PO Box 2345, Beijing 100023, China
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TOPIC HIGHLIGHT

John Geibel, MD, Dsc and Walter Longo, MD, *Series Editors*

Modern management of rectal cancer: A 2006 update

Glen C Balch, Alex De Meo, Jose G Guillem

Glen C Balch, Alex De Meo, Jose G Guillem, Colorectal Service at Memorial Sloan-Kettering Cancer Center New York, New York 10021, United States
Correspondence to: Jose G Guillem, MD, MPH, Colorectal Service, Memorial Sloan-Kettering Cancer Center, 1275 York Avenue, Room C-1077, New York, NY 10021, United States. guillemj@mskcc.org
Telephone: +1-212-6398278 Fax: +1-646-4222318
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Abstract

The goal of this review is to outline some of the important surgical issues surrounding the management of patients with early (T1/T2 and N0), as well as locally advanced (T3/T4 and/or N1) rectal cancer. Surgery for rectal cancer continues to develop towards the ultimate goals of improved local control and overall survival, maintaining quality of life, and preserving sphincter, genitourinary, and sexual function. Information concerning the depth of tumor penetration through the rectal wall, lymph node involvement, and presence of distant metastatic disease is of crucial importance when planning a curative rectal cancer resection. Preoperative staging is used to determine the indication for neoadjuvant therapy as well as the indication for local excision versus radical cancer resection. Local excision is likely to be curative in most patients with a primary tumor which is limited to the submucosa (T1N0M0), without high-risk features and in the absence of metastatic disease. In appropriate patients, minimally invasive procedures, such as local excision, TEM, and laparoscopic resection allow for improved patient comfort, shorter hospital stays, and earlier return to preoperative activity level. Once the tumor invades the muscularis propria (T2), radical rectal resection in acceptable operative candidates is recommended. In patients with transmural and/or node positive disease (T3/T4 and/or N1) with no distant metastases, preoperative chemoradiation followed by radical resection according to the principles of TME has become widely accepted. During the planning and conduct of a radical operation for a locally advanced rectal cancer, a number of surgical management issues are considered, including: (1) total mesorectal excision (TME); (2) autonomic nerve preservation (ANP); (3) circumferential resection margin (CRM); (4) distal resection margin; (5) sphincter preservation and options for restoration of bowel continuity; (6) laparoscopic approaches; and (7) postoperative quality of life.

INTRODUCTION

Rectal cancer is a major health concern in the United States, with an estimated 40 340 new cases diagnosed in 2005[1]. There are four major goals in the treatment of a patient with rectal cancer: (1) local control; (2) long-term survival; (3) preservation of anal sphincter, bladder, and sexual function; and (4) maintenance or improvement in quality of life. These goals are best achieved through a multi-modality approach delivered by a multi-disciplinary team. The aim of this review is to outline some of the important surgical issues surrounding the management of patients with early (T1/T2 and N0), as well as locally advanced (T3/T4 and/or N1) rectal cancer.

PREOPERATIVE STAGING

Information concerning the depth of tumor penetration through the rectal wall, lymph node involvement, and presence of distant metastatic disease is of crucial importance when planning a curative rectal cancer resection. Preoperative staging is used to determine the indication for neoadjuvant therapy, as well as to determine whether local excision or radical cancer resection will provide optimal surgical treatment.

The most common imaging modalities currently used in the preoperative staging of rectal cancer are endorectal ultrasound (ERUS), computed tomography (CT) scan, magnetic resonance imaging (MRI), and positron emission tomography (PET) scan.

ERUS

ERUS is an accurate method to preoperatively stage rectal cancers. Although operator-dependent, it can be performed at the time of patient evaluation with minimal preparation or patient discomfort. ERUS is used to clinically determine the tumor (T) and lymph

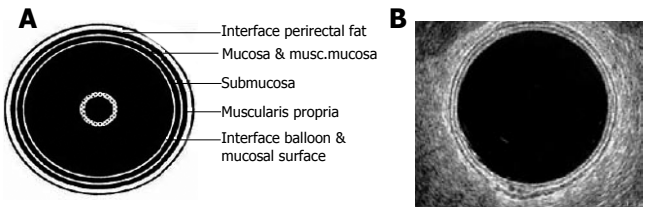

Figure 1 Rectal wall anatomy. **A**: Schematic diagram of ERUS image; **B**: Actual image of normal ERUS[3].

node (N) stage of rectal cancer (Figure 1). According to currently available data, ERUS is 62% to 92 % accurate for T-staging and 64% to 88% accurate for N-staging[2,3]. ERUS is limited by its steep learning curve, operator variability, and limitations for staging near-obstructing tumors and downstaged tumors after chemoradiation therapy. Nevertheless, ERUS is currently considered the most accurate method for local staging of rectal cancer. The performance of ERUS in staging rectal cancer may be overestimated in the literature due to publication bias[4]. A recent analysis of 4118 subjects reported an overall mean T-staging accuracy of 85% (median, 88%) and N-staging accuracy of 75% (median, 76%). Both T-staging and N-staging accuracy rates declined over time with the lowest rates reported in more recent literature[4].

