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SYSTEMATIC REVIEW

Gastrointestinal function outcomes following radical and conservative colorectal surgery for deep endometriosis: A systematic review and meta-analysis

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Abstract

Introduction: Patients who have undergone colorectal surgery for symptomatic deep endometriosis may still encounter persistent or worsening digestive complaints. The aim of the present work was to analyze gastrointestinal function outcomes after radical and conservative colorectal surgery to further elucidate the effect of surgery on postoperative bowel function.

Material and Methods: PubMed, EMBASE, Web of Science, Clinical Trials.gov and the Cochrane Database databases were searched from January 1, 2010 until April 1, 2024. The quality of included studies was assessed by the Downs and Black quality checklist. Studies including patients with colorectal endometriosis who either underwent segmental resection (SR) or conservative approaches and reported data on bowel function were included.

Results: From the initial pool of 55 studies, 14 reported patient reported outcome measures eligible to be pooled in the meta-analysis. Conservative surgery was less associated with constipation and increased number of daily stool (>3/day) when compared to SR ($p=0.02$ and $p=0{,}0004$, respectively). No difference was found in the occurrence of gas and stool incontinence ($p=0.72$), postsurgical defecation pain ($p=0.44$) and time to defer defecation (≤15 min; $p=0.64$). Patients in the conservative surgery group reported higher postoperative Gastrointestinal Quality of Life Index (GIQLI) when compared to SR ($p=0.01$). However, when comparing changes between pre- and postsurgical patient reported outcome measures within the respective groups, rather than evaluating postsurgical outcomes alone, none of the intervention groups showed significant changes between pre- and postsurgical GIQLI, Knowles Eccersley Scott Symptom Score(KESS) and Wexner scores ($p=0.28$, $p=0.94$ and $p=0.78$, respectively).

Abbreviations: DE, deep endometriosis; FTDR, full thickness discoid resection; GI, gastrointestinal function; GIQLI, Gastrointestinal Quality of Life Index; KESS, Knowles Eccersley Scott Symptom Score; LARS, low anterior resection syndrome.

Conclusions: Segmental resection seems to be associated with higher rates of postoperative constipation and lower GIQLI scores when compared to conservative surgery. However, when comparing the change of gastrointestinal function symptoms reflected by changes of gastrointestinal function parameters from pre- to postoperative rather than focusing on purely postoperative parameters alone, no significant difference of these parameters was observed between surgical techniques.

KEYWORDS
conservative surgery, deep endometriosis, gastrointestinal function, segmental resection

1 | INTRODUCTION

Bowel endometriosis can be observed in 3% to 37% of the women presenting with endometriosis.[1] Women suffering from colorectal deep endometriosis (DE) frequently report gastrointestinal (GI) function impairment.[2] Within this, up to 70% of patients with rectal endometriosis report defecation pain and over 50% of the patients experience cyclic constipation.[3] Furthermore, the presence of colorectal DE does cause symptoms similar to lower anterior resection syndrome (LARS) per se.[4,5] Patients who undergo surgery for symptomatic colorectal endometriosis may continue to experience digestive complaints.[6] Dubernard et al. evaluated the quality of life following colorectal surgery for DE and observed significant improvements in gynecological and some digestive symptoms. However, constipation and tenesmus increased in up to 27% of these women[7] which is supported by Benbara et al. regarding an increased prevalence of tenesmus postoperatively.[8] As a consequence, neither SR (SR) nor conservative colorectal surgery like full thickness discoid resection (FTDR) or rectal shaving may provide amelioration of digestive complaints.[9]

Although the exact pathomechanisms causing digestive dysfunction following colorectal surgery are still a matter of controversy, impaired function of the autonomous nerve supply of the rectum, moderate stenosis of the colorectal anastomosis and colorectal intussusception are suggested etiologies that may contribute to impairment of GI function.[10] Another constraining component is the absence of preoperative normative data on GI function of patients who undergo colorectal surgery for DE, since LARS-like symptoms are observed in 18.5% (major LARS) and 27.8% (minor LARS) of patients with untreated colorectal DE.[11]

In line with this, Roman et al. reported that baseline rates of severe constipation are relevant factors exerting influence on postsurgical functional outcomes.[12] The true impact of different surgical approaches on the digestive complaints of patients with colorectal DE appears increasingly complex. We aimed to evaluate the current evidence comparing GI function outcomes following radical, that is, SR vs conservative surgery such as FTDR and shaving for colorectal DE.

Key message

Segmental resection seems to be associated with higher rates of post-operative constipation and lower GIQLI scores when compared to conservative surgery. However, when comparing the change of GI symptoms reflected by changes of GI function parameters from pre- to postoperative rather than focusing on purely postoperative parameters alone, no significant difference of these parameters was observed between surgical techniques.

2 | MATERIAL AND METHODS

2.1 | Search strategy and study selection

The present study was conducted following the Preferred Reporting Items for Systematic Reviews and Meta- Analyses (PRISMA) guidelines.[13] A PRISMA checklist detailing the adherence to reporting standards is provided as supplementary information. The protocol of this review has been registered in the international prospective register of systematic reviews (PROSPERO, CRD42023476251). To identify eligible studies, a literature search was performed in the electronic databases United States National Library of Medicine and National Institutes of Health (PUBMED Medline), Excerpta Medica database (EMBASE), Web of Science, Clinical Trials.gov and the Cochrane Database, covering the period from January 1, 2010 until April 1, 2024. The search strategy used the following MeSH terms: ("bowel endometriosis" or "colorectal endometriosis") AND ("surgery for endometriosis" or "conservative management" or "radical management" or "colorectal resection" or "shaving" or "full thickness resection" or "disc excision") AND ("bowel function").

The inclusion criteria for this review were set using the PICOS (Patients, Intervention, Comparator, Outcomes, Study Design) formulation, and studies were considered if they met the following criteria: (1) population type: patients with colorectal endometriosis who underwent colorectal excision of the disease; (2) intervention type: segmental resection (SR); (3) control type: full thickness discoid resection (FTDR); (4) outcome type: bowel function reflected by either symptom

reporting and reported by validated tools evaluating bowel function; (5) study design type: clinical trials and observational studies. Studies were excluded from this review if one or more of the following exclusion criteria were present: (1) studies reporting a review of literature or only reporting one arm of surgical intervention without the control group; (2) studies in another language than English; (3) studies describing a novel technique; (4) case-series and case reports.

2.2 | Data extraction and outcomes

Two independent reviewers (E.D. and D.P.) screened the titles and abstracts of all identified articles for relevance. Any discrepancies were resolved through discussion or consultation with a third reviewer (G.H.). The bibliographic records were downloaded and imported into Endnote software program (Ver X9.3.3) to save, remove duplicates, and analyze the search results.

