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ORIGINAL RESEARCH

Long-term gastrointestinal function outcomes of women undergoing nerve-vessel sparing segmental or full-thickness discoid resection for deep colorectal endometriosis

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Abstract

Introduction: Patients undergoing colorectal surgery for symptomatic deep endometriosis may experience postoperative impairment of gastrointestinal function. However, there is limited information on long-term follow-up of this surgical sequela. We aimed to analyze 5-year postsurgical outcomes of gastrointestinal function in these patients, reflected by lower anterior resection syndrome (LARS) scores and gastrointestinal quality of life index (GIQLI).

Material and Methods: This prospective study included patients who either underwent nerve-vessel-sparing segmental resection (NVSSR) or full-thickness discoid resection (FTDR) for symptomatic colorectal deep endometriosis from April 2017 to May 2022 at two tertiary referral centers. As published previously, gastrointestinal function was evaluated by LARS and GIQLI scores pre- and postsurgically (postoperative visit 1) and was now re-evaluated (postoperative visit 2) to gain information on long-term outcomes.

Results: Out of 121 patients, 92 were eligible for the final analysis at postoperative visit 2. The mean follow-up interval was 58.5 ± 17.9 months in the NVSSR group and 61.6 ± 10.7 months in the FTDR group. As published previously, presurgical LARS-like symptoms were observed in 42/92 (45.7%) of patients, including 37/76 (48.7%) in the NVSSR group and 5/16 (31.3%) in the FTDR group. Compared to preoperative LARS scores, patients in the NVSSR group showed a significant reduction of LARS scores at long-term postoperative visit 2 ($p = <0.001$), with LARS scores remaining stable over postoperative visit 1 and visit 2 ($p = 0.09$) at 5 years postoperatively. In women following FTDR, presurgical and long-term postoperative visit 2 LARS scores remained statistically unchanged ($p < 0.73$), with worsening of LARS scores between postoperative visit 1 and visit 2 ($p = 0.02$). In contrast, significant improvement of

Abbreviations: DE, deep endometriosis; FTDR, full-thickness discoid resection; GI, gastrointestinal; GIQLI, Gastrointestinal Quality of Life Index; LARS, low anterior resection syndrome; NVSSR, nerve vessel sparing segmental resection.

GIQLI was observed between the preoperative visit and postoperative visit 2 at 5 years follow-up in both NVSSR and FTDR groups ($p \leq 0.001$ and $p = 0.001$, respectively).

Conclusions: Compared to presurgical values, long-term gastrointestinal function reflected by LARS scores remains improved following NVSSR, whereas it remains unchanged following FTDR. However, when GIQLI is applied as patient-reported outcome measurement (PROM), patients show permanent, long-term improvement of gastrointestinal function following either NVSSR or FTDR for symptomatic colorectal endometriosis.

KEYWORDS

deep endometriosis, full-thickness discoid resection, gastrointestinal quality of life index, low anterior resection syndrome, nerve vessel sparing segmental resection

1 | INTRODUCTION

Colorectal deep endometriosis (DE) affects 3%–20% of reproductive-aged women.[1,2] In symptomatic patients, the presence of bowel DE is not only associated with severe pain symptoms and impaired fertility but is also related to impaired gastrointestinal (GI) function, reflected by decreased gastrointestinal quality of life index (GIQLI), lower anterior resection syndrome (LARS)-like symptoms, or defecation pain.[2–4] As one of the therapeutic options, surgery emerges as a contentious choice, with debates regarding its necessity and extent.[5] To date, there is no consensus on the optimal type of surgery for treating bowel DE. The decision between the three surgical options, including shaving, full-thickness discoid resection (FTDR) or segmental resection with its variant of preservation of nerves and vessels (NVSSR) depends primarily on factors, such as lesion size, location, uni- or multifocality, and, finally, the surgeon's personal experience and expertise.[2,6] Several studies have investigated which specific type of surgery is most beneficial for patients with DE, particularly in terms of short- and long-term outcomes.[6] Recent evidence showed conflicting results in terms of major complications and GI function outcomes in patients undergoing surgical excision of intestinal DE either using segmental resection techniques or FTDR.[6] Within this, segmental resection may be associated with higher complication rates and worse GI function outcomes, reflected by higher LARS scores compared to so-called conservative approaches like rectal shaving or FTDR.[7–9] In contrast to this, some studies reported an improvement in GI function postoperatively or did not observe such a difference.[2,10–12,13] In addition, these data need to be interpreted in the light of recent studies demonstrating that GI function may already be impaired before surgery, primarily due to the nature of endometriotic lesions and their effect on GI function.[2,14,15,13]

