

Can community surgeons perform laparoscopic colorectal surgery with outcomes similar to tertiary care centres?

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Introduction: The use of the laparoscopic approach in colorectal surgery (LCS) is the subject of active debate. Studies demonstrating its safety and feasibility in tertiary care centres are now available. The aim of this study was to examine the results of LCS performed in a community hospital setting. **Methods:** We prospectively studied 100 patients who underwent an LCS at the North Bay District Hospital (a 200-bed community hospital located 350 km away from the nearest tertiary care centre). All operations were performed by 2 community surgeons who transitioned themselves from an open to a laparoscopic approach. **Results:** Between October 2000 and December 2003, 100 patients (56 women and 44 men, mean age 64 yr) underwent an LCS for benign ($n = 54$) and malignant ($n = 46$) disease. Median operating time was 165 minutes (range 70–350 min), and the conversion rate was 10%. The intraoperative complication rate was 3%. There were 10 major postoperative complications and 14 minor postoperative complications. There was no intraoperative mortality and one 30-day mortality secondary to cardiogenic shock. The median length of stay was 4.5 days (range 2–45 d). At a mean follow-up of 18 months, no trocar site or wound recurrences were noted. The mean number of resected lymph nodes was 10.6. **Conclusion:** Our study suggests that it is possible for community surgeons to transition themselves from an open to a laparoscopic approach and to perform LCS with outcomes similar to those of tertiary care centres.

Introduction : La chirurgie colorectale par laparoscopie (CCL) fait actuellement l'objet de débats. Il existe maintenant des études qui en démontrent la sécurité et la faisabilité dans les centres de soins tertiaires. Cette étude visait à analyser les résultats de la CCL pratiquée en contexte d'hôpital communautaire. **Méthodes :** Nous avons étudié de façon prospective 100 patients qui ont subi une CCL à l'Hôpital de district de North Bay (hôpital communautaire de 200 lits situé à 350 km du centre de soins tertiaires le plus proche). Toutes les interventions ont été pratiquées par deux chirurgiens communautaires qui ont effectué eux-mêmes la transition de la technique ouverte à la laparoscopie. **Résultats :** Entre octobre 2000 et décembre 2003, 100 patients (56 femmes et 44 hommes âgés en moyenne de 64 ans) ont subi une CCL pour une maladie bénigne ($n = 54$) et un cancer ($n = 46$). La durée médiane de l'intervention s'est établie à 165 minutes (intervalle de 70 à 350 min) et le taux de conversion a atteint 10 %. Le taux de complications intraopératoires s'est établi à 3 %. Il y a eu 10 complications postopératoires majeures et 14 mineures. Il n'y a pas eu de mortalité intraopératoire et on a enregistré un décès à 30 jours à la suite d'un choc cardiogène. La durée médiane du séjour s'est établie à 4,5 jours (intervalle de 2 à 45 j). Au suivi moyen de 18 mois, on n'a constaté aucune récurrence au point d'entrée du trocart ou au niveau de la plaie. Le nombre moyen de ganglions lymphatiques résectés s'est établi à 10,6. **Conclusion :** Notre étude indique qu'il est possible pour les chirurgiens communautaires d'effectuer eux-mêmes la transition de la technique ouverte à la laparoscopie et de procéder à des interventions de CCL qui produisent des résultats semblables à ceux des centres de soins tertiaires.

In the last decade, minimally invasive techniques have revolutionized the way we approach abdominal surgery. Laparoscopic cholecystec-

tomy is now considered a standard of care, and laparoscopy is being applied to other surgical procedures including antireflux surgery, appendectomy,

hernia repair and splenectomy. Since the first report of laparoscopic colectomy in 1991,¹ developments in the field of laparoscopic colorectal surgery

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(LCS) have been rapid, and LCS has been demonstrated to be safe and feasible in tertiary care centres, with many published series in the literature.²⁻¹² However, whether this approach is safe and feasible in a community hospital setting remains to be evaluated. The purpose of this study is to present the results of the first 100 laparoscopic colorectal procedures performed in a community hospital by 2 surgeons who transitioned themselves from an open to a laparoscopic approach.

