SURGICAL ENDOSCOPY

and Other Interventional Techniques

Laparoscopic resection for rectal cancer: a prospective analysis of thirty-month follow-up outcomes in 312 patients

Seon-Hahn Kim,[1] In-Ja Park,[1] Yong-Geul Joh,[2] Koo-Yong Hahn[2]

[1] Colorectal Division, Department of Surgery, Digestive Disease Center, DongGuk University Hospital, Goyang
[2] Laparoscopic Colon Surgery Unit, Department of Surgery, Hansol Hospital, Seoul, Korea

Abstract

Background: This study aimed to prospectively evaluate operative safety and mid-term oncologic outcomes of laparoscopic rectal cancer resection performed by a single surgeon.

Methods: Three hundreds twelve patients (male, 181) were enrolled in this analysis. 257 patients (82.4%) had tumors located below 12 cm from the anal verge. Distribution of TNM stages was 0:I:II:III:IV = 4.2%:17.9%:32.4%:37.2%:8.3%. 225 patients (71.1%) had T3/T4 lesions. Pre- and post-operative radiation was given in 6 and 20 patients, respectively.

Results: Sphincter-preserving operation was performed in 85.9%. Mean operating time was 212 minutes. Conversion rate was 2.6%. Overall morbidity rate was 21.1%. Anastomotic leakage occurred in 6.4%. Operative mortality rate was 0.3%. Mean number of harvested nodes was 23. Mean distal tumor-free margin was 2.8 cm. The circumferential resection margin was positive in 13 patients (4.2%). With a mean follow-up of 30 months in the stage I–III patients, the local recurrence rate was 2.9%. Systemic recurrence occurred in 11.7%. No port-site recurrence was observed.

Conclusion: Laparoscopic resection of rectal cancer provided safe operative parameters and adequate mid-term oncologic outcomes. When considering a high volume of advanced and low-lying cancers but rather narrow indication to radiotherapy, the 2.9% local recurrence rate seems promising data. Long-term follow-up is mandatory to draw conclusion.

Key words: Rectal cancer — Laparoscopic resection — Mid-term outcome — Prospective

Because laparoscopic colectomy for colon cancer results in equivalent cancer-related survival to open colectomy when performed by experienced surgeons [20], it is reasonable that the next step is to evaluate the benefits and oncologic outcomes of laparoscopic rectal cancer resection. While several observational series from experts have so far demonstrated a promise of advantages and oncologic safety of laparoscopic rectal cancer resection [1, 3, 11, 16], these issues remain to be further proven in large scale randomized trials. Recently, the MRC-CLASSIC trial [5] demonstrated that total mesorectal excision (TME) was undertaken more frequently in the laparoscopic group while the positive rate of circumferential margin (CRM) was not significantly higher in the laparoscopic-anterior resection group than in the open-anterior resection group. However, the quality of surgery may be heterogeneous among the surgeons involved in that trial.

The aim of this study was to prospectively evaluate operative safety and mid-term oncologic outcome of laparoscopic rectal cancer resection performed by a single surgeon (SHK) in over 300 patients.

Materials and methods

All patients diagnosed with rectal adenocarcinoma admitted to Hansol Hospital were considered for laparosocopic resection. Exclusion criteria were as follows: (1) those with intestinal obstruction requiring urgent decompression, (2) males with T4 tumor in the lower third of the rectum accessed by transrectal ultrasonography and pelvic CT scan, (3) those with contraindication to general anesthesia under pneumoperitoneum. The rectum was divided into three parts; the lower third (within 7 cm from the anal verge), the middle third (8–12 cm), and the upper third (13–16 cm). This study included the 312 consecutive rectal cancer patients who underwent laparoscopic resection performed by a single surgeon (SHK) between January 2000 and December 2004. Data was collected prospectively.

