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Laparoscopic and Open Subtotal Colectomies Have Similar Short-Term Results

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Key Words
Subtotal colectomy · Inflammatory bowel disease · Laparoscopy

Abstract
Background: Laparoscopic subtotal colectomy (STC) is a complex procedure. It is possible that short-term benefits for segmental resections cannot be attributed to this complex procedure. This study aims to assess differences in short-term results for laparoscopic versus open STC during a 15-year single-institute experience. ***Methods:*** We reviewed consecutive patients undergoing laparoscopic or open elective or subacute STC from January 1997 to December 2012. ***Results:*** Fifty-six laparoscopic and 50 open STCs were performed. The operation time was significantly longer in the laparoscopic group, median 266 min (range 121–420 min), compared to 153 min (range 90–408 min) in the open group ($p < 0.001$). Median hospital stay showed no statistical difference, 14 days (range 1–129 days) in the laparoscopic and 13 days (range 1–85 days) in the open group. Between-group postoperative complications were not statistically different. ***Conclusions:*** Laparoscopic STC has short-term results similar to the open procedure, except for a longer operation time. The laparoscopic approach for STC is therefore only advisable in selected patients combined with extensive preoperative counseling.

Introduction

Laparoscopic colorectal surgery has proved itself to be technically feasible as well as oncologically safe [1, 2]. Its well-known advantages are less blood loss and less pain, a faster return to normal bowel function, a shorter in-hospital stay and an improved quality of life in the first 30 days after surgery [3].

Subtotal colectomy (STC; also referred to as total abdominal colectomy) and restorative proctocolectomy are complex laparoscopic procedures. These procedures require mobilization of all segments of the large bowel and access to both flexures, combined with advanced tech-

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niques for specimen extraction and possible ileal pouch reconstruction [4]. Indications for STC include ulcerative colitis, Crohn's disease, polyposis coli, hemorrhage, malignancy and colonic inertia [5]. Surgery for inflammatory bowel disease constitutes a particular challenge because the intestine is often inflamed and is thus more fragile.

A drawback of the widespread use of complex laparoscopic surgery for inflammatory bowel disease is the steep learning curve and the required level of expertise. As a result, prolonged operative times continue to offset the previously mentioned advantages of a laparoscopic approach [4]. Some surgeons justify the longer time with the significantly improved cosmetic result [6, 7], and claim that the recovery time is shorter [4, 8–12]; however, not all authors, even those from high-volume centers, have been able to confirm this [13]. The short-term advantages for laparoscopic STC are also thrown out by the cost of the prolonged operative time. Thus, the question is not only whether or not complex laparoscopic surgery such as STC is feasible, but whether it is advisable [14]. We hypothesized that laparoscopic STC is feasible, but might not be the procedure of choice for every patient as the short-term advantages may be overestimated.

Materials and Methods

All consecutive patients who received either a laparoscopic or open (both elective and subacute) STC from January 1997 to December 2012 in a large teaching hospital were prospectively entered into a Web-based database and analyzed. Proctocolectomies were excluded from this study. The teaching center provides a training program for laparoscopic colorectal surgery. Laparoscopic STC was mostly performed from 2002 to 2012. The choice for either open or laparoscopic surgery was based on the availability of surgeons and not on patient and disease characteristics. Subacute surgery was defined as surgery planned within a week, excluding operations performed within 12 h. Patients undergoing a laparoscopic STC were compared to controls undergoing an open procedure. Conversion from laparoscopic to open procedure was analyzed using an intention-to-treat principle. All operative procedures were performed by dedicated colorectal surgeons or residents under their supervision. Patient characteristics, operative and postoperative data were collected. Hospital stay was defined as days in hospital after the operation. Complications and mortality were followed until 30 days after surgery. In the case of a hospital stay of longer than 30 days, all inhospital complications were reported.

Surgical Technique

The operative technique has been described before [15, 16]. The medial or lateral approach of the first dissection of the mesocolon was dependent on the presence of malignancy as an operative indication. The decision for an ileorectal anastomosis or end-ileostomy was based on clinical characteristics combined with future surgery, such as restorative proctocolectomy. Location of the specimen extraction, as well as trocar position was dependent on the intraoperative findings. Conversion was defined as the need for a larger incision than strictly necessary for the specimen extraction.

