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# Short- and Midterm Outcomes of Laparoscopy-Assisted Colectomy for Colon and Rectosigmoid Cancer

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## ABSTRACT

Background: Laparoscopy-assisted colectomy (LAC) has gained acceptance for the treatment of colon cancer. Objective: To evaluate the use and outcomes of LAC. Patients: Patients who underwent LAC (n = 176) for colon and rectosigmoid cancer (2001-2008). Results: There were 97 men (55.1%) and 79 women(44.9%), whose median age was 67.5 years (range, 33-99 years). The median operating time for patients who underwent LAC was 216 minutes (range, 70-440). The median blood loss was 60 ml (range 10-610 ml). Intra- and postoperative complications occurred in 3 (1.7%) and 16 patients (9.1%), respectively. The morbidity rate of patients was 0%. The overall survival rates for 3 years were 100.0%, 97.5%, 95.9%, 90.1% and 77.9% for stages 0, Ⅰ, Ⅱ, Ⅲa and Ⅲb, respectively. The relapse-free survival rates for 3 years were 100.0%, 100.0%, 90.1%, 65.7% and 62.3% for stages 0, Ⅰ, Ⅱ, Ⅲa and Ⅲb, respectively. Conclusion: This study confirmed the favorable short- and midterm operative results in patients who underwent LAC.

**Key words :** Laparoscopy, Colon cancer

## INTRODUCTION

Laparoscopy-assisted colectomy (LAC) was first reported in 1991[1]. Laparoscopic colonic resections are feasible and safe, offering better cosmetic results than open surgery in the short term as well as better pain control, bowel function, and a shorter postoperative stay[2-4]. Recently, Lacy et al.[5] published the first randomized trial addressing this issue. These authors reported unforeseen better long-term survival for node-positive patients treated by LAC. We present the short- and midterm LAC results in a single-institution.

## PATIENTS AND METHODS

The indications for laparoscopic surgery used to manage colorectal cancer have gradually expanded in our institution based on the preoperative diagnosis of the tumor. When we started LAC in 1998, only T1 tumors in the colon were targeted. In 2001, T2 tumors, and in 2003 T3 tumors in the colon and the rectosig-

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moid were included. Patients with bulky tumors, those with bowel obstruction, and those who did not consent to laparoscopic surgery were excluded. Between April 2001 and March 2008, 176 consecutive selected patients with colon and rectosimoid cancer underwent laparoscopic surgery in our institution. The patients underwent examinations of blood, serum carcinoembryonic antigen, colonoscopy, barium enema or air enema, chest radiography, and computed tomography of the abdomen and pelvis for preoperative staging of tumor extent. No patients in this study received preoperative radiation or chemoradiation. They received mechanical bowel preparation with polyethylene glycol electrolyte solution for two days before surgery and prophylactic intravenous antibiotics were administered at the induction of anesthesia. A urinary catheter was inserted after the patient was put under general anesthesia. A nasogastric tube was routinely used overnight after the operation.

In patients who underwent attempted laparoscopic resections, the peritoneal cavity was accessed by the open method and carbon dioxide was insufflated to maintain intraperitoneal pressure of 8 to 10 mm Hg. Vessels were controlled with endoscopic clips intracorporeally in most circumstances. Following bowel mobilization and vessel division, the tumor-bearing segment was retrieved through an incision at a convenient site with adequate wound protection. In case of a right-sided to sigmoid colonic lesion, resection and anastomosis were performed extracorporeally using linear staplers. Rectosigmoid anastomosis was performed using a circular stapler, which was inserted transanally.

Operative mortality was defined as death that occurred during the same hospital stay or within 30 days following the primary operation. Operative morbidity was defined as complications that contributed to prolonged hospital stay or led to additional interventions or procedures.

Adjuvant chemotherapy was offered to patients with stage III disease and stage II disease in the presence of other risk factors. The decision was made jointly by the surgeons and the patient. The policy of adjuvant therapy did not change during the study period, and 5-fluorouracil-based regimens were used for the majority of patients.

## POSTOPERATIVE SURVEILLANCE

Patients were followed-up at intervals of 3 months during the first 3 years and at 6-month intervals from the fourth to fifth year. Thereafter, the patients were observed yearly. Follow-up surveillance was performed on symptom and sighn, physical examination, blood tests, the level of serum carcinoembryonic antigen, endoscopic examination and CT scans.

## DATA COLLECTION AND STATISTICAL ANALYSYS

Data on the patients' demographics, medical mortality, locations of the tumors, pathological classification (the Japanese Research Society classification for colorectal cancer)[6], operative details, postoperative outcomes, and follow-up status were studied retrospectively.

