

*Original Article*

# Laparoscopic Abdominoperineal Resection for Lower Rectal Malignancy in National Taiwan University Hospital: Eight-Year Experience

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**Key Words**

Laparoscopic surgery;  
Abdominoperineal resection;  
Lower rectal cancer

**Purpose.** Laparoscopic abdominoperineal resection (APR) has been used in the management of lower rectal cancer. The purpose of this study was to assess our experience in laparoscopic APR at National Taiwan University Hospital.

**Methods.** Between January 2003 and November 2011, 37 patients who were diagnosed as lower rectal malignancy and who underwent laparoscopic APR were enrolled in this study. Lower rectal malignancy was defined as the cancer located within 6cm above the anal verge. Laparoscopic resection was based on the following oncological principles: en bloc resection with high ligation of inferior mesenteric vessels, no-touch isolation and total mesorectal excision.

**Results.** Laparoscopic APR was successfully performed in all patients without conversion. There were 16 male and 21 female patients with an average age of  $61.5 \pm 13.6$  years (range: 30-85 years). The pathological TNM staging was distributed as following: stage I in 9 patients, stage II in 12 patients, stage III in 13 patients, and stage IV in 3 patients. The mean operation time was  $298.3 \pm 77.3$  minutes. All the patients experienced a quick recovery except one patient had perineal abscess formation requiring surgical debridement. There was no intraoperative complication. By the Clavien-Dindo complication classification, there were grade I complication in 2 patients, grade II in 6 patients, and grade III in 1 patient. One patient developed local recurrence, and 12 patients developed distant metastases. The estimated 3-year survival rate was 82.17%.

**Conclusions.** Laparoscopic APR was a safe and feasible procedure for lower rectal malignancy. Following the surgical principle of laparoscopic APR ensured satisfactory oncological outcomes.

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Since the first introduction of laparoscopic colectomy in the 1990s,<sup>1-4</sup> the newly developed me-

thod, which was used initially in the treatment of benign diseases including adenomas and endometriosis,

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has been recognized to be technically feasible and oncologically acceptable in the treatment of colorectal malignant lesions.<sup>5,6</sup> As compared with conventional laparotomy, laparoscopic surgery for colorectal cancer has the advantages of less blood loss, faster bowel recovery, and shorter hospitalization compared with conventional laparotomy without compromising oncological results.<sup>5-7</sup> The advancement of laparoscopic surgery has gradually revolutionized conventional abdominoperineal resection (APR), first described in 1908 by Miles, used for the treatment of lower rectal cancer invading the perianal muscles or dentate line, into a minimal invasive prospective. Initially, it was uncertain whether a proper mesorectal excision could be performed with laparoscopic surgery. Nevertheless, data collected over the last decades have shown that laparoscopic APR enables superior short-term perioperative results than conventional open colectomy.<sup>8,9</sup> Regarding long-term oncological outcomes, some randomized studies have demonstrated that laparoscopic APR does not jeopardize the survival while compared with the conventional APR.<sup>8,10</sup> Our previous retrospective phase II study showed that laparoscopic APR could be performed safely and efficiently, which enabled good functional recovery and acceptable short-term outcomes.<sup>11</sup> In Taiwan, colorectal malignancy has become the leading cause of malignancy in recent years, particularly owing to the western lifestyle. Left-sided colon cancer accounts for approximately 30% of all colorectal malignancy. For the lower rectal cancer near the dentate line, multidisciplinary treatment has been applied including concurrent chemoradiation therapy in order to downstage the tumor or to increase the possibility of anal-preserving procedure. The surgical resection remains the pivot treatment to achieve treatment with a curative intention. Regarding open APR in Taiwan, several studies have been reported employing either a conventional method, or a modified open procedure, i.e., without abdominal incision or laparoscopy,<sup>12-14</sup> however, data of treatment of laparoscopic APR are still limited.<sup>11,15</sup> Herein, the aim of this study was to present the eight-year experiences of laparoscopic APR in National Taiwan University Hospital and to compare the surgical results with current literatures.

## Materials and Methods

Between January 2003 and November 2011, 37 consecutive patients were diagnosed with lower rectal cancer and underwent laparoscopic APR at National Taiwan University Hospital. Lower rectal cancer was defined as the location of the tumor is less than 6 cm above the anal verge. All patients underwent laparoscopic abdominoperineal resection during these periods. The preoperative studies for staging included colonoscopy, computed tomography (CT), and magnetic resonance imaging (MRI). Positron emission tomography (PET) was arranged for those with suspected distant metastasis.

