Total Colectomy, Mucosal Proctectomy, and Ileoanal Anastomosis*

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Utsunomiya J, Iwama T, Imajo M, Matsuo S, Sawai S, Yaegashi, K, Hirayama R. Total colectomy, mucosal proctectomy, and ileoanal anastomosis. Dis Colon Rectum 1980;23:459–466. A safe and practical procedure for total colectomy and mucosal proctectomy with ileoanal anastomosis has been developed and performed by us on 11 patients with adenomatosis coli and two patients with ulcerative colitis. The major features of the operative procedure are 1) total removal of the rectal mucosa to just above the dentate line; 2) preservation of anorectal function by a long rectal cuff procedure achieved by rectal mucosal excision from a level just below the sacral promontory, using a rectal internal stent and gauze packing techniques for rectal mucosal stripping, with, in some patients, an ileal reservoir added; and 3) prevention of pelvic sepsis by intraoperative rectal irrigation, rectal cuff drainage, and a temporary defunctioning loop ileostomy. Of six patients with at least three months of follow-up after reconstruction, each has returned to normal life, averaging two to seven semiformed stools each day. A side-to-end ileoanal anastomosis with a low-lying, loop-type ileal reservoir provided the best functional results. [Key words: Anastomosis, ileoanal; Colectomy, total; Proctectomy, mucosal; Surgery, colectomy and ileoanal anastomosis]

AS THE LONG-TERM RESULTS of treatment of adenomatosis coli are examined, total colectomy with ileorectostomy followed by treatment of polyps in the remaining rectum by fulguration[1] is a source of conflict among specialists in this field.[2,3] Patients with retained rectum require long-term scrutiny.[2] In our Polyposis Center, the central register of polyposis in Japan,[3a] we have observed an increasing number of patients with a retained rectum who were not under adequate surveillance.[4] In addition, unsatisfactory long-term results of the rectum-preserving operation for colitis (Aylett operation)[5] also have been noted.[6]

For these reasons, we sought a practical and acceptable procedure for total removal of the large-bowel mucosa that preserved anal function. We describe our procedure of total colectomy, mucosal proctectomy and ileoanal anastomosis, and the preliminary results we have obtained.

*Received for publication March 19, 1980.

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Operative Technique

The patient is placed in slight lithotomy position, and rectal irrigation is performed through an indwelling No. 30 balloon catheter, using 2000 ml saline solution containing bactericidal agents. The abdomen is opened by an extended left paramedian incision and the entire colon freed from lateral attachments. The ileum is divided near the ileocecal junction and the rectum is mobilized to the level of the second sacral vertebra. Ordinarily, the superior rectal artery is preserved. The intestinal irrigation is repeated after ligating the sigmoid colon.

A balloon catheter inserted into the rectum is advanced into the sigmoid colon and fixed to the colon by ligating the colon distal to the balloon (Fig. 1). The catheter is also fixed to the perianal skin by safety

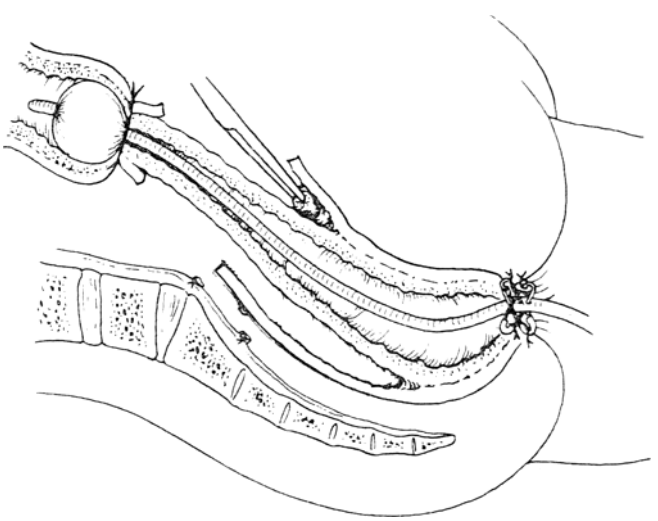

FIG. 1. Balloon catheter used as a rectal internal stent.

