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RESEARCH ARTICLE

Comparison of the Characteristics of Patients Undergoing Elective and Emergency Surgery for Crohn's Disease: A Single-Center Retrospective Cohort Study

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ABSTRACT

Aim: Most patients with Crohn's disease (CD) have a lifetime threat of emergency or elective surgery. These patients tend to have a high risk of postoperative complications. This study aims to compare the preoperative and operative characteristics and postoperative complications of patients who underwent emergency and elective surgery for CD.

Method: Patients with CD aged ≥18 years who underwent emergency and scheduled surgery between January 2016 and April 2021 in a single-center general surgery clinic were included in this study. The patients' demographic characteristics, comorbidities, drugs used, indications for surgery, preoperative laboratory findings, surgery type, anastomosis method, blood transfusion, infection parameters, surgical procedures, need for a postoperative intensive care unit, length of hospital stay, early postoperative complications, need for reoperation, and early surgical mortality were evaluated retrospectively from the hospital files.

Results: The study included 25 patients within the date range determined retrospectively. There were 18 (72%) men and 7 (28%) women, and the mean age was 37.7±12.5 years. Eleven (44%) patients were operated on under emergency conditions, and 14 (56%) patients were surgically treated under elective circumstances. An ostomy was performed in 5 (20%) of the emergency surgery patients.

Conclusion: Postoperative serious complications (Clavien-Dindo grade ≥3) still occur at high rates in patients operated on for CD. Ostomy indication and a longer hospital stay are more common in patients undergoing emergency surgery.

Keywords: Crohn's disease, surgery, early complication

Introduction

As a long-standing inflammatory bowel disease (IBD), Crohn's disease (CD) can affect all parts of the gastrointestinal tract and result in major complications, such as stenoses, fistulas, and abscesses.[1] Despite advances in medical treatment, up to 80% of patients with CD have a lifetime risk of surgery and bowel resection.[2] According to the literature, 10%-37% of patients with CD experience postoperative complications following surgery.[3,4] Many evaluations have reported that bowel resection in patients with CD has a different risk profile when compared with groups of patients without IBD. In particular, higher incidences of intra-abdominal septic problems, including enteric fistulas and intra-abdominal abscesses, have been reported.[5] In addition, anti-tumor necrosis factor (anti-TNF) and other drugs used in CD have been shown to affect wound healing negatively.[6,7] Despite the advances in diagnostic methods, unfortunately, a significant portion of patients with CD are diagnosed with perforation, intra-abdominal abscesses, and ileus under emergency conditions, such as during an emergency operation.[8] Due to these negative factors specific to CD, postoperative complications and the factors affecting these maintain their importance.[1] Our study compares the early

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postoperative outcomes of patients undergoing emergency and elective surgery for CD.

Materials and Methods

Patients who underwent elective surgery because of the diagnosis of CD in the general surgery clinic of the authors' hospital and patients whose diagnosis of CD was not known preoperatively but was confirmed in the pathology specimen postoperatively were evaluated in the study. Patients with CD aged ≥18 years who underwent emergency or elective surgery in the general surgery clinic between January 2016 and April 2021 were included in the study. Patients who underwent surgery due to a fistula, stricture, perforation, and mass image according to the status and complications of CD were included. Patients with a previous history of abdominal surgery were excluded. Patients who had an ostomy without resection, simultaneous perianal surgery, and intra-abdominal abscess drainage without resection were excluded. The patients' demographic characteristics, comorbidities, drugs used, indications for surgery, preoperative laboratory findings, surgery type, anastomosis type, blood transfusion, infection parameters, surgical procedures, need for a postoperative intensive care unit, length of hospital stay, early postoperative complications, need for reoperation, and early surgical mortality were reviewed retrospectively from the hospital files. Preoperative computed tomography was routinely taken in all patients. Oral contrast was used for a possible fistula diagnosis in elective patients (Figures 1-3). Postoperative complications were assessed according to the Clavien-Dindo classification.[9] Patients classified as a Clavien-Dindo grade ≥3 because of serious complications were included in the study. Surgery-related mortality was deemed as mortality within 30 days of surgical intervention.

The authors' University of Health Sciences Turkey, İstanbul Haseki Training and Research Hospital's Ethics Committee approved the study (approval number: 84-2021, date: 08.09.2021).

Statistical Analysis

Analysis of the statistics was calculated using SPSS 15.0, which was designed for Microsoft Windows. Regarding the descriptive statistical analysis, numbers and/or percentages were employed for the categorical variables. The numerical variables consisted of the mean, standard deviation, minimum, maximum, and median. The distributions in the groups were collated using the chi-squared test. The likeness of the numerical variables between the two independent groupings was made using the Student's t-test if the data were normally distributed and the Mann-Whitney U test when this was not the case. The level of significance was accepted as $p<0.050$.

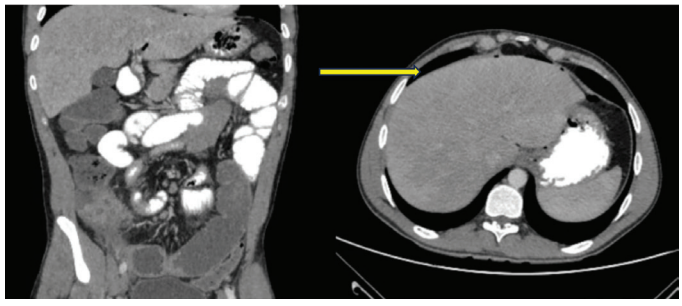

Figure 1. Perforation and free air in the abdomen due to Crohn's disease. Computed tomography image

Results

The study was completed with 25 patients within the date range determined retrospectively. There were 18 (72%) men and 7 (28%) women, and the mean age was 37.7±12.5. While 11 (44%) patients were operated on due to emergency conditions, the remaining 14 (56%) were operated on under elective conditions. The mean surgery time was 149±42.4 minutes. The mean hospital stay was found to be 11.9±8.7 days. The average preoperative white blood cell, mean preoperative C-reactive protein (CRP), and mean preoperative albumin values were 8.6±3.9, 86.0±91.9, and 3.0±0.7, respectively. While 16 (64%) patients received preoperative treatment for CD, 9 (36%) patients had not received that treatment. Among the patients who received treatment, 8 (32%) were using 5-aminosalicylates, 3 (12%) anti-TNF, and 5 (20%) immunosuppressant agents (Table 1).

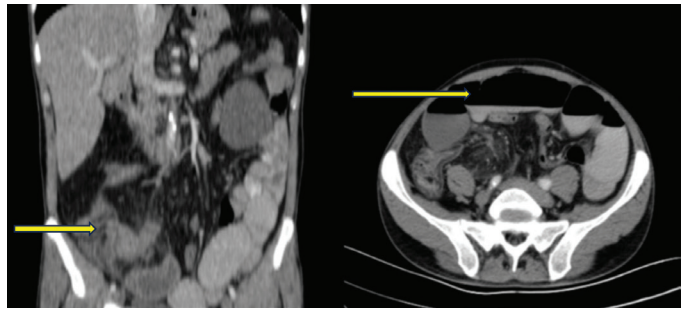

Figure 2. Stricture and mechanical bowel obstruction due to Crohn's disease. Computed tomography image

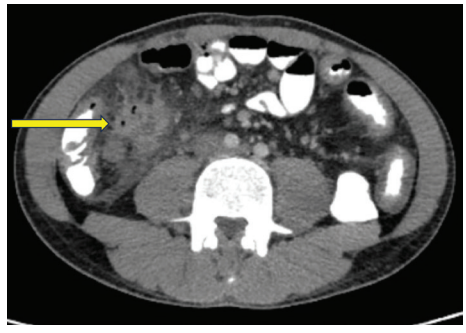

Figure 3. Intra abdominal abscess due to Crohn's disease. Computed tomography image

All patients underwent open surgery. A segmental small bowel resection along with right hemicolectomy was carried out on 2 patients in the emergency surgery group. An anastomosis was employed in 20 (80%) patients, and an ostomy was performed in 5 (20%). All patients with an ostomy were in the emergency surgery group. Ostomies were opened as an end ileostomy. Intraoperatively 2 units of erythrocyte suspension was given to 1 of the 2 patients in the emergency group, and 2 units of erythrocyte suspension was given to 1 patient on the 1st day postoperatively (Table 2). In the early period postoperatively, complications were observed in 5 patients, which consisted of an intra-abdominal abscess in 3 patients and an anastomotic leakage in 2 patients (Clavien-Dindo grade ≥3) (Table 3). Two patients with an anastomotic leakage were reoperated. Patients who were operated on due to an anastomotic leak were in the emergency surgery group and underwent right hemicolectomy. Since an anastomosis would be risky, an end ileostomy was performed. Mortality occurred in 1 patient.

Discussion

This study compared the operative and postoperative early complications between emergency and elective patient groups operated on for CD.

Surgery for CD carries an elevated risk for complications, such as an infected wound, anastomotic leakage, and intra-abdominal sepsis.[10] Although the patient group in our study had a lower mean age and morbidity, they had similar postoperative complication rates as a patient group undergoing similar surgery for cancer.[11] Complications such as intra-abdominal sepsis and anastomotic leakage can cause life-threatening results. In a study of 79 patients by Ghoneima et al.[12], anastomotic leakage and intra-abdominal sepsis were observed in 11 (13.9%) patients. Similarly, Zuo et al.[13] found intra-abdominal septic complications in 39 (11.3%) patients in a large study of 344 patients who underwent ileocecal resection and anastomosis. Again, Galata et al.[14] found 29 (23%) major complications (Clavien-Dindo grade ≥3) in a study of 126

Table 1. Preoperative demographic data

		Total	Surgery		
			Emergency	Elective	
		n (%)	n (%)	n (%)	p
Sex	Female	7 (28)	3 (27.3)	4 (28.6)	1.000
	Male	18 (72)	8 (72.7)	10 (71.4)	
Age median ± SD		37.8±12.6	39.3±11.1	36.6±13.9	0.605
Preoperative WBC		8.6±3.9	9.8±5.0	7.7±2.6	0.269
Preoperative CRP		86.0±91.9	109.3±88.1	67.6±93.9	0.071
Preoperative albumin		3.0±0.7	2.8±0.8	3.1±0.5	0.329
Preoperative medication	No medication	9 (36)	3 (27.3)	6 (42.9)	0.714
	5 ASA	8 (32)	5 (45.5)	3 (21.4)	
	Anti-TNF	3 (12)	1 (9.1)	2 (14.3)	
	Immunosuppression	5 (20)	2 (18.2)	3 (21.4)	
ASA	1	5 (20)	2 (18.2)	3 (21.4)	0.790
	2	19 (76)	8 (72.7)	11 (78.6)	
	3	1 (4)	1 (9.1)	0 (0.0)	
Location of the disease	Ileocecal	18 (72)	7 (63.6)	11 (78.6)	0.656
	Terminal ileum	7 (28)	4 (36.4)	3 (21.4)	
Surgery indication	Stricture	9 (36)	1 (9.1)	8 (57.1)	<0.001
	perforation	9 (36)	9 (81.8)	0 (0.0)	
	Fistula	4 (16)	1 (9.1)	3 (21.4)	
	Mass	3 (12)	0 (0.0)	3 (21.4)	

SD: Standard deviation, WBC: White blood cell, CRP: C-reactive protein, ASA: American Society of Anesthesiologists, TNF: Tumor necrosis factor

cases. Kanazawa et al.[15], on the other hand, found major complications in 17 (2.7%) patients out of 663, which was lower compared with previous studies. Our study found major complications in 5 (20%) patients, consistent with the literature.

Many factors affecting postoperative complications in patients with CD have been investigated.[16] Among these factors, preoperative CRP and albumin values were found to affect surgical outcomes other than CD.[17,18] Similarly, in many studies, preoperative CRP and albumin values were found to be correlated with postoperative complications in CD.[12,13,19] Yamamoto et al.[11] emphasized that preoperatively low albumin levels, steroid usage, and the presence of an abscess or a fistula during laparotomy significantly elevated the possibility of major complications following surgery. Our study found no significant difference in preoperative albumin and CRP values when the emergency and elective surgery groups were compared. No statistically significant differences were found when the emergency and elective groups were compared in terms of major complications.

The need for an ostomy in CD-related surgery has increased compared with non-CD-related surgeries. For complicated CD, rates of up to 35% are reported in the literature.[20] The rate of complications is higher in emergency surgeries than in elective surgeries. Celentano et al.[21], in their study, found that 22% of patients with CD required an ostomy in emergency surgeries and 11.5% in elective ones. Similarly, Sakurai Kimura et al.[22] found that an ostomy was performed in 39.4%

Table 2. Operative demographic data

		Total	Surgery		
			Emergency	Elective	
		n (%)	n (%)	n (%)	p
Type of surgery	Ileocecal resection	13 (52.0)	6 (54.5)	7 (50)	0.635
	Right hemicolectomy	9 (36.0)	3 (27.3)	6 (42.9)	
	Combined resection	3 (12.0)	2 (18.2)	1 (7.1)	
Anastomosis type	No anastomosis	5 (20)	5 (45.5)	0 (0.0)	0.015
	Side-to-side	17 (68)	5 (45.5)	12 (85.7)	
	End-to-side	3 (12)	1 (9.1)	2 (14.3)	
Anastomosis technique	No anastomosis	5 (20)	5 (50)	0 (0)	0.001
	Manual	5 (20)	0 (0)	5 (33.3)	
	Staple	15 (60)	5 (50)	10 (66.6)	
Operation time (minute)		149.2±42.4	146.4±478	151.4±39.4	0.719
End ileostomy		5 (20)	5 (20)	0 (0)	0.001

Table 3. Postoperative demographic data

		Total	Surgery		
			Emergency	Elective	
		n (%)	n (%)	n (%)	p
Early complication	(-)	20 (80)	7 (63.6)	13 (92.9)	0.133
	(+)	5 (20)	4 (36.4)	1 (7.1)	
	Intra-abdominal abscess	3 (12.0)	2 (18.2)	1 (7.1)	
	Anastomotic leak	2 (8.0)	2 (18.2)	0 (0.0)	
Duration of stay (day)		11.9±8.7	17.0±10.1	7.9±4.5	0.028
Postoperative intensive care		1 (4)	1 (9.1)	0 (0)	0.440
Blood transfusion		2 (8)	2 (18.2)	0 (0)	0.183
Re-operation		2 (8.0)	2 (18.2)	0 (0)	0.183
Mortality		1 (4.0)	1 (9.1)	0 (0)	0.440

of emergency surgeries and 18.5% of elective surgeries. In our study, all 5 (20%) patients who underwent ostomy were in the emergency group. When emergency surgeries were evaluated, the rate of 45% was found to be higher than in the related literature.

Study Limitations

Since the laparoscopic approach in the surgical management of CD in our clinic was less routine than in patients without CD, our laparoscopic case number was low, and, therefore, laparoscopy was not included in our study. Unfortunately, this was a weakness of the study. Additionally, the retrospective methodology and the small number of patients were other limitations of our study.

