Ileal Pouch–Anal Anastomosis for Chronic Ulcerative Colitis

Long-term Results

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The aim of this study was to determine the long-term outcome among 390 patients with ulcerative colitis who underwent ileal J pouch–anal anastomosis and whether patient or operative factors influenced results. The combined operative morbidity rate for the pouch–anal anastomosis and the subsequent closure of the temporary ileostomy was 29% (bowel obstruction, 22%; pelvic sepsis, 5%), with one death due to pulmonary embolus. The probability of a successful outcome at 5 years was 94%. Of the 24 patients who failed (6% of total), 18 did so within 1 year (4%), three during year 2 (1%), three during year 3 (1%), and none thereafter. Stool frequency (7 stools/24 h), the occurrence of pouchitis (14%), and satisfactory daytime continence (94% of patients) remained stable over 4 years after operation, whereas nocturnal fecal spotting decreased (51% of patients to 20%). Women had more spotting than men, whereas patients over 50 years old had more stools per day than those 50 years or younger. In conclusion, ileal pouch–anal anastomosis achieved a reasonable stool frequency and satisfactory continence in patients with ulcerative colitis over the long-term. These results support the ileal pouch–anal anastomosis as a safe, satisfactory alternative to permanent ileostomy.

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SINCE THE REPORT by Martin and colleagues in 1977,[1] ileoanal anastomosis and, more recently, ileal pouch–anal anastomosis has become a popular surgical alternative among some surgeons for patients with chronic ulcerative colitis. The reasons for this popularity are severalfold. The disease is "cured" by the colectomy, proximal proctectomy, and distal endorectal mucosal resection. Reasonable enteric continence is maintained because the anal sphincters are preserved. The reservoir capacity of the distal bowel is restored by incorporating an ileal pouch. The necessity for ileostomy is eliminated.

The impact of such a curative yet continence-preserving operation could be profound; appropriately timed surgical intervention might become more acceptable to patients and their physicians and, in turn, earlier referral for operation, when conditions for a successful outcome are optimal, would be assured. The potential attractions of the ileal pouch–anal anastomosis, however, must be balanced by the fact that the operation is relatively new and the long-term results unknown.

Since our survey of the literature 5 years ago,[2] which detailed the clinical results of 25 series of ileoanal patients during the preceding 48 years, 66 additional reports have been published. None of these past studies, however, has documented the clinical and functional results of the operation in a large group of patients with a single disease, operated on in a single institution, using the same operative technique, with a follow-up over the longer term. Therefore, our aims were to investigate the clinical results of patients operated on only for ulcerative colitis, all of whom had an ileal "J" pouch–anal anastomosis performed at the two Mayo-affiliated hospitals. We also sought to determine whether the functional results improved, deteriorated, or remained stable over time, and whether operative or patient factors influenced results.

Patients and Methods

Between January 1981, and January 1986, 522 patients underwent ileal pouch–anal anastomosis for either ulcerative colitis or familial polyposis coli at Mayo. Four hundred thirty-two patients had the operation per-

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formed for ulcerative colitis using the two limb "J" shaped ileal reservoir design similar to that described by Utsunomiya and associates.[3] Three hundred ninety patients have been followed for 6 months to 5 years (mean: 2.3 years) and form the basis of this report.

One half of the patients were men. The mean (±SD) age of the group was 31 ± 9 years. The patients passed a mean (±SD) of 9 ± 5 stools/day before operation. Moreover, 15% of patients had intermittent (2 times/week or less) loss of small amounts of stool (spotting) and 5% were more frequently and grossly incontinent before the operation. One half of the patients (49%) complained of sexual difficulties; 21% stated they did not engage in any sexual activity because of their disease and an additional 28% reported their activity was reduced abnormally. Symptoms of urinary urgency, frequency, and difficulty with the urinary stream were reported by 5% of the patients.

Abdominal colectomy, proximal proctectomy, resection of the distal rectal mucosa, ileal J pouch–anal anastomosis, and construction of a temporary diverting ileostomy comprised the first stage of the operation. The rectal mucosal resection was conducted from below, beginning at the dentate line and including the columns of Morgagni. The dissection proceeded proximally to 1–2 cm above the levator ani muscle complex; the resulting cuff of remaining rectal tunica muscularis was therefore 3–5 cm in length.

