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ORIGINAL ARTICLE

Clinical feasibility of laparoscopic lateral pelvic lymph node dissection following total mesorectal excision for advanced rectal cancer

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Abstract
Purpose To evaluate the technical feasibility, safety and oncological outcomes of laparoscopic lateral pelvic lymph node dissection in patients with advanced low rectal cancer.
Methods Laparoscopic lateral pelvic lymph node dissection was performed in 18 patients from November 2009 to September 2012. The data regarding the patient demographics, surgical outcomes and short-term oncological outcomes were analyzed.
Results In all 18 patients, the procedures were completed without conversion to open surgery. The mean length of the operation was 603.7 min (473–746 min). The mean number of harvested lateral pelvic lymph nodes was 16.9 (7–27), and five patients (27.8 %) had lymph node metastases. The postoperative mortality and morbidity rates were 0 and 16.7 %, respectively. Three patients developed Grade 2 urinary retention. No local recurrence had developed after a mean follow-up period of 23.6 months.
Conclusion Laparoscopic lateral pelvic lymph node dissection is technically feasible, safe and oncologically acceptable within the limitations of the short-term follow-up period.

Keywords Laparoscopy · Lateral pelvic lymph node dissection · Rectal cancer

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Introduction

The management of lateral pelvic lymph nodes (LPLNs) in patients with low rectal cancer differs considerably between Western countries and Japan. In Western countries, preoperative chemoradiotherapy with total mesorectal excision (TME) is the standard treatment for low rectal cancer. Lateral pelvic lymph node dissection (LPLD) is not regularly performed in Western countries, because LPLN metastasis is generally considered to be a systemic disease, and because LPLD often leads to urinary and sexual dysfunction [1–3]. On the other hand, in Japan, the incidence of LPLN metastasis from low rectal cancer is reported to be about 15 %, and TME with LPLD has been the standard procedure for patients with low rectal cancer [4–6]. It was reported that LPLD can improve the 5-year survival rate of patients with T3–T4 low rectal cancer by 8 % and can reduce the local recurrence rate by half [6]. The indication for LPLD in Japan is "T3 or T4 rectal cancer that extends below the peritoneal reflection" according to the Japanese guidelines (Japan Society for Cancer of the Colon and Rectum Guidelines 2010 for the Treatment of Colorectal Cancer). As described above, there has been a great debate on the efficacy of LPLD for locally advanced low rectal cancer between Western countries and Japan.

Laparoscopic surgery has been generally accepted as a minimally invasive approach for the treatment of patients with colorectal cancer [7, 8]. Laparoscopic LPLD is technically challenging because of its difficulty, and therefore has not been widely practiced. As a result, there are only a few reports about the technical feasibility of laparoscopic LPLD [9–12]. These reports demonstrated less operative blood loss and less postoperative complications compared with open surgery. In the present study, we report the technical feasibility, safety and oncological outcomes in 18 patients with low rectal cancer who underwent laparoscopic

