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Postoperative complications after bowel endometriosis surgery by shaving, disc excision, or segmental resection: a three-arm comparative analysis of 364 consecutive cases

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Objective: To assess the postoperative complications related to three surgical procedures used in colorectal endometriosis: rectal shaving, disc excision, and segmental resection.
Design: Retrospective comparative study using data prospectively recorded in the North-West Inter Regional Female Cohort for Patients with Endometriosis (CIRENDO) database.
Setting: University tertiary referral center.
Patient(s): A total of 364 consecutive patients with deep endometriosis infiltrating the rectosigmoid, were stratified into three arms according to the technique used.
Intervention(s): All patients had a laparoscopic surgical procedure to treat bowel endometriosis: rectal shaving (145 patients), disc excision (80 patients), or segmental colorectal resection (139 patients).
Main Outcome Measure(s): Postoperative complication rate was assessed using Clavien-Dindo classification.
Result(s): Clavien 3b postoperative complications were recorded in 43 patients (11.8%), two thirds of whom were managed by segmental colorectal resection ($P < .001$). Fourteen cases of rectovaginal fistula (3.8%) were reported: three in the shaving arm (2.1%), three in the disc excision arm (3.7%), and eight in the segmental colorectal resection arm (5.8%) ($P = .13$). Twenty-four cases (6.6%) of pelvic abscess were recorded in patients free of fistula or leakage. One year after the surgery pregnancy rate (PRs) and delivery rate were comparable between patients with or without severe complications who intended to get pregnant. Three years postoperatively, the PR in infertile patients was 66.7%, with spontaneous conception in 50% of cases.
Conclusion(s): Our data suggest that using a strategy prioritizing shaving, whenever it is possible, could be related to a reduction in severe complication rates. However, prudence is required before concluding that extensive disease should not be treated by segmental resection because of the risk of complications. (Fertil Steril® 2018;109:172–8. ©2017 by American Society for Reproductive Medicine.)
Key Words: Rectal shaving, disc excision, colorectal resection, colorectal endometriosis, postoperative complication

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The incidence of bowel endometriosis is estimated to affect 5%–12% of women with deep endometriosis. The rectum and rectosigmoid junction are the preferential localizations of all intestinal endometriotic sites in 70%–93% of patients (1, 2). Medical therapies do not provide disease control in the long term when treatment is discontinued and may fail to stop disease progression (3). Colorectal surgery, with a laparoscopic approach is considered to be efficient

to treat bowel endometriosis [4]. The surgical management of bowel endometriosis is complex and may be responsible for severe postoperative complications such as rectovaginal fistula, pelvic abscess, hemoperitoneum, or peritonitis [5]. At present, several surgical procedures are performed: nodule excision without opening the rectum (shaving), resection of the nodule with excision of the anterior rectal wall (disc excision), and segmental colorectal resection [6]. This latter procedure is often preferred because of a belief that this approach greatly reduces the risk of recurrence and can remove larger colorectal nodules. However, the risk of unfavorable outcomes seems to be higher when segmental colorectal resection is performed [7].

Hence, choosing the optimal surgical procedure is complex and based on many factors related to a patient's characteristics (e.g., age, desire to preserve fertility, nodule localization) and a surgeon's practices. The aim of this present study was to assess, in a large series, the postoperative complications related to these three laparoscopic surgical procedures used to treat bowel endometriosis: rectal shaving, disc excision, and segmental colorectal resection.

MATERIALS AND METHODS

We conducted a retrospective comparative cohort study from June 2009 to December 2015 in the Department of Obstetrics and Gynecology at Rouen University Hospital, Rouen, France. We enrolled consecutive patients managed for colorectal endometriosis. Patients were allocated to one of three arms based on their surgical management: the rectal shaving arm, the disc excision arm, or the segmental colorectal resection arm. Patients managed by both rectal disc excision and sigmoid colon resection were excluded.