Preoperative chemoradiation was not advocated in our division and indicated only to low-lying T4 tumor in males, which was not considered for laparoscopic resection. But patients referred from other institutes after receiving neoadjuvant therapy were included in the study. Postoperative radiotherapy, generally 50 Gy, was performed to

patients with close circumferential (≤2 mm) or distal (≤5 mm) margin, tumor perforation during surgery, or N2 disease. As adjuvant chemotherapy, starting usually 1 week after surgery, oral tegafur-uracil (260 mg/m2/day for 6 to 12 months) was administered to patients with stage II disease, and 6 cycles of 5-day continuous infusion of 5-FU (425 mg/m2/day) plus leucovorin (20 mg/m2/day) every 28 days to those with stage III disease.

Follow-up was performed on regular visits of 3-month interval for the first two postoperative years, then of 6-month interval for the next 3 years, thereafter yearly. Follow-up studies included physical examination and serum CEA assay every 3 months for the first 2 years and thereafter every 6 months. Chest X-ray and abdominopelvic computed tomography was taken every 6 months. Colonoscopy and sigmoidoscopy were performed alternatively every 6 months. Additional tests were performed on an as-needed basis.

Surgical technique

The patient is placed in a modified lithotomy position with head-down and right-side down tilting. The surgeon stands on the patient's right side. Using a 5-port technique under the vision of a flexible videoscope (LTF-V3, Olympus Corp., Tokyo), the dissection is begun around the origin of the inferior mesenteric artery (IMA) while preserving the pre-aortic sympathetic neural plexus. The IMA is divided at its origin. When poor collateral circulation is anticipated in such patients of cardiovascular disease, hypertension, diabetes, or old age above 70-year, an effort is made to preserve the left colic artery while completing wide and thorough lymphadenectomy around the root of the IMA. The sigmoid and descending colons are mobilized up to the splenic flexure using a medial-to-lateral dissection technique.

The rectum is then mobilized as far distally as required by the tumor location, starting with posterior dissection along an avascular plane. Dissection is continued laterally to the right side first then to the left side, and finally to the anterior side of the rectum. Total mesorectal excision is performed for cancers of the middle and lower rectum. For upper rectal lesion, the mesorectum is divided at 5 cm distal to the tumor (partial mesorectal excision).

The rectum is divided using articulating endoscopic linear staplers (mostly ETS-FLEX from Ethicon, sometimes EndoGIA Universal from Tyco). A distal rectal wash out is routinely performed. The specimen is delivered through a small incision at the left lower quadrant port, while the wound is covered with an impermeable protector. Transection of the proximal bowel is performed extra-corporeally. The anastomosis is performed intracorporeally using a standard double-stapling technique. In cases of very low-lying cancer in which sphincter-preservation is desired, transanal intersphincteric dissection, extraction of the specimen per the anus, and pull-through hand-sewn coloanal anastomosis are performed. For abdominoperineal resection, the sigmoid colon is divided and TME is completed during the abdominal phase of rectal dissection. After perineal dissection in a usual fashion, the specimen is extracted through the perineum. Finally an end colostomy is constructed at the preplanned site.

Results

Of a total of 312 patients, 181 were men and 131 were women. Mean age was 59 ± 12 (30–88) years. Fifty three patients (17%) were 70-years and older. One-hundred thirteen patients (36.2%) had at least one co-morbid medical condition. Fifty seven patients (17.8%) had a history of abdominal surgery. Among them, 23 patients (7.4%) had major operations. The American Society of Anesthesiologists (ASA) class III was in 14.1% vs. I/II in 85.9%. Mean body mass index (BMI) was 23.6 ± 3.2 (range, 16.2–35) kg/m2. It was over 25 kg/m2 in 64 patients (20.5%). Preoperative chemoradiation and postoperative radiation as adjunct therapy were given in 6 and 20 patients, respectively. Tumors were located in the lower third in 137 patients, in the middle third in 120 patients, and in the upper third in 55 patients. 257 patients (82.4%) had mid- to low lying lesion below 12 cm from the anal verge.