Data extraction was performed from included studies as follows: study characteristics (name of the authors, year of publication, design of the study, sample size), characteristics of study participants (mean age, body-mass index, previous surgery for endometriosis, mean follow-up time in months), data on surgical technique, that is, type of the anastomosis, height of the lowest nodule (mm from the anal verge), major complication rates according to Clavien-Dindo classification,[14] abnormal bowel symptoms (constipation, gas/stool incontinence, defecation pain, increased number of daily stool >3/day, time to defer defecation ≤15 min) and the scores of the validated instruments used in the extracted studies (*Knowles Eccersley Scott Symptom* Score [KESS]),[15] Wexner score,[16] Low Anterior Resection Syndrome (LARS)[17] and Gastrointestinal Quality of Life Index (GIQLI).[18] The Knowles-Eccersley-Scott Symptom questionnaire (KESS) was used to diagnose constipation, which is composed of 11 individual items with a maximum of 39 points. Higher scores indicate increased symptom severity.[15] The Wexner scale is composed of 5 items and scores from 0 to 4. It is used to measure the functional impact of fecal incontinence. The score 0 corresponds to continence and 20 represents anal incontinence.[16] LARS Score was originally designed to assess quality of life following low anterior resection for rectal cancer and includes 5 questions regarding bowel function, consequently dividing patients into three groups: no LARS with 0–20 points, minor LARS: 21–29 and major LARS: 30–42.[17] This tool was shown to be also useful in evaluating patients after radical colorectal surgery for DE.[11,19,20] The GIQLI was a self-administered questionnaire comprising 36 questions that scored from 0 to 4, being 0 classified as worse and 4 as best quality of life.

2.3 | Risk of bias assessment

Two independent reviewers assessed the risk of bias in the included studies using validated instruments. The quality of included studies was assessed by Downs and Black Checklist.[21] This checklist includes 27 criteria, widely covering areas reporting quality, external and internal validity, and power. Downs and Black score ranges were given quality levels as: excellent (26–28); good (20–25); fair (15–19); and poor (<14) (Table 1). Conflicts regarding study quality were resolved by the authors. Risk of bias in the included RCT's was assessed by Cochrane risk of bias tool for randomized trials (RoB 2) (Table S1).[22]

2.4 | Statistical analyses

Analyses were performed using Cochrane Collaboration's Review Manger Version 7.5.0. Comparisons were performed when at least 2 studies could be pooled into a forest plot (random effects model). For all metric outcomes, mean values and standard deviations were extracted pre- and post-surgery from the studies. If medians and quartiles or medians with min and max were available, mean values and standard deviations were calculated using the Excel file by Wan et al.[23] The standard deviation of the differences of pre- and post-surgical values for the two intervention groups was calculated using correlation coefficients from the study by Hudelist et al.[5] The results are expressed as Odds Ratio (95% CI confidence interval) for dichotomous data and mean differences (95% CI) for metric data.

3 | RESULTS

A total of 128 articles were obtained following the database search. After removing duplicates, 79 studies were screened for title and abstract. The full text of 55 articles was assessed for eligibility. Thirty-nine studies were excluded and the reason for the exclusion is depicted in Figure 1. Eventually, 16 studies were included in the qualitative synthesis but only 13 of them reported eligible data to be analyzed in the meta-analysis. Figure 1 shows a PRISMA flow diagram of the selection process and the exclusion criteria.

3.1 | Patient characteristics and outcomes

Nine retrospective cohort studies,[11,19,20,24–29] three prospective studies,[5,30,31] one cross-sectional study[32] and three randomized controlled trials (RCTs)[33–35] were included in the systematic review enrolling 1846 patients; 799 (43.3%) underwent SR and 1047 (56.7%) underwent conservative surgery (FTDR and/or shaving). The mean age was 33.5 ± 4.1 vs. 32.9 ± 3.2 years ($p = 0.61$) and the mean BMI was 23.7 ± 2.1 vs. 24 ± 2.9 ($p = 0.87$) in SR group and conservative group, respectively. Median follow-up interval was 53.4 ± 24.2 months in the SR group and 49.2 ± 18.8 months in the conservative group ($p = 0.61$). Thirty-seven percent had previous surgery for endometriosis in the SR group and 30.3% in the conservative group ($p = 0.13$). Only six studies reported on the anatomical height of the lowest rectal DE lesion with a mean height of the lowest nodule of 92.5 ± 5 mm from the anal verge (SR group) vs. 90 ± 20 mm (conservative group), respectively ($p = 0.82$).[5,27,29,33–35] Major complication rates according to Clavien-Dindo were comparable among

TABLE 1 Risk of bias regarding assessment of the included non-randomized controlled studies according to the Downs and Black Score.

	Roman et al. 2010a	Roman et al. 2010	Roman et al. 2016	Bourdel et al. 2018	Hudelist et al. 2018	Mabrouk et al. 2018	Bokor et al. 2020	Farella et al. 2021	Darici et al. 2022	Villa et al. 2023	Hudelist et al. 2023
Hypothesis/aims/objectives clearly stated	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Main outcome measures clearly described	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y
Characteristics of patients/subjects clearly described	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Interventions of interest clearly described	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Distribution of principal confounders in each group clearly described	Y	N	Y	N	Y	Y	Y	Y	N	N	Y
Main findings clearly described	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Estimates of random variability in the data provided	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Important adverse events reported	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Characteristics of patients lost to follow-up described	Y	Y	N	Y	Y	Y	N	Y	Y	N	N
Actual probability values reported	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Participants approached representative of entire population	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y
Participants recruited representative of entire population	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y
Staff, places and facilities representative of majority of population	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Blinding of study subjects	N	N	N	N	N	N	N	N	N	N	N
Blinding of assessors	N	N	N	N	N	N	N	N	N	N	N
Data based on data-dredging clearly stated	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 1 (Continued)

	Roman et al. 2010a	Roman et al. 2010	Roman et al. 2016	Bourdel et al. 2018	Hudelist et al. 2018	Mabrouk et al. 2018	Bokor et al. 2020	Farella et al. 2021	Darici et al. 2022	Villa et al. 2023	Hudelist et al. 2023
Adjustment of different length of follow-up or duration between case and control	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Appropriate statistical tests used	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Compliance to intervention reliable	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Main outcome measure reliable and valid	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Intervention groups or case-controls recruited from same population	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Intervention groups or case-controls recruited at the same time	N	N	N	N	Y	N	N	N	N	N	Y
Study subjects randomized to the interventions	N	N	N	N	N	N	N	N	N	N	N
Was concealed randomization to allocation undertaken	N	N	N	N	N	N	N	N	N	N	N
Adequate adjustment made in the analysis of confounders	N	N	N	N	Y	N	N	Y	N	N	Y
Patient losses accounted for	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/a	N/A
Sufficiently powered cohort size	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y
Level of evidence	3+	3+	3+	4+	5+	4+	4+	4+	4+	3+	5+
Total Score	18	16	20	22	26	23	22	24	21	17	25

Abbreviations: N/A, non-applicable; N, no; Y, yes.

