

Laparoscopic Resection of Rectal Cancer

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ABSTRACT: **Background:** The treatment of rectal cancer has changed significantly over the last few decades. Advanced surgical techniques have led to an increase in the rate of sphincter-preserving operations, even for low rectal tumors. This was facilitated by preoperative oncologic treatment and the use of chemoradiation to downstage the tumor before resection. The introduction of total mesorectal excision further improved the oncologic outcome and became the standard of care. The use of laparoscopy for rectal resection is the most recent addition to this series of improvements, but in contrast to the use of laparoscopy in colon cancer its role is not yet well defined.

Objectives: To present our experience with laparoscopic surgery for upper and lower rectal tumors.

Methods: A database was used to prospectively collect all data on laparoscopic rectal surgery in our department since we started performing these procedures in 1997. Follow-up data were collected from outpatient clinic visits, oncology files and telephone interviews. Updated survival data were retrieved from the national census.

Results: Of 750 laparoscopic colorectal procedures performed over a 13 year period, 67 were for rectal cancer. Of these, 29 were resections for tumors in the upper rectum (11–15 cm from the anal verge) and 38 for tumors at 10 cm or below. Surgery was performed in 24 patients after neoadjuvant chemoradiation. There were 54 sphincter-preserving operations and 13 abdominoperineal resections. The mean operative time was 283 minutes. Conversion to an open procedure was required in 22% of the cases. Anastomotic leaks occurred in 17% of cases. Postoperative mortality was 4.5%. Long-term follow-up was available for 77% of the group, for a mean period of 42 months. Local recurrence was diagnosed in 4.5% of the patients and overall 5 year survival was 68%.

Conclusions: Laparoscopic rectal resection is a demanding procedure. However, laparoscopy may become the preferred approach since it is a minimally invasive procedure and has an acceptable oncologic outcome that is comparable to that with the open approach. This conclusion, however, needs further validation.

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KEY WORDS: rectum, cancer, mesorectal excision, anterior resection, laparoscopy

The treatment of rectal cancer has significantly changed over the last few decades. Advances in surgical technique led to an increase in the rate of sphincter-preserving operations, even for low rectal cancer, and a significant decrease in the number of patients left with a permanent colostomy after an abdominoperineal resection of the rectum. Advances in oncologic treatments, together with the concept of neoadjuvant treatment, further enhanced the possibility of sphincter-preserving surgery by downgrading the tumor before surgical removal [1,2]. Introduction of the concept of total mesorectal excision [3], which is currently considered the standard of care in rectal surgery, led to a significant improvement in the oncologic outcome by decreasing the local recurrence rate. Applying laparoscopic techniques to rectal resection for cancer is the most recent development, aiming to improve the postoperative recuperation while keeping the same surgical principles and aiming for a similar oncologic outcome as in open surgery.

We present our experience with laparoscopic surgery for upper and lower rectal tumors, supported by cumulative experience published by several authors over recent years [4–13].

PATIENTS AND METHODS

Starting in 1997, we have used laparoscopy for resection of rectal cancer. Patients were referred for neoadjuvant chemoradiation based on the tumor location (below the peritoneal reflection) and the tumor stage, as diagnosed on preoperative imaging (T2 and above).

DATA COLLECTION

All demographic and surgical data were prospectively recorded using an electronic database. The data included all relevant perioperative information such as the use of neoadjuvant chemoradiation, as well as events in the postoperative course. Follow-up data were obtained from surgery clinic visits, the oncology files and telephone interviews. Survival data were obtained from the national census.

SURGICAL TECHNIQUE

For high rectal tumors, > 10 cm from the anal verge, we performed anterior resection of the rectum with partial mesorectal excision, aiming for a distal margin of 5 cm below

the tumor. Tumors located ≤ 10 cm from the anal verge were treated with TME. The decision to preserve the sphincters or complete an abdominoperineal resection was based on the ability to achieve clear distal margins and to maintain a good functional outcome.

For low rectal cancer, the surgery was performed according to accepted TME principles, maintaining the integrity of the mesorectum down to the pelvic floor to achieve a meticulous clearance of the pelvis while preserving the autonomic nerves [Figure 1]. Special attention was paid to identifying the ureters. Encircling the left ureter with a vessel loop was commonly practiced, for easy identification and preservation throughout the various stages of the operation [Figure 2].

Low rectal transection was performed using roticulating endoscopic linear staplers. Pushing the perineum upward by

an assistant may help in cases that have a deep and narrow pelvis, mainly in males. In some cases, according to the surgeon's preference, a laparoscopic assisted approach was used: namely, a short Pfannenstiel incision was made following the laparoscopic dissection and the transection was completed using a mechanical stapler. An end-to-end anastomosis stapler was used to restore the continuity. Creating a rectal pouch was selective, based on the surgeon's preference as well as the technical feasibility.