The vast majority of studies lack a long-term follow-up on GI function exceeding 1–2 years postoperatively. The stability of possible improvements and the effect of persistence or recurrence of these symptoms on GI function over time therefore remain uncertain. In addition, most of the research on long-term outcomes of bowel endometriosis surgery is retrospective.[11,12,16] Some studies have provided prospective data with varying follow-up rates,[2,17–19] and the results suggest that more research is needed to conclusively determine whether these benefits are sustained over time.

Key message

Gastrointestinal function reflected by the patient reported outcome measurement, gastrointestinal quality of life index is permanently improved in the majority of patients following either nerve-vessel-sparing segmental resection or full-thickness discoid resection for symptomatic colorectal endometriosis.

To further elucidate the effects of colorectal surgery regarding the possible changes in GI function over time, the present study aimed to evaluate long-term postoperative prospective follow-up data reflected by GIQLI and LARS scores in patients who underwent surgical excision of bowel endometriosis by either NVSSR or FTDR.

2 | MATERIAL AND METHODS

2.1 | Study design and patients

This prospective study included patients who either underwent NVSSR or FTDR for surgical resection of colorectal DE from April 2017 to May 2022 at two tertiary endometriosis referral centers (Hospital of St. John of God, Vienna and Rudolfinerhaus Private Clinic, Vienna). The presurgical diagnosis of colorectal endometriosis was made by transvaginal sonography, following the IDEA consensus guidelines, by an expert-level sonographer /EFSUMB level III (GH).[20] Findings from the transvaginal ultrasound examination were recorded using the #Enzian classification.[21,22] Baseline characteristics including age, body mass index, gravidity, parity, and previous surgical treatments were recorded.

All surgical procedures were conducted by a primary gynecological surgeon (GH) within a multidisciplinary team that included two colorectal surgeons (BD, TB) and a urological surgeon. The

primary indication for surgery was quality of life–reducing pain not responding to conservative treatments and/or infertility. In all institutions, the goal of surgical treatment was resection of all macroscopically evident endometriotic foci while preserving and/or enhancing fertility. Initially, all procedures were performed laparoscopically under general anesthesia, utilizing four ports and administering a single-shot intravenous antibiotic treatment 1 h before surgery. The authors have previously outlined the indications for the surgical method,[15] surgical steps for the modified segmental resection technique NVSSR and the FTDR technique in detail.[23]

The primary outcome of this work was to evaluate the long-term effect of surgery on GI function, reflected by changes in LARS and GIQLI scores. While LARS is primarily designed for rectal cancer surgery, it has also been utilized to assess bowel function following radical resection of bowel endometriosis.[24] The questionnaire consists of five questions, and the selected options are summed up to yield the final result. There are three main subgroups from which the final score is subdivided: minor LARS (20–29 points), major LARS (30–42 points), and no LARS (0–20 points).[12] GIQL refers to a set of questionnaires designed to assess the quality of life specifically related to GI health.[25] Patients rated GIQL on a scale of 0–144, with 0 being the lowest and 144 the highest score possible.

