

# Does Mesorectal Preservation Protect the Ileoanal Anastomosis after Restorative Proctocolectomy?

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## Abstract

**Background and aims** The technique of rectal dissection during restorative proctocolectomy might influence the rate of septic complications. The aim of this study was to analyze the morbidity of restorative proctocolectomy in a consecutive series of patients who had rectal dissection with complete preservation of the mesorectum.

**Patients and methods** One hundred thirty-one patients who had restorative proctocolectomy for chronic inflammatory bowel disease with handsewn ileopouch-anal anastomosis (IPAA) and preservation of the mesorectal tissue were analyzed by chart reviews and a follow-up investigation at a median of 85 (14–169) months after surgery.

**Results** Only one of 131 patients had a leak from the IPAA, and one patient had a pelvic abscess without evidence of leakage, resulting in 1.5% local septic complications. All other complications including the pouch failure rate (7.6%) and the incidence of both fistula (6.4%) and pouchitis (47.9%) were comparable to the data from the literature.

**Conclusion** The low incidence of local septic complications in this series might at least in part result from the preservation of the mesorectum. As most studies do not specify the technique of rectal dissection, this theory cannot be verified by an analysis of the literature and needs further approval by a randomized trial.

**Keywords** Handsewn anastomosis · Ileoanal anastomosis · Pouch · Local septic complications · Rectal dissection

## Introduction

Restorative proctocolectomy is the treatment of choice for the surgical management of ulcerative colitis for most patients, as the large bowel is completely removed and anal continence is maintained with an acceptable stool frequency and anal function.<sup>1–4</sup> Performing the procedure without

morbidity, especially preventing local septic complications, is a major determinant of the long-term success, as local septic complications impair the functional outcome and increase the risk of consecutive pouch failure.<sup>5–8</sup>

While a double-loop J-pouch is the generally accepted ileal reservoir, further technical features are still under debate including the way the ileopouch-anal anastomosis (IPAA) is fashioned<sup>9</sup> and the question whether a protective ileostomy should be used routinely or selectively.<sup>10–12</sup>

One technical detail that might also influence perioperative morbidity is the technique of rectal dissection. Most surgeons prefer to mobilize the rectum in the avascular mesorectal space, as this allows bloodless preparation in a clearly defined anatomical plane and because they are used to this technique from rectal cancer surgery. However, the mesorectal fat is completely removed leaving behind a large cavity at the pelvic floor, which may be filled with hematoma and increase the risk of pelvic abscess formation later. Furthermore, this technique may increase the risk of damaging the pelvic nerves with the consequence of bladder or sexual dysfunction. If the rectal dissection is performed close to the bowel wall, the

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mesorectal fat can be completely preserved. Most of the aboral part of the pouch is surrounded by a funnel-like mesorectal wrap, no cavity remains at the pelvic floor, and the mesorectum covers at least the linear suture lines of the IPAA that might reduce the risk of local septic complications. Notably, some studies have reported increasing rates of anastomotic leakage after introducing total mesorectal excision as a new standard for the treatment of rectal cancer.<sup>13,14</sup> In formerly performed conventional rectal cancer surgery, the mesorectum had often been removed incompletely, resulting in higher local recurrence rates<sup>15</sup> but obviously in less anastomotic leakage, as well.<sup>13,14</sup>

To evaluate the hypothesis of a protective effect of the preserved mesorectum, we analyzed the morbidity of restorative proctocolectomy for the treatment of ulcerative colitis and indeterminate colitis in a consecutive series of patients treated over a period of 12 years at our institution with this technique.

## Patients and Methods

All patients having had a restorative proctocolectomy between January 1990 and December 2002 at our institution were identified by a chart review. We included all patients with handsewn IPAA in which the rectal preparation was performed close to the bowel so that the mesorectal fat was preserved. Therefore, we did not include patients who had been treated for ulcerative colitis associated with low rectal cancer, as total mesorectal excision was performed in these cases. We further excluded all patients with Union Internationale Contre le Cancer stages II and III colorectal cancer and other advanced malignancies. To make the data as consistent as possible, we did also not include patients that were treated with restorative proctocolectomy for other indications, as for example familial adenomatous polyposis (FAP).

