ORIGINAL CONTRIBUTION

Functional Outcomes After Rectal Resection for Deep Infiltrating Pelvic Endometriosis: Long-term Results

Suna Erdem[1] • Sara Imboden, M.D.[2] • Andrea Papadia, M.D., Ph.D.[2]
Susanne Lanz, M.D.[2] • Michael D. Mueller, M.D.[2] • Beat Gloor, M.D.[1]
Mathias Worni, M.D., M.H.S.[1]

1 Department of Visceral Surgery and Medicine, Inselspital, Bern University Hospital Bern, University of Bern, Switzerland
2 Department of Gynecology and Obstetrics, Inselspital, Bern University Hospital, University of Bern, Switzerland

BACKGROUND: Curative management of deep infiltrating endometriosis requires complete removal of all endometriotic implants. Surgical approach to rectal involvement has become a topic of debate given potential postoperative bowel dysfunction and complications.

OBJECTIVE: This study aims to assess long-term postoperative evacuation and incontinence outcomes after laparoscopic segmental rectal resection for deep infiltrating endometriosis involving the rectal wall.

DESIGN: This is a retrospective study of prospectively collected data.

SETTINGS: This single-center study was conducted at the University Hospital of Bern, Switzerland.

PATIENTS: Patients with deep infiltrating endometriosis involving the rectum undergoing rectal resection from June 2002 to May 2011 with at least 24 months follow-up were included.

MAIN OUTCOME MEASURES: Aside from endometriosis-related symptoms, detailed symptoms on evacuation (points: 0 (best) to 21 (worst)) and incontinence (0–24) were evaluated by using a standardized questionnaire before and at least 24 months after surgery.

RESULTS: Of 66 women who underwent rectal resection, 51 were available for analyses with a median follow-up period of 86 months (range: 26–168). Forty-eight patients (94%) underwent laparoscopic resection (4% converted, 2% primary open), with end-to-end anastomosis in 41 patients (82%). Two patients (4%) had an anastomotic insufficiency; 1 case was complicated by rectovaginal fistula. Dysmenorrhea, nonmenstrual pain, and dyspareunia substantially improved ($p < 0.001$ for all comparisons). Overall evacuation score increased from a median of 0 (range: 0–11) to 2 points (0–15), $p = 0.002$. Overall incontinence also increased from 0 (range: 0–9) to 2 points (0–9), $p = 0.003$.

LIMITATIONS: This study was limited by its retrospective nature and moderate number of patients.

CONCLUSIONS: Laparoscopic segmental rectal resection for the treatment of deep infiltrating endometriosis including the rectal wall is associated with good results in endometriotic-related symptoms, although patients should be informed about possible postoperative impairments in evacuation and incontinence. However, its clinical impact does not outweigh the benefit that can be achieved through this approach. See **Video Abstract** at http://links.lww.com/DCR/A547.

KEY WORDS: Endometriosis; Dysmenorrhea; Evacuation; Incontinence; Laparoscopy; Rectal resection.

Endometriosis is a widespread disease characterized by the presence of endometrial gland and stroma outside the uterus, affecting up to 10% to 15% of

Supplemental digital content is available for this article. Direct URL citations appears in the printed text, and links to the digital files are povided in the HTML and PDF versions of the arcticle on the journal's Web site (www.dcrjournal.com).

Support/Funding: None reported.

Financial Disclosures: None reported.

Presented at the meeting of the Swiss Surgical Society, Bern, Switzerland, May 31 to June 2, 2017.

Correspondence: Beat Gloor, M.D., Department of Visceral Surgery and Medicine, Inselspital, Bern University Hospital, University of Bern, Freiburgstrasse, CH-3010 Bern, Switzerland. E-mail: beat.gloor@insel.ch

Dis Colon Rectum 2018; 61: 00–00
DOI: 10.1097/DCR.0000000000001047
© The ASCRS 2018

Copyright © The American Society of Colon & Rectal Surgeons, Inc. Unauthorized reproduction of this article is prohibited.

women of reproductive age.[1] Symptoms are most often related to menstruation-associated pelvic pain and infertility, which occurs in about two-thirds of affected women.[2] Deep infiltrating endometriosis is defined as a penetration of endometriotic implants >5 mm under the peritoneal surface.[3] Such implants are commonly found in the uterosacral ligaments, rectovaginal septum, or bowel wall and are often responsible for patient symptoms, such as for dyspareunia, dysmenorrhea, pain during defecation, or rectal bleeding during menstruation.[4,5]

The involvement of the rectum or rectosigmoid junction signifies a severe form of deep infiltrating endometriosis affecting 5.3% to 12% of women with endometriosis.[1] Only a minority of those patients is asymptomatic, whereas the others often experience abdominal bloating, constipation, intestinal cramping, hematochezia, or painful bowel movements. Those symptoms are often associated with a significant reduction in quality of life.[6–8] Treatment of patients with deep infiltrating endometriosis who are symptomatic or trying to conceive is difficult and challenging, but always involves an attempt to achieve complete resection.[9] The traditional approach to attempt complete resection is to perform a segmental colorectal resection of the affected area, whereas newer techniques include shaving off the affected area or performing disc excisions.[10] However, lasting symptom relief and recurrence control appear to be improved among patients undergoing rectal resection, in comparison with the more conservative surgical approach.[11–13] However, more conservative surgery leads to better digestive functional outcomes and a reduction in early postoperative complications.

Although the recurrence rate might be lower, the potential downside of segmental rectal resection is the possibility of bowel dysfunction and an increase in early postoperative complications.[6,9] These symptoms are well described among patients undergoing formal rectal resections with total mesorectal excision, for example, for rectal cancer,[14,15] and include increased stool frequency, bowel fragmentation, fecal urgency, as well as incontinence, all of which have a significant negative impact on quality of life.

However, the impact of rectal resection for deep infiltrating endometriosis on postoperative bowel dysfunction is not clearly defined. In 2013, Roman et al published data for apparently better functional outcomes in women with rectal endometriosis who underwent conservative surgical therapy (rectal shaving or disc excision) in comparison with the population after colorectal resection, but only a few studies evaluated postoperative bowel dysfunction and impact on quality of life by using a standardized questionnaire.[9,16–18]

Therefore, the primary aim of this observational study was to assess, in detail, long-term postoperative defecation outcomes after complete removal of all endometriotic implants including segmental rectal resection. Second, endometriosis-associated gynecological symptoms were assessed to ensure that the primary aim of the surgery was achieved.

