GENERAL GYNECOLOGY

Surgery-related complications and long-term functional morbidity after segmental colo-rectal resection for deep infiltrating endometriosis (ENDO-RESECT morb)

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Abstract

Purpose Segmental resection has been generally associated with increased peri-operative risk of major complications. While major complications are widely acknowledged, minor complications, such as slight, to moderate infections, peripheral sensory disturbances, bladder voiding dysfunction, postoperative urinary obstruction, and sexual disorders are less reported. The aim of this study is to investigate the surgery-related complications and functional disorders, as well as to evaluate their persistence after long-term follow-up in women undergone segmental resection for deep infiltrating endometriosis. Special attention is given to evaluating impairments of bowel, bladder, and sexual function.

Methods All clinical data obtained from medical records of women who underwent segmental resection for intestinal endometriosis between October 2005, and November 2017, in Catholic University Institutions. Perioperative morbidity was classified by Extended Clavien–Dindo classification. Postoperative intestinal, voiding, and sexual morbidity was estimated by the compilation of specific questionnaires.

Results Fifty women were included in the study. Forty-three high colorectal resections (86%), 6 low resections (12%), and 1 ultra-low resection (2%) were performed, while in 3 cases (6%) multiple resections were needed. The overall complication rate was 44%. Nineteen women (38%) experienced early complications and 3 women (6%) late complications. Long-term functional postoperative complications were composed of intestinal in 30%, urinary in 50%, and sexual in 64% of the study population. Median follow-up was 55.5 months.

Conclusions Segmental resection, when indicated, offers a radical and feasible approach for bowel deep infiltrating endometriosis, resulting in an improved general quality of life. The bowel and bladder complications appear to be acceptable and often reversible. Postoperative sexual dysfunctions, such as anorgasmia and insufficient vaginal lubrication, appear to persist over time. Surgeons and women have to be aware of the incidence of this kind of complications.

Keywords Deep infiltrating endometriosis · Segmental resection · Intestinal disorders · Voiding disorders · Sexual dysfunction · Personalized medicine

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Introduction

Deep infiltrating endometriosis (DIE) is characterized by the invasion of adjacent anatomical structures, which can result in distortion of pelvic anatomy [1–4]. The disease affects women of reproductive age and causes pelvic pain, infertility, gastro-intestinal dysfunction, and quality of life (QoL) impairment [1, 2, 5]. When pharmacotherapy fails, or anatomic distortion causes infertility or results in organ damage (e.g. hydronephrosis, bowel occlusion/subocclusion), laparoscopic surgery is the treatment of choice [3, 4, 6, 7].

Two surgical approaches are usually employed in the management of colorectal-DIE: the radical approach, mainly consisting of segmental resection (SR), and the conservative, or symptom-guided approach, which favors conservation of the rectum by shaving or full-thickness and discoid excision [8–12]. The conservative approach may improve digestive functional outcomes and is commonly considered to be preferable in reducing the risk of immediate postoperative complications. It can be adopted in selected cases and in the absence of occlusive symptoms [9]. On the other hand, SR has been associated with a higher likelihood of eradication of disease but with an increased risk of major peri-operative complications [13]. Nevertheless, recent literature suggests that the incidence of peri-operative complications in cases employing either the conservative or radical approach appears comparable, or lower, for SR [14–18].

While major complications have been widely reported, minor complications, including sensory disturbances, bladder voiding dysfunction, postoperative urinary obstruction, and sexual disorders have been less so reported [19, 20].

Moreover, long-term surgery-related complications, as well as functional morbidity are still rarely evaluated [20–22]. The aim of this study was to investigate, in depth, the postoperative, surgery-related complications and the transient and permanent functional disorders in our single-center SR-population over a period of long-term follow-up (FU). Special attention was given to impairment of bowel, bladder, and sexual function.

Methods

Study population and surgery

This observational cohort study ENDO-RESECT, morbidity-section, (ClinicalTrials.gov ID: NCT03824054) reports clinical data about women who underwent SR for intestinal-DIE between October 2005, and November 2017, at the Catholic University Institutions.

Inclusion criteria were clinically diagnosed intestinal-DIE triaged to SR for clinical management [9], and age between 18 and 47 years.

