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Pain and fertility outcomes of nerve-sparing, full-thickness disc or segmental bowel resection for deep infiltrating endometriosis (DIE) – a prospective cohort study

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Conflict of interest

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

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ABSTRACT

Introduction: Choosing the optimal treatment for bowel endometriosis (DIE), i.e. conservative versus radical surgery, is under debate. We aimed to evaluate the surgical outcomes of segmental resection (SR) and disc resection (DR) regarding fertility, pain symptoms and quality of life score of women with colorectal DIE. **Material and methods:** From March 2011 to December 2016, 134 consecutive patients with symptomatic DIE of the rectosigmoid up to 25cm from the anal verge undergoing SR or DR were prospectively evaluated regarding reduction in pain symptoms, fertility outcomes and complication rates according to Clavien-Dindo classification. **Results:** Of the 134 patients included SR was performed in 102 (76.1%) patients and DR was performed in 32 (23.9%) patients. There was no difference in duration of surgery, complication rates, mean hospital stay or discrepancy in hemoglobin level comparing the two groups. There was no significant difference regarding reduction of pain symptoms, fertility and functional outcomes. One-hundred and twelve (83.6%) patients were followed-up long term. In both cohorts there was a significant reported decrease in pain symptoms and increase in quality of life scores. Of all the 61 infertile patients, 26 (42.6%) became pregnant spontaneously and 13 (21.3%) via in vitro fertilization (IVF) with an overall pregnancy rate of 63.4%. The overall complication rate (Clavien-Dindo III-IV) was 8/134 (5.9%) without statistical significant difference between the cohorts. **Conclusions:** Both conservative surgery with disc resection and nerve-vessel sparing segmental resection reduce pain symptoms with equal morbidity. Fertility is improved with surgery with both techniques.

Key words

deep infiltrating endometriosis, colorectal resection, disc resection, pain symptoms, conservative surgery, infertility

Key message

Improvement of pain symptoms and quality of life score can be achieved in patients undergoing surgery segmental resection or disc resection due to symptomatic rectosigmoid endometriosis. We observed good fertility results both, spontaneous and after assisted reproduction technique in the subgroup of patients with infertility.

Abbreviations

ASRM American Society for Reproductive Medicine

DIE deep infiltrating endometriosis

DR disc resection

IVF in vitro fertilization

LARS lower anterior resection syndrome

PR pregnancy rate

TVS transvaginal sonography

INTRODUCTION

Deep infiltrating endometriosis (DIE) is defined as infiltrative growth of extrauterine endometrial glands and stroma extending below the peritoneal surface >5 mm (1). DIE affecting the colon and/or rectum has been associated with severe pain symptoms (2), altered digestive function (3) and decreased fertility (4) consequently leading to an impaired quality of life in these patients. Medical treatment does offer a valuable therapeutical option in the majority of women affected with colorectal DIE (5). However, a significant percentage of women will experience continuing pain or may not tolerate side effects of medical therapy (6). In addition, spontaneous and in vitro fertilization rates have been demonstrated being decreased in women with advanced disease and colorectal endometriosis (2). These issues may, to a significant extent, be overcome by surgical removal of DIE lesions and thereby offer an effective alternative treatment strategy to these patients (4), (7). Several studies have demonstrated a significant drop in pain scores and amelioration of impaired sexual functioning in women following surgical resection of colorectal endometriosis (7). Furthermore, there is increasing evidence demonstrating overall pregnancy rates (PR) ranging from 42% up to 80% in women with resected colorectal disease (4). To date, there is an ongoing discussion on how to optimally resect bowel endometriosis. Rectal shaving which involves resection of DIE leaving the bowel mucosa intact and limited full thickness discoid resection either conducted laparoscopically or transanally have been proposed as so-called conservative treatment approaches (8), (9), (10). In contrast, full thickness resection of a whole bowel segment has been advocated in advanced colorectal DIE where limited resection techniques are difficult to apply (11), (12). However, there is a variety in the approach to segmental bowel resection for DIE. Standard colorectal resection which is primarily