CT

The vast majority of patients with clinically localized rectal cancer have an abdominopelvic CT prior to surgical resection, in an effort to identify intra-abdominal metastatic disease prior to a curative or radical resection. However, the role of CT in the preoperative locoregional staging of rectal cancer is much more limited. In fact, the accuracy of CT for T-stage (53% to 94%) and N-stage (54% to 70%), are substantially lower overall than that of ERUS[2].

MRI

The traditional body-coil MRI is less accurate than ERUS and is rarely used for locoregional staging of rectal cancer. However, newer techniques of endorectal coil MRI and phased-array MRI have been reported to be 66% to 92% accurate in determining T-stage, and can reliably determine extent of tumor mesorectal involvement in up to 100% of cases[2,5,6]. Although promising in the preoperative staging of rectal cancer, MRI is limited by its relatively small field of view (when using the endorectal coil), expense, and patient intolerance. Similar to ERUS, restaging patients treated with preoperative chemoradiation using MRI does not appear to be as accurate. In a study of 50 patients who underwent restaging, MRI had the accuracy of 52% in T stage and 68% in N stage[7]. Most of the inaccuracy in both T and N stages was caused by overstaging, believed to be a result of the inability of MRI to differentiate treatment-induced fibrosis from viable tumors. MRI may play an important role in the future by determining preoperatively whether the mesorectal fascia has been breached by tumor, and thus optimize patient selection for neoadjuvant therapy. The results of an ongoing prospective, multicenter trial should better define the role of MRI in the preoperative staging of patients with rectal cancer.

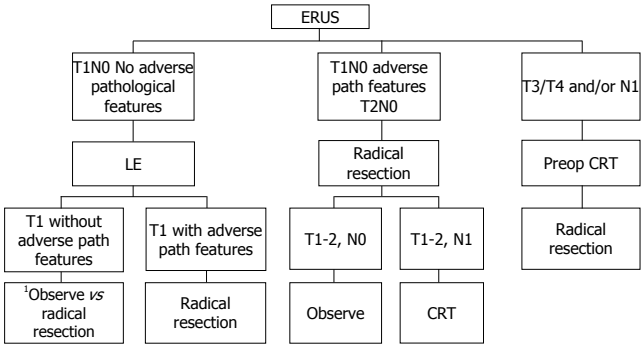

Figure 2 Treatment algorithm for patients with rectal cancer and no evidence of distant metastases. LE: local excision; CRT: chemoradiation therapy. Observation following a LE of a T1 adenocarcinoma, even with good pathological features, may result in 20% local recurrence at 10 years.

PET

PET scanning has been used in the postoperative evaluation of potential recurrences after a curative resection of rectal cancer. This is often initiated by a rising CEA level. However, preliminary data from a prospective trial conducted at our institution suggests that PET may have a role in determining locally advanced rectal cancer response to neoadjuvant chemoradiation[8]. As such, PET can potentially guide changes to the type of neoadjuvant chemoradiation to increase tumor response, as well as guide extent of subsequent surgical therapy. An ongoing, large, prospective study aims to confirm these encouraging results.

SELECTION OF CURATIVE RESECTION

Local excision is likely to be curative in patients with a primary tumor which is limited to the submucosa (T1N0M0), without high-risk features (i.e., poorly differentiated, vascular and neural invasion) and in the absence of metastatic disease. However, recent retrospective series with long-term follow-up suggest that even T1 rectal cancers without high-risk features have higher recurrence rates than expected[9-12]. Therefore, an increasing percentage of these patients are undergoing radical rectal resection. The decision to pursue a radical resection versus a local excision for an early staged rectal cancer is most difficult when the radical resection would require a permanent colostomy. Careful discussion of risks and benefits with the patient is particularly essential in this circumstance.

Once the tumor invades the muscularis propria (T2), radical rectal resection in acceptable operative candidates is recommended. In patients with transmural and/or node positive disease (T3/T4 and/or N1) with no distant metastases, preoperative chemoradiation followed by radical resection according to the principles of TME has become widely accepted (Figure 2). In patients with metastatic disease, complex and interrelated variables such as patient co-morbidities, patient expectations, and

resectability of metastases must be considered when planning surgical therapy. For patients with unresectable distant metastatic disease, surgical excision of the primary rectal cancer may still be considered when palliation of symptoms is anticipated.