A diverting ileostomy was commonly created after performing a low colorectal anastomosis, or for higher anastomoses if technical difficulties or other factors suggested a high risk for anastomotic breakdown.

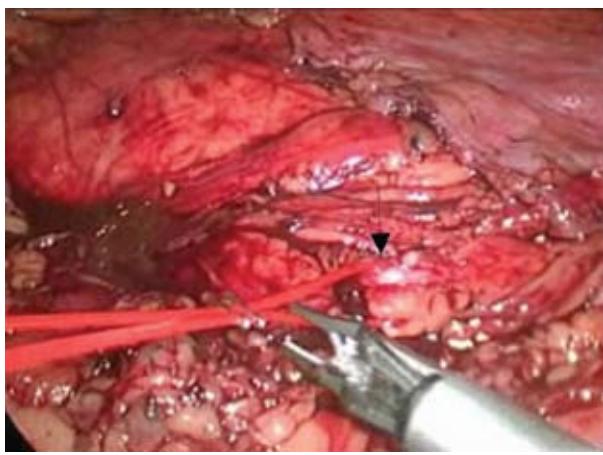
Bowel preparation before surgery was not mandatory but was preferred by most surgeons before resecting a low rectal cancer, especially when a diverting ileostomy was planned.

TME = total mesorectal excision

Figure 1. At the conclusion of the rectal resection, the pelvis is "empty," down to its floor. Autonomic nerves are preserved (arrows)



Figure 2. The left ureter (arrow) is encircled with a vessel loop for easy identification and preservation



RESULTS

Between the years 1997 and 2009, 750 laparoscopic colorectal procedures were performed in our department and 67 of them were for rectal cancer. In 64 patients (95%) the surgery was done with curative intent; in the remaining 3 patients it was considered a palliative procedure as they had an existing metastatic disease. Local tumor pathological stage was T1 in 10 patients, T2 in 20, T3 in 33 and T4 in 4 patients. The tumor location was "high" (11–15 cm from the anal verge) in 29 patients; mid or low rectal cancer was diagnosed in 38 patients. Twenty-four patients received neoadjuvant chemoradiation treatment before surgery and 27 patients received oncologic treatment after the resection. Twenty-two patients underwent preoperative mechanical bowel preparation and 45 patients were operated without such preparation.

The 29 patients diagnosed with high rectal cancer underwent laparoscopic anterior resection with partial mesorectal excision. The 38 patients with low rectal cancer underwent laparoscopic rectal resection with TME; 25 had sphincter preservation and low rectal anastomosis, and 13 had an abdominoperineal resection with creation of a permanent colostomy. In 22 patients, 18 of whom had low rectal cancer, a temporary diverting ileostomy was constructed.

The mean operative time was 283 minutes. Conversion was required in 15 patients (22%) due to technical difficulties with the rectal dissection, technical problems with the stapling device or injury to surrounding structures. There was one ureteral injury and two inadvertent enterotomies. The mean postoperative stay was 10 days, during which 27 patients (40%) suffered from various postoperative complications. Anastomotic leak occurred in 9 patients (17%), and 6 patients (9%) required a reoperation. Three patients (4.5%) died after surgery, all due to septic complications following an anastomotic leak.

Negative resection margins, including radial margins, were achieved in all patients. Lymph node retrieval was adequate, with a mean of 14 lymph nodes (range 2–23) after TME for low rectal cancer, 15 (2–40) after anterior resection for high rectal cancer, and 8 (2–30) after abdominoperineal resection.

Long term follow-up was complete for 49 patients (77%), for a mean period of 42 months (range 2–102 months). Local recurrence was diagnosed in 3 patients (4.5%) and metastatic disease developed in 15 patients. Fifteen patients died, and the Kaplan-Meier 5 year overall survival for the whole group was 68%.

DISCUSSION

The laparoscopic approach to rectal cancer seems a natural extension of the use of laparoscopy for colon cancer, which is already established as advantageous in short-term aspects [14] and as effective as the open approach in long-term oncologic aspects [15]. Yet, this approach has not yet gained wide acceptance despite several studies, some of them comparative, that together comprise more than a thousand patients [Table 1] [4–13]. The results of these studies are promising: operative time is around 4 hours, except in the hands of highly expert surgeons, and the conversion rate is similar to that described for colon cancer. Morbidity is significant, but not dissimilar to that after open surgery, with an anastomotic leak rate of about 17%. Postoperative mortality is rare. The laparoscopic operation yields an acceptable specimen with good surgical margins and appropriate number of retrieved lymph nodes. The long-term outcome is as good as after

open surgery, with an acceptable local recurrence rate and 5 year survival. The results of our study reflect those found in the literature but in some aspects are not as good: the mean operative time nears 5 hours, the conversion rate is above 20%, and the postoperative mortality is 4.5%. Despite that, the local recurrence rate is less than 5% and the 5 year survival is around 70%.

