A Personal Experience with 100 Consecutive Total Colectomies and Straight Ileoanal Endorectal Pull-throughs for Benign Disease of the Colon and Rectum in Children and Adults

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In 1974 total colectomy and ileoanal straight endorectal pull-through (ERPT) were first used at our institution for the definitive management of total colonic Hirschsprung's disease in infants and children. Early success with this operation encouraged us to use this procedure in children and adults with ulcerative colitis and familial polyposis in 1977. Since 1974 we have performed total colectomy and straight ileoanal ERPT on 100 consecutive patients with ulcerative colitis (79), familial polyposis (19), and total colonic Hirschsprung's disease (10). Patients who have undergone a colectomy and ERPT but have not had their temporary ileostomy closed have been excluded from this report. This group of patients represents the only large series of straight ERPTs available for comparison with the various reservoir modifications that have been reported. All operations were performed under the direction of the author. The mean age at surgery was 20.6 ± 9.8 years, with a range of 1 to 48 years. Forty-six patients were younger than 18 years at the time of operation. All patients with ulcerative colitis and familial polyposis underwent a temporary loop ileostomy with total abdominal colectomy with ERPT; the 10 infants and children with Hirschsprung's disease underwent the total colectomy and ERPT without a back-up ileostomy. There were two deaths in this series, one from fulminate hepatic failure in the late postoperative period and the other from multiple bowel fistulas and sepsis in a teenager with Crohn's disease, in whom the initial diagnosis was ulcerative colitis. Follow-up has ranged from 3 months to 15 years. There were 13 cases of adhesive bowel obstruction, seven of which required an enterolysis. Pelvic sepsis occurred in three patients, two of whom required operative drainage. Two women developed rectovaginal fistulas, which healed with temporary diversion. Minor wound infections occurred in five patients. There were no anastomotic leaks, nor were any cases of pouchitis encountered. In five patients permanent conversion to a Brooke ileostomy was required.

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Mean stool frequency 3 years after surgery was 7.7 per 24 hours. Daytime continence was achieved in all patients. Occasional nocturnal soiling occurred in 11.1% of patients at 1 year and was absent by 3 years. Neither age nor diagnosis (ulcerative colitis *versus* familial polyposis) affected stool frequency. The straight endorectal ileoanal pull-through compares favorably with pull-throughs using various reservoir procedures (7.7 *versus* 7 stools per 24 hours) and appears to have a lower incidence of major complications (0% pouchitis *versus* 14% to 26%, 0% daytime incontinence *versus* 6%, and 3% pelvic sepsis *versus* 5% to 7%). Therefore the straight ERPT remains an appropriate alternative for both children and adults with benign disease of the colon and rectum.

MARTIN'S LANDMARK REPORT in 1977 ushered in a new era in the management of ulcerative colitis.[1] Most centers initially used the straight pull-through method for patients with ulcerative colitis and familial polyposis. However disenchantment with high stool frequencies and a significant incidence of complications prompted these various groups to develop a variety of reservoirs to increase rectal capacitance and, thereby, decrease stool frequency.[2-10] In essence a Kock-type pouch was added to the pull-through.[11] The theoretical and physiologic advantages of a reservoir have been recently reviewed by Wong et al.[12] With the introduction of the reservoirs, however, has come a number of complications not seen with the straight endorectal pull-through (ERPT), such as pouchitis and a higher incidence of pelvic sepsis.[13-22]

Our experience with the straight ERPT at the University of Michigan Medical Center has been quite different than

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the experience reported by other centers, with a stool frequency comparable to that seen with reservoirs and an incidence of complications lower than that reported with the various pouches.[23–30] Because this group of patients represents the only large series of straight ERPTs in children and adults, we have reviewed our experience with this procedure so that our results can be compared with the many series using different types of reservoirs.

Materials and Methods

Between July 1977 and October 1989, 100 children and adults (71 with ulcerative colitis, 19 with familial polyposis, and 10 with total colonic Hirschsprung's disease) underwent total colectomy and straight ileoanal ERPT under the direction of the author. Patients who had not yet undergone closure of their temporary loop ileostomy were excluded from this review. The mean age at operation was 20.6 ± 9.8 years (range, 1 to 48 years). The mean age of the children with Hirschsprung's disease at the time of operation was 17 months and the mean age of the children and adults with ulcerative colitis and familial polyposis was 22.8 ± 10.0 years at the time of surgery. There were 58 female and 42 male patients.

