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Determinants of long-term function and general well-being in patients with an ileoanal pouch

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Abstract

Background and aim: Fecal incontinence and/or evacuation difficulty are common after ileoanal pouch surgery. This study aimed to determine whether the development of these symptoms can be predicted so that preventive measures might be instituted.
Methods: A consecutive series of 46 patients with ulcerative colitis (median age at surgery, 41 years; 50% female) and a functioning pouch for a duration ≥12 months was included. Assessment utilized medical record review and questionnaires on pre- and postoperative bowel function, quality of life, and psychological well-being. Pouch function was assessed by the Colorectal Functional Outcome score (0 = no impairment, 100 = worst impairment). Good pouch function was defined as a score ≤24.
Results: Fecal incontinence occurred in 67% preoperatively and 54% postoperatively; evacuation difficulty occurred in 65% and preoperatively and 85% postoperatively. The postoperative median Colorectal Functional Outcome score was 20 (range 2–74), with 44% of patients >24 (poor pouch function). Preoperative nocturnal fecal incontinence (odds ratio [OR] 4.92, 95% confidence interval [CI] 1.2–19.4, $P = 0.02$) and pouchitis (OR 5.41, 95% CI 1.2–23.7, $P = 0.02$) were associated with poor pouch function after multivariable regression analysis. Postoperative satisfaction, psychological well-being, and quality of life were significantly better in those with good pouch function, while poor sleep, impaired work, and sexual dysfunction were independently associated with poor pouch function.
Conclusions: Functional bowel symptoms are common before and after pouch surgery and are associated with the impairment of patient-reported outcomes. Preoperative nocturnal fecal incontinence predicts poor pouch function. Therapeutic focus on continence, bowel evacuation, psychological well-being, and quality of life should begin before surgery.

Introduction

Proctocolectomy with ileoanal pouch formation is the most common surgery performed for patients with refractory ulcerative colitis (UC). Good pouch function has been defined as bowel frequency of less than six times per day and one or less per night, full continence, an ability to defer defecation for at least 15 min, and the ability to evacuate easily.[1] Health-related quality of life and patient satisfaction are high when pouch function is good, but poor pouch function negatively impacts physical, psychosocial, and sexual functioning and productivity.[2] Fecal incontinence and evacuation difficulty are common after pouch surgery.[2,3] It is unknown whether the development of these symptoms can be predicted before surgery. If so, it could lead to a preoperative behavioral intervention for bowel dysfunction.

Fecal incontinence occurs in up to 52% of patients with an ileoanal pouch[2] and in 24–87% of patients with UC during both active and quiescent inflammatory bowel disease (IBD).[4,5] Fecal urgency and fear of incontinence also cause significant distress, shame, embarrassment, and isolation.[6] Difficult or incomplete defecation affects up to 26% of patients with IBD in disease remission[7] and up to 56% of patients with an ileoanal pouch.[3] In the absence of active inflammation or mechanical obstruction from strictures, these symptoms can be improved with medical and behavioral treatments.[8,9]

Postoperative pouch function may also be affected by psychological factors. Illness beliefs, and self-efficacy are known to influence illness outcomes in IBD.[10] Increased symptom severity is associated with lower positive illness perceptions, poorer quality of life, and greater degrees of anxiety and depression.[10]

The purpose of this study was to investigate the bowel symptoms experienced by patients before and after pouch surgery and to determine predictors of pouch function by taking into

account a broad range of physical, psychological, and disease-related factors.

Methods

Patients. All patients with a diagnosis of UC who had ileoanal pouch surgery at one specialist hospital (December 2007 to December 2017) were identified from medical records. Patients subsequently diagnosed with Crohn's disease or cuffitis were excluded. Patients were 18 years or older at the time of surgery and had a functioning pouch for at least 12 months at the time of the survey. Initial telephone contact assessed eligibility, and consent was obtained before the survey was posted. The investigators were not part of the surgical team.