Conclusion

Postoperative serious complications (Clavien-Dindo grade ≥3) still occur at high rates in patients operated on for CD. We found that the indication for an ostomy and a longer hospital stay were more common in patients who underwent emergency surgery.

Ethics

Ethics Committee Approval: The authors' University of Health Sciences Turkey, İstanbul Haseki Training and Research Hospital's Ethics Committee approved the study (approval number: 84-2021, date: 08.09.2021).

Informed Consent: Retrospective study.

Authorship Contributions

Surgical and Medical Practices: H.B., S.Ç.Ö., H.A., A.H., Concept: H.B., M.A., Design: H.B., F.E., Data Collection or Processing: M.A., A.H., A.K., D.Y., Analysis or Interpretation: H.B., S.Ç.Ö., Literature Search: H.B., H.A., Writing: H.B., D.Y.

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RESEARCH ARTICLE

Outcomes of Crystallized Phenol Treatment in Sacrococcygeal Pilonidal Sinus Disease and Factors Affecting Recurrence: A Retrospective Study

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ABSTRACT

Aim: This study aimed to evaluate outcomes of crystallized phenol application (CPA) in sacrococcygeal pilonidal sinus disease (PSD) and factors affecting its recurrence.

Method: A total of 125 patients who underwent PSD surgery between February 2021 and March 2023 were analyzed retrospectively. Data including age, sex, body mass index (BMI), grade of hirsutism, daily sitting duration, primary or recurrent PSD, previous abscess drainage, number of sinus pits, operation duration, local anesthetic dose, postoperative complications, number of shaves per month, and recurrence were recorded. A total of 77 patients who were treated with CPA were included.

Results: The patients comprised 68 men and nine women, with a mean age of 22.6±3.1 (range: 14-43) years. The mean operation duration was 13.7±2.6 min, and the mean dose of local anesthetic was 11.6±1.9 mL. Hematoma developed in only one patient after surgery. The median follow-up was 12 (range: 2-21) months. The total success rate of CPA was 75.4% and 96.1% at the first and second sessions, respectively. The recurrence rate was 3.89% at 1 year and was significantly higher in patients who were overweight and obese, had a higher grade of hirsutism (>grade 2), a higher number of sinus pits (>3), and shaved fewer times per month (<2 times/month) ($p<0.001$). Multivariate logistic regression analysis revealed that BMI, grade of hirsutism, and the number of shaves were significant factors for recurrence ($p<0.001$).

Conclusion: CPA is a simple, inexpensive, and safe non-invasive method with acceptable recurrence rates. Weight, hair, and hygiene are the significant factors affecting the recurrence.

Keywords: Crystallized phenol application, sacrococcygeal pilonidal sinus disease, pilonidal abscess, pilonidal sinus excision

Introduction

Pilonidal sinus disease (PSD) is an acquired disease originating from distended hair follicles and is commonly seen in the young population, affecting 26 individuals per 100,000.[1,2] It is more common in men and mostly involves the sacrococcygeal region.[3,4] It is usually seen in individuals with a high hair ratio, poor hygiene, and who spend long periods in a sitting position.[5] In a study including 6,000 patients, Karydakis[6] reported that hair falling from the body induced a foreign body reaction in the follicles and inflammation.

In clinical practice, PSD is characterized by one or more pits with hairs inside the sacrococcygeal region. Swelling, discharge, and pain while sitting are common symptoms, which adversely affect the quality of life of patients. The treatment is challenging due to the recurrent nature of the disease. Although many treatment modalities have been proposed, there is currently no consensus.[7] Surgical excision is the standard treatment in PSD; however, less invasive methods are used to prevent postoperative pain, infection, wound problems, and delay of the return to daily routine.

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Crystallized phenol application (CPA) -the phenol melts at body temperature- is a minimally invasive method discussed in the literature, and favorable outcomes have been reported.[8] The main advantages of this method compared with others are the expedition of a return to daily routine with day surgery, shorter operation duration, minimal discomfort, fewer complications, early recovery, similar recurrence rates, and better cosmetic results.[9] Several studies have examined the effectiveness of CPA in PSD and reported a success rate of 86% in the literature.[10-12]

In the present study, we aimed to evaluate the outcomes of CPA in sacrococcygeal PSD and the factors affecting recurrence.

Materials and Methods

This multi-center, retrospective study was conducted at the general surgery outpatient clinics of three healthcare centers between February 2021 and March 2023. Written informed consent was obtained from the patients. The study was carried out after Erzurum Faculty of Medicine Institutional Review Board approval (approval number: BAEK 2023/01-10) and conducted following the principles of the Declaration of Helsinki. Patients who underwent PSD surgery were reviewed. All surgery was performed by two surgeons, both of whom graduated from their surgical residency training in the same clinic and worked together in the same clinic for 5 years after graduation. Data including age, sex, body mass index (BMI), grade of hirsutism, daily sitting duration, primary or recurrent PSD, previous abscess drainage, number of sinus pits, operation duration, local anesthetic dose, postoperative complications, number of shaves per month, and recurrence were recorded.

The modified Ferriman-Gallwey score was used for the clinical evaluation of hirsutism.[13] The daily sitting duration was divided into three groups: <3 h/day, 3-6 h/day, and >6 h/day. Patients who had abscesses during the examination were given oral antibiotics (875 mg of amoxicillin and 125 mg of clavulanic acid) after drainage and were operated on 10 days later. The patients who were treated with CPA were discharged on the same day with recommendations to return to their daily routine. During follow-up, hair removal with depilatory creams or shaving from waist to hip once a month for 3 years was instructed. All patients were scheduled for follow-up at week 4. A second dose of CPA was administered to the patients in whom the PSD was not closed after 4 weeks and still had discharge. On postoperative day 50, a third dose of CPA was administered to the sinuses that were not closed. The CPA to the pilonidal sinus is shown in Figure 1.

Recovery was defined as the complete closure of the sinuses and the absence of discharge and pain. Sinuses that did not close after the third dose of CPA were excised. Recurrence was defined as the reoccurrence of sinuses with discharge and pain after a complete recovery. All patients were questioned about postoperative recurrence during follow-up in the outpatient setting or by phone.

A total of 125 patients who underwent PSD surgery in our center during the study period were analyzed retrospectively. Patients who underwent total sinus excision (n=34) were excluded. Patients who could not be reached by phone during follow-up or who were lost to follow-up (n=14) were also excluded. Finally, a total of 77 patients who met the inclusion criteria were enrolled. The study flowchart is shown in Figure 2.

Crystalline Phenol Application

One day before the operation, all patients were asked to shave their hair from waist to hip. All applications were performed in a completely sterile fashion in the outpatient setting. The patients were placed in a prone position on the table, and local anesthesia was performed with 2% lidocaine around the sinus after povidone-iodine application. With the aid of a thin mosquito clamp, the hairs in the sinus were removed and the sinus pouch was curetted with a biopsy curette. Nitrofurantoin pomade (Furacin, Eczacıbaşı Pharmaceuticals, İstanbul, Turkey) was applied around the sinus to prevent chemical irritation. Crystallized phenol (Botapharma Laboratories, Ankara, Turkey) was then applied in the pouch. After hemostasis was achieved, the procedure was terminated by dressing. The patients were discharged on the same day.

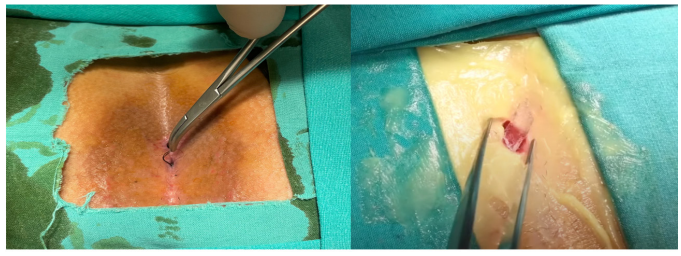

Figure 1. Crystallized phenol application to pilonidal sinus

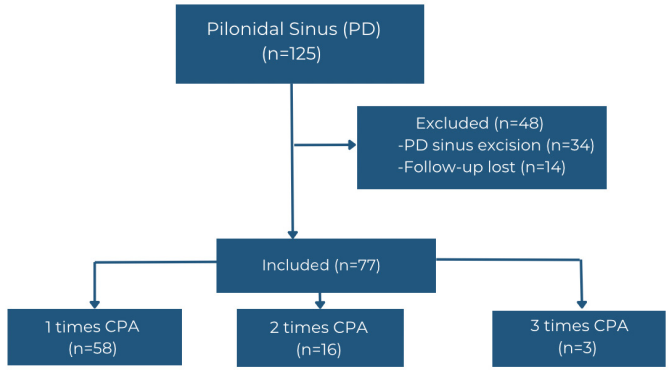

Figure 2. Study flowchart
CPA: Crystalline phenol application

Statistical Analysis

Statistical analysis was performed using SPSS software for Windows version 28.0 (IBM Corp., Armonk, NY, USA). Descriptive data were expressed as mean ± standard deviation or median (min-max) for continuous variables and in number and frequency for categorical variables. The distribution of variables was analyzed using the Kolmogorov-Smirnov test. Univariate regression analysis of the independent variables and their influence on the dependent variable (recurrence) was used. The chi-squared test was used for the comparison of two categorical variables, and multivariate logistic regression analysis was performed to identify predictors of recurrence. A p-value of <0.050 was considered statistically significant.

Results

A total of 68 (88.3%) of the patients were men and 9 (11.7%) were women, with a mean age of 22.6±3.1 years. The majority of patients had obesity and a high grade of hirsutism. The mean operation duration was 13.7±2.6 min, and the mean dose of local anesthetic was 11.6±1.9 mL. Hematoma developed in only one patient after CPA. The median follow-up was 12 months (range: 2-21). The demographic and clinical characteristics of the patients are shown in Table 1.

Univariate regression analysis was performed to identify factors affecting demographic characteristics, postoperative outcomes, and recurrence. A second dose of CPA was administered to 16 patients in whom PSD was not closed after 4 weeks and who still experienced discharge. Three patients needed additional CPA after the two sessions of CPA because their sinuses were not closed. The total success rate of CPA was 75.4% and 96.1% at the first and second sessions, respectively. Relapse occurred in two patients in the eighth month and one patient in the ninth month after CPA. All these patients underwent total sinus excision later due to recurrence. The recurrence rate was 3.89% at 12 months.

Sex was not found to be a significant factor for recurrence (p=0.054). However, the recurrence rate was significantly higher in patients who were overweight and obese, with a higher grade of hirsutism, a higher number of sinus pits, and a lower number of shaves per month (p<0.001). Daily sitting duration, recurrent PSD, and abscess were not found to be significant factors for recurrence (p=0.122, p=0.254, and p=0.067, respectively) (Table 2).

The multivariate logistic regression analysis revealed that BMI, grade of hirsutism, and number of shaves per month were significant factors for recurrence (p<0.001). The number of pits was not found to be a significant factor (p<0.093) (Table 3).

Table 1. Demographic and clinical characteristics of patients

Variable	Patients, n, %
Age, mean (years)	22.6±3.1
Sex	
Male	68 (88.3)
Female	9 (11.6)
BMI	
Underweight (<18.5 kg/m^2)	0
Normal weight (18.5-24.9 kg/m^2)	29 (37.6)
Overweight (25-29.9 kg/m^2)	28 (36.3)
Obese (≥30 kg/m^2)	20 (25.9)
Modified Ferriman-Gallwey visual analog scale	
1	21 (27.2)
2	32 (41.5)
3	24 (31.1)
Daily sitting (h)	
<3	19 (24.6)
3-6	35 (45.4)
>6	23 (29.8)
Primary sinus	64 (83.1)
Recurrent sinus	13 (16.8)
Presence of abscess at presentation	
Yes	18 (23.3)
No	59 (76.6)
Number of pit openings	
1	12 (15.5)
2	29 (37.6)
3	25 (32.4)
4	11 (14.2)
Mean procedural duration (min)	13.7±2.6
Mean dose of local anesthetic used (cc)	11.6±1.9
Follow-up, month, median	12 (2-21)

Values are given as number and range (in brackets). cc: Cubic centimeter, min: Minutes, BMI: Body mass index

Discussion

PSD is a chronic and difficult-to-treat disease that is most commonly seen in young men.[14] In the present study, we evaluated the outcomes of CPA in sacrococcygeal PSD and factors affecting recurrence. In our study, the majority of the patients were young men.

Although total surgical excision is the standard treatment for PSD, CPA is more commonly preferred as it is inexpensive, requires a short operation duration and hospital stay, involves less postoperative pain, and has low complication and recurrence rates.[5,10,15] It was first applied in 1964.[16] Phenol is a

Table 2. Univariate regression analysis results

Variable	Non-recurrent (%)	Recurrent (%)	95% CI	p-value
Sex			32.01-47.98	0.054
Male	51 (87.9)	17 (89.4)		
Female	7 (12.06)	2 (10.5)		
BMI			45.95-56.04	<0.001
Normal weight (18.5-24.9 kg/m^2)	24 (41.3)	4 (21.05)		
Overweight (25-29.9 kg/m^2)	22 (37.9)	7 (36.8)		
Obese (≥30 kg/m^2)	12 (20.6)	8 (42.1)		
Hirsutism grade			44.82-59.07	<0.001
1	18 (31.03)	3 (15.7)		
2	20 (34.4)	12 (63.1)		
3	20 (34.4)	4 (21.05)		
Daily sitting duration (h)			31.67-46.32	0.122
<3	16 (27.5)	3 (15.7)		
3-6	26 (44.8)	9 (47.3)		
>6	16 (27.5)	7 (36.8)		
Primary/recurrent sinus			8.20-27.8	0.254
Primary	50 (86.2)	14 (73.6)		
Recurrent	8 (13.7)	5 (26.3)		
Abscess			43.45-56.45	0.067
Yes	7 (12.06)	11 (57.8)		
No	51 (87.9)	8 (42.1)		
Pit number			36.21-51.7	<0.001
1	10 (17.2)	0		
2	27 (46.5)	4 (21.05)		
3	17 (29.3)	8 (42.1)		
4	4 (6.8)	7 (36.8)		
Number of shaves				<0.001
Once a month	40 (68.9)	0		
Every 2 months	11 (18.9)	3 (15.7)		
Every 3 months	6 (10.3)	10 (52.6)		
Never	1 (1.7)	6 (31.5)		

BMI: Body mass index, CI: Confidence interval

chemical with antiseptic, anesthetic, and sclerosing properties and is available in crystalline or liquid form. Crystallized phenol melts at body temperature after application and turns into a liquid.[17] The overall success rate varies between 62% and 95% in the literature, regardless of the PSD characteristics and treatment modalities.[18] The Clinical Practice Guidelines for the Management of PSD recommends CPA, with a 67-100% cure rate and <20% recurrence rate.[18] In a study including 209 patients, Sozuer et al.[19] reported that the overall success

Table 3. Multivariate logistic regression analysis results

Variable	95% CI	p-value
BMI	45.95-62.07	<0.001
Hirsutism grade	41.89-68.10	<0.001
Number of shaves	42.54-59.32	<0.001
Number of pits	36.21-51.7	0.093

BMI: Body mass index, CI: Confidence interval

rate of CPA was 93.1% at 12 months. In the present study, the success rate was consistent with the literature.