## Surgical Technique

Colectomy was performed by dissecting the mesentery close to the bowel wall, as far as dysplasia or cancer had been excluded by preoperative colonoscopy. Especially, the ileocolic artery was thoroughly preserved. Rectal preparation was performed close to the bowel wall in all cases so that the mesorectal fat was preserved. All IPAA procedures were performed by the first (ADR) or the senior author (KHV). The ileum pouch was designed as a 15- to 20-cm J-shaped reservoir, using linear staplers (two 90-mm cartridges and, optionally, an additional 50-mm cartridge) inserted from the

oral side, leaving behind a small bridge of undissected bowel wall close to the apex. Mucosectomy was performed transanally in all cases. A 2- to 3-cm muscular cuff was preserved. The ileopouch-anal anastomosis was performed by placing four to eight anchoring sutures (polyglactin, Vicryl® 3–0, Ethicon) to the top of the muscular cuff to fix the pouch wall approximately 2 cm above the apex to the top of the muscular cuff. Then, the apex was incised, and the actual IPAA was fashioned with 12–18 polyglactin 3–0 stitches (Vicryl®, Ethicon) suturing the whole bowel wall to the anoderm. The pouch was drained using a 24 Ch urinary catheter inserted through the anus for 5–7 days.

A protective ileostomy was performed routinely, if the IPAA was not completely free of tension or if dissection of ileal branches or the periphery of the central route of the superior mesenteric artery necessary to achieve a sufficient length of the bowel caused an apparent reduction in blood flow at the apex of the pouch. Furthermore, diversion was also used routinely in all patients on immunosuppressive drugs or on cortisol in a dose of 20 mg or higher. If patients who did not meet at least one of these criteria asked for a one-stage procedure, an ileostomy was abandoned. A suprapubic catheter was routinely installed into the bladder. It was removed postoperatively if the patients were well mobilized and bladder evacuation was proven to be sufficient (residual urinary volume less than 50 ml). Closure of ileostomy was intended 12 weeks after initial surgery. Before ileostomy closure, the integrity of the IPAA was evaluated by clinical investigation, contrast enema, and endoscopic examination.

## Follow-Up

Between January 2003 and August 2004, all patients were invited for a personal interview and a follow-up investigation. Those patients who agreed to take part in the follow-up but who were not able to come for a personal interview and an examination had a telephone interview. Data on the long-term course of those patients who were not available for an interview were collected from the hospital charts, as well as by contacting the patient's gastroenterologists and primary care physicians. However, data on pouchitis and fistulas were only analyzed from those patients who had a personal or a telephone interview, because data collection without asking the patients specifically for the symptoms might underestimate the real incidence of these criteria. For functional evaluation, these patients were also asked to document the frequency of defecation as well as their bowel habits in a 14-day incontinence diary. Incontinence was measured using an incontinence score according to Vaizey.<sup>16</sup>

## Morbidity Analysis

The data were analyzed for both early morbidity (complications presenting up to 3 months after initial surgery) and late morbidity (complications presenting later than 3 months after surgery). Anal fistulas, presenting within the first 3 months after IPAA, were classified as anastomotic leakage and, therefore, as early local septic complications.

## Results

Restorative proctocolectomy with handsewn IPAA was performed in a consecutive series of 142 patients with chronic inflammatory bowel disease between January 1990 and December 2002 at our institution. However, 11 patients were excluded for colorectal cancer ( $n=10$ ) or for an advanced primitive neuroectodermal tumor of the rectosigmoid junction. One hundred twenty-three of the remaining 131 patients had the diagnosis of ulcerative colitis. Eight patients with the likely diagnosis of ulcerative colitis (UC) also had some evidence of Crohn's disease and were classified as indeterminate colitis. Of the 131 patients, 73 were male. The median age of the patients was 33.0 (12–70) years at the time of restorative proctocolectomy and 25 (5–59) years at the onset of the bowel disease, respectively. The median duration of the disease at the time of surgery was 94 (2–325) months.

