



Complete Surgery for Low Rectal Endometriosis

Long-term Results of a 100-Case Prospective Study

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Objective: We conducted a prospective study to assess the long-term results of complete surgery for low rectal endometriosis (LRE), paying particular attention to surgical complications, functional results, and disease recurrence after a follow-up of at least 5 years.

Summary Background Data: Deep infiltrating endometriosis (DIE) may infiltrate the midlow rectum and lead to severe pelvic pain. Complete resection of LRE is reluctantly considered by young women of childbearing age.

Methods: From 1995 to 2003, 100 women with severe pelvic pain and previous incomplete surgery (n = 82) underwent complete open surgery for LRE after thorough preoperative imaging work-up. This included total or subtotal rectal excision with combined resection of all extrarectal endometriotic lesions. Univariate analysis of predictive factors for transient neurogenic bladder and surgical complications was performed. Mean follow-up was 78 ± 15 months.

Results: All patients underwent rectal resection with straight coloanal (n = 16) or low colorectal anastomosis (n = 84). A concomitant extrarectal procedure was required in all instances, including gynecologic procedures (n = 100), additional intestinal (n = 45), and urologic (n = 23) resections. A fertility-preserving procedure was possible in 92% of the patients. Mean numbers of DIE and endometriotic lesions were 3.9 ± 1.4 and 5.5 ± 1.6 per patient, respectively. There were no deaths and the surgical morbidity rate was 16%. Sixteen patients developed a transient peripheral neurogenic bladder, which was more frequently observed after coloanal anastomosis ($P < 0.001$) or concomitant hysterectomy ($P < 0.01$) and in patients with more than 4 DIE lesions ($P < 0.05$). At last follow-up, 94 patients had complete (n = 83) or very satisfactory (n = 11) relief of symptoms. Urine voiding and fecal continence was satisfactory in all cases. There was no recurrence of colorectal and/or urologic endometriosis and the overall DIE recurrence rate was 2%.

Conclusions: Complete surgery for LRE provides excellent long-term functional results in 94% of the patients, provided all extraintestinal endometriotic lesions are resected during the same surgical procedure. In that setting, the overall 5-year recurrence rate is very low.

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Endometriosis is defined as the presence of functioning endometrial tissue outside of the uterine cavity. It affects 6 to 10% of all women of childbearing age.¹ Intestinal involvement has been esti-

mated to occur in 8% to 12% of women with endometriosis.^{2–4} The most common sites are the rectosigmoid junction (65%), the ileocaecal junction (20%), and the rectum (15%).^{5,6} Deep infiltrating endometriosis (DIE) is considered a specific, aggressive form of endometriosis that penetrates more than 5 mm under the peritoneal surface.⁷ This specific entity is responsible for refractory pelvic pain, of which the intensity is correlated with the depth of infiltration.^{7,8} Rectal involvement is observed in 13% of the patients with DIE.⁸ Rectal involvement is associated with extraintestinal DIE and adnexal endometriosis in 70% and 80% of the patients, respectively.^{9,10} Several reports have focused on the surgical management of colorectal endometriosis.^{2,3,6,11–14} The majority of previous reports involved patients with rectosigmoid endometriosis, leading to segmental resection with high colorectal anastomosis. Historical series have emphasized that incomplete resection of DIE, with castration, may lead to persistent pain or recurrent endometriosis.^{15,16}

To our knowledge, there are few data specifically focusing on low rectal endometriosis (LRE) requiring total or subtotal rectal excision. LRE represents the most severe form of DIE, characterized by infraperitoneal rectal invasion responsible for severe pelvic pain and bowel symptoms.^{7,8} Over the past 14 years, as a tertiary referral center for DIE, we undertook a prospective, combined gynecologic and digestive program of complete surgery for LRE. Our surgical objectives were to remove all endometriotic lesions and preserve fertility after a thorough preoperative assessment including clinical and imaging work-ups. This strategy was based on previous experiences of complete surgical excision of DIE lesions, which resulted in significant reduction of painful functional symptoms^{17,18} and recurrence.^{8,19}

The aim of this study was to assess long-term results of complete open surgery for LRE with particular attention to surgical complications, functional results, and disease recurrence in a consecutive series of 100 women with a follow-up of more than 5 years.

PATIENTS AND METHODS

Patients

Between 1995 and 2003, 100 consecutive women underwent complete surgery for LRE. LRE was defined preoperatively, based on the following clinical and endoscopic ultrasonographic criteria: (a) rectal invasion of the infraperitoneal rectum, including low and mid rectum located within 8 cm of the dentate line, reachable on rectal examination, (b) full-thickness invasion of the muscular layer greater than 15 mm on rectal endoscopic ultrasonography. During the same period, 105 patients with superficial rectal endometriosis, small-size lesion or endometriosis of the rectosigmoid junction underwent laparoscopic excision of the implants, full-thickness rectal disc excision or anterior resection with high colorectal anastomosis. These 105 patients were excluded from the present study. Overall, these 100 patients with LRE represented 49% of all patients treated for colorectal endometriosis in our unit during the study period.

The decision for complete surgery was made within the context of a multidisciplinary team. The decision was based on: (a)

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the severity of pelvic pain; (b) a physical examination in accordance with at least 2 of the following: rectal endoscopic ultrasonography, transvaginal ultrasonography, multidetector CT scan, pelvic magnetic resonance imaging; (c) patients' agreement on surgical treatment after detailed information by both gynecologic and gastrointestinal (GI) surgeons. All consecutive patients of the present series were operated on until October 2003 and were followed for more than 5 years. None of the patients were lost to follow-up.

Preoperative Work-Up

All patients underwent a preoperative protocol work-up including physical examination, rectal endoscopic ultrasonography, transvaginal ultrasonography, multidetector CT scan and pelvic magnetic resonance imaging (MRI). Patients with obstructive hydronephrosis underwent multidetector CT urography or uro-MRI and renal scintigraphy.

