Standardized Laparoscopic Sphincter-preserving Total Mesorectal Excision for Rectal Cancer: Long-term Oncologic Outcome in 217 Unselected Consecutive Patients

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Purpose: This study was designed to evaluate the impact of a standardized laparoscopic total mesorectal excision (TME) on the long-term oncologic outcome of unselected patients with rectal cancer (RC).

Methods: Unselected consecutive patients with histologically proven RC underwent a standardized laparoscopic TME with medial to lateral approach encompassing 9 sequential steps: (1) ligation of inferior mesenteric vessels, (2) mobilization of the left colon and sigmoid colon (medial to lateral), (3) posterior dissection of the rectum, (4) lateral mobilization of the sigmoid, left colon, and splenic flexure, (5) left and right side dissection of the rectum, (6) anterior dissection of the rectum, (7) transection of the rectum, (8) delivery of the specimen, and (9) colorectal anastomosis.

Results: From 2005 to June 2012, laparoscopic sphincter-preserving TME was attempted in 217 patients with a 6.5% conversion rate. There were 91 women and 126 men, aged 58.3 years (range, 22 to 84 y), with body mass index of 26.10 (range, 20 to 45), operative time was 150.4 minutes (range, 60 to 330 min), and 24.7 (range, 4 to 98) lymph nodes were harvested. Length of stay was 7.56 days (range, 3 to 32 d). Complication rate was 17.05%. The mean follow-up time of all patients was 36.12 months (range, 1 to 89 mo). Local recurrence rate was 3.6% and distant recurrence rate was 8.7%. The 5-year disease-free survival rates were 81.5%.

Conclusions: A standardized laparoscopic sphincter-preserving TME resulted in a favorable short-term outcome in unselected patients with RC.

Key Words: laparoscopy, TME, rectal cancer

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Although laparoscopy is now widely utilized for rectal cancer (RC) surgery in daily practice, descriptions of a standardized surgical technique did not become available up to now. There have been many descriptions of the surgical technique used for laparoscopic total mesorectal excision (TME) such as hand-assisted, straight laparoscopy, hybrid laparoscopy including sphincter-saving procedure, and abdominoperineal resection. The efficacy of laparoscopy for RC is still controversial because of the lack of data concerning long-term oncologic outcomes, bias for patient selection, and utilization technique. This study was designed to evaluate the impact of a standardized laparoscopic sphincter-preserving TME for neoplasia of RC on the long-term outcome of an unselected set of consecutive patients.

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PATIENTS AND METHODS

This was a prospective study, and data were extracted from a prospectively maintained database. Consecutive unselected patients with histologically proven RC underwent a standardized laparoscopic TME. Patients were operated by 1 surgeon (O.A.). Patients with previous conventional abdominal surgery defined as other than cholecystectomy or appendectomy and patients with morbid obesity defined as body mass index >35 and cT4 tumors were not excluded. The study endpoint was the long-term oncologic outcome after a standardized laparoscopic TME. The long-term oncologic outcome included the following variables: operative time, distal and lateral resection margins, the integrity of the mesorectum, lymph nodes harvested, length of stay, complications, local recurrences and distant metastasis, and disease-free survival. Conversion was termed as any unplanned laparotomy at any time during surgery, regardless of the incision length. Patients who had radiologically T_3 or T_4 tumor and any lymph node-positive RC patients were treated with either neoadjuvant long-course chemoradiotherapy (45 Gy pelvic irradiation and concomitant 5 FU-Leucovorin) or short-course radiotherapy (25 Gy pelvic irradiation). Short-course radiotherapy was preferred in a selected group of patients without any risk of lateral margin positivity, according to the pelvic phase array magnetic resonance imaging. All neoadjuvant cases, pT_3-T_4 and those who had positive lymph node(s) were threatened with 4 courses of FUFA.

Surgical Technique

Bowel cleansing was carried out by the administration of both oral and rectal sodium phosphate preparations the day before surgery. All patients received preoperative antibiotic prophylaxis as a combination of single doses of 1.5 g cefuroxime axetil and 500 mg metronidazole administered IV. Prophylaxis for deep vein thrombosis was carried out through the administration of both low–molecular-weight heparin and antiembolic socks. Patients received endotracheal anesthesia and underwent placement of a nasogastric

IMAGE 1. The patient's position.

tube and urinary catheter. Patients were in the supine position in a bean bag with the right arm tucked and the left arm abducted, and legs were positioned in semilithotomy. Legs should be lifted <15 degrees (Image 1).