Following CPA, hospital stays and return to work have been reported to be shorter than for surgical methods.[12] Topuz et al.[11] compared CPA with surgical excision and found that patients who underwent CPA had less pain, and children could return to school earlier with a less negative effect on their social life. In the current study, hematoma developed in only one patient after CPA, and all patients were discharged uneventfully on the same day. During the short-term follow-up, no complication was observed and the daily life of the patients was not affected.

In their study, Dogru et al.[20] reported a recurrence rate of 4.84% after CPA. Ulusoy and Nikolovski[21] also reported a recurrence rate of 20.7%, and Tazeoglu and Dag[22] reported a recurrence rate of 8.4%. In our study, the recurrence rate was 3.89% at 1 year, which is lower than previous studies. Due to the relatively short follow-up, the recurrence rate is lower than the previous reports.

Although several factors are implicated in the development of a recurrence, the main factors are poor hygiene and a high ratio of hair.[23,24] Hair falling from various parts of the body to the sacrococcygeal region may cause PSD development and recurrence.[25,26] Shaving and particular care for hygiene can prevent recurrence by removing the hairs that fall and accumulate in this area.[27,28] Hair removal with depilatory creams or lasers are the recommended methods. In the current study, a high ratio of hair and number of shaves were found to be significant factors for recurrence. Additionally, all patients were recommended to shave or apply hair removal treatment monthly for 3 years after surgery.

A high BMI has also been shown to be associated with postoperative complications and recurrence.[29,30] In our study, obesity was also found to be a significant factor for recurrence. As being overweight is associated with poor hygiene, it should be paid special attention.

Although the recurrence rate varies in the literature, the majority of the studies have short-term follow-ups. Therefore, long-term follow-ups are needed to accurately evaluate the recurrence rates (i.e., 5- or 10-year follow-up).[17,31,32] In the present study, the median follow-up was 12 months, and the results seem to be acceptable. Further long-term studies may provide more reliable conclusions on this subject. Nevertheless, CPA can be used as the first choice in the treatment of PSD, since there is no postoperative incision scar with more favorable cosmetic results.

Study Limitations

The main limitations of this study include its retrospective design, relatively small sample size, and short follow-up. Further multi-center, large-scale, long-term prospective studies are warranted to establish more robust conclusions.

Conclusion

Our study results suggest that CPA is a simple, inexpensive, and safe non-invasive method with acceptable recurrence rates. Hair, weight, and hygiene are the significant factors affecting the recurrence. It should be considered as the first choice for every patient with PSD, as it provides more favorable postoperative cosmetic results. A high ratio of hair, increased weight, and poor hygiene are the main factors that affect recurrence.

Ethics

Ethics Committee Approval: This study was approved by the Erzurum Faculty of Medicine Ethics Committee (approval number: BAEK 2023/01-10).

Informed Consent: Written informed consent was obtained from the patients.

Authorship Contributions

Concept: N.O., M.K., Design: N.O., M.K., Data Collection or Processing: N.O., M.K., Analysis or Interpretation: N.O., Literature Search: N.O., Writing: N.O.

Conflict of Interest: No conflict of interest was declared by the authors.

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RESEARCH ARTICLE

Surgical Outcomes After Colorectal Surgery for Intestinal Deep Endometriosis: A Retrospective Cohort Study

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ABSTRACT

Aim: Deep endometriosis (DE) is defined as infiltrating lesions greater than 5 mm in depth and is one of the more severe forms of endometriosis. The surgical management of DE infiltrating the bowel is complex and controversial. The primary aim of this study was to determine post-operative complications and outcomes in patients undergoing surgical treatment for bowel endometriosis.

Method: A retrospective study was conducted of all patients who underwent surgical treatment for bowel endometriosis between 2012 and 2020 at two centers. All demographic data and peri-operative data, including symptoms, imaging, type of operation, length of stay, complications, and length of follow-up were analyzed.

Results: A total of 167 patients underwent combined gynecological and colorectal surgery for intestinal DE. Complete data was available for 108 patients, who were included in the final analyses. Pelvic pain was the most common symptom, with 82/108 (75.9%) patients reporting it as the main symptom. Pre-operative dedicated ultrasound detected a rectal endometrial nodule in 101/108 (93.5%) patients. All operations were performed laparoscopically; 27/108 (25%) patients underwent a rectal shave, 15/108 (13.9%) patients underwent a disc resection, and 66/108 (61.1%) patients underwent segmental resection for bowel endometriosis. One anastomotic leak was identified in our cohort. Sonographic recurrence of endometriosis was identified in 22.5% of the patients after a median follow-up of 12 months. All of the patients with recurrence were treated with medical management only.

Conclusion: Laparoscopic surgery for endometriosis was performed with an acceptable rate of complications and recurrence in this cohort.

Keywords: Laparoscopic, endometriosis, segmental resection, colorectal, complications

Introduction

Deep endometriosis (DE) affecting the bowel wall is defined as lesions infiltrating 5 mm under the peritoneum. Bowel endometriosis is estimated to affect between 5-12% of all endometriosis patients, with 70-93% of these located preferentially in the rectum and recto-sigmoid junction.[1,2] The most common symptoms in patients with DE include pain, dysmenorrhea, dyspareunia, dyschezia, and occasionally per rectal bleeding.[3]

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Surgical excision is the mainstay of treatment for this form of endometriosis, as medical therapies may only provide temporary analgesic relief and are associated with higher recurrence and progression rates if used as the primary treatment.[4,5] There are several surgical options for the treatment of bowel endometriosis, including disc and segmental resection. Complications associated with segmental resection have previously been documented.[6] These complications are more prevalent in cases of lower rectal operations compared to sigmoid resection. Various strategies have been defined to minimize complication rates after bowel surgery.[7]

The main aim of this study was to review the surgical treatment of bowel endometriosis by focusing on complications and recurrence.

Materials and Methods

This retrospective study included all patients who underwent surgical treatment for bowel endometriosis between 2012 and 2020 at two centers. All of the patients were operated on by the same gynecological surgeon-sonologist (GC) and colorectal surgeon (WB). This multi-disciplinary approach is in accordance with both the World Endometriosis Society and the National Institute for Health and Care Excellence guidelines.[8,9] All demographic and peri-operative data, including age, symptoms at presentation, pre-operative imaging results, type of operation, postoperative complications, and follow-up data were analyzed.

All of the patients underwent a specialist DE transvaginal ultrasound scan (TVS) in accordance with the International DE Analysis consensus statement[10] to assess the size and location of DE lesions, including the status of the pouch of Douglas (PoD), and the presence/absence of endometriomas. All TVSs were performed by GC or an experienced member of their team (Figures 1, 2). Symptomatic women with a TVS diagnosis of rectosigmoid DE were then referred to WB for a colorectal consultation to review considerations for performing joint gynecological/colorectal laparoscopic surgery. The surgical approaches were discussed between the patients and WB including the risks involved. All of the patients underwent bowel preparation pre-operatively using Prepkit-C® (Fresenius Kabi, Bad Homburg, Germany).

Surgical technique

All of the patients underwent laparoscopic excision of all macroscopically visible endometriosis. Bowel endometriosis was treated with either a laparoscopic shave, disc excision, or segmental resection. If the lesion was suitable for dissection off the bowel wall, it was shaved using laparoscopic scissors, diathermy, or a laparoscopic linear stapler to excise it from the anterior bowel wall. The disc excision procedure was performed as described by Woods et al.[11]

All segmental resections were carried out laparoscopically. Our technique for segmental resection involves preserving the inferior mesenteric artery (IMA). Once the rectum has been dissected off the posterior vagina and the PoD is cleared, the proximal and distal extents of bowel endometriosis are marked. The lateral peritoneal attachments of the sigmoid colon to the pelvic wall are mobilized to straighten the rectum and colon. The mesentery is fenestrated close to the bowel wall at the proximal extent of the resection margin. The mesentery is then divided using a Harmonic® scalpel (Ethicon Endo-Surgery, Cincinnati Ohio, USA). The proximal and distal extents of resection margins are resected using an Echelon Flex™

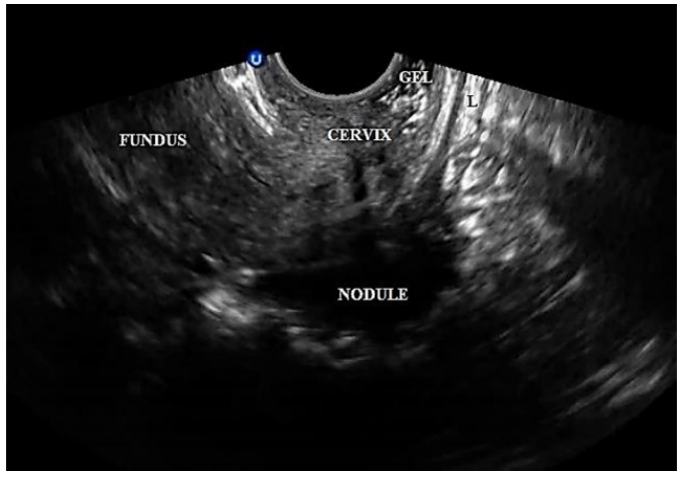

Figure 1. A transvaginal ultrasound image (sagittal plane) showing a deep infiltrating endometriotic nodule involving the anterior rectum. The "sliding sign" was negative at the retro-cervical region (due to adhesions between the anterior rectal nodule and posterior cervix), indicating a complete pouch of Douglas obliteration
L: Lumen of the rectum

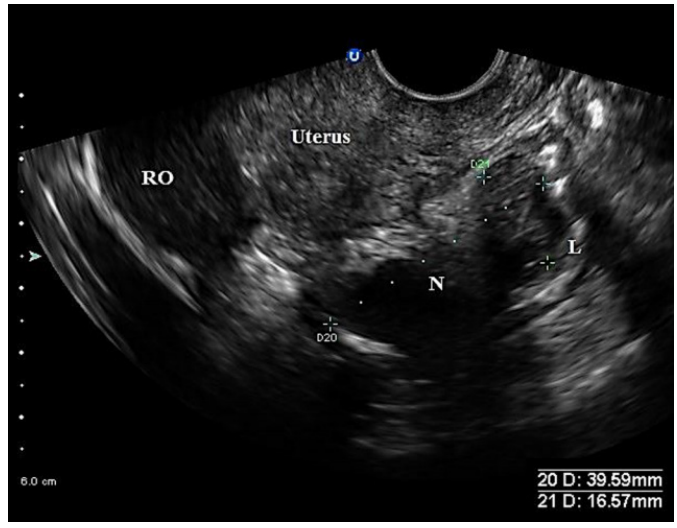

Figure 2. Transvaginal ultrasound image (sagittal plane) demonstrating a right ovarian endometrioma with a co-existing deep infiltrating endometriotic nodule (N) of the rectosigmoid bowel
RO: Right ovary, L: Bowel lumen

(Ethicon) linear stapler. The proximal colon is then adequately mobilized to allow for tension-free anastomosis. The colon is exteriorized through the iliac fossa from the left using a muscle-splitting incision. The anvil of the circular stapler is then secured into the proximal colon. The bowel is returned to the peritoneal cavity and end-to-end stapled anastomosis is performed using the circular stapler. A flexible sigmoidoscopy is performed to assess the integrity of the anastomosis.

Ethics approval

This study was approved by the Nepean Blue Mountains Local Health District Human Research Ethics Committee in accordance with the National Health and Medical Research Council Act 1992, and the National Statement on Ethical Conduct in Human Research 2007 (updated July 2018).

Statistical Analysis

Data collection was performed using Excel (Microsoft, Redmond, WA, USA). Continuous variables were expressed as mean and standard deviation and a median with an interquartile range. Categorical variables were expressed as counts and proportions with percentages. A comparison of proportions was performed by estimating the relative risk and conducting a chi-square test, or multinomial logistic regression and odds ratios. A p-value <0.05 was considered significant. Data were analyzed using SAS software (v.9.4; SAS Institute Inc., Cary, NC, USA).

Results

A total of 167 patients underwent combined gynecological and colorectal surgery for intestinal DE. Complete data was available for 108 patients, who were included in the final analyses. The most common symptom in patients undergoing surgery was pelvic pain, which 82/108 (75.9%) patients reported as their primary symptom. Dysmenorrhea, dyspareunia, and dyschezia were reported by 72/108 (67.3%), 70/108 (64.8%), and 64/108 (59.3%) patients, respectively; 43/108 (39.8%) patients also had issues with infertility at the time of their operation. In our cohort, 42/108 (38.9%) patients had previously undergone surgery for endometriosis (Table 1).

All patients underwent pre-operative TVS to assess the degree of endometriosis. Ultrasound was used to detect rectosigmoid DE, which was identified in 101/108 (93.5%) patients pre-operatively. Uterosacral ligament DE was identified in 75/108 (69.4%) patients, and endometrioma was identified in 63/108 (58.3%) patients via pre-operative TVS. Additionally, 31/108 (28.7%) patients were identified as having rectosigmoid DE greater than 3 cm or multi-focal disease on pre-operative TVS.

All operations were performed laparoscopically in our series; 27/108 (25%) patients underwent a rectal shave, 15/108 (13.9%) patients underwent disc resection, and 66/108 (61.1%) patients underwent segmental resection. Patients with a rectosigmoid lesion greater than 3 cm, or multi-focal rectosigmoid disease, were more likely to undergo segmental resection, and this was statistically significant (p<0.001) (Table 2). In performing segmental resection, 65/66 (98.5%) patients had the IMA spared during their resection. Only 1 patient in our cohort required a diverting loop ileostomy. The median length of stay was 3 days in the rectal shave cohort, 3 days in the disc resection cohort, and 4 days in the segmental resection cohort. Endometriosis was confirmed on histology in 95 (92.2%) patients. Information was missing for 5 patients.

