



## Laparoscopic colorectal resection: short-term outcomes after 60 procedures – A single center initial experience

### Laparoskopska hirurgija kolona i rektuma – naša iskustva nakon 60 učinjenih procedura

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#### Abstract

**Background/Aim.** Laparoscopic colorectal surgery is now widely accepted surgical method in the treatment of malignant and benign colorectal diseases. It is getting constantly more supporters due to its positive effects on enhanced patient recovery. The aim of this study was to determine the safety of minimally invasive approach as well as perioperative data, oncologic results and postoperative data. **Methods.** Prospective observational cohort clinical study was carried out at the Department for Colorectal and Pelvic Oncologic Surgery, First Surgical University Hospital, Clinical Center of Serbia, Belgrade. We analyzed demographics records concerning the type of surgery, clinicopathological features and oncological data for all operated patients. Records on early postoperative follow-up were also evaluated. **Results.** Laparoscopic colorectal resection was performed in 60 patients. Mean age of patients was 65 (29–87) years. Majority of patients were man, 37 (62%) of them. The most

common indication was colorectal cancer (43 patients, 71.6%); 12 (20%) patients were operated due to the colorectal polyps unfitted for colonoscopic resection and 5 (8.3%) were operated due to Crohn's disease. Average number of lymph node harvested in patients with colorectal carcinoma was 22.5 (6–52). We achieved negative resection margins in all patients operated due to carcinoma. Mean duration of hospital stay was 5 (4–12) days. Postoperative complications were encountered in 5 (8.3%) patients. Overall mortality rate was 1.7% (1 patient died due to thromboembolism). **Conclusion.** This study showed that initiation of laparoscopic colorectal resection is feasible and safe with short hospital stay, adequate oncologic resection and number of lymph node harvested.

#### Key words:

colonic neoplasms; digestive system surgical procedures; laparoscopy; postoperative complications; rectal neoplasms.

#### Apstrakt

**Uvod/Cilj.** Laparoskopske operacije kolona i rektuma su široko prihvaćene i koriste se u tretmanu malignih i benignih oboljenja. Zbog značajno bržeg oporavka bolesnika sve veći broj hirurga uči i podržava ovu metodu. Cilj rada bio je da se utvrdi bezbednost minimalno invazivnog pristupa, kao i procena perioperativnih rezultata, onkoloških rezultata i postoperativnih podataka. **Metode.** Prospektivna opservaciona kohortna klinička studija je sprovedena na IV Odeljenju za kolorektalnu i pelvičnu onkološku hirurgiju Klinike za digestivnu hirurgiju – Prve hirurške Kliničkog Centra Srbije. Kod svih operisanih bolesnika analizirani su demografski podaci, patohistološke karakteristike tumora, vrsta hirurške

intervencije, kao i rane postoperativne komplikacije. **Rezultati.** Laparoskopska kolorektalna resekcija je učinjena kod 60 bolesnika koji su imali maligne i benigne lezije. Njihova prosečna starost je iznosila 65 (29–87) godina. Operisano je 37 (62%) muškaraca i 23 (38%) žena. Zbog kolorektalnog karcinoma operisana su 43 (71,6%), zbog polipa 12 (20%) i Kronove bolesti 5 (8,3%) bolesnika. Kod bolesnika sa kolorektalnim karcinomom, prosečno je odstranjeno 22,5 (6–52) limfnih nodusa. Negativne hirurške margine su postignute kod svih bolesnika sa karcinomima. Dužina hospitalizacije je iznosila 5 (4–12) dana. Postoperativne komplikacije su zabeležene kod 5 (8,3%) bolesnika. Zabeležen je jedan smrtni ishod (1,7%) zbog tromboembolije. **Zaključak.** Ova studija je pokazala da se laparoskopska kolorektalna hirurgija može

bezbedno izvoditi, uz nizak procenat postoperativnih komplikacija, kratko vreme boravka u bolnici, uz adekvatnu hiruršku resekciju i broj odstranjenih limfnih nodusa.

