

PROCEEDINGS

ADVANTAGES AND LIMITING FACTORS IN LAPAROSCOPIC COLORECTAL SURGERY

Angel Arabadzhiev, Monika Momchilova, Vesela Petrova, Tsvetan Popov, Aysun Mehmed,
Svilen Maslyankov, Manol Sokolov

*Prof. Alexander Stanishev Clinic of Surgery, Aleksandrovska University Hospital, Bulgaria
Department of Surgery, Faculty of Medicine, Medical University of Sofia, Bulgaria*

ABSTRACT

INTRODUCTION: Laparoscopic surgery has become the gold standard for surgical treatment of diseases of the gastrointestinal tract. In terms of results, it is comparable and has established itself as a reliable alternative to conventional surgery, both in benign and malignant diseases. The minimally invasive approach enjoys all the short-term advantages, such as less postoperative pain, better cardiopulmonary function, faster recovery of the gastrointestinal passage, faster mobilization and recovery, shorter intensive care, and hospital stay. Long-term oncological outcomes still remain debatable.

AIM: Our study aims to demonstrate the advantages of the laparoscopic approach and highlight some of its limiting factors in terms of operative time and postoperative stay in the conditions of the Clinic of Anesthesiology and Intensive Care (CAIL).

MATERIALS AND METHODS: A total of 42 patients with histologically proven colorectal cancer (CRC) and resection with primary anastomosis were retrospectively included. We divided the patients into two groups according to the surgical technique: Group A: 21 patients operated by laparoscopic surgery (LS), and Group B: 21 patients operated by conventional open surgery (OS). Some of the basic characteristics: sex, age, body mass index (BMI), preoperative staging, mean operative time, postoperative period in CAIL, and analgesia, were examined.

RESULTS: The mean operative time (MOT) in the LS group was 201 min and 189 min in the OS group. With respect to the gender factor, the MOT in LS was 211 min in men and 185 min in women, while in OS, there was no difference in MOT in relation to the gender factor. The mean operative time in patients compared to BMI was examined. In patients with normal weight, it was 160 min in LS and 351 min in OS, 220 min and 164 min in overweight patients, and 218 min and 197 min in obese patients, respectively. In the OS group, all patients had a stay in CAIL of more than 72 hours, while in LS only 57% of patients stayed for 72 hours. Regarding intraoperative and postoperative analgesia, natural opioid analgesics, including morphine, were administered to 10% of the LS group and 100% of the OS patients. Semi-synthetic opioid analgesics were administered in 60% of LS patients and 100% of OS patients.

CONCLUSION: Laparoscopic colorectal surgery does not show an advantage in terms of mean operative time, but patients have a shorter stay in the CAIL setting, less postoperative pain, and enjoy all the advantages of a minimally invasive approach with equivalent oncological outcomes

Keywords: *laparoscopic surgery (LS), open surgery (OS), average operative time, BMI, ICU*

Address for correspondence:
Angel Arabadzhiev
Aleksandrovska University Hospital
1 St. Georgi Sofiyski Blvd
1431 Sofia
Bulgaria
e-mail: dr.aar91@gmail.com

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INTRODUCTION

Colon cancer accounts for nearly 1.1 million cancer cases and was responsible for more than 550,000 deaths worldwide in 2018 (1). It is the 3rd most frequently diagnosed oncological disease in the world (2). Laparoscopic colectomy was introduced in 1991 (3). Initially, the minimally invasive approach was not accepted and even rejected as a method of oncological surgical treatment. The reasons were some technical difficulties, such as working in several abdominal quadrants, ligation of vessels and restoration of the passage after intestinal interruption, as well as some oncological problems such as adequate lymphatic dissection, adequate tumor distance during resection, postoperative complications, and survival (4). With the accumulation of laparoscopic surgical experience and advances in technology, these limiting factors have been cleared over time. By introducing the medial approach, the difficulty of multi-quadrant surgery was minimized. Ligation of the great vessels and intraoperative coagulation have become easier with the introduction of new energy devices, such as bipolar forceps and ultrasound devices. Regarding the oncological outcomes of surgical treatment of colorectal cancer (CRC), the method has been accepted as an alternative with equivalent results but enjoying all the advantages of the minimally invasive approach, reported in several multicenter prospective randomized trials (RCTs) (5–9). Since then, additional evidence has accumulated to support the feasibility, safety, and benefits of laparoscopic oncologic treatment of CRC (10–12).