During the study period, patients' data and follow-up were prospectively recorded in the North-West Inter Regional Female Cohort for Patients with Endometriosis (CIRENDO) database (NCT02294825) by a clinical research technician. This study has been approved by the French authority CCTIRS (Advisory Committee on information processing in healthcare research) [8]. A detailed preoperative questionnaire was used to complete patients' symptom history. Standardized gastrointestinal questionnaires were routinely used to assess preoperative and postoperative digestive function: the Gastrointestinal Quality of Life Index [9], the Knowles-Eccersley-Scott-Symptom Questionnaire [10], the Fecal Incontinence Quality of Life index, and the Bristol stool scale [11]. Patients also completed the Medical Outcome Study, a 36-item short-form health survey, used in the evaluation of quality of life and health status. Prospective recording of data concerning medical history, clinical symptoms, findings of clinical and imagery examinations, surgical procedures, and postoperative outcomes was performed in the North-West Inter Regional Female Cohort for Patients with Endometriosis (CIRENDO), which is a prospective cohort, financed by the G4 Group (the university hospitals of Rouen, Lille, Amiens, and Caen) and coordinated by one of the authors (H.R.).

All women referred to our department for deep endometriosis had a clinical examination performed by a surgeon experienced in endometriosis and a magnetic resonance imaging (MRI) examination. When deep endometriosis was confirmed, endorectal ultrasound was performed to check whether the rectum was involved and to estimate the depth of rectal wall infiltration. Computed tomography (CT)-based virtual colonoscopy was often used to check for digestive tract stenosis and associated digestive tract localizations. Complementary examinations, such as cystoscopy and unenhanced helical CT, were performed in women with associated involvement of the urinary tract.

The operative strategy was first discussed with the patient and the digestive surgeon before a decision was made concerning the surgical procedure to be used (i.e., rectal shaving, disc excision, or segmental colorectal resection). The choice of procedure was decided preoperatively in most cases, on the basis of multiple arguments, such as endometriosis nodule features, symptoms, age, pregnancy intention, as discussed in our previous reports [12–14]. The principles and goals of the surgical approach were discussed before surgery, and patients were informed of the main postoperative complications.

Allocation to the three arms was based on the surgical procedure performed: rectal shaving, disc excision, or segmental resection. Patients with multiple colorectal nodules requiring several associated procedures were allocated as follows: patients with both rectal shaving and colorectal segmental resection or disc excision were allocated to the segmental resection group or to the disc excision group, respectively. Patients who had both rectal disc excision and segmental resection of the sigmoid colon were excluded from the study, because the attribution of complications to either one or the other procedure would have been disputable. The techniques used on the bowel have been presented extensively in our previous original studies and video articles [12–16]. One senior gynecologic surgeon exclusively dedicated to endometriosis (H.R.) performed most surgical procedures, assisted by five digestive surgeons, if required. Our team also includes five experienced gynecologic surgeons who performed the other procedures included in the study.

In patients with no further pregnancy intention and adenomyosis, hysterectomy was proposed to improve postoperative outcomes [17]. The decision to perform primary stoma (ileostomy or colostomy) was based on intraoperative findings after discussion between gynecologic and digestive surgeons. Postoperative continuous hormone therapy (HT) was recommended in patients with no pregnancy intention, with the aim of reducing the risk of postoperative recurrences. Surgical procedures were not experimental and analysis of data was retrospective, thus our study was exempt from approval by the institutional review board.

Statistical analysis was performed using Stata 11.0 software (Stat Corporation). We present the number of patients and percentages (qualitative variables), as well as median values and range (continuous variables). Comparison was performed using Fisher's exact test (qualitative variables), and continuous variables were assessed by one-way analysis of variance (ANOVA) between groups. $P < .05$ was considered statistically significant.

RESULTS

From June 2009 to December 2015, 371 consecutive patients had a laparoscopic procedure for symptomatic deep endometriosis infiltrating the rectosigmoid. Seven patients were excluded from the analysis because they had both rectal disc excision and segmental resection of the sigmoid colon. Consequently, 364 patients were allocated to the three arms of the study: 145 (39.8%) to the rectal shaving arm, 80 (22%) to the disc excision arm, and 139 (38.2%) to the segmental colorectal resection arm (Supplemental Fig. 1, available online).

Patients' characteristics and preoperative complaints are summarized in Tables 1 and 2. Patients managed by shaving were significantly older and had received more frequently previous surgeries for endometriosis. Preoperative infertility was more frequently recorded in patients managed by segmental resection. Symptoms were roughly comparable between the three groups.