Study variables
Surgical factors. The medical record was searched for diagnosis, indication for surgery, age at time of surgery, timing of surgery (elective or emergency), surgical approach (open or laparoscopic), type of pouch (J or W), type of anastomosis (stapled or hand-sewn), two-stage (proctocolectomy and pouch formation + stoma closure) or three-stage surgery (colectomy + completion proctectomy and pouch formation + stoma closure), and postoperative complications. Complications were defined as short term (<30 days after pouch surgery) and long term (>30 days after surgery).

Demographic factors. The survey included questions about education level, body mass index (BMI), relationship status, parity, mode of delivery, and employment status. Additional items included were sleep quality, the ability to work, smoking status, and sexual functioning.

Bowel function pre- and postoperatively. Patients were asked to recall preoperative symptoms, including bowel frequency, urgency, fecal incontinence, and evacuation difficulties. Preoperative fecal incontinence was defined as any unwanted leakage of stool from the anal passage. Patients were asked to report whether incontinence occurred during flare ups (active disease phase) or when there was no flare (quiescent disease phase). Emptying difficulties included straining; a feeling of incomplete emptying; and manual maneuvers, suppositories, or laxatives to assist emptying.

Current bowel function was assessed by the Colorectal Functional Outcome (COREFO) questionnaire.[11] The COREFO has five domains: incontinence, social impact, frequency, stool-related aspects, and use of medication. The COREFO total and domain scores range from 0 to 100, with higher scores indicating greater bowel dysfunction. A mean total COREFO score of 24 has been reported for patients with an ileoanal pouch.[11-14] Patients in this study were divided into two groups for comparison: a "better than average" pouch function group (COREFO total score of 24 or less) and a "worse than average" pouch function group (COREFO total score greater than 24). Comparisons were also made between patients with COREFO scores in the highest and lowest thirds to determine whether threshold values for "good" *versus* "poor" pouch function could be better defined.

Pouch function was also assessed by the Pouch Dysfunction score (PDS),[15] which has six weighted items and a total

ranging from 0 to 7.5. Lower scores represent better pouch function, and a score of 2.5 or more is associated with moderate to severe symptoms affecting quality of life.[15]

Quality of life. Disease-specific and generic quality-of-life (QoL) measures included the Inflammatory Bowel Disease Questionnaire (IBDQ),[16] the Short Form-36 health survey (SF-36),[17] and the EuroQoL (EQ-5D).[18]

The IBDQ has four domains: bowel symptoms, systemic symptoms, and emotional and social functioning. It has been used previously in patients with an ileoanal pouch.[19] The total score ranges from 32 to 224, with higher scores representing better functioning.

The SF-36 has demonstrated sensitivity to change in the health status of pouch patients.[20]

The EQ-5D[18] allows patients to rate their own health status on a visual analog scale ranging from 0 to 100 (100 = best imaginable health) and creates a single utility score of overall health status. A utility score of 1.0 indicates perfect health.

Psychological well-being. The hospital anxiety and depression scale (HADS) identifies anxiety and depression in patients with physical health problems.[21] Subscale scores, for anxiety or depression, of 8 or above are indicative of altered mood.[22] The total score ranges from 0 to 42, with higher scores indicating greater emotional distress.

Health outcomes and psychological well-being are influenced by patients' attitudes and beliefs regarding their health condition.[23] The nine-item Brief Illness Perception Questionnaire (BIPQ) assesses cognitive and emotional perceptions of illness.[24] The BIPQ rates patients' views of their illness or condition using a scale from 0 to 10 for each item, with higher scores reflecting poorer health perception.

General self-efficacy measures overall self-belief or confidence in the ability to manage difficult life situations. The New General Self-Efficacy (NGSE) questionnaire consists of eight items, each rated 1–5 with maximum score 40. Higher total scores represent greater self-efficacy.[25]

Additional questions assessed patients' satisfaction with current symptoms and preference for a pouch or a stoma if they could choose their treatment again.

