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ORIGINAL ARTICLE

# Outcome of laparoscopic surgery for colon cancer in elderly patients

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**Keywords**
Colon cancer; elderly patient; laparoscopic surgery

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**Abstract**

*Introduction:* The aim of this study was to evaluate whether elderly patients with colorectal cancer benefit from laparoscopic colon surgery (LAC) in comparison to open colon surgery (OC).

*Methods:* Patients with colon cancer were divided into four groups; $> 75$ years ($CC_{>75}$) [$LAC_{>75}$ ($n=36$), $OC_{>75}$ ($n=15$)] and $\leq 75$ years [$LAC_{\leq 75}$ ($n=90$), $OC_{\leq 75}$ ($n=26$)]. Differences in postoperative short-term outcomes were analyzed among the age and procedure groups.

*Results:* Intraoperative blood loss was significantly less in the $LAC_{>75}$ group ($68 \pm 168$ ml) than in the $OC_{>75}$ group ($118 \pm 130$ ml, $P=0.040$). The C-reactive protein of patients in the $OC_{>75}$ group ($5.4 \pm 2.2$ mg/dl) tended to be less than that of the $LAC_{>75}$ group ($6.1 \pm 2.8$ mg/dl, $P=0.080$) on postoperative day 1. The time to the first passage of flatus was significantly shorter in the $LAC_{>75}$ group ($2.0 \pm 0.7$ days) than in the $OC_{>75}$ group ($2.7 \pm 0.8$ days, $P=0.003$). Postoperative hospital stays were also shorter in the $LAC_{>75}$ group ($14.2 \pm 9.4$ days) than in the $OC_{>75}$ group ($18.0 \pm 8.3$ days, $P=0.038$). No mortality was registered in the $LAC_{>75}$ group, while one patient in the $OC_{>75}$ group died during the postoperative course. The rate of postoperative morbidity was similar between the $LAC_{>75}$ and $OC_{>75}$ groups [13.9% (5/36) versus 20.0% (3/15), $P=0.679$].

*Conclusion:* LAC provides some advantages over OC in patients with colon cancer aged $> 75$ years as well as in those aged $\leq 75$ years. LAC can be safely performed in very elderly patients with colon cancer.

## Introduction

The incidence of colorectal cancer has been increasing recently in the general population. Along with increases in life expectancy, the incidence of new cases of elderly patients diagnosed with colorectal cancer is on the rise (1). The only curative treatment for colorectal cancer is operative excision. Traditionally, colorectal cancer is treated by open colorectal surgery (OC). However, since 1991, laparoscopic colorectal surgery (LAC) has become a popular surgical option. Although the indication for advanced colorectal cancer remains controversial, several studies have reported the advantages of LAC over OC, especially with regard to short-term outcomes such as less pain, rapid recovery of bowel function, shorter hospital stay, and better cosmetic results (2–7). Interestingly, recent studies reported no differences in long-term outcome in patients with colorectal cancer treated by LAC or OC (6–9).

Since elderly patients are likely to have concomitant medical diseases, they are high risk for surgery (10–13). Because of the surgical risks face by the elderly, the aforementioned advantages become important in reducing morbidity and mortality rates in the elderly. Several studies have reported the advantages of LAC in the elderly (14–25), though the majority of these studies have defined the elderly as patients aged $\geq 70$ years. Given the increased incidence of colorectal cancer in elderly patients, it is necessary to evaluate the advantages of LAC in these patients. Moreover, it is necessary to evaluate the advantages of LAC strictly in older patients, as, there have been few reports suggesting the advantages in old patients based on the comparison to those in young patients.

The aim of this retrospective study was to compare the short-term outcomes of LAC and OC for elderly patients with colon cancer (CC). Elderly patients were defined as patients older than 75 years ($CC_{>75}$ group). In this study, we also examined short-term outcomes of LAC and OC in CC patients 75 years of age or younger ($CC_{\leq 75}$ group). Then, the advantages of LAC over OC in the $CC_{>75}$ group were compared to those in the $CC_{\leq 75}$ group.

## Materials and Methods

The study protocol was approved by the Human Ethics Review Committee of Suita Municipal Hospital (Suita, Japan), and signed consent was obtained from each patient. The hospital records of 167 patients who underwent elective colon cancer surgery at the Department of Surgery, Suita Municipal Hospital between July 2004 and December 2007 were reviewed retrospectively. In order to exclude the influence of differences in surgical procedures, only patients with CC were included. Cases with cancer recurrence, emergency cases, and cases with neoadjuvant therapy were also excluded from this study. Exclusion criteria for laparoscopic colectomy were as follows: tumor with infiltration to adjacent organs on an ultrasound and/or a CT, and those with intestinal obstruction or perforation requiring urgent decompression. Of the 167 patients, 51 were older than 75 years; 36 (21%) underwent LAC for CC during the period ($LAC_{>75}$ group), while 15 patients (9%) underwent OC for CC during the same period ($OC_{>75}$ group). We also analyzed the medical records of 116 patients who were $\leq$ 75 years of age who underwent LAC (90 [54%] patients, $LAC_{\leq 75}$ group) and OC (26 [16%] patients, $OC_{\leq 75}$ group) for CC. In the present study, based on previous reports with a cutoff age of 75 years, patients over 75 were defined as elderly in this study (15,18,20,25).

All operative procedures were performed by the same surgical team. The selection of surgical procedure was based on surgical preference, rather than randomization. Conversion to laparotomy was defined as the need for a standard laparotomy at any time during the procedure, either because of complications or technical difficulties. The patients with conversion were included in the LAC group based on the concept of intention-to-treat analysis. After the operation, early mobilization was encouraged. Oral intake was restarted after the appearance of peristalsis. Postoperative management was uniform and performed regardless of surgical procedure. Eligibility for discharge was considered when oral intake was well tolerated and the patient was not febrile.

The hospital records were reviewed for information on gender, age, BMI, perioperative laboratory results including albumin, hemoglobin, leukocyte count, lymphocyte count and C-reactive protein (CRP), preoperative pulmonary function tests including vital capacity and forced expiratory volume in 1.0 second, preoperative complications, ASA score as determined by the anesthesiology team preoperatively, tumor location, cancer stage, operation time, intraoperative blood loss, length of postoperative hospital stay, and postoperative outcome including mortality and morbidities (26). The stage of CC was assessed according to Dukes' classification. Death within 30 days after surgery was considered operative mortality. Morbidities were defined as complications that required additional treatment.

Data were expressed as mean $\pm$ SD. Differences between groups were assessed by the $\chi^2$ test, Fisher's exact test or the Mann–Whitney *U*-test. Statistical analysis was performed using StatView (version 5.0, SAS Institute, Cary, USA). $P < 0.05$ was considered statistically significant.

