EVALUATION OF PHYSIOLOGIC FUNCTION OF COLONIC POUCH ANASTOMOSES AFTER EXCISION FOR RECTAL CANCER

HUANG Zhongrong 黄忠荣

Department of Surgery, The Central Hospital of Jianghan Oil Field, Qianjiang, Hubei Province 433124, China

ABSTRACT

Objective: To study the physiology value of colonic pouch anastomosis after rectal cancer excision. Methods: Forty-six patients with total mesonectal excision for carcinoma were randomized to either a straight (Group A, n=23) or a colonic pouch anastomosis (Group B, n=23). The neorectal physiologic function of patients in both groups was evaluated, which included laboratory studies. Results: Sphincter pressures in both groups were similar. Preoperative compliance of the rectum was restored after surgery in the Group B, 0.296 (0.224－0.347) L/Kpa, but there was a significant decrease after surgery in the Group A, 0.194 (0.112－0.235) L/Kpa $P<0.001$. By a multiple regression analysis, neo-rectal compliance was associated with favorable clinical function, and hypermotility of the canal was associated with adverse clinical function. Conclusion: Colonic pouch-anastomosis restores neorectal compliance, which is important for good function after low anterior resection.

Key words: Low anterior resection, Coloanal anastomosis, Colonic pouch, Anorectal physiology

An artificial anus may decrease a patient's quality of life. Therefore, sphincter-preserving operations are now being used.[1] Although most patients with rectal carcinoma can be offered a sphincter-saving operation, continence may be challenged because patients often experience both urgent and frequent bowel movements.[2,3] The degree of these symptoms appear to be correlated with the height of the anastomosis above the anal verge.[1] Formation of a colonic pouch will obviate much of the dysfunction associated with the low-site "straight" anastomosis.[4] The present study investigated physiologic characteristics of the colonic pouch and of the straight anastomosis. The aims were to compare the two methods in a randomized trial and to relate the physiologic variables to clinical bowel function.

PATIENTS AND METHODS

Patients

Forty-six patients had rectal lesions coexisting with functional disorders and were diagnosed documented as rectal carcinoma by rectoromanoscopy. The characteristics of the 46 patients are shown in Table 1, and no statistical difference could be discerned between groups.

Table 1. Patient's characteristics

Item	Straight (n=23)	Pouch (n=23)
Men: women	13:10	12:11
Median age range	51 (43－68)	52 (38－72)
Tumor stage (Dukes stage A,B,C,D)	6,8,9,0	5,10,7,1
Median (range) tumor height above anal verge (cm)	8 (4－11)	8 (5－11)
Part of colon used for reconstruction (sigmoid: descending)	15: 8	15: 8
Median (range) anastomotic height above anal verge (cm)	5 (3－6)	4 (2.5－6)

Methods

Forty-six patients had a total mesorectal excision within the trial (straight anastomosis, n=23; pouch anastomosis, n=23). The double-stapling technique was used for the anastomosis. The colonic pouch, 6 to 8 cm in length, was fashioned by folding the colon and creating a side-to-side anastomosis through the apex of the pouch, using the sigmoid and the descending colon. A temporary loop ileostomy was used in all patients. One patient with a Dukes Stage D cancer had a simultaneous wedge resection of a

Accepted for publication: October 27, 1999

Correspondence to: Huang Zhongrong, Department of Surgery, The Central Hospital of Jianghan Oil Field, Qianjiang 433124, Hubei Province, China; Phone: (0086-7262)-240430; Fax: (0086-728)-6504574

solitary liver metastasis. Anastomotic stricture was dilated in one patient in each group. We graded the continence score (CS), and we measured maximum resting pressure (resting pressure), and the maximum tolerable volume pressure (tolerable volume). Resting and squeeze pressures were measured by a pressure transducer catheter (Φ 2 mm microtip transducer, PT-157 J). Threshold volume and tolerable volume were measured by filling air into a 10 cm latex balloon. Mean slope of the response was calculated as compliance.

Evaluation of Clinical Bowel Function

We used a questionnaire with the following items to evaluate bowel function: (1) frequency of bowel movements (24 hours); (2) degree of urgency and ability to defer defecation for 30 minutes: coded as always, often, sometimes, never, coded as 0,1,2,3; (3) degree of impaired evacuation: ability to evaluate the bowel in less than 15 minutes: always, often, sometimes, never, coded as 0,1,2,3; and (4) level of continence was graded according to Kirwan's classification[4]: grade 1, perfect; grade 2, incontinent of flatus; grade 3, occasional minor soiling; grade 4, frequent major soiling.