METHODS

Ethical approval was obtained from the University of Bern Ethics Commission of the Canton of Bern. All patients enrolled in the study were treated with segmental rectal resection for deep infiltrating rectovaginal endometriosis in the Department of Gynecology and Obstetrics, University Hospital of Bern, Switzerland, from June 2002 to May 2011.

Preoperatively, all patients were examined by pelvic examination and transvaginal ultrasound. In unclear cases, a preoperative MRI was performed to further characterize disease spread. All patients with suspected deep infiltrating endometriosis with potential rectal involvement were preoperatively informed about a possible rectal resection. However, the definitive decision to perform a rectal resection was made intraoperatively on the basis of interdisciplinary discussion.

Baseline information on the patients was collected in a prospectively maintained database. Patient characteristics included age, previous surgery or medical treatment for endometriosis, infertility, gestation, parity, and revised American Fertility Society score. Surgical characteristics included the technique used (laparoscopic, converted, primary open), level of anastomosis from the anal verge, type of anastomosis (end-to-end, side-to-end), operation time, blood loss, simultaneous surgery, and postoperative complications.

To assess bowel function in detail, we used a questionnaire published by Hallböök (see Supplementary Tables 1 and 2, http://links.lww.com/DCR/A632 and http://links.lww.com/DCR/A633).[19] This questionnaire focuses on 2 important aspects of defecation, evacuation, and incontinence symptoms. The evacuation score is based on 7 questions; for each question, there are 0 to 3 points to allocate (total of 0 is the best score, a total of 21 points is the worst). In analogy, the incontinence score is based on 8 questions with identical point distributions possible. Long-term follow-up was performed at least 24 months after surgery by a telephone interview performed by 2 researchers (S.E., M.W.). In addition, patients were asked whether they had pain during defecation, felt constipated, had incomplete emptying of the bladder, and/or had urge or stress incontinence. In analogy to the former questions, they were graded from 0 (best) to 3 (worst). To assess specific endometriosis-related symptoms, patients were also questioned on a 4-point scale about dysmenorrhea, nonmenstrual pelvic pain, and dyspareunia.

Copyright © The American Society of Colon & Rectal Surgeons, Inc. Unauthorized reproduction of this article is prohibited.

Description of Surgical Technique

All patients were operated on in an interdisciplinary setting by a gynecologist and a colorectal surgeon. All patients underwent preoperative mechanical bowel preparation. Pneumoperitoneum was established with carbon dioxide (CO_2) at the level of the umbilicus, using an open technique and a 12-mm trocar. Three additional trocars, a 12-mm trocar suprapubic in the midline and two 5-mm trocars in the left and right iliac fossa, were put in place under visual control. After exploration of the pelvic cavity and excision of all visible endometriotic implants, the rectum was mobilized. The dorsal vagina was opened under digital control and then the endometriotic lesion was removed first from the vagina and then from the rectovaginal septum. At this point, the endometriotic lesion was still adherent only to the ventral rectum wall, and here the decision for need and the extent of rectal resection was made. Rectal mobilization was done preserving the mesorectum. Careful dissection was performed to avoid injury to any of the pelvic autonomic nerves. The mesorectum and rectum were transected approximately 1 cm distal of the endometriotic implant by using an ultrasound dissector and Endo-GIA. The suprapubic incision was enlarged to 4 to 6 cm to allow bowel exteriorization. The resection was limited to the infiltrated segment with a safety distance of 1 to 2 cm. Transection was done with scissors allowing for clear visibility of bowel perfusion. The large bowel was closed by creating a purse for the anvil. The end of the large bowel was placed back in the pelvic cavity and the suprapubic abdominal incision was closed. Using a curved intraluminal stapler (diameter of 29 or 33 mm) introduced rectally, rectal anastomosis was created under laparoscopic control. All anastomoses were tested intraoperatively with air. The creation of a protective loop ileostomy was at the discretion of the colorectal surgeon and was mainly advocated for anastomosis ≤5 cm from the anal verge.

Statistical Analysis

Given matched outcomes data, statistical analyses were performed using the nonparametric Wilcoxon signed-rank test. Subgroup analyses were performed by splitting the patient cohort according to the median distance of the anastomosis from the anal verge (7 cm). In addition, subgroup analyses regarding evacuation and incontinence were performed according to the length of follow-up; patients were grouped into long (≤7 years) and very long follow-up (>7 years). Statistical significance level was set at $p < 0.05$. All analyses were conducted using STATA/SE version 11.2 (Stata Corporation, College Station, TX).

RESULTS

During the study period, 213 women were surgically treated at our institution for endometriosis located in the rectovaginal septum. The focus for this study is on a total of 66 women who underwent colorectal resection with rectal anastomosis for deep infiltrating endometriosis from June 2002 to May 2011. Of those patients, median age was 33 years (range: 24–46) (Table 1). Given that 15 patients were lost to follow-up, only 51 patients were available for long-term follow-up. Among those, the median age was 32 years (range: 24–46). A large proportion of those patients had a history of surgical (75%) or medical (63%) endometriosis

TABLE 1. Patient, surgical, and postoperative information

Characteristics	*Patients treated, n (%)*	*Patients with long-term follow-up, n (%)*
Patients	66 (100)	51 (100)
Median age, y (range)	33 (24–46)	32 (24–46)
Previous surgery for endometriosis	46 (70)	38 (75)
Previous medical treatment for endometriosis	41 (62)	32 (63)
Gestation	11 (17)	10 (20)
Parity	7 (11)	6 (12)
rAFS score[a] IVa	55[a] (83)	43 (84)
Technique		
Laparoscopy	63 (95)	48 (94)
Conversion	2 (3)	2 (4)
Primary laparotomy	1 (2)	1 (2)
Level of anastomosis		
At or below 7 cm from anal verge	40 (61)	29 (57)
Above 7 cm from anal verge/	26 (39)	22 (43)
Median distance from anus, cm (range)	7 (3–18)	7 (3–18)
End–end anastomosis	56 (85)	42 (82)
Side–end anastomosis	9 (14)	9 (18)
Operation time, min, median (range)	309 (160–480)	300 (180–480)
Median estimated blood loss, mL (range)	280 (50–1500)	200 (50–1000)
Complications		
Anastomotic insufficiency	2	2
Anastomotic stenosis[b]	1	1
Rectovaginal fistula	1	1
Transient urinary retention	2	1
Ureter lesion	1	1
Superficial wound infection	1	1
Abscess in the urogenital tract	1	1
Mortality	0	0
Additional surgery		
Salpingo-oophorectomy	11	10
Ureterolysis	26	21
Ureteroneocystostomy	1	1
Peritoneal excision of endometriotic implants	45	33
Resection of dorsal part of the vagina	6	5
Protective Ileostomy	7	7
Median follow-up, n (range)	N/A	86 (26–168)