## Results

The preoperative clinical characteristics of the patients are summarized in Table 1. There was a higher percentage of female patients in the $CC_{>75}$ group than in the $CC_{\leq 75}$ group. BMI, albumin, hemoglobin, and lymphocyte count were lower in the $CC_{>75}$ group than in the $CC_{\leq 75}$ group, and preoperative respiratory function of the $CC_{>75}$ group was worse than that of the $CC_{\leq 75}$ group. As shown in Table 2, a greater proportion of the $CC_{>75}$ group had a higher ASA score than the $CC_{\leq 75}$ group. Relative to the $CC_{\leq 75}$ patients, a greater percentage of $CC_{>75}$ patients had incidences of premorbid medical diseases and previous abdominal surgery . However, comparison of LAC and OC groups showed no significant differences in the above preoperative factors for both the $CC_{>75}$ and $CC_{\leq 75}$ groups.

Table 3 shows tumor- and surgery-related characteristics. Tumor location and stage were did not differ among the four groups. The operation time was significantly longer in the $LAC_{>75}$ group ($202 \pm 47$ min) than in the $OC_{>75}$ group ($170 \pm 49$ min, $P = 0.021$). Intraoperative blood loss was significantly less in the $LAC_{>75}$ ($68 \pm 168$ ml) than in the $OC_{>75}$ ($118 \pm 130$ ml, $P = 0.040$). On the other hand, there was no significant difference in operation time between the $LAC_{\leq 75}$ group ($197 \pm 69$ min) and $OC_{\leq 75}$ group ($228 \pm 162$ min, $P = 0.511$), although intraoperative blood loss in the $LAC_{\leq 75}$ group was significantly less than in the $OC_{\leq 75}$ group ($64 \pm 135$ ml versus $149 \pm 283$ ml, $P = 0.042$).

A planned LAC was subsequently switched to OC in five (13.9%) of the 36 patients in the $LAC_{>75}$ group. The reasons for the conversion included bleeding in three patients, and dense adhesion in two. In nine out of 90 patients (10.0%) in the $LAC_{\leq 75}$ group, LAC was replaced

**Table 1** Preoperative clinical features of patients with colon cancer (CC) enrolled in this study

| | $CC_{>75}$ group | | | $CC_{\leq 75}$ group | | | *P*-value | |
|---|---|---|---|---|---|---|---|---|
| | LAC (n = 36) | OC (n = 15) | *P*-value | LAC (n = 90) | OC (n = 26) | *P*-value | $LAC_{>75}$ versus $LAC_{\leq 75}$ | $OC_{>75}$ versus $OC_{\leq 75}$ |
| Sex (male/female) | 13/23 | 7/8 | 0.482 | 54/36 | 14/12 | 0.575 | 0.015 | 0.658 |
| Age (years)* | 82.0 ± 4.6 | 81.9 ± 5.7 | 0.948 | 64.9 ± 7.4 | 63.8 ± 7.8 | 0.515 | < 0.001 | < 0.001 |
| BMI ($kg/m^2$)* | 20.1 ± 3.2 | 19.5 ± 3.8 | 0.204 | 22.5 ± 3.0 | 21.9 ± 3.0 | 0.319 | | |
| Preoperative laboratory data | | | | | | | | |
| Albumin (g/dl)* | 3.4 ± 0.6 | 3.4 ± 0.6 | 0.986 | 3.9 ± 0.6 | 3.9 ± 0.6 | 0.910 | 0.007 | 0.043 |
| Hemoglobin (ng/ml)* | 11.4 ± 2.3 | 11.3 ± 1.6 | 0.884 | 12.5 ± 2.3 | 12.6 ± 2.0 | 0.877 | 0.027 | 0.048 |
| Leukocyte ($/mm^3$)* | 6008 ± 1506 | 6209 ± 1550 | 0.184 | 6351 ± 1343 | 6575 ± 1591 | 0.821 | 0.956 | 0.597 |
| Lymphocyte ($/mm^3$)* | 1405 ± 531 | 1367 ± 525 | 0.681 | 1669 ± 579 | 1656 ± 548 | 0.902 | 0.120 | 0.198 |
| Preoperative respiratory function | | | | | | | | |
| VC (l)* | 2.09 ± 0.60 | 1.97 ± 0.61 | 0.601 | 2.80 ± 0.72 | 2.74 ± 0.62 | 0.475 | < 0.001 | 0.003 |
| $FEV_{1.0}$ (l)* | 1.68 ± 0.53 | 1.67 ± 0.47 | 0.946 | 2.25 ± 0.66 | 2.19 ± 0.6 | 0.673 | < 0.001 | 0.007 |

*Data are mean ± SD.

$FEV_{1.0}$, forced expiratory volume in 1.0 second; LAC, laparoscopic colon surgery; OC, open colon surgery; VC, vital capacity.

**Table 2** Preoperative characteristics related to previous history in patients with colon cancer (CC) enrolled in this study

| | $CC_{>75}$ group | | | $CC_{\leq 75}$ group | | | *P*-value | |
|---|---|---|---|---|---|---|---|---|
| | LAC (n = 36) | OC (n = 15) | *P*-value | LAC (n = 90) | OC (n = 26) | *P*-value | $LAC_{>75}$ versus $LAC_{\leq 75}$ | $OC_{>75}$ versus $OC_{\leq 75}$ |
| Previous abdominal surgery (%) | 19 (52.8) | 8 (53.3) | 0.991 | 25 (27.8) | 8 (30.8) | 0.766 | 0.008 | 0.154 |
| ASA score (1/2/3) | 0/20/16 | 0/8/7 | 0.885 | 45/40/5 | 14/10/2 | 0.827 | < 0.001 | 0.016 |
| Preoperative complications (%) | 16 (44.4) | 8 (53.3) | 0.858 | 23 (25.6) | 6 (23.1) | 0.797 | 0.038 | 0.049 |
| Cardiovascular disease (%) | | | | | | | | |
| Arrhythmia (%) | 4 (11.1) | 2 (13.3) | | 4 (4.4) | 1 (3.8) | | | |
| Ischemic heart disease (%) | 2 (5.6) | 1 (6.7) | | 4 (4.4) | 1 (3.8) | | | |
| Valvular disease (%) | 1 (2.8) | 0 (0) | | 1 (1.1) | 0 (0) | | | |
| Pulmonary dysfunction (%) | 2 (5.6) | 2 (13.3) | | 4 (4.4) | 1 (3.8) | | | |
| Liver dysfunction (%) | 1 (2.8) | 0 (0) | | 4 (4.4) | 0 (0) | | | |
| Renal dysfunction (%) | 1 (2.8) | 1 (6.7) | | 0 (0) | 1 (3.8) | | | |
| Diabetes (%) | 5 (13.9) | 2 (13.3) | | 11 (12.2) | 4 (15.4) | | | |
| Neuromuscular disease (%) | 1 (2.8) | 2 (13.3) | | 1 (1.1) | 0 (0) | | | |
| Autoimmune disease (%) | 0 (0) | 0 (0) | | 1 (1.1) | 1 (3.8) | | | |
| ASA score (1/2/3) | 0/20/16 | 0/8/7 | 0.885 | 45/40/5 | 14/10/2 | 0.827 | < 0.001 | 0.016 |

LAC, laparoscopic colon surgery; OC, open colon surgery.

with OC because of bleeding in two patients, dense adhesion in four, and the potential spread of cancer cells to adjacent organs in three. The conversion rate was not significantly different between $LAC_{>75}$ and $LAC_{\leq 75}$ groups ($P = 0.540$).

