Laparoscopic Surgery for Ulcerative Colitis

Luca Stocchi, M.D.¹

ABSTRACT

Laparoscopic techniques have become increasingly used in the treatment of ulcerative colitis: in experienced hands, they are safe and feasible. Recovery advantages have not been consistently demonstrated and functional results have been comparable to open surgery. Other possible benefits and costs issues have also been inconsistent. Further investigation on the role of laparoscopic surgery for ulcerative colitis with larger populations and longer follow-up with a focus on recovery parameters, quality of life, and costs are needed.

KEYWORDS: Laparoscopic surgery, ulcerative colitis, recovery, cosmesis, costs

Objectives: On completion of this article, the reader should be able to summarize the indications and techniques of laparoscopic surgical management of ulcerative colitis.

The surgical management of inflammatory bowel disease has been significantly changed by the advent of laparoscopic techniques. In particular, laparoscopic techniques have become increasingly used in the treatment of ulcerative colitis. Current indications for laparoscopic surgery in the surgical treatment of ulcerative colitis, surgical techniques, and results after laparoscopic surgery, particularly in comparison with open surgery, are evaluated in this review article.

LAPAROSCOPIC SURGERY FOR ACUTE COLITIS

Indications

A subgroup of patients with ulcerative colitis requires surgical intervention for acute colitis unresponsive to medical treatment. These patients are generally evaluated in the hospital after maximal medical treatment has failed to improve their symptoms and they have developed either severe or fulminant ulcerative colitis.^{1,2} Under these circumstances, the operation of

choice is an initial total abdominal colectomy with creation of an end ileostomy and preservation of the rectum or rectosigmoid stump to reduce postoperative morbidity. In most of these cases, the long-term plan would include recovery from the abdominal colectomy for 3 to 6 months followed by elective completion proctectomy and ileal pouch-anal anastomosis (IPAA). In addition, other candidates for an initial total abdominal colectomy are those patients who are not so acutely ill to require a hospital admission, but have also received prolonged treatment with high doses of steroids and/or other immunosuppressive medications so that they have progressively become anemic or malnourished. In these cases the surgeon might well decide that the general status of the patient is too poor to warrant a total proctocolectomy with ileal pouch-anal anastomosis (IPAA). Furthermore, there may be cases where a total abdominal colectomy might be preferable to clarify a possible diagnosis of Crohn disease instead of ulcerative colitis and provide useful information to guide subsequent management and counseling. Recently, some specialized centers have

¹Department of Colorectal Surgery, Digestive Disease Institute, Cleveland Clinic, Cleveland, Ohio.

Address for correspondence and reprint requests: Luca Stocchi, M.D., Department of Colorectal Surgery, Cleveland Clinic, 9500 Euclid Ave., Desk A31, Cleveland, OH 44195 (e-mail: stocchi@ccf.org).

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proposed that patients requiring surgery for ulcerative colitis who have received treatment with infliximab within the last 3 months preceding surgery should also have an initial total abdominal colectomy without proctectomy as they have reported a significant increase in morbidity after ileal pouch-anal anastomosis performed in patients receiving infliximab.^{3,4} Although this specific contraindication to immediate creation of IPAA remains controversial,⁵⁻⁸ it has certainly added to the pool of patients who undergo initial total abdominal colectomy.

In general, the indications for laparoscopic total abdominal colectomy without proctectomy are similar to the established indications for open surgery. In fact, most patients who require an initial total abdominal colectomy are candidates for a laparoscopic approach. However, a subset of patients are not good candidates for laparoscopic total abdominal colectomy, for example, in the case of acute colitis complicated by either colonic perforation or toxic megacolon. Moreover, the patient who is acutely ill with fulminant colitis might still receive better treatment with a more expeditious open abdominal colectomy rather than laparoscopic abdominal colectomy. In particular, if the surgeon feels that the tissues are very friable and are at increased risk of intraabdominal colonic injury during surgical manipulation, he or she might prefer to perform the operation with open technique. In addition, in those rare cases where a Turnbull–Blowhole procedure is considered, such as in pregnant patients,⁹ the open technique remains necessary.

Results of Laparoscopic Surgery for Acute Colitis

There are no published prospective randomized trials comparing laparoscopic and open total abdominal colectomy for ulcerative colitis. However, several comparative reports have indicated that laparoscopic surgery is safe and feasible in case of acute severe colitis (Table 1).