In recent years, laparoscopic interventions have become increasingly established and account for more than half of all elective surgeries performed in patients with colon carcinoma. The widespread use of laparoscopic surgery has led to the advancement

of surgeons, who have become increasingly experienced in minimally invasive techniques, thereby reducing intraoperative time and patient hospital stay.

AIM

This material aims to present the advantages and some limiting factors of laparoscopic surgery compared to the open method.

MATERIALS AND METHODS

In the present study, a total of 42 patients underwent surgery in the Surgery Clinic of Alexandrovska University Hospital. Regarding the gender factor, 22 were male and 20 were female. The youngest patient was 40 years old, and the oldest was 88 years old. The average age of the examined patients was 68. All patients had histologically verified CRC, staged preoperatively with the necessary staging systems for the respective localization, and resection with primary anastomosis was performed. Individual characteristics—gender, age and BMI, were examined in all patients. In patients, intraoperative and postoperative analgesia was examined and tracked, according to the type of frequency, by days. We divided the patients into two groups according to the surgical technique: Group A—21 patients operated by laparoscopic surgery (LS), and Group B—21 patients operated by conventional surgery (OS). Exclusion factors of the study were low rectal carcinomas with abdominoperineal resection, converted laparoscopic resections, and palliative surgical interventions.

Statistical Analysis

The SPSS (Statistical Package for the Social Sciences) software, version 16.0, was used to process the survey data. The accepted critical significance level was $\alpha \leq 0.05$. The corresponding null hypothesis was rejected when the p-value was less than α . All sub-

Table 1. Mean operative time by gender in LS and OS groups.

	N	LS Mean (min)	Min (min)	Max (min)	p
Men	13	220	120	360	0.01*
Women	8	160	100	240	
	N	OS Mean (min)	Min (min)	Max (min)	
Men	11	191	100	240	
Women	10	200	100	300	

*chi-square statistic

jects were described using descriptive statistics and frequency analysis. Chi-square test was applied.

RESULTS

The mean operative time (MOT) in the LS group was 201 min and 189 min in the OS group. Regarding the gender factor, a statistically significant difference ($p=0.01$) was observed (Fig. 1, Table 1)

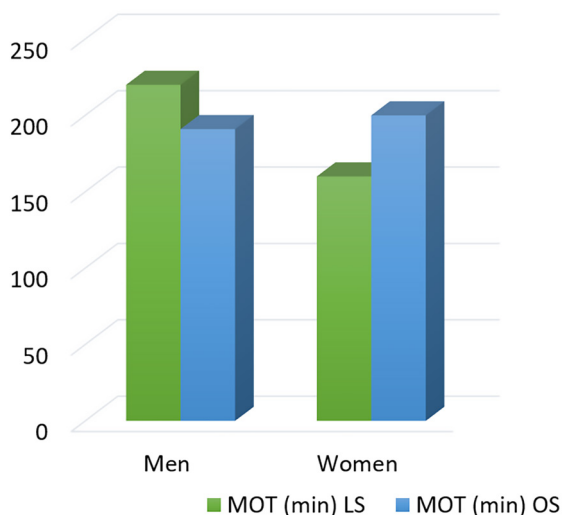


Fig. 1. Estimated mean operative time in the laparoscopic and open groups in relation to gender ($p=0.01$)

The mean operative time in patients compared to BMI was examined. In patients with normal weight it was 160 min in LS and 351 min in OS; 220 min and 164 min in overweight individuals; 218