Table 4 compares the postoperative outcome of the four groups. The leukocyte count and CRP on postoperative day (POD) 1 were significantly lower in the $LAC_{\leq 75}$ than $OC_{\leq 75}$ (leukocyte on POD1: $8294 \pm 1742/mm^3$ versus $9253 \pm 2354 mm^3$, $P = 0.034$; CRP on POD1: $5.4 \pm 2.6$ versus $7.4 \pm 2.4$ mg/dl, $P = 0.002$). $LAC_{>75}$ patients' CRP on POD1 tended to be less than that of the $OC_{>75}$ group ($5.4 \pm 2.2$ versus $6.1 \pm 2.8$ mg/dl, $P = 0.080$), and yhe leukocyte count on POD1 was similar in both groups ($7883 \pm 1930/mm^3$ versus $8637 \pm 1742/mm^3$, $P = 0.196$). There were no significant differences in the time to the first walk or oral solid food intake among the four groups. The time to the first passage of flatus was significantly shorter in the LAC groups than in the OC groups, among both the $CC_{>75}$ groups ($2.0 \pm 0.7$ versus $2.7 \pm 0.8$ days, $p = 0.003$) and $CC_{\leq 75}$ groups ($1.9 \pm 0.8$ versus $2.5 \pm 0.9$ days, $P = 0.009$). Postoperative hospital stay for the LAC group was also significantly shorter than for the OC group, among the $CC_{>75}$ groups (14.2 ± 9.4 versus

**Table 3** Tumor-related and surgery-related features of patients with colon cancer (CC) enrolled in the study

| | $CC_{>75}$ group | | | $CC_{\leq 75}$ group | | | *P*-value | |
|---|---|---|---|---|---|---|---|---|
| | LAC (n = 36) | OC (n = 15) | *P*-value | LAC (n = 90) | OC (n = 26) | *P*-value | $LAC_{>75}$ versus $LAC_{\leq 75}$ | $OC_{>75}$ versus $OC_{\leq 75}$ |
| Tumor location (C/A/T/D/S) | 8/7/4/1/16 | 3/4/3/0/5 | 0.805 | 10/16/11/6/47 | 3/6/6/2/9 | 0.517 | 0.509 | 0.788 |
| Dukes' (A/B/C/D) | 12/13/8/3 | 6/6/2/1 | 0.877 | 28/33/25/4 | 6/9/8/3 | 0.628 | 0.790 | 0.489 |
| Operation time (min)* | 202 ± 47 | 170 ± 49 | 0.021 | 197 ± 69 | 228 ± 162 | 0.511 | 0.342 | 0.111 |
| Intraoperative blood loss (ml)* | 68 ± 168 | 118 ± 130 | 0.040 | 64 ± 135 | 149 ± 283 | 0.042 | 0.764 | 0.261 |

*Data are mean ± SD.

A, ascending colon; C, cecum; D, descending colon; LAC, laparoscopic colon surgery; OC, open colon surgery; S, sigmoid colon; T, transverse colon.

**Table 4** Postoperative outcome of patients with colorectal cancer (CC) enrolled in this study

| | $CC_{>75}$ group | | | $CC_{\leq 75}$ group | | | *P*-value | |
|---|---|---|---|---|---|---|---|---|
| | LAC (n = 36) | OC (n = 15) | *P*-value | LAC (n = 90) | OC (n = 26) | *P*-value | $LAC_{>75}$ versus $LAC_{\leq 75}$ | $OC_{>75}$ versus $OC_{\leq 75}$ |
| Leukocyte on POD1 (/$mm^3$)* | 7883 ± 1930 | 8637 ± 1742 | 0.196 | 8294 ± 2001 | 9253 ± 2354 | 0.034 | 0.632 | 0.962 |
| CRP on POD1 (mg/dl)* | 5.4 ± 2.2 | 6.1 ± 2.8 | 0.080 | 5.4 ± 2.6 | 7.4 ± 2.4 | 0.002 | 0.681 | 0.314 |
| First walking (days)* | 1.5 ± 0.6 | 1.7 ± 0.8 | 0.184 | 1.4 ± 0.6 | 1.5 ± 0.6 | 0.502 | 0.493 | 0.111 |
| First bowel flatus (days)* | 2.0 ± 0.7 | 2.7 ± 0.8 | 0.003 | 1.9 ± 0.8 | 2.5 ± 0.9 | 0.009 | 0.601 | 0.340 |
| Restart of oral intake (days)* | 4.4 ± 1.1 | 4.7 ± 0.9 | 0.410 | 4.1 ± 1.0 | 4.3 ± 0.9 | 0.401 | 0.106 | 0.094 |
| Postoperative hospital stay (days)* | 14.2 ± 9.4 | 18.0 ± 8.3 | 0.038 | 13.1 ± 6.4 | 16.2 ± 8.0 | 0.045 | 0.309 | 0.445 |
| Mortality (%) | 0 (0) | 1 (6.7) | | 0 (0) | 0 (0) | | — | 0.366 |
| Morbidity (%) | 5 (13.9) | 3 (20.0) | 0.679 | 14 (15.6) | 6 (23.1) | 0.385 | 0.8133 | 0.819 |
| Arrhythmia | 0 (0) | 0 (0) | | 1 (1.1) | 0 (0) | | | |
| Pneumonia | 0 (0) | 1 (6.7) | | 0 (0) | 0 (0) | | | |
| Anastomotic leakage | 1 (2.8) | 0 (0) | | 0 (0) | 1 (3.8) | | | |
| Intraabdominal abscess | 0 (0) | 1 (6.7) | | 3 (3.3) | 2 (7.7) | | | |
| Wound infection | 3 (8.3) | 1 (6.7) | | 10 (11.1) | 3 (11.5) | | | |
| Postoperative ileus | 1 (2.8) | 0 (0) | | 2 (2.2) | 0 (0) | | | |
| Urinary tract infection | 1 (2.8) | 0 (0) | | 0 (0) | 1 (0) | | | |
| Delirium | 1 (2.8) | 1 (6.7) | | 3 (2.2) | 1 (3.8) | | | |

*Data are mean ± SD.

