

Do laparoscopic colectomy techniques compromise oncologic principles?

L. Panait, S. Suresh, T.T. Fancher, P. Singh-Braich, Y. Sim, S.J. Dudrick

The Stanley J. Dudrick Department of Surgery, Saint Mary's Hospital, Waterbury, CT

Rezumat

Sunt principiile oncologice compromise în colectomiile laparoscopice?

Introducere: Tehnicile laparoscopice pentru rezecțiile de colon au avantaje clare față de tehnicile chirurgicale clasice. Deși atât colectomiile laparoscopice cu asistență manuală (HALC), cât și cele total laparoscopice (LAC) sunt modalități valide în tratamentul cancerului de colon, superioritatea uneia sau alteia dintre aceste tehnici nu a fost încă demonstrată din punct de vedere oncologic.

Material și Metodă: Acest studiu retrospectiv a evaluat rezultatele comparative ale colectomiilor laparoscopice cu asistență manuală și celor total laparoscopice. Studiul s-a desfășurat pentru o perioadă de 5 ani la un spital comunitar din Statele Unite ale Americii, asociat cu un program de rezidențiat în chirurgie. S-au analizat datele demografice ale pacienților, locația tumorilor și stagiul neoplasmelor. Rezultatele celor două tehnici chirurgicale laparoscopice au fost comparate în ceea ce privește numărul de ganglioni limfatici în specimenul rezecat, prezența marginilor de rezecție pozitive pentru neoplasm, timpul operator, durata spitalizării și prezența complicațiilor postoperative.

Rezultate: În perioada studiată, HALC a fost efectuată la 50 de pacienți, iar LAC la 23 de pacienți. Datele demografice au fost similare între cele două grupuri. Timpul operator a fost mai lung pentru LAC, comparativ cu HALC (178 vs. 125 min., $p < 0.05$). Numărul de ganglioni limfatici prezenți în specimen a fost mai mare la pacienții care au fost operați

prin tehnica LAC, comparativ cu HALC (14 vs. 10, $p < 0.05$). Nu au existat diferențe semnificative în ceea ce privește marginile pozitive, complicațiile postoperatorii sau durata spitalizării.

Concluzii: Deși în instituția noastră tehnica HALC a fost mai prevalentă și a fost asociată cu durata operatorie mai scăzută, numărul de ganglioni limfatici prezenți în specimenul rezecat a fost scăzut comparativ cu tehnica LAC. Principiile oncologice trebuie respectate mai presus de orice, indiferent de tehnica chirurgicală aleasă.

Cuvinte cheie: colectomiile laparoscopice, principii oncologice

Abstract

Background: Benefits of laparoscopic techniques over traditional open techniques in colon surgery are well recognized. Although both hand-assisted laparoscopic colectomy (HALC) and laparoscopic-assisted colectomy (LAC) can be effective in the treatment of colon cancer, the superiority of either technique has yet to be determined for oncologic procedures.

Materials and Methods: A five-year retrospective study comparing outcomes of hand-assisted laparoscopic and laparoscopic-assisted colectomies for cancer was conducted at our community-based teaching hospital. Demographic data, tumor location and stage of the disease were analyzed. Outcomes compared between the two procedures included number of lymph nodes retrieved, presence of positive margins, operative time, length of stay, and number of early postoperative complications.

Results: Fifty patients underwent HALC, while 23 underwent LAC during the study period. Demographic data were similar between the two groups. Operative time was longer for LAC, compared with HALC (178 vs. 125 min., $p < 0.05$), however, the average number of lymph nodes retrieved was significantly

Corresponding author: Lucian Panait, M.D.
Saint Mary's Hospital
The Stanley J. Dudrick Department of Surgery
56 Franklin St., Waterbury, CT 06706
Tel.: (203) 709-6315, Fax: (203) 709-6089
E-mail: Lucian.Panait@stmh.org

higher in LAC compared with HALC (14 vs. 10, $p < 0.05$). No significant differences were recorded for positive margins, postoperative complications, or the length of hospital stay.

Conclusions: While HALC was more prevalent at our institution and proved to be associated with decreased operative times, the number of lymph nodes retrieved was sub-optimal compared less favorably with LAC. Above all, oncologic principles should be respected and achieved regardless of the operative technique used.