In all patients the diagnosis was confirmed histologically after sigmoidoscopic or colonoscopic examination. In the children with Hirschsprung's disease, the diagnosis was made with a suction rectal biopsy.[31]

The operative technique has been described in detail in previous reports.[23–25] The mucosal proctectomy is entirely carried out from the abdominal approach, with removal of an intact mucosal and submucosal tube. A 4- to 5-cm rectal muscular cuff is left and the ileoanal anastomosis is performed 1 cm above the dentate line. The anastomosis is performed with absorbable polyglycolic acid sutures and the muscular cuff is drained with a sump suction catheter for 24 to 48 hours after operation. The top of the rectal cuff is tacked to the pull-through ileum with silk sutures. Before closure of the abdomen, a temporary loop ileostomy is created in the right lower quadrant of all patients with ulcerative colitis and familial polyposis. None of the children with Hirschsprung's disease underwent a diverting ileostomy. The ileostomy was closed 2 to 3 months after the ERPT.

Follow-up was complete in this group of 100 patients and involved monthly visits for the first 6 months, visits every 3 months for the remaining 6 months, and then yearly visits. Sigmoidoscopy was carried out on all patients with ulcerative colitis yearly and every 6 months in patients with familial polyposis; biopsies were taken to detect dysplastic changes in patients with ulcerative colitis and any evidence of new polyp formation or malignant degeneration in the cases of familial polyposis.

Stool frequencies were compared at various time intervals and between age groups and diagnosis using the paired Student's t test.

Results

The follow-up has ranged from 3 months to 15 years. There have been two deaths in the series (operative mortality rate, 2%). The first occurred in a teenager with ulcerative colitis and pericholangiolitic hepatitis who developed fulminate hepatic failure 8 months after surgery. The second was in a 13-year-old girl who had an initial diagnosis of ulcerative colitis and underwent a colectomy and an ERPT. After closure of her loop ileostomy, she developed severe diarrhea and intestinal obstruction requiring multiple operations. Eventually she developed multiple enterocutaneous fistulas and invasive sepsis and died 2.5 years after her ERPT. Histologic evaluation of her small intestine at autopsy revealed extensive Crohn's disease. Thirteen patients developed adhesive intestinal obstruction, seven of whom required an enterolysis. Two patients developed pelvic abscesses, which required operative drainage, and a third patient developed a pelvic phlegmon that resolved with intravenous antibiotics. Rectovaginal fistulas developed in two women and both healed with temporary intestinal diversion. There were five minor wound infections.

In six patients mild narrowing of the ileoanal anastomosis was found and this responded easily to early digital rectal dilatation. There were no anastomotic leaks encountered at the ileoanal anastomosis. No patients developed clinical or histologic evidence of pouchitis during the entire follow-up period.

Five patients (5%) were converted to a Brooke ileostomy. One additional patient with familial polyposis was found to have an anaplastic carcinoma at the anal margin of the mucosal proctectomy specimen on histologic examination and required abdominal perineal resection 1 week after the ERPT. One of the five patients, a 10-year-old girl, developed recurrent symptoms of inflammatory

TABLE 1. *Postoperative Complications in 100 Patients Undergoing Total Colectomy and Ileoanal Endorectal Pull-through*

Complication	Percentage of Patients with Complication
Adhesive intestinal obstruction	13
Adhesive intestinal obstruction requiring enterolysis	7
Pelvic abscess	2
Rectovaginal fistula	2
Conversion to ileostomy	5
Minor wound infection	5

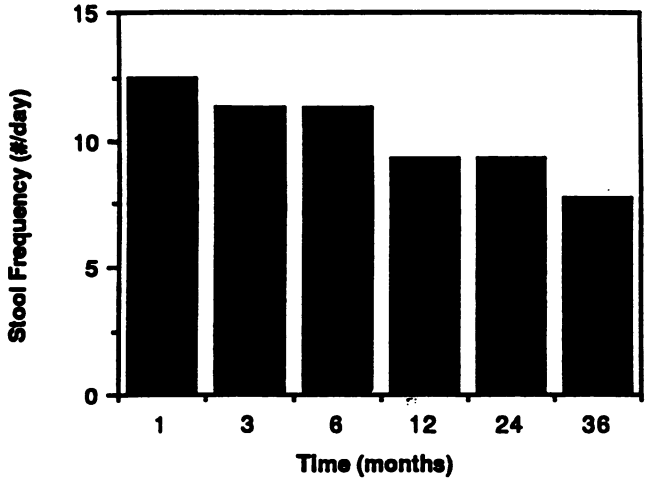

FIG. 1. The stool frequency for the entire series decreased during the 3-year period to a value of 7.7 ± 4.3 per 24 hours.