CHEMORADIATION THERAPY

The use of perioperative chemoradiation therapy (CRT) for rectal cancer continues to evolve. Based largely on the results of two multicenter trials, the 1990 NIH Consensus Conference on rectal cancer recommended postoperative chemoradiation for patients with transmural and/or node positive rectal cancer[13]. Although postoperative therapy for stage II/III rectal cancer remains a reasonable option, many centers have adopted a treatment strategy of using preoperative chemoradiation therapy. The benefits of neoadjuvant chemoradiation therapy have been well documented, and include tumor regression and downstaging associated with increased tumor resectability and a higher rate of sphincter preservation[14-18]. Moreover, complete pathologic response rates up to 10% to 25% can be achieved[18-25]. The German Rectal Cancer Study Group recently completed a large, prospective, randomized trial that compared preoperative versus postoperative chemoradiation in the treatment of clinical stage II and III rectal cancer[26]. They concluded that, although there was no difference in overall survival between the two groups, there was a significant reduction both in local recurrence rate (6% *vs* 13%, $P = 0.006$) and treatment toxicity in the preoperative group. Although the quality of life for patients treated with preoperative CRT may transiently decrease, this finding is counterbalanced, in large part, by the potential for improved oncologic outcome in properly selected patients[27].

Current studies evaluating treatment outcomes in rectal cancer patients with a complete or near complete response to neoadjuvant chemoradiation have demonstrated improved survival compared to partial responders or non-responders[14,18]. In one report, patients with a complete pathological response had a 5 year disease-free survival of 95.2% compared to 55.4% for those with a partial or no pathological response ($P = 0.03$)[14]. In a recent report from MSKCC, 297 patients with locally advanced (T3-4 and/or N1) rectal cancer were treated with preoperative chemoradiation therapy followed by TME[28]. Patients who achieved > 95% pathological response from preoperative CRT had a significantly improved 10 year OS and RFS rates, when compared to those patients with a < 95% pathological response[28].

In light of the significant response rates that can be achieved with preoperative therapy, some have suggested limiting further surgical therapy to transanal excision alone[29,30]or observation[31,32] for patients with a complete response. This approach is limited by the difficulty in precisely determining tumor response to chemoradiation and assessing residual mesorectal lymph node involvement. Currently, assessment of tumor response is determined postoperatively by objective measurements of tumor volume in the surgical specimen compared to preoperative clinical staging; however, preoperative staging is based on subjective evaluation and, with current methods and technology, remains unreliable following chemoradiation. ERUS is considered the most accurate way to stage rectal cancer. But after radiation therapy, it is difficult to distinguish between residual tumor and radiation fibrosis and accuracy decreases to 47%-58%[33-37].

Similarly, restaging patients treated with preoperative chemoradiation using MRI does not appear to be accurate[7]. As discussed earlier, a preliminary report from MSKCC showed response assessment may be improved with the use of FDG-PET scanning[8]. In a series of 15 patients, FDG-PET scanning was able to more accurately assess treatment responses; confirmation with a large, prospective study is ongoing.

In patients that undergo transanal local excision, there is a risk of leaving residual disease in the mesorectum, even after combined preoperative chemoradiation therapy. Many studies have reported 1.8% to 16% of patients with lymph node involvement despite a complete pathological response in the primary tumor[38-40]. Given the inability of existing imaging modalities to reliably confirm the eradication of mesorectal nodal metastases, patients undergoing TAE alone following preoperative CRT are at risk for local failure due to residual nodal disease. Currently, there are no data to support the routine use of TAE in these patients, and definitive treatment should continue to be rectal resection with TME.

These data strongly support the need for prospective clinical trials designed to optimize the combination and sequencing of multidisciplinary neoadjuvant therapy in order to maximize survival and locoregional control rates in rectal cancer patients. If the response rate can be enhanced, it may permit less radical surgery in patients with complete responses to preoperative therapy and adjust the dose intensity or duration of postoperative chemotherapy. Ultimately, the aim of this approach is to be able to individualize or customize a patient's treatment based upon expression of molecular markers, genetic signatures using gene arrays and response to systemic therapy preoperatively.

In patients treated with preoperative chemoradiation, surgical resection is generally deferred until 6 to 8 weeks following completion of therapy in order to allow maximal tumor response, as well as patient recuperation from the toxicities sometimes associated with chemoradiation. Although the benefit of a prolonged interval from completion of chemoradiation to surgery is unclear, when clinically necessary it does not appear to increase the operative blood loss, operative time, and positive margin rate[41].