rAFS = revised American Fertility Society.
[a]Eleven patients total had endometriosis stage rAFS score III.
[b]Treated by single endoscopic dilation.

Copyright © The American Society of Colon & Rectal Surgeons, Inc. Unauthorized reproduction of this article is prohibited.

TABLE 2. Overall evacuation and incontinence score (n = 51)

	Evacuation Score			*Incontinence Score*		
Characteristics	*Preoperative*	*Follow-up*	*p value*	*Preoperative*	*Follow-up*	*p value*
All patients						
Median (range)	0 (0–11)	2 (0–15)	0.002	0 (0–9)	2 (0–9)	0.003
Mean (SD)	1.7 (3.0)	3.4 (3.8)		1.3 (2.0)	2.1 (2.3)	
Anastomotic height						
≤7 cm (n = 29)						
Median (range)	0 (0–11)	2 (0–15)	0.02	1 (0–5)	1 (0–5)	0.1
Mean (SD)	2.1 (3.3)	3.7 (4.2)		1.0 (1.5)	1.5 (1.4)	
>7 cm (n = 22)						
Median (range)	0 (0–11)	1.5 (0–11)	0.03	0 (0–9)	2 (0–9)	0.008
Mean (SD)	1.1 (2.5)	2.9 (3.1)		1.6 (2.6)	3.0 (3.0)	

treatment (Table 1). Surgical pretreatment mainly consisted of laparoscopic resection of visible peritoneal implants, whereas no patient underwent prior small-bowel, colon, or rectal resection. During clinical workup, all patients underwent careful gynecological examination including endovaginal ultrasound to assess the extent of endometriosis, whereas 7 patients (13.7%) had an MRI, in addition, for unclear findings. Magnetic resonance imaging confirmed deep infiltrating endometriosis in all 7 patients; a rectal wall infiltration was suspected and documented in 4. Most patients were surgically treated by laparoscopy (n = 48, 94%); 2 patients (4%) had to be converted to open surgery because of uncontrollable intraoperative bleeding unrelated to rectal resection; and in 1 patient, an open surgical procedure was performed because of expected extensive adhesions based on prior open abdominal surgery. Two patients experienced major postoperative complications. Both patients had an anastomotic insufficiency treated with drainage and loop ileostomy creation; after verification of healing of the anastomotic insufficiency in 1 patient, the ileostomy was taken down without any further problems. The second anastomotic insufficiency was further complicated by a rectovaginal fistula after ileostomy closure. Reoperative surgery consisted in creation of a new loop ileostomy. During the same intervention, the rectovaginal fistula was closed by direct suture and interposition of an omental patch. After confirmation of proper healing, the ileostomy was closed without further complications. All patients had complete removal of all visible implants during surgery. Histology proved an involvement of the muscular and submucosal layer of the rectal wall in all patients. The maximal diameter of the intramural endometriotic lesion was 0.2 to 1 cm (median: 8mm). However, this only describes the part of the endometriotic lesion in the wall and not the whole size of the lesion, because all patients had significant perifocal fibrosis leading to macroscopically larger lesions in the rectal wall. Five patients (9.8%) had a protective loop ileostomy because of the low level of the anastomosis (all ≤5cm), whereas, in 2 patients, a loop ileostomy was created given a postoperative complication of an anastomotic insufficiency as described above. All ileostomies were successfully reversed during the first 3 months postoperatively. During follow-up, 3 patients had a recurrence in the septum rectovaginale, and 1 patient needed a re-resection, however, of the small intestine.

Composite Evacuation and Incontinence Score

After a median follow-up of 86 months (range: 26–168), the composite evacuation score increased from a median of 0 (range: 0–11) to 2 (range: 0–15), $p = 0.002$ (Table 2). The increase in overall evacuation score is based mainly on an increase in medication used to evacuate, difficulties to empty, the need to return to evacuate, feelings of incomplete emptying, and time needed to evacuate ($p < 0.05$ for all variables) (Table 3). The composite incontinence score also increased from a median of 0 (range: 0–9) to 2 (range: 0–9), $p = 0.003$. Here, warning before passing motion and the ability to defer evacuation were mainly responsible for this change ($p < 0.05$ for both variables) (Table 4).

Gynecological Symptoms

After long-term follow-up, 35 patients (68.6%) were free of dysmenorrhea, whereas 16 patients (31.4%) reported persistent mild symptoms ($p < 0.001$) (Figure 1A). Similar results were found for nonmenstrual pain; 36 patients (70.6 %) experienced nonmenstrual pain before surgery, whereas 37 patients (68.6%) did not report any nonmenstrual pain during long-term follow-up ($p < 0.001$) (Figure 1B). In addition, pain during sexual intercourse lessened. Although 32 patients (62.8%) experienced dyspareunia before surgery, only 16 patients (31.4%) reported dyspareunia during long-term follow-up ($p < 0.001$) (Figure 1C).

Subgroup Analyses by Height of Anastomosis/Length of Follow-up

All analyses were repeated for the subgroup of patients with an anastomosis at or below 7 cm (n = 29, 57%), mea-

Copyright © The American Society of Colon & Rectal Surgeons, Inc. Unauthorized reproduction of this article is prohibited.