Exclusion criteria were previous or ongoing malignant disease; contraindications to surgery; incomplete surgery; preoperative menopause; surgery different from SR and re-anastomosis; and unconfirmed endometriosis at pathology. Ostomy creation and multiple resections were not considered exclusion criteria.

Initially, all cases were diagnosed with pelvic examination and pelvic ultrasound, while magnetic resonance imaging was used if needed in case of uncertain ultrasound findings [23].

The classification of SR in high (≥ 8 cm), low (> 5 and < 8 cm), and ultra-low (≤ 5 cm) resection was performed according to the distance of the rectal margin of transection from the anal verge [24]. The SR nerve-sparing technique was employed following its adoption in the scientific literature in 2012 [25].

Endometriosis was classified by the revised American Fertility Society Score (rAFS) [26]. Surgeries were performed by a well-trained gynecology team belonging to the same institution, allowing for standardization and reproducibility of interventions.

SR was performed using the laparoscopic classic Knight–Griffen technique [9–11]. A temporary loop ileostomy was created in cases of ultra-low resection or unsuccessful or insecure anastomosis (e.g., leak evidence), and reversed within 3 months after SR.

If there was no desire for pregnancy, oral contraception (OC) was recommended for at least 6 months following surgery. In the case of iatrogenic menopause following surgery, hormone replacement therapy (HRT) was administered [27].

Complications were gleaned from medical records and classified by the extended Clavien–Dindo classification [28].

We defined "surgical morbidity" as consisting of a complication that was strictly related to the surgical procedure (e.g., postoperative fever, abscess, hemorrhage or organ injures), and "functional morbidity" as an alteration of organ physiology and sensation (e.g., voiding disorders, urinary urgency, altered vaginal lubrication). The term "anorgasmia" was defined as a sexual dysfunction in which orgasm cannot be achieved despite adequate stimulation [29] rather than a situation in which penetration is hindered because of dyspareunia.

Questionnaires adopted

Women were asked to evaluate pain with the visual analogue scale (VAS) [30].

Postoperative intestinal functional disorders (diarrhea syndrome and constipation) were estimated employing the Gastrointestinal Symptom Rating Scale Questionnaire (GSRS) [31–35].

Postoperative functional voiding and sexual disorders where investigated employing a questionnaire specifically developed for this study and based upon previous experiences in the literature [21].

Questions were answered with a "yes" or "no" response, or by using a rating scale that included "never, occasionally (less than once per week), frequently (once or more per week), daily". The following questions were used for the analysis: "Is your urinary stream weak, prolonged, or slow?", "Do you have a feeling of incomplete bladder emptying?", "Do you suffer from complete urinary retention?", "Do you need to use the abdominal press to empty

the bladder?", "Do you feel the urge to empty the bladder?", "Do you suffer from involuntary leakage of urine and, if so, is it because you feel uncontrollable urgency or because urinary incontinence occurs with physical effort?". Questions relating to sexual dysfunction included "Do you have sufficient vaginal lubrication during intercourse?", "Do you suffer from new-onset anorgasmia?" [22]. The responses "never," "occasionally," and "insufficient" were treated as "no," and the responses "frequently," "daily," and "sufficient" were treated as "yes" [21].

All of the questionnaires relating to presurgical status were completed by women during the FU period, while the questionnaires about postsurgical status were executed at the time of the last FU contact.

The evaluation of questionnaires about postsurgical voiding and sexual disorders was performed by the gynecologic team, while those of gastrointestinal status by a gastroenterologist.

Statistics

Continuous variables were reported as median and range or as mean ± standard deviation (SD). Categorical variables were reported as frequencies and percentages.

Preoperative and postoperative scores were compared with t test for two dependent means, and alternatively with the Wilcoxon signed-rank test. The Chi-square test was applied for the comparison of group proportions. All tests were two-sided. Differences with a $p < 0.05$ were considered statistically significant.

Univariate logistic regression analysis was performed to identify risk factors for postoperative complications.

All statistical analyses were performed with SPSS version 20.0 (Chicago, IL).

Ethical approval

Local IRB approval was obtained (Institutional Committee [intramural] no. PROT. APROV. IST CICOG-31-10-18\100).

