The American Society of Colon and Rectal Surgeons Clinical Practice Guidelines for the Management of Rectal Cancer

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The American Society of Colon and Rectal Surgeons (ASCRS) is dedicated to ensuring high-quality patient care by advancing the science, prevention, and management of disorders and diseases of the colon, rectum, and anus. The Clinical Practice Guidelines Committee is composed of society members who are chosen because they have demonstrated expertise in the specialty of colon and rectal surgery. This committee was created to lead international efforts in defining quality care for conditions related to the colon, rectum, and anus and to develop clinical practice guidelines based on the best available evidence. Although they are not proscriptive, these guidelines provide information on which decisions can be made and do not dictate a specific form of treatment. These guidelines are intended for the use of all practitioners, health care workers, and patients who desire information about the management of the conditions addressed by the topics covered in these guidelines.

These guidelines should not be deemed inclusive of all proper methods of care nor exclusive of methods of care reasonably directed toward obtaining the same results. The ultimate judgment regarding the propriety of any specific procedure must be made by the physician in light of all the circumstances presented by the individual patient.

STATEMENT OF THE PROBLEM

Colorectal cancer remains the third most common cancer for both men and women, and the second leading cause of cancer-related deaths in the United States annually. It is projected that 145,600 new colorectal cancer cases will have been diagnosed and an estimated 51,020 deaths from colorectal cancer will have occurred in 2019.[1] It is difficult to estimate statistics attributable specifically to rectal cancer because, historically, much of the reporting for rectal cancer has been combined with colon cancer as the single disease entity of "colorectal cancer."[1] Overall, the incidence of colorectal cancer has declined over the past decades, largely because of risk factor modification and screening.[2] However, the 18- to 50-year age group represents a unique cohort of patients in whom the incidence of rectal cancer has been increasing. In contrast to overall trends, rectal cancer incidence increased by 1.8% annually in younger adults between 1990 and 2013.[1]

In an effort to ensure that patients with rectal cancer receive appropriate care using a multidisciplinary approach, the ASCRS collaborated with a multispecialty effort to develop the National Accreditation Program in Rectal Cancer to create educational modules and a set of clinical standards focusing on program management, clinical services, and quality improvement regarding rectal cancer.[3,4] Because rectal cancer management involves

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multiple disciplines working in conjunction with one another, the surgical guidelines presented here must be viewed within that context and represent only a portion of the treatment necessary for the optimal care of patients with rectal cancer. Colorectal cancer screening, bowel preparation, enhanced recovery pathways, surveillance after curative treatment, and prevention of thromboembolic disease, while relevant to the management of patients with rectal cancer, are beyond of the scope of these guidelines and are addressed in other guidelines.[5–9] A guideline focusing on colorectal surgery and frailty is forthcoming.

METHODOLOGY

These guidelines are based on the last set of ASCRS Practice Parameters for the Management of Rectal Cancer published in 2013.[10] A systematic search of MEDLINE, PubMed, Embase, and the Cochrane Database of Collected Reviews was performed from January 1, 2013 through January 15, 2020. Individual literature searches were conducted for each of the different sections of the guideline (Fig. 1). An additional limitation to core clinical journals was applied if the initial word combination search returned more than 500 articles. Directed searches using embedded references from primary articles were performed in selected circumstances. The 1812 screened articles were evaluated for their level of evidence, favoring clinical trials, meta-analysis/systematic reviews, comparative studies, and large registry retrospective studies over single institutional series, retrospective reviews, and peer-reviewed, observational studies. Additional references identified through embedded references and other sources as well as practice guidelines or consensus statements from relevant societies were also reviewed. A final list of 361 sources was evaluated for methodologic quality, the evidence base was examined, and a treatment guideline was formulated by the subcommittee for this guideline. The final grade of recommendation and level of evidence for each statement were determined using the Grades of Recommendation, Assessment, Development, and Evaluation system (Table 1). When agreement was incomplete regarding the evidence base or treatment guideline, consensus from the committee chair, vice chair, and 2 assigned reviewers determined the outcome. Members of the ASCRS Clinical Practice Guidelines Committee worked in joint production of these guidelines from inception to final publication. Recommendations formulated by the subcommittee were reviewed by the entire Clinical Practice Guidelines Committee. Final recommendations were approved by the ASCRS Executive Council. In general, each ASCRS Clinical Practice Guideline is updated every 5 years. No funding was received for preparing this guideline, and the authors have declared no competing interests related this material. This guideline conforms to the Appraisal of Guidelines for Research and Evaluation (AGREE) checklist.

Defining the Rectum

The lower limit of the rectum is usually defined by the anorectal ring, an anatomic landmark palpable on physical examination or visible radiographically as the upper border of the anal sphincter and puborectalis muscles.[11] The upper limit of the rectum has been variably defined by the splaying of the teniae coli, the sacral promontory, the proximal valve of Houston, or the level of the peritoneal reflection. A recent consensus conference defined the point of the sigmoid take-off (ie, the junction of the sigmoid mesocolon and mesorectum) as seen on cross-sectional imaging as the upper limit of the rectum.[12] Given that the correlation among these landmarks is imperfect and the presence of all 3 valves of Houston is inconsistent, the upper limit of the rectum, from a clinical perspective, can be somewhat elusive. In practice, the location of a rectal cancer is most commonly assessed by the distance from its distal margin to the anal verge, defined as the beginning of the hair-bearing skin. Tumors within 15 cm of the anal verge are typically classified as rectal cancers, although the total length of the rectum can vary by body habitus and sex.[11]

PREOPERATIVE ASSESSMENT

Evaluation

1. **A cancer-specific history should be obtained eliciting disease-specific symptoms, associated symptoms, family history, and perioperative medical risk. Routine laboratory values, including CEA level, should also be evaluated, as indicated. Grade of recommendation: Strong recommendation based on moderate-quality evidence, 1B.**

A cancer-specific history remains a cornerstone of the preoperative evaluation. Bleeding, pain, or symptoms related to obstruction should be assessed to help determine the urgency and sequence of evaluation and intervention; this consideration is particularly relevant when neoadjuvant therapy is being considered. Urinary, sexual, and bowel function should be reviewed and symptoms indicative of malignant fistulas or severe radiating pain may alert the surgeon to locally advanced disease involving adjacent pelvic organs. The patient's medical fitness to undergo multimodality treatment should be assessed to guide treatment planning and perioperative management. A thorough discussion of perioperative risk stratification is beyond the scope of this guideline.[13–15]

A family history should typically document relevant premalignant lesions and cancers including details like the age at diagnosis and the lineage of affected first- and second-degree relatives. Patients should be asked about known predisposing hereditary cancer syndromes, prior genetic testing, and family ancestry or ethnicity that may be relevant.[16] Patients with findings suggestive of an inherited susceptibility to colorectal cancer should typically