The abdomen was prepped. The surgeon and the first assistant stood on the patient's right side, and the second assistant stood on the patient's left side. Pneumoperitoneum was induced using carbon dioxide insufflated to a pressure of 12 mm Hg by placement of a 10-mm trocar in the supraumbilical skin. A 30-degree telescope was introduced for peritoneal inspection. A 15-mm port was placed 3 cm medial to the right anterior superior iliac spine. A disposable threaded 5-mm port was placed in the right upper quadrant lateral to the rectus muscle sheath and rostral to the umbilicus. A reusable threaded 5-mm port was placed 3 cm rostral to the pubic tubercle just left to the midline (Image 2). Reusable instruments include bowel graspers and scissors. The disposables include an ultrasonic activated device and staplers.

Consecutive patients with histologically proven RC underwent a standardized laparoscopic TME with medial to lateral approach encompassing 9 sequential steps: (1) ligation of inferior mesenteric vessels, (2) mobilization of the left colon and sigmoid colon (medial to lateral), (3) posterior dissection of the rectum, (4) lateral mobilization of the sigmoid, left colon, and splenic flexure, (5) right and left pelvic dissection and TME, (6) anterior dissection of the rectum, (7) transection of the rectum, (8) delivery of the specimen, and (9) colorectal anastomosis.

Patient was kept in a 30-degree Trendelenburg position and was turned right at 15 degrees (Image 3). Small bowels changed position out of view of vision by the gravity. Omentum majus was picked up over the transverse colon and optimum view of vision was created (Image 4).

Ligation of Inferior Mesenteric Vessels

Inferior mesenteric pedicule was lifted and then peritoneum was incised with endoscopic scissors. The nerve-free triangle that locates near the inferior mesenteric artery (IMA) root was dissected with the unipolar cautery applied on the endoscopic scissors. The branches of the left autonomic Nerve trunk was seen. IMA was liberated with sharp dissection, whereas the autonomic nerve was preserved (Image 5). IMA was closed with clips and cut close to the aorta.

IMAGE 2. The trocar's position on the abdominal wall.

Peritoneum was incised with endoscopic scissors just below the third part of the duodenum, and then the inferior mesenteric vein was isolated near the inferior border of the pancreas (Image 6). Inferior mesenteric vein was closed with clips under the venous bifurcation. This technique supplies the mobilization of the left flexure easier.

Mobilization of the Left Colon and Sigmoid Colon (Medial to Lateral Approach)

After the ligation of the inferior mesenteric vessels, sharp dissection was performed in an avascular area between embryologic planes with scissors (Image 7). Blunt dissection could cause little bleeding and result in the loosening of the correct dissection plane. The left uretery and the gonodal veins stayed at the retroperitoneum and they should be kept out of sight in the correct dissection plane. Sharp dissection should be continued in the inferior board of the spleen at the top and in the abdominal wall at the lateral. Liberating the colon to the spleen at the

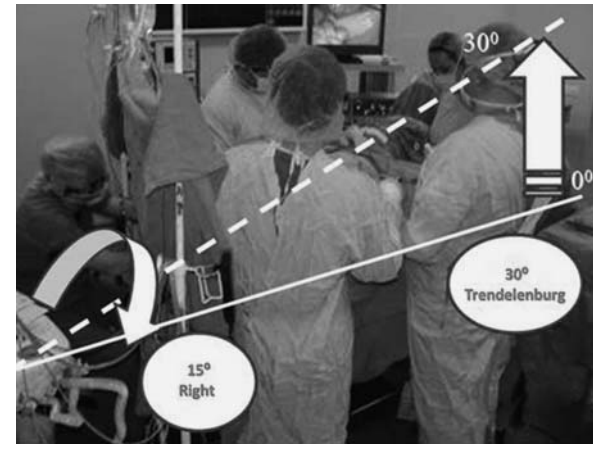

IMAGE 3. Patient's position.

IMAGE 4. View of vision after the patient's position.