Methods

From October 2000 to December 2003, 100 patients admitted for elective colorectal surgery underwent a laparoscopic approach. The first 20 cases were limited to benign disease, with the exception of case number 12, an elderly female with multiple comorbidities and a small sigmoid cancer. During the first 40 resections, 29 cases were excluded from the laparoscopic approach (13 right hemicolectomies, 3 left hemicolectomies, 8 sigmoid resections, 2 anterior resections and 3 abdominal-perineal resections). Exclusion criteria included large tumours (> 5 cm), multiple previous surgeries and large body habitus (body mass index [BMI] > 40). Of the remaining 60 cases, no patients were excluded from a laparoscopic approach. The 2 general surgeons involved in this study were in private practice in North Bay for fewer than 5 years and had no formal training in advanced laparoscopic surgery. For the first 25 cases, the surgeons worked with each other. During the remainder of the series, the surgeons were assisted primarily by general practitioners.

The North Bay District Hospital is a 200-bed acute care rural hospital in Northern Ontario that serves a community of 50 000 people with a surrounding catch of approximately 50 000. The closest tertiary care centre is 350 km away. All patients were referred by their family physicians.

Data were prospectively entered into a database that was developed and maintained by the surgeons who performed the procedures (Table 1).

Wound infection prophylaxis (bowel preparation and antibiotics) and deep vein thrombosis prophylaxis (5000 units subcutaneous heparin 1 hour preoperation) were routinely used. Informed consent was obtained before the surgery.

Pneumoperitoneum was achieved with Veres needle insufflation in the left upper quadrant. A direct vision trocar was used to enter the abdominal cavity in various quadrants, depending on the procedure. A lateral approach was used for each procedure, and dissection was performed with the Ultrasonic shears (Ultracision Harmonic Scalpel, Ethicon Endosurgery, Cincinnati, Ohio). High ligation of major mesenteric vessels was performed intracorporeally with endoliner staplers (Endo GIA Universal 12 mm, with an Endo GIA Reticular 30–2.0 mm load, Auto Suture, US Surgical Corporation, Norwalk, Conn.). For right-sided procedures, bowel resection and a side-to-side stapled anastomosis (Multifire GIA 60, 3.8 mm load and TA 90, 3.5-mm load, Auto Suture, US Surgical Corporation) was performed extracorporeally through a small midline incision. For left-sided colectomies, the bowel was transected intracorporeally with endoliner staplers (Endo GIA Universal 12 mm with a 45–3.5 mm load, Auto Suture, US Surgical Corporation). The specimen was then exteriorized and resected through a small muscle splitting

incision in the left lower quadrant. Reconstitution of the bowel was performed under laparoscopic vision with an end-to-end stapled anastomosis (Premium Plus CEEA 25–31 mm, Auto Suture, US Surgical Corp). When laparoscopic abdominal perineal resection was performed, the specimen was extracted through the perineum.

After the operation, early ambulation was encouraged. Nasogastric tubes were used temporarily to decompress the stomach during the procedure and were then removed. All patients were started on a clear fluid diet immediately after the operation. The decision to increase the feedings was based on the presence of bowel sounds and the ability of patients to tolerate clear fluids. Patients were discharged when they were tolerating a regular diet and passing flatus.

Results are reported as mean (standard deviation [SD]) or median (range) where appropriate. Results were evaluated with 2-tailed Student's *t* test and Fisher's exact test when appropriate. A *p* value of less than 0.05 was considered significant.

Results

The study group included 100 patients who underwent laparoscopic colorectal surgery for benign and malignant disease. There were 56 women and 44 men. The mean age was 64 years (SD 13.6 yr) and the mean American Association of Anesthesiologists (ASA) score was 2 (SD 0.7). The mean BMI was 27 (SD 5.1) and was

Table 1

Database fields			
Patient data	Operative data	Outcomes	Pathology
Age/sex	Date	Conversion	Length of specimen
BMI	Operative times	Intraoperative complications	Margins
ASA score	Assistants	Postoperative complications	TNM classification
Preoperative tests	Nurses	Follow-up	Recurrence to last follow-up
BMI = body mass index; ASA = American Society of Anesthesiologists; TNM = tumour/nodes/metastases.			

calculated according to the height and weight recorded on the anesthesia chart. For the first 40 cases, BMI ranged from 16 to 40. For the remaining cases, for which no patients were excluded from a laparoscopic approach, BMI ranged from 19 to 45.

The most common indication for surgery was malignant disease (46 patients), followed by diverticular disease (31 patients) and polyps (13 patients) (Table 2). The most common procedures performed were sigmoid resections (35 patients) and right hemicolectomies (21 patients) (Table 3). Ten patients were converted to open surgery (Table 4). The median operating time was 165 minutes (range 70–350 min).

