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Outcomes of laparoscopic colon cancer surgery in a population-based cohort in British Columbia: are they as good as the clinical trials?

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Abstract

BACKGROUND: Randomized controlled trials have shown equivalent outcomes for laparoscopic-assisted colectomy (LAC) and open colectomy (OC) when performed by well-trained surgeons experienced in both techniques. Our goal was to evaluate the outcomes of LAC at a population level.

METHODS: Using the prospectively collected Gastrointestinal Cancer Outcomes Unit database from the British Columbia Cancer Agency, short- and long-term outcomes in patients with colon cancer treated with LAC and OC were compared from 2003 to 2008 inclusive.

RESULTS: There was a statistically significant increase in the proportion of LAC from 2003 to 2008 ($P < .001$). LAC was more likely to be performed in the elective setting ($P < .001$) and for smaller tumors ($P < .001$). A similar proportion of patients had a minimum of 12 lymph nodes identified by pathology (58% vs 60%, P = not significant). Disease-free survival was similar for the 2 groups after adjusting for stage, emergency presentation, and adjuvant chemotherapy. There was no difference in overall survival.

CONCLUSIONS: The introduction of LAC for colon cancer in British Columbia outside of optimized clinical trial conditions appears to be effective and safe.

Colorectal cancer constitutes 13% of all new cancer diagnoses and is the second leading cause of cancer death in North America.[1] Nearly all patients with colorectal cancer will undergo some form of resection for their cancer.[2] With the publication of several trials in the mid-2000s that compared open colectomy (OC) with laparoscopic-assisted colectomy (LAC) for cancer,[3–7] laparoscopic resection has become an accepted modality for colon cancer treatment. The Clinical Outcomes of Surgical Therapy (COST) trial published in 2004 was a landmark trial that showed equivalent recurrence and survival rates for patients who were randomized to open or laparoscopic colon cancer resection.[5] A large meta-analysis has confirmed similar oncologic outcomes and improved short-term outcomes (ie, pain control and hospital stay) for patients treated with LAC.[8] Current guidelines emphasize that the oncologic adequacy of the

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operation should not be compromised if a laparoscopic approach is used, and conversion to open surgery is encouraged if there is any doubt.[9]

Although a myriad of randomized trials have compared OC with LAC, these have been performed in highly specialized settings by surgeons who not only have previous subspecialty training (often in minimally invasive surgery) but also have received technical credentialing to be allowed to participate in the trials.[10] It is only within these highly controlled and specialized centers that the equivalence of the 2 techniques has been shown in large trials. Patients who were excluded from these trials tended to have more comorbidities and more advanced stage disease.[11] These factors may lead to worse overall outcomes of LAC in the general population when compared with those shown in randomized trials. So far, population-based studies comparing OC and LAC have only examined short-term outcomes such as complication rates[12] and in-hospital mortality.[13] Relatively little is known about the short- and long-term oncologic outcomes of laparoscopic colon resection on a population level. The goal of the current study was to examine the trends in the use and quality of laparoscopic surgery in the province of British Columbia.

Methods

Patient selection and data collection

The Gastrointestinal Cancer Outcomes Unit database is a prospectively collected database that maintains demographic, surgical, pathologic, and outcomes data on all patients with colon or rectal cancer who are referred to the British Columbia Cancer Agency (BCCA).[14] These data are collected according to predefined categories by qualified health records administrators experienced in data abstraction for colorectal cancer.[15] Some surgical details were obtained from the BCCA charts using a retrospective chart review. Recurrence data at the BCCA are obtained through follow-up visits, a letter follow-up from general practitioners, and audits of patients who have died without a documented relapse. Mortality data are linked to the Gastrointestinal Cancer Outcomes Unit from provincial vital statistics.[15] This study was approved by the institutional ethics boards at the BCCA and Providence Health Care (St. Paul's Hospital).

Inclusion and exclusion criteria

Between 2003 and 2008, all patients with stage I to III colon cancer resected with curative intent, including locally advanced cancers, were included. Emergency and elective cases were included. Rectal cancers and cancers in which the primary originated from the appendix were excluded. Patients with synchronous cancers in the colon or any other organs were excluded as were those who had previously been treated for colon cancer. If there was no record of surgery detailing the operative approach, the patient was excluded from the analysis.

Statistical analysis

Continuous variables were compared using the Student *t* test. Proportions were compared using the Fisher exact test for dichotomous variables and the chi-square test for multiple variables. Medians were compared with the Mann-Whitney *U* test. The chi-square test was used to compare the proportions of LAC performed each year during the study period. Kaplan-Meier curves were used to estimate overall and relapse-free survival. A Cox proportional-hazards regression model was used for multivariate analysis of relapse-free survival. This multivariate model included variables that were significant on univariate analysis.

Results

Between 2003 and 2008, a total of 2,065 patients meeting our inclusion criteria had surgery for colon cancer in the province of British Columbia. Operative reports were missing for 52 patients. Therefore, a total of 2,013 records were analyzed; 312 (15%) of the patients underwent LAC. The rate of conversion from laparoscopic to open surgery was 19.2%. Those cases converted from LAC to OC were included in the LAC group for analysis. Age, sex, and the administration of adjuvant chemotherapy were similar between the 2 groups. Less than 5% (15 patients) of emergency cases were performed laparoscopically. Right-sided cancers were more likely to be resected laparoscopically than all other cancers ($P < .004$). Proportionately, a higher percentage of patients with stage I cancer underwent LAC (Table 1).

The proportion of LAC increased during each year of study ($P < .001$). This proportion increased from 2% (8) of all colectomies for colon cancer in 2003 to 25% (89) in 2008 (Fig. 1). There was no difference in the proportion of patients who had more than the recommended 12 nodes retrieved between the 2 groups, with 60% of patients having at least 12 nodes retrieved in both groups (Fig. 2).

There was no difference in overall survival estimates for patients who underwent LAC compared with OC at a median of 2.3 years (Fig. 3A). The unadjusted disease-free survival favored the laparoscopic group (Fig. 3B). After adjusting for potentially confounding factors using multivariate Cox proportional-hazards regression modeling, there was no difference in disease-free survival between the 2 groups (Table 2). In addition to the results shown in Table 2, the initial model included 3 other factors. Tumor location ($P = .190$), sex ($P = .90$), and age ($P = .49$) were not significantly different between the 2 groups during univariate analysis and were therefore omitted from the final