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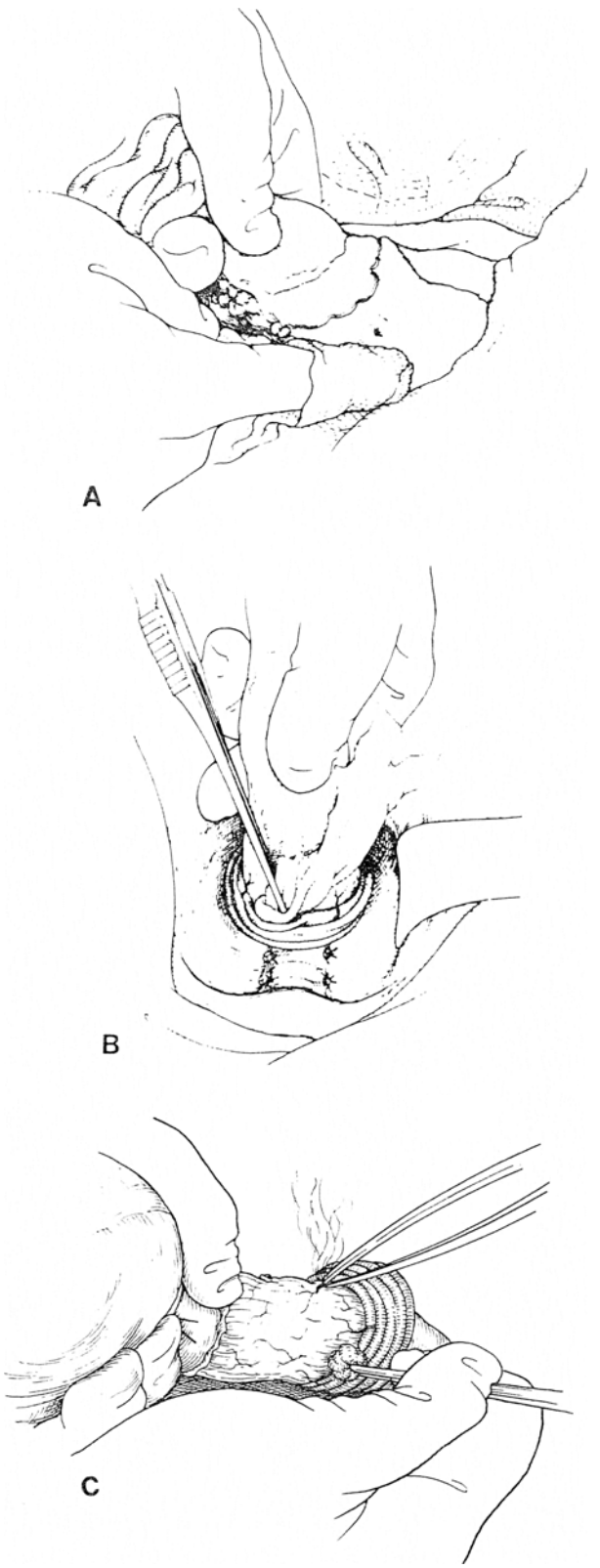

FIG. 2. Abdominal rectal mucosal stripping. (A) Starting detachment of seromuscular layer from submucosal layer. (B) Gentle gauze packing between the two layers. (C) Eversion of rectal muscular layer and hemostasis.

pins. With this technique, the rectal catheter is used as an internal stent to protect the rectal mucosal tube from breaking during the stripping and to elevate the pelvic floor to provide an easier and deeper stripping into the pelvic area.

Rectal mucosal stripping is started at a level a few centimeters below the sacral promontory. Using a scalpel, the seromuscular layer of the rectum is divided circumferentially. By holding the balloon of the catheter with tension, the rectum is stretched and the seromuscular layer is then detached from the submucosal layer by gently pushing down the cut edge with a sheet of gauze or a pusher to elevate the seromuscular layer (Fig. 2A). Separation of the submucosal layer is performed more easily at the mesenteric side than at the antimesenteric side. Gauze is then gently inserted by a forceps and readily packed in the space between the two layers (Fig. 2B). This maneuver seems the safest for stripping the mucosal sheet without tearing. Submucosal vessels bridging the two layers are carefully identified, coagulated with bipolar electric forceps and divided (Fig. 2C). Meticulous hemostasis is essential for successful dissection of the rectal mucosa. Stripping is extended distally as far as possible until the area just above the anal canal is reached. If the detached rectal mucosa should become torn, the opening is closed immediately by suturing, to prevent further tearing of the mucosa.

