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Changes in bowel symptoms after different pelvic organ prolapse surgeries among elderly women at the 1-year follow up

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Abstract

Objective: To investigate the prevalence of bowel symptoms in patients with pelvic organ prolapse (POP), to evaluate the changes in bowel symptoms after different POP surgeries, and to identify risk factors for unrelieved bowel symptoms.

Methods: This was an observational prospective cohort study conducted at Peking University First Hospital from 2020 to 2021. Demographic, clinical, and therapeutic data were collected. Participants underwent POP Quantification examination and completed the Pelvic Floor Distress Inventory-20 questionnaire at baseline and 1 year postoperatively.

Results: The prevalence of bowel symptoms and bothersome bowel symptoms in women with POP was 46.38% and 24.40%, respectively. Surgical correction of prolapse was associated with significant relief in bowel symptoms ($P < 0.05$). Colpocleisis may relieve bowel symptoms better than reconstructive surgeries (41% vs. 31%, $P = 0.048$). However, 35% of women had at least one bowel symptom at the 1-year follow up. A long perineal body (Pb) and levator ani muscle injury were found to be predictors of unrelieved bowel symptoms in patients undergoing colpocleisis and those undergoing reconstructive surgery, respectively (odds ratio [OR] 2.306, 95% confidence interval [CI] 1.112–4.783, $P = 0.025$ and OR 3.245, 95% CI 1.266–8.317, $P = 0.014$, respectively), and perineoplasty was a protective factor for women who underwent colpocleisis (OR 0.102, 95% CI 0.025–0.417, $P = 0.001$)

Conclusion: Women with POP have a high prevalence of bowel symptoms. Although bowel symptoms can be relieved after POP surgeries, one-third of women still experience bowel symptoms. A long Pb and levator ani muscle injury were associated with unrelieved bowel symptoms, while perineoplasty was a protective factor.

KEYWORDS

bowel symptoms, pelvic organ prolapse, prevalence, risk factors, surgery

1 | INTRODUCTION

Pelvic organ prolapse (POP) is often associated with lower urinary tract symptoms, bowel symptoms, abdominopelvic pain and sexual

dysfunction and affects approximately 25%–35% of women.¹ None of these symptoms or functional complaints pose an immediate threat to life, but they can alter body image and may affect personal, social, and sexual activities, significantly impacting quality of life

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and leading to depression and anxiety.² As the aging population and proportion of people diagnosed with obesity increase, the need for POP-related health care increases annually. It is predicted that the number of visits for POP services could increase by 35% in the next 10 years.³

Most patients with POP have support defects in multiple vaginal compartments (anterior, apical, posterior). Anatomically, defects in any of the posterior compartment structures could disturb rectal evacuation, resulting in bowel symptoms such as splinting, straining, and incomplete evacuation. Defects contribute to the high prevalence of bowel symptoms in women with POP; the median prevalence rates of obstructive defecation, anal incontinence, and painful evacuation are 53%, 19% and 15%, respectively.⁴

A high prevalence of bowel symptoms in women with POP has been noticed. Several studies investigating the relationship between POP and bowel symptoms have been published.⁵⁻⁷ However, few reports focus on the effects of POP surgeries on bowel symptoms and the risk factors for postoperative bowel symptoms.

The aims of the present study were to evaluate the prevalence of nine bowel symptoms in women with POP and the impact of these bowel symptoms on women's quality of life. We also evaluated the changes in bowel symptoms after different POP surgeries and identified risk factors for unrelieved bowel symptoms.

2 | MATERIALS AND METHODS

This observational prospective cohort study was approved by the ethics committee of Peking University First Hospital. A total of 373 women who underwent surgery for symptomatic POP between January 2020 and June 2021 were identified and included in the present study. Patients with a previous history of prolapse surgery or medical conditions that affect anorectal physiology or cause bowel symptoms were excluded. Informed consent was obtained from all patients.

The present study was approved by the Peking University First Hospital's Ethics Committee (approval number 2022-285-002), and consent was obtained from all study participants. The study followed the code of ethics of the Declaration of Helsinki.