Patients were assessed for preexisting GI function impairment, as indicated by LARS and GIQLI scores within 4 weeks prior to surgery as well as 3- (postsurgical visit 1) and 5-year postsurgery (postsurgical visit 2). The intermediate-term outcomes regarding changes in LARS and GIQLI have been evaluated previously by our group.[2] All assessments conducted at 3- and 5-year follow-ups were performed via structured telephone interviews by three authors (DP, AR, and TH). STROBE criteria were followed for reporting.[26]

2.2 | Statistical analysis

Descriptive results are presented using means and standard deviations as well as *n* and %. The changes in the LARS and GIQLI scores were tested for significant differences between the measurement times and groups using repeated-measures analysis of variances. The differences were normally distributed, the variances were homogeneous, and the Box's M test was not significant. The effect size between two measurement times is indicated using Cohen's *d*. Effects from 0.20 are considered small, from 0.50 medium, and from 0.80 large.[27] The statistical analyses were performed with SPSS 29, and a *p*-value of ≤0.5 was considered statistically significant.

3 | RESULTS

Ninety-two out of 121 (76%) patients who underwent surgery for symptomatic colorectal DE and were eligible for the first follow-up (postoperative visit 1) at 3 years could be evaluated at the second follow-up (postoperative visit 2) and were included in the final analysis.[2] NVSSR was performed in 76/92 (82.6%) patients and 16/92 (17.4%) patients underwent FTDR. The mean follow-up time was 58.5 ± 17.9 months in the NVSSR group and 61.6 ± 10.7 months in the FTDR group ($p = 0.5$). Patient characteristics, demographic data, and DE severity, which was assessed according to #Enzian classification, are depicted in Table 1.

As published previously[2] and demonstrated for completeness, preoperative LARS-like symptoms were observed in 42/92 (45.7%) patients included (Table 2).

Evaluating patients undergoing NVSSR, LARS-like symptoms were observed in 37/76 (48.7%) patients preoperatively and were observed in 10/76 (13.2%) patients at the postoperative visit 2.

To demonstrate the changes over time, the mean LARS score was 8.3 ± 10.1 at visit 1 and 10.43 ± 9.62 at visit 2. When comparing LARS scores between visit 1 and visit 2, GI function reflected by LARS scores remained stable in the NVSSR group ($p = 0.09$) (Figure 1). Equally, stable GIQLI scores were observed (123 ± 18 at visit 1 and 124 ± 15 at visit 2, $p = 0.47$) (Figure 2). Compared to preoperative LARS scores, patients undergoing NVSSR showed a permanent significant decrease in LARS scores (18.1 ± 11.9 vs. 10.43 ± 9.62, $p < 0.001$) and an increase in GIQLI scores (91 ± 2 vs. 124 ± 5, $p < 0.001$) at postoperative visit 2, demonstrating long-term improvement in GI function.

In the FTDR group, 5/16 patients (31.3%) presented with preoperative LARS-like symptoms and only 1/16 (6.3%) patients at postoperative visit 1 and 3/16 (18.3%) patients at postoperative visit 2 presented with these symptoms. The mean LARS score was 6 ± 6.7 at postoperative visit 1 and significantly increased to 11.9 ± 9.4 at postoperative visit 2 ($p = 0.02$) (Figure 1). In contrast, GIQLI remained stable between postoperative visit 1 and postoperative visit 2 (123 ± 1 vs. 116 ± 2, $p = 0.13$) (Figure 2). Compared to preoperative LARS-like symptoms, LARS scores remained unchanged in the FTDR group at long-term postoperative visit 2 (12.6 ± 11.2 vs. 11.9 ± 9.4, $p < 0.735$). When comparing presurgical GIQLI scores to postoperative visit 2, we observed a permanent improvement of GI function reflected by GIQLI (92 ± 2 vs. 116 ± 2, $p = 0.001$).

3.1 | Subgroup analysis of the patients with preexisting minor or major LARS

When analyzing 42/92 (45.7%) patients with presurgical minor or major LARS-like symptoms, LARS scores remained stable between postoperative visit 1 and postoperative visit 2 (11.1 ± 12.3 vs. 14.0 ± 10.5, ($p = 0.49$)). A permanent improvement was observed at postoperative visit 2 when compared to preoperative values (28.6 ± 4.9 vs. 14.0 ± 10.4, $p < 0.001$). In addition, GIQLI scores were unchanged at postoperative visit 1 and postoperative visit 2 (121 ± 2 vs. 121 ± 2, $p = 1.0$) with a permanent improvement at long-term follow-up visit 2 when compared to preoperative values (84 ± 2 vs. 121 ± 2, $p < 0.001$).