The patient is then placed in a more exaggerated lithotomy position and the Parks anal retractor is inserted. Rectal mucosal stripping is then initiated from the anal approach. Saline solution containing adrenalin is injected submucosally to elevate the mucosal layer and a circumferential mucosal incision is made just above the dentate line to initiate removal of the entire rectal mucosa.

After the retractor is removed, fixing sutures are placed between the anal verge and the perineal skin in order to expose the anal canal. The mucosal cut edge is held together with the sheet of gauze in the rectum by several mucosal clamps (Fig. 3). The excision of mucosa from the muscular layer is completed by dissection with scissors and sponge. Aided by the abdominal operator, the mucosa in continuity with the entire colon is now removed through the anal orifice, avoiding soiling of the rectal muscular cuff by intestinal contents (Fig. 4). The rectal cuff is filled with a sponge immersed in an antimicrobial solution.

Three different types of ileoanal anastomosis have been performed (Fig. 5): 1) End-to-end method without reservoir (Type A-1), 2) End-to-end method with an isoperistaltic double-barreled ileal reservoir outside cuff (Type A-2), and 3) Side-to-end method with

an antiperistaltic ileal loop reservoir inside the cuff (Type B).

Type A-1 procedure: After the ileal mesentery is freed from the retroperitoneal tissues, and fully mobilized to the duodenum, the ileocecal artery is divided to elongate the ileal mesentery. The terminal ileum is brought through the rectal muscular cuff and the cut end of the ileum sutured with interrupted (000) Dexon sutures to the cut edge of the anal mucocutaneous line and the internal sphincter. Two Penrose drains are placed through the ileoanal anastomotic line into the space between the rectal cuff and the ileum. Recently, two fine plastic tubes are placed in the cuff through the abdominal wall and connected to a closed continuous suction apparatus. In two instances the ileal end was left closed and reconstructed secondarily two weeks after the initial operation.

Type A-2 procedure: The ileoanal anastomosis is performed in the same manner as Type A-1, but the ileum is divided about 40 cm from the ileal end and a side-to-side anastomosis of 20 cm length is performed to create an isoperistaltic double-barreled reservoir outside the rectal cuff.

Type B procedure: The point of the ileal loop which reaches the lowest level of the pelvis is selected and, at this point, usually about 20 to 30 cm from the ileal stump, a fine Nélaton catheter is placed through the mesentery for traction. The last main branches of the inferior mesenteric vessels are divided, and a slit is made in the avascular part of the mesentery. The ileocecal vessels are carefully preserved and the ileal loop extended by about 10 cm. After the loop is fixed by a continuous seromuscular suture, a long side-to-side anastomosis is performed, using a GIA autosuture apparatus to create an ileal reservoir (Fig. 6A). By retracting the catheter at the apex of the loop, the reservoir is brought through the rectal cuff down to the anus.

From the perineal approach, the ileal loop is fixed to the internal sphincter by several (000) Dexon sutures, and the apex of the loop is incised by a longitudinal incision of about 2 cm in length. The edge of the intestinal wall is sutured to the cut edge of the mucocutaneous junction and internal sphincter at the dentate line by interrupted sutures. The cuff is drained (Fig. 6B). From the abdomen, the rectal cuff is fixed to the pulled-through ileum by several interrupted sutures. The retroperitoneum is reconstructed and the peritoneal cavity irrigated thoroughly with 4000 ml saline solution.

A temporary defunctioning loop ileostomy is performed to prevent pelvic sepsis. A loop of ileum, 40 cm from the ileoanostomy, is brought out through a retroperitoneal tunnel in the right abdominal wall following the technique of Turnbull et al.[7] The abdominal cavity is drained by a closed suction apparatus. The rectal cuff drains are removed on the fifth post-

