

# *Safety and advantages of laparoscopic-assisted colectomy*

## **Varnost in prednosti laparoskopsko asistirane kolektomije**

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### **Abstract**

**Aim.** Laparoscopic surgery for colorectal cancer, especially laparoscopic rectal surgery, has been introduced recently. Laparoscopic colectomy has developed rather slowly because of the relatively complicated anatomy and demanding surgical techniques. This study was designed to report our early experience with laparoscopic-assisted colorectal procedures done at this Department, and presents important lessons we have learned therefrom.

**Materials and Methods.** The first laparoscopic colon resection was performed at this Department on 16 January 1996. Clinical and operation records of 38 operations for benign and malignant diseases done by 2005 were reviewed. The data retrieved included patient demographics, selected intra-operative parameters, and postoperative outcomes. Similar data were collected for 1,207 case-matched open surgical procedures performed during the same period. All data were entered into a database and analysed using a statistical software package.

**Results.** The diagnoses included: cancer (92.1% vs. 95%), polyps (5.3% vs. 3.1%) and rectovaginal fistula (2.6% vs. 1.9%). In four (10.5%) cases, laparoscopy was converted to open surgery because of bleeding and locally advanced disease. The laparoscopic-assisted procedures performed included: six right hemicolectomies, nine left hemicolectomies, seven anterior resections and 16 abdominoperineal resections. The mean operative time was longer for laparoscopic-assisted colectomy than for open surgery (208 minutes vs. 150 minutes,  $P < 0.05$ ), but the mean duration of analgesic requirements (2.5 days vs. 4.5 days,  $P = 0.008$ ), mean time to resumption of oral diet (2.42 days vs. 3.95 days,  $P = 0.005$ ) and mean length of hospital stay (7 days vs. 11 days,  $P = 0.007$ ) were shorter, and the morbidity rates (13.1% vs. 40.1%,  $P < 0.05$ ) were lower. No respiratory and local wound complications were found in our laparoscopic-assisted group.

**Conclusions.** Laparoscopic-assisted colorectal surgery has proved a safe and effective treatment modality with statistically significant clinical benefits for strictly selected patients

**Key words.** Laparoscopy, colorectal cancer, operative time, morbidity, hospital stay.

## **Izveček**

**Cilj.** Laparoskopska kirurgija kolorektalnega raka, zlasti še laparoskopska rektalna kirurgija, je bila uvedena v klinično prakso šele pred kratkim. Metoda laparoskopske kolektomije se je razvijala dokaj počasi zaradi sorazmerno zapletene anatomije in zahtevne kirurške operativne tehnike. V študiji prikazujemo naše zgodnje rezultate z laparoskopsko asistirano kolorektalno kirurgijo na našem oddelku in predstavljamo pomembne izkušnje, ki smo si jih pri tem pridobili.

**Bolniki in metode.** Prvo laparoskopsko resekcijo širokega črevesa smo naredili na tukajšnjem oddelku 16. januarja 1996. Predstavljamo klinične in operativne značilnosti 38 operacij benignih in malignih bolezni širokega črevesa v letu 2005. Prikazujemo demografske podatke bolnikov, nekatere medoperativne kazalce in pooperativne izide zdravljenja. Enaki kazalci so bili zbrani pri 1207 bolnikih z različnimi klasičnimi operativnimi postopki, narejenimi v istem obdobju. Podatki so bili vnešeni v bazo podatkov in analizirani s statističnimi programi.

**Rezultati.** Vključeni so bili bolniki z naslednjimi diagnozami: rak, polipi in rektovaginalna fistula. V štirih primerih se je kirurg odločil za preklon v odprt klasični poseg zaradi krvavitve in/ali lokalno napredovane bolezni. Laparoskopsko asistirani postopki, ki smo jih izvajali, vključujejo: šest desnih hemikolektomij, devet levih hemikolektomij, sedem sprednjih nizkih resekcij in 16 abdominalnoperinealnih resekcij. Povprečni operativni čas je bil daljši pri laparoskopsko asistirani kolektomiji kot pri klasični kirurgiji, toda povprečni čas trajanja analgezije in čas, potreben za pričetek oralne prehrane in srednja ležalna doba so bili krajši, prav tako pa je bila tudi stopnja obolevnosti nižja pri laparoskopskih posegih. V laparoskopsko asistirani skupini ni bilo zapletov v dihalih ali na mestu kirurških ran.