Key-words: hand-assisted laparoscopic colectomy, laparoscopic-assisted colectomy, HALC, LAC

Introduction

When laparoscopic assisted colectomy (LAC) surgery was first introduced as an effective technique for colon resection, the initial literature comparing LAC to open colectomy showed multiple short-term benefits, including decreased postoperative pain, earlier return of gastrointestinal function, shorter hospital stays, and fewer postoperative pulmonary and wound complications. (1,2) Furthermore, when performed following established oncologic principles, LAC matched the short- and long-term outcomes of conventional open surgery (OS). (3)

Hand-assisted laparoscopic colectomy (HALC) is a hybrid technique that employs a special hand access device. By use of this special technology, maintenance of a pneumoperitoneum is possible while the surgeon inserts a hand into the abdomen to assist in visualization, retraction, dissection, and the use of laparoscopic instrumentation. (4-6) The procedure augments tactile feedback and increases the ease of handling large mobile organs, thus allowing HALC to be less difficult to perform technically than a LAC. (7) Although the incision made in a HALC is larger, HALC has a shorter learning curve compared with LAC. (1) Despite these differences, comparison studies of HALC and LAC have shown that short term outcomes and costs are similar. (8)

Some studies have compared the ability to conform with oncologic principles for LAC and OS, whereas others have compared OS to a combination of LAC or HALC. (9) However, few studies have evaluated the ability to abide by oncologic principles in comparisons between HALC and LAC procedures. (10)

The purpose of this study was to evaluate our institution's initial experience with laparoscopic procedures for colon cancer, to perform a comparative analysis of the two procedures more commonly employed, and to compare their relative adherence to oncologic principles.

Materials and Methods

After receiving approval by the Institutional Review Board, we performed a comprehensive retrospective study of the cancer database of our community hospital. All patient records, indicating that a laparoscopic surgical procedure was used as

the means of treatment for colon cancer, were initially reviewed. Of the patients in this group, only those who underwent a laparoscopic operation for colon cancer between January 2004 and June 2009 were included for further review for this study. Patient identification was obscured to protect their privacy and to prevent against any bias. The patient records were divided into two groups, based on the operation performed, HALC or LAC. The two groups were then compared with regard to patient demographics, tumor location and stage. Additionally, operative outcomes for each procedure were evaluated and analyzed, including specimen margin status, lymph node retrieval yield, operative time, conversion rate, postoperative complications (i.e., cardiac, wound infection, ileus, intra-abdominal abscess) and post-operative length of hospital stay.

Statistical analysis was performed with Chi-square and t-test as appropriate, with a p value of 0.05 or less considered significant.

Operative technique

The procedures were stratified according to the location of the lesion and by the technique used to perform the resection. A laparoscopic-assisted colectomy indicates that the dissection, devascularization, and division of the bowel were all performed intracorporeally. In the case of right hemicolectomies and transverse hemicolectomies, the upper midline trocar incision was enlarged to approximately 5 cm to extract the specimen and exteriorize the ends of the bowel. A GIA stapler was then used to create a side-to-side anastomosis. The bowel was then placed back into the abdomen, the wound closed, and pneumoperitoneum restored. The laparoscope was reinserted to evaluate the anastomosis in-situ. Conversely, if a sigmoid colectomy or low-anterior resection were performed, after the colon and mesentery were stapled, a trocar incision was enlarged to approximately 3 to 4 cm to extract the specimen and exteriorize the proximal end of transected colon. A 29- to 31-mm EEA anvil was inserted into the proximal colon and secured with a purse-string suture. The colon was then placed back into the abdomen and the port site closed. Pneumoperitoneum was restored, and an EEA circular stapling device was placed transanally to create an end-to-end anastomosis under laparoscopic visualization.

For hand-assisted colectomies, a hand port was placed at the beginning of the case in the supraumbilical midline to facilitate retraction and dissection of the bowel. Once adequate large bowel mobilization was achieved, the pneumoperitoneum was discontinued. Following resection of the involved colon and its mesentery, and re-anastomosis of the proximal and distal segments, the bowel was returned to the abdominal cavity.

Results

From January 2004 to June 2009, a total of 73 patients underwent laparoscopic colon resections for cancer at our community based teaching hospital. Fifty HALCs were performed by 2

surgeons, while 23 LACs were performed by 4 surgeons. None of the surgeons were fellowship trained in minimally invasive or colo-rectal surgery; however, two of the surgeons performing LAC underwent fellowship training in surgical oncology. General surgery residents participated in all cases.