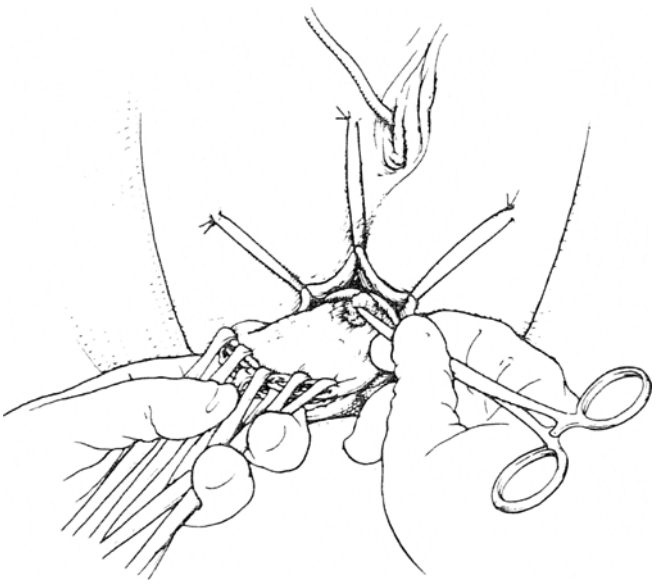

FIG. 3. Anal rectal mucosal stripping. Starting just above the dentate line (total mucosal proctectomy) and extracting the mucosal tube.

FIG. 4. The *en bloc* resected specimen of adenomatosis.

