 3 (4.9%; asthma in 2 and familial Mediterranean fever in 1). Six patients (9.8%) were current smokers, and 2 (3.3%) had a history of previous lower abdominal surgery. Hernias were right-sided in 23 patients (37.7%), left-sided in 19 (31.1%), and bilateral in 19 (31.1%). The most common hernia type was indirect (n=38, 62.3%), followed by direct (n=15, 24.6%), combined (n=5, 8.2%), femoral (n=2, 3.3%), and pantaloon (n=1, 1.6%). Nine patients (14.8%) had a recurrent hernia, and 11 (18.0%) had an inguinoscrotal hernia. The peritoneal tear was located at the hernia sac in 34 patients (55.7%), laterally in 22 (36.1%), and at multiple sites in 5 (8.2%).

The two groups were comparable with respect to age, sex, BMI, ASA score, comorbidities, history of previous lower abdominal surgery, hernia side, hernia type, recurrent hernia, and tear location (all p>0.05). The only significant difference between the groups was the presence of an inguinoscrotal hernia, which was more frequent in the vessel-sealing device group (10/34, 29.4%) than in the clip group (1/27, 3.7%; p=0.016). Baseline characteristics of the two groups are summarized in Table 1.

Intraoperative Outcomes

The mean operative time was 45.9±7.3 minutes in the clip group and 46.2±8.7 minutes in the vessel-sealing device group (mean difference, −0.4 minutes; 95% CI, −4.6 to +3.8; p=0.855). Veress needle decompression of the pneumoperitoneum was required in 5 patients (8.2%) overall: 1 patient (3.7%) in the clip group and 4 patients (11.8%) in the vessel-sealing device group (p=0.371). Conversion to another technique was required in a single patient (1.6%), in whom the TEP procedure was converted to TAPP repair because of inadequate working space despite closure of the peritoneal tear; this patient was in the clip group (1/27, 3.7% vs 0/34, 0%; p=0.443). No conversion to open repair occurred. One intraoperative complication was recorded (1.6%): an inferior epigastric vessel injury in the vessel-sealing device group, which was controlled laparoscopically (0/27 vs 1/34, 2.9%; p=1.000). No bladder, bowel, or thermal injuries were observed in either group. Intraoperative outcomes are presented in Table 2.

Postoperative and Follow-up Outcomes

All patients were discharged on the first postoperative day. Early postoperative complications occurred in 8 patients (13.1%): 4 in the clip group (14.8%) and 4 in the vessel-sealing device group (11.8%; p=1.000). These con-

Table 1. Baseline demographic and clinical characteristics of the two groups

Variable	Clip group (n=27)	Sealing device group (n=34)	p
Age (years), mean±SD	45.7±10.4	47.1±13.3	0.666[a]
Sex, n (%)			1.000[b]
Male	26 (96.3)	33 (97.1)	
Female	1 (3.7)	1 (2.9)	
BMI (kg/m²), mean±SD	27.4±2.7	26.5±2.1	0.128[a]
ASA score, n (%)			0.140[c]
I	1 (3.7)	5 (14.7)	
II	26 (96.3)	27 (79.4)	
III	0 (0)	2 (5.9)	
Diabetes mellitus, n (%)	2 (7.4)	4 (11.8)	0.685[b]
Hypertension, n (%)	2 (7.4)	5 (14.7)	0.448[b]
Other comorbidity, n (%)	1 (3.7)	2 (5.9)	1.000[b]
Current smoker, n (%)	3 (11.1)	3 (8.8)	1.000[b]
Previous lower abdominal surgery, n (%)	1 (3.7)	1 (2.9)	1.000[b]
Hernia side, n (%)			0.594[c]
Right	12 (44.4)	11 (32.4)	
Left	7 (25.9)	12 (35.3)	
Bilateral	8 (29.6)	11 (32.4)	
Hernia type, n (%)			0.323[c]
Indirect	16 (59.3)	22 (64.7)	
Direct	5 (18.5)	10 (29.4)	
Combined	4 (14.8)	1 (2.9)	
Femoral	1 (3.7)	1 (2.9)	
Pantaloon	1 (3.7)	0 (0)	
Recurrent hernia, n (%)	4 (14.8)	5 (14.7)	1.000[b]
Inguinoscrotal hernia, n (%)	**1 (3.7)**	**10 (29.4)**	**0.016**[b]
Peritoneal tear location, n (%)			0.109[c]
Hernia sac	19 (70.4)	15 (44.1)	
Lateral	7 (25.9)	15 (44.1)	
Multiple	1 (3.7)	4 (11.8)	