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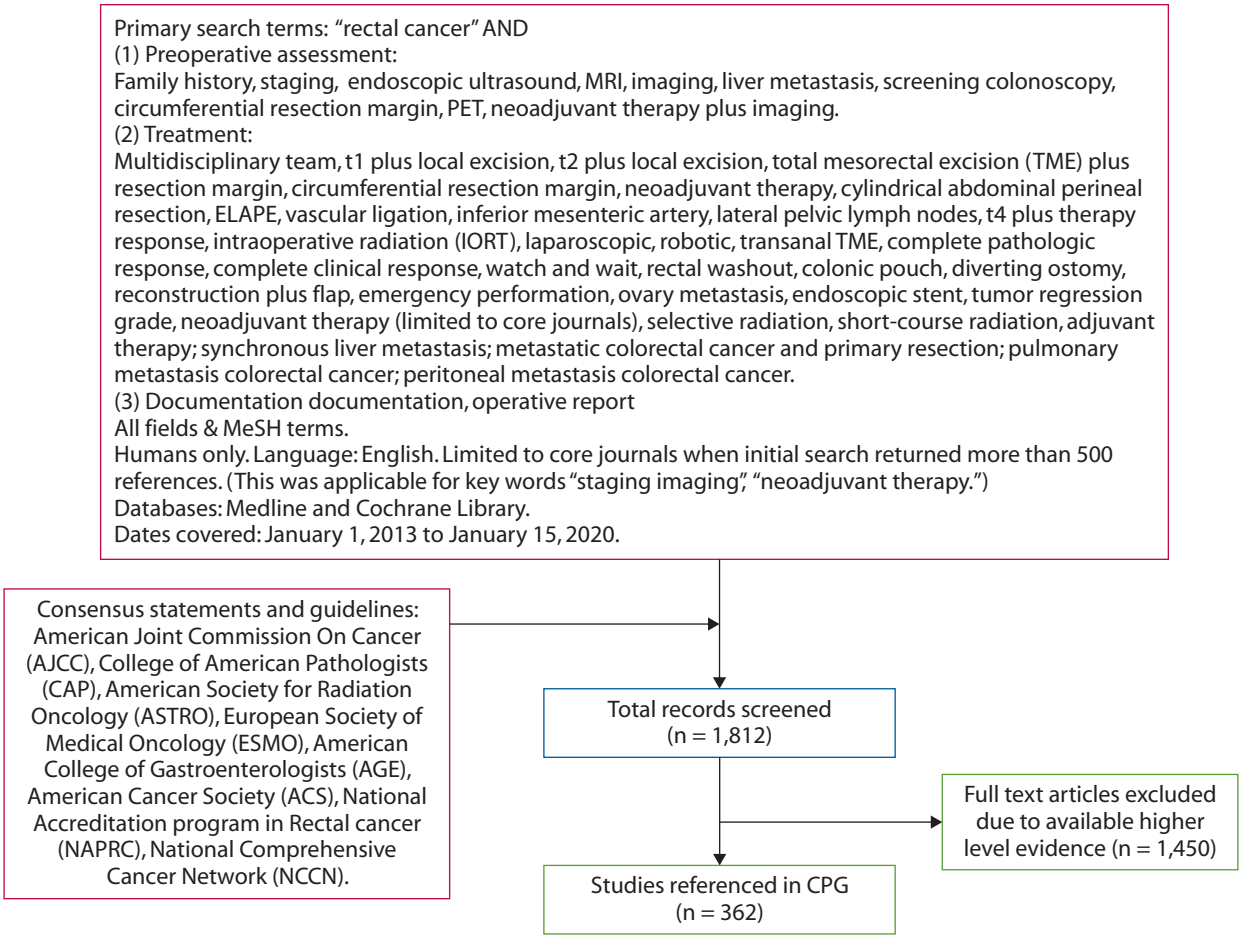

FIGURE 1. PRISMA literature search flow sheet. CPG = Clinical Practice Guideline.

be referred for genetic counseling. Guidelines on the management of patients with inherited colorectal cancer have been previously published.[17,18]

Routine laboratory bloodwork and a CEA level are part of the preoperative evaluation. The baseline CEA level before initiating elective treatment is prognostic of long-term survival and is used as a reference during post-therapy surveillance.[19] Although CEA levels assessed at different time points during multimodality treatment can correlate with treatment response, CEA does not reliably predict pathologic response to neoadjuvant therapy.[20–23] There is insufficient evidence to support the routine use of other tumor markers such as CA19-9 in the evaluation of patients with rectal cancer.[24]

2. As a part of a complete physical examination, the distance of the distal extent of the cancer from the anal verge and the cancer's relation to the sphincter complex should typically be assessed. Grade of recommendation: Strong recommendation based on low-quality evidence, 1C.

Assessment of the relationship between the distal extent of the lesion to both the anorectal ring (ie, top of the sphincter complex) as well as the anal verge is essential for treatment planning and for evaluating the patient's candidacy for sphincter preservation and should ideally be performed before initiating neoadjuvant therapy, which may cause regression of the lesion. The distance should be assessed by digital examination and endoscopically (rigid proctoscopy may provide a more accurate measurement than flexible sigmoidoscopy). Endoscopic tattooing for purposes of anticipated intraoperative localization or to facilitate mucosal surveillance in the event of a clinical complete response may be helpful.[25–29]

3. Before elective treatment, the histological diagnosis of invasive adenocarcinoma should be confirmed, and patients should typically undergo a full colonic evaluation so the treatment plan can address synchronous pathology, as needed. Grade of recommendation: Strong recommendation based on moderate-quality evidence, 1B.

It is important to confirm the histological diagnosis of invasive adenocarcinoma before initiating therapy in the elective setting, because rectal neoplasms of other histologies may be amenable to nonresectional or different multimodality treatment options.[30] Because endoscopic biopsy may be nondiagnostic or incongruent with the clinical

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TABLE 1. The GRADE system: grading recommendations

Grade	*Description*	*Benefit versus risk and burdens*	*Methodologic quality of supporting evidence*	*Implications*
1A	Strong recommendation, High-quality evidence	Benefits clearly outweigh risk and burdens or vice versa	RCTs without important limitations or overwhelming evidence from observational studies	Strong recommendation, can apply to most patients in most circumstances without reservation
1B	Strong recommendation, Moderate-quality evidence	Benefits clearly outweigh risk and burdens or vice versa	RCTs with important limitations (inconsistent results, methodologic flaws, indirect or imprecise) or exceptionally strong evidence from observational studies	Strong recommendation, can apply to most patients in most circumstances without reservation
1C	Strong recommendation, Low- or very-low quality evidence	Benefits clearly outweigh risk and burdens or vice versa	Observational studies or case series	Strong recommendation but may change when higher-quality evidence becomes available
2A	Weak recommendation, High-quality evidence	Benefits closely balanced with risks and burdens	RCTs without important limitations or overwhelming evidence from observational studies	Weak recommendation, best action may differ depending on circumstances or patients' or societal values
2B	Weak recommendations, Moderate-quality evidence	Benefits closely balanced with risks and burdens	RCTs with important limitations (inconsistent results, methodologic flaws, indirect or imprecise) or exceptionally strong evidence from observational studies	Weak recommendation, best action may differ depending on circumstances or patients' or societal values
2C	Weak recommendation, Low- or very-low quality evidence	Uncertainty in the estimates of benefits, risks and burden; benefits, risk, and burden may be closely balanced	Observational studies or case series	Very weak recommendations; other alternatives may be equally reasonable

GRADE = Grades of Recommendation, Assessment, Development, and Evaluation; RCT = randomized controlled trial.
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impression of invasive adenocarcinoma because of a sampling error, repeat endoscopic or operative biopsies may be required to establish the histological diagnosis for purposes of treatment planning. Operative excisional biopsy is typically not performed unless it is done as a curative-intent transanal full-thickness excision with adequate radial margins as discussed in detail later.

Patients newly diagnosed with rectal cancer should typically undergo a full colon evaluation. Although the incidence of synchronous colorectal cancer is low, in the range of 1% to 3%, the incidence of synchronous adenomas or other polyps can be as high as 30%.[31–34] Colonoscopy is a preferred evaluation method because it offers a therapeutic platform to treat synchronous polyps.[35,36] In cases where a colonoscopy is not completed, for instance, due to an obstructing cancer, CT colonography may be used.[37–40] Computed tomography colonography has been shown to be a superior diagnostic study compared with double-contrast barium enema among patients with symptoms suggestive of colorectal cancer and can detect synchronous lesions.[41] In patients receiving neoadjuvant therapy, colonoscopy may be reattempted if there is sufficient tumor regression to permit passage of a colonoscope. If a preoperative colon evaluation is not performed, typically in cases where urgent intervention is needed for obstructing lesions, a complete colonoscopy should be planned postoperatively.