Operative Technique

The goals of complete surgery were to excise the deep endometriotic nodule including rectum, posterior vaginal fornix, uterosacral ligaments, and all extrarectal endometriotic deposits. All efforts were made to preserve fertility. The surgical procedure was systematically conducted by a GI and a gynecologic surgeon, in association with a urologic surgeon when requested.

All patients underwent open surgery via a midline incision. The first step of the surgical procedure was a complete exploration of the pelvis and abdominal cavity to assess the extent of endometriotic disease. The second step was the complete mobilization of the left colon, a section of the sigmoid colon, and confection of pedicled omentoplasty. The third step included ureterolysis and treatment of adnexal lesions. This was important as it facilitated surgical exposure and dissection of the deep endometriotic nodule (fourth step). To ensure free surgical margins, a total mesorectal excision with ligation of the inferior mesenteric artery was performed. The rectum was mobilized posteriorly and laterally down to the pelvic floor in the plane of the fascia recti. Anteriorly, the plane of dissection was that of healthy nonfibrotic tissue, in front of the deep endometriotic nodule, including, in most cases, en-bloc resection of both uterosacral ligaments, and full-thickness of the upper posterior vaginal wall together with rectal specimen (Fig. 1). All efforts were made to preserve the pelvic plexuses, except in cases of nerve invasion. Below the deep endometriotic nodule, the dissection of the rectum was continued in the plane of the rectovaginal septum. The rectum was sectioned at least 2-cm below the lower margin of the endometriotic lesion to ensure free distal surgical margins,²⁰ to avoid rectal section within periendometriotic muscular hyperplasia,^{21,22} and to increase the distance between vaginal closure and low rectal anastomosis. The technique of straight low colorectal or coloanal anastomosis was performed using the 2-stapled technique. The rectal stump was first closed using a linear articulated stapler and end-to-end colorectal or coloanal anastomosis was then fashioned using the circular 29 or 31 mm stapler. The pedicled omental flap was interposed in the rectovaginal septum between the vaginal and colorectal sutures. Additional intestinal endometriotic lesions were treated as dictated by the anatomic location (Fig. 2) with free margins of at least 2 cm for the same reasons mentioned previously. A defunctioning ileostomy was systematically performed to protect the low rectal anastomosis. Urinary tract endometriotic lesions were resected according to their anatomic extent. Bladder endometriosis was treated by partial cystectomy (Fig. 3). Extrinsic ureteral strictures were treated by extensive ureterolysis up to the uretero-bladder junction after preoperative double pig-tail ureteral stenting. The treatment of intrinsic ureteral involvement consisted of segmental resection followed by ureteral submucosal antireflux reimplantation (Fig. 4). Rare instances of complete renal destruction because of

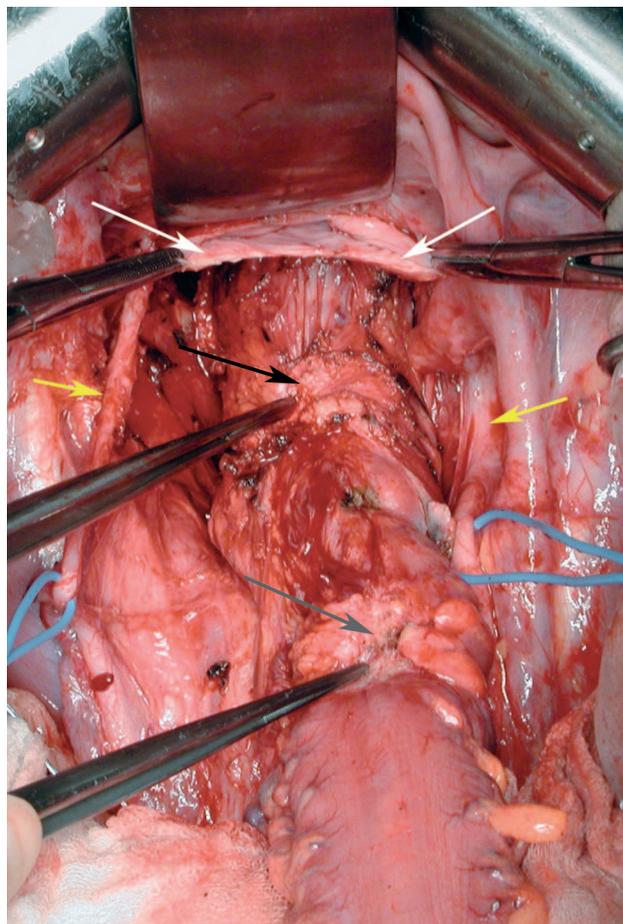


FIGURE 1. Surgical pelvic view after extended left and right ureterolysis (yellow arrows), left adnexectomy, partial posterior colpectomy (white arrows) showing rectal endometriosis with invasion to the posterior vaginal wall and uterosacral ligaments (black arrow) and second rectosigmoid endometriotic lesion (gray arrow).

chronic upper urinary tract distension were treated by ureteronephrectomy when renal function was less than 15% on renal scintigraphy. On completion of the surgery, 2 suction drains were inserted in the pelvic space.

Pathologic Examination of Surgical Specimens

The diagnosis of endometriotic deposit was based on the presence of endometrial glands or epithelium within the surgical specimen. The presence of nonspecific pathologic features (surrounding fibrosis, hemorrhagic foci, hemosiderin deposits, smooth muscle hyperplasia) was not considered sufficient for the diagnosis of endometriosis.