Reported conversion rates after laparoscopic total abdominal colectomy have been very acceptable, ranging from zero to 8%.¹⁰⁻¹⁶

In addition, most series have reported reduced length of hospital stay after laparoscopic procedures when compared with open counterparts (Table 2). The great majority of patients who undergo laparoscopic total abdominal colectomy can undergo subsequent proctectomy and IPAA,^{14,17-19} performed either laparoscopically or via a small lower abdominal midline or Pfannenstiel incision, an approach that has been described as “minimal access.”¹⁸ In this respect a laparoscopic Hartmann stump with minimal adhesions could be the ideal setting to initiate a completion proctectomy rather than a longer rectosigmoid stump into the subcutaneous tissue. There is still insufficient data to assess whether a truly laparoscopic restorative proctectomy or a minimal access restorative proctectomy are preferable. In general, a laparoscopic total abdominal colectomy is an effective operation that results in accelerated recovery for patients with acute colitis while retaining comparable morbidity when compared with the open technique. Some of the possible benefits of laparoscopic surgery, such as reduction of pain and cosmesis, have not been formally assessed after total abdominal colectomy, which is generally not the definitive operation for patients with ulcerative colitis. A total abdominal colectomy using a laparoscopic approach may provide advantages in the appropriate patients. However, the natural history of acute ulcerative colitis makes patient selection for laparoscopic surgery paramount to minimize potentially fatal complications in this often very morbid patient population.

Elective Surgical Management of Ulcerative Colitis

Surgical options for elective management of ulcerative colitis include total proctocolectomy with creation of an end ileostomy, total proctocolectomy with continent

Table 1 Selected Contemporary Series* Comparing Perioperative Morbidity of Laparoscopic versus Open Total Abdominal Colectomy for Acute Ulcerative Colitis

Author	Year	Open/ Laparoscopic Patients	Laparoscopic Technique Used	Morbidity after Open Surgery (%)	Morbidity after Laparoscopic Surgery (%)	P Value
Dunker et al ¹⁰	2000	32/10	Mixed (2 HALS)	75	60	0.13/0.71
Marcello et al ¹¹	2001	29/19	Standard	24	16	NA
Seshadri et al ¹²	2001	36/37	Standard	44	24	NS
Marceau et al ¹³	2007	48/40	Standard	56	35	>.1
Ouaissi et al ¹⁴	2008	22/23	Standard	45.5	34.8	NS
Watanabe et al ¹⁵	2009	30/30	HALS	63	37	0.041
Telem et al ¹⁶	2010	61/29	Standard	34	28	NS

*≥Year 2000, ≥10 patients/group.

HALS, Hand-assisted laparoscopic surgery; NA, not applicable; NS, nonsignificant.

Note: Dunker et al includes 2 and 5 patients with Crohn's disease in the laparoscopic and open groups, respectively. Morbidity was recalculated and was originally reported divided into minor and major complications with *p* values of 0.13 and 0.17, respectively. Seshadri et al includes 6 and 10 cases of Crohn's disease for laparoscopic and open surgery, respectively.

Table 2 Contemporary Selected Series* Comparing Recovery Parameters Following Laparoscopic versus Open Total Abdominal Colectomy for Acute Ulcerative Colitis

Author	Year	Open/ Laparoscopic Patients	Open/Laparoscopic Return to Bowel Function	P Value	Open/Laparoscopic LOS	P Value
Dunker et al ¹⁰	2000	32/10	2.3/3.1	0.99	18/14.6	0.13/0.71
Marcello et al ¹¹	2001	29/19	2/1	0.003	6/4	0.04
Seshadri et al ¹²	2001	36/37	NA	NA	9/6	0.001
Marceau et al ¹³	2007	48/40	NA	NA	12/9	<.10
Ouaïssi et al ¹⁴	2008	22/23	NA	NA	13/9.3	0.032
Watanabe et al ¹⁵	2009	30/30	NA	NA	33/23	0.041
Telem et al ¹⁶	2010	61/29	NA	NA	6/4.5 14.4/10.3	<0.001 NS

*≥Year 2000, ≥10 patients/group.

HALS, Hand-assisted laparoscopic surgery; LOS, length of hospital stay.

Note: Data are reported as mean except in the studies by Marcello, Seshadri, and Watanabe, which report median values. Telem et al reported separately the length of hospital stay for patients with postoperative complications and without complications ($p < 0.001$). In Ouaïssi et al the mean length of hospital stay also includes hospitalization for complications. Reports from Marceau et al and Ouaïssi et al come from the same institution.

ileostomy, total proctocolectomy with IPAA, and total abdominal colectomy with ileorectal anastomosis. Among these, a creation of an IPAA is currently considered the preferred standard of care. Patients who are not suitable candidates for IPAA can be treated with laparoscopic total proctocolectomy and end ileostomy. On the other hand, laparoscopic surgery in the creation of an ileorectal anastomosis following total abdominal colectomy is technically feasible, but is rarely indicated.²⁰ Similarly, total proctocolectomy and creation of a continent ileostomy is generally performed on patients who had previous surgical procedures for ulcerative colitis and is therefore typically performed using open technique. Ileorectal anastomosis and continent ileostomy will therefore not be further discussed in this review.

What Really Constitutes Laparoscopic IPAA? Variability within the Same Definition

A variety of techniques is currently referred to as “laparoscopic IPAA.” In some cases, the dissection of the rectum and the transection at the anorectal ring are performed using standard laparoscopic techniques. The specimen is then removed through either a small lower midline incision, a Pfannenstiel incision, or through the site where a subsequent diverting loop ileostomy will be created.²¹ Some surgeons perform a completely laparoscopic rectal dissection, but prefer to transect the distal rectum through the extraction site using a conventional linear stapler.²² In other cases, the rectal dissection is not performed laparoscopically, rather it is performed under direct vision using the future extraction site and following complete laparoscopic mobilization of the abdominal colon.