Data on early morbidity were available from all 131 patients. Four patients were lost in follow-up, and four patients had died. Three of these four patients had their protective ileostomies closed and, therefore, had a functioning pouch before death. Five patients did not have their protective ileostomies closed. Three of these patients were satisfied with the stoma and decided not to have it closed (two men, 71 under 46 years old, one woman, 51 years old), and two had not yet had their stomas closed at the time of follow-up. Thus, data on the long-term success of IPAA were available from 118 patients. Ninety-four of these patients had a personal ( $n=75$ ) or a telephone ( $n=19$ ) interview and could therefore be evaluated for pouchitis, fistulas, and the functional outcome.

In 14 of the 131 initially treated patients, the restorative proctocolectomy with IPAA was performed without a protective stoma (one-stage procedure). In another seven patients who had already had prior subtotal colectomy, restorative proctectomy with IPAA had also been performed without an ileostomy, resulting in 21 cases of IPAA performed without a protective stoma. A classical two-stage procedure with restorative proctocolectomy and IPAA as well as a protective ileostomy was performed in 79 cases.

Thirty-one patients had a three-stage procedure, with subtotal colectomy and end-ileostomy as a first step, restorative proctocolectomy with IPAA and a protective ileostomy as a second step, and finally the reversal of the ileostomy.

## Early Morbidity

Two patients had local septic complications. One female had an anovaginal fistula. The fistula was diagnosed 4 weeks after an IPAA without a protective stoma. The colon was removed 3 months before as an emergency. As the fistula occurred early after the IPAA procedure, it was classified as an anastomotic leakage. It was successfully managed by a transanal approach without protective ileostomy. A second patient had a pelvic abscess that was successfully treated by a computed tomography-guided percutaneous drainage. This patient had the IPAA protected with a diverting ileostomy. However, clinical and radiology examinations did not give any evidence of a stapler-line or anastomotic failure. An infected pelvic hematoma was the most likely cause of this abscess. No further local septic complication occurred. Two other cases presented with peritonitis for other reasons (see Table 1): One patient had urinary peritonitis caused by a dislocation of a suprapubic urinary catheter. The other patient had bacterial peritonitis after restorative proctocolectomy, which had been performed as an emergency procedure for perforated colitis. In this case, a restorative procedure was done instead of a subtotal colectomy and an end ileostomy on the patient's expressive demand. The peritonitis was cured by three programmed re-laparotomies, lavages, and antibiotic treatment. During these procedures, the IPAA and the pouch were investigated by endoscopy and by filling the bowel with dye. Both the stapler-lines of the pouch and the handsewn IPAA were intact. Therefore, the rate of local septic complications was 1.5% (2/131). The rate of anastomotic leakage was 0.8% (1/131) for the total cohort and 4.8% (1/21) for the subgroup of patients treated without a protective ileostomy.

Table 1 summarizes 44 early complications that were documented in a total of 273 procedures. Looking at the 131 IPAA procedures only, 21 complications were documented. None of the patients had bladder dysfunction requiring prolonged urinary diversion. Table 2 presents the cumulative patient-related morbidity separately for the patients treated with one-stage, two-stage, and three-stage procedures, respectively. Notably, cumulative morbidity was highest in the patients treated with the three-stage procedure.

**Table 1** Procedure-specific Morbidity

Procedure	Morbidity	Number
Proctocolectomy, IPAA no ileostomy ( <i>n</i> =14)	Total	14 (100%)
	No morbidity	10 (71%)
	Morbidity	
	<i>Wound hematoma</i>	1
	<i>Peritonitis<sup>a</sup></i>	1
Proctocolectomy, IPAA, protective ileostomy ( <i>n</i> =79)	Total	79 (100%)
	No morbidity	67 (85%)
	Morbidity	
	<i>Intra-abdominal hemorrhage</i>	1
	<i>Intraluminal hemorrhage</i>	1
	<i>Subileus/ileus</i>	2
	Wound healing disorder	1
	<i>Peritonitis<sup>c</sup></i>	1
	Catheter sepsis	1
	Pancreatitis	1
Subtotal colectomy, end ileostomy ( <i>n</i> =38)	Total	38 (100%)
	No morbidity	25 (66%)
	Morbidity	
	Wound healing disorder	5
	Pancreatitis	3
	Thrombembolic	1
	<i>Peritonitis<sup>d</sup> (rectal stump leakage)</i>	1
	<i>Intraluminal hemorrhage</i>	1
	Catheter sepsis	1
	Urinary tract infection	1
Proctectomy (after initial subtotal colectomy), IPAA, no ileostomy ( <i>n</i> =7)	Total	7 (100%)
	No morbidity	6 (86%)
	Morbidity	<i>Anovaginal fistula</i> 1 (14%)
Proctectomy (after initial subtotal colectomy), IPAA, protective ileostomy ( <i>n</i> =31)	Total	31 (100%)
	No morbidity	27 (87%)
	Morbidity	<i>Intra-abdominal hemorrhage</i> 1 Wound healing disorder 2 Peripheral nerve paralysis 1
Closure of ileostomy ( <i>n</i> =104)	Total	104 (100%)
	No morbidity	94 (90%)
		<i>Anastomotic leakage</i> 1
		Subileus 7
		Disturbed wound healing 2