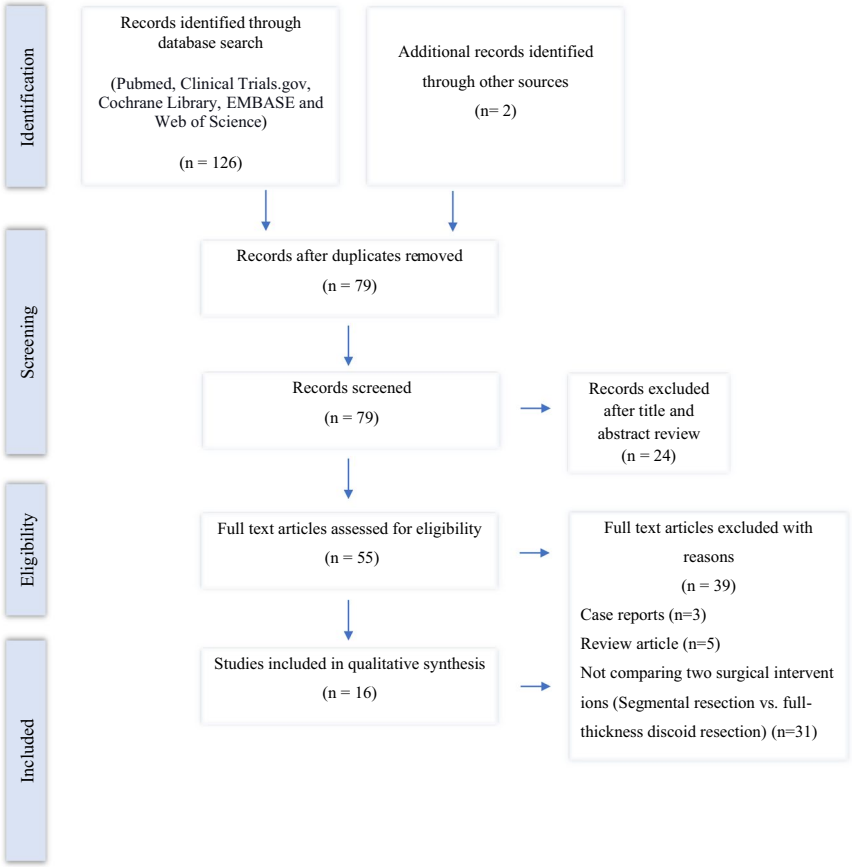

FIGURE 1 PRISMA flow diagram of the selection process and the exclusion criteria.

the two groups with 15.9% in SR patients vs. 10.3% in the conservative cohort ($p=0.15$). Characteristics of studies included according to PICOS (Population, Intervention, Comparison, Outcomes, and Study design) criteria are depicted in Table 2.

3.1.1 | Meta-analysis

Fourteen studies were found to report eligible data to be included in the meta-analysis. Three studies were the follow-up data of an RCT (ENDORE trial).[33–35] The remaining 11 studies were non-randomized trials including questionnaires to assess the bowel function before and after the surgical intervention.[5,11,20,24,25,27–35] Regarding the quality assessment of the included studies, one study was ranked as "excellent",[31] 7 studies were ranked as "good"[5,11,20,27–30] and three studies[24,25,32] were ranked as "fair" according to the Downs and Black Score. Three RCTs were assessed according to RoB2 were found to be low risk.[33–35]

3.2 | Evaluation of postsurgical digestive symptoms and parameters reflecting GI function

3.2.1 | Constipation

Six studies reported on prevalence of postoperative constipation.[24,25,28,32,34,35] Three studies included in the final analysis reflected the follow-up of the only RCT on this subject (ENDORE-Trial).[33–35] Conservative surgery was less associated with constipation than SR (OR = 2.02; 95% CI [1.12–3.66], $p=0.02$) $I^2=0\%$; Figure 2).

3.2.2 | Gas and stool incontinence

No difference was found in the occurrence of gas and stool incontinence between SR and conservative surgery in the included 5 studies (OR = 1.13; 95% CI [0.59, 2.15], $p=0.72$, $I^2=27\%$; Figure S1).

3.2.3 | Defecation pain

Defecation pain was reported as the number of affected patients in five studies[24,30,33–35] and reported as mean values according to the numeric analog scale (NAS) in four studies.[5,11,28,31] In the studies reporting the number of affected patients, no significant difference was found between SR and conservative surgery (OR = 1.26; 95% CI [0.70, 2.25], $p=0.44$, $I^2=4\%$; Figure S2). Three studies reflected the follow-up of the same RCT (ENDORE-Trial).[33–35]

In the studies where defecation pain was reported as mean values according to NAS, no difference was found between SR and conservative surgery (OR = 0.42; 95% CI [−0.35, 1.19], $p=0,35$, $I^2=9\%$, Figure S2).

TABLE 2 Characteristics of studies included according to PICOS (Patients, Intervention, Comparator, Outcomes, Study Design) criteria.

Authors	Year	Intervention	Number of patients included	Outcome	Study design
Roman et al.	2010	SR FTDR	15 31	Major constipation, rectal bleeding	Retrospective
Roman, Marpeau et al.	2010	SR FTDR	25 16	Dysmenorrhea VAS, dyspareunia VAS, non CPP VAS, defecation pain, gas and incontinence, number of stools/day, post operative well being (4 options)	Retrospective
Katarzyna et al.	2016	SR FTDR	11 5	Dysmenorrhea VAS, non menstrual pelvic pain VAS, dyspareunia VAS, defecation pain VAS, rectal bleeding, ODS score, constipation score, Cleveland incontinence score, bowel motions per week, Quality of life	Retrospective
Bourdel et al.	2018	SR Shaving	23 172	Dysmenorrhea VAS, CPP VAS, dyspareunia VAS, dyschezia VAS, constipation, diarrhea, rectal bleeding	Retrospective
Roman et al.	2016	SR Shaving	25 46	KESS, Wexner, GIQL, dysmenorrhea VAS, dyspareunia VAS, intermenstrual pain VAS	Retrospective
Roman et al. (Endore-24 M)	2018	SR FTDR/shaving	33 27	KESS, Wexner, GIQL, Short form 36, dysmenorrhea VAS, dyspareunia VAS, intermenstrual PP VAS	RCT
Roman et al. (Endore-60 M)	2018	SR FTDR	28 27	KESS, Wexner, GIQL, Short form 36, dysmenorrhoe VAS, dyspareunia VAS, intermenstrual pelvic pain VAS	RCT
Hudelist et al.	2018	SR FTDR	81 31	Dysmenorrhea VAS, dyspareunia VAS, dyschezia VAS, dysuria VAS, LARS, QoL	Prospective
Mabrouk et al.	2019	Shaving FTDR SR	297 33 62	Dysmenorrhea VAS, CPP VAS, dyspareunia VAS, dyschezia VAS, dysuria VAS, constipation	Retrospective
Bokor et al. (Noseres/ Cirendo)	2021	SR FTDR	139 66	LARS	Retrospective
Farella et al.	2021	SR FTDR	64 108	LARS	Retrospective
Scheepers et al.	2021	SR Shaving	17 57	Constipation, fecal incontinence, lars	Retrospective
Villa et al.	2023	SR FTDR	36 16	Giql, bristol, cradi-8, abnormal stool frequency, delay to evacuate, diarrhea, constipation	Cross-sectional
Darici et al.	2022	SR FTDR	62 15	Dysmenorrhea vas, dyspareunia vas, dyschezia vas, lars, qol	Retrospective
Roman et al.	2022	SR FTDR	28 27	Increased number of daily stools, dyschezia vas, loss of gas/stool, giql, kess, wexner, short form-36, dysmenorrhoe vas, dyspareunia vas, non cpp vas	Prospective
Hudelist et al.	2023	SR FTDR	98 23	Dysmenorrhea vas, dyspareunia vas, dyschezia vas, lars, qol	Prospective

Abbreviations: CPP, chronic pelvic pain; CRADI-8, colorectal-anal distress inventory-8; FTDR, full thickness discoid resection; GIQLI, gastrointestinal quality of life; LARS, Low anterior resection syndrome; SR, segmental resection; VAS, visual analog scale.