Perioperative Surgical Care

All patients were given a preoperative mechanical bowel preparation. Long-acting GnRH analogues were started 1 month prior to and continued for 5 months following surgery. Patients with obstructive uretero-hydronephrosis were treated preoperatively with double pig-tail ureteral stenting. Patients with urinary symptoms, bladder endometriosis or preoperative double pig-tail ureteral stenting were submitted to preoperative urinalysis. Oral intake was started on day 1 with progressive return to normal diet. Long-acting

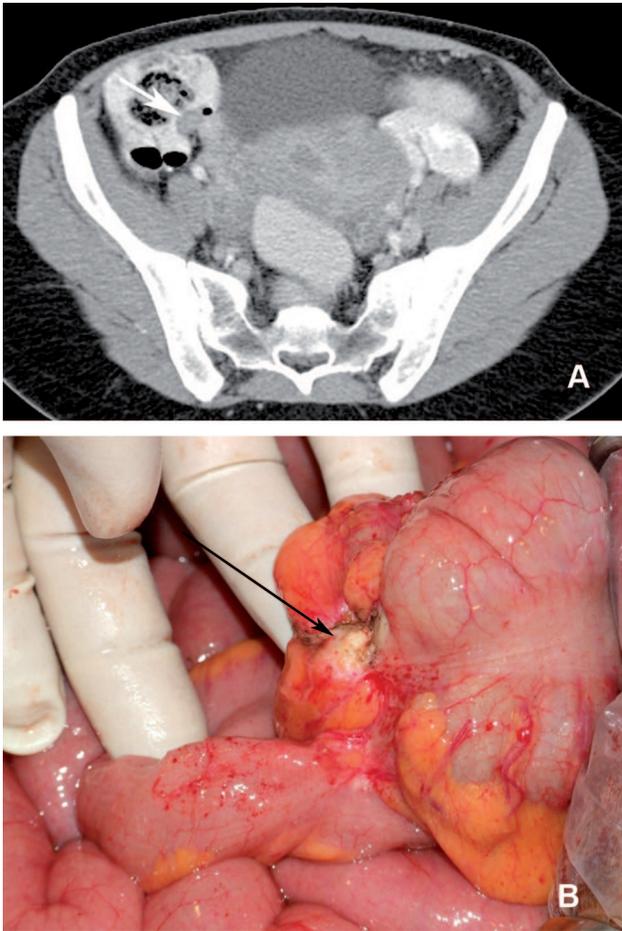


FIGURE 2. A, Radiologic CT scan (white arrow) and (B) surgical views of caecal endometriosis (black arrow) treated by wedge resection.

α -blockers were given from day 3 onwards for duration of 2 months. Urinary catheter was removed on day 7 and followed by urinalysis and intermittent self-catheterization twice a day for 3 days to check postvoid residual. Patients with a volume greater than 100 mL were instructed to start an intermittent self-catheterization program. This was continued until the postvoid residual was less than 100 mL for at least 3 consecutive days. A transient peripheral neurogenic bladder was defined when intermittent self-catheterization was required after hospital discharge within 15 days. Thromboprophylaxis with low-molecular weight heparin was started 6 hours after surgery and continued for 1 month after hospital discharge.

The temporary defunctioning ileostomy was closed at 2 months if there were no radiologic signs of anastomotic leakage. As part as a randomized trial comparing early and delayed temporary stoma closure, 16 patients underwent early ileostomy closure on day 8.²³ Renal and bladder ultrasonography were systematically performed at 2 months to check the upper urinary tract and measure postvoid residual. Urinalyses were repeated every 2 months during the first 6 months.

Functional Assessment

Patients were reviewed at 1, 3, and every 6 months during the first 2 postoperative years and yearly thereafter. Patients were seen alternatively by a GI and a gynecologic surgeon for clinical examination and functional evaluation. This included the assessment of

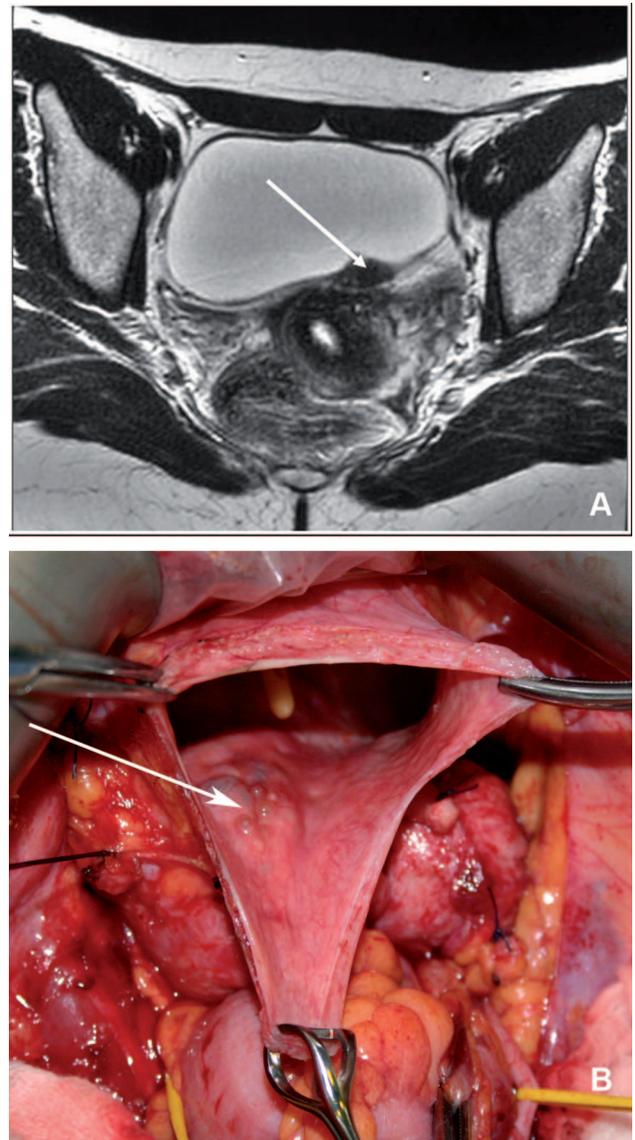


FIGURE 3. A, MRI axial T2-weighted sequence showing a hypointense nodule infiltrating the posterior bladder wall (white arrow) and (B) surgical view of dark blue endometriotic nodules (white arrow) in the bladder wall after cystostomy prior to partial cystectomy.