Intraoperative findings are shown in Table 3. In the shaving arm, rectal nodules were significantly smaller in size than in the rectal disc excision arm or the segmental colorectal resection arm. In the disc excision arm, there was a higher rate of large vaginal infiltration, due to allocation in this arm of 32 women (40%) managed by the Rouen technique for large nodules of the lower and midrectum. The diameter of rectal disc removed varied between 25 and 80 mm (45 ± 14 mm) and the height of the rectal suture was 85 ± 37 mm above the anus. In 63.7% of cases the diameter of rectal disc removed was > 35 mm. In the segmental colorectal resection arm, the length of rectal piece removed varied between 30 and 250 mm (102 ± 40 mm) and the height of the rectal suture was 101 ± 44 mm above the anus. A transitory stoma was

performed in 111 patients (30.5%) who underwent both rectal and vaginal resections: 67 in the segmental colorectal resection arm, 44 in the disc excision arm vs. none in the shaving arm. Operative time was shorter in the shaving arm; however, the rate of hysterectomy was more than fivefold than in the other two groups.

Follow-up averaged 40 ± 22 months. Data on immediate postoperative complications were available in all patients. Table 4 presents the major postoperative complications recorded in our study, stratified according to the Clavien-Dindo classification. The mean rate of Clavien 3b postoperative complications was 11.8%, representing 43 patients, among whom more than half (29 patients) were in the segmental colorectal resection arm ($P = .001$). Eight cases of stenosis of colorectal anastomosis (5.8%) were recorded in the segmental colorectal resection arm ($P = .003$), six of which were managed by endoscopic dilation and two by secondary colorectal resection.

Fourteen patients had rectovaginal fistula (3.8%): 3 in the shaving arm (2.1%), 3 in the disc excision arm (3.7%), and 8 in the segmental colorectal resection arm (5.8%) ($P = .13$). Seven fistulas (50%) occurred in patients with partial colpectomy, although omentoplasty was performed in all cases. Eight (57%) of these 14 patients with rectovaginal fistula previously had a protective defunctioning stoma, and the fistula was revealed by imaging techniques 2 months after the surgery. Five of these 14 patients had a stoma during the 2 weeks after the primary surgery. One of these 14 patients, who was managed by shaving, had a fistula that was revealed by CT 2 weeks after surgery, and was treated exclusively by antibiotics with favorable outcomes. To repair the fistula, an exclusively vaginal approach was successfully performed in four (28.6%) patients,

TABLE 1

Patients' characteristics and surgical antecedents.

Characteristics	Whole sample (N = 364; %)	Shaving (N = 145; 39.8%)	Disc excision (N = 80; 22%)	Segmental colorectal resection (N = 139; 38.2%)	P value
Age (y)	33 ± 6.5	36.1 ± 7.1	30 ± 4.7	31.4 ± 5.2	< .001
BMI (kg/m^2)	24.1 ± 5.1	24.4 ± 5.5	24.5 ± 5.1	23.5 ± 4.7	.25
Antecedents of endometriosis in patient's family	59 (16.2)	24 (16.5)	15 (18.7)	20 (14.4)	.73
Antecedents of gynecologic surgery	209 (57.4)	87 (60)	43 (53.7)	79 (56.8)	.65
Laparotomies	44 (12.1)	27 (18.6)	8 (10)	9 (6.4)	.04
No. of previous laparoscopies					
1	31 (8.5)	19 (13.1)	5 (6.2)	7 (5)	.02
≥2	13 (3.3)	9 (6.2)	3 (3.7)	2 (1.4)	.02
Reason for previous surgeries					
Pelvic pain	138 (37.9)	53 (36.5)	30 (37.5)	55 (39.6)	.87
Infertility	38 (10.4)	18 (12.4)	6 (6.2)	15 (10.8)	.35
Cystectomy					
Right ovary	70 (19.2)	33 (22.8)	12 (15)	25 (18)	.33
Left ovary	67 (18.4)	26 (17.9)	13 (16.2)	28 (20.1)	.76
Psychological care (anxiety, depression)	109 (29.9)	47 (32.4)	30 (37.5)	32 (23)	.05
Obstetrical antecedents					
Nulligesta	210 (57.7)	69 (47.6)	53 (66.2)	83 (63.3)	.006
Nullipara	241 (66.2)	82 (34)	60 (24.9)	99 (41.1)	.006
Miscarriage	53 (14.6)	25 (17.2)	6 (7.5)	22 (15.8)	.34
Ectopic pregnancies	10 (2.7)	3 (2.1)	4 (5)	3 (2.2)	.35
Documented infertility	128 (35.2)	49 (33.8)	18 (22.5)	61 (43.9)	.006

