

# Laparoscopic IPAA Is Not Associated With Decreased Rates of Incisional Hernia and Small-Bowel Obstruction When Compared With Open Technique: Long-term Follow-up of a Case-Matched Study

Cigdem Benlice, M.D. • Luca Stocchi, M.D. • Meagan Costedio, M.D.  
Emre Gorgun, M.D. • Tracy Hull, M.D. • Hermann Kessler, M.D. • Feza H. Remzi, M.D.

Department of Colorectal Surgery, Digestive Disease Institute, Cleveland Clinic, Cleveland, Ohio

**BACKGROUND:** There are scant data on the presumed reduction of small-bowel obstruction and incisional hernia rates associated with laparoscopic IPAA.

**OBJECTIVE:** The aim of this study was to compare long-term outcomes after open vs laparoscopic IPAA based on a previous study from our institution.

**DESIGN:** This was a retrospective cohort study (from January 1992 through December 2007).

**SETTINGS:** The study was conducted in a high-volume, specialized colorectal surgery department.

**PATIENTS:** Patients included those who were enrolled in a previous institutional case-matched (2:1) study that examined 238 open and 119 laparoscopic IPAA.

**MAIN OUTCOME MEASURES:** Long-term complications, including incisional hernia clinically detected by physician, adhesive small-bowel obstruction requiring hospital admission and surgery, pouch excision, and pouchitis rates, were collected. Laparoscopic abdominal colectomy followed by rectal dissection under direct vision (lower midline or Pfannenstiel incision) and

converted cases were analyzed within the laparoscopic group.

**RESULTS:** Groups were comparable with respect to age, sex, BMI, and extent of resection (completion proctectomy vs proctocolectomy), consistent with the original case matching. Mean follow-up was significantly longer in the open group (9.6 vs 8.1 years;  $p = 0.008$ ). Open and laparoscopic operations were associated with similar incidences of incisional hernia (8.4% vs 5.9%;  $p = 0.40$ ), small-bowel obstruction requiring hospital admission (26.1% vs 29.4%;  $p = 0.50$ ), and small-bowel obstruction requiring surgery (8.4% vs 11.8%;  $p = 0.31$ ). A subgroup analysis comparing 50 patients with laparoscopic rectal dissection versus 69 patients with rectal dissection under direct vision confirmed statistically similar incidences of incisional hernia, hospital admission, and surgery for small-bowel obstruction.

**LIMITATIONS:** This study was limited by its retrospective nature.

**CONCLUSIONS:** Some of the anticipated long-term benefits of laparoscopic IPAA could not be demonstrated in this cohort. The lack of such long-term benefits should be discussed with patients when proposing a laparoscopic approach.

**Financial Disclosure:** None reported.

Poster presentation at the meeting of The American Society of Colon and Rectal Surgeons, Hollywood, FL, May 17 to 21, 2014.

**Correspondence:** Luca Stocchi, M.D., Desk A-30, Department of Colorectal Surgery, Digestive Disease Institute Cleveland Clinic, 9500 Euclid Ave, Cleveland, OH 44195. E-mail: stochl@ccf.org

Dis Colon Rectum 2015; 58: 314–320  
DOI: 10.1097/DCR.0000000000000287  
© The ASCRS 2015

**KEY WORDS:** Ileal pouch-anal anastomosis; Incisional hernia; Laparoscopic surgery; Long-term outcomes; Small bowel obstruction.

Total proctocolectomy with IPAA<sup>1</sup> has become the preferred surgical option for the majority of patients with ulcerative colitis who cannot be treated medically and select patients with familial adenomatous

polyposis.<sup>2,3</sup> As the experience in laparoscopic colorectal surgery has accumulated, an increasing number of patients requiring IPAA have been offered a laparoscopic approach.

A number of reports, including 2 prospective randomized trials,<sup>4,5</sup> have indicated that laparoscopic IPAA is safe and feasible when compared with the open approach. A number of series have also examined short-term results of laparoscopic IPAA in terms of functional outcomes, cosmesis, quality of life, and body image.<sup>6-10</sup> However, data on the long-term incidence of incisional hernia (IH) and small-bowel obstruction (SBO) after laparoscopic IPAA remain limited. There is evidence both from our institution<sup>11</sup> and from others<sup>12,13</sup> that laparoscopic IPAA results in a reduced formation of adhesions. These findings are consistent with the data indicating that laparoscopic colorectal surgery is associated with a decreased incidence of IH and SBO when compared with open surgery.<sup>14,15</sup> A previous case-matched study<sup>6</sup> from our institution indicated that laparoscopic IPAA provides recovery advantages over open IPAA. In this study, we investigated the follow-up of patients enrolled previously into a study to observe the difference between the laparoscopic and open techniques with respect to long-term complications. The aim of our study was the evaluation of such long-term complications after open and laparoscopic IPAA based on the same original patient cohort.

