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Evaluation of Diverting Ileostomy in Laparoscopic Low Anterior Resection for Rectal Cancer

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BACKGROUND: Diverting ileostomy is believed to mitigate the effects of anastomotic complications in low anterior resections (LAR) for rectal cancer. However, there are no data about the effects of diverting ileostomy on the outcomes of laparoscopic LAR.
METHODS: We retrospectively reviewed the medical records of 77 consecutive rectal cancer patients who had undergone laparoscopic LAR with ($n = 23$) or without ($n = 54$) diverting ileostomy. The patients' data were recorded and supplemented on short-term follow-up visits and included standard demographics, operative procedure, location of the cancer, and final pathologic diagnosis. We noted length of hospitalisation, complications, and time interval from ileostomy creation to closure. Morbidity and mortality were also included.
RESULTS: Surgical intervention requiring anastomotic leakage occurred in three patients who underwent laparoscopic LAR without diverting ileostomy. The anastomosis level of patients who underwent laparoscopic LAR with diverting ileostomy was significantly lower than that of patients who underwent laparoscopic LAR without diverting ileostomy ($p < 0.05$).
CONCLUSION: Anastomosis level and total mesorectal excision are the main factors for creation of diverting ileostomy in laparoscopic LAR. Laparoscopic LAR without diverting ileostomy could be selectively performed. Our study provides a basis for further prospective randomised studies on the role of diverting ileostomy in LAR. [*Asian J Surg* 2011;34(2):63–68]

Key Words: diverting ileostomy, laparoscopy, low anterior resection, rectal cancer, temporary protective stoma

Introduction

Low anterior resection (LAR) is defined as the removal of the proximal portion of the rectum with re-anastomosis of the colon to the extraperitonealised portion of the rectum.[1] The surgical approach to rectal carcinoma has progressed substantially in the last few decades because of the application of laparoscopy to colorectal surgery.[2–5] However, anastomotic leakage is still a serious problem after sphincter-saving surgery for rectal cancer.[6] Diverting stomata are used to reduce leakage-related complications after LAR, but the routine use of diverting stomata is controversial because of reported morbidity associated with their creation and closure.[7,8]

Many authors believe that patients treated with total mesorectal excision (TME) and neoadjuvant chemoradiotherapy (NCRT) require a diverting stoma after open LAR.[9–11] At the same time, there is a tendency for the creation of a diverting stoma in sphincter-saving laparoscopic rectal cancer surgery.[9] No study has evaluated the

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role of diverting ileostomy in laparoscopic LAR. Therefore, we evaluated the effects of diverting ileostomy on the outcomes of laparoscopic LAR in rectal cancer patients.

Patients and methods

We retrospectively reviewed the medical records of 77 (40 male, 37 female) consecutive rectal cancer patients who had undergone laparoscopic LAR (partial mesorectal excision [PME] or TME) with or without diverting ileostomy with curative intent by a single surgical team from November 2003 to August 2009. The exclusion criteria for performing laparoscopic LAR were (1) tumour-related factors: tumours larger than 8 cm, obstructing tumour, intestinal perforation, and tumours that invade adjacent organs, and (2) patient-related factors: contraindications for laparoscopic surgery such as severe cardiopulmonary disease.

The patients' data were recorded and supplemented on short-term follow-up visits and included standard demographics, the operative procedure, location of the cancer, and the final pathologic diagnosis. We noted the length of hospitalisation, complications, and time interval from ileostomy creation to closure. Morbidity and mortality were also included. The patients were followed by the surgery and medical oncology outpatient clinics.

Preoperative preparation

Physical examination, biochemical analysis, optical colonoscopy, biopsy of the tumoural lesion, and computed tomography of the chest, abdomen, and pelvis were evaluated before surgery for every patient. In NCRT patients, surgery was performed 6–8 weeks after completing NCRT. A clear-fluid diet (90 mL of sodium phosphate soda *per os*) was given to the patients for mechanical bowel preparation on the day before the surgery. Antibiotic prophylaxis consisted of metronidazole (500 mg) and was intravenously administered at the time of anaesthesia induction.