Statistical Analysis

Nonparametric tests were used for comparison of grouped data. Significance was claimed when the *P* value of a two-sided test was less than or equal to 0.05. The rank score was used as the dependent variables in relation to the outcome. Probabilities to enter and omit variable in the regression were both set at 5 percent.

Anal Function

Table 2 shows that there was no difference in sphincter pressures between sigmoid and descending colon either before or after surgery. Amplitude of anal resting pressure oscillations (anal motility) was increased postoperatively by twofold. Frequency of oscillations was from 6 to 12 per minutes.

Table 2. Physiologic characteristics of the anal canal and (neo) rectum

Item	Before surgery		At one year after surgery	
	Straight (n=23)	Pouch (n=23)	Straight (n=21)	Pouch (n=21)
Resting pressure (Kpa)	1.48 (0.93–2.13)	1.87 (1.29–2.35)	1.60 (1.08–2.32)	1.64 (1.09–2.43)
Squeeze pressure (Kpa)	5.23 (2.51–6.29)	6.00 (4.05–7.69)	6.08 (3.00–9.12)	6.93 (4.93–9.13)
Anal canal motility (quotient)	0.21 (0.08–0.24)	0.14 (0.08–0.20)	0.30 (0.23–0.42)	0.30 (0.13–0.51)
(Neo) rectoanal inhibitory reflex (no. positive)	23	23	14	11
Maximum (neo) rectal volume (L)	0.278 (0.211–0.336)	0.230 (0.205–0.255)	0.128 (0.097–0.175)	0.253 (0.215–0.291)
Compliance (L/Kpa)	0.347 (0.255–0.418)	0.275 (0.224–0.347)	0.194 (0.112–0.235)	0.296 (0.224–0.347)
(Neo) rectal motility (quotient)	0.14 (0.05–0.23)	0.07 (0.05–0.24)	0.41(0.24–0.63)	0.33(0.14–0.63)

Neorectal Function

Neorectal volumes at distention pressures of 0.98 to 5.88 Kpa and maximum volume were significantly larger in the pouch group after one year (Figure 1 and Table 2). Both compliance and maximum volume were maintained after surgery in the pouch group compared with the preoperative status, whereas there were significant decreases in the straight anastomosis group (Table 2). Neorectal motility increased in both groups postoperatively. Figure 2 shows percentile plot of individual maximum volumes.

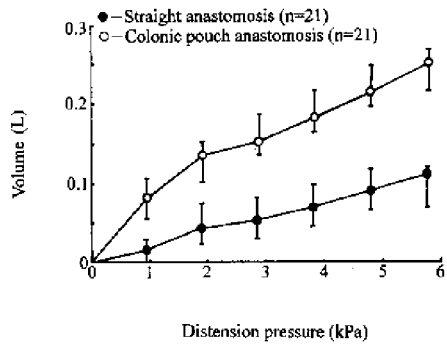

Fig. 1. Neorectal volume at one year at defined distention pressures obtained by manovolumetry. $P<0.01$ for straight vs. Pouch at distention pressures 0.98–5.88 Kpa (Wilcoxon's rank-sum test).

Relation of Physiologic Variables to Clinical Outcome

Multiple regression analysis shows high

compliance and a low amplitude of anal canal oscillation and were associated with good function (i.e., lower rank scores; Table 3). Factors entered in the regression model were age, gender, part of colon used (sigmoid/descending), anastomotic height, and the physiologic variables as shown in Table 2. Figure 4 shows univariate regression between individual compliance values and rank scores. Median rank score for the pouch group was significantly lower (20 vs 27; $P<0.001$), indicating a better clinical function.

Table 3. Stepwise regression analysis of clinical bowel function factors at one year after surgery

Item	Coefficient	Standard Error	P value	R^2 (adjusted)
Intercept	29.69	2.42		
Compliance	-4.60	0.99	$P<0.001$	
Anal canal motility	9.92	4.72	0.04	0.32

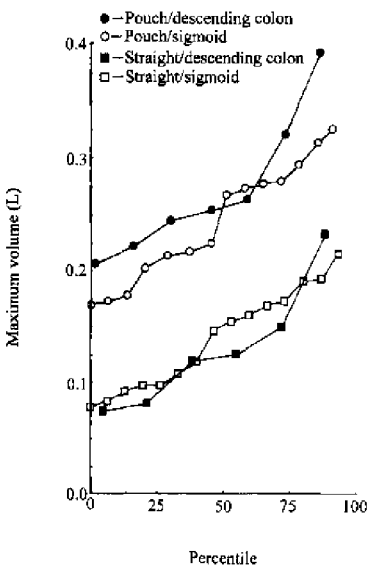

Fig. 2. Percentile plot of individual maximum volumes in all 42 patients at one year after surgery by part of colon used for reconstruction. Each marker represents one patient.