Baseline evaluations included demographic data, detailed medical history and physical examination. Pelvic floor ultrasound data were extracted from medical records. Pelvic Organ Prolapse Quantification (POP-Q) examination and questionnaires were performed at baseline and the 1-year follow up. We administered the Pelvic Floor Distress Inventory (PFDI-20) preoperatively and at 1 year postoperatively. The PFDI-20 is a validated, condition-specific questionnaire including the Colorectal-Anal Distress Inventory (CRADI-8) subscale, which specifically addresses bowel symptoms (splinting, straining, incomplete emptying, fecal incontinence of solid stool, fecal incontinence of liquid stool, flatus incontinence, pain during defecation, fecal urgency, and anorectal prolapse) and associated quality of life.⁸ All women completed the questionnaire under the guidance of specialists. If the patients reported the presentation

of symptoms, then they were asked to rate the severity of bother. We defined responses 3 (moderately) and 4 (quite a bit) as bothersome symptoms.

All operations were performed by one surgeon with experience in urogynecologic surgery. The decision for surgery was made based on a discussion with the woman about her body image and desire for future sexual function. After having either vaginal hysterectomy or laparoscopic hysterectomy, women underwent colpocleisis or reconstructive surgeries (suspension of the vaginal apex to the sacrum, sacrospinous ligament or uterosacral ligament with native tissue or mesh, combined with anterior vaginal repair with or without mesh and posterior colporrhaphy). Some of the women underwent perineoplasty.

Postoperative bowel symptoms and bothersome bowel symptoms were categorized into four groups (relieved, persistent, worsened, or de novo) depending on the changes between baseline and 1 year of follow up.

Data were analyzed with SPSS Statistics version 26.0 (IBM, Armonk, NY, USA). The data in accordance with a normal distribution are expressed as the mean and standard deviation. Non-normally distributed variables are presented as medians and interquartile ranges. Enumeration data are expressed as the rate (%). *t* tests, χ^2 tests or Mann-Whitney *U* tests were applied. For paired data, a paired *t* test, McNemar χ^2 test, and Wilcoxon matched-pairs test were used. A multivariate logistic regression model adjusting for previous hysterectomy, age, body mass index (BMI; calculated as weight in kilograms divided by the square of height in meters), parity, Bp point, perineoplasty, perineal body (Pb) length and levator ani muscle injury preoperatively was constructed to determine the predictors of unrelieved bowel symptoms after POP surgeries. The level of statistical significance was set at *P* value less than 0.05.

3 | RESULTS

A total of 373 eligible women with complete follow-up data were enrolled, most were postmenopausal (321; 90.93%). The mean age of the women was 65.09 ± 9.87 years, and the mean BMI was 24.85 ± 2.93 . All women underwent posterior colporrhaphy or colpocleisis. Of the 373 women, 175 (46.92%) underwent colpocleisis, 124 (33.24%) underwent laparoscopic uterosacral ligament suspension, 48 (12.87%) underwent transvaginal anterior vaginal wall mesh repair, 14 (3.75%) underwent sacrospinous ligament fixation, and 12 (3.22%) underwent laparoscopic sacrocolpopexy (Table 1). None of the patients had recurrence of prolapse or symptoms (a sensation of protrusion from the anus or perineal area) during the follow-up period.

There were significant differences between the preoperative and postoperative prevalence of all bowel symptoms and bothersome bowel symptoms ($P < 0.05$). The preoperative prevalences of bowel symptoms of any degree of bother and bothersome bowel symptoms were 46.38% (173/373) and 24.40% (129/373), respectively. A total of 40.48% (151/373) of women presented with obstructed bowel