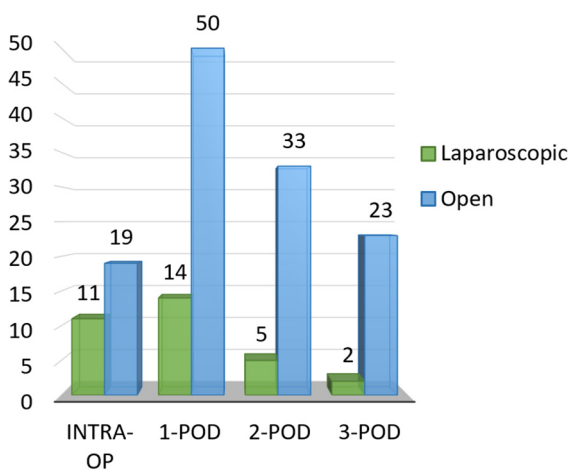


Fig. 2. Use of narcotic analgesics in patients operated laparoscopically and conventionally ($p = 0.03$)

*chi-square statistic

min and 197 min in obese patients, with the difference not being statistically significant ($p=0.1$).

In the OS group, all patients had an ICU stay of more than 72 hours, while in LS, 33% of patients stayed for 24 hours. Regarding perioperative and postoperative analgesia, morphine analgesics were administered to 10% of the LS group and 100% of the OS patients. Opioid analgesics were administered in 60% of LS patients and 100% of OS patients. Narcotic analgesics were administered predominantly in OS patients, the difference being statistically significant ($p=0.03$) (Fig. 2).

DISCUSSION

Oncological diseases of the colon and rectum are increasingly common in clinical practice among the population worldwide. With the detailed study of diseases and the introduction of chemo- and radiotherapy, treatment has become complex and increasingly effective in the oncological aspect. Neoadjuvant treatment increased the chance of achieving clear resection lines (R0), improved radicality, and increased the survival rate by up to 95% (13). Along with the multidisciplinary approach in the treatment of CRC, surgical treatment lies at the heart of this therapeutic process. Surgical intervention aims to follow established oncological principles in accordance with practical parameters, which include: 1) resection with clear resection lines; 2) en bloc resection of adjacent tissue attached to the primary tumor; 3) lymphatic dissection of at least 12 regional lymph nodes identified by pathologists (14,15).

With the advancement of technology in medicine, and especially laparoscopy, a path has been paved to change the role of minimally invasive methods in colorectal diseases, originally envisaged as an adjunct to open surgery, to an important operative modality. It presents undeniable benefits, such as minimal trauma, little pain, and reduction of bacterial contamination.

A major discussion regarding the laparoscopic approach is feasibility and oncologic outcomes. Numerous studies (16,17,18) from as early as the 1990s reported comparability of isolated lymph nodes in laparoscopic versus open surgery. Melotti et al. also concluded that resection line spacing in the minimally invasive approach did not differ from that in open surgery (19). A meta-analysis showed that the

number of isolated lymph nodes was higher in the laparoscopic group, with the differences being statistically significant (20). Bretagnol et al. reported that R0 resection could be achieved in 93% of patients undergoing laparoscopic resections. All these correlations support the thesis that the laparoscopic approach is adequate and with comparable oncological results as in open surgery.

In our study, we have considered some of the main problems in laparoscopic surgery related to short-term results, namely MOT, excess weight as a limiting factor, and the need to use narcotic analgesics. Braga et al., with their randomized study, looked at identical parameters and proved that the laparoscopic approach had significantly better results than the open method. With regard to MOT, we observe a significant difference in men and women in the laparoscopic group, which is statistically significant, while no similar difference is observed in the open approach. The explanation for the increased operative time in laparoscopic operations in males can be explained by the narrow pelvis and impaired ergonomics in anterior rectal resections and performing total mesorectal extraction (TME). In a randomized study in patients treated for colon cancer, a longer operative time (142 x 118 min) was observed in LS ($p < 0.001$) (8). Regarding rectal cancer, a multicenter study reported significantly longer times, as did our study (180 x 150 min) among patients with LS ($p < 0.001$) (21). A meta-analysis of 25 randomized trials also supported the claim of longer operative times in laparoscopic colorectal surgery (22).

