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# LESS

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Science

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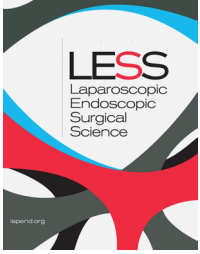
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**References** should be numbered consecutively in the order in which they are first mentioned in the text (6 authors then "et al"). Vancouver referencing style should be used for all references ([https://www.nlm.nih.gov/bsd/uniform\\_requirements.html](https://www.nlm.nih.gov/bsd/uniform_requirements.html)).

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# The relationship between age and the development of major complications in patients who underwent laparoscopic surgery due to colon cancers

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## ABSTRACT

**Introduction:** The laparoscopic approach is preferred in colorectal cancer cases, yet concerns arise regarding the development of complications among the elderly patient population. This study aims to investigate the difference in the development of major complications between patients aged 65 and older undergoing laparoscopic procedures for colorectal cancer diagnoses and the younger patients.

**Materials and Methods:** Between 2013 and 2023, records of patients who underwent laparoscopic surgery due to colorectal cancers at our center were extracted. Demographic characteristics, pathology data, complications developed during hospitalization, and lengths of stay were gathered from hospital records.

**Results:** A total of 72 patients were included in the study, with 18 patients aged 65 and older and 54 patients aged younger than 65. When patients were evaluated based on the development of major and minor complications, all demographic and pathological characteristics were found to be similar. Only in the group of patients aged 65 and older, the length of hospital stay was found to be longer ( $p < 0.001$ ). In the multivariate analysis conducted, age was not found to be significant for the development of major complications (OR: 0.895 [0.246-3.264],  $p = 0.897$ ).

**Conclusion:** This study has shown that being aged 65 or older or younger is not associated with the development of major complications in patients undergoing surgery for colorectal cancer. It has also demonstrated that laparoscopic surgical procedures can be safely used in patients aged 65 and older. Further studies with larger patient cohorts could provide more clarity on this topic.

**Keywords:** Age, Colon cancer, Complication, Laparoscopy, Morbidity

## Introduction

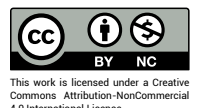
In our evolving and changing society, the average life expectancy has increased from an average of 49 years in the 1950s to 71 years today.<sup>[1]</sup> This increase has led to the

development and updating of treatment protocols for the elderly population's illnesses. The World Health Organization (WHO) has defined the threshold for old age as 65.<sup>[2]</sup>



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The incidence rates of colorectal cancers, which are currently the fourth most common cancer, also increase with age.<sup>[3]</sup> With advancing age, the incidence of colorectal cancers increases due to various factors, leading to increased research in elderly patient populations today. By 2050, it is expected that 23% of the population in Western Europe will be aged 65 and older. This demographic shift underscores the need for different studies focusing on colorectal procedures for this age group in the future, particularly for general surgeons.<sup>[4]</sup>

Studies have yielded different results in the elderly patient population. Currently, there is no consensus on whether conventional or minimally invasive surgery provides superior survival outcomes in colorectal cancers. While conventional surgery was initially noted to be shorter, recent studies indicate similar durations for both procedures due to increased proficiency. Furthermore, contemporary studies demonstrate lower rates of surgical site infections in patients undergoing minimally invasive procedures. However, efforts to alleviate surgeons' apprehensions toward laparoscopy to minimize surgical duration in older patients continue.<sup>[5-8]</sup>

This study aims to evaluate the morbidity outcomes in patients aged 65 and older compared to younger patients following laparoscopic surgical procedures.

## Materials and Methods

### Study Design

Before data collection, ethical approval for the study was obtained with decision number 2024/05/795 from the Ethics Committee of the same institution. The study was conducted in accordance with ethical standards, and patient confidentiality and privacy were strictly maintained.

This retrospective cohort study focused on the examination of records of patients who underwent surgery for colorectal malignancies at the Gastroenterologic Surgery Department of Koşuyolu Training and Research Hospital between January 1, 2013, and December 31, 2021. Ethical approval was obtained before commencing data collection, ensuring adherence to the principles outlined in the Declaration of Helsinki and relevant ethical guidelines.

### Inclusion Criteria

Patients were included in the study based on specific criteria to ensure homogeneity and relevance to the research objectives. The inclusion criteria comprised the following: Patients who underwent elective surgery for histologically confirmed colon and rectum adenocarcinoma with a laparoscopic approach, having comprehensive clinical and pathological data available for analysis, and only patients aged 18 years or older were considered.

### Exclusion Criteria

To ensure the integrity and specificity of the study, the following exclusion criteria were applied: Patients who underwent conventional, palliative, or emergency surgery, patients who did not undergo R0 resection. Cases with inadequate dissection, positive surgical margins, or R2 resection were excluded to maintain the study's focus on complete and oncologically appropriate surgical resections, ensuring the findings' reliability and validity. Patients not operated on according to oncological principles, and patients with postoperative follow-up durations of less than 30 days, were also excluded from the study.

### Data Collection

All data were obtained from the electronic database, ensuring accuracy and reliability in the analysis. Demographic information, preoperative tumor markers,<sup>[9]</sup> prior operation records, history of neoadjuvant therapy, pathology data, operation durations, postoperative follow-up complications,<sup>[10]</sup> length of hospital stays, and survival data were retrospectively reviewed for all patients. American Society of Anesthesiologists (ASA) and operation duration records were obtained from anesthesia records.<sup>[11]</sup>

### Surgery and Follow-up

The study initiated by collecting data from 371 individuals who underwent surgery for colorectal cancer at our center between 2013 and 2021. Of this group, 197 were excluded for reasons such as missing pathology or diagnostic data (2 cases), conventional approach (195 cases). Two subjects were excluded due to a postoperative follow-up period of less than 3 months. Ultimately, 72 participants met the inclusion criteria.



Among these, tumor localizations were distributed as follows: cecum,<sup>[10]</sup> ascending colon, transverse colon,<sup>[1]</sup> descending colon,<sup>[5]</sup> sigmoid colon, and rectum. Neoadjuvant chemoradiotherapy was routinely administered to patients with mid and low rectal cancer before surgery.

### Statistical Analysis

The software IBM® SPSS® (Statistical Package for the Social Sciences) version 25 (IBM Corp. Armonk, NY, USA) was used for statistical analysis. The distribution of numerical data was performed using the Kolmogorov-Smirnov test with the non-normal distribution results. Qualitative data were presented as frequency and percentage. Continuous measurements were presented as median (IQR). The chi-square test was utilized for comparisons involving categorical variables. The relationship between continuous parameters and mortality was examined through the application of the Mann-Whitney U test. Additionally, the Receiver Operating Characteristic (ROC) curve was examined to determine the cut-off value of age. For the analysis of factors influencing morbidity, univariate Cox regression tests were conducted. A significance level of 0.05 was considered for all tests.

### Results

A total of 72 patients were evaluated for the study. Within these patients, morbidity rates were separated as 57 (79.1%) minor and 15 (20.8%) major complications. Patients' demographic and clinicopathologic features were evaluated according to major and minor complications. Hospitalization duration was longer in the major complication group (6.88±1.25 vs. 14±7.69,  $p<0.001$ ). Other demographic and clinicopathologic features were similar ( $p>0.05$ ). Demographic and clinicopathologic variables' evaluation based on complications is presented in Table 1.

Then, patients were divided as <65 years and ≥65 years into two groups with the cut-off point based on the WHO's elderly recommendation. Fifty-four patients were included in the younger group, whereas 18 patients were included in the older group. Male patients were more in the elderly group (34.1% vs. 12.9%,  $p=0.039$ ). Tumor localizations showed differences too. The younger group consisted of 9 cecum, 15 ascending colon, 4 descending colon, 13 sigmoid, and rectum colon tumors. In the elder group, 11 patients had sigmoid colon tumors.

The rest consisted of 3 rectum and 1 each of cecum, ascending colon, transverse colon, and descending colon ( $p=0.022$ ). Other variables were similar between groups ( $p>0.05$ ) (Table 2).

Since the only variable showing relation with major complication development was hospitalization duration, multivariate analysis was not proceeded. A univariate Cox regression analysis was performed for complication development based on patients' age below or above 65, and age was found irrelevant to morbidity in laparoscopic colorectal procedures (OR: 895 [0.246-3.246],  $p=0.867$ ) (Table 3).

### Discussion

This study was conducted to evaluate the relationship of elderly patients with morbidity incidence in laparoscopic colorectal procedures. We found similar major complication rates between elder and younger patients in our study. Only hospitalization duration was longer in the elder patients group. We believe this result is due to the late stabilization of other comorbidities in older groups and the late return to daily activity compared to the younger population. In our experience, we think the laparoscopic approach is feasible in the elder population too.

Minimally invasive surgery is considered to be more favorable in any indicated surgery possible. While providing advantages like smaller incision scars and faster adaptation to daily routine, it shows similar efficiency with conventional approaches in pathologic specimen quality, which makes laparoscopy more favorable for many surgeons. However, there are still some issues with the selection of the approach, and age is one of the main considerable topics regarding this. Even if recent studies reveal similar operative times between the two approaches, surgeons may tend to use conventional practices to avoid any complications in this fragile population and avoid laparoscopy.<sup>[4,5]</sup>

Frasson et al.<sup>[4]</sup> published the results of their randomized control trial in 2008 based on 535 colorectal cancer patients. In this study, the cutoff value was based on age 70. In the conventional group, elder patients suffered higher morbidity rates and longer hospitalization duration. But in the laparoscopic group, morbidity ratios and hospitalization length were recorded as similar between groups. Our study showed similar results. We didn't include conventional procedures in our study,



**Table 1. Patient demographic and clinicopathologic variables according to Minor/Major complication**

<b>Variables</b>	<b>Minor n=57 (79.1%)</b>	<b>Major n=15 (20.8%)</b>	<b>p<sup>†</sup></b>
Age, years			
<65	43 (59.3%)	11 (40.7%)	0.897
≥65	14 (54.9%)	4 (45.1%)	
Gender			
Male	32 (60.3%)	9 (39.7%)	0.788
Female	25 (53.5%)	6 (46.5%)	
ASA score			
1	2	0	0.174
2	20	2	
3	35	13	
Localization			
Caecum	8	2	0.363
Ascending Colon	10	6	
Transvers Colon	1	0	
Descending Colon	5	0	
Sigmoid Colon	21	3	
Rectum	12	4	
T Stage			
T1	8	1	0.157
T2	9	0	
T3	34	10	
T4	6	4	
N Stage			
N0	33	11	0.507
N1	15	2	
N2	9	2	
M Stage			
M0	56	15	0.605
M1	1	0	
LVI			
No	33	11	0.275
Yes	24	4	
PNI			
No	42	12	0.615
Yes	15	3	
Tumor grade			
Well	15	3	0.890
Moderately	37	10	
Poorly	5	2	
Mucinous Component			
No	45	14	0.197
Yes	12	1	

Table 1. CONT.

Variables	Minor n=57 (79.1%)	Major n=15 (20.8%)	p <sup>†</sup>
Neoadjuvant Therapy			
No	51	12	0.324
Yes	6	31	
Stage			
1	13	1	0.230
2	22	10	
3	21	4	
4	1	0	
	<b>Median (IQR)</b>		<b>p<sup>‡</sup></b>
BMI	26.24±3.58	24.78±4.21	0.682
Total Lymph Node	22.10±12.53	24.20±9.00	0.372
CEA, ng/mL	7.76±14.68	13.09±20.51	0.494
CA 19,9 ng/mL	12.09±10.30	11.58±20.18	0.087
CA 125 ng/mL	12.11±8.38	19.74±39.38	0.847
Surgery Duration	270.18±74.40	298.33±116.78	0.483
LOS	6.88±1.25	14±7.69	<0.001*

BMI: Body Mass Index; ASA: American Society of Anesthesiology, LVI: Lymphovascular Invasion, PNI: Perineural Invasion. LOS: Length of Hospital Stay; IQR: Inter Quartile Range; p<0.05, p<0.01, \*p<0.001 †: Chi-Square, ‡: Mann Whitney U.

but elder and young patients showed similar major complication rates. However, our elder group showed longer hospitalization in our study, even though our elder cut-off was lower than the study. We believe our patient population consisted of more comorbid patients. We couldn't calculate comorbidity indexes; however, our patient population consisted of more ASA 3 patients than the study mentioned.

A recent study evaluated the safety of laparoscopic procedures for octogenarians. 199 patients aged 80 and above were included in this study, and 116 laparotomy and 83 laparoscopy patients were divided as arms of the study. Intraoperative blood transfusion and bleeding were higher in the laparotomy group. The laparoscopic group had better general morbidity rates. Major complication rates were also similar, and the length of hospitalization was recorded as lower in the laparoscopy group. Our study, whereas compared age rather than procedures.<sup>[12]</sup>

Another recent study from 2016 evaluated laparoscopic right hemicolectomy outcomes for elder patients. Four groups consisted of age ranges below 64, 65-74, and 75-84.

As expected, the last two groups had higher ASA scores. Also, advanced-staged patients were more consistent in the last two groups. However, major complication rates were similar between groups. Minor complication rates were higher in the last group. The only independent variable related to postoperative complications recorded was blood transfusion. Our study showed similar results, with major morbidity occurrence rates distributed similarly between groups.<sup>[13]</sup> This topic is mentioned also in a systematic review, and aging increases the incidence of more comorbidities these patients would have. So even if it isn't statistically relevant, these patients' tendency for complications should always be considered.<sup>[6]</sup>

Our study has some limiting factors. First of all, it's designed retrospective. Our patient population is small as only laparoscopic procedures were included. Also, we didn't include comorbidity indexes. But our patient group showed heterogeneous distribution based on pathologic stages and disease characteristics. Even though sigmoid and rectum cancer were dominant in the elder group, it didn't show any difference regarding complication rates.

**Table 2. Demographic and clinicopathologic characteristics of patients sorted by age**

<b>Variables</b>	<b>&lt;65 years n=57 (79.1%)</b>	<b>≥65 years n=15 (20.8%)</b>	<b>p<sup>†</sup></b>
Gender			
Male	27 (50)	14 (34.1)	0.039*
Female	27 (50)	4 (12.9)	
ASA Score			
1	2	0	0.174
2	20	2	
3	32	16	
Localization			
Caecum	9	1	0.022*
Ascending Colon	15	1	
Transverse Colon	0	1	
Descending Colon	4	1	
Sigmoid Colon	13	11	
Rectum	13	3	
T Stage			
T1	5	4	0.551
T2	7	2	
T3	34	10	
T4	8	2	
N Stage			
N0	31	13	0.349
N1	15	2	
N2	8	3	
M Stage			
M0	53	18	0.561
M1	1	0	
LVI			
No	34	10	0.577
Yes	20	8	
PNI			
No	39	15	0.346
Yes	15	3	
Tumor grade			
Well	13	5	0.388
Moderately	34	13	
Poorly	7	0	
Mucinous Component			
No	42	17	0.111
Yes	12	1	
Neoadjuvant Therapy			
No	47	16	0.837
Yes	7	2	

Table 2. CONT.