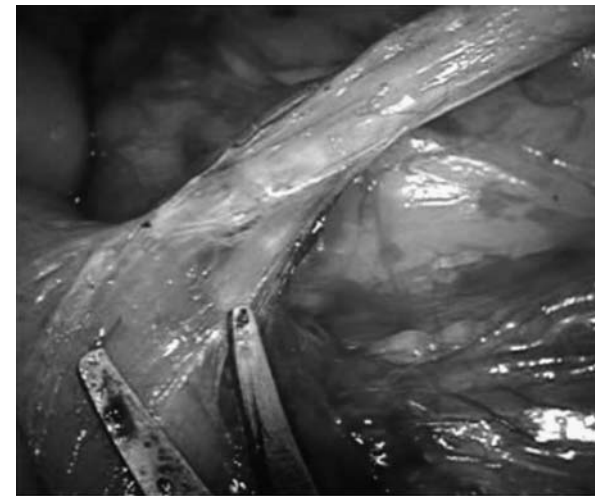

IMAGE 6. The inferior mesenteric vein.

posterior side was the main step of the left flexure mobilizing. The ligaments between the spleen and the left flexure were cut, and the omentum majus was also removed at the anterior side. The mobilization of the left flexure was completed. The sigmoid colon was lifted and sharp dissection was resumed in the iliac crest at the posterior side.

Posterior Dissection of the Rectum

The sigmoid colon was lifted and the pelvic dissection was started in front of the sacral promontorium. Unipolar cautery was used for mesorectal dissection. Sharp dissection was continued in the avascular plane staying between the hypogastric nerves (Image 8). Endoscopic scissors provided sharp dissection in the correct plane and preserved the integrity of the fascia propria recti. Posterior dissection was finished at the pelvic floor (Image 9).

Lateral Mobilization of the Sigmoid, Left Colon, and Splenic Flexure

The Toldt fascia was incised and cut with scissors. The mobilization of the left and sigmoid colons was completed. If inadequate medial to laterally dissection would be performed, the incision of the Toldt fascia would not be enough for mobilizing the colon. In such a case, the dissection must be continued at the lateral side and the possibility of harming the uretery and gonodal veins increases.

Right, Left, Anterior Pelvic Dissection, and TME

After completing the posterior side of the rectum, both hypogastric nerve plexus became visible at the pelvic side walls. The right and left sides of the mesorectum were dissected, respectively. Blunt dissection and using bipolar energy devices could cause harm to the nerve bundles, which carry urinary and sexual signals just around the mesorectum.

The Last Step Was the Anterior Dissection of the Mesorectum

Closed view and unipolar cautery dissection on the Denonviller's fascia or rectovaginal septum, while seeing the seminal vesicles or vaginal wall, were the main components of the successful complete mesorectal excision (Image 10). In addition, sharp dissection is important for adequate circumferential surgical margin and surgery

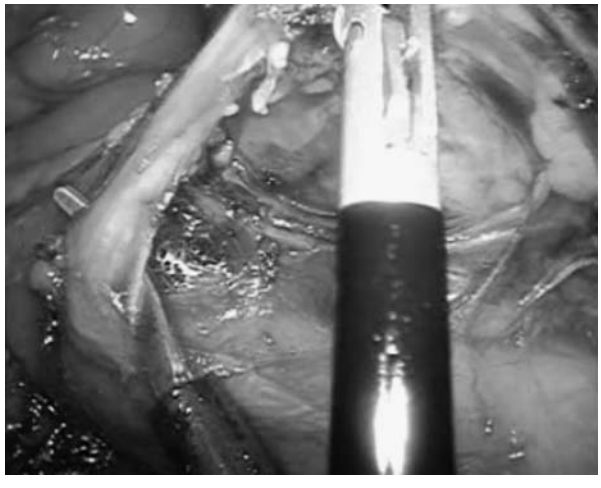

IMAGE 5. The inferior mesenteric artery root and autonomic nerves.

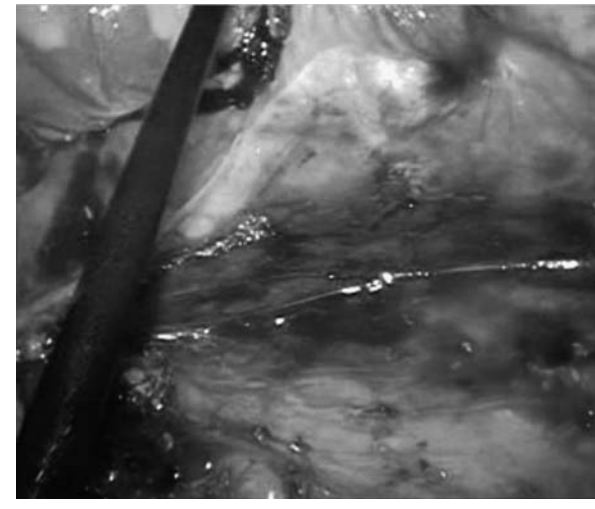

IMAGE 7. The medial to laterally dissection plane.