pelvic pain, bowel symptoms, dysmenorrhea, sexual function, ano-rectal, and voiding functions. Items of sexual function included relief of dyspareunia, frequency of sexual intercourse, and self-reporting of a satisfactory sexual life. The assessment of bowel function consisted of: total daily bowel movements, occasional minor leaking (≤ 2 episodes weekly), pad wearing, clustering (incomplete evacuation with several bowel motions within one hour), urgency (inability to defer defecation more than 15 minutes), ability to differentiate gas from stool, and use of either antidiarrheal medications (loperamide) or bulking medications (ispaghul). Incontinence was assessed by the continence score of Jorge and Wexner.²⁴ Evaluation of voiding function consisted of: frequency of daily voiding, urgency (inability to defer micturition more than 15 minutes), occasional urinary incontinence (≤ 2 episodes weekly), hesitancy, strain to start, and incomplete bladder emptying.

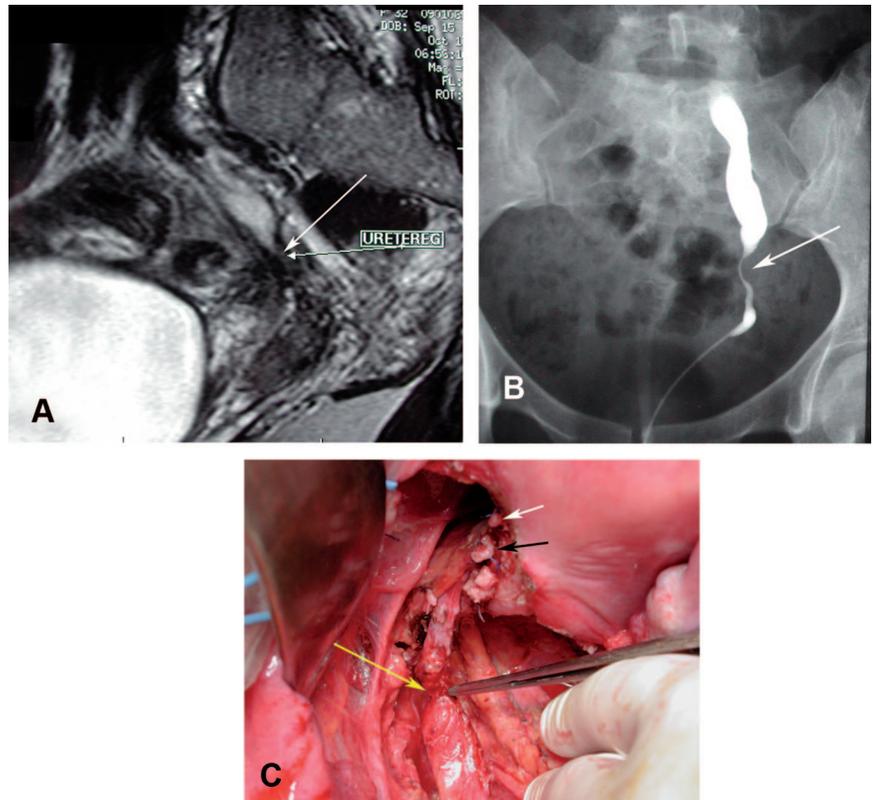


FIGURE 4. A, MRI axial T2-weighted sequence and (B) retrograde ureteropyelography before double pig-tail stenting showing a regular stenosis of left pelvic ureter (white arrows) because of intrinsic ureteral endometriosis. C, Surgical view showing intrinsic ureteral invasion (yellow arrow) after left adnexectomy (white arrow) and division of left uterine artery (black arrow).

Statistical Analysis

Data are shown as means (standard deviation) or median (range). Continuous data were compared by means of the Mann-Whitney *U* test and categorical data by the χ^2 test. Univariate analysis was performed to determine predictors of transient neurogenic bladder and surgical complications. The considered variables for the univariate analysis were: age ≥ 35 years, previous multiple surgery, additional urologic procedure, additional ileocaecal resection, coloanal anastomosis, number of DIE lesions ≥ 4 , and concomitant hysterectomy. *P* values were considered to be statistically significant at the 5% level.

RESULTS

Preoperative Assessment

Demographic data of the cohort, details of previous treatment and preoperative symptoms are given in Table 1. On physical examination, a firm rectal mass with normal mucosa was felt in 95 patients at a mean distance of 5 ± 2 cm (range: 3–8) from the dentate line. The overall diagnostic accuracy of combined physical examination, pelvic MRI, and rectal endoscopic ultrasonography for the diagnosis of LRE was 100%. Ovarian endometriomas ($n = 71$), adenomyosis ($n = 69$), and bladder endometriosis ($n = 9$) were best imaged by transvaginal ultrasonography and pelvic MRI. Conversely, additional intestinal lesions (sigmoid and ileocaecal junction) were best diagnosed by CT scan with a sensitivity of 58% (26 of 45 patients).