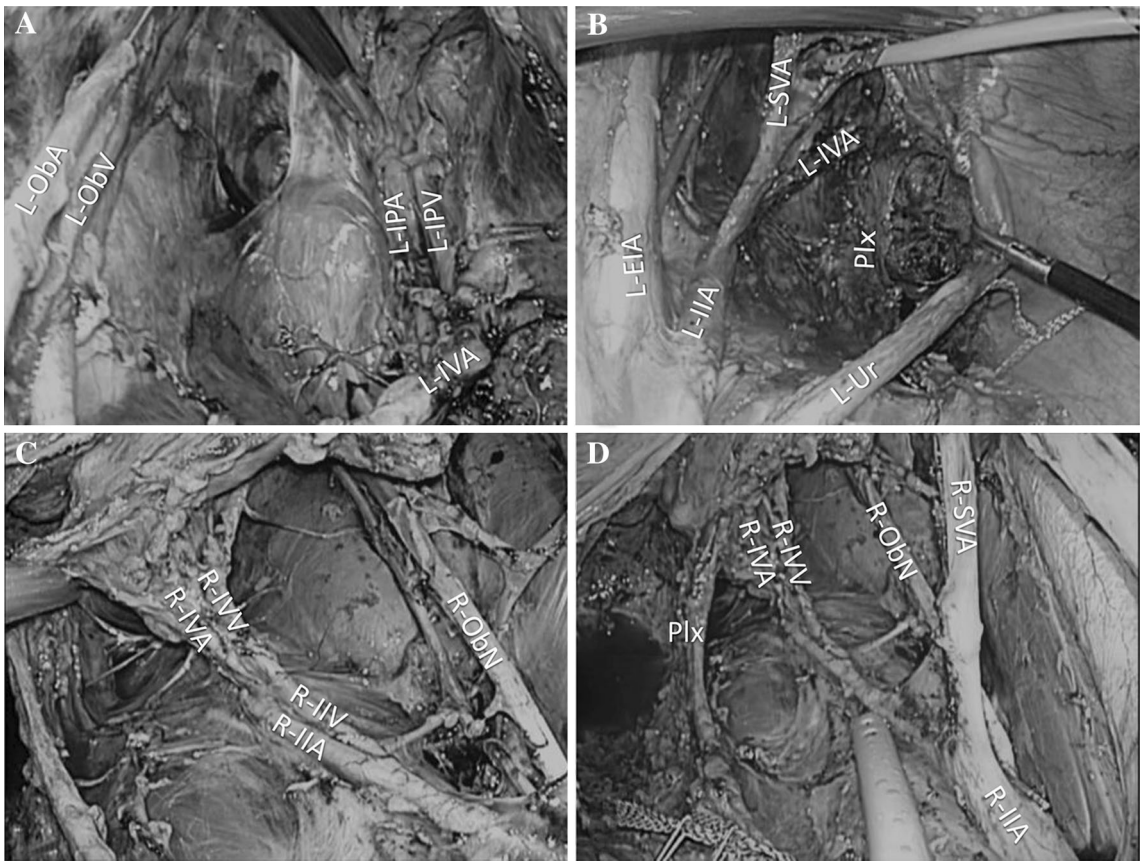

Fig. 1 Intraoperative view of a dissected pelvic side-wall with preservation of the vascular and nerve structures. **a** Dissection in left obturator fossa. **b** Dissection along left internal iliac vessels. **c** Dissection in right obturator fossa. **d** Dissection along right internal iliac vessels. *ObA* obturator artery, *ObV* obturator vein, *IPA* internal pudendal artery, *IPV* internal pudendal vein, *IVA* inferior vesical artery, *IVV* inferior vesical vein, *EIA* external iliac artery, *IIA* internal iliac artery, *IIV* internal iliac vein, *SVA* superior vesical artery, *Plx* pelvic plexus

TME with LPLD, and also provide a review of the previous reports. The present results may more directly demonstrate the efficacy of laparoscopic LPLD than the previous reports, because all patients in the present study underwent bilateral LPLD without preoperative radiotherapy.

Patients and methods

A total of 18 patients with low rectal cancer (located below the peritoneal reflection) who underwent laparoscopic TME and bilateral LPLD from November 2009 to September 2012 were reviewed retrospectively. None of the patients received preoperative radiotherapy or chemotherapy. The TNM stages in our series were classified according to the UICC 7th edition, in which LPLN was included in the regional lymph node classification of rectal cancer. The patient demographics, surgical data, postoperative complications, postoperative urinary retention [evaluated by the Common Terminology Criteria for Adverse Events (CTCAE) version 4.0] and the data on local and systemic recurrence were analyzed.

At our institution, LPLD following TME has been performed for T3–T4 low rectal cancer according to the Japan Society for Cancer of the Colon and Rectum Guidelines for the Treatment of Colorectal Cancer. The choice of whether to give preoperative chemoradiotherapy was based on a joint decision by the patients and physicians. For patients who chose preoperative chemoradiotherapy, we performed only TME and omitted LPLD for cases without radiological LPLN metastasis. In principle, we have adopted the laparoscopic approach for rectal cancers, except cases with bulky primary tumors and/or massive lymph node metastasis. This series described in this study was consecutive patients who underwent laparoscopic bilateral LPLD following TME without preoperative radiotherapy.

The postoperative surveillance program in our institute includes a carcinoembryonic antigen (CEA) determination every 3 months, chest/abdominal/pelvic computed tomography (CT) scans every 6 months and colonoscopy every

Table 1 The clinicopathological characteristics of the patients ($n = 18$)

Age (years, mean ± SD, range)	58.7 ± 12.7	26–80
Sex (*n*)		
Male	14	
Female	4	
BMI (kg/m^2, mean ± SD, range)	23.7 ± 4.6	18.0–39.5
Distance from the AV (mm, mean ± SD, range)	37.4 ± 19.2	10–70
Tumor diameter (mm, mean ± SD, range)	59.6 ± 19.6	20–80
Radiological LPLN metastasis (*n*)		
Negative	12	
Positive	6	
Pathological LPLN metastasis (*n*)		
Negative	13	
Positive	5	
Distant metastasis (*n*)		
Negative	12	
Positive	6	
pTNM stage (*n*)		
2a	5	
2b	0	
2c	0	
3a	0	
3b	4	
3c	3	
4a	5	
4b	1	

SD standard deviation, *BMI* body mass index, *AV* anal verge, *LPLN* lateral pelvic lymph node

12 months for the first 3 years. For the subsequent 2 years, patients undergo a CEA determination every 6 months, chest/abdominal/pelvic CT scan every 12 months and colonoscopy every 12–24 months. Magnetic resonance imaging (MRI) and fluorodeoxyglucose-positron emission tomography (FDG-PET) were carried out in cases with a suspicion of recurrence; however, they were not routinely performed.