TABLE 1 Patient characteristics, demographic data, and intraoperative findings of 92 women undergoing nerve-vessel sparing segmental (NVSSR) or full thickness discoid resection (FTDR) for colorectal deep endometriosis (DE).

	NVSSR ($n=76$)	FTDR ($n=16$)	p-value
Age (years)	34.45 ± 5.32	31.19 ± 4.00	**0.023**[a]
Gravidity	0 (0–2)	0 (0–1)	0.814[b]
Parity	0 (0–3)	0 (0–1)	1.000[b]
Previous pelvic surgery, *n* (%)			
1	30 (39.5%)	5 (31.3%)	0.586[c]
≥2	3 (3.9%)	0 (0%)	
Laparoscopy, *n* (%)	73 (96.1%)	16 (100%)	1.000[b]
Conversion to laparotomy, *n* (%)	2 (2.6%)	0 (0%)	1.000[b]
Duration of surgery (min)	219.99 (83–452)	159.5 (92–242)	**<0.001**[a]
Hospital stay (days)	6.19 (3–12)	5.25 (3–11)	0.053[a]
Protective stoma, *n* (%)	12 (15.8%)	1 (6.3%)	0.453[b]
Presence of adenomyosis, *n* (%)	39 (51.3%)	9 (56.3%)	0.788[b]
rASRM stage, *n* (%)			
Stage I	3 (3.9%)	2 (12.5%)	0.076[c]
Stage II	10 (13.2%)	5 (31.3%)	
Stage III	14 (18.4%)	3 (18.8%)	
Stage IV	49 (64.5%)	6 (37.5%)	
ENZIAN classification			
ENZIAN A (Vagina/RVS), *n* (%)	46 (60.5%)	11 (68.8%)	0.586[b]
ENZIAN B (USL, Parametrium), *n* (%)	69 (90.8%)	16 (100%)	0.348[b]
#ENZIAN C (Rectum/Sigmoid), *n* (%)	76 (100%)	16 (100.0%)	
C1 (<1 cm)	1 (1.4%)	2 (12.5%)	**<0.001**[c]
C2 (1–3 cm)	22 (28.9%)	14 (87.5%)	
C3 (>3 cm)	53 (69.7%)	0 (0%)	
FA, *n* (%)	39 (51.3%)	9 (56.3%)	0.788[b]
FB, *n* (%)	11 (14.5%)	3 (18.8%)	0.705[b]
FU, *n* (%)	11 (14.5%)	1 (6.3%)	0.684[b]
ENZIAN P	62 (81.6%)	15 (93.8%)	0.455[b]
ENZIAN O	47 (61.8%)	11 (68.8%)	0.777[b]
ENZIAN T	52 (68.4%)	9 (56.3%)	0.390[b]

Note: Bold values indicate statistically significance.

Abbreviations: #ENZIAN, ENZIAN Score for deep infiltrating endometriosis; DE, colorectal deep endometriosis; FA, adenomyosis; FB, bladder; FTDR, full thickness discoid resection; FU, ureter; NVSSR, nerve-vessel sparing segmental resection; Rasrm, Revised American Society of Reproductive Medicine.

[a]Independent samples *t*-test.

[b]Fisher's exact test.

[c]Chi-squared test.

As depicted in Table 3, 37/76 (49%) in the NVSSR group presented with preexisting minor or major LARS-like symptoms. LARS scores (11.5 ± 11.5 vs. 13.0 ± 10.5, $p=1.0$) and GIQLI (120.6 ± 20.4 vs. 121.5 ± 16.2, $p=1.0$) were observed stable between postoperative visit 1 and visit 2. Compared to preoperative LARS scores, patients in the NVSSR group showed a significant reduction in LARS scores (28.7 ± 5.1 vs. 13.0 ± 10.4, $p<0.001$) and an overall improvement in GIQLI at postoperative visit 2 (83.2 ± 16.4 vs. 121.5 ± 16.2, $p<0.01$, respectively).