BMI: body mass index; ASA: American Society of Anesthesiologists; SD: standard deviation. [a]Independent samples t-test; [b]Fisher's exact test; [c]Chi-square test. Combined refers to bilateral hernias with differing hernia types on each side.

sisted of seroma in 6 patients (3 in each group) and hematoma in 2 patients (1 in each group). All early complications were managed conservatively and were classified as Clavien–Dindo grade I. No surgical site infection, urinary retention, or mesh-related complication was observed.

The median follow-up was 26.3 months (range, 13.2–39.9 months), and all 61 analyzed patients completed at least 12 months of follow-up. Follow-up duration did not differ between the groups (p=0.427). Follow-up was conducted by outpatient clinical examination in 45 patients (73.8%) and by structured telephone interview in 16 (26.2%); the method of follow-up did not differ between the groups (clip group: 7/27, 25.9%; vessel-sealing device group: 9/34, 26.5%; p=1.000). Hernia recurrence occurred in 4 patients overall (6.6%; 95% CI, 2.6–15.7%) at 11, 12, 16, and 19

Table 2. Intraoperative, postoperative, and follow-up outcomes

Outcome	Clip group (n=27)	Sealing device group (n=34)	Difference (95% CI)	p
Intraoperative				
Operative time (min), mean±SD	45.9±7.3	46.2±8.7	−0.4 (−4.6 to +3.8)	0.855[a]
Veress needle decompression, n (%)	1 (3.7)	4 (11.8)	−8.1 (−21.0 to +4.9)	0.371[b]
Conversion to TAPP, n (%)	1 (3.7)	0 (0)	+3.7 (−3.4 to +10.8)	0.443[b]
Conversion to open repair, n (%)	0 (0)	0 (0)	–	–
Intraoperative complication, n (%)	0 (0)	1 (2.9)	−2.9 (−8.6 to +2.7)	1.000[b]
Inferior epigastric vessel injury	0 (0)	1 (2.9)		
Early postoperative (≤30 days)				
Any complication, n (%)	4 (14.8)	4 (11.8)	+3.1 (−14.2 to +20.3)	1.000[b]
Seroma	3 (11.1)	3 (8.8)		
Hematoma	1 (3.7)	1 (2.9)		
Clavien-Dindo grade, n (%)				
Grade 0	23 (85.2)	30 (88.2)		
Grade I	4 (14.8)	4 (11.8)		
Length of hospital stay (days)	1	1	–	–
Follow-up				
Follow-up (months), mean±SD	25.4±7.6	27.0±8.1	−1.6 (−5.7 to +2.5)	0.427[a]
Hernia recurrence, n (%)	2 (7.4)	2 (5.9)	+1.5 (−11.1 to +14.2)	1.000[b]
Chronic groin pain, n (%)	1 (3.7)	0 (0)	+3.7 (−3.4 to +10.8)	0.443[b]
Bowel obstruction, n (%)	0 (0)	0 (0)	–	–

TAPP: transabdominal preperitoneal; SD: standard deviation; CI: confidence interval. Differences are expressed as the clip group minus the sealing device group; for continuous variables as the mean difference in minutes, and for categorical variables as the risk difference in percentage points. All patients were discharged on the first postoperative day. [a]Independent samples t-test; [b]Fisher's exact test.

months postoperatively: 2 patients in the clip group (7.4%) and 2 in the vessel-sealing device group (5.9%; p=1.000). All recurrences were confirmed by ultrasonography and repaired using the open Lichtenstein technique. Chronic groin pain was reported by 1 patient (1.6%) in the clip group (3.7% vs 0%; p=0.443). No patient in either group developed bowel obstruction or preperitoneal herniation during the follow-up period. Postoperative and follow-up outcomes are summarized in Table 2.