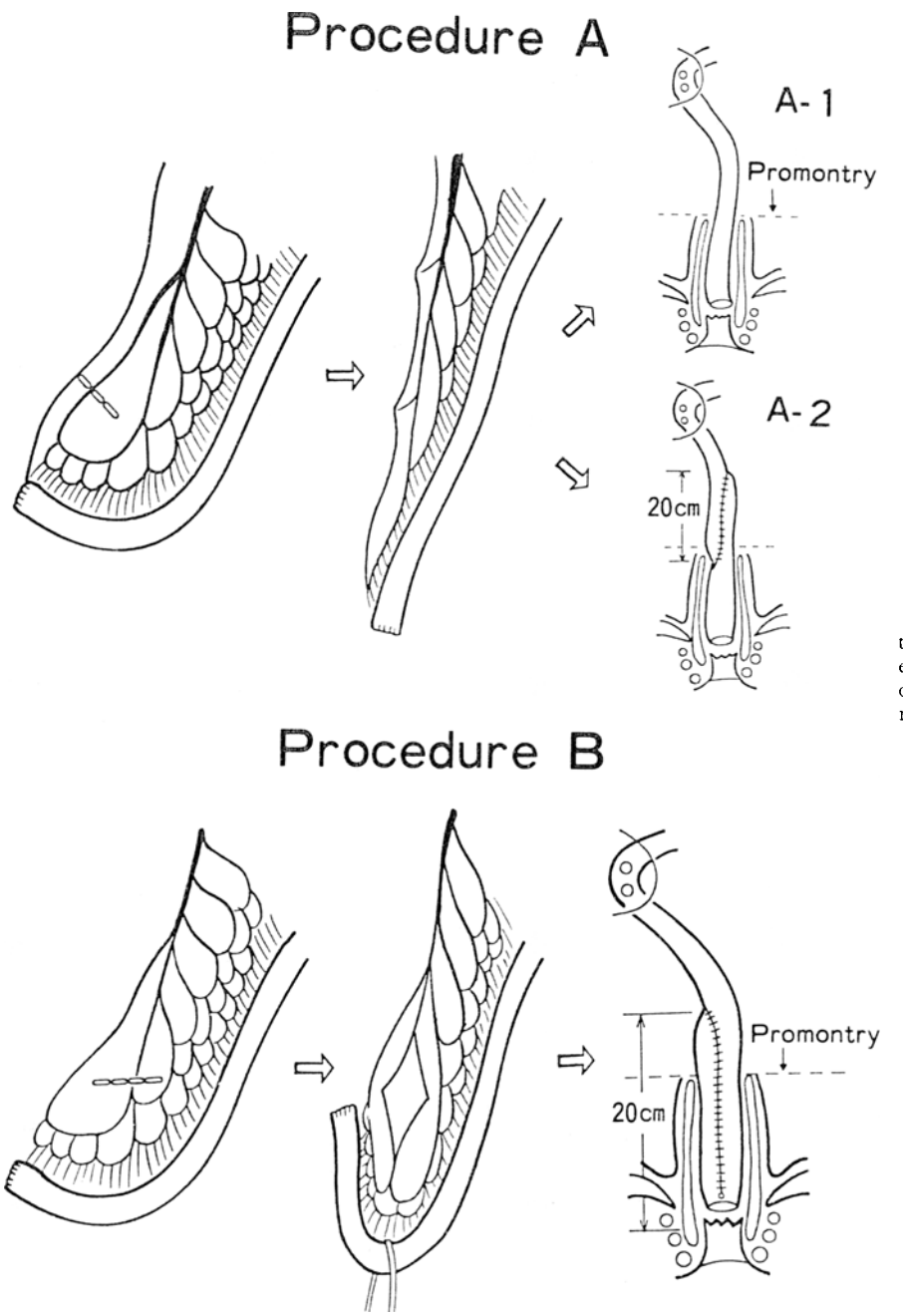

FIG. 5. Three types of ileoanal anastomosis. A-1 = End-to-end without reservoir. A-2 = End-to-end with reservoir outside rectal cuff. B = Side-to-end with reservoir inside cuff.

operative day. Three months after the first operation, the patient is readmitted for closure of the ileostomy.

Results

From January 1978 through May 1979, we performed this procedure on 11 patients with adenomatosis coli and two with ulcerative colitis (total 13). Of the polyposis patients, seven were males and four were females; the average age was 22 years, ranging from 11 to 41 years. One patient was a 27-year-old woman who had had a colectomy seven years earlier and developed a small cancer in the rectum. Another was a 45-year-old woman who had a large cancer in the sigmoid colon which involved the ileum. Both patients with ulcerative colitis were women aged 17 and 25 years, respectively. The former patient had been symptomatic for two years and the latter, who had had symptoms for 10 years, showed extensive pseudopolyposis of the entire colon and rectum.

The first-stage operation has been carried out on 13 patients, and, of these, the second-stage operation (closure of the loop ileostomy) on six. Operative duration for the first-stage operation averaged 6½ hours,

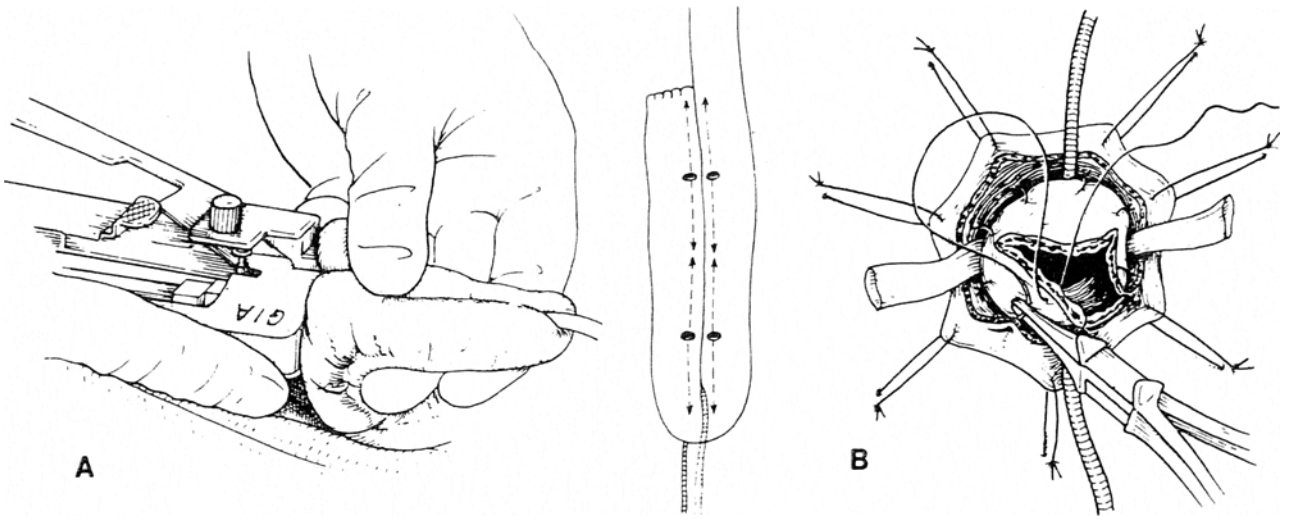

FIG. 6. Type B procedure. (A) Construction of ileal reservoir. (B) Technique of ileoanal anastomosis.

and blood loss averaged 1,600 ml. Most blood loss occurred during the 60 to 90 minutes required for removal of the rectal mucosa. In all instances, mucosal stripping was successfully performed. Mucosal stripping was easier in younger patients and more difficult in patients with ulcerative colitis. With increased experience and improved technique, the duration of the operation has been shortened, and the blood loss lessened.