3.2.4 | Increased number of daily stool (>3/day)

Conservative surgery was less associated with increased number of daily stool (>3/day) when compared to SR in the eligible six studies (OR = 2.67; 95% CI [1.55, 4.58], p = 0,0004, I^2 = 0%; Figure 3).

3.2.5 | Time to defer defecation ≤15 min

No difference was found between two surgical intervention groups regarding time to defer defecation (≤ 15 min), (OR = 1.16; 95% CI [0.63, 2.12], p = 0.64, I^2 = 0%) (Figure S3).

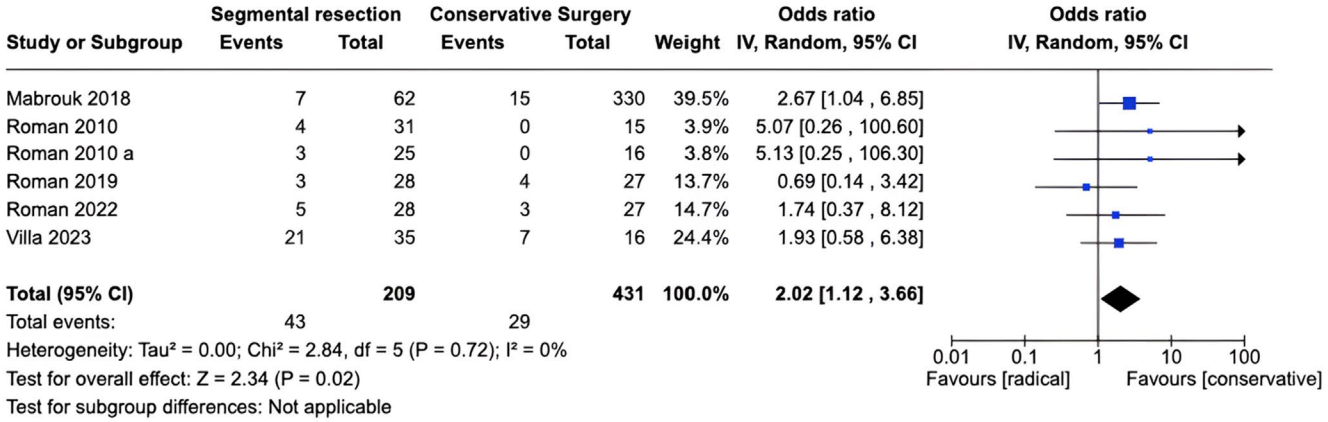

FIGURE 2 Forest plot depicting postsurgical constipation comparing segmental resection (SR) vs conservative surgery.

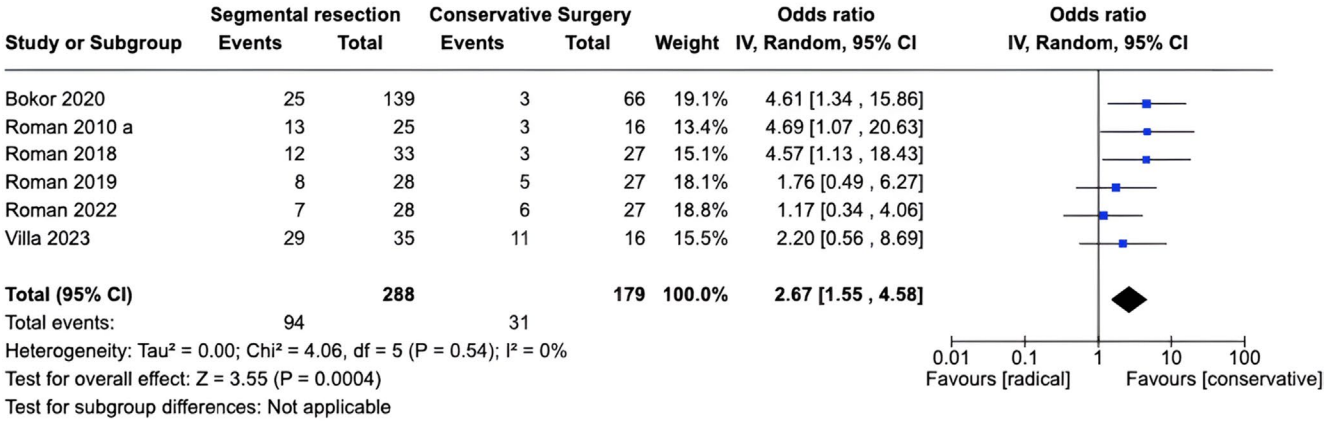

FIGURE 3 Forest plot depicting postsurgical increased number of daily stool (>3/day) comparing segmental resection (SR) vs conservative surgery.

3.3 | Results of the postsurgical patient-reported outcome measures (PROMs) used to assess GI function (GIQLI, KESS, Wexner and LARS score)

Few studies reported data using PROMs including GIQLI, KESS, Wexner and LARS to evaluate postsurgical GI function. Six studies reported on postoperative GIQLI[5,27,29,33–35] and found significantly increased GIQLI scores of patients treated with conservative surgery when compared to SR (OR = −5.76; 95% CI [−10.33, −1.18], $p = 0.01$, $I^2 = 66\%$). Four studies, three of which reflected the follow-up of the ENDORE-trial at 24 months, 60 months and 7 years reported data on KESS and Wexner scores without significant differences between SR and conservative surgery (OR = 0.74; 95% CI [−1.11, 2.60], $p = 0.07$, $I^2 = 58\%$ and OR = 0.20; 95% CI [−0.08, 0.49], $p = 0.5$, $I^2 = 0\%$, respectively).[27,33–35] Five studies reported on postoperative LARS and found no statistically significant difference among the two groups (OR = 1.18; 95% CI [0.79, 1.76], $p = 0.41$, $I^2 = 25\%$). A detailed description of the studies is depicted in Table 3 and Forest plots of PROMs are listed in Figure 4.

3.4 | Results of studies reporting on pre- and postsurgical GI function

Out of 13 studies, three studies reported data on pre- and postoperative KESS and Wexner scores. All three studies were the follow-up of the same RCT.[33–35] Four studies reported pre- and postoperative data on GIQLI[5,33–35] and one study on pre- and postoperative LARS (or LARS-like symptoms).[5] Overall changes of pre- compared to postsurgical values of KESS, Wexner and GIQLI did not reveal significant differences between SR vs conservative surgery intervention groups (OR = −0.11; 95% CI [−2.77, 2.56], $p = 0.94$, $I^2 = 0\%$, OR = 0.10; 95% CI [−0.62, 0.83], $p = 0.78$, $I^2 = 0\%$ and OR = 3.18; 95% CI [−2.57, 8.93], $p = 0.28$, $I^2 = 0\%$, respectively). It was not possible to conduct an analysis of pre- and post-surgical LARS scores as there was only one study reporting pre-surgical LARS Scores[5] (Figure 5).