## RESULTS

There were 97 men (55.1%) and 79 women (44.9%), whose median age was 67.5 years (range, 33-99 years). Tumor locations and pathological classification are shown in Table 1. Palliative resection was performed for 12 patients (6.9%), because of the presence of unresectable distant metastasis (n = 12) .

Between April 2001 and March 2008, 176 consecutive selected patients with colon and rectosimoid cancer underwent laparoscopic surgery in our institution. When we performed LAC in 2001, only 11 patients who had T1 and T2 tumors in the colon were targeted. However, the rate of LAC for all colon cancers rose to over 70% between April 2007 and March 2008, as shown in Figure 1.

The operative details and complications are shown in Table 2. The median operating time for patients who underwent LAC was 216 min-

utes (range, 70–440 years). The median blood loss was 60 ml (range 10–610 ml). In those patients with successful laparoscopic procedures, the permissible length of the incision was 4.0–6.9 cm. Eleven patients underwent initial laparoscopy that required conversion. The reasons for conversion were advanced tumors invading neighboring organs (n = 2), adhesions (n = 4), inability to locate the tumors (n = 2), and difficulty of the surgical technique (n =3).

**Table 1** Patient detail and Pathological classification

| | number | % |
|---|---|---|
| Number of patients | 176 | |
| Age(mean) | 67 | |
| Sex | | |
| male | 97 | 55.1 |
| female | 79 | 44.9 |
| Tumor site | | |
| C | 20 | 11.4 |
| A | 36 | 20.5 |
| T | 15 | 8.5 |
| D | 7 | 4.0 |
| S | 62 | 35.2 |
| RS | 36 | 20.5 |
| Number of patients with pathology form | | |
| Depth | | |
| M | 17 | 9.7 |
| SM | 26 | 14.8 |
| MP | 23 | 13.1 |
| SS | 95 | 54.0 |
| SE | 12 | 6.8 |
| SI | 3 | 1.7 |
| pN stage | | |
| N0 | 118 | 67.0 |
| N1 | 44 | 25.0 |
| N2 | 12 | 6.8 |
| N3 | 2 | 1.1 |
| p-Stage | | |
| 0 | 17 | 9.7 |
| Ⅰ | 41 | 23.3 |
| Ⅱ | 59 | 33.5 |
| Ⅲa | 33 | 18.8 |
| Ⅲb | 12 | 6.8 |
| Ⅳ | 14 | 8.0 |
| M stage | | |
| M (−) | 162 | 92.0 |
| M (+) | 14 | 8.0 |
| Cur stage | | |
| CurA | 162 | 92.0 |
| CurB | 2 | 1.1 |
| CurC | 12 | 6.8 |

Intra- and postoperative complications occurred in 3 (1.7%) and 16 patients (9.1%), respectively, as shown in Table 2. The causes of intraoperative complications were hemorrhage (n = 1) ureteric injury (n = 2), and vessel/bladder injury (n = 1). The causes of postoperative morbidity were wound infection (n = 7), intra-abdominal abscess (n = 1), anastomotic stenosis (n = 1), bowel obstruction (n = 2), cholelithiasis (n = 2), colitis (n = 2), and duodenal ulcer (n = 1). The mortality rate of patients was 0% in the intra- and postoperative periods (0–30 days).

## SURVIVAL ANALYSIS

The average follow-up interval of the surviving patients with nondisseminated disease (stages 0–III) was 33.3-month. The overall survivals and relapse-free survivals of patients with stage 0 to stage III disease are shown in Figures 2 and 3. The overall survival rates for 3 years were 100.0%, 97.5%, 95.9%, 90.1% and 77.9% for stages 0, Ⅰ, Ⅱ, Ⅲa and Ⅲb, respectively. The relapse-free survival rates for 3 years were 100.0%, 100.0%, 90.1%, 65.7% and 62.3% for stages 0, Ⅰ, Ⅱ, Ⅲa and Ⅲb, respectively.

**Table 2** Operative and post operative outcome

| | | |
|---|---|---|
| OperativeTime (median) | 216(70-440) | (min) |
| Blood loss (median) | 60(10-670) | (ml) |
| | number | % |
| Conversion to open surgery | 11 | 6.3 |
| Intra-operative complications | 4 | 2.3 |
| clinicaly significant hemorrhage | 1 | 0.6 |
| bowel injury | 0 | 0.0 |
| ureteric injury | 2 | 1.1 |
| vessel/bladder injury | 1 | 0.6 |
| others | 0 | 0.0 |
| Post-operative complications | 16 | 9.1 |
| wound infection | 7 | 4.0 |
| abdominal abscess | 1 | 0.6 |
| anastomotic leakage | 0 | 0.0 |
| anastomotic stenosis | 1 | 0.6 |
| bowel obstruction | 2 | 1.1 |
| others | 5 | 2.8 |

## DISCUSSION

The overall operative morbidity of all the patients was 9.1%, which was comparable to other high-volume centers with analysis of large numbers of patients[7, 8]. Moreover, operations were performed on elderly patients with concomitant medical diseases, and the resections were palliative for 12 patients with advanced local or distant diseases. Indeed, most morbidities were due to medical causes.