Complications: Of the 13 patients, eight sustained one or more complications. There was no mortality. Pelvic infection—so-called "cuff abscess"—was the most common complication, occurring in three patients during the second week, the second month and the sixth month respectively after the first-stage operation. Usually, elevation of temperature with accompanying perianal pain preceded a discharge of purulent, bloody mucus from the anal orifice. These patients were managed successfully by making an incision in the transposed ileal wall extending from the fistula opening at the anastomosis.

Massive bleeding occurred in the cuff of a patient with adenomatosis for whom an ileoanal anastomosis was made by the Type A-1 method. In this patient, we reoperated on the second postoperative day and found the rectal cuff filled with large clots and arterial bleeding in the mesentery of the transposed ileum torn from excessive tension. The rectal cuff was closed and a permanent abdominal ileostomy fashioned. In two instances, intestinal obstruction occurred from intraperitoneal adhesions, and in one a loop ileostomy prolapsed; both required reoperation.

Bowel function: The six patients who had adenomatosis are currently under observation for their postoperative bowel function. At first, they had 10 to 20 watery stools each day, but after a few weeks the frequency subsided (Fig. 7). If five bowel movements each day are regarded as the maximum tolerable frequency,[8] the Type B procedure achieved this goal in the shortest period after operation, namely seven weeks (Table 1). Type A-1 results were generally comparable, but Type A-2 resulted in a longer delay.

Of those patients who had been followed for more than three months after closure of their ileostomy and more than eight months after the initial operation, the average frequency of bowel movements was fewer than three each day in two patients, fewer than five in two patients, and fewer than seven in one (Table 1). Immediately after closure of the ileostomy, the patients who underwent Type A-1 or A-2 procedures

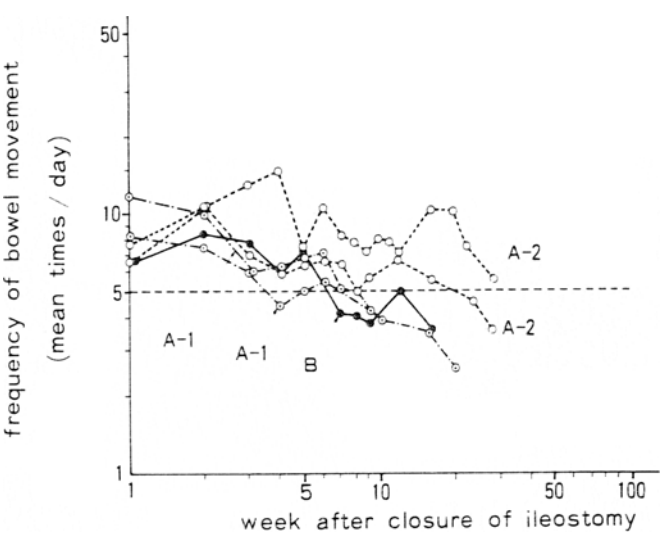

FIG. 7. Frequency of bowel movement after closure of ileostomy.

TABLE 1. *Defecation Function of Six Male Patients after Treatment*

	Age (years)	Type of Operation	Months after Operation to Evaluation		Frequency per Day	Weeks to 5 or Fewer per Day	Urge Frequency per Day	Stool	Incontinence	Use of Medication
			1-Stage	2-Stage						
Patient 1	11	A-1	9	3	4	8	5–6	Semi-formed	Soiling, sometimes at night	Morning, every other day
Patient 2	14	A-1	8	4	2	9	10	Semi-formed	None	None
Patient 3	15	A-2	11	7	4–5	20	10	Semi-formed	None	Morning, every other day
Patient 4	18	A-2	12	7	7	>30	10–15	Mushy	Soiling, 2/week at night	Every night
Patient 5	21	B	10.5	5	3	7	0	Semi-formed	None	None
Patient 6	30	B*	5	1	6	—	5	Mushy	None	Every day

* Subtotal mucosal proctectomy.