performed for cancer of the rectum or sigmoid colon involves mobilization of the rectosigmoid as in standard total mesorectal excision surgery including resection of a significant length of the bowel around the lesion as well as the surrounding tissue up to the plane between the mesorectum and the presacral fascia (13). This standard technique may also be applied for colorectal DIE in institutions where the general surgeon is primarily involved for segmental resections as reported previously (14), (15), (16), (17). In accordance with previous publications (18) our strategy for surgical resection of bowel disease includes conservative and radical, i.e. segmental removal of DIE with the aim of limiting the resected segment to the area of infiltration with a tubular, nerve- but also mesorectum and artery-sparing treatment approach. Transvaginal sonography (TVS) is performed by the gynecological surgeon is essential in our pre-operative work-up. In addition, to the classical nerve-sparing technique, we also aim to spare all tissues and vessels surrounding the rectal wall, which is then resected in a limited, tubular manner. The present study was conducted to evaluate the short- and long-term outcomes of disc and limited nerve-vessel sparing segmental resection regarding perioperative morbidity, long-term pain and fertility outcomes.

MATERIAL AND METHODS

From March 2011 to August 2016, a total of 134 women underwent surgical treatment for deep infiltrating endometriosis (DIE) out of which all showed involvement of the rectum and/or sigmoid colon involving at least the serosal and muscular layer confirmed by histological analysis. All preoperative scans and surgical procedures were performed in our departments by one main gynecological surgeon (G.H.) in a multidisciplinary team setting consisting of 4 colorectal surgeons (B.D, T.B, F.B, M.D.) and 2 urological surgeons. The departments are linked tertiary referral centers for patients with severe endometriosis. Over the study period, all women with rectal DIE including cases with DIE of other locations (vagina, rectovaginal septum, urinary bladder and/or ureteric involvement) were treated surgically. All patients were recruited from our pelvic pain clinic and underwent preoperative TVS for detection of DIE and clinical examination by one person (G.H.) followed by renal sonography to diagnose possible hydronephrosis. Clinical data including age, body mass index, parity, previous surgical treatments and symptoms described by a numerical 10-point analogue rating scale for dysmenorrhea, dyspareunia, dyschezia and dysuria and quality of life were evaluated prospectively pre- and post-operatively (Table 1). Women who failed to achieve a clinical pregnancy by > 12 months or more of regular unprotected intercourse were considered infertile. All infertile women had preoperative infertility workup including ovulation studies, TVS examination and semen analysis. Women under the age of 18 years, patients with psychiatric disorders or a history of malignancy as well as virgins were excluded from the analysis.

Intraoperative details were noted, and a postoperative check-up was performed at 2 months followed by a telephone survey at the time of re-evaluation of data in order to update the information on symptoms, fertility and bowel and/or bladder/renal function. Postoperative bowel function was assessed using the validated scoring system for lower anterior resection syndrome (LARS) (19). This scoring system is validated on patients with rectal cancer but can provide information on bowel related quality of life for patients undergoing bowel surgery for advanced endometriosis.

Surgical procedure and postoperative management

Surgical treatment was indicated on the basis of pain symptoms and/or infertility and was performed by a multidisciplinary team. All rectal surgery and cases of ureterolysis or utereral resection with uretroneocystostomy were performed by one gynecological surgeon (G.H.), in collaboration with one out of four general surgeons (B.D; T.B, F.B., M.D.) and one out of two urological surgeons in a team setting. All except one of the procedures were initially performed laparoscopically under general anesthesia using 4 ports with single-shot antibiotic treatment i.v. one hour prior to surgery.

Surgical procedures regarding rectosigmoidal DIE consisted of either full thickness rectal disc resection (DR) or rectal segmental resection (SR). In brief, surgical steps were as follows: adhesiolysis of the physiological attachment of the sigmoid followed by identification of the left ureter. The peritoneum was then further opened to identify the hypogastric plexus on both sides, pararectal and Okabayashi spaces were dissected bilaterally including dissection of all autonomous nerve fibres and lateralization of nodular DIE in cases of extensive DIE spreading to the pelvic sidewall. In these cases of bilateral involvement of the hypogastric plexus, DIE was resected to the level of the lower part of the hypogastric nerve plexus thereby leaving minor portions of DIE in situ to avoid neural damage. Dissection of the affected area of the bowel was then performed in close contact with the lateral bowel wall in a tubular fashion limited purely to the area with visible DIE, aiming to spare all fatty tissues, the hypogastric nerve plexus and vessels lateral of the rectal wall segment which was then resected, Figure 1A-C. The dissection was then extended to the level of healthy, unaffected colon and/or rectum located below and above the area of bowel DIE. In cases of concomitant vaginal involvement, the nodule was divided into a rectal and vaginal portion and the vaginal fornix was resected and again closed with interrupted vicryl 1/0 sutures. In cases of deep muscular involvement up to 1.5 - 2 cm in diameter, the affected area was resected in a disc-like full-thickness manner using a circular transanally applied stapling device as primarily described by Woods et al. (8). Alternatively, the nodule was fixed by a suture and positioned into an opened laparoscopically applied linear stapler followed by firing and specimen retraction, preceded by the introduction of a bougie device with the stapler in a closed position to exclude narrowing of the bowel

lumen. This technique, however was only applied at the beginning of this study and was later substituted by the transanal disc resection.