## MATERIALS AND METHODS

All of the patients who underwent open vs laparoscopic IPAA, enrolled in a previous institutional case-matched study, were retrospectively investigated by using data from a prospectively collected database. Surgical techniques, postoperative management, indications for surgery, and 1-year and 5-year functional outcomes were described previously.<sup>6</sup> The extraction site was through a Pfannenstiel incision, except in 1 patient who had a periumbilical extraction site. The definition of laparoscopic IPAA included both cases of laparoscopic rectal dissection and cases of laparoscopic total abdominal colectomy followed by rectal dissection under direct vision. Each patient undergoing laparoscopic IPAA enrolled in the original study had been 1:2 matched with 2 counterparts who had open IPAA between 1992 and 2007 based on age (within 2 years), sex, extent of resection (completion proctectomy or proctocolectomy), date of surgery (within 2 years), and BMI (within 2 kg/m<sup>2</sup>). Conversion to open surgery was defined as performance of a conventional midline laparotomy, with an abdominal incision longer in size than what was initially planned for specimen retrieval. Patients whose operations were started laparoscopically but ultimately required conversion to laparotomy were considered in the laparoscopic group in an intention-to-treat analysis.

The analysis of long-term complications included incidence, location, and surgical repair of IH; adhesive SBO requiring hospital admission with nonoperative management; adhesive SBO requiring surgery; pouch excision; and pouchitis rates. We also performed a subgroup analysis based on the specific approach used for rectal dissection, totally laparoscopic vs dissection under direct vision (using either a lower midline or Pfannenstiel incision). An additional analysis was performed comparing patients who underwent completely laparoscopic operations, including laparoscopic rectal dissection, and patients who underwent open surgery. In addition, we evaluated the specific effect of the application of sodium hyaluronate methylcellulose antiadhesion barrier (Seprafilm, Genzyme Corporation, Cambridge, MA) on SBO. Data were obtained from our institutional review board–approved, prospectively maintained electronic pouch database, supplemented by office visits and patient charts as necessary.

IH was defined as any abdominal wall gap with or without an associated bulge in the area of the incisional scar, which was palpable on clinical examination and/or identified on radiologic imaging. Confirmation of a diagnosis of IH required review of radiologic reports or office visit reports. The definition of IH only applied to patients who had resumed anal defecation through the newly created IPAA. Temporary incisional or parastomal hernias occurring during the different stages of surgical treatment, for example, after initial total abdominal colectomy or while the patient had a diverting ileostomy, were excluded from the analysis. Each individual surgical incision was considered as a possible IH site, including the midline incision, former ileostomy stoma site, trocar sites, and a Pfannenstiel incision/extraction site. SBO was defined on the basis of accepted clinical and radiologic criteria, which have been described previously.<sup>2</sup> An adhesion-related SBO was assumed when no other causes of mechanical SBO could be identified during successful nonoperative management or when adhesions causing SBO were encountered at the time of surgery to treat SBO. We confirmed SBO based on the reports from office visits, letters from outside facilities, and notes from the emergency department as necessary. The incidence of both IH and SBO was assessed based on the number of patients experiencing at least 1 event. Pouch excision was defined as pouch removal because of chronic dysfunction or persistent chronic pelvic infection and treated with end ileostomy (pouch failure) or redo pouch surgery. The diagnosis of pouchitis was also based on previously described symptoms and endoscopic findings.<sup>2</sup>

Statistical significance was assumed when the *p* value (2-sided) was <0.050. Categorical variables were analyzed with  $\chi^2$  or Fisher exact test, and quantitative variables were analyzed with a Wilcoxon rank-sum test.