Abo. Complications in bowel endometriosis surgery. Fertil Steril 2017.

TABLE 2

Principal pain symptoms related to pelvic endometriosis.

Pain symptoms	Whole sample (N = 364; %)	Shaving (N = 145; 39.8%)	Disc excision (N = 80; 22%)	Segmental colorectal resection (N = 139; 38.2%)	P value
Dysmenorrhea	351 (96.4)	140 (96.5)	77 (96.2)	134 (96.4)	.99
Primary dysmenorrheal	208 (57.1)	90 (62.1)	40 (50)	78 (56.1)	.21
Biberoglu & Behrman dysmenorrhea score	2.3 ± 0.5	2.2 ± 0.4	2.3 ± 0.5	2.4 ± 0.5	.001
Intensity of dysmenorrhea (VAS scale >4)	344 (94.5)	134 (92.4)	76 (95)	134 (96.4)	.36
Cyclic symptoms associated with dysmenorrheal					
Defecation pain	264 (72.5)	102 (70.3)	64 (80)	98 (70.5)	.24
Rectorrhage	59 (16.2)	12 (8.3)	17 (21.2)	30 (21.6)	.004
Constipation	178 (48.9)	62 (42.8)	46 (57.5)	70 (50.4)	.097
Diarrhea	180 (50)	66 (45.5)	47 (58.7)	69 (49.6)	.16
Bloating	212 (58.2)	89 (61.4)	44 (55)	79 (56.8)	.59
Urinary pain	97 (26.6)	43 (29.7)	22 (27.5)	32 (23)	.44
Having had sexual intercourse	314 (86.3)	115 (79.3)	73 (91.2)	126 (90.6)	.007
Deep dyspareunia	279 (76.6)	116 (80)	66 (82.5)	97 (69.8)	.018
Biberoglu & Behrman deep dyspareunia score	2 ± 1.1	2 ± 1.1	2.1 ± 1.1	2 ± 1.1	.97
Intensity of dyspareunia (VAS>4)	194 (53.3)	82 (56.6)	47 (58.8)	65 (46.8)	.14
Evaluation of digestive function					
KESS constipation score (total value)	12.7 ± 6.8	10.7 ± 6.5	13.6 ± 6.3	14.1 ± 7	.53
Frequency of bowel movements (KESS item 3)	0.3 ± 0.5	0.3 ± 0.6	0.4 ± 0.5	0.4 ± 0.6	.61
Abdominal pain (KESS item 6)	2.4 ± 1	2.3 ± 1	2.4 ± 0.9	2.5 ± 1	.82
GIQLI score (total value)	88 ± 22.9	93.8 ± 24.4	84 ± 21.7	84.8 ± 21	.22
Bowel urgency (GIQLI item 30)	2.5 ± 1.1	2.5 ± 1.1	2.4 ± 1.1	2.4 ± 1.1	.88
Wexner score >2	82 (22.5)	32 (22.1)	19 (23.8)	31 (22.3)	.97
Lack of ability to defer defecation >5min	58 (15.9)	23 (15.9)	12 (15)	23 (16.6)	.98

Note: KESS = Knowles-Eccersley-Scott-Symptom Questionnaire; GIQLI = Gastrointestinal Quality of Life Index; VAS = visual analog scale.

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open surgery was required in six (42.9%) patients, whereas four patients (28.6%) were treated exclusively by protective defunctioning stoma. Segmental colorectal resection was performed in three cases during the secondary surgery.