TABLE 2. *Rehabilitation Status of Six Male Patients after Treatment*

	Age (years)	Type of Operation	Preoperation Occupation	Months Lost from Normal Activity	Body Weight (kg)		Social Activity
					Before Operation	After Operation	
Patient 1	11	A-1	Student, primary school	8.5	26.0	32.6	Return to school
Patient 2	14	A-1	Student, middle school	5.3	47.0	46.0	Return to school, playing soccer as a regular player
Patient 3	15	A-2	Student, high school	11	52.0	53.0	Return to school (one year delay), playing volleyball
Patient 4	18	A-2	Clerk	11	52.0	48.0	Return to job, normally active
Patient 5	21	B	Designer	12	53.0	57.0	Return to job, normally active
Patient 6	30	B*	Fireman	6.5	54.0	50.5	Return to job, working at desk

* Subtotal mucosal proctectomy

initially had an urge to defecate quite frequently but this frequency gradually subsided. The patient who had the Type B procedure had no urgency at all.

Of the six patients who have completed reconstruction, four showed excellent fecal continence and two sometimes soiled during the night. No medication was necessary in two patients, and one patient takes occasional antidiarrheal agents. Barium-enema study showed the transposed ileal reservoir to have a configuration similar to the rectum (Fig. 8).

Rehabilitation status: All six reconstructed patients have returned to their preoperative state of living (Table 2). Two work as a clerk and a designer respectively; one is a fireman now placed at desk work as a course of preparation for return to his normal, strenuous job, and two students have returned to their classes. One of the boys returned as a regular member of his soccer team and another to his volleyball team.

Discussion

Nissen[9] is credited as the first to attempt ileoanal anastomosis in a boy with adenomatosis coli in 1932. Since Ravitch and Sabiston's extensive experimental[10,11] and clinical[5] study on this surgical procedure in 1947, it has remained one of the main unsolved problems of gastrointestinal surgery despite interest by many surgeons. Because fecal incontinence often results, ileoanal anastomosis has not been regarded as a popular procedure for adenomatosis or for colitis.[1,12,13] However, recently, encouraging results have been reported by several other authors.[14–18]

After a series of animal experiments and some preliminary clinical trials we have devised an operation with ileoanal anastomosis. The main objectives are total removal of rectal mucosa, preservation of fecal continence, and prevention of pelvic infection.

Total removal of rectal mucosa

Devine and Ebb[14] left the lowest few cm of rectal mucosa because they considered this sensory area essential for fecal continence. This principle was followed by Martin *et al.*,[15] Safaie-Shirazi and Soper,[16] and Tossati[19] who observed good results. Our experience has shown that cancer occurred in some instances near the dentate line in the patients with adenomatosis, and histiologic examination has revealed many microfoci of adenoma involving transitional epithelium near the dentate line. If the area is not removed, a risk of cancer is left and the patients must be placed on a regular check-up schedule, as is practiced for patients retaining their entire rectum after colectomy. Such an operation should be called subtotal mucosal proctectomy to distinguish it from total mucosal proctectomy which should remove entirely the risk of cancer in the rectum.

Thus, we decided to remove the rectal mucosa down to the upper edge of the dentate line. Peck[17] and Parks and Nicholls[18] have made similar recommendations. However, the value of leaving the lowest rectal mucosa in these operations is not yet clearly shown. Subtotal mucosal proctectomy might be practical in the setting of inflammatory destruction of the anorectal muscular structure in colitis.

Preservation of optimum fecal continence

Two major considerations that help obtain optimum fecal continence are 1) creation of a long rectal cuff and 2) a low ileal reservoir. We preserve a long rectal muscular wall of 15 cm, although 8 cm is regarded as sufficient to protect the anorectal reflex.[20] Our idea is to preserve the maximum neuromuscular structure of the rectum in which its mucosal layer is replaced with the ileal wall as indicated by Peck.[17] We think it is one of the reasons for our satisfactory results.

