

## Laparoscopic total colectomy: Does the indication influence the outcome?

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### Abstract

**AIM:** To assess and compare outcomes of laparoscopic total colectomy performed for a variety of indications.

**METHODS:** Sixty six patients underwent laparoscopic total colectomy for inflammatory bowel disease (IBD) (13) and other diseases (53). Data on demographics, pre- and post-operative outcomes were collected prospectively.

**RESULTS:** Mean operative time was 4.5 h. Conversion rate was 13.6%. Total colectomy performed for IBD was associated with a significantly higher anastomotic leak rate (23.1% vs 1.9%,  $P < 0.05$ ). On univariate analysis, hand sewn anastomosis and treatment with more than 20 mg of prednisolone for at least 3 mo was associated with a higher anastomotic leak rate ( $P < 0.05$ ). No significant difference was found in return of gut function and overall morbidity between disease groups.

**CONCLUSION:** Laparoscopic total colectomy is feasible and outcomes are equivalent whatever the indication, except for anastomotic leak rate which is higher for patients with IBD.

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**Key words:** Colectomy; Inflammatory bowel disease; Laparoscopy; Familial adenomatous polyposis; Constipation; Colonic neoplasms; Hereditary nonpolyposis; Diverticulosis; Treatment outcomes

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### INTRODUCTION

Numerous studies have demonstrated the benefits of laparoscopic segmental colonic resection for benign and malignant disease<sup>[1,2]</sup>. Proven advantages include im-

proved cosmesis, decreased blood loss and a reduction in postoperative pain, fatigue and time to resumption of oral intake. In contrast, data concerning laparoscopic total colectomy has been less compelling. Common indications for total colectomy include familial adenomatous polyposis (FAP), Lynch syndrome, slow transit constipation and inflammatory bowel disease (IBD) such as Crohn's disease and ulcerative colitis (UC). Restorative proctocolectomy with ileal pouch-anal anastomosis (IPAA) is the treatment of choice in UC. For selected patients presenting with mild disease in the rectum, no dysplasia and with normal rectal compliance, a subtotal colectomy with ileo-distal sigmoid anastomosis may be an alternative and was performed in this study. Few published reports exist and mainly report techniques performed for a single indication or include small numbers of patients<sup>[3-10]</sup>. The aim of this study was to report the outcomes of laparoscopic total colectomy based on indication, comparing IBD with other indications.

## MATERIALS AND METHODS

### Patients

Between June 1998 and June 2007, 66 consecutive patients underwent a laparoscopic total or subtotal colectomy for benign or malignant disease. Patients were admitted to two surgical departments of Hospices Civils de Lyon and operated on by several surgeons (Digestive Surgical Department of Centre Hospitalier Lyon-Sud and Digestive Surgical Department of Centre Hospitalier Edouard Herriot). Thirteen patients (19.7%) presented with IBD (11 with UC and 2 with colonic Crohn's disease), 40 patients (60.6%) with FAP, 7 patients (10.6%) with slow transit constipation, 5 patients (7.6%) with colonic cancer and Lynch syndrome and 1 patient (1.5%) with diffuse colonic diverticulosis. Patients with IBD were operated on for failure of medical treatment. All patients with IBD except 1 patient with UC received at least 3 mo of maintenance steroid treatment [prednisolone, mean 24.2 mg daily (SD = 11.1)]. The dosage of prednisolone used was > 20 mg for 7 patients and ≤ 20 mg for 5 patients. Six patients (46%) with IBD had an immunosuppressive treatment [azathioprine ( $n = 5$ ) and cyclosporine ( $n = 1$ )]. No patient with UC had fulminant disease as defined by two or more of the following findings: tachycardia (heart rate > 120 beats per minute), temperature greater than 38.0°C, peritoneal signs and white blood cell count greater than 11 000/mL.

### Surgical technique

All patients underwent bowel preparation with polyethylene glycol or sodium phosphate. Under general anesthesia, patients were placed in a modified lithotomy position with legs slightly abducted and arms tucked to the sides. A nasogastric tube was inserted during surgery but postoperative use depended on the individual surgeon's routine practice. Pneumoperitoneum was established with a Veress needle at an abdominal pressure of 12 mmHg. A 10 mm port was placed at the umbilicus for the 30°