In patients with bowel involvement above 2 cm in diameter evaluated by presurgical TVS and the intraoperative situs, as well as in patients with multiple, i.e. ≥ 2 bowel lesions, a full-thickness segmental resection (SR) was performed according to our institutional practice standards by enlarging the suprapubic incision to 3 cm to facilitate exteriorization of the bowel segment which was purely resected in the area of visible endometriotic involvement. In all cases, the hypogastric plexus was spared from resection. In all but 4 cases we were able to spare the mid and lower rectal artery. Initially, stapling device was positioned within 1-2 cm below the level of infiltration and transected. End-to-end or in rare cases lateral to end colorectal anastomosis was then constructed using a rectally introduced forceps. In cases of urinary tract endometriosis, surgical techniques have been described previously (20). Complications were graded according to the Clavien–Dindo classification system as follows: I, minor complications not requiring medical or surgical intervention; II, complications requiring pharmacological treatment or blood transfusion; III, complications requiring re-intervention; IV, life-threatening complications, and V, death (21). Blood loss was calculated from the difference in the hemoglobin level before and 24 h after surgery. Histological criteria for colorectal endometriosis included the presence of ectopic endometrial glands and stromal tissue penetrating through the bowel wall. The largest diameter of the lesions was measured on the colorectal specimen. The extent of DIE was recorded intraoperatively by using the ENZIAN scoring system for characterization of DIE (22), (23). In addition, the American Society for Reproductive Medicine (ASRM) score (22) was used to describe the extraperitoneal extent of endometriosis and adhesions.

Statistical analyses

Data were analyzed using SPSS software (IBM Corp. Armonk, NY). Parametric and nonparametric continuous variables were compared with Student's t-test and the Mann–Whitney U test, and categorical variables were compared with Wilcoxon signed-rank or Fisher's exact test, as appropriate. P-values of ≤ 0.05 were considered statistically significant.

Ethical approval

The procedure was not considered experimental and the study was approved by the local IRB (Institutional Review Board at Hospital St John of God and Wilhelminen Hospital, Vienna, Austria; Institutional Review Board, reference number WSP 2011-1-GYN, 12 December 2011).

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RESULTS

Epidemiological data and short-term results

Patient characteristics, demographic and data on fertility are presented in Table 1. Details on intraoperative findings and additional surgical procedures for DIE are listed in Table 2. Severity of DIE was evaluated according to the ASRM score as well as by the ENZIAN score for DIE (24), (22). Results and outcomes of urinary tract endometriosis procedures have been described previously (20). Out of 134 patients with rectosigmoidal DIE, 102 (76.1%) underwent SR whereas 32 (23.8%) underwent DR. Two of the three patients that had a laparotomy in the SR group (2.0%) had converted from laparoscopy. None of the patients in the DR group had to undergo a conversion to laparotomy. Protective ileostomy was performed in 12 patients (11.8%) in the SR group and was not deemed necessary in any of the DR patients. Further data on intra- and perioperative outcomes are depicted in Table 2. The rate of minor complications (grade I and II) was 8.8% for the SR group and 12.5% for the DR group. Major complications (grade III) occurred in 7/102 patients (6.9%) in the SR group and in 1/32 patients (3.1%) in the DR group.