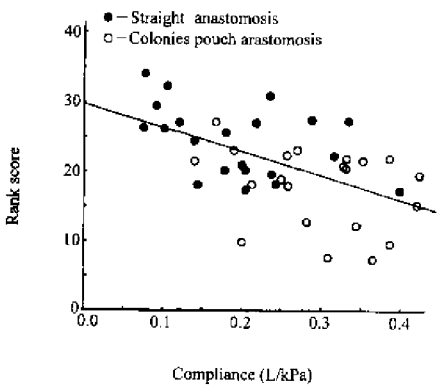

Fig. 3. Regression analysis between compliance and rank score at one year after surgery (a lower score indicates better function). Rank score = 31.2 − 3.9 × compliance; $R^2=0.29$; $P<0.001$

DISCUSSION

Fecal continence is maintained by the interaction of several factors, which include fecal consistency, colonic motility, rectal distensibility, anorectal angle, and internal and external anal sphincter activity. Dysfunction of more than one of these factors causes stool incontinence. The causes of stool incontinence after low anterior resection include dysfunction of the internal anal sphincter, the reservoir, and the pelvic floor.[5] Dysfunction of the reservoir is caused by rectal compliance, minimum threshold volume, or maximum tolerable volume. In this study, the physiology of the distal bowel was assessed in patients before and after surgery for rectal cancer. Although some had bulky tumors, manovolumetry was performed preoperatively in all patients Median volume was 0.2 L. To describe the reservoir function, volume measurement at defined distention pressures and a calculated compliance value related to sensory function were used. Increased volumes and compliance of the neorectum, as show in this study, is the advantage of the colonic pouch compared with straight reconstruction. Multiple stepwise regression analysis shows that compliance predicts rectal function. Although this implies a relation between physiologic variables and function, only 32 percent of the variability of the rank score was explained by this association (adjusted $R^2=0.32$; Table 3). Other sources of variability among patients, such as intestinal motility, secretion, and absorption also influence bowel function. Regarding sensory thresholds at lower pressures but higher volumes may allow a greater tolerance in case of rapid filling of the distal bowel. This is one explanation why pouch patients experience less urgency than patients with straight anastomosis. There was a threefold increase in transient volume reductions of the neorectum after surgery, reflecting bowel wall contractions as a triggered response to distention. In some patients contraction waves of the neorectum almost emptied the bowel, despite a distention pressure of 2.89 Kpa. Other studies have shown decreased resting pressures following a colonanal anastomosis,[6,7] but this was

not verified in our study. Hypermotility of the anal canal after surgery, seen as oscillations in internal sphincter pressure, is probably caused by proximity of the anastomosis. Height of the anastomosis is an important determinant of function,[1] but because of the standardized total mesorectal excision, it was not decisive for function in this study. To sum up, colonic pouch-anal anastomosis restores neorectal volume and compliance and significantly improves clinical function of the bowel in comparison with the traditional straight anastomosis after a rectal excision.

REFERENCES

[1] Xiao XW. Relationship between internal anal sphincter function and length of remaining rectum after resecting rectal carcinoma. World Chin J Diges 1998; 6:643.

[2] Williams NA, Price R, Johnston D. The long term effect of sphincter preserving operations for rectal carcinoma on function of the anal sphincter in man. Br J Surg 1980; 67: 203.

[3] Williamson Me, Lewis WG, Holdsworth PJ, et al. Decrease in the anorectal pressure gradient after low anterior resection of the rectum: a study using continuous ambulatory manometry. Dis Colon Rectum 1994; 37:1228.

[4] Lazorthes F, Fages P, Chiotasso P, et al. Resection of the rectum with construction of a colonic reservoir and colo-anal anastomosis for carcinoma of the rectum. Br J Surg 1986; 73:136.

[5] Batignani G, Monaci I, Ficari F. What affects continence after anterior resection of the rectum? Dis Colon Rectum 1991; 34:329.

[6] Williamson Mej, Lewis WG, Finan PJ, et al. Recovery of physiologic and clinical function after low anterior resection of the rectum for carcinoma: myth or reality? Dis Colon Rectum 1995; 38: 411.

[7] Miller AS, Lewis WG, Holdsworth PJ, et al. Factors that influence functional outcome after coloanal anastomosis for carcinoma of the rectum. Br J Surg 1995; 1327.