CRP, C reactive protein; LAC, laparoscopic colon surgery; OC, open colon surgery; POD, postoperative day.

18.0 ± 8.3 days, $P = 0.038$) and $CC_{\leq 75}$ groups (13.1 ± 6.4 versus 16.2 ± 8.0 days, $P = 0.045$). One patient of the $OC_{>75}$ group died from severe ischemic colitis during the postoperative course, whereas no mortality was recorded in the remaining three groups. The incidence of postoperative morbidities was 13.9% in the $LAC_{>75}$ group, which was not significantly different from that of the other three groups. Furthermore, no postoperative morbidities specific to old age were encountered in the present study.

## Discussion

It is well known that advancing age has a greater likelihood for preoperative compensated systemic insufficiencies, which might be unmasked by surgical stress. In general, elderly patients are at poor risk for surgery. Laparoscopic surgery has gained wide acceptance as a treatment modality in colorectal surgery. Most laparoscopic procedures are usually performed using a carbon dioxide pneumoperitoneum, which can lead to cardiopulmonary loading and potential complications (27,28). For this reason, some surgeons tend to avoid LAC for elderly patients, although there is no solid evidence that age should be a limiting factor (2–7).

The present study showed that LAC could be performed as safely as OC even in potentially compromised elderly patients in terms of postoperative mortality and morbidity. In addition to safety, LAC had certain benefits over OC in elderly patients with respect to intraoperative blood loss, time to the first passage of flatus, and postoperative hospital stay, although operation time to complete LAC

was significantly longer than that of OC in elderly patients. Furthermore, because the present study was retrospectively designed, the start of oral intake was not based on the first passage of flatus, which reflects the return of bowel function, during the period of the present study. If we had determined the oral intake based on the first passage of flatus during the study period, the postoperative hospital stay in the LAC group would have been shorter. Although previous studies have reported similar results, there have been no studies comparing these benefits between elderly patients and younger patients (14–25). Based on the comparison in the present study, we showed that these benefits for elderly patients were equal to those for the younger patients.

The present study was not a randomized controlled study, and there was an apparent selection bias. In this series, the operation time was not significantly different between LAC and OC in the $CC_{\leq 75}$ patients. The reason might be that OC was selected for complicated cases in $CC_{\leq 75}$ patients such as adhesion and large tumor size. In other words, surgeons seemed to decide conversion earlier for elderly cases than non-elderly because they wanted to shorten operation time for the elderly.

Though the long-term outcome of LAC is not clear yet, the above data suggest that the benefits of LAC in the early postoperative period are similar for both elderly and younger patients. It is somehow difficult to discuss the long-term outcomes for elderly patients because many have concomitant diseases that may affect survival. For the elderly, a longer hospital stay may be associated with certain complications such as hospital-acquired infection, loss of activity of daily life, and senile dementia. Therefore, for such patients, a short hospital stay and rapid recovery are more important issues than for non-elderly patients. Since similar results were noted in the short-term outcomes irrespective of age, we propose that LAC for elderly patients has certain benefits similar to those of LAC for younger patients.

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# Stage IV 大腸癌に対する腹腔鏡下原発巣切除

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**Laparoscopic Bowel Resection for Stage IV Colorectal Cancer:** Yoshihito Ide and Kohei Murata (*Dept. of Surgery, Suita Municipal Hospital*)

*Summary*

The purpose of this study was to review the outcomes of laparoscopic bowel resection for patients with Stage IV colorectal cancer. Twenty nine patients with cStage IV disease were undergone a bowel resection during the period from April 2006 to December 2009 in our hospital. Twenty one patients were undergone a laparoscopic resection and the other 8 for an open resection. Our data base was reviewed retrospectively regarding the patient demography, operation time, amount of bleeding, dissection level, stoma operation rate, perioperative morbidity and mortality, length of stay, induction rate for chemotherapy, the length between operation and chemotherapy and response rate for chemotherapy. Then the usefulness of laparoscopic resection and open resection were compared. There were significant differences in amount of bleeding, stoma operation rate, perioperative morbidity and the length of stay. Especially, the complication rate was significantly lower in those with laparoscopic resection than open resection (9.5% versus 63%). Hence, a laparoscopic bowel resection is safe and feasible option for Stage IV colorectal cancer patients. **Key words:** Stage IV colorectal cancer, Laparoscopic surgery, Palliative bowel resection

**要旨**　大腸癌治療ガイドラインにおいて，Stage IV であっても有症状で耐術能に問題がなければ原発巣切除が推奨されている。原発巣切除における腹腔鏡手術の有用性，妥当性を retrospective に検討した。対象は 2006 年 4 月～2009 年 12 月までの間に cStage IV と診断され，原発巣を切除する目的で手術を行った 29 例（腹腔鏡群 21 例，開腹群 8 例）。手術時間，出血量，郭清度，ストーマ造設率，合併症，在院日数，開腹移行，化学療法導入率，化学療法開始日，奏効率，観察期間を検討項目とした。出血量，ストーマ造設率，合併症率，在院日数で有意差があった。特に合併症は腹腔鏡群が 2 例（9.5%）に対し，開腹群は 5 例（63%）と高率であった。Stage IV における腹腔鏡下原発巣切除術は安全性に問題なく，腹腔鏡手術の低侵襲性を享受できることから，Stage IV 症例において有用であると考えられた。

## はじめに

下血，腹部膨満，便秘など症状を有し，精査にて大腸癌と診断された場合，20～40%の割合で遠隔転移を有していると報告されている[1]。大腸癌治療ガイドラインにおいては Stage IV の治療方針として，原発巣，遠隔転移巣のどちらも切除可能な場合，切除を推奨している[2]。遠隔転移巣が切除困難な場合，有症状で耐術能に問題がなければ原発巣切除を推奨しているが，その有用性については controversial である。また，Stage IV 大腸癌に対する原発巣切除手術は術後早期に化学療法を行うため，また QOL 向上のため，安全かつ低侵襲に行われることが重要であり，腹腔鏡手術のよい適応であると考えるが，有用性，妥当性についての報告は少ない。今回，Stage IV における腹腔鏡手術の安全性，有用性を検討する目的で以下の検討を行った。

## I. 対象，方法

2006 年 4 月～2009 年 12 月までの間に切除不能進行大腸癌と診断され，原発巣を切除する目的で手術を行った 29 例を対象とした。腹腔鏡で 21 例，開腹で行われたのが 8 例であった。吹田市民病院で手術を行い，大腸専門