Surgical Procedure

Forty-five patients had multiple DIE intestinal lesions, including the rectum and rectosigmoid junction ($n = 9$), rectum and sigmoid ($n = 25$), rectum and ileo-caecal junction ($n = 11$) with a mean number of 1.6 ± 0.8 intestinal DIE lesions per patient. Of the

45 patients, 8 (17.8%) had triple rectal, sigmoid, and ileocaecal endometriosis. Ninety-three patients had multiple resections of extraintestinal DIE lesions including the vagina ($n = 64$), uterosacral ligaments ($n = 88$), ureters ($n = 14$), and bladder ($n = 9$) with a mean number of 2.3 ± 1.2 extraintestinal DIE lesions per patient. The overall mean number of DIE lesions was 3.9 ± 1.4 per patient. Seventy-one patients presented with 99 ovarian endometriomas and 35 patients had 57 peritoneal implants. The anatomic distribution of all endometriotic lesions is detailed in Table 2. The rectal procedure consisted of subtotal excision of the rectum with low-stapled colo-rectal anastomosis ($n = 84$) and total excision of the rectum with straight coloanal anastomosis ($n = 16$). The mean height of low colorectal anastomosis from the dentate line, evaluated by digital examination, was 3.6 ± 1.3 cm (range: 0–6 cm). Defunctioning ileostomy was carried out in 96 patients. A pedicled omentoplasty was interposed between colorectal anastomosis and the posterior vaginal wall in 91 instances. Details of additional surgical procedures are given in Table 3. Twenty-nine patients underwent a concomitant urologic procedure for bladder endometriosis ($n = 9$), extrinsic ($n = 6$), or intrinsic ($n = 14$) ureteral endometriosis, 23 of whom required surgical resection. Surgical treatments consisted of partial cystectomy ($n = 9$), extensive ureterolysis after preoperative double pig tail stenting ($n = 6$), and uni- ($n = 7$) or bilateral ($n = 2$) ureteral resection with submucosal antireflux bladder reimplantation. Five patients with intrinsic ureteral endometriosis complicated by long-lasting silent hydronephrosis and loss of ipsilateral renal function were treated with nephroureterectomy. Five patients had undergone a previous hysterectomy with bilateral adnexectomy. Among the remaining 95 patients, 87 (92%) underwent a fertility-preserving procedure defined as an operation preserving at least the uterus, one fallopian tube and one ovary. The reasons for hysterectomy in the remaining 8 patients were severe bilateral adnexal

TABLE 1. Characteristics of 100 Patients With Low Rectal Endometriosis

Age (yr)*	32 ± 5 (21–47)
Body mass index (kg/m ²)*	21.8 ± 3.6
ASA score	
ASA I	84
ASA II	15
ASA III	1
rAFS stage (%) [†]	
Stage I	7
Stage II	13
Stage III	43
Stage IV	37
Previous medical treatment	91
Danazol	7
Progestins	24
GnRH analogues	76
Duration of treatment (mo) [‡]	11 (4–60)
Previous surgery for endometriosis	82
Laparoscopic surgery	59
Open surgery	29
Multiple procedures	48
Hysterectomy	5
Duration of symptoms (mo) [‡]	48 (12–168)
Infertility	70
Primary	43
Secondary	27
Gynecologic symptoms	98
Dysmenorrhea	94
Deep Dyspareunia	91
Chronic pelvic pain	78
Bowel symptoms	90
Dyschezia	67
Painful constipation	61
Rectal bleeding	36
Urologic symptoms	18
Suprapubic pain	11
Frequency	9
Hematuria	3
Cyclic exacerbation of symptoms	90

*Data are presented as means ± SD (range).

[†]According to the revised American Fertility Society Classification (1985).[‡]Data are presented as medians (range).

lesions (n = 3), multiple uterine leiomyomas (n = 3), and severe adenomyosis (n = 2). Mean operative time was 5.3 ± 3.5 hours (range: 4–9 hours).

Pathologic Findings

LRE was confirmed in all patients. Full-thickness invasion of the muscular layer was observed in all cases, with deep invasion to the submucosal layer in 45 cases. The median distal resection margin on the fixed specimen was 23 mm (range: 18–45) and all resection margins were free of endometriosis. The mesorectal circumferential margin was greater than 1 mm in 96 patients. The median length of the resected colorectal segment was 18 cm (range: 14–41). The median size of the rectal lesion was 26 mm (range: 18–64 mm). Pathologic findings of surgical specimen are presented in Table 4.

TABLE 2. Anatomical Distribution and Number of Endometriotic Lesions in 100 Patients With Low Rectal Endometriosis

Location	No. Lesions
Intestinal lesions	
Rectum	100
Mid rectum	84
Low rectum	16
Rectosigmoid junction	9
Sigmoid	25
Ileum	12
Appendix	8
Caecum	6
Total number of intestinal lesions	160
Mean number of intestinal lesions/patient	1.6 ± 0.8
DIE lesions	
Posterior	223
USL*	141
Vagina	64
Ureter [†]	18
Anterior	
Bladder	9
Total number	232
Mean number/patient	2.3 ± 1.2
Total number of DIE* lesions	392
Mean number of DIE* lesions/patient	3.9 ± 1.4
Other endometriotic lesions	
Ovarian endometriomas [‡]	99
Peritoneal implants [§]	57
Total number of endometriotic lesions	548
Mean number of endometriotic lesions/patient	5.5 ± 1.6

*USL: Uterosacral ligament (unilateral, n = 35; bilateral, n = 53).

[†]Ureters (unilateral, n = 10; bilateral, n = 4).[‡]Ovarian endometriomas (unilateral, n = 43; bilateral, n = 28).[§]Peritoneal implants in 35 patients.

DIE indicates deep infiltrating endometriosis.