bowel disease after her ERPT and colectomy. The histologic diagnosis of the colon and terminal ileum specimens was ulcerative colitis. A repeat biopsy of her small intestine revealed Crohn's disease and she was converted to an end ileostomy. A second patient underwent a sigmoidoscopy at another institution shortly after closure of his ileostomy, at which time the pull-through ileum was separated from the rectal cuff. He developed a huge rectoperineal fistula that was treated with a end ileostomy. It is hoped that this ileostomy will be able to be closed in the future. Only three patients (3%) were converted to an ileostomy because of dissatisfaction with their stool frequency (between 10 and 15 per 24 hours). All three patients were continent during the day and at night.

Daytime continence was achieved in all but two patients within 3 months after ileostomy closure, and reached 100% 1 year after operation. Seven patients (7%) experienced minimal nighttime soiling during the first year after ileostomy closure; this nocturnal leakage disappeared 2 years after surgery.

Stool frequency progressively declined after operation, reaching a value of 7.7 ± 4.3 per 24 hours 3 years after the pull-through (Fig. 1). All patients were able to evacuate spontaneously immediately after ileostomy closure. Stool frequency was also analyzed by age groups and diagnosis. There were no statistically significant differences between those patients younger than and older than 18 years (6.3 ± 4.1 *versus* 9.0 ± 4.2; Fig. 2). Likewise patients with familial polyposis had the same stool frequency 3 years after operation as those with ulcerative colitis (7.8 ± 2.4 *versus* 9.0 ± 4.5, Fig. 3). In addition age did not appear to be a factor in stool frequency when analyzing the ulcerative colitis and familial polyposis patients separately (Figs. 4 and 5). The children with total colonic Hirschsprung's disease experienced 3.5 stools per 24 hours 3 years after the ERPT.

Discussion

A review of the world literature in 1985 revealed that more than 500 ERPTs had been performed for ulcerative colitis and polyposis, the large majority of which involved a reservoir.[25] Because no institution has done enough straight ERPTs to adequately evaluate and compare with their reservoir procedure, and because almost all the straight ERPTs were done during each center's early experience with the entire procedure, when the learning

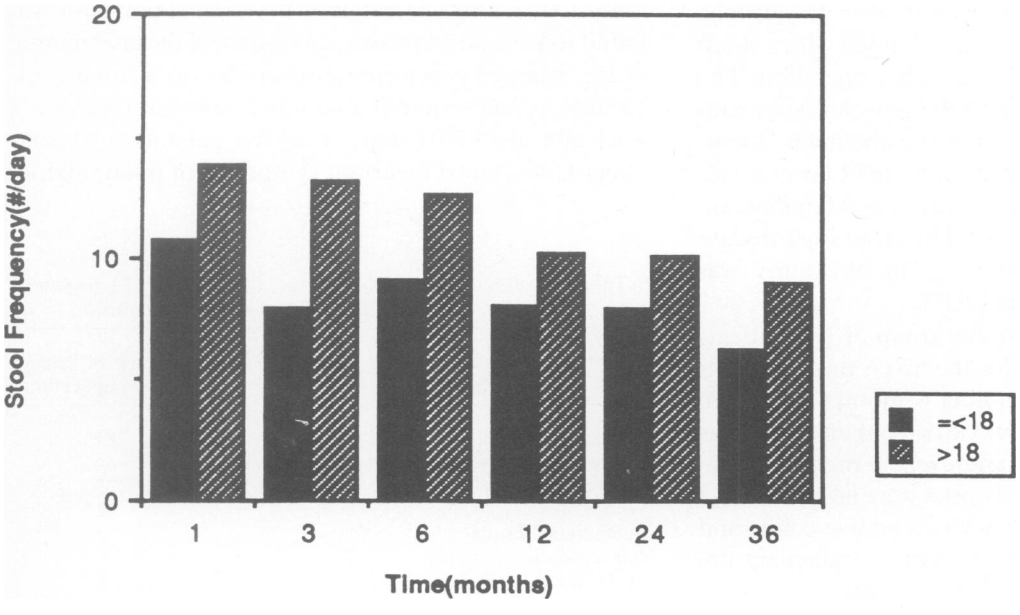

FIG. 2. A comparison of stool frequency in patients less than and more than 18 years of age for the entire series shows that there was no significant difference at 3 years (6.3 ± 4.1 *vs.* 9.0 ± 4.2).