Complications typed in italics required surgical intervention

<sup>a</sup> Urine peritonitis caused by a dislocated suprapubic urinary catheter

<sup>b</sup> Septicaemia from infected deep vein thrombosis

<sup>c</sup> Peritonitis probably caused from intra-abdominal abscess and insufficient antibiotic treatment during initial surgery

<sup>d</sup> Peritonitis caused by leakage of the rectal stump

## Late Morbidity

### Long-Term Success of IPAA

Nine of 118 patients with long-term success evaluation had had a pouch excision (*n*=5) or were defunctioned (*n*=4) at the time of follow-up, resulting in a pouch failure rate of 7.6% (9/118). The reasons for pouch failure were pouch dysfunction in four,

severe anal disease in two, and Crohn's disease in three patients. The median follow-up time was 85 (14–169) months.

### Fistulas

Six of 94 patients with follow-up interview developed anal fistulas and abscesses more than 3 months after surgery.

**Table 2** Cumulative, Patient-related Morbidity

Mode of surgery		Complete procedures	Patients with at least one complication
One-stage	Proctocolectomy with IPAA without protective ileostomy	14	4 (28.6%)
Two-stage	Proctocolectomy with IPAA with protective ileostomy + closure of ileostomy	73	18 (24.7%)
	Subtotal colectomy and end ileostomy + proctectomy with IPAA without protective ileostomy	7	3 (42.9%)
Three-stage	Subtotal colectomy and end ileostomy + Proctectomy with IPAA with protective ileostomy + Closure of ileostomy	31	17 (54.8%)

These complications occurred at a median of 47 (22–131) months after IPAA. Two of the fistulas were cured surgically, one was treated with a permanent seton, and three were managed conservatively.

### Pouchitis

Of the 94 eligible patients, 49 (52.1%) never had pouchitis. Of the remaining 45 patients, 17 complained about only one episode of pouchitis, 13 had more than one episode, and 15 had at least one episode of pouchitis per year.

### Functional Outcome

The median frequency of defecation at daytime was 6 (range 2–16). The median stool frequency at nighttime was 0.5 (0–5), and the total frequency over 24 h was 7 (2–19). Thirty-five of the 94 patients (36%) used bulky agents on a regular basis, and three patients (3.1%) were not able to postpone defecation for at least 15 min. Fifty patients (53%) were not able to discriminate stool and flatus. Alterations in social life affecting the patients at least sometimes were reported by 20 of 94 individuals (21.3%). The median Vaizey incontinence score was 3 (0–18).

### Discussion

Restorative proctocolectomy can be performed with low mortality rates of 0–0.8%.<sup>1,8,17–23</sup> However, the procedure is still associated with a significant morbidity of 19% to more than 50%.<sup>11,18,23–30</sup> To a large extent, this morbidity results from local septic complications of the ileoanal anastomosis. Local septic complications do not only represent a cause of severe, potentially life-threatening secondary complications, but also impair the functional outcome and increase the risk of consecutive pouch failure.<sup>4,7,31,32</sup> The leakage rates of IPAA from various clinical studies are summarized in Table 3. They range

between 0% and 12.6% in a series in which patients with FAP were included, exclusively.<sup>33–35</sup> For studies in which only or predominantly patients with inflammatory bowel diseases were included, the leakage rates are somewhat higher, ranging between 2.7% and 15%.<sup>1,7,19,36,37</sup> Other local septic complications are pelvic abscesses without anastomotic leakage, fistulas, and pouch necroses.