Variables	<65 years n=57 (79.1%)	≥65 years n=15 (20.8%)	p <sup>†</sup>
Stage			
1	9	5	0.677
2	24	8	
3	20	5	
4	1	0	
	<b>Median (IQR)</b>		<b>p‡</b>
BMI	26.59±7.74	25.64±3.71	0.252
Total Lymph Node	23.26±7.74	20.50±9.29	0.108
CEA, ng/mL	9.67±16.87	6.41±13.36	0.666
CA 19,9 ng/mL	13.13±13.76	8.19±8.58	0.101
CA 125 ng/mL.	14.60±20.83	11.08±4.21	0.864
Surgery Duration	275.74±89.93	276.94±82.57	0.850
Hospitalization	8.30±4.89	8.56±3.82	0.713

BMI: Body Mass Index; ASA: American Society of Anesthesiology; LVI: Lymphovascular Invasion; PNI: Perineural Invasion. LOS: Length of Hospital Stay; IQR: Inter Quartile Range; \* p<0.05, p<0.01, p<0.001 †: Chi-Square, ‡: Mann Whitney U.

We believe the elderly will become more tolerable for concerns within surgeons for the laparoscopic approach with increasing tendency and articles related within years. Laparoscopy is feasible and has similar complication ratios in all ages. Further studies focusing on cancer origin and specific complication differences between age groups will provide more certain verdicts within this matter.

## Conclusion

Elderly age is not an issue for choosing operative approach criteria. Older patients showed similar morbidity incidence with younger patients in colorectal procedures. This fragile population should be approached with concern. Larger population-based studies will provide better knowledge for future aspects regarding patient evaluation.

Table 3. Prognostic factors for major complications, identified by univariate Cox regression analysis

Prognostic factors	OR	95% CI	p
Age, ≥65 years	0.895	0.246-3.264	0.867

CI: Confidence Interval; OR: Odds Ratio; PNI: Perineural Invasion; GLR: Glucose/Lymphocyte Ratio p<0.05, p<0.01.

## Disclosures

**Ethics Committee Approval:** Koşuyolu Yüksek İhtisas Eğitim ve Araştırma Hastanesi, Tarih 05.03.2024, Karar no 2024/05/795 This study was approved by the Kosuyolu Yuksek Ihtisas Training and Research Hospital Ethics committee on 05.03.2024 with 2024/05/795 number.

**Peer-review:** Externally peer-reviewed.

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**Authorship Contributions:** Concept – I.C.A.; Design – I.C.A., M.D.; Supervision – E.P., M.D.; Data Collection – A.O.S., S.A.; Analysis and/ or interpretation – İ.C.A.; Literature Search – I.C.A.; Writing – I.C.A., A.O.S., S.A.; Vritical Review – M.D., A.S.S.

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# Effect of closed drainage system on prevention of seroma after laparoscopic total extraperitoneal repair in primary M3 and L3 inguinal hernia

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## ABSTRACT

**Introduction:** Seroma that can be seen after endoscopic completely extraperitoneal inguinal hernioplasty (TEP) is a major problem in patients who are concerned about recurrence. In this study, a prospective study design was prepared in our clinic in order to see the incidence of seroma after TEP and the effect of closed system negative pressure drainage, which is one of the methods thought to reduce it.

**Materials and Methods:** Primary M3 and L3 unilateral inguinal hernias were randomly divided into two groups. Group I was the group in which a drain was placed after TEP, and Group II was the group in which no drain was placed after TEP. In Group I patients, a hemovac drain was placed behind the mesh and the perforated end of the drain was placed in the preperitoneal space. Anatomical 3D mesh (3DMax™ Mesh, BD, USA) was applied to all cases.

**Results:** There were 41 patients in Group I and 39 patients in Group II. 73 of the patients were men and 7 were women. According to the EHS classification, 47 of the hernias were L3 type and 33 were M3 type. Seroma was detected in 5 patients in Group I and 13 patients in Group II on the 7<sup>th</sup> postoperative day ( $p < 0.024$ ). There was no difference between the groups in the seromas seen in the 3<sup>rd</sup> month after surgery.

**Conclusion:** Seroma is common after TEP, especially in M3 and L3 hernias. This situation is confused with hernia recurrence in the patient. This may cause fear and panic in the patient. The drainage system installed in large hernias in the early postoperative period reduces the development of seroma and these concerns are eliminated. In addition, having patients come to the team performing the surgery for check-ups at regular intervals is effective in relieving patients' concerns.

**Keywords:** Drain, Extraperitoneal space, Laparoscopic hernia, TEP

## Introduction

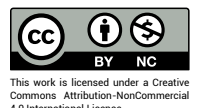
Inguinal hernia repairs are one of the most common procedures performed in general surgical departments. Approximately 20 million hernia repairs are performed

annually all over the world.<sup>[1,2]</sup> Since the 90s, when laparoscopic repair began, minimally invasive surgical techniques have evolved, and laparoscopic transabdominal preperitoneal (TAPP) repair and total extraperitoneal re-



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pair (TEP) have emerged.<sup>[3]</sup> The European Hernia Society recommends laparo-endoscopic hernia repair for patients (all sexes) with primary unilateral inguinal hernia due to the lower incidence of postoperative pain and reduced incidence of chronic pain.<sup>[4]</sup> The increase in the number of surgeries causes an increase in complications. Although hernia recurrence remains at low levels upon learning the technique, groin pain is more prominent today. One of the factors of pain is the complications that may occur after surgery. Patient comfort is also very important after laparoscopic hernia surgery. Especially, the swelling that may occur in the patient's groin area after surgery suggests early recurrence, which increases patient distress. Seroma or hematoma is one of the causes of swelling in the groin area after surgery. The main reasons for the development of seroma are intraoperative bleeding and large dissection areas. Seroma often affects the quality of life of patients after surgery and presents with pain and an inguinal or scrotal mass. There are studies in the literature that prevent the development of early and late seroma, and that drains placed in the preperitoneal area during surgery reduce the development of seroma.<sup>[5-7]</sup> In this prospective study, the effect of closed system preperitoneal space drainage on seroma was investigated in unilateral hernia patients undergoing laparoscopic total extraperitoneal hernia repair. The clinically detected seroma formation in the inguinal region on the 7<sup>th</sup> day after laparoscopic TEP hernioplasty for inguinal hernia was compared. Clinical seroma sizes in the inguinal region were measured 7 days and 3 months postoperatively. Total operative time, total drain output, urinary retention, wound complications, early and late postoperative pain scores, and recurrence were also evaluated.

## Materials and Methods

This study was approved by the Ethical Committee of the Fatih Sultan Mehmet Training and Research Hospital, Istanbul, Türkiye, on 25.10.2018 with registration number FSMEA-H-KAEK 2018/40. Written informed consent was obtained from each participating patient prior to the study. This study was conducted in a tertiary referral centre with a case volume of more than 300 per year.

Patients between the ages of 18 and 80 with a unilateral inguinal hernia who presented to our surgical outpatient clinic were eligible for inclusion in the study. Patients were excluded if they had bilateral or recurrent inguinal hernia, incarcerated hernia, irreducible hernia, or significant co-morbidities. From January 2021 to February 2022,

patients who would undergo unilateral TEP were randomly selected and divided into two groups (Fig. 1). The primary outcome was seroma size on postoperative day 7. Secondary outcomes included clinical seroma formation and seroma size on days 1, 7, 1 month, and 7 months postoperatively, length of postoperative stay, pain score, and recurrence. Group I was the group where a drain would be placed after TEP (n=41), and Group II was the group where no drain was placed after TEP (n=39). A hemovac drain was placed behind the mesh, with the perforated end of the drain entering the preperitoneal cavity, in the patients in Group I (Fig. 2). Anatomical 3D mesh (3DMax™ Mesh, BD, USA) was applied to all cases. Seroma was defined as painless swelling observed in the inguinal region on the side of the operated hernia, which is not displaced by coughing and/or cannot be reduced (Fig. 3). No objective imaging study such as ultrasound was used to define or measure the fluid collection.

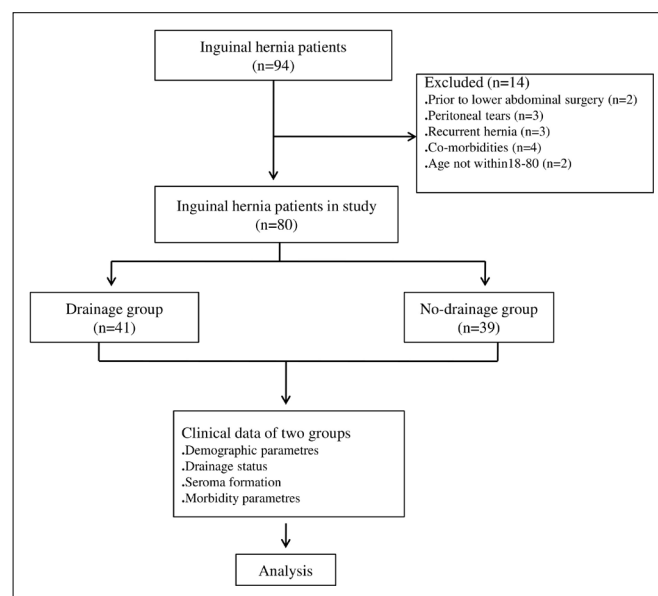


Figure 1. Flowchart.



Figure 2. Drain behind the 3D mesh.





**Figure 3.** Seroma swelling after surgery.

### Operative Details

The procedure was carried out in a standard manner as described earlier. In all patients, the preperitoneal space was prepared with a balloon trocar. Anatomical mesh (3DMax™ Mesh, Large, 10.8 cm x 16.0 cm, BD, USA) was applied to all cases. The bleeding was controlled with the help of bipolar electrocautery. The mesh was fixed with either titanium tacks (ProTack™ Fixation Device, Covidien Medtronic®, US) over the superior and medial aspects. The mesh was placed without wrinkle, covering all the fascial defects in the groin—Hasselbach triangle, indirect ring, femoral triangle, and obturator ring. In the drain group, a standard closed suction drain (12F) was kept in the preperitoneal space and the space was deflated, taking care not to displace the mesh. In the non-drain group, no drain was put. The rest of the procedure was similar.

One dose of antibiotic injection, Ceftriaxone, was given in the preoperative period. Diclofenac intramuscular was given 4 hours after the procedure. The drain was taken out the next morning (range: 12 to 24 hours after the operation).

### Statistical Analysis

Statistical analysis was performed using SPSS version 27.0 (SPSS Inc., Chicago, Illinois). Quantitative parameters were presented as the arithmetic mean and standard deviation (SD) or median and interquartile range (IQR) depending on the normality of the distribution assessed

by the Shapiro-Wilk test. Categorical variables were reported as numbers. The relationship between qualitative variables was assessed by Chi-square test or Fisher's exact test. Differences between groups were compared using the Student's t-test for normally distributed variables.

### Results

There were 41 patients in Group I and 39 patients in Group II. Seventy-three of the patients were male (91.3%) and 7 were female (8.8%). According to the European Hernia Society (EHS) classification, 47 of the hernias were L3 inguinal hernias and 33 were M3 inguinal hernias (Table 1). The study started with ninety-four patients. Fourteen patients were excluded from the study. Eighty patients were included and randomized. There was no difference in the mean length of hospital stay between the two groups. The overall incidence of seroma formation was 5% (n=4). On the 7<sup>th</sup> postoperative day, seroma was observed in 5 patients in Group I and 13 patients in Group II (p<0.024). The average size of the seromas seen after the third month was two fingers (approximately 3 cm). There was no difference between the groups in the 4 seromas seen at the postoperative 3<sup>rd</sup> month (p>0.10). Percutaneous aspiration (n=2) and observation (n=2) were applied to patients who developed seroma. Seromas resolved spontaneously in a mean of 3.5 (mean) months. The postoperative complications of the two groups are shown in Table 2. Scrotal edema, urinary retention, and wound infection rates of the two groups were similar. Follow-up ranged from 9 to 45 months (median, 22 mo). The mean operating time in the drain group (30.43±6.0 min) was more than the non-drain group (28.07±6.8 min; p=0.027). The rate of seroma formation was significantly higher in the non-drain group (13/39 hernias, 33.3%) compared with the drain group (5/41 hernias, 12.19%; p=0.022). No recurrence was observed in

**Table 1. Patient demographics**

	Drain	No drain
Number of patients (n)	41	39
Mean age, years (SD)	52.8/12.7	52.8/12.9
Sex: male/female (n)	39/2	34/5
Smoker (n)	24	17
Co-morbidities(n)	2	3
Side of hernia: left/right (n)	19/22	20/19
Primary hernia type (M3/L3) (n)	16/25	17/22
SD: Standard deviation.		

**Table 2. Postoperative complications**

	Drain (n=41)	No-drain (n=39)	p
Day 7 clinical seroma formation, (n)	5	13	0.024
Mouth 3th clinical seroma formation, (n)	1	5	NS
Mean drain output, (ml/SD)	55±14.7	-	NS
Wound infection,(n)	0	0	
Range of drain output (ml)	10-80	-	
Urinary retention,(n)	4	3	NS
Early recurrence, (n)	0	0	
Aspiration after 3 <sup>th</sup> mouth, (n)	0	2	NS
Conversion to open, (n)	0	0	
Hospital stay, d (IQR)	1.0 (0-2)	1.1 (0-1)	NS
Return to normal activities, day (IQR)	8 (7-10)	8.1(7-9)	NS

NS: Not-significant; IQR (interquartile).

either group in the early follow-up of the patients. The two patients who underwent outpatient percutaneous needle aspiration of the seroma developed recurrence of the swelling after the procedure. Culture of the aspirated fluid was negative for microorganisms, and there was no superimposed infection.

## Discussion

Preperitoneal seroma, together with hematoma, is the most common complication after endoscopic TEP inguinal hernia repair.<sup>[8]</sup> The occurrence of seroma after laparoscopic inguinal hernia repair causes anxiety in patients. Especially, the perception of hernia recurrence brings with it anxiety that the patient will have surgery again. Therefore, the development of seroma should always be kept in mind, and the patient's anxiety should be eliminated by calling the patient for control by the surgery team. After TEP repair, most seromas disappear within 3 months, but the swelling in the groin area causes the patient to feel anxious and believe that the hernia is recurring.<sup>[5]</sup> The European Hernia Association defines and classifies seroma into types 0-IV.<sup>[9]</sup> Type 0 is no clinical seroma. Types I and II are known as incidents, which are often encountered in clinical practice and do not need to be dealt with. Types III and IV are called complications.<sup>[10]</sup> Type IV (seroma that needs to be treated) includes major seroma-related complications (need to puncture the seroma, seroma drained spontaneously, applicable to open approach, deep infection, recurrence, and mesh rejection).<sup>[11]</sup> In our study, type IV seroma was detected in two patients, and these patients were treated with nee-

dle aspiration under sterile conditions. Seromas seen in other patients resolved spontaneously after an average of 4 months. In our opinion, seromas observed after laparoscopic hernia repairs are a condition that should be taken seriously. Thus, Aravind and Cook's study found that aseptic surgery infection was mostly secondary to postoperative seroma, and when the time was prolonged and the effusion continued to develop, severe complications such as mesh displacement, local pain, and cellulitis might occur.<sup>[12]</sup> We think that preventing the development of seroma or keeping the duration of seroma short is important in this context. In our study, we found that drains placed in a closed system significantly reduced the development of seroma. Drains removed after 24 hours do not cause pain or a decrease in patient comfort.