Regarding pre- and postoperative pain symptoms, defecation pain was the most frequently reported symptom and analyzed in 8 studies,[20,24,25,29,31,33,34] followed by diarrhea,[28–30,33,34] constipation,[28–30,33,34] increased number of daily stool,[28,33,34] time taken to evacuate[28,33,34] and gas and stool incontinence.[28,33,34] Preoperative

TABLE 3 Results of the patient-reported outcome measures (PROMS) used to assess bowel function (GIQLI, KESS and Wexner and LARS) pre- and postsurgically.

					BOWEL FUNCTION						QoL	
					LARS		KESS		Wexner		GIQLI	
Authors	Year	Intervention	Number of patients included	Study design	pre-OP	post-OP	pre-OP	post-OP	pre-OP	post-OP	pre-OP	post-OP
Roman et al.	2016	SR	25	Retrospective	N/A	N/A	N/A	15 (1–27)	N/A	1 (0–9)	N/A	91 (36–140)
		Shaving	64					9 (1–24)		0 (0–8)		114 (68–167)
Roman et al. Endore	2018	SR	33	RCT	N/A	N/A	10 (7–19)	9 (5–17)	1 (0–4)	0 (0–2)	92 (86–104)	121 (99–128)
		FTDR/shaving	27				13 (9–18)	10 (5–15)	0 (0–3)	0 (0–1)	89 (82–105)	111 (97–135)
Roman et al. Endore	2019	SR	28	RCT	N/A	N/A	10 (6.5–17.5)	7.5 (4–15)	0 (0–3.5)	0 (0–2)	93.5 (86–107)	116 (97–126)
		FTDR/shaving	27				13 (9–18)	10 (6–15)	0 (0–3)	0 (0–1)	89 (82–105)	119 (99–130)
Hudelist et al.	2018	SR	81	Prospective	N/A	98,8%	N/A	N/A	N/A	N/A	2.8*	8.5*
		DR	31			93,5%					4.2*	8.3*
Bokor et al.	2020	SR	139	Retrospective	N/A	31,6%	N/A	N/A	N/A	N/A	N/A	N/A
		DR	66			37,9%						
Farella et al.	2021	SR	64	Retrospective	N/A	56,25%	15.4 + −7.4	N/A	N/A	N/A	80.2	N/A
		DR	108			38,89%	14.3 + −7.2				86.1	
Darici et al.	2022	SR	62	Retrospective	N/A	11,3%	N/A	N/A	N/A	N/A	N/A	N/A
		DR	15			6,7%						
Roman et al. ENDORE	2022	SR	28	Prospective	N/A	N/A	10 (6.5–17.5)	8.0 (5–15)	0 (0–3.5)	0 (0–1)	93.5 (86–107)	106 (81–120)
		FTDR/shaving	27				13 (9–18)	11.5 (7–16)	0 (0–3)	0 (0–1)	89 (82–105)	110 (88–129)
Hudelist et al.	2023	SR	98	Prospective	27.5%	9.1%	N/A	N/A	N/A	N/A	N/A	N/A
		DR	23		26%	8.6%						
Villa et al.	2023	SR	35	Cross-sectional	N/A	N/A	N/A	N/A	N/A	N/A	N/A	91.91 ± 23.05
		FTDR/shaving	16									102.19 ± 26.98

Abbreviations: FTDR, full thickness discoid resection; GIQLI, gastrointestinal quality of life; LARS, low anterior resection syndrome; N/A, non-applicable; SR, segmental resection.

*Scores were assessed by numeric analog scale.

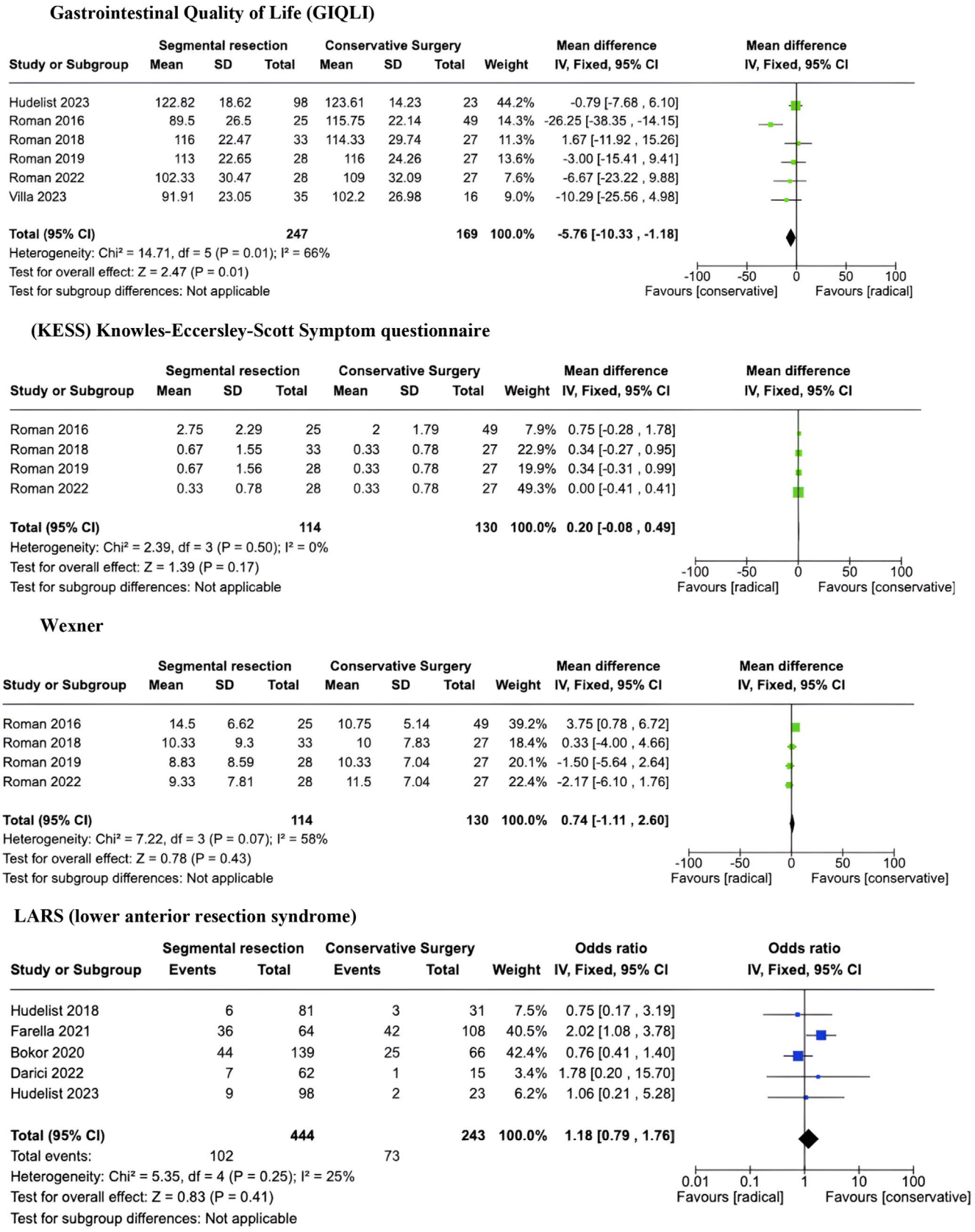

FIGURE 4 Forest plot depicting postsurgical PROMs used to assess GI function (GIQLI, KESS, Wexner and LARS score) comparing segmental resection (SR) vs conservative surgery.

rectal bleeding and cyclic rectal bleeding were reported in one study[29] (Table 3).