Surgical procedure

All patients underwent laparoscopic LAR by two surgeons (TK and IH) under general anaesthesia. A standard technique was used as previously reported.[12] Surgery was performed intra-corporeally and involved organ mobilisation, vessel ligation, colon and rectum transection, and anastomosis. The patients were placed in the lithotomic position (30° Trendelenburg and 15° right lateral tilt). Four to five trocars were used for the procedure. Trocar size was between 5 and 10 mm. Among these, one was used as a camera port, one for retraction, and two as working ports. Under laparoscopic guidance, routine exploration was performed. The omentum and transverse colon were placed beneath the diaphragm and over the liver. The mesentery of the sigmoid colon was hung up by a device that was placed inside *via* the port in the left quadrant. The retroperitoneum was incised at the level of the promontorium above the iliac bifurcation. The right ureter and gonadal vessels were identified during medial to lateral dissection. Toldt's fascia was protected to preserve these structures. Dissection was begun by ligation of the inferior mesenteric artery close to its origin and the inferior mesenteric vein at the inferior border of the pancreas. The mesorectum was then sharply dissected to the pelvic floor posteriorly. With the help of posterior anatomic dissection space, lateral dissection of the rectum was performed. The sigmoid colon and the descending colon were freed from their lateral attachments before anterior mesorectal excision. Special care was taken to preserve the inferior mesenteric plexus and the hypogastric plexus. The rectum was excised while completely enveloped within the fascia propria recti in the TME patients and was partially excised 5 cm below the peritoneal reflection in the PME patients. The resected specimen was retrieved within an extraction bag (Endocatch II, US Surgical Corporation, Norwalk, CT, USA) through a Pfannenstiel incision. The anastomosis was performed using a double-stapling technique with an endoscopic linear stapler and a circular stapler. Rectal washout was performed during the anastomosis. The distance from the anal verge to the anastomosis was measured with digital rectal examination.

Closure of ileostomy

Before ileostomy closure, the distal anastomosis was checked with a barium enema. Ileostomy closure was approached *via* a circumstomal incision. A hand-sewn anastomosis was performed with a single layer of interrupted polyglycolic sutures. Side-to-side functional end-to-end anastomosis was performed with two 6-cm linear cutter staplers.

Histopathological evaluation

The specimens were sliced at approximately 3- to 5-mm intervals after the mesorectal surface had been inked. The

lymph nodes were submitted for microscopic examination. Histopathological examination of the mesorectal fascia was evaluated according to a standardised procedure described by Quirke et al[13] Recorded parameters included the number of harvested lymph nodes and the longitudinal and radial margins of the resected specimen. TNM classification according to the American Joint Committee on Cancer was used to determine the pathologic stage of the tumour.

Statistics

All data are expressed as median (range). The Mann-Whitney *U* test and the χ^2 test (Fisher's exact test) were used for the continuous and the categorical variables, respectively. Statistical Package for Social Sciences 12.0 (SPSS Inc., Chicago, IL, USA) was used to assess the significance of differences between groups. A p value of less than 0.05 was considered significant.

Results

The patients' characteristics and histopathological results are given in Tables 1–3. There was no conversion to open surgery during any procedure. Laparoscopic

Table 1. Patients' demographics and follow-up data

	Ileostomy (+) ($n=23$)	Ileostomy (−) ($n=54$)
Age (yr)*	59 (40–78)	61 (40–91)
Sex (M/F)	15/8	25/29
Body mass index (kg/m^2)	28.4 (21–40)	24.7 (18.5–38.2)
Level of anastomosis (cm)*	2 (1.5–3.5)	4.5 (2–7)†
No. of anastomotic leakage	–	3 (6%)
Stoma retraction	1 (4%)	–
Need for permanent stoma	1 (4%)	2 (4%)
Wound infection	2 (9%)	1 (2%)
Sexual dysfunction	1 (4%)	–
Incisional hernia	1 (4%)	–
Postoperative hospital stay (d)*	7 (5–16)	7 (6–19)
Closure time of ileostomy (mo)*	4 (2–12)	–

*Data were expressed as median (range); †($p<0.05$). NCRT = neoadjuvant chemoradiotherapy; ileostomy (+) = the patients with ileostomy; ileostomy (−) = the patients without ileostomy.

Table 3. Characteristics of the loop ileostomy patients

	No. of patients
NCRT	5
Comorbidity	6
Positive hydropneumatic test	3
Longer stapler line with Z-form	3
Incomplete doughnuts	1
Tensile strength of anastomosis	1
Deep and narrow pelvis	4

NCRT = neoadjuvant chemoradiotherapy.