The "J" pouch was constructed from two 15–20-cm limbs of terminal ileum that were either stapled[4] or sutured together. The pouch was pulled through the short rectal muscular cuff and anchored circumferentially to the internal sphincter and puborectal muscle. Sutures were then placed such that the sensitive anoderm,[5] which was left *in situ,* was anastomosed to the mucosa of the pouch at the level of the dentate line (Fig. 1).

Three hundred sixty-three patients (92%) had a diverting ileostomy (loop, 95%; Brooke, 5%) established concomitantly, whereas 27 patients did not. The temporary stoma was placed 25–30 cm proximal to the pouch. After tests were later performed to determine the integrity of the anastomosis and the function of the anal sphincters, the ileostomy was closed at a second operation. The stoma was resected and an end-to-end anastomosis constructed in 38%, whereas the remaining patients had simple closure. The midline incision was reentered in 17% of the patients because adhesions prevented the safe closure of the ileostomy through a peristomal incision. The mean (±SD) interval from ileal pouch–anal anastomosis to ileostomy closure was 95 ± 60 days (median: 76 days).

A data file was established for each patient that contained preoperative, postoperative, and follow-up information. Preoperative data included stool frequency, history of incontinence, and whether sexual or urinary problems were present. Postoperative data included mortality, morbidity (pelvic infection, intestinal obstruction, wound infection, and others), use of medication, degree of continence, and stool frequency at dismissal after closure of ileostomy. Follow-up data included stool frequency, degree of continence, stool consistency, whether gas could be discriminated from stool; use of medication; sexual and urinary problems; occurrence of pouchitis; and failure of the operation. Follow-up of all patients was initiated at 6 months after closure of the ileostomy and conducted yearly thereafter by a data clerk. At no time did a surgeon enter data into the file or conduct follow-up surveys.

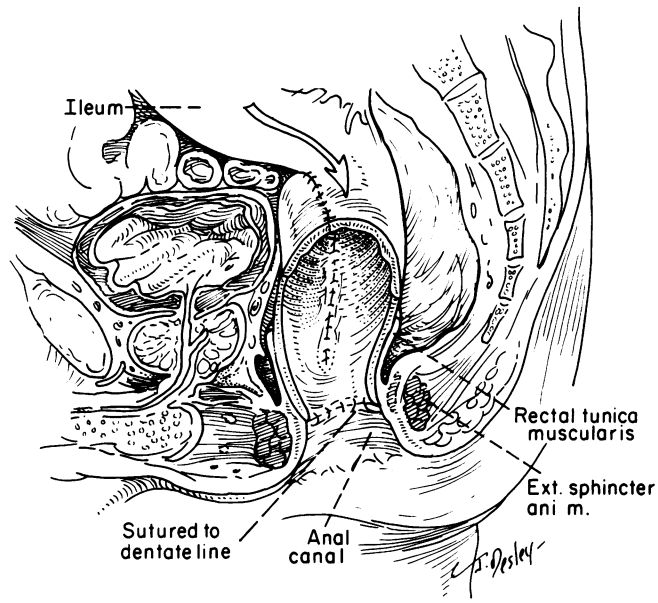

FIG. 1. Diagram of completed ileal "J" pouch anastomosed to the internal sphincter and the anoderm.

Although difficult to define precisely, incontinence during the day and night was recorded as none, spotting (1–2 episodes/week), or frequent and gross (more than 2 episodes/week). Pouchitis was identified as a syndrome manifest as frequent watery, often bloody stools, urgency, incontinence, abdominal cramping, malaise, and fever. An episode of pouchitis was considered to have occurred if these symptoms were present for 2 or more days and was promptly relieved (within 48 hours) by the administration of metronidazole, 250 mg q.i.d. Failure of the operation was defined as establishment of a permanent ileostomy, with or without excision of the pelvic pouch.