Some[17,18,21–23] consider an ileal reservoir to be useful for better continence, whereas others[14–16] do not employ it. Many types of reservoir also have been reported.[17,18,21–23] Our ileoanal reconstruction methods were of three varieties, namely without reservoir, with reservoir in a high location, and with reservoir in a low location. The results observed in the frequency of bowel movements showed the low reservoir (B) better than the high reservoir (A-2).

Our type B procedure may be superior because the reservoir is located in the lowest part of the pelvic area, as is a normal rectal ampulla, and ileal peristalsis is interrupted by antiperistaltic side-to-side anastomosis; thus, when attached with the long rectal cuff, the complex may work better as a rectal substitute. This method has another advantage since it provides less risk of tearing the mesentery. We believe that either the A-1 or B procedure (Fig. 5) can be chosen depending on the length of the mesentery and other conditions.

Prevention of pelvic infection and other complications

A high complication rate has been a main deterrent to ileoanal anastomosis.[1,13,14] In particular, pelvic infection results in operative failure. Denuded rectum is less resistant to infection, and so called "cuff abscess," apt to occur between the cuff and the transposed ileum, destroys the muscular structure of the anorectal region, produces a stricture around the

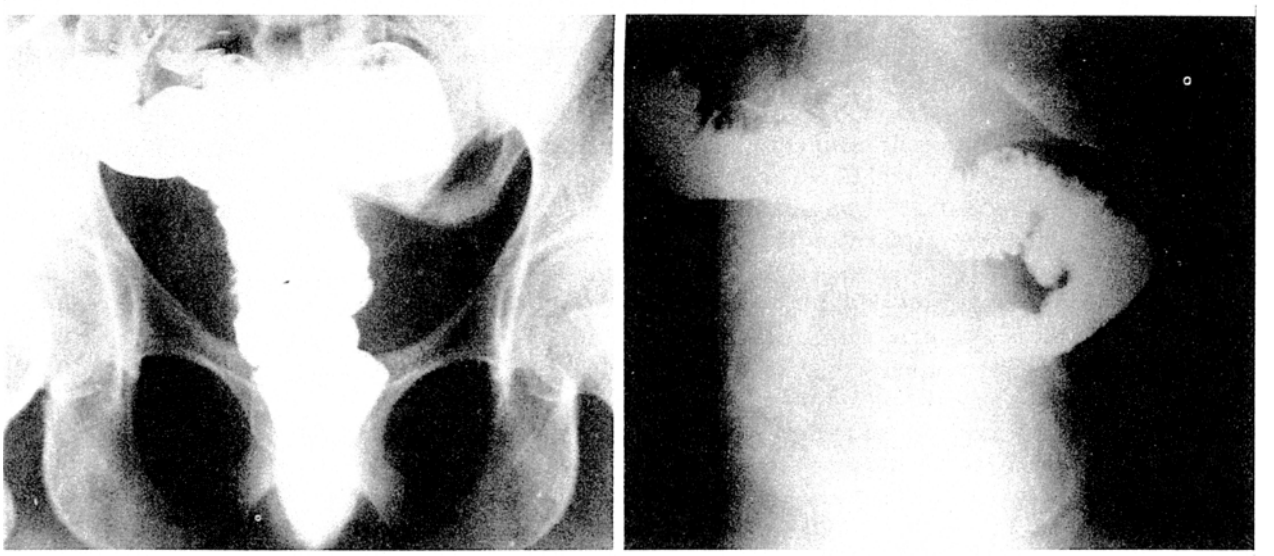

FIG. 8. Barium enema of the transposed ileum (Type B) in the rectal cuff, showing a configuration similar to the rectum.

anastomosis, and results in incontinence. One of the tactics we employed was the temporary defunctioning loop ileostomy. Although we experienced cuff abscesses in three instances, the anastomosis was protected by the ileostomy for more than three months and stricturing did not occur. The other essential points of our methods are intraoperative rectal irrigation to minimize the intestinal bacterial level, *en bloc* removal of the stripped mucosa with the colon through the anus to avoid soiling inside the rectal cuff, and effective draining within the cuff.

Necrosis of the transposed ileum due to twisted mesentery can be another serious complication[24] though we have not experienced it. With a Type B procedure, this is unlikely because the ileal loop receives a bilateral blood supply.

Acknowledgment

The authors deeply appreciate the continuous encouragement and support of this study by Dr. Kenichi Asano, Professor and Chairman of our department.

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