Table 2. Staging of the patients and mean number of harvested lymph nodes

	TME ($n=23$) Ileostomy (+)	TME ($n=17$) Ileostomy (−)	PME ($n=37$) Ileostomy (−)
Tumour stage			
Stage I	10	4	12
Stage II	7	8	18
Stage III	6	4	4
Stage IV	0	1	3
Mean no. of harvested lymph nodes*	16 (3–31)	18 (12–28)	14 (10–28)
Evaluation of mesorectum			
Complete	15	10	–
Incomplete	1	2	–
Near complete	7	5	–

*Data were expressed as median (range). TME = total mesorectal excision; PME = partial mesorectal excision; ileostomy (+) = patients with ileostomy; ileostomy (−) = patients without ileostomy.

sphincter-saving TME was performed in 40 patients, whereas 37 patients underwent laparoscopic PME. The median distance of the anastomosis was 2 cm (1.5–3.5 cm) from the anal verge for patients who underwent laparoscopic LAR with diverting ileostomy, whereas the median distance was 4.5 cm (2–7 cm) for patients who underwent laparoscopic LAR without diverting ileostomy. This value was significantly different between the groups ($p < 0.05$). Diverting ileostomy was created in 23 (30%) patients. The patients who had diverting ileostomies also underwent TME. No patients who underwent PME required a diverting ileostomy. Comorbid factors, NCRT, deep and narrow pelvis, positive hydropneumatic test result, longer stapler line with Z-form, incomplete doughnuts, and tensile strength of anastomosis were the common characteristics in the diverting ileostomy patients. Six patients underwent NCRT, and five of them received a diverting ileostomy. Comorbid factors were uncontrolled diabetes mellitus in two patients, severe kidney insufficiency in two patients, and compensated chronic liver disease in two patients. Uncontrolled diabetic patients also had peripheral neuropathy, and one of them had a diabetic leg ulcer. Of these patients, severe cardiac insufficiency developed in the one whose stoma could not be closed. There were two end-stage renal disease patients who had been receiving haemodialysis treatment for 5 years. Both patients with hepatic insufficiency had hepatitis B infection and grade B (according to the modified Child-Pugh classification) chronic liver disease. The characteristics of the diverting ileostomy patients are summarised in Table 3.

Our anastomotic leakage rate was 4% for all laparoscopic LAR and 6% for laparoscopic LAR without ileostomy. No anastomotic leakage occurred in the patients who underwent laparoscopic LAR with ileostomy. The postoperative stay was 7 days (5–16 days) in patients with a diverting ileostomy and 7 days (6–19 days) in patients without diversion after laparoscopic LAR. There were no statistically significant differences between the groups in terms of anastomosis leakage, permanent stoma, wound infection, sexual dysfunction, and incisional hernia rates ($p > 0.05$). There were no statistically significant differences in terms of postoperative hospital stay, body mass index, and number of harvested lymph nodes between patients with or without diverting ileostomy ($p > 0.05$). Prolonged postoperative hospital stay was associated with wound infections and re-operations caused by anastomotic leakage.

No patients had evidence of contrast extravasation before stoma closure. Ileostomy closure was performed 4 months (2–12 months) after the initial procedure. The duration between ileostomy construction and closure was changed according to the patients' scheduling preferences, waiting list, and need for adjuvant chemotherapy.

The diverting stomata of only three patients were unable to be closed. One patient did not want to undergo re-operation, and one had severe cardiac disease that did not allow for re-operation. A 75-year-old woman required a permanent transverse colostomy after ileostomy closure because of resistant faecal incontinence.

Wound infection developed in three patients. Two of these infections were related to the diverting ileostomy. Sexual dysfunction (a male patient who had undergone TME with a diverting ileostomy) was observed in one patient. One patient required urgent surgery because of retraction of the diverting ileostomy, and an incisional hernia developed after ileostomy closure in another patient. There was no perioperative or postoperative mortality related to leakage or stoma complications.

Discussion

The survival of rectal cancer patients has been prolonged with the utilisation of TME and NCRT. On the other hand, these modalities are often associated with a high frequency of anastomotic dehiscence.[6–10] The overall anastomotic leakage rate has been reported at 9.8–19.2% in conventional LAR.[14–17] A diverting stoma is often created to minimise the impact of pelvic sepsis from an anastomotic dehiscence following coloanal or colorectal anastomosis.[8,9,18] A temporary colostomy or ileostomy is created for decompression of colorectal anastomosis as a diverting stoma. No prospective studies have reported that colostomy as a diverting stoma is better than ileostomy or vice versa. Diverting colostomy causes a higher rate of stoma complications such as infection and stoma prolapse. However, ileostomy tended to cause more post-closure surgical complications.[19,20] We prefer the creation of loop ileostomies in our clinical practice.