TABLE 1 Demographic and clinical characteristics of participants ($n=373$).^a

Characteristics	Value
Age, year	65.09 ± 9.87
Menopausal	321 (90.93)
BMI	24.85 ± 2.93
Parity	1.00 (1.00–2.00)
Nullipara	4 (1.07)
Primipara	192 (51.47)
Multipara	177 (47.46)
POP duration, month	24.00 (12.00–60.00)
Delivery mode	
Vaginal delivery	362 (98.10)
Cesarean section	7 (1.90)
Previous hysterectomy	20 (5.36)
Any vaginal delivery with macrosomia (>4 kg)	12 (3.25)
POP-Q	
Ap	−1.00 (−2.00 to 0.00)
Bp	−1.00 (−2.00 to 0.00)
D	−3.00 (−4.00 to 0.00)
Gh, cm	6.04 ± 1.08
Pb, cm	3.14 ± 0.88
Posterior compartment prolapse Bp ≥ 2	66 (17.69)
Levator ani muscle injury	137 (43.20)
Sphincter defect	14 (4.40)
Hiatus area, m ²	
At rest	18.10 (16.00–21.10)
On Valsalva	28.90 (25.50–33.80)
Surgical treatment	
Reconstructive surgeries	198 (53.08)
ULS + anterior and posterior vaginal repair	124 (33.24)
SSLF + anterior and posterior vaginal repair	14 (3.75)
Sacrocolpopexy + anterior and posterior vaginal repair	12 (3.22)
Anterior vaginal wall mesh repair + posterior vaginal repair	48 (12.87)
Obliterative surgeries	175 (46.92)

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by the square of height in meters); Gh, genital hiatus; Pb, perineal body; POP-Q, pelvic organ prolapse quantification; SSLF, sacrospinous ligament fixation; ULS, uterosacral ligament suspension.

^aData are presented as mean ± standard deviation, median (interquartile range), or number (percentage).

symptoms of any degree of bother, and straining (139/373, 37.27%) was the most common bowel symptom. At 1 year postoperatively, 34.58% (129/373) of women reported at least one bowel symptom. A total of 6.70% (25/373) of women had at least one problem that was

moderately bothersome or quite bothersome. Patients showed that all bowel symptoms were relieved, especially splinting, straining, incomplete evacuation, and solid stool incontinence ($P < 0.001$) (Table 2). A significant difference between preoperative and postoperative CRADI scores was also observed ($P < 0.05$) (Table 3). POP surgeries alleviated bowel symptoms and bothersome bowel symptoms in approximately 77% (134/173) and 84% (76/91) of women, respectively. Splinting showed the highest remission rate (53/66, 88%) while flatus incontinence had the lowest remission rate (25/39, 64%) in all bowel symptoms. Postoperative new-onset defecation symptoms occurred in 25 (12.5%) patients, but only 8 (32.0%) women felt bothered (Table 4).

Bowel symptoms were categorized based on the change from baseline to the 1-year follow up, and the results are summarized in Table 4. Women who had colpocleisis were significantly more likely than those with reconstructive surgery to report relief of bowel symptoms after surgery (41% vs. 31%, $P = 0.048$) (Table 5).

Women were divided into two groups according to POP surgeries. The demographic data and pelvic ultrasound results were compared between symptom change categories. The incidence of levator ani muscle injury was higher in women with unrelieved symptoms (56.8% versus 31.5%, $P = 0.016$) in the reconstruction surgery group, and the Pb was longer in women with unrelieved symptoms (2.94 ± 0.84 cm versus 3.43 ± 1.02 cm, $P = 0.024$) and fewer women underwent perineoplasty (65.2% vs. 88.9%, $P = 0.020$) in the colpocleisis group (Table 6).

After controlling for age, previous hysterectomy, BMI, parity, Bp, and perineoplasty, long Pb and levator ani muscle injury were found to be predictors of unrelieved bowel symptoms after colpocleisis and reconstructive surgery, respectively (odds ratio [OR] 2.306, 95% confidence interval [CI] 1.112–4.783, $P = 0.025$ and OR 3.245, 95% CI 1.266–8.317, $P = 0.014$, respectively), and perineoplasty was a protective factor for women who performed colpocleisis (OR 0.102, 95% CI 0.025–0.417, $P = 0.001$) (Table 7).