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表 1 患者背景の比較

| | 腹腔鏡群(n=21) | 開腹群 (n=8) | p値 |
|---|---|---|---|
| 年齢 (歳) | 66.4 (41～86) | 73.5 (55～93) | 0.83 |
| 男性 | 13 (62%) | 6 (75%) | 0.68 |
| PS 2以上 | 7 (33%) | 2 (25%) | >0.9 |
| 直腸 | 4 (19%) | 5 (63%) | 0.067 |
| 転移巣 | | | |
| 肝 | 17 | 7 | |
| 肺 | 4 | 0 | |
| 腹膜 | 3 | 0 | |
| リンパ節 | 2 | 1 | |
| 骨 | 1 | 0 | |
| イレウス | 7 (33%) | 6 (75%) | 0.067 |
| 経肛門イレウスチューブ | 6 (29%) | 3 (38%) | 0.68 |
| 周術期輸血 | 7 (33%) | 2 (25%) | >0.9 |

表 2 結 果

| | 腹腔鏡群 (21例) | 開腹群 (8例) | p値 |
|---|---|---|---|
| 手術時間 (分) | 200 (146～300) | 239 (135～387) | 0.66 |
| 出血量 (mL) | 50 (10～150) | 419 (50～1,500) | <0.05 |
| D1 郭清 | 2 (9.5%) | 2 (25%) | 0.3 |
| ストーマ造設例 | 2 (9.5%) | 5 (63%) | <0.05 |
| 合併症 | 2 (9.5%) | 5 (63%) | <0.05 |
| 開腹移行 | 2 (9.5%) | — | |
| 術後在院日数 (日) | 15 (9～54) | 24 (16～110) | <0.05 |
| 化学療法導入率(%) | 17 (81%) | 7 (88%) | >0.9 |
| 化学療法開始日(日) | 28 (11～137) | 21 (16～255) | 0.79 |
| 奏効率 (%) | 82% | 86% | >0.9 |
| 観察期間 (日) | 326 (35～1,177) | 436 (110～1,404) | |

医師2名のどちらかが手術を執刀または指導した。検討は retrospective に行い，統計は $\chi^2$ test，Fisher's exact test，Mann-Whitney U-test を必要に応じ用いた。p値 0.05 以下を有意差ありとした。

## II. 結 果

腹腔鏡群 (n=21) と開腹群 (n=8) の2群に分けて，患者背景を検討した (表1)。年齢，性別，全身状態 (PS)，原発部位，転移巣，イレウスの有無，経肛門イレウスチューブ使用例，周術期輸血例の各項目を検討した。年齢は腹腔鏡群で 66.4 歳 (中央値 41～86 歳)，開腹群で 73.5 歳 (中央値 55～93 歳) であった。PS 2以上が腹腔鏡群で7例 (33%，PS 2: 4例，PS 3: 3例)，開腹群で2例 (25%，PS 2: 1例，PS 3: 1例) であった。原発部位が直腸である例は腹腔鏡群で4例 (19%)，開腹群で5例 (63%) と開腹群で直腸が多い傾向があった。転移巣は腹腔鏡群で肝 17 例，肺4例，腹膜3例，リンパ節2例，骨1例 (重複あり)，開腹群で肝7例，リンパ節1例であった。原発巣による症状のうちイレウスを腹腔鏡群で7例 (33%)，開腹群で6例 (75%) に認めた。術前に経肛門イレウスチューブを留置したのは，そのうち腹腔鏡群6例 (29%)，開腹群3例 (38%) であり，腹腔鏡群でその割合が多かった。

次に手術時間，出血量，D1 郭清となった割合，ストーマ造設率，合併症，開腹移行，術後在院日数，化学療法導入率，化学療法開始日までの日数，奏効率，観察期間について両群を検討した (表2)。出血量，ストーマ造設割合，合併症率，術後在院日数で有意差をもって開腹群が多かった。合併症は腹腔鏡群で2例 (9.5%，腸炎1例，縫合不全1例)，開腹群で5例 (63%，SSI 2例，肺炎1例，膿瘍1例，イレウス1例) であった。腹腔鏡群で2例 (9.5%) に開腹移行を認めた。術後治療に関しては両群に差はなかった。手術から化学療法開始までの日数は腹腔鏡群で 28 日 (中央値 11～137 日)，開腹群で 21

日（中央値16～255日）と有意差はなかった。化学療法は両群とも80%程度導入できたが，5例導入できなかった。

## III. 考　察

Stage IVに対する原発巣切除手術は転移巣も切除可能であれば根治の可能性も考えられるが，その割合はあまり多くなく，palliative surgeryととらえることもできる。術後早期に化学療法を導入する必要があるため，原発巣切除手術はより安全に，より低侵襲に行われることが重要であり，腹腔鏡手術のよい適応と考えられる。Stage IVに対する原発巣切除手術において，腹腔鏡を選択することは安全性の面でも問題ないとする報告が多くある[3]。本研究でも術後短期成績において，問題のない結果と考える。Lawら[4]は開腹手術に対する腹腔鏡手術の有用性を報告している。当院におけるcStage IV原発巣切除術式の選択基準はイレウスがない，または経肛門イレウスチューブなどで減圧可能な症例は腹腔鏡手術を第一選択としており，massiveな腫瘍，他臓器浸潤のあるもの，減圧不可なイレウス，緊急手術例などは開腹手術となる。そのため，本研究における2群は対等ではなく，バイアスのかかった検討であることは否めない。優越性を検討するにはprospectiveな検討が必要であるが，Stage IVという特殊性から，RCTを検討するのは難しい。

無症状例における原発巣切除の意味は今後検討する必要があるが，原発巣切除が予後にも影響するという報告もある[5]。

本研究では，手術から化学療法導入までの日数に腹腔鏡の優越性が反映されるのではないかと考えたが，腹腔鏡群でやや長い傾向にあった。これは腹腔鏡群は術後早期に退院し，改めて外来にて化学療法を施行する例が17例中15例（88%）と多かったが，開腹群では7例中3例（43%）と少なかった。QOLの面では早期退院できた腹腔鏡群が優れている可能性がある。症例の80%程度が化学療法を導入できていたが，5例導入できなかった。この5例中，4例が術前PS 3であり，全身状態不良例に対する原発巣切除の適応は慎重に検討する必要がある。

本研究において短期成績は腹腔鏡手術群で良好であったが，中長期成績に関しては，さらなる検討が必要である。

## 結　語

Stage IVにおける腹腔鏡下原発巣切除術は安全性に問題はなく，腹腔鏡の低侵襲性を享受できることから，積極的に行うべきと考えられた。

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# Transumbilical single-incision laparoscopic surgery for sigmoid colon cancer