3.4.1 | Subgroup analysis excuding follow-up data from single cohort studies

In order to exclude studies that might entail a possible multiplication effect on the meta-analysis, the follow-up studies of the ENDORE Trial[34,35] published in 2019[35] and 2022[34] were excluded in a subgroup analysis. Following exclusion, a significant increase in postoperative GIQLI was observed in conservative surgery group when compared to the SR group (OR = −6.14; CI [−11.30, −0.99], $p = 0.02$). However; when comparing changes of pre- and postoperative variables of GIQLI, no influential effect was observed when excluding these studies (OR = 0.46; CI [−6.76,7.67], $p = 0.9$).[34,35]

4 | DISCUSSION

Colorectal surgery for DE is a radical treatment option that includes SR techniques such as nerve- and vessel-sparing SR as well as conservative procedures such as FTDR and shaving.[5] There is an ongoing debate regarding the benefits of one procedure over the other in terms of severe complications and GI function outcomes.[36,37] PROMs used in high-quality studies to evaluate GI function in patients with endometriosis predominantly include GIQLI, LARS, KESS and Cleveland Clinic Fecal Incontinence Severity Scoring System/Wexner scores.[38] However, a recent

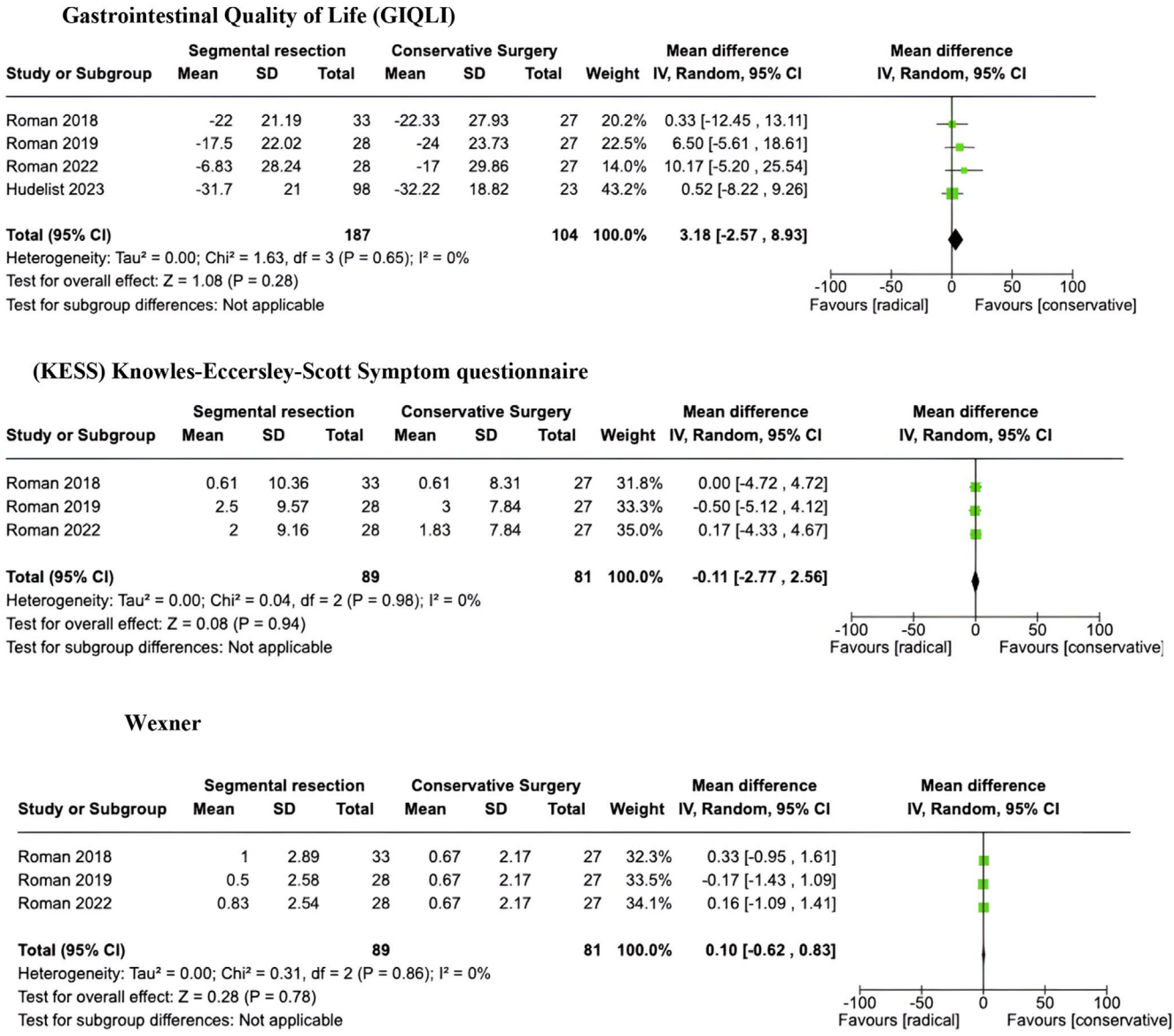

FIGURE 5 Forest plot of difference in pre and postsurgical PROMs used to assess GI function (GIQLI, KESS and Wexner score) comparing segmental resection (SR) vs conservative surgery.

consenus on the use and validity of PROMs to be used in studies evaluating outcomes of interventions in endometriosis therapy suggested GIQLI as the first choice instrument for evaluation of GI function.[39]

The present work analyzed the available evidence on GI function outcomes following SR and conservative techniques by analyzing previously mentioned PROMs and pain symptoms. The results of the present work demonstrate lower postsurgical constipation rates and frequency of daily stools in women following conservative surgeries when compared to SR. Differences in constipation rates in favor of conservative surgery have also been reported in a meta-analysis published by Quintairos et al.[37] This observation is based on the theory that shortening of the rectum by SR may influence colonic water absorption and cause greater damage to the intestinal autonomous innervation leading to increased constipation after SR.[40] The present work included three additional studies on post-surgical constipation rates with the largest caseload analyzed by Mabrouk et al.[28,32,34] Interestingly, a sensitivity analysis excluding the work by Mabrouk et al. resulted in similar constipation rates following any type of intervention demonstrating that the statistical significance regarding lower rates of constipation following conservative surgeries was shifted primarily by this study. Mabrouk et al. reported on 297 patients who underwent rectal shaving, 33 patients who underwent FTDR and only 62 patients following SR. A possible explanation may be that patients with shaving surgeries will undergo more "superficial operations", resulting in a lesser degree of constipation afterwards.