**Table 1.** Comparison of long-term results between laparoscopic and open IPAA

Variable	Open (N = 238)	Laparoscopic (N = 119)	p
Follow-up, mo, mean (SD)	116 (64.0)	98 (50.0)	0.008
Anti-adhesion barrier usage, n (%)	43 (18.1)	23 (19.3)	0.77
Incisional hernia, n (%)	20 (8.4)	7 (5.8)	0.40
Midline	12	1	
Former ileostomy site	8	3	
Umbilical port site	NA	1	
Umbilical extraction site	NA	1	
Right lower quadrant port site	NA	1	
Pfannenstiel extraction site	NA	0	
Hospital admission for SBO, n (%)	62 (26)	35 (29.4)	0.50
Surgery for SBO, n (%)	20 (8.4)	14 (11.8)	0.31
Pouch excision, n (%)	12 (5.0)	7 (5.9)	0.74
Pouchitis incidence, n (%)	93 (39.1)	28 (23.5)	0.003
Median time to pouchitis, mo (range)	22 (0–207)	26 (0–152)	0.89

SBO = small-bowel obstruction; NA = not applicable.

## RESULTS

Long-term follow-up data were available on a total of 357 previously matched patients who had undergone IPAA. All of the ileal pouch procedures were performed electively. A total of 25 patients (7%; 2 patients in the laparoscopic group and 23 patients in the open group) undergoing initial total abdominal colectomy required urgent surgery. Mean age at the time of first surgery, sex, BMI, and extent of resection (completion proctectomy vs proctocolectomy) were comparable between the groups based on the case matching of the original study. Similarly, antiadhesion barrier usage had also been comparable between the groups. Preoperative serum albumin levels before the initial operation were comparable (4.04 vs 4.14 g/dL for the laparoscopic and open groups;  $p = 0.59$ ). Nine patients (7.6%) initially approached laparoscopically had required conversion.

With respect to preoperative medications (ie, preceding the initial operation), groups were comparable for the use of infliximab (28.0% vs 17.6%;  $p = 0.07$ ), mesalamine (46.5 vs 49.6%;  $p = 0.61$ ), mercaptopurine (11.0% vs 4.9%;  $p = 0.11$ ), azathioprine (12.2% vs 12.6%;  $p = 0.93$ ), and cyclosporine (0 vs 3.3%;  $p = 0.15$ ) for patients who underwent laparoscopic and open IPAA. Although steroid use was more common in the open IPAA group (50.7% vs 38.2%;  $p = 0.037$ ), the duration of steroid treatment was longer in the laparoscopic IPAA group (39.8 vs 29.9 months;  $p = 0.023$ ). The incidence of SBO preceding the ileostomy takedown after hospital discharge after IPAA was comparable between the groups (12 patients (10%) in the laparoscopic group vs 19 patients (7%) in the open group;  $p = 0.44$ ).

Results of comparative long-term outcomes are reported in Table 1. Mean follow-up for all of the patients combined was  $9.1 \pm 5.0$  years and was significantly longer in the open group compared with the laparoscopic group ( $9.6 \pm 5.4$  vs  $8.1 \pm 4.3$  years;  $p = 0.008$ ; same times reported in months in Table 1). IH developed in 27 patients (7%) based on the entire

cohort and was comparable between the groups (Table 1). It was notable that, among the different hernia sites, there were no cases of IH occurring at the Pfannenstiel extraction site of 117 patients treated laparoscopically. The details on timing, location, treatment, and length of hospital stay associated with IH repair are reported in Table 2. A total of 24 (89%) of 27 patients underwent surgical treatment for IH. The remaining 3 patients (1 midline and 1 former ileostomy site in the open group and 1 former ileostomy site in the laparoscopic group) were diagnosed with IH but did not undergo surgical repair. Four patients with IH had also experienced abdominal wall hernia before re-establishment of intestinal continuity, specifically 2 parastomal hernias followed by IH at the former ileostomy sites and 2 midline IHs, of which 1 former ileostomy site was in the laparoscopic group, whereas the remaining 3 patients underwent open surgery. There was a single case of IH occurring in the midline among converted patients. Two cases of IH occurred in 12 mm port sites used for IPAA performed in 1998 and 1999. There were no additional cases of port-site IHs. There were 4 patients with recurrent IH after initial repair; they were treated with mesh repair and have been free from further recurrence after a median follow-up of 10 years (range, 3–22 years). The diagnosis of IH occurred earlier in the laparoscopic group, but this did not amount to a statistically significant difference, and the combined median length of stay when considering all of the operations was also comparable (Table 2). Baseline patient characteristics and risk factors were similar among individuals who experienced IH after laparoscopic vs open IPAA (Table 3). With respect to SBO, 97 patients (27%) required a total of 136 hospital admissions for nonoperative management, 21 (22%) of whom had more than 1 admission, ranging from 2 to 6. Of all of the patients experiencing SBO, 34 patients (35%) required surgery to relieve the obstruction. When comparing both rates of hospital admission and surgery for SBO, there were no significant differences between the laparoscopic and open techniques. Regarding timing of