Statistical analysis. Categorical variables were reported as percentages and continuous variables as medians with interquartile ranges. Unadjusted effects of variables on primary outcomes (pouch symptoms and overall function) were evaluated using Wilcoxon's rank sum test for continuous variables and χ^2 or Fisher's exact tests for categorical variables as appropriate. Continuous data were assessed for normality by the Shapiro–Wilk test. All tests were two-tailed, with a *P* value below 0.05 considered statistically significant.

Perioperative factors (possible causes) and postoperative variables (possible consequences), with $P < 0.10$ on univariate analysis, were considered for inclusion in separate multivariable logistic regression analyses. Backward elimination was performed, with final models consisting of significant variables only. The area under the receiver operating characteristic (ROC) curve and Hosmer-Lemeshow χ^2 test were used to check model fit.

Correlations between the COREFO score and key measures (PDS, IBDQ, and HADS) were assessed using Spearman's rho. Data were analyzed using STATA statistical software (version 15: StataCorp, College Station, TX, USA).

Ethical considerations. Ethics approval was obtained from the Hospital Human Research Ethics Committee (HREC/16/SVHM/214).

Results

Study population. Sixty-two patients were identified from the medical record database, with 55 eligible for inclusion following screening. Reasons for exclusion were: permanent stoma ($n = 2$), deceased ($n = 1$, not pouch-related), declined participation ($n = 2$), and unable to be contacted ($n = 2$). Forty-six patients (median age 50 [range 24–73] years; 50% females) returned the surveys (84%). Patient demographics are shown in Table 1.

Surgical history. Most patients had an elective (67%), laparoscopic (63%), two-stage procedure (56%) with a J pouch (85%) and stapled anastomosis (91%) for UC, with a median time of 5 years from stoma closure (Table 2). The indication for surgery was dysplasia in three patients.

The most common short-term complication was intestinal ileus (30%). The most common long-term complications were pouchitis (30%), stricture (24%), and intestinal obstruction (17%).

Preoperative bowel symptoms. Thirty-one patients (67%) reported fecal incontinence preoperatively (Table 3). Fecal incontinence was reported more frequently during active flares (67%) compared to inactive disease phases (33%). Urgency and inability to defer defecation by >15 min affected 89% and 59% of the patients during active and inactive disease phases, respectively. The rates of preoperative fecal incontinence were compared by time since surgery (<5 years *vs* ≥5 years) and were not significant ($P = 0.52$).

Straining (65%) and incomplete emptying (63%) were reported preoperatively, with some requiring laxatives (24%), suppositories (22%), or manual assistance (17%) including perineal pressure or anal digitation. Of the 46 patients. 17 (37%) considered these symptoms to be problematic.

Postoperative bowel function. The median total COREFO score was 20 (range 2–74), the mean was 24.6, and standard deviation was 17.6. The median PDS score was 1.25 (range 0–7.5) and was strongly positively correlated with the COREFO score ($r = 0.82$ [$P < 0.0001$]). The median score and interquartile range (IQR) for the COREFO domains were incontinence 15 (3–25), impact 19 (6–36), frequency 38 (25–38), stool-related aspects 17 (8–42), and medication 33 (8–50).

Median defecation frequency was five to seven per day and one to two overnight. Twenty-six patients reported urgency, with 10 unable to defer defecation for >15 min. Fecal incontinence occurred in 41 and 54% of the patients during the day and night, respectively (Table 3); 46% were totally continent. Twenty-three (50%) patients were using medication to thicken stools, and 13 (28%) used continence pads regularly.