**Zaključek.** Laparoskopsko asistirana kolorektalna kirurgija se je izkazala kot varna in učinkovita metoda zdravljenja s statistično značilnimi kliničnimi prednostmi za izbrane bolnike.

**Ključne besede.** Laparoskopija, kolorektalni rak, trajanje operacij, obolevnost, ležalna doba.

## ***Introduction***

Since the successful introduction of laparoscopic colectomy by Jacobs et al. (1), laparoscopic surgery, especially laparoscopic rectal surgery used for the treatment of colorectal cancer, has developed considerably (2-20). The evolution of laparoscopic colorectal surgery in the past decade has brought immediate short-term benefits to patients, including earlier postoperative pain relief and return of bowel function, shorter hospital stay, and better cosmesis (21-23). As compared to the open technique, the new surgical approach allows the same oncological radicality in the term of length of specimen, extent of regional lymphadenectomy, and recurrence rate (2,6,19, 24-31).

Colon and rectal surgical procedures by laparoscopic approach were introduced at this Department in 1996 (32). The aim of this study was to review our early results by comparing them with those obtained in a series of matched conventional open operations, and to identify key

lessons learned from this early experience that may be beneficial to any department embarking on laparoscopic colon and rectal surgery.

## ***Materials and methods***

Clinical and operative records of all patients undergoing laparoscopic-assisted colon and rectal surgical procedures between January 1996 and December 2004 were reviewed with the aim of obtaining clinical data, and recording selected intraoperative parameters and postoperative outcomes of these patients. All procedures were performed by at least one of the two consultant colorectal surgeons at the Department (MBB, DK), assisted by colorectal residents. These two surgeons had completed exit certification in general surgery and had attended training courses on laparoscopic colorectal surgery at overseas centres of excellence. The selection of patients was based on the preference of the operating surgeon. The initial series included only patients with benign conditions, but with improved

experience the technique began to be used in patients with malignant lesions.

All patients were given a mechanical bowel preparation a day before surgery. A combination of two antibiotics, cefuroxime (Ketocef) and metronidazole (Medazol), was infused intravenously on induction of anaesthesia. A urinary catheter and a nasogastric tube were inserted in all cases. Patients were placed in the supine or gynaecological position for the right or left hemicolectomy, respectively.

All laparoscopic colonic resections were performed after the creation of a pneumoperitoneum with carbon dioxide, either via the percutaneous insertion of a Veress needle or, if the patient had previous abdominal surgery, using the open Hasson technique. For both right and left hemicolectomy, four 10-12-mm laparoscopic trocars (Ethicon Endo-Surgery) were used. The location of the port sites depended on the site of the lesion.

For right hemicolectomy, the entire cecum, the ascending colon, and the hepatic flexure as far as the proximal third of the transverse colon were mobilized. After the right ureter, the iliac vessels, and the duodenum had been identified, the right colic and ileocolic arteries to their origin, the right branch of the middle colic artery and the distal ileum were divided intracorporeally using a laparoscopic linear stapling device (Endo-GIA, Ethicon Endo-Surgery). The distal margins of the specimen were divided extracorporeally at the level of the transverse colon through a 5-6-cm mini-laparotomy placed supraumbilically. The affected area was draped with a plastic sleeve to prevent the implantation of neoplastic cells. An extracorporeal ileocolic anastomosis was made in an end-to-end or end-to-side fashion using a hand-sewn technique. A silastic intraperitoneal drain was left in situ for as long as flatus passed.