The concomitant chemoradiation therapy (CCRT) was performed preoperatively in patients with advanced colon cancer (T3-4 or positive lymph nodes). For preoperative chemotherapy, the patients received variant chemotherapeutic regimens according to the protocol in National Taiwan University Hospital, including modified Mayo regimens (5-Fuorouracil [5-FU]: 450 mg/m<sup>2</sup>; and folinic acid: 25 mg/m<sup>2</sup>, weekly for 12 courses), FOLFOX-4 regimens (5-FU: 2,600 mg/m<sup>2</sup>, folinic acid: 300 mg, and oxaliplatin: 85 mg/m<sup>2</sup>, biweekly for 6 courses), and the selective addition of bevacizumab to FOLFOX-4. As to radiation, patients were treated in the supine position with megavoltage radiation (10 MV) from the linear accelerator. A dose of 45 Gy (1.8 Gy per daily fraction, 5 fractions per week for a total of 25 fractions) was prescribed at the isocenter of beam axes. No boost treatment was administered. Surgery was carried out 5-10 weeks following completion of CCRT.

The definition of "conversion" denoted any extension of the 12-mm wounds, except the left lower incision, or the requirement of midline laparotomy during the surgery. Laparoscopic resection ensured the following oncological principles: en bloc resection with high ligation of inferior mesenteric vessels, no-touch isolation, and total mesorectal excision. The Internal Review Board of National Taiwan University Hospital approved the study protocol.

## Surgical procedures

All the surgeries were performed or were super-

vised by surgeons experienced in laparoscopic or open colorectal surgery. Under endotracheal intubation and general anesthesia, the patients were placed in the lithotomy position with both legs supported in stirrups. Pneumoperitoneum was achieved by mini-laparotomy at the right paraumbilical incision. Three 12 mm working ports were sequentially inserted under direct vision in the bilateral subcostal area and lower abdomen. Low ligation was performed using endoclips or endoscopic staplers (Ethicon®, USA). The sigmoid colon and rectum were mobilized down to the level of the pelvic floor. The ureters, hypogastric nerves, and pelvic parasympathetic plexus were carefully identified and protected. The sigmoid colon was transected with laparoscopic endoscopic staplers (Ethicon®, USA). An end -colostomy was performed over the left lower abdomen and was then matured. The perineal phase was initiated by an incision over the perineal area, and after the incision of the levator ani muscle, the mesorectum was fully mobilized. The specimen was retrieved through the perineal wound. The perineal wound was closed with 1-0 Vicryl® absorbable suture material (Ethicon®, USA) in a continuous multilayer fashion.

## Results

### Demography

Among 37 patients recruited in this study, the average age was  $61.5 \pm 13.6$  years. The male to female ratio was 16:21, and the average body mass index was  $23.1 \pm 3.6$  kg/m<sup>2</sup>. The majority of the patients (n = 30, 81.1%) presented with bloody stool, whereas 2 patients (5.4%) were asymptomatic and were found to have rectal cancer during the health examination. The detailed demographic data of the patients are presented in Table 1.

### Perioperative and postoperative result

The average operative time was  $298.3 \pm 77.3$  minutes, and the average blood loss was  $265.9 \pm 151.0$  mL. Neither conversion nor re-laparotomy was

performed. The postoperative ileus duration was  $3.4 \pm 1.6$  days, and the time to resume oral intake was  $3.9 \pm 2.0$  days. The average hospitalization stay after surgery was  $13.8 \pm 10.0$  days (Table 2). According to the Clavien-Dindo classification system, postoperative complications were classified as grade I in 2 patients, grade II in 6 patients, and grade III in 1 patient. The patient of grade III complications eventually required