Perioperative Complications

There were no postoperative deaths. The overall surgical morbidity rate was 16%. Details of surgical complications are given in Table 5. Two patients underwent urgent reoperation for early postoperative bleeding. The overall rate of colorectal anastomotic leakage was 6%. Two patients developed a minor colorectal fistula treated medically in one instance, and by percutaneous drainage in the second case. Four patients developed a rectovaginal fistula. Two cases occurred on days 10 and 11 after early stoma closure and were treated by redo of temporary ileostomy; the remaining 2 patients were diagnosed shortly after late stoma closure, despite normal anterograde water-soluble contrast opacification and were similarly treated by redo of diverting ileostomy. All 4 patients experienced complete healing of rectovaginal fistula and underwent delayed closure of diverting stoma. Overall, all 6 patients with anastomotic leakage were treated conservatively without colorectal anastomosis dismantling. Two patients who underwent a complete pelvic ureterolysis during surgery developed a urine leak secondary to ureteral necrosis. One patient was treated conservatively with endoscopic placement of double pig-tail stents, whereas the second required reoperation for bladder reimplantation. The overall rate of reoperation was 7%. Sixteen patients experienced a transient peripheral neurogenic bladder. In that setting, mean duration of clean, inter-

TABLE 3. Additional Surgical Procedures in 100 Consecutive Patients With low Rectal Endometriosis

	No. Patients
Additional procedures	100
Additional intestinal resections	45
Sigmoidectomy	34
Ileocaecal resection	5
Wedge caecal resection	1
Ileal resection	1
Ileal resection + appendectomy	2
Appendectomy	2
Partial posterior colectomy	64
Uterosacral ligament resections	88
Unilateral	35
Bilateral	53
Ureterolysis + double pig tail stenting	6
Unilateral ureteral endometriosis	10
Ureteral resection + bladder reimplantation	7
Nephroureterectomy	3
Bilateral ureteral endometriosis	4
Bilateral ureteral resection + bladder reimplantation (BRI)*	2
Ureteral resection + BRI* + nephroureterectomy	2
Partial cystectomy	9
Adnexal procedures	71
Ovarian cystectomy	47
Adnexectomy	14
Cystectomy + contralateral adnexectomy	10
Hysterectomy with bilateral adnexectomy	8
Resection of inferior hypogastric nerve	28
Unilateral	23
Bilateral	5

BRI indicates bladder reimplantation.

TABLE 4. Postoperative Complications Following Complete Surgery for Low Rectal Endometriosis (n = 100)

	n
Mortality	0
Postoperative complications	16
Colorectal anastomotic leakage	2
Recto-vaginal fistula	4
Urinary leak	2
Postoperative bleeding	2
Wound infection	6
Transient neurogenic bladder	16
Blood transfusion	6
Intraoperative	2
Postoperative	4
Reoperation*	7

*Redo of ileostomy (n = 4), hemoperitoneum (n = 2), bladder reimplantation (n = 1).

mittent self-catheterization was 6 weeks (range: 3–18 weeks) before the return to satisfactory voiding function. There were no cases of deep venous thrombosis or pulmonary embolism. Median time for returning to work was 3 months (range: 2–5.8 months). Univariate analysis of predictive factors (Table 6) showed that a coloanal

TABLE 5. Pathological Confirmation of Endometriosis in Resected Surgical Specimens From 100 Patients With Low Rectal Endometriosis

	n	%
Rectum	100	100
Other intestinal lesions	56/60	93
Rectosigmoid junction	9/9	100
Sigmoid	23/25	92
Ileum	11/12	92
Appendix	7/8	88
Caecum	6/6	100
Vaginal posterior wall	60/64	94
Uterosacral ligaments	124/141	88
Ureter	11/18	61
Bladder	9/9	100
Ovarian endometriomas	99/99	100
Peritoneal implants	57/57	100

anastomosis ($P < 0.001$), a concomitant hysterectomy ($P < 0.01$) and the presence of more than 4 DIE lesions ($P < 0.05$) were significantly associated with an increased risk of transient neurogenic bladder. In return, no significant predictors were found to be associated with surgical complications.

Long-term Functional Results

Mean follow-up was 78 ± 15 months (range: 60–168). At last follow-up, 94 patients had complete (n = 83) or very satisfactory (n = 11) relief of gynecologic and bowel symptoms, based on both gynecologic and GI evaluations. This included relief of chronic pelvic pain, return of normal menstruation, return to normal sexual life and satisfactory anorectal and voiding functions. Bowel function was slightly impaired during the first 6 months, mainly because of increased daily bowel movements and clustering. The use of anti-diarrheal and bulking medications was therefore used in 85% of the women for a median duration of 6.8 months (range: 3–14). None of the patients complained of fecal incontinence after the operation. At the 5-year follow-up, mean stool frequency per day was 1.8 ± 1.3 (range: 0–4) with excellent bowel function. Postoperative voiding function was mainly characterized by a significant incidence of hesitancy (19%), straining to start (31%), and incomplete emptying (27%) at the 6-month follow-up, as a consequence of surgical pelvic autonomic denervation. All 16 patients with postoperative transient neurogenic bladder recovered satisfactory voiding function and none of them eventually required long-term self catheterization. However, 11% of the patients still required pushing abdominal efforts for complete voiding at the 5-year follow-up. Except for 3 women who had preoperative occasional stress incontinence, none of our patients complained of urinary incontinence at the 5-year follow-up. Longitudinal assessment of functional outcome (Table 7) indicates that both bowel and voiding functions improved substantially within 1 year of surgery and appeared excellent and stable after 2 years.