We recorded 24 cases (6.6%) of pelvic abscess in patients free of fistula or leakage: 19 patients (5.2%) were managed exclusively by antibiotics and 5 women (1.4%) required a second laparoscopy to drain the abscess. There was no statistically significant difference between the three groups for these complications. Five patients (1.4%) had early rectorrhage requiring endoscopy: three (3.7%) in the disc excision arm, two (1.4%) in the segmental colorectal resection arm, and none in the rectal shaving arm (*P*= .07). Thirty patients (8.2%) developed transitory bladder atony requiring 3 weeks to 6 months of autocatheterization; 16 of these 30 patients were in the disc excision arm (*P*< .001).

No patient managed by shaving had a primary stoma. Two patients with postoperative fistula were ultimately managed by stoma–one of whom had a peristomal hernia. We recorded one case of severe postoperative hemoperitoneum that required open surgery in emergency, one case of peritonitis due to leakage of the colonic suture, and four cases of cutaneous abscess that were managed by local care.

One patient (0.3%) exhibited leakage of the colorectal anastomosis, requiring open surgery and protective defunctioning stoma. Two other patients (0.5%) had postoperative peritonitis due to small bowel injuries.

Supplemental Table 1, available online, presents digestive functional outcomes at 1 and 3 years after surgery depending on the type of procedure performed. Postoperative overall gastrointestinal quality of life was significantly and durably improved. Improvement of constipation was not significant in patients managed by shaving at 1 year, and in all three groups at 3 years. Conversely, there was an improvement in scores concerning diarrhea and embarrassment related to bowel movements.

Supplemental Table 2, available online, compares functional digestive and fertility outcomes 1 year after surgery in patients with and without severe complications. Data suggest that postoperative complications did not impair functional outcomes 1 year after surgery. There was a strong tendency toward a lower rate of women with pregnancy intention among patients with complications; however, pregnancy rate (PR) and delivery rate were comparable between patients who intended to get pregnant in the two groups.

Supplemental Table 3, available online, presents fertility outcomes in preoperatively infertile patients. Among 128 infertile patients, 19 underwent hysterectomy (13 had shaving, 2 had disc excision, and 4 had segmental resection), thus no longer had a pregnancy intention. One year after the procedure 37.5% of previously infertile women with postoperative pregnancy intention became pregnant, and 33.3% of pregnancies were spontaneous. Three years after the procedure, the PR reached 66.7% and 50% of conceptions were spontaneous.

TABLE 3

Intraoperative findings.