**Table 1.** Demography and clinical data

|                                            |                         |
|--------------------------------------------|-------------------------|
| Age (mean $\pm$ SD, range)                 | 61.5 $\pm$ 13.6 (30-85) |
| Gender (male:female)                       | 16:21                   |
| BMI                                        | 23.1 $\pm$ 3.6          |
| Previous abdominal surgery                 | 0                       |
| Presentation                               |                         |
| Bloody stool                               | 30                      |
| Bowel behavior change                      | 2                       |
| Healthy examination                        | 2                       |
| Abdominal pain                             | 1                       |
| Body weight loss                           | 1                       |
| Tenesmus                                   | 1                       |
| ASA grade                                  |                         |
| I                                          | 18                      |
| II                                         | 14                      |
| III                                        | 5                       |
| Concurrent chemoradiation therapy (No., %) | 18 (49)                 |
| Preoperative staging* (No., %)             |                         |
| T1-T2                                      | 21 (56.8)               |
| T3-T4                                      | 16 (43.2)               |
| N0                                         | 25 (67.6)               |
| N1-3                                       | 12 (32.4)               |
| M0                                         | 35 (94.6)               |
| M1                                         | 2 (5.4)                 |

\* It meant post-CCRT clinical staging for the patients receiving complete course of CCRT.

**Table 2.** Intraoperative and postoperative results

|                                                          |                   |
|----------------------------------------------------------|-------------------|
| Operative duration (minutes)                             | 298.3 $\pm$ 77.3  |
| Blood loss (mL)                                          | 265.9 $\pm$ 151.0 |
| Conversion number                                        | 0                 |
| Combined surgical procedure                              | 8                 |
| Salpingoophorectomy (unilateral/bilateral)               | 1/2               |
| Metastatic liver resection                               | 2                 |
| Synchronous colon cancer resection (Right hemicolectomy) | 2                 |
| Adnexectomy                                              | 1                 |
| Time to flatus (days)                                    | 3.4 $\pm$ 1.6     |
| Time to resumption of oral intake (days)                 | 3.9 $\pm$ 2.0     |
| Hospitalization after surgery (days)                     | 13.8 $\pm$ 10.0   |

wound debridement owing to perineal abscess formation (Table 3). The morbidity rate was 29.7%. Surgical mortality was defined as death within 30 days after surgery. No surgical mortality was observed in this study.

### Oncological outcomes

The average number of lymph nodes retrieved was  $16.1 \pm 11.5$ . No recurrence was observed at the trocar sites or surgical wounds. The circumferential resection margin was free of tumor in all patients. During the follow-up period (medium, 54 months; range, 13-109 months), tumor recurrence developed in 13 patients: 6 patients in stage II, 5 in stage III and 2 in stage IV respectively. Among them, pelvic recurrence was noted in 1 patient (stage III), whereas distant metastasis was noted in 12 patients (Table 4). The estimated 3-year survival rate was 82.2% (Fig. 1a). The survival rates for each stage were as follows: 100% for stage I and II, 62.5% for stage III, and 50.0% for stage IV (Fig. 1b).

## Discussion

APR remains the principal treatment in the management of lower rectal malignancy in patients with anal sphincter dysfunction or involvement, despite the advances in CCRT and refinement of sphincter-preserving surgery. The superiority of laparoscopic surgery over conventional open surgery for colorectal cancer has been repeatedly confirmed by many studies, as reflected by a faster postoperative recovery in patients undergoing laparoscopic surgery, owing to its minimally invasive nature,<sup>5,6,16</sup> however,

**Table 3.** Complication

| Type                            | Number (n = 9) |
|---------------------------------|----------------|
| Perineal abscess                | 3              |
| Intestinal obstruction/Ileus    | 2              |
| Urinary tract infection         | 1              |
| Upper gastrointestinal bleeding | 1              |
| Urinary retention               | 1              |
| Cardiovascular accident         | 1              |

the studies of laparoscopic APR are limited, especially in Taiwan.<sup>11,12</sup> Uncertainty remains regarding the capability to perform adequate total mesorectal excision and to achieve a sufficient circumferential safety margin in the era of laparoscopic surgery. Our study showed that the laparoscopic APR is a safe and feasible procedure in the management of lower rectal malignancy, which produces good functional results in patients, without compromising oncological outcomes.