Various technical modifications of the pouch procedure have been described, and technical details are still a matter of debate. In contrast to the initially described technique of hand-suturing the apex of the pouch to the anal canal after mucosectomy, the double-stapling technique is increasingly used. In a recent meta-analysis, Lovegrove et al.<sup>9</sup> found that patients with stapled IPAA have better nighttime continence than those with the handsewn alternative, but for other criteria, the functional data were comparable. Another meta-analysis did not show any disadvantage when the handsewn was compared with the stapled technique.<sup>38</sup> Lovegrove et al.<sup>9</sup> found a leak rate of 8.8% for IPAA procedures performed with handsewn anastomosis and 5.2% for stapled procedures, respectively, resulting in an average leak rate of 6.9% (123/1774 patients).

In our series, only one of 131 patients (0.8%) with handsewn anastomosis had leakage of the IPAA, resulting in a total rate of early local septic complications of 1.5%. Fistulas occurred in six of our 94 eligible patients (6.4%). This is within the wide range of 1.6–14.2% of fistulas reported from other trials in which restorative proctocolectomy was predominantly performed for ulcerative colitis.<sup>7,19,26,36,39–41</sup> These fistulas were extremely unlikely to have resulted from silent anastomotic leakage, as none of the fistulas occurred earlier than 22 months after initial surgery. Pouchitis was more likely to have triggered fistula formation. The rate of 47.6% of our patients who had at least one episode of pouchitis and our pouch failure rate of 7.6% are both in accordance with other long-term follow-up studies on IPAA for ulcerative colitis.<sup>8,12,17,21,35,42–45</sup>

The very low rate of local septic complications in our series probably results from various technical aspects: One reason might be the preservation of the mesorectal fat by performing the rectal dissection close to the bowel wall.

**Table 3** Leak Rates of the IPAA from Studies on Restorative Proctocolectomy with Respect to the Technique of Anastomosis and Rectal Dissection