TABLE 3. Composite evacuation score

	Overall			*≤7 cm*			*>7 cm*		
Variables	*Preop*	*F/U*	*p value*	*Preop*	*F/U*	*p value*	*Preop*	*F/U*	*p value*
Medication to evacuate (enemas or suppositories)									
Never (0)	46 (90.2)	35 (68.6)	0.007	27 (93.1)	20 (69.0)	0.01	19 (86.4)	15 (68.2)	0.28
Less than once weekly (1)	4 (7.8)	10 (19.6)		2 (6.9)	4 (13.8)		2 (9.1)	6 (27.3)	
1–6 times weekly (2)	0	3 (5.9)		0	3 (10.3)		0	0	
Every day (3)	1 (2.0)	3 (5.9)		0	2 (6.9)		1 (4.6)	1 (4.6)	
Difficulties to empty									
Never (0)	40 (78.4)	29 (56.9)	0.03	20 (69.0)	14 (48.3)	0.22	20 (90.9)	15 (68.2)	0.05
Less than once weekly (1)	4 (7.8)	12(23.5)		2 (6.9)	8 (27.6)		2 (9.1)	4 (18.2)	
1–6 times weekly (2)	4 (7.8)	7 (13.7)		4 (13.8)	4 (13.8)		0	3 (13.6)	
Every day (3)	3 (5.9)	3 (5.9)		3 (10.3)	3 (10.3)		0	0	
Digitation to evacuate									
Never (0)	51 (100)	49 (96.1)	0.16	29 (100)	27 (93.1)	0.16	22 (100)	22 (100)	1
Less than once weekly (1)	0	2 (3.9)		0	2 (6.9)		0	0	
1–6 times weekly (2)	0	0		0	0		0	0	
Every day (3)	0	0		0	0		0	0	
Return to evacuate									
Never (0)	44(86.3)	33 (64.7)	0.02	24 (82.8)	18 (62.1)	0.10	20(90.9)	15(68.2)	0.08
Less than once weekly (1)	1 (2.0)	8 (15.7)		1 (3.5)	4 (13.8)		2 (9.1)	4 (18.2)	
1–6 times weekly (2)	2 (3.9)	7 (13.7)		2 (6.9)	5 (17.2)		0	2 (9.1)	
Every day (3)	4 (7.8)	3 (5.9)		2 (6.9)	2 (6.9)		0	1 (4.6)	
Feeling of incomplete emptying									
Never (0)	42 (82.4)	29 (56.9)	0.008	22 (75.9)	16 (55.2)	0.17	20 (90.9)	13 (59.1)	0.008
Less than once weekly (1)	3 (5.9)	11 (21.6)		2 (6.9)	6 (20.7)		1 (4.6)	5 (22.7)	
1–6 times weekly (2)	3 (5.9)	7 (13.7)		3 (10.3)	5 (17.2)		0	2 (9.1)	
Every day (3)	3 (5.9)	4 (7.8)		2 (6.9)	2 (6.9)		1 (4.6)	2 (9.1)	
Straining to evacuate									
<5 min (0)	42 (82.4)	37 (72.6)	0.23	22 (75.9)	20 (69.0)	0.40	20 (90.9)	17 (77.3)	0.39
5–10 min (1)	8 (15.7)	12 (23.5)		7 (24.1)	8 (27.6)		1 (4.6)	4 (18.2)	
10–20 min (2)	1 (2.0)	1 (2.0)		0	0		1 (4.6)	1 (4.6)	
>20 min (3)	0	1 (2.0)		0	1 (3.5)		0	0	
Time needed to evacuate									
<5 min (0)	40 (78.4)	34 (66.7)	0.04	21 (72.4)	19 (65.5)	0.45	19 (86.4)	15 (68.2)	0.03
5–10 min (1)	10 (19.6)	12 (23.5)		8 (27.6)	9 (31.0)		2 (9.1)	3 (13.6)	
10–20 min (2)	1 (2.0)	3 (5.9)		0	0		1 (4.6)	3 (13.6)	
>20 min (3)	0	2 (3.9)		0	1 (3.5)		0	1 (4.6)	

Values displayed are number of responses (%) to individual questions.
F/U = follow-up; Preop = preoperative.

sured from the anocutaneous line, or above 7 cm (n = 22, 43%). Composite evacuation score increased significantly for both subgroups during follow-up, whereas the incontinence score increased only significantly for patients with an anastomosis higher than 7 cm (Table 2). Details of the composite evacuation and incontinence score for the 2 subgroups can be found in Tables 3 and 4. For patients with low anastomoses, pain during defecation decreased, whereas urge incontinence increased significantly (Table 5). For anastomoses higher than 7 cm, constipation increased significantly. Additional subgroup analyses were performed to assess whether very long follow-up time (>7 years) would have a different outcome than patients with a long-term follow-up (≤7 years). Patients with long-term follow-up had an impairment of the median composite evacuation score from 1 to 3 ($p = 0.32$), whereas it was 0 to 1.5 ($p = 0.43$) for patients with a very long follow-up. Median composite incontinence score increased from 0 to 1 ($p = 0.17$) for patients with long-term follow-up, whereas it increased from 0 to 2 points ($p = 0.55$) for patients with very long follow-up.

DISCUSSION

This is an assessment of late postoperative bowel function after segmental rectal resection for deep infiltrating endometriosis. This observational study concludes that treatment of deep infiltrating endometriosis of the rectum, including segmental rectal resection, can be performed safely by using an interdisciplinary approach. Defecation and incontinence symptoms are nevertheless slightly impaired even during long-term follow-up. However, complete surgical excision of all endometriotic implants leads to a significant improvement in endometriosis-related symptoms, including dysmenorrhea, nonmenstrual pain, and dyspareunia. Dyspareunia was still reported by some

Copyright © The American Society of Colon & Rectal Surgeons, Inc. Unauthorized reproduction of this article is prohibited.