Among the 108 patients, 5 patients suffered a Clavien-Dindo Grade IIIb complication requiring surgical intervention (Table 3). One patient suffered an anastomotic leak with a concurrent ureteric injury, which was subsequently repaired robotically via defunctioning ileostomy and left-ureteric reimplantation. Two patients had a ureteric injury; 1 case was suture-repaired intra-operatively, and 1 delayed thermal injury was managed conservatively with a ureteric stent. One patient had a uretero-vaginal fistula, which was initially

Table 1. Pre-operative data

Variable	Median (interquartile range)
Age	37 (31-41.5)
Pre-operative symptoms	**n (%)**
Pelvic pain	82 (75.9)
Dysmenorrhea	72 (68.5)
Dyspareunia	70 (64.8)
Dyschezia	64 (59.3)
Infertility	43 (39.8)
Previous endometriosis surgery	42 (38.9)
Transvaginal ultrasound scan	
Uterosacral ligament lesion	
1. Nil	33 (30.6)
2. Unilateral	39 (36.1)
3. Bilateral	36 (33.3)
Endometrioma(s)	
1. Nil	45 (41.7)
2. Unilateral	40 (37.0)
3. Bilateral	23 (21.3)
Rectosigmoid DE	101 (93.5)
Rectosigmoid DE lesion >3 cm/multifocal	31 (28.7)

DE: Deep endometriosis

Table 2. Association of the type of resection with the size of lesions and postoperative recurrence

	n/n (%)		
Type of resection	**Lesion multifocal = no; (n=76)**	**Lesion multifocal = yes; (n=31)**	**p-value**
Shave	26 (34.2)	1 (3.2)	
Disc	13 (17.1)	2 (6.5)	<0.001
Segment	37 (48.7)	28 (90.3)	
	Recurrence = no; (n=54)	**Recurrence = yes (n=16)**	**p-value**
Shave	11 (20.4)	2 (12.5)	
Disc	6 (11.1)	4 (25.0)	0.34
Segment	37 (68.5)	10 (62.5)	

Table 3. Post-operative complications (Clavien-Dindo classification)

Grade	Complication (number)	Management (number)
I	Colitis (3)	Conservative treatment only
II	Urinary tract infection (3)	Treated with intravenous (IV) antibiotics
	Port site infection (1)	Treated with IV antibiotics
III	**Bowel:**	
	Anastomotic leak	Managed with diverting ileostomy
	Urological:	
	Inadvertent cystostomy (1)	Repaired intraoperatively
	Ureteric injury (3)	Surgical repair (2), Stent (1)
	Utero-vaginal fistula	Surgical repair
IV	Nil	

managed with a diverting nephrostomy and eventually surgically repaired via a ureteric re-implant. One patient had an inadvertent cystostomy, which was recognized and repaired intraoperatively. Seven patients suffered a Clavien-Dindo Grade I-II complication. Three patients were admitted post-operatively with colitis, which was managed conservatively. Three patients admitted with urinary tract infections were treated with antibiotics, and 1 patient had a port-site infection, which was treated conservatively with antibiotics. There were no deaths in our cohort.

Follow-up data was available for 93/108 (86.1%) patients. The median follow-up was for the duration of 12 months (interquartile range, 0-60 months); 16/93 (17.2%) patients had significant ongoing pain post-operatively. Ongoing dyschezia was present in 6/43 (14.0%) patients with available data. A follow-up DE scan was performed in 71 post-operative patients, with a median time from surgery to scan of 12 months. This revealed an overall ultrasound-detected DE recurrence rate of 22.5%. The recurrence rate in the rectal shave, disc excision, and segmental resection cases was 15.4%, 40%, and 20.8%, respectively. The type of resection was not statistically significantly associated with recurrence (Table 2). All of the patients with recurrence were treated with medical management; no patients required a repeat operation within 12 months.

Discussion

A growing volume of Australian data has become available in recent years regarding the surgical treatment of DE involving the bowel.[12-14] In this study of 108 patients, all operations for DE involving the bowel were performed laparoscopically with no conversion to open. The surgeries involved segmental resection in 61.1% of patients. Previous studies have stated a conversion rate of 2-12%.[15-17] The conversion rate has steadily improved over time, which could be attributed to increasing experience with laparoscopic bowel surgery. At our institution, there is a multi-disciplinary approach to the treatment of DE involving gynecology and colorectal teams. The combined experience in non-endometriosis laparoscopic surgery may also have allowed for a 0% conversion rate in our cohort.

In our series, 98.5% of patients who underwent a segmental resection for DE had the IMA preserved during surgery. The colonic mesentery was divided close to the segment of the bowel to be resected, thereby preserving the major vascular

pedicle to the remaining colon. Preservation of the IMA has also been utilized in resection for diverticular disease.[18] Scioscia et al.[19] indicated IMA-saving colorectal surgery for endometriosis to be safe and feasible. Although studies indicate no difference in anastomotic leak rates, IMA-saving resection can yield benefits, such as preserving bowel length and nerve preservation. A randomized control trial by Masoni et al.[20] showed that patients who underwent colonic resection with an IMA preserving technique had reduced incidence of defecatory disorders. We believe limited segmental resection for endometriosis to be safe, and that it should be utilized in patients undergoing bowel surgery for endometriosis, as long as other parameters for safe anastomosis can be achieved.

There is clinical equipoise regarding the treatment of bowel endometriosis. Various algorithms have been developed to suggest the ideal surgical treatment for this condition.[21] In cases where lesions greater than 3 cm are present, for patients with multi-focal lesions, or cases with lesions involving >1/3 of the bowel lumen, segmental resection is recommended. Studies have shown greater complication rates with segmental resection.[2,22] In our cohort, the decision for segmental resection was based on pre-operative and intra-operative information regarding bowel endometriosis. All patients received a pre-operative dedicated DE ultrasound to characterize bowel endometrial nodules. The intra-operative decision to undergo segmental resection was based on the location and extent of the disease. In our cohort, patients with rectosigmoid DE lesions greater than 3 cm or multi-focal DE lesions were more likely to undergo segmental resection. A systematic review in 2012 found an overall complication rate of 22% in patients who underwent surgery for bowel endometriosis. Severe intestinal complications were established at 6.4%, which included anastomotic leak, rectovaginal fistula, and bowel obstruction.[2] A recent retrospective study of 142 patients established a major complication rate of 8.5%.[23] Our study had a major complication rate of 4.6%. The majority of major complications occurred in the segmental resection cohort, which may have been related to the extensive dissection of tissue to clear the more complex burden of disease.

Post-operative recurrence of endometriosis can be difficult to measure. There are various ways in which recurrence can be defined; it can be symptomatic, defined by imaging, or histology. This has given rise to a vast number of heterogeneous studies reporting on recurrence rates after bowel endometriosis surgery. Vignali et al.[24] reported 3- and 5-year recurrence rates of 20% and 43%, respectively, for pain. The rate of recurrence on post-operative imaging has been reported to range between 10% and 50%.[25-27] This high recurrence could also be attributed to residual disease, rather than a true recurrence rate.[28] If the definition of recurrence is ignored, the average recurrence rate is reported to be approximately 20%.[29] This recurrence rate was very similar to our cohort, which had a recurrence rate of 22.5%.

Study Limitations

The authors recognize the limitations of this retrospective study. Not all patients in this study were followed up post-operatively for the same period of time. This may have led to an underestimation of post-operative complications. There is an assumption that, owing to the complex nature of this type of surgery, patients will present back to the same hospital with complications; however, patients may also seek medical attention elsewhere. Another limitation of this study is the reporting of recurrence. Although the majority of patients underwent a post-operative DE ultrasound to check for recurrence, this was not protocolized. Scanning patients at different time periods may have yielded a false positive reading on an ultrasound scan for recurrence. It is noted, however, that the gynecology unit at our institution has extensive experience with DE ultrasound.[30-32]

Conclusion

Complex laparoscopic surgery for the treatment of bowel endometriosis is safe if performed collaboratively. Segmental resection for bowel endometriosis can be performed without extensive dissection as long as the principles of safe bowel anastomosis are adhered to.

Ethics

Ethics Committee Approval: This study was approved by the Nepean Blue Mountains Local Health District Human Research Ethics Committee in accordance with the National Health and Medical Research Council Act 1992, and the National Statement on Ethical Conduct in Human Research 2007 (updated July 2018).

Informed Consent: Retrospective study.

Authorship Contributions

Concept: W.B., G.C., Design: W.B., G.C., Data Collection or Processing: A.S., N.D., Analysis or Interpretation: A.E., M.A., Literature Search: A.S., N.D., Writing: A.S., N.D.

Conflict of Interest: No conflict of interest was declared by the authors.

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RESEARCH ARTICLE

External Sphincter-Sparing Anal Fistulotomy Plus Seton Drainage for Complex Fistula-In-Ano

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ABSTRACT

Aim: Several sphincter-saving surgical techniques have been developed, but overall healing rates have been mediocre. An external sphincter-sparing anal fistulotomy plus seton drainage (ESSAF-S) prioritizes the management of the intersphincteric space and involves dividing the internal sphincter and debriding the intersphincteric space to remove the focus of fistula formation.

Method: This was a retrospective review of all patients who underwent ESSAF-S between January 2020 and December 2021 in a single institution. The primary outcome was the primary healing rate. Secondary outcomes included overall healing rate, postoperative complications, and incontinence rate based on the postoperative Wexner incontinence score (WIS).

Results: A total of 21 patients (11 men, 10 women, mean age 43.1±12.3 years) underwent ESSAF-S during the study period. The mean follow-up time was 11.9±4.4 months. The primary healing rate was 76.2%. Five patients required a second procedure (3 fistulotomy, 2 fistula-tract laser closure), and 1 patient had a persistent fistula afterward. The overall healing rate was 95.2%. Two (9.5%) patients developed gas incontinence after the procedure. The median WIS was 0 (range: 0-13). There was no significant difference between the preoperative and postoperative WIS (p>0.05).

Conclusion: An external sphincter-sparing anal fistulotomy plus seton drainage is an effective procedure for complex anal fistula with a high overall healing rate and low complication rate.

Keywords: Complex anal fistula, FiLAC, fistula-in-ano, seton, LIFT, VAAFT

Introduction

Perianal abscesses emerging from infected intersphincteric proctodeal glands are the main instigator of perianal fistulae, with other causes, such as inflammatory bowel disease, malignancies, and perianal trauma, making up <10% of perianal fistula origin.[1-4] Classifying fistulae into simple and complex fistulae using the Standard Practice Task Force classification streamlines the management pathway, although other classifications, such as Park's, St. James University Hospital, and Garg's, also have their advantages.[5,6]

Simple fistulae are effectively managed by a fistulotomy, with an average healing rate of 93.7% and low morbidity.[7] However, there is no gold standard treatment for complex fistula-in-ano. Attempts to balance sphincter preservation against a high cure rate produced various surgical techniques with variable success rates. Currently practiced techniques range from those that minimally disrupt the sphincter complex, such as fistula-tract laser closure (FiLAC), video-assisted anal fistula treatment (VAAFT), definitive drainage seton, anal fistula plug, fibrin glue, and over-the-scope-clip closure of internal fistula opening, to techniques that disrupt the sphincter complex and

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surrounding tissue to different degrees (albeit in a controlled manner), such as the ligation of intersphincteric tract (LIFT), endorectal advancement flap (ERAF), and fistulotomy or fistulectomy with primary sphincteroplasty (FIPS). However, no technique has emerged as the best, with most having recurrence rates of >10%.[8,9]

The importance of addressing the intersphincteric space in the management of complex anal fistula has been gaining attention.[3,9] The nodus of the complex anal fistula is within this space, and one approach is that the intersphincteric space should be treated like an abscess within a closed space.[3,9-12] Hence, applying the principles of abscess management (i.e., incision and drainage) should be part of a fistula treatment. This involves laying open the intersphincteric space, debridement of the affected area, and letting healing occur by secondary intention.[10,11] The concept was eloquently described by Garg as the ISTAC (*intersphincteric tract is like an abscess in closed space*), DRAPED (*draining all pus and ensuring continuous drainage*), and HOPTIC (*healing occurs progressively till it is interrupted irreversibly by a collection*) principles.[9] Several papers have been published showing techniques respecting this concept but with different procedural names, such as transanal opening of intersphincteric space (TROPIS), modified Park's procedure, tunnel-like fistulectomy plus draining seton combined with incision of internal opening of anal fistula (TFSIA), and external sphincter-sparing anal fistulotomy (ESSAF).[10,12-14] An external sphincter-sparing anal fistulotomy plus seton drainage (ESSAF-S) is a technique that combines ESSAF with a loose draining seton to assure adequate drainage after the debridement of the intersphincteric space, hence promoting better wound recovery and reducing recurrence rate.[11] This report presents our results using this technique.

Materials and Methods

Patients and study design

This was a retrospective analysis of prospectively collected data. Data that were recorded included patients' demographics, past medical history, previous surgical treatment for fistula-in-ano, symptoms and clinical findings on physical examination during the first clinic review, duration of hospital stay, duration of surgical procedure, interval between definitive procedure and last clinic follow-up, and outcomes. The study was approved by the University of Health Sciences Turkey, İzmir Tepecik Training and Research Hospital Non-Interventional Research Ethics Committee (approval number: 2022/12-28, date: 11.01.2023).

The ESSAF-S procedure was offered to all adult patients with high (involving more than one-third of the external sphincter), recurrent, and complex fistula-in-ano conditions during the study period. Transsphincteric fistula, suprasphincteric fistula, and extrasphincteric fistula were defined as complex fistula-in-ano. An active ongoing perianal abscess was not considered an exclusion criterion. Patients who did not want to undergo the ESSAF-S procedure were treated with other suitable methods, which included FiLAC, loose seton, and tunnel fistulectomy.

The exclusion criteria were as follows:

1. Simple fistula-low or superficial fistula (involving less than one-third of the external sphincter) and intersphincteric fistula,
2. Tuberculous fistula,
3. Neoplastic fistula,
4. Inflammatory bowel disease (Crohn's disease and ulcerative colitis)-associated fistula-in-ano,
5. Anovaginal fistula.

Treatment protocol

All patients underwent a clinical examination, rigid rectoscopy, and/or flexible sigmoidoscopy as part of their preoperative assessment. Pelvic magnetic resonance imaging was performed on patients with recurrent fistula. The procedure was performed under either spinal or general

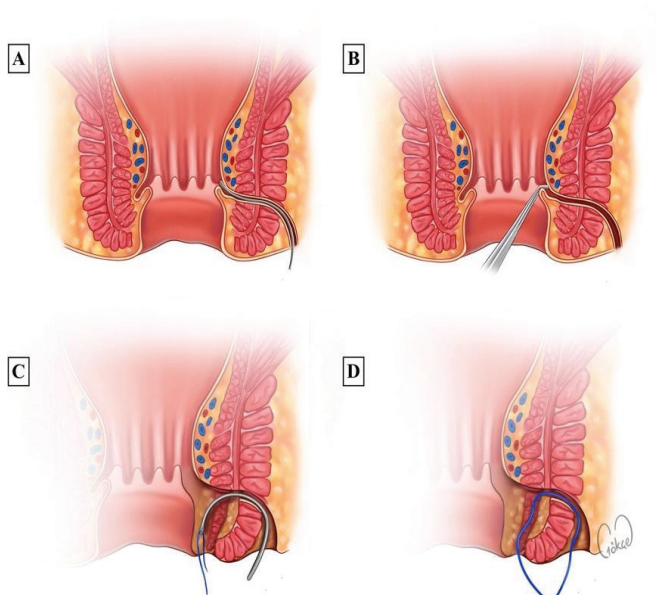

Figure 1. (A-D) show the illustrated sequence of the external sphincter-sparing anal fistulotomy plus seton drainage procedure. (A) The fistula tract is identified, and a metal probe is used to cannulate the tract. (B) The tip of a right-angled forceps is introduced into the internal opening of the fistula. The anal canal mucosa is cut caudally towards the external anal fistula opening. A fistulotomy is performed starting from the external opening until the external sphincter muscle. (A) Fistulotomy is also performed to the proximal portion of the anal fistula, cutting the internal sphincter, until the intersphincteric space. The intersphincteric space and the remnant fistula tract within the external sphincter are debrided thoroughly. (C,D) A seton is looped around the external sphincter and loosely secured. The wound is left to heal by secondary intention

anesthesia. Antibiotics were only given in cases with active abscesses. The patients were placed in a lithotomy position with sterile preparation. A video demonstrating the technique is linked with this article. The surgical steps are as follows (Figures 1, 2):

1. The fistula tract is identified, and a metal probe is used to cannulate the tract.

2. The tip of a right-angled forceps (i.e., Mixter forceps) is introduced into the internal opening of the fistula. The anal canal mucosa is cut caudally towards the external anal fistula opening.