We adopted an aggressive policy for stage IV diseases, and resection of the primary lesion was usually performed except in those with very high operative risk to avoid bleeding and obstruction due to the primary cancer. In addition, during the study period, new chemotherapeutic agents were not widely available for patients with stage IV diseases.

The better survival of patients who had nondisseminated disease and underwent laparoscopic resection was an unexpected finding. In most reports and randomized trials, the long-term survival of patients with laparoscopic resection was similar to that of those who underwent open procedures. However, better long-term survival in patients with laparoscopic resection has also been reported. In the study of Lacy et al., which randomized 219 patients to either open or laparoscopic surgery for colon cancer, the probability of survival was better in the laparoscopic group[5]. The improvement was attributed to the better survival of patients with stage III disease. Capussotti et al. also found that, in lymph node-positive patients who underwent laparoscopic colonic resection, better survival could be achieved[9]. The better results might be attributable to the favorable immunologic response and reduced stress responses in patients with laparoscopy. The prospective randomized clinical trials to address the safety and oncologic effectiveness of LAC compared with open colectomy (OC)[10]. Although one early single-institution trial suggested that LAC may result in better outcomes than OC, seven larger subsequent multi-institutional trials and meta-analysis have not detected considerable differences in either short- or long-term outcomes by surgical approach[11-17]. These multicenter

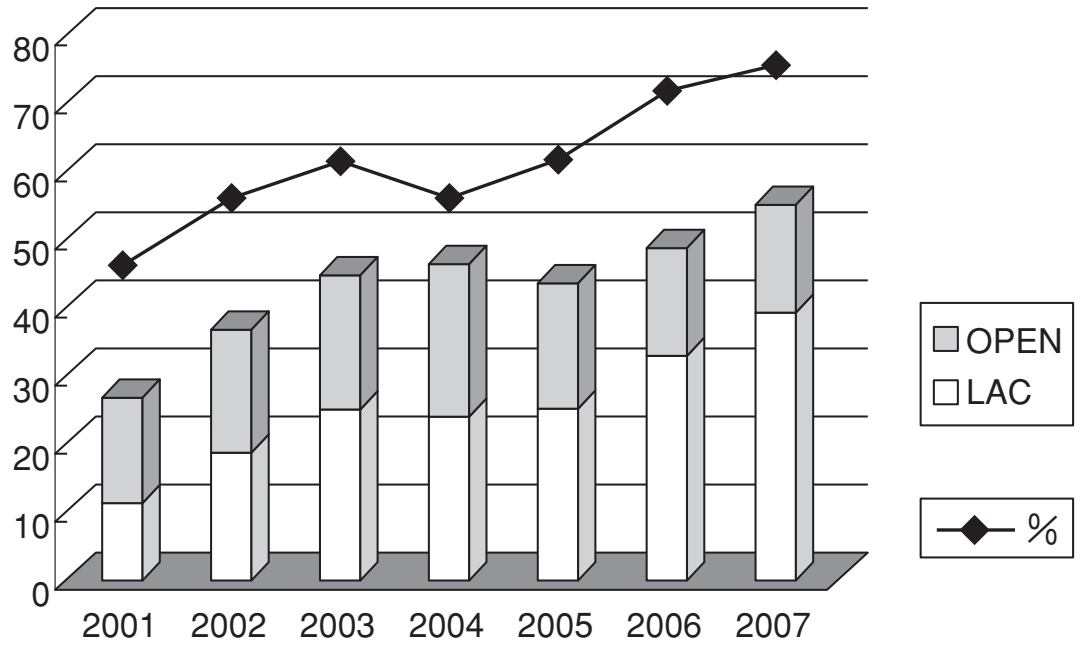


**Fig. 1 The number of operation and rate of LAC**
The number of operation (OC and LAC) for colon cancer and the rate of LAC for all colon cancers rose to over 70% between April 2007 and March 2008