There were no clinically significant differences in the patient age, sex distribution, tumor location or pathologic stage of the tumor (Table 1). Most lesions were located in the cecum and ascending colon (38% and 36% of HALCs, and 47% and 34% of LACs, respectively). Stage I was predominant in both groups (48% of HAL cases and 34% of LAC cases).

With regard to the operative outcomes, the time to complete the procedure was significantly higher in the LAC group (126 ± 38 min. for HALC and 178 ± 39 min. for LAC, $p < 0.001$). However, the lymph node yield achieved with HALC was lower than with LAC (9.9 ± 5 vs. 13.8 ± 5 , $p = 0.007$). No significant differences were achieved for the number of positive margins, conversion rate, postoperative complications, or length of hospital stay (Table 2).

Discussion

The guidelines for care of colon cancer patients suggest that 90-92 % of cases are treated surgically.(11) Extensive reviews have noted that the use of laparoscopic approaches for curable colon and rectal cancer qualify as safe and effective alternatives to open surgical approaches.(12)

Such favorable outcomes achieved with laparoscopic surgery for colon cancer have been documented by a variety of studies. The findings have noted associated faster recovery rates and improved short-term outcomes, shorter hospital stays and fewer complications.(13-16)

HALC is a hybrid surgical technique which integrates tactile feedback and direct hand manipulation of tissue into the laparoscopic approach. Supporters of this technique advocate various advantages over total laparoscopic procedures, including ease of handling of large organs or tissues, shorter learning curves, and better work ergonomics, especially when dissection in multiple abdominal quadrants is involved.(6,7,17,18) Moreover, hand-assisted laparoscopic approaches can be used as an intermediate step by non-expert laparoscopic surgeons who seek to transition to more advanced surgical techniques with decreased invasiveness compared with open surgery.

Multiple studies have compared the outcomes of HALC and LAC for various surgical conditions, including cancer, and most authors agree that HALC is usually associated with decreased operative time compared with LAC.(8,19-24) Similarly, in our retrospective study, HALC patients had significantly shorter operative times compared with LAC. This variation may be influenced by different factors, which cannot be controlled in a non-randomized study. They vary from patient related factors such as body mass index or the presence of abdominal adhesions, to surgeon related factors, including operative experience and/or the extent of resident involvement with the case, or to operating room related factors, such as nursing or anesthesia delays.

Table 1. Demographic data of hand-assisted and laparoscopic-assisted colectomy patients

	HALC (n=50)	LAC (n=23)
Male : Female	27:23	9:14
Median age (years)	77 (51-88)	72 (57-95)
Tumor location in Colon		
Cecum	19 (38%)	11 (47%)
Ascending	18 (36%)	8 (34%)
Transverse	5 (10%)	0
Descending	2 (4%)	1 (4%)
Sigmoid	6 (12%)	3 (13%)
Stage		
Stage I	24 (48%)	8 (34%)
Stage II	18 (36%)	5 (21%)
Stage III	7 (14%)	6 (26%)
Stage IV	0	0

HALC – hand-assisted laparoscopic colectomy,
LAC – laparoscopic-assisted colectomy

Table 2. Outcomes of patients undergoing hand-assisted and laparoscopic-assisted colectomies for cancer

	HALC (n=50)	LAC (n=23)	p value
Operative time (min.)	126	178	<0.001
Lymph node yield	9.9	13.8	0.009
Positive margins	2 (4%)	0/23	NS
Conversion rate	4 (8%)	4 (17%)	NS
Postoperative complications	14 (28%)	5 (21%)	NS
Ileus	5 (10%)	3 (13%)	NS
Cardiac	4 (8%)	0	NS
Wound infection	1 (2%)	1 (4%)	NS
Intra-abdominal abscess	0	1 (4%)	NS
Other	4 (8%)	0	NS
Length of stay	5.5	6.8	0.07

HALC – hand-assisted laparoscopic colectomy,
LAC – laparoscopic-assisted colectomy, NS – not significant

Similar conversion rates to open surgery for the two groups were demonstrated in our study, which is consistent with the findings of other authors.(10,20,21,24) Likewise, no statistically significant difference was shown in the post-operative complication rates.