The type of procedure performed was as follows: 52 anterior resections, 155 low anterior resections, 59 ultra-low anterior resections (anastomotic line located within 1 cm above the dentate line; double-stapling in 50 patients and transanal hand-sewn in 9 patients), 44 abdominoperineal resections, and 2 Hartmann's procedures. Of the 266 patients who underwent sphincter preserving procedure with primary anastomosis, 48 patients (18.0%) required a diverting ileostomy at the time of initial operation in whom with preoperative radiation, ultra-low anterior resection and hand-sewn anastomosis, positive air leak test, incomplete doughnuts, or difficulties during pelvic dissection. In 21 patients (6.7%), concomitant laparoscopic procedure such as subtotal gastrectomy, adrenalectomy, left lateral hepatic segmentectomy, or S6 hepatic segmentectomy was undertaken simultaneously in addition to proctectomy. In 3 patients, double resection (right colectomy plus proctectomy) was performed for right side colonic lesion associated with rectal cancer. Eight patients (2.6%) needed conversion to an open procedure, which was defined as requirement of any additional unplanned incision to complete the procedure. Reasons for conversion were excessive tumor fixity ($n = 4$), stapler failure ($n = 1$), tumor perforation during dissection ($n = 1$), suspicious distal resection margin ($n = 1$), and narrow pelvis ($n = 1$). Mean operating time was 212 ± 64 (range, 23–535) minutes. Mean operative blood loss was 101 ± 143 (range, 30–1200) mL. Mean time to first diet intake was 2.3 (range, 1–13) days. Mean duration of postoperative hospital stay was 11 (range, 5–57) days (Table 1).

The distribution of tumors according to the TNM classification of the American Joint Committee on Cancer 6th edition was as follows: stage 0 in 13 patients (4.2%), stage I in 56 (17.9%), stage II in 101 (32.4%), stage III in 116 (37.2%), and stage IV in 26 (8.3%). The pathological depth of tumor invasion was Tis in 13 patients, T1 in 9, T2 in 65, T3 in 183, and T4 in 42. Mean tumor size was 4.6 ± 1.7 (range, 0.8–13) cm. Mean number of lymph nodes harvested was 23 ± 12 (range, 0–69). Mean length of distal resection margin was 2.8 ± 1.6 (range, 0.2–9.0) cm. Circumferential margin was positive in 13 patients (4.2%): microscopic involvement ($n = 3$), 0.1 mm ≈ 1 mm ($n = 4$), and 1.1 mm ≈ 2 mm ($n = 6$) (Table 2).

Sixty-seven (21.5%) patients had intra- or postoperative complications. Intraoperative complication occurred in 3 patients including one ureteral, one urethral, and one small bowel injury. Ureteral injury was repaired under direct vision via the 5-cm planned incision at the left lower quadrant port site. Urethral injury was detected postoperatively in a male patient undergoing ultra-low anterior resection and was managed with suprapubic cystostomy. Small bowel injury was also detected postoperatively and required laparotomy. The most common postoperative complication was wound complication (20 cases). Among these, six occurred in the perineal wound

Table 1. Operative details and short-term surgical outcomes

Characteristic	No.	(%)
Type of resection		
Anterior resection	52	(16.7)
Low anterior resection	155	(49.7)
Ultra-low anterior resection	59	(18.9)
Double stapling anastomosis	50	
Pull-through hand-sewn anastomosis	9	
Abdominoperineal resection	44	(14.1)
Hartmann's procedure	2	(0.6)
Conversion	8	(2.6)
Concomitant operation		
Gastric		
Subtotal gastrectomy	4	
Wedge resection	1	
Hepatic		
Left lateral segmentectomy	1	
S6 segmentectomy	2	
Gynecologic		
Vaginal excision	6	
Oophorectomy	2	
Myomectomy	1	
Colonic		
Right colectomy	2	
Ileocecal resection	1	
Others		
Adrenalectomy	1	
Cholecystectomy	2	
Operating time (min, mean $\pm$ SD)	212 $\pm$ 64 (23–535)*	
Blood loss (mL, mean $\pm$ SD)	101 $\pm$ 143 (30–1200)*	
Time to passage of flatus (days, mean)	1.6 (1–11)*	
Time to first bowel movement (days, mean)	2.9 (1–11)*	
Time to oral intake (days, mean)	2.3 (1–13)*	
Time to discharge (days, mean)	11 (5–57)*	