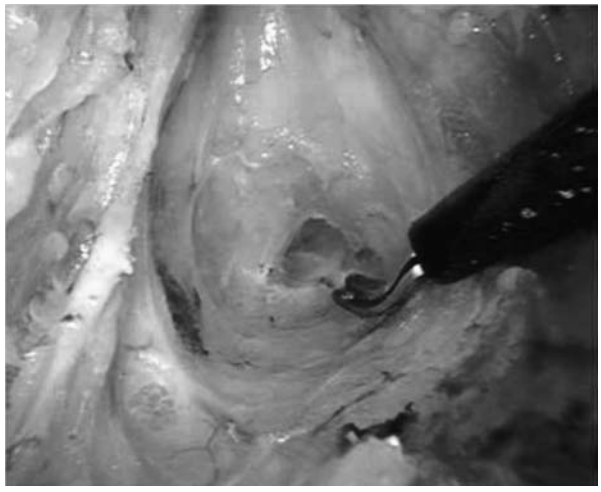

IMAGE 8. Posterior dissection of the rectum and inferior hypogastric nerves.

without complications, such as perforation of the tumor or late onset rectovaginal fistulas and so on.

Transection of the Rectum

After the TME, the level of the transection of the rectum was decided according to the tumor localization. Endostaples were introduced from the 15-mm port. In deep tumors, especially in the male pelvis, sometimes 1 endostaple could not close and cut the rectum and second or third endostaples could be required. Longer staple line (for example Z shape) may cause low flow state at the rectal side of the anastomosis and end up with anastomotic leakage. In such a situation, an extra port should be introduced at the suprapubic region for putting the endostaple on the direct angle.

Delivery of the Specimen

The sigmoid mesocolon was divided with the bipolar energy devices according to the vascular pedicule. A 5-cm pfannenstiel incision was made. The rectum was taken out of the abdomen after implantation of the wound protector. The rectum and sigmoid colon were cut. Adequate bleeding

IMAGE 9. Pelvic wall after posterior dissection of the rectum.

IMAGE 10. Anterior dissection of the rectum in the male patient.

should be seen at the proximal side. The anvil of the circular staple was placed after purse suture. Peritoneum was closed with 3/0 polyglycolic acid suture and then fascia was closed with polydixanone suture.

Colorectal Anastomosis

Pneumoperitoneum was induced again. Circular staple was introduced by the third assistant gently. Rough movements could cause rectal stump injury and re-resection, or sometimes hand-sewn anastomosis may be essential. The most important topic of the creating anastomosis is undoubtedly the unrotated colon. If the colon was rotated, the surgeon should repose the colon at the correct mesenteric axis. The anvil was put to the staple and the staple was closed. There must be some fatty tissues between the 2 bowel sides. The staple was fixed. A colorectal anastomosis was performed.

A transanal circumferential mucosal incision was made just above the dentate line removing the upper half of the internal anal sphincter for partial intersphincteric resection. The rectum and sigmoid colon are pulled through the anal channel and resected. Hand-sewn coloanal anastomosis was performed.

Postoperative Care

The ileostomy was closed for 2 to 3 months after resection. Patients were followed up in the outpatient clinic by the same surgeon every 3 months for 2 years, every 6 months after 2 years, and every year after 5 years. During the initial 5 years, the concentration of plasma carcinoembryonic antigen and carbohydrate antigen 19-9 were determined at each visit, and colonoscopy and radiologic examinations were conducted on an annual basis.

STATISTICS

For differences in continuous variables, the statistics were summarized as means. Differences among such variables were tested using either Student *t* test or the Wilcoxon rank-sum test. The comparisons across multiple means were made using 1-way analysis of variance. For categorical data, the summary statistics consisted of proportions, and the comparisons were made with either the χ^2d test or Fisher exact test. The survival rate analysis was performed

using the Kaplan-Meier method. Statistical significance was attributed at the 5% level ($P < 0.05$). The data were analyzed with the SPSS Program for Windows (version 12.0; SPSS Inc., Chicago, IL).

RESULTS

Patient Characteristics

The patients' demographic and operative characteristics are summarized in Table 1.