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**Abstract**
*Background* Transumbilical single-incision laparoscopic surgery is an emerging concept that could offer excellent cosmetic results [1]. The authors describe an index case of curatively intended resection of early-stage sigmoid colon cancer using this technique [2, 3].
*Methods* A 75-year-old woman with a body mass index of 24 underwent surgery by two colorectal surgeons who had hundreds of experiences with laparoscopic colorectal surgery. Three 5-mm ports were placed linearly in the vertical 2-cm skin incision in the umbilicus. Almost all the procedures were performed with usual laparoscopic instruments such as a 5-mm flexible laparoscope and the Harmonic ACE (Ethicon Endo-Surgery, Cincinnati, OH, USA). Also, the operative procedures were much the same as in usual laparoscopic surgery. The sigmoid colon was mobilized using a medial approach. Then the root of the superior rectal artery and inferior mesenteric vein were divided using the EnSeal tissue sealing and hemostasis system (SurgRx, Inc. Redwood City, CA, USA). Low-profile trocars were mandatory to minimize interferences among instruments. The rectum was divided 5 cm distal to the lesion with one firing of an endoscopic stapler. The specimen was extracted through a 2-cm transumbilical laparotomy. End-to-side anastomosis using a circular stapler was performed intraabdominally, and air tightness was confirmed by the anastomotic leak test.
*Results* The operative time was 192 min. There was no intra- or postoperative morbidity. Altogether, 20 cm of sigmoid was resected with negative tumor margins, and 14 lymph nodes were harvested. The patient started receiving meals and was discharged on postoperative days 2 and 7, respectively. The final pathology showed Tis, N0, M0, stage 0. The scar was invisible at 1 month.
*Conclusion* Single-incision laparoscopic colectomy is feasible and safe for selected patients and gives a favorable cosmetic result. By well-trained surgeons, this technique could be a realistic option for colorectal cancer surgery.

**Keywords** Colon cancer · Invisible scar · Laparoscopic surgery · Sigmoidectomy · Single incision · Transumbilical

**Disclosures** Ichiro Takemasa, Mitsugu Sekimoto, Masataka Ikeda, Tsunekazu Mizushima, Hirofumi Yamamoto, Yuichiro Doki, and Masaki Mori have no conflicts of interest or financial ties to disclose.



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LETTER TO THE EDITOR

# Laparoscopic reoperation of anastomotic leakage after a laparoscopic low anterior resection of the rectum

**Mitsugu Sekimoto · Ichiro Takemasa · Tsunekazu Mizushima · Masataka Ikeda · Hirofumi Yamamoto · Yuichiro Doki · Masaki Mori**

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Dear Editor:

Anastomotic leakage occurs in 10–20% of cases undergoing low anterior resection of the rectum (LAR), and it often causes peritonitis, which requires patients to undergo a reoperation. Recently, laparoscopic surgery has been indicated for lesions in the lower rectum and the leakage rate has been reported to be similar to that in open surgery. However, there has been little discussion of whether the reoperation should be done laparoscopically or by open surgery. We present a case of a laparoscopic reoperation for anastomotic leakage after a laparoscopic LAR for lower rectal cancer.

The patient, a 58-year-old man, was 171 cm tall and weighed 73.6 kg. He was diagnosed with a tumor 3 cm in diameter on the anterior rectal wall 5 cm from the anal verge. The pathological diagnosis was adenocarcinoma. He underwent a laparoscopic LAR with total mesorectal excision. The anastomosis was made at 3 cm from the anal verge using the double-stapling technique. The operation was uncomplicated and lasted 345 min. The estimated blood loss was 30 ml. A drainage tube was placed transabdominally in the pelvic cavity. No diverting stoma was created. Frequent watery diarrhea occurred 10 h postoperatively and continued for 5 h. The discharge from the drainage tube became turbid; the turbidity of the discharge increased as time passed. The patient developed lower abdominal pain with a sign of muscular defense, indicating the need for a reoperation. At that time, no abdominal distention occurred and no air retention in the bowels was seen on the plain abdominal X-rays. This suggested that the reoperation could be performed laparoscopically. The reoperation started 18 h after the first operation and was performed via the incisions made during the first operation. There was no adhesion in the abdominal cavity. A portion of the small bowel was slightly distended; however, the entire abdominal cavity could be observed easily. Purulent debris adhered to the surface of the small bowels in the pelvis and also to the surface of the pelvic cavity. The peristalsis of bowel was exacerbated. The blood supply and the continuity of the anastomosis were maintained, thus the anastomosis was conserved. Following the lavage of the abdominal cavity, an additional drainage tube was placed trans-abdominally in the pelvic cavity. Lastly, a diverting loop ileostomy was created. The operating time was 135 min. No additional incision was made except for the site of the stoma. The postoperative course was uneventful. Oral intake started on the fifth day. No surgical site infection occurred, and the patient resumed work on the 15th postoperative day. The healing of the anastomosis was confirmed by colonoscopy and an enema 6 months postoperatively, following the diverting stoma was closed.

Anastomotic leakage after open surgery requires open surgery as a matter of course. However, managing of anastomotic leakage after laparoscopic surgery has not been discussed extensively. In the past, there were concerns regarding the safety of creating pneumoperitoneum under infectious peritoneal conditions. However, the laparoscopic surgery has proven to be safe for appendicitis with peritonitis, perforation of diverticulum and abdominal trauma. Furthermore, the merits of laparoscopic surgery in comparison to open surgery, such as better cosmesis, less pain, and fewer wound complications have been demonstrated in these infectious operations. These merits would be expected

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for a laparoscopic reoperation for anastomotic leakage as well.

A poor view due to distended bowels has been reported as the most frequent causes of conversion to open surgery during laparoscopic surgery for peritonitis. However, during this operation, the bowels had not distended and the view was good. This was thought because the reoperation was performed immediately after the onset of the leakage. We think the promptness is the key to successful laparoscopic reoperation. Also, the earlier measure may also contribute to the earlier recovery of the patients.

Although further study would be necessary, we believe that laparoscopic reoperations could be a choice for an anastomotic leakage after laparoscopic LAR.

イレウスの手術術式

# 腹腔鏡下手術の適応と手技上の工夫

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イレウスの手術術式

# 腹腔鏡下手術の適応と手技上の工夫

*Indication and technique of laparoscopic surgery for ileus*

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●要旨● 癒着性イレウスに対する腹腔鏡下手術は，イレウス管で減圧が効いている循環動態が安定した症例，保存的治療で軽快するが再発を繰り返す症例を適応としている。手術手技上デバイスの選択は重要なポイントで，腸管の癒着に関してはシザースによる鋭的剝離が副損傷を防ぐためにも好ましいと考えている。また，減圧後であっても腸管の組織は脆弱であり，愛護的な操作が必要である。腸管損傷などの副損傷が生じた場合は，小開腹併用または開腹手術に移行して確実な対処を行うことが重要である。

● key words：イレウス，イレウス解除術，腹腔鏡下手術

## はじめに

消化器外科医である限り，イレウスは日常的に遭遇する代表的な疾患である。保存的に改善する症例がほとんどであるが，手術が必要となる場合も少なくない。絞扼性イレウスや減圧できず敗血症性ショックを呈しているような症例に対しては，患者情報・身体所見・血液生化学検査・画像診断などを迅速に解析し，緊急に対応しなければならない。一方，減圧が効果的でバイタルサインは安定し感染徴候もないが解除できないイレウス，慢性的に繰り返すイレウスも手術適応と考えられている。