Intraoperative findings	Whole sample (N = 364; %)	Shaving (N = 145; 39.8%)	Disc excision (N = 80; 22%)	Segmental colorectal resection (N = 139; 38.2%)	P value
Rectal nodule diameter (N = 340)					
<1 cm	50 (13.8)	42 (29.2)	1 (1.2)	7 (5)	<.001
1–2.9 cm	97 (26.7)	57 (39.6)	21 (26.2)	19 (13.7)	<.001
≥3 cm	193 (53.2)	45 (31.2)	55 (68.7)	93 (66.9)	<.001
Vaginal infiltration (N = 200)					
<1 cm	28 (7.7)	10 (6.9)	4 (5)	14 (10.1)	.36
1–2.9 cm	57 (15.7)	29 (20)	14 (17.5)	14 (10.1)	.06
≥3 cm	115 (31.6)	33 (22.8)	34 (42.5)	48 (34.5)	.006
Operative time (min)	208 ± 94	152 ± 71	213 ± 95	263 ± 79	.01
Operative route					.19
Laparotomy	1 (0.3)	1 (0.7)	0	0	
Laparoscopic	342 (94)	138 (95.2)	76 (95)	128 (92.1)	
Laparotomy + laparoscopic	15 (4.1)	2 (1.4)	4 (5)	9 (6.5)	
Robotic-assisted laparoscopic	20 (5.5)	11 (7.6)	3 (3.7)	6 (4.3)	
Revised AFS score	72 ± 42	75 ± 44.8	52.1 ± 30.3	80.4 ± 41.2	.001
Endometriosis stage					.036
2	50 (13.7)	22 (15.2)	13 (16.2)	15 (10.8)	
3	45 (12.4)	19 (13.1)	16 (20)	10 (7.2)	
4	269 (73.9)	106 (73.1)	51 (63.7)	112 (80.6)	
Douglas pouch complete obliteration	213 (58.5)	82 (56.5)	40 (50)	91 (65.5)	.14
Endometriosis lesions on the diaphragm	64 (17.6)	22 (15.2)	8 (10)	34 (24.5)	.016
Management of ovarian endometriomas					
Right ovary	131 (36)	24 (16.5)	30 (37.5)	77 (55.4)	<.001
Left ovary	142 (39)	21 (14.5)	35 (43.7)	86 (61.9)	<.001
Adhesiolysis					
Right adnexa	192 (52.7)	57 (39.3)	41 (51.2)	94 (67.6)	<.001
Left adnexa	219 (60.2)	62 (42.8)	47 (58.7)	110 (79.1)	<.001
Deep posterior endometriosis nodules localization					.024
Left USL	62 (17)	21 (14.5)	12 (15)	29 (20.9)	.324
Right USL	44 (12.1)	19 (13.1)	14 (17.5)	11 (7.9)	.093
Rectovaginal septum	51 (14)	30 (20.7)	6 (7.5)	15 (10.8)	.011
Both left and right USL and rectovaginal septum	184 (50.5)	62 (42.8)	47 (58.7)	75 (54)	.042
Hysterectomy + colpectomy	51 (14)	42 (29)	4 (5)	5 (3.6)	<.001
Surgical procedures on digestive tract					
Sigmoid colon disc excision	4 (1.1)	0 (0)	3 (3.7)	1 (7.2)	.018
Sigmoid colon resection	26 (7.1)	0 (0)	0 (0)	26 (18.7)	<.001
Ileocecal resection	16 (4.4)	3 (2.1)	1 (1.2)	12 (8.6)	.011
Transitory stoma	111 (30.5)	0	44 (55)	67 (48.2)	<.001
Surgical procedures on urinary tract	57 (15.7)	22 (15.2)	8 (10)	27 (19.4)	.18
Resection of the bladder	25 (6.9)	8 (5.5)	3 (3.7)	14 (10.1)	.16
Advanced ureterolysis requiring JJ stent	16 (4.4)	6 (4.1)	4 (5)	6 (4.3)	.95
Ureteral resection and uretero-cystostomy	8 (2.2)	2 (1.4)	2 (2.5)	4 (2.9)	.66

Note: AFS = American Fertility Society; USL = uterosacral ligament.

Abo. Complications in bowel endometriosis surgery. Fertil Steril 2017.

DISCUSSION

We report the results of a complete assessment of postoperative complications after the management of bowel endometriosis, stratified by three surgical procedures. Our three-arm comparative analysis revealed significantly more Clavien Dindo 3b complications in the segmental colorectal resection arm. Some were due to the type of surgery itself, whereas other outcomes were related to nodule size and localization requiring a specific procedure. As the three groups were not similar in terms of the extent and severity of the disease, the rate of complications could also be related to the overall difficulty of the surgery and not to the use of the colorectal procedure itself. Our data suggest that using a strategy prioritizing shaving, whenever possible could be related to a reduction in the rate of severe complications and the risk of symptomatic postoperative bowel stenosis. However,

prudence is required before concluding that extensive disease should not be treated by segmental resection because of the risk of complications.

Our study has two main strengths: the large sample size and the prospective data recorded in a database. Our large sample size allowed us to highlight several significant differences in terms of postoperative complications between the three arms. In addition, symptoms were roughly comparable, which further increases the statistical power of comparisons presented in Table 4. Prospective recording of data in a specific database managed by a dedicated clinical researcher reduced the risk of patients lost to follow-up.

Because we used the three different procedures in comparable proportions suggests that our team proposes a personalized strategy to each patient. We try to select the optimal procedure based on a patient's overall characteristics and not only on

TABLE 4

Postoperative complications.