Author	Year	Number	Indication UC/IC+CD/FAP/other	Anastomosis handsewn/stapler	Protective ileostomy	Meso rectum	Leakage rate	Percentage
Atkinson <sup>65</sup>	1994	175	158/16/0/0	n. av.	n.av.	n. av.	10/175	5.7
Bauer <sup>18</sup>	1997	392	392/0/0/0	392/0	55.6%	n. av.	35/326	10.7
Björk <sup>33</sup>	2001	59	0/0/59/0	54/5	n.av.	n. av.	0	0
Braun <sup>55</sup>	1995	93	71/0/12/0	0/93	100%	Excised	3/83	3.6
Dayton <sup>36</sup>	2002	644	565/79/0/0	644/0	n.av.	n. av.	18/644	2.7
Everett <sup>56</sup>	1989	60	n. av.	60/0	67.7%	Excised	3/60	5
Fazio <sup>19</sup>	1995	1005	858/75/62/10	n. av.	91.2%	n. av.	29/1005	2.9
Foley <sup>66</sup>	1995	460	382/32/46/0	460/0	99.8%	n. av.	14/392	3.6
Gullberg <sup>67</sup>	2001	86	85/0/1/0	0/86	10.5%	n. av.	7/86	8.1
Heuschen <sup>7</sup>	2002	706	494/0/212/0	706/0	86.5%	n. av.	20/706	2.8
Hultén <sup>68</sup>	1994	307	307/0/0/0	307/0	100%	n. av.	31/307	10.1
Ikeuchi <sup>30</sup>	2004	100	100/0/0/0	100/0	0%	n. av.	4/100	4
Järvinen <sup>54</sup>	1993	200	190/10/0/0	178/22	67%	Preserved	21/200	10.5
Krausz <sup>21</sup>	2005	174	146/0/28/0	94/80	88.4%	n. av.	8/174	4.8
Lake <sup>69</sup>	2004	100	87/4/9/0	9/91	71%	n. av.	5/91	5.5
Mathey <sup>22</sup>	1993	213	164/0/47/0	n. av.	100%	n. av.	11/157	7
Mowschenson <sup>46</sup>	2000	130	127/0/3/0	0/130	21.5%	n. av.	10/130	7.7
McCourtney <sup>57</sup>	1997	103	87/0/9/0	3/100	95.1%	Excised	6/100	6
McIntyre <sup>70</sup>	1997	54	54/0/0/0	27/27	n.av.	n. av.	1/27	7.4
Marcello <sup>26</sup>	1993	460	382/0/0/0	460/0	99.8%	n. av.	14/460	3
MacRae <sup>32</sup>	1997	551	201/25/25/0	322/219	78.8%	n. av.	65/551	11.8
Michelassi <sup>1</sup>	2003	391	378/13/0/0	274/117	65%	n. av.	26/391	6.4
Maartense <sup>58</sup>	2004	60	40/0/20/0	30/30	25%	Excised	4/30	6.7
Panis <sup>59</sup>	1996	93	n. av.	93/0	100%	Excised	3/93	3.2
Pescatori <sup>37</sup>	1988	84	51/0/32/0	84/0	97.6%	Preserved	13/84	15
Pishori <sup>42</sup>	2004	303	285/18/0/0	0/303	97%	n. av.	12/303	4
Poggioli <sup>71</sup>	1993	140	122/0/18/0	74/68	n. av.	n. av.	11/140	7.8
Remzi <sup>34</sup>	2001	119	0/0/119/0	42/77	69%	n. av.	7/119	5.9
Romanos <sup>23</sup>	1997	200	177/13/7/3	53/147	69.5%	n. av.	1/200	0.5
Salemans <sup>53</sup>	1992	72	51/0/21/0	72/0	100%	n. av.	6/71	8.4
Schippers <sup>72</sup>	1998	86	86/0/0/0	0/86	100%	n. av.	4/86	4.7
Sugerman <sup>12</sup>	2000	192	178/6/8/0	n. av.	0%	n. av.	14/192	7.3
Setti-Carraro <sup>73</sup>	1994	110	103/3/0/4	103/3/0/4	94.5%	n. av.	6/110	5.5
Young <sup>29</sup>	1999	100	73/5/20/2	50/50	100%	n. av.	6/100	6
von Roon <sup>35</sup>	2007	189	0/0/189/0	121/54	70.3%	n. av.	22/175	12.6
Ziv <sup>74</sup>	1996	692	692/0/0/0	238/454	92.9%	n. av.	18/692	5.9

n. av.=not available

UC=ulcerative colitis, IC=indeterminate colitis, CD=Crohn's disease, FAP=familial adenomatous polyposis

This results in a small funnel-like cavity in which the pouch sits more tightly in the pelvis than after total mesorectal excision. Although the ileoanal anastomosis itself is not covered by mesorectal fat in most cases, there might be less room in the pelvis for postoperative hematoma or fluid collections carrying a risk of subsequent infection and abscess formation in the deep pelvis. An infected pelvic hematoma might lead to a secondary damage of the IPAA. As presented in Table 3, we also reviewed the literature on IPAA morbidity for a potential impact of the technique of mesorectal dissection. Unfortunately, most authors did not specify the mode of rectal dissection. Only two trials clearly describe a dissection technique close to the bowel wall,<sup>37,54</sup> and five studies describe that the mesorectum was ex-

cised.<sup>55–59</sup> The leakage rates seem to be higher in the patients treated with mesorectal preservation. However, these studies had started the patient recruitment in 1980<sup>37</sup> and 1985,<sup>54</sup> respectively, and therefore include, at least to some extent, the learning curve of the procedure and can hardly be compared to more recent data. Apart from that, more than 90% of the patients treated with mesorectal preservation had a handsewn anastomosis, which might be associated with an increased rate of local septic complications.<sup>4,9</sup> Therefore, the hypothesis that the preserved mesorectum protects the IPAA cannot be verified from the published literature.

A second reason for the low rate of local septic complications concerns the anastomotic technique: The two-layered anastomosis we used has the potential advantage of

reducing tension to the actual ileoanal anastomosis. Tension cannot always be avoided by mobilization and preparation of the mesentery, but it may be neutralized by the anchoring stitches placed between the muscular cuff and the pouch. The actual ileoanal anastomosis is basically tension free.