Surgical Technique

All the procedures were sphincter-preserving surgeries (SPS). Double-stapled anastomosis was performed on 179 (82.4%) patients, and 38 patients underwent intersphincteric resections and hand-sewn coloanal anastomoses (17.6%) (Table 2). The median operative time was 150 ± 52.3 minutes (range, 60 to 330 min). The conversion rate was 6.5% (n = 14). The reasons for conversion were: 5 too large tumors, 3 insufficient vascular supplies, 1 bleeding, 1 major vascular injury caused by the veress needle, 3 adjacent organ invasions, and 1 ureteral injury. The mean time of return of the bowel function was 1.58 ± 1.09 days (range, 0 to 11 d) and that of the resumption of oral feeding was 2.19 ± 1.37 days (range, 1 to 12 d).

Complications

Intraoperative complications were met in 5 (2.3%) patients, and perioperative mortality was recorded in 1 patient who was a 84-year-old man. Metabolic acidosis was developed at the postoperative fourth hour. We explorated immediately and we could not find any abnormality, except low state of the intestines (venous mesenteric ischemia). We lost him at the postoperative 12th hour at the intensive care unit. Postoperative complications were observed in 127 (24.8%) patients. The most common complication was anastomotic leakage (Table 3).

Histopathological Results

The distribution of the patients' pathologic diagnoses according to their TNM classification was as follows: stage 0, 22 patients (10.1%); stage I, 45 patients (20.7%); stage II, 70 patients (32.3%); stage III, 79 patients (36.4%); and stage IV, 1 patient (0.5%) (Table 4). The stage IV patient had received adjuvant chemotherapy. The mean tumor size was 3.5 ± 1.8 cm. The mean distal margin was 2.3 ± 1.8 (range, 0 to 10). Distal margin positivity was detected in 2 (0.9%) patients (Table 4). Transanal excision and hand-sewn coloanal anastomosis were performed in one of these patients, and APR was performed for the other patients. Circumferential margin (CRM) involvement was present in 4 (1.8%) cases. Eight patients had pT4 tumor. One of them was localized in the distal, 2 patients in the mid, and 5 patients in the proximal rectum. Laparoscopic surgical procedures were as follows: 1 patient had resection of the invazed small bowel segments, 1 salphingo-oferectomy, 1 patient had total abdominal hysterectomy and bilateral salphingo-oferectomy (TAH + BSO), 1 patient had TAH + BSO and resection of the invazed small bowel segments, and 1 patient had partial bladder resection. Converting to open surgery was required by one of them with salphingo-oferectomy. All of the patients with pT4 had negative CRM and 1 patient had incomplete mesorectum. The mean number of harvested lymph nodes was 24.7 (range, 4 to 98). The mean number of metastatic lymph nodes was 1.5 ± 3.5 (range, 0 to 29). Mesorectum integrity evaluations performed by the Department of Pathology revealed that the mesorectum was totally resected or nearly so in 191 of the 217 (88%) cases.

TABLE 1. Patient Demographics and Operative Characteristics

	No. Patients [n (%)]
Age (median ± SD)	58 ± 12.5 (22-84)*
Sex	
Male	126 (58.1)
Female	91 (41.9)
Body mass index (BMI) (kg/m^2)	26 ± 2.9
American Society of Anesthesiologists (ASA) Classification	
1	22 (10.2)
2	94 (43.3)
3	74 (34.1)
4	27 (12.4)
Localization	
Upper	75 (36.9)
Middle	62 (28.6)
Lower	80 (34.5)
Neoadjuvant therapy	
None	94 (43.3)
Chemoradiotherapy	94 (43.3)
Short-course radiotherapy	29 (13.4)

Oncologic Treatment and Pathologic Outcomes

Ninety-four (43.3%) of the 217 patients with RC did not have neoadjuvant treatment. Sixty-four of the patients had proximal tumors, and 14 of them localized in other sides and had pT1,2 tumor. Of the patients, 123 had received neoadjuvant treatment. Their clinical staging distribution was as follows: 5 (4%) patients had stage I, 28 (22.9%) patients had stage II, and 90 (73.1%) patients had stage III. After surgical treatment, pathologic staging was as follows: 22 (17.8%) patients had stage 0, 22 patients had stage I (17.8%), 35 (28.4%) patients had stage II, and 44 (36.0%) patients had stage III. Of the 217 cases, 197 had received adjuvant chemotherapy. Of them, 123 underwent adjuvant chemotherapy because of the neoadjuvant treatment protocol. The rest of the patients had adjuvant therapy because of the pathologic staging (T3N0, Tany N +).

