

Case Analysis

## Early Experience of Laparoscopic Right Hemicolectomy: A Single-Center Analysis

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### Key Words

Laparoscopy;  
Right hemicolectomy;  
Colorectal cancer

**Background.** In recent years, the laparoscopic approach has generally been applied in right hemicolectomy, but it has not been proven to be more effective than conventional right hemicolectomy.

**Methods.** This was a single-surgical team, single-center study. Data was prospectively recorded and retrospectively analyzed. From July 1999 to July 2003, all patients admitted via our outpatient department for elective right hemicolectomy of proved colonic malignancy were evaluated for eligibility. Cases of emergent operation and obvious sign of bowel obstruction were excluded.

**Results.** From July 1999 to July 2003, a total of 118 patients received elective right hemicolectomy. Among them, 84 patients received the conventional method, and 34 patients received the laparoscopic method. There were more male patients, more early tumors, lower wound infection rates, and lower anastomotic leakage rates in the laparoscopic group than in the conventional group. But, there was no difference in total operative time and hospital stay between the two groups. The overall survival rates in the laparoscopic group and the conventional group were 61.8% and 68.7%, respectively, but there was no significant difference between the two groups.

**Conclusion.** In selected patients, laparoscopic right hemicolectomy is a safe and effective method in Taiwan. Large-scale randomized controlled trials are needed to identify variables which may improve long-term survival of patients who undergo laparoscopic surgery.

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Colorectal cancer was reported to be the second leading cause of cancer-related death in Taiwan in 2007. The laparoscopic approach for colectomy has generally been applied in recent years, and has been recognized as a safe and effective method. Numerous studies have demonstrated earlier return of bowel function and shorter hospital stay.<sup>1-6</sup> In regard to adequacy of oncological clearance for disease control and overall survival, there is no difference between the

laparoscopic approach and the conventional approach.<sup>1-5,7-9,10-12</sup>

In Taiwan, however, few studies have been conducted that directly compare laparoscopic and conventional right hemicolectomy in the same period. The aim of our study was to determine if laparoscopic right hemicolectomy is a better treatment method than conventional open right hemicolectomy.

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## Patients and Methods

The study protocol was approved by the institutional review board of our hospital. Only one surgical team at our hospital that performs laparoscopic surgery was included in the current study. From July 1999 to July 2003, patients admitted via the outpatient department of Taichung Veterans General Hospital for elective right hemicolectomy of proved malignancy of the cecum, ascending colon, and parts of the transverse colon were evaluated for eligibility in this study. Patients requiring emergency surgery, patients admitted via other medical departments (gastrointestinal section, for example), those with signs of total obstruction, and those with metastatic colorectal cancer were excluded from this study. All patients' demographic data and surgical details were recorded in our database and analyzed retrospectively.

The patients were admitted one or two days prior to scheduled surgery. Basic surveys including cell counts, biochemistry, blood coagulation profiles, chest-X-ray and electrocardiography were obtained. Clear liquid diet, oral cathartics and mechanical colon preparation were given one day before surgery. We do not routinely use oral antibiotics for chemical colon preparation.

The conventional surgery was performed by one of four attending members on our surgical team. The laparoscopic surgery was performed by two of them. The decision to convert to conventional surgery was made if one of the following conditions occurred: excessive tumor fixity or uncertainty of tumor clearance, inaccessibility of tumor, unexpected bowel injury, ureter injury, or uncontrolled bleeding.

Time of surgery was defined as duration of anesthesia, i.e., from the time of preparing induction to the time the patient was moved to the recovery room post anesthesia as recorded by the anesthesiologist. All transfusions given intraoperatively or within 3 days of operation were recorded as surgery-related transfusions. Mortality was defined as death within 30 days of operation. In addition, we also accessed the database of the Bureau of Health Promotion, Taiwan, in order to record the number of patients who died at home. Anastomotic leakage was diagnosed when clinical signs indicated pus, gas, or fecal content from a

drainage tube, or passage from a wound, or radiologically apparent peritonitis or pelvic abscess revealed by computed tomography of the abdomen. We do not routinely perform post-operative lower GI series to document a subclinical leak. Wound infection was defined as pus accumulation in the wound, and deterioration of wound condition requiring removal of stitches and application of wet-dressing. The tumor size, number of lymph nodes harvested, distal margin and proximal margin of resection were confirmed by two registered pathologists. Hospital fees were calculated based on our applications to the Bureau of National Health Insurance, Taiwan, for reimbursement. As such, patients admitted via non-surgical departments were excluded from the study in order to avoid confounding the results of fee analysis. Only fees from the surgical ward were included for analysis in the study. Because laparoscopic surgery was not covered by the National Health Insurance during the study period, patients paid an additional out-of-pocket charge of \$30,000 New Taiwan Dollars (NTD) per surgery.