The length of hospital stay is used by many authors as an indirect reflection of the cost of hospitalization. One could speculate that the decreased incision size associated with LAC and the absence of the hand port leads to decreased bowel manipulation and subsequent ileus, as well as wound related complications in LAC. However, a meta-analysis by Aalbers et al. found no significant difference in the length of stay between the patients operated by HALC or LAC.(25) In our study, HALC patients had a shorter length of stay compared with LAC patients, but statistical significance was not achieved.

The 2011 report by the National Comprehensive Cancer Network (NCCN) entitled, "Clinical Practice Guidelines in Oncology: Colon Cancer version 3," states that a minimum of 12 lymph nodes must be examined to clearly establish stage II

colon cancer.(26) Even for Stage III disease, the number of lymph nodes retrieved correlate with survival.(26, 27) The lymph node retrieval yield is of fundamental importance regarding any surgical technique when trying to comply with oncologic principles. Very few studies to date have performed sound oncological comparisons between HALC and LAC. Targarona et al. found no difference between HALC and LAC patients with regard to intraperitoneal tumor cell dissemination, specimen length, and number of lymph nodes harvested. (10) However, a study by Ringley et al. concluded that the lymph node yield was significantly lower in LAC cases compared with HALC (8 vs. 16).(22) This is contrary to the findings of our study, in which LAC patients had a significantly higher lymph node yield compared with HALC patients. We justify this finding by the difference in technique between the two procedures. In HALC, the involved segment of large bowel to be resected is brought outside the peritoneal cavity, and the mesentery is stapled similarly to the open technique, as close to the base as possible, but through a small incision sometimes with less than optimal visualization and mobilization. Conversely, most of our LAC patients underwent stapling of the mesocolon intraperitoneally, with adequate retraction and visualization, and the opportunity to bring the stapler jaws as close to the base of the mesentery as possible.

Our study has some obvious limitations. Because it is retrospective, there is no opportunity for patient randomization. Two general surgeons performing HALC were compared with four surgeons performing LAC, of which two were fellowship trained in surgical oncology. Furthermore, the technical skills of the surgeons, or the extent of resident involvement as primary surgeon, were not quantified.

In conclusion, this retrospective study suggests that LAC appears to be superior to HALC for lymph node retrieval and oncologic resection in accordance with established standards of care. HALC is associated with decreased operative time, but not decreased length of stay. A prospective randomized study with strictly controlled procedures established for surgeons and pathologists is indicated to validate these findings and conclusions more definitively.