**Ključne reči:**

**kolon, neoplazme; hirurgija digestivnog sistema, procedure; laparoskopija; postoperativne komplikacije; rektum, neoplazme.**

## Introduction

Laparoscopic colorectal surgery is developing strongly, and is becoming the mainstay treatment option for colorectal cancer and benign colorectal diseases in developed countries. It has been recognized as a first treatment option for colorectal cancer according to some leading surgical associations. The first colorectal laparoscopic resection was reported by Jacobs et al.<sup>1</sup> in 1991, while Watanabe et al.<sup>2</sup> were first to report results of laparoscopic colorectal resection for colon cancer in 1993<sup>2</sup>.

In the development of the procedure laparoscopy was reserved for smaller, early cancers. For instance, starting in 1996, health insurance in Japan covered expanses of laparoscopic colorectal resection only for early stages cancer. With the advance of surgical technique and followed with technological innovations, laparoscopy was introduced for larger and advanced tumors, and currently is being recognized as equally effective to open colorectal resection even for this indication<sup>3,4</sup>. According to Japan's National Registry for Colorectal Cancer, 40,000 colorectal resections are being performed yearly, which compares number of open procedures. The trends are similar in Europe; for example, in Great Britain in 2012, 40% of colorectal resections were performed laparoscopically, comparing to only 5% in 2005<sup>5</sup>.

The reasons beyond the drawbacks in the development of laparoscopic colorectal surgery were technique difficulties, lack of clinical evidence, learning curve and fear of tumor spreading during laparoscopy. Current evidence, however, strongly suggest that there are no statistically significant differences between open and laparoscopic surgery regarding the incidence of tumor local recurrence, distant metastases or disease free survival<sup>6-9</sup>.

Proper surgical training, as well as prior experience with open procedures must back up the initiation of laparoscopic colorectal surgery. The goal of this study was to present the initial experience of single institution with the special emphasis on safety ie. early complication rate analysis<sup>5</sup>.

## Methods

This prospective observational cohort clinical study was conducted at the Department for Polorectal and pelvic Sncologic surgery, First Surgical University Hospital, Clinical Center of Serbia, Belgrade starting from January 2015 till January 2018.

The study included 60 patients in whom laparoscopic colorectal resection was performed for benign and malignant colorectal diseases. The database was created and tracked prospectively and included: demographic data, records about surgical intervention, and in colorectal carcinoma cases, his-

tological report which included TNM tumor stage, number of lymph nodes harvested and surgical margins analysis. For the purpose of this study 30 days follow-up data were analyzed with the intent of early postoperative complications evaluation.

Primary aim was safety of minimally invasive (MI) approach, while secondary aims were perioperative data (duration, blood lose), oncological results (number of lymph nodes) and postoperative data (excluding complications).

Prior to surgery all patients underwent diagnostic protocol, which included colonoscopy, rigid rectoscopy, abdominal and pelvic computed tomography and pelvic magnetic resonance imaging (MRI) scan for rectal carcinoma. The preoperative radiographic tumor stage was given for all patients with colorectal cancer, regarding the locoregional tumor status and presence of distant metastases.

All patients were properly informed about the surgical intervention and signed informed consent.

Preoperative bowel preparation was performed using the polyethylene glycol solutions. Prophylactic antibiotics and low molecular weight heparin were routinely employed.

### *Surgical technique*

The patients were placed supine, with head down position. The peritoneal cavity was accessed with open Hasson approach and the carbon dioxide was insufflated, maintaining the intraabdominal pressure of 10–12 mmHg. In the case of colorectal cancer surgical resection was performed according to The American Joint Committee on Cancer (AJCC) recommendations<sup>10</sup>.

In the case of right colectomy, extracorporeal hand sewn anastomosis was performed. In the case of left colon or rectal cancer intracorporeal anastomosis was performed using “double stapler technique”.

All surgical specimens underwent detailed histopathological examination.

Postoperatively nasogastric tube was kept for couple of hours (until patients were full awake); peroral intake of clear fluids was initiated at the day of surgery, followed by soft food diet on the first postoperative day. Abdominal drain was extracted on the second postoperative day. First regular clinical check-up was conducted 30 days after surgery, earlier in case if patients reported any kind of digestive symptomatology. Operative morbidities were defined as complications that lead to prolonged hospitalization or any type of other medical intervention including reoperation, induced by operative treatment.

