Original Article

Laparoscopic Abdominoperineal Resection for Low Rectal Adenocarcinoma

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Purpose. Laparoscopic abdominoperineal resection (LAPR) is an accepted alternative to open resection for treating patients with low rectal adenocarcinoma, but the long term results are seldom reported. The purpose of our study was to evaluate the long term outcome in low rectal adenocarcinoma patients treated with laparoscopic abdominoperineal resection.

Methods. We reviewed our experience with 35 patients who underwent laparoscopic abdominoperineal resection for low rectal adenocarcinoma at Changhua Christian Hospital between 1999 and 2003, and another 31 low rectal adenocarcinoma patients who accepted open abdominoperineal resection during the same period of time was compared. The patient's short term outcome, such as bowel function recovery time, duration of hospital stays and long term oncological result were recorded and analyzed. The option for conversion rate, laparoscopic operation time and complication were also discussed.

Results. Of 66 total patients, 31 were in the open group and 35 were in the laparoscopic group; 4 (11%) of the latter were converted to open surgery. The overall complication rate in this study is 24.24% and there was no operative mortality in the study. No port-site metastasis was found in laparoscopic group, and no surgical wound metastasis was found in open group. No statistically significant difference in body weight, height, BMI, anesthesia score, pre-operative chemoradiotherapy, cancer stage, survival time, and mean operative time was found among the 3 groups. Blood loss for open surgery and completed laparoscopic resection were (mean $\pm$ SD) 619 ± 355.4 mL vs 325 ± 292.7 mL (p = 0.001). The time that bowel function resumed, time to ingestion of water, and time to resumption of solid foods between the open and laparoscopic groups were (mean $\pm$ SD) 2.5 ± 0.6 vs 2 ± 0.8 days (p = 0.032), 2 ± 0.8 vs 1.5 ± 0.6 days (p = 0.015), and 3.7 ± 0.9 vs 3.2 ± 0.9 days , respectively (p < 0.005). The over all survival rates at 5 years were 65.72% in open group and 69.40% in laparoscopic group (p = 0.7723).There are four local recurrent (6.06%) in the study. Distal metastasis at 5 years follow-up was noted in 14 patients and located at liver, lung and adrenal gland.

Conclusion. Laparoscopic abdominoperineal resection is a feasible alternative to the conventional open technique for the treatment of patients with low rectal adenocarcinoma.
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W. Ernest Mile's description of abdominoperineal resection of a low rectal tumor in 1908 was a landmark in the history of colorectal surgery.[1,2] Since then recent prospective randomized trials have shown that compared with open resection the use of laparoscopic techniques can reduce postoperative pain, can shorten postoperative ileus, can lessen the duration of hospital stay, and can allow for rapid resumption of normal daily activities.[3,4] Moreover, the long-term oncologic result of laparoscopic resection of colon cancer is equal to that of open colectomy.[5] However, laparoscopic resection of low rectal cancer currently remains controversial, even though it has benefits such as those mentioned above for laparoscopic colectomy as well as allowing for good visualization of the pelvic cavity, especially in patients with an extremely narrow pelvis, during resection of low rectal cancer.[6] Hence, the purpose of this study was to retrospectively evaluate and compare the result of laparoscopic and open abdominoperineal resection for low rectal adenocarcinoma.

Patients and Methods

From January 1999 through December 2003, 35 patients at our hospital underwent elective laparoscopic abdominoperineal resection (LAPR) for primary low rectal adenocarcinoma. The patients were matched with a group of 31 patients who underwent open abdominoperineal resection for low rectal adenocarcinoma during the same period. Low rectal adenocarcinoma was defined as a tumor located between 0 cm to 6 cm from the anal verge.

All patients were clinically staged by physical examination, complete colonoscopy, endorectal ultrasound, abdominal and pelvic computed tomography, and/or magnetic resonance imaging. Biopsies, which were collected in all patients, were pathologically proven as rectal adenocarcinoma. Distant metastases of the lungs were found by plain chest x-ray and metastases in the liver were detected by abdominal ultrasound or computed tomography examination. Complete blood count and carcinomembryonic antigen test were conducted before treatment.