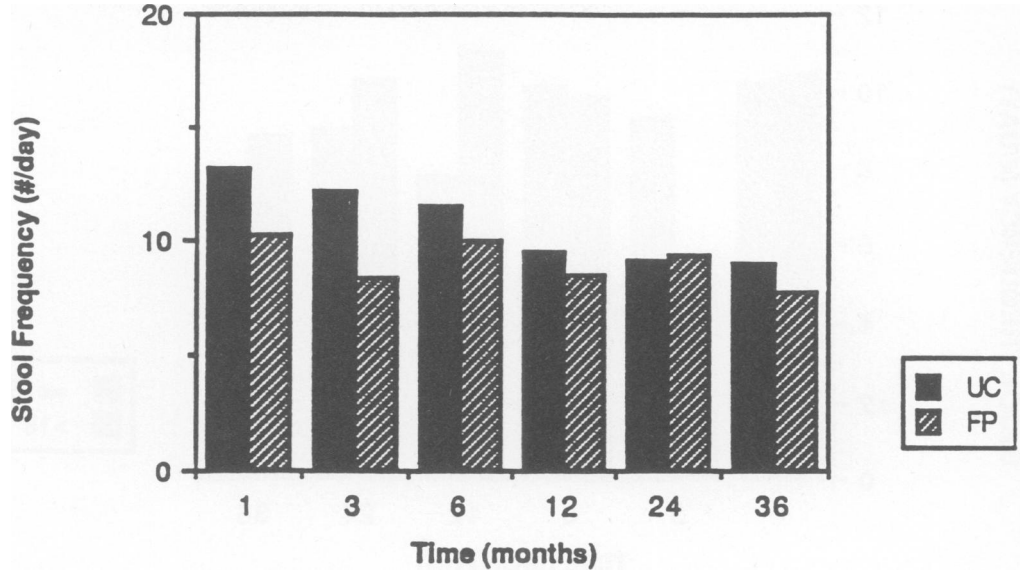

FIG. 3. There was no significant difference in stool frequency between patients with ulcerative colitis (UC) and familial polyposis (FP) (9 ± 4.5 *vs.* 7.8 ± 2.4).

curve was steep, it is impossible to equitably compare the two procedures. The stool frequencies reported with the various reservoirs have ranged from 4 to 9 per day (5 to 7 for the J-pouch,[13,14,18,20–22] 4 to 9 for the S-pouch,[16–18,21,23] and 6 for the lateral ileal reservoir[15]). Recently we tried to evaluate the various reservoir procedures with the straight ERPT in an experimental model and found that there were no differences in any of the clinical and physiologic parameters studied between the various reservoir procedures and the straight ERPT.[32]

The incidence of pelvic sepsis in the various series of reservoirs reported ranges from 3% to 20%.[8,9,13,15,17,18–20,21,33] This high incidence is not surprising in view of the long suture line that must be placed within the rectal cuff with the various reservoir procedures. In the current series, pelvic abscess occurred in two patients (2%), both of whom required operative drainage; and a pelvic phlegmon, responsive to antibiotic therapy, occurred in a third patient.

Clearly the most serious complication of the reservoirs is pouchitis. The incidence of this complication varies from 5% to 25%.[10,13,15,17,18,20,21,33] This is one complication that can be completely avoided with the straight ERPT; none of our patients developed any evidence of pouchitis. Nicholls found that 90% of the reservoirs that were sub-

