Adequacy of Lymph Node Retrieval in Laparoscopic Surgery for Colorectal Cancer

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Key Words
Colorectal cancer;
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Lymph node retrieval

Purpose. The aim of this study was to compare laparoscopic colorectal cancer resection to conventional colorectal cancer resection with regard to the number of lymph nodes retrieved.

Methods. Between November 2007 and October 2009, we retrospectively investigated 1252 patients with colorectal cancer who underwent curative resection at Lin Kou Chang Gung Memorial Hospital. The patients were divided into two groups: those who underwent laparoscopic surgery and those who underwent open surgery. The clinicopathologic variables of two groups were analyzed and compared, including age, gender, body mass index (BMI), tumor location, tumor size, neoadjuvant therapy, tumor stage, and the number of lymph nodes retrieved.

Results. Group 1 comprised 1091 patients who underwent open surgery, and group 2 comprised 161 patients who underwent laparoscopic colorectal surgery. There was no difference in age, gender, BMI, tumor location, and tumor stage between the two groups. However, there was a significant difference in tumor size between group 1 and group 2 (4.5 ± 2.1 cm vs. 3.8 ± 1.7 cm, \( p < 0.001 \)). Further, there was no significant difference in the number of lymph nodes retrieved between group 1 and group 2 (27.2 ± 14.5 vs. 25.8 ± 14.2, \( p = 0.248 \)).

Conclusion. For selected patients, lymph node retrieval during laparoscopic colorectal cancer resection was adequate in the surgical cases at Lin Kou Chang Gung Memorial Hospital. However, long-term follow-up examinations are required to show if there is any difference in local recurrence and survival between patients who undergo laparoscopic colorectal cancer resection and those who undergo conventional colorectal cancer resection.

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Laparoscopic surgery was first described in an animal study in 1901.\(^1\) Since then, laparoscopic techniques have greatly improved because of advances in equipment, including video systems and surgical instruments. In the late 1970s and early 1980s, the use of laparoscopic surgery was widespread, and it was rapidly adopted for several types of abdominal surgery because of its obvious advantages such as smaller incisions, lesser postoperative pain, shorter hospital stay, and quicker return to work. Laparoscopic colonic surgery for benign disease was first described in 1991.\(^2\) Thereafter, with acceptable complication rates, laparoscopic colonic surgery was widely used mainly for benign diseases. Moreover, in several
prospective, randomized, controlled studies, laparoscopic surgery was successfully used to treat malignancies of the colon and the rectum; these studies compared laparoscopic surgery to conventional surgery with regard to short-term outcomes and long-term survival of patients.\(^3\)\(^6\) Regardless of the method used, the principles of surgical resection of colorectal cancer include en bloc removal of the main tumor with adequate margins of normal colon together with the corresponding lymph-bearing structures. The number of lymph nodes retrieved from the specimens of colorectal cancer has been proved to be a significant factor for staging and survival, and the National Cancer Institute and American Joint Committee of Cancer recommends that at least 12 lymph nodes should be harvested and examined for proper staging of colorectal cancer.\(^7\)

The aim of this study was to compare the number of lymph nodes retrieved by laparoscopic resection and by conventional resection for colorectal cancers performed at Lin Kou Chang Gung Memorial Hospital.

**Materials and Methods**

Between November 2007 and October 2009, 1564 consecutive patients underwent colorectal cancer resection at Lin Kou Chang Gung Memorial Hospital. Of these 1564 patients, 312 were excluded from further analyses because they had either recurrent cancer or synchronous colorectal cancer, or because they had undergone emergent operation, local excision, or palliative resection. Finally, 1252 patients were included in this study, and they underwent bowel resection with curative intent for colorectal cancer. On the basis of the operative methods, these patients were divided into two groups: those who underwent conventional open surgery (1091 patients) and those who underwent laparoscopic surgery (161 patients). The operative method for the patients was selected on the basis of the willingness of each patient and the opinion of the surgeon (Fig. 1).