4 | DISCUSSION

Rectal prolapse, pelvic organ support defects (posterior compartment prolapse, perineal descent), and defecatory dyssynergia are often associated with bowel symptoms, especially obstructive bowel symptoms.¹ Although bowel symptoms may be ignored in women presenting to gynecology clinics for POP, more than half of women with pelvic floor disorders still have defecatory complaints.² In the present study, the prevalence of bowel symptoms and bothersome bowel symptoms in women with POP was 46.38% and 24.40%, respectively, which was lower than that reported by Raza-Khan et al. (83%).⁴ The lower prevalence may be because patients felt too embarrassed to report their symptoms. Obstructive bowel symptoms were found in 40.48% of patients, which is in agreement with a recent study (43%),⁹ and straining was the most common and frequent bowel symptom, followed by incomplete evacuation. Incontinence bowel symptoms were found in 11%, which is in agreement with a previous study,¹⁰ but the incidence of flatus incontinence (10%) was

TABLE 2 Comparison of preoperative versus postoperative bowel symptoms.^a

Symptom	Preoperative	Postoperative	P value
Any bowel symptom	173 (46.38)	129 (34.58)	<0.001
Bothersome bowel symptom	91 (24.40)	25 (6.70)	<0.001
Splinting	60 (16.09)	19 (5.09)	<0.001
Straining	139 (37.27)	90 (24.13)	<0.001
Incomplete evacuation	77 (20.64)	40 (10.72)	<0.001
Obstructive bowel symptom	151 (40.48)	104 (27.88)	<0.001
Incontinence, solid stool	28 (7.51)	10 (6.28)	<0.001
Incontinence, liquid stool	34 (9.12)	21 (5.63)	0.021
Flatus incontinence	39 (10.46)	27 (7.24)	0.031
Incontinent bowel symptom	40 (10.72)	33 (8.85)	0.281
Pain with defecation	26 (6.97)	10 (2.68)	0.001
Fecal urgency	53 (14.21)	29 (7.77)	0.001
Anorectal prolapse	21 (5.63)	8 (2.14)	0.002
Pain/Irritable bowel symptom	58 (15.55)	34 (9.12)	0.001

^aData are presented as number (percentage).

TABLE 3 Comparison of preoperative and postoperative CRADI scores.^a

CRADI score	Preoperative	Postoperative	P value
CRADI	0 (0–11.11)	0 (0–2.78)	<0.001
CRADI—obstruction	0 (0–25.00)	0 (0–8.33)	<0.001
CRADI—incontinence	0 (0–0)	0 (0–0)	0.002
CRADI—pain/irritation	0 (0–0)	0 (0–0)	<0.001

Abbreviation: CRADI, Colorectal-Anal Distress Inventory.

^aData are presented as median (interquartile range).

much lower than in some studies, which reported up to 48%.¹¹ This can be attributed to a higher incidence of anal sphincter defects in their population than in our population (4.4% vs. 25%), which also suggests an association between anal sphincter defects and incontinent bowel symptoms. In addition, the difference in the prevalence of bowel symptoms might be related to differences in cultural lifestyles, diet habits, ages, and degrees of prolapse in the study population.

The objectives of POP surgery include restoring normal vaginal anatomy and relieving prolapse-related symptoms. Although a goal of POP surgery is the restoration of normal anatomical structure, POP patients are more satisfied with the alleviation of symptoms, which shows the importance of functional recovery in POP surgery. At present, surgical management of POP includes reconstructive surgery and colpopcleisis. It has been reported that colpopcleisis has the advantages of better anatomical outcomes and lower relapse rates than reconstructive surgery.¹² We found that none of the women who underwent colpopcleisis or reconstructive surgery reported prolapse or symptoms recurrence during follow up. Although previous studies have shown that, in general, women who undergo POP surgery experience postoperative relief of bowel symptoms,^{6,13}

changes in individual bowel symptoms after surgery were not described, and different surgery methods were not compared. In the present study, we described the changes in bowel symptoms after POP surgery. In addition, we compared the changes in postoperative bowel symptoms between reconstructive surgery and colpopcleisis.

There is evidence of a conflict in the relationship between bowel symptoms and posterior vaginal prolapse. Although Karjalainen et al.¹⁴ found a strong relationship between obstructed defecation symptoms and posterior wall anatomy, most studies showed no significant correlation between the severity and location of prolapse and the presence of bowel symptoms.^{15–17} Bradley et al.¹³ found that effective POP surgery, with or without a concomitant posterior procedure, alleviates symptoms of obstructed defecation, which is consistent with the conclusions of the present study. In the present study, all participants underwent posterior colporrhaphy. Surgical correction of prolapse by colpopcleisis or reconstructive surgery was associated with statistically and clinically significant improvement in CRADI scores at the 1-year follow up and relief of all bowel symptoms, especially obstructive bowel symptoms, thus indicating that posterior compartment prolapse and anterior or central compartment prolapse may contribute to obstructive bowel symptoms in women with moderate to severe prolapse.