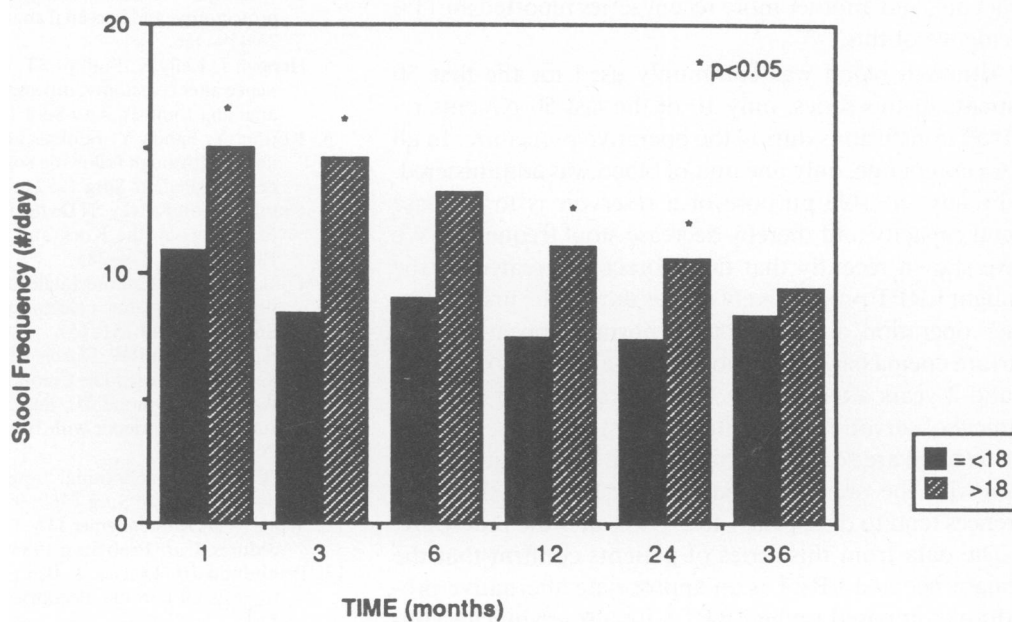

FIG. 4. Age appeared to have no effect on the stool frequency among the ulcerative colitis patients.

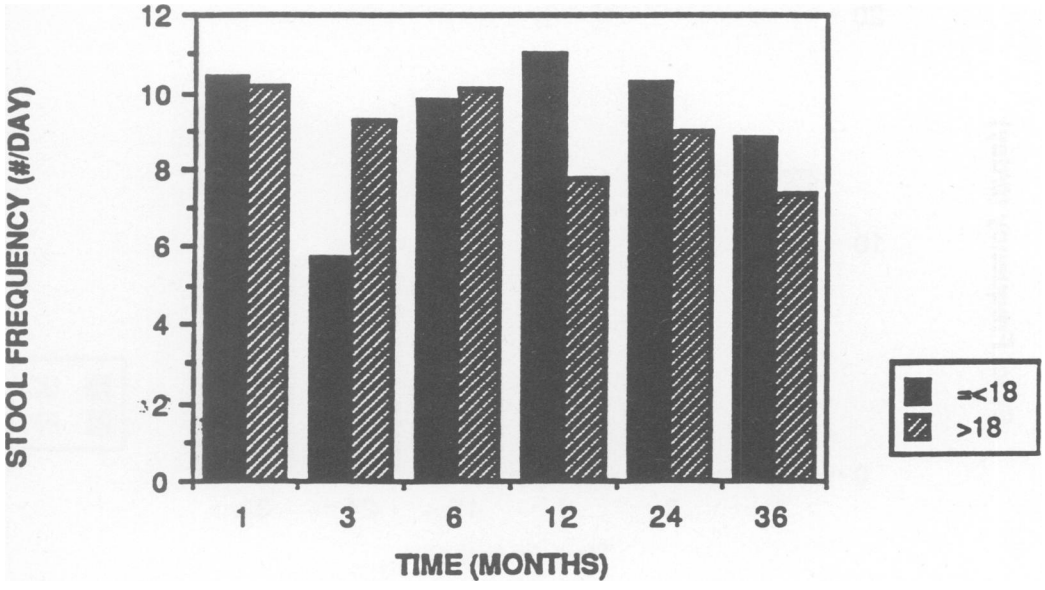

FIG. 5. Age appeared to have no effect on stool frequency among the familial polyposis patients.

jected to biopsy showed evidence of chronic and acute inflammation.[10,18] All of our patients have undergone an annual or semiannual biopsy of their pull-through ileum; none of these biopsies have shown any significant inflammation.

Adhesive intestinal obstruction is a significant complication in all the series reported, including our own. The incidence ranges from 8% to 35%, with a significant number of these patients requiring an enterolysis.[8-10,12,13,15,17,20-22]

Spontaneous evacuation has been noted to be a problem for patients who have undergone the S reservoir. One series reported a 53% incidence of inability to spontaneously evacuate, and another more recent series reported an 11% incidence of this.[17,33]

Although blood was commonly used for the first 50 patients in this series, only 10 of the last 50 patients received transfusions during the operative procedure. In all cases except one, only one unit of blood was administered.