Data Collection

All surgical and pathological data were prospectively collected in our Colorectal Surgery Data Bank.

Preoperative chemotherapy and radiotherapy

All patients with preoperative clinical stage T3 or T4 or regional lymph node enlargement were suggested to be treated with preoperative concurrent chemoradiotheraphy (CCRT), and 11 patients accepted the treatment in this study. Radiation was delivered with 15-MV photon beams, using a 3-field belly board radiation technique or 3-dimensional conformal radiotherapy (3DCRT). Treatment dose was 50.4 Gy in 28 fractions for 5 weeks. During chemotherapy, high doses of 5-fluorouracil (5-FU) and leucovorin were given concurrently with radiation. All patients received weekly 24-hour intravenous continuous infusions of 5-FU, 2000 to 2100 mg/m^2 body surface area/day, and slow infusions of leucovorin, 500 to 200 mg/m^2 body surface area/day.

Operative technique

Laparoscopic abdominoperineal resection (LAPR)

The techniques of LAPR have well been described by others.[7] Patients were placed in the modified lithotomy position. Pneumoperitoneum established with veress needle. A 12-mm trocar was placed through a 1-cm supraumbilical incision. A Fujinon flexible laparoscope (Fujinon, Wayne, NJ, USA) was introduced through the port and all subsequent surgery was performed under direction visualization. Also inserted were one 12-mm trocar and three 5-mm trocars into the abdomen to facilitate use of the laparoscopic stapling instruments.

Dissection and division began from the left lateral attachment of the sigmoid colon and identification of the Toldt's fascia. The inferior mesemteric vessels were divided with the clips and ultrasonic scalpel after the window was created in the sigmoid mesentery. After the entire sigmoid and mesosigmoid colon were fully mobilized, the rectum was retracted upward and forward so that the loose areolar plane between the

mesorectum and the presacral fascia could be identified. The presacral plane was dissected as far as possible with the ultrasonic scalpel and hypogastric nerves could easily be visualized.

The dissection moved first to the right and then to the left of the rectum. Anterior dissection of the rectum was done in front of the Denonvilliers' fascia and posterior dissection was done alone the Waldeyer's fascia. Next, the lateral ligaments on either side of the rectum were divided. Posteriorly, the pelvic nerve was identified and preserved, and the mesorectum was completely excised. Finally, the left colon was transected using an endostapler.

Division of the skin, subcutaneous fat and levator ani muscle from perineal approach allowed a window to be made posteriorly through in Waldeyer's fascia. The remainder of the perineal dissection was completed. An end colostomy was fashioned by bringing the colon out through the left iliac fossa trocar site. Suction drainage was inserted through the perineum, and the perineal incision was closed in layers.

Open abdominoperineal resection (APR)

The open abdominoperineal resection (APR) procedure was performed as the laparoscopic abdominoperineal resection (LAPR) except the midline laparotomy wound.

Statistical analyses

The Fisher's exact test, Mann-Whitney U test, Kruskal-Wallis test, and one-way ANOVA with LSD multiple comparisons were used to compare discrete, nonparametic, and variance data. The Kaplan-Meier method was used for survival intervals and differences between the groups were compared by use of the log-rank test.

Results

Thirty-one patients (47%) were in the open resection group and 35 patients (53%) were in the LAPR group. Four of the laparoscopic group (11%) were converted to open abdominoperineal resection because of bulky tumors (n = 2), adhesion from prior surgery (n = 1), and iatrogenic rectal perforation (n = 1). Patient characteristics are shown in Table 1. Patient sex, height, weight, body mass index (BMI), preoperative concurrent chemoradiotherapy (CCRT) and ASA score were comparable between the open and LAPR groups, but the results were not statistically significant.