Morbidity was reported according to the National Cancer Institute Common Toxicity Criteria: grade I of postoperative complications – asymptomatic or mild symptoms (clini-

cal or diagnostic observations only); grade II – moderate (minimal, local or noninvasive intervention indicated; limiting age-appropriate instrumental activities of daily living - ADL); grade III – severe or medically significant but not immediately life threatening (hospitalization or prolongation of existing hospitalization indicated; disabling; limiting self-care ADL); grade IV – life-threatening consequences (urgent intervention indicated), and grade V – death<sup>11</sup>.

## Results

At the Department for Colorectal and Pelvic Oncological Surgery, 60 patients underwent laparoscopic colorectal resection in the observed period due to malignant and benign lesions. Mean age of patients was 65 (29–87) years. Majority of patients were man, 37 (62%) of them. The most common indication was colorectal cancer – 43 (71.6%), 12 (20%) patients were operated due to the endoscopically unresectable colonic polyp resection and 5 (8.3%) were operated due to Crohn's disease.

Detailed number and type of the surgical procedures performed is shown in Table 1.

**Table 1**  
**Types of laparoscopic procedures performed**

Procedure	Patient n (%)
Low anterior resection	12 (20)
Low anterior resection + loop ileostomy	3 (5)
Right hemicolectomy	29 (48.3)
High anterior resection	8 (13.3)
Left hemicolectomy	8 (13.3)
Total	60 (100)

In patients with colorectal cancer, average number of lymph nodes harvested was 22.5 (6–52). Results of the histopathological analysis are shown in Table 2.

**Table 2**  
**Histopathologic characteristics of patients with colorectal cancer (n = 37)**

Characteristics	Grade n (%)
T stage	
<i>in situ</i> carcinoma	5 (13.5)
1	6 (16.2)
2	8 (21.6)
3	16 (43.2)
4	2 (5.4)
N stage	
0	28 (75.7)
1	6 (16.2)
2	5 (13.5)
Number of retrieved lymph nodes, median (range)	22.5 (6–52)

**T – tumor; N – node**

Mean duration of the procedure was 182 min (range 120–270 min). The duration of the procedure was influenced

by the learning curve, since the mean duration of the last 10 procedures was 155 min. Mean duration of ileocecal resection and right hemicolectomy was 169 min (range 120–252 min), for left hemicolectomy and high anterior resection 202 min (156–246 min) and for low anterior resection with or without ileostomy 232 min (192–270 min).

Among the 7 (7/67, 10.4%) patients who underwent laparoscopic conversion to open surgery, five conversions were performed due to huge body mass index (BMI), one because of the bowel distension caused by intestinal occlusion and one due to the peritoneal dissemination.

Mean duration of hospital stay was 5 (4–2) days.

Postoperative complications were encountered in 5 (8.3%) patients. Three patients were conservatively treated due to the postoperative bowel paresis (Grade III), one patient was reoperated due to colonic ischemia (Grade IV) and one patient suffered a myocardial infarction followed with massive mesentery thrombosis. This patient was reoperated and died on the 30th postoperative day due to another myocardial infarction (Grade V). Overall, mortality rate in this study population was 1.7%.

## Discussion

This clinical study was performed in order to present initial experience in performing laparoscopic colorectal resections in the high volume center, specialized in colorectal cancer and pelvic oncology surgery, with a high number of oncological procedures performed by open surgery. Primary endpoint was safety of MI approach. Secondary aims were perioperative data (duration), oncologic results (number of lymph nodes) and postoperative data (excluding complications).

In this study 7 patients underwent conversion to open procedure (7/60), or 11.6% of overall procedures number, which is comparable with the literature results, especially those analyzing learning curve<sup>12–14</sup>. If we analyze the number of conversions to open surgery per year, there is a significant drop (3 conversions in first and second year, one conversion in third year). Five conversions were performed due to huge body mass index (BMI), one because of the bowel distension caused by intestinal occlusion and one due to the peritoneal dissemination. This can also be partially explained by a learning curve. It is now a standpoint that patients with high BMI and visceral adiposity have the biggest advantage with MI surgical treatment. However, one must observe that those patients are being operated only by the experienced (high volume) surgeons<sup>15</sup>.

Incidence of complications is not statistically different when results of open surgery are compared with laparoscopic surgery<sup>16, 17</sup>. In this study early postoperative complications were observed in 5 (8.3%) patients. These results partly coincide with the ones reported in huge surgical series with MI colorectal resections such as study by Juo et al.<sup>18</sup> who have reported 19.8% of complications on 116,261 operated patients, or Kang et al.<sup>19</sup> who reported 24.1% complications rate on 43,165 patients. In the aforementioned studies mortality rates were 0.4 and 0.49%, respectively.