For left hemicolectomy, the superior and mid extraperitoneal rectum, the sigmoid, the descending colon, and the splenic flexure as far as the distal third of the transverse colon were mobilized. The left ureter and the iliac vessels were identified, along with the inferior mesenteric pedicle. The inferior mesenteric artery at its origin (or after the origin of the left colic artery), the inferior mesenteric vein at the level of the

ligament of Treitz, and the superior rectum were divided intracorporeally with the endo-GIA stapler. The left colon was divided and the stapler head was placed extracorporeally through a 5-6-cm protected suprapubic mini-laparotomy (Pfannenstiel incision). Using a circular stapler a T-T stapled colorectal anastomosis was performed intracorporeally and checked with a hydro-pneumatic test. Additional intracorporeal stitches were placed to reinforce the suture and prevent gas leakage. In all patients the inferior margin of resection was below the peritoneal space after the pelvic peritoneum had been sutured. A silastic intracorporeal drain was left in place for 48 hours, and a perianastomotic extraperitoneal drain for as long as the faeces passed. All the removed specimens were measured after fixation in 10% formalin for 24 hours. The lymph nodes were dissected and counted using standard methods.

The following parameters were evaluated: conversion rate (for the laparoscopic group), operative time, resumption of gastrointestinal functions, length of hospital stay, morbidity rates within 30 days of operation, length of surgical specimen, number of harvested lymph nodes and pathological Dukes' stage.

The Student's *t*-test and the Mann-Whitney U test were used to determine the significance of the differences in mean values for continuous variables. A *P* value of <0.05 was deemed significant.

## Results

A total of 1,245 patients were enrolled in the study: 38 treated by laparoscopy and 1,207 by open surgery. The groups were matched for gender and consisted of 20 male and 18 female patients. Their mean age was 67.5 years (range; 51 – 74 yrs) (Table 1).

Table 2 shows the diagnoses for the laparoscopy group of 38 patients. Thirty-five patients were operated on for carcinoma, two had colorectal polyps and one a rectovaginal fistula. The diagnoses established in the control group are indicated in the same table.

**Table 1**

Patient characteristics.

	<b>Laparoscopic-assisted</b>		<b>Open</b>	
Number	38		1207	
Gender	Male	Female	Male	Female
	20	18	668	539
Mean age (years)	67.5		65.6	
Range	51-74		33-90	

**Table 2**

Indications for surgery.

	<b>Laparoscopic-assisted</b>	<b>Converted</b>	<b>Open</b>
Cancer	35 (92.1%)	4 (11.4%)	1146 (95%)
Polyps	2 (5.3%)	-	37 (3.1%)
Rectovaginal fistula	1 (2.6%)	-	24 (1.9%)

**Table 3**

Types of operation.

	<b>Laparoscopic-assisted</b>	<b>Converted</b>	<b>Open</b>
Right hemicolectomy	6	-	252
Left hemicolectomy	9	3	398
Anterior resection	7	1	503
Abdominoperineal resection	16	-	54
Total	38	4	1207

**Table 4**

Mean specimen length, mean number of harvested lymph nodes, and pathological stage.

	<b>Laparoscopic-assisted</b>	<b>Open</b>
Mean length of specimen (cm)	21.3 (16-29)	22.1 (15-32)
Mean number of lymph nodes	10.4 (5-17)	10.8 (4-31)
Pathological stage		
Dukes A (%)	6 (17.1)	229 (20)
Dukes B (%)	7 (20)	309 (27)
Dukes C (%)	13 (37.2)	412 (36)
Dukes D (%)	9 (25.7)	195 (17)

**Table 5**

Factors in postoperative recovery.

	Laparoscopic-assisted	Open	Sig.
Mean operative times (minutes)	208	150	<0.001
Range	80-305	90-260	
Mean duration of analgesic requirements (days)	2.5	4.5	0.008
Range	1-4	1-8	
Mean time to commencement of oral diet (days)	2.42	3.95	0.005
Range	2-8	2-11	
Mean length of stay (days)	7	11	0.007
Range	5-13	5-19	

**Table 6**

The incidence of postoperative complications.

	Laparoscopic-assisted	Open	Sig.
General complications	5	192	n.s. p>0.05
Respiratory	-	29	
Cardiac	1	16	
Urinary	2	24	
Intraabdominal haematoma	1	-	
Anastomotic dehiscence	1	120	
Local complications	-	301	s. p<0.05
Wound infection	-	279	
Wound dehiscence	-	22	
Total	5	493	s. p<0.05

Four (10.5%) of the 38 procedures attempted laparoscopically required conversion to open surgery: two because of excessive bleeding occurring during dissection, and two because of locally advanced disease which made the dissection technically difficult. Table 3 shows the remaining 34 laparoscopic-assisted procedures which were completed successfully.