Analysis of Data

Proportions were compared in two or more groups with chi-square tests or, where appropriate, with Fisher's

TABLE 1. *Postoperative Morbidity after Ileal Pouch–Anal Anastomosis and after Closure of the Ileostomy in 390 Patients*

Complication	% of Patients with Complication
After ileal pouch–anal anastomosis	
Small bowel obstruction	13
Transient	8
Required reoperation	5
Pelvic sepsis	5
Antibiotics alone	3
Required reoperation	3
Wound infection	3
Urinary retention	7
Transient	5
Required catheterization	2
After closure of ileostomy	
Small bowel obstruction	9
Transient	4
Required reoperation	5
Anastomotic leakage	2

exact test. Changes over time of an event within individuals were analyzed with the sign test or with signed-rank tests for ordinal variables. Ordinal variables were compared in two or more groups with rank-sum procedures. The probability of the occurrence of an event in a fixed period was modeled multivariately with the logistic regression model. Comparisons of continuous variables were made with student's t-test or, where appropriate, with rank-sum tests. Survivorship free of pouch excision was estimated by the Kaplan-Meier method. Comparisons of survivorship curves were made with log-rank tests. Survivorship was modeled multivariately with Cox's proportional hazards model.

Results

Clinical Outcome

Early. One of the 390 patients (0.2%) had a massive pulmonary embolus and died 2 weeks after dismissal from the initial operation. Overall, 29% of patients had a postoperative complication after either the initial or the second operation (Table 1). After the first operation, the most frequent complication was small bowel obstruction, which occurred in 51 patients (13%). Twenty of the 51 patients (5% overall) required reoperation, primarily to lyse adhesions, whereas the remainder resolved spontaneously. Pelvic sepsis occurred in 5% of the patients. Pelvic sepsis was manifest clinically as fever, leukocytosis, and localized abdominal tenderness and, on computed tomographic (CT) scan, either as a phlegmon or an obvious abscess. One third of the patients were treated successfully by antibiotic therapy alone, whereas the other two thirds required operative drainage. Abdominal wound infections occurred in 3% of patients. Urinary retention was a transient problem in 7% of patients, but required intermittent catheterization in less than 2%.

After closure of the ileostomy, 9% of patients had a small bowel obstruction for which operative correction was required in 5%. Anastomotic leakage at the site of the closure occurred in 2% and usually required re-establishment of the ileal stoma. All such patients, however, had re-establishment of intestinal continuity subsequently.

Late. The principle late complications were anastomotic stricture and pouchitis. Many patients had a filmy, web-like stricture at the anastomosis at the time of ileostomy closure; these were easily dilated and did not recur. Five per cent of the patients, however, had persistent strictures that required dilation intermittently. Pouchitis occurred at variable times throughout the postoperative period in 14% of patients; the initial onset of symptoms varied from 1 to 2 months after closure of the ileostomy to as long as 5 years after closure. The mean (±SD) interval from operation to occurrence of pouchitis was 16 ± 14 months. Four per cent of patients had multiple episodes. Administration of metronidazole (250 mg q.i.d.) nearly always resulted in a prompt response. Several patients, however, required low-dose metronidazol therapy (250 mg q.d.) continuously to prevent recurrence of the syndrome.

Sexual dysfunction occurred in 11% of the men and 12% of the women overall. Three men (1.5%) were impotent, seven (4%) complained of retrograde ejaculation, and the remainder reported lack of motivation or fatigue as the causes of sexual inactivity. Dyspareunia was the principle sexual complaint in women and occurred in 7%, while 3% of women stated that the fear of leakage of stool inhibited sexual relations.

Functional Outcome

Early. At the time of dismissal from the hospital after closure of the ileostomy, the patients had a mean (±SD) stool frequency of 6 ± 2 stools/day with 1 ± 1 stools at night. Sixty per cent of the patients were always continent, 36% had occasional fecal spotting, and 4% had episodes of gross incontinence. Fifty-five per cent of the patients were placed on antidiarrheal medication, and 56% were dismissed using stool bulking agents.