oblique viewing laparoscope. Four additional ports were placed under laparoscopic vision: one 12 mm port in the right lower quadrant, one 10 mm port in the right and left upper quadrants and one 5 mm port in the suprapubic position. Dissection and division of the mesentery was performed with a 10 mm laparoscopic Ligasure device (Ligasure Atlas; Valleylab, Boulder, CO, United States) or a 5 mm blade Harmonic Scalpel (Ultracision Shears Harmonic Scalpel LCS; Ethicon Endosurgery SA, Issy-Les-Moulineaux, France) according to the surgeon's preference, without mesenteric lymphadenectomy except for malignancy. Total colectomy was performed from right to left (lateral to medial dissection). The procedure involved right colonic mobilization as well as hepatic flexure mobilization followed by transverse colonic dissection. The omentum was elevated off the transverse colon (except for cancers involving the transverse colon). The splenic flexure and finally the left colonic dissection were followed by division at the rectosigmoid junction using a laparoscopic linear stapler. Patients had either an ileo-distal sigmoid or ileorectal anastomosis. For an ileo-distal sigmoid anastomosis (subtotal colectomy), a short lower midline incision was made for exteriorisation and resection of the specimen and formation of a hand sewn anastomosis. For an ileorectal anastomosis (total colectomy), the bowel was divided at the rectosigmoid junction and the specimen removed through a short transverse incision in the right lower quadrant. After re-establishment of the pneumoperitoneum, a stapled end-to-end ileorectal anastomosis was performed with an endoluminal stapling gun. A pelvic drain was used selectively.

### Outcome measures

Demographics, including age, gender and indication for colectomy, were collected prospectively for all patients.

The principle outcome measures were: (1) Intraoperative data: operative time, surgical procedure performed, conversions and their reasons, creation of a stoma; and (2) Early postoperative: time to first bowel movement and time with nasogastric tube, complications, anastomotic leak, radiological intervention, reoperation, length of hospital stay.

The period of inclusion was divided into two 5-year periods: 1998 to 2002 and 2003 to 2007.

### Statistical analysis

Statistical analysis was performed using SPSS version 17.0 (SPSS Inc., Chicago, IL, United States). Results are expressed as the mean ± SD. Comparisons between groups were performed using the Student *t* test for continuous data and  $\chi^2$  or Fisher exact test for categorical data. Multivariate analysis was performed using a logistic regression. A *P* value < 0.05 was considered statistically significant.

## RESULTS

### Intraoperative data

Mean operative time was 4.5 h (Table 1). Length of op-

**Table 1** Demographic and intraoperative data (mean  $\pm$  SD) *n* (%)

	Crohn ( <i>n</i> = 2)	Ulcerative colitis ( <i>n</i> = 11)	FAP ( <i>n</i> = 40)	Lynch syndrome ( <i>n</i> = 5)	Constipation ( <i>n</i> = 7)	Diverticulosis ( <i>n</i> = 1)	All ( <i>n</i> = 66)
Age (yr)	28.0 $\pm$ 9.7	42.5 $\pm$ 12.7	46.1 $\pm$ 19.4	44.8 $\pm$ 19.6	36.4 $\pm$ 8.9	57.0 $\pm$ 0.0	44.4 $\pm$ 17.0
Female	0	3 (27.3)	17 (42.5)	1 (20)	7 (100)	0	28 (42.4)
Operative time (h)	4.0 $\pm$ 0.0	4.6 $\pm$ 0.5	4.5 $\pm$ 1.5	4.1 $\pm$ 1.3	4.2 $\pm$ 1.0	5.0 $\pm$ 0.0	4.5 $\pm$ 1.24
Stoma	1 (50.0)	0	0	0	0	0	1 (1.5)
Conversion	0	2 (18.2)	6 (15)	0	1 (14.3)	0	9 (13.6)
Anastomosis							
Ileorectal	0	3 (27.3)	37 (92.5)	4 (80)	1 (14.3)	1 (100)	46 (69.7)
Ileo-distal sigmoid	2 (100)	8 (72.7)	3 (7.5)	1 (20)	6 (85.7)	0	20 (30.3)

FAP: Familial adenomatous polyposis.

**Table 2** Outcomes based on indication for surgery (mean  $\pm$  SD) *n* (%)

	Inflammatory bowel disease ( <i>n</i> = 13)	Other indications ( <i>n</i> = 53)	<i>P</i> value
Age (yr)	42.5 (12.6)	44.9 (18.3)	0.663
Female	3 (23.1)	25 (47.2)	0.115
Operative time (h)	4.5 $\pm$ 0.5	4.40 $\pm$ 1.36	0.899
Conversion	2 (15.4)	7 (13.2)	> 0.999
Length of stay (d)	15.2 $\pm$ 7.5	12.8 $\pm$ 6.7	0.274
Time to first bowel movement (days from surgery)	4.9 $\pm$ 3.1	4.3 $\pm$ 3.1	0.522
Nasogastric tube <sup>1</sup>	9 (69.2)	25 (47.2)	0.154
Overall morbidity	5 (38.5)	19 (35.8)	> 0.999
Anastomotic leak	3 (23.1)	1 (1.9)	0.022
Reoperation	3 (23.1)	6 (11.3)	0.364
Radiological drainage	1 (7.7)	3 (5.7)	> 0.999