Obesity is rapidly becoming a global pandemic and we are increasingly seeing overweight and obese patients requiring LS. Although the ideal approach for these individuals is preoperative weight loss, this is often difficult to achieve (23). Obesity was once considered a contraindication for LS, however, the laparoscopic approach is well suited for obese patients given their increased susceptibility to thromboembolic events and difficult wound healing after laparotomy (23). In our study, we have looked at how obesity affects the intraoperative time and we notice a non-significant increase in MOT in obese patients operated laparoscopically.

Minimally invasive surgery has been reported to reduce postoperative pain and complications, and

shorten hospital stay (24). In the present study, patients undergoing minimally invasive colorectal surgery had approximately equivalent analgesia values in the intraoperative period and progressive reduction on postoperative days 1 to 3 compared with patients undergoing OS, who had more pain and required high doses of opioid analgesics after surgery. This proves the advantage of the laparoscopic approach as a minimally invasive method with minimal trauma and postoperative comfort for the patient.

CONCLUSION

The laparoscopic approach used to treat colorectal cancer has proven advantages, such as equivalent oncologic outcomes along with minimal hospital stay, reduced pain, and minimal blood loss. The proven limiting factors were confirmed in the present study. They are male gender, which complicates ergonomics during surgery, and obesity, which leads to a number of problems related to the alteration of anatomical structures. With the advancement of technology and surgical laparoscopic experience, the minimally invasive approach will become the main alternative for the treatment of this type of pathology.

REFERENCES

1. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin.* 2018;68(6):394-424. doi: 10.3322/caac.21492.
2. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2019. *CA Cancer J Clin.* 2019;69(1):7-34. doi: 10.3322/caac.21551.
3. Jacobs M, Verdeja JC, Goldstein HS. Minimally invasive colon resection (laparoscopic colectomy). *Surg Laparosc Endosc.* 1991;1(3):144-50.
4. Lacy A. Colon cancer: laparoscopic resection. *Ann Oncol.* 2005;16 Suppl 2:ii88-92. doi: 10.1093/annonc/mdj733.
5. Clinical Outcomes of Surgical Therapy Study Group; Nelson H, Sargent DJ, Wieand HS, Fleshman J, Anvari M, et al. A comparison of laparoscopically assisted and open colectomy for colon cancer. *N Engl J Med.* 2004;350(20):2050-9. doi: 10.1056/NEJMoa032651.