POP surgeries alleviated bowel symptoms and bothersome bowel symptoms in approximately 77% and 84% of women, respectively, but approximately 35% of patients had at least one bowel symptom at the 1-year follow up. Women who had colpopcleisis were significantly more likely than those with reconstructive surgery to report relief of bowel symptoms after surgery, which is plausible because colpopcleisis could better repair the defects of the rectovaginal septum, subsequently changing the anatomical structure of the posterior compartment and resolving bowel dysfunction. Colpopcleisis is an option for patients with advanced POP, numerous concomitant diseases, and no desire for sexual activity in the future. Some

TABLE 4 Change in any and bothersome bowel symptoms after prolapse surgery.^a

Bowel symptom	Any bowel symptom					Bothersome bowel symptom				
	Postoperative					Postoperative				
	Preoperative	Relieved	Persistent	Worsened	De novo	Preoperative	Relieved	Persistent	Worsened	De novo
Total bowel symptom	173/373 (46)	134/173 (77)	33/173 (19)	6/173 (4)	25/200 (13)	91/373 (24)	76/91 (84)	15/91 (16)	-	8/200 (4)
Splinting	60/373 (16)	53/60 (88)	6/60 (10)	1/60 (2)	3/313 (1)	36/373 (10)	35/36 (97)	1/36 (3)	-	1/313 (0.3)
Straining	139/373 (37)	97/139 (70)	38/139 (27)	4/139 (3)	14/234 (6)	66/373 (18)	60/66 (91)	6/66 (9)	-	-
Incomplete evacuation	77/373 (21)	61/77 (79)	16/77 (21)	-	10/296 (3)	44/373 (12)	39/44 (89)	5/44 (11)	-	4/296 (1.4)
Incontinence, solid stool	28/373 (8)	19/28 (68)	9/28 (32)	-	1/345 (0.3)	1/373 (0.3)	1/1 (100)	-	-	-
Incontinence, liquid stool	34/373 (9)	22/34 (65)	10/34 (29)	2/34 (6)	7/339 (2)	6/373 (2)	3/6 (50)	3/6 (50)	-	2/339 (0.6)
Flatus incontinence	39/373 (10)	25/39 (64)	14/39 (36)	-	7/334 (2)	7/373 (2)	6/7 (86)	1/7 (14)	-	-
Pain with defecation	26/373 (7)	20/26 (77)	6/26 (23)	-	3/347 (0.9)	3/373 (0.8)	3/3 (100)	-	-	-
Fecal urgency	53/373 (14)	35/53 (66)	18/53 (34)	-	10/320 (3)	11/373 (3)	9/11 (82)	2/11 (18)	-	1/320 (0.3)
Anorectal prolapse	21/373 (6)	15/21 (71)	6/21 (29)	-	2/352 (0.6)	1/373 (0.3)	1/1 (100)	-	-	1/352 (0.3)

^aData are presented as number (percentage).

previous studies were consistent with the present study. A study by Vij et al.¹⁸ showed that colpocleisis had no adverse effect on bladder or bowel function. Villot et al.¹⁹ and Song et al.²⁰ also found that CRADI scores decreased and bothersome bowel symptoms were significantly relieved after colpocleisis. Additionally, a recent meta-analysis showed that bowel symptoms were less prevalent after colpocleisis, and the scores for the colorectal domains of CRADI significantly improved postoperatively.²¹ However, Collins et al.²² found that colpocleisis is associated with a greater risk of postoperative de novo bowel symptoms. In the present study, de novo bowel symptoms in women who underwent reconstructive surgery and colpocleisis were 8% and 5%, respectively.