3. A fistulotomy is performed starting from the external opening. The fistula tract is laid open to the level of the external sphincter muscle. The skin overlying the tract is cut towards the previously made cut edge of the anal mucosa. The sphincter muscle is easily visualized after the incisions are made.

4. A fistulotomy is performed to the proximal portion of the anal fistula until the intersphincteric space, using a right-angled forceps tip as a guide. The internal sphincter muscle containing the fistula is also divided at this stage.

5. The intersphincteric space and the remnant fistula tract within the external sphincter are debrided thoroughly. This is to remove any residual epithelial or granulation tissue and reduce the possibility of fistula recurrence.

6. A seton is looped around the external sphincter and loosely secured. The wound is left to heal by secondary intention.

All the procedures were performed by experienced colorectal surgeons (M.C.T. and A.E.C.).

Postoperative management

The procedures were performed as day cases when possible. The patients were discharged with non-opioid analgesia. Patients with active abscesses were discharged with a complete course of oral antibiotics. All patients had an outpatient follow-up examination at postop day seven, 1 month after the procedure, and followed by 3-monthly outpatient clinic reviews. The loose seton was left *in situ* for at least 3 months.

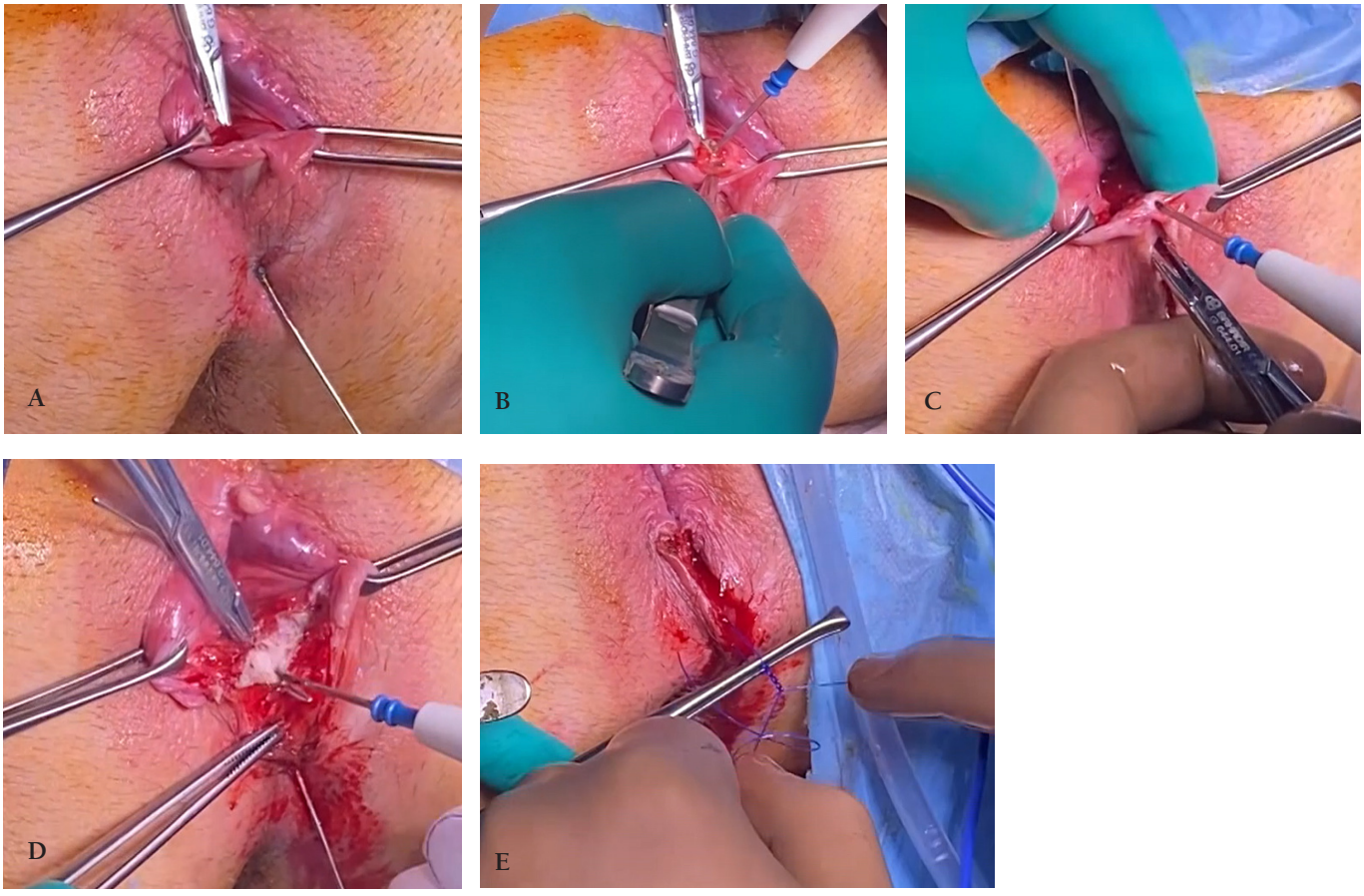

Figure 2. (A-E) show the sequence of the external sphincter-sparing anal fistulotomy procedure. (A) The fistula tract is identified, and a metal probe is used to cannulate the tract. (B) The tip of a right-angled forceps is introduced into the internal opening of the fistula. The anal canal mucosa is cut caudally towards the external anal fistula opening. (C) A fistulotomy is performed starting from the external opening until the external sphincter muscle. (D) A fistulotomy is also performed to the proximal portion of the anal fistula, cutting the internal sphincter, until the intersphincteric space. The intersphincteric space and the remnant fistula tract within the external sphincter are debrided thoroughly. (E) A seton is looped around the external sphincter and loosely secured. The wound is left to heal by secondary intention

Outcomes measures

The primary outcome measure was the primary fistula healing rate. Secondary outcome measures included the overall healing rate, complications, and incontinence rate. Patients were classified according to the Parks classification at the time of surgery.[6] Healing was assessed using a perianal fistula severity scoring system, as follows: 0- no active disease or complete healing, 1- slight drainage with minimal symptoms, 2- persistent symptomatic drainage, and 3- severe perianal disease, potentially requiring diversion.[15] A score of 0 or 1 would result in the removal of the indwelling seton. Patients with higher scores at the end of 3 months would be assessed again for persistent or non-healing fistula. Patients were asked whether they experienced any major incontinence symptoms (solid or liquid stool or gas incontinence) and were asked to complete the Wexner incontinence score (WIS) questionnaire before the ESSAF-S procedure and during their last follow-up. Patients with a WIS ≥1 were considered incontinent. A WIS ≤4 was defined as mild incontinence and a WIS ≥5 was defined as severe incontinence.[16] A validated Turkish version of the questionnaire was used.[17]

Statistical Analysis

Statistical analysis of data was performed using SPSS version 26 (IBM Corp; Armonk, NY, US). Continuous data were described using mean ± standard deviation or median and range (minimum-maximum). Numbers and percentages were used to present categorical data. The paired sample sign test was applied to analyze the preoperative and postoperative WIS. The significant cut-off point was set at $p<0.05$.

Results

Between January 2020 and December 2021, 21 consecutive patients agreed for ESSAF-S to be performed. There were 11 (52.4%) men and 10 (47.6%) women. The mean age was 43.1±12.3 years (range: 16-69 years). Nine (43%) patients had a body mass index >30 kg/m^2. Three (14.3%) patients were active smokers and 13 (61.9%) patients were ex-smokers. Nineteen (90.5%) patients had a transsphincteric fistula and 2 (9.5%) had a suprasphincteric fistula. Almost two-thirds of the patients had undergone previous anal fistula surgery (Table 1). Table 2 summarizes the outcomes of the study. The average operative time was 25.2±5.7 minutes (range: 15-41 minutes). All patients were managed as day cases. Two patients had active abscesses and were discharged with a course of oral antibiotics. One patient was readmitted on the same day due to pain and was discharged after 2 days of parenteral analgesia. The mean follow-up period was 11.9±4.4 months (range: 7-23 months). Five (23.8%) patients had persistent fistula. Three patients only required a simple fistulotomy, whereas two patients were treated using FiLAC. One recurrence was recorded after the FiLAC treatment and a draining seton was placed afterwards. The medians for preoperative and postoperative WIS were both 0 (range: 0-13) and were not significantly different ($p>0.05$, paired sample sign test). Two (9.5%) patients noted a new onset of difficulty to control flatus postoperatively. Their WIS were 3 and 8. The number of patients who had impaired continence preoperatively and postoperatively was four (gas only - two, gas and liquid - two), and six (gas - four, gas and liquid - two), respectively. No patients complained of solid stool incontinence (Table 3).

Discussion

Highlighting the importance of managing the intersphincteric space in treating fistula-in-ano implied that the treatment strategy had to change. The primary aim is no longer to close the fistula tract but. to treat the space as if it were an abscess. The intersphincteric space must be laid open, similar to the de-roofing of an abscess, thoroughly debrided, and left to continuously drain and heal by secondary intention.[3,12-14] Continuous drainage is important to prevent any collection

Table 1. Patient demographics

Parameters	
Mean age (years)	43.1±12.3
Gender	
- Male	11 (52.4%)
- Female	10 (47.6%)
Mean BMI (kg/m^2)	27.9±5.2
Cigarette smoker	
- Active	3 (14.3%)
- Ex-smoker	13 (61.9%)
Diabetes mellitus	0 (0%)
Mean preoperative Hb level	13.5±1.1
Mean preoperative WCC level	8.0±3.1
Mean preoperative platelet level	281.5±52.0
Fistula type	
- Transsphincteric	19 (90.5%)
- Extrasphincteric	2 (9.5%)
Previous anal fistula surgery	13 (61.9%)
- FiLAC	10
- LIFT	1
- Loose seton	2

Data presented as mean ± standard deviation, or number (%)

BMI: Body mass index, Hb: Hemoglobin, WCC: White cell count, FiLAC: Fistula-tract laser closure, LIFT: Ligation of intersphincteric tract

from forming, which could halt the healing process.[9] The effect of this process translated to the high healing rate seen in fistulotomy and FIPS (Table 4).[7,9,18] Procedures that do not fulfill the principle in its entirety, such as LIFT, FiLAC, VAAFT, and ERAF (Table 4), have not managed to reach healing rates as high as the procedures listed in Table 5. The ESSAF-S technique respects these principles by laying open the intersphincteric space and the placement of a loose seton. The seton allows continuous drainage and promotes healing by causing an inflammatory response and fibrosis.[11,19]

Table 5 summarizes the outcomes of published studies of fistula surgery techniques similar to ESSAF-S. All of the techniques involved laying open the intersphincteric space by dividing the internal sphincter. This study's primary healing rate of 76.2% was similar to the two largest studies.[12,20] The modified Park's procedure reported the highest primary cure rate of 93.75%.[13] The authors endorse closing the external sphincter defect after debriding the intersphincteric space and the remnant tract within the external sphincter. The TFSIA technique by Yan and Ma[14] also had a commendable primary cure rate. The technique involved complete excision of the fistula tract from the external opening to the intersphincteric space. These variations are unique compared with other techniques. However, whether the proprietary methods made a difference is uncertain, as they were small studies with a short follow-up duration.

When combined with a secondary treatment for patients with persistent fistula, our overall success rate was comparable

Table 2. Outcome of ESSAF-S procedure

Parameter			
Mean operative time (min)	25.2±5.7		
Total hospital stay (days)	1		
Follow-up duration (months)	11.9±4.4		
Primary healing rate	16 (76.2%)		
Persistence	5 (23.8%)		
Re-operation			
- Fistulotomy	3		
- FiLAC	2		
- Seton*	1		
Overall healing rate	20 (95.2%)		
New onset postprocedure incontinence	2 (9.5%)		
Median Wexner score (min.-max.)	**Preop**	**Postop**	
	0 (0-13)	0 (0-13)	p=0.5
- Perfect continence (score = 0)	17 (81%)	15 (71.4%)	
- Mild incontinence (score ≤4)	2 (9.5%)	3 (14.3%)	
- Major incontinence (score ≥5)	2 (9.5%)	3 (14.3%)	

* Loose draining seton for one patient with persistent fistula after a second operation (FiLAC). Data presented as mean ± standard deviation, median (range minimum-maximum), or number (%). FiLAC: Fistula-tract laser closure

Table 3. Preprocedural and postprocedural Wexner incontinence scoring by all patients. New onset of incontinence involved difficulty in controlling flatus only

	None		**Rarely**		**Sometimes**		**Usually**		**Always**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
Solid stool	21	21	0	0	0	0	0	0	0	0
Liquid	19	19	2	2	0	0	0	0	0	0
Gas	17	15	2	2	1	2	0	1	1	1
Pad usage	18	17	0	0	0	1	2	2	1	1
Lifestyle alteration	19	17	0	1	1	1	0	1	1	1

Table 4. List of anal fistula surgical techniques with healing rate and/or recurrence rate, and incontinence rate based on recent systematic review or meta-analysis

Procedure	Follow-up (months)	Healing rate	Recurrence rate	Complication/incontinence rate
LIFT (25)	Mean 10.3 (8.4-12.2)	76.4% (95% CI: 68.9-82.5%)		Pooled mean 0%
VAAFT (26)	Median 16.5 (8-48)	83% (95% CI: 81-85%)	16% (95% CI: 14-18%)	WIS 1.09 (95% CI: 0.9-1.27)
Loose Seton (27)	Median 16 (6-42)		10.3% (95% CI: 7.2-14.7%)	9.5% (6.5-13.8%)/3.2% (95% CI: 1.6-6.1%)
FiLAC (28)	Median 23.7 (2.33-60)	69.7% (95% CI: 54.4-85%)		1% (95% CI: 0-2%)
ERAF (29)	-		21% (95% CI: 15.3-26.8%) - Mucosal flap: 30.1% (95% CI: 25.5-34.7%) - Partial thickness flap: 19% (95% CI: 15.5-22.6%) - Full thickness flap: 7.4% (95% CI: 4-10%)	13.3% (95% CI: 8-18.6%) Incontinence rate by flap thickness: - Mucosal flap: 9.3% (95% CI: 5.4-13.1%) - Partial thickness flap: 10.2% (95% CI: 0.5-14.6%) - Full thickness flap: 20.4% (95% CI: 14.2-26.6%)
FIPS (18)	Weighted average 28.9 (12-81)	93.2% (range: 85.7-100%) 69.9% (range: 28.6-100%) (healing rate without dehiscence)	6.8% (range: 0-15%)	Sphincter dehiscence 2.2% (range: 0-8.3%) Incontinence 12.4% (2.7% major incontinence)

CI: Confidence interval, WIS: Wexner incontinence score, LIFT: Ligation of intersphincteric fistula tract, VAAFT: Video-assisted anal fistula treatment, FiLAC: Fistula-tract laser closure, ERAF: Endorectal advancement flap, FIPS: Fistulotomy or fistulectomy with primary sphincteroplasty

with the other studies (Table 4). Garg's TROPIS study had the lowest overall success rate, at 87.6%.[20] However, it is the largest prospective study on the technique which gave the result heavier significance. The study limited re-do surgery to the same surgical method (i.e., TROPIS), whereas other studies treat persistent or recurrent fistulas using variable techniques such as fistulotomy, ERAF, FiLAC, and a loose seton.[11-14,21] Excluding Garg's series, more than half of the patients who needed a second procedure were successfully managed with a simple fistulotomy. The combination treatment strategy produced an overall healing rate of 93-100%, but these studies also involved small sample numbers, and further investigation is needed.

