Acceptable short-term outcome of laparoscopic subtotal colectomy for inflammatory bowel disease

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ABSTRACT

INTRODUCTION: Laparoscopic colectomy for both benign and malignant disease, including inflammatory bowel disease (IBD), has recently been shown to have many advantages compared with open surgery. This study aimed to compare the effect of laparoscopic versus open subtotal colectomy (STC) for IBD on overall morbidity.

MATERIAL AND METHODS: A total of 99 patients undergoing STC for IBD at our institution from 2007 through 2011 were identified. Patients undergoing open STC were compared with patients undergoing laparoscopic STC. Outcomes included 30-day morbidity, conversion to laparotomy, intraoperative blood loss, operative time, admission time, late onset complications and 30-day mortality. Results are presented as median values.

RESULTS: A total of 57 patients underwent open STC (Group 1) and 42 patients laparoscopic STC (Group 2). Group 1 comprised 26 males and 31 females, with a median age of 35 years and a body mass index (BMI) of 23.2 kg/m^2. Group 2 comprised 18 males and 24 females, with a median age of 34 years and a BMI of 23.5 kg/m^2. Group 2 had less morbidity (42.9% versus 75.4%, $p < 0.002$), reduced blood loss (100 ml versus 200 ml, $p < 0.001$), longer operative time (193.5 min. versus 128 min., $p < 0.001$), shorter length of hospital stay (six days versus 16 days, $p < 0.001$) than Group 1. One patient died (Group 1). There was no difference in late onset complications and no conversions to laparotomy in the laparoscopic group.

CONCLUSION: Laparoscopic STC has a longer operative time, but improves short-term outcomes compared with open surgery.

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The treatment of inflammatory bowel disease (IBD) with immunosuppressive and/or immunomodulating biological drugs has increased significantly and their role in the decreased need for surgery has been discussed continuously over the past decade [1, 2]. A population-based study found that the surgery rate within the first year of diagnosis had decreased significantly from the 1960s to the early 2000s with a significant association between "no surgery" and the use of azathioprine, 6-mercaptopurine and infliximab [3]. The same study also reported an increase in the annual incidence of inflammatory bowel disease in Denmark from 1/100,000 inhabitants in 1962-1987 to 8.6/100,000 inhabitants in 2003-2005 with a pronounced peak incidence in the age group of 16-25 year-olds.

Since first described in 1991, laparoscopic surgery has evolved and it has gained acceptance as the surgical approach for patients with IBD [4]. Laparoscopic surgery for IBD has shown a significant difference in outcome compared with open surgery [5-7].

This study was designed to compare the effect on overall morbidity of laparoscopic STC (LSTC) versus open STC (OSTC) in IBD patients.

MATERIAL AND METHODS

We performed a retrospective study on patients undergoing STC for IBD in the five-year period from January 2007 to December 2011 at our institution. The patients were identified in the hospital database and stratified into two groups based on surgical approach, open surgery (Group 1) and laparoscopic surgery (Group 2). The diagnosis was confirmed by biopsy and/or pathological examination after surgery. The surgical approach for each patient was decided exclusively by the availability of the laparoscopic team counting three surgeons. There was a short learning period for two of the surgeons who both had previous laparoscopic experience. Following this training period, the patients were operated on in both scheduled daytime and on-call hours, including weekends. Disease severity before surgery was measured using the Mayo Score (Disease Activity Index) for each patient. All patients received a fast-track post-operative regimen including early mobilization, epidural anaesthesia, restrictive post-operative fluid treatment and early enteral nutrition without the use of nasogastric tube and drains.

Each patient's chart was reviewed, and the following parameters were recorded: Gender, age, body mass index (BMI), American Society of Anaesthesiologists score (ASA), diagnosis, disease duration, treatment with immunosuppressive and/or immunomodulating biological drugs, medication duration, Mayo Score, prior abdominal surgery, operative indication (emergency/elective) where emergency surgery was defined as surgery ≤ 48 hours after indication, and elective surgery with intention to treat, operative time, estimated intra-

TABLE 1

Clavien-Dindo classification of surgical complications.