The mean tumor size in the 35 cancer patients undergoing laparoscopic-assisted procedures was 4.5 cm (range; 2.2-10.5 cm). The mean specimen length in the laparoscopic-assisted and open surgery groups was 21.3 cm and 22.1 cm, respectively (P>0.05). The mean number of lymph

nodes identified in the specimens resected laparoscopically was 10.4 vs. 10.8 in the open group specimens (P>0.05). The distribution of patients by the Dukes' stage was similar (Table 4).

The laparoscopic approach required significantly longer times in the operating room. The mean operative time was 150 minutes (90-260) for the open procedure, and 208 minutes (80-305) for the laparoscopic-assisted operation, averaging an additional 58 minutes in this series (Table 5). The number of days patients required parenteral opiates was significantly less in the laparoscopic cohort, i.e. a mean of 2.5 days compared to 4.5

days in the open group ( $P=0.008$ ). As concerns the commencement of oral feeding, the laparoscopic-assisted group took a significantly shorter time than the open surgery group, i.e. 2.42 days versus 3.95 days ( $P=0.005$ ). Similarly, laparoscopic-assisted group was discharged from the hospital significantly earlier than the open group (mean; 7 vs. 11 days) (Table 5). General complications were established in five (13.1%) patients in the laparoscopic-assisted group, as compared to 192 (15.9%) in the open group (Table 6). The laparoscopic groups had no respiratory or wound complications, which was not the case in the open-resection group (301 of 1,207).

## **Discussion**

Minimally invasive surgical procedures are associated with well-described patient benefits, which include: less postoperative pain, shorter period of ileus, reduced hospital stay, and improved cosmesis (21-23). The benefits of laparoscopic-assisted colorectal procedures, however, have not been consistently demonstrated (33,34).

Laparoscopic bowel surgery was introduced at this Department in 1996. The results of this analysis of our early experience serve as the audit database, as well as the reference for our practice.

Both groups were comparable concerning the demographic distribution of patients. The indications for surgery were similar in both groups, yet not identical in number. The decision for using the minimally invasive approach was invariably made by the operating surgeon. Large, bulky and advanced tumors were excluded. The initial series included mainly patients who required a loop diversion colostomy for advanced cancer in the lower third of rectum. Laparoscopic stoma creation is an ideal prelude to the more complex laparoscopic colorectal resections: it is less technically demanding and carries much lower morbidity rates, and, in addition, it familiarizes the surgical team with the operating room setup and with various technical manoeuvres, such as bowel handling and mobilisation.

The identical number of lymph nodes harvested in both the laparoscopic-assisted and open surgery group with cancers (10.4 vs. 10.8) suggested

a comparable adequacy of oncological clearance in these patients, a point that has been proven in several studies (35,36). The laparoscopic-assisted group did have a significantly longer mean operative time than the open group, yet it was progressively reduced with increased experience, as is generally the case in laparoscopic surgeons. Our conversion rate of 10.5% fell within the range reported in the literature. Hopefully, it will further improve with a larger number of laparoscopic procedures being performed routinely.

A significant advantage conferred by the laparoscopic-assisted technique was reduced duration of analgesic requirements (2.5 vs. 4.5 days;  $P=0.008$ ), which was probably due to a smaller incision length. Similarly, the laparoscopic group tolerated oral diet sooner than the open surgery patients (2.42 vs. 3.95 days;  $P=0.005$ ), and had a significantly shorter hospital stay than the open group (mean 7 vs. 11 days;  $P=0.007$ ).

Despite the established absolute difference in the overall complication rate, no significant differences were found between the two groups as concerns the general complication rate. On the other hand, the laparoscopic-assisted group showed no pulmonary complications and no local wound complication, while the wound-related complication rate in the open group was 24.9%.

Our experience to date indicates that laparoscopic-assisted colon and rectal procedures used in selected patients are safe. They confer significant advantages in terms of decreased morbidity, faster postoperative recovery and preservation of functional status. Early experience should be acquired from performing technically simple procedures, such as abdominoperineal resection, before progressing to definitive resections, i.e. right and left hemicolectomy or anterior rectal resections for cancer.

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