6. Guillaou PJ, Quirke P, Thorpe H, Walker J, Jayne DG, Smith AM, et al. Short-term endpoints of conventional versus laparoscopic-assisted surgery in patients with colorectal cancer (MRC CLAS-ICC trial): multicentre, randomised controlled trial. *Lancet*. 2005;365(9472):1718-26. doi: 10.1016/S0140-6736(05)66545-2.
7. Hewett PJ, Allardyce RA, Bagshaw PF, Frampton CM, Frizelle FA, Rieger NA, et al. Short-term outcomes of the Australasian randomized clinical study comparing laparoscopic and conventional open surgical treatments for colon cancer: the ALCCaS trial. *Ann Surg*. 2008;248(5):728-38. doi: 10.1097/SLA.0b013e31818b7595.
8. Lacy AM, García-Valdecasas JC, Delgado S, Castells A, Taurá P, Piqué JM, et al. Laparoscopy-assisted colectomy versus open colectomy for treatment of non-metastatic colon cancer: a randomised trial. *Lancet*. 2002;359(9325):2224-9. doi: 10.1016/S0140-6736(02)09290-5.
9. Veldkamp R, Kuhry E, Hop WC, Jeekel J, Kazemier G, Bonjer HJ, et al. Laparoscopic surgery versus open surgery for colon cancer: short-term outcomes of a randomised trial. *Lancet Oncol*. 2005;6(7):477-84. doi: 10.1016/S1470-2045(05)70221-7.
10. Bagshaw PF, Allardyce RA, Frampton CM, Frizelle FA, Hewett PJ, McMurrick PJ, et al. Long-term outcomes of the australasian randomized clinical trial comparing laparoscopic and conventional open surgical treatments for colon cancer: the Australasian Laparoscopic Colon Cancer Study trial. *Ann Surg*;256(6):915-9. doi: 10.1097/SLA.0b013e3182765ff8.
11. Bonjer HJ, Hop WC, Nelson H, Sargent DJ, Lacy AM, Castells A, et al. Laparoscopically assisted vs open colectomy for colon cancer: a meta-analysis. *Arch Surg*. 2007;142(3):298-303. doi: 10.1001/archsurg.142.3.298.
12. Jayne DG, Guillaou PJ, Thorpe H, Quirke P, Copeland J, Smith AM, et al. Randomized trial of laparoscopic-assisted resection of colorectal carcinoma: 3-year results of the UK MRC CLASICC Trial Group. *J Clin Oncol*. 2007;25(21):3061-8. doi: 10.1200/JCO.2006.09.7758.
13. Petrelli F, Coiu A, Lonati V, Barni S. A systematic review and meta-analysis of adjuvant chemotherapy after neoadjuvant treatment and surgery for rectal cancer. *Int J Colorectal Dis*. 2015;30(4):447-57. doi: 10.1007/s00384-014-2082-9.
14. Nelson H, Petrelli N, Carlin A, Couture J, Fleshman J, Guillem J, et al. Guidelines 2000 for colon and rectal cancer surgery. *J Natl Cancer Inst*. 2001;93(8):583-96. doi: 10.1093/jnci/93.8.583.
15. Chang GJ, Rodriguez-Bigas MA, Skibber JM, Moyer VA. Lymph node evaluation and survival after curative resection of colon cancer: systematic review. *J Natl Canc Inst*. 2007;99(6):433-41. doi: 10.1093/jnci/djk092.
16. Psaila J, Bulley SH, Ewings P, Sheffield JP, Kennedy RH. Outcome following laparoscopic resection for colorectal cancer. *Br J Surg*. 1998;85(5):662-4. doi: 10.1046/j.1365-2168.1998.00634.x.
17. Kwok SP, Lau WY, Carey PD, Kelly SB, Leung KL, Li AK. Prospective evaluation of laparoscopic-assisted large bowel excision for cancer. *Ann Surg*. 1996;223(2):170-6. doi: 10.1097/00000658-199602000-00009.
18. Rhodes M, Rudd M, Nathanson L, Fielding G, Siu S, Hewett P, et al. Laparoscopic anterior resection: A consecutive series of 84 patients. *Surg Laparosc Endosc*. 1996;6(3):213-7.
19. Melotti G, Tamborrino E, Lazzaretti MG, Bonilauri S, Mecheri F, Piccoli M. Laparoscopic surgery for colorectal cancer. *Semin Surg Oncol*. 1999;16(4):332-6. doi: 10.1002/(sici)1098-2388(199906)16:4<332::aid-ssu9>3.0.co;2-5.
20. Korolija D, Tadić S, Simić D. Extent of oncological resection in laparoscopic vs. open colorectal surgery: meta-analysis. *Langenbecks Arch Surg*. 2003;387(9-10):366-71. doi: 10.1007/s00423-002-0335-5.
21. Ding KF, Chen R, Zhang JL, Li J, Xu YQ, Lv L, et al. Laparoscopic surgery for the curative treatment of rectal cancer: results of a Chinese three-center case-control study. *Surg Endosc*. 2009;23(4):854-61. doi: 10.1007/s00464-008-9990-0.
22. Weeks JC, Nelson H, Gelber S, Sargent D, Schroeder G; Clinical Outcomes of Surgical Therapy (COST) Study Group. Short-term quality-of-life outcomes following laparoscopic-assisted colectomy vs open colectomy for colon cancer: a randomized trial. *JAMA*. 2002;287(3):321-8. doi: 10.1001/jama.287.3.321.
23. atory WE Jr, O'Sullivan J, Fudem G, Dunn R. Abdominal surgery in patients with severe morbid obesity. *Plast Reconstr Surg*. 1994;94(7):976-87. doi: 10.1097/00006534-199412000-00011.

24. Schwenk W, Haase O, Neudecker J, Müller JM. Short term benefits for laparoscopic colorectal resection. *Cochrane Database Syst Rev*. 2005;2005(3):CD003145. doi: 10.1002/14651858.CD003145.pub2.