Grade	Definition
I	Any deviation from the normal post-operative course without the need for pharmacological treatment or surgical, endoscopic and radiological interventions Allowed therapeutic regimens are: drugs like antiemetics, antipyretics, analgetics, diuretics, electrolytes, and physiotherapy This grade also includes wound infections opened at the bedside
II	Requiring pharmacological treatment with drugs other than such allowed for grade I complications Blood transfusions and total parenteral nutrition are also included
III	Requiring surgical, endoscopic or radiological intervention
IIIa	Intervention not under general anaesthesia
IIIb	Intervention under general anaesthesia
IV	Life-threatening complication (including CNS complications)[a] requiring IC/ICU management
IVa	Single organ dysfunction (including dialysis)
IVb	Multiorgan dysfunction
V	Death of a patient
Suffix "d"	If the patient suffers from a complication at the time of discharge, the suffix "d" is added to the respective grade of complication. This label indicates the need for a follow-up to fully evaluate the complication

CNS = central nervous system.
"d" = "disability".
IC = intermediate care.
ICU = intensive care unit.
a) Brain haemorrhage, ischaemic stroke, subarachnoidal bleeding, but excluding transient ischaemic attacks.

TABLE 2

Patient characteristics.

	Open subtotal colectomy (n = 57)	Laparoscopic subtotal colectomy (n = 42)	p-value
Gender, n (%)			NS
Male	26 (45.6)	18 (42.9)	
Female	31 (54.4)	24 (57.1)	
Age, years, median (range)	35.0 (3-76)	34.0 (13-84)	NS
Body mass index, kg/m^2, median (range)	23.2 (17.3-35.6)	23.5 (16-37)	NS
ASA score, median (range)	2 (1-5)	2 (2)	NS
Diagnosis, n (%)			NS
Ulcerative colitis	48 (84.2)	35 (83.3)	
Crohn's disease	6 (10.5)	5 (11.9)	
Inderterminate colitis	3 (5.3)	2 (4.8)	
Disease duration, months, median (range)	26.0 (0-484)	38.0 (1-204)	NS
Immunosuppressive/modulating med., n (%)	51 (89.5)	42 (100)	NS
Medication duration, n (%)			NS
Days	2 (3.9)	0 (0)	
Weeks	4 (7.8)	0 (0)	
Months	11 (21.6)	16 (38.1)	
Years	34 (66.7)	26 (61.9)	
Prior abdominal surgery, n (%)	14 (24.6)	3 (7.1)	< 0.023

ASA = American Society of Anesthesiologists; NS = non-significant.

operative blood loss, intraoperative complications, surgical complications after surgery, post-operative complications, re-operation (≤ 30 days), length of stay (LOS), re-admission, re-admission time, complications after discharge (≤ 30 days), late-onset complications (> 30 days), 30-day mortality and follow-up time. All minor and major complications were defined prior to the study. Major complications were Clavien-Dindo Classification, Grade III and IV. Minor complications were Clavien-Dindo Classification Grade I-II (**Table 1**) [8]. Primary outcome was overall morbidity and was defined as all complications within 30 days of surgery, re-operation, re-admission and 30-day mortality (with a maximum of one event per patient). The analysis compromised only the most severe complication in each patient.

Secondary outcomes included conversion to laparotomy, estimated intraoperative blood loss, operative time, admission time and late complications, which were defined as complications occurring more than 30 days after surgery.

The statistical analysis was performed using SPSS Statistics (IBM SPSS Statistics 20.0 for Mac, SPSS Inc., Chicago, Illinois, USA) and included the Mann-Whitney U-test, χ^2-test and Fisher's exact test, as appropriate. Results are presented as number of patients and medians (with ranges). A p-value < 0.05 was considered statistically significant.

Trial registration: not relevant.