Late. Nearly all patients had a favorable outcome over the long-term (Fig. 2). Only 24 of the 389 patients (6%) had a permanent ileostomy established and, therefore, failed the operation. The causes of failure, alone or in combination, were recurrent pouchitis, multiple stools, gross nighttime fecal incontinence, and granulomatous ileitis. Of the 24 patients who failed, 18 failed within 1 year (4% of the total patients operated), three

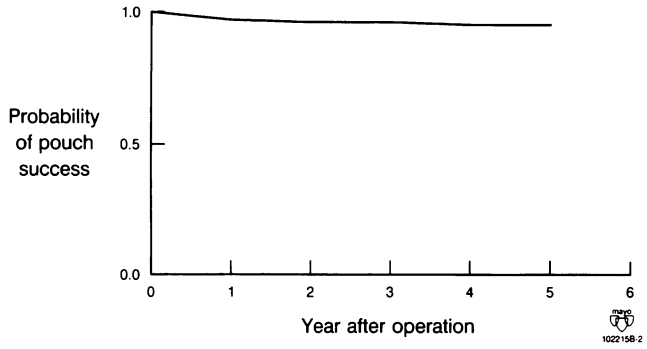

FIG. 2. The probability of successful outcome with functioning pouch against year after operation. No patient failed after 3 years.

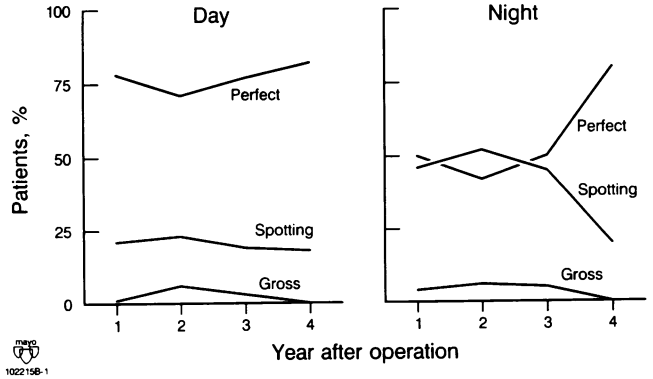

FIG. 3. Daytime and nighttime continence after ileal pouch–anal operation against the years after operation. Perfect = no fecal leakage. Spotting = fecal spotting of underclothes, 3 cm or less in diameter, two times or less per week. Gross = gross fecal incontinence more than two times per week. Data points are connected for illustrative purposes.

during the second year (1%), three during the third year (1%), and none thereafter.

All patients could evacuate the ileal pouch spontaneously; none required intubation. Table 2 and Figure 3 detail the stool frequency, pattern of continence, ability to discriminate gas from stool, and use of medication from 6 months to 5 years after ileal pouch–anal anastomosis. The daytime and nighttime stool frequency as well as the pattern of daytime continence did not change as the patients were followed after operation. In contrast, the incidence of nocturnal incontinence and dependency on medications declined. Moreover, the ability to discriminate gas from stool appeared to improve. By a mean of 2.3 years after operation, 33% of the patients had solid stools, 58% had semiformed stools, and 8% had liquid stools. Whereas the mean ± SD stool frequency was 9 ± 5 stools/day before operation, it had decreased to 6 ± 2 stools/day after operation ($p < 0.001$).

To determine whether clinical and functional results had improved as experience with the operation increased, results in the first 195 patients were compared with those of the second 195 patients (Table 3). Although the overall rate of complications did not differ between the groups, the incidence of some complications, such as the need to reoperate for obstruction after the initial operation and the rate of small bowel obstruction after the second operation, were less among the latter 195 patients. Moreover, urinary problems occurred with less frequency in the more recent patients. Functionally, however, the stool frequency and degree of continence were no different between groups at 1 year. Therefore, although some aspects of perioperative morbidity appeared to improve, the impact of that improvement on later function was nil.

A criticism of these data is that they are based on a comparison between different patient populations, and that factors other than time might have produced these differences. However, a subset of the patients ($N = 93$) had follow-up data available both at 1 year after operation and again at 3 years after operation (Table 4). The findings in this group were nearly identical to those of the larger group. Stool frequency and daytime continence remained stable, whereas nighttime incontinence clearly improved ($p < 0.05$).