Characteristics	Whole sample (N = 364; %)	Shaving (N = 145; 39.8%)	Disc excision (N = 80; 22%)	Segmental colorectal resection (N = 139; 38.2%)	P value
Follow-up (mo)	40 ± 22	46 ± 22.9	32.3 ± 20.4	37.9 ± 20.3	<.001
Clavien 3 postoperative complications					
Clavien 3a postoperative complications	11 (3)	1 (0.7)	4 (5)	6 (4.3)	.10
Clavien 3b postoperative complications	43 (11.8)	8 (5.5)	6 (7.5)	29 (20.9)	<.001
Rectovaginal fistulae	14 (3.8)	3 (2.1)	3 (3.7)	8 (5.8)	.13
Pelvic abscess requiring second laparoscopy	19 (5.2)	5 (3.4)	2 (2.5)	12 (8.6)	.09
Pelvic abscess managed by only antibiotics	5 (1.4)	3 (2.1)	0	2 (1.4)	.64
Stenosis of colorectal anastomosis	8 (2.2)	0	0	8 (5.8)	.003
Transitory bladder atony requiring 3 week to 6 month autocatheterization	30 (8.2)	8 (5.5)	16 (20)	6 (4.3)	<.001
Stoma-related early complications	8 (2.2)	0	6 (7.5)	2 (1.4)	.001
Severe abdominal hemorrhage requiring open surgery in emergency	1 (0.3)	0	1 (1.2)	0	.22
Peritonitis after stoma closure	1 (0.3)	0	1 (1.2)	0	.22
Cutaneous abscess	4 (1.1)	0	4 (5)	0	.002

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those related to deep endometriosis nodules. Specifically, we consider that two nodules of similar characteristics require personalized management: a more radical approach in a young nullipara with pregnancy intention, in whom the delay for recurrence is long, and a more conservative approach in an older patient with no pregnancy intention, in whom the delay until menopause is short. This strategy explains significant differences regarding women's age and the use of hysterectomy between the shaving arm and the disc excision and segmental resection arms. However, there are arguments suggesting that the women managed by colorectal resection had more severe disease, based on a higher American Fertility Society revised score and an increased frequency of stage 4 endometriosis. With regard to women managed by disc excision, they frequently had low rectal nodules requiring the Rouen technique, as they had an increased frequency of vaginal infiltration measuring >3 cm in diameter.

The inclusion of patients managed for low rectal nodules in the disc excision arm explains the high rate of postoperative transitory bladder dysfunction and stoma-related complications. In our opinion, these outcomes are related more to nodule size and localization than to the surgical technique itself. Hypothetically, if these women with low rectal nodules had been allocated to either of the other two arms, this would have significantly increased the complication rate in the arm concerned, with subsequent changes in overall outcomes. Other outcomes were directly related to the surgical procedure used, such as postoperative bowel stenosis that was directly related to performing colorectal anastomosis using the circular transanal stapler (18).

Postoperative severe complications impacted the intention to become pregnant immediately after surgery. It is logical that patients with prolonged care due to fistulae or stenosis of anastomosis were less likely to try to conceive 1 year after their surgery and hence postponed conception. However, patients with complications and with intention to conceive had comparable PR and delivery rate to controls, suggesting

that postoperative complications do not necessarily have an impact on the likelihood of conceiving.

When surgery for colorectal endometriosis was offered to patients with preoperatively documented infertility, we observed good postoperative PRs. One and 3 years after the procedure, one third and two thirds of women, respectively, became pregnant, with high rates of spontaneous conception. These results feed the debate on the role of deep endometriosis surgery in infertile women, as a valuable alternative to systematic first-line IVF (19).

Our study also has several weaknesses. The sample size might have been too small to reveal statistically significant differences when complication rates were similar. We were only able to reveal a tendency toward a higher rate and not an actual higher rate of rectovaginal fistula and pelvic abscess after segmental resection. However, previous studies also observed that rectovaginal fistula and leakage more frequently occurred in patients managed by segmental resection. A recent large French study (20), including 1,135 patients managed for colorectal endometriosis, reported the risk of fistula and leakage after shaving, disc excision, and segmental resection as 1.3%, 3.6%, and 4.7%, respectively.