**Table 2.** Comparison of hernia characteristics and repair outcomes between laparoscopic and open IPAA patients

Variable	Open (n/N = 20/238 [8.4%])	Laparoscopic (n/N = 7/119 [5.8%])	p
Time to hernia diagnosis, mo, median (range) <sup>a</sup>	13.5 (4–52)	6 (1–52)	0.09
Repair of initial hernia, n	18	6	0.75
Mesh repair	10	1	
Midline	7	1	
Former ileostomy site	3	0	
Primary repair	8	5	
Midline	4	0	
Former ileostomy site	4	2	
RLQ port site	NA	1	
Umbilical port site	NA	1	
Umbilical extraction site	NA	1	
Repair of recurrent hernia, n	2	2	
Mesh repair	1	2	
Midline	1	1	
Umbilical extraction site	NA	1	
Primary repair	1	–	
Former ileostomy site	1	–	
Overall length of stay, d, median (range) <sup>b</sup>	4 (1–37)	4 (3–5)	0.58

NA = not applicable; RLQ = right lower quadrant.

<sup>a</sup>Data show the interval between re-establishment of intestinal continuity and diagnosis of incisional hernia.

<sup>b</sup>Overall length of stay for each patient was the combined length of hospital stay associated with each hernia repair, as applicable.

the initial episode of SBO after re-establishment of intestinal continuity, groups were comparable (6.3 vs 9.4 months;  $p = 0.75$ ). Four patients in the laparoscopic group experiencing SBO had been conversions. When considering only patients with SBO, baseline characteristics and risk factors were again comparable between the groups except for the antiadhesion barrier, which had been applied significantly more often during open surgery (Table 4).

When considering the entire cohort, 34% ( $n = 121$ ) of patients experienced at least 1 episode of pouchitis.

Median time to pouchitis from the time of IPAA for all of the patients was 22.5 months (range, 0–207.0 months). Pouchitis rates were significantly increased in the open group, albeit after a significantly longer follow-up when compared with the laparoscopic group. When considering median intervals to the first episode of pouchitis from the time of IPAA construction, the 2 groups were in fact comparable (26 months (range, 0–152 months) vs 22 months (range, 0–207 months) for the laparoscopic and open groups;  $p = 0.89$ ).

**Table 3.** Comparison of patient characteristics and risk factors for the development of incisional hernia between laparoscopic and open IPAA patients

Variable	Open (n/N = 20/238 [8.4%])	Laparoscopic (n/N = 7/119 [5.8%])	p
Follow-up, mo, mean (SD)	110.3 (48.4)	130.5 (63.5)	0.14
Age, y, mean (SD)	40.7 (15.7)	45.0 (15.0)	0.54
Men, n	10	2	0.003
Diagnosis, n			0.61
Ulcerative colitis	18	6	
FAP	1	1	
Colon cancer	1	0	
Extent of resection, n			0.58
Proctocolectomy	11	3	
Completion proctectomy	9	4	
Previous abdominal surgery, n	5	2	0.96
BMI, kg/m <sup>2</sup>	29.0	28.2	0.54
Diabetes mellitus, n	1	0	0.52
COPD, n	1	0	0.52
Other comorbidities, n <sup>a</sup>	4	3	0.26
Wound infection, n	7	1	0.27
Wound dehiscence, n	2	0	0.35

COPD = chronic obstructive pulmonary disease; FAP = familial adenomatous polyposis.

<sup>a</sup>Data include hypertension and deep vein thrombosis.