The immunity of the internal sphincter from surgical division was challenged by Eisenhammer[22] in the early 1950s with the development of the lateral internal sphincterotomy (LIS) procedure.[16] The internal sphincter is in a closely confined space, splinted by a longitudinal muscle sheath and the external sphincter, which prevents any significant retraction of the internal sphincter when divided.[22] This translated to transient mild to moderate incontinence in approximately one-third of patients receiving an LIS, and <5% clinically significant incontinence after 5 years post-surgery.[16,23] The majority of this was difficulty in controlling flatus, and incontinence to solid feces was rare. Several risk factors for incontinence have been identified, such as two or more vaginal deliveries, instrumentation during vaginal deliveries, multiple previous perianal abscess drainage or anal fistula surgery, reduced external anal sphincter thickness on endoanal ultrasound, and reduced pre-operative voluntary contraction pressure on anal manometry.[16,23,24] It is worthwhile considering these factors before recommending internal sphincter division to patients.

Our incontinence rate of 9.5% is comparable with the other similar techniques, albeit slightly higher (Table 5). However, 61.9% of our patient cohort had previously undergone a different type of anal fistula surgery. We also report our incontinence rate based on the WIS, which is more sensitive than patient-reported incontinence; significant differences between the two methods of enquiring about incontinence have been observed.[23] Garg's TROPIS series had similar proportions of patients who had previous anal fistula surgery, but the reported incontinence rate was only 7.8%.[20]

Table 5. Comparison of outcomes with other techniques similar to ESSAF-S

Procedure name	Authors	Number of patients	Follow-up (months)	Primary healing rate	Persistence/ recurrence rate after primary surgery	Overall success rate	Incontinence rate
ESSAF-S	[a]Current study	21	Mean 11.9±4.4	76.2%	23.8%	95.2%	- 9.5% gas incontinence - No significant difference between preoperative and postoperative WIS - WIS median 0 (0-13)
	[a]Kennedy and Zegarra[11]	32	Mean 36 (13-65)	78%	22%	93%	- 33% gas incontinence - 3.1% occasional liquid seepage
TROPIS	[b]Garg et al.[20]	306	Median 36 (7-67)	78.4%	21.6%	87.6%	- 7.8% (majority gas incontinence) - No significant difference between preoperative and postoperative incontinence rate and Vaizey's incontinence score - Postoperative Vaizey's incontinence score 0.014±0.39
	[b]Li et al.[21]	41	Median 22.2 (6-35)	85.3%	14.7%	100%	- No significant difference between preoperative and postoperative incontinence rate and Wexner incontinence score - Postoperative mean WIS 0.22±0.47
Modified Park's	[b]El-Said et al.[13]	32	Median 12 (6-24)	93.75%	6.25%	100%	- No significant difference between preoperative and postoperative incontinence rate and Wexner incontinence score - WIS Median 0 (0-17)
TFSIA	[b]Yan and Ma[14]	40	6	87.5%	12.5%	-	- Not mentioned - Postoperative mean WIS 0.68±0.47
ESSAF	[a]Parnasa et al.[12]	59	Mean 12±14.7	71%	29%	93%	- 1.7% fecal incontinence

[a]Retrospective, [b]Prospective, ESSAF-S: External sphincter-sparing fistulotomy plus seton drainage, TROPIS: Transanal opening of intersphincteric space, TFSIA: Tunnel-like fistulectomy plus draining seton combined with incision of internal opening of anal fistula, ESSAF: External sphincter-sparing anal fistulotomy, WIS: Wexner incontinence score

The study did have a longer follow-up period (average 36 months) compared with our study. As the function of the internal sphincter after division has a high potential of recovering with time, this may account for the lower rate.[22,23]

Study Limitations

The main limitations of this study were its retrospective nature and small sample size. The study also lacked more objective continence assessments, such as an anorectal manometry study and sphincter assessment using endoanal ultrasound. There was no quality-of-life assessment to convey patients' perspectives on the treatment regime. This was also a single-center study with a short-term follow-up.

Conclusion

An external sphincter-sparing anal fistulotomy plus seton drainage is an effective technique for complex fistula-in-

ano with a success rate and complication rate comparable with other previously described similar techniques. The rate of clinically significant incontinence is also relatively low. However, larger prospective studies with objective continence assessment, longer follow-ups, and randomized trials comparing the method to other surgical techniques are required to investigate the safety and efficacy of this treatment.

Ethics

Ethics Committee Approval: The study was approved by the University of Health Sciences Turkey, İzmir Tepecik Training and Research Hospital Non-Interventional Research Ethics Committee (approval number: 2022/12-28, date: 11.01.2023).

Informed Consent: Retrospective study.

Authorship Contributions

Surgical and Medical Practices: H.A.T., M.A.S.A., S.D.A., A.E.C., M.C.T., Concept: H.A.T., M.A.S.A., S.D.A., A.E.C., M.C.T., Design: H.A.T., A.E.C., M.C.T., Data Collection or Processing: H.A.T., M.A.S.A., S.D.A., Analysis or Interpretation: H.A.T., A.E.C., M.C.T., M.F., Literature Search: H.A.T., M.A.S.A., Writing: H.A.T.

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RESEARCH ARTICLE

Comparison of Minimally Invasive and Open Colon Surgery for the Treatment of T4 Colon Cancer in a Tertiary Care Institution Using Propensity Score Matching Analysis

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ABSTRACT

Aim: Despite the increasing popularity of minimally invasive surgery (MIS) in recent years, its efficacy in treating T4 colon cancer remains a subject of ongoing debate. This study aimed to assess the perioperative and oncological outcomes of MIS for T4 colon cancer in comparison with open surgery (OP).

Method: We conducted a retrospective cohort analysis on 181 consecutive patients who underwent a T4 colon cancer resection through either MIS or OP between December 2014 and September 2021. Converted patients were evaluated in the MIS group according to the intention-to-treat principle. Propensity score matching (PSM) was employed based on age, gender, American Society of Anesthesiologists score, and the T-stage subgroup (T4a and T4b) to control for potentially confounding factors. Demographics short-term and long-term oncological outcomes were evaluated and compared between the two groups.

Results: Post-PSM resulted in 49 patients in each group. Both groups were comparable in terms of patient demographics, clinical stage at diagnosis, and postoperative morbidity. The median operative time was longer in the MIS group (167 vs. 132 minutes, p<0.01). The lymph node yield and the quality of complete mesocolic excision did not differ significantly between the two groups. The conversion rate was 8.2%. The 5-year overall survival (85.0% for the MIS group vs. 88.5% for the OP group, p=0.7) and the disease-free survival (62.5% for the MIS group vs. 70.0% for the OP group, p=0.33) rates were comparable between the groups.

Conclusion: MIS is a safe approach for treating T4 colon cancer, demonstrating satisfactory outcomes. The method offers oncologically acceptable results, reinforcing its potential advantages.

Keywords: Colorectal neoplasms, colorectal surgery, minimally invasive surgical procedures

Introduction

Colorectal cancer is a serious cause of mortality and morbidity and is the third most common type of cancer and the fourth leading cause of cancer-related deaths in both men and women.[1]

The primary treatment for non-metastatic, localized colon cancer is surgery. While historically open surgery (OP) had been preferred, the first-ever laparoscopic resection of colorectal cancer was performed in 1991 by Jacobs et al.[2] Laparoscopic surgery has been popularized since 1991 and provides advantages over OP in terms of short-term outcomes, such as reduced postoperative pain, decreased blood loss, shorter hospital stay, earlier resumption of bowel function, early mobilization, and better cosmesis[3-7] without any compromise in long-term oncologic outcomes.[3,8-11] Due to these advantages,

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the laparoscopic approach is becoming more extensively used in treating colorectal cancer at all stages except T4.

No consensus has yet been reached on the optimal surgical approach in T4 colorectal tumors, and there is still an ongoing debate. Data in the literature that compare the results of open and laparoscopic resection of T4 tumors in depth are rare. According to the American Joint Committee on Cancer (AJCC),[4] European Association of Endoscopic Surgery,[12] and National Comprehensive Cancer Network[13] guidelines, laparoscopic treatment of T4 colorectal cancers is not recommended due to technical difficulties of en bloc resection, longer operative times, higher perioperative morbidity, and questionable oncologic outcomes.[14] These guidelines recommend OP, which enables easier extensive en bloc resection and avoids suspicion of tumor seeding due to excessive manipulation used in the laparoscopic technique.

In recent years, there has been significant improvement in minimally invasive surgery (MIS) techniques and surgeons' experience. Parallel to these advances, growing literature on this topic demonstrated that the laparoscopic technique is safe and feasible in locally advanced cancers,[15-18] and other research demonstrated good surgical and oncologic outcomes.[15,17,19,20] However, these studies have certain limitations: a low number of cases, retrospective design, and lack of long-term oncological results.[15,16,18,21,22] Therefore, although these articles show promising results, they still provide insufficient evidence to support laparoscopic resections.

This study aims to retrospectively demonstrate our experience in the MIS of T4 colorectal cancer. Furthermore, we compare R0 resection rates, perioperative results, and short- and long-term oncologic outcomes between propensity score-matched MIS and OP groups with T4 tumors.

Materials and Methods

Patients who underwent elective MIS or OP in Koç University Hospital and VKF American Hospital between January 2014 and September 2021 were recorded and their data were prospectively gathered and retrospectively analyzed. This study was approved by Koç University Institutional Board of Review (approval code: 2020.491.IRB1.181, date: 04.03.2021) and was conducted in compliance with the 1964 Helsinki Declaration. All participants agreed to a written informed consent before their participation. All methods were carried out according to the institutional review board's relevant guidelines and regulations. Each patient was also discussed in the multidisciplinary team consisting of general surgery, medical oncology, radiation oncology, gastroenterology, radiology, pathology, and nuclear medicine. This study included patients aged >18 years with a T4 tumor located between the cecum and rectosigmoid colon. Patients undergoing emergency surgery, patients presenting with perforated tumors, patients with metastatic disease or underlying inflammatory bowel disease, and familial adenomatous polyposis were excluded. Patient demographics, including age, gender, body mass index (BMI), and history of previous abdominal surgery, were recorded. The American Society of Anesthesiologists (ASA) Physical Status Classification, length of stay, biochemical results, complications (anastomotic leakage, wound dehiscence, bleeding, ileus), operative details (type and duration of surgery), pathology reports (tumor location and dimensions, lymph node status, tumor invasion depth, number of harvested lymph nodes, apical lymph node status, surgical margin status, AJCC stages, and distance between vascular tie and tumor epicenter/colon wall), intensive care unit stay, readmission, data related with follow-up visits, morbidity, and perioperative mortality status were recorded.

The patients' routine preoperative evaluation included a complete physical examination, colonoscopy and biopsy, computerized tomography (CT) of the chest and abdomen, and positron emission tomography with 2-deoxy-2-(fluorine-18) fluoro-D-glucose integrated with CT if necessary. Surgical procedures were performed using oncological resection principles. The extent of the surgery was decided according to the tumor location and adjacent organ involvement, and an en bloc resection was preferred in the case of adjoining organ involvement. The conversion was defined as performing laparotomy during MIS due to factors such as bleeding, adhesions, and tumor perforation to achieve R0 resection and critical alterations in patients' vital status (Figures 1, 2). En bloc resections, cholecystectomy, and stoma-creation were accepted as additional procedures. Patients with postoperative complications within 30 days of colectomy were graded using the Clavien-Dindo grading system.[23]

At the joint discretion of the surgeon and the patient, a decision was made on whether the surgery would be performed with an MIS or an OP technique. MIS was offered regardless of the presence of a history of previous abdominal surgery. Whereas the MIS strategy included high ligation, mediolateral dissection, radical lymphadenectomy, and en bloc multi-visceral resection, the open approach consisted of vein and artery ligation, followed by lateral-to-medial dissection, radical lymphadenectomy, and an en bloc multi-visceral resection.

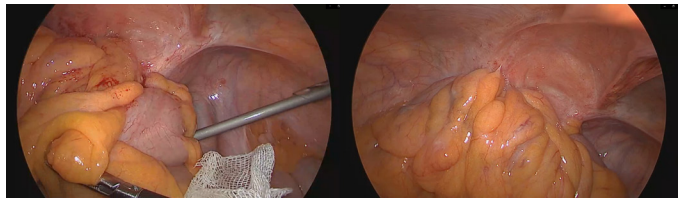

Figure 1. Laparoscopic view of a tumor in the sigmoid colon. Due to the invasion of the urinary bladder by the tumor, the procedure is converted to open surgery

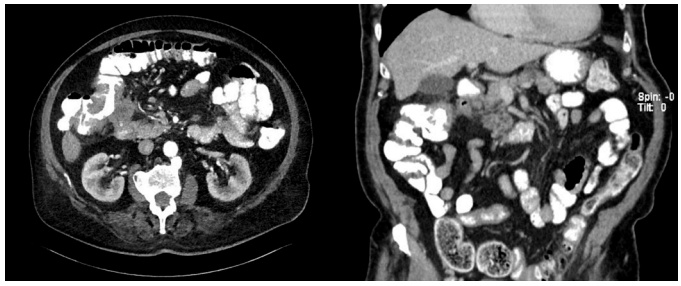

Figure 2. Computerized tomography scan showing a tumor in the right colon directly invading the pancreas and the second part of the duodenum

Patients meeting the criteria were split into two groups: the MIS group, consisting of patients who underwent laparoscopic or robotic surgery, and the OP group, consisting of patients who underwent OP. Patients who converted from MIS procedures to OP procedures were evaluated in the MIS group based on the intention-to-treat principle. Propensity score matching was performed to minimize the confounding factors and selection bias. Age, gender, ASA score, and pathological T-stage subgroup (pT4a or pT4b) were the variables included in the score matching. Nearest neighbor matching was performed in a 1:1 ratio, with the caliper width set at 0.2. Postoperative outcomes were assessed and compared between the two groups.

The patients' oncological follow-up was carried out in accordance with the American Society of Clinical Oncology and American Society of Colon and Rectal Surgeons guidelines.[24,25] Follow-up visits were scheduled every 3 months for the first 2 years and then every 6 months for the next 2 years. A physical examination was performed, and tumor marker levels (CEA, Ca-125, Ca 19-9) were measured during every follow-up visit. An annual control colonoscopy and CT scan of the chest and abdomen to check for recurrent cancer in the lymph nodes, lungs, and liver were performed for the first 3 years after surgery. The frequency of follow-up visits and tests was adjusted according to the disease's progression.