A possible alternative to standard laparoscopic techniques is the use of hand-assist devices.^{17,23} In fact, evidence from a prospective randomized trial indicates that hand-assist devices can be useful reducing operative times while maintaining the morbidity and

recovery benefits of standard laparoscopic techniques in colorectal surgery.²⁴ More specifically, there is evidence from comparative studies of the advantages of hand-assisted technique for laparoscopic IPAA.²⁵ Although increasingly accepted for intraabdominal colonic dissection, especially in obese patients, many surgeons still view the intracorporeal hand as poorly suitable for the restricted spaces of a pelvic dissection, so that a portion or the entire rectal dissection is again performed through the Pfannenstiel incision used to insert the hand-assist device used for the laparoscopic colonic dissection. In some cases, the specimen held under tension through the opening of the hand-assist device may facilitate rectal exposure for a standard laparoscopic rectal dissection. As different combinations of these various dissection and transection techniques are reported, it is more difficult to objectively evaluate the data from laparoscopic IPAA as a whole when compared with the open technique.

Surgical Techniques

Several different laparoscopic surgical techniques have been described in the treatment of ulcerative colitis.^{23,25–}

²⁹ The feasibility of laparoscopic IPAA has been reported in the case of synchronous primary sclerosing cholangitis³⁰ and in patients who have undergone liver transplantation.³¹

In this section, we describe the technique commonly used in our unit for the dissection of the abdominal colon and the rectum, respectively, with reconstruction of the intestinal continuity using IPAA.

Laparoscopic Total Abdominal Colectomy

The patient is positioned in a modified lithotomy position and the chest is strapped to the operating table prior to prepping and draping of the patient. Alternatively, an inflatable “bean bag” can be used to minimize

the possibility of patient sliding during the change in patient positioning.

The surgical approach using standard laparoscopic techniques requires initial creation of pneumoperitoneum, generally at 12 to 14 mm Hg. We generally use 4 ports. One supraumbilical midline 10-mm Hasson cannula is placed initially and then pneumoperitoneum is established. Additionally, a 5-mm port is placed in the left lower quadrant or at the left interclavicular line along the transverse umbilical line depending on the size of the patient, a 12-mm port site in the right lower quadrant or at the right interclavicular line along the transverse umbilical line, and an additional 12-mm port located 2 to 3 fingerbreadths cephalad to the pubic bone and 2 cm to the right of the midline. The latter port is generally used to perform most of the laparoscopic rectal dissection and to place the endostapler for transection at the anorectal ring in case a total proctocolectomy is performed at once. When a hand-assisted approach is instead used, the disposition of the port sites vary slightly and the procedure begins with placement of a hand-assist device through a Pfannenstiel incision, which generally ranges from 6 to 8 cm depending on the hand size of the main operator. In this case, 3 additional ports are used that are placed similarly to what has been described as the straight laparoscopic approach.

The dissection can be performed in a lateral to medial fashion or in a medial to lateral fashion and we generally prefer the latter. Following laparoscopic visualization of the liver and the rest of the abdomen to rule out metastatic or other unsuspected disease, the colonic dissection generally begins with identification and takedown of the ileocolic vascular pedicle, which facilitates the exposure and preservation of the underlying second and third portions of the duodenum. In the presence of ulcerative colitis associated with biopsy-proven carcinoma or dysplasia with or without DALM (dysplasia-associated lesion or mass), the lymphovascular pedicles should be taken at their origins, which is otherwise not necessary in benign inflammatory disease. The right ureter may also be visible at this time, but its identification is not as critical as the identification of the left ureter during mobilization of the left colon. We find that a steep Trendelenburg and left tilted position is very helpful in a lateral to medial dissection and while taking the lateral attachments of the right colon and retroperitoneal attachments of the terminal ileum. However, this is not necessarily the case when working on the ileocolic lymphovascular pedicle in a medial-to-lateral dissection. The medial dissection is performed caudad-to-cephalad to expose the undersurface of the proximal transverse colon and the gallbladder. The posterior attachments of the ascending colon and a portion of the hepatic flexure can also be taken down during the medial portion of the dissection. The subsequent takedown of the lateral and superior attachments allows complete medialization of

the right colon. A reverse Trendelenburg position is generally preferable for mobilization of the hepatic flexure, especially in heavier patients.