In our study, the seroma formation was significantly lower in the drain group (n=5) than in the non-drain group (n=13; p<0.024). The rate of seroma formation in the non-drainage group (43%) was higher than the rates described in other studies (1.9% to 22%). The reason for this was interpreted as longer surgery times and wider dissection in the non-drainage group. Extensive dissection, mesh, and hernia type (direct or indirect) are effective in the development of seroma. Especially in large direct hernias, seroma accumulation in the defect area is an expected situation. Various techniques have been developed to prevent seroma formation. It suggests that closing or not closing the medial hernia defect in laparoscopic inguinal hernioplasty reduces the risk of recurrence and seroma formation without an increase in postoperative pain or

complications.<sup>[13]</sup> Pini et al.<sup>[14]</sup> suggest that suturing and fixing the transversalis fascia to the Cooper ligament in the treatment of direct inguinal hernia is a safe, feasible, and recommendable method to prevent postoperative seromas. In our study, it was determined that the type of hernia did not have a significant effect on the development of seroma in the group in which we used a drain. In 35 randomized controlled studies including a total of 3496 patients, no difference was found in the seroma incidence rates in patients undergoing laparoscopic repair and Lichtenstein repair.<sup>[15]</sup>

## Conclusion

Preperitoneal drainage for 23 hours after laparoscopic TEP hernioplasty for inguinal hernia can effectively decrease seroma formation in the early postoperative period and potentially improve postoperative pain. The frequent occurrence of seroma after TEP is confused with recurrence, especially after hernia surgery. This may cause fear and panic in the patient. It is effective for the patients to visit the surgeon who performed the operation at regular intervals for control to eliminate the concerns of the patients.

## Disclosures

**Ethics Committee Approval:** This study was approved by the Ethical Committee of the Fatih Sultan Mehmet Training and Research Hospital, Istanbul, Türkiye, on 25.10.2018 with registration number FSMEAH-KAEK 2018/40.

**Peer-review:** Externally peer-reviewed.









**Conflict of Interest:** None declared.

**Authorship Contributions:** Concept – B.A., Y.İ.; Design – B.A., Y.İ., Y.G.; Supervision – N.E.B., A.C.B.; Materials – B.A., A.T.F., N.E.B.; Data collection and/or processing – B.A., Y.İ., Y.G.; Analysis and/ or interpretation – B.A., A.E., M.M.F.; Literature search – M.M.F., B.A.; Writing – B.A., A.E., B.T.; Critical review – B.A., K.M., A.T.F.

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# Is endoscopic balloon dilatation and oral iron preparation treatment adequate in the treatment of Plummer-Vinson syndrome?

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## ABSTRACT

**Introduction:** The main objective of this study is to present 10 Plummer-Vinson Syndrome cases treated and followed up at our clinic alongside cases in current literature.

**Materials and Methods:** The cases of 10 patients with prospective records of Plummer-Vinson Syndrome treated and followed up in the Gastroenterological Surgery Clinic of the hospital were evaluated.

**Results:** Seven (70%) of the patients were female, and three (30%) were male, with a mean age of 45±18. All the patients had a mean hemoglobin value of 8.4±0.94 g/dL and a mean erythrocyte volume level of 63±5.01 fL, and their ferritin levels were 6.5±5.42 ng/dL, which accounted for iron deficiency in the patients. With barium swallow studies before endoscopy, all patients were shown to have esophageal webs. All patients underwent endoscopic balloon dilatation under sedoanalgesia. Three cases of recurrence were observed, and those patients underwent the balloon dilatation process again. Squamous cell carcinoma in the distal esophagus was detected in one case in the 72nd month of follow-up.

**Conclusion:** Endoscopic balloon dilatation together with oral iron replacement is a safe, simple, and efficient mode of treatment. As Plummer-Vinson Syndrome is regarded as a precancerous condition, endoscopic follow-up is required for subsequent treatment.

**Keywords:** Dysphagia; Esophageal Web; Iron Deficiency Anemia; Plummer-Vinson Syndrome

## Introduction

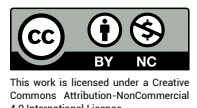
Plummer-Vinson Syndrome (PVS) is a rare condition also known as Paterson-Brown-Kelly Syndrome. Its main clinical features include web(s) in the upper esophagus, dysphagia, and iron deficiency anemia.<sup>[1-3]</sup> Although the pathogenesis of PVS remains largely unknown, it has been

suggested that iron deficiency anemia, genetics, malnutrition, and autoimmune conditions are effective in its etiology.<sup>[4-7]</sup> It is generally seen more in middle-aged women.<sup>[8]</sup> On one hand, there are studies that argue that the most significant step in PVS treatment is iron replacement.<sup>[4,5]</sup> However, other studies in the literature report that endoscopic dilatation or incision should be performed in cases



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with esophageal webs that have been unresponsive to iron treatment.<sup>[6-8]</sup> The prognosis of PVS is almost perfect when it is not accompanied by hypopharynx and upper esophageal squamous cell carcinoma. If carcinoma develops, the prognosis dramatically deteriorates.<sup>[9]</sup>

### Aim

This study presents 10 Plummer-Vinson Syndrome cases at our clinic that were treated with endoscopic balloon dilatation and were then followed up.

## Materials and Methods

### Study Design

The cases of 10 patients with prospective records of Plummer-Vinson syndrome treated and followed in the Gastroenterological Surgery Clinic were evaluated. The Clinical Research Evaluation Board approved the study protocol.

### Study Population

Adult patients (>18 years of age) who presented to our clinic with dysphagia, who had a web in the proximal esophagus detected through barium swallow studies or endoscopy of the gastrointestinal system, and who had iron deficiency were regarded as having Plummer-Vinson Syndrome. Patients who had these criteria but who also had a history of pharynx or esophagus injury, surgery, or radiotherapy and/or who had missing file records were excluded from the study. Patients with hemoglobin levels below 12.0 g/dL for women and 13.0 g/dL for men, with serum ferritin levels below <30 µg/L and with mean corpuscular volume (MCV) below <80 fL were regarded to have iron deficiency anemia.<sup>[10]</sup>

The severity of dysphagia in the patients was classified according to their oral food intake. Those who were able to swallow solid food were assigned grade 0, those who ingested a semisolid diet, grade 1, those who could only take soft food, grade 2, and those who could only take liquid food, grade 3. Those who had complaints with any kind of food were classified as grade 4.

### Instruments

Examinations were performed with a FUJINON VP-4450 & XL-4450 Endoscopy set. Dilatation was performed with multidiameter esophageal balloon catheters (CRE™; Fixed Wire, Boston Scientific).

### Technique

All patients were given information prior to the procedures, and their informed consent forms were approved. Before the procedure, all the patients were shown through barium swallow studies to have a web. Endoscopic procedures were performed with propofol (Propofol ampoule, FRESENIUS KABI®) and fentanyl citrate (Talinat ampoule, VEM®) under sedoanalgesia. A guide wire was placed in the endoscope compartment. After that, dilatation was performed without fluoroscopy. In general, the dilator size was gradually increased. The first endoscopy and laboratory checks were done in the third month after the procedure. During the clinical follow-up, additional dilatation procedures were performed until symptomatic improvement was achieved if the esophageal web and dysphagia recurred.

### Data

Patients' data with respect to age, gender, presenting complaints, physical examination results, laboratory results, radiological data, endoscopic results, accompanying upper gastrointestinal system malignancy, recurrence, and follow-up duration (months) were recorded.

### Statistical Analysis

The statistical analyses of the data collected were performed using the SPSS 21.0 package program. Categorical measurements were summarized in numbers and percentages, whereas continuous measurements were summarized in mean and standard deviation figures (also in median and minimum-maximum figures where necessary). Differences between laboratory values after iron treatment were compared using a paired samples T-test. The level of significance was set at  $p < 0.05$ .

## Results

Seven (70%) of the patients were female, and three (30%) were male, with a mean age of  $47 \pm 18$  years. All patients had dysphagia symptoms. Six (60%) of the cases had grade 1 dysphagia, three (30%) had grade 2, and one (10%) had grade 3. The mean duration of dysphagia complaints was  $74.1 \pm 81.2$  (9–240) months. Nine (90%) of the patients were suffering from weight loss. The clinical features of the patients have been summarized in Table 1.

The laboratory results of the patients revealed that all of them had hypochromic microcytic anemia. The pa-

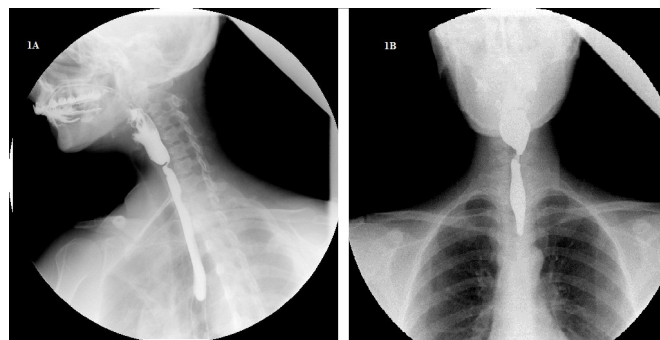
**Table 1. Clinical characteristics of patients**

Case	Gender	Age	Dysphagia Score	Dysphagia time (month)	Weight Loss
1	F	18	1	12	Yes
2	F	34	2	84	Yes
3	M	34	1	120	Yes
4	F	51	3	240	Yes
5	F	45	1	12	Yes
6	M	71	2	24	Yes
7	F	67	1	9	No
8	F	56	2	180	Yes
9	M	45	1	36	Yes
10	F	44	1	24	Yes

F: Female; M: Male.

tients' mean hemoglobin level was found to be  $8.4 \pm 0.94$  g/dL, their MCV value was  $63 \pm 5.01$  fL, their ferritin level was  $6.5 \pm 5.4$  ng/dL, their iron-binding capacity was  $479.3 \pm 80$   $\mu$ g/dL, and their iron level was  $16.2 \pm 12.1$   $\mu$ g/dL. No distinctive features were found in their serum liver or kidney function tests. The hematological laboratory results of our patients have been summarized in Table 2.

A barium esophageal passage graph was performed for all patients before the endoscopy, and an outlook consistent with webs in the proximal esophagus was observed (Fig. 1). The esophagoscopy performed on all these patients demonstrated webbing in the cervical esophagus. All patients underwent endoscopic balloon dilatation under sedoanalgesia (Fig. 2). No complications were ob-



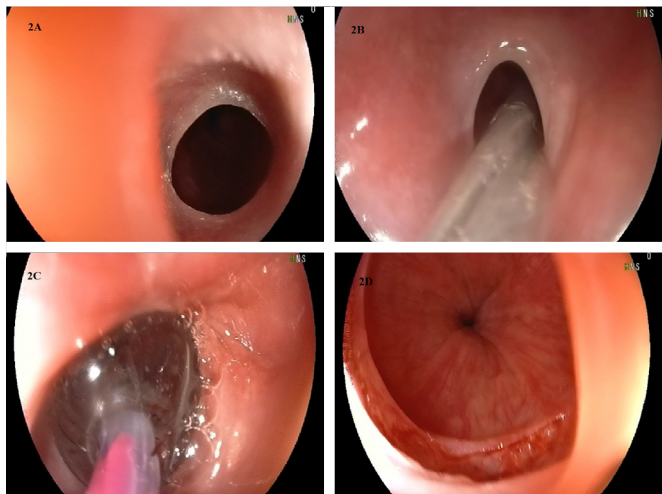
**Figure 1 (a, b).** Barium swallow showing esophageal web.

served in the patients following the procedure. All the patients were started on an oral iron treatment after the procedure. Dysphagia complaints were eliminated in all the patients (Fig. 3).

**Table 2. Hematological data of patient**

Case	Hgb (g/dl)	MCV (fL)	Iron ( $\mu$ g/dl)	IBC ( $\mu$ g/dl)	Ferritin (ng/dl)
1	7	54	20	460	4
2	6,7	58	8	632	2
3	9	64	12	584	2
4	9,1	69	14	460	20
5	8,5	58	8	510	4
6	7,8	67	21	421	5
7	9	69	48	376	11
8	8,6	62	8	450	7
9	9	65	13	400	6
10	9,5	64	10	500	4

Hgb: Hemoglobin; MCV: mean corpuscular volume; IBC: iron-binding capacity.



**Figure 2 (a-d).** An endoscopic view after successful sequential dilatation using balloon dilatation

There was a statistically significant difference between the laboratory values of the patients before and after the oral iron therapy ( $p < 0.05$ ) (Table 3).

During a mean follow-up period of  $29.6 \pm 24.4$  months (range 6–84 months), recurrence was observed in three patients. These patients received balloon dilatation again. Squamous cell carcinoma (SCC) was detected at the lower



**Figure 3.** View of patient after six months of balloon dilatation treatment.

end of the esophagus at the fourth year of follow-up endoscopy in one patient. Clinically, the patient was T3N+ following the radiological evaluation. After neoadjuvant chemoradiotherapy, the patient received an Ivor-Lewis esophagectomy. No recurrence or distant organ metastasis was found in the patient during the 12-month post-op follow-up. The follow-up and treatment features of the patients have been summarized in Table 4.

**Table 3. Changes in laboratory values after iron therapy**

Variable	Before oral iron therapy	After oral iron therapy	p
Hemoglobin (g/dL)	8.4±0.94	12.7±1.1	<0.001
Mean corpuscular volume (fL)	63±5.01	87.5±2.75	<0.001
Serum Ferritin (µg/L)	6.5±5.4	55.9±11.9	<0.001

**Table 4. Follow-up of patients after endoscopic balloon dilation**

Case	Recurrence	First Recurrence Time (Month)	Follow-up EBD number	Follow-up (month)	Malignancy during follow-up
1	No	-	-	12	No
2	Yes	6	1	14	No
3	Yes	24	1	84	Distal esophagus SCC
4	No	-	-	48	No
5	No	-	-	50	No
6	No	-	-	24	No
7	No	-	-	24	No
8	Yes	15	1	26	No
9	No	-	-	6	No
10	No	-	-	8	No

EBD: endoscopic balloon dilatation; SCC: squamous cell carcinoma.