In bowel symptoms that are a result of abnormal vaginal anatomy, however, correction of these defects is not always associated with an improvement in symptoms, which may be the result of multiple factors. Although in the present study most women reported relief of bowel symptoms, 17% had persistent, worsened, or de novo bowel symptoms. The incidence of de novo bowel symptoms and bothersome bowel symptoms in POP patients was 12.5% and 4%, respectively, which was lower than that reported by other scholars.⁵ Unrelieved bowel symptoms after POP surgery may be the result of other nonanatomic factors or may be related to changes in diet and reduced activity after surgery.

The pathogenesis of bowel symptoms in women with POP is not completely understood; however, it is considered a multifactorial and complex process. We found that a levator ani muscle injury was associated with a three-fold increased risk of unrelieved bowel symptoms after reconstructive surgery, which was consistent with Tan et al.,⁹ who found that defecation symptoms were significantly correlated with levator ani muscle injury. The levator ani muscle is of particular significance as it constitutes a sphincteric mechanism around the urethra, vagina, and anorectum. The integrity of the levator ani muscle can be destroyed during vaginal delivery, subsequently increasing the risk of unrelieved bowel symptoms after POP surgery.

Among women who underwent colpocleisis, we found that a longPb was a risk factor for unrelieved bowel symptoms, whereas perineoplasty was a protective factor. Bowel symptoms attributed to POP may also result from perineal descent. Perineal descent may lead to incomplete defecation because of the protrusion of the anterior rectal wall into the posterior wall of the vagina.³ In previous studies, researchers used the sum of the anatomic landmarks genital hiatus (Gh) and Pb length as the measure of perineal descent and found that the Pb and Gh+Pb measurements were positively correlated with constipation symptoms.^{3,23} In addition, in studies by Khunda et al.,²⁴ Gh and Pb, as well as Gh+Pb, were strongly associated with excessive levator hiatus distensibility, and it is plausible that the dimensions of the levator hiatus may play a role in the etiology of POP, which in turn causes bowel symptoms.

The main strength of our research is clinical applicability. Studies related to bowel symptoms after POP surgery are scarce. We used validated PFDI-20 questionnaires to evaluate bowel symptoms and associated quality of life. We not only studied the effects of

TABLE 5 The proportion of symptoms change categories in each trial from baseline to 1 years' follow up.^a

	Symptom improved	Symptom persistent	Symptom worsened	New onset symptoms	Asymptomatic with no symptom change
Reconstructive surgery (n=198)	62 (31)	20 (10)	5 (2.5)	16 (8)	95 (48)
Colpocleisis (n=175)	72 (41)	13 (7)	1 (0.6)	9 (5)	80 (46)
P value	0.048	0.364	0.220	0.257	0.662

^aData are presented as number (percentage).

TABLE 6 Comparison in demographics and pelvic ultrasound results between symptoms change categories in POP surgeries.^a

	Reconstructive surgery (n=198)			Colpocleisis (n=175)		
	Relieved symptoms (n=62)	Unrelieved symptoms (n=41)	P value	Relieved symptoms (n=72)	Unrelieved symptoms (n=23)	P value
Age, year	58.85 ± 8.24	60.20 ± 6.38	0.380	71.61 ± 5.99	71.74 ± 5.51	0.928
Menopausal	47 (82.5)	36 (92.3)	0.166	66 (91.7)	22 (95.7)	-
BMI	25.11 ± 2.65	25.36 ± 2.75	0.645	24.50 ± 3.19	23.52 ± 2.68	0.186
Parity	1 (1-2)	1 (1-2)	0.176	2 (1-2)	2 (1-2)	0.571
Vaginal delivery	61 (98.4)	39 (95.1)	0.159	69 (97.2)	23 (100)	1.000
Previous hysterectomy	5 (8.1)	2 (4.9)	0.700	6 (8.5)	1 (4.3)	0.858
Any vaginal delivery with macrosomia (>4 kg)	2 (3.3)	2 (4.9)	1.000	1 (1.4)	0 (0.0)	1.000
Bp	-1 (-2 to 1)	-1 (-2 to 0)	0.814	-1 (-2 to 2)	-1 (-2 to 1)	0.405
Pb, cm	3.27 ± 0.89	3.18 ± 0.72	0.584	2.94 ± 0.84	3.43 ± 1.02	0.024
Posterior compartment prolapse Bp ≥2	12 (19.4)	4 (9.8)	0.188	19 (26.4)	5 (21.7)	0.655
Levator ani muscle injury	17 (31.5)	21 (56.8)	0.016	31 (47.0)	10 (47.6)	0.959
Sphincter defect	4 (7.1)	1 (2.7)	0.645	1 (1.5)	2 (9.5)	0.146
Hiatus area at rest, cm ²	19.05 (16.40-21.23)	17.75 (15.80-21.63)	0.572	17.30 (15.70-19.35)	19.35 (14.98-22.73)	0.211
Hiatus area on Valsalva, cm ²	30.20 (25.50-34.20)	30.65 (27.70-37.75)	0.345	28.60 (25.35-33.47)	26.00 (24.25-34.11)	0.384
Perineoplasty	53 (86.9)	32 (78.0)	0.331	64 (88.9)	15 (65.2)	0.020