Determinants of Outcome

Stool frequency. Older patients had more stools during the day than did younger patients at a mean of 2.3

TABLE 2. *Functional Results of Ileal Pouch–Anal Anastomosis from 6 Months to 5 Years After Operation in 389 Patients*

Parameter	Follow-up					
	6 mo	1 yr	2 yr	3 yr	4 yr	5 yr
No. of stools (mean ± SD)						
Day	5 ± 2	5 ± 3	6 ± 3	6 ± 2	6 ± 3	6 ± 2
Night	1 ± 1	1 ± 1	2 ± 2	2 ± 1	1 ± 1	2 ± 1
Able to discriminate gas from stool (% of patients)	69	77	73	84	77	86
Lomotil (% of patients)	26	19	17	25	6	4
Metamucil (% of patients)	43	36	40	38	30	27

TABLE 3. *Comparison of Clinical and Functional Results of Ileal Pouch–Anal Anastomosis Between the First 195 Patients Operated On and the Second 195 Patients*

	Group of Patients		
	First	Second	p
Mean age (years)	31	31	NS
Sex (men:women)	1:1	1:1	NS
Overall complications (% of patients)	31	26	NS
Reoperation for obstruction after IPAA (% of patients)	10	4	<0.02
Obstruction after ileostomy closure (% of patients)	13	3	<0.01
Urinary retention (% of patients)	11	3	<0.04
Mean stool frequency ± SD at 1 year			
Day	6 ± 2	6 ± 3	NS
Night	1 ± 1	1 ± 1	NS
Never incontinent at 1 year (% of patients)			
Day	75	80	NS
Night	47	48	NS

years after operation (≤50 years, 6 ± 3 stools/day; >50 years, 8 ± 4 stools/day; p = 0.05). Older patients did not, however, have more stools at night. Stool frequency was not different between men and women. Postoperative small bowel obstruction did not predispose to increased stool frequencies. Not surprisingly, we found that the greater the number of stools, the more frequently patients were incontinent (Table 5). Whether patients had pouchitits or ultimately failed the operation could not be predicted by the preoperative or immediate postoperative stool frequency.

Incontinence. The age of the patients did not correlate with the ability to achieve continence after ileal pouch–anal anastomosis. Patients who had postoperative bowel obstruction were no more likely to be incontinent at follow-up than those who did not. Women, however, had more fecal spotting than did men both during the day and night (day: women, 33%, *vs.* men, 14%, p < 0.001; night: women, 56%, *vs.* men, 44%, p < 0.02). Although patients who were incontinent before operation were more often incontinent early after closure of the ileostomy (p < 0.001), such early incontinence did not influence the ability to achieve continence later.

TABLE 4. *Comparison of Functional Results in the Same 93 Patients 1 Year and 3 Years after Operation*

	Period After Operation	
Parameter	1 Year	3 Years
Stool frequency (mean ± SD)		
Day	6 ± 2	6 ± 3
Night	1 ± 1	1 ± 1
Incontinent, spotting and gross (% of patients)		
Day	11	9
Night	30	13*
Lomotil use (% of patients)	30	18

* p < 0.05 compared with 1 year value.

TABLE 5. *Relationship of Postoperative Incontinence to Later Stool Frequency (N = 389 Patients)*

	Mean ± SD No. of Stools at Follow-up (mean: 2.3 years)	
Postoperative Incontinence	Day	Night
At follow-up mean: 2.3 years		
No	5.6 ± 2.3	1.2 ± 1.0
Yes, spotting	7.5 ± 4.5	1.9 ± 1.3
Yes, gross	10.2 ± 3.9*	3.4 ± 3.0*

* p < 0.001 rank-sum test.

Pelvic sepsis. The development of pelvic sepsis was not correlated with age or gender of the patients. Importantly, pelvic sepsis did not appear to affect the degree of early or late continence achieved by the patients nor the early or late stool frequency. Furthermore, patients who had pelvic sepsis were no more likely to fail the operation than those who did not. However, if pelvic sepsis occurred, closure of the ileostomy was delayed appreciably (no sepsis, mean interval between ileal pouch–anal anastomosis and closure = 94 days, *vs.* sepsis = 141 days, p < 0.002).

Pouchitis. The occurrence of pouchitis did not correlate with the age or sex of the patients. Patients in whom pouchitis developed were no more likely to have had pelvic sepsis or other postoperative complications than those who did not. Moreover, sexual and urinary problems did not occur with any higher frequency in patients who had episodes of pouchitis.