Results

Fifty women with intestinal-DIE that underwent SR answered the questionnaires and were included in the study. The indication for surgery included the failure of hormonal treatment in controlling the symptoms after a period of observation of least 6 months, and, in those cases in which there was the desire for pregnancy, of those patients in which infertility was ascertained [9]. All patients were noted to be have severe impairment of QoL because of the disease. Two patients (4%) presented with a history of sub-occlusive events, and 16 women (32%) were infertile with the desire

for pregnancy. Median follow-up after SR was 55.5 months (range 25–170 months) ending in November 2019.

As reported in Table 1 the median age was 38 years (range 24–46). Forty-nine women (98%) had received surgery for endometriosis previously at other hospitals. All women suffered preoperative dysmenorrhea, while 38 patients (76%) complained of dyschezia. Dysuria and dyspareunia were present in 12 (24%) and 32 (64%) women, respectively. In particular, one patient was unable to have vaginal intercourse because of severe dyspaurenia.

All women were staged as equal to, or greater than stage III, by the rAFS. In 54% of cases a fertility-sparing surgery was performed.

Table 2 summarizes the location of DIE at the time of surgery. Single and multiple colo-rectal nodules were present in 70% and 30% of women, respectively.

Parametrial and peri-ureteral nodules were present in 34 (68%) and 32 (64%) women, and they were bilateral in 11 (22%) and 14 (28%) women, respectively. Prevesical nodules, defined as peritoneal implants, or infiltration of the bladder wall were present in 14 (28%) and 2 (4%) women, respectively. The localization of DIE on the posterior vaginal wall was noticed in 20 (40%) women.

Table 3 reports surgery and hospitalizations data. All surgeries started with laparoscopy, but conversion to laparotomy was necessary in 8 cases (16%) due to the need for the performance of multiple bowel resections in 3 (6%) cases, and the finding of extensive abdominal adhesions. Median operating time was 280 (100–480) min. In particular, the median for a laparoscopic procedure was

Table 1 Demographic and disease characteristics of 50 women undergoing colorectal surgery for endometriosis

Characteristic	TOT ($N = 50$)
Age at surgery (years), median (range)	38 (46–24)
Body mass index (kg/m^2), median (range)	21 (18–31)
Previous surgery for endometriosis, N (%)	
0	1 (2)
1	24 (48)
2	25 (50)
Preoperative symtoms, N (%)	
Dysmenorrhea	50 (100)
Dyschezia	38 (79)
Dysuria	12 (24)
Dyspaurenia	32 (64)
Chronic pelvic pain	29 (58)
Stage, N (%)[a]	
III (moderate)	9 (18)
IV (severe)	41 (82)

VAS Visual Analogue Scale (VAS) for symptomatic women

[a]According to rAFS classification

Table 2 Endometriosis clinical status

Charateristic of disease	TOT (*N* = 50)
Colo-rectal nodule, *N* (%)	
Single	35 (70)
Multiple	15(30)
Max dimension of the nodule (mm), median (range)	30 (10–60)
Distance from anal verge (mm), median (range)	50 (15, 100)
Adenomyosis	22 (44)
Endometrioma, *N* (%)	33 (66)
Monolateral	25 (50)
Bilateral	8 (16)
Parametrial nodule, *N* (%)	34 (68)
Monolateral	23 (46)
Bilateral	11 (22)
Periureteral nodule, *N* (%)	32 (64)
Monolateral	18 (36)
Bilateral	14 (28)
Prevesical nodule (peritoneal), *N* (%)	14 (28)
Bladder nodule (detrusor infiltrations), *N* (%)	2 (4)
Vaginal nodule, *N* (%)	20 (40)

Table 3 Surgical procedures and hospitalization

Variables	TOT (*N* = 50)
Laparoscopy, *N* (%)	50 (100)
Conversion to laparotomy, *N* (%)	8 (16)
Type of bowel resection, *N* (%)	
High	43 (86)
Low	6 (12)
Ultra-low	1 (2)
Number of resections	
Multiple resections	3 (6)
Single resection	47 (54)
Loop ileostomy creation, *N* (%)	13 (26)
Parametrectomy, *N* (%)	31 (62)
Ureterolysis, *N* (%)	44 (88)
Vesical nodule resection, *N* (%)	2 (4)
Vaginal nodule resection, *N* (%)	20 (40)
Hysterectomy, *N* (%)	8 (16)
Adnexectomy, *N* (%)	10 (20)
Monolateral	6 (12)
Bilateral	4 (8)
Cyst enucleation, *N* (%)	26 (52)
Estimated blood loss (mL), median (range)	175 (50–1000)
Operative time (min), median (range)	280 (100–480)
Laparoscopy	222 (100–305)
Laparotomy	340 (240–480)
Hospital stay (days), median (range)	6 (3–15)