However, surgical preference and experience towards one selected surgical approach may also influence postsurgical complication rates and sequelae due to the factor of surgical experience suggesting that these results need to be interpreted with caution. In addition, a recent follow-up study of the RCT (ENDORE-Trial) by Roman et al. reported insignificant postoperative results regarding constipation in the conservatively managed group when compared to SR.[33–35]

The most common PROM used in included studies was GIQLI,[5,29,33–35] followed by the KESS and Wexner questionnaires which were used in four studies and three studies included follow-up data from the same RCT, published by Roman et al.[33–35] Hudelist et al. provided data on pre- and postoperative LARS scores (LARS-like symptoms).[5] Four papers reported exclusively on post-surgical LARS scores.[11,20,29,31] Studies exclusively reporting postsurgical PROMs show a significant increase in postoperative GIQLI scores in favor of conservative surgery when compared to SR. No relevant difference could be observed between SR and conservative surgery for other PROMs.

However, when baseline, that is, presurgical GIQLI scores were considered and the changes between the pre-vs postsurgical scores were analyzed, no difference could be observed between the radical surgery, that is, SR vs conservative approaches. The lack of relevant differences in changes of GI function following SR and conservative surgery as demonstrated by this analysis may be explained by several factors. First and foremost, postsurgical GI function may not solely depend on the surgical technique but on the degree of overall radicality of removal of disease including adenomyosis and DE affecting other sites. Residual adenomyosis and peripheral and central sensitization has been shown to influence autonomous nerve function and will therefore also have implications on GI function.[41,42] Secondly, factors such as a general inflammatory state caused by DE and fixation of the rectum by secondary adhesions have been suggested to contribute to GI function impairment.[43] As a consequence, the effect of surgical adhesiolysis as part of colorectal surgery will also contribute to changes in GI function independent of the approach used. Thirdly, the notion of a high presurgical prevalence of GI function impairment reflected by LARS-like symptoms present in nearly 30% of colorectal DE patients before surgery and the postsurgical worsening of LARS sores in only 4.1% of women following colorectal surgery by either SR or FTDR suggest that GI function needs to be interpreted in the light of preexisting presurgical impairment already present and caused by DE.[5] Reporting preexisting PROMs on GI function is relevant as a variety of GI symptoms are common in patients with colorectal endometriosis.[44,45]

The present work may have some limitations. Firstly the studies included do have different follow-up intervals. Since bowel function (or dysfunction) may change over time we can not exclude a possible influence of heterogenous follow-up intervals on the results of this meta-analysis. Another possible limitation of the present meta-analysis is the influence of studies including multiple follow-up data from the same study cohort.[34,35] In order to exclude a possible multiplication effect, we performed a subgroup analysis and observed a benefical effect of conservative surgery in favor of GIQLI. However, we want to underline that this effect still was not present when comparing pre- and post operative means which may be more important in terms of clinical relevance. Finally, surgical experience is a factor that will always influence surgical outcome data. This factor was not evaluated in the present anaylsis and could not be evaluated for given reasons.

To best to our knowledge this study is the first systematic review and meta-analysis analyzing changes in pre-vs post-surgical GI function outcomes. Nevertheless, the data presented in this systematic review and meta-analysis have to be interpreted in the light of a relevant heterogeneity that exists throughout the included studies as different PROMs were used by different groups (KESS, Wexner[33–35] and LARS[5,11,20]) at different follow-up intervals.

5 | CONCLUSION

At first sight, radical surgery, i.e., SR appears to be associated with increased postsurgical constipation rates and increased number of daily stool (>3/day) and lower GIQLI scores when compared to conservative surgery. However, when presurgical GI function parameters and their changes following surgery are taken into account, the results of this analysis do not suggest a benefit of conservative surgery over SR.

AUTHOR CONTRIBUTIONS

Ezgi Darici: conceived the study, designed the protocol, performed the literature search, selected the studies and extracted the relevant information, wrote the first draft of the paper. **Attila Bokor**: conceived the study, designed the protocol, critically revised successive drafts of the paper. **Daria Pashkunova**: designed the protocol, performed the literature search, selected the studies and extracted the relevant information, wrote the first draft of the paper. **Birgit Senft**: synthesized the data. **Nilüfer Cimşit**: designed the protocol, wrote the first draft of the paper. Gernot Hudelist: conceived the study, selected the studies and extracted the relevant information, critically revised successive drafts of the paper.

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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.