TABLE 4. Composite incontinence score

	Overall			≤7 cm			>7 cm		
Variables	*Preop*	*F/U*	*p value*	*Preop*	*F/U*	*p value*	*Preop*	*F/U*	*p value*
Warning before passing motion									
Always (0)	39 (76.5)	31 (60.8)	0.006	23 (79.3)	18 (62.1)	0.1	16 (72.7)	13 (59.1)	0.03
Often (1)	5 (9.8)	9 (17.7)		3 (10.3)	7 (24.1)		2 (9.1)	2 (9.1)	
Sometimes (2)	3 (5.9)	7 (13.7)		0	2 (6.9)		3 (13.6)	5 (22.7)	
Never (3)	4 (7.8)	4 (7.8)		3 (10.3)	2 (6.9)		1 (4.6)	2 (9.1)	
Ability to differentiate gas from feces									
Always (0)	41 (80.4)	39 (76.5)	0.48	23 (79.3)	23 (79.3)	0.96	18 (81.8)	16(72.7)	0.16
Often (1)	6 (11.8)	7 (13.7)		4 (13.8)	5 (17.2)		2 (9.1)	2 (9.1)	
Sometimes (2)	2 (3.9)	3 (5.9)		2 (6.9)	1 (3.5)		0	2 (9.1)	
Never (3)	2 (3.9)	2 (3.9)		0	0		2 (9.1)	2 (9.1)	
Ability to defer evacuation									
>30 min (0)	43 (84.3)	35 (68.6)	0.03	24 (82.8)	22 (75.9)	0.73	19 (86.4)	13 (59.1)	0.008
15 min (1)	4 (7.8)	7 (13.7)		3 (10.3)	6 (20.7)		1 (4.6)	1 (4.6)	
5 min (2)	1 (2.0)	7 (13.7)		1 (3.5)	1 (3.5)		0	6 (27.3)	
Never (3)	3 (5.9)	2 (3.9)		1 (3.5)	0		2 (9.1)	2 (9.1)	
Wearing a pad during the day									
Never (0)	50 (98.0)	48 (94.1)	0.16	29 (100)	28 (96.6)	0.32	21 (95.5)	20 (90.9)	0.32
Less than once weekly (1)	0	1 (2.0)		0	1 (3.5)		0	0	
1–6 times weekly (2)	0	1 (2.0)		0	0		0	1 (4.6)	
Every day (3)	1 (2.0)	1 (2.0)		0	0		1 (4.6)	1 (4.6)	
Wearing a pad at night									
Never (0)	50 (98.0)	48 (94.1)	0.16	29 (100)	28 (96.6)	0.32	21 (95.5)	20 (90.9)	0.32
Less than once weekly (1)	0	1 (2.0)		0	1 (3.5)		0	0	
1–6 times weekly (2)	0	1 (2.0)		0	0		0	1 (4.6)	
Every day (3)	1 (2.0)	1 (2.0)		0	0		1 (4.6)	1 (4.6)	
Incontinence for gas									
Never (0)	49 (96.1)	45 (88.2)	0.11	29 (100)	25 (86.2)	0.05	20 (90.9)	20 (90.9)	0.97
Less than once weekly (1)	1 (2.0)	5 (9.8)		0	3 (10.3)		1 (4.6)	2 (9.1)	
1–6 times weekly (2)	1 (2.0)	1 (2.0)		0	0		1 (4.6)	0	
Every day (3)	0	0		0	1 (3.5)		0	0	
Incontinence of loose stool									
Never (0)	48 (94.1)	45 (88.2)	0.08	27 (93.1)	25 (86.2)	0.16	21 (95.5)	20 (90.9)	0.32
Less than once weekly (1)	3 (5.9)	5 (9.8)		2 (6.9)	4 (13.8)		1 (4.6)	1 (4.6)	
1–6 times weekly (2)	0	1 (2.0)		0	0		0	1 (4.6)	
Every day (3)	0	0		0	0		0	0	
Incontinence of feces									
Never (0)	51 (100)	50 (98.0)	0.32	29 (100)	29 (100)	1.0	22 (100)	21 (95.5)	0.32
Less than once weekly (1)	0	1 (2.0)		0	0		0	1 (4.6)	
1–6 times weekly (2)	0	0		0	0		0	0	
Every day (3)	0	0		0	0		0	0	

Values displayed are number of responses (%) to individual questions.
F/U = follow-up; Preop = preoperative.

patients. However, the complaints were minor, and thus none of those patients underwent repeat diagnostic laparoscopy to exclude recurrent or persistent endometriosis given the multidimensional etiology of dyspareunia.

Deep infiltrating rectovaginal endometriosis significantly impacts the quality of life because of its association with chronic pelvic pain, dysmenorrhea, deep dyspareunia, and cyclic bowel alterations.[18] Many studies have demonstrated that a radical surgical removal of the endometriosis leads to improvement of the symptoms and also of quality of life.[20–22] However, postoperative complications and long-term bowel dysfunction can impair those positive results, and, therefore, knowing the expected effect of the chosen surgical technique is essential.[23–25]

The treatment of deep infiltrating rectovaginal endometriosis is still a matter of controversy, especially concerning the surgical technique.[26] Surgery is the primary treatment modality for symptomatic deep infiltrating endometriosis involving the rectum.[13]

Although medical treatment is generally effective for endometriosis-related pain, it is less so for deep infiltrating rectovaginal disease.[27] Careful assessment of symptoms, disease extent, and knowledge of the reproductive plans of the patient are necessary to select the appropriate treatment. As such, a specialized gynecological team in conjunction with surgeons experienced in laparoscopic colorectal surgery is best suited to manage the problem of endometriosis involving the rectum; this has also been

Copyright © The American Society of Colon & Rectal Surgeons, Inc. Unauthorized reproduction of this article is prohibited.