In our study population we did not encounter pulmonary complications, which coincide with the results of Owen et al.<sup>20</sup> who found significantly less pulmonary complications in patients who were treated laparoscopically opposed to the open surgery.

Average length of hospitalization was 5 (4–12) days, which is comparable with other studies with laparoscopic colorectal resections where average hospital stay duration is reported in range from 4 to 9.7 days<sup>19–22</sup>. The longest hospital stay (12 days) was observed in a patient who had ischemic damage of the colon postoperatively. The hospital stay for patients with postoperative intestinal paresis was 9–10 days.

Mean duration of the procedure was 182 min (range 120–270 min), which is in concordance with the other clinical studies, where mean duration was reported to range between 159 and 297 min<sup>23,24</sup>. One important remark when it comes to the mean operative time should be taken into consideration. The procedures for the rectal cancer are more complex, and time consuming than those for the right or left colon. In our study mean operative time was longer for procedures conducted on the rectum than those conducted on the right colon. The operative time was, as expected, influenced with the learning curve, and was significantly shorter in last 10 procedures. Having this in mind, we should approach the results of study by Prakash et al.<sup>22</sup> who have reported the mean operative time of 297 min, but for rectosigmoidal can-

cer, and with the results from initial learning curve included. The shortest mean operative time was reported by Kiran et al.<sup>24</sup>, 146 minutes, but their study included resection of the right and left colon.

Our study showed that laparoscopic colorectal resection is not inferior to the open procedure when it comes to oncologic issue. According to AJCC, one needs to harvest minimally 12 lymph nodes to have the proper tumor staging<sup>25</sup>. Average number of harvested lymph nodes in our study was 22.5 (ranging 6–25), which makes it sufficient enough.

The study limitations are small number of patients and a short follow-up interval. Another important limitation is absence of the control group, presumably in this case, patients with similar characteristic who were treated with open surgery.

### Conclusion

This study showed that initiation of laparoscopic colorectal resection is feasible with low rate of postoperative complications, short hospital stay, adequate oncologic resection and number of lymph node harvested.

This is the reason why MI becomes a standard in the surgical treatment of colonic and rectal diseases.

