

CHAPTER 7

Surgical treatment: minimally invasive surgery

More than 3 decades have passed since Jacobs and Plasencia¹ first reported on laparoscopic colectomy for colon cancer.

The history of minimally invasive surgery in colon cancer has been negatively impacted by numerous reports of isolated cases of tumor implants at the trocar site or in the incision for the extraction of the surgical specimen. This situation has caused many groups not to adopt the technique and has forced a detailed analysis of this approach.²

Minimally invasive surgical procedures include multiport, single-port, hand-assisted laparoscopic surgery, and robotic surgery. This approach can achieve the same goals as open surgery.

Indications for laparoscopic surgery are determined by the experience of the surgeon and the care center, the characteristics of the tumor (location, degree of disease progression, and its response to previous treatment), and patient factors (obesity, history of previous surgeries).

There is evidence that the magnitude of the resected specimen is similar, both in the extent of the margins and in the number of nodes removed.³

A study by Bokey et al.,⁴ demonstrated in 61 cases that laparoscopic right hemicolectomy for cancer does not differ from conventional surgery in mean proximal (10.1 vs 11.9 cm) and distal (10 vs 13.4 cm) resection margins or in the number of lymph nodes removed. Multiple multi-institutional randomized trials from centers and surgeons trained in the United States and around the world have demonstrated an oncologic outcome equivalent to open surgery, with a decrease in hospital stay and better short-term results.^{5,6}

The proven advantages of laparoscopic surgery over conventional surgery are reduced postoperative pain, hospital stay, and postoperative ileus. While Japanese guidelines recommend laparoscopic surgery as an acceptable treatment for colon cancer, NCCN and ESMO recommend it in limited cases without advanced local disease, bowel obstruction, or tumor perforation.

The rate of parietal implants reported in various series is highly variable and ranges from 0 to 21%. The period of appearance of metastases ranges from 7 days to 24 months.² Cutaneous implants are also observed in laparoscopic surgery of other affected organs (pancreas, ovary, gallbladder) and the common factor is the surgical technique. Observational studies and meta-analyses on single-port vs. multiport technique have demonstrated equivalent surgical and oncologic outcomes.^{7,8} There is no difference in operative time, number of lymph nodes removed, length of resection, and postoperative complications.⁹

Hand-assisted surgery for the treatment of right colon cancer has been evaluated in randomized controlled trials and its comparison with classical laparoscopic surgery has shown similar short-term results. Compared with open surgery, it was associated with less pain and better recovery, with no long-term oncological differences.^{10,11}

Comparison of robotic surgery with laparoscopic surgery for the treatment of right colon cancer indicates no differences in postoperative morbidity and short-term oncological progression, although robotics requires longer operating times and higher costs.¹²

In an early retrospective study, Salomon¹³ compared 92 patients operated on for CRC, 46 by laparoscopy and 46 by conventional surgery. The conversion rate was 8.7%. The hospital stay for laparoscopy was shorter and there were no differences in the number of lymph nodes removed, recurrence and overall survival. No implants were reported. In a later study, they compared 170 patients, 49% with cancer. They found no metastases at the trocar sites and survival was similar in both groups.

Rossi et al.¹⁴ analyzed the results of their initial experience in laparoscopic colorectal surgery. Of their first 100 laparoscopic surgeries, 39% were for cancer. Conversion was 17%, operating time 240 minutes, hospital stay 3 days, morbidity 14%, and mortality 1%. They have established this approach as their preferred approach ever since.

Rotholz,¹⁵ together with the group from the Hospital Alemán of Buenos Aires, among their multiple publications on laparoscopic colorectal surgery, reported a feasibility study on sentinel node research, the performance of which is neither standard nor recommended. They identified 91% of the nodes, with a sensitivity and specificity of 100%.

Therefore, it is stated that when there is training and resources available, it is preferable to perform colectomy for colon cancer using a selective minimally invasive approach. Evidence IA.³

Operating time

Although increased operating time in colorectal surgery is associated with worse surgical outcomes, laparoscopic and robotic operations have improved outcomes despite longer operating times. However, “prolonged” operating time has not been consistently defined.

A very recent retrospective cohort study of 42 hospitals included 23,098 adult patients who underwent six elective colorectal surgical procedures (right colectomy, left/sigmoid colectomy, total colectomy, low anterior resection, ileal pouch-anal anastomosis, and abdominoperineal resection) performed by open, laparoscopic, or robotic approaches between 2011 and 2019. Operative time was 7 vs. 5 days in the open approach, 5 vs. 4 days in the laparoscopic approaches, and 4 vs. 3 days in the robotic approach. Complications occurred in 42 vs. 28% in the open approach, 24 vs. 17% in the laparoscopic approach, and 27 vs. 13% in the robotic approach, and hospital discharge was similar in the 3 groups. It was concluded that prolonged operating time is associated with a longer hospital stay and a higher probability of complications, although this negative effect is reduced with minimally invasive approaches.¹⁶

The advantages of the multiport laparoscopic approach apply to the surgical treatment of all segments of the colon for cancer.