EARLY RECTAL CANCER (T1/T2 AND N0)

Local excision

Transanal local excision (LE) for T1 rectal cancer offers minimal morbidity and minimal long-term functional problems compared to radical resection (i.e., APR or LAR). On the other hand, recent evidence suggests that patients treated with LE have higher local recurrent rates than those treated with radical resection[10-12,42]. Preoperative

Table 1 Oncologic outcome for transanal excision of rectal cancer

Study (yr)	*n*	Follow-up (mo)	Local recurrence (%)	Overall survival (%)
Taylor *et al* (1998)[45]	24	52	T1: 40 T2: 50	67
Chakravarti *et al* (1999)[44]	52	52	T1: 11 T2: 62	66
Steele *et al* (1999)[43]	110[1]	48	T1: 7 T2: 20	T1: 87 T2: 85
Mellgren *et al* (2000)[42]	108	53	T1: 17 T2: 46	69
Paty *et al* (2002)[10]	125	80	T1: 17 T2: 26	T1: 74 T2: 72
Endreseth *et al* (2005)[12]	35	24-97	T1: 12	T1: 70
Madbouly *et al* (2005)[11]	52	55	T1: 29	T1: 89

[1]Patients with T2 cancers on pathology were treated with postoperative chemoradiation.

staging is relatively inaccurate and rates of LR vary widely from 7% to 40% after LE for T1 tumors[10-12,42-45]. Based on more recent, larger studies with longer follow-up, the LR rate appears to be approximately 10% to 25%. In those patients that recur after LE, only 50% or less will ultimately be cured by radical resection for salvage[46]. Because local excision does not remove the lymph node bearing tissue of the rectum (mesorectum), optimal patient selection is imperative in order to diminish the likelihood of offering this procedure to a patient whose rectal cancer might have lymph node metastases.

The risk of lymph node involvement is 0%-12% for T1 cancers, 12%-28% for T2 cancers, and 36%-79% for T3 cancers[47]. Features associated with a significantly increased risk of lymph node metastases include poor differentiation, lymphovascular invasion, and size greater than 3 centimeters[48,49]. It is therefore not surprising that, following local excision, local regional recurrence rates can be as high as 11%-29% for T1 tumors, 25%-62% for T2 tumors, and > 40% for T3 tumors[10,11,47]. Overall survival has been reported from 70% to 89% in recent series of properly selected patients (Table 1)[10-12,43,44]. However, most studies on transanal excision have follow-up data of less than 5 years and a relatively small sample size. This, in addition to the long natural history of the disease, makes conclusions on long term efficacy difficult. In 67 T1 patients treated by LE, a study at Memorial Sloan Kettering Cancer Center reported a 74% 10 year DSS[10].

In patients who develop a locoregional recurrence following local excision of rectal cancer, salvage with a radical resection is possible, with several small series reporting a 50% to 88% disease-free survival (DFS)[44,50]. After final pathology is available from a LE, consideration should be given to immediate radical resection (i.e., within 30 d). Thus, high-risk tumor characteristics and a location or size that does not enable a re-excision with clear margins warrants radical salvage surgery in order to achieve maximum local disease control. In one report of 21 patients at MSKCC, immediate radical surgery in stage I patients with adverse features was superior to those treated initially with LE followed by salvage surgery at the time of local recurrence; 94% DFS was noted in the group treated with immediate radical resection for adverse pathology versus 55% in the cohort treated with radical surgery after LR was documented[51]. A recent report from the Mayo clinic also showed that LE followed by radical surgery within 30 d does not compromise outcome compared with primary radical surgery. In the largest series published to date, 49 patients who underwent successful surgical salvage of local recurrence after LE of T1 rectal cancer, 55% required an extended pelvic dissection with en bloc resection of adjacent pelvic organs[46]. Despite the fact that 47 of 49 patients had complete resection of their pelvic disease, 58% had recurred or died of disease within 33 mo. Five year DSS was 53%[46].

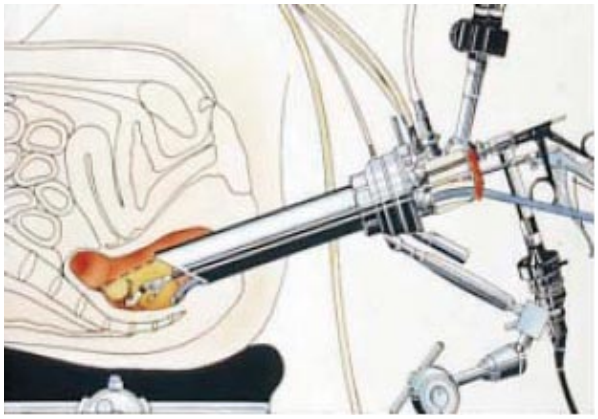

Figure 3 Specialized equipment in use for the performance of TEM[90].