With respect to the technique of vessel ligation, we have progressively transitioned from the use of laparoscopic vascular staplers to exclusive use of tissue-sealing devices. We find them less expensive and at least as safe and practical as the systematic use of vascular staplers. Following complete mobilization of the right colon, it is generally possible to identify the right edge of the omentum, the first three portions of the duodenum, the head of the pancreas, and the right edge of the transverse mesocolon. At this stage, it is possible to take down the right and left branches of the middle colic artery using a tissue-sealing device or, if necessary, identify and similarly take down more proximally the short trunk of the middle colic artery near the pancreas. Preservation of the omentum is left to the discretion of the operating surgeon. If the omentum is taken along with the specimen, it is possible to take it together with the transverse mesocolon. The takedown of the omentum and transverse mesocolon is continued using a tissue-sealing device from right to left until the splenic flexure is reached. In some cases, it is possible to take down the splenic flexure from cephalad to caudad in continuity with the transverse colon dissection, which is typically performed in a reverse Trendelenburg position. In other, more complex cases, a combined approach including mobilization of the proximal descending colon in a retrograde fashion after tilting the table to the right may become necessary to complete mobilization of the splenic flexure. Following that, the patient position is reversed to Trendelenburg and the inferior mesenteric artery/superior rectal artery pedicle is identified. If the operation to be performed is a total abdominal colectomy and there are no oncologic concerns, we favor preservation of the superior rectal artery. In this case, we mobilize the sigmoid colon from lateral to medial and identify the sigmoidal arteries and take them down as needed.

At this stage, the decision is made whether to transect the rectum as a Hartmann stump or leave a longer rectosigmoid stump to be brought in the subcutaneous tissue of the extraction site. This depends on the specific indications for surgery and the quality of the tissues, which is assessed intraoperatively. For example, when acute colitis in a malnourished patient is often associated with severely inflamed, friable tissues, we preferentially leave the stapled rectosigmoid in the subcutaneous tissue. Some surgeons routinely avoid creation of a Hartmann stump in all cases of acute colitis. A possible advantage of a Hartmann stump may be facilitation of subsequent laparoscopic completion proctectomy. In fact, although the identification of a Hartmann stump after open total abdominal colectomy can often be challenging due to the severity of the adhesions, in the patient treated with laparoscopic

surgery there are frequently only minimal intraabdominal adhesions. In any case, we avoid entering the presacral space at this time. Once the transection site is decided, we generally proceed to takedown of the surrounding mesocolic tissue with tissue-sealing devices and bowel transection using endoGIA 60 mm. We then complete the mesocolic takedown in a retrograde fashion also using an energy delivery device from the level of bowel transection in a cephalad direction until we join the proximal mesocolic edge near the mobilized splenic flexure.

It is also possible to perform the rectal or rectosigmoid transection after complete devascularization and exteriorization of the specimen by placing a linear stapler through the extraction site. This is our preference in those cases where the rectosigmoid is placed subcutaneously. We routinely check that the entire colon and terminal ileum lie anteriorly to the remainder of the small bowel prior to exteriorization. The exteriorization site can be a small Pfannenstiel or vertical lower midline incision and we routinely place a small wound protector prior to exteriorization. Before removing the specimen from the field, we check again to ensure the appropriate mesenteric orientation of the exteriorized terminal ileum, which we then transect and prepare for the creation of a terminal ileostomy. The specimen is then removed from the field, the stoma aperture created in the premarked site, typically on the right, and the appropriately oriented terminal ileum passed. If the operation has proceeded smoothly, we generally start closing the abdominal incisions at this time without repeat laparoscopy. A large Malecot drain is placed transanally into the rectum to facilitate decompression of the newly fashioned transection line.

Rectal Dissection and Ileal-Pouch Anal Anastomosis

If the planned operation is a total proctocolectomy no transection is performed at the level of the rectum or sigmoid. Instead, the superior rectal artery is taken down close to the rectum which can facilitate access to the presacral space. When a completion proctectomy is performed, there may be filmy adhesions with some loops of small bowel, which are typically limited and can be taken down laparoscopically. When the initial colectomy was performed laparoscopically, we often note minimal or no adhesions in this area. In particular, if a Hartmann stump has been previously created, a completion proctectomy can begin laparoscopically using the same port-sites previously selected for the abdominal colectomy. On the other hand, in those cases when the rectosigmoid stump was brought to the subcutaneous tissue, it is necessary to begin a completion proctectomy with mobilization of the colorectal segment using the existing extraction site in-

cision. Once the bowel is mobilized and replaced inside the abdominal cavity, pneumoperitoneum can then be established. A takedown of the inferior mesenteric near its origin is advisable when oncologic concerns are an issue as described above. It is possible to mobilize the rectum circumferentially all the way down to the pelvic floor using a completely laparoscopic technique and in this case, we generally prefer using the tissue-sealing devices. However, other surgeons contend that laparoscopic mobilization with electrocautery or scissors allows a more accurate identification of the anatomical planes. It is also technically possible to do an intramesorectal dissection of the rectum, although we believe that an appropriate, nerve-sparing complete mesorectal excision with the use of the above-mentioned instruments is feasible in a most cases and can accomplish the same functional results with respect to sexual and urinary function.