## Discussion

The syndrome's most commonly known name, Plummer-Vinson, is derived from physicians Henry Stanley Plummer (1874–1936) and Porter Paisley Vinson (1890–1959), who worked at the Mayo Clinic. They reported 91 cases with long-term iron deficiency anemia, dysphagia, and upper esophageal spasm without anatomic stenosis in their study published in 1912.<sup>[1]</sup> Paterson and Kelly, on the other hand, were the first ones to define this syndrome, known for features such as anemia, iron deficiency, dysphagia, glossitis, cheilitis, and koilonychia.<sup>[2,3]</sup>

The etiology of PVS still remains unclear. It has been suggested that the most probable mechanism in PVS is the rapid loss of iron-dependent enzymes related to iron deficiency and the consequent high level of cellular destruction. The loss of these enzymes causes mucosal degeneration, atrophic changes, and web formation related to dysphagia. Researchers have suggested that PVS-related dysphagia is generally related to iron deficiency, and studies demonstrating that iron supplements alleviated patients' complaints have been published as well.<sup>[4,5]</sup> Researchers have also reported that esophageal motility was upset in PVS, and they demonstrated that this motility disorder regressed with iron treatment.<sup>[5]</sup> Nutritional problems, genetics, and autoimmune causes can be listed among other causes.<sup>[6,7]</sup>

There is no exact data on the incidence and prevalence rates of the syndrome. PVS was common among Caucasians in the first half of the twentieth century in the northern hemisphere. Today, however, it is very rarely seen. The syndrome has been reported in the literature mostly in the form of case reports with a limited number of clinical studies.<sup>[11,12]</sup> There have only been a limited number of case reports from Turkey, and our study is the first clinical study to be published in the country.

While the syndrome is most often seen in middle-aged women in particular, other cases have also reported the syndrome in some people's seventh decade and in the population of children.<sup>[13-15]</sup> In Bakari et al.'s study,<sup>[12]</sup> 86.6% of their sample of 135 patients who had been diagnosed with PVS were female, with a mean age of 43 years. When we reviewed the literature on the subject and also included our own cases, we saw that the majority of cases were middle-aged female patients.

Dysphagia is generally painless, intermittent, or progressive over the years and is limited to solid food and is some-

times accompanied by weight loss. Goel et al.<sup>[11]</sup> reported that most of the 37 patients covered by their study had grade 1 and 2 dysphagia. The mean duration of dysphagia was 24 (4–324) months, and the mean body mass index was 18.3 (12.8–25.8) kg/m<sup>2</sup>. In our study, however, 90% of the patients had weight loss, and the mean duration of dysphagia was 74.1 (9–240) months.

The major clinical and diagnostic criteria for PVS include post-cricoid dysphagia, upper esophageal web, and iron deficiency anemia. Although esophageal webs can be detected through barium passage graphs, the best method is video fluoroscop.<sup>[13,15]</sup> These rings can also be shown by endoscopy of the upper gastrointestinal system. Through the endoscopy, these rings are seen as planes that are smooth-surfaced, thin, or grey-colored. Endoscopic examination of the upper gastrointestinal system should be performed very carefully in case of suspected webs, since most webs are located in the proximal esophagus and can be ruptured because of their thin structure.<sup>[11,16]</sup>

Laboratory results are generally correlated with iron deficiency anemia. The levels of serum hemoglobin, hematocrit, MCV, serum iron, and ferritin decrease, while the total iron-binding capacity increases. Laboratory anomalies, except for these, cannot generally be defined.<sup>[11-13,17]</sup> In our study, hematological values consistent with iron deficiency anemia were detected in line with the literature, while no distinguishing features were detected in the other laboratory results. Pallor, fatigue, and tachycardia related to anemia can also be seen; glossitis, angular cheilitis, atrophic oral mucosa, and spoon nail (koilonychias) may also be encountered.<sup>[11]</sup>

Motility disorders such as achalasia, as well as esophageal diverticula, malignant tumors, benign strictures, spastic motility disorders, scleroderma, diabetes mellitus, gastroesophageal reflux disease, neuromuscular and skeletal muscle disorders, can be considered for differential diagnosis. After the differential diagnosis, which will differentiate the syndrome from other possible causes of iron deficiency and dysphagia, meaning that the disease has been clarified as PVS, the syndrome is then fundamentally treated by iron supplementation and esophageal dilatations.<sup>[14]</sup> Within the framework of dilatation treatment, dilatation can be performed for up to 17 mm after passing to the distal esophageal narrowness, especially using a guide wire. Although this problem can generally be treated at a single session, some patients need more than one session for treatment.<sup>[18]</sup> All the patients in our study

underwent guided endoscopic balloon dilatation. The dilatation began with a 12 mm balloon at the first stage, the balloon diameter was gradually increased and finished at 17 mm. Dilatation in all patients was successfully completed without complications. Seven (70%) cases did not require additional dilatation in endoscopy follow-up. In the three (30%) other patients, a second dilatation procedure was performed.

Goel et al.<sup>[11]</sup> reported that they performed endoscopic balloon dilatation for 31 patients and only two cases necessitated a second session. The authors also gave an oral iron preparation and folic acid to all their patients with iron deficiency anemia. We performed balloon dilatation in all cases; only three necessitated an additional session. We also started oral iron replacement treatment with all our patients.

Salihoun et al.<sup>[8]</sup> performed a total of 62 bougie dilatation procedures on 41 patients. No complications such as bleeding or perforation took place during the procedures, and the endoscope was easily able to pass through the esophagus after the procedure. The authors did not report any recurrences or malign degeneration during the mean follow-up duration of 31.5 (3–60) months.

Fall et al.<sup>[18]</sup> stated in their retrospective study covering 50 cases that they performed bougie dilatation on 36 patients with stricture and webs, with accidental endoscopic rupture for 6 out of 14 patients without stricture, and they only started 8 patients on iron treatments. The authors reported dysphagia recurrence during the follow-ups in seven patients who had received bougie dilatation only because of stricture. The authors also reported that only one of these patients developed esophageal stenosis following seven bougie dilatations within six years.

As PVS was associated with an increased incidence of post-cricoid carcinoma (4–16%) in a study published by Chisholm in 1974, the syndrome is considered precancerous for the hypopharynx and the cervical esophagus.<sup>[9]</sup> Apart from this study, esophagus and stomach cancer accompaniment with PVS have been reported, but the etiopathogenesis of the premalignant behavior of the syndrome is still unknown. Endoscopic follow-up is recommended<sup>[18,12]</sup> Within the scope of our study, one patient developed SCC in the distal esophagus in the 72<sup>nd</sup> month of follow-ups. The patient received an Ivor-Lewis esophagectomy. No recurrence or distant organ metastasis was detected during the post-op 12-month follow-up

period. Based on this case and on the data presented in the literature, patients who only receive iron treatments and whose endoscopy cannot be fully performed should be given endoscopic follow-up even if their complaints are mechanically eliminated following treatment.

There are a few limitations to our study. The first and most important is that the study was done with a limited number of patients. Secondly, the median duration of the follow-up period was limited to 24 months. Because of these two limitations, we cannot comment on the risk of recurrence or malignancy. The third limitation is the absence of another treatment group to compare balloon dilatation therapy. The strong points of our study included the prospective records, the predefined diagnostic criteria, and implementation of the management strategy and the full follow-up of the participants.

## Conclusion

PVS is a rarely seen clinical condition, with most information limited to case reports. When it does occur, it is frequently seen in middle-aged female patients. Oral iron replacement with endoscopic balloon dilatation is a safe, simple, and effective treatment method. Since PVS is regarded as a precancerous condition, endoscopic follow-up is necessary following treatment.

## Disclosures

**Ethics Committee Approval:** The study was approved by the Local Ethics Committee.

**Peer-review:** Externally peer-reviewed.

**Conflict of Interest:** None declared.

**Authorship Contributions:** Concept – E.G.; Design – Ö.Ö.; Supervision – S.G.; Materials – A.S.S.; Data collection and/or processing – M.D.; Analysis and/ or interpretation – E.G., E.P.; Literature search – M.D.; Writing – E.G.; Critical review – M.D.

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# Laparoscopic versus open repair for perforated peptic ulcer: A single-center analysis

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## ABSTRACT

**Introduction:** The aim of this study was to evaluate and compare the early postoperative outcomes of patients who underwent laparoscopic and open repair for perforated peptic ulcer disease in our clinic.

**Materials and Methods:** An observational single-center study was conducted at the Marmara University Pendik Training and Research Hospital between June 2018 and June 2023. Demographic characteristics, comorbidities, preoperative laboratory tests, surgical technique, duration of operation, ulcer location (duodenal, gastric, prepyloric), postoperative length of hospital stay, readmission, and complications were analyzed. Patients were divided into two groups, open and laparoscopic operations, and compared.

**Results:** We compared 99 patients who underwent open surgery (OS) with 23 who underwent laparoscopic surgery (LS). The median age of the entire cohort was 42.5 years (IQR 30.3–62). There was no difference between the two groups in terms of ulcer location. The operative time was longer in the laparoscopic group (45 min OS vs. 60 min LS,  $p < 0.001$ ). Although the median length of hospital stay was three days between the two groups, there was a significant difference in favor of the laparoscopic group. There were no significant differences in postoperative complications or 30-day mortality between the two groups (0.754 and 0.684, respectively).

**Conclusion:** Compared with the open method, the laparoscopic method can be safely applied in the surgical treatment of peptic ulcer perforation without increasing complications. In suitable patients, advantages such as shorter hospital stays can be utilized.

**Keywords:** Emergency Surgery, Laparoscopic Repair, Minimally Invasive Surgery, Outcomes, Peptic Ulcer Disease, Perforated Ulcer

## Introduction

Peptic ulcer disease is a widespread disease that affects a considerable number of patients worldwide, with an annual incidence ranging from 0.10% to 0.19%. Although

the incidence of this disease has been on the decline due to improved medical treatment options, the occurrence of perforated peptic ulcer (PPU) has been steadily increasing over the last few decades, particularly in the elderly pop-



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ulation. PPU has a high mortality rate, ranging from 1.3% to 20%, and is an acute surgical emergency that necessitates prompt identification and management for positive outcomes. Once preoperative resuscitation is complete, emergency surgery is crucial to fix the visceral perforation and thoroughly clean the peritoneum.<sup>[1-5]</sup>

The World Society of Emergency Surgery (WSES) guidelines recommend operative treatment for patients with perforated peptic ulcers with significant pneumoperitoneum, extraluminal contrast extravasation, or signs of peritonitis. Repair can be accomplished in most patients with simple suturing of the ulcer margins and optional omental patch repair, while gastrectomy is rarely necessary. Minimally invasive techniques and advances in training have made it possible to use laparoscopy in perforated peptic ulcer surgery, which has several advantages over open repair, including reduced morbidity, such as a lower risk of postoperative wound infection, less postoperative pain, and a shorter length of stay. It is recommended that a laparoscopic approach be used in hemodynamically stable patients, whereas an open surgical approach is recommended if laparoscopic skills and equipment are not available.<sup>[1-4,6]</sup>

The aim of this study was to evaluate and compare the early postoperative outcomes of patients who underwent laparoscopic and open repair for perforated peptic ulcer disease in our clinic.

## Materials and Methods

An observational single-center study was conducted at the Marmara University Pendik Training and Research Hospital between June 2018 and June 2023. The study analyzed the data of patients who underwent surgery for PPU.

The study was conducted in accordance with the Declaration of Helsinki. The study was approved by the Marmara University School of Medicine Clinical Research Ethics Committee (Number: 09.2023.1095).

The data of patients over 18 years of age who underwent surgery for intraabdominal perforation were analyzed. Patients who underwent surgery for a prediagnosis of peptic ulcers were included in the study. Patients with perforations secondary to malignant ulcers or trauma and patients with intestinal perforation were excluded.

During the study period, perioperative data were gathered from clinical records, pathology, and radiology reports through the hospital's electronic health record system.

Demographic characteristics, comorbidities, preoperative laboratory tests (white blood cell count (reference range:  $4-11 \times 10^3/\mu\text{L}$ ), C-reactive protein (reference range: 0-5 mg/L)), surgical technique, duration of operation, ulcer location (duodenal, gastric, prepyloric), postoperative length of hospital stay, readmission, and complications were analyzed. Patients were divided into two groups, open and laparoscopic operations, and compared.

## Surgical Techniques

The operations employed the pedicled omental patch technique, also known as Graham omentoplasty.<sup>[7,8]</sup> All open repairs were conducted via midline laparotomy. After identifying the perforation site, an omental patch was created and sutured with 2-0 silk sutures, ensuring three points of fixation. The abdominal cavity was then irrigated with an adequate amount of saline solution. Following hemostasis, one drain was positioned in the operative area, and another was placed in the pelvis.

In laparoscopic repairs, a 10 mm laparoscope with a 10 mm trocar and two 5 mm trocars were used. The initial 10 mm trocar was introduced into the peritoneal space through an umbilical incision, and pneumoperitoneum was established with carbon dioxide at a pressure of 12-14 mmHg. The two 5 mm trocars were placed at the umbilical level along the right and left midclavicular lines. Once the perforation site was identified, an omental patch was created and sutured with 2-0 silk sutures at three fixation points. The abdominal cavity was then irrigated with an adequate amount of saline solution. After achieving hemostasis, a drain was placed in the operative area. The fascia defect created by the 10 mm trocar was sutured.

The primary aim of this study was to examine the early postoperative outcomes of patients who underwent surgery in the PPU and, second, to compare the effects of open and laparoscopic operations.

## Statistical Analysis

We conducted the statistical analysis using the Statistical Package for Social Sciences (SPSS) (version 25 for Mac; IBM Corp., Armonk, NY, USA). Continuous variables are described using either median values and interquartile ranges (IQRs) or means and standard deviations. Categorical variables were analyzed using frequency. The Kolmogorov-Smirnov test was used to evaluate the homogeneity of the data. The categorical variables were



compared using either two-tailed chi-square tests or Fisher's exact tests. The study utilized either independent two-sample t-tests or Mann-Whitney U tests to compare ordinal data. The statistically significant confidence interval was set at 95%, and the two-sided p value was 0.05.

## Results

During the study period, 127 patients who underwent surgery for a prediagnosis of peptic ulcer perforation were included, two patients who experienced perforation secondary to malignancy, three patients who were excluded due to missing information, and 122 patients who were included and analyzed.

We compared 99 patients who underwent open surgery (OS) with 23 who underwent laparoscopic surgery (LS). The median age of the entire cohort was 42.5 years (IQR 30.3-62). Patient ages ranged from 20 to 90 years.

Age, sex, comorbidities, white blood cell count, and C-reactive protein level are shown in Table 1. There was a significant difference between the OS and LS groups in terms of parameters other than sex.

A comparison of postoperative outcomes is shown in Table 2. There was no difference between the two groups in terms of ulcer location. The operative time was longer in the laparoscopic group (45 min OS vs. 60 min LS,  $p < 0.001$ ). Although the median length of hospital stay was three days between the two groups, there was a significant difference in favor of the laparoscopic group. There were no significant differences in postoperative complications or 30-day mortality between the two groups (0.754 and 0.684, respectively).