Sensitivity Analysis

Given the significantly higher proportion of inguinoscrotal hernias in the vessel-sealing device group, an additional analysis was performed after excluding these patients, yielding 26 patients in the clip group and 24 in the vessel-sealing device group. In this balanced subgroup, no significant differences were observed between the clip and vessel-sealing device groups with respect to Veress needle decompression (1/26, 3.8% vs 3/24, 12.5%; p=0.340), early postoperative complications (3/26, 11.5% vs 2/24, 8.3%; p=1.000), recurrence (2/26, 7.7% vs 1/24, 4.2%; p=1.000), or operative time (46.3±7.1 vs 46.5±8.9 minutes; p=0.984). The findings of the primary analysis were therefore unchanged (Table 3).

Discussion

Peritoneal tears are among the most frequently encountered intraoperative events during TEP inguinal hernia repair,

Table 3. Sensitivity analysis excluding patients with inguinoscrotal hernia

Outcome	Clip group (n=26)	Sealing device group (n=24)	Difference (95% CI)	p
Operative time (min), mean±SD	46.3±7.1	46.5±8.9	−0.3 (−4.8 to +4.3)	0.984[a]
Veress needle decompression, n (%)	1 (3.8)	3 (12.5)	−8.7 (−23.8 to +6.5)	0.340[b]
Early postoperative complication, n (%)	3 (11.5)	2 (8.3)	+3.2 (−13.3 to +19.7)	1.000[b]
Hernia recurrence, n (%)	2 (7.7)	1 (4.2)	+3.5 (−9.5 to +16.5)	1.000[b]

CI: confidence interval; SD: standard deviation. a: Independent samples t-test; b: Fisher's exact test.

with a reported incidence ranging from 11% to 67% across published series.[4,5,10,11] In the present series, a peritoneal tear occurred in 74 of 295 patients (25.1%), a figure closely comparable to the 22.2% reported by Donmez et al.[4] in a Turkish cohort of similar size. The clinical importance of a peritoneal tear lies primarily in the intraoperative period. Carbon dioxide escaping through the defect creates a pneumoperitoneum that compresses the extraperitoneal space and progressively reduces the working area available for dissection and mesh placement.[7] Loss of working space is the leading cause of conversion during TEP repair; a large peritoneal tear has been shown to increase the risk of conversion approximately sixfold,[7] and peritoneal rupture accounted for three of the seven conversions in a recent Turkish series.[12] A second, less frequent concern relates to the postoperative period, as an unclosed peritoneal defect may permit the bowel to herniate into the preperitoneal space or adhere to the prosthetic mesh, with the potential for bowel obstruction.[8]

Despite the rationale for closure, whether peritoneal tears should be routinely closed remains unresolved. Shpitz et al.[9] left peritoneal tears open in a prospective series and observed no attributable complications during follow-up, concluding that routine closure is unnecessary and that most tears can be managed safely without repair. Donmez et al.[4] similarly left small tears (≤5 mm) open, reserving closure for larger defects. In contrast, McKay reported preperitoneal herniation with early bowel obstruction through an unclosed peritoneal defect following laparoscopic inguinal hernia repair, a complication that required reoperation.[8] Notably, neither the International Guidelines for Groin Hernia Management[1] nor their 2023 update[3] provides any statement or recommendation on the management of peritoneal tears during TEP repair, reflecting the paucity of evidence on this issue.

In the present series, every peritoneal tear was closed regardless of size, and among the 61 patients in whom the tear was closed with a clip or a vessel-sealing device, the conversion rate was 1.6% (1 of 61). This contrasts with the 31.25% conversion rate reported by Donmez et al.[4] among patients with peritoneal tears, in a practice in which small tears were left open. Although the two series are not directly comparable and this observation is hypothesis-generating rather than confirmatory, it is consistent with the possibility that routine closure of all tears, irrespective of size, helps preserve the extraperitoneal working space and reduces the need for conversion. No patient in either group developed bowel obstruction or preperitoneal herniation over a median follow-up of 26.3 months, indicating that closure with either device prevented the late complication that constitutes the principal argument in favor of repair.