222 (100–305) and for a laparotomy 340 (240–480) min, respectively. Forty-three (86%) high, 6 (12%) low, and 1 (2%) ultra-low SR were performed, while in 3 cases (6%)

multiple resections were required. Forty women (80%) received a nerve-sparing surgery.

Temporary loop ileostomy was performed in 13 patients (26%): 1 ultra-low SR, 3 multiple SRs, 8 vagina opening cases due to infiltrating nodules (in order to try to reduce the risk of rectovaginal fistula or to reduce its symptoms in case of formation), and 1 postoperative late complication. Parametrectomy was performed in 31 cases in which the presence of a parametrial nodule was confirmed. Ureterolysis was necessary in 44 women (88%). A vesical nodule was removed by partial cystectomy in 2 cases (4%), and the bladder catheter was removed after control cystography.

Partial vaginal resection due to the presence of a vaginal nodule was performed in 20 women (40%) and, in addition, one patient required a concomitant hysterectomy.

Total hysterectomy was performed in 8 women (16%) affected by adenomyosis, who no longer intended to conceive.

Six women (12%) underwent monolateral adnexectomy, while 4 patients (8%) were subjected to bilateral adnexectomy. Ovarian cyst enucleation was performed in 26 women (52%). Iatrogenic menopause was noted only in those patients subjected to bilateral adnexectomy (8% of population) and HRT was initiated in all women.

All women obtained a complete surgical DIE-eradication with no residual visible disease at the end of surgery.

Sixteen patients (32%) expressed the desire for pregnancy after surgery. Of these, 8 patients (50%) conceived: 3 patients (19%) spontaneously and 5 (62.5%) with assisted reproductive techniques [33].

Table 4 shows the surgical and functional morbidity observed. No intraoperative complications were noted with the exception of the conversions to laparotomy for severe adhesion in 10% of cases and the need to perform multiple resections in 6% of cases. Twenty-two postoperative complications were recorded. Overall, the complication rate (including minor and major complications) was 44%. In particular, early and late complications appeared in 19 (38%) and 3 (6%) cases, respectively. The early complications observed were minor-grade I and II, while all late complications reported were major-grade III.

Minor early-grade I complications observed included 2 (4%) cases of fever not requiring antibiotics, 8 (16%) cases of postoperative urinary retention, and 4 (8%) of inferior limb paresthesia. Inferior limb paresthesia resolved spontaneously after a variable period of time following surgery. Minor early-grade II complications included 4 (8%) cases of fever requiring antibiotics, and 1 (2%) case of anastomotic bleeding necessitating intravenous infusion of tranexamic acid.

Major late grade III complications appeared in 3 cases (6%). In particular, there was one case (2%) of uretero-vaginal fistula requiring nephrostomy (grade IIIb) and 2 cases

Table 4 Colo-rectal resection surgery-related complications and functional disorders

Post operative complications	Total (N = 50)
Early (within 30 days) according to Clavien–Dindo classification	
1	14 (28%)
2	5 (10%)
3	0
4	0
Late (within 6 months) according to Clavien–Dindo classification	
1	0
2	0
3	3 (6%)
4	0
Post-operative intestinal disorders	25 (50%)
Post-operative urinary disorders	25 (50%)
Post-operative sexual disorders	32 (64%)
Type of post-operative intestinal disorders	**Total N = 25 (% with intestinal disorder)**
Constipation (grade 2–3)[b]	17 (68)
Diarrhea syndrome (grade 2–3)[b]	8 (32)
Type of post-operative urinary disorders	**Total N = 25 (% with urinary disorder)**
Urinary retention (neurogenic bladder requiring catheterization)	8 (32%)
Transient (N = 7)	
Permanent (N = 1)	
Lack of urge to urinate	10 (40%)
Transient (N = 7)	
Permanent (N = 3)	
Weak/slow/prolonged urinary flow (not requiring stable/intermittent catheterization)	14 (56%)
Transient (N = 4)	
Permanent (N = 10)	
Urinary urgency	3 (12%)
Transient (N = 0)	
Permanent (N = 3)	
Stress incontinence	2 (8%)
Transient (N = 0)	
Permanent (N = 2)	
Type of post-operative sexual disorders	**Total N = 32 (% with sexual disorder)**
Anorgasmia	6 (19%)
Transient (N = 0)	
Permanent (N = 6)	
Insufficient vaginal lubrication during intercourse	32 (100%)
Transient (N = 1)	
Permanent (N = 31)	