A third reason might be that we used protective ileostomies in most of our patients. One reason was that the majority of the patients were on high-dose steroids or immunosuppressive drugs. In addition, if patients did not specifically ask for a one-stage procedure, we rather performed a protective ileostomy. It is possible that some patients experienced minor leakage that was not recognized under diversion, but this was also true for patients included in other studies on IPAA morbidity (see Table 3). The average leakage rate of all studies in which 100% of the IPAA procedures were done with a diverting ileostomy was 4.9% (64/1296), whereas the average leak rate was 6.2% (18/292) for studies on IPAA without diversion. The latter is in accordance with our 4.8% leak rate in the subgroup of 21 patients treated without diversion, but our 0% leak rate in 110 patients with a diverting ileostomy is remarkable, especially as we had exclusively treated patients with chronic inflammatory bowel disease, which are known to experience more local septic complications than patients without inflammatory diseases.<sup>5</sup>

Overall, the low rate of local septic complications in our series raises the question whether the broad use of protective ileostomies is really mandatory. Grobler et al.<sup>10</sup> found in a randomized trial that restorative proctocolectomy can be performed without a protective ileostomy in selected patients without increase in the incidence of local septic complications, and Heuschen et al.<sup>25</sup> found a lower rate of complications in selected patients after one-stage procedures as compared to two-stage procedures in a matched-pair analysis. A low incidence of local septic complications in selected patients with IPAA is also confirmed by the 21 one-stage patients in our series. Additionally, the analysis of cumulative morbidities demonstrates that the highest morbidity rates were found for patients who had three-stage procedures. In fact, these patients present a negative selection. However, morbidity of ileostomy closure contributed significantly to the cumulative morbidity of the two- and three-stage operations. In the literature, ileostomy closure is associated with a mortality of 0–2%,<sup>47–50</sup> a morbidity of 11–33%,<sup>49–52</sup> and a leak rate of 1–3% in most<sup>47,48,51,52</sup> but up to 9% in some trials.<sup>50,53</sup> Thus, omitting an ileostomy has some very attractive aspects. If further trials confirm the idea of anastomotic protection by mesorectal preservation, this technique might also allow us to treat more patients with one-stage procedures, and maybe, some of the patients that have so far been treated with three-stage procedures can safely be treated with two-stage procedures.

Aside from these potential effects on the safety of the IPAA, mesorectal preservation has a second potential advantage: Staying away from the pelvic nerves might reduce the risk of postoperative sexual and bladder dysfunction, affecting up to 19.8% of the patients after IPAA in some series.<sup>60</sup> Retrograde ejaculation has repeatedly been described with an incidence of 1.2–4%<sup>21,61,62</sup> or even higher.<sup>63</sup> We did not systematically record sexual and bladder function, but the fact that none of our patients had significant urinary retention can at least be interpreted as one indicator of pelvic autonomic nerve preservation.

One disadvantage of mesorectal preservation could be that functional results in terms of frequency of defecation, urgency, or incontinence might be worse because of a reduced capacity of the pouch when located in a narrow funnel of mesorectal fat. Indeed, the median frequency of defecation was slightly higher than reported by others, but the incidence of urgency was lower.<sup>1,4</sup> The median Vaizey incontinence score of 3 in our series was significantly lower than the score of 7 presented by Heuting et al.<sup>60</sup> for their cohort of 111 patients with IPAA. Therefore, overall, the functional data were similar to those of other comparable trials. Finally, our recently published physiology examinations demonstrated pouch capacity and compliance values within the normal range,<sup>64</sup> indicating that mesorectal preservation is unlikely to reduce the pouch function.

In summary, our data show that restorative proctocolectomy with handsewn anastomosis can be performed with low specific morbidity. The rate of local septic complications in this series, which is much lower than in most other series published over the last 20 years, might in part result from the preservation of the mesorectal fat. As the technique of rectal dissection is not mentioned in the majority of the trials on restorative proctocolectomy, this theory cannot be verified by a systemic review of the literature. However, the low rate of local septic complications, after handsewn ileoanal anastomosis in our series, asks for a prospective randomized trial on the technique of rectal dissection in restorative proctocolectomy.

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