Sexual and urinary dysfunction. Older patients did not have more sexual problems before operation than younger patients, nor did men have more sexual difficulties before operation than women. However, older patients had more sexual dysfunction after operation than did younger patients (no problem, mean age: 30 years *vs.* problem, mean age: 36 years; p < 0.001). In addition, patients with sexual problems tended to have a slightly higher stool frequency than those who did not and were more likely to be incontinent during the day and night. The incidence of both sexual and urinary dysfunction did not differ between men and women. Finally, pelvic sepsis did not predispose patients to later sexual or urinary problems.

Multiple Regression Analysis

Using a Cox proportional hazards model, multivariate analysis of age, occurrence of pelvic sepsis, inconti-

nence (before operation or at dismissal), and preoperative and dismissal stool frequency showed no significant effect on either ultimate failure of the operation, late stool frequency, or development of pouchitis. However, the incidence of incontinence at follow-up was significantly affected by the preoperative stool frequency; the more stools before ileal pouch–anal anastomosis, the more likely patients were to be incontinent after operation (beta weight: 0.13; $p < 0.03$).

Discussion

Patients with chronic ulcerative colitis are "cured" of their colitis by proctocolectomy. Sometimes lesser operations, such as ileorectostomy, are performed in selected patients with good results. Complete removal of *all* diseased colonic mucosa, however, is the ideal central goal of surgery for ulcerative colitis. The ileal pouch–anal anastomosis operation accomplishes this goal, retains the usual transanal anatomic pathway for defecation, and maintains reasonable continence. However, because the operation is new and unproven, its widespread acceptance as a surgical alternative awaits documentation that it is safe, has acceptable morbidity, achieves its promised clinical and functional goals in most patients, and performs predictably over time.

This study found that ileal pouch–anal anastomosis can be performed safely, but that morbidity was high; 29% of patients had a postoperative complication. The major complications were obstruction of the small intestine, pelvic infection, and pouchitis. Overall, 22% of patients had a small bowel obstruction in the immediate postoperative period. Five per cent of these patients required reoperation after the initial procedure, and an additional 5% after closure of the ileostomy. This 10% reoperation rate, although greater than desirable, is similar to the 7–13% incidence of reoperation for obstruction reported after proctocolectomy and permanent ileostomy[6–9] and the 15–20% incidence reported after ileorectostomy.[10,11] Construction of a loop ileostomy might predispose to obstructive complications,[12] such as torsion of the afferent limb about the mesentery of the stoma. We agree with others,[13] however, that episodes of obstruction were related more to postoperative adhesions than to the type of ileostomy used. Our experience with other types of stomas, or with no stoma at all, has shown no clear advantages over the loop configuration. Therefore, we continue to use this stoma in most patients.

Pelvic infections occurred in 5% of the patients. Although Becker and Raymond[13] reported no pelvic sepsis in 100 patients who had ileal pouch–anal anastomosis, Williams and Johnston, summarizing the results of nine series, found the mean rate of pelvic infection to be 18%.[14] Indeed, the rate of pelvic sepsis reported previously from our institution was 11%.[15] The decrease in the rate of pelvic sepsis in the current report is substantial and may reflect improved techniques for excising the rectal mucosa, use of a shorter muscular cuff, and more effective drainage of the pelvic space.[4] We could not find a correlation, however, between the occurrence of pelvic sepsis and impaired function, the development of late complications, or failure of the operation. Nevertheless, the sequelae of pelvic infections can be devastating; pelvic fibrosis, anastomotic stricture with overflow incontinence, persistent sinuses, and fistulae can lead to incapacitating dysfunction and ultimate failure of the operation.

The most vexing medical problem in our patients continued to be pouchitis. This syndrome occurred with no predictability and at various times after operation. The cause of pouchitis is obscure, but resembles the syndrome seen in patients with continent ileostomies. In these patients, bacterial overgrowth in the pouch[16] and in the proximal small intestine[17] has been described. O'Connell et al.[18] documented similar bacterial overgrowth in patients after ileal pouch–anal anastomosis. However, they found no correlation between such overgrowth and a poor result. Because such patients respond to metronidazole, pouchitis is likely caused either directly by bacteria, or by a mucosal response to the presence of bacteria within the pouch. Not all patients with crampy abdominal pain and watery diarrhea after ileal pouch–anal anastomosis, however, have pouchitis. In patients who do not respond rapidly to metronidazole, outflow obstruction from the pouch, secondary to narrowing at the anastomosis, may cause increased stool frequency and incontinence.