The blood loss was significantly less in the laparoscopic group. The time to pass first bowel motion, try water, on diet were significantly shorter in

Table 1. Patient characters

	Open APR (n = 31)	Complete Laparoscopic APR (n = 31)	Converted to open APR (n = 4)	p
Gender				
Male	17 (55%)	21 (68%)	4 (100%)	0.216
Female	14 (45%)	10 (32%)	0	
Median Body Height (m)	1.6 (1.4-1.8)	1.6 (1.3-1.8)	1.6 (1.5-1.7)	0.51
Median Body Weight (kg)	60 (35-88)	57 (33-85)	58 (45-71)	0.771
BMI*	22.9 (15.1-31.2)	21.1 (17.4-28.1)	21.6 (17.3-26.1)	0.816
Pre-op CCRT				
Yes	3 (10%)	7 (22.5%)	1 (25%)	0.441
No	28 (90%)	24 (77.5%)	3 (75%)	
ASA score**				0.135
ASA1	2 (6%)	1 (3.2%)	1 (25%)	
ASA2	10 (32%)	12 (38.7%)	3 (75%)	
ASA3	18 (58%)	18 (58.1%)	0	
ASA4	1 (4%)	0	0	

*BMI: Body Mass Index; **ASA score: American Society of Anesthesiologists Score.

the laparoscopic group than in the open group. But the results of operation time and hospital stay were not statistically significant (see Table 2). Two patients in the laparoscopic group had pathologic complete response after preoperative concurrent chemoradiotheraphy (CCRT).

The over all survival rates at 5 years were 65.72% in open group and 69.40% in laparoscopic group (p = 0.7723) (Fig. 1). There are four local recurrent (6.06%) in the study, two in open group, one in complete laparoscopic APR group, and one in convertion group. Distal metastasis at 5 years follow-up was noted in liver, lung, adrenal gland (Table 3). In the LAPR group, there is one patient was noted combine with liver and lung metastasis and the other one patient was combine with lung and adrenal gland metastasis. No surgical wound metastasis was found in open APR group, and no port-site metastasis was found in laparoscopic APR group.

There was no operative mortality in three group and details of the complications in the three group was shown in Table 4. Complications occurred in 16 patients (24.24%) in this study. Intraoperative complication of rectal perforation with fecal contamination occurred in LAPR group requiring conversion to open. There was one presacral plexus injury and one vagina injury when dissection of the rectum due to advanced tumor in open group. The perineal wound complica-
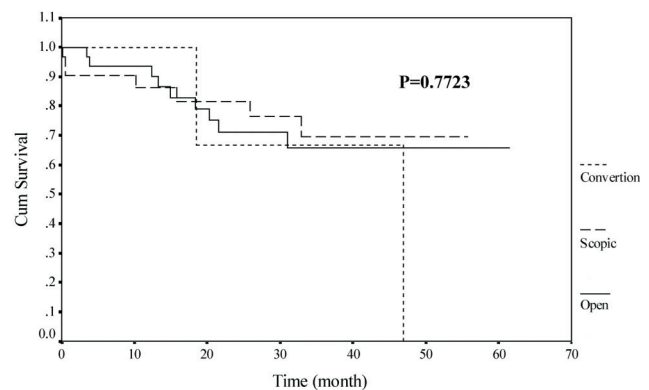

Fig. 1. Comparison of survival of patients in open APR, laparoscopic APR and conversion groups.

Table 2. Postoperative results

	Open APR (n = 31)	Complete Laparoscopic APR (n = 31)	Converted to open APR (n = 4)	*p*
Operating time (min; mean ± SD)	224 ± 78.4	243 ± 64.9	257 ± 53.9	0.462
Blood loss (ml; mean ± SD)	619 ± 355.4	325 ± 292.7	250 ± 108	0.001
Time to pass first bowel motion (days; mean ± SD)	2.5 ± 0.6	2 ± 0.8	2.3 ± 1	0.032
Time to try water (days; mean ± SD)	2 ± 0.8	1.5 ± 0.6	1.8 ± 1	0.015
Time to on diet (days; mean ± SD)	3.7 ± 0.9	3.2 ± 0.9	4.3 ± 1	0.03
Hospital stay (days; mean ± SD)	11.2 ± 9.5	11.8 ± 6.2	11.5 ± 5.7	0.959
Stage of cancer (TNM)				0.626
Stage I	6 (19.4%)	8 (25.8%)	2 (50%)	
Stage II	12 (38.7%)	10 (32.3%)	0	
Stage III	9 (29.0%)	8 (25.8%)	2 (50%)	
Stage IV	4 (12.9%)	3 (9.7%)	0	
Complete Response (CR)	0	2 (6.5%)	0	