Statistical Analysis

All data were entered into a database and analyzed with SPSS statistical software (version 20.0 for Windows; SPSS, Chicago, Ill., USA). Statistical analysis was performed using the Student t test, the $\chi 2$ test or the Mann-Whitney U test to determine significant differences between groups. A p value ≤ 0.05 was considered statistically significant.

Results

From January 1997 to December 2012, 1,978 laparoscopic colorectal procedures were performed in the teaching center; 56 of the patients underwent a laparoscopic STC and 50 received an open STC. In this period, 36 laparoscopic proctocolectomies were also performed, but these were excluded from the analysis. Baseline patient characteristics are comparable in both groups (table 1). The only significant difference in characteristics was the presence of a previous laparotomy in 20% of the laparoscopic patients versus 40% in the open-surgery patients. Indications for surgery were inflammatory bowel disease (IBD) in 21 (38%) and 17 (34%) and malignancy in 21 (38%) and 17 (34%) in the laparoscopic and open group, respectively. An end-ileostomy was performed in 36% of the laparoscopic group and in 56% of the open group, and an ileorectal anastomosis in 64 and 44%, respectively. An ileorectal anastomosis was combined with a deviating ileostomy in 4 patients in the laparoscopic group. Neither operation indication nor type of anastomosis showed a statistically significant difference between the 2 groups.

In the open group, 37 of 50 operations (74%) were performed by surgeons, compared to 40 of 56 (71%) in the laparoscopic group. Of the rest, at least half of the procedure was performed by surgical residents or attending surgeon-trainees, supervised by a colorectal surgeon with extensive laparoscopic colorectal experience. There were no differences in outcome or operation time between the operations performed by a surgeon and a resident or trainee under supervision.

Operative data are shown in table 2. Median operation time was significantly longer in the laparoscopic group with 266 min (range 121–420 min) compared to 153 min (range 90–408 min) in the open group ($p < 0{,}001$). In the laparoscopic group, there were 11 conversions (20%). Reasons for conversion were adhesions (n = 3), a T4 tumor (n = 3), advanced disease in IBD (n = 3), bleeding (n = 1) and a dolichocolon (n = 1). Median hospital stay was not signifi-

Table 1. Patient characteristics

	Laparoscopic (n = 56)	Open (n = 50)	p value
BMI	25±3.4	26±6.1	0.81*
Previous laparotomy	11 (20%)	20 (40%)	0.02**
Immunosuppressive medication	26 (46%)	18 (36%)	0.27**
Malnutrition	6 (11%)	8 (16%)	0.42**
Age, years	59±21.2	58±15.8	0.54*
Gender (M)	34 (61%)	23 (47%)	0.13**
Diabetes	7 (13%)	4 (8%)	0.45**
ASA 1–2 vs. ASA 3–4	38 (68%) vs. 18 (32%)	28 (56%) vs. 22 (44%)	0.21**

Data are presented as mean ± standard deviation or as counts. ASA = American Society of Anesthesiologists physical status classification system.

* Mann-Whitney U Test, ** χ^2 test.

Table 2. Operation data

	Laparoscopic (n = 56)	Open (n = 50)	p value
Operation time	266 (121–420)	153 (90–408)	<0.001
Blood loss	300 (0–1,500)	300 (0–1,600)	0.61*
Conversion rate	11 (20%)	NA	
Hospital stay	14 (1–129)	13 (1–85)	0.91

Data are presented as median and range or as percentage. Data were analyzed using the Mann-Whitney U test. NA = Not applicable.

Table 3. Postoperative complications

	Laparoscopic (n = 56)	Open (n = 50)	p value
Patients with postoperative complications	25 (45%)	14 (28%)	0.07
Anastomotic leakage	6/36 (17%)	2/22 (9%)	0.59
Cardiovascular	1 (2%)	1 (2%)	0.96
Respiratory	3 (5%)	1 (2%)	0.36
Other	15 (27%)	10 (20%)	0.41
Surgical reintervention	10 (18%)	9 (20%)	0.99
Unforeseen ICU admittance	8 (14%)	11 (22%)	0.30
Mortality	3 (5%)	5 (10%)	0.37

Data are presented as counts and were analyzed using the χ^2 test.

cantly different, with 14 days (range 7–129 days) in the laparoscopic group and 13 (range 6–30) in the open group. An ERAS (Enhanced Recovery after Surgery) program was introduced in 2006, initially for partial colectomies, so most of these procedures were not followed by ERAS.