Staging

1. **Rectal cancer should typically be staged according to the American Joint Committee on Cancer TNM system before initiating treatment. Grade of recommendation: Strong recommendation based on moderate-quality evidence, 1B.**

Rectal cancer should be staged according to the TNM system before treatment, except when emergent surgery is required. The TNM system, as defined by the American Joint Committee on Cancer, describes the depth of local tumor invasion (T stage), the extent of regional lymph node involvement (N stage), and the presence of distant metastasis (M stage).[42,43] Updated 8th edition staging definitions categorize lymph nodes harboring micrometastasis (clusters of 20 or more cancer cells or metastases measuring >0.2 mm and <2 mm in diameter) as N1 disease, the presence of tumor deposits (N1c disease) as stage III regardless of the status of the lymph nodes, and peritoneal metastases as M1c disease.[42,43] Rectal cancer should be described by both its initial clinical stage (cTNM), which guides treatment decisions, as well as the final pathologic

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stage (pTNM), which can provide prognostic information.[42] Clinical stage can be further prefixed to designate the staging modality used, including u for ultrasound, mr for MRI, and ct for CT scan. For patients treated with preoperative therapy, pathologic tumor response is reported as ypTNM.[44,45]

2. Rectal cancer protocol pelvic MRI is the preferred modality for locoregional clinical staging. Endorectal ultrasound (EUS) may be considered when differentiating between early T stages (ie, T1 versus T2 tumors) or when MRI is contraindicated. Grade of recommendation: Strong recommendation based on moderate-quality evidence, 1B.

Magnetic resonance imaging staging of rectal cancer, using standardized technical protocols and reporting templates, assesses the depth of tumor penetration, presence of locoregional nodal metastases, and the relationship between lesions (tumor and/or nodes) within the mesorectum and the mesorectal fascia.[46,47] Thus, MRI can help predict surgical clearance of the circumferential resection margin (CRM), the shortest distance between disease (tumor and/or malignant nodes) and the mesorectal fascia.[47–49] A positive CRM has been variably defined as cancer within 1 mm or within 2 mm[50,51] of the mesorectal fascia or levator ani muscle; the National Comprehensive Cancer Network currently defines it as within 1 mm.[52] A positive CRM is associated with increased risk for local recurrence and decreased survival (5-year local recurrence: HR = 3.50; 95% CI, 1.53–8.00; $p < 0.05$; 5-year overall survival: HR = 1.97; 95% CI, 1.27–3.04; $p < 0.01$).[53–55] Primary tumor features including T4 status, extramural vascular invasion, CRM within 1 mm, or extramural tumor depth of at least 5 mm are considered high-risk features.[56,57] These factors should be considered as a critical part of clinical staging and are vital for planning preoperative therapy as discussed in Multidisciplinary Treatment Planning.

Endorectal ultrasound should typically be considered complementary to MRI for purposes of clinical staging and is most useful in differentiating between early T stages (ie, T1 versus T2 tumors).[57] Magnetic resonance imaging may also be contraindicated when certain implantable medical devices are present (ie, metallic implants, MR incompatible pacemakers).[58,59] Disadvantages of EUS include operator dependency, limited accuracy in assessing bulky or locally advanced lesions, patient discomfort, and inability to evaluate stenotic lesions that preclude passage of the transducer.[58,59]

Accurately staging potentially involved pelvic lymph nodes (including mesorectal, lateral pelvic, and inguinal compartments) remains a diagnostic challenge for all imaging modalities.[60] Sensitivity and specificity for clinical nodal staging have been reported as 55% and 74% for CT, 67% and 78% for EUS, and 66% and 76% for MRI.[48,61] Nodal staging accuracy may be improved by incorporating criteria such as a spiculated border and mixed signal intensity as seen on MRI.[57,62,63]

3. Clinical staging for metastatic disease should typically be conducted in patients with rectal cancer. Grade of recommendation: Strong recommendation based on moderate-quality evidence, 1B.

Clinical staging of distant metastatic disease should typically be completed before initiating treatment, because the presence of metastatic disease influences the treatment plan. In patients with metastatic rectal cancer from the Swedish Cancer Registry, the most common sites of metastasis were liver (70%), lung (47%), bone (12%), and nervous system (8%).[64] Clinical staging should typically include contrast-enhanced CT scan of the chest, abdomen, and pelvis. Pulmonary CT, with its increased sensitivity and better ability to arbitrate otherwise indeterminate lesions over time, is recommended rather than chest x-ray.[65,66] Computed tomography without intravenous contrast followed by triphasic (arterial, venous, and portal) contrast is generally the modality of choice for detecting and characterizing hepatic lesions.[67–69] For smaller lesions, and to evaluate a liver with background fatty liver changes, MRI may be superior to multidetector CT and positron emission tomography (PET).

There is insufficient evidence to support the routine use of PET/CT alone in the clinical staging of primary rectal cancer.[60] Although PET/CT has been used for staging patients with suspected disease recurrence or for excluding other sites of distant disease in patients with stage IV rectal cancer being considered for curative-intent surgery, the evidence supporting added clinical value is limited.[70,71] Positron emission tomography /CT may have a role in evaluating equivocal findings on contrast-enhanced CT.[72,73]

4. Restaging evaluation should be considered after neoadjuvant therapy in patients with locally advanced rectal cancer. Grade of recommendation: Strong recommendation based on low-quality evidence, 1C.

Restaging evaluation consisting of clinical and endoscopic assessment and cross-sectional imaging should typically be considered after neoadjuvant therapy, in particular, if the assessment of local tumor response would influence the need for additional therapy and/or alter the surgical approach, or if there is a unique concern for interval development of metastatic disease. Importantly, restaging evaluates patients for a possible clinical complete response (cCR) and can adjust patient expectations. Some studies have demonstrated a change in treatment strategy after restaging in 11% to 15% of patients, typically due to identification of metastatic disease, but others have shown limited or no benefit to restaging.[74,75] Although restaging is typically performed by repeating the same imaging studies that were done initially, the assessment of tumor response

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to neoadjuvant therapy has been challenging because of limited T and N staging accuracy for MRI, CT, or EUS in this setting.[76–79] Advanced functional MRI (ie, diffusion-weighted MRI) and/or PET/CT scan may potentially improve the accuracy of assessing treatment response.[70,80]

Multidisciplinary Treatment Planning

1. **The treatment of patients with rectal cancer should typically incorporate a multidisciplinary team tumor board discussion. Grade of recommendation: Strong recommendation based on low-quality evidence, 1C.**

Optimal management of patients with rectal cancer requires input and coordination among a team of clinicians including expertise from surgery, pathology, radiology, radiation, and medical oncology, and other ancillary team members. Although discussion of rectal cancer management by an multidisciplinary team can improve preoperative clinical staging, modify and individualize multimodality treatment, plan technical aspects of surgery, and review pathologic staging, more studies are needed to demonstrate a potential impact on disease-free and overall survival (OS).[81–83]

2. **If either a temporary or permanent ostomy is being considered, preoperative education and stoma site marking should typically be performed. Grade of recommendation: Strong recommendation based on moderate-quality evidence, 1B.**