RESULTS

A total of 195 patients underwent STC. Of these, 99 patients had a diagnosis of IBD and were included in the study. The most common indication for surgery was ulcerative colitis (UC), 83.8%. A total of 57 57.6%) patients underwent open surgery (Group 1) and 42 (42.4%) patients had a laparoscopic operation (Group 2).

The two groups were well-matched on all parameters except that 24.6% of the patients in Group 1 had had prior abdominal surgery compared with 7.1% in Group 2 (p < 0.023) (**Table 2**). Medical treatment prior to surgery was similar in the two groups. Four patients in each group were treated with only prednisolon, six patients in the OSTC group received no medication. All other patients received multiple medications (both immunosuppressive and immunomodulating drugs). Disease Severity Index showed that there was no significant difference between the OSTC and the LSTC group (**Table 3**). However, the Mayo Score was lower in patients having elective open surgery (p = 0.045).

Operative data show no difference between the two groups regarding intraoperative complications (Table 3). The complications recorded were two iatrogenic injuries to the spleen and one perforation of the bowel in the OSTC group. These complications were managed intraoperatively and all had an uneventful post-operative course. No laparoscopic STC was converted into laparotomy.

Overall morbidity is summarized in **Table 4**. Major complications recorded in Group 1 were pulmonary (n = 8), cardiac (n = 2), septicaemia (n = 6), acute renal failure (n = 3), ileus (n = 9), subileus (n = 4), intraabdominal abscess (n = 4), deep wound dehiscence (n = 5), small-bowel perforation (n = 1) and peritonitis (n = 4). In Group 2, we recorded one septicaemia, four cases of ileus and one case of subileus. The most common minor complication in both groups was wound complication with 16 (28% of all patients in Group 1) and three (7.2% of all patients in Group 2) cases (p < 0.002). Other minor complications in Group 1 included pneumonia (n = 1), electrolyte disturbance (n = 2) and small-bowel fistula (n = 3), and in Group 2 pneumonia (n = 2) and small-bowel fistula (n = 1).

One patient in Group 1 died (patient with an ASA score of 5) within 30 days of surgery. The patient was transferred acutely from another hospital with multi organ failure due to extensive pancolitis and malnutrition. The patient underwent emergency operation and died of sepsis and multi organ failure 27 days after surgery. There was no mortality in Group 2.

Median LOS was 16 days (range 6-240 days) in Group 1 and six days (range 3-35 days) in Group 2 (p < 0.001). Patients without any post-operative complications had a median LOS of ten days (range 6-107 days) in Group 1 and six days (range 3-14 days) in Group 2 (p < 0.001).

Readmissions were caused by ileus (n = 4), subileus (n = 2), pain (n = 1), dehydration (n = 1) and deep wound dehiscence (n = 1) following OSTC and ileus (n = 4), pain (n = 1) and dehydration (n = 1) following LSTC. The median readmission LOS was 7.0 days (range 1-35 days) in Group 1 and 6.5 days (range 1-62 days) in Group 2. Reoperations were due to ileus (n = 5), deep wound dehiscence (n = 4), peritonitis (n = 1) and abscess (n = 1) following OSTC and ileus (n = 4) and peritonitis (n = 1) following LSTC.

Table 5 shows late complications and follow-up.

DISCUSSION

Laparoscopic surgery for IBD is regarded as safe as open surgery, even in overweight and obese patients, and it is accompanied by earlier discharge from hospital and less morbidity [7, 9-11]. It has been demonstrated that laparoscopic subtotal colectomy is comparable to open subtotal colectomy [12, 13]. However, LSTC can also be challenging in patients with IBD because of their preoperative immunosuppressive state and nutritional status. These patients often have a fragile bowel due to inflammation that requires great caution and laparoscopic routine. Another issue is that the severity of disease at the time of surgery may have an impact on the outcome.

TABLE 3

Operative data and disease severity index at the time of surgery (Mayo Score).