**Table 4.** Comparison of patient characteristics and risk factors for the development of small-bowel obstruction between laparoscopic and open IPAA patients

Variable	Open (n/N = 62/238 [26%])	Laparoscopic (n/N = 35/119 [29%])	p
Follow-up, mo, mean (SD)	122 (64.8)	101 (49.2)	0.10
Age, y, mean (SD)	31.2 (13.4)	33 (13.8)	0.54
Men, n	31	17	0.89
Diagnosis, n			0.83
Ulcerative colitis	44	23	
FAP	16	11	
Cancer	1	0	
Crohn's disease	1	1	
BMI, kg/m <sup>2</sup>	23.6	22.4	0.26
Extent of resection, n			0.93
Proctocolectomy	50	28	
Completion proctectomy	12	7	
Anti-adhesion barrier usage, n	19	3	0.01
Previous abdominal surgery, n	13	5	0.37

FAP = familial adenomatous polyposis.

A total of 19 patients (5.3%) required pouch excision, with rates comparable between the open and laparoscopic groups (12% vs 7%;  $p = 0.74$ ). No patient included in this study underwent permanent stoma diversion with a dysfunctional pouch left in situ. The cause of pouch excision was chronic pelvic sepsis in all but 1 patient treated laparoscopically who developed pouch ischemia and another patient with recurrent rectal cancer who had undergone open IPAA with total mesorectal excision for adenocar-

cinoma complicating ulcerative colitis. A redo IPAA was performed in 4 and 2 patients originally treated with the open and laparoscopic techniques ( $p = 0.73$ ).

Of 119 patients with laparoscopic IPAA, rectal dissection was performed laparoscopically in 50 patients and under direct vision in 69 patients. These 2 subgroups were comparable with respect to age, sex, BMI, and extent of resection. As shown in Table 5, the rates of IH, SBO requiring hospital admission or surgery, and pouch excision were statistically similar between the 2 subgroups. An additional subgroup analysis was also performed comparing patients who underwent complete laparoscopic operations, including laparoscopic rectal dissection, and patients undergoing open surgery, which also did not reveal any significant differences in rates of IH ( $p = 0.87$ ), SBO requiring hospital admission ( $p = 0.60$ ), or SBO requiring surgery ( $p = 0.70$ ).

We also compared laparoscopic and open IPAA based on the actual treatment received, so that converted patients were included in the open group. Laparoscopic and open groups were again comparable with respect to incidence of IH (5.5% vs 8.5%;  $p = 0.3$ ), SBO requiring hospital admission (28% vs 26%;  $p = 0.5$ ), and SBO requiring surgery (11.8% vs 8.5%;  $p = 0.3$ ).

Prospectively collected records of functional outcomes were available for 106 patients at 10 years and specifically for 29 patients (24%) in the laparoscopic group and 77 patients (32%) in the open group. Groups were comparable in terms of pad use ( $p = 0.37$ ), fecal urgency ( $p = 0.46$ ), dietary restriction ( $p = 0.58$ ), social restriction ( $p = 0.77$ ), work restriction ( $p = 0.12$ ), and sexual restriction ( $p = 0.38$ ).

## DISCUSSION

The present study reports long-term outcomes of laparoscopic and open IPAA after a mean follow-up of 9.1 years.

**Table 5.** Subgroup analysis comparing demographics and long-term results among patients undergoing rectal dissection under direct vision vs laparoscopic rectal dissection

Variable	Rectal dissection under direct vision (N = 69)	Laparoscopic rectal dissection (N = 50)	p
Age, y, mean (SD)	33.8 (13.3)	35.3 (15.3)	0.73
Men, mean (SD)	40 (58)	29 (42)	0.08
Extent of resection			0.49
Completion proctectomy	13	12	
Proctocolectomy	56	38	
BMI, kg/m <sup>2</sup>	24.7 (4.9)	24.6 (4.4)	0.94
Anti-adhesion barrier use	13	10	0.87
Follow-up, mo, mean (SD)	108.0 (52.0)	83 (43.3)	0.002
Incisional hernia	3	4	0.45
Former ileostomy site	2	1	
Umbilical port site	1	1	
RLQ port site	0	1	
Midline	0	1	
Pfannenstiel extraction site	0	0	
Hospital admission for SBO	24	11	0.13
Surgery for SBO	11	3	0.11
Pouch excision	5	2	0.44
Pouchitis	21	7	0.03

Values are reported as absolute values unless noted otherwise.  
RLQ = right lower quadrant; SBO = small-bowel obstruction.