## Discussion

Laparoscopic surgery has been applied in many fields, and more advantageous results have been reported than those of open surgery.<sup>[9-14]</sup> The use of laparoscopy in peptic ulcer surgery is associated with lower morbidity and a shorter total length of hospital stay. There was no significant difference in mortality, postoperative sepsis, abscess, or reoperation rate between the open and closed methods. Although the WSES guidelines recommend using a laparoscopic approach in hemodynamically stable patients, some studies have shown that LS can be used as an alternative option even for hemodynamically unstable patients when performed by experienced surgeons.<sup>[3,6,15]</sup>

No single factor alone can easily identify patients at high risk for poor outcomes, but older age, the presence of comorbidities, and a delay in surgery have consistently been associated with a greater risk of death. The most widely used disease-specific prediction rule for PPU patients is the 'Boey score', which is based on major medical illness, preoperative shock, and duration of perforation longer than 24 hours before surgery. However, other predictive scores have been proposed.<sup>[16-18]</sup> The search for the ideal descriptor to select the right patient and use the appropriate surgical method is ongoing.

A delay in surgery has been consistently associated with mortality. Closure of the perforation by laparotomy and suturing the closure with or without overlying the omental pedicle has been the main approach for many years. Endoscopic treatment options and sutureless surgical options such as fibrin sealant are available, but there are no strong recommendations. Laparoscopic repair of perforated ulcers is increasingly used.<sup>[6,16,18-20]</sup> However, as in

**Table 1. Comparison of preoperative features**

Variables	All patients n=122	Open surgery n=99	Laparoscopic surgery n=23	p
Age (years) (median, IQR)	42.5 (30.3-62)	45 (32-62)	36 (26-43)	0.003
Sex (n, %)				
Female	20 (16.4)	14 (14.1)	6 (26.1)	0.209
Male	102 (83.6)	85 (85.9)	17 (73.9)	
White blood cell count ( $\times 10^3/\mu\text{L}$ ) (mean $\pm$ SD)	13 $\pm$ 5	13.6 $\pm$ 5.16	10.5 $\pm$ 3	0.006
C-reactive protein (mg/L) (median, IQR)	8.6 (3.2-26.1)	10.3 (3.2-26.4)	3.8 (1.6-11.3)	0.015
Comorbidities (n, %)	0.024			
Absent	97 (79.5)	75 (75.8)	22 (95.7)	
Present	25 (20.5)	24 (24.2)	1 (4.3)	

Table 2. Comparison of postoperative outcomes

Variables	All patients n=122	Open surgery n=99	Laparoscopic surgery n=23	p
Surgical technique (n, %)				<0.001
Graham patch	75 (61.5)	69 (69.7)	6 (26.1)	
Modified Graham patch	47 (38.5)	30 (30.3)	17 (73.9)	
Frequencies of ulcer location (n, %)				0.776
Duodenal	62 (50.8)	50 (50.5)	12 (52.2)	
Prepyloric	44 (36.1)	35 (35.4)	9 (39.1)	
Gastric	16 (13.1)	14 (14.1)	2 (8.7)	
Duration of operation (min) (median, IQR)	45 (41.3-60)	45 (40-57.5)	60 (57.5-80)	<0.001
Complications (n, %)				0.688
Absent	111 (91)	89 (89.9)	22 (95.7)	
Present	11 (9)	10 (10.1)	1 (4.3)	
Complications (n, %)				0.754
Postoperative ileus	4 (3.3)	4	0	
Abdominal Evisceration	2 (1.6)	2	0	
Leakage at repair site	2 (1.6)	1	1	
Wound infection	1 (0.8)	1	0	
Pulmonary embolism	1 (0.8)	1	0	
Sepsis	1 (0.8)	1	0	
Length of hospital stay (days) (median, IQR)	3 (3-4)	3 (3-4)	3 (2-3)	0.002
Readmission (n, %)				0.161
Absent	118 (96.7)	97 (98)	21 (91.3)	
Present	4 (3.3)	2 (2)	2 (8.7)	
30-day mortality (n, %)	6 (4.9)	5 (5.1)	1 (4.3)	0.684

our study, there may be a bias in favor of laparoscopic repair in patients with better general conditions. With the increasing experience of laparoscopy in peptic ulcer perforation surgery, it can be applied in patients with worse baseline values, and the results can be improved.

In meta-analyses comparing patients with open and laparoscopic omental patches, the incidence of postoperative leakage, reoperation, intra-abdominal collection, wound dehiscence, and incisional hernia were comparable between the two methods. Surgical site infection and pneumonia were less common in the laparoscopy group. Laparoscopic techniques resulted in shorter hospitalization and lower postoperative pain scores. The operative duration was longer in the laparoscopy group.<sup>[1,3]</sup> In our study, similar to the literature, there was no difference between the two groups in terms of postoperative complications. There was no difference in terms of readmission. Patients in the laparoscopy group had a longer operative time and shorter hospital stay.

There are studies reporting postoperative mortality rates of up to 30% for patients in the PPU. According to a meta-analysis, the 30-day mortality rates were 3.8% and 6.8% in the laparoscopy and open groups, respectively, and were significantly lower in the laparoscopy group.<sup>[1,16,18]</sup> In our study, there was no significant difference in mortality between the two groups.

Our study has several limitations. This was a single-center and retrospective study. The number of patients who underwent laparoscopic surgery was small. Laparoscopy was preferred for younger patients in stable condition, which may have affected the results.

## Conclusion

Compared with the open method, the laparoscopic method can be safely applied in the surgical treatment of peptic ulcer perforation without increasing complications. In suitable patients, advantages such as shorter hospital stays can be utilized.



## Disclosures

**Ethics Committee Approval:** This study was performed in line with the principles of the Declaration of Helsinki. This study was approved by the Marmara University Faculty of Medicine Clinical Research Ethics Committee (Number: 09.2023.1095).

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# Comparison of three-dimensional mesh (3D mesh) without fixation versus polypropylene mesh with fixation in patients of inguinal hernia undergoing totally extraperitoneal repair

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## ABSTRACT

**Introduction:** We aimed to compare the results of patients who underwent inguinal hernia repair with non-fixation pre-shaped three-dimensional (3D) mesh and fixation with polypropylene meshes (PPM) using the totally extraperitoneal (TEP) method.

**Materials and Methods:** A total of 96 patients who underwent laparoscopic hernia repair with the diagnosis of inguinal hernia between April 2019 and September 2023 were retrospectively analyzed. The patients were divided into two groups according to the mesh type used: staple fixation (SF) group (n=52), in which light-weight PPM was used, and non-staple fixation (NSF) group (n=44), in which pre-shaped 3D mesh was used. Patients' age, sex, body mass index (BMI), ASA score, comorbidities, hernia type, Visual Analog Scale (VAS) score at rest (VAS-rest) and while in motion (VAS-act), and chronic groin pain (CGP) were recorded. Postoperative follow-ups were performed at one, four weeks and three, and 12 months.

**Results:** The surgical time was found to be shorter in NSF group patients than in the SF group (p=0.011). In the SF group, four patients developed seroma, one patient developed urinary retention, and two patients developed hematoma. In the NSF group, seroma developed in three patients, urinary retention developed in two patients, and one hematoma was observed. Recurrence was observed in two patients in the SF group at 10 and 14 months, and in one patient in the NSF group at eight months. In the NSF group, groin pain was found less frequently on Day 1 and at Week 1 than in the SF group, indicating a statistically significant difference (p<0.001 and p<0.001, respectively).

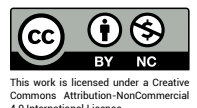
**Conclusion:** Applying pre-shaped 3D mesh without any fixation is a safe and applicable method in inguinal hernia surgery. We recommend this method, as CGP is less than the polypropylene mesh fixation method and does not increase recurrence. This method can be performed by experienced surgeons with low complication rates.

**Keywords:** CGP, NSF, SF, TEP, VAS-act, VAS-rest, Comorbidities, Hernia, Laparoscopic, Mesh, Postoperative, Recurrence, Seroma, Surgical time, Three-dimensional, Urinary retention



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## Introduction

Inguinal hernia surgery is still one of the most common surgical procedures worldwide. It was first applied laparoscopically in the 1990s.<sup>[1]</sup> A Cochrane database study revealed the advantages of laparoscopic inguinal hernia repair compared to open surgery.<sup>[2]</sup> Transabdominal preperitoneal (TAPP) and totally extraperitoneal (TEP) approaches are the most commonly applied techniques of laparoscopic inguinal hernia surgery. Although many techniques have been reported in the literature regarding mesh types and fixation methods applied in surgery, no definitive conclusion has been reached. Chronic groin pain (CGP) and recurrence rates after laparoscopic inguinal hernia surgery determine the success of this technique.<sup>[3]</sup> Regardless of the technique, the incidence of CGP in patients after these surgeries is, on average, 5-10%.<sup>[4]</sup> This situation negatively affects the quality of life after surgery. The definition of CGP is defined by the Association for the Study of Pain as groin pain that persists for more than 3 months after inguinal hernia surgery.<sup>[5]</sup> Nerve damage during dissection, thermal nerve injury, and entrapment of the nerves in fixation devices can be listed as the causes of groin pain. Apart from nerve injuries, stapling may lead to inflammation of the ligamentous insertions around the pubic symphysis, causing somatic pain. Metallic tacks were used in the early years for mesh fixation in the preperitoneal area. This has been seen as the main cause of pain. In order to protect patients from CGP, many techniques have been developed for mesh fixation, and absorbable tacks, fibrin glue, and cyanoacrylate have been tried, and apart from this, the results of self-gripping mesh and non-fixation pre-shaped three-dimensional (3D) mesh have been evaluated in studies.

Polypropylene meshes (PPMs) are made of prolene fibers arranged in a network with pores of differing sizes. They are classified on the basis of density of material and its surface area as heavyweight (90 gm/sq meter to 100 gm/sq meter); middleweight (45 gm/sq meter); and lightweight (less than 45 gm/sq meter).<sup>[6,7]</sup> The pre-shaped 3D mesh was first used in 1998 by Dr. Pajotin. Its most important features include the fact that it is anatomically designed, easily positioned, and fixation-free in nature with reduced pain.<sup>[8,9]</sup> In the present study, we aimed to compare the results of patients who underwent inguinal hernia repair with non-fixation pre-shaped 3D mesh and fixation with PPM using the TEP method.

## Materials and Methods

This retrospective study was conducted at Erzurum Hınıs Şehit Yavuz Yürekseven State Hospital and Istanbul Avrupa Şafak Hospital General Surgery Department between April 2019 and September 2023. Patients who were operated on for bilateral, unilateral, and recurrent inguinal hernia by three surgeons were reviewed. Patients who underwent inguinal hernia repair with pre-shaped 3D mesh and lightweight PPM were identified. Patients who underwent TAPP, had cancer concurrent with inguinal hernia, and could not be followed up were excluded from the study. The primary outcome was CGP and hernia recurrence, while the secondary outcomes included surgical time, pain score, hospital stay, wound and mesh-related seroma, hematoma, urinary retention, and orchitis. During the study period, a total of 145 patients were identified where laparoscopic hernia repair was performed with the diagnosis of inguinal hernia. Of these patients, 96 who were eligible for the study were included. A total of 49 ineligible cases were excluded from the study. The study flowchart is shown in Figure 1.

The patients were divided into two groups according to the mesh type used: staple fixation (SF) group (n=52) in which lightweight PPM was used and non-staple fixation (NSF) group (n=44) in which pre-shaped 3D mesh was used.

A written informed consent was obtained from each patient. The study protocol was approved by the Ethics Committee of the University of Health Sciences, Erzurum Faculty of Medicine (Date: 13.03.2024, Decision No: 2024/03-42). The study was conducted in accordance with the principles of the Declaration of Helsinki.

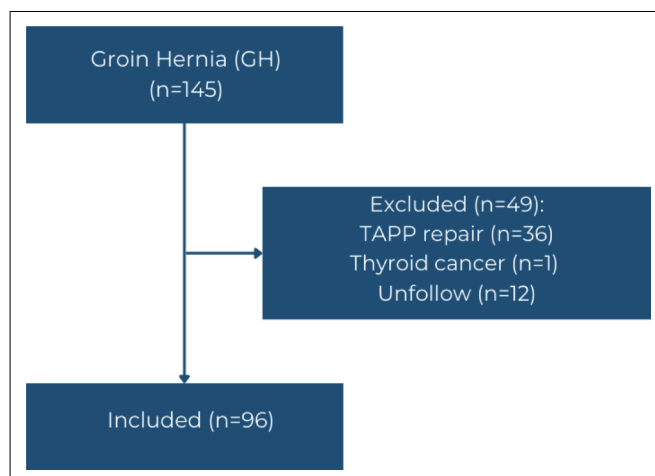


Figure 1. Study flowchart.

## Data Collection and Assessment

Patients' age, sex, body mass index (BMI), ASA score, comorbidities, hernia type, Visual Analog Scale (VAS) score at rest (VAS-rest), and while in motion (VAS-act) were recorded. The pain was measured on postoperative Day 1 and after one week using the VAS ranging from no pain "0" to worst pain "10". Intraoperative and postoperative data were noted. Postoperative follow-ups were performed at one, four weeks, and three and 12 months. The VAS score was evaluated. Follow-ups were carried out at the outpatient clinic, and patients who could not attend the check-up were contacted by phone, and their information was updated. The patient's recurrence was decided based on the repeat examination and the patients' expression of swelling in the groin. In suspicious cases, further examination was performed by requesting superficial organ ultrasonography.

## Operative Technique

All laparoscopic TEP repairs were performed under general anesthesia. With a single video monitor at the foot end of the patient, a 2-cm transverse infraumbilical incision was made extending from the midline to the opposite side of the hernia. Blunt dissection was performed to expose the anterior sheath. Once the rectus abdominis muscle was exposed, it was swept laterally to expose the posterior rectus sheath. A 10-mm, 30° telescope was inserted and used to bluntly dissect the areolar tissue in the preperitoneal space. Low-pressure pneumoperitoneum was created. Two 5-mm ports were inserted between the symphysis pubis and umbilicus, on the midline. The cord structures were dissected free of peritoneal attachments, and the sac reduced back to the peritoneal cavity. After all possible hernia sites (indirect, direct, and femoral) were made visible, the mesh placement stage was started. The mesh was placed between the peritoneum and transversalis fascia. After mesh placement, the preperitoneal space was deflated under observation. Pneumoperitoneum is released gradually. The infraumbilical trocars site was closed with a 2-0 Vicryl.