Currently, local excision for cure is recommended only for carefully selected T1 tumors without high-risk features[9,10]. Patients must be followed closely and for a long period, since almost a third of local recurrences after TAE of early stage rectal cancer occur 5 years or more after local excision[10]. The role of adjuvant chemotherapy and radiation after LE is not defined at this time. Local excision is also an option for palliation in patients with locally advanced rectal cancer or stage IV patients unsuitable for radical resection[52].

Transanal endoscopic microsurgery (TEM)

TEM is an option for excising rectal cancers that are otherwise inaccessible by standard transanal excision[53]. Using a specially designed 40 millimeter diameter and 25 centimeter long operating endoscope, tumors located as high as 10 centimeters anteriorly, 15 centimeters laterally, and 20 centimeters posteriorly can be excised under direct vision (Figure 3). TEM provides a technique for full thickness excision of both benign and properly selected malignant lesions (i.e., T1 with no high risk features) that are too high for transanal excision and would otherwise require radical resection[53]. It is imperative to keep in mind that the selection criteria for TEM are the same as those for local excision (described above)[54]. When used on appropriately selected early-stage lesions, TEM can achieve oncologic results similar to those of radical resection,

Table 2 Oncologic outcome for potentially curative radical rectal resection of rectal cancer according to the principles of TME

Study (yr)	*n*	Follow-up mo	Dukes stage *n* (%)	Local recurrence (%)	Overall survival (%)
Enker *et al* (1995)[57]	246	72	B: 99 (40) C: 147 (60)	7	LN negative: 87 LN positive: 64
Heald *et al* (1998)[56]	519	99	A: 102 (20) B: 167 (32) C: 142 (27) D: 108 (21)	3	80 (DFS)
Martling *et al* (2000)[55]	381	24	A: 128 (34) B: 140 (37) C: 112 (29) Not Documented: 1 (< 1)	6	79
Wibe *et al* (2002)[58]	686	29	A: 165 (24) B: 261 (38) C: 260 (38)	7	Not Reported
Nesbakken *et al* (2003)[59]	134	38	A: 38 (28) B: 56 (42) C: 40 (30)	9	66
Bulow *et al* (2003)[64]	311	36	A 73 (23) B: 143 (46) C: 93 (30) Not documented: 2 (1)	11	77

LN: Lymph node; DFS: Disease free survival.

while limiting morbidity and mortality[54].

LOCALLY ADVANCED RECTAL CANCER (T3/T4 AND/OR N1)

During the planning and conduct of a radical operation for a locally advanced rectal cancer, a number of surgical management issues are considered, including: (1) total mesorectal excision (TME); (2) autonomic nerve preservation (ANP); (3) circumferential resection margin (CRM); (4) distal resection margin; (5) sphincter preservation and options for restoration of bowel continuity; (6) laparoscopic approaches; and (7) postoperative quality of life. The sections that follow examine each of these issues.

Total Mesorectal Excision (TME)

TME is a technique which requires precise dissection in an areolar plane between the visceral fascia that envelops the rectum and mesorectum and the parietal fascia overlying the pelvic wall structures. The end result of this procedure, when performed properly, is an intact mesorectum containing the draining lymph nodes of the rectum. This technique also facilitates pelvic autonomic nerve preservation. TME emphasizes the achievement of negative CRM and distal margins, thus optimizing the oncologic outcome for the patient. TME has been shown to achieve a negative CRM in up to 96% of resected specimens[55]. Most importantly, large series from surgical teams worldwide using TME techniques have reported local failure rates as low as 3% and overall 5-year survival of up to 80% (Table 2)[55-59]. This compares favorably