Table 1 Patient demographics and pouch function

Characteristic	Total ($n = 46$)	Better pouch function COREFO ≤24 ($n = 26$)	Worse pouch function COREFO >24 ($n = 20$)	*P* value	Good *versus* poor†
Age, median (range) or [IQR], years					
At time of pouch surgery	41 (18–66)	37 [22–52]	41 [29–56]	0.25	0.16
At time of survey (current age)	50 (24–73)	47 [28–56]	50 [40–60]	0.18	0.10
Gender and parity, *n* (%)					
Males	23 (50)	16 (62)	7 (35)	0.07	0.27
Females	23 (50)	10 (38)	13 (65)		
Parous	14	6	8	0.11	0.25
Nulliparous	9	4	5		
Relationship status, *n* (%)					
Single	20 (44)	13 (50)	7 (35)	0.31	0.30
Married/de facto	26 (57)	13 (50)	13 (65)		
Education level, *n* (%)					
Tertiary—degree/diploma	25 (54)	14 (54)	11 (55)	0.94	0.46
Nontertiary	21 (46)	12 (46)	9 (45)		
Smoking status, *n* (%)					
Current	3 (6)	2	1	0.58	0.58
Previously	20 (44)	13	7		
Never	23 (50)	11	12		
Body mass index, median (range) or [IQR], kg/m^2	25 (18–34)	25 [22–28]	27 [22–31]	0.30	0.63

†*P* value for comparison between the 15 patients with the lowest COREFO total scores (good < 14) and the 15 patients with the highest COREFO total scores (poor > 30).
COREFO, colorectal functional outcome score; IQR, interquartile range.

Table 2 Surgical factors, disease factors, and pouch function

Characteristic	Total (*n* = 46)	Better pouch function COREFO ≤24 (*n* = 26)	Worse pouch function COREFO >24 (*n* = 20)	*P* value	Good *versus* poor†
Duration of disease prior to surgery, median (range) or [IQR], years	10 (1–30)	11 [2–20]	9 [3–14]	0.51	0.83
Length of time with a stoma, median (range) or [IQR], months	4 (1–36)	3 [3–6]	7 [3–12]	0.07	0.02
Time since stoma closure, median (range) or [IQR], years	5 (1–9)	4 [2–7]	6 [3–7]	0.54	0.71
Stages of surgery, *n* (%)					
2	26 (56)	18 (69)	8 (40)	0.05	0.07
3	20 (44)	8 (31)	12 (60)		
Surgical approach, *n* (%)					
Laparoscopic	29 (63)	18 (69)	11 (55)	0.32	0.26
Open	17 (37)	8 (31)	9 (45)		
Pouch type, *n* (%)					
J	39 (85)	23 (88)	16 (80)	0.68	0.59
W	7 (15)	3 (12)	4 (20)		
Anastomosis type, *n* (%)					
Stapled	42 (91)	24 (92)	18 (90)	0.78	1.00
Anastomosis	4 (9)	2 (8)	2 (10)		
Surgical timing, *n* (%)					
Acute	15 (33)	6 (23)	9 (45)	0.12	0.12
Elective	31 (67)	20 (77)	11 (55)		
Complications—short term, *n* (%)					
Intestinal obstruction (ileus)	14 (30)	12 (46)	2 (10)	0.01	0.09
Infection	4 (9)	1 (4)	3 (15)	0.30	0.21
Anastomotic leak	1 (2)	0	1 (5)	0.46	
Hemorrhage	1 (2)	1 (4)	0	1.00	
Fistula	1 (2)	1 (4)	0	1.00	
Complications—long term, *n* (%)					
Pouchitis	14 (30)	4 (15)	10 (50)	0.02	0.04
Intestinal obstruction (ileus)	8 (17)	4 (15)	4 (20)	1.00	1.00
Stricture	11 (24)	5 (19)	6 (30)	0.37	0.69
Infection	2 (4)	1 (4)	1 (5)	1.00	1.00

†*P* value for comparison between the 15 patients with the lowest COREFO total scores (good < 14) and the 15 patients with the highest COREFO total score (poor > 30).
COREFO, colorectal functional outcome score; IQR, interquartile range.

