Laparoscopic colectomy: trends in implementation in Canada and globally

Marius Hoogerboord, MB ChB,
MSc

James Ellsmere, MD, MS

Antonio Caycedo-Marulanda,
MD, MSc

Carl Brown, MD, MSc

Shiva Jayaraman, MD, MSc

David Urbach, MD, MSc

Sean Cleary, MD, MSc, MPH

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Correspondence to:

S. Cleary

Department of Surgery, Mayo 12-11D

Mayo Clinic

200 First St SW

Rochester MN 55905

cleary.sean@mayo.edu

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SUMMARY

Comparisons with other high-income countries suggest that Canada has been slower to adopt laparoscopic colectomy (LC). The Canadian Association of General Surgeons sought to evaluate the barriers to adoption of laparoscopic colon surgery and to propose potential intervention strategies to enhance the use of the procedure. Given the clinical benefits of laparoscopic surgery for patients, the increasing needs for surgical care and the desire of Canadian general surgeons to advance their specialty and enhance the care of their patients, it is an important priority to improve the utilization of LC.

The first study of laparoscopic colectomy (LC) was published in 1991.¹ Throughout the 1990s, adoption of the technique was hampered by concerns regarding oncologic safety and effectiveness.^{2,3} This concern led to further studies and, by 2004, randomized controlled trial evidence clearly showed that LC accelerated patients' postoperative recovery and reduced length of hospital stay (LOS) while providing equivalent oncologic outcomes compared with open colectomy (OC).⁴ Fewer postoperative complications and shorter LOS imply cost savings to the health care system, which is of considerable importance in an era of rising health care expenditures across all of Canada.⁵

Comparisons with other high-income countries suggest a lower adoption rate of LC in Canada.⁶⁻⁹ The Canadian Association of General Surgeons (CAGS) formed a task force to evaluate the barriers to adoption of laparoscopic colon surgery and to propose potential intervention strategies to enhance the use of the procedure. As an initial step, the task force was asked to complete a literature review of existing publications on this topic to identify patterns of implementation and barriers to adoption in Canada and other countries.

UPTAKE OF LAPAROSCOPIC COLECTOMY IN CANADA

Population-based data from Ontario show that between 2002 and 2009, the proportion of elective LC increased from 13% to 37%.¹⁰ In British Columbia, the proportion of patients with colon cancer undergoing LC increased from 2% to 25% between 2003 and 2008.¹¹ Using population-level data, Hoogerboord and colleagues¹² showed that from 2004 to 2014, the pan-Canadian rate of LC for elective surgeries increased from 9% to 52%. Provincial utilization rates ranged from 11% in Newfoundland to 60% in British Columbia.¹² The rate of LC in Canada was lower than in South Korea, the Netherlands and the United States, but higher than in the United Kingdom, Norway and Sweden (Fig. 1).⁶⁻⁹

PREDICTORS OF UPTAKE OF LAPAROSCOPIC COLECTOMY

Compared with OC, the laparoscopic approach is technically more difficult because of the absence of tactile feedback, operating with 2-dimensional vision, and limited degrees of manoeuvrability of instruments. The number of cases required to complete the learning curve for LC varies between 30

Fig. 1. Proportion of laparoscopic colectomy in Canada compared with other high-income countries.

and 70 and depends on the extent of formal training in laparoscopic surgery, exposure to other advanced laparoscopic techniques, dexterity and ability to perform delicate manoeuvres with 2-dimensional vision.¹³

The Canadian health care system can present unique challenges to the adoption of new technology and minimally invasive surgical techniques. In the survey by Moloo and colleagues,¹⁴ limitations in operating room time allocation were cited by 55% of surgeons as a barrier to LC. Since most hospitals in Canada function with a global operating budget and volume-based and/or quality-based hospital reimbursement is limited in extent and impact, the introduction of new technology and equipment into Canadian operating rooms has been much slower than in other countries. Restrictions in capital and operating budgets have limited investments in permanent and single-use laparoscopic equipment. Approximately 25% of Canadian surgeons felt that they did not have adequate laparoscopic equipment to perform LC at their hospitals.¹⁴

POTENTIAL STRATEGIES TO INCREASE THE USE OF LAPAROSCOPIC COLECTOMY

Effective strategies to increase use of LC may include greater emphasis on advanced laparoscopic training during resi-

dency, more minimally invasive surgery fellowships, and intensive hands-on training courses and mentorship programs for established surgeons (Box 1).¹⁴⁻¹⁶ Also, dissemination of practice guidelines and consensus statements, practice audits and feedback, and the development of care algorithms and clinical care guidelines have been shown to positively affect change in surgical practice and institutional culture.¹⁷

Several methods for teaching advanced laparoscopic techniques to established surgeons exist, including short (weekend) courses, comprehensive programs consisting of didactic sessions, cadaver laboratories, and observation of live surgeries and simulation platforms (e.g., minimally invasive surgery trainer).¹⁶ The optimal model for training and dissemination of advanced laparoscopic surgery into community practice has not been established. However,

Box 1: Strategies to increase use of laparoscopic colectomy in Canada

Resident training

- Increase exposure to advanced laparoscopic procedures

Fellowship training

- Increase number of minimally invasive surgery fellowship programs

Practising surgeons

- Intensive hands-on courses
- Postcourse mentorship programs

adoption is enhanced when mentorship by laparoscopic experts forms part of a training program.¹⁸ A team-based approach, where training also includes operating room nurses, has been shown to be more effective in establishing successful laparoscopic programs.¹⁹