Transient: condition arose in the post-operative period but resolved at the time of last follow-up

Permanent: condition arose in the post-operative period and persistent at the time of last follow-up

(4%) of anastomotic stenosis. One case of anastomotic stenosis was managed with endoscopic dilatation (grade IIIb), while the second case required a new surgery for loop ileostomy creation because of the severity of the stenosis and the adhesions found during the procedure (grade IIIc).

Regarding functional morbidity, 25 (50%), 25 (50%), 32 (64%) women suffered from intestinal, voiding, and sexual issues, respectively.

In particular, constipation grade 2–3 was reported by 17 women (68%), while 6 (18%) suffered from diarrhea syndrome.

Urinary retention was noted in 8 women (16%) out of the total population, comprising 32% of all urinary complications observed. In particular, 7 women (88%) at last FU contact had recovered normal urinary function, while

only 1 patient (4%) had a permanent neurogenic bladder (grade Id) requiring self-catheterization.

Ten women (20%) experienced the loss of urinary urge while preserving the normal capacity to micturate. The lack of urge to urinate represented 40% of all the urinary complications observed. Seven of the women (70%) affected by this disorder recovered sensation over time, while 3 (30%) remained impaired.

Weak and/or obstructed urination was noted in 14 (28%) of the whole population, representing 56% of all the urinary complications. Four women (29%) had recovered function at the time of last FU, while 10 women (71%) sustained a permanent sensation of urinary obstruction.

Three women (6%) experienced new-onset urinary urgency syndrome, accounting for 24% of all urinary disorders. It remained permanent in 100% of the cases over time.

Stress incontinence appeared in 4% of the whole population (2 patients), which comprised 8% of all urinary disorders. This disorder remained permanent in 100% of cases over time.

New-onset anorgasmia was reported by 6 women (12.5%), representing 19% of all sexual impairment symptoms. Anorgasmia remained permanent in 100% of affected cases.

Insufficient vaginal lubrication during intercourse was reported by 32 women (66.5%) and remained permanent in 97% of cases.

Table 5 demonstrates an analysis of possible predictors of post-operative urinary disorders. Previous surgery, stage, and preoperative symptoms did not appear to determine post-operative impairment. The presence of bilateral parametrial nodules appeared likely to be associated with post-operative urinary dysfunction, which achieved the limit of statistical significance ($p = 0.09$). Concomitant hysterectomy was the only parameter associated with post-operative onset of urinary disorders ($p = 0.05$).

All women experienced persistence of a cure in terms of less pain at last FU (Supplementary Table 1).

Discussion

The present study shows that, when indicated, radical procedures for deep endometriosis including SR allow for long-lasting relief of symptoms with an acceptable rate of complications and functional morbidity. The risk of rectal and urinary dysfunction is acceptable and often transient. In particular, the risk of persistent urinary retention and prolonged need for self-catheterization is low. On the other hand, the likelihood of sexual dysfunction (particularly insufficient vaginal lubrication) is extremely high and persists over time.

SR in DIE has been extensively studied in several series. The cure rate in terms of reduction of pain is well documented and the risk of major complications reported in the literature ranges widely between 7.4% and 25% [19, 21, 36–46]. While postoperative gastrointestinal outcomes have been well investigated [35, 40, 41, 46, 47], urinary and sexual function appear less defined [47–50]. In particular, data about urinary and sexual function are almost exclusively focused on the evaluation of items such as "dysuria", "urinary retention" or "dyspaurenia" and "post-operative sexual quality of life" [14, 40]. The generally shorter-term FU-periods employed in prior publications further obscures actual functional morbidity after SR [17, 19, 21, 35].