When analyzing patients who underwent FTDR, only 5/16 (31%) patients presented with preexisting LARS-like symptoms, and no significant change was observed in LARS scores or GIQLI scores either between postoperative visit 1 and visit 2 (8.2 ± 610.23 vs. 21.6 ± 7.8, $p=0.2$; and 120.4 ± 11.8 vs. 114.4 ± 20.8, $p=0.78$, respectively). Equally, presurgical LARS and GIQLI scores remained unchanged compared to postoperative visit 2 (28.0 ± 3.7 vs. 21.6 ± 7.8, $p=0.22$ and 91.6 ± 8.7 vs. 114.4 ± 20.8, $p=0.23$, respectively).

TABLE 2 Long-term gastrointestinal function outcomes regarding low anterior resection syndrome (LARS) scores and gastrointestinal quality of life (GIQL) scores following nerve vessel-sparing segmental resection (NVSSR) and full-thickness discoid resection (FTDR) for colorectal deep endometriosis.

	NVSSR ($n=76$)				FTDR ($n=16$)			
Visit	**Presurgical**	**Postsurgical 1**	**Postsurgical 2**	***p* value**	**Presurgical**	**Postsurgical 1**	**Postsurgical 2**	***p* value**
Follow-up time (months)	—	39.77 ± 16.36	58.54 ± 17.86	—	—	43.98 ± 10.85	61.64 ± 10.69	—
GIQL (M ± SD)	90.88 ± 18.14	123.07 ± 18.81	124.34 ± 14.45	<0.001* 0.477**	91.81 ± 19.25	123.06 ± 14.21	116.44 ± 15.00	0.001* 0.125**
LARS (M ± SD)	18.13 ± 11.93	8.25 ± 10.13	10.43 ± 9.62	<0.001* 0.09**	12.63 ± 11.21	6.00 ± 6.69	11.94 ± 9.39	0.735* 0.019**
LARS, *n* (%)								
No LARS	39 (51.3)	66 (86.8)	66 (86.8)		11 (68.7)	15 (93.7)	13 (81.2)	
Minor LARS	23 (30.3)	7 (9.3)	6 (7.9)		4 (25.0)	1 (6.3)	3 (18.8)	
Major LARS	14 (18.4)	3 (3.9)	4 (5.3)		1 (6.3)	0 (0)	0 (0)	

Note: Data are presented as mean ± standard deviation or *n* (%).

Abbreviations: FTDR, full-thickness discoid resection; GIQL, Gastrointestinal Quality of Life; LARS, Low Anterior Resection Syndrome; NVSSR, nerve following nerve vessel sparing segmental resection.

*$p<0.05$ compared to presurgical. **$p<0.05$ when compared to postsurgical-1.