Consultation with an enterostomal therapist is typically recommended for patients whose rectal cancer treatment may involve stoma creation. Preoperative stoma site marking and patient education can improve time to ostomy proficiency and decrease ostomy-related complications.[84–86] Guidelines on stoma marking and surgery have been previously published.[87,88]

TREATMENT

Surgical Techniques and Operative Considerations

Local Excision

1. **Local excision is an appropriate treatment modality for carefully selected patients with cT1N0 rectal cancer without high-risk features. Grade of recommendation: Strong recommendation based on moderate-quality evidence, 1B.**

Local excision is an acceptable curative-intent treatment in highly selected patients with cT1N0 rectal cancer with favorable clinical and histological features. Transanal excision may also be appropriate for patients with more advanced cT disease but who are considered medically unfit for radical cancer surgery. Whereas local excision offers advantages of minimizing operative risk and functional sequelae, it does not adequately remove or pathologically stage the mesorectal lymph nodes. The risk of occult nodal metastasis from T1 lesions ranges from 6% to 11% with greater risk associated with pathologic features such as SM3 invasion, poor differentiation, tumor budding, and lymphovascular or perineural invasion.[89,90] Accurate preoperative staging and careful patient selection are essential when contemplating local excision. Distinguishing early depth of invasion (ie, Tis, T1, T2) may be difficult with MRI, and EUS may be utilized as a complementary staging tool in certain situations. Clinical criteria for local excision typically include small (<3 cm) adenocarcinomas limited to <30% of the rectal circumference, that are well or moderately differentiated, without lymphovascular invasion, perineural invasion, tumor budding on tissue biopsy, and no clinical nodal involvement, and that are accessible transanally for full-thickness excision.[52] Given our current understanding of the applicability of local excision, the grade of this statement has been changed from a 2B in the 2013 guidelines to a 1B.[10]

Technically, local excision involves full-thickness excision, ideally with a ≥10 mm grossly normal circumferential margin with a depth down to perirectal fat providing a minimum of a 2-mm-deep margin.[52] The surgeon should typically orient the specimen to facilitate pathologic assessment, and tangential, piecemeal, or fragmented excision should be avoided, if possible. The procedure can be performed as a conventional transanal excision or by using a transanal endoscopic platform like transanal endoscopic microsurgery (TEMS) or transanal minimally invasive surgery (TAMIS). While there is a paucity of well-designed randomized, controlled trials, studies suggest that TEMS offers better visualization and access to more proximal lesions than conventional transanal excision, and TEMS and TAMIS appear to be comparable.[91–93] Endoscopic submucosal dissection, an advanced colonoscopic procedure, can potentially treat lesions with very superficial submucosal invasion, but the optimal patient selection criteria for this approach remain controversial.[94]

The rate of local recurrence following local excision varies from 7% to 21% for T1 lesions and is consistently higher than that after radical resection.[95–97] Patients should appreciate that if pathologic examination reveals significant risk factors like deeper T stage, inadequate margins, poor differentiation, deep submucosal (SM3) invasion, tumor budding, or lymphovascular or perineural invasion, subsequent radical resection will typically be recommended.

In general, local excision is considered an oncologically inadequate treatment for cT2 lesions because the local recurrence rate ranges from 26% to 47%, and these tumors have an elevated risk for harboring occult nodal disease.[98] Radical resection should typically be recommended under these circumstances.

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When patients with high-risk T1 and T2 lesions refuse radical resection or prioritize sphincter preservation, adjuvant chemoradiation in combination with local excision has been considered. In a systematic review of patients with pT1/T2 rectal lesions removed by local excision, those who went on to receive adjuvant chemoradiation (n = 405) were compared to those who underwent radical resection (n = 130). Despite the limited retrospective data and selection bias, the weighted average local recurrence rates for adjuvant chemoradiation and radical resection were 10% (95% CI, 4–21) versus 6% (95% CI, 3–15) for pT1 lesions and 15% (95% CI, 11–21) versus 10% (95% CI, 4–22) for pT2 lesions.[99] Thus, in high-risk patients who refuse or are unfit for radical resection, adjuvant chemoradiation should typically be recommended after local excision and should be followed by surveillance for a potentially salvageable recurrence.[100]

Local excision has also been performed after neoadjuvant chemoradiation for select T1/T2 lesions. This approach has been studied in clinical trials.[101–104] Two prospective trials randomly assigned 50[104] and 47[103] patients with cT2 rectal cancer to neoadjuvant chemoradiation and local excision versus standard resection. Long-term data reported no statistically significant differences in local recurrence or disease-free survival. However, a pooled analysis demonstrated high rates of morbidity (22.3%), in particular, postoperative pain and suture line dehiscence (9.7% for each).[105,106] These patients require counseling regarding possible long-term outcomes, and the safety and efficacy of this approach remain unestablished in routine clinical practice.

Radical Resection

1. **A thorough surgical exploration should typically be performed at the time of operation. Grade of recommendation: Strong recommendation based on low-quality evidence, 1C.**

Surgical exploration should typically include a thorough assessment of the peritoneal cavity and the abdominal organs to detect or rule out metastatic disease (eg, radiographically occult metastasis, carcinomatosis), more advanced local disease (eg, fixation to adjacent organs), synchronous lesions, or coexisting pathology.[107] Unexpected findings that impact the operative plan and the decision to proceed with the operation should, ideally, be discovered before ligating the vascular pedicle and committing to a resection.

2. **For curative resection of tumors of the upper third of the rectum, a tumor-specific mesorectal excision should typically be performed as part of a low anterior resection (LAR) with the mesorectum divided, ideally, at least 5 cm below the distal margin of the tumor. For tumors of the middle and lower thirds of the rectum, total mesorectal excision (TME) should typically be performed as a part of an ultralow anterior resection or abdominoperineal resection (APR). A 2-cm distal mural margin is usually adequate for distal rectal cancers when combined with TME. A 1-cm distal mural margin is generally acceptable for cancers located at or below the mesorectal margin. Grade of recommendation: Strong recommendation based on the high-quality evidence, 1A.**

Appropriate surgical technique is integral to optimizing oncological outcomes and minimizing morbidity, and should follow the principles and anatomic planes of a TME. Dissection between the visceral and parietal layers of the endopelvic fascia facilitates en bloc removal of the rectal cancer and associated mesentery, lymphatics, and tumor deposits. Mesorectal excision can preserve the autonomic nerves and reduce intraoperative bleeding and the rate of local recurrence.[108] Among patients registered in Medical Research Council (MRC) CR07 and NCIC-CTG CO16 trial, the 3-year local recurrence rate was 4% for the group with a good (ie, mesorectal) plane of dissection compared with 13% for the group with a poor (ie, muscularis propria) plane of dissection ($p = 0.003$).[109]

Importantly, distal mesorectal spread of rectal cancer often extends further than distal intramural spread. Although distal intramural spread is relatively uncommon (found beyond 1 cm from the distal edge of the intraluminal cancer in only 4% to 10% of rectal cancers), deposits of distal mesorectal nodal spread can occur up to 3 to 4 cm distal to the primary cancer.[110,111] To address the propensity for both intramural and mesorectal involvement, for tumors of the upper rectum, the mesorectal excision should typically extend 5 cm below the distal edge of the tumor; for tumors of the middle and lower rectum, a TME (ie, excision of all mesorectum to its most distal extent) is required with a distal rectal resection margin of, ideally, at least 2 cm. For tumors of the very distal rectum at or below the mesorectal margin, a mural margin of 1 cm appears acceptable in conjunction with a TME in appropriately selected patients.[112] Even shorter distal margins may be acceptable in selected patients who are highly motivated for sphincter preservation and who have demonstrated favorable tumor regression after neoadjuvant therapy.[113–115] In cases where preoperative anal function and distal pathologic clearance are adequate, TME may be followed by creation of an ultralow colorectal anastomosis or coloanal anastomosis. In cases where the tumor directly involves the anal sphincter or the levator muscles, where there is loss of integrity of the intersphincteric plane, or where a margin-negative resection of the tumor would result in unacceptable sphincter function, an APR should typically be performed.