CONCLUSION

The rate of LC in Canada appears to be lower than in other comparable high-income countries, including South Korea, the Netherlands and the United States, with significant variability across the country. This variability in use of LC indicates a variety of barriers, some of which may be specific to the Canadian health care environment; a review of the literature includes surgeon-related factors (e.g., completing a steep learning curve, access to training and mentorship) and regional health system factors (e.g., financial constraints, operating room time and resource limitations, hospital and physician reimbursement models, and access to technology). Given the clinical benefits of laparoscopic surgery for patients, the increasing needs for surgical care and the desire of Canadian general surgeons to advance their specialty and enhance the care of their patients, it is an important priority to improve the utilization of LC. Given the complexities of these issues and the importance to patients and the profession, the Canadian Association of General Surgeons has assembled a task force to study the barriers to LC and propose priorities and initiatives to address the identified barriers and increase the use of LC across the country.

Affiliations: From the Division of General Surgery, Department of Surgery, Dalhousie University, Halifax, NS (Hoogerboord, Ellsmere); the Division of General Surgery, Department of Surgery, Northern Ontario School of Medicine, Sudbury, Ont. (Caycedo-Marulanda); the Division of General Surgery, Department of Surgery, University of British Columbia, Vancouver, BC (Brown); the Division of General Surgery, Department of Surgery, University of Toronto, Toronto, Ont. (Jayaraman, Urbach); the Department of Surgery, St. Joseph's Health Centre, Toronto, Ont. (Jayaraman); the Department of Surgery, Women's College Hospital, Toronto, Ont. (Urbach); and the Department of Surgery, Mayo Clinic, Rochester, MN (Cleary).

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References

1. Jacobs M, Verdeja JC, Goldstein HS. Minimally invasive colon resection (laparoscopic colectomy). *Surg Laparosc Endosc* 1991; 1:144-50.
2. Alexander RJ, Jaques BC, Mitchell KG. Laparoscopically assisted colectomy and wound recurrence. *Lancet* 1993;341:249-50.
3. O'Rourke N, Price PM, Kelly S, et al. Tumour inoculation during laparoscopy. *Lancet* 1993;342:368.
4. Nelson H, Sargent D, Wieand HS, et al.; Clinical Outcomes of Surgical Therapy Study Group. A comparison of laparoscopically assisted and open colectomy for colon cancer. *N Engl J Med* 2004;350:2050-9.
5. National Health Expenditure Trends. 1975-2015. Ottawa, Ontario: Canadian Institute for Health Information; 2015.
6. Moghadamyeghaneh Z, Carmichael JC, Mills S, et al. Variations in laparoscopic colectomy utilization in the United States. *Dis Colon Rectum* 2015;58:950-6.
7. Taylor EF, Thomas JD, Whitehouse LE, et al. Population-based study of laparoscopic colorectal cancer surgery 2006-2008. *Br J Surg* 2013;100:553-60.
8. Kolfshoten NE, van Leersum NJ, Gooiker GA, et al. Successful and safe introduction of laparoscopic colorectal cancer surgery in Dutch hospitals. *Ann Surg* 2013;257:916-21.
9. Park SJ, Lee KY, Lee S. Laparoscopic surgery for colorectal cancer in Korea: nationwide data from 2008-2013. *J Minim Invasive Surg* 2015;18:39-43.
10. Chan BP, Gomes T, Musselman RP, et al. Trends in colon cancer surgery in Ontario: 2002-2009. *Colorectal Dis* 2012;14:e708-12.
11. Aslani N, Lobo-Prabhu K, Heidary B, et al. Outcomes of laparoscopic colon cancer surgery in a population-based cohort in British Columbia: Are they as good as the clinical trials? *Am J Surg* 2012;204:411-5.
12. Hoogerboord CM, Levy AR, Hu M, et al. Uptake of elective laparoscopic colectomy for colon cancer in Canada from 2004/05 to 2014/15: a descriptive analysis. *CMAJ Open* 2018;6:E384-90.
13. Schlachta CM, Mamazza J, Seshadri PA, et al. Defining a learning curve for laparoscopic colorectal resections. *Dis Colon Rectum* 2001; 44:217-22.
14. Moloo H, Haggar F, Martel G, et al. The adoption of laparoscopic colorectal surgery: a national survey of general surgeons. *Can J Surg* 2009;52:455-62.
15. Dominguez EP, Barrat C, Shaffer L, et al. Minimally invasive surgery adoption into an established surgical practice: impact of a fellowship-trained colleague. *Surg Endosc* 2013;27:1267-72.
16. Birch DW, Sample C, Gupta R. The impact of a comprehensive course in advanced minimal access surgery on surgeon practice. *Can J Surg* 2007;50:9-12.
17. Urbach DR. Closing in on surgical practice variations. *Ann Surg* 2014;259:628-9.
18. Birch DW, Bonjer HJ, Crossley C, et al. Canadian consensus conference on the development of training and practice standards in advanced minimally invasive surgery: Edmonton, Alta., Jun. 1, 2007. *Can J Surg* 2009;52:321-7.
19. Birch DW, Misra M, Farrokhyar F. The feasibility of introducing advanced minimally invasive surgery into surgical practice. *Can J Surg* 2007;50:256-60.