References

- ***. Hand-assisted laparoscopic surgery vs standard laparoscopic surgery for colorectal disease: a prospective randomized trial. HALS Study Group. *Surg Endosc.* 2000;14(10):896-901.
- Larson DW, Cima RR, Dozois EJ, Davies M, Piotrowicz K, Barnes SA, et al. Safety, feasibility, and short-term outcomes of laparoscopic ileal-pouch-anal anastomosis: a single institutional case-matched experience. *Ann Surg.* 2006;243(5):667-70; discussion 670-2.
- Noel JK, Fahrbach K, Estok R, Cella C, Frame D, Linz H, et al. Minimally invasive colorectal resection outcomes: short-term comparison with open procedures. *J Am Coll Surg.* 2007; 204(2):291-307.
- Ballantyne GH, Leahy PF. Hand-assisted laparoscopic colectomy: evolution to a clinically useful technique. *Dis Colon Rectum.* 2004;47(5):753-65. Epub 2004 Apr 13.
- Darzi A. Hand-assisted laparoscopic colorectal surgery. *Surg Endosc.* 2000;14(11):999-1004.
- Kurian MS, Patterson E, Andrei VE, Edye MB. Hand-assisted laparoscopic surgery: an emerging technique. *Surg Endosc.* 2001;15(11):1277-81.
- Meijer DW, Bannenberg JJ, Jakimowicz JJ. Hand-assisted laparoscopic surgery: an overview. *Surg Endosc.* 2000;14(10): 891-5.
- Ozturk E, Kiran RP, Geisler DP, Hull TL, Vogel JD. Hand-assisted laparoscopic colectomy: benefits of laparoscopic colectomy at no extra cost. *J Am Coll Surg.* 2009;209(2):242-7. Epub 2009 May 28.
- Yin WY, Wei CK, Tseng KC, Lin SP, Lin CH, Chang CM, et al. Open colectomy versus laparoscopic-assisted colectomy supported by hand-assisted laparoscopic colectomy for resectable colorectal cancer: a comparative study with minimum follow-up of three years. *Hepatogastroenterology.* 2009;56(93):998-1006.
- Targarona EM, Gracia E, Garriga J, Martínez-Bru C, Cortés M, Boluda R, et al. Prospective randomized trial comparing conventional laparoscopic colectomy with hand-assisted laparoscopic colectomy: applicability, immediate clinical outcome, inflammatory response, and cost. *Surg Endosc.* 2002;16(2):234-9. Epub 2001 Oct 13.
- 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.
- Young-Fadok TM, Fanelli RD, Price RR, Earle DB. Laparoscopic resection of curable colon and rectal cancer: an evidence-based review. *Surg Endosc.* 2007;21(7):1063-8. Epub 2007 May 5.
- Kieran JA, Curet MJ. Laparoscopic colon resection for colon cancer. *J Surg Res.* 2004;117(1):79-91.
- Nelson H, Sargent D, Wieand HS, et al. A comparison of laparoscopically assisted and open colectomy for colon cancer. *N Engl J Med.* 2004;350:2050-2059. *Cancer Treat Rev.* 2004;30(8): 707-9.
- Abraham NS, Young JM, Solomon MJ. Meta-analysis of short-term outcomes after laparoscopic resection for colorectal cancer. *Br J Surg.* 2004; 91(9):1111-24.
- 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.
- Nakajima K, Lee SW, Cocilovo C, Foglia C, Kim K, Sonoda T, et al. Hand-assisted laparoscopic colorectal surgery using GelPort. *Surg Endosc.* 2004;18(1):102-5. Epub 2003 Sep 10.
- Targarona EM, Gracia E, Rodriguez M, Cerdán G, Balagué C, Garriga J, et al. Hand-assisted laparoscopic surgery. *Arch Surg.* 2003;138(2): 133-41; discussion 141.
- Marcello PW, Fleshman JW, Milsom JW, Read TE, Arnell TD, Birnbaum EH, et al. Hand-assisted laparoscopic vs. laparoscopic colorectal surgery: a multicenter, prospective, randomized trial. *Dis Colon Rectum.* 2008;51(6):818-26; discussion 826-8. Epub 2008 Apr 17.
- Anderson J, Luchtefeld M, Dujovny N, Hoedema R, Kim D, Butcher J. A comparison of laparoscopic, hand-assist and open sigmoid resection in the treatment of diverticular disease. *Am J Surg.* 2007;193(3): 400-3.
- Lee SW, Yoo J, Dujovny N, Sonoda T, Milsom JW. Laparoscopic vs. hand-assisted laparoscopic sigmoidectomy for diverticulitis. *Dis Colon Rectum.* 2006;49(4):464-9.
- Ringley C, Lee YK, Iqbal A, Bocharov V, Sasson A, McBride CL, et al. Comparison of conventional laparoscopic and hand-assisted oncologic segmental colonic resection. *Surg Endosc.* 2007;21(12):2137-41. Epub 2007 May 24.
- Tjandra JJ, Chan MK, Yeh CH. Laparoscopic vs. hand-assisted ultralow anterior resection: a prospective study. *Dis Colon Rectum.* 2008;51(1):26-31. Epub 2007 Dec 18.
- Yano H, Ohnishi T, Kanoh T, Monden T. Hand-assisted laparoscopic low anterior resection for rectal carcinoma. *J Laparoendosc Adv Surg Tech A.* 2005;15(6):611-4.
- Aalbers AG, Biere SS, van Berge Henegouwen MI, Bemelman WA. Hand-assisted or laparoscopic-assisted approach in colorectal surgery: a systematic review and meta-analysis. *Surg Endosc.* 2008;22(8):1769-80.
- NCCN Clinical Practice Guidelines in Oncology: Colon Cancer V.3.2011. Available at www.nccn.org/professionals/physician_gls/f_guidelines.asp. Last accessed May 21, 2011.
- Le Voyer TE, Sigurdson ER, Hanlon AL, Mayer RJ, Macdonald JS, Catalano PJ, et al. Colon cancer survival is associated with increasing number of lymph nodes analyzed: a secondary survey of intergroup trial INT-0089. *J Clin Oncol.* 2003;21(15):2912-9.