These results, which reflect the difference between large, single-surgeon series, and a smaller series originating from a teaching institution and averaging the results of several surgeons, may be the clue to understanding why laparoscopic rectal resection is not yet widely accepted. While anterior resection for high rectal cancer may be considered a relatively easy procedure for the experienced laparoscopic surgeon, laparoscopic TME for mid and low rectal cancer is a demanding procedure. Familiarity with deep pelvic anatomy is a prerequisite, and mastery of laparoscopic techniques is required in order to complete a safe and thorough dissection of the rectum out of the pelvis, which is often deep and narrow. Avoiding injury to adjacent structures, along with autonomic nerve identification and preservation, are important in order to avoid complications and achieve a good genitourinary functional outcome [16].

It should be noted that after gaining anatomical knowledge and technical expertise, the surgeon enjoys certain advantages offered by laparoscopy such as better lighting, better view and more accurate dissection under magnification. It remains to be shown whether the use of robotic assisted surgery may further enhance pelvic dissection and improve results [17].

A debate still exists regarding the outcome benefit of the laparoscopic approach, and this should be divided into short

Table 1. Results of laparoscopic rectal surgery studies*

Author [ref]	Year	No. of patients	Operating time (min)	Conversion rate (%)	Anastomotic leak rate (%)	Mortality (%)	Mean hospital stay days	No. of lymph nodes retrieved	Local recurrence rate (%)	5 year survival (%)
Morino [4]	2003	100	250	12	17	2	17	13	4	74
Leroy [5]	2004	102	202	3	17	2		8	6	65
Dulucq [6]	2005	218	138	12	10	1	6	24	7	67
Tsang [7]	2006	105	170	2		0	10		9	81
Staudacher [8]	2007	226	245	6	17	0	10	14	6	81
Anderson [9]**	2007	1403						10	7	3YS=76
Laurent [10]***	2009	238		15	12	0.8	9		4	83
Gouvas [11]***	2009	45	166	9	16	0	6			
Khaikin [12]***	2009	32	240	12			6			
Milsom [13]	2009	103		3	8	0			5	91
Rosin (present study)	2010	67	238	22	17	4.5	10	14	4.5	68

* Numbers are rounded to integers

** Meta-analysis, controlled. 3YS = 3 year survival

*** Controlled trial vs. open surgery

and long-term aspects. Laparoscopy is mainly advantageous in the short-term recovery period, since it obviates large incisions, abdominal wall retraction and bowel handling. It is clear that patients who suffer from complications, or in whom conversion to the open procedure was necessary, are unlikely to benefit from these advantages, and the advantages are less apparent in the study when subgroup analysis is not done and intention-to-treat analysis is used. Nevertheless, for those who recover uneventfully, comprising the absolute majority in all series, the advantage of the minimally invasive approach is apparent, as was repeatedly shown for most laparoscopic procedures. In the long term, the main consideration is oncologic. In this aspect, the safety of the laparoscopic approach was already shown in several series [Table 1] [4-13], but more data are needed to reach a conclusion.

The use of mechanical bowel preparation before rectal surgery deserves a special note. In our department we abandoned the routine use of mechanical bowel preparation before colonic surgery, based on trials that showed no evident advantage to this practice [18]. However, when looking at the anastomotic leak rate in the current series, only 2 of the 22 patients who had bowel prep had a leak (9%) as compared to 7 patients out of 45 without bowel prep (16%). While these numbers are too small to draw a statistically significant conclusion, the trend is alarming. On top of that, for low rectal cancer in which a diverting ileostomy is likely to be constructed due to a high risk of anastomotic failure, it makes no sense to leave a colon full of feces just above this area. Therefore, we currently prepare all our patients who have mid and low rectal cancer and are scheduled for TME with low anastomosis.

In conclusion, our study reflects the current literature regarding laparoscopic surgery for rectal cancer. Reducing the surgical trauma, while keeping the oncologic outcome comparable to that achieved with open surgery, seems to be beneficial for patients diagnosed with rectal cancer.

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"I don't want any "yes-men" around me. I want everybody to tell me the truth even if it costs them their jobs"

Samuel Goldwyn (1879-1974), American movie producer and founder of several film studios

"A physician is not angry at the intemperance of a mad patient; nor does he take it ill to be railed at by a man in a fever. Just so should a wise man treat all mankind, as a physician does his patient; and looking upon them only as sick and extravagant"

Lucius Annaeus Seneca (BCE 3-65 CE), Roman Stoic philosopher, statesman and dramatist

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