## Follow-up

Post-operatively, standard follow-up by the surgeon consisted of regular visits at 3-month intervals for the first 3 years, 6-month intervals for the 4<sup>th</sup> and 5<sup>th</sup> year, and yearly visits thereafter. The adjuvant chemotherapy was administered as indicated by the National Comprehensive Cancer Network (NCCN) guidelines. Follow-up studies included physical examination, CEA (carcinoembryonic antigen), chest X-ray, abdominal sonography or abdominal computed tomography at each visit. Colonoscopy follow-up was done in the first year and repeated in the next year if positive for adenoma or other malignancies. If negative, colonoscopy was done three years later. Other studies were performed on an as-needed basis.

## Operative techniques

Laparoscopic right hemicolectomy was performed according to the standardized method used at our hospital. The patient was put in a left-tilt Trendelenburg position, and pneumoperitoneum with a pressure of

12 cmH<sub>2</sub>O was initiated after the first trocar site using Hasson's method. A total of 4 trocars were used: two 12 mm trocars (umbilicus and left upper abdomen) and two 5 mm trocars. The procedure began with an incision at the medial peritoneum of the root of the ileocolic artery inside the mesocolon, the so-called medial-to-lateral approach. Then the root of the ileocolic artery was exposed, skeletonized and high ligation was done next to its origin from the superior mesenteric vessels. Then, dissection was done bluntly to separate the mesocolon from retroperitoneal structures. Dissection was made from above the retroperitoneum and the Gerota's fascia to the hepatocolic ligament. The omentum along the transverse colon was divided and the lesser sac was entered. The hepatocolic ligament was ligated and the transverse colon was mobilized. Then, the white line of Toldt was lysed to totally immobilize the ascending colon. Besides, the right colic artery, and the middle colic artery were identified and ligated. One of the trocars was enlarged for specimen extraction and extracorporeal anastomosis. We routinely used a commercial wound protector ("Rogan®") when extracting the specimen to protect the wound from infection and prevent wound seeding of cancer cells. The anastomosis was carried out using GIA-80 autosuture or hand-sewn suture at the discretion of the surgeon(s). During the whole procedure, blunt dissection was carried out under magnified direct vision and 1<sup>st</sup>, 2<sup>nd</sup> generation harmonic scalpel (Johnson and Johnson®) and ligature scalpel (Tyco Co., Ltd.) were used if sharp dissection or hemostasis was required.

Conventional surgery was performed following the same oncological principle of high ligation and no touch, as with laparoscopic surgery. Thus, the specimens obtained from conventional surgery were the same as those obtained from laparoscopic surgery. The attending surgeon chose either the lateral-to-medial or medial-to-lateral approach.

### Statistical analysis

The variables tested in the treatment groups were compared using the  $\chi^2$  test and independent t-test (and, when necessary, the Mann-Whitney U test). Survival analysis (Kaplan-Meier) and log-rank tests were

used to evaluate the efficacy of the treatments. Differences were considered significant at  $p < 0.05$ . Data are presented as mean  $\pm$  SD. The data were analyzed by the statistical program SPSS for Windows 10.0 (SPSS, Inc., Chicago, IL).

## Results

From July 1999 to July 2003, a total of 118 patients who received elective right hemicolectomy for curative resection of adenocarcinoma of the colon were enrolled in this study. There were 75 males and 43 females with a mean age of 66.3 years. (Table 1) Among them, 84 patients received conventional right hemicolectomy, and 34 patients received laparoscopic right hemicolectomy. Five of 34 patients (14.7%) received laparoscopic surgery but were converted to conventional surgery due to advanced tumor in three patients (60%), unexpected bowel injury in one patient (20%), and uncontrolled bleeding in one patient (20%). There were 54 male patients (64.3%) in the conventional group and 21 male patients (61.8%) in the laparoscopy group. The proportion of male patients was significantly higher in the conventional group than in the laparoscopic group. However, there was no difference between the laparoscopic and conventional group with regard to age, body mass index, and ASA score.

The mean total operative time was 186 minutes and 206 minutes in the laparoscopy group. The mean total number of lymph nodes harvested was 22.1 in the conventional group and 19.7 in the laparoscopic group. There were no significant differences in the mean total operative time and mean total number of lymph nodes harvested between the two groups.

There were 4 patients with anastomotic leakage (4.8%) and 13 patients with wound infection (15.5%) in the conventional group, whereas there was one patient with anastomotic leakage (2.9%) and 4 patients with wound infection (11.8%) in the laparoscopic group. The leakage rate and wound infection rate were significantly higher in the conventional group than in the laparoscopic group.