* Values are ranges

Table 2. Data related to histopathologic outcomes

Characteristic	No.	(%)
TNM stage		
0	13	(4.2)
I	56	(17.9)
II	101	(32.4)
III	116	(37.2)
IV	26	(8.3)
Depth of tumor invasion (T stage)		
is	13	(4.2)
1	9	(2.9)
2	65	(20.8)
3	183	(58.6)
4	42	(13.5)
Positive circumferential margin	13	(4.2)
Microscopic involvement	3	
0.1~1.0 mm	4	
1.1~2.0 mm	6	
Tumor size (cm, mean $\pm$ SD)	4.6 $\pm$ 1.7 (0.8–13)*	
No. of harvested lymph node (mean $\pm$ SD)	23 $\pm$ 12 (0–69)*	
Distal resection margin (cm, mean $\pm$ SD)	2.8 $\pm$ 1.6 (0.2–9.0)*	

* Values are ranges

after abdominoperineal resection. Anastomotic leakage, documented only if clinical symptoms or signs were present such as fecal or purulent discharge from the pelvic drain associated with fever, leukocytosis, pelvic abscess, or generalized peritonitis, developed in 17 pa-

Table 3. Morbidity and mortality

Variable	Number of patient (%)
Intraoperative complications	3 (1%)
Ureter injury	1
Urethra injury	1
Small bowel injury	1
Postoperative complications	64 (20.5%)
Wound Complication	20
Anastomotic leak	18
Prolonged ileus	15
Urinary retention	7
Anastomotic bleeding	3
Intra-abdominal abscess	3
Rectovaginal fistula	2
Intra-abdominal bleeding	2
Others	5
Mortality	1 (0.3%)

Table 4. Recurrence analysis of the 273 patients of stage I–III undergoing laparoscopic resection with curative intent

Mean follow-up period	27 (range, 6–65) months
Local recurrence	8 (2.9%)
Median time to local recurrence	15 (4–20) months
Systemic recurrence	32 (11.7%)
Median time to systemic recurrence	16 (4–63) months
Port-site recurrence	none

tients (6.4%) among the 268 patients undergoing sphincter preserving procedure with anastomosis. Radiologic evaluation using a water-soluble dye was not performed in our study. Nine leaked patients had the tumors in the middle third of the rectum and the other 8 patients had the tumors in the lower third. No one with leak had tumors in the upper third. Sixteen of the 17 leaked patients were successfully managed by laparoscopic irrigation and diverting ileostomy construction. One patient was treated by drainage alone. One required Hartmann's procedure because of heavy fecal contamination and large anastomotic defect. Prolonged ileus, defined as ileus permitting no oral intake even after postoperative 7 days, occurred in 15 patients (4.8%). Six patients (1.9%) developed urinary retention requiring indwelling or intermittent catheter drainage after the postoperative 7th day. One of them needed cystostomy to manage it. Anastomotic beeding occurred in 3 patients: colonoscopic control in one patient and spontaneous stop in the other two patients. There were 2 patients with intraabdominal bleeding, but they were not required surgical intervention. Other complications were rectovaginal fistula ($n = 2$), parastomal hernia ($n = 2$), wound evisceration at the umbilical port site ($n = 1$), and fecal impaction causing transverse colon perforation on the 16th day after abdominoperineal resection ($n = 1$). There was one patient with 30-day mortality (0.3%), in whom descending colonic ischemia causing fecal peritonitis developed on the 13th day after abdominoperineal resection (Table 3).