Oncologic Results and Survival Rates

After a median follow-up of 31 months (range, 1 to 89 mo), tumor recurrence occurred in 27 (12.4%) of the 217 patients (Table 5). Local recurrence occurred in 8 (3.6%) patients, of which 3 had both local recurrence and systemic metastasis. Systemic metastasis was found in 19 (8.7%) patients. Three of the 8 locally recurrent patient were localized in the proximal rectum, and therefore they did not have neoadjuvant therapy. All recurrent tumors were pT3 and the mesorectum was completely excised, except 1.

TABLE 2. Data Related to Surgery (n = 217)

	n (%)
Surgical Technique	
Double-stapled anastomosis	179 (82.4)
Pull-through hand-sewn anastomosis	38 (17.6)
Conversion to open surgery	14 (6.5)
Operating time (min, median ± SD)	150 ± 52.3 (60-330)

TABLE 3. Complications

Complications	n (%)
Intraoperative	5 (2.3)
Ureteral injury	1 (0.4)
Bleeding	2
Aort	1 (1.8)
Presacral veins	1
Postoperative	38 (17.5)
Anastomotic leak	10 (4.6)
Prolonged ileus	5 (2.3)
Wound complication	5 (2.3)
Urinary tract infections	4 (1.8)
Intra-abdominal abscess	2 (0.9)
Stoma complications	1 (0.4)
Rectovaginal fistula	2 (0.9)
Coloplasty ischemia	1 (0.4)
Small bowel injury	1 (0.4)
Male genital infections	2 (0.9)
Fecal peritonitis	2 (0.9)
Evisceration	2 (0.9)
Upper GI bleeding	1 (0.4)
Mortality	1 (0.4)

GI indicates gastrointestinal.

All patients with mid and distal tumor CRM was negative and 3 of them had locally advanced tumor and received neoadjuvant treatment. The Kaplan-Meier estimate of the 5-year overall survival (OS) rate for laparoscopic rectum resection was 87.5% (Fig. 11). Five-year disease-free survival was found to be in 81.5% patients (Fig. 12). The local recurrence-free survival rate was 94.3% at the end of 5 years (Fig. 13). The stage-specific OS rates for laparoscopic rectum resection at the end of 5 years as estimated by Kaplan-Meier were 81.8% for stage 0, 93.1% for stage I, 86.3% for stage II, and 88.3% for stage III (Fig. 14).

TABLE 4. Histopathologic Data

	No. Patients (n) (%)
TNM stage	
0	22 (10.1)
I	45 (20.7)
II	70 (32.3)
III	79 (36.4)
IV	1 (0.5)
T stage (depth of tumor invasion)	
Is	2 (0.9)
0	20 (9.2)
1	13 (6.0)
2	48 (22.2)
3	126 (58.1)
4	8 (3.6)
N stage	
N0	137 (63.1)
N1	54 (24.9)
N2	26 (12.0)
Tumor size (cm, mean ± SD)	3.5 ± 1.8 (0-9)*
Distal margin	
Positive	2 (0.9)
Negative	215 (99.1)
Distal resection margin distance (cm, mean ± SD)	2.3 ± 1.8 (0-10)*
Positive circumferential margin	4 (1.8)
No. harvested lymph nodes (mean ± SD)	24.7 (4-98)*
No. metastatic lymph nodes (mean ± SD)	1.5 ± 3.5 (0-29)*
Total mesorectal excision	
Complete	139 (64.0)
Nearly complete	52 (24.0)
Incomplete	26 (12.0)

*Range.

TABLE 5. Tumor Recurrence and/or Metastasis Types and Rates

Recurrence/Metastasis	n (%)
Total local recurrence	8 (3.6)
Systemic metastasis	19 (8.7)
Liver metastasis	10 (4.6)
Peritoneal metastasis	5 (2.3)
Lung metastasis	2 (0.9)
Liver and lung metastasis	1 (0.5)
Bone metastasis	1 (0.5)
Local recurrence and systemic metastasis	3 (1.4)
Local recurrence and liver metastasis	1 (0.5)
Local recurrence and lung metastasis	1 (0.5)
Local recurrence, liver, and lung metastasis	1 (0.5)
Total	27 (12.4)

DISCUSSION

The most important variable in assessing the feasibility and efficacy of laparoscopic versus open resection for RC is the pelvic dissection and the ligation level of IMA. This variable can primarily be measured by the adequacy of the CRM and distal margin, the completeness of the mesorectum, harvested lymph node number, the recurrence rate, and OS rates. This report on 217 patients is the largest unselected and consecutive series of a single surgeon; standardized laparoscopic TME to date resulted in a favorable long-term outcome.