<sup>1</sup>Numbers of patients (%) requiring a nasogastric tube for more than 1 postoperative day when inserted intraoperatively or requiring postoperative insertion.

eration was not statistically different for IBD compared to other indications (Table 2). One protecting loop ileostomy was performed for Crohn's disease. Conversion rate was 13.6% (9 patients). Seven conversions were due to intra-abdominal adhesions. Super obesity (body mass index > 50) was responsible for one conversion and rectal trauma during stapling of an ileorectal anastomosis for the other. The conversion rate was not statistically different between IBD and other indications. Ileo-distal sigmoid anastomosis was the most common used for IBD [10/13 patients (76.9%)] and slow transit constipation [6/7 patients (85.7%)]. For other indications, an ileorectal anastomosis was most often performed [42/46 patients (91.3%)]. These results were compared between the 2 periods of inclusion (Table 3). Length of operation was shorter after 2002 (4.2 h *vs* 5.0 h, *P* = 0.0156). There was no significant difference in conversion rate between the two time periods.

### Early postoperative outcomes

Early postoperative results are reported in Table 4. There were no postoperative deaths (30 d mortality). A nasogastric (N-G) tube was left *in situ* postoperatively in 43 patients (65.1%). In 17 patients it was removed on the

**Table 3** Comparison of outcomes over 2 consecutive time periods (mean  $\pm$  SD) *n* (%)

	1998-2002 ( <i>n</i> = 21)	2003-2007 ( <i>n</i> = 45)	<i>P</i> value
Inflammatory bowel disease	10 (47.6)	3 (6.7)	< 0.0001
Operative time (h)	5.0 $\pm$ 0.9	4.2 $\pm$ 1.3	0.0156
Conversion	4 (19.0)	5 (11.1)	0.4499
Length of stay (d)	16.5 $\pm$ 7.9	11.8 $\pm$ 5.9	0.0093
Time to first bowel movement (days from surgery)	5.1 $\pm$ 3.5	4.1 $\pm$ 2.8	0.2439
Overall morbidity	10 (47.6)	14 (31.1)	0.1941
Anastomotic leak	2 (9.5)	2 (4.4)	0.5865
Reoperation	5 (23.8)	4 (8.9)	0.1300

first postoperative day. Twenty-six patients had postoperative small bowel ileus resulting in the N-G tube being left for a median of 3 d after surgery. Of the 23 patients whose N-G tube was removed immediately after surgery, 8 (34.8%) required re-insertion. Therefore, an N-G tube was considered useful in 34 patients (51.5%).

Although the overall complication rate (36.4%) was not statistically greater for patients with IBD (Table 2), anastomotic leak was more frequent following surgery for UC and Crohn's disease (23.1% *vs* 1.9%, *P* = 0.022). On univariate analysis, anastomotic leaks were also significantly correlated with the type of anastomosis (4/20 anastomotic leaks for hand sewn anastomosis *vs* 0/46 for stapled anastomosis, *P* = 0.0067) and maintenance treatment with steroids > 20 mg (3/7 *vs* 1/59, *P* = 0.0029). On multivariate analysis, none of these parameters appeared to significantly increase the anastomotic leak rate. Complications that increased the length of stay were reported (Table 4). In patients with UC, these were profuse diarrhea lasting 10 d (1) and prolonged ileus (1). In patients with FAP: aspiration pneumonia (1), prolonged ileus (1), segmental portal vein thrombosis (1) and intra-abdominal abscess without anastomotic leak (4) requiring reoperation in 2 patients, percutaneous radiological drainage in 1 and treatment with antibiotics in another. In patients with Lynch syndrome: intra-abdominal abscess without anastomotic leak treated by antibiotics only (1), lymph leak which delayed intra-abdominal drain removal (1) and small bowel obstruction treated non-operatively (1). For diverticulosis: intra-abdominal bleeding requiring