In terms of ultimate failure of the operation, the 6% failure rate reported here is similar to that reported by others.[12,14] Because the number of patients who failed was small and the reasons for failure so varied, no single factor was found to correlate significantly with excision of the pouch. It was reassuring, however, that most failures (75%) occurred early, during the first year, and that no patient had a delayed failure (>3 years).

In terms of the number of stools and the degree of continence achieved by the patients, the long-term functional results of ileal pouch–anal anastomosis were relatively stable. We reported earlier that stool frequency improved in the first 6–18 months after operation.[15] The current series shows that after this initial period, the mean daytime and nighttime stool frequency and the level of daytime continence vary little from 1 to 5 years after operation. That the stool frequency did not decline with time may be partially explained by our findings that stool frequency is directly related to the daily amount of stool output and indirectly related to

the threshold volume and to the efficiency of pouch emptying.[19] Threshold volume is that volume of enteric content present in the pouch that triggers waves of high pressure. Such pressure waves are uncomfortable, herald the call to stool, and if large enough, may overwhelm the resting and squeeze pressures generated by the anal sphincters. The efficiency of evacuation can be measured using radiolabeled artificial stool and gamma camera imaging.[20]

Because most patients evacuate 50–60% of the threshold volume (which is approximately 45% of the maximum pouch capacity of approximately 320 mL)[19] and because the mean output of stool per day is between 400–800 mL, patients will naturally evacuate four to eight times per day. It follows, therefore, that stool frequency may be decreased by either decreasing the total output per day, increasing the efficiency of emptying, or increasing the threshold volume. Of these, the easiest to achieve would be to increase the threshold volume by increasing the maximum capacity. To this end, several workers have advocated a "W"-shaped pouch, which apparently provides a larger initial volume than that of the "J" design and consequently results in a lower stool frequency and improved continence.[21,22] It will be important, however, to determine if the advantages of such higher capacity are offset by more inefficient emptying of the pouch.

Although daytime continence remained stable after operation, encouragingly, the incidence of occasional fecal spotting at night decreased from 51% at 6 months to 20% at 4 years after operation and gross incontinence decreased from 4% to 0%. The incidence of both, however, rose slightly at 5 years. This finding might be caused by gender sampling bias; whereas the ratio of women to men was 1:1 at each interval from 6 months to 4 years, at 5 years it was 2:1. Overall, we found women had more daytime and nighttime incontinence than men at each follow-up interval, an observation that differs from our earlier report.[15] The reasons for this finding are unknown. However, women generally have more problems with fecal continence than men.[23] Thus, our results may merely reflect a gender predisposition to incontinence that persists after ileal pouch–anal anastomosis.

The single preoperative factor that was found by multivariate analysis to have influenced continence after ileal pouch–anal anastomosis was the preoperative stool frequency. Although no studies have documented the impact of severity of disease on the functional outcome of patients after ileal pouch–anal anastomosis, this aspect of our results suggests that the more decompensated the patient before operation, in terms of stool frequency, the more problems with continence after operation.

We confirmed our earlier report that serious sexual problems were relatively few after ileal pouch–anal anastomosis. However, we found that three men (1.5% of the total at risk) were impotent. After proctocolectomy and permanent ileostomy for inflammatory bowel disease, the rate of impotency ranges between 5% and 12%,[14] whereas after ileorectal anastomosis, no patients have been reported to be impotent. Our results, therefore, fall in between these extremes and are in keeping with the observation of others[12,14] that difficulty with erection after ileal pouch–anal anastomosis can occur. The 4% incidence of retrograde ejaculation is similar to that reported by others[13,14] and is probably caused by disruption of the pelvic sympathetics. Although this incidence is lower than the 9% reported earlier from our institution,[15] the problem remains troublesome.