The conversion rate from minimally invasive to open surgery has decreased over time, from 12% to 10% in the right colon and from 11.9% to 9.9% in the left colon. The number of lymph nodes removed has also increased and the incidence of involved surgical margins has decreased.^{3,13}

Laparoscopy in the emergency setting

In a nationwide observational study, 158 patients undergoing laparoscopic resection were compared with 474 patients undergoing open resection in an emergency setting between 2009 and 2016. At 90 days, laparoscopy had significantly fewer complications (26.6 vs 38.4%, OR 0.59, 95% CI 0.39–0.87) and similar mortality. At 3 years, laparoscopy resulted in better OS (81 vs 69.4%, HR 0.54, 95% CI 0.37–0.79) and DFS (68.3 vs 52.3%, HR 0.64, 95% CI 0.47–0.87). Multivariate regression analyses of the 2002 unmatched patients confirmed an independent association of laparoscopy with fewer 90-day complications and improved 3-year survival. It was concluded that intentional emergency laparoscopic resection might improve short- and long-term outcomes in patients with left-sided obstructive colon cancer compared with emergency open resection, which requires confirmation in future studies.⁶

REFERENCES

1. Jacobs M, Plasencia G. Laparoscopic colon surgery: some helpful hints. *Int Surg.* 1994;79:233–34.
2. Berends FJ, Kazemier G, Bonjer HJ, et al. Subcutaneous metastases after laparoscopic colectomy. *Lancet.* 1994;344:58.
3. Vogel JD, Felder SI, Bhama AR, et al. The American Society of Colon and Rectal Surgeons Clinical Practice Guidelines for the Management of Colon Cancer. *Dis Colon Rectum.* 2022;65:148–77.
4. Bokey EL, Moore JW, Chapuis PH, et al. Morbidity and mortality following laparoscopic-assisted right hemicolectomy for cancer. *Dis Colon Rectum.* 1996;39:S24–8.
5. Braga M, Vignali A, Gianotti L, et al. Laparoscopic versus open colorectal surgery: a randomized trial on short-term outcome. *Ann Surg.* 2002;236:759–66; discussion 767.
6. Zwanenburg ES, Veld JV, Amelung FJ, et al. Short- and Long-term Outcomes After Laparoscopic Emergency Resection of Left-Sided Obstructive Colon Cancer: A Nationwide Propensity Score-Matched Analysis. *Dis Colon Rectum.* 2023;66:774–84.
7. Katsuno G, Fukunaga M, Nagakari K, et al. Short-term and long-term outcomes of single-incision versus multi-incision laparoscopic resection for colorectal cancer: a propensity-score-matched analysis of 214 cases. *Surg Endosc.* 2016;30:1317–25.
8. Dong B, Luo Z, Lu J, et al. Single-incision laparoscopic versus conventional laparoscopic right colectomy: A systematic review and meta-analysis. *Int J Surg.* 2018;55:31–8.
9. Kang BM, Kim HJ, Kye B-H, et al. Multicenter, randomized single-port versus multiport laparoscopic surgery (SIMPLE) trial in colon cancer: an interim analysis. *Surg Endosc.* 2018;32:1540–49.
10. Chung CC, Ng DCK, Tsang WWC, et al. Hand-assisted laparoscopic versus open right colectomy: a randomized controlled trial. *Ann Surg.* 2007;246:728–33.
11. Ng LWC, Tung LM, Cheung HYS, et al. Hand-assisted laparoscopic versus total laparoscopic right colectomy: a randomized controlled trial. *Colorectal Dis.* 2012;14:e612–7.
12. Park JS, Choi G-S, Park SY, et al. Randomized clinical trial of robot-assisted versus standard laparoscopic right colectomy. *Br J Surg.* 2012;99:1219–26.
13. Salomón M. Cáncer del colon localmente avanzado. En: Lumi CM, Bianchi R, Canelas A, Colliá Ávila K, Farina PA, Laporte M, Mattacheo AE, Pastore RLO, eds. *Enfermedades del colon, recto y ano.* Buenos Aires: Sociedad Argentina de Coloproctología; 2023:710–17.
14. Rossi G, Vaccaro C, Ojea Quintana G, et al. Laparoscopia colorrectal: evaluación de 100 casos consecutivos. *Rev Argent Coloproct.* 2006;17:243–49.
15. Rotholtz N, Casas MA. Cáncer de recto. Tratamiento multimodal. En: Lumi CM, Bianchi R, Canelas A, Colliá Ávila K, Farina PA, Laporte M, Mattacheo AE, Pastore RLO, eds. *Enfermedades del colon, recto y ano.* Buenos Aires: Sociedad Argentina de Coloproctología; 2023:745–54.
16. Unruh KR, Bastawrous AL, Kanneganti S, et al. The Impact of Prolonged Operative Time Associated With Minimally Invasive Colorectal Surgery: A Report From the Surgical Care Outcomes Assessment Program. *Dis Colon Rectum.* 2024;67:302–12.