In addition to addressing the distal resection margin, obtaining an adequate CRM is critical, because a positive CRM independently predicts worse local recurrence and

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disease-free survival (DFS).[109,116] A positive CRM is more likely when disease (tumor, adenopathy, or tumor deposit) is present within 1 mm of the mesorectal fascia[55] and/or when an inappropriate dissection plane within the mesorectum is used rather than a TME.[109]

Abdominoperineal resection, compared with LAR, has historically been associated with higher risks for a positive CRM and tumor perforation, which are adverse prognostic indicators for local recurrence and reduced OS.[117–121] Extralevator abdominoperineal excision (ELAPE), a surgical technique that emphasizes wide division of the levator ani muscle en bloc with the rectum and the anal canal, aims to minimize the risks of CRM positivity and intraoperative tumor perforation and results in a cylindrical pathologic specimen without the "waist" typically seen after conventional APR.[122–124] The procedure can be performed in a lithotomy or prone jackknife position and is associated with larger perineal defects and increased risk for perineal wound complications like hernia and poor wound healing.[125] Although the conclusions of systematic reviews comparing ELAPE and conventional APR have been inconsistent, ELAPE is likely best used selectively in the subgroup of patients with bulky and locally advanced rectal cancers that involve the levator muscle, are anteriorly located, or are otherwise at higher risk for intraoperative perforation.[126–131]

3. Vascular ligation at the origin of the superior rectal artery with resection of the associated lymphatic drainage is typically appropriate for rectal cancer resection. Grade of recommendation: Strong recommendation based on moderate-quality evidence, 1B.

Curative resection of rectal cancer involves removing the blood supply and lymphatics from the origin of the superior rectal artery. Ligating the inferior mesenteric artery (IMA) just distal to the takeoff of the left colic artery at the origin of the superior rectal artery has been termed "low tie," whereas ligating the IMA at its takeoff from the aorta has been termed "high tie." Routine low tie with resection of all associated lymphatic tissue is typically appropriate for rectal cancer resection.[107,132] Given the evidence, this guideline grade was adjusted from a 1A in 2013 to a 1B.

High tie of the IMA with resection of associated lymph nodes is indicated in selected patients when clinically suspicious lymph nodes are present at the level of the IMA. Nodal metastasis at this level is prognostic for systemic spread including extended periaortic nodal metastases.[133,134] Suspicious periaortic lymph nodes should typically be biopsied, and a more extended lymph node dissection can be performed at the discretion of the surgeon.[107] A high tie may also be indicated when vascular ligation at the level of the IMA is needed to provide mobilization to afford adequate length for a tension-free anastomosis.

There is currently insufficient evidence to support routine high tie practice. This technique raises a theoretical concern for possible increased risk of anastomotic leak, and its purported oncologic superiority remains unestablished. Systematic reviews comparing low tie and high tie have shown no significant differences in blood loss, surgical times, defecatory function, postoperative complications, or survival, whereas low tie has been shown to better preserve genitourinary function.[135,136]

4. In the absence of a clinically positive lymph node in the lateral pelvic compartment, routine lateral pelvic lymph node dissection is not typically required. Grade of recommendation: Strong recommendation based on low-quality evidence, 1C.

Lateral pelvic lymph node dissection (LPLND) removes the nodal compartment along the common iliac, internal iliac, and obturator arteries. A meta-analysis including 5502 patients from 20 studies (only one was randomized) compared TME with LPLND to TME without LPLND and found that LPLND did not confer a significant survival benefit, but increased male urinary and sexual dysfunction was suggested.[137] Nonetheless, since the lateral compartment is an area of concern for recurrent disease that may be difficult to salvage, ipsilateral LPLND of clinically positive lateral pelvic nodes is indicated.[138,139] Although the size criteria for a "clinically positive" lymph node in this setting remains controversial, the International Lateral Node Study Consortium found that patients with lateral pelvic nodes of more than 7 mm in the short axis on pretreatment MRI experienced significantly less local recurrence when treated with chemoradiation, TME, and LPLND (5.7%) in comparison with chemoradiation and TME without LPLND (19.5%, $p = 0.04$).[139] For patients with clinically negative lateral nodes at diagnosis, the JCOG0212 trial randomly assigned 701 patients who were not treated with chemoradiation to TME versus TME plus LPLND. Among the 328 patients who underwent LPLND, the rate of pathologically positive lateral pelvic nodes was 7.3%.[140] Tumor below the peritoneal reflection (OR = 8.95; 95% CI, 1.18–68.04; $p = 0.03$) and lateral pelvic node > 5 mm at diagnosis (OR = 4.06; 95% CI; 1.59–10.34; $p = 0.003$) were associated with pathologically positive lateral nodes.[140] In the setting of no neoadjuvant chemoradiation, the TME plus LPLND group had a lower local recurrence rate than the TME group (7.4% versus 12.6%, $p = 0.02$) although no difference in 5-year relapse-free survival (73.3% versus 73.4%).[141]

5. In patients with T4 rectal cancer, curative-intent resection of involved adjacent organs should typically be performed en bloc. Grade of recommendation: Strong recommendation based on moderate-quality evidence, 1B.

Curative-intent surgical management of patients with T4 rectal cancer should aim to achieve an R0 (microscopically

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negative) resection margin, because surgical margin is a key determinant of overall prognosis.[142,143] R0 resection in these patients often requires an extended or multivisceral resection with dissection beyond the TME plane.[144] Careful preoperative evaluation is necessary to assess the likelihood of surgical curability, plan neoadjuvant therapy, and orchestrate a multispecialty surgical team. Magnetic resonance imaging can predict rectal cancers that are unlikely to be amenable to a curative resection.[145] Patients with disease invading adjacent organs within the central pelvic compartment, typically amenable to an R0 resection, usually undergo neoadjuvant chemoradiation which can decrease the risk of local failure.[101] Patients with disease breaching the central compartment and extending to the lateral pelvic sidewall and/or sacrum are more challenging; preoperative therapy in these patients aims to induce tumor regression and may include both systemic chemotherapy and otherwise standard chemoradiation as discussed in Multidisciplinary Treatment Planning.[146,147]

There is ongoing controversy regarding the most appropriate management of patients with tumor extension into an adjacent organ who undergo neoadjuvant therapy and experience a response such that the cancer no longer involves the adjacent structure. Although these patients, classically, have undergone en bloc resection of the previously involved tissues, an alternative approach involves individualizing therapy by changing the management strategy to allow for preservation of a pelvic organ or the anal sphincter complex. In a retrospective series of 101 patients with mrT4b disease, of 67 patients whose post-neoadjuvant restaging MRI showed significant tumor downstaging, a change in the surgical strategy allowing organ preservation was feasible in 42 patients (63%), and the responders' 3-year local recurrence rate was 14%; the local recurrence rate among the 34 nonresponders who had an inadequate response to neoadjuvant therapy was significantly higher (32%; HR = 1.6; 95% CI, 1.02–2.59; $p = 0.04$).[148]

6. Intraoperative radiation therapy may be used in selected patients with microscopically involved (R1) or close resection margins. Grade of recommendation: Weak recommendation based on low-quality evidence, 2C.