We generally attempt to tailor the mesorectal excision so that the lateral dissection is performed closer to the rectal wall than to the pelvic sidewalls to minimize the risk of nerve injury at this level. The anterior dissection is typically performed after posterior and lateral mobilization. Unless the patient has an anterior rectal carcinoma, we routinely preserve the Denonvilliers fascia. An appropriately completed rectal dissection to the level of the levators should expose the distal rectum as a tubular intestinal structure not covered by mesorectum or other fat at the level of the anorectal ring. At that time, the transection at the level of the anorectal ring is performed using a reticulating endostapler passed through the suprapubic port site. The tip of a finger placed in the anus with the proximal interphalangeal joint at the level of the anal verge provides a useful estimate of the appropriate level of transection that requires appropriate adjustment based on the gender and body habitus of the individual patient. This assessment is not different from what is required in the open technique. However, the specific orientation of the laparoscopic staple line is not such a critical factor, provided an intact staple line is placed at the appropriate level of the anorectal ring. For example, an anteroposterior orientation does not compromise the integrity of the subsequent IPAA and may well be the best technical option depending on the exposure for the laparoscopic stapler in the deep pelvis.

We try to optimize the distal rectal dissection so that no more than two cartridges are required for distal transection as there is some data indicating that this could increase the incidence of anastomotic leak.³² Following complete mobilization the colon and rectum the specimen is exteriorized by enlarging the suprapubic port into a 4- to 5-cm transverse Pfannenstiel incision. Generally, the abdominal fascia is also incised transversely so that cephalad and caudad fascial flaps

can be developed, and the underlying rectus muscle entered along the midline with a muscle-splitting incision. We prefer to enter the peritoneal cavity using the most cephalad portion of this midline access to minimize the risk of bladder injury. We then place a wound protector and remove the entire specimen in continuity with the terminal ileum. Alternatively, a traditional linear stapler can be placed through the extraction site to transect the rectum at the level of the anorectal ring instead of using a laparoscopic stapler.

Once the specimen is exteriorized, we take down the endileostomy, if there is one, perform transection at the terminal ileum, and construct a 15- to 20-cm ileal J-pouch using 2 cartridges of ILA 100, similar to the open technique. Some surgeons reinforce the blind loop of the pouch with transfixing or imbricating sutures of reabsorbable material. The anvil of the circular stapler is then placed in the distal, lateral opening of the ileum used to create the J-pouch and secured with a purse string suture. Pneumoperitoneum is then reestablished by replacing the port through the wound protector at the extraction site and temporarily reapproximating the skin defect with towel clips. The pin of the circular stapler is advanced through the anorectal ring under laparoscopic vision in preparation for a stapled anastomosis. Similar to the open technique, it is important to ensure that the shaft of the stapler is passed proximal to the level of the sphincter mechanism and gentle pressure is exerted by the instrument against the anorectal staple line before deploying the pin to minimize the risk of staple line disruption.

Particular care should be used in opening the stapler in a female patient so that the pin is passed through the posterior portion of the anorectal ring to minimize the risk of including a portion of the vagina in the stapled IPAA thus causing an iatrogenic pouch-vaginal fistula. The progressive closure of the stapler may be monitored laparoscopically to ensure appropriate apposition of the 2 anastomotic segments. At this stage in female patients a laparoscopic grasper can be used to push the vagina anteriorly and out of harm's way. According to some surgeons, this particular portion of the laparoscopic operation offers improved exposure when compared with its open counterpart. Once the firing of the staple is completed and the instrument removed, the anastomotic doughnuts are checked and an air-leak test performed as it is typically done in the open technique.

A loop of bowel is then selected to create a proximal diverting loop ileostomy, which is generally fashioned at the time of the IPAA as for most patients after open technique. At this time we routinely place a drain in the presacral space, which is exited through the left-sided 5-mm port-site and secured to the skin after removal of the port. Pneumoperitoneum is then again

evacuated and the final selection and orientation of the adequate ileal loop for the creation of a proximal diverting ileostomy is finalized through the extraction site. We generally orient the ileal loop under direct vision through the extraction site, wrap it with a hyaluronate-based membrane (Seprafilm®, Genzyme Corp., Cambridge, MA), and pass through the stoma aperture. It is generally possible to ensure the orientation of the ileostomy through the extraction site. However, in those cases in which the anatomy is more difficult, it is possible to reestablish pneumoperitoneum at this time and control the orientation of the ileostomy loop laparoscopically. Following that, we close the fascia of the extraction site and the 10-mm and 12-mm port sites. We do not routinely close the fascia of 5-mm port-sites. We also generally do not use the ileostomy site for a port placement, but this is a possible option in a patient with a suitable anatomy.