As a minimally invasive procedure, laparoscopic LAR is frequently preferred for the treatment of rectal cancer. Many authors have agreed that laparoscopic LAR is a feasible technique that can be performed in accordance with the principles of surgical oncology.[21–29] According to review of the laparoscopic series, the mean stoma creation rate

was approximately 50% (range, 0–65%) for LAR.[21–26,28] Laparoscopy has been considered to be an additional risk factor for leakage in rectal surgery.[9] In our study, diverting ileostomy was initially performed in 30% of all patients and ultimately in 34%. Diverting ileostomies were also created in three patients who had anastomotic leakage. Our diverting stoma creation rate in laparoscopic LAR was similar to that of the open series, and our anastomotic leakage rate was 4% overall for laparoscopic LAR and 6% for laparoscopic LAR without diverting ileostomy.

Potential disadvantages of diverting stomata include the need for another operation, longer hospital stay, and ostomy-related complications such as prolapse, retraction, necrosis, stenosis, peristomal abscess, parastomal hernia, and skin problems. Furthermore, ostomy construction and closure is associated with considerable morbidity and increased costs.[5,8,21] The morbidity can rise to 42%. The patient's quality of life significantly decreases because of the stoma.[30,31] Incisional hernia and stoma retraction were the diverting ileostomy-related major complications in our series. In many patients, the stoma closure time is usually postponed. It could take 4 months depending on factors such as hospital waiting lists, patient scheduling preferences, and need for adjuvant chemotherapy. The aesthetic appearance of laparoscopy may also be affected by a diverting stoma. Although intended to be temporary, a substantial proportion of these ostomies can never be reversed.[15,16] In our series, three of the diverting stomata were not able to be reversed.

It is difficult to select patients who will benefit from a diverting stoma. The general indications for diversion are low proximity of the anastomosis to the anal verge, high tension of the anastomosis, leakage on hydro-pneumatic tests, incomplete circular stapler doughnuts, NCRT, male gender, obstruction, infection, peritoneal contamination, intra-operative remarks, comorbidity, and surgeon's experience.[11,28] Harmful effects of NCRT on intestinal tissue increase the morbidity of the surgical intervention. However, the diverting stoma rates in our open and laparoscopic LAR series were similar. Laparoscopy is not a factor that forces us to create a diverting stoma in LAR. Diabetes, end-stage renal disease, and chronic liver disease were the comorbid factors of the patients who required ileostomy. It is well known that these systemic chronic pathologies cause malnutrition and impaired wound-healing processes. The negative effects of these disorders on the intestines may be noticed during surgical exploration by colorectal surgeons and are important in determining whether the diversion is needed. It is difficult to compare the results of the studies because they were structured with heterogeneous groups of patients. Some series included anterior resections, whereas others included patients who underwent LAR.[23,32] In our study, diverting ileostomy was not performed depending on definitive criteria, but the risk factors were similar to those in the literature data among the diverting ileostomy patients. In our opinion, the surgeon's discretion and experience may be the most important factors in the decision of whether to add a diverting stoma in laparoscopic LAR in high-risk patients.

This was not a randomised prospective study. Planning a randomised trial that compares diversion stoma versus no diversion in LAR would be extremely difficult. It is impossible to avoid a diverting ileostomy in high-risk patients. Only one randomised study on this topic has been published. Ulrich et al[33] evaluated 34 patients who underwent open LAR. They performed intra-operative randomisation when they were satisfied with the safety of the anastomosis depending on results of the air insufflation test. They suggested that sphincter-saving LAR without diverting ileostomy is risky and have declared that they routinely create a diverting stoma in patients who undergo LAR with TME in their clinical practice.[33] Objectively, diverting ileostomy reduces leakage-related complications in LAR. However, according to the traditional approach, some patients unnecessarily receive diverting stomata in LAR. Of all the patients 66% of LAR and 35% of TME patients recovered without the need for diverting ileostomy.

Anastomosis level and TME are the most frequent factors for creation of diverting ileostomy in laparoscopic LAR. The low leakage rate of the anastomoses in our laparoscopic LAR patients encourages us to selectively create diverting ileostomies. This is the first study to evaluate the role of diverting ileostomy in laparoscopic LAR. Our study provides a basis for further prospective randomised studies on the role of diverting ileostomy in laparoscopic LAR.

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