Mean follow-up period was 30 (range, 8–68) months in the 273 patients of stages I–III. The patients with stages 0 and IV were excluded from the recurrence analysis. Eight patients (2.9%) developed local recur-

Table 5. Details of the 8 patients with local recurrence

Patient	Sex	Age	Stage (TN)	Tumor location	Adjuvant radiotherapy	Time to recurrence (mon)	Site of recurrence	Treatment of recurrence	Treatment outcome
1	F	68	T3N1	Lower	No	13	Anastomosis	Lap APR	CR
2	M	36	T3N0	Lower	Preoperative	17	Pelvic wall + SR	Chemo	PD
3	M	31	T3N2	Lower	No	15	Pelvic wall + SR	Chemo	PD
4	M	52	T3N0	Lower	Postoperative	20	Pelvic wall	Chemo + cyberknife	SD
5	F	51	T4N0	Middle	No	14	Pelvic wall	Chemo	PD
6	M	67	T3N2	Lower	No	10	Perineum	Chemo + Radiotherapy	PD
7	M	68	T3N1	Lower	No	8	Pelvic wall	Chemo	PD
8	F	60	T3N2	Lower	No	4	Pelvic wall + SR	Chemo	PD

SR, systemic recurrence; Lap, laparoscopic; APR, abdominoperineal resection; Chemo, chemotherapy; CR, complete remission; PD, progressive disease; SD, stable disease

rence, and 32 patients (11.7%) had systemic metastases. Among the 8 patients of local recurrence, 3 patients had systemic metastases simultaneously. Median time to local recurrence was 13.5 (range, 4–20) months. Six occurred in the lateral pelvic wall, one in the perineal wound, and one in the anastomosis site. Regarding the treatment for local recurrence, one patient presenting anastomotic recurrence underwent re-laparoscopic resection (abdominoperineal) with curative intent. The other 7 patients received chemotherapy with or without radiotherapy (including cyberknife in one patient). The sites of systemic metastases were liver ($n = 14$), lung ($n = 11$), non-regional lymph nodes ($n = 6$), peritoneal seeding ($n = 4$), bone ($n = 2$), brain ($n = 2$), and adrenal gland ($n = 1$) in order of frequency. Median time to systemic recurrence was 16 (range, 4–63) months. There was no port-site recurrence (Table 4). The details of the 8 patients with local recurrence are shown in Table 5.

Discussion

Laparoscopic colectomy for colon cancer has gained much acceptance since the COST trial [21] from the United States and Canada demonstrated equivalent oncologic outcomes. However, regarding rectal cancer surgery, laparoscopic resection remains controversial mainly because of technical challenges and more importantly a lack of long-term data from large scale series. The aim of this study was, in a fairy large number of consecutive rectal cancer patients laparoscopically treated by a single surgeon, to evaluate operative safety in terms of morbidity and mortality and oncologic adequacy in terms of margins, number of lymph nodes harvested, and 2 year recurrence data.

Of particular importance in rectal cancer surgery is TME with clear CRM. A prospective, case-control study demonstrated a 7% CRM positivity in the laparoscopic group ($n = 41$) vs. 12% in the open group ($n = 41$) [2]. However, recent data from the CLASSIC trial showed the raised positive CRMs in the laparoscopic-anterior resection group (12%) compared to the open group (6%). This difference was not significant ($p = 0.19$), while TME was undertaken more frequently in the laparoscopic group (78%) than in the open one