CRM positivity is a well-known marker for the increased risk for local recurrence.[1] It is essential to put the principles of TME into practice to save the mesorectal envelope, to obtain an adequate CRM and distal margin, and thereby to reduce local recurrence rates.[2,3] The first randomized study for laparoscopic rectal resection showed that positive CRMs were identified in 14% of patients who underwent open resection and 16% of those who had laparoscopic resection ($P = 80$).[3] Of the patients undergoing anterior resection (AR), the rate of CRM positivity was 12% in the laparoscopy group versus 6% in the open surgery group ($P = 0.19$). We only have 4 (1.8%) patients who had CRM involvement having a 6.5% conversion rate and this contrasts with the data in the CLASICC trial.[4] This might be explained by the multicenter studies and some surgeons were still in the learning curve during its early phase, which was evident from the high conversion rate (34% for RC).[4] The low conversion rate reflects the importance of an accumulation of experience and a specialized team.

The distal resection margin is another important factor contributing to local recurrence. Dividing the rectum laparoscopically is not always feasible, especially in male patients with a narrow pelvis. The limited angulation of the stapler and the physical limitations of working in the bony confines of the pelvis are common deterrents. In addition, to evaluate the distal margin of the tumor can be very difficult for patients who had neoadjuvant treatment. In

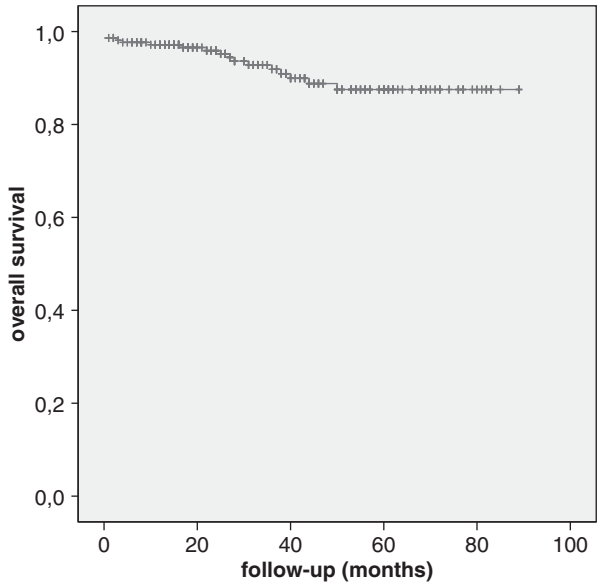

FIGURE 11. Overall survival curve.

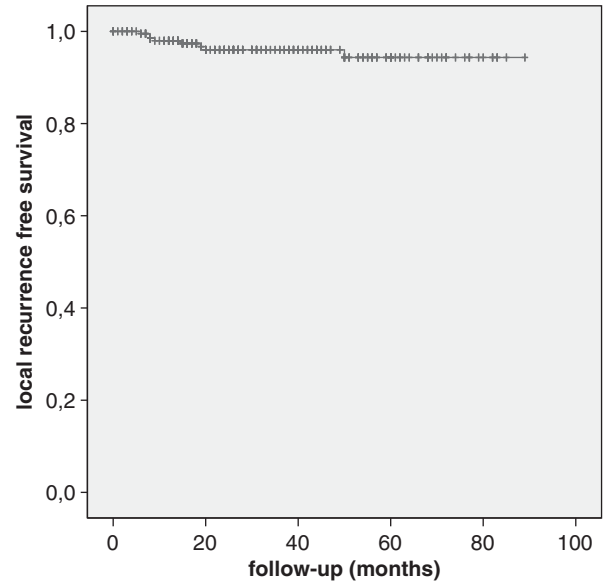

FIGURE 13. Local recurrence-free survival curve.

these circumstances, to reduce distal margin positivity, intersphincteric resection and coloanal anastomosis can be more safe and feasible. In our series, distal margin positivity was present in 2 cases; of these, transanal re-excision and hand-sewn coloanal reanastomosis were performed on 1 patient, whereas APR was performed in the remaining patient to obtain R0 resection for a better oncologic outcome, because margin positivity cannot be compensated for adjuvant therapy.[5]

Preoperative radiotherapy for RC was proven to reduce local recurrence rates in Swedish, Dutch, and German studies of open surgery.[6–8] Selective neoadjuvant chemoradiotherapy is commonly adopted for laparoscopic RC surgery. No studies have reported whether the effects of radiotherapy differ between laparoscopic RC resection and open surgery in terms of characteristics and outcomes.