There were 3 intraoperative complications and 24 postoperative complications (Table 5). The 3 intraoperative complications involved hemorrhage managed by conversion and included a tear to the inferior pole of the spleen, an injury to the sacral venous plexus and an injury to the colonic mesentery. Of the 24 postoperative complications, 14 were minor and 10 were major. The 14 minor complications included 11 wound infections, 1 seroma, 1 pneumonia and 1 episode of congestive heart failure. The 10 major complications included the following:

- 2 anastomotic leaks requiring reoperation (treated with defunctioning stomas)
- 2 postoperative cases of intra-

abdominal bleeding requiring reoperation (in both cases, a large hematoma was evacuated, but no active cause of bleeding was found)

- 1 early anastomotic stricture (managed with balloon dilatation)
- 3 small bowel obstructions requiring reoperation (1 was secondary to inadvertently suturing the seromuscular layer of small bowel to the abdominal wall, and 2 were caused by adhesions in the pelvis)
- 1 colovaginal fistula after a low rectal cancer resection (treated with a defunctioning stoma)
- 1 wound dehiscence (patient with severe long-term obstructive pulmonary disease).

There was no intraoperative mortality and 1 postoperative mortality. The postoperative mortality was a 71-year-old woman with long-term obstructive pulmonary disease (on home oxygen) and severe peripheral vascular disease. The patient had severe recurrent diverticulitis, which had failed medical management. She had a complete preoperative medical evaluation and underwent a routine elective sigmoid resection without any intraoperative complications. On postoperative day 3, she developed cardiogenic shock and succumbed to multiple organ failure.

The median length of stay for the entire series was 4.5 days (range 2–45 d) (Table 6). The median length of stay for the 90 patients who had a successful laparoscopic approach was 4.0 days (range 2–42 d) and for the 10 patients who were converted to open surgery was 12.5 days (range 6–45 d).

Of the 100 laparoscopic colorectal resections, 46 were performed for malignant disease. There were no trocar site recurrences and no wound recurrences at a mean follow-up of 18 months (SD 8.0 mo). In cases where resection was performed with curative intent, there were no locoregional recurrences at a mean follow-

Table 2

Indications for surgery	
Indication for surgery	No. of cases
Adenocarcinoma	46
Diverticulitis	31
Polyp	13
Inflammatory bowel disease	5
Intussusception	1
Duplication cyst	1
Fecal incontinence	1
Radiation proctitis	1
Blunt trauma	1

Table 3

Laparoscopic colorectal procedures performed	
Surgical procedures performed	No. of cases
Ileocecal resection	4
Ileorectal anastomosis	1
Right hemicolectomy	21
Transverse colon resection	3
Left hemicolectomy	9
Sigmoid resection	35
Low anterior resection	12
Hartmann's procedure	3
Hartmann's reversal	5
Subtotal colectomy	2
Proctocolectomy	1
Proctectomy	1
Abdominal perineal resection	3

Table 4

Factors leading to conversion to open surgery	
Indication for conversion	No. of cases
Inflammation	2
Tumour bulk	2
Rectal stump mobilization	1
Appropriate TME dissection	1
Splenic laceration	1
Difficult subtotal colectomy	1
Pelvic hemorrhage	1
Mesentery hemorrhage	1

TME = total mesorectal dissection.

Table 5

List of postoperative complications	
Postoperative complications	No. of cases
Major complications (n = 10)	
Small bowel obstruction	3
Intra-abdominal hemorrhage	2
Anastomotic leak	2
Anastomotic stricture	1
Fistula	1
Wound dehiscence	1
Minor complications (n = 14)	
Wound infections	11
Pneumonia	1
Seroma	1
Congestive heart failure	1

up of 18 months (SD 8.0 mo). The mean number of nodes resected was 10.6 (SD 6.0).

Discussion

Many reports from tertiary care centres have demonstrated that laparoscopic colorectal surgery is safe and feasible for both benign and malignant disease.^{6-11,13-15} However, whether the same results can be reproduced in a community hospital setting has not yet been demonstrated.

The 2 community surgeons transitioned themselves from open to laparoscopic colorectal surgery. As part of this transition, no hand-assist devices were used. The laparoscopic experience of each surgeon before the colorectal case series consisted primarily of cholecystectomy and ap-

pendectomy. During the colorectal case series, the surgeons also developed laparoscopic antireflux surgical experience. During case 31, the surgeons did receive proctoring from an expert surgeon from the Centre for Minimal Access Surgery (CMAS) at McMaster University in Hamilton, Ontario. During the second half of the series, as part of a collaborative research effort with CMAS, the surgeons evaluated various mentoring techniques, including telementoring and telerobotic assisting. Also, during collaboration with CMAS, one of the surgeons accepted an appointment at CMAS as faculty staff.