Although this study is limited by the relatively low number of patients included, one of the major strengths of the present study is the collection of detailed data on functional morbidity over a long follow-up period. Only a very few studies (employing a smaller sample size and/or a shorter follow-up period) have investigated similar outcomes [20, 24, 49]. In this study, factors associated with an impairment of urinary function were identified. After multivariable correction for possible confounding variables, we observed that the presence of bilateral endometriosis nodules and the performance of hysterectomy were associated with a higher functional morbidity. It is possible that involvement of the pelvis on both sides may impair the neural fibers of the left and right inferior hypogastric plexus. In spite of the extensive use of nerve sparing techniques in this series, the eradication of disease may be a cause of bilateral damage of the autonomic system. Since the ortho-sympathetic fibers (which control continence) lie more cranially than the parasympathetic nerves (which modulate micturition), it is not surprising that the need for bilateral procedures was associated with a higher rate of persistent incontinence or urgency, rather than permanent retention [20, 24, 51–53]. In cases of DIE, hysterectomy requires a radical procedure that involves wide parametrial dissection [54]. As already described, hysterectomy for deep endometriosis is associated with a higher rate of overall complications (including pelvic dysfunction) [54]. On the other hand, it has been demonstrated that patients with deep infiltrating lesions have some degree of preoperative (although often asymptomatic) neural dysfunction [55]. Therefore, surgery may be a contributing factor, although not the only one, responsible for urinary, rectal, and sexual disturbances.

A limitation of the present study is that only 50 women were enrolled over a 12-year period. Only those patients that completed the long follow-up questionnaires were included. Another possible limitation of this series was the exclusion of a control group. It should be acknowledged that DIE is a complex disease, requiring different types of surgical treatments depending on the type, location and size of the lesions, and the degree of infiltration of different organs. As a consequence, a control population was not able to be included in this study. The rate of conversion to laparotomy (16%) was higher in this study, compared with previous

Table 5 Univariable logistic regression analysis of predictors of urinary disorders (permanent and transient) in women undergoing colorectal surgery for endometriosis ($n = 50$)

Variables	N (%) of women with urinary complication	N (%) of women with no urinary complication	Unadjusted OR (95% CI)	P
Clinical characteristics				
Prior surgery for endometriosis				0.4
1	11 (44%)	14 (56%)	Ref	
> 1	14 (56%)	11 (44%)	1.61 (0.53–4.94)	
Stage				0.7
III	5 (55.6%)	4 (44.4)	Ref	
IV	20 (48.8%)	21 (51.2)	0.76 (0.18–3.24)	
Preoperative dysuria				0.1
Yes	4 (33.3)	8 (66.7)	0.30 (0.07–1.26)	
No	18 (62.1)	11 (37.9)	Ref	
Preoperative dyspareunia				0.7
Yes	17 (53.1)	15 (46.9)	0.80 (0.21–3.09)	
No	7 (58.3)	5 (41.7)	Ref	
Preoperative chronic pelvic pain				0.9
Yes	15 (51.7)	14 (48.3)	1.07 (0.30–3.83)	
No	7 (50)	7 (50)	ref	
Preoperative dyschezia				0.5
Yes	18 (47.4)	20 (52.6)	0.64 (0.17–2.39)	
No	7 (58.3)	5 (41.7)	Ref	
Endometriosis clinical status				
Number of nodule				
Single				
Multiple				
Endometrioma				0.7
Yes	17 (51.5)	16 (48.5)	1.19 (0.37–3.85)	
No	8 (47.1)	9 (52.9)	Ref	
Parametrial nodule bil				
Yes	8 (72.7)	3 (27.3)	3.45 (0.79–15)	0.09
No	17 (43.6)	22 (56.4)	Ref	
Periureteral nodule bil				0.5
Yes	8 (57.1)	6 (42.9)	1.49 (0.43–2.17)	
No	17 (47.2)	19 (52.8)	Ref	
Bladder nodule				0.5
Yes	7 (43.7)	9 (56.2)	0.69 (0.21–2.28)	
No	18 (52.9)	16 (47.1)		
Surgical characteristic				
Level of resection				0.8
High	22 (51.2)	21 (48.8)	1.39 (0.28–7)	
Low and ultralow	3 (42.9)	4 (57.1)		
Parametrectomy				0.8
Yes	16 (51.6)	15 (48.4)	1.18 (0.38–3.72)	
No	9 (47.4)	10 (52.6)	Ref	
Ureterolysis				1
Yes	22 (50)	22 (50)	1	
No	3 (50)	3 (50)	Ref	
Resection and vagina opening				0.2
Yes	12 (60)	8 (40)	1.96 (0.62–6.19)	
No	13 (43.3)	17 (56.7)	Ref	
Hysterectomy				0.05
Yes	7 (87.5)	8 (40)		
No	18 (42.9)	17 (56.7)		