PERIOPERATIVE RESULTS OF LAPAROSCOPIC IPAA

Most data on laparoscopic IPAA comes from non-randomized studies. The great majority of reports concur that IPAA performed laparoscopically is associated with longer operative times than their open counterparts. However, few series have reported comparable operative times.^{14,22,33} Similarly, most series also indicate a reduction in estimated blood loss following a laparoscopic versus open IPAA.^{26,33,34} However, the clinical significance of such a reduction remains questionable. Conversion rates of laparoscopic IPAA have been generally lower than what is reported for laparoscopic colectomy for cancer, ranging from zero to 11%.^{21,26,34-41} Morbidity following laparoscopic versus open IPAA has been similar (Table 3). In addition, the studies reporting on readmission rates have also found no difference between laparoscopic and open IPAA.^{36,42}

Postoperative advantages attributed to the laparoscopic approach also include an accelerated postoperative recovery. In particular, several series have reported more rapid return to bowel function after laparoscopic procedures, which has been generally associated with a correspondingly reduced length of hospital stay (Table 4). However, there have been trials in which the reduction in time to bowel function after laparoscopic IPAA has not uniformly resulted in a corresponding shorter hospital stay.^{22,33,42} As different surgeons often selectively perform laparoscopic or open surgery, it is possible that variability in postoperative care pathways might explain at least some of the results reported in the various studies. Future investigation will need to focus on objective recovery parameters with uniform and well-defined postoperative management so that the expected advantages in recovery after laparoscopic surgery will be elucidated.

Table 3 Selected Contemporary Series* Comparing Morbidity of Laparoscopic versus Open IPAA for Ulcerative Colitis

Author	Year	Open/ Laparoscopic Patients	Laparoscopic Technique Used	Morbidity after Open Surgery (%)	Morbidity after Laparoscopic Surgery (%)	P Value
Marcello et al ²⁶	2000	20/20	Standard	25	20	NA
Araki et al ³³	2001	11/21	Standard laparoscopic abdominal colectomy, open rectal dissection	45.5	33.3	NS
Brown et al ³⁵	2001	13/12	Standard	15.4	16.7	NS
Hashimoto et al ³⁴	2001	13/11	Standard laparoscopic abdominal colectomy, open rectal dissection	38.5	54.5	NA
Maartense et al ⁴²	2004	30/30	HALS	20	23.3	NS
Larson et al ³⁶	2006	200/100	Mixed (23 HALS)	37	33	0.55
Zhang et al ³⁸	2007	25/21	Standard	28	23.8	NS
Heise et al ³⁹	2008	91/60	Straight laparoscopic abdominal colectomy, open rectal dissection	NA	10.8	NA
Ouaïssi et al ¹⁴	2008	22/23	Standard	45.5	65.2	NS
El Gazzaz et al ⁴¹	2009	238/119	Mixed (9 HALS)	21.5	23.1	0.091
Fichera et al ²²	2009	106/73	Standard	41.2	48	NS

*≥Year 2000, ≥10 patients/group.

IPAA, ileal pouch-anal anastomosis; HALS, hand-assisted laparoscopic surgery.

Note: The series of Marcello et al, Larson et al, and Heise et al include 14, 2, and 5 patients with familial adenomatous polyposis, respectively. In Ouaïssi et al, Hashimoto et al, and Fichera et al the morbidity was recalculated, specific overall P values not reported.

Table 4 Contemporary Selected Series* Comparing Recovery Parameters Following Laparoscopic versus Open IPAA for Ulcerative Colitis

Author	Year	Open/ Laparoscopic Patients	Open/Laparoscopic Return to Bowel Function	P Value	Open/ Laparoscopic LOS	P Value
Marcello et al ^{26*}	2000	20/20	4/2	0.03	8/7	0.02
Araki et al ³³	2001	11/21	5.4/1.7	<0.05	39/36	NS
Brown et al ³⁵	2001	13/12	3/3	NS	8/7.5	NS
Hashimoto, 2001 et al ³⁴	2001	13/11	4.3/3.6	NS	31.3/24.9	<0.05
Maartense et al ⁴²	2004	30/30	NA	NA	11/10	NS
Larson et al ^{36*}	2006	200/100	3/2	0.017	7/4	<0.001
Zhang et al ³⁸	2007	25/21	4/2	<0.001	11/9	<0.001
Heise et al ^{39*}	2008	91/60	4.5/3.6	0.04	8.2/6.3	<0.001
Ouaïssi et al ¹⁴	2008	22/23	NA	NA	19/13	NS
El Gazzaz et al ⁴¹	2009	238/119	3/2	0.001	6/5	0.001
Fichera et al ²²	2009	106/73	3.6/2.6	0.008	7.4/8.3	0.135

*≥Year 2000, ≥10 patients/group.

IPAA, ileal pouch-anal anastomosis; LOS, length of hospital stay.

Note: Studies report median values except for Araki et al, Heise et al, Ouaïssi et al, and Fichera et al, which report mean values. Hashimoto et al reported return to bowel function as "duration of postoperative prohibition from eating." The series of Marcello et al, Larson et al, and Heise et al include 14, 2, and 5, patients with familial adenomatous polyposis, respectively.