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REFERENCES

1. Bong JW, Yu CS, Lee JL, et al. Intestinal endometriosis: diagnostic ambiguities and surgical outcomes. *World J Clin Cases*. 2019;7:441-451.
2. Revised American Society for Reproductive Medicine classification of endometriosis: 1996. *Fertil Steril*. 1997;67:817-821.
3. Roman H, Ness J, Suciu N, et al. Are digestive symptoms in women presenting with pelvic endometriosis specific to lesion localizations? A preliminary prospective study. *Hum Reprod*. 2012;27:3440-3449.
4. Reh LM, Darici E, Montanari E, et al. Differences in intensity and quality of bowel symptoms in patients with colorectal endometriosis: an observational cross-sectional study. *Wien Klin Wochenschr*. 2022;134:772-778.
5. Hudelist G, Pashkunova D, Darici E, et al. Pain, gastrointestinal function and fertility outcomes of modified nerve-vessel sparing segmental and full thickness discoid resection for deep colorectal endometriosis - a prospective cohort study. *Acta Obstet Gynecol Scand*. 2023;102:1347-1358.
6. Roman H, Bridoux V, Tuech JJ, et al. Bowel dysfunction before and after surgery for endometriosis. *Am J Obstet Gynecol*. 2013;209:524-530.
7. Dubernard G, Piketty M, Rouzier R, Houry S, Bazot M, Darai E. Quality of life after laparoscopic colorectal resection for endometriosis. *Hum Reprod*. 2006;21:1243-1247.
8. Benbara A, Fortin A, Martin B, et al. Surgical and functional results of rectosigmoidal resection for severe endometriosis. *Gynecol Obstet Fertil*. 2008;36:1191-1201.
9. Roman H, Vassilieff M, Tuech JJ, et al. Postoperative digestive function after radical versus conservative surgical philosophy for deep endometriosis infiltrating the rectum. *Fertil Steril*. 2013;99:1695-1704.
10. Armengol-Debeir L, Savoye G, Leroi AM, et al. Pathophysiological approach to bowel dysfunction after segmental colorectal resection for deep endometriosis infiltrating the rectum: a preliminary study. *Hum Reprod*. 2011;26:2330-2335.
11. Darici E, Denkmayr D, Pashkunova D, Dauser B, Birsan T, Hudelist G. Long-term surgical outcomes of nerve-sparing discoid and segmental resection for deep endometriosis. *Acta Obstet Gynecol Scand*. 2022;101:972-977.
12. Roman H, Bubenheim M, Huet E, et al. Baseline severe constipation negatively impacts functional outcomes of surgery for deep endometriosis infiltrating the rectum: results of the ENDORE randomized trial. *J Gynecol Obstet Hum Reprod*. 2019;48:625-629.
13. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Int J Surg*. 2010;8:336-341.
14. Clavien PA, Sanabria JR, Strasberg SM. Proposed classification of complications of surgery with examples of utility in cholecystectomy. *Surgery*. 1992;111:518-526.
15. Knowles CH, Eccersley AJ, Scott SM, et al. Linear discriminant analysis of symptoms in patients with chronic constipation: validation of a new scoring system (KESS). *Dis Colon Rectum*. 2000;43:1419-1426.
16. Jorge MJ, Wexner SD. Etiology and management of fecal incontinence. *Dis Colon Rectum*. 1993;36:77-97.
17. Emmertsen KJ, Laurberg S. Low anterior resection syndrome score: development and validation of a symptom-based scoring system for bowel dysfunction after low anterior resection for rectal cancer. *Ann Surg*. 2012;255:922-928.
18. Eypasch E, Williams JI, Wood-Dauphinee S, et al. Gastrointestinal quality of life index: development, validation and application of a new instrument. *Br J Surg*. 1995;82:216-222.
19. Scheepers WFW, Maas JWM, van de Kar MMA. Bowel function and quality of life following surgery for deep endometriosis. *J Psychosom Obstet Gynaecol*. 2022;43:334-339.
20. Bokor A, Hudelist G, Dobó N, et al. Low anterior resection syndrome following different surgical approaches for low rectal endometriosis: a retrospective multicenter study. *Acta Obstet Gynecol Scand*. 2021;100:860-867.
21. Downs SH, Black N. The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. *J Epidemiol Community Health*. 1998;52:377-384.
22. Sterne JAC, Savović J, Page MJ, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. *BMJ*. 2019;366:l4898.
23. Wan X, Wang W, Liu J, Tong T. Estimating the sample mean and standard deviation from the sample size, median, range and/or interquartile range. *BMC Med Res Methodol*. 2014;14:135.
24. Roman H, Loisel C, Resch B, et al. Delayed functional outcomes associated with surgical management of deep rectovaginal endometriosis with rectal involvement: giving patients an informed choice. *Hum Reprod*. 2010;25:890-899.
25. Roman H, Rozsnayi F, Puscasiu L, et al. Complications associated with two laparoscopic procedures used in the management of rectal endometriosis. *JSLS*. 2010;14:169-177.
26. Michalak KA, Cameron-Jeffs R, Yen AHF, et al. Impact of bowel endometriosis surgery on bowel and bladder function, pain symptoms and quality of life. *J Endometr Pelvic Pain Dis*. 2016;8:55-61.
27. Roman H, Milles M, Vassilieff M, et al. Long-term functional outcomes following colorectal resection versus shaving for rectal endometriosis. *Am J Obstet Gynecol*. 2016;215:762.e1-762.e9.
28. Mabrouk M, Raimondo D, Altieri M, et al. Surgical, clinical, and functional outcomes in patients with rectosigmoid endometriosis in the gray zone: 13-year long-term follow-up. *J Minim Invasive Gynecol*. 2019;26:1110-1116.

29. Farella M, Tuech JJ, Bridoux V, et al. Surgical management by disk excision or rectal resection of low rectal endometriosis and risk of low anterior resection syndrome: a retrospective comparative study. *J Minim Invasive Gynecol*. 2021;28:2013-2024.
30. Bourdel N, Comptour A, Bouchet P, et al. Long-term evaluation of painful symptoms and fertility after surgery for large rectovaginal endometriosis nodule: a retrospective study. *Acta Obstet Gynecol Scand*. 2018;97:158-167.
31. Hudelist G, Aas-Eng MK, Birsan T, et al. Pain and fertility outcomes of nerve-sparing, full-thickness disk or segmental bowel resection for deep infiltrating endometriosis-a prospective cohort study. *Acta Obstet Gynecol Scand*. 2018;97:1438-1446.
32. Villa NAC, Benetti-Pinto CL, Yela DA. Evaluation of bowel function of women with colorectal endometriosis: a cross-sectional study. *Reprod Sci*. 2023;30:3590-3596.
33. Roman H, Bubenheim M, Huet E, et al. Conservative surgery versus colorectal resection in deep endometriosis infiltrating the rectum: a randomized trial. *Hum Reprod*. 2018;33:47-57.
34. Roman H, Huet E, Bridoux V, et al. Long-term outcomes following surgical Management of Rectal Endometriosis: seven-year follow-up of patients enrolled in a randomized trial. *J Minim Invasive Gynecol*. 2022;29:767-775.
35. Roman H, Tuech JJ, Huet E, et al. Excision versus colorectal resection in deep endometriosis infiltrating the rectum: 5-year follow-up of patients enrolled in a randomized controlled trial. *Hum Reprod*. 2019;34:2362-2371.
36. Juul T, Elfeki H, Christensen P, Laurberg S, Emmertsen KJ, Bager P. Normative data for the low anterior resection syndrome score (LARS score). *Ann Surg*. 2019;269:1124-1128.
37. Quintairos RA, Brito LGO, Farah D, et al. Conservative versus radical surgery for women with deep infiltrating endometriosis: systematic review and meta-analysis of bowel function. *J Minim Invasive Gynecol*. 2022;29:1231-1240.
38. Abbott J, Billow M, Gallant T, et al. Patient-reported outcome measures used in randomized controlled trials following surgical intervention for endometriosis: a structured review from the AAGL practice guidelines group. *J Minim Invasive Gynecol*. 2024;31:71-83.
39. Nicolas-Boluda A, Le Roux E, Tavenet A, et al. Developing a set of patient-centered outcomes for routine use in endometriosis: an international Delphi study. *Acta Obstet Gynecol Scand*. 2024;103:138-152.
40. Milone M, Vignali A, Milone F, et al. Colorectal resection in deep pelvic endometriosis: surgical technique and post-operative complications. *World J Gastroenterol*. 2015;21:13345-13351.
41. Cardaillac C, Levesque A, Riant T, et al. Evaluation of a scoring system for the detection of central sensitization among women with chronic pelvic pain. *Am J Obstet Gynecol*. 2023;229:530.
42. Grundström H, Gerdle B, Alehagen S, Berterö C, Arendt-Nielsen L, Kjølhede P. Reduced pain thresholds and signs of sensitization in women with persistent pelvic pain and suspected endometriosis. *Acta Obstet Gynecol Scand*. 2019;98:327-336.
43. Darwish B, Roman H. Surgical treatment of deep infiltrating rectal endometriosis: in favor of less aggressive surgery. *Am J Obstet Gynecol*. 2016;215:195-200.
44. Remorgida V, Ferrero S, Fulcheri E, Ragni N, Martin DC. Bowel endometriosis: presentation, diagnosis, and treatment. *Obstet Gynecol Surv*. 2007;62:461-470.
45. Roman H, Ness J, Suciu N, et al. Are digestive symptoms in women presenting with pelvic endometriosis specific to lesion localizations? *A Preliminary Prospective Study Hum Reprod*. 2012;27:3440-3449.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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