### R E F E R E N C E S

- Jacobs M, Verdeja JC, Goldstein HS. Minimally invasive colon resection (laparoscopic colectomy). *Surg Laparosc Endosc*. 1991; 1(3): 144–50.
- Watanabe M, Ohgami M, Teramoto T, Kitajima M. Laparoscopic local excision of the cecum for cecal creeping tumor. *Surg Laparosc Endosc* 1997; 7(2): 144–7.
- Kobayashi H, Miyata H, Gotob M, Baba H, Kimura W, Kitagawa Y, et al. Risk model for right hemicolectomy based on 19,070 Japanese patients in the National Clinical Database. *J Gastroenterol* 2014; 49(6): 1047–55.
- Matsubara N, Miyata H, Gotob M, Tomita N, Baba H, Kimura W, et al. Mortality after common rectal surgery in Japan: a study on low anterior resection from a newly established nationwide large-scale clinical database. *Dis Colon Rectum* 2014; 57(9): 1075–81.
- The English national training programme for laparoscopic colorectal surgery. <http://lapco.nhs.uk> [accessed 2015 January 27]
- Ohtani H, Tamamori Y, Arimoto Y, Nishiguchi Y, Maeda K, Hirakawa K. A meta-analysis of the short- and long-term results of randomized controlled trials that compared laparoscopy-assisted and conventional open surgery for colorectal cancer. *J Cancer* 2011; 2: 425–34.
- Di B, Li Y, Wei K, Xiao X, Shi J, Zhang Y, et al. Laparoscopic versus open surgery for colon cancer: a meta-analysis of 5-year follow-up outcomes. *Surg Oncol* 2013; 22(3): e39–43.
- Fleshman J, Sargent DJ, Green E, Anvari M, Stryker SJ, Beart RW Jr, et al. Clinical Outcomes of Surgical Therapy Study Group. Laparoscopic colectomy for cancer is not inferior to open surgery based on 5-year data from the COST Study Group trial. *Ann Surg* 2007; 246(4): 655–62; discussion 662–4.
- Vallribera Valls F, Landi F, Espín Basany E, Sánchez García JL, Jiménez Gómez LM, Martí Gallostra M, et al. Laparoscopy-assisted versus open colectomy for treatment of colon cancer in the elderly: morbidity and mortality outcomes in 545 patients. *Surg Endosc* 2014; 28(12): 3373–8.
- Amin MB, Edge S, Greene F, Byrd DR, Brookland RK, Washington MK, et al. *AJCC Cancer Staging Manual*. 8th ed. New York: Springer; 2017.
- National Cancer Institute. Common Terminology Criteria for Adverse Events v.4.0 (CTCAE). Available from: [http://ctep.cancer.gov/protocolDevelopment/electronic\\_applications/ctc.htm](http://ctep.cancer.gov/protocolDevelopment/electronic_applications/ctc.htm). [Accessed 2012 June 20].
- Melotti G, Tamborrino E, Lazzagretti MG, Bonilauri S, Meccheri F, Piccoli M. Laparoscopic surgery for colorectal cancer. *Semin Surg Oncol* 1999; 16: 332–6.
- Stocchi L, Nelson H. Laparoscopic colectomy for colon cancer trial update. *J Surg Oncol* 1998; 68(4): 255–67.
- Hasegawa H, Kabeshima Y, Watanabe M, Yamamoto S, Kitajima M. Randomized controlled trial of laparoscopic versus open colectomy for advanced colorectal cancer. *Surg Endosc* 2003; 17(4): 636–40.
- Yang T, Wei M, He Y, Deng X, Wang Z. Impact of visceral obesity on outcomes of laparoscopic colorectal surgery: a meta-analysis. *ANZ J Surg* 2015; 85(7–8): 507–13.
- Wang CL, Qu G, Xu HW. The short- and long-term outcomes of laparoscopic versus open surgery for colorectal cancer: a meta-analysis. *Int J Colorectal Dis* 2014; 29(3): 309–20.
- Steele SR, Brown TA, Rush RM, Martin MJ. Laparoscopic vs open colectomy for colon cancer: results from a large nationwide population-based analysis. *J Gastrointest Surg* 2008; 12(3): 583–91.
- Juo YY, Hyder O, Haider AH, Camp M, Lidor A, Abuja N. Is minimally invasive colon resection better than traditional approaches? First comprehensive national examination with propensity score matching. *JAMA Surg* 2014; 149(2): 177–84.

19. Kang CY, Chaudhry OO, Halabi WJ, Nguyen V, Carmichael JC, Stamos MJ, et al. Outcomes of laparoscopic colorectal surgery: data from the Nationwide Inpatient Sample 2009. *Am J Surg* 2012; 204(6): 952–7.
20. Owen RM, Perez SD, Lytle N, Patel A, Davis SS, Lin E, et al. Impact of operative duration on postoperative pulmonary complications in laparoscopic versus open colectomy. *Surg Endosc* 2013; 27(10): 3555–63.
21. Wilson MZ, Hollenbeak CS, Stewart DB. Laparoscopic colectomy is associated with a lower incidence of postoperative complications than open colectomy: a propensity scorematched cohort analysis. *Colorectal Dis* 2014; 16(5): 382–9.
22. Chen K, Zhang Z, Zuo Y, Ren S. Comparison of the clinical outcomes of laparoscopic assisted versus open surgery for colorectal cancer. *Oncol Lett* 2014; 7(4): 1213–8.
23. Prakash K, Varma D, Rajan M, Kamlesh NP, Zacharias P, Ganesh Narayanan R, et al. Laparoscopic colonic resection for rectosigmoid colonic tumours: a retrospective analysis and comparison with open resection. *Indian J Surg* 2010; 72(4): 318–22.
24. Kiran RP, Kirat HT, Ozturk E, Geisler DP, Remzi FH. Does the learning curve during laparoscopic colectomy adversely affect costs? *Surg Endosc* 2010; 24(11): 2718–22.
25. McDonald JR, Renehan AG, O'Dwyer ST, Haboubi NY. Lymph node harvest in colon and rectal cancer: Current considerations. *World J Gastrointest Surg* 2012; 4(1): 9–19.

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