Thirty-nine patients (85%) reported straining and incomplete evacuation (Table 3). Nineteen (41%) patients considered these a problem. Half the patients were using manual assistance to assist defecation.

Factors associated with worse pouch function.
Twenty-six (46%) respondents had a COREFO score over 24, indicating worse-than-average pouch function. The 15 lowest COREFO scores were below 14 ("good function"), and the 15 highest were greater than 30 ("poor function"). Fifteen (33%) patients had a PDS ≥2.5, indicating moderate to severe symptoms, the same 15 patients with the highest COREFO scores.

None of the demographic variables shown in Table 1 were significant with either group comparison (COREFO ≤24 *vs* >24 or COREFO <14 *vs* >30).

There was no significant difference in pouch function between patients who had a three-stage and those who had a two-stage procedure (Table 2). The median length of time with a stoma was shorter in the better pouch function group but was only significant when the good *versus* poor groups were compared. The duration of bowel disease prior to surgery, timing of surgery, time since stoma closure, type of anastomosis, surgical approach, and type of pouch were not associated with pouch function. Pouchitis was the only long-term complication associated with poor pouch function (Table 2).

At the time of the survey, one patient was on azathioprine, two were taking metronidazole, and none were on a biologic.

Nocturnal fecal incontinence, during a flare of UC, was the only preoperative bowel symptom significantly related to postoperative bowel symptoms and worse pouch function (Table 3). It was associated with postoperative fecal incontinence during the day (*P* = 0.003) and night (*P* = 0.006).

The postoperative bowel symptoms most associated with worse pouch function were fecal incontinence during both day and night, fecal urgency, and straining to defecate (Table 3).

Preoperative treatment for a mental health condition was not related to pouch outcome, but a higher postoperative HADS score was associated with worse pouch function (Table 3). Poor

Table 3 Pre- and postoperative factors associated with pouch function

Characteristic	Total (*n* = 46)	Better pouch function COREFO ≤24 (*n* = 26)	Worse pouch function COREFO >24 (*n* = 20)	*P* value	Good *versus* poor†
Preoperative factors, *n* (%)					
Preoperative fecal incontinence—total	31 (67)	14 (54)	17 (85)	0.08	0.47
Preoperative fecal incontinence—diurnal	31 (67)	14 (54)	17 (85)	0.08	0.47
Active phase	31 (67)	14 (54)	17 (85)	0.08	0.47
Inactive phase	15 (33)	9 (35)	6 (30)	0.58	1.00
Preoperative fecal incontinence – nocturnal					
Active phase	20 (43)	6 (23)	14 (70)	0.02	0.02
Inactive phase	8 (17)	3 (12)	5 (25)	0.27	0.64
Preoperative fecal urgency					
Active phase	41 (89)	22 (85)	19 (95)	0.46	0.33
Inactive phase	27 (59)	14 (54)	13 (65)	0.65	0.54
Preoperative evacuation difficulty					
Straining	30 (65)	17 (65)	13 (65)	0.98	0.90
Incomplete emptying	29 (63)	17 (65)	12 (60)	0.72	0.57
Preoperative mental health treatment	8 (17)	2 (8)	6 (30)	0.06	0.16
Postoperative factors, *n* (%)					
Postoperative fecal incontinence—total	25 (54)	11 (42)	14 (70)	0.002	<0.001
Postoperative fecal incontinence					
Daytime	19 (41)	5 (19)	14 (70)	0.002	<0.001
Nocturnal	25 (54)	11 (42)	14 (70)	0.002	<0.001
Postoperative fecal urgency					
Inability to defer >15 min	26 (57)	10 (39)	16 (80)	0.007	<0.001
Postoperative evacuation difficulty					
Straining	39 (85)	21 (81)	18 (90)	0.02	0.07
Incomplete emptying	39 (85)	21 (81)	18 (90)	0.08	0.13
HADS total score, median (range) or [IQR]	7 (2–16)	4 [2–7]	13 [6–20]	0.01	0.004
Sexual dysfunction	14 (30)	5 (19)	9 (45)	0.001	<0.001
Work affected	22 (48)	7 (27)	15 (75)	0.003	0.003
Sleep quality (0–10), median [IQR]	6 [4–7]	7 [6–8]	5 [4–6]	0.001	0.001

†*P* value for comparison between the 15 patients with the lowest COREFO total scores (good < 14) and the 15 patients with the highest COREFO total score (poor > 30).