Intraoperative radiation therapy (IORT), a dose escalation tool to potentially improve local control, allows targeted delivery of a high fraction of radiation to a resection bed intraoperatively and is available as high-dose rate IORT and intraoperative electron radiation therapy. Although reported doses range between 10 Gy and 20 Gy, the exact dose is tailored to margin status and the nature of the radiated tissue.[149]

The utility of IORT remains controversial. A systematic review and meta-analysis including 3003 patients with colorectal cancer treated with IORT from 14 prospective and 15 retrospective studies reported that IORT was used to treat locally advanced primary cancer in 61% of the patients and locally recurrent disease in 39% of the patients.[150] There is no role for routine IORT in the setting of an optimal R0 resection. A randomized, controlled trial of 142 patients with locally advanced primary rectal cancer treated with neoadjuvant chemoradiation and resection with or without IORT showed that 5-year local control exceeded 90% in both arms and that there was no added benefit to IORT.[151]

The most commonly reported indications for IORT are microscopically positive (R1) or narrowly negative (2 mm or less tumor-free margin) colorectal cancer resection margins, as determined by intraoperative frozen pathologic assessment.[150,152–154] Retrospective studies regarding the use of IORT for selected patients with high-risk primary rectal cancers have reported favorable 5-year local control rates of over 85%.[149,150] Intraoperative radiation therapy in the setting of locally recurrent rectal cancer has been associated with 5-year local control rates ranging from 25% to 79%, although patient selection bias influences these outcomes.[150] Despite the heterogeneity of the available studies, an aggregate review of comparative studies of patients with colorectal cancer reported that IORT was associated with improved local control (pooled OR = 0.22; 95% CI, 0.05–0.86; p=0.03) and improved DFS (HR = 0.51; 95% CI, 0.31–0.85; $p = 0.009$) compared with patients who did not receive IORT.[150]

The complications most commonly attributed to IORT are wound infection and pelvic abscess, with reported rates of 25% or more.[149] The large systematic review summarized above showed that IORT was associated with increased wound complications (OR = 1.86; 95% CI, 1.03–3.38; $p = 0.04$) but not overall (OR = 1.13; 95% CI, 0.77–1.65; $p = 0.57$), urologic (OR = 1.35; 95% CI, 0.84–2.82; $p = 0.47$), or anastomotic (OR = 0.94; 95% CI, 0.42–2.1; $p = 0.98$) complications.[150]

7. Minimally invasive approaches to TME can be considered and should typically be performed by experienced surgeons with technical expertise. Grade of recommendation: Strong recommendation based on high-quality evidence, 1A.

Minimally invasive surgery (MIS) for rectal cancer improves short-term perioperative outcomes, but, in contrast to MIS for colon cancer, the long-term oncologic results of MIS for rectal cancer remain unclear.[155] Randomized, controlled trials have raised concerns regarding the pathologic outcomes of laparoscopic resection for rectal cancer, and the impact of these outcomes on long-term survival is still being elucidated. Before 2015, 3 phase III trials (COLOR II, CLASICC, and COREAN) randomly assigned patients with rectal cancer to laparoscopic versus open resection.[153–157] All 3 trials showed no significant differences in 3-year local recurrence rates or 5-year DFS rates; however, the CLASICC trial, which randomly as-

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signed 794 patients at a 2:1 ratio to laparoscopic versus open resection, reported a slightly higher, although not statistically significant, CRM positivity rate in the laparoscopic group (16% versus 14%; $p = 0.8$).[156–159] Given the currently available literature, the statement grade regarding MIS for rectal cancer was changed from a 1B in the 2013 guidelines to a 1A.[10]

Two more recent phase III, randomized, controlled trials each failed to demonstrate noninferiority of laparoscopy compared with open surgery for rectal cancer when composite pathologic end points were examined. The ACOSOG Z6051 trial randomly assigned patients with rectal cancer to laparoscopic (n = 244) or open (n = 222) surgery and reported that the composite primary end point (CRM >1 mm, negative distal margin, and TME completeness) was met in significantly fewer patients in the laparoscopic arm (81.7%; 95% CI, 76.8%–86.6% versus 86%; 95% CI, 82.5%–91.4%).[160] The Australian trial, ALaCaRT, similarly determined the success of resection using a composite end point after randomly assigning patients to laparoscopy (n = 238) or open (n = 237) surgery. Successful resection was achieved in significantly fewer patients in the laparoscopic arm (82% versus 89%; risk difference of –7.0%; 95% CI, –12.4% to ∞; $p = 0.38$ for noninferiority).[161] Meta-analyses of randomized, controlled trials have reported higher rates of incomplete resection defined as failure to resect an intact mesorectum with no defects deeper than 5 mm and no coning toward the distal margin (13.2% versus 10.4%; RR = 1.31; 95% CI, 1.05–1.64; $p = 0.02$) in the laparoscopic groups.[162,163]

Although the pathologic outcomes related to MIS rectal cancer surgery are concerning, available survival outcomes from the relevant trials are still limited to less than a 5-year median follow-up duration. In the ACOSOG Z6051 trial, 462 patients were eligible for survival analysis at a median of 3.9 years after laparoscopic (n = 240) or open (n = 222) resection.[164] The surgical approaches did not differ with respect to 2-year DFS (laparoscopic 79.5%; 95% CI, 74.4–84.9 versus open 83.2%; 95% CI, 78.3–88.3), and had similar rates of locoregional recurrence (laparoscopic 4.6% versus open 4.5%), and distant recurrence (laparoscopic 14.6% versus open 16.7%). In this trial, worse DFS was associated with unsuccessful resection (HR = 1.87; 95% CI, 1.21–2.91), defined as the composite of incomplete specimen (HR = 1.65; 95% CI, 0.85–3.18), positive CRM (HR = 2.31; 95% CI, 1.40–3.79), and positive distal margin (HR = 2.53; 95% CI, 1.30–3.77).[164] In the ALaCaRT trial, 450 patients (225 laparoscopic and 225 open resections) were followed for a median of 3.2 years. The 2 groups did not significantly differ in 2-year local recurrence rate or 2-year DFS. Because event rates were low at the 2-year interval, longer follow-up is needed to better evaluate the oncologic impact of the surgical approach.[165]

Data regarding robotic rectal cancer surgery have yet to mature. The ROLARR trial randomly assigned patients to robotic (n = 237) versus laparoscopic (n = 234) rectal cancer surgery and did not demonstrate a significant reduction in the conversion rate (the primary end point) and showed no difference in the CRM positivity rate (5.1% robotic versus 6.3% laparoscopic; adjusted OR = 0.78; 95% CI, 0.35–1.76; $p = 0.56$).[166] A meta-analysis of 1305 patients with rectal cancer from 8 randomized trials comparing robotic (n = 647) versus laparoscopic (n = 658) surgery showed lower rates of conversion to open in the robotic group (5.7% versus 11.9%; 95% CI, 1.36–3.61; $p = 0.001$). Pathologic outcomes including resection margin status and number of lymph nodes harvested were similar between the groups, but no comparisons of oncologic outcomes were reported.[167–169]

8. Transanal total mesorectal excision (taTME) remains controversial with regard to perioperative and long-term oncologic outcomes. Grade of recommendation: Strong recommendation based on moderate-quality evidence, 1B.