Long-term follow-up data and fertility outcomes

All patients attended a follow-up visit at 2 months postoperatively and 112/134 (83.5%) patients took part in a telephone interview and answered a self-administered questionnaire on pain symptoms, bowel function (19) and fertility outcome. Twenty-two women were lost to follow-up (16.4%). The mean follow-up interval was 36.5 (± 21.9) months in the SR and 34.3 (± 24.3) months in the DR group. No cases of recurrent rectosigmoidal DIE were observed at the visit 2 months postoperatively. However, one patient in the SR group was diagnosed with postoperative bowel stenosis and underwent balloon dilatation. However, whereas no patient out of the SR group reported symptoms suggestive of recurrent rectosigmoidal DIE later onwards, 2 women with prior DR (6.2%) reported severe recurrent dyschezia and dysmenorrhea and exhibited recurrent rectal DIE diagnosed via TVS. Table 3 and Figure 2 and 3 depict changes in symptoms and quality of life scores. All patients who were eligible to long-term follow-up were asked whether they would repeat the surgery with all its consequences. Ninety-three percent in the SR cohort and 90.3 percent in the DR group were in favour of surgery.

Outcomes of infertile patients regarding the long-term effect of surgery on fertility are presented in Table 4. In the series presented, 50/81 (61.7%) women eligible for long-term follow-up in the SR and 11/31 (35.4%) in the DR group presented with infertility preoperatively. As depicted, infertility was more common in the SR group versus the DR patients (50/81, 61.7% versus 11/31, 35.4%). Within these groups, 39 pregnancies (overall PR 39/61, 63.9%) were observed with a mean postsurgical

conception interval of 7 months (range 2-51 months) and 5 months (range 1-48 months) in the SR and DR group respectively. Regarding all 61 infertile patients, 26 (42.6%) became pregnant spontaneously and 13 (21.3%) via in vitro fertilization (IVF). Out of the patients who became spontaneously pregnant, 8/26 (30.8%) women achieved pregnancies ≥ 2 separate occasions and delivered to term 2 times. Pregnancies on ≥ 2 separate occasions were observed in 5/13 (38.5%) patients following in IVF with 1 term delivery. Data on miscarriage, extrauterine pregnancy, preterm birth and ongoing PR are depicted in Table 4 resulting in an overall postoperative live birth rate of 30/61 (49.2%). In the patient group that was not infertile preoperatively and eligible for long-term follow-up desiring a pregnancy following surgery (n=12), we observed 7 pregnancies (58.3%; 4 spontaneous pregnancies, 3 via IVF) resulting in 2 miscarriages, 1 preterm birth, 3 term deliveries and 1 ongoing pregnancy.

DISCUSSION

There is increasing but still limited evidence that infertile patients with advanced stage DIE do benefit from radical surgery regarding altered postsurgical spontaneous and IVF PRs (4). However, the situation is complex in this patient group since multiple additional influencing factors such as age, ovarian reserve and the presence or absence of adenomyosis do influence postoperative fertility outcomes and must be taken into account in the light of possible severe complications of radical surgery (2), (25). Recently, Iversen et al. (4) reviewed the available literature providing detailed information on complications and fertility outcomes following surgical treatment of colorectal endometriosis. Although no randomized controlled trials have been conducted so far, retrospective and prospective studies on complications and postsurgical PR show a great variation in outcomes with spontaneous and overall PRs ranging from 8% and 42% (26) to 50% and 80% (11). The present study included 72 patients with colorectal DIE and infertility. Although 11 women were lost to follow-up, we observed a spontaneous PR and overall PR of 42.6% and 63.9% and a live birth rate of 49.2% respectively. This is in line with previous reports and underlines the beneficial effect of radical surgery for colorectal DIE on fertility especially when taking into account that a significant percentage of infertile women with previous bowel DIE will conceive naturally and may therefore avoid IVF with its potential risks such as hyperstimulation syndrome, multiple pregnancies and exacerbation of symptoms and/or bowel obstruction (27). Whether infertility in the absence of pain symptoms justifies extensive surgery in patients with colorectal DIE remains highly questionable given the potential risks of surgery and satisfying outcomes of primary IVF in these patients (2). In our cohort, only one woman with absent symptoms and multiple previous IVF failures opted for surgery.