Although the risk of pouch excision and the time to pouchitis onset were comparable between the 2 groups, as expected, our data indicate that laparoscopic IPAA is not associated with the anticipated benefits of decreased rates of IH and SBO. In particular, both the overall incidence of adhesive SBO requiring hospital admission and the proportion of patients requiring surgery for SBO were similar, unlike what was reported previously by our own institution when considering patients undergoing a variety of laparoscopic vs open colorectal surgical procedures.<sup>16,17</sup> Our case-matched study design helps minimize patient heterogeneity and adds meaningful data on these specific long-term outcomes after laparoscopic IPAA. With respect to IH, the present study was focused on 1 specific surgical procedure but confirms the results from other series indicating a lack of significant benefits associated with laparoscopic colorectal resections,<sup>18–21</sup> including data from 3 prospective randomized trials.<sup>21–23</sup> Other series, including an earlier study from our institution, have instead indicated a reduction in IH rates associated with laparoscopic colorectal surgery.<sup>17,24,25</sup> The discrepancy among these findings might depend on specific study design and length of follow-up. It is, however, notable that the incidence of IH in both study groups remains relatively low when compared with IH rates after midline laparotomy in general, which range between 9% and 20%<sup>26</sup> at 1 year after midline laparotomy and can increase further with longer follow-up.<sup>27</sup> The overall low incidence of IH in the present study reflects the 4.3% rate reported by our institution in an earlier audit of open ileal pouch procedures.<sup>28</sup> This particular difference between our IH rates and the rest of the literature probably depends on the characteristics of our select study population, constituted by young and relatively lean individuals, who are frequently in good general health. Therefore, it is not surprising that the majority of patients experiencing IH underwent surgical repair. The only study to our knowledge specifically comparing the incidence of IH after laparoscopic vs open IPAA is the series by Fichera et al,<sup>29</sup> where, for a mean follow-up of 24.8 months, 73 patients were treated with a laparoscopic technique and 106 with an open technique. No cases of IH were reported in the laparoscopic group compared with 8.8% after open surgery.<sup>29</sup> Similarly, Duff et al<sup>30</sup> did not identify a single case of IH in 75 patients undergoing laparoscopic IPAA after a median follow-up of 33 months. Our study assessed the individual incidence of IH based on its specific location, and it is notable that there was no patient with IH occurring at the Pfannenstiel incision site. This confirms the findings reported previously by Fichera et al<sup>29</sup> and corroborates the preferential use of this extraction site for laparoscopic colorectal surgery in general, when technically possible. With regard to the specific IH locations in our laparoscopic group, they consisted of 1 midline IH after conversion, 3 port-site hernias, and 3 hernias occurring in former diverting ileostomy stoma apertures, which

are created under direct vision through the extraction site. Therefore, it is possible that, with an already low incidence of IH after open IPAA, the putative advantages of laparoscopic surgery in the reduction of IH rates for this specific procedure might require a much larger sample size to become statistically detectable.

Unlike IH, SBO is a frequent long-term complication after IPAA, possibly because of the extent of dissection involving both the abdominal cavity and the pelvis. In a recent meta-analysis of 61 studies assessing open IPAA and subdivided according to the year of publication, the incidence of SBO varied between 11.4% after the year 2000 and 13.1% based on earlier studies.<sup>31</sup> These figures are consistent with our overall institutional rate of 13%<sup>2</sup> but are substantially lower than the SBO rates reported both in the present study and in other series on open IPAA, which are approximately  $\geq 20\%$ .<sup>32</sup> One particular study has even reported a cumulative incidence exceeding 31% after 10 years,<sup>33</sup> which surpasses the incidence of SBO after colorectal resection for different indications.<sup>16,17</sup> The prospective rather than retrospective nature of the current study and its length of follow-up are again the most likely explanations for the relatively high rate of SBO in either group.

The results from the current study are in contrast with other data suggesting that laparoscopic colorectal surgery is associated with a decreased rate of SBO.<sup>30,34</sup> In addition, at least 3 different studies have concurrently found that laparoscopic IPAA is associated with decreased rates of adhesions, possibly because of decreased small-bowel manipulation and incision length,<sup>11–13</sup> 2 of which evaluated patients undergoing laparoscopic rectal dissection.<sup>11,13</sup> Our subset analysis assessing the potential benefits of laparoscopic rectal dissection suggests a possible reduction in both the incidence of SBO and the requirement of surgery, but our numbers are insufficient to reach statistical significance. A future study with a larger sample size, inclusive of surgeons who routinely perform the rectal dissection laparoscopically, might clarify the impact of the more extensive use of the laparoscopic technique on SBO.