イレウスに対する腹腔鏡下手術はすでに1991年から報告されており，その有用性が述べられている[1)2)]。今回は，イレウスに対する腹腔鏡下手術に関して検討した。

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## イレウスに対する腹腔鏡下手術の位置づけと手術適応

イレウスに対する手術として，低侵襲で再癒着が少ないという考えのもとに腹腔鏡下手術が選択されるケースが増えてきた。当科における手術適応は，イレウス管で減圧が効いている循環動態が安定した症例，保存的治療で軽快するが再発を繰り返す症例としている。最近の報告では同様の症例を手術適応としている報告が多く[3)〜6)]，一定のコンセンサスが得られていると思われる。

## 開腹手術と比較しての優劣

開腹手術と比較して優れる点は，癒着剝離部位や手術創部への再癒着が少ないとされていることである。実際にイレウス再発例が少ないという報告もみられる[7)]。このような背景のもとにイレウスに対する腹腔鏡下手術が増えてきたわけであるが，一方で術中腸管損傷などの合併症の報告もされている[8)9)]のが現状である。つまり，腹腔鏡下手術による副損傷が問題点であり，これに対する対策が重要である。

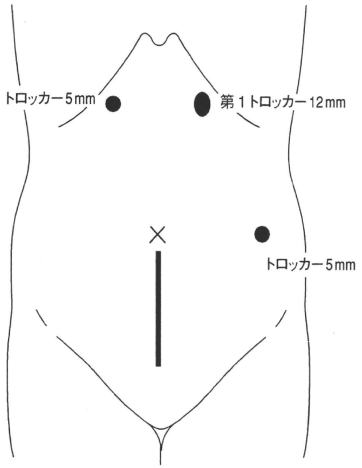


図1　トロッカー挿入部位
第1トロッカーは，手術痕を避けたできるだけ遠い場所を選択して挿入する。スコープで腹腔内を観察して2本目・3本目と挿入していく。triangulationを維持できるのが理想である

図2　癒着
腸管が腹壁と強固に癒着していた。癒着性イレウスの原因と判断

## 腹腔鏡下手術の問題点とその対策

減圧が十分でない場合には，十分な術野を確保できず解剖学的な位置関係も把握しづらい。減圧が効果的であった場合でも腸管が脆弱化していることが多く，より愛護的な操作が必要となる。時に損傷を伴う可能性もあり，さらには損傷したことに気づかず術後に遅発性の腹膜炎を呈し重篤化することさえあり得る。つまり，術中の確認作業が困難な腹腔鏡下手術では手術適応を順守することと，その欠点を補う工夫が必要である。

ひとつの工夫として小開腹併用の腹腔鏡下手術が報告されている[10)~14)]。小開腹創から複雑な癒着の剝離

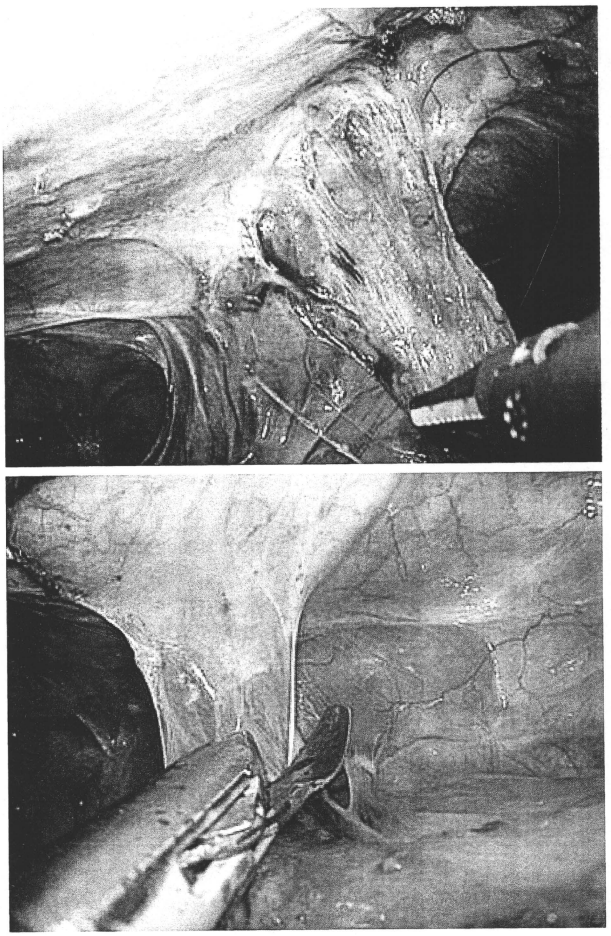

図３　デバイスの選択
大網の腹壁への癒着であれば止血を十分に行う目的で超音波凝固切開装置を用いているが，腸管の腹壁への癒着に対しては熱損傷を避けるためにバイポーラシザースを用いている

操作を行ったり，閉創前に確実なイレウス解除と腸管損傷の有無の確認を行うことで，安全・確実な手術を腹腔鏡下手術の利点を消さないままに確保するのが狙いである。

## 開腹手術にコンバートするタイミング

術前から癒着の程度や手術の困難性に関して予想できるのが理想的であるが，イレウスの場合は予想どおりの所見で予定どおりの手術とはいかない場合が多

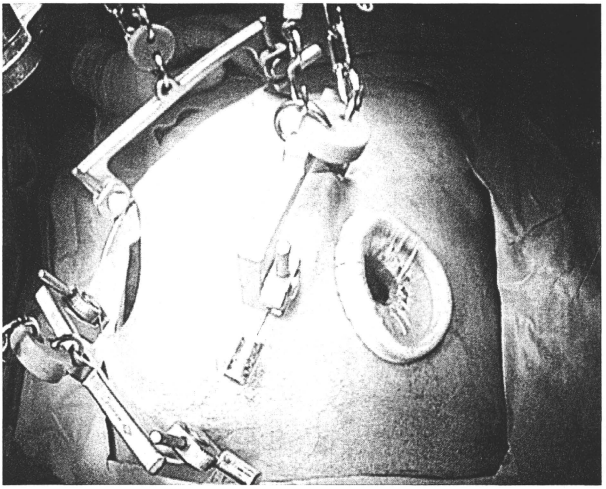

図4　吊り上げ式併用
吊り上げ式併用により腹壁をさらに持ち上げることで，カウンタートラクションをかけることもある

く，開腹手術へコンバートするケースが他の腹腔鏡下手術よりも多いと思われる。そのタイミングとしては当然，腹腔鏡下手術継続が困難な状況（術野確保困難や高度癒着）や腸管損傷などの副損傷が生じた場合となる。腹腔鏡下手術にこだわるならば小開腹創からの操作を次のステップとして考えてもよいが，確実な状況確認と手術操作ができることが条件である。不確定要素が少しでも残るようであれば，しっかりと開腹して手術を行うべきである。