Similarly to fertility outcomes, there is also a wide range of complication rates following colorectal resection techniques for bowel DIE (28), (7). Within this, some groups have advocated the increasing use of conservative techniques such as shaving or DR over segmental resection for surgical treatment of bowel DIE. To date, there are no definitive indications for any of these 3 techniques. When summarizing the current evidence on complications of conservative and segmental resection techniques, Donnez et al. (28) found slightly higher rates of urinary retention (0%-17.5%), ureteral lesions (0%-2%), anastomotic leakage (0%-4.8%) and abscess formation (0%-4.2%) following segmental bowel resection compared to those in shaving or DR with similar rates of rectovaginal fistulas (0%-18%) in segmental resected women and conservative treatment groups (0%-11.8%). As a consequence, some authors argue that if technically feasible, shaving and/or DR should be favoured over segmental bowel resection in the light of these observations (28), (29). So far, one prospective randomized trial compared SR versus DR in women with colorectal DIE up to 15cm above the anus and more than 20mm in length. Short-term outcomes and complication rates did not differ significantly between the two groups. Although the authors demonstrated the feasibility of conservative surgery for larger lesions, i.e. above 2 cm in length, no significant differences regarding functional outcomes and PRs were observed with a 15% rate of bowel stenosis requiring additional procedures and a 63.6% rate of temporary stoma in the segmental resection arm (30).

In our practice, women with lesions measuring more than 2 cm in diameter predominantly undergo segmental resection based on our experience and the evidence that there is no proven benefit of conservative surgery in this patient cohort. Although we observed more complications in the SR group regarding anastomotic leakage (1.9% versus 0%) and rectovaginal fistula (1% versus 0%), these differences did not prove statistically significant. In addition, the observed leakage rate and fistula rate in the SR cohort range amongst the lowest published so far (28). Furthermore, we did not observe significant differences in long term functional outcomes regarding minor or major LARS nor a high rate of bowel stenosis in SR patients (1.2%) as reported by Roman and colleagues in their randomized controlled trial comparing SR and DR reaching 15.2% (30). Therefore, we do not strictly support the tendency to promote conservative surgical techniques wherever and whenever possible and even in large lesions as suggested by Donnez et al. (28), Bordel and colleagues (31) or Nezhat et al. (32). Furthermore, our rate of protective ileostomies with 11.8 % in the SR group and 0% in the DR is much lower than the ones reported by groups strongly supporting conservative surgery (9), (30), (29). Based on the morbidity of protective ileostomies regarding patient discomfort, risks of local infection and the need for a second surgical intervention, one may question whether a general increase of conservative surgical approaches combined with high rates of protective stomas for the sake of omitting segmental resection provides an argument in favour of this approach. On the other hand, it must be stated that the rate of concomitant vaginal resection was higher in the series published by Roman et al. (30), which might in part explain the increased use of protective ileostomies.

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As suggested in an expert opinion paper and review of the literature (31), full resection of DIE should be the goal in order to achieve an optimal outcome when surgery is chosen as a treatment strategy for rectosigmoidal DIE. The authors suggest that SR should be favoured in sigmoidal lesions, multiple nodules and lesions above 3 cm in diameter as well as deep infiltrating disease involving the submucosa and/ or mucosa. Our analysis supports this approach demonstrating low morbidity even when radical surgical approaches, i.e. SR are favoured over conservative approaches in lesions between 2-3 cm in diameter and above. Our analysis does also have some weaknesses. First and foremost, this study was not undertaken in a randomized controlled and blinded setting. As a consequence, differences in results regarding SR and DR must be interpreted with caution. Furthermore, 16.4% of patients were lost to follow-up, which may indeed influence the results in a negative way. One explanation for the loss to follow-up may also be the fact that the majority of these patients were from different ethnical backgrounds and had left the country. Finally, we only evaluated functional outcomes postoperatively and did not evaluate LARS scores and bowel function over time. Despite the potential risks of bowel surgery and possible long-term functional impairment of bowel function, the final question remaining is whether the benefit outweighs possible complications and rectosigmoidal dysfunction following surgery. In our cohort, 94% in the SR group and 90% of patients in the DR cohort would again favour surgery when asked whether to repeat the procedure or not.

CONCLUSION

Taken together, the results of the present analysis underline the beneficial effect of both, DR and SR for DIE for improvement of pain symptoms and increasing fertility. The decision whether to favour conservative surgery or segmental resection in patients with singular and large lesions should, in our opinion and based on the present evidence, left to the interdisciplinary surgical team and individual experience.

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FIGURE LEGENDS

Figure 1A: Intraoperative situs of nerve-vessel sparing SR demonstrating the left pelvic sidewall with

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ureter (*), fibres of the inferior hypogastric plexus (**), mesorectal fatty tissue and vessels (++), vagina following colectomy for DIE (+) and rectum.

Figure 1B: Rectal segment with DIE following tubular nerve-vessel sparing dissection (**) sparing all tissue lateral to the rectal wall (++).