(62%). For abdominoperineal resections, no difference was seen in CRM positivity between the groups in that trial. In our study, the TME quality was evaluated only as CRM positivity (≤ 2 mm), which is a fundamentally critical end-point of TME. We believe the 4.2% positive rate of our series is promising data when considering a high portion of locally advanced tumors (stage III, 37.2%; T3/4, 71.8%) and low-lying lesions (middle/lower, 82.4%), associated with an acceptable rate of sphincter-preserving operation (85.6%). Other parameters such as number of lymph-node yield (mean, 23) and length of distal resection margin (mean, 2.8 cm on the fixed specimen) also indicated adequate quality of surgery in the present study. Mean operating time (212 minutes) was comparable or slightly exceeding to that of other series [1, 3, 11]. We think the low conversion rate (2.3%) and a certain number of combined surgeries might influence on the operating time. In regard to conversion to an open procedure, there seems to be two different groups in the literature. A certain group of surgeons reported less than 3% of conversion rate [1, 11]. But most others, even experts, reported 18% to 29% [3, 5, 12, 17]. This big discrepancy of conversion rate among series seems to be more related to surgeon's threshold to conversion rather than surgeon's expertise. In addition, a well-trained team approach (not the operator's experience alone) is probably another important factor to reduce conversions and that might be the case of our series. Although not well described in other reports of the literature, concomitant operations with rectal cancer resection were also feasible laparoscopically, when indicated such as the 4 cases of subtotal gastrectomy for early gastric cancer (Table 1). In the majority of the ultra-low anterior resection cases (50/59), the procedure was performed by a double-stapling technique. In our mind, it is essential for this technique to completely dissect the rectum especially the posterior aspect down to the pelvic floor close to the anal canal.

The overall complication rate was comparable to that from other laparoscopic series [3, 11]. No one had intraabdominal bleedings requiring laparotomy to control them. There were three cases of wound complication requiring surgical repair: one wound evisceration at the umbilical port site, two parastomal hernias. All the details of morbidity seem to be acceptable as shown in Table 3. One unique intraoperative complication in our practice was urethral injury in a male patient undergo-

ing ultra-low anterior resection. This type of injury was historically described in abdominoperineal resection, in which the membranous urethra is vulnerable to injury during perineal dissection [18]. Anastomotic leakage is of much importance in rectal cancer surgery, with ranging 4% to 11% in rate when performed by experienced TME surgeons [4, 7, 10, 22]. Although the rate of clinical leaks was increased (13% to 17%) in some laparoscopic series [1, 16], it was within acceptable ranges in other series [3, 11, 17]. Much important data was recently released from the CLASSIC trial, in which the rate of anastomotic dehiscence did not differ between actual treatment groups; 7% in the open group vs. 8% in the laparoscopic group [5]. In the present study, the leak rate was 6.8%. The majority of leaked patients were successfully managed using a minimally invasive fashion, that was laparoscopic irrigation plus diverting ileostomy through a widened incision of the right lower quadrant cannula site. In our mind, one major advantage of laparoscopic proctectomy vs. conventional procedure is the possibility of redoing a minimally invasive approach for leaked patients when surgical intervention is indicated. Urinary retention is a well known sequel of rectal cancer surgery even in the era of TME, from 10% to 15% [14, 16, 22]. Preserving the pelvic autonomic nerves is closely associated with reducing the incidence [9]. Our prospectively collected data showed only 6 patients (1.9%) needed urinary catheterization for voiding after the postoperative 1 week. We believe that a systematic team approach to rectal cancer surgery using laparoscopy can provide meticulous dissection of the rectum with minimal injury to surrounding nerves through a well-lighted, magnified view, thus low incidence of urinary dysfunction.

As mentioned, we excluded the stage IV patients from the recurrence analysis since these patients may die of disease progress before local recurrence develops. The overall local recurrence rate was 2.9% with a mean follow-up of 30 months in the current study. Even though, as demonstrated in a recent report from Basingstoke [15], about half of local recurrences of rectal cancer may occur after the first 2 postoperative years, we are confident that this rate will be still within acceptable ranges in long-term analysis. In order to evaluate rectal cancer surgery-quality, local recurrence rate of middle to lower lesion is probably more relevant than that of upper rectal cancers because the treatment outcome of upper rectal cancer is similar to that of sigmoid cancer [13]. Morino et al. [16] reported the 4.2% local recurrences rate in the 100 such patients, with a median follow-up of 45.7 months. Ours is 4.4% (8 of the 182 mid to low stage I–III patients). None of the upper rectal cancer patients developed local recurrence. Additionally, local recurrence in advanced tumors seems one pertinent issue to evaluate since preoperative radiotherapy was not routinely given in our series. The local recurrence rate after curative resection in advanced tumors (above T3) of our series was 4.0 % (7 in the 166 T3 tumors and 1 in the 33 T4 tumors = 8/199). Moreover, when we looked at the local recurrence rate in the TNM stages II–III patients, it was 3.7 % (=8/217). The German rectal cancer trial [19] demonstrated the 5-year cumulative local recurrence