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by the square of height in meters); Pb, perineal body.

^aData are presented as mean ± standard deviation, median (interquartile range), or number (percentage).

TABLE 7 Logistic regression model for unrelieved bowel symptoms after two pelvic organ prolapse surgeries.

Variables	Unrelieved symptoms after reconstructive surgery		Unrelieved symptoms after colpocleisis	
	OR (95% CI)	P value	OR (95% CI)	P value
Age	1.021 (0.959-1.088)	0.512	1.024 (0.917-1.144)	0.675
BMI	1.038 (0.876-1.231)	0.666	0.840 (0.677-1.042)	0.113
Parity	0.949 (0.570-1.579)	0.840	1.015 (0.516-1.994)	0.966
Previous hysterectomy	0.543 (0.078-3.768)	0.537	0.343 (0.019-6.131)	0.467
Bp ≥2	0.326 (0.074-1.428)	0.137	0.861 (0.186-3.988)	0.849
Pb, cm	0.866 (0.472-1.588)	0.642	2.306 (1.112-4.783)	0.025
Levator ani muscle injury	3.245 (1.266-8.317)	0.014	1.402 (0.427-4.600)	0.578
Perineoplasty	0.549 (0.164-1.840)	0.331	0.102 (0.025-0.417)	0.001

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by the square of height in meters); CI, confidence interval; OR, odds ratio; Pb, perineal body.

different surgical methods on bowel symptoms but also evaluated the relationship between pelvic floor ultrasound and postoperative bowel symptoms. In addition, the present study had a longitudinal design and participant retention was high, with a follow-up rate of 100%. However, there are several limitations of the present study. First, the study is a single-center study, and the sample size is still not large enough. Second, no additional anorectal testing or imaging was performed on these POP patients to assess their bowel symptoms. Finally, we did not follow up the patients for longer than 1 year, and it is possible that some bowel symptoms may change beyond this time.

In conclusion, 46.38% of women with POP experienced bowel symptoms, and straining was the most prevalent. Surgical correction of prolapse is associated with significant relief of bowel symptoms, especially obstructive bowel symptoms. While approximately 34.58% of patients still had bowel symptoms at the 1-year follow up, 12.5% of the patients experienced de novo bowel symptoms in the absence of anatomical failure. A long Pb and a levator ani muscle injury are associated with unrelieved bowel symptoms, whereas perineoplasty is a protective factor. As the presence of bowel symptoms can impact postoperative satisfaction, bowel symptoms and related risk factors should be assessed and considered before making treatment plans. In addition, the present study provides insight that anterior or central compartment prolapse may also contribute to obstructive bowel symptoms in women with moderate to severe prolapse, but a longer follow-up time is needed to better understand the temporal nature and associations with the persistence of bowel symptoms after POP surgery.

AUTHOR CONTRIBUTIONS

Ye Lu conceptualized and supervised the study, and performed the writing—review and editing; Xiaoxiao Wang performed the project administration and methodology, and wrote the original draft; Xinrong Zhuang performed the investigation contributed to data curation; and Lei Zhang contributed to data curation.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data sets analyzed in current study are available from the corresponding author on reasonable request.

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