Detailed information regarding patient- and tumor-related variables was obtained from the Colorectal Section Tumor Registry in the hospital. The variables included age, gender, body weight, body height, tumor location, tumor size, neoadjuvant therapy, tumor stage, and the number of lymph nodes retrieved. On the day of admission, the body mass index (BMI) of the patients was calculated on the basis of their height (m) and weight (kg). Rectal cancers were defined as tumors located within 15 cm from the anal verge, and colon cancers were defined as tumors located greater than 15 cm from the anal verge. Tumor size was determined by measuring the maximum diameter of the tumor. For selective rectal cancers, neoadjuvant therapy involved preoperative concurrent chemoradiation therapy or radiation therapy alone. Tumor stage was defined according to the TNM classification by the American Joint Committee on Cancer (AJCC) Cancer Staging Manual, 6th ed. 2002.

All analyses were performed using the Statistical

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**Fig. 1.** Study profile.
Package for the Social Sciences, release 11.0 (SPSS Inc., Chicago, IL). The difference in clinicopathological features between the two groups was examined using the chi-square test for dichotomous variables and the t-test for continuous variables. Statistical significance was set at $p < 0.05$.

**Results**

Table 1 shows the differences in clinicopathological features between patients in the two groups. Although there was no difference in mean age, gender, BMI, tumor location, neoadjuvant therapy, and tumor stage between the two groups, there was a significant difference in tumor size (open surgery group, $4.5 \pm 2.1$ cm; laparoscopic surgery group, $3.8 \pm 1.7$ cm) ($p < 0.001$).

Table 2 shows that there was no difference in the number of lymph nodes excised between the open surgery group ($27.2 \pm 14.5$) and the laparoscopic surgery group ($25.8 \pm 14.2$) ($p = 0.248$). There was also no difference in the number of lymph nodes involved between the open surgery group ($1.8 \pm 3.3$) and the laparoscopic surgery group ($1.8 \pm 3.6$) ($p = 0.949$).

Table 3 shows that there was no difference in the percentage of cases in which less than 12 lymph nodes were removed between the two groups.

**Discussion**

Since the first videoendoscopic colectomy in 1991, several studies have compared laparoscopic colectomy to conventional colectomy. The short-term advantages of laparoscopic colectomy are as follows: reduced blood loss, reduced intensity of pain, improved pulmonary function, shorter duration of postoperative ileus, reduced duration of hospital stay after surgery, and improved quality of life in the early postoperative course. Several studies have supported that laparoscopic resection for colon cancer is associated with a long-term outcome similar to that of open colectomy for colon cancer; however, further randomized trials are required to support the long-term outcome of laparoscopic surgery for cancer of rectum.

The recommended minimum of number of lymph nodes retrieved during colorectal resection has been controversial. The National Cancer Institute and AJCC have recommended that at least 12 lymph nodes be harvested and examined for proper staging of colorectal cancer because the number of lymph nodes retrieved from the specimens of colorectal cancer has proved to be a significant factor for staging and survival. Prandi et al. reported that Dukes’ B patients with greater than 7 lymph nodes in a specimen had a significantly short overall survival and a relapse-free survival compared to those from whom 8-12, 13-17, or > 18 lymph nodes had been retrieved.
reported that the number of lymph nodes retrieved by a surgeon and analyzed by a pathologist is a prognostic variable for survival.\textsuperscript{11} In an Node-negative patient, a strong correlation was indeed observed because the overall survival and cause-specific survival improved as more nodes were retrieved. Of the Dukes’ C patients, the survival rate of both N1 and N2 patients also improved as more nodes were removed; 90\% of N1 patients showed a 5-year survival rate when more than 40 nodes were removed (vs. 74\% when only 11-40 nodes were removed, \(p < 0.0001\)) and 71\% of N2 patients showed a 5-year survival rate when more than 35 lymph nodes were removed (vs. 51\% when less than 35 nodes were removed, \(p = 0.002\)). Goldstein et al. believed that the maximum possible lymph nodes should be excised and analyzed during curative resection for cancer.\textsuperscript{12}