FUNCTIONAL RESULTS, COSMESIS, AND BODY IMAGE

As an increasing number of studies has confirmed the feasibility and safety of laparoscopic IPAA, the focus of investigators has started shifting toward evaluation of possible functional benefits of laparoscopic IPAA. In particular, one aspect of functional evaluations has consisted of prospective collection on data concerning defecatory function, such as number of daily and nightly bowel movements, stool consistency, incidence of fecal incontinence, fecal soilage and need for pad usage,

similar to what has been traditionally done for open IPAA. In addition, formal evaluation of quality of life has also been performed, often using validated questionnaires in the attempt to assess whether a minimally invasive technique achieved superior benefits when compared with open IPAA. Few studies have evaluated these outcomes and they are difficult to compare as they have used different methodologies. The evaluation of functional defecatory parameters in two case-matched series has revealed similar overall results between patients undergoing laparoscopic IPAA versus open IPAA.^{41,43}

Other comparative studies have confirmed substantial equivalence between the two techniques in this regard.^{14,22,41,44} However, in some specific areas, laparoscopic surgery has been associated with improved functional results when compared with open technique. For example, one series has indicated that dietary restrictions were less common after laparoscopic surgery rather than open surgery.⁴⁴ In addition, another study has indicated that laparoscopic surgery was associated with an increased incidence of constipation rather than liquid bowel movements and a decreased incidence of perianal rash.²² Two different studies have reported a decreased frequency of pad usage.^{22,41} With respect to sexual function, body image, and quality of life, the overall results have also been comparable.^{42,44,45} One study has however reported lower scores in the specific domain of orgasmic function scores in men undergoing laparoscopic IPAA.⁴⁵ In this respect, it is important to note that the comparison in this specific domain revealed a statistically significant disparity in outcomes, but the actual difference amounted to less than one point (9.2 vs 9.9) using a validated sexual function score. The statistical results might therefore not be associated with a corresponding clinically relevant difference, especially considering that the overall function was rated as comparable in both men and women. The outcomes regarding cosmesis have been variable. Although one study from Europe has detected significantly better cosmetic satisfaction after laparoscopic surgery,⁴⁴ evaluation of cosmesis was comparable in a different analysis from the United States.⁴⁵ Body image and quality of life were also comparable in this study. It is noticeable that in the European study the main incision length for laparoscopic-assisted procedures was 15 cm as opposed to a mean length of incision of almost 24 cm for conventional IPAA. A recent study has addressed the perceived issue of possible differences between a hand-assisted laparoscopic IPAA and the standard of the total laparoscopic IPAA. In this analysis, 35 patients⁴⁶ undergoing standard laparoscopic IPAA were compared with the patients previously enrolled in a prospective randomized trial that had compared hand-assisted laparoscopic IPAA and open IPAA.⁴² Results from this study did not suggest any significant benefits in quality of life when compared with the hand-assisted laparoscopic restorative proctocolectomy.

It is important to point out that both in case-matched studies and especially in purely retrospective analyses, patient selection could explain at least some of the differences in favor of laparoscopic IPAA. The evidence to date suggests that there might be some functional and quality of life benefits associated with laparoscopic IPAA. However, the consistency and relevance of these benefits remains questionable and will require further evaluation with longer follow-up.

OTHER POSSIBLE ADVANTAGES OF LAPAROSCOPIC IPAA

Anticipated long-term advantages in favor of laparoscopic restorative proctocolectomy should include reduction in the formation of abdominal and pelvic adhesions,^{47–49} which in turn could lead to reduction in the incidence of small bowel obstruction and incisional hernias.^{22,50,51} These are possible longer-term advantages in favor of laparoscopic surgery which reflect what has been suggested for laparoscopic intestinal resection in general. More specifically, a distinctive advantage of laparoscopic restorative proctocolectomy derived from an allegedly decreased pelvic scarring could be increased fecundity, which is adversely affected by open IPAA⁵² in the often young, female patients. This is an issue which remains difficult to evaluate, especially considering the heterogeneity of the techniques collectively referred as “laparoscopic IPAA,” as previously discussed. The specific technique of rectal dissection might have a considerable influence on fecundity, but there is currently no data that can indicate if any of the different minimally invasive techniques can increase fecundity compared with open IPAA. Only long-term data for each specific laparoscopic surgical technique will possibly bring some clarity in this already controversial issue.

As laparoscopic IPAA results in longer operative times but shorter hospital stay in several series, it is possible that the accelerated recovery might offset the increased operative costs and results in a less invasive but also less expensive surgical approach. Little data are available on costs after laparoscopic versus open IPAA, but at this time there does not seem to be a significant difference between the two techniques.^{39,42}