**Table 4** Early postoperative results (mean  $\pm$  SD) *n* (%)

	Crohn ( <i>n</i> = 2)	Ulcerative colitis ( <i>n</i> = 11)	FAP ( <i>n</i> = 40)	Lynch syndrome ( <i>n</i> = 5)	Constipation ( <i>n</i> = 7)	Diverticulosis ( <i>n</i> = 1)	All ( <i>n</i> = 66)
Length of stay (d)	17.5 $\pm$ 9.2	14.7 $\pm$ 7.6	11.2 $\pm$ 4.4	12.8 $\pm$ 6.9	13.7 $\pm$ 7.9	13 $\pm$ 0	13.3 $\pm$ 6.7
First bowel movement (d)	5.5 $\pm$ 3.5	4.8 $\pm$ 3.2	3.7 $\pm$ 2.7	4.6 $\pm$ 3.2	7.1 $\pm$ 4.1	5 $\pm$ 0	4.4 $\pm$ 3.1
Nasogastric tube <sup>1</sup>	1 (50)	7 (63.6)	19 (47.5)	1 (20)	4 (57.1)	1 (100)	34 (51.5)
Complications	2 (100)	3 (27.3)	11 (27.5)	4 (80)	3 (43)	1 (100)	24 (36.4)
Anastomotic leak	2 (100)	1 (9.1)	0	0	1 (14.3)	0	4 (6.1)
Wound abscess	0	0	2 (5)	1 (20)	1 (14.3)	0	4 (6.1)
Surgery for bowel obstruction	0	0	1 (2.5)	0	1 (14.3)	0	2 (3)
Other complications	0	2 (18.2)	8 (20)	3 (60)	0	1 (100)	14 (21.2)
Reoperation	2 (100)	1 (9.1)	3 (7.5)	0	2 (28.6)	1 (100)	9 (13.6)
Radiological intervention	1 (50)	0	3 (7.5)	0	0	0	4 (6.1)

<sup>1</sup>Numbers of patients (%) requiring a nasogastric tube for more than 1 postoperative day when inserted intraoperatively or requiring postoperative insertion. FAP: Familial adenomatous polyposis.

**Table 5** Studies of total and segmental colectomy

Authors	Indication	No. of patients	Procedure	Conversion (%)	Morbidity (%)	Anastomotic leaks (%)	Reoperation (%)	Hospital stay (d)
Hamel <i>et al</i> <sup>[9]</sup>	Crohn	21	STC (L)	24	33	10	10	8.8
Pokala <i>et al</i> <sup>[11]</sup>	FAP, C, Lynch, IBD	34	TC + STC (L)	11.8	26.5	5.9	8.8	4.1
		34	TC + STC (O)	NA	38.2	0	11.8	6.8
Hsiao <i>et al</i> <sup>[4]</sup>	C	44	TC (HA)	0	18.2	2.3	6.8	7.6
Delaney <i>et al</i> <sup>[1]</sup>	Cancer, IBD, DD	11 044	SegC (L)	10.1	26	0.26	0.5	6.3
		21 689	SegC (O)	NA	31.8	0.18	0.3	8.5
Current series	IDB	13	TC + STC (L)	15.2	38.5	23.1	23.1	15.2
	Non IBD	53		13.2	35.8	1.9	11.3	12.8
	All	66		13.6	36.4	6.1	13.6	13.3

STC: Subtotal colectomy; TC: Total colectomy; SegC: Segmental colectomy; L: Laparoscopic; O: Open; HA: Hand assisted; FAP: Familial adenomatous polyposis; C: Slow transit Constipation; IBD: Inflammatory bowel disease; DD: Diverticular disease; NA: Not applicable.

re-operation (1). Nine reoperations were necessary: 4 for peritonitis after an anastomotic leak, 2 intra-abdominal abscesses without anastomotic leak, 2 for small bowel obstruction and 1 for intra-abdominal bleeding.

Length of hospital stay was 13.3 d (SD = 6.7) with no significant difference between patients with and without IBD (Table 2). Length of hospital stay was shorter after 2002 (11.8 d *vs* 16.5 d, *P* = 0.0093) (Table 3). No significant difference was found between these 2 periods in the time to first bowel movement, overall morbidity, anastomotic leak rate and reoperation rate.

## DISCUSSION

This study reports the results of 66 consecutive patients who underwent a laparoscopic total colectomy. Our data shows that this operation is feasible and safe with no mortality and acceptable morbidity, as reported in previous studies<sup>[3-11]</sup> (Table 5). The early postoperative results highlight problems with bowel function after total colectomy with a mean of 4.4 d until the first bowel movement. 51.5 % of patients needed a nasogastric tube. Recovery of gut function seems longer than following segmental laparoscopic colectomy when patients rarely require nasogastric tube insertion (less than 15%) and can be discharged on the fourth postoperative day<sup>[12,13]</sup>. No