The major functional disturbance in women continued to be painful intercourse (7%), the incidence of which, although unchanged from our previous report, continues to be substantially lower than the 53% reported after ileorectal anastomosis.[24] In addition, fear of leakage of stool inhibited sexual relations in an additional 3%; indeed, the higher the stool frequency and rate of incontinence, the more likely patients were to have sexual problems. Reassuringly, however, the potentially serious complication of pelvic infection did not appear to predispose patients to later sexual dysfunction.

In summary, ileal pouch–anal anastomosis is a safe operation but carries a significant risk of complications. If a complication such as pelvic sepsis or small bowel obstruction occurs, however, it does not appear to predispose the patient to unacceptable stool frequencies, more incontinence, or an increased chance of failure. The functional parameters of stool frequency and daytime continence, which improved early after operation,[15] reached a plateau by 2 years and remained stable thereafter. Nighttime incontinence and dependency on medications, however, continued to diminish.

Our data show that the best results with ileal pouch–anal anastomosis occur in young, male patients who are not compromised severely before the operation. There is no question, however, that the operation is not perfect, that it is complicated, that some patients are not candidates, that morbidity, particularly obstruction and pouchitis, remain troublesome, that incontinence, although improving with time, affects patients adversely, and that failures continue to occur. Balancing these problems are the observations that the great majority of patients with ileal pouch–anal anastomosis achieve satisfactory enteric continence, maintain willful defecation, retain essentially normal urinary and sexual function, and do not have a stoma. Although no operation can make a patient with chronic ulcerative colitis "normal," of the

curative surgical procedures available today, that which comes closest to the norm is ileal pouch–anal anastomosis. Based on these long-term results, ileal pouch–anal anastomosis can be recommended to the majority of patients who require operation for chronic ulcerative colitis.

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Discussion

DR. ARNOLD G. CORAN (Ann Arbor, Michigan): I would like to congratulate the authors on an excellent series, probably the largest series of endorectal pullthroughs reported thus far in the literature.

I would also like to thank them for asking me to discuss their paper. I do so with great humility since our experience at the University of Michigan is far less than theirs.

Since 1977, we have done 80 straight endorectal pullthroughs without a reservoir on patients with ulcerative colitis and familial polyposis who range in age from 4 to 48 years. Six of these patients were reconverted to a Brook ileostomy of which three were done because of dissatisfaction with stool frequency.

Daytime continence was achieved in all of these patients within 1 month after closing the temporary ileostomy and nocturnal incontinence occurred in the first year in six of these patients and then finally disappeared.

(Slide) The mean stool frequency in this group declined progressively over the first 3 years to 8 per 24 hours, which compares favorably with the six reported in the current series.

We have also analyzed the stool frequency by age groups above and below 18 years of age and above and below 30 years of age and could find no statistical difference. We also analyzed them by gender and again found no differences. This is consistent with our finding as you will see in the next slide (Slide) that the neorectum progressively dilates over this 3-year period, finally achieving what appears to be a normal rectal reservoir capacity 2–3 years after the endorectal pullthrough.

I would like to ask the authors three questions: how did they specifically obtain their follow-up data on stool frequency and continence? We found that frequent and close follow-up of our patients is necessary to determine what the actual frequency is. For example, we find sometimes that a stool frequency can vary by 100% if, in the case of a college student, they are getting ready for final exams, if there is marital strife, etc. I have seen patients with an average frequency of three stools a day increase their frequency to 10 or 12 under emotional stress.

Second, how exactly was the endorectal dissection done? Was any of it done from above or below or both ways, and in those cases, was the intact mucosal-submucosal tube removed so that they feel assured that all the potential disease has been removed?

Third, were there times when the "J" pouch could not be performed because of significant tension at the anastomosis?

I have occasionally had to do a "J" pouch because the tension at the anastomosis with a straight pullthrough was too great and *vice versa*. I am wondering that the authors did in the cases where there was too much tension.

Essentially, it appears that the results with the straight endorectal pullthrough in our much smaller series and the results with the ileal pouch anal anastomosis are similar in terms of continence, frequency, and complications. I do believe that the straight pullthrough is somewhat easier to do and takes less time. In general, the operation takes us about 3.5–4 hours and we seldom use blood.

Probably, as has been the experience with Hirschsprung's disease, the most important factor in the results of this operation is the experience of the surgeon.