rate was 5.7% in clinical T3 and T4 patients receiving preoperative radiotherapy. In regards to pattern and time onset of systemic recurrence, there were no unusual findings in our series as shown in Table 4. We did not evaluate survival outcomes since the follow-up period was not long enough to draw any conclusions. Instead, the data from experienced laparoscopic hands in the literature showed promise of adequate long-term survival. Leroy et al. [11] observed 75% of cancer-specific survival rate at 5 years with 6% of local recurrence rate in an analysis of 102 patients with a mean follow-up of 36 months. In the Morino's report [16], the 5-year overall survival rate was 74%. Barlehner et al. [1] analyzed the outcomes of 194 patients with a mean follow-up of 46.1 months. At 5 years, the overall survival rate was 76.9% (100% for stage I, 94.4% for stage II, 66.6% for stage III). The cancer-related survival and the local recurrence rates were 87.7% and 4.1% at 5 years. These outcomes are comparable to those collected from experienced conventional surgeons such as Dr. Heald (5-year disease-free survival rate 80% and local recurrence 6%) [6], Dr. Killingback (5-year overall survival rate 72.5% and local recurrence 7.6%, median follow-up 82 months) [8], and Dr. Enker (5-year disease-free survival rate 75% and local recurrence 7%, median follow-up 45.6 months)[4].

We believe the CLASSIC trial, the first multi-center randomized trial for laparoscopic versus conventional rectal cancer resection as a subgroup study, justified further study to investigate oncologic safety and adequacy of this type of procedure because no definitive disadvantages were seen in the short-term analysis [5]. Some other randomized trials addressing on this issue should be organized soon. The present study demonstrates that a systematic team approach to laparoscopic rectal cancer resection provides promising mid-term outcomes. Moreover, optimal laparoscopic surgery for rectal cancer may greatly reduce the need for radiotherapy to achieve adequate local control since our local recurrence data is more than acceptable, especially when considering a large volume of locally advanced and low-lying lesions but a very small number of patients receiving radiation before surgery. This seems highly attainable not only by precise preoperative assessment but also by meticulous dissection of the rectum through a well-lighted magnified laparoscopic view inside of the pelvis, while minimally manipulating the tumor. Long-term analysis is mandatory to confirm this statement.

References

1. Barlehner E, Benhidjeb T, Anders S, Schicke B (2005) Laparoscopic resection for rectal cancer: outcomes in 194 patients and review of the literature. Surg Endosc 19: 757–766
2. Breukink SO, Pierie JP, Grond AJ, Hoff C, Wiggers T, Meijerink WJ (2005) Laparoscopic versus open total mesorectal excision: a case-control study. Int J Colorectal Dis 20: 428–433
3. Delgado S, Momblan D, Salvador L, Bravo R, Castells A, Ibarzabal A, Pique JM, Lacy AM (2004) Laparoscopic-assisted approach in rectal cancer patients: lessons learned from >200 patients. Surg Endosc 18: 1457–1462
4. Enker WE, Merchant N, Cohen AM, Lanouette NM, Swallow C, Guillem J, Paty P, Minsky B, Weyrauch K, Quan SH (1999) Safety

and efficacy of low anterior resection for rectal cancer: 681 consecutive cases from a specialty service. Ann Surg 230: 544–552