## Mesh Types and Placement

In the SF group, a lightweight PPM was used, with a size of 15x12 cm, and fixed with staple tacks. In the NSF group, 8.5x13.7 cm knitted polypropylene pre-shaped mesh (3DMax™-Mesh) was used, which does not require fixing with staple tacks. The pre-shaped 3D mesh elimi-

nates the need for tools such as sutures, tacks, or staplers, thus eliminating potential nerve damage. The meshes are curled to the middle from the upper and lower edges when outside the body. The meshes that were sent from the 10-mm trocar were positioned centrally to cover the inner inguinal ring, and medially to cover the pubic tubercle. With the help of blunt instruments such as a grasper, the upper fold of the rounded mesh was fixed. The lower fold was unrolled until it went below the peritoneal reflection and then the upper fold was opened to cover all potential hernia sites. The pre-shaped 3D mesh was gently pressed with the grasper to make it adhere to the surrounding tissues. Usually, three tacks were sufficient to secure the standard PPM mesh to the os pubis, the Cooper ligament, and the top of the iliopubic tract. After surgery, the patients were monitored in the ward. The oral regimen was started on the same day, and the patients were discharged the next day.

## Statistical Analysis

Statistical analysis was performed using IBM SPSS for Windows version 22 software (IBM Corp, Armonk, NY, USA). Descriptive data were expressed as mean and standard deviation (SD), median (min-max), or number and frequency, where applicable. The independent sample t-test was used to compare the quantitative continuous data between the two groups. The difference between repeated measurements within the group was analyzed by the paired group test. A p-value of <0.05 was considered statistically significant.

## Results

A total of 118 inguinal hernia repairs were performed, both unilateral and bilateral. No statistically significant difference was observed in terms of the patients' demographic data, BMI, American Society of Anesthesiologists (ASA) score, hernia characteristics, preoperative pain score, and comorbidities (Table 1).

Peri- and postoperative data are given in Table 2. There was a statistically significant difference between the groups in terms of the surgical time. The surgical time was found to be shorter in NSF group patients than in the SF group (p=0.011). In the SF group, four patients developed seroma, one patient developed urinary retention, and two patients developed hematoma. In the NSF group, seroma developed in three patients, urinary retention developed in two patients, and one hematoma was observed. Pa-

**Table 1. Preoperative data**

Variables	SF (n=52) n (%)	NSF (n=44) n (%)	p
Age (min-max)	41.32+11.56 (23-68)	43+12.37 (26-70)	0.531
Sex			0.625
Male	48 (92.3)	41 (93.1)	
Female	4 (7.6)	3 (6.8)	
BMI	29.35+3.21 (22.5-38.2)	28.65+2.43 (21.4-37.6)	0.310
ASA score			0.525
1	45 (86.5)	39 (88.6)	
2	7 (13.4)	5 (11.3)	
Hernia characteristics			0.254
Unilateral	42 (80.7)	32 (72.7)	
Bilateral	10 (19.2)	12 (27.2)	
Recurrent	7 (13.4)	4 (9.09)	
Preoperative pain scores			
VAS-rest	1.425+1.321 (0-4)	1.235+1.12 (0-4)	0.345
VAS-act	3.550+1.354 (1-6)	3.940+1.250 (2-6)	0.210
Comorbidities			0.212
Hypertension	8 (15.3)	9 (20.4)	
Lung disease	4 (7.6)	2 (4.5)	
Diabetes mellitus	6 (11.5)	5 (11.3)	
Benign prostatic hyperplasia	2 (3.8)	1 (2.2)	
Smoking	43 (82.6)	36 (81.8)	
Obesity	15 (28.8)	10 (22.7)	

SF: staple fixation; NSF: non-staple fixation; VAS: Visual Analog Scale; VAS-rest: Score at rest; VAS-act: Score at motion.

**Table 2. Peri- and postoperative data**

Variables	SF (n=52) n (%)	NSF (n=44) n (%)	p
Mean Length of Surgery (minute)	50.75+18.8 (39-91)	42.82+16.54 (30-69)	0.021
Postoperative early complications			0.545
Seroma	3 (5.7)	1 (2.2)	
Hematoma	2 (3.8)	0 (0)	
Urinary retention	1 (1.9)	1 (2.2)	
Orchitis	0 (0)	0 (0)	
Length of hospital stay (day)	1.65+0.45 (1-3)	1.15+0.15 (1-2)	0.325
Follow-up duration (month)	31.5+9.46 (12-45)	29.8+7.25 (11-41)	0.156
Recurrence	2 (3.8)	1 (2.2)	0.612

SF: staple fixation; NSF: non-staple fixation.

tients with seroma were followed, no additional intervention was performed, urine evacuation was performed with a temporary Foley catheter for urinary retention, and patients who were followed for hematoma were dis-

charged without any additional intervention. Recurrence was observed in two patients in the SF group at 10 and 14 months, and in one patient in the NSF group at eight months.



Considering the postoperative first day and first week VAS scores, there was a significant decrease in both groups compared to the preoperative period. In the NSF group, groin pain was found less frequently on Day 1 and at Week 1 than in the SF group, indicating a statistically significant difference ( $p < 0.001$  and  $p < 0.001$ , respectively) (Table 3). Both groups were given 4x1,000 mg paracetamol IV as an analgesic during their postoperative follow-up and 4x1,000 mg paracetamol oral for one week after discharge.

## Discussion

The main goal of inguinal hernia surgeries is to shorten surgical time, repair with the correct technique, ensure low morbidity, early return to daily life, less pain, acceptable cost, better cosmetic result, and low recurrence. The most important developments in this regard are the mesh-applied tension-free anterior hernia repair described by Lichtenstein in the late 1980s and the introduction of laparoscopic methods in the 1990s.<sup>[10,11]</sup> Studies comparing laparoscopic inguinal hernia repair with classical open hernia repair have shown that the minimally invasive approach contributes greatly to patients' early comfort, less postoperative pain, shorter hospital stay, and faster return to work.<sup>[12-14]</sup> Particularly, the use of meshes in inguinal hernia surgeries has reduced recurrence rates.<sup>[15]</sup> Choosing the right mesh determines the surgical results as much as the surgical technique.<sup>[16]</sup> The ideal mesh implant would be chemically inert, resistant to stress, pliable, non-carcinogenic, hypoallergenic, and resistant to modification by body tissue.<sup>[17]</sup>

Chronic groin pain morbidity has come to the fore in the long term, particularly due to the decrease in recurrence rates with prosthetic mesh materials. Therefore, studies

on the choice of mesh used in inguinal hernia repair continue. Many studies have demonstrated that CGP complications are lower in TEP and TAPP techniques compared to open hernia repair.<sup>[18-20]</sup>

Apart from this, laparoscopic hernia surgery has a positive effect on the quality of life (QoL) scores of patients.<sup>[21]</sup> Choosing non-fixation mesh in laparoscopic hernia repair reduces CGP and also reduces costs due to not using fixation staplers.<sup>[3]</sup> Non-fixation mesh can be applied safely in both TAPP and TEP methods.<sup>[22]</sup> In addition, since there is no need for mesh fixation after surgery, the need for analgesics is reduced due to less pain.<sup>[23]</sup> Büyükkaşık et al.<sup>[24]</sup> compared fixation and non-fixation groups using standard PPM in inguinal hernia repair and found that there was less pain in the non-fixation group one month after discharge. In another study using NSF, repair with preshaped 3D mesh was safe, reduced the CGP rate and morbidity, and shortened the operating time.<sup>[25]</sup> Tiwari et al.<sup>[26]</sup> evaluated the pain, recurrence, and morbidity results after inguinal hernia repair with 3D mesh in a prospective observational study and published its positive results. In our study, only patient groups with similar demographic and hernia characteristics who underwent TEP were evaluated. Although there was a significant improvement in both groups compared to the preoperative period, considering the VAS score on Day 1 and Week 1 after surgery, the pain in the NSF group was statistically significantly less than the SF group. However, no significant difference was observed between the groups at Month 3.

Considering the surgical times between the NSF group and the SF group, it was found to be shorter in the NSF group, indicating a statistically significant difference. These results were similar to the studies conducted by Cucuk et al.<sup>[27]</sup> and Birk et al.<sup>[28]</sup>

**Table 3. Mean VAS scores**

Variables	SF	NSF	p
VAS-rest	1.425+1.321 (0-4)	1.235+1.12 (0-4)	0.345
VAS-act	3.550+1.354 (1-6)	3.940+1.250 (2-6)	0.210
VAS 1 <sup>st</sup> day (POD1)	1.150+0.450 (0-2)	0.710+0.115 (0-1)	0.012
VAS 1 <sup>st</sup> week	0.630+0.420 (0-2)	0.210+0.310 (0-1)	0.001
VAS 3 <sup>rd</sup> month	0.361+0.471 (0-2)	0.135+0.211 (0-2)	0.872

SF: staple fixation; NSF: non-staple fixation; VAS: Visual Analog Scale; VAS-rest: Score at rest; VAS-act: Score at motion; POD1: postoperative day 1.

Many complications may occur in the early period after laparoscopic inguinal hernia surgery. The rates of seroma, hematoma, and urinary retention developing in both groups of patients after surgery were found to be low and consistent with the literature.<sup>[28,29]</sup> Therefore, no statistically significant difference was observed between the groups in the hospitalization period of the patients. Moreover, the use of non-fixation mesh is considered a safe method, as it does not increase recurrence rates.<sup>[10]</sup> The recurrence rate after pre-shaped 3D mesh repair has been reported as 0 to 3.3% during 12 to 26 months of follow-up in different studies in the literature.<sup>[25,30,31]</sup> Cucuk et al.<sup>[28]</sup> used NSF self-gripping mesh during a mean follow-up period of 25.8 months, and no recurrence was observed. In our study, the follow-up period in the SF and NSF groups was 31.5±9.46 months and 29.8±7.25 months, respectively, and the recurrence was seen in two (3.8%) and one patient (2.2%), respectively. Recurrence occurred at 14 and 16 months in the SF group and at 12 months in the NSF group, and the patients were reconstructed with the TAPP method. These results are consistent with the literature.

Of note, as in all surgeries, minimally invasive surgery is preferred in inguinal hernia surgery, and with the development of technology, studies comparing laparoscopic inguinal hernia repair with robotic repair have begun to be reported in recent years.<sup>[32]</sup>

Nonetheless, the main limitation to our study is its retrospective design with a relatively small sample size. Therefore, we believe that prospective studies in larger series are needed. In addition, it is necessary to evaluate the 10-year results of NSF pre-shaped 3D mesh follow-up period. We suggest that the study yielded a positive effect in terms of evaluating the results by performing TEP laparoscopically with a single technique and excluding patients who underwent TAPP from the study.

## Conclusion

In conclusion, applying pre-shaped 3D mesh without any fixation is a safe and applicable method in inguinal hernia surgery. We recommend this method, as CGP is less than the polypropylene mesh fixation method and does not increase recurrence. This method can be performed by experienced surgeons with low complication rates.

## Disclosures

**Ethics Committee Approval:** The study protocol was approved by the Ethics Committee of the University of Health Sciences, Erzurum Faculty of Medicine (Date: 13.03.2024, Decision No: 2024/03-42). The study was conducted in accordance with the principles of the Declaration of Helsinki.

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# Management of the stump in complicated acute appendicitis: Conversion to open surgery or laparoscopic stapler?

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## ABSTRACT

**Introduction:** This study aims to compare the efficacy and safety of using laparoscopic staplers versus conversion to open surgery in the management of the appendiceal stump in cases of complicated acute appendicitis (AA).

**Materials and Methods:** A total of 123 patients who underwent surgery for complicated AA at our clinic between 2020 and 2024 were included in the study. Of these, 98 (79.7%) underwent open appendectomy (OA), and 25 (20.3%) underwent laparoscopic appendectomy (LA) with a stapler. The patients were retrospectively analyzed and compared in terms of demographic characteristics, hospital stay duration, post-operative complications, and surgical site infections.

**Results:** The mean age of the patients was  $37.60 \pm 11.23$  years, and the mean BMI was  $28.77 \pm 3.90 \text{ kg/m}^2$ . The mean hospital stay was  $5.02 \pm 1.77$  days. Surgical site infections were more frequent in the OA group (27.6%) compared to the LA group (8.0%) ( $p=0.040$ ). The mean hospital stay was longer in the OA group ( $5.16 \pm 1.79$  days) compared to the LA group ( $4.44 \pm 1.58$  days) ( $p=0.049$ ). No significant difference was found in the incidence of post-operative complications between the two groups ( $p=0.526$ ).

**Conclusion:** The findings suggest that completing the surgery laparoscopically results in better outcomes compared to converting to open surgery in cases of complicated acute appendicitis. The use of a laparoscopic stapler is associated with safer and more effective closure of the appendiceal stump, leading to fewer surgical site infections and shorter hospital stays. Prospective studies with larger patient populations are needed to confirm these findings.

**Keywords:** Acute Appendicitis, Appendiceal Stump Management, Laparoscopic Stapler, Laparoscopic Surgery

## Introduction

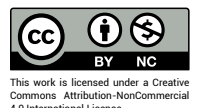
Among abdominal pathologies, the most common cause requiring emergency surgery is acute appendicitis (AA).<sup>[1]</sup> Although open surgery is the most commonly used treat-

ment method, laparoscopic surgery has begun to replace open surgery with developments in technology in recent years.<sup>[2]</sup> The popularity of laparoscopic appendectomy (LA) is due to the various advantages it offers patients.



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Since the laparoscopic approach requires smaller surgical incisions, it reduces postoperative pain, shortens hospital stay, and allows patients to return to normal activities more quickly compared to open appendectomy (OA).<sup>[2,3]</sup> Additionally, cosmetic results are more satisfactory compared to open surgery. However, many factors determine the success of this surgical technique, and among these factors, the management of the appendix stump has an important place.

One of the most important differences between laparoscopic and open surgery is the method used to close the appendix stump. While this method is more standard in open surgery, there are different approaches in laparoscopic surgery such as stapler, endoloop, titanium clip, non-absorbable polymer clip (hem-o-lok clip), external knot tying, intracorporeal ligation, hand-made loop, ligasure, or simply using bipolar coagulation to cut the stump.<sup>[4,5]</sup>

The choice between converting to open surgery or closing the stump with a stapler may depend on the surgeon's experience, the patient's clinical condition, and the specific conditions of the operation. However, studies on the effectiveness and safety of both methods provide important data to determine which method is more suitable to improve surgical outcomes. Closing the stump with a stapler is not standard practice in our clinic. In cases where the appendix is perforated close to the cecum or there is severe inflammation-edema in the cecum/appendix stump, the surgeon may prefer to close it with a stapler. However, sometimes to ensure the safety of the appendix stump, converting from laparoscopic to open surgery is also a viable method.

In this article, we aimed to examine the effectiveness and safety of using laparoscopic staplers to safely close the stump in cases of AA by comparing the perioperative process and early postoperative results (within the first month) of the stump closure.

## Materials and Methods

The demographic characteristics, operation notes, and postoperative summaries of patients who underwent surgery due to complicated AA between 2020 and 2024 at the General Surgery Clinic of a major training and research hospital were retrospectively reviewed.