Surgical procedure

The port placement for laparoscopic LPLD was the same as that for TME. Five ports were set: a para-umbilical port for the laparoscope, two ports at the anterior axillary line over the right lower abdominal quadrant for working ports and two others for working ports in the left lower abdominal quadrant, symmetrical to the right ports. The operator stood on the right side of the patient for left LPLD and on the left side for right LPLD. Laparoscopic LPLD was performed before reconstruction of the bowel continuity in cases of sphincter muscle-preserving operations, and after closure of the perineal wound following rectal resection in cases of abdominoperineal resection (APR). LPLNs were defined as lymph nodes outside the pelvic plexus, along the internal iliac and common iliac vessels and in the obturator fossa [6].

During the LPLD, the ureter and the hypogastric nerve were first confirmed and picked up in order to avoid injuring them. Then, the lymph nodes were dissected in order, along the external iliac vessels, the common iliac vessels, in the obturator fossa and along the internal iliac vessels, carefully preserving the hypogastric and obturator

Table 2 The surgical outcomes of the patients ($n = 18$)

Conversion to open procedure (*n*)	0	
Surgical procedure		
LAR	8	
ISR	1	
APR	9	
Length of operation (min, mean ± SD, range)	603.7 ± 76.2	473–746
Estimated blood loss (ml, mean ± SD, range)	379.2 ± 324.2	10–930
No. of LPLN harvested (*n*, mean ± SD, range)	16.9 ± 5.9	7–27
Postoperative morbidity (*n*)		
Anastomotic leakage	1	
Wound infection	0	
Small bowel obstruction	2	
Lymphatic leakage	2	
Deep venous thrombosis	1	
Postoperative mortality (*n*)	0	
Time to tolerate diet (days, mean ± SD, range)	4.6 ± 2.5	3–14
Postoperative hospital stay (days, mean ± SD, range)	25.5 ± 10.7	9–56
Urinary retention[a] (*n*)	3 (Grade 2)	

LAR low anterior resection, *ISR* inter-sphincteric resection, *APR* abdominoperineal resection, *SD* standard deviation, *LPLN* lateral pelvic lymph node

[a] Urinary retention was evaluated by the Common Terminology Criteria for Adverse Events (CTCAE) version 4.0

Table 3 The oncological outcomes of the patients ($n = 18$)

Surgical curability (*n*)		
R0	12	
R1	0	
R2	6	
Follow-up duration (months, mean ± SD, range)	23.6 ± 10.8	11.9–41.4
Local recurrence (*n*)	0	
Recurrence of R0 patients (*n*)	1	

SD standard deviation

nerves (Fig. 1). Considering the incidence of LPLN metastasis, the most important areas are the obturator fossa and the distal side along the internal iliac vessels. For the obturator fossa, we dissected the lymph nodes located in the area surrounded by the internal obturator muscle, psoas major muscle, levator ani muscle and vesicohypogastric fascia, preserving the obturator nerve. For the distal side along internal iliac vessels, we defined the goal of the dissection as where the lower bladder arteries branched from the internal iliac vessels and the internal pudendal artery entered Alcock's canal in this report.

Results

Eighteen patients were recruited over a 35-month period. Their clinicopathological characteristics are summarized in Table 1. The radiological diagnosis showed that there were six cases with metastatic LPLNs. All patients underwent bilateral laparoscopic LPLD. Five cases had metastatic LPLNs confirmed on pathological examination, and four of these cases had been diagnosed preoperatively. Six cases had resectable liver or lung metastasis diagnosed by radiological examination. After primary tumor resection and systemic chemotherapy, the resectability of the metastatic lesions was evaluated in these six cases. The metastatic lesions could be successfully resected in four cases. However, for the other two cases, the metastatic lesions had progressed to be unresectable because there were multiple new lesions.

The surgical data are summarized in Table 2. All operations were completed successfully without conversion to an open procedure. A sphincter-preserving procedure was performed in nine patients, and APR was performed in nine patients. The mean length of the operation was 603.7 min (473–746 min). The mean intraoperative blood loss was 379.2 mL (10–930 mL), with three cases requiring intraoperative transfusion. The total number of harvested LPLNs ranged from seven to 27 (mean 16.9). There were no postoperative deaths. Three patients (16.7 %) developed one or more specific postoperative complications, including one with anastomotic leakage, two with postoperative small bowel obstruction, two with lymphatic leakage and one with an asymptomatic deep venous thrombosis. All patients with postoperative complications could be managed conservatively, requiring no surgical intervention. The mean time to tolerate an oral diet was 4.6 days (3–14 days). It was possible to start the diet according to the normal clinical pathway in most of the cases. The mean postoperative hospital stay was 25.5 days (9–56 days). No severe urinary dysfunction was observed in any of the patients, but three patients developed temporary urinary retention following removal of the catheter and required another catheterization.