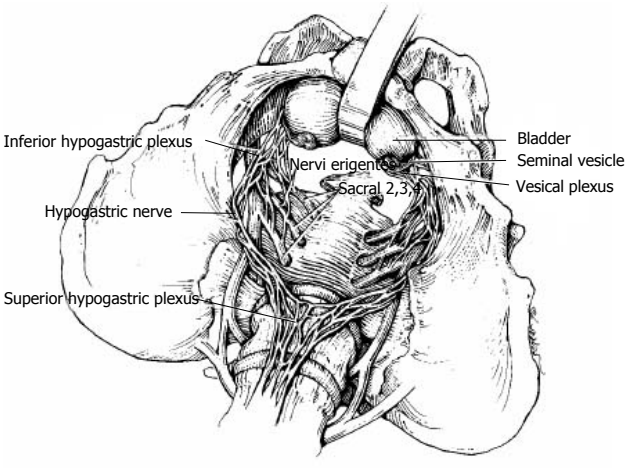

Figure 4 Diagram of pelvic autonomic nerve anatomy[73].

with large reviews of standard surgery that reported local recurrence rates of 15% to 19%, with some studies reporting local failure as high as 48%[60,61]. In fact, in studies comparing rectal resection according to the principles of TME to historical controls of standard, blunt mesorectal dissection, the patients treated with TME consistently have lower local recurrence rates[55,62-64]. Currently, TME should be considered an integral aspect of the optimal surgical management of the patient with locally advanced rectal cancer.

Autonomic nerve preservation

The sympathetic nerves of the pelvis originate from the T12 to L3 ventral nerve roots, ultimately forming the preaortic superior hypogastric plexus (Figure 4)[65]. Distal to the aortic bifurcation, the superior hypogastric plexus forms the hypogastric nerve, which may be intimately associated with the visceral fascia of the mesorectum. Injury to the hypogastric sympathetic nerve trunks results in increased bladder tone with reduced bladder capacity, voiding difficulty, impaired ejaculation in men, and loss of vaginal lubrication and dyspareunia in women. The parasympathetic nerves of the pelvis (nervi erigentes), arising from the S2 to S4 ventral nerve roots, join the hypogastric nerves (sympathetic) on the pelvic sidewall to form the inferior hypogastric plexus (pelvic autonomic nerve plexus) (Figure 4)[65]. Damage to the parasympathetic nerves leads to erectile dysfunction, impaired vaginal lubrication, and voiding difficulty.

Truncal ANP is defined as preservation of the anterior nerve roots of S2, S3, and S4, the superior hypogastric nerves, and the pelvic autonomic nerve plexus[57]. With careful autonomic nerve preservation, postoperative genitourinary and sexual dysfunction can be reduced from 25% to 75% to as low as 10% to 28%[66]. More specifically, neurogenic bladder can be reduced from 9% to 40% with conventional rectal resection to as low as 0% to 11% with TME and ANP[66-68]. The rate of sexual dysfunction may be further reduced by using intraoperative nerve stimulators to help identify and preserve the pelvic autonomic nerves[69]. It must be emphasized, however, that

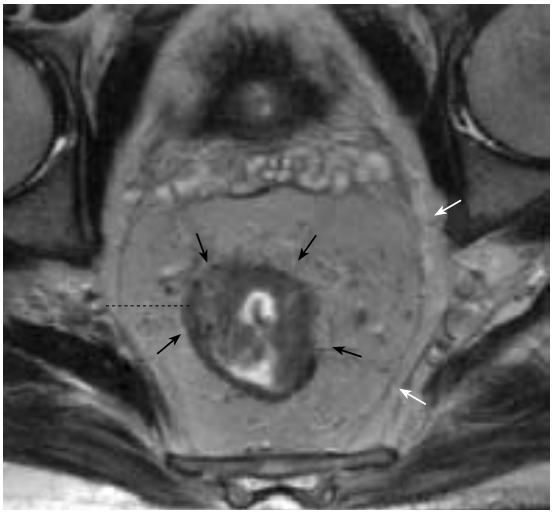

Figure 5 MRI of rectal cancer with demonstration of circumferential resection margin (CRM)[6]; Black arrows: rectal cancer; White arrows: mesorectal fascia; Dashed line: CRM, which is defined as the shortest distance from rectal cancer to the lateral resection margin of the mesorectum.

factors other than ANP, such as history of chemoradiation, patient co-morbidities (i.e. -atherosclerosis, diabetes mellitus, hypertension), medications (i.e. beta-blockers), and alcohol use may contribute to genitourinary and sexual dysfunction following radical rectal resection.

Circumferential resection margin (CRM)

The importance of the CRM in minimizing local recurrence of rectal cancer was first reported in 1986 (Figure 5). A recent series of 686 patients with rectal cancer treated with TME after a median follow-up of 29 mo documented a 5% local recurrence rate for patients with CRM > 1 millimeter and a 20% local recurrence rate for a CRM $\leqslant$ 1 millimeter[58]. Obtaining a negative CRM is likely to result in decreased rates of local recurrence, distant metastases, and death. In order to provide an optimal oncologic outcome, the surgeon must make all efforts to obtain a negative CRM, including en bloc resection of contiguous structures.