COREFO, Colorectal functional outcome; HADS, hospital anxiety and depression score; IQR, interquartile range.

pouch function was also significantly associated with sexual dysfunction, poor sleep quality, and impaired working ability (Table 3). Sexual dysfunction was reported by 14 (30%) respondents. Five patients (11%) were not sexually active due to their bowel condition, while four (9%) had major limitations due to the pouch. Only 26 (57%) patients were in a relationship.

Work was affected by pouch symptoms in 22 patients, with missed workdays (26%), reduced working hours (20%), and limited work choices (11%).

Patients with worse pouch function had significantly lower QoL scores in both disease-specific and general measures (Table 4). The IBDQ total score and the COREFO total score were strongly negatively correlated (*r* = 0.78, *P* < 0.001). Poorer illness perception and self-efficacy were also significantly associated with worse functional outcome. Patients with anxiety (HADS ≥8) but not depression were more likely to have worse pouch function.

The group with better pouch function had a higher satisfaction rate and were more likely to opt for a pouch again. None of the patients stated that, given a choice again, they would prefer to have a permanent stoma, although six patients with COREFO scores >30 were undecided (Table 4).

The results of the univariate and multivariable logistic regression analyses of the perioperative factors are shown in Table 5. Two factors were independently associated with pouch function. Patients with a history of pouchitis and those with preoperative nocturnal fecal incontinence during active UC disease phases were more likely to have worse pouch function. Model discrimination was good, with area under the ROC curve value of 0.765 and Hosmer-Lemeshow $\chi^2(2)$ value of 0.01, *P* = 0.997.

Logistic analyses of postoperative factors found sleep quality, work impairment, and sexual dysfunction to be independently associated with worse pouch function (Table 6), with an area under the ROC curve value of 0.911 and Hosmer-Lemeshow $\chi^2(6)$ value of 0.87, *P* = 0.990.

Discussion

This study investigated the relationship between pre- and postoperative bowel symptoms in patients with an ileoanal pouch. To our knowledge, this is the first study to examine evacuation difficulties experienced by patients prior to pouch surgery. Straining and incomplete emptying were common preoperatively and increased in frequency postoperatively. Coordination of

Table 4 Quality of life, psychological factors, and pouch function

Measure	Better pouch function COREFO ≤24 (n = 26)	Worse pouch function COREFO >24 (n = 20)	P value	Good *versus* poor†
IBDQ total, median (IQR)	195 (185–209)	148 (119–174)	<0.001	<0.001
SF-36, median (IQR)				
Physical functioning	97 (95–100)	77 (70–92)	<0.001	<0.001
Role limits—physical health	100 (100–100)	50 (0–100)	<0.001	<0.001
Role limits—emotional health	100 (100–100)	67 (0–100)	0.005	<0.001
Energy/fatigue	70 (50–75)	35 (18–48)	<0.001	<0.001
Emotional well-being	84 (68–92)	68 (48–82)	0.03	0.03
Social functioning	100 (75–100)	63 (50–75)	<0.001	<0.001
Body pain	100 (78–100)	68 (33–79)	<0.001	<0.001
General health	80 (65–95)	38 (28–63)	<0.001	<0.001
EQ-5D, median (IQR)				
Visual analog	85 (80–90)	70 (55–79)	0.002	0.001
Index	0.88 (0.77–1.0)	0.73 (0.67–0.78)	0.003	<0.001
BIPQ total, median (IQR)	5 (1–20)	40 (23–48)	<0.001	<0.001
GSES, median (IQR)	37 (32–40)	32 (29–34)	0.003	<0.001
HADS, n (%)				
Anxiety (HADS ≥8)	5 (19)	11 (55)	0.01	0.04
Depression (HADS ≥8)	3 (12)	5 (25)	0.23	0.16
Satisfaction, n (%)				
Satisfied	23 (89)	8 (40)	<0.001	<0.001
Neither satisfied nor dissatisfied	3 (12)	6 (30)		
Dissatisfied	0 (0)	6 (30)		
Preferred treatment option, n (%)				
Pouch	24 (92)	14 (70)	0.05	0.03
Permanent stoma	0 (0)	0 (0)		
Undecided or unknown	2 (8)	6 (30)		