However, many factors can influence the number of retrieved lymph nodes for colorectal cancer resection: experience of the surgeon, pathologist, and radiotherapist; age and gender of patients; type of surgical resection; tumor differentiation; depth of tumor invasion; tumor location; tumor size; tumor stage; length of the resected bowel segment; stage of acute inflammation; and preoperative radiotherapy.\textsuperscript{13-22} Galal et al. reported that laparoscopic colorectal cancer resection can be used for lymph node retrieval (24 ± 19) in a manner similar to that of the open surgical approach (25.2 ± 21.4) (\(p = 0.5\)).\textsuperscript{23} Polignano et al. reported that both the surgeon and the pathologist can have a dramatic impact on the survival of colorectal cancer patients. In their study, it was reported that the surgeon and pathologist should maximize their efforts and adopt appropriate and refined surgical and pathological techniques to avoid scarce lymphadenectomy and incomplete pathological examination.\textsuperscript{24}

In our study, we harvested 27.2 ± 14.5 lymph nodes by using the conventional surgical procedure and 25.8 ± 14.2 lymph nodes by using the laparoscopic procedure; these results were similar to those of other studies.\textsuperscript{4,24-26} In the case of colon cancers, 30.1 ± 15.3 and 28.3 ± 15.4 lymph nodes were retrieved using the conventional surgical procedure and the laparoscopic procedure, respectively (\(p = 0.399\)). In the case of rectal cancers, the number of lymph nodes retrieved using the conventional and laparoscopic surgical procedures was 23.5 ± 12.5 and 21.8 ± 11.3, respectively (\(p = 0.291\)). Lymph node retrieval using the laparoscopic surgical procedure was found to be adequate for the procedures conducted at the Lin Kou Chang Gung Memorial Hospital.

However, a disadvantage was that there was a significant difference in tumor size between group 1 (4.5 ± 2.1 cm) and group 2 (3.8 ± 1.7 cm) (\(p < 0.001\)) because it was not a randomized controlled trial. Surgeons may be required to perform conventional surgical procedure for a patient if they believe that it may be difficult or risky to perform the laparoscopic surgical procedure.

### Conclusion

Lymph node retrieval during laparoscopic colorectal...
cancer resection was found to be adequate at Lin Kou Chang Gung Memorial Hospital. For selected patients, laparoscopic colorectal cancer resection is another option. However, long-term follow-up examinations are required to show if there is any difference in local recurrence and survival between patients who undergo laparoscopic colorectal cancer resection and those who undergo conventional colorectal cancer resection.

References

腹腔鏡大腸直腸癌手術淋巴結擴清的適當性

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目的 本文主要在比較腹腔鏡大腸直腸癌切除和傳統剖腹大腸直腸癌切除，兩者清除的淋巴結數目是否有明顯差異。

方法 本文收集了林口長庚醫院大腸直腸外科自 2007 年 11 月至 2009 年 10 月大腸直腸癌接受手術切除的病例，共有 1252 例。把這些病例依傳統剖腹大腸直腸癌切除或腹腔鏡大腸直腸癌切除分為兩組。比較兩組病例的年齡、性別、身體質量指數、腫瘤位置、腫瘤大小、術前輔助性治療、癌症期別和清除的淋巴結數目。

結果 第一組是傳統剖腹大腸直腸癌切除的病例，共 1091 例；第二組是腹腔鏡大腸直腸癌切除的病例，共 161 例。兩組病例中，病患的年齡、性別、身體質量指數、腫瘤位置和癌症期別並無明顯差異。第一組 (4.5 ± 2.1 公分) 和第二組 (3.8 ± 1.7 公分) (p < 0.001) 的腫瘤大小有明顯差異。然而第一組 (27.2 ± 14.5) 和第二組 (25.8 ± 14.2) (p = 0.248)，兩組清除的淋巴結數目並無明顯差異。

結論 林口長庚醫院大腸直腸外科的經驗，對於特定的病患，腹腔鏡手術用於大腸直腸癌切除，術中對於淋巴結擴清是適當合理的。但是腹腔鏡大腸直腸癌切除和傳統剖腹大腸直腸癌切除，兩者間對於疾病復發率及病患存活率是否有明顯差異，則必須再仰賴長期的追蹤。

關鍵詞 大腸直腸癌、腹腔鏡手術、淋巴結擴清。