Distal resection margin

Distal spread greater than 1 centimeter beyond the mucosal edge of rectal cancer has been documented in only 10% of cases, all in poorly differentiated, node-positive lesions[70]. Recent data support this finding, suggesting that margins as small as 1 centimeter may provide acceptable oncologic results. In a series from our institution, the recurrence-free survival and local recurrence rates with 3 years of follow-up after preoperative combined modality therapy (CMT) and TME-based resection were not significantly different in patients when margins less than or equal to 1 centimeter were compared to those greater than 1 centimeter. Thus, although we advocate striving for a 2-centimeter distal resection margin when feasible, acceptable oncologic results may be achieved with margins of at least 1 centimeter, especially when resection follows CRT.

Sphincter preservation and restorative options

In patients with acceptable preoperative anorectal function, ideal body habitus and pelvic anatomy, sphincter preservation is usually possible for rectal cancer located greater than one centimeter above the upper portion of the anorectal ring. Generally, slender patients with a wide pelvis are more appropriate for sphincter preserving resection of distal rectal cancer than obese patients with a narrow pelvis[66,73]. Male patients with a long, narrow pelvis and/or enlarged prostate present a technical challenge that may preclude a restorative procedure[73]. Finally, patients with impaired preoperative anorectal function may be better treated with radical resection and permanent colostomy, thus avoiding substantial postoperative perineal morbidity[73]. Hence, it is imperative that the surgeon exercise sound clinical judgment when selecting patients for restorative rectal resection.

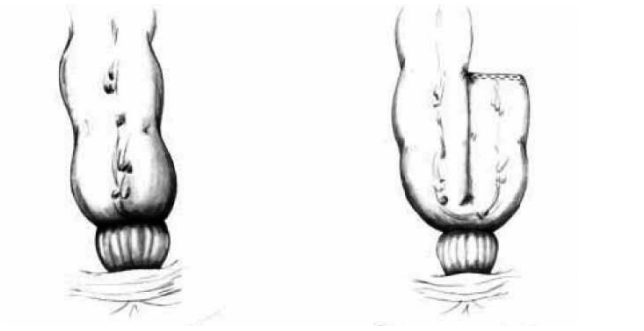

Figure 6 Illustrated comparison of a straight coloanal anastomosis and a coloanal anastomosis with a colonic J-pouch[74].

Classically, bowel continuity following low anterior resection (LAR) was restored with a straight colorectal or coloanal anastomosis. In 1986, J-pouch coloanal anastomosis was developed in order to increase colonic reservoir function and improve quality of life following an LAR that required coloanal anastomosis for restoration of bowel continuity (Figure 6)[74]. A prospective, randomized trial comparing patients with a straight CAA and a coloanal J-pouch anastomosis using the European Organization for Research and Treatment of Cancer (EORTC) QLQ-C30 and QLQ C-38 demonstrated an improved postoperative quality of life in the patients reconstructed with a J-pouch[74]. Randomized studies have demonstrated the superiority of a 6 to 8 cm coloanal J-pouch anastomosis relative to a straight coloanal anastomosis, particularly during the first year following surgery[75]. There is a significant reduction in the postoperative anastomotic leak rate, number of stools per day, and improved quality of life in patients with a J-pouch versus those with a straight coloanal anastomosis after LAR[76].

One disadvantage of the colonic J-pouch is that up to 25% of patients treated with an LAR are not candidates for the procedure, due in large part to the somewhat bulky size of the pouch[77]. In 1997, an alternative procedure, known as the transverse coloplasty, was introduced in an attempt to create a distal colonic reservoir (Figure 7)[78]. A recent randomized trial demonstrated comparable functional results, with improved neorectal sensitivity, when patients undergoing transverse coloplasty-anal anastomoses were compared to those reconstructed with a J-pouch[77]. However, another trial documented

increased leak rates with transverse coloplasty and no differences in bowel function, when compared to a colonic J-pouch[79]. Therefore, colonic J-pouch provides optimal postoperative bowel function with lower morbidity than transverse coloplasty and in most cases should be the primary method of bowel reconstruction when a coloanal anastomosis is required following an LAR[74,79]. However, when reconstruction with a J-pouch is not technically feasible, transverse coloplasty-anal anastomosis provides a reasonable option for bowel reconstruction.