Transanal TME (taTME), proposed to overcome some of the technical challenges of laparoscopic distal mesorectal surgery, builds on the techniques developed for transabdominal–transanal operations, TEMS and TAMIS. A systematic review of 7 retrospective studies comparing taTME (n = 270) with laparoscopic TME (n = 303) showed shorter operation times (weighted mean difference = –23.45; 95% CI, –37.43 to –9.46; $p < 0.01$) and a lower conversion rate (OR = 0.29; 95% CI, 0.11–0.81; $p = 0.02$) for the taTME approach, and other systematic reviews have confirmed these trends.[170–172]

TaTME has been reported to be associated with a technical learning curve of approximately 40 cases.[173,174] Intraoperative adverse events reported by the International taTME Registry include dissecting incorrect tissue planes during the perineal phase of operation with attendant injuries to the urethra, bladder, vagina, and rectum; problems maintaining pneumopelvis have also been reported.[175] Recently, a collaborative retrospective study from 2 international taTME registries highlighted 25 cases of carbon dioxide (CO_2) embolism among 6375 cases, yielding an estimated incidence of 0.4%.[176] CO_2 embolism under these circumstances occurs in the setting of venous bleeding and pneumopelvis and may be manifested by a fall in the end-tidal CO_2 (in 88% of the reported cases) or hemodynamic instability (in 52% of the reported cases) potentially leading to cardiovascular collapse requiring cardiopulmonary resuscitation.[176,177] When a CO_2 embolism is suspected, pneumopelvis should be released, the patient should be placed in left lateral decubitus and Trendelenburg position, and appropriate hemodynamic support should be instituted.[177]

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A systematic analysis of 17 studies comparing 600 patients undergoing taTME and 639 patients undergoing laparoscopic/robotic TME found that taTME was associated with a lower risk of CRM positivity (OR = 0.47; 95% CI, 0.29–0.75; $p = 0.002$).[170] However, a Norwegian case review of 110 taTME procedures found a local recurrence rate of 9.5% after a short, median postoperative interval of only 11 months.[178] The atypical recurrence pattern after taTME was described as rapid and multifocal in the pelvis and along the sidewalls, and recurrence was not always associated with intraoperative technical issues. These data led to a moratorium on taTME by the Norwegian health authorities until a national audit was completed.[178] Controversy regarding this approach persists, given its learning curve, the concern for complications, and the lack of long-term oncologic outcomes data. A multicenter, randomized, controlled trial comparing taTME with laparoscopic TME (COLOR III) is expected to enroll 1098 patients and may provide additional insight into this technique.[179]

9. Patients with an apparent complete clinical response to neoadjuvant therapy should typically be offered radical resection. A "watch and wait" management approach can be considered for highly selected patients in the context of a protocolized setting. Grade of recommendation: Strong recommendation based upon moderate-quality evidence, 1B.

Neoadjuvant chemoradiation therapy has been associated with a pathologic complete response (pCR) rate of up to 20% or higher.[180] The response rate varies by the neoadjuvant regimen used and the interval between treatment completion and response assessment.[181] Patients who achieve pCR have no gross or microscopic residual tumor in their surgical specimens and can generally expect excellent long-term outcomes.[182–184] However, there is currently no reliable way to accurately identify patients with a pCR short of histologically evaluating a TME resection specimen. For this reason, radical resection is typically offered to patients after completing neoadjuvant therapy.

Response to neoadjuvant therapy can be assessed clinically and a cCR is characterized by 1) no palpable tumor on digital rectal examination, 2) no visible pathology other than a flat scar on endoscopy, and 3) no evidence of disease on cross-sectional imaging.[185] The need for radical resection in the setting of an apparent cCR has been called into question, in particular, if this strategy would jeopardize sphincter preservation; however, a major concern is that the correlation between cCR and pCR is poor, and confident patient selection, in terms of which patients will actually have a pCR, remains elusive.

Endoscopic assessment alone is insufficient to accurately identify cCR. In a correlation study, 70 of 93 patients (75%) with no disease identified by clinical examination and endoscopy had pathologic foci of tumor found at the time of resection.[186] In another series, 19 of 31 patients with a pCR (61%) after neoadjuvant chemoradiotherapy had a residual mucosal abnormality preoperatively.[187] Because up to 17% of patients with no mural disease (ypT0) may still harbor lymph node metastasis, clinical and endoscopic assessment of response alone cannot reliably predict pCR or obviate the need for radical excision.[188] Cross-sectional imaging with CT, MRI, or PET help identify patients with a cCR.[189–191] Postneoadjuvant MRI can show fibrosis as low signal intensity on T2-weighted images and residual tumor as high signal intensity on diffusion-weighted images and assesses extraluminal disease.[189,190]

Despite concerns regarding oncologic adequacy, a "watch and wait" nonoperative approach has been explored in selected patients who achieve a cCR, given the risks of and reluctance for undergoing radical resection in the setting of a possible pCR.[192–196] Evidence supporting this approach includes a pooled 2-year local recurrence rate of 15.7% (95% CI, 11.8–20.1) and that salvage surgery has been feasible in 83.8% to 95.4% of patients with a recurrence.[197–199] Data from the International Watch & Wait Database indicate that 97% of regrowth occurring during the first 2 years was local within the bowel wall.[200] When "watch and wait" patients were compared to patients who underwent radical resection and were found to have pCR, no differences in OS were detected in an early meta-analysis, but a more recent retrospective study showed inferior 5-year OS (73%; 95% CI, 60%–89% versus 94%; 95% CI, 90%–99%) as well as worse DFS (75%; 95% CI, 62%–90% versus 92%; 95% CI, 87%–98%) in "watch and wait" patients.[201] In addition, a higher rate of distant metastasis was observed among "watch and wait" patients who had local recurrence versus those who did not (36% versus 1%, $p < 0.001$).[201] High-quality, prospective data with longer follow-up and larger sample sizes are necessary to better evaluate the "watch and wait" approach. Therefore, a "watch and wait" management approach can be implemented after informed consent in highly selected patients who achieve a cCR in a protocolized setting with a defined follow-up regimen.

10. In patients undergoing a TME, rectal washout may be considered. Grade of recommendation: Weak recommendation based on low-quality evidence, 2C.

Because viable exfoliated malignant cells have been demonstrated in the lumen of patients undergoing rectal cancer resection, circular staplers used to create colorectal anastomoses may provide a mechanism by which tumor cells can implant.[202] A rectal washout can be undertaken before stapling to potentially reduce the burden of exfoliated cells in the rectal lumen, possibly reducing recurrence due to this mechanism. Two meta-analyses using nonrandomized data show a lower local recurrence rate associated with using rectal washout, although the comparative patient groups were not controlled for other potential confounders for local recurrence.[203,204]

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11. During LAR, a colonic reservoir may be considered. Grade of recommendation: Weak recommendation based on moderate-quality evidence, 2B.

Low anterior resection syndrome with postoperative bowel dysfunction that may include urgency, clustering, and increased frequency of bowel movements, and fecal incontinence has been attributed, in part, to the loss of the reservoir function of the rectum after proctectomy.[205] Various surgical techniques have been developed, including colonic J-pouch, transverse coloplasty, and the side-to-end (Baker) colorectal anastomosis to augment the residual reservoir after proctectomy and potentially improve postoperative function. Overall, meta-analyses have not demonstrated substantial differences among these options in terms of the risks of anastomotic leak or stricture or the need for reoperation, owing to wide, overlapping confidence intervals, and there are limited data regarding long-term functional outcomes.[206,207] A colonic J-pouch has been shown to reduce bowel frequency and urgency for up to 18 months postoperatively compared with a straight, end-to-end anastomosis.[206–208] Studies comparing colonic J-pouch to side-to-end anastomosis have shown similar outcomes, whereas evidence supporting the use of transverse coloplasty is more limited.[208–211]

12. During LAR, assessment of anastomotic integrity should typically be performed. Grade of recommendation: Strong recommendation based on moderate-quality evidence, 1B.