One major particularity of the current study relating to RC is that most of the patients with middle and distal RC underwent preoperative radiotherapy and chemotherapy. Concerning the use of neoadjuvant therapy, we have observed a significant number of cases in which the tumor was downstaged. In our experience, neoadjuvant chemoradiotherapy has the benefit of tumor downstaging and allows some locally advanced tumors to be excised by laparoscopy. Despite unselected cases, the low rate of microscopic resection margin involvement and using preoperative neoadjuvant treatment in this study are reflected by the favorable local recurrence rate 3.6% over a median

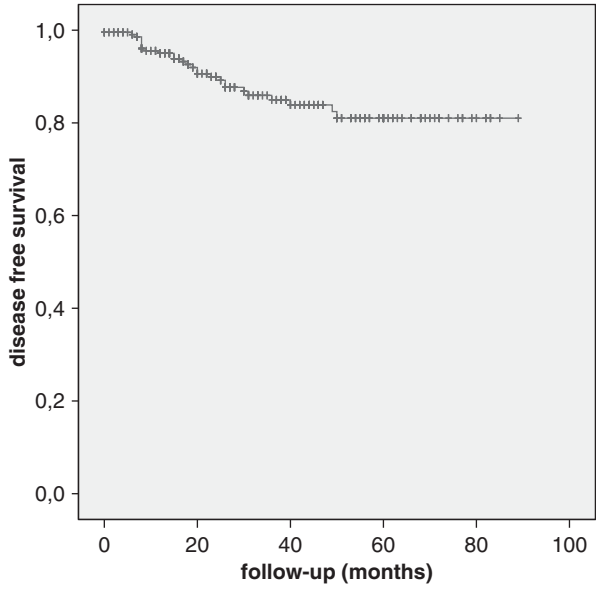

FIGURE 12. Disease-free survival curve.

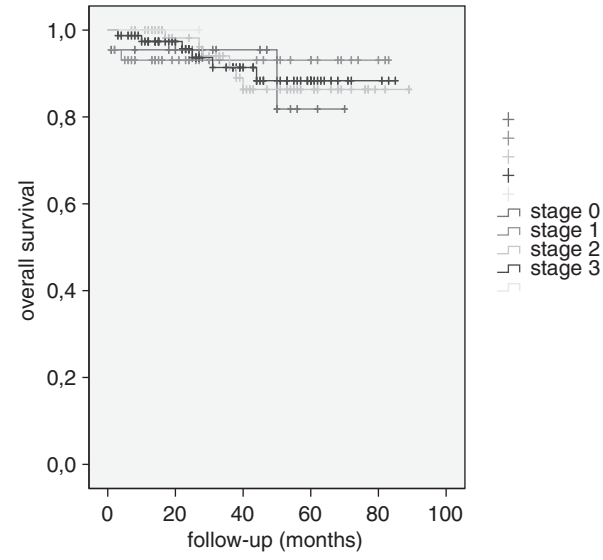

FIGURE 14. Overall survival curves for each stage.

of 31 months. This shows the feasibility of performing laparoscopic procedures, but obviously needs further randomized studies.

In 2010, the UK MRC CLASICC trial reported long-term outcomes for RC. The 5-year OS rate was 52.9% for open surgery and 60.3% for laparoscopic surgery ($P = 0.132$).[4] No difference in the OS was detected between the 2 techniques for patients with RC undergoing either AR or APR. For AR, the 5-year OS rate was 56.7% for open surgery and 62.8% for laparoscopic surgery ($P = 0.247$). A single-institution, large retrospective review of 579 patients who underwent laparoscopic resection for rectosigmoid cancer or RC was reported by Ng et al[9] and long-term survival was also evaluated. Over a 15-year period, 316 patients underwent laparoscopic AR, 152 patients underwent SPS, and 92 patients underwent APR. The median follow-up period was 56 months. The 5- and 10-year OS rates were 70% and 45.5%, respectively. Our estimated 5-year survival of 81.5% is comparable to these results. It is noted that the confidence interval for the overall and disease-free 5-year survival for these patients is large.

CONCLUSIONS

Although these results were obtained from a team that specialized in both laparoscopic and open-surgery approaches and operated on a high volume of cases, laparoscopic surgery should become a standard procedure in RC surgery under the demonstrated advantages of the procedure in the future with the technological developments and specialization of surgeons.

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