## 手術術式の具体的なコツ，工夫

トロッカー挿入部位の決定は難しいが，できるだけ術前CTやイレウス管造影で癒着部位を予想して決定する。手術痕下の腹壁との癒着が多いため，第1トロッカーは必然的に手術痕を避けた，できるだけ遠い場所を選択することが多い（図1）。スコープで腹腔内を観察して，癒着剝離を効果的に行うことができる場所に2本目以降のトロッカーを挿入する。

腹腔内操作では，まず原因となる癒着を同定（図2）して剝離を開始するが，これら操作の際にも腸管自体を把持するのは避けるべきである。腸管は浮腫や血流不良により脆弱になっており，容易に損傷が起きる。無傷性把持鉗子を用いて，腸管ではなく腸間膜などを必要最小限の力で把持することが重要と思われる。

腹壁との癒着を剝離する際にまず重要なのは，デバイスの選択である。大網の腹壁への癒着であれば止血を十分に行う目的で超音波凝固切開装置を用いているが，腸管の腹壁への癒着に対しては超音波凝固切開装置ではなくバイポーラシザースを用いている（図3）。キャビテーションによる腸管損傷を防ぐために，シザースによる鋭的な剝離が適している。次に，確実に確認作業を行い容易に剝離操作を行うためには，牽引によるカウンタートラクションを効果的にかけることが重要である。気腹により腹壁が上がることでカウンタートラクションをかけやすくなるが，吊り上げ式併用で行うとさらに腹壁側に持ち上がるようになり，よい術野が得られることもある（図4）。

腸管が高度な癒着を呈していた場合，腸管損傷をきたすこともあり得る。その際には，原則として小開腹創から引き出して確実な修復を行うよう心がけている（図5～7）。術後の穿孔性腹膜炎は，どうしても防ぎたい合併症である。

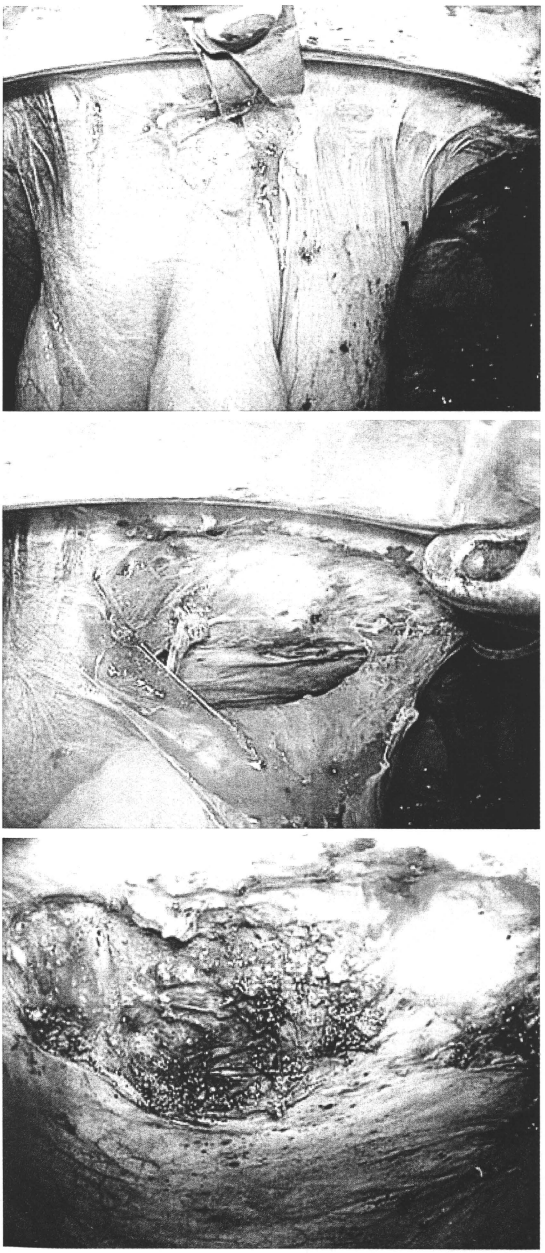

図5　強固な癒着
　バイポーラシザースを用いた腸管と腹壁の癒着剝離

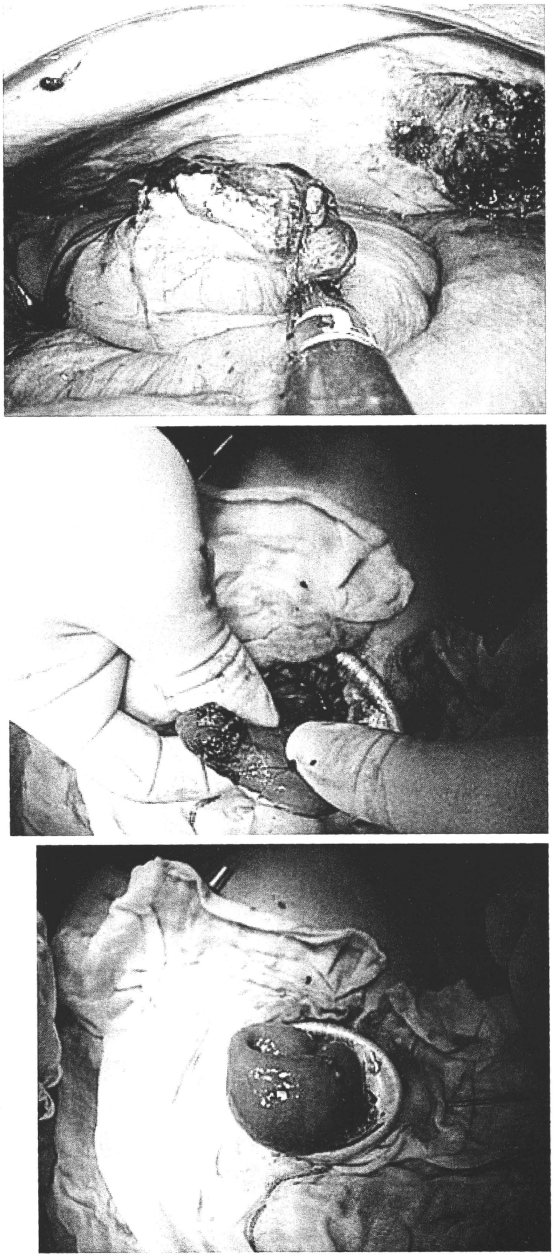

図６　腸管損傷に対する小開腹の修復
　小開腹創から引き出して確実な修復を行うよう心がけている