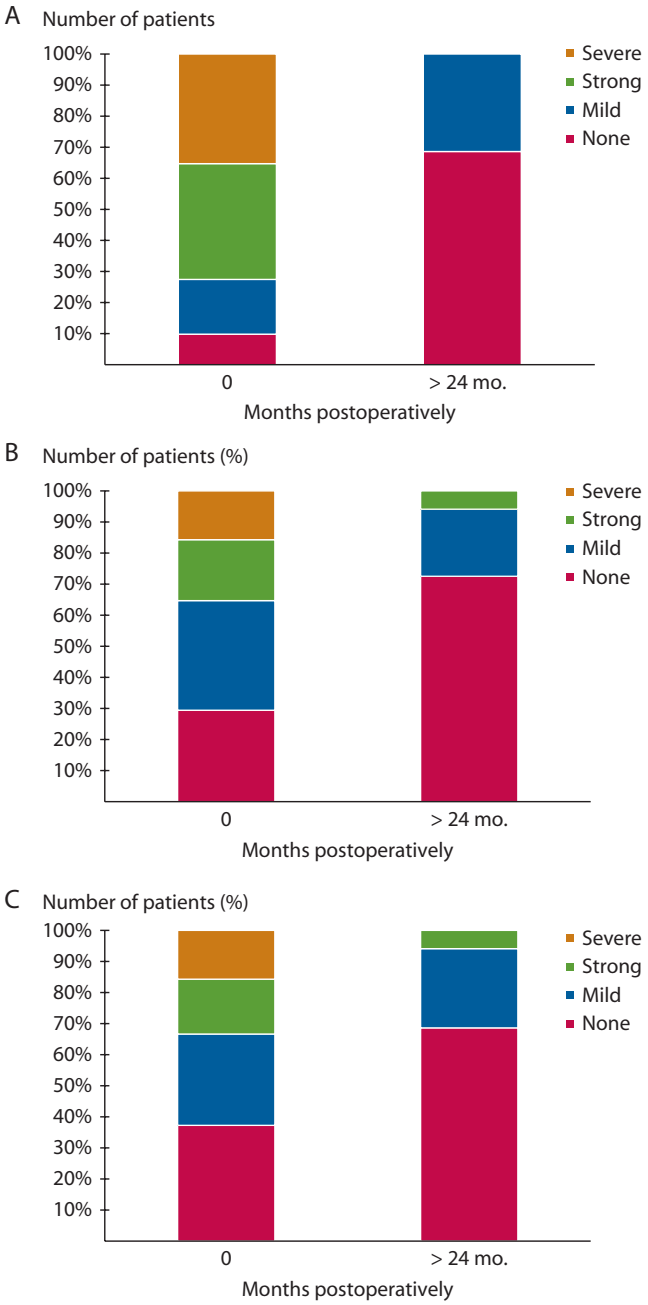

FIGURE 1. A, Pain during menstruation before and after operation. B, Nonmenstrual pain before and after operation. C, Pain during intercourse before and after operation.

advocated for by others.[28] Because of advances in laparoscopic techniques, including a so-called nerve-sparing technique, deep pelvic endometriosis can be managed laparoscopically, even when low anterior rectal resection is necessary.[13,28] The feasibility and safety of laparoscopy are supported by the low conversion and perioperative complication rate in this study. Because of the camera-associated magnification and better visualization of endometriotic implants, laparoscopic excision of endometriosis is our preferred technique. In 3 (4.5%) of our patients, conversion to an open or a primary open technique was necessary. This rate compares well to values between 12.7% and 13.7% reported for colorectal resections for both endometriosis and primary colorectal diseases.[6] Aside from functional impairment, rectal resection is also associated with postoperative morbidity.[28] One of the most feared complications after sphincter-preserving colorectal surgery, with a reported incidence of 2.5% to 23%, is anastomotic insufficiency and rectovaginal fistula; both are associated with a risk of long-term anastomotic-related complications.[15,29] An independent risk factor for the occurrence of anastomotic leaks after intestinal segmental resection is the colorectal anastomosis being less than 10 cm away from the anal verge.[30] Therefore, the recommendation in these cases is the consideration of a temporary protective ileostomy.[31] Overall, an anastomotic insufficiency rate of 3% (n = 2) and a fistula rate of 1.5% (n = 1) among our patient population is comparably low to previous studies with an incidence between 0% to 10% and 0% to 14%.[21,32]

Other surgical approaches to treat rectal endometriosis are disc excision or rectal shaving.[10] This kind of treatment can be done in minor involvement of the rectal wall, but in larger lesions it carries the risk of an incomplete resection. According to Remorgida et al,[33] the disc resection results in incomplete removal of the lesion in over 40% of patients. In our series, the pathology report confirmed an involvement of the rectal wall through the muscular and into the submucosal layer, indicating that a full-thickness resection was necessary and that no unnecessary rectal resections were performed. In a previous study from our group, we showed that positive margins at rectal surgery are an independent risk factor for the recurrence of disease.[13] However, no recurrence was observed on the stapled line, originating from colorectal foci. In fact, 3 patients had a recurrence in the septum rectovaginale and 1 needed a small-bowel resection. This said, given that segmental resection provides long-term pain relief, is safe, and has, in general, only a minor impairment in long-term bowel function results, it should be considered as a treatment option for patients with true deep infiltrating endometriosis of the rectum to achieve a complete resection of all endometriotic implants. However, to prove that rectal resection is more beneficial than the more conservative rectal shaving, prospective, randomized trial data would be necessary.

In the case of a sphincter-preserving procedure in colorectal surgery, the partial or total loss of the rectal reservoir and its replacement with the remaining colon is associated with changes in bowel habit, including a wide spectrum of symptoms including frequent bowel movements, urgency, fecal incontinence, and disordered evacuation.[34,35] Keane et al[34] recently summarized the complex issue about functional outcomes after rectal resection in a

Copyright © The American Society of Colon & Rectal Surgeons, Inc. Unauthorized reproduction of this article is prohibited.