In the group of conversions there were more complications and relaparotomies as well as longer operation times; this was, however, not statistically significant. Postoperative complications showed no statistically significant differences (table 3) between the groups, al-

though the rates of these complications were relatively high. In the laparoscopic group, 10 patients underwent a relaparotomy. Indications were anastomotic leakage (n = 6), small bowel ischemia (n = 1), intraabdominal abscess drainage (n = 2) and a deviating ileostomy for incontinence (n = 1). In the open group, 9 relaparotomies were performed. Indications were anastomotic leakage (n = 2), intraabdominal abscess drainage (n = 4) and cholecystectomy because of an acalculous cholecystitis (n = 1). Two negative relaparotomies were performed in the open group. Other complications included ileus, wound infection and urinary tract infection.

Discussion

The aim of this study was to assess whether the short-term advantages of laparoscopic colorectal surgery in general [3] can also be transferred to an extended and complex operation such as an STC; not all studies report short-term advantages [13, 16, 17]. The relatively high conversion rate of 20% compared to, for example, the conversion rate for laparoscopic rectosigmoid resections (9.9%) performed in the same hospital [18] (both in unselected populations and comparable to other centers) reflects the complexity of this procedure. We did not find any differences in short-term results such as hospital stay, and our finding of a longer operation time is confirmed in other studies [11, 13, 16, 19–22]. Postoperative complications did not show a significant difference between the open and the laparoscopic group (this was only investigated in relatively small numbers).

The small numbers investigated is a weakness in this study which was partially due to the exclusion of proctocolectomies. Inclusion of proctocolectomies would have made the study groups more heterogeneous. Hospital stay was quite long in both groups and without a difference between groups. In our opinion, this underlines the vulnerable category of patients undergoing STC in the elective and particularly the subacute setting.

The study period includes the learning phase of the laparoscopic surgeons for STC in particular. For investigating a possible effect of this specific curve during the study period, the numbers are small. When comparing two 8-year periods, we found no significant differences in operation time or postoperative complications. The laparoscopic surgeons do, however, have extensive experience with laparoscopic segmental colorectal resections; for the period of the study, almost 2,000 laparoscopic colorectal procedures were performed with good results [15, 18]. It is apparent that a laparoscopic STC is a more complex operation that requires additional experience when compared to segmental resections. Furthermore, the patients that need a (subacute) STC represent a vulnerable group, prone to a complicated postoperative course. The lack of advantage of the laparoscopic approach in a subacute setting was confirmed by others [23].

The decision about whether to perform open or laparoscopic surgery was based on the availability of surgeons, who are 'randomly' scheduled. It is often stated that laparoscopic surgery offers advantages in IBD. However, segmental and (sub)total resections are often combined in these analyses, making interpretation of these results for STCs potentially hazardous [10, 12, 24], so we only analyzed STCs, which meant the number to study was lower.

A Cochrane review shows that further studies are required for long-term results such as adhesions and the incidence of incisional hernia [25]. Other studies describe long-term advantages such as a decreased incidence of adhesive small bowel obstruction and incisional hernia as well as improved cosmesis [7, 8, 25, 26, 27]. Long-term results were not the aim of this study. Given the described high incidence of small bowel obstruction after open STC of up to 24% [28], we can speculate that for this specific long-term complication, an advantage can be expected, especially in young patients with IBD anticipating potential future surgery.

We conclude that laparoscopic STCs have short-term results similar to the open procedure, combined with a longer operating time. We were not able to find the short-term advantages in the laparoscopic group that have been described by others [4, 8–12], although some high-volume centers confirm our results [23, 29]. Considering the extended complexity of the laparoscopically performed STC compared with segmental resections, the possible benefits should be carefully weighed up against the possible disadvantages. We therefore state that the laparoscopic approach for subtotal colectomy is only advisable in selected patients, in combination with extensive preoperative counselling.

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