†P value for comparison between the 15 patients with the lowest COREFO total scores (good < 14) and the 15 patients with the highest COREFO total score (poor > 30).

BIPQ, Brief illness perception questionnaire; COREFO, Colorectal functional outcome score; EQ-5D, Euro quality of life instrument; GSES, General self-efficacy score; HADS = hospital anxiety and depression score; IBDQ, Inflammatory bowel disease questionnaire; IQR, interquartile range; SF-36, short form 36 instrument.

Table 5 Logistic regression analyses of perioperative variables related to worse pouch function (COREFO > 24)

Variable	Univariate analysis		Multivariable analysis	
	OR (95% CI)	P	OR (95% CI)	P
Gender (female *vs* male)	2.97 (0.88–9.98)	0.08	4.20 (0.87–20.33)	0.07
Length of time with stoma (months)	1.09 (0.98–1.21)	0.09	1.06 (0.87–1.29)	0.57
Stages of surgery (3 *vs* 2)	3.38 (0.99–11.46)	0.05	3.58 (0.87–14.79)	0.08
Preoperative diurnal fecal incontinence†	3.00 (0.84–10.69)	0.09	1.14 (0.19–6.75)	0.88
Preoperative nocturnal fecal incontinence†	5.00 (1.39–17.94)	0.01	4.92 (1.25–19.41)	0.02
Preoperative mental health treatment	5.14 (0.91–29.03)	0.06	1.46 (0.13–16.06)	0.76
Pouchitis history	5.50 (1.38–21.85)	0.02	5.41 (1.25–23.74)	0.02

†During disease flares.

CI, confidence interval; COREFO, Colorectal Functional Outcome; OR, odds ratio.

evacuation may be compromised in some patients before surgery. Evacuation problems have been reported in up to 56%[3] of patients with an ileoanal pouch and have been shown to increase with time.[26] Brandsborg *et al.*[15] demonstrated that emptying difficulty significantly affected patients' QoL and was poorly recognized by clinicians.[27]

Preoperatively, only 33% of the patients in the current study were fully continent. The rates of preoperative incontinence were independent of time since surgery. Similar rates of fecal incontinence have been reported[5] in patients with UC during both active flares (87%) and remission (60%), suggesting that recall was reliable.

Table 6 Logistic regression analyses of postoperative factors associated with worse pouch function (COREFO > 24)

Variable	Univariate analysis		Multivariable analysis	
	OR (95% CI)	*P*	OR (95% CI)	*P*
Gender (female *vs* male)	2.97 (0.88–9.98)	0.08	2.21 (0.41–12.08)	0.36
Current age	1.03 (0.99–1.07)	0.21	1.03 (0.97–1.1)	0.35
Poor sleep quality (0–10)	0.57 (0.38–0.84)	0.005	0.51 (0.30–0.87)	0.01
Work affected by bowel	0.12 (0.32–0.47)	0.002	0.14 (0.02–0.81)	0.03
Sexual dysfunction	5.69 (1.93–16.74)	0.002	5.55 (1.48–20.84)	0.01
HADS total (0–42)	1.11 (1.02–1.21)	0.02	1.02 (0.88–1.17)	0.83

CI, confidence interval; COREFO, Colorectal Functional Outcome; HADS, hospital anxiety and depression scale; OR, odds ratio.