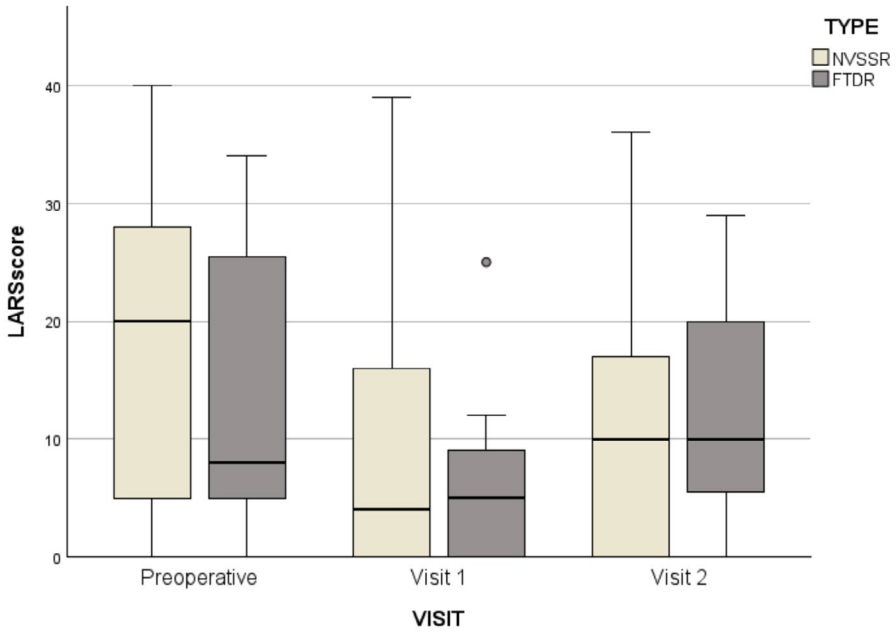

FIGURE 1 Comparison of low anterior resection syndrome (LARS) scores between visits in nerve vessel sparing segmental resection (NVSSR) and full-thickness discoid resection (FTDR) groups.

4 | DISCUSSION

In this study, we investigated GI function outcomes reflected by LARS scores and GIQLI at a mean of 5 years following colorectal surgery for DE. Our previously published findings demonstrated a significant reduction in both minor and major LARS scores at the first postoperative visit 1 at the 3-year follow-up for both groups.[2] This decrease remained stable at the postoperative visit 2 at a 5-year follow-up. However, patients in the FTDR group experienced an increase in their symptoms as measured by LARS between the postoperative visit 1 and visit 2 with a return to presurgical baseline values. However, both NVSSR and FTDR groups reported permanently improved GIQLI scores at long-term follow-up. A subgroup analysis of patients with preexisting minor and/or major LARS-like symptoms preoperatively demonstrated that the outcomes were comparable with the entire patient cohort.

To date, there are only 2 prospective studies which are the follow-up of the same RCT reporting on long-term postsurgical GI function outcomes at 5 –and 7–years post-surgery.[18,28]

In the ENDORE study, Roman et al. observed comparable results regarding GIQLI scores of patients who underwent either conservative surgery or segmental resection. Follow-up data of this

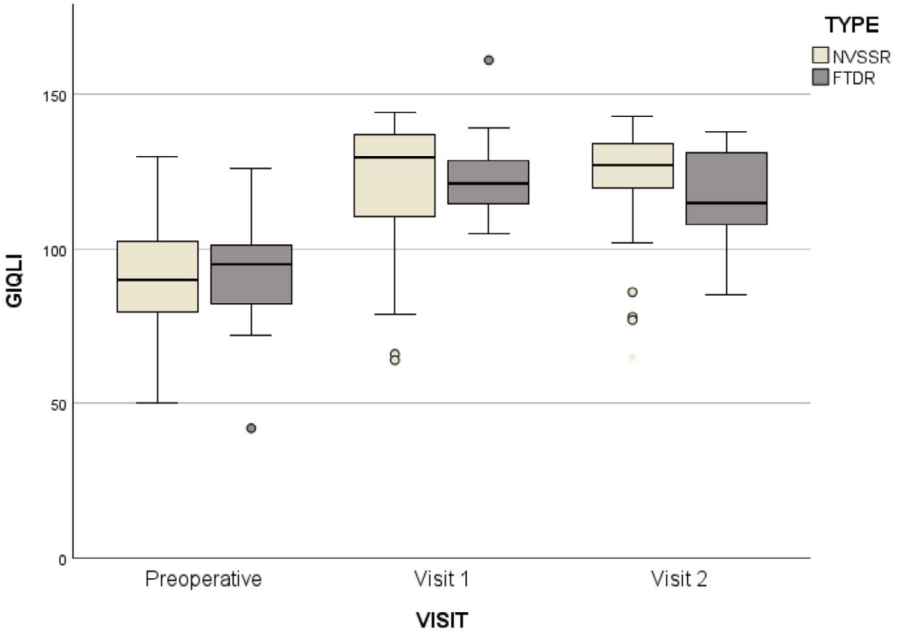

FIGURE 2 Comparison of gastrointestinal quality of life index (GIQLI) scores between visits in nerve vessel sparing segmental resection (NVSSR) and full-thickness discoid resection (FTDR) groups.

TABLE 3 Subgroup analysis of the patients with preexisting minor or major low anterior resection syndrome (LARS) following nerve vessel-sparing segmental resection (NVSSR) and full-thickness discoid resection (FTDR) for colorectal deep endometriosis.