Table 3. Overall tumor local recurrent and distant metastasis

	Open APR	Complete Laparoscopic APR	Converted to open APR
Local Recurrent			
	2	1	1
Distant Metastasis			
Liver	4	2	0
Lung	3	1	2
Liver + Lung	1	0	0
Lung + Adrenal gland	0	1	0

Table 4. complication

	Open APR	Complete Laparoscopic APR	Converted to open APR
Intraoperative			
Presacral plexus injury	1 (3%)	0	0
Rectal perforation	0	0	1 (25%)
Vagina injury	1 (3%)	0	0
Postoperative			
Subcautaneous emphysema	0	2 (6%)	0
Ileus	2 (6%)	1 (3%)	0
Perineal wound infection	2 (6%)	1 (3%)	1 (25%)
Perineal wound herniation	1 (3%)	1 (3%)	0
Stoma necrosis	1 (3%)	1 (3%)	0
MCA infarction	0	1 (3%)	0
Total	7	7	2

tions was seem the major morbidity of the study. Changes in consciousness with hemiplegia occurred in one old patient of the LAPR group 3 days after the operation. Myocardial infarction was diagnosed after a neurologist examined the patient.

Discussion

Although laparoscopic colectomy has evidence-based advantages in short term and long term outcome in colon cancer, but as far as rectal adenocarcinoma is concern, the long term results have been seldom reported. In this study the overall survival rate at 5 years were 65.72% in open group and 69.40% in laparoscopic group (p = 0.7723), and it is comparable to other studys.[7,8] This study clearly demonstrated that laparoscopy did not jeopardize patient's oncologic outcome, therefore it is safe to apply laparoscopic technique in rectal adenocarcinoma patients. In some studies, the authors reported the risk of port-site metastasis[9-11] due to tumor cell shedding and subsequent implantation, but in this study there was no wound or port-site metastasis observe in either open or laparoscopic group.

The conversion rates are in consistency in the published reports from 10% to 25%.[18] Our data showed a reasonable conversion rate of 11% (4/35), and this is comparable with most of the published reports. Base on our experience in laparoscopic surgery, we believe that it is difficult for surgeon to predict which cases can be completed laparoscopically based on the pre-operative work-up. Conversion rate is associated with the experience of the surgeon as well as first assistants and camera surgeon. The current study cannot given any information of predicting conversion rate due to small sample size. However, it is crucial to determinate when to convert, and one must know that an early conversion is beneficial to the patient. If conversion is made earlier the outcome of converted case is similar to patients undergoing open surgery.[12,13]

In our data, the operative time in the LAPR group was longer than in the open group, but the difference was not statistically significant. We strongly believe that operation time will decrease as we continue practice laparoscopic colorectal surgery routinely. By performing laparoscopic procedure routinely, not only the surgeon gain experience in laparoscopic surgeon, the entire team will collaborate better. The average operative time spent for laparoscopic group in the first two years is 279 minutes and in the least two years is 207 minutes. In our data, it showed as the case number of the LAP group increased, the operative time indeed decreased.

The overall complication rate in this study is 24.24%, and like in our published data perineal wound morbidity seems to be the most common complication.[6-8] In the this study, there are two unexpected complications in the laparoscopic group, these complication is never previously observed in open surgery-subcutaneous emphysema and stoma strangulation causing stoma necrosis. The reason for developing subcutaneous emphysema is caused by inadequate

placement of trocar, instead of inserting the trocar into the abdominal cavity, it was left in the pre-peritoneal space, and causing subcutaneous emphysema. Hence, adequate placement of trocar is one of the important factors in the success of laparoscopic colorectal surgery. The stoma necrosis case in laparoscopic group was due to the mesentery axis torsion when creating stoma. This is due to negligence during surgery, surgeon did not check the mesentery axis by laparoscopy before creating the stoma. So, re-pneumoperitonization and reassurance of the intestine axis is very important in laparoscopic colorectal surgery.