literature (3–6%) [42, 43]. This finding is likely related to the presence of extensive adhesions (98% of women previously had undergone surgery, with 50% of them having undergone two or more procedures) and the need for the performance of multiple resections in 6% of cases.

Regarding major complication, the rate of uretero-vaginal fistula (2%) and anastomotic stenosis (4%) was similar to data reported previously in the literature [17, 46, 47]. Of note, no rectovaginal fistulas were reported in this series.

The rate of post-operative "diarrhea syndrome" noted in 16% of the study population could be interpreted to be merely frequent bowel movements (FBM), as reflected in recent literature and in the QoL section of this study [17, 19, 35].

No relationship was observed between the onset of FBM and multiple resections, the length of the specimen removed, or the level of SR [35].

The overall rate of urinary dysfunction was observed to be 50%, which was higher than the published literature (0% to 30.4%, with a mean value of 3.4%). However, the incidence of urological morbidity associated with intestinal-DIE as reported in the literature is poorly documented and is probably underestimated due to the short FU observation periods [47]. Furthermore, several additional urological issues, such as the "lack of the urge to urinate", "urinary urgency," "stress incontinence," "weak/slow/prolonged urinary flow," and "urinary retention" were investigated in this study but not in previous reports [47, 49].

After long-term FU, urinary function was recovered in more than 72% of patients which is of interest because the reversibility of voiding disorders was not widely acknowledged and quantified in previous reports [47].

While a dramatic reduction in dyspaurenia was observed, an alarming 64% of women reported an overall incidence of new-onset sexual dysfunction. The literature lacks "quantitative" data concerning post-operative sexual dysfunction and, indeed, such prior studies are few [22] frequently being based on sexual QoL questionnaires providing "qualitative" results [19, 50]. Despite new-onset sexual dysfunction, overall sexual QoL actually was noted to have improved after SR, likely because of a considerable reduction of severe preoperative dyspareunia [5, 35, 50].

The etiology of vaginal dysfunction is thought to be due to damage of local autonomic nerves. In addition, resection of segments of the posterior vaginal wall often results in fibrosis, causing loss of vaginal physiologic function, such as lubrication and sensitivity [21, 49]. Indeed, vaginal posterior wall resection was performed in 40% of patients in this study which may have influenced the sexual outcomes.

Premature iatrogenic menopause per se could have led to the onset of sexual dysfunction, partially altering the results of this study. However, patients with early menopause represented only a small percentage of the study population (8%),

and only 2 patients (4%) had sexual dysfunction (insufficient permanent vaginal lubrication). The use of systemic HRT in all these patients may have mitigated this possible bias [56].

Further research on these topics is needed to better clarify the incidence of post-operative sexual dysfunction when these surgical procedures are employed.

In conclusion, data from the present study show that the risk of surgical and functional complications associated with SR for radical excision of DIE is generally low and reversible [40, 48]. Special consideration should be given to alterations of sexual well-being (insufficient vaginal lubrication and new-onset anorgasmia) that can persist over time, or even remain permanent. These data may serve as the basis for a thorough and comprehensive counseling of patients who are candidates for this type of surgery and should prompt further investigations aimed at mitigating post-operative morbidity. A multidisciplinary approach to post-operative clinical FU that includes a gynecologist, uro-gynecologist, gastroenterologist, and sexologist may help patients cope with the various post-operative disorders observed here.

Compliance with ethical standards

Conflict of interest R. R. have no conflict of interest to declare. Author declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee (no. PROT. APROV. IST CICOG-31-10-18\100) and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

Informed consent Informed consent was obtained from all individual participants included in the study.

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