When the tumor directly invades other organs or structures, with or without perforation, it is staged as

**Table 1. Characteristics of the 118 patients who received right hemicolectomy**

	Conventional group	Laparoscopic group	<i>p</i> -value
Case number	84	34	
Mean age (years)	65.5 ± 12.68	68.5 ± 11.49	0.377
Sex (male/female)	54/30	21/13	0.002
Tumor size (cm)	5.7 ± 2.42	5.5 ± 2.80	0.269
ASA score			0.542
1	3 (3.6%)	0 (0%)	
2	58 (69.0%)	24 (70.6%)	
3	23 (27.4%)	10 (29.4%)	
Body mass index	24.6 ± 2.74	24.2 ± 1.87	0.858
Depth of tumor invasion			0.157
T1	4 (4.8%)	3 (8.8%)	
T2	9 (10.7%)	7 (20.6%)	
T3	51 (60.7%)	21 (61.8%)	
T4	20 (23.8%)	3 (8.8%)	
Staging			0.05
Early tumor (T1+2)	13 (15.5%)	10 (29.4%)	
Advanced tumor (T3+4)	71 (84.5%)	24 (70.6%)	
Mean total lymph nodes harvested	22.1 ± 10.64	19.7 ± 10.23	0.111
Mean total operative time (min)	186 ± 43.53	206 ± 44.68	0.70
Mean total hospital stay (days)	14.2 ± 6.77	13.1 ± 5.42	0.27
Wound infection rate	14/84 (16.7%)	1/34 (2.9%)	0.043
Anastomotic leakage rate	4/84 (4.8%)	1/34 (2.9%)	< 0.001
Mortality (within 30 days)	0	0	

T4. There were more patients with T4 staging in the conventional group than in the laparoscopic group, but the difference was not statistically significant (23.8%: 8.8%,  $p = 0.15$ ). On the other hand, there were more with early tumor staging (T1 and T2) in the laparoscopic group than in the conventional group (29.4%: 15.5%,  $p = 0.05$ ) (Table 1).

The overall survival at 5 years was 61.8% in the laparoscopic group and 68.7% in the conventional open right hemicolectomy group. There was no significant difference between the two groups ( $p = 0.371$ ) (Fig. 1). There was no mortality in either group.

## Discussion

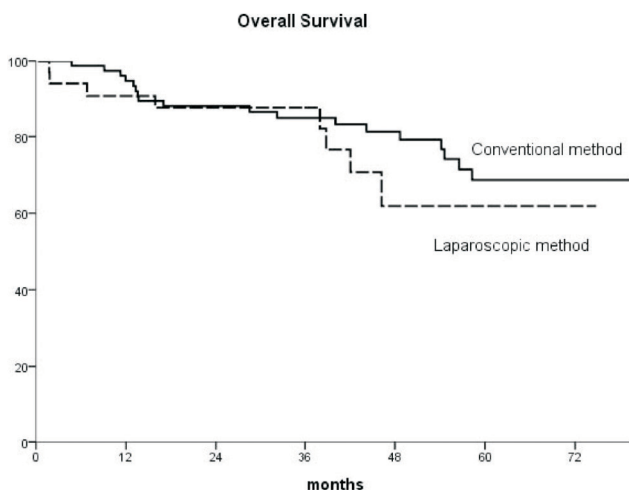
In recent years, most reports indicated that patients who received laparoscopic colectomy had earlier bowel movement, shorter hospital stay, and better post-operative life quality.<sup>1-12</sup> But, these results were not compatible with the findings in our study.

In our study, the patients who received laparoscopic right hemicolectomy were predominately female, had a lower leakage rate, a lower wound infection rate,

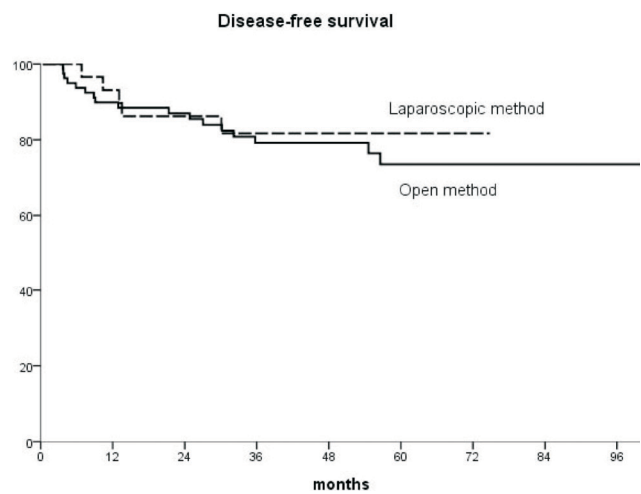
and were much more likely to have early cancer than those who received conventional surgery. However, total operative time and length of hospital stay were similar between the two groups. In addition, there was no difference in the total number of lymph node dissections, disease-free survival and overall survival rates between the conventional and laparoscopic groups.