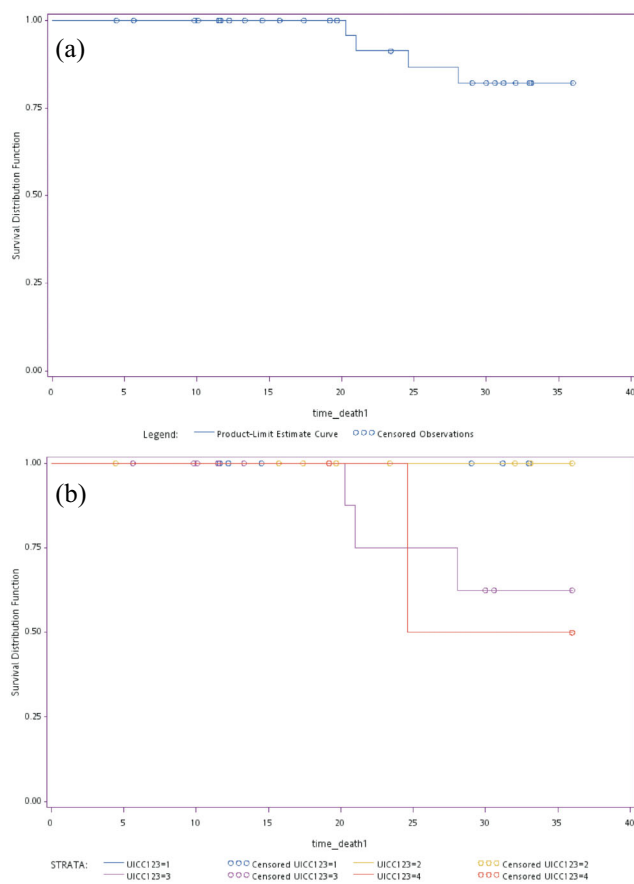
The nature of minimally invasive surgery offers many substantial advantages such as less wound discomfort, better cosmesis, and a shortened postoperative recovery in the management of patients with colon disorders including colorectal malignancies, inflammatory bowel diseases, and functional illness. The minimally invasive characteristic might be associated with decreased bowel manipulation, which minimizes the irritation to the abdominal organs. Less abdominal wall incision enables minor cytokine release secondary to peritoneal irritation-associated inflammation.<sup>17,18</sup>

Despite the longer operative duration and prolonged learning curve of laparoscopic surgery versus open surgery, laparoscopic surgery has been widely

**Table 4.** Oncological data

|                             |                 |
|-----------------------------|-----------------|
| Surgical clearance          |                 |
| Lymph node dissection (No.) | $16.1 \pm 11.5$ |
| Length (cm)                 | $31.2 \pm 8.0$  |
| Distal margin (cm)          | $3.6 \pm 1.5$   |
| Positive rate of CRM (No.)  | 0               |
| Pathological stage          |                 |
| AJCC I                      | 9               |
| AJCC II                     | 12              |
| AJCC III                    | 13              |
| AJCC IV                     | 3               |
| Local recurrence (No.)      | 1               |
| Distant metastasis (No.)    | 12*             |
| Liver                       | 3               |
| Lung                        | 7               |
| Brain                       | 1               |
| Bone                        | 1               |
| Kidney/retroperitoneum      | 1/1             |

\* Two patients presented with multiple metastasis: one with liver and lung metastasis and one with liver and kidney metastasis.



**Fig. 1.** Overall 3-year survival rate (a) and 3-year survival rate of each stage (b).

accepted for the management of colon malignancies in this decade. For upper or mid-rectal cancer, low anterior resection combined with total mesorectal excision provides technically and oncologically satisfactory results. Advances in laparoscopic techniques, including double-stapling techniques and sphincter-preserving procedures, have lowered the necessity of permanent colostomy for lower rectal cancer. In addition, improvements in CCRT help reduce tumor size and decrease circumferential involvement in rectal cancer.<sup>19,20</sup> Despite the abovementioned treatments, APR is required in approximately 18% of patients with lower rectal cancer.<sup>21</sup>

Indeed, the introduction of laparoscopic surgery in the management of lower rectal cancer has revolutionized the traditional APR procedure described by Miles in 1908.<sup>22</sup> Some obstacles existed in performing a proper mesorectal dissection along the “holy plane”

described by Heald.<sup>23</sup> With the accumulation of experiences of laparoscopic colectomy, laparoscopic APR has been performed recently by some skilled laparoscopists. Many studies have demonstrated that the laparoscopic approach does not compromise the radicality of total mesorectal excision.<sup>24,25</sup> Further, the laparoscopic surgery enabled a much detailed dissection technically due to magnified system in a narrow pelvic space, especially in male patients.