The primary outcomes were oncological, such as R0 resection rates, overall survival (OS), disease-free survival (DFS), short and long-term mortality, and morbidity.

Statistical Analysis

Statistical analysis of the results was carried out using SPSS version 21.0 (IBM, Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD) or median (range) based on data distribution, whereas categorical variables were presented as absolute values and percentages. Student's t-test and the Mann-Whitney U test were used to compare normally and non-normally distributed variables, respectively. Fisher's exact test and the chi-squared test were used to analyze categorical variables. The Kaplan-Meier curve was utilized to evaluate OS, and survival differences between ages were compared using the log-rank method. Cox's proportional hazards regression model was used for the combined effect of different parameters on survival. Statistical significance was defined by a p-value of <0.05.

Results

Between January 2014 and September 2021, 181 patients with colon cancer clinically staged as T4 were operated upon, and 51 patients were excluded because of distant metastasis. Thus, the total sample size was 130 before matching, and after matching, 49 patients were selected for each group (Chart 1). The patients were followed up for 75 months on average. The

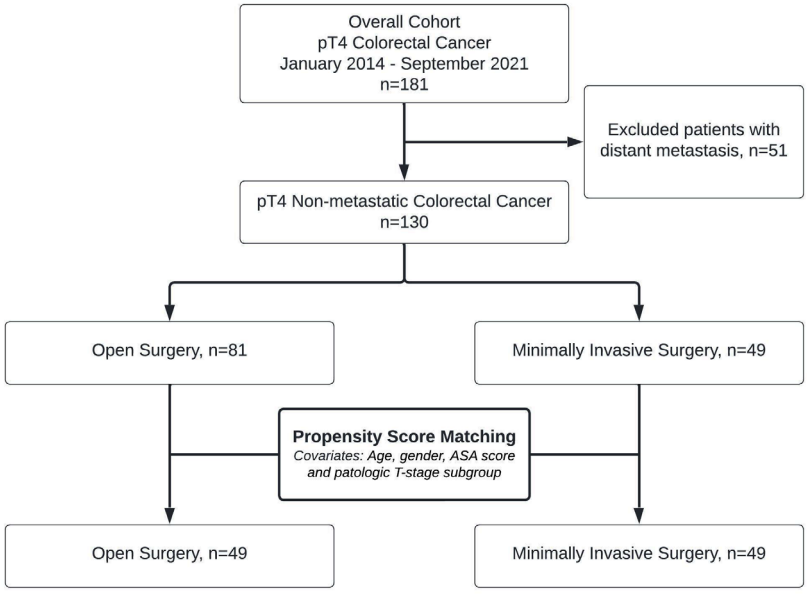

Chart 1. Flowchart

mean age, male proportion, and BMI of the patients were 65 (SD=16.8)/68 (SD=14.9), 59.2/57.1%, and 26.7 (SD=5.3)/22.7 (SD=5.2) for the MIS and OP groups, respectively (Table 1). The "T" stage based on histopathology of surgery specimen was T4a for 42 and 40 patients and T4b for the remaining 7 and 9 patients for the MIS and OP groups, respectively, and there was no significant difference in the pT and pN grades between the two surgical groups (p=0.59 and p=0.88, respectively) (Table 2). Seventy-nine (70.4%) of the patients were ASAI-II, and the remaining 29 (29.6%) were ASAIII-IV and were similar in both groups (p=0.83). Furthermore, there were no differences in tumor location or type of surgery (p=0.51 and p=0.27, respectively) (Tables 1, 3).

The median operation duration for the MIS group was significantly longer than for the OP group (167.65 and 132 minutes, respectively, p<0.01) (Table 3).

The conversion rate was 8.2% (Table 3). The main reasons for conversion were bleeding and technical difficulties.

The mean length of hospital stay and Clavien-Dindo scores of the patients were similar in both groups (p=0.28 and p=0.18). Nine patients in the MIS group and twelve patients in the OS group had additional surgery, and there was no significant difference (p=0.45). The postoperative surgical complication rate, reoperation rate, readmission, and mortality within 30 days were also similar between the two groups (p=0.16, p=0.28, p=0.39, p=1.0, respectively). Anastomotic leakage was observed in none of the patients in the MIS group and 3 patients in the OP group, and no statistically significant difference was found between the two groups (p=0.79) (Table 4).

Surgical margin positivity was not observed in the histopathological analysis of any surgically resected specimen in both groups. The number of harvested lymph nodes was >12 in both groups, which is the minimum required number for accurate staging, and the average numbers were 43.10 and 40.71 in the MIS and OP groups, respectively (p=0.17). Tumor size was higher in the OP group than in the MIS group, but the difference did not reach statistical significance (5.5 cm vs. 4.4 cm, respectively, p=0.08). There was no significant difference between the lymphovascular and perineural invasion rates (p=0.52 and p=0.7, respectively). Furthermore, the distance between the vascular tie and colon wall and between the vascular tie and tumor were similar in both groups (p=0.82 and p=0.33, respectively) (Table 2).

The overall 5-year survival rate was 85% in the MIS group and 88.5% in the OP group, and there was no significant difference (p=0.7) (Chart 2). Furthermore, the 5-year DFS rates were similar, at 62.5% for the MIS group and 70% for the OP group (p=0.33) (Chart 3). The local recurrence rate was comparable between the two groups (14.2% in the OP group vs. 31.1% in the MIS group, p=0.12).

Table 1. Patient charecteristics after matching

	MIS (n=49) n (%) or mean (SD)	OP (n=49) n (%) or mean (SD)	p-value
Age	65.35 (16.84)	68.16 (14.94)	0.19
Sex			0.84
Male	29 (59.2%)	28 (57.1%)	
Female	20 (40.8%)	21 (42.9%)	
BMI (kg/m^2)	26.65 (5.29)	22.66 (5.15)	0.82
ASA score			0.83
1-2	34 (69.4%)	35 (71.4%)	
≥3	15 (30.6%)	14 (28.6%)	
Tumor location			0.46
Cecum	3 (6.1%)	6 (12.2%)	
Ascending colon	11 (22.4%)	9 (18.4%)	
Hepatic flexure	2 (4.1%)	8 (16.3%)	
Transverse colon	6 (12.2%)	3 (6.1%)	
Splenic flexure	6 (12.2%)	4 (8.2%)	
Descending colon	2 (4.1%)	2 (4.1%)	
Sigmoid colon	12 (24.5%)	9 (18.4%)	
Rectosigmoid colon	7 (14.3%)	8 (16.3%)	
Previous abdominal surgery (+)	18 (36.7%)	20 (40.8%)	0.68

MIS: Minimally invasive surgery, SD: Standard deviation, OP: Open surgery, BMI: Body mass index, ASA: American Society of Anesthesiologists

Table 2. Pathological results after matching

	MIS (n=49) n (%) or mean (SD)	OP (n=49) n (%) or mean (SD)	p-value
pT			0.59
4a	42 (85.7%)	40 (81.6%)	
4b	7 (14.3%)	9 (18.4%)	
pN			0.78
0	16 (32.7%)	19 (38.8%)	
1a	7 (14.3%)	7 (14.3%)	
1b	12 (24.5%)	10 (20.4%)	
1c	1 (2%)	1 (2%)	
2a	5 (10.2%)	8 (16.3%)	
2b	8 (16.3%)	4 (8.2%)	
Harvested lymph node	43.10 (18.85)	40.71 (15.69)	0.17
Tumor size (largest cm) (min.-max.)	4.4 (2-13)	5.5 (3-17)	0.08
Surgical margin positivity	0 (0%)	0 (0%)	1
Lymphovascular invasion	32 (65.3%)	35 (71.4%)	0.52
Perineural invasion	27 (67.5%)	20 (47.6%)	0.07
Distance between vascular tie and colon wall	11.49 (3.3)	11.31 (3.59)	0.82
Distance between vascular tie and tumor	13.17 (4.14)	12.24 (4.11)	0.33

MIS: Minimally invasive surgery, SD: Standard deviation, OP: Open surgery, min.: Minimum, max.: Maximum

Table 3. Intraoperative results after matching

	MIS (n=49) n (%) or mean (SD)	OP (n=49) n (%) or mean (SD)	p-value
Type of surgery			0.27
Right hemicolectomy	16 (32.7%)	22 (44.9%)	
Left hemicolectomy	5 (10.2%)	5 (10.2%)	
Anterior resection	10 (20.4%)	13 (26.5)	
Extended right hemicolectomy	0 (0.0%)	1 (2.0%)	
Total hemicolectomy	2 (4.1%)	2 (4.1%)	
Subtotal colectomy	7 (14.3%)	4 (8.2%)	
Low anterior resection	9 (18.4%)	2 (4.1%)	
Conversion to open surgery	4 (8.2%)		
Operative time (minutes)	167.65 (64.41)	132 (41.29)	**<0.01**
Additional surgery	9 (18.4%)	12 (24.5%)	0.45
Cholecyctectomy	3 (6.1%)	3 (6.1%)	
Pulmonary wedge resection	0 (0%)	1 (2.0%)	
Splenectomy	1 (2.0%)	0 (0%)	
Gastrectomy	0 (0%)	1 (2.0%)	
Appendectomy	0 (0%)	1 (2.0%)	
Oopherectomy	1 (2.0%)	1 (2.0%)	
Small bowel resection	3 (6.1%)	4 (8.2%)	
Liver segmentectomy	1 (2.0%)	1 (2.0%)	

MIS: Minimally invasive surgery, SD: Standard deviation, OP: Open surgery

Table 4. Postoperative results after matching

	MIS (n=49) n (%) or mean (SD)	OP (n=49) n (%) or mean (SD)	p-value
Length of hospital stay (days)	7.20 (2.44)	7.71 (2.99)	0.28
Clavien-Dindo classification			0.18
<3	43 (87.8%)	38 (77.6%)	
≥3	6 (12.2%)	11 (22.4%)	
Complications within 30 days	9 (18.4%)	15 (30.6%)	0.16
Readmission within 30 days	0 (0.0%)	1 (2.0%)	0.39
Reoperation within 30 days	1 (2.0%)	4 (8.3%)	0.28
Mortality within 30 days	1 (2.0%)	1 (2.0%)	1
Anastomotic leak (+)	0 (0.0%)	3 (6.1%)	0.79

MIS: Minimally invasive surgery, SD: Standard deviation, OP: Open surgery

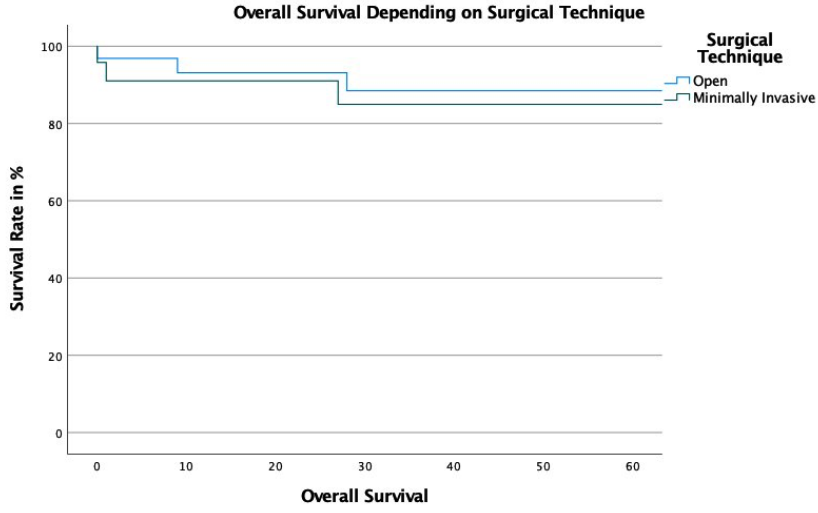

Chart 2. Overall survival depending on the surgical technique

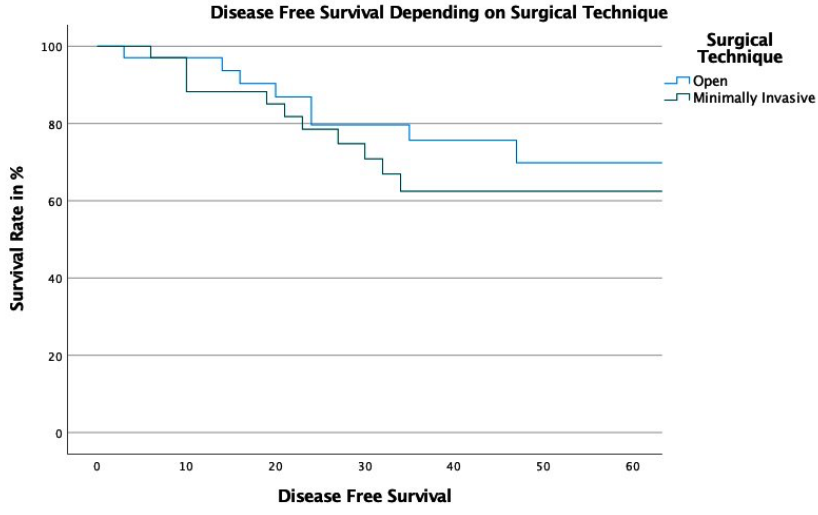

Chart 3. Disease-free survival depending on the surgical technique

Discussion

The surgical treatment of T4 colon cancer is challenging, regardless of whether the MIS or OP technique is deployed. Surgery for T4 colon cancer includes the en bloc resection of adjacent infiltrated structures. Surgeons with limited experience benefit from guidelines,[26] whereas more experienced colorectal surgeons have less trouble in decision-making during patient selection and changing the preoperative surgical strategy. Therefore, the practices of more experienced surgeons, such as those in this study, may deviate from the guideline-suggested paths. As a result, even though guidelines determine approximately similar clinical strategies, the approach can vary among different centers.

The crucial factor for conversion to OP is the degree of invasion into adjacent structures. Although there is no definitive written rule, its presence helps discriminate T4a tumor from T4b and is approached differently. Unfortunately, according to Feinberg et al.[27], the preoperative distinction between T3 and T4a tumors is complex, which makes the decision-making process of finding the optimal surgical strategy challenging.

Conversion to OP causes undesirable consequences. Conversion from MIS to OP methods offers several advantages, but it also carries the potential risk of conversion when opting for the laparoscopic method. Hence, we incorporated and examined these patients in the MIS group utilizing the intention-to-treat principle. Also, as stated by Klaver et al.[28], high conversion rates create a risk of disturbing outcomes in the case of intention-to-treat analysis, which was not the case in our sample. The conversion rate was 8.2%, which is in accordance with rates presented in the literature, which range from 7.6% to 18% (Liu et al.[29] 10.7%, Chan and Tan[30] 8.6%, Bretagnol and Leroy[31] 18%, Kang et al.[32] 7.6%, Kim et al.[33] 13.7%, COLOR Trial Group[34] 17%). Despite being in the normal range of the literature, the conversion rate is close to the lower border due to the high-level experience of our surgeons and surgical team and being a high-volume center. Preoperative preparation for conversion can be essential in the practice of MIS resection of T4 tumors. Informing operation room staff about possible conversion before the onset of surgery in cases with a higher risk of conversion is beneficial as it allows adequate surgical instrument preparation. In patients with a high risk of conversion, we routinely prepare to keep the surgical instruments for OP ready in the operating theatre during MIS, enabling prompt intervention in the case of an emergency.