Several techniques for managing peritoneal tears during TEP repair have been described, including decompression of the pneumoperitoneum with a Veress needle, endoloop ligation, intracorporeal suturing, clip application, and sealing with energy devices. Comparative data remain scarce. Lau et al.[13] compared endoscopic stapling, pretied suture loop ligation, and endoscopic suturing and found stapling to be the fastest technique. Nitta et al.[14] reported closure with polymer locking clips (Hem-o-lok) in 23 patients and demonstrated that clip closure was significantly faster than endoscopic suturing (7.6 vs 16.2 minutes). Energy-based sealing was first described by Mathew and Pokhrel, who sealed 101 tears with bipolar diathermy without postoperative complications or recurrence,[6] and was subsequently evaluated by Yanar et al.[10] in 86 patients, who reported no conversions attributable to the tear and no increase in recurrence or seroma compared with patients in whom no tear occurred.

Our findings are consistent with these reports. Veress needle decompression was required in 5 of 61 patients (8.2%), and no conversion occurred in the vessel-sealing device

group. To our knowledge, however, no study has directly compared clip closure with energy-device closure. Yanar et al.[10] explicitly identified the absence of a comparison group using alternative closure methods as a limitation of their study and called for trials comparing bipolar sealing with other techniques; notably, the 12 patients in whom they used clips were excluded from their analysis.[10] The present study addresses that gap.

In the present series, no significant difference was detected between the two closure methods for any outcome examined. The mean difference in operative time was −0.4 minutes (95% CI, −4.6 to +3.8), excluding any clinically relevant difference between the two techniques. Operative time was virtually identical (45.9±7.3 vs 46.2±8.7 minutes; p=0.855), as were the need for Veress needle decompression (3.7% vs 11.8%; p=0.371), early postoperative complications (14.8% vs 11.8%; p=1.000), and recurrence (7.4% vs 5.9%; p=1.000). These findings should not be interpreted as demonstrating equivalence, because the study was not powered to detect differences in infrequent events; approximately 160 patients per group would be required to detect a difference in the rate of Veress needle decompression of the observed magnitude. They do, however, provide the first direct evidence bearing on a question that has previously been addressed only by assertion.

The absence of any difference in operative time merits comment. Nitta et al.[14] found clip closure to be substantially faster than endoscopic suturing (7.6 vs 16.2 minutes), and Lau et al.[13] likewise found endoscopic stapling to be faster than suturing,[13] establishing that clip-based closure is an efficient technique. The present data extend these findings by showing that clips are also no slower than an energy-sealing device: the mean difference in operative time was −0.4 minutes (95% CI, −4.6 to +3.8), excluding any clinically relevant difference between the two techniques. This has practical relevance, as energy devices carry a cost burden that may limit their availability in some centers.[10] If clip closure is neither slower nor associated with worse outcomes, the choice between the two techniques may reasonably be governed by availability and cost rather than by presumed efficiency.

A theoretical concern specific to energy-based closure is thermal injury. The preperitoneal space is confined, and the peritoneum lies close to the bladder, spermatic cord structures, and inferior epigastric vessels. Thermographic studies of a 5-mm bipolar vessel-sealing device have demonstrated lateral thermal spread of approximately 4 mm,[15] and collateral nerve injury has been shown experimentally at a clearance of 1 mm, although not at 2 mm or more.[16] In the present series, no thermal injury to the bladder, bowel, or cord structures occurred in any of the 34 patients in whom the vessel-sealing device was used. Clip application avoids thermal energy altogether and may therefore be preferable when a tear lies immediately adjacent to a vulnerable structure, although this could not be tested using the present data.