There may be several reasons for these findings. First, only two of our four surgeons performed laparoscopic right hemicolectomy during the study period. Second, if computed tomography showed that the tumor penetrated the serosa of the colon or invaded the nearby tissue, the locally advanced tumor was impressed. Therefore, patients with advanced tumor were not considered for the laparoscopic approach. This may have caused a disparity in the number of patients in the two groups. Third, selection bias may exist in our retrospectively collected data. It warrants assessment but somewhat reflects the practical condition. Besides, this is a retrospective study and shortcomings associated with this design are present in our study.

Fourth, there may be more variations in operative procedures for right hemicolectomy than for anterior resection. The common variations in the middle colic



**Fig. 1.** There was no difference between the two groups in overall survival. ( $p = 0.371$ )



**Fig. 2.** There was no difference between the two groups in disease-free survival. ( $p = 0.709$ )

artery make laparoscopic dissection uncertain, especially when operating on an obese patient or a patient with advanced adhesion when there is loss of tactile sensation. Besides, pre-operative localization and staging of right-sided colon cancers are sometimes incompatible with the intra-operative and histopathologic findings.<sup>13</sup> This makes laparoscopic surgery without tactile sensation more difficult. In addition, the entrance of the lesser sac and the omentum along the transverse colon are hard to approach. Vessel variation makes it hard to control bleeding. Thus, we did not expect the total operative time for laparoscopic surgery to be shorter than that for conventional surgery.

In summary, patients who received the laparoscopic method had shorter hospital stay, earlier bowel movement, decreased total operative time, and lower analgesic agent dosage after operation than patients in the conventional group. In our previous study (or: in our [include the year] study), 276 patients received anterior resection. Among them, 140 patients received laparoscopic anterior resection, 99 patients received conventional anterior resection, and 6 patients received laparoscopic surgery followed by conversion to the open method (This study should be listed in the Reference section. – Ed.). The laparoscopic method yielded outcomes which were not inferior to those with conventional surgery, and resulted in shorter hospital stays, lower hospital fees, and lower wound complication rates. Thus, the results of this study may ac-

tually reflect the early learning curve in laparoscopic right hemicolectomy. Improved results may be expected as case numbers increase with time.

Besides, mini-incision of right hemicolectomy is feasible and has advantages of no larger than the incision size used in a laparoscopic approach if multiple incisions made for trocars are added to the main incision length.<sup>14</sup> Mini-incision procedure may cause less pain and let patients recover quickly after operation. However, mini-incision approach was not specially performed in our hospital. Further evaluation and analysis will be considered.

## Conclusion

In our study, patients who received laparoscopic right hemicolectomy had a lower anastomotic leakage rate and a lower wound infection rate. It is as safe and effective as conventional right hemicolectomy, especially in selected patients. However, its effects on operative time, admission fees and oncologic results need to be evaluated in large-scale randomized, controlled trials.

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## 病例分析

# 腹腔鏡右側大腸切除手術之早期經驗： 單一醫療機構之分析

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**目的** 近年來，以腹腔鏡方式行右側大腸根除性切除的手術日漸增加。但是從術後結果來比較，似乎並沒有達到很好的成效。

**方法** 這是一個單一醫學中心，由單一外科團隊執行的研究。從 1999 年至 2003 年所有自門診住院接受右側大腸根除性切除以治療大腸癌的病人皆會接受評估是否符合於此一研究。急診手術及腸道完全阻塞的案例被排除在外。

**結果** 從 1999 年七月到 2003 年七月間，一共有 118 位病患接受右側大腸根除性切除手術。其中使用腹腔鏡手術有 84 位，34 位接受傳統手術。我們發現，腹腔鏡手術這組，有較高比例的男性病換，較多早期的腫瘤，較低的傷口感染率，較低的腸吻合滲漏率。但是在總手術時間上，總住院天數，跟傳統手術並無差異。腹腔鏡手術的五年存活率為 61.8%，傳統手術為 68.75，兩組病患的存活率在統計學上也無差異。

**結論** 在臺灣，大腸癌病患經過完整的術前評估後，選擇性的腹腔鏡右側大腸根除性手術，為一安全且有效益的方法。

**關鍵詞** 腹腔鏡、右側大腸切除、大腸直腸癌。