	Open subtotal colectomy (n = 57)	Laparoscopic subtotal colectomy (n = 42)	p-value
Operative indication, n (%)			NS
Elective	23 (40.4)	10 (23.8)	
Emergency	34 (59.6)	32 (76.2)	
Mayo Score, median (range)			NS
Elective	6 (1-10)	8 (4-11)	
Emergency	9 (4-11)	9 (7-10)	
Operative time, min., median (range)	128.0 (79-259)	193.5 (119-346)	< 0.001
Estimated blood loss, ml, median (range)	200.0 (0-3200)	100.0 (0-900)	< 0.001
Complications during surgery, n (%)	3 (5.3)	0 (0)	NS

NS = non significant.

TABLE 4

Post-operative complications. The values are n (%).

	Open subtotal colectomy (n = 57)	Laparoscopic subtotal colectomy (n = 42)	p-value
Major complications, Clavien-Dindo III-IV[a]	46 (80.7)	6 (14.3)	< 0.001
Minor complications, Clavien-Dindo I-II[a]	22 (38.6)	6 (14.3)	< 0.001
Patients with complications	28 (49.1)	11 (26.2)	0.024
Readmission	9 (15.8)	6 (14.3)	NS
Reoperation	11 (19.3)	5 (11.9)	NS
30-day mortality	1 (1.8)	0 (0)	NS
Overall morbidity < 30 days of surgery	43 (75.4)	18 (42.9)	< 0.002

NS = non-significant.
a) Total number of events recorded.

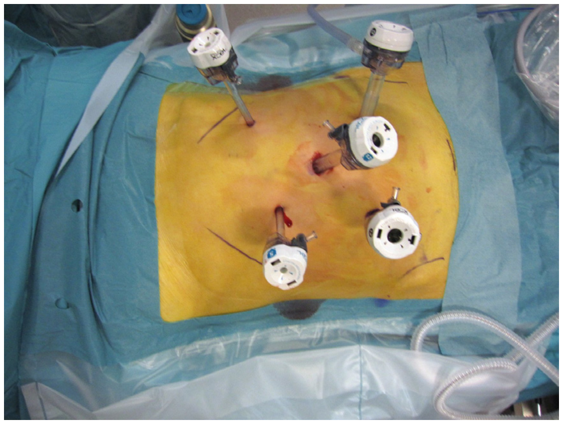
TABLE 5

Late complications and follow-up.

	Open subtotal colectomy (n = 57)	Laparoscopic subtotal colectomy (n = 42)	p-value
Late complications > 30 days post surg., n (%)	22 (38.6)	9 (21.4)	NS
Abscess, n	1	1	
Chronic abdominal pain, n	1	0	
Wound infection, n	2	2	
Wound dehiscence, n	4	1	
Hernia, n	4	2	
Small-bowel fistula, n	2	0	
Ileus, n	4	1	
Subileus, n	4	2	
Follow-up time, months, median (range)	24.0 (0-47)	16.0 (2-31)	< 0.01

NS = non-significant.

This study counted two well-matched groups regarding patient characteristics (as shown in Table 2), with only prior abdominal surgery being significantly different between the two groups. In the present series, disease severity index measured by the Mayo Score just before surgery showed no difference between the OSTC



Trocar placement in laparoscopic subtotal colectomy.

and the LSTC group. The operative approach for each patient relied exclusively on the availability of the laparoscopic team. Neither poor general condition nor prior abdominal surgery was regarded as a contraindication for a laparoscopic approach. Either a chief resident under the supervision of a senior surgeon or a specialist operated the patients in the OSTC group. The laparoscopic team comprised three senior surgeons of whom two initially underwent a training period.

Recent studies have reported the increasing rate of successful treatment of IBD patients with especially immunomodulating biological agents [1, 14]. A study by Kunitake et al [15] showed no association between perioperative influximab and an increased rate of post-operative complications.

Despite the successful treatment, it is estimated that up to 83% of patients with Crohn's disease (CD) and 25% of the UC patients will need surgical intervention at some point [3].