The study was approved by the Local Ethics Committee of our hospital (Approval number: 2024/206).

Patients with perforated, gangrenous appendicitis, or with edema-inflammation observed at the appendiceal root/cecum were considered to have complicated appendicitis.

According to the operation notes, 123 patients with complicated AA, whose appendices were identified laparoscopically but whose appendectomies were completed either with a stapler or by conversion to open surgery based on the surgeon's preference, were included in the study. A routine 12 mm laparoscopic stapler was used as the stapling device. Patients were compared based on age, gender, BMI, presence of comorbidities (Diabetes mellitus, hypertension, asthma, chronic obstructive pulmonary disease, and coronary artery disease), length of hospital stay, and postoperative clinical course, including pericecal inflammation/abscess observed in imaging (USG or CT) and detection of surgical site infection.

Patients who underwent open surgery from the beginning, those whose surgeries were converted to open due to the inability to visualize the anatomy, those whose appendiceal stumps were closed by methods other than a stapler, and those whose data were unavailable were excluded from the study.

All statistical analyses were performed using SPSS (Statistical Package for Social Sciences) for Windows version 25.0 (SPSS Inc., Chicago, IL, USA).

We used mean and standard deviation for the expression of study data. Additionally, numeric (n) values and percentages (%) were reported. The Chi-square test was employed for the comparison of two categorical variables. For the comparison of a categorical variable with a numeric value, the Mann-Whitney U test was used. All statistical calculations were two-sided, and a p-value of less than 0.05 indicated statistical significance at a 95% confidence interval.

## Results

The data of 1717 patients who underwent appendectomy between 2020 and 2024 were retrospectively analyzed. The number of patients meeting the inclusion criteria was 123. Of these patients, 98 (79.7%) underwent open appendectomy, and 25 (20.3%) underwent laparoscopic stapler appendectomy. The mean age of the patients was  $37.60 \pm 11.23$  years, and the mean BMI was  $28.77 \pm 3.90$  kg/m<sup>2</sup>. The average hospital stay was  $5.02 \pm 1.77$  days. Among the patients, 85 were male (69.1%) and 38 were female

(30.9%). A total of 17 patients had comorbid conditions (13.8%). Postoperative complications were observed in 24 patients (19.5%), and surgical site infections were detected in 29 patients (23.6%).

In the OA group, the mean age was 36.98±10.82 years, while in the LA group, it was 40.04±12.65 years ( $p=0.295$ ). The mean BMI in the OA group was 28.66±4.03, compared to 29.20±3.40 in the LA group ( $p=0.370$ ). In the OA group, 69 patients (70.4%) were male, and in the LA group, 16 patients (64.0%) were male ( $p=0.536$ ). In the OA group, 11 patients had comorbid conditions (11.2%), whereas in the LA group, 6 patients had comorbid conditions (24.0%) ( $p=0.099$ ) (Table 1).

In the OA group, postoperative complications included peri-cecal inflammation in 14 patients and peri-cecal abscess in 4 patients, totaling 18 patients (18.4%). In the LA group, complications included peri-cecal inflammation in 4 patients and peri-cecal abscess in 2 patients, totaling 6 patients (24.0%) ( $p=0.526$ ). Surgical site infections were observed in 27 patients (27.6%) in the OA group, compared to 2 patients (8.0%) in the LA group ( $p=0.040$ ). The average hospital stay was 5.16±1.79 days in the OA group and 4.44±1.58 days in the LA group ( $p=0.049$ ) (Table 2).

No early complications requiring re-operation or intestinal fistula were observed in any of our patients. There were no mortalities.

## Discussion

This study indicates that the use of a laparoscopic stapler could be a viable option for the safe closure of the appendiceal stump in cases of complicated AA. The findings reveal no significant difference in the incidence of complications between the groups. Additionally, operations completed laparoscopically were associated with lower rates of surgical site infections and shorter hospital stays.

Ensuring the secure closure of the appendiceal stump is critical in appendectomy procedures, as an improperly closed stump can result in severe complications such as peritonitis, sepsis, or fistula formation, or necessitate subsequent surgeries.<sup>[6]</sup>

Numerous controlled studies comparing laparoscopic and open surgical procedures report significant advantages of the laparoscopic technique. One of the most notable advantages is the reduced rate of surgical site infections. This reduction can be attributed to the near-complete prevention of abdominal wall contamination by the ports

**Table 1. Clinical and demographic features**

	OA n=98 (79.7%)	LA n=25(20.3%)	Total n=123	p
Age (years), Mean±SD	36.98±10.82	40.04±12.65	37.60±11.23	0.295
BMI, Mean±SD	28.66±4.03	29.20±3.40	28.77±3.90	0.370
Sex, n (%)				
Male	69 (70.4)	16 (64.0)	85 (69.1)	0.536
Female	29 (29.6)	9 (36.0)	38 (30.9)	
Comorbid Condition, n (%)	11 (11.2)	6 (24.0)	17 (13.8)	0.099

BMI: body mass index; OA: open appendectomy; LA: laparoscopic appendectomy; SD: standard deviation.

**Table 2. Post-operative findings**

	OA n=98 (38.5%)	LA n=25 (61.5%)	Total n=123	p
Surgical Site Infection, n (%)	27 (27.6)	2 (8.0)	29 (23.6)	0.040a
Hospital Stay, Mean±SD	5.16±1.79	4.44±1.58	5.02±1.77	0.049a
Post-operative Complication, n (%)	18 (18.4)	6 (24.0)	24 (19.5)	0.526

<sup>a</sup>Statistically significant at the confidence level of 0.95; OA: Open appendectomy; LA: laparoscopic appendectomy; SD: standard deviation.

used during laparoscopic procedures.<sup>[7,9]</sup> Similarly, in our study, surgical site infections were more frequently detected in open surgery.

Although this study does not focus on the use of hemo-lock clips or endo-loops, it is necessary to discuss their applications. The decision to use a stapler in cases of AA is primarily made in instances where severe inflammation extends to the appendiceal root. In contrast, a study by a Polish-German research group demonstrated that in 107 cases of severe inflammation (ulcerophlegmonous/gangrenous appendicitis), the appendiceal stump could be successfully closed using clips.<sup>[10]</sup> However, the main issue lies in the diameter of the clips used. In situations where the cecum and appendiceal stump are significantly edematous, laparoscopic clips may not fully encircle the appendix. Similarly, concerns regarding endo-loop usage revolve around the potential for fistula formation following partial transection of the appendiceal root during tightening. Properly securing the loop knot, especially in cases of severe or prolonged inflammation where the appendiceal root is delicate, requires experience.<sup>[11]</sup> As such, a single method cannot always be applied to all patients. Accordingly, a study in 2014 recommended that the optimal method for closing the appendiceal stump should be determined by the surgeon based on intraoperative findings.<sup>[12]</sup>

A review of the literature shows that patients undergoing OA for complicated AA tend to have longer hospital stays compared to those undergoing LA.<sup>[13,14]</sup> This difference is attributed to higher rates of surgical site infections, early intestinal adhesions, and greater pain in OA patients.<sup>[15]</sup> Consistent with these findings, our study also demonstrated a significantly longer hospital stay for the OA group.

The incidence of postoperative intra-abdominal infection and abscess was found to be similar between the two groups in our study. There are many studies on this subject in the literature. In a study published in 2017 by the meta-analysis of a total of 26 studies, the rate of intra-abdominal abscess detection in the OA group was 8%, while this rate was found to be 6% in the LA group. However, no statistical difference was detected between the two groups.<sup>[16]</sup>

Our study has some limitations. First of all, our study is a retrospective study. Our number of patients is limited. Cost analysis could not be performed because we did not have data to perform cost analysis. Surgery times were not calculated.

## Conclusion

According to our study, we believe that completing the case laparoscopically rather than open surgery in complicated AA cases has better results. To achieve this, we think that the appendix stump can be closed safely with a laparoscopic stapler.

## Disclosures

**Ethics Committee Approval:** This study was approved by Sancaktepe Şehit Prof. Dr. İlhan Varank Training and Research Hospital Ethics Committee (Approval number: 2024/206).

**Peer-review:** Externally peer-reviewed.

**Conflict of Interest:** None declared.

**Authorship Contributions:** Concept – F.M., C.B.O.; Design – F.M., C.B.O.; Supervision – F.M., C.B.O.; Fundings – F.M.; Materials – F.M.; Data Collection – C.B.O.; Analysis and interpretation – F.M.; Literature Review – C.B.O.; Writer – F.M., C.B.O.; Critical Review – F.M., C.B.O.

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# Which technique is used in laparoscopic bilateral inguinal hernia surgery?

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## ABSTRACT

**Introduction:** The present study aims to bridge this gap by providing an extensive comparative analysis of totally extraperitoneal (TEP) versus transabdominal preperitoneal (TAPP) techniques to correct bilateral inguinal hernias, focusing on their efficiency, safety levels, and complication rates.

**Materials and Methods:** We used a retrospective cohort study design that compared TEP with TAPP results among adult patients who underwent bilateral inguinal hernia repair from January 2021 to December 2023 at our institution. Exclusion criteria were recurrent hernias, emergency procedures, or patients who were not suitable for the minimally invasive approach. Surgical results, including complication rates, recovery outcomes, and operative details, were analyzed systematically.

**Results:** A total of 144 patients, 51 with TAPP and 93 with TEP, were included in the study. There was no statistical difference between the groups in terms of mean age, body mass index, and length of hospital stay. The mean VAS scores in pain assessment the morning after surgery were  $3.1 \pm 1.5$  (TAPP) and  $2.9 \pm 1.4$  (TEP) respectively, and there was no significant difference between the two methods ( $p=0.346$ ). Complications and readmission rates did not show significant differences between the two approaches.

**Conclusion:** Both TEP and TAPP are effective laparoscopic methods that can be applied in bilateral inguinal hernia surgery. This is because no major complications are observed in either surgical procedure. Patient characteristics and surgical experience are the main determinants of the procedure to be chosen.

**Keywords:** Bilateral inguinal hernia, Laparoscopic hernia repair, TAPP, TEP

## Introduction

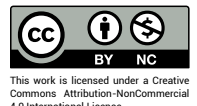
Hernia management has been revolutionised by laparoscopic inguinal hernia repair. This technique has reduced postoperative pain, shorter hospital stays, and faster return to daily activities compared to traditional open repair techniques.<sup>[1]</sup> Totally extraperitoneal (TEP) and transabdominal preperitoneal (TAPP) approaches are the most

widely used approaches among laparoscopic techniques for bilateral inguinal hernia repair. They have several distinct advantages and technical considerations that may be associated with them.<sup>[2]</sup> Therefore, despite the widespread adoption of these methods, clinicians still debate whether one is preferred over another based on patient outcomes such as complication rates or overall efficacy.<sup>[3,4]</sup>



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Laparoscopy itself allows both TEP and TAPP operations while minimising tissue damage around the hernial sac. However, unlike TEP, which avoids entering the peritoneal cavity, thus reducing the chances of intra-abdominal complications, TAPP makes it possible to reach directly at this site through an incision within the abdominal wall, thus making surgeons more familiar with anatomical orientation in general. Furthermore, some specific types of hernia, especially bilateral hernias, may be easier to manage using this approach than any other method because it provides direct access to their sites from within the abdominal space itself.<sup>[5,6]</sup>

Comparative studies have given us insight into what TEP and TAPP procedures result in looking at areas such as operation time, postoperative pain, length of stay in a hospital, and recurrence rates. However, these studies frequently produce contradictory results, where some do not show significant differences between the methods, while others emphasise the strengths or weaknesses of one method compared to another.<sup>[7]</sup> This kind of variance in the medical literature reveals the intricacies associated with the evaluation of surgical techniques that can depend on several factors including surgeon experience, patient selection, and methodological variations in different studies.<sup>[4]</sup>

In recent years, studies aiming to close the knowledge gap by making detailed comparisons of TEP and TAPP techniques in bilateral inguinal hernia repair have increased. In these studies, the positive and negative aspects of both techniques were tried to be elucidated based on the demographic characteristics of the patients, surgical data, complications, postoperative results, and cost-effectiveness.<sup>[2-4]</sup> Our aim is not to compare TAPP and TEP hernia repair techniques in a broad sense, but to evaluate effectiveness and safety, especially in the context of bilateral hernias.

Additionally, our hernia surgery study is very current and reflects the latest trends and outcomes due to ever-changing surgical practices and constant advances in laparoscopic technology. In conclusion, with this study, we aim to improve treatment strategies in laparoscopic bilateral inguinal hernia surgery, improve patient outcomes, and contribute to optimising surgical practice.

## Materials and Methods

### Study Design and Population

This retrospective cohort study compared the effectiveness and outcomes of two laparoscopic techniques for

inguinal hernia repair: total extraperitoneal and transabdominal preperitoneal, focusing specifically on patients with bilateral inguinal hernias. In this context, primary bilateral inguinal hernia patients aged 18 and over who underwent surgery at our center between January 2021 and December 2023 were evaluated. Due to the difference in the anatomy of the inguinal region, female patients were not included in the study to ensure standardization. Patients with recurrent hernias, emergent procedures, or patients who could not be treated with a minimally invasive approach were excluded.

### Groups to Analyse and Techniques

In this comparative study, patients undergoing laparoscopic bilateral inguinal hernia repair were systematically divided into two main groups based on a surgical strategy focused on TEP and TAPP. The decision to allocate any patient into either group was made by surgeon preference along with anatomical evaluations of each patient, thus selecting a specific technique for each case. All surgeries were performed by the same team working specifically on hernia.

#### Totally Extraperitoneal Technique (TEP)

The TEP method involves creating a working area within the preperitoneal region, located just outside the peritoneal cavity.

#### Transabdominal Preperitoneal (TAPP) Technique

The TAPP method is a procedure that allows access to the bilateral hernia area by entering the peritoneal cavity. In both techniques, polypropylene meshes are placed on both sides after the hernia areas are sufficiently released. When choosing between TEP and TAPP methods, the supervisory physician factors in some factors, including the nature of the patient's previous surgical history involved and the pros/cons inherent in each approach. Therefore, every patient receives appropriate surgery to repair his/her bilateral inguinal hernia, depending on its anatomical arrangement and general health considerations.

### Variables Analysed

Preoperative diagnosis of all patients was made by detecting hernia both on physical examination and inguinal region ultrasonography. Demographic/clinical characteristics of the patients, such as age, body mass index

(BMI), American Society of Anesthesiologists (ASA) score, surgery duration, visual analog scale (VAS) on the first postoperative day, and hospitalization duration, were recorded. Rates of seroma, hematoma, unexpected readmission in the first 30 days, and recurrence in the first 6 months were used to provide a more detailed safety profile for each approach.

Data analysis was performed using SPSS version 25.0, with t-test or Mann-Whitney U test applied for continuous variables, and Chi-square or Fisher exact test for categorical variables. A P value of less than 0.05 was considered significant. Multivariable logistic regression was used to adjust for confounders. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki, and due to its retrospective nature, only a standard surgical informed consent form was obtained from individual subjects before surgery. Ethical approval numbered 623 (13/12/2023-623) was received from our hospital's clinical research ethics committee.