The principal limitation of the comparison is that the choice of closure method was not randomized. Patients in whom the vessel-sealing device was used had a significantly higher proportion of inguinoscrotal hernias (29.4% vs 3.7%; p=0.016), which reflects intraoperative workflow rather than a judgment regarding either device: in scrotal hernias, the vessel-sealing device is typically already in use for dissection of the adherent sac and is therefore the instrument at hand when a tear occurs. This distinction matters because scrotal hernia is the strongest known risk factor for peritoneal tear, increasing the odds more than 20-fold,[4] and it is also an independent predictor of seroma formation.[17] The vessel-sealing device group therefore had a systematically more difficult case mix. To address this, an additional analysis was performed after excluding patients with inguinoscrotal hernias, yielding well-balanced groups of 26 and 24 patients. In this subgroup, no significant differences were observed in Veress needle decompression, early postoperative complications, recurrence, or operative time, and the findings of the primary analysis were unchanged. It is also notable that, despite having a higher burden of a known risk factor for seroma, the vessel-sealing device group did not develop more seromas than the clip group (8.8% vs 11.1%).

Hernia recurrence occurred in 4 of 61 patients (6.6%), which was higher than the rate of <1% reported in a large TEP series with more than a decade of follow-up.[5] With only four events, the estimate is imprecise (95% CI, approximately 2.6% to 15.7%), and the cohort consists exclusively of patients in whom a peritoneal tear occurred, representing a technically more demanding subgroup: two of the four had bilateral hernias, two had recurrent hernias, and in all four, the tear was located at the hernia sac. Recurrence after laparoscopic repair is most often attributable to inadequate mesh coverage of the myopectineal orifice rather than to the management of intraoperative events,[18] and recurrences were evenly distributed between the two closure groups (2 in each),

providing no indication that either device contributed to failure of the repair.

Limitations

This study has several limitations that should be acknowledged. First, it is a retrospective, single-center study, and the choice of closure method was determined by surgeon preference and device availability rather than by randomization. This introduced a significant imbalance in the proportion of inguinoscrotal hernias between the groups, which we addressed by means of an additional analysis restricted to non-scrotal hernias; nevertheless, residual confounding by unmeasured factors cannot be excluded. Second, the study was not powered to detect differences in infrequent outcomes such as conversion, intraoperative complications, or recurrence, and the absence of statistically significant differences should not be interpreted as evidence of equivalence. Third, peritoneal tear size was estimated intraoperatively by reference to the jaws of an open endoscopic grasper rather than directly measured and was not systematically documented; the widely used classification of tears into small, medium, and large categories could therefore not be applied, and adjustment for tear severity was not possible. Fourth, operative time reflects the duration of the entire procedure rather than the time required specifically for tear closure and may therefore be insufficiently sensitive to detect a genuine difference in closure efficiency between the two devices. Fifth, six patients (8.2% of those eligible) were lost to follow-up; attrition was proportionally similar between the groups (clip group, 2 of 29, 6.9%; vessel-sealing device group, 4 of 38, 10.5%), making differential loss an unlikely source of bias. Sixth, although the majority of patients (73.8%) underwent outpatient clinical examination, follow-up was conducted by structured telephone interview in the remainder, and only symptomatic patients underwent ultrasonography; asymptomatic recurrences may therefore have been missed. The method of follow-up did not differ between the groups. Finally, consumable use was not recorded, and a formal cost analysis comparing the two techniques could not be performed.

Conclusion

In this retrospective comparative study, closure of peritoneal tears during TEP inguinal hernia repair with 5-mm titanium clips or a bipolar vessel-sealing device produced comparable intraoperative and postoperative outcomes, with no significant differences in operative time, need for Veress needle decompression, conversion, complications, or recurrence over a median follow-up of 26 months. No patient in either group developed bowel obstruction or preperitoneal herniation, indicating that closure with either method effectively addresses the principal theoretical hazard of an unrepaired peritoneal defect. Given that the two techniques appear to perform similarly and that clips are not slower than an energy-based device, the choice of closure method may reasonably be guided by device availability and cost. These findings are exploratory and require confirmation in larger, prospective studies with adequate power and standardized measurement of peritoneal tear size.

Disclosures

Ethics Committee Approval: The study was approved by the institutional ethics committee of Şehit Prof. Dr. İlhan Varank Hospital (approval number: E-46059653-050.04-31934084, date: 29.06.2026).

Informed Consent: The requirement for informed consent was waived owing to the retrospective design.

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