Disease Recurrence

After a mean follow-up of 78 ± 15 months, no cases of recurrent intestinal or urologic endometriosis were documented in the present series. The overall endometriosis recurrence rate was 6%, and recurrence rate of DIE was only 2%. Mean delay for diagnosis of recurrent disease was 48 ± 21 months (range: 24–102). Two patients had recurrent uterosacral DIE, in association with recurrent adnexal endometriosis and symptomatic adenomyosis. These 2 patients underwent reoperation for complete hysterectomy 7

TABLE 6. Univariate Analysis of Predictive Factors for Transient Neurogenic Bladder and Surgical Complications

	Transient Neurogenic Bladder		<i>P</i>	Surgical Complications		<i>P</i>
	Present (n = 16)	Absent (n = 84)		Present (n = 10)	Absent (n = 90)	
Age ≥35 yr	6/16	28/84	0.74	4/10	30/90	0.67
BMI >25	4/16	16/84	0.58	1/10	19/90	0.40
Multiple previous surgery	10/16	38/84	0.20	6/10	42/90	0.42
Additional intestinal resection*	2/16	7/84	0.59	1/10	8/90	0.91
Coloanal anastomosis	9/16	7/84	<0.001	1/10	15/90	0.59
Hysterectomy	4/16	4/84	<0.01	1/10	7/90	0.81
No. DIE lesions ≥4	11/16	44/84	<0.05	7/10	48/90	0.31

*Excluding sigmoidectomy and appendectomy.

TABLE 7. Bowel and Voiding Functions After Radical Surgery for Low Rectal Endometriosis (n = 100)

	6 mo	1 yr	2 yr	5 yr
Bowel function				
Total daily bowel movements*	3.2 ± 1.7	2.0 ± 1.6	2.1 ± 1.4	1.8 ± 1.3
Occasional minor leak (%)	4	2	1	0
Pad wearing (%)	6	5	3	3
Clustering (%)	47	22	14	9
Urgency (<15 min) (%)	6	4	4	2
Gas/stool discrimination (%)	94	94	97	100
Bowel medications (%)	85	27	8	2
Continence Wexner Score	2.5 ± 0.9	2.1 ± 0.8	1.9 ± 0.8	1.4 ± 0.6
Voiding function				
Frequency (≤3 h between voiding) (%)	16	11	7	4
Urgency (<15 min) (%)	11	3	3	2
Occasional incontinence (%)	3	2	2	3
Hesitancy (%)	19	13	7	7
Strain to start (%)	31	23	14	13
Incomplete emptying (%)	27	19	13	11

*Quantitative data summarized as means ± SD.

and 9 years after initial fertility-preserving complete surgery. Four additional patients had recurrent adnexal endometriosis. The overall reoperation rate for endometriosis recurrence was 2%.

DISCUSSION

The present series is the first prospective study to report late outcome and recurrence rates after complete surgery for LRE. All

100 patients were followed for more than 5 years and none of them was lost to follow-up.

Though debatable in view of cost implications and thorough intraoperative assessment, extensive preoperative imaging evaluation was systematically performed to obtain a precise mapping of all endometriotic lesions, for both patient's information and consent prior to complete surgery. LRE was consistently associated with multifocal, extrarectal DIE lesions with a mean number of 3.9 DIE lesions per patient. An extrarectal procedure was therefore required in all instances. This included an additional intestinal and a urologic procedure in 45% and 29% of patients, respectively. LRE was confirmed in all patients by full-thickness invasion of the muscular layer of the mid or low rectum. Similarly, muscular invasion was demonstrated in 93% of other resected intestinal lesions, 61% of resected ureters and 100% of partially resected bladders. These pathologic findings highlight the value of thorough preoperative work-up and complete exploration for the recognition of all extrarectal DIE lesions.

The surgical treatment of LRE represented a challenging surgery because of additional extrarectal resections and the high prevalence (82%) of previous pelvic surgery. In most cases, the anterior dissection of the rectal nodule was conducted with en-bloc resection of uterosacral ligaments, the posterior vaginal fornix, and the parametrium in case of lateral invasion. To minimize the risks of rectovaginal fistula, attention was paid to increase the distance between vaginal closure and low colorectal anastomosis and to interpose a pedicled omentoplasty between the 2 sutures. Similarly, a straight coloanal anastomosis was performed in patients with complete rectal excision to avoid the proximity of a stapled colonic J-pouch to the vaginal suture. A defunctioning ileostomy and pelvic drainage were systematically performed to decrease both the prevalence and severity of low colorectal anastomotic leakage, as suggested by several trials and a meta-analysis.²⁵⁻²⁷

These preventive measures resulted in low rates of symptomatic colorectal anastomotic leakage (2%), rectovaginal fistula (4%), perioperative blood transfusion (6%), and reoperation (7%) when compared with previous surgical series of colorectal endometriosis.²⁸⁻³² All patients with colorectal anastomotic leakage were treated successfully without anastomotic dismantling. We strongly believe that the combination of systematic diverting ileostomy, interposition of omentoplasty and nonjuxtaposed vaginal and colorectal sutures were major factors in preventing and facilitating the conservative treatment of anastomotic leaks. Delayed ureteral ischemic necrosis related to extensive ureterolysis was observed in rare instances (2%) and we believe that increased use of preoperative endoscopic ureteral double pig-tail stenting may help to prevent this

complication. Univariate analysis failed to identify predictive factors of surgical complications but this might be due to the low surgical morbidity rate.

The most frequent specific complication of complete surgery for LRE was transient peripheral neurogenic bladder (16%). The inferior hypogastric nerves are easily recognized and preserved during surgery but may require resection in cases with lateral pelvic wall invasion. In addition, the inferior hypogastric plexus consists of multiple fibers in proximity to the uterosacral ligaments, the distal course of ureters and the upper third of the posterior vaginal wall. Their injury is, in our experience, more likely to occur in cases of bilateral uterosacral endometriosis, parametrial invasion and low rectal extension, as suggested by others.³³ As a matter of fact, univariate analysis showed that the need for coloanal anastomosis or concomitant hysterectomy and the presence of more than 4 DIE lesions were significant predictors of transient neurogenic bladders. However, our 16% rate of transient peripheral neurogenic bladder compared favorably to the 21 to 29% rates reported in previous series of colorectal endometriosis.^{33,34}

According to prospective longitudinal follow-up, 5-year functional results were judged excellent or very satisfactory by 94% of the patients and these results appeared stable with time. This included relief of chronic pelvic pain, return of painless menstruation, return to normal sexual life and satisfactory anorectal and voiding functions. It is however noteworthy that 11% of the patients still require pushing efforts for complete bladder emptying, a number similar to that reported by other groups.³³ Late anorectal function was reported as excellent in nearly all patients, and may be attributable to young age, low rates of previous delivery, or absence of previous radiotherapy. Indeed, functional results after surgery for LRE appear much better than those reported following low colorectal³⁵ or coloanal anastomosis^{36,37} for rectal cancer.