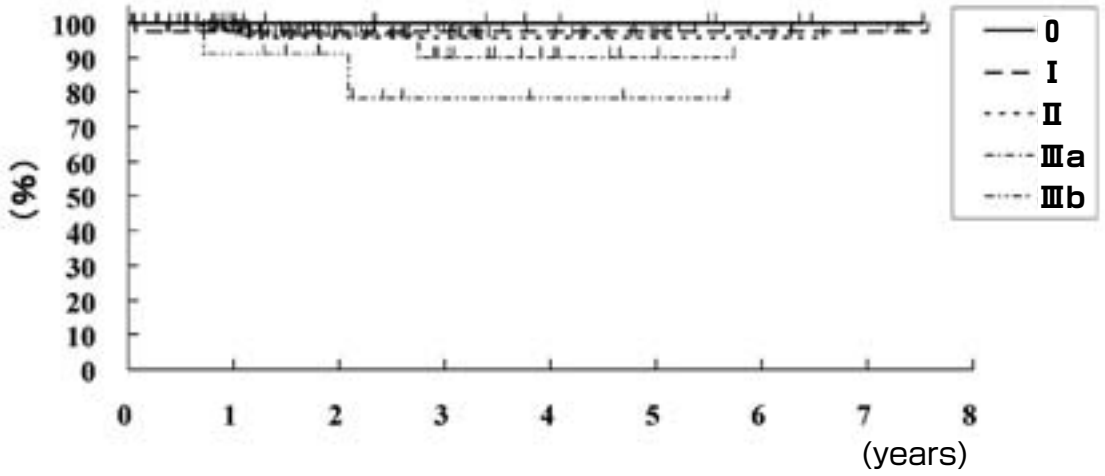


**Fig. 2** Over-all survival curves stratified by the Japanese Research Society classification against cancer tumor stage

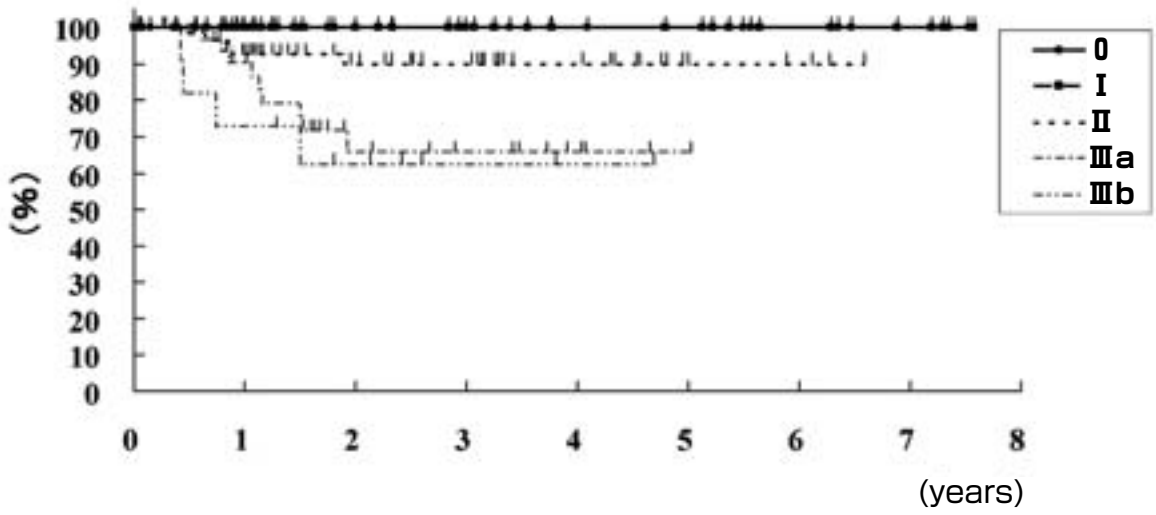


**Fig. 3** Relapse-free survival curves stratified by the Japanese Research Society classification against cancer tumor stage

clinical trials were followed by numerous single-institution trials and cohort studies from centers with high-volume expertise or interest in LAC, most of which also demonstrated comparable results for LAC and OC[15-16,18-21]. Experimental and clinical studies have shown that laparoscopy causes a lower impairment of cell-mediated immunitary function than open operation[22-24]. They have generated the hypothesis that laparoscopy could be a more suitable technique for treating neoplasticdiseases.

## CONCLUSION

This study confirmed the favorable short- and midterm operative results in patients who underwent laparoscopic resection of colon and rectosigmoid cancer. The operative mortality of LAC was 9.1%. Laparoscopic-assisted colectomy for colon and rectosigmoid cancer is feasible, safe, and has many short-term benefits, including reduction of perioperative mortality. The oncological clearance is equivalent to the open procedure. Further work would be required also needed to standardize the surgical expertise.

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(Accepted for publication, Jan. 20, 2009)