Despite its case-matched design, the current study remains retrospective in nature with its inherent limitations. In addition, the enrollment period of the original study was 15 years, during which technical advancements in laparoscopic surgery could have made the laparoscopic study group less homogeneous. Long-term follow-up from the above-mentioned randomized studies will provide the most definitive data assessing the presumptive long-term advantages of laparoscopic IPAA.

Although reaffirming the safety and feasibility of the laparoscopic approach in pouch surgery, we believe that it is necessary to disclose to patients that, although laparoscopic IPAA is associated with a number of short-term recovery benefits, the present data fail to confirm advantages of the laparoscopic technique in the long-term reduction of IH and SBO.

## REFERENCES

1. Parks AG, Nicholls RJ. Proctocolectomy without ileostomy for ulcerative colitis. *Br Med J*. 1978;2:85–88.
2. Fazio VW, Kiran RP, Remzi FH, et al. Ileal pouch anal anastomosis: analysis of outcome and quality of life in 3707 patients. *Ann Surg*. 2013;257:679–685.
3. Stocchi L. Laparoscopic surgery for ulcerative colitis. *Clin Colon Rectal Surg*. 2010;23:248–258.
4. Maartense S, Dunker MS, Slors JF, et al. Hand-assisted laparoscopic versus open restorative proctocolectomy with ileal pouch anal anastomosis: a randomized trial. *Ann Surg*. 2004;240:984–991.
5. Schiessling S, Leowardi C, Kienle P, et al. Laparoscopic versus conventional ileoanal pouch procedure in patients undergoing elective restorative proctocolectomy (LapConPouch Trial): a randomized controlled trial. *Langenbecks Arch Surg*. 2013;398:807–816.
6. El-Gazzaz GS, Kiran RP, Remzi FH, Hull TL, Geisler DP. Outcomes for case-matched laparoscopically assisted versus open restorative proctocolectomy. *Br J Surg*. 2009;96:522–526.
7. Larson DW, Dozois EJ, Piotrowicz K, Cima RR, Wolff BG, Young-Fadok TM. Laparoscopic-assisted vs open ileal pouch-anal anastomosis: functional outcome in a case-matched series. *Dis Colon Rectum*. 2005;48:1845–1850.
8. Ahmed Ali U, Keus F, Heikens JT, et al. Open versus laparoscopic (assisted) ileo pouch anal anastomosis for ulcerative colitis and familial adenomatous polyposis. *Cochrane Database Syst Rev*. 2009;(1):CD006267.
9. Polle SW, Dunker MS, Slors JF, et al. Body image, cosmesis, quality of life, and functional outcome of hand-assisted laparoscopic versus open restorative proctocolectomy: long-term results of a randomized trial. *Surg Endosc*. 2007;21:1301–1307.
10. Michelassi F, Lee J, Rubin M, et al. Long-term functional results after ileal pouch anal restorative proctocolectomy for ulcerative colitis: a prospective observational study. *Ann Surg*. 2003;238:433–442.
11. Hull TL, Joyce MR, Geisler DP, Coffey JC. Adhesions after laparoscopic and open ileal pouch-anal anastomosis surgery for ulcerative colitis. *Br J Surg*. 2012;99:270–275.
12. Bartels SA, Vlug MS, Henneman D, Ponsioen CY, Tanis PJ, Bemelman WA. Less adhesiolysis and hernia repair during completion proctocolectomy after laparoscopic emergency colectomy for ulcerative colitis. *Surg Endosc*. 2012;26:368–373.
13. Indar AA, Efron JE, Young-Fadok TM. Laparoscopic ileal pouch-anal anastomosis reduces abdominal and pelvic adhesions. *Surg Endosc*. 2009;23:174–177.
14. Laurent C, Leblanc F, Bretagnol F, Capdepon M, Rullier E. Long-term wound advantages of the laparoscopic approach in rectal cancer. *Br J Surg*. 2008;95:903–908.
15. Rosin D, Zmora O, Hoffman A, et al. Low incidence of adhesion-related bowel obstruction after laparoscopic colorectal surgery. *J Laparoendosc Adv Surg Tech A*. 2007;17:604–607.