enhanced recovery protocol was followed in this study. These protocols have demonstrated their benefit in improving outcomes after segmental colonic resection<sup>[14,15]</sup>. They reduce the time to restoration of bowel function and the length of hospital stay. No studies have evaluated these protocols for total colectomy with the majority of controlled trials including only segmental colectomies. It is therefore difficult to extrapolate the results of these trials to the management of patients after total colectomy. However, length of stay and restoration of bowel function appear longer in our series than in previous published series of total colectomies (Table 5). This may be explained by the long time period over which our study was conducted. When analyzed in two consecutive 5-year time periods (Table 3), a decrease in operative time and length of hospital stay was observed. This is likely due to an improvement in operative technique (riding the learning curve) and in postoperative care. Although no formal enhanced recovery protocol was followed, there was a definite evolution in postoperative care in our unit based on elements of enhanced recovery such as early enteral feeding and mobilization with avoidance of opiate analgesia. Enhanced recovery protocols have demonstrated their utility following segmental colectomy and may also improve outcomes following laparoscopic total colectomy. A randomised controlled trial is necessary to evaluate

this. Refinement in patient selection in our unit may also explain fewer patients with IBD undergoing surgery over time.

IBD is not a common indication for total colectomy. In our series, it was performed principally for UC. Restorative proctocolectomy with IPAA is the treatment of choice in UC. However, in patients, especially young women, with mild rectal disease, no dysplasia and normal rectal compliance, a subtotal colectomy may be an alternative to IPAA that may give better functional results with reduced risk of infertility. Evaluation of the long-term results of total colectomy for UC was not the aim of this study and would require a controlled trial with large numbers of patients.

Morbidity in this study was higher than for segmental colectomy with a reoperation rate of 13.6% (0.5% in a recent study using a large national database of 11 044 segmental laparoscopic colectomies<sup>[1]</sup>), but equivalent to other studies of total colectomy for IBD (Table 5).

We compared IBD with other indications for total colectomy. No difference in operative time, conversion rate, the length of stay or overall morbidity was seen. However, there were significantly more anastomotic leaks in patients with IBD, especially Crohn's disease. Both patients with Crohn's disease suffered anastomotic leaks although one had a defunctioning stoma. Several studies report high morbidity rates (up to 35%), with a conversion rate reaching 30% for laparoscopic surgery in Crohn's disease<sup>[3,8,16-18]</sup>. In our opinion, all patients with Crohn's disease who undergo total colectomy should be prepared for a defunctioning stoma. For patients without IBD, the anastomotic leak rate (1.9%) was equivalent to segmental colectomy which varies between 0% and 7%<sup>[1,19]</sup>. A hand sewn anastomosis and maintenance treatment with more than 20 mg of prednisolone daily were risk factors for anastomotic leak in univariate but not multivariate analysis. Patients with IBD were more likely to possess both these factors but larger numbers are required to evaluate these factors fully. Tilney *et al.*<sup>[10]</sup>, in a meta-analysis of outcomes after laparoscopic or open total colectomy, reported 63 patients who underwent a restorative laparoscopic total colectomy. Our series is one of the largest reporting laparoscopic total colectomy in the literature and involved two surgical centers although a large multicenter prospective study would help clarify many issues raised.

In conclusion, laparoscopic total colectomy is feasible even for patients with IBD but complication rates are higher and return to normal gut function slower than for segmental colectomy. Outcomes are equivalent whatever the indication, except for anastomotic leak rate which is higher for patients with IBD. To achieve the best outcomes in this group, careful patient selection with a low threshold for a defunctioning stoma is essential.

## COMMENTS

### Background

Numerous studies have demonstrated the benefits of laparoscopic segmental colonic resection for benign and malignant disease. Proven advantages include improved cosmesis, decreased blood loss and a reduction in postoperative

pain, fatigue and time to resumption of oral intake. In contrast, data concerning laparoscopic total colectomy has been less compelling. The aim of this study was to report the outcomes of laparoscopic total colectomy based on indication, comparing inflammatory bowel disease (IBD) with other indications.

### Research frontiers

In the area of mini-invasive surgery, laparoscopy was applied to colorectal surgery. The aim was to reduce the surgical stress to improve the post-operative course.

### Innovations and breakthroughs

Based on a large series, this study describes the outcomes of laparoscopic total colectomy and is a reference for comparison in future studies.

### Applications

The study results show that laparoscopic total colectomy is feasible and outcomes are equivalent whatever the indication, except for anastomotic leak rate which is higher for patients with IBD. The study results suggest that all patients with Crohn's disease who undergo total colectomy should be prepared for a defunctioning stoma.

### Peer review

This paper demonstrates the outcomes of laparoscopic total colectomy performed for a variety of indications.

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