TABLE 5. Other general symptoms

	Overall			≤7 cm			> 7 cm		
Variables	*Preop*	*F/U*	*p value*	*Preop*	*F/U*	*p value*	*Preop*	*F/U*	*p value*
Pain during defecation									
Never (0)	38 (74.5)	44 (86.3)	0.08	20 (69.0)	26 (89.7)	0.01	18 (81.8)	18 (81.8)	0.88
Less than once weekly (1)	7 (13.7)	7 (13.7)		5 (17.2)	3 (10.3)		2 (9.1)	4 (18.2)	
1–6 times weekly (2)	4 (7.8)	0		3 (10.3)	0		1 (4.6)	0	
Every day (3)	2 (3.9)	0		1 (3.5)	0		1 (4.6)	0	
Constipation									
Never (0)	39 (76.5)	26 (51.0)	<0.001	18 (62.1)	15 (51.7)	0.05	21 (95.5)	11 (50.0)	0.002
Less than once weekly (1)	11 (21.6)	18 (35.3)		11 (37.9)	10 (34.5)		1 (4.6)	8 (36.4)	
1–6 times weekly (2)	1 (2.0)	6 (11.8)		0	3 (10.3)		0	3 (13.6)	
Every day (3)	0	1 (2.0)		0	1 (3.5)		0	0	
Incomplete emptying of the bladder									
Never (0)	46 (90.2)	41 (80.4)	0.01	24 (82.8)	21 (72.4)	0.05	22 (100)	20 (90.9)	0.16
Less than once weekly (1)	5 (9.8)	7 (13.7)		5 (17.2)	5 (17.2)		0	2 (9.1)	
1–6 times weekly (2)	0	2 (3.9)		0	2 (6.9)		0	0	
Every day (3)	0	1 (2.0)		0	1 (3.5)		0	0	
Urge incontinence									
Never (0)	48 (94.1)	42 (82.4)	0.01	27 (93.1)	21 (72.4)	0.01	21(95.5)	21 (95.5)	1.0
Less than once weekly (1)	3 (5.9)	7 (13.7)		2 (6.9)	6 (20.7)		1 (4.6)	1 (4.6)	
1–6 times weekly (2)	0	0		0	0		0	0	
Every day (3)	0	2 (3.9)		0	2 (6.9)		0	0	
Stress incontinence									
Never (0)	50 (98.0)	48 (94.1)	0.16	28(96.6)	26 (89.7)	0.16	22 (100)	22 (100)	1.0
Less than once weekly (1)	1 (2.0)	3 (5.9)		1 (3.5)	3 (10.3)		0	0	
1–6 times weekly (2)	0	0		0	0		0	0	
Every day (3)	0	0		0	0		0	0	

Values displayed are number of responses (%) to individual questions.
F/U = follow-up; Preop = preoperative.

systematic review. They report that 18 bowel function instruments, over 30 symptoms, and postoperative time periods ranging from 4 weeks to 14.6 years are reported over a time period from 1986 to 2016. A direct comparison of those results mainly gathered from patients after colorectal resections based on oncologic diseases or resections associated with complications from diverticular disease with the results of our study would be misleading. There are inherent differences in patient demographics and extent of resection, as well as the application of neoadjuvant or adjuvant local or systemic treatment. All those factors are known to be associated with worse long-term functional outcomes and are limited if not absent within our patient population. Scheer et al[36] performed a systematic review and meta-analysis on long-term GI functional outcomes following anterior resection for rectal cancer in 2011. They found that incontinence and urgency were reported in up to 90% of the patients, whereas 75% were wearing a pad, rates that are significantly higher than reported by our patients.

Our results suggest an acceptable clinical impairment in both evacuation and incontinence symptoms; based on the questionnaires developed and published by Hallböök and Sjödahl, this impairment increases only by a median of 2 points for both the evacuation (9.5%) and incontinence (8.3%) scores. In contrast, Roman et al[9] reported in a retrospective study better long-term outcomes for constipation and incontinence if patients were treated by shaving over rectal resection, based on several established scores. However, in our experience, rectal shaving instead of full-thickness resection is not an option for deep infiltrating endometriotic lesions because we found that microscopically incomplete resection was a risk factor for recurrence.[13]

Our study also has some limitations that need to be discussed. The number of patients included is limited and follow-up is not complete. In addition, our results are based completely on patient-reported outcomes and no formal clinical examination was performed to objectify bowel dysfunction, such as the clinical examination by a colorectal surgeon, a manometry, or contrast evacuation study. Future research should include such measures.

CONCLUSIONS

Although radical rectal surgery entails some risks with regard to incontinence and constipation, the overall improvement of endometriosis-related symptoms that can be achieved in a team-oriented setting involving gynecologic and colorectal surgeons makes colorectal resection feasible and safe. However, it is paramount to inform

Copyright © The American Society of Colon & Rectal Surgeons, Inc. Unauthorized reproduction of this article is prohibited.

patients of the potential complications and long-term changes in bowel habits before the operation. Further research will be necessary to directly compare rectal resection, disc excision, and shaving in future trials. Until then, complete resection including rectal resection is a treatment option in the armamentarium of any dedicated team dealing with deep infiltrating endometriosis of the rectum.