In our study, there was a 10% conversion rate, which is similar to rates reported by tertiary care centres.^{6,7,10,11} As identified by Schlachta and colleagues, the surgeon's laparo-

scopic colorectal experience and a diagnosis of malignancy were factors predicting the risk of conversion.¹⁶ We noted that oncological concerns (regarding tumour bulk and the ability to perform an adequate total mesorectal excision) accounted for 30% of our conversions. The median operating time for our series was 165 minutes (range 70–350 min) and is within the range reported by tertiary care centres.^{7,10,11}

In our series, the rates of intraoperative (3%) and postoperative complications (14% minor complications, 10% major complications) are well within the range published by tertiary care centres.^{6,7,10,11} We did, however, note a high wound infection rate early in the series (26% or 9/34 patients). In May 2002, after case 34 in the series, a change in the protocol for wound infection prophylaxis and the routine use of a wound protector were introduced (Table 7). After this change, the wound infection rate decreased to 3% ($p < 0.001$).

Our median length of stay for the entire series was 4.5 days (range 2–45 d), which is similar to results reported by tertiary care centres.^{7,10,11} We confirm that the laparoscopic approach combined with early feedings, early ambulation and a proactive nursing team leads to an early discharge in a community hospital setting.

Laparoscopic colorectal resection for carcinoma continues to illicit debate. Early reports of trocar site recurrence and wound recurrence rates of up to 10% led to concerns regarding the laparoscopic approach for malignancy.¹⁰ In the more recent literature, trocar site recurrence is estimated at less than 2%.¹⁷⁻²⁰ At a mean 18-month follow-up, we noted no trocar site or wound recurrences.

The appropriateness of laparoscopic rectal cancer surgery in view of the absence of evidence for equivalent outcomes had been considered. We were aware that surgeons in tertiary care centres were performing laparoscopic rectal cancer surgery in

Table 6

Length of stay		
Length of stay analysis	No. of patients	Length of stay, d; Median (range)
Entire series	100	4.5 (2-45)
Successful laparoscopic approach	90	4 (2-42)
Uncomplicated post-operative course	72	4 (2-12)
Complicated post-operative course	18	5 (3-42)
Converted to open surgery	10	12.5 (6-45)
Uncomplicated post-operative course	3	7 (6-7)
Complicated post-operative course	7	15 (9-45)

Table 7

Protocol for wound infection prophylaxis		
Protocol components	Before May 2002	Since May 2002
Routine wound protection	None	Wound protector (Steri-Drape 3M Health Care)
Bowel preparation	4 L CoLyte day before OR, clear fluid diet day before OR	4 L CoLyte day before OR Clear fluid diet day before OR
Oral antibiotic prophylaxis	None	Ciprofloxacin 500 mg PO Methronidazole 500 mg PO Given evening before OR
IV antibiotic prophylaxis	Cefotetan 1 g IV given in pre-admit clinic	Ampicillin 1 g IV Gentamycin 100 mg IV Methronidazole 500 mg Given in OR

OR = operating room; PO = orally; IV = intravenous.

the absence of randomized controlled trials. We felt that this tumour site could be included in our case series as long as the outcome results were being followed through the database. During the first half of the case series, 3 rectal cancers were attempted laparoscopically, and all were converted because of oncological concerns with the total mesorectal excision resection.

The question regarding the appropriate number of lymph nodes per specimen is also an area of debate. In the laparoscopic colorectal literature, the mean number of lymph nodes retrieved ranges from 6 to 14.²⁰⁻²³ The mean number of nodes in our series was 10.6 (range 1-27), which is well within the published range.²⁰⁻²³ The actual number of lymph nodes retrieved from a specimen is influenced by the extent of the oncological resection, as well as the quality of the pathological evaluation. Recently, we have received educational sessions targeting the importance of an oncological resection and adequate pathological harvest. As well, the pathology department has hired a pathology technician and a new pathologist. Since these changes, we have noticed a significant increase in lymph node counts from our specimens.

Conclusion

The results of this study suggest that it is possible for community surgeons to perform laparoscopic colorectal surgery for benign and malignant disease with short-term outcomes similar to tertiary care centres. We also suggest that it is possible for community surgeons with no formal training in advanced laparoscopic surgery to transition themselves from an open to a laparoscopic approach and perform laparoscopic colorectal surgery with short-term outcomes similar to tertiary care centres.

Competing interests: None declared.

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