This study focused on patient-reported symptoms and function rather than physiological parameters of anal sphincter and pouch function. The only preoperative bowel symptom associated with worse pouch function (COREFO > 24) was nocturnal fecal incontinence when UC was active. Scott *et al.*[28] demonstrated that anal canal length, anal sphincter squeeze pressure, and pouch capacity were not associated with postoperative outcomes. Preoperative low anal resting pressure was associated with postoperative nocturnal fecal incontinence, but preoperative continence status was not reported.

Perfect continence was achieved by 44% of our cohort postoperatively, consistent with published rates of 37–50%.[29,30] The percentage of patients using antidiarrheal medications and protective pads postoperatively were also similar to published data.[31,32]

Pelvic floor muscle dysfunction is frequently associated with evacuation problems[33] and pouchitis[34] in patients with an ileoanal pouch. Patients with inactive inflammatory bowel disease or an ileoanal pouch who have fecal incontinence or evacuation difficulty respond to behavioral treatment, including pelvic floor muscle training or "biofeedback."[9,33,35] The increased postoperative rate of poor pouch function in patients with preoperative nocturnal fecal incontinence suggest that this group may benefit from perioperative behavioral training to improve bowel function, although this now needs to be proven prospectively.

Pouch function, assessed with the COREFO score, correlated strongly with the PDS and the IBDQ scores. We compared groups above and below the reported mean COREFO score of 24, and compared patients with a score in the lowest third (COREFO < 14) and those in the highest third (COREFO > 30). This did not change the variables included in the multivariable analyses and suggests that COREFO scores <14 and >30 could be used to define good *versus* poor function, respectively.

Age, gender, BMI, parity, and surgical factors were not significant determinants of pouch function, in this study, following regression analysis. A meta-analysis[36] also found no relationship between pouch outcome and surgical approach or anastomosis type.

Pouchitis was the only postoperative complication adversely affecting pouch function. A history of pouchitis was more common in patients with worse pouch function. Only 3 of 14 patients with a history of pouchitis were on medication for pouchitis at the time of the survey, and pouchitis was not significantly related to specific bowel symptoms.

Impaired pouch function has been shown to be associated with anxiety[37] and low QoL,[2,15] and this was confirmed in the present study. The factors affecting QoL in this study, similar to other studies, were sleep quality,[38] ability to work,[29,37] and sexual function.[29,38] Patients with worse pouch function also had more negative beliefs about their condition and their ability to manage it well. The interrelationships between pouch function, QoL, psychological functioning, and sexual dysfunction deserve further exploration.

Limitations of the present study include the cohort size from a single center, the potential for recall bias of preoperative bowel function, and the patients' interpretation of active UC *versus* inactive disease. The number of patients was modest for a single center, but complication rates were low, suggesting surgical volume was not a major factor. Patients consistently reported differences in continence rates between active and quiescent UC preoperatively, and these correspond with reported prevalence rates. Strengths include the inclusion of consecutive patients, a high response rate, and relevant findings consistent with existing reports involving larger cohorts.

In summary, functional bowel symptoms were very common in patients both before and after ileoanal pouch surgery. Preoperative nocturnal fecal incontinence is predictive of worse pouch function and should serve as a prognostic marker and focus for therapy. QoL for the total cohort was generally good. Most patients were satisfied with their current condition and would opt to have a pouch again. Worse pouch function was negatively associated with QoL, psychological well-being, and satisfaction. Functional bowel symptoms, psychological factors, and other factors influencing QoL should be recognized early postoperatively and should serve as a therapeutic focus.

Acknowledgments

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