16. Reshef A, Hull TL, Kiran RP. Risk of adhesive obstruction after colorectal surgery: the benefits of the minimally invasive approach may extend well beyond the perioperative period. *Surg Endosc*. 2013;27:1717–1720.
17. Duepre HJ, Senagore AJ, Delaney CP, Fazio VW. Does means of access affect the incidence of small bowel obstruction and ventral hernia after bowel resection? Laparoscopy versus laparotomy. *J Am Coll Surg*. 2003;197:177–181.
18. Ihedioha U, Mackay G, Leung E, Molloy RG, O'Dwyer PJ. Laparoscopic colorectal resection does not reduce incisional hernia rates when compared with open colorectal resection. *Surg Endosc*. 2008;22:689–692.
19. Skipworth JR, Khan Y, Motson RW, Arulampalam TH, Engledow AH. Incisional hernia rates following laparoscopic colorectal resection. *Int J Surg*. 2010;8:470–473.
20. Burns EM, Currie A, Bottle A, Aylin P, Darzi A, Faiz O. Minimal-access colorectal surgery is associated with fewer adhesion-related admissions than open surgery. *Br J Surg*. 2013;100:152–159.
21. Taylor GW, Jayne DG, Brown SR, et al. Adhesions and incisional hernias following laparoscopic versus open surgery for colorectal cancer in the CLASICC trial. *Br J Surg*. 2010;97:70–78.
22. Braga M, Frasson M, Vignali A, Zuliani W, Civelli V, Di Carlo V. Laparoscopic vs open colectomy in cancer patients: long-term complications, quality of life, and survival. *Dis Colon Rectum*. 2005;48:2217–2223.
23. Winslow ER, Fleshman JW, Birnbaum EH, Brunt LM. Wound complications of laparoscopic vs open colectomy. *Surg Endosc*. 2002;16:1420–1425.
24. Laurent C, Leblanc F, Bretagnol F, Capdepon M, Rullier E. Long-term wound advantages of the laparoscopic approach in rectal cancer. *Br J Surg*. 2008;95:903–908.
25. Andersen LP, Klein M, Gögenur I, Rosenberg J. Incisional hernia after open versus laparoscopic sigmoid resection. *Surg Endosc*. 2008;22:2026–2029.
26. Diener MK, Voss S, Jensen K, Büchler MW, Seiler CM. Elective midline laparotomy closure: the INLINE systematic review and meta-analysis. *Ann Surg*. 2010;251:843–856.
27. Fink C, Baumann P, Wente MN, et al. Incisional hernia rate 3 years after midline laparotomy. *Br J Surg*. 2014;101:51–54.
28. Fazio VW, Ziv Y, Church JM, et al. Ileal pouch-anal anastomoses complications and function in 1005 patients. *Ann Surg*. 1995;222:120–127.
29. Fichera A, Silvestri MT, Hurst RD, Rubin MA, Michelassi F. Laparoscopic restorative proctocolectomy with ileal pouch anal anastomosis: a comparative observational study on long-term functional results. *J Gastrointest Surg*. 2009;13:526–532.
30. Duff SE, Sagar PM, Rao M, Macafee D, El-Khoury T. Laparoscopic restorative proctocolectomy: safety and critical level of the ileal pouch anal anastomosis. *Colorectal Dis*. 2012;14:883–886.
31. de Zeeuw S, Ahmed Ali U, Ali UA, et al. Update of complications and functional outcome of the ileo-pouch anal anastomosis: overview of evidence and meta-analysis of 96 observational studies. *Int J Colorectal Dis*. 2012;27:843–853.
32. Meagher AP, Farouk R, Dozois RR, Kelly KA, Pemberton JH. J ileal pouch-anal anastomosis for chronic ulcerative colitis: complications and long-term outcome in 1310 patients. *Br J Surg*. 1998;85:800–803.
33. MacLean AR, Cohen Z, MacRae HM, et al. Risk of small bowel obstruction after the ileal pouch-anal anastomosis. *Ann Surg*. 2002;235:200–206.
34. Linden BC, Bairdain S, Zurakowski D, Shamberger RC, Lillehei CW. Comparison of laparoscopic-assisted and open total proctocolectomy and ileal pouch anal anastomosis in children and adolescents. *J Pediatr Surg*. 2013;48:1546–1550.