Our primary outcome was overall morbidity comprising post-operative complications, re-admission, re-operation and 30-day mortality. Initial results with intended LSTC for inflammatory bowel disease reported by Qazi et al showed a high risk of major complications after emergency LSTC compared with elective LSTC [16]. Another population-based study showed an association between a substantial 30-day mortality and emergency total colectomy in IBD patients (5.3%, 76/1,439 patients) [1]. We found a significantly lower overall morbidity rate in our LSTC group, with no significant difference the LSTC group was subsequently divided into elective and emergency surgery.

Five of ten elective LSTC patients (50%) had complications compared with 13 of 32 emergency LSTC patients (40.6%). Other studies have shown overall laparoscopic morbidity rates in the 21-72% range [5, 6, 10, 13, 16]. No significant difference was recorded for re-admission, re-operation and 30-day mortality between the two groups, though one death was recorded in the OSTC group.

Our secondary outcomes included conversion to laparotomy, estimated perioperative blood loss, operative time, LOS and late complications.

No conversions to laparotomy were recorded among the 42 LSTCs in Group 2, which is consistent with a study by Boyle et al [7]. Other studies have demonstrated conversion rates ranging from 3% to 34% [10, 12, 13, 16]. We found a significantly increased operative time and a significantly decreased estimated perioperative blood loss in the LSTC group than in the OSTC group, as also reported in the literature [6, 13]. The decreased estimated blood loss following laparoscopic operation may indicate less traumatic surgery especially in high-risk patients. Marceau et al suggested that a possible explanation of the increased operative time could be the laparoscopic learning curve, supporting recent results from our institution showing laparoscopic operative times nearing those of the open approach [13]. As shown in a number of studies, laparoscopic surgery shortens post-operative LOS [5, 7, 12, 16]. Reported LOS ranges from five to 11 days for laparoscopic surgery, which is consists with our median LOS of 6.0 days for our LSTC group. This was significantly shorter than the LOS seen in our OSTC group (16.0 days). LOS without any post-operative complications was also significantly shorter in the LSTC group than in the OSTC group. However, there was one elderly patient with a LOS of 107 days after uncomplicated surgery in the open group. This patient stayed admitted to hospital for social reasons (waiting for a place in a rehabilitation facility/nursing home)

Boyle et al advise caution when using LOS as an outcome of surgical effect; however, the ten days of difference observed between LOS in our two study groups must be recognized as being extremely large [7].

The median follow-up time was 24 and 16 months for OSTC and LSTC, respectively. Although the risk of incisional hernia is lower in laparoscopic surgery, two LSTC patients developed incisional hernia, and we found no significant difference in the occurrence of hernia between the two groups [5, 12].

A clear cosmetic advantage in favour of LSTC has been suggested [8, 13-14] and with 16 of the 57 patients (28.1%) in our OSTC group and 11 of the 42 patients (26.2%) in our LSTC group being ≤ 25 years of age at the time of surgery, this could have considerable impact on their future quality of life. Perhaps, small incisions combined with fewer adhesions, as reported after laparoscopic surgery, may result in a decreased rate of late complications in the future and this will possibly make it easier to treat the late surgical complications. Dowson et al [17] ascribed the fewer adhesions to a minimized peritoneal trauma in laparoscopic surgery. Hildebrandt et al [11] found a lower increase of granulocyte elastase after laparoscopic surgery than after open surgery, which they interpreted as an indication of less pronounced tissue injury after laparoscopic surgery; this finding could also explain the fact that fewer adhesions form.

We recognize that our study has several limitations including that it is a single-institution, retrospective analysis with inherent selection bias. Laparoscopic cases were performed based on the availability of the laparoscopic team, which led to the noted selection of resections between the open and laparoscopic groups. In addition, the number of patients included is small and makes for a limited material.

CONCLUSION

This study demonstrates that LSTC can offer great advantages compared with OSTC, both for the patient and the hospital. The cost of expensive laparoscopic equipment and longer operative times are balanced by the benefit of a lower overall morbidity, decreased estimated blood loss and shorter length of stay.

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