## Results

Bilateral inguinal hernia surgery was performed on 237 male patients during the study period. Eighteen patients who underwent surgery due to recurrent hernia and seventy-four patients who underwent open surgery were excluded from the study. Data from 145 patients, 51 (35%) with TAPP and 94 (65%) with TEP, were included in the study. Analysis of demographic and surgical characteristics between TAPP and TEP methods showed no statistically significant differences in age, BMI, or ASA scores between patients undergoing bilateral laparoscopic inguinal hernia repair. The mean ages of the patients did not differ significantly between the TAPP (53.78±10.43 years) and TEP (53.24±12.31 years) groups (Table 1).

Surgery time and hospital stay were also comparable. The p-values between these two procedures were 0.822 and 0.115, respectively, and there was no significant difference. Surgery time ranged from 50 minutes to 200 minutes. It was observed that the majority of the patients were discharged the next morning after the surgery (Table 1).

The mean VAS scores in pain assessment the morning after surgery were 3.1±1.5 (TAPP) and 2.9±1.4 (TEP) respectively, and there was no significant difference between the two methods (p=0.346). The rate of unexpected readmission within 30 days after surgery was similar in both groups (2% for TAPP, 2.1% for TEP; p=0.75). The findings in these patients were seroma, hematoma, or subileus attack. Patients who developed hematoma and had subileus attacks were hospitalized and treated without surgery. Patients who developed seroma were followed up at the outpatient clinic and recovered without any need for drainage (Table 2). In addition, the rates of chronic groin pain lasting three months or longer and hernia recurrence in the first 6 months were similar between the groups, with p-values of 0.459 and 0.621, respectively, indicating that there was no significant difference (Table 2).

**Table 2. Postoperative complications and outcomes**

	TAPP n=51	TEP n=94	p
VAS (Mean±SD)	3.1±1.5	2.9±1.4	0.346
Readmission 30 Days, n (%)	1 (2)	2 (2.1)	0.785
Chronic Inguinal Pain, n (%)	2 (3.9)	3 (3.1)	0.459
Hernia Recurrence, n (%)	2 (3.9)	2 (2.1)	0.621

TAPP: Transabdominal preperitoneal; TEP: Totally extraperitoneal; VAS: Visual analog scale; SD: Standard deviation.

**Table 1. Comparison of demographic data and perioperative results of surgical techniques**

	TAPP n=51 (35%)		TEP n=94 (65%)		p
	Mean (Min-Max)	±SD	Mean (Min-Max)	±SD	
Age	53.78 (31-73)	10.43	53.24 (22-80)	12.31	0.778
BMI	26.62 (19-36)	3.37	26.66 (17-34)	3.05	0.947
Surgery Duration (minute)	101.2 (60-195)	32.17	98.41 (50-200)	32.17	0.822
Hospital Stay (day)	1.25 (1-3)	0.52	1.19 (1-3)	0.44	0.115

TAPP: Transabdominal preperitoneal; TEP: Totally extraperitoneal; BMI: Body mass index; Min: minimum; Max: maximum; SD: Standard deviation.

Although a balloon trocar was used in the TEP method, mesh fixation was generally not required. In the TAPP method, tacks were generally used to fix the mesh. In addition, locking sutures were used to close the peritoneal flaps. Other surgical equipment was similar for both techniques. Therefore, no cost analysis was performed between the two techniques in terms of materials used.

## Discussion

Our research highlights the effectiveness of both TEP and TAPP in the treatment of bilateral laparoscopic inguinal hernias. This understanding led us to a deeper appreciation of the need for personalized surgical intervention to align with the competence of the surgeon and the unique characteristics of each particular case.

Although findings in previous studies have contributed some useful facts on this topic, it is known that there is a paucity of literature comparing TAPP and TEP techniques, especially for bilateral hernias. There is not yet a common ground as to which method will yield better overall results. For this reason, studies have specifically addressed the management and economic aspects of complications related to hernia repair.<sup>[8,9]</sup> Although it is known that there is a longer operating time and learning curve for laparoscopic methods in hernia surgery, studies have shown additional advantages such as less postoperative pain, early return to normal activities, and a comparable recurrence rate compared to open Lichtenstein repair.<sup>[10]</sup>

A study comparing the Lichtenstein and TAPP procedures for bilateral inguinal hernia reported that TAPP effectively reduced postoperative pain, hospital stay, and postoperative complications.<sup>[11]</sup> Sharma et al.<sup>[12]</sup> prospectively compared TEP and TAPP methods in bilateral inguinal hernias. In this study, they found the average surgery time and postoperative pain score to be high in the TEP group. They also emphasized that the difference between the two groups in terms of cost could be ignored. In our study, we saw that the costs were balanced due to the different materials used in both techniques. Additionally, in our study, we did not detect a statistically significant difference between the two groups in terms of surgery times and postoperative pain scores. Similarly, Jaiswal et al.<sup>[8]</sup> reported in their study that pain at the 24th hour after surgery was higher in TAPP patients than in TEP patients, but the difference was not statistically significant.

Ortenzi et al.<sup>[9]</sup> found that TAPP and TEP had similar overall complication risks, incidence of postoperative acute

and chronic pain, and recurrence rates. In the long term, chronic pain is reported as the most common complication in both groups. In our study, the presence of pain at the 3<sup>rd</sup> month follow-up was found to be 4.5% and 3.5% in the TAPP and TEP groups, respectively. Because TAPP and TEP have comparable results, the choice of technique depends on the surgeon's skills, training, and experience. Postoperative pain is expected to be less observed in TEP in laparoscopic hernia repair, as it preserves peritoneal integrity. For this reason, the TEP technique can be preferred over TAPP. Additionally, there are studies showing that patients treated with TEP experience early recovery and faster return to routine work.<sup>[13]</sup> A meta-analysis that randomized 1519 hernia patients to TEP and TAPP repair groups concluded that TEP and TAPP had distinct advantages over each other.<sup>[14]</sup> Although both repair techniques were found to be equally effective in a prospective randomized study including 100 patients, it was reported that TEP had a better patient satisfaction score than TAPP.<sup>[15]</sup> Although studies have found the rate of seroma to be higher in the postoperative period, especially in the TEP group compared to TAPP, it has been reported that it resolves without requiring intervention.<sup>[8,15]</sup> In our study, we had two patients with seroma, and they were in the TEP group. However, this rate may actually be higher. Since we did not use a routine imaging examination during follow-up, only seromas detected by USG in symptomatic patients were recorded.

Various studies have been conducted by researchers to determine the results of laparoscopic TAPP and TEP techniques in inguinal hernia repairs, but very few have focused on bilateral inguinal hernia repairs using these methods.<sup>[1,12,16]</sup> This study seeks to bridge this gap by providing a comparative analysis of the adequacy, safety, and complication rates associated with using either technique in the treatment of bilateral hernias. In contrast to much broader findings that do not discriminate between unilateral or bilateral repairs, our results show that both TAPP and TEP are equally effective in resolving a double-sided groin hernia, with lower risk potential adjustments of TAPP. These results may have been influenced by various factors, including inherent technical distinctions between TAPP and TEP, surgical expertise and preference of the operating surgeon, as well as specific anatomical and health characteristics of patients undergoing bilateral hernia repair. Even though it is more invasive than the latter technique, direct visual operation access might be among the reasons for the lesser complications associated with TAPP, especially during the treatment of a double-sided hernia.



Although the research adds valuable information to compare laparoscopic TAPP and TEP techniques to repair bilateral hernias located in the groin area, it has some limitations. One major limitation is that this study is retrospective in design, which is useful for collecting a large amount of data over a long period but may cause data collection and patient selection biases. Furthermore, the use of medical records and operative reports alone may omit some clinical subtleties and postoperative complications, probably affecting the accuracy of the comparison between these two surgical methods. Additionally, the fact that this study only focused on one hospital setting could limit its generalizability to other surgical settings where variations in surgeons' skills, patient characteristics, and procedural protocols could affect the outcomes of TAPP or TEP hernia repair.

Our study provides important information about the comparable results of TAPP and TEP techniques in bilateral hernia repair. Therefore, while our study adds to the growing corpus of evidence supporting both TAPP and TEP techniques as safe and effective means of treatment for patients with inguinal hernias, more multicenter randomized trials involving different patient groups are needed to confirm our findings, as well as increase their relevance in wider surgical settings and types of patients.

## Conclusion

Our study showed that TEP and TAPP are effective laparoscopically in the treatment of bilateral inguinal hernia. Both techniques can be safely preferred in bilateral inguinal hernia surgeries. However, it would be more beneficial to choose the method with more experience according to patient characteristics in the selection of surgical technique.

## Disclosures

**Ethics Committee Approval:** Ethical approval numbered 623 (13/12/2023-623) was received from our hospital's clinical research ethics committee.

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**Authorship Contributions:** Concept – H.K., İ.K.; Design – H.K., M.B.; Supervision – H.K., İ.K.; Fundings – M.D., F.G.; Materials – H.K., M.D., F.G.; Data collection and processing – H.K., F.G.; Analysis and interpretation – H.K., M.D., F.G.; Literature search – H.K., M.D., F.G.; Writing – H.K., F.G., İ.K.; Critical review – H.K., İ.K.


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# An unexpected complication after bariatric surgery due to combine antidiabetic drugs; euglycemic diabetic ketoacidosis

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Sodium-glucose co-transporter-2 (SGLT-2) inhibitors are a new class of antihyperglycemic drugs that regulate blood sugar levels.<sup>[1,2]</sup> They carry the risk of euglycemic diabetic ketoacidosis (euDKA), which is rare and also seen in our case.<sup>[3,4]</sup>

Our aim is to present the post-operative euDKA and management of a diabetic patient who underwent laparoscopic sleeve gastrectomy due to the use of Empagliflozin and Metformin, the first case in literature.

A 38-year-old male patient has been suffering from type 2 diabetes for 10 years. Oral antidiabetic medication (using SGLT-2 inhibitor - Synjardy®). Body Mass Index 38 kg/m<sup>2</sup>.

The patient had a tachycardia of 115/min. Tachycardia was evaluated as post-operative pain. The patient's highest blood glucose level measured was 198 mg/dl. The patient stated that he was thirsty. His extremities were cold. Bedside abdominal ultrasound was reported normal.

Echocardiography and cardiac examination were normal. Procalcitonin value was 9. Considering that intraabdominal sepsis may be present, broad-spectrum antibiotics were started. It was observed that the patient urinated 3000 cc in the last 3 hours. In the following process, the patient's mental state tended to sleep and the respiratory rate started to accompany tachypnea with a rate of 25/min. All measured sugar values were below 200 mg/

dl. He produced another 2000 cc of urine. Arterial blood gas and complete urinalysis were studied. PH: 7.23 (reference range: 7.35-7.45), and HCO<sub>3</sub> - 3 mmol/L (reference range: 20-28 mmol/L), Base deficit - 18 mmol/L (reference range: 4-14 mmol/L) came in. There were 3+ ketones in the urine. Although blood sugars were not high, it was thought that euglycemic diabetic ketoacidosis might be present.

The patient was followed by hourly blood glucose measurement, 4x1 day arterial blood gas measurement, and 12-hour biochemistry parameters. Insulin infusion was started to the patient starting from a dose of 1 unit/hour.

In the post-operative 15 days, insulin was discontinued under the supervision of an endocrinologist. The patient is currently in the post-operative second year, and his blood sugar is normal. He does not use any antidiabetic medication. The fact that none of the detected cases belonged to euDKA indicates that our patient was rare.

As a result, patients with poor glucose regulation after bariatric surgery and using oral antidiabetic drugs should be prepared more carefully preoperatively. Post-operative follow-up is important. Experienced teamwork is essential for the early detection of undesirable complications.



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**Disclosures**


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# The use of rigid bronchoscopy in foreign body aspiration

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Dear Editor,

Foreign body aspiration is a frequent and urgent medical condition, particularly in children and the elderly. In this context, rigid bronchoscopy has emerged as a preferred method for the safe and effective removal of foreign bodies from the airways.

Rigid bronchoscopy holds significant importance among bronchoscopy procedures due to its diagnostic and therapeutic capabilities. The main advantages of this method include the ability to remove large and variously shaped foreign bodies, providing adequate airway control, and managing bleeding effectively. Additionally, during rigid bronchoscopy, the operator can obtain a broader visual field and better evaluate changes in the airway.

In cases of foreign body aspiration, the rapid and effective intervention provided by rigid bronchoscopy plays a crucial role in reducing patient morbidity and mortality. Accurate diagnosis and prompt intervention are vital, especially in pediatric foreign body aspiration cases. Therefore, rigid bronchoscopy is considered the gold standard in the treatment of pediatric patients.

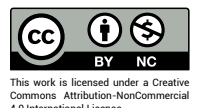
The success of the procedure is directly influenced by the presence of an experienced team and appropriate equipment. Hence, it is essential that healthcare institutions have sufficient equipment and training in this area. Furthermore, the teams must be knowledgeable and prepared to manage potential complications during bronchoscopy.

Literature reviews support the efficacy and reliability of rigid bronchoscopy in foreign body aspiration. For example, Ghosh et al.<sup>[1]</sup> highlighted the life-saving potential of rigid bronchoscopy in pediatric patients. Their study involving 138 children under 12 years of age demonstrated that, with the necessary expertise, trained anesthesia team, and a pediatric ICU, rigid bronchoscopy successfully managed the majority of tracheobronchial foreign body cases, with only two fatalities reported. Similarly, Sezer et al.<sup>[2]</sup> emphasized the critical role of endoscopic methods, including rigid bronchoscopy, in the removal of foreign bodies from the respiratory system. They discussed the high success rates and early postoperative discharge of patients, underlining the importance of timely intervention to prevent severe morbidity and mortality. Özdemir et al.<sup>[3]</sup> conducted a retrospective analysis of 337 children with suspected airway foreign body aspiration and highlighted the effectiveness of endoscope-assisted rigid bronchoscopy. They found that the use of a rigid endoscope during rigid bronchoscopy allowed for better visualization of distal bronchi and foreign bodies, particularly in children under the age of 3 years, improving the safety and success of the procedure. Additionally, Wadhera et al.<sup>[4]</sup> assessed epidemiological data and the role of rigid bronchoscopy in 200 patients with suspected foreign body aspiration. They found that rigid bronchoscopy was a safe and effective tool for the management of tracheobronchial foreign bodies, particularly in pediatric patients, with the most common foreign body being peanuts



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and the right main bronchus being the most common site of lodgement.

In conclusion, rigid bronchoscopy is a proven, effective, and reliable method for foreign body aspiration. Its correct and timely use improves the quality of life for patients and minimizes life-threatening risks. Therefore, it is crucial to promote the widespread use of rigid bronchoscopy in clinical practice and to educate healthcare professionals on this method.

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