5. Guillou PJ, Quirke P, Thorpe H, Walker J, Jayne DG, Smith AM, Heath RM, Brown JM, MRC CLASICC trial group (2005) Short-term endpoints of conventional versus laparoscopic-assisted surgery in patients with colorectal cancer (MRC CLASICC trial): multicentre, randomised controlled trial. Lancet 365: 1718–1726

6. Heald RJ, Moran BJ, Ryall RD, Sexton R, MacFarlane JK (1998) Rectal cancer: the Basingstoke experience of total mesorectal excision, 1978–1997. Arch Surg 133: 894–899

7. Karanjia ND, Corder AP, Bearn P, Heald RJ (1994) Leakage from stapled low anastomosis after total mesorectal excision for carcinoma of the rectum. Br J Surg 81: 1224–1226

8. Killingback M, Barron P, Dent OF (2001) Local recurrence after curative resection of cancer of the rectum without total mesorectal excision. Dis Colon Rectum 44: 473–483

9. Kneist W, Heintz A, Junginger T (2005) Major urinary dysfunction after mesorectal excision for rectal carcinoma. Br J Surg 92: 230–234

10. Law WL, Chu KW (2004) Anterior resection for rectal cancer with mesorectal excision: a prospective evaluation of 622 patients. Ann Surg 240: 260–268

11. Leroy J, Jamali F, Forbes L, Smith M, Rubino F, Mutter D, Marescaux J (2004) Laparoscopic total mesorectal excision (TME) for rectal cancer surgery: long-term outcomes. Surg Endosc 18: 281–289

12. Leung KL, Kwok SP, Lam SC, Lee JF, Yiu RY, Ng SS, Lai PB, Lau WY (2004) Laparoscopic resection of rectosigmoid carcinoma: prospective randomised trial. Lancet 363: 1187–1192

13. Lopez-Kostner F, Lavery IC, Hool GR, Rybicki LA, Fazio VW (1998) Total mesorectal excision is not necessary for cancers of the upper rectum. Surgery 124: 612–617

14. Maurer CA, Z'Graggen K, Renzulli P, Schilling MK, Netzer P, Buchler MW (2001) Total mesorectal excision preserves male genital function compared with conventional rectal cancer surgery. Br J Surg 88: 1501–1505

15. Moore E, Heald RJ, Cecil TD, Sharpe GD, Sexton R, Moran BJ (2005) Almost all five year disease free survivors are cured following rectal cancer surgery, but longer term follow-up detects some late local and systemic recurrences. Colorectal Dis 7: 403–405

16. Morino M, Parini U, Giraudo G, Salval M, Brachet Contul R, Garrone C (2003) Laparoscopic total mesorectal excision: a consecutive series of 100 patients. Ann Surg 237: 335–342

17. Poulin EC, Schlachta CM, Gregoire R, Seshadri P, Cadeddu MO, Mamazza J (2002) Local recurrence and survival after laparoscopic mesorectal resection for rectal adenocarcinoma. Surg Endosc 16: 989–995

18. Saha SK (1984) A critical evaluation of dissection of the perineum in synchronous combined abdominoperineal excision of the rectum. Surg Gynecol Obstet 158: 33–38

19. Sauer R, Becker H, Hohenberger W, Rodel C, Wittekind C, Fietkau R, Martus P, Tschmelitsch J, Hager E, Hess CF, Karstens JH, Liersch T, Schmidberger H, Raab R, German Rectal Cancer Study Group (2004) Preoperative versus postoperative chemoradiotherapy for rectal cancer. N Engl J Med 351: 1731–1739

20. The American Society of Colon and Rectal Surgeons (2004) Approved statement: laparoscopic colectomy for curable cancer. Dis Colon Rectum 47: A1

21. The Clinical Outcomes of Surgical Therapy Study Group (2004) A comparison of laparoscopically assisted and open colectomy for colon cancer. N Engl J Med 350: 2050–2059

22. Zaheer S, Pemberton JH, Farouk R, Dozois RR, Wolff BG, Ilstrup D (1998) Surgical treatment of adenocarcinoma of the rectum. Ann Surg 227: 800–811