The oncological outcomes are summarized in Table 3. R0 operations were performed for all 12 patients with no distant metastases. Of these 12 patients, one patient developed lung metastasis 34 months after the rectal resection, and it was removed curatively by video-assisted thoracic surgery. There has been no local recurrence in any of the 18 patients within the short median follow-up period of 23.6 months.

Discussion

Laparoscopic surgery has become generally accepted as a minimally invasive approach, and is now commonly performed in the treatment of patients with colorectal cancer [7, 8]. Laparoscopic LPLD was thought to be technically challenging because of its technical difficulty and the complicated anatomy of the pelvic side-wall. There have been a few reports that have demonstrated the technical feasibility, safety and oncological outcomes of laparoscopic LPLD [9–12]. In most of the previous reports, patients who had radiologically diagnosed LPLN metastasis underwent TME with therapeutic LPLD limited to the metastatic side, and the rate of bilateral LPLD was about 30 % [9, 10, 12]. As the contralateral LPLNs and pelvic nerve plexus were not involved in surgery, it might be difficult to evaluate the effects of laparoscopic LPLD on clinical, functional and oncological outcomes in such cases. In addition, in the present study, all patients underwent bilateral LPLD without receiving preoperative radiotherapy. Therefore, the present results may demonstrate the efficacy of laparoscopic LPLD more directly than the previous reports.

LPLD has not been broadly accepted in Western countries because it can cause postoperative genitourinary dysfunction [1]. Moreover, rectal cancer with LPLN metastasis is considered to be a systemic disease, not a local disease. In Western countries, TME with preoperative chemoradiotherapy has been the standard strategy for low rectal cancer, and it has been reported to reduce the local recurrence rate [2]. However, a recent study showed that preoperative chemoradiotherapy without LPLD was unable to control LPLN metastasis and local recurrence [13]. It is thought to be important for surgeons to develop the skills necessary for LPLD as an alternative to chemoradiotherapy.

The present study shows that laparoscopic LPLD may be as effective as open surgery for the oncologic clearance of LPLN, and it also decreases the previously reported disadvantages of open LPLD, such as greater intraoperative blood loss and urinary dysfunction [6, 14]. The total number of retrieved laparoscopic LPLNs per patient in the present series (median 18; mean 16.9) was similar to that of

a Japanese multicenter study (median 17) in which the open conventional approach was used for dissection [6]. Moreover, there have been no local recurrences in our series, although the follow-up period (mean 23.6 months) is too short to establish the oncological outcome.

The mean intraoperative blood loss in the present series was 379.2 mL, which was similar to that of TME without LPLD and less than that of TME with LPLD in the JCOG0212 study [14]. With regard to the postoperative urinary function, there were no cases of grade 3 or 4 urinary retention that required catheterization. Considering the incidence of grade 3 or 4 urinary retention in previous reports with the open approach for LPLD [1], it is thought that laparoscopic LPLD may have an advantage with regard to preservation of the urinary function.

The mean length of the operation (603.7 min) in the present series was long, as it was for laparoscopic bilateral LPLD in the previous report [11]. However, our laparoscopic team is still on the learning curve for the laparoscopic LPLD procedure, and the time is therefore expected to continue to decrease as facility with the surgical procedure develops.

The laparoscopic LPLD may not have inferiority to the open procedure, other than the potentially longer operation. In terms of the procedures used for lymphatic dissection, the laparoscopic surgery is similar to the open surgery. However, we do not ligate the lymphatic vessels at all, but instead dissect them using an electric or ultrasonic scalpel, which is unlike the open surgery. There were two cases in the present series of lymphatic leakage postoperatively. Therefore, it might be helpful to use a vessel-sealing device at that time of laparoscopic LPLD in order to prevent the occurrence of lymphatic leakage.

The postoperative hospital stay in this paper was longer than that of the previous report [9]. Our series included nine cases of stage 4 disease and nine cases with construction of a permanent colostomy. Consequently, the introduction of chemotherapy and/or stoma rehabilitation for these patients required a longer hospital stay.

Therefore, laparoscopic TME with LPLD appears to be technically feasible and safe, as well as oncologically acceptable, although the follow-up period was short in the present study. A prospective controlled study comparing laparoscopy and conventional open surgery with a long-term follow-up evaluation will be needed to confirm the present results.

Conflict of interest T Furuhata and co-authors have no conflicts of interest.

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