The rapid recovery of bowel function is one of the major advantages of laparoscopic surgery. Many studies comparing open and laparoscopic colectomy showed a significant decrease in the time of flatus or stool passage;[14-17] we found the same results in our study. This is not surprising, in our unit we routinely ask the patient to try water soon as patient recovered from anesthesia, and early mobilization is encourage. Postoperation cares were no difference in between to group. Moreover, we provided stoma education and management as early as possible. We strongly believe that laparoscopic surgery is indeed having some impact when bowel function return is considered. In this study, laparoscopic group did not show any benefit in length of hospital stay, this because postoperation patient care is standardized in our institute either open or laparoscopic surgery. Also the sample size may influence the outcome of the study.

Conclusion

In this study, we demonstrated that not only the technical feasibility and safety in LAPR for patient with low rectal adenocarcinoma, also shown that the long term oncological outcome is comparable to traditional open APR. To prove the superiority of laparoscopy in cancer patients, a randomization of open and laparoscopy should be re-conducted, because the techniques of laparoscopy had change for better, and instruments, operation room, and video system had improved. Until the result of randomization, LAPR for rectal adenocarcinoma should only be perform by surgeon who is familiar with the technique.

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腹腔鏡經腹部會陰部切除手術治療低位直腸癌

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目的　對於傳統經腹部會陰部切除手術而言，使用腹腔鏡經腹部會陰部切除手術來治療低位直腸癌是另一個被接受可以選擇的手術方式。但是對於腹腔鏡經腹部會陰部切除手術的長期預後追蹤卻較少被提出來討論。本篇研究的目的是要討論利用腹腔鏡經腹部會陰部切除手術治療低位直腸癌的長期預後。

方法　從 1999 年到 2003 年，有 35 位低位直腸癌患者在彰化基督教醫院接受經腹部會陰部切除手術，另外有 31 位低位直腸癌患者在同一時期接受傳統經腹部會陰切除手術被提出來做比較。二者的短期預後，如腸道恢復時間、住院天數等以及長期預後，如存活率等被提出來比較分析。另外針對由腹腔鏡手術改為傳統手術的原因、腹腔鏡手術時間長短以及手術併發症等也都有深入討論。

結果　在所有 66 位患者中，有 31 位接受傳統經腹部會陰部切除手術，有 35 位接受腹腔鏡經腹部會陰部切除手術，但其中又有 4 位 (11%) 於手術中由腹腔鏡手術改為傳統經腹部會陰部切除手術。手術併發症的比例為 24.24%。沒有患者因為接受腹腔鏡或傳統手術而造成死亡。沒有腹腔鏡通氣導管位置或是傳統手術傷口的腫瘤轉移。在患者的特徵：包括體重、身高、BMI 值、麻醉評估分數、術前是否接受化學治療、癌症分期、存活時間、以及平均手術時間，各組都沒有顯著統計學上差異。術中失血量在傳統手術與腹腔鏡手術分別為 (mean ± SD) 619 ± 355.4 ml 與 325 ± 292.7 ml (p = 0.001)，有統計學上差異。腸道恢復的時間與開始喝水、開始進食的時間在傳統手術與腹腔鏡手術分別為 (mean ± SD) 2.5 ± 0.6 與 2 ± 0.8 天 (p = 0.032)、2 ± 0.8 與 1.5 ± 0.6 天 (p = 0.015)、3.7 ± 0.9 與 3.2 ± 0.9 天，均有統計學上差異 (p < 0.05)。在五年存活率方面：傳統手術與腹腔鏡手術分別為 65.72% 與 69.40% (p = 0.7723)，沒有顯著統計學上差異。有四位患者有術後腫瘤局部復發的情形，復發率為 6.06%。五年的遠處器官轉移共有 14 位患者，分別在肝臟、肺臟、腎上腺被發現。

結論　對於要接受手術的低位直腸癌患者，除了傳統經腹部會陰部切除手術，腹腔鏡經腹部會陰部切除手術是另一個可選擇的治療方式。

關鍵詞　腹腔鏡經腹部會陰部切除手術、低位直腸癌。