Achieving high R0 resection rates is crucial in oncologic surgery, particularly for patients with T4 colorectal cancer, because R0 resection is considered one of the most critical factors affecting long-term survival.[35-38] In this study, the R0 resection rate was 100%, and the harvested lymph node number was ≥12, as suggested for appropriate staging in both the MIS and OP cases. These results are a measure of our surgical experience and our success in managing patients with colorectal cancer. Analyses of the intraoperative frozen section of all patients in our routine clinical practice are among the most critical factors in achieving a high R0 resection rate.

As a result of smaller incisions, laparoscopic surgery offers faster recovery and early mobilization, preventing complications of immobility, without any significant drawbacks. A shorter hospital stay is more comfortable for patients and may also decrease hospital-related complications. In this study, although the MIS group exhibited a shorter length of hospital stay compared with the OP group in patients with T4 colon tumors, the difference was not statistically significant after matching.

The distance from the vascular tie to the tumor epicenter is one of the parameters that can help to measure the quality of complete mesocolic excision.[39-44] This distance was found to be greater in the MIS group than in the OP group, without reaching statistical significance. This may indicate the quality of the MIS approach in reaching complete mesocolic excision, which is a crucial part of current oncologic colon surgery.

After MIS resection of T4 colon tumors, we found the 5-year OS and DFS rates to be 85% and 62.5%, respectively. This is in accordance with the data in the literature, where the 5-year OS and DFS rates range from 44.6% to 77.2% and 39.4% to 63.5%, respectively.[20,35,45,46] Our patients' survival rates are close to the upper limits presented in the literature, which demonstrates the high quality of care in our center. According to our study, MIS has comparable long-term oncologic outcomes and does not increase morbidity and mortality. As pivotal elements in evaluating the oncological outcome, OS and DFS are essential parameters. Our results show that MIS offers 5-year OS and DFS rates that are comparable with OP.

Study Limitations

Our study has some limitations. First, it is conducted in a single institution. Second, it is a retrospective study, and there is a lack of randomization in the selection procedure because of its retrospective nature. When extracting messages, we focused on the applicability of the MIS to patients with T4 colon cancer.

Conclusion

This study demonstrated that if the tumor's en bloc resection can be achieved, MIS should not be accepted as an absolute contraindication in T4 colon cancers, with its advantages of achieving oncologically acceptable results. The decision should be made individually based on patient characteristics and surgeons' experience.

Ethics

Ethics Committee Approval: This study was approved by Koç University Institutional Board of Review (approval code: 2020.491.IRB1.181, date: 04.03.2021).

Informed Consent: All participants agreed to a written informed consent before their participation.

Authorship Contributions

Surgical and Medical Practices: İ.H.Ö., D.S.U., İ.F.A., S.Z., D.B., E.B., Concept: İ.H.Ö., E.B., E.Ö., A.R., D.B., E.B., Design: İ.H.Ö., E.B., E.Ö., A.R., D.B., E.B., Data Collection or Processing: S.N.K., A.D.K., S.S., M.Y., E.Ö., D.S.U., İ.F.A., S.Z., Analysis or Interpretation: İ.H.Ö., S.N.K., A.D.K., S.S., M.Y., E.B., E.Ö., D.S.U., İ.F.A., S.Z., A.R., Literature Search: İ.H.Ö., S.N.K., A.D.K., M.Y., Writing: İ.H.Ö., S.N.K., A.D.K., S.S., M.Y., E.B., E.Ö., D.S.U., İ.F.A., S.Z., A.R., D.B., E.B.

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CASE REPORT

A Combination of Dilatation and Stenting for Treatment of Anal Stricture: A Case Report

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ABSTRACT

Intersphincteric resection (ISR) was introduced recently as an alternative procedure for abdominoperineal resection and sparing the anal sphincter. Anastomosis stricture is a common complication after ISR. In this study, we attempted to maintain the dilatation longer using a stent in combination with dilatation during a single session on a patient who was suffering from anal stricture after an ISR procedure. Six weeks following neoadjuvant chemo-radiotherapy, a 52-year-old woman underwent ISR. She presented to the hospital with a rectal adenocarcinoma at a 3 cm distance from the anal verge. A complete diverting tube ileostomy was performed as a protective stoma instead of a conventional loop ileostomy. The patient reported hard defecation at 6 weeks after surgery. A severe anastomosis stricture was detected during the digital rectal exam. Dilatation was performed under general anesthesia. The lumen was dilated up to 1.5 cm with Hegar dilators, and colonic mucosa were confirmed by a rigid rectoscope. A polyvinyl chloride soft tube with a length of 20 cm and a diameter of 17 mm was used as a stent to maintain the dilatation. Instead of dilatation alone, we combined dilatation with a convenient anal stent. The patient was discharged on the postoperative third day. During the 2 weeks of follow up with the tube, the patient did not report any challenges in terms of mobilization and lifestyle. There was no bleeding. However, tenesmus was described during this 2-week period by the patient. After the removal of the tube on the fourteenth day, the stricture was resolved and defecation was within normal. After a follow-up period of 2 months, there were no reported problems regarding defecation. This treatment modality could be recommended as a first-line treatment instead of surgical revision procedures (e.g., flap or stricturoplasty) in the future because it is a minimally invasive procedure.

Keywords: Dilatation, intersphincteric resection, rectal cancer, stricture

Introduction

Surgery is still considered the main treatment for lower rectal cancer. Abdominoperineal resection is a common surgical procedure for these patients.[1] Intersphincteric resection (ISR) is a recently introduced alternative procedure for sparing the anal sphincter.[2] However, functional problems and postoperative complications have been reported with this approach; anastomosis stricture is a common complication after ISR.[3] Although Hegar dilatation of the stricture is the most common procedure used, recurrence rates are still high.[4] Therefore, we thought about an additional approach to maintain the dilatation longer.

In this study, a case of anal stricture after ISR, which was treated with a combination of dilatation and stenting, is introduced and discussed.

Case Report

A 52-year-old woman with a body mass index of 29.10 kg/m^2 presented to the hospital with positive fecal occult blood testing and no other complaints. A colonoscopy showed a tumor at a 3 cm distance from the anal verge. Histopathological evaluations revealed a diagnosis of rectal adenocarcinoma. Preoperative staging showed no distant metastasis. Pelvic magnetic resonance imaging showed a T3 tumor without perirectal lymph node involvement. The patient had a reported history of hypertension.

Six weeks after neoadjuvant chemo-radiotherapy, she underwent ISR. After ISR was completed, a handsewn coloanal anastomosis with separated silk sutures was performed using a Lone Star retractor. A complete diverting tube ileostomy was performed as a protective stoma instead of a conventional loop ileostomy. Oral feeding was started on the first postoperative

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day. The tube ileostomy was removed at 2 weeks postop. Normal defecation occurred after the tube removal. The patient was discharged on the tenth day after surgery. Definitive pathological results showed distal rectal adenocancer (stage T2N1b).

The patient reported hard defecation 6 weeks following the surgery. A severe anastomosis stricture was detected during a digital rectal exam. The patient signed the informed consent form for the planned surgery. Dilatation was performed under general anesthesia, using Hegar dilators. After appropriate dilatation, a rigid rectosigmodoscope was inserted through the anus. Interestingly, there was no bowel mucosa and there was a huge pouch without luminal connection. We inserted a thin dilator (diameter: 3 mm) in different directions through the anus to find the colonic orifice; it was found at the lateral wall of the pouch (Figure 1).

The lumen was dilated up to 1.5 cm with Hegar dilators, and colonic mucosa was confirmed by the rigid rectoscope. A polyvinyl chloride (PVC) soft tube with a length of 20 cm and a diameter of 17 mm was used as a stent for maintaining the dilatation. The tube (stent) was configured as shown in Figure 2. To prevent migration of the stent, the distal part of the stent was prepared as shown in Figure 3, allowing for fixture to the skin without disturbing the patient's movement and position (i.e., sitting). The stent was fixed to the skin using #0 silk sutures.

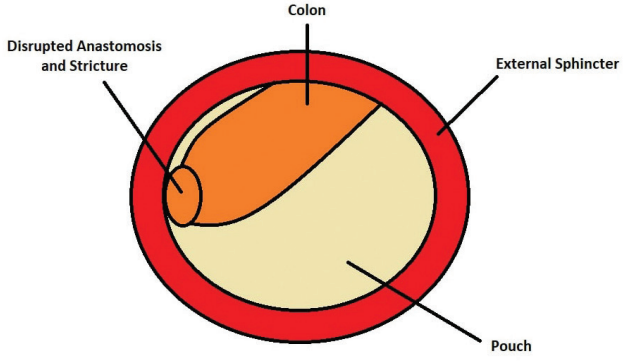

Figure 1. Schematization of Stricture

Figure 2. The Stent

Oral feeding began on postoperative day 1, and defecation through the tube occurred on postoperative day 2. The patient was discharged on the third day following surgery. During the 2 weeks of follow up, the patient did not report any challenges in terms of mobilization and lifestyle. There was no bleeding. However, tenesmus was described before removing the stent. After removal of the tube, the stricture was resolved, and the patient's defecation was normal. Since the patient rejected a colostomy, the only option was stricturoplasty. However, this was not suitable because it could interrupt the planned chemotherapy. Therefore, we thought of another minimally invasive solution, and the patient was very satisfied with the outcome of the procedure. The pouch was significantly smaller than before. After a follow-up period of 10 months, no problems regarding defecation were reported, and the pouch disappeared.

Discussion

The most common complications of ISR are the following: anastomotic leakage, stricture, fistula, pelvic sepsis, wound complications, bleeding, bowel obstruction, and mucosal prolapse. According to the literature, the stricture rate after ISR can be up to 16%.[5] It is also known that ISR is an independent risk factor for the development of stricture.[6]

The current treatments of stricture after ISR are dilatation via Hegar dilators, endoscopic balloons, and surgical procedures including flaps, stricturoplasty, or permanent ostomy.[7] Hegar dilatation may cause complications such as bowel perforation, anastomotic rupture, and perirectal abscess after dilation procedures, and further surgical intervention may be required[4] because the recurrence rate after dilatation is high within short periods. Therefore, in this study, we attempted to maintain the dilatation longer using a stent in combination with dilatation during a single surgery. The patient was receiving adjuvant chemotherapy, which made us hesitate to perform flap surgery. In addition, the patient refused a colostomy. As such, our options were limited.

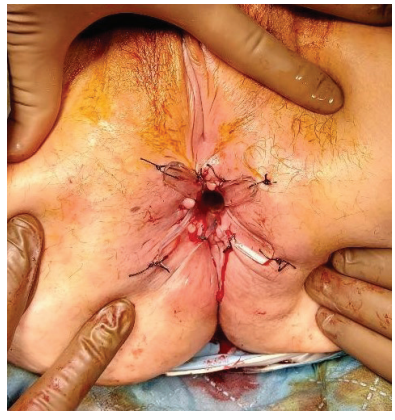

Figure 3. The Placement of the Stent

To the best of our knowledge, this is the first time this type of anal stricture management has been reported; instead of dilatation alone, we combined dilatation with a convenient anal stent. This treatment modality can be recommended as a first-line treatment instead of surgical revision procedures (e.g., flap or stricturoplasty) in the future since it is minimally invasive.

Stenting was not described for anal stricture in previous studies because it is uncomfortable and there is a high risk of migration. However, in this case, we used a flexible and convenient PVC stent which would be a good solution for both migration and discomfort. The promising results of this minimally invasive approach may lead to it becoming a first-line treatment for anal stricture in the future.

Further prospective randomized studies with a large number of patients and longer follow-up times are needed to evaluate the efficacy of this approach for anal stricture treatment.

Conclusion

Using a convenient anal stent in combination with dilatation gave a good result for the treatment of anal stricture. This minimally invasive procedure may become a first-line treatment for anal stricture in the future.

Ethics

Informed Consent: The patient signed the informed consent form for the planned surgery.

Authorship Contributions

Surgical and Medical Practices: Ö.F.İ., W.A., Concept: Ö.F.İ., W.A., Design: Ö.F.İ., W.A., Data Collection or Processing: Ö.F.İ., W.A., Analysis or Interpretation: Ö.F.İ., W.A., Literature Search: Ö.F.İ., W.A., Writing: Ö.F.İ., W.A.

Conflict of Interest: No conflict of interest was declared by the authors.

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VIDEO ARTICLE

Stapled Hemorrhoidopexy for the Treatment of Hemorrhoidal Disease: A Video Vignette

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ABSTRACT

Hemorrhoidal disease is a common proctologic disease characterized by enlarged, inflamed, thrombosed, or prolapsed hemorrhoids, with symptoms including pain and rectal bleeding. This video presents a 28-year-old female patient with a grade 3-4 hemorrhoidal disease who underwent stapled hemorrhoidopexy using the prolapse and hemorrhoids system.

Keywords: Hemorrhoids, proctology, surgery

Introduction

Stapled hemorrhoidopexy is an efficient surgical procedure for hemorrhoidal diseases, particularly with mucosal prolapse.[1] This technique reduces the length of hospital stays and may have an advantage in terms of decreased operating times, reduced post-operative pain, and less bleeding; however, it is associated with an increased rate of recurrent prolapses.[2-4] Almost all the recurrence cases are related to technical failures. This video aims to show the detailed technique steps of the stapled hemorrhoidopexy to prevent future complications during this procedure.

The procedure for prolapse and hemorrhoids was introduced in 1993 as a novel treatment for hemorrhoidal disease and was originally described as rectal mucosectomy. The procedure's creator, Antonio Longo, described this surgery as an excision of a rectal internal mucosal prolapse.[5]

Case Report

This video introduces a case of a 28-year-old woman who had hemorrhoids. The patient had complaints of anal swelling, soiling, and bleeding. The physical examination revealed grade 3-4 hemorrhoidal disease. Her obstructed defecation score was 5, and a grade 1 rectocele was identified during a pelvic floor examination. No other issues were found during the rectosigmoidoscopy. A stapled hemorrhoidopexy procedure was performed, and the patient was discharged on postoperative day one and received recommendations for daily wound care. The postoperative visual analog scale scores were 1, 0, 0, and 0 on the first day, first week, first month, and third month, respectively. No recurrence was observed during the 3-month postoperative follow-up.

Ethics

Authorship Contributions

Surgical and Medical Practices: R.K., S.L., Concept: R.K., S.Ö., S.L., Design: R.K., Data Collection or Processing: S.Ö., Analysis or Interpretation: C.Ş., Literature Search: C.Ş., Writing: C.Ş.

Conflict of Interest: No conflict of interest was declared by the authors.

Video 1.
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