	NVSSR ($n=37$)				FTDR ($n=5$)			
Visit	**Presurgical**	**Postsurgical 1**	**Postsurgical 2**	***p*-value**	**Presurgical**	**Postsurgical 1**	**Postsurgical 2**	***p* value**
Follow-up time (months)	—	39.77 ± 16.36	58.54 ± 17.86	—	—	43.98 ± 10.85	61.64 ± 10.69	—
GIQL (M ± SD)	83.22 ± 16.42	120.59 ± 20.43	121.51 ± 16.24	<0.001* 1.000**	91.60 ± 8.74	120.40 ± 11.80	114.40 ± 20.84	0.234* 0.785**
LARS (M ± SD)	28.70 ± 5.09	11.51 ± 11.48	13.03 ± 10.44	<0.001* 1.000**	28.00 ± 3.67	8.20 ± 610.23	21.60 ± 7.77	0.225* 0.200**

Note: Data are presented as mean ± standard deviation or *n* (%).

Abbreviations: FTDR, full-thickness discoid resection; LARS, Low Anterior Resection Syndrome; GIQL: Gastrointestinal Quality of Life; NVSSR: nerve following nerve vessel sparing segmental resection.

*$p<0.05$ compared to presurgical. **$p<0.05$ compared to postsurgical 1.

study showed significant improvement shortly after surgery, with no further improvement or impairment of GI function recorded at 1–7 years postoperatively, reflected by Wexner, KESS, and GIQLI scores. These findings are consistent with our results, particularly in terms of the GIQLI, suggesting that surgery has a sustained positive impact on patients' quality of life.

In the present work, we observed that patients in the FTDR group exhibited permanently increased GIQLI scores ($p=0.001$) despite showing increased LARS scores at long-term follow-up. Therefore, a complex relationship exists between specific GI symptoms and an impairment of quality of life. This raises the question of the ideal patient-reported outcome measure (PROM) to use for assessing GI function in patients who underwent surgery for bowel endometriosis. There is disagreement over the best instrument to use, as the authors of a previously published study identified 48 distinct PROMs that are used to assess different aspects of the impact of endometriosis on patients.[29] One of the most commonly used PROMs in studies reporting on GI function outcomes is GIQLI,[2,18,28,30,31] followed by the KESS and Wexner questionnaires. Based on our findings, we suggest that LARS scores may not accurately reflect the impact of long-term GI function impairment on patients' GI quality of life. In addition, conservative surgery such as FTDR has been associated with less negative effects on postsurgical GI function in several analyses, which stands in contrast to our observation if LARS is used as PROM but not GIQLI.[9] This view is also favored by a recently published Delphi consensus clearly supporting the use of GIQLI for the assessment of GI function outcomes of patients with endometriosis.[32]

The present work has some limitations. First and foremost, the loss to follow-up rate was 24%, which may be attributed to the long-term interval for reevaluation. Secondly, the number of patients in the FTDR group was low compared to patients having undergone segmental resection. The current study's strengths include the so far largest cohort of patients having undergone segmental resection with an extended mean follow-up period of over 5 years and the study's prospective setting.

5 | CONCLUSION

GI function, as indicated by GIQLI scores, remains permanently improved following conservative or radical surgery for symptomatic colorectal DE at a mean long-term follow-up of 5 years. However, utilization of other PROMs such as LARS may yield different results in certain subgroups and should be interpreted with caution.

AUTHOR CONTRIBUTIONS

Daria Pashkunova: Project development, data collection, manuscript writing, editing. Ezgi Darici Kurt and Theresa Hudelist: Data collection, manuscript writing, editing. Anna Rath: Data collection. Attila Bokor: Project development. Gernot Hudelist: Project development, manuscript writing, editing. All authors commented on the manuscript. All authors read and approved the final manuscript.

CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author.

ETHICS STATEMENT

The study was approved by the Local Institutional Review Board (IRB at Hospital St. John of God 2017/1-BB) on April 5, 2017. Patient consent to be included in the study was obtained prior to surgery.

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