Finally the sole purpose of a reservoir is to increase rectal capacity and thereby decrease stool frequency. We have shown recently that the neorectum created by the straight ERPT progressively dilates during the first 2 years after operation and develops a normal appearance on barium enema (suggesting normal rectal capacity) between 1 and 2 years after surgery.[30] This is consistent with the clinical observation that initially the stool frequencies on the average are somewhat higher with the straight ERPT then with the reservoir modification; however these differences tend to disappear 1 to 2 years after the procedure.

The data from this series of patients confirm that the straight ileoanal ERPT is an appropriate alternative procedure (compared to the ERPT with a reservoir) for children and adults with ulcerative colitis, familial polyposis, and total colonic Hirschsprung's disease, with comparable functional results and fewer complications than are seen with the reservoir procedures.

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Discussion

DR. KEITH A. KELLY (Rochester, Minnesota): Dr. Coran, I enjoyed your paper and congratulate you on a fine series of 100 consecutive cases of straight ileo-anal anastomosis, that is, an anastomosis made with no ileal pouch. These results are excellent. They are comparable to those of other large series reported recently from around the world. Your patients healed well, they had few complications, good control, and little diarrhea. Only five ended up with a permanent ileostomy.

I have two questions for you. The first is, what about the first 6 months after operation? Did the patients have any problems with troublesome diarrhea or incontinence during this time?

The distal ileum has a small capacity. It only holds about 15 to 30 mL. Dilatation does take place with time. After the first 6 months to 1 year, the patients may then have a satisfactory fecal reservoir. However, at first the distal ileal capacity is small and I would expect your patients to have troublesome diarrhea and some incontinence.

We tried the straight ileo-anal anastomosis in 50 patients at Mayo a few years back, and we did notice that at least in our adult patients, diarrhea and incontinence were present during the first 6 months to 1 year. When we studied these patients in the laboratory, their distal ileal segment was poorly distensible. Moreover, when the segment was distended, the patients had large contractions, which were propulsive and caused leakage. So, Dr. Coran, what about the first 6 months?

The second question relates to ileal 'pouchitis.' I presume what you mean here is that there is no terminal ileitis in the distal ileum anastomosed to the anal canal. You did indicate that you had endoscopic and histologic evidence that that was the case, but you did not show us any of that data.

We found in studying our own patients with the straight pull-through that some of them did have a nonspecific ileitis in the distal ileum. In a few cases with symptomatic distal ileitis, resection of that segment was necessary. Thus, our early data did not allow us to breathe easy about the "pouchitis" question even in the straight ileo-anal patients. Stasis is present in the terminal ileum after ileoanal anastomosis. At least, in the colitis patients, one might expect in some patients an inflammatory response to this stasis and to the bacterial overgrowth that accompanies it.

DR. HARVEY J. SUGERMAN (Richmond, Virginia): You stated in the abstract that there was no difference in stool frequency when age was used as a criterion. However, in your data of ulcerative colitis and familial polyposis patients, the average number of stools were nine and ten per day. Since the patients with Hirschsprung's disease were excluded from that group, I wonder if there was a statistically significant difference in stool frequency between the Hirschsprung's patients, who had to be very young, and your older patients with ulcerative colitis and familial polyposis, as the average for the entire group was 7.7 stools per day?

DR. ALVIN L. WATNE (Peoria, Illinois): Our group had a small experience in this operation, and Dr. Hrabovsky and I found that the children tolerated the straight ileo-anal pull-through much more readily than the adults. As Dr. Coran implied, the first 6 months is a very difficult adjustment time, and we found that the children tolerated this adaptation time better than the adults. I would appreciate their comments on that division of their patients.

DR. ARNOLD CORAN (Closing discussion): I would like to preface my answers to the specific questions by just stating that the motivation for submitting the paper was that there is a sense around the country, around the world, that the straight endorectal pull-through is inappropriate for adults or even for older children. I wanted to present this data to show that, in fact, it does appear to work reasonably well for both older children and adults.

In response to Dr. Kelly's question, the first 6 months is not as good as the second year. There is no question about it. In general, the stools are around 10 to 12, sometimes to 15, per 24 hours. However, they are continent. It is extremely unusual for them to be incontinent. I don't know whether this relates to the technique that we use for doing the