REFERENCES

1. Daraï E, Cohen J, Ballester M. Colorectal endometriosis and fertility. *Eur J Obstet Gynecol Reprod Biol*. 2017;209:86–94.
2. Giudice LC. Clinical practice. Endometriosis. *N Engl J Med*. 2010;362:2389–2398.
3. Darwish B, Roman H. Surgical treatment of deep infiltrating rectal endometriosis: in favor of less aggressive surgery. *Am J Obstet Gynecol*. 2016;215:195–200.
4. Fauconnier A, Chapron C, Dubuisson JB, Vieira M, Dousset B, Bréart G. Relation between pain symptoms and the anatomic location of deep infiltrating endometriosis. *Fertil Steril*. 2002;78:719–726.
5. Tarjanne S, Heikinheimo O, Mentula M, Härkki P. Complications and long-term follow-up on colorectal resections in the treatment of deep infiltrating endometriosis extending to bowel wall. *Acta Obstet Gynecol Scand*. 2015;94:72–79.
6. Seracchioli R, Poggioli G, Pierangeli F, et al. Surgical outcome and long-term follow up after laparoscopic rectosigmoid resection in women with deep infiltrating endometriosis. *BJOG*. 2007;114:889–895.
7. Soto E, Catenacci M, Bedient C, Jelovsek JE, Falcone T. Assessment of long-term bowel symptoms after segmental resection of deeply infiltrating endometriosis: a matched cohort study. *J Minim Invasive Gynecol*. 2016;23:753–759.
8. Mabrouk M, Montanari G, Guerrini M, et al. Does laparoscopic management of deep infiltrating endometriosis improve quality of life? A prospective study. *Health Qual Life Outcomes*. 2011;9:98.
9. Roman H, Milles M, Vassilieff M, et al. Long-term functional outcomes following colorectal resection versus shaving for rectal endometriosis. *Am J Obstet Gynecol*. 2016;215:762.e1–762.e9.
10. Roman H, Moatassim-Drissa S, Marty N, et al. Rectal shaving for deep endometriosis infiltrating the rectum: a 5-year continuous retrospective series. *Fertil Steril*. 2016;106:1438–1445.e2.
11. Koga K, Takamura M, Fujii T, Osuga Y. Prevention of the recurrence of symptom and lesions after conservative surgery for endometriosis. *Fertil Steril*. 2015;104:793–801.
12. Cao Q, Lu F, Feng WW, Ding JX, Hua KQ. Comparison of complete and incomplete excision of deep infiltrating endometriosis. *Int J Clin Exp Med*. 2015;8:21497–21506.
13. Nirgianakis K, McKinnon B, Imboden S, Knabben L, Gloor B, Mueller MD. Laparoscopic management of bowel endometriosis: resection margins as a predictor of recurrence. *Acta Obstet Gynecol Scand*. 2014;93:1262–1267.
14. Bryant CL, Lunniss PJ, Knowles CH, Thaha MA, Chan CL. Anterior resection syndrome. *Lancet Oncol*. 2012;13:e403–e408.
15. Hain E, Manceau G, Maggiori L, Mongin C, Prost À la Denise J, Panis Y. Bowel dysfunction after anastomotic leakage in laparoscopic sphincter-saving operative intervention for rectal cancer: a case-matched study in 46 patients using the Low Anterior Resection Score. *Surgery*. 2017;161:1028–1039.
16. Roman H, Vassilieff M, Tuech JJ, et al. Postoperative digestive function after radical versus conservative surgical philosophy for deep endometriosis infiltrating the rectum. *Fertil Steril*. 2013;99:1695–1704.
17. Moawad NS, Guido R, Ramanathan R, Mansuria S, Lee T. Comparison of laparoscopic anterior discoid resection and laparoscopic low anterior resection of deep infiltrating rectosigmoid endometriosis. *JSLS*. 2011;15:331–338.
18. Bassi MA, Podgaec S, Dias JA Jr, D'Amico Filho N, Petta CA, Abrao MS. Quality of life after segmental resection of the rectosigmoid by laparoscopy in patients with deep infiltrating endometriosis with bowel involvement. *J Minim Invasive Gynecol*. 2011;18:730–733.
19. Amin AI, Hallböök O, Lee AJ, Sexton R, Moran BJ, Heald RJ. A 5-cm colonic J pouch colo-anal reconstruction following anterior resection for low rectal cancer results in acceptable evacuation and continence in the long term. *Colorectal Dis*. 2003;5:33–37.
20. Fritzer N, Tammaa A, Salzer H, Hudelist G. Effects of surgical excision of endometriosis regarding quality of life and psychological well-being: a review. *Womens Health (Lond)*. 2012;8:427–435.
21. Dubernard G, Piketty M, Rouzier R, Houry S, Bazot M, Darai E. Quality of life after laparoscopic colorectal resection for endometriosis. *Hum Reprod*. 2006;21:1243–1247.
22. Meuleman C, Tomassetti C, D'Hoore A, et al. Surgical treatment of deeply infiltrating endometriosis with colorectal involvement. *Hum Reprod Update*. 2011;17:311–326.
23. Wullschleger MF, Imboden S, Wanner J, Mueller MD. Minimally invasive surgery when treating endometriosis has a positive effect on health and on quality of work life of affected women. *Hum Reprod*. 2015;30:553–557.
24. Abbott JA, Hawe J, Clayton RD, Garry R. The effects and effectiveness of laparoscopic excision of endometriosis: a prospective study with 2-5 year follow-up. *Hum Reprod*. 2003;18:1922–1927.
25. Garry R, Clayton R, Hawe J. The effect of endometriosis and its radical laparoscopic excision on quality of life indicators. *BJOG*. 2000;107:44–54.
26. Kössi J, Setälä M, Enholm B, Luostarinen M. The early outcome of laparoscopic sigmoid and rectal resection for endometriosis. *Colorectal Dis*. 2010;12:232–235.
27. Fedele L, Bianchi S, Zanconato G, Tozzi L, Raffaelli R. Gonadotropin-releasing hormone agonist treatment for endometriosis of the rectovaginal septum. *Am J Obstet Gynecol*. 2000;183:1462–1467.
28. Bachmann R, Bachmann C, Lange J, et al. Surgical outcome of deep infiltrating colorectal endometriosis in a multidisciplinary setting. *Arch Gynecol Obstet*. 2014;290:919–924.
29. Jung SH, Yu CS, Choi PW, et al. Risk factors and oncologic impact of anastomotic leakage after rectal cancer surgery. *Dis Colon Rectum*. 2008;51:902–908.
30. Laganà AS, Vitale SG, Trovato MA, et al. Full-thickness excision versus shaving by laparoscopy for intestinal deep infiltrating endometriosis: rationale and potential treatment options. *Biomed Res Int*. 2016;2016:3617179.

Copyright © The American Society of Colon & Rectal Surgeons, Inc. Unauthorized reproduction of this article is prohibited.

31. Trippia CH, Zomer MT, Terazaki CR, Martin RL, Ribeiro R, Kondo W. Relevance of imaging examinations in the surgical planning of patients with bowel endometriosis. *Clin Med Insights Reprod Health*. 2016;10:1–8.
32. Darai E, Ackerman G, Bazot M, Rouzier R, Dubernard G. Laparoscopic segmental colorectal resection for endometriosis: limits and complications. *Surg Endosc*. 2007;21:1572–1577.
33. Remorgida V, Ragni N, Ferrero S, Anserini P, Torelli P, Fulcheri E. How complete is full thickness disc resection of bowel endometriotic lesions? A prospective surgical and histological study. *Hum Reprod*. 2005;20:2317–2320.
34. Keane C, Wells C, O'Grady G, Bissett IP. Defining low anterior resection syndrome: a systematic review of the literature. *Colorectal Dis*. 2017;19:713–722.
35. Emmertsen KJ, Laurberg S. Low anterior resection syndrome score: development and validation of a symptom-based scoring system for bowel dysfunction after low anterior resection for rectal cancer. *Ann Surg*. 2012;255:922–928.
36. Scheer AS, Boushey RP, Liang S, Doucette S, O'Connor AM, Moher D. The long-term gastrointestinal functional outcomes following curative anterior resection in adults with rectal cancer: a systematic review and meta-analysis. *Dis Colon Rectum*. 2011;54:1589–1597.

Copyright © The American Society of Colon & Rectal Surgeons, Inc. Unauthorized reproduction of this article is prohibited.