In previous studies, oncological outcomes with respect to local control and survival were inferior in patients who underwent APR than in those who underwent low anterior resection, which could be associated with dissemination of the tumor cells near the dentate line due to surgery.<sup>26,27</sup> The result is imperative of unique behaviors of lower rectal cancer, which warrants further studies.

In our study, the postoperative results were acceptable, and the majority of the patients were discharged uneventfully, except 1 patient who had prolonged hospitalization owing to poor perineal wound healing. Eight patients in our study underwent laparoscopic APR in conjunction with other combined procedures due to obvious distant metastasis and suspicious tumor invasion, which led to a longer operative time than that reported in the literature.<sup>8,21,28,29</sup> The reported morbidity of laparoscopic APR varies, ranging from 0-45.1%.<sup>8,9,28</sup> In our study, the most complicated patients recovered with conservative treatment. Notably, all of the patients showed grade I and grade II postoperative complications, except 1 patient who underwent reoperation for perineal wound abscess formation and showed smooth recovery. Concerning mortality, there was no immediate postoperative death in our study, which is comparable with the results reported in the literatures (0-2.5%).<sup>8,9,28,30</sup>

We evaluated the short-term oncological outcomes by surgical clearance in term of the number of lymph nodes harvested, the distal margin, the length of specimens, and the positive circumferential resection margin rate, which would be important in defining the completeness of a laparoscopic surgery. Our study showed that the number of retrieved lymph nodes was enough to evaluate the nodal staging adequately. Because of the limited follow-up duration,

the 5-year survival rates of the patients are not available. Preliminary results show that the estimated 3-year survival was 82.2%, as compared with the reported 3-year survival rate of 66.8% in the literature.<sup>28</sup> Our study reported a superior result for patients with stage I and stage II tumors; in these patients, the disease-free survival rate was 50% and the overall survival rate was 100%. The disease-free survival rate and overall survival rate decreased to 33.3% and 66.7% in stage III and stage IV tumors.

## Conclusion

Laparoscopic APR could be safely performed in despite of a high technical challenge to be overcome. The superiority of laparoscopic surgery could be achieved and the complications were acceptable. Current data showed that a comparable interim oncological outcome could be achieved following the surgical principles.

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原 著

## 腹腔鏡腹部會陰聯合切除手術於低位直腸癌： 臺大醫院之八年經驗

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**目的** 腹腔鏡腹部會陰聯合切除手術已經用於低位直腸癌的治療。本篇研究旨在探討臺大醫院於腹腔鏡腹部會陰聯合切除手術的手術結果。

**方法** 自 2003 年 1 月至 2011 年 11 月，總共有 37 位接受腹腔鏡腹部會陰聯合切除手術的低位直腸癌患者並收案進行分析。低位直腸癌之定義為距肛門口 6 公分之直腸惡性腫瘤。腹腔鏡手術遵循下述癌症廓清原則：完整腫瘤清除、下腸繫膜血管之高位結紮、不接觸腫瘤以及全直腸繫膜切除。

**結果** 腹腔鏡腹部會陰聯合切除手術成功地實行於所有患者而毋須轉換為開腹手術。共有 16 位男性以及 21 位女性患者，平均年齡是  $61.5 \pm 13.6$  歲（範圍從 30 歲至 85 歲）。病理分期如下：第一期 9 位患者，第二期 12 位，第三期 13 位以及第四期 3 位。平均手術時間為  $298.3 \pm 77.3$  分鐘。除了一位患者因為會陰部膿瘍產生而必須再次接受清創手術，所有患者皆順利出院。無術中的併發症發生。依據 Clavien-Dindo 併發症分類，其中 2 名患者屬於第一級，6 名屬第二級，而 1 名屬第三級。所有患者皆定期回診追蹤，其中一名患者發生局部復發，12 名患者發生遠端轉移。估算三年存活率為 82.17%。

**結論** 對於低位直腸癌而言，腹腔鏡腹部會陰聯合切除手術是安全而且可行的手術。依癌症廓清原則而施行腹腔鏡腹部會陰聯合切除手術可確保滿意的治療成果。

**關鍵詞** 腹腔鏡手術、腹部會陰聯合切除手術、低位直腸癌。