The overall risk of complication observed in our sample was comparable to that reported by other investigators (7, 21–25). Fanfani et al. (7) reported a case control study with 136 patients who underwent discoid (48 patients) or segmental rectosigmoid resection (88 patients) for bowel endometriosis. The early complication rate was 12.5% with 2.9% of rectovaginal fistula and 1.1% of anastomotic leakage. Similarly, Kondo et al. (22) conducted a retrospective study that enrolled 226 patients managed laparoscopically for rectal nodules by the same three procedures that we used. The overall major postoperative complication rate was 9.3% including 3.6% of rectovaginal fistula.

Previous comparisons between disc excision and segmental resection were rather unfavorable to segmental resection (7, 22). In these series, disc excision was mostly performed using an

end-to-end circular stapler (60%), which can remove 3.5 or 4 cm of disc in diameter. Conversely, 40% of our disc excisions were much larger and were performed using a semicircular stapler to remove large nodules of the low and midrectum, which explains the increased risk of postoperative complications in this arm and the loss of statistical significance compared with segmental resection. However, we believe that disc excision is an interesting technique that aids conservation of the rectum and improves postoperative functional outcomes in young women with large low and midrectal nodules.

Our results suggest the value of using a strategy prioritizing the conservative management of bowel endometriosis. This strategy may also be used in patients with multiple colorectal nodules. Shaving or disc excision of the mid/low rectum may be associated with short segmental resection of the sigmoid colon, leading to conservation of the low rectum along with the healthy bowel between two consecutive localizations. Nevertheless, patients managed by combined procedures were not enrolled in this present study. A caseseries study specifically concerning patients with combined procedures is currently ongoing.

In conclusion, we report here postoperative complications in a large series of patients managed for bowel endometriosis by three surgical procedures. Our data suggest that using a strategy prioritizing shaving, whenever possible could be related to a reduction in the rate of severe complications and the risk of symptomatic postoperative bowel stenosis. However, care should be taken before concluding that extensive disease should not be treated by segmental resection because of a higher risk of complications, which could be related to the severity of the disease and not only to the surgical procedure. Nevertheless, a more definitive answer will soon be provided by the Functional Outcomes of Surgical Management of Deep Endometriosis Infiltrating the Rectum (ENDORE) randomized trial comparing digestive outcome 24 months after colorectal resection or conservative surgery in large rectal endometriosis (26).

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SUPPLEMENTAL FIGURE 1
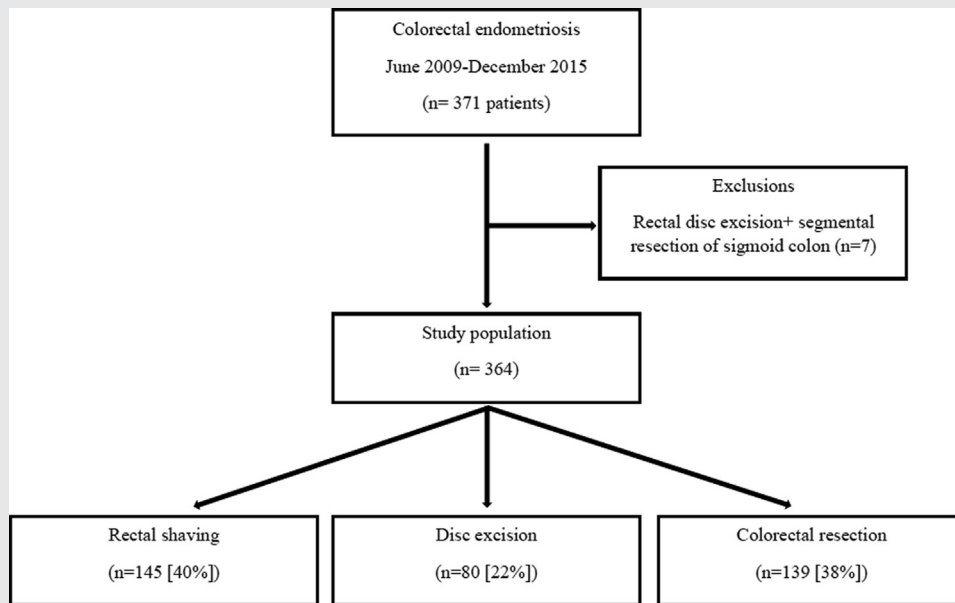
Study flow chart.

Abo. Complications in bowel endometriosis surgery. Fertil Steril 2017.