The 5-year recurrence rate was very low, as suggested by an overall endometriosis recurrence rate of 6%, with only 2% experiencing recurrent DIE. In particular, no cases of recurrent intestinal or urologic endometriosis were documented after complete surgery of LRE. We strongly believe that these unexpected and excellent figures are related to a "carcinologic" surgical approach. First, all additional extrarectal sites of endometriosis were removed together with LRE; second, total mesorectal excision and en-bloc resection of the rectal nodule together with posterior vaginal fornix and uterosacral ligaments were important to ensure free anterior and circumferential resection margins; third, rectal section at least 2-cm below the endometriotic nodule resulted in a 100% rate of free distal resection margins; Fourth, all additional intestinal and urologic endometriotic deposits were resected with 2-cm-free surgical margins. As a matter of fact, high rates of rectal recurrence because of positive surgical margins have been reported after conservative treatment of rectal endometriosis including rectal wall shave (22%) or limited disc excision (5%).³⁸ Though not substantiated by previous randomized trials, the potential benefits of perioperative hormonosuppressive treatment, which was given to all patients for 6 months, may be of interest in view of our very low rate of recurrence.

Several reports have focused on the surgical treatment of colorectal endometriosis.^{2,3,6,11-14} Large series of open surgery for rectosigmoid endometriosis have been previously reported with satisfactory results.²⁻⁴ Few or no details were given regarding extraintestinal DIE lesions and long-term functional results. All patients underwent high colorectal anastomosis and nearly half of them had a nonfertility preserving surgery. Some authors have subsequently emphasized the benefits of a laparoscopic approach for colorectal endometriosis.^{11,28,30,31} These series are characterized by an important heterogeneity with respect to depth and anatomic level

of rectosigmoid endometriosis. Other authors have proposed a laparoscopic, transvaginal technique for the resection of rectosigmoid endometriosis,^{29,32} based on extraction of the colorectal specimen and placement of the anvil of the circular stapler through a transverse colpotomy. Surprisingly, in these 2 series, very few patients underwent combined partial colectomy or resection of uterosacral ligaments, whereas vaginal and uterosacral endometriosis were demonstrated in 64% and 88% of our patients with LRE, respectively.

Recently, encouraging results of laparoscopic resection of LRE have been reported with a 2-year follow-up in 71 patients.²⁸ The surgical policy of this group was similarly based on segmental rectal resection, complete resection of all endometriotic lesions and fertility-preserving surgery. The rate of conversion to laparotomy was 10%, which is low, considering the surgical constraints of LRE. Surprisingly, the prevalence of extrarectal endometriotic lesions was much lower than that of our series with decreased additional intestinal (21% vs. 45%), vaginal (30% vs. 64%), bladder (1.5% vs. 9%), ureteral (3% vs. 14%), and ovarian (32% vs. 71%) lesions. Interestingly, their rates of hysterectomy (10% vs. 8%) and uterosacral ligament resection (87% vs. 88%) were very similar to our figures. Their overall rate of anastomotic leak was slightly higher than that reported in our series (12.6% vs. 6%) and this could be due to a much lower rate of diverting stoma (7% vs. 96%). Functional results appeared very satisfactory at 2 years, but details on disease recurrence are missing. A large series of 357 patients treated laparoscopically for rectosigmoid endometriosis similarly reported lower rates of extrarectal endometriotic lesions when compared with our figures: additional intestinal (6.2%), vaginal (32%), urologic (0%), uterosacral, and adnexal lesions (data not available).³⁹ The DIE recurrence rate (8.4%) appeared in this series much higher than that of our series, at a 2-year follow-up with 20% of patients lost to follow-up. The reasons for such discrepancies between our results and these 2 laparoscopic series remain unclear. Deep muscular invasion by endometriosis was demonstrated in nearly all extrarectal resected specimens from the present series, with a mean number of nearly 4 DIE lesions per patient, which is much higher than the 2.3 DIE lesions per patient reported by Darai.²⁸

Our results may have been biased by the selection of more severe patients, as suggested by an 82%-rate of previous surgery and a 16%-rate of total rectal excision with coloanal anastomosis.

In conclusion, this large surgical series emphasizes several important guidelines for the treatment of LRE: (1) The selection of patients for surgery requires a multidisciplinary approach and complete preoperative imaging work-up by an experienced radiologist; (2) the procedure is a challenging surgery including en-bloc resection of LRE and resection of all extrarectal DIE lesions; (3) recto-vaginal fistula is a rare and severe complication prevented by both diverting stoma and omentoplasty; (4) extensive ureterolysis should be followed by transient double pig-tail stenting; (5) transient peripheral neurogenic bladder is a specific complication requiring transient self catheterization in 16% of cases; (6) long-term functional results are excellent with no recurrent colorectal or urologic endometriosis.

Based on this large experience of open surgery in a tertiary referral center, we believe that any laparoscopic program for the surgical treatment of LRE should be based on similar surgical principles of complete surgery and produce long-term functional assessment, low rates of complications and disease recurrence. Consequently, we started, for selected patients, a laparoscopically assisted surgical program for the treatment of LRE in 2006.

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