PROSPECTIVE RANDOMIZED TRIALS EVALUATING LAPAROSCOPIC IPAA

There is only one prospective randomized trial comparing laparoscopic and open techniques for restorative proctocolectomy⁴² published to date. Sixty patients were randomized into 2 equal groups undergoing open IPAA versus hand-assisted laparoscopic IPAA. The main hypothesis to be tested was that laparoscopic IPAA would have a faster postoperative recovery during the first 3 months following surgery. The main metric used to evaluate postoperative recovery was intentionally based on quality of life assessments, as the authors postulated that hospital discharge is an endpoint which can be influenced by many subjective factors. This study was powered based on the assumption that a 20% difference in quality of life would be clinically significant. A Pfannenstiel incision was initially created and the sigmoid colon was mobilized through this incision. After insertion of the hand port, laparoscopic colectomy was completed using the hand-assisted technique. Transection of the terminal ileum was performed using an

endostapler. Following complete colonic mobilization the hand port was removed and the proximal rectum was transected through the Pfannenstiel incision to remove the abdominal colon. The rectum was then dissected, distally transected, and removed using the Pfannenstiel incision followed by double-stapled IPAA. In both the laparoscopic hand-assisted and open procedures a diverting loop ileostomy was created at the surgeon's discretion. Both groups received patient-controlled analgesia and then transitioned to narcotic medications with formal pain score evaluations. In patients who were not diverted, a Foley catheter was inserted transanally into the pouch for 5 days and patients were allowed to have only clear liquids during this period to prevent obstruction of the pouch catheter with more formed stools. After 5 days the catheter was removed and the diet was further advanced. The patients were discharged when they had acceptable stool frequency and could tolerate a normal diet. Quality of life was assessed using SF-36 and a GIQLI questionnaire,⁴² which are recognized quality of life assessment tools. Not surprisingly, operative times were longer after laparoscopic procedures by ~90 minutes when compared with open counterparts. Morbidity was reported as divided into minor and major complications, none of which was statistically different between the 2 groups. The median hospital stay of 10 days after laparoscopic procedures was 1 day shorter than after open IPAA, but this did not reach statistical significance. Similarly, there was an equally significant decline in quality of life in the first 2 weeks after surgery regardless of the surgical approach used. However, quality of life parameters returned to baseline 4 weeks postoperatively and continued improving up to 3 months after surgery when compared with quality of life before surgery, but this was again not different between the 2 groups. Costs were not significantly increased after laparoscopic surgery. The European health care environment and the trial design do not make the results from this study easily and entirely applicable to contemporary American practices. However, this study provides methodologically strong data in the evaluation of laparoscopic versus open IPAA. Results from this study confirm safety of the laparoscopic approach but do not indicate striking benefits in recovery parameters, costs, or quality of life.

The design of another planned prospective randomized trial has been published in 2006.⁵³ The LapConPouch-Trial has been designed as a randomized controlled, single-center, "expertise-based" trial on patients undergoing primary elective restorative proctocolectomy. The two groups under investigation should include totally laparoscopic IPAA versus open IPAA and have been powered at 80 patients per group. The primary endpoints are the assessment of differences in intraoperative blood loss and need for perioperative blood transfusions. The selection of these endpoints was based

on the results from the investigators' institution indicating that laparoscopic-assisted IPAA with the rectal dissection performed through the extraction site had comparable results to the open procedures based on these specific parameters. Secondary endpoints will include postoperative morbidity, formal measurements of postoperative pain and lung function, recovery parameters including length of hospital stay and quality of life, all of which will be assessed up to 12 months postoperatively. The expected duration of the trial was planned to be 4 years with patient accrual starting in September 2004. However, the results from this trial have not yet been published.

LAPAROSCOPIC TOTAL PROCTOCOLECTOMY WITH END ILEOSTOMY

Laparoscopic surgery is also a feasible option for those patients who need a total proctocolectomy with creation of an end ileostomy.⁵⁴ This subgroup includes elderly, infirm patients, patients with significant comorbidities and in general patients with poor sphincter tone for a variety of reasons. Furthermore, some younger, fitter individuals can make an informed decision not to have a restorative procedure performed once aware of the expected functional results and limitations of IPAA. In addition, some cases of low rectal carcinomas complicating ulcerative colitis are not suitable for an oncologically radical sphincter-saving procedure. In many of these patients, the perineal wound can be used as an extraction site. In the absence of a malignancy requiring a wider perineal excision, the laparoscopic procedure can be completed with perineal removal of the specimen after intersphincteric proctectomy, so that no major abdominal or perineal incisions are necessary.⁵⁵

CONCLUSIONS

Several studies have demonstrated that laparoscopic ileal pouch anal anastomosis is safe and feasible, at least in experienced hands. Recovery advantages have been demonstrated by many series, but they have not been consistent in every center. On the other hand, functional results have been comparable to open surgery, although long-term functional outcomes are still not available. Therefore, equivalence in long-term functional results remains to be demonstrated. In addition, some other possible benefits of laparoscopic surgery such as reduction in overall costs have also not been consistently reported for laparoscopic IPAA. Surgeons with adequate training in complex laparoscopic surgery are attracted to laparoscopic surgery, largely because of the data reported for laparoscopic resection for colon cancer. In most cases, some of the concerns regarding cancer dissemination do not exist for inflammatory bowel disease which could potentially increase the popularity of laparoscopic total

abdominal colectomy and IPAA. However, further investigation on the role of laparoscopic surgery for ulcerative colitis is needed. Future studies with larger populations and longer follow-up should particularly focus on recovery parameters, quality of life, and costs to assess the extent of the benefits attributed to laparoscopic surgery for ulcerative colitis.

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