Laparoscopic approaches

Data from small, non-randomized studies evaluating laparoscopic-assisted rectal cancer resection suggest that laparoscopic-assisted TME is feasible when performed by experienced surgeons[80]. From these non-randomized reports, oncologic outcome does not appear to be impaired by laparoscopic rectal cancer resection[81-83]. In addition, short-term morbidity may be reduced in the laparoscopic group, while oncologic outcome is not compromised[81-83]. However, pending prospective, randomized trials focusing on laparoscopic resection of rectal cancer need to be concluded before definitive recommendations can be made concerning the safety and oncologic efficacy of these procedures.

Quality of life following radical resection

Although improved outcome is the ultimate goal for the surgical treatment of rectal cancer, there has recently been increased interest in the quality of life of patients following radical rectal resection. As previously discussed, performing a rectal resection according to the principals of TME with ANP substantially reduces the incidence of postoperative genitourinary and sexual dysfunction. In fact, a recent series reported that even in the face of postoperative fecal incontinence, genitourinary dysfunction, and sexual dysfunction, patients were satisfied with their quality of life following rectal resection[84]. A recent 4-year prospective study of 329 patients with rectal cancer reported the quality of life following radical resection[85]. Using the EORTC QLQ-30 and CR-38 questionnaires, they report that patients undergoing LAR have improved quality of life when compared to patients undergoing APR. In addition, patients who had no stoma, or had their stoma reversed, reported a substantially improved postoperative quality of life compared to patients with a permanent stoma[85].

Another large series with 2 years of follow-up, using the EORTC QLQ-C30 and QLQCR-38 questionnaire, reported opposite results. Patients with a permanent stoma reported significantly better social function ($P = 0.005$), less anxiety ($P = 0.008$), and higher self-esteem ($P = 0.0002$) than patients who underwent restoration of bowel continuity[86]. These findings have been supported by others in the literature[87]. In addition, others have reported that postoperative quality of life improves with time, and should therefore be evaluated in a dynamic fashion[88]. To add further complexity to this issue, patients who are treated with a very low colorectal or coloanal anastomosis may have a decreased postoperative quality of life than patients treated with APR and permanent stoma[89]. It is clear that postoperative quality of life is dependent upon the interaction of patient factors (i.e. co-morbidities and preoperative anorectal function), tumor factors (i.e. extent of local invasion, distance from the anal verge), and surgical factors (i.e. level of the anastomosis). However, the conflicting data in the literature concerning quality of life evaluation for patients with resected rectal cancer underscore the importance of the development of more sensitive, validated instruments.

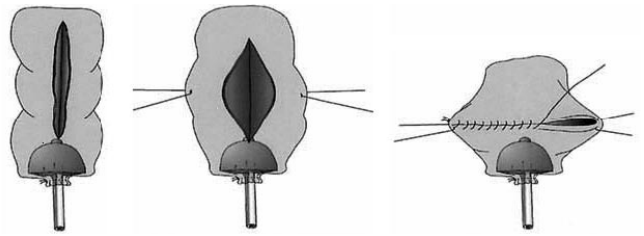

Figure 7 Technique of construction of a stapled coloanal anastomosis with a transverse coloplasty pouch. Alternatively, the pouch may be hand-sewn to the anal canal[77].

In conclusion, surgery for rectal cancer continues to develop towards the ultimate goals of improving local control and overall survival, maintaining quality of life, and preserving sphincter, genitourinary, and sexual function. In appropriate patients, minimally invasive procedures, such as local excision, TEM, and laparoscopic resection allow for improved patient comfort, shorter hospital stays, and earlier return to preoperative activity level. Currently, local excision for cure is recommended only for carefully selected T1 tumors without high-risk features. Recent studies suggest that in patients with resectable rectal cancer, a response to preoperative chemoradiation is predictive of decreased local recurrence and improved survival. As response rates to neoadjuvant therapy continue to improve, it will enable more patients to undergo sphincter-sparing surgery, and will additionally provide a guide to postoperative chemotherapy regimens. However, at this time the existing imaging modalities are limited by their inability to confirm eradication of mesorectal nodal metastases; thus, patients undergoing TAE alone following preoperative chemoradiation therapy are at risk for local failure due to unidentified residual nodal disease. Currently, there are no data to support the routine use of TAE in these patients, and definitive treatment should continue to be rectal resection with TME. By strictly adhering to the principles of TME with autonomic nerve preservation, maintenance of urinary and sexual function can be achieved in the majority of patients undergoing a curative radical rectal cancer resection. The ultimate goal is for physicians to be able to individualize a patient's treatment based upon expression of molecular markers, genetic signatures using gene arrays and response to systemic therapy preoperatively, optimizing the combination and sequencing of multidisciplinary neoadjuvant therapy in order to maximize survival and locoregional control rates.

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