Figure 1C: Consequent specimen from nerve and vessel – sparing segmental resection showing involvement of the bowel wall (*) disrupting the normal muscular layer (**).

Figure 2: Changes in QoL scores following segmental resection (SR, blue blots) and disc resection (DR, green blots) for colorectal endometriosis.

Figure 3: Changes in pain scores following segmental resection (SR) and disc resection (DR) for colorectal endometriosis regarding dysmenorrhea (blue blots), dyspareunia (green blots) and dyschezia (green blots).

Table 1. Patient characteristics, symptoms and demographic data of patients undergoing segmental and discoid resection for colorectal DIE.

Table 2. Intraoperative findings and perioperative morbidity data of patients undergoing segmental and discoid resection for colorectal DIE.

Table 3. Long term outcomes of 112 eligible patients regarding pain symptoms following segmental and discoid resection for colorectal DIE.

Table 4. Long term outcomes of 112 eligible patients (66 infertile patients) regarding fertility following segmental and discoid resection for colorectal DIE.

Table 1. Patient characteristics, symptoms and demographic data of patients undergoing segmental and discoid resection for colorectal DIE.

	Segmental resection (n=102)	Disc resection (n=32)	p-value
Age (years) (mean ± SD)	34.5 ± 7.0	34.0 ± 0.7	0.484
Parity (mean ± SD)	0.06 ± 0	0.09 ± 0	0.657
Gravidity (mean ± SD)	0.15 ± 0	0.28 ± 0	0.214
Previous surgery for endometriosis, n (%)			
1	22 (21.6)	7 (21.9)	0.915
≥ 2	10 (9.8)	3 (9.4)	0.945
Infertility, n (%)	60 (58.9)	12 (37.5)	<0.03
Dysmenorrhoea, n (%)	102 (100)	32 (100)	1
Dyspareunia, n (%)	70 (68.6)	27 (84.4)	0.05
Dyschezia, n (%)	67 (65.7)	16 (50)	0.13
Dysuria, n (%)	13 (12.7)	4 (12.5)	0.98
Reason for surgery			
Pain symptoms; reduced QoL	42 (41.3)	20 (62.5)	<0.04
Infertility	1 (0.9)	0 (0.0)	<0.0001
Pain symptoms plus infertility	59 (57.8)	12 (37.5)	<0.05

Table 2. Intraoperative findings and perioperative morbidity data of patients undergoing segmental and discoid resection for colorectal DIE.

	Segmental resection (n=102)	Disc resection (n=32)	p-value
Duration of surgery, (minutes; median, range)	210.5 (120-480)	199 (75-388)	0.71
Laparoscopy, n (%)	101 (99)	32 (100)	0.31
Laparotomy, n (%)	1 (0.98)	0 (0)	0.32
Conversion to laparotomy, n (%)	2 (2)	0 (0)	0.09
Protective stoma, n (%)	12 (11.8)	0 (0)	0.0004
AFSr stage I, n (%)	4 (3.9)	2 (6.3)	0.60
AFSr stage II, n (%)	15 (14.7)	9 (28.1)	0.13
AFSr stage III, n (%)	21 (20.6)	7 (21.9)	0.88
AFSr stage IV, n (%)	63 (61.8)	14 (43.8)	0.08
ENZIAN A (Vagina/RVS), n (%)	85 (83.3)	28 (87.5)	0.55
ENZIAN B (USL, Parametrium), n (%)	84 (82.4)	31 (96.9)	0.004
ENZIAN C (Rectum/ Sigmoid) n (%)	102 (100)	32 (100)	1
C1 (<1cm)	2/102 (1.9)	24/32 (75)	<0.0001
C2 (1-3 cm)	19/102 (18.7)	8/32 (25)	0.46
C3 (>3cm)	81/102 (79.4)	0/32 (0)	<0.0001

Height of stapler anastomosis			
<7cm	28/102 (27.4)	14/32 (43.8)	0.11
7-25 cm	63/102 (61.8)	18/32 (56.3)	0.25
>25 cm	11/102 (10.8)	0/32 (0)	<0.0007
FA, n (%)	52 (51)	11 (34.3)	0.10
FB, n (%)	9 (8.8)	3 (9.3)	0.92
FU, n (%)	6 (5.9)	3 (9)	0.66
Ureterolysis, n (%)	41 (40.2)	14 (43.8)	0.73
Ureteral reimplantation, n (%)	2 (2)	1 (3)	0.74
Partial cystectomy, n (%)	9 (8.8)	3 (9.4)	0.92
Endometrioma surgery >3cm, n (%)	38 (37.3)	9 (28.1)	0.34
Vaginal opening & resection	28 (27.5)	15 (46.9)	0.057
Hospital stay (DAYS, mean ± SD)	7.6 ± 3.0	6.8 ± 3.0	0.16
Hemoglobin level g/dL difference, (mean ± SD)	1.76 ± 1.06	1.87 ± 1.84	0.75
Postoperative complications (Clavien-Dindo Grade I-IV; n, %)			
Grade I			
Hematoma (subcutaneous)	1 (0.98)	0 (0)	0.32
Urinary retention	6 (5.9)	3 (9.4)	0.54
Grade II			
Colpectomy infection	1 (0.98)	1 (3.1)	0.52

Compartment syndrome	1 (0.98)	0 (0)	0.32
Grade III			
Hematoma (subcutaneous)	1 (0.98)	0 (0)	0.32
Anastomotic leakage	2 (1.9)	0 (0)	0.16
Hemoperitoneum	3 (2.9)	1 (3.1)	0.953
Rectovaginal fistula	1 (0.98)	0 (0)	0.32
Grade IV			
	0 (0)	0 (0)	1

AFSr, American Fertility Society revised; ENZIAN, ENZIAN score for deep infiltrating endometriosis – FA, adenomyosis; FB, bladder; FU, ureter;

Table 3. Long term outcomes of 112 eligible patients regarding pain symptoms following segmental and discoid resection for colorectal DIE.

	Segmental resection (n=81)			Disc resection (n=31)		
Mean duration of postop follow-up in months (mean ± SD)	36.5 ± 21.9			34.3 ± 24.3		
Symptom score (NAS)	presurgical	postsurgical	p-value	presurgical	postsurgical	p-value
Dysmenorrhoea (mean ± SD)	8.3 ± 1.7	2.1 ± 2.1	<0.0001	7.8 ± 1.7	2.5 ± 2.2	<0.0001
Dysparunia (mean ± SD)	3.5 ± 3.0	0.7 ± 1.5	<0.0001	4.9 ± 2.5	1.2 ± 1.5	<0.0001
Dyschezia (mean ± SD)	4.2 ± 3.5	0.7 ± 1.5	<0.0001	3.0 ± 3.5	0.6 ± 1.4	0.0001
Dysuria (mean ± SD)	0.7 ± 1.9	0.09 ± 0.5	0.009	0.6 ± 1.7	0.1 ± 0.3	0.18
Quality of life score (mean ± SD)	2.8 ± 1.5	8.5 ± 1.5	<0.0001	4.2 ± 2.2	8.3 ± 1.2	<0.0001
Would patient repeat surgery? (YES/NO)		76 (93.8)			28 (90.3)	0.88
LARS						
no LARS (0-20)						
minor LARS (21-29)		75 (92.6)			28 (90.3)	0.71
major LARS (30-42)		5 (6.2)			1 (3.2)	0.48
Bowel stenosis (symptomatic)		1 (1.2)			2 (6.4)	0.66
		1 (1.2)			0 (0.0)	0.32

SD, standard deviation; LARS, lower anterior resection syndrome score

Table 4. Long term outcomes of 112 eligible patients (66 infertile patients) regarding fertility following segmental and discoid resection for colorectal DIE.

	Segmental resection (n=81) (n, %)	Disc resection (n=31) (n, %)	p-value
Presurgical infertility	50/81 (61.7)	11/31 (35.4)	0.01
Pregnancy rate (spontaneous and IVF - subfertile patients)	32/50 (64.0)	7/11 (63.6)	0.98
Spontaneous pregnancy rate	20/50 (40)	6/11 (54.5)	0.41
IVF pregnancy rate	12/50 (24)	1/11 (9)	0.018
Time to pregnancy months, median (min - max)	7 (2 - 51)	5 (1 - 48)	0.83
Miscarriage	5/32 (15.6)	1/7 (14)	0.94
Extrauterine pregnancy	0/32 (0)	0/7 (0)	1
Preterm birth	4/32 (12.5)	1/7 (14)	0.91
Term delivery	21/32 (65.6)	4/7 (57.1)	0.70
Ongoing pregnancy	2/32 (6.3)	5/7 (71.4)	0.011