The reported incidence of anastomotic leak after LAR ranges from 3% to 23% with the variation possibly influenced by the differences in patient populations and in surgical techniques, use of neoadjuvant radiotherapy, formation of a diverting ostomy, definition of an anastomotic leak, and use of different radiological modalities to demonstrate a leak.[212,213] Anastomotic leak contributes to postoperative morbidity and has been associated with decreased OS and increased local recurrence.[214–217]

Intraoperative maneuvers to assess an anastomosis, including leak testing, endoscopic examination, and microperfusion evaluation, facilitate immediate intervention which, in turn, may reduce subsequent leak-related complications. Options for intraoperative correction include primary suture repair, taking down the faulty anastomosis and constructing a new anastomosis, and/or creating a diversion. Performing a leak test has been associated with lower leak rates in systematic reviews of retrospective data, presumably by facilitating intraoperative correction.[218,219] A positive intraoperative leak test can occur in 1.5% to 24.7% of cases and is associated with a significant risk of having a subsequent clinical leak in comparison with a negative leak test (11.4% versus 4.2%, $p < 0.001$).[219,220] Although intraoperative endoscopic evaluation of the anastomosis can detect anastomotic defects, systematic reviews do not demonstrate a difference in the anastomotic complication rate related to performing an on-table endoscopy.[219,220] Intraoperative assessment using autofluorescent dyes, such as indocyanine green (ICG), can assess anastomotic perfusion. Pooled analysis of nonrandomized data showed that fluorescence imaging significantly reduced the leak rate after rectal cancer surgery (ICG group with 555 patients: 1.1% versus non-ICG group with 747 patients: 6.1%; $p = 0.02$), but prospective data from randomized trials are not yet available.[218,221]

13. A diverting ostomy should be considered after LAR. Grade of recommendation: Strong recommendation based on moderate-quality evidence, 1B.

Several meta-analyses have examined the protective utility of a diverting ostomy after LAR for rectal cancer.[222–227] In a recent pooled analysis of randomized trials and comparative studies, a diverting ostomy reduced the rate of clinical anastomotic leak (OR = 0.43; 95% CI, 0.28–0.67) and the rate of reoperation (OR = 0.62; 95% CI, 0.40–0.94) but diverted patients risked having stoma-related morbidity (OR = 1.32; 95% CI, 1.05–1.65).[225] A review of 23 studies examining risk factors for anastomotic leak found that patients with a low rectal anastomosis (variably defined as within 5–8 cm of the anal verge; OR = 3.26; 95% CI, 2.31–4.62), male sex (OR = 1.48; 95% CI, 1.37–1.60), or preoperative radiotherapy (OR = 1.65; 95% CI, 1.06–2.56) may benefit the most from fecal diversion.[228] Loop ileostomy is generally preferred over loop colostomy because of the typical ease of reversal; however, loop ileostomy has been associated with an increased incidence of high stoma output and dehydration.[226,229]

14. A management plan for the perineal defect after rectal cancer resection should typically be established preoperatively, incorporating options such as omentoplasty or reconstruction with a myocutaneous flap. Grade of recommendation: Weak recommendation based on moderate-quality evidence, 2B.

Perineal wound complications are relatively common after primary perineal closure during APR. A meta-analysis of 32 studies including 7247 patients reported that the perineal complication rates after APR without and with neoadjuvant radiation were 15.3% (95% CI, 12.1–19.2) and 30.2% (95% CI, 19.2–44.0), and the corresponding rates after ELAPE were 14.8% (95% CI, 9.5–22.4) and 37.6% (95% CI, 18.6–61.4), whereas perineal hernia rates were 1.8% (95% CI, 0.4–8.3) and 2.0% (95% CI, 0.5–7.0) after APR and ELAPE.[230] An analysis of the American College of Surgeons National Surgical Quality Improvement Program database showed that patient-related factors may also contribute to the risk of perineal wound dehiscence, including ASA classification ≥4 (OR = 2.2, $p = 0.003$), history of smoking (OR = 2.2, $p < 0.001$), history of chronic obstructive pulmonary disease (OR = 1.7, $p = 0.03$), BMI

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≥35 (OR = 1.9, $p = 0.001$), and surgeon-anticipated need for closure with a flap (OR = 2.9, $p < 0.001$).[231] The authors concluded that modifying or optimizing risk factors, to the degree it is practical, may be as important as the specific perineal wound closure technique used.

Although direct comparison of flap versus primary wound closure is challenging due to selection bias and the heterogeneous nature of flaps used in practice, a systematic review of 10 studies including 566 patients (226 flaps and 340 primary closures) revealed that primary closure was associated with significantly greater likelihood of both overall (OR = 2.17; 95% CI, 1.34–3.14; $p = 0.001$) and major (OR = 3.64; 95% CI, 1.43–7.79; $p = 0.005$) perineal wound complications.[232] When omentoplasty was examined in a recent meta-analysis of 1894 patients (including 839 patients undergoing omentoplasty), omentoplasty did not significantly reduce 30-day perineal wound complications (RR = 1.0; 95% CI, 0.92–1.82) or the chronic perineal sinus rate (RR = 1.08; 95% CI, 0.53–2.20).[233]

15. Oophorectomy is typically advised for grossly abnormal ovaries or contiguous extension of rectal cancer, but routine prophylactic oophorectomy is not recommended. Grade of recommendation: Strong recommendation based on low-quality evidence, 1C.

In patients with apparent direct rectal cancer extension involving an ovary, en bloc oophorectomy should typically be performed as part of a curative-intent resection. In patients with suspected or known metastatic disease involving an ovary, oophorectomy has been associated with a survival benefit in retrospective series of selected patients.[234] In these situations, bilateral oophorectomy should typically be performed even if 1 ovary appears grossly normal.[234–236]

In patients with grossly normal-appearing ovaries, there are insufficient data to support routine prophylactic oophorectomy at the time of rectal cancer resection.[237] Prophylactic oophorectomy should be considered in women with rectal cancer with an inherited risk for developing ovarian cancer and in postmenopausal women desiring risk reduction. In *BRCA1* or *BRCA2* carriers, preventive oophorectomy has been associated with an 80% reduction in the risk of ovarian, fallopian tube, or peritoneal cancer and a 77% reduction in all-cause mortality.[238] In patients with Lynch syndrome, prophylactic hysterectomy together with bilateral salpingo-oophorectomy effectively prevents endometrial and ovarian cancer.[17,239]

Tumor-Related Emergencies

1. The management of patients with rectal cancer presenting with tumor-related emergencies should follow the principles of optimal oncologic therapy when possible, depending on the specific clinical circumstances. Grade of recommendation: Strong recommendation based on low-quality evidence, 1C.

Emergencies related to rectal cancer typically include bleeding, obstruction, and perforation. Up to 20% of all patients with colorectal cancer present as emergencies and the management of such patients can be challenging because of competing treatment priorities and the generally higher risk of morbidity.[240–242] For patients presenting with synchronous metastatic disease where the disease burden warrants palliative-intent treatment, optimal management should typically involve multidisciplinary input regarding treatment options and shared decision making that considers life expectancy as well as patient wishes and priorities. The management of patients who present with obstruction or potentially resectable synchronous metastatic disease is discussed below. Among patients with nonmetastatic cancer whose disease is amenable to curative intent treatment, optimal management should typically address immediate threats to life while preserving the opportunity to pursue multimodality treatment, as indicated. Emergent resection of a locally advanced rectal cancer omitting multimodality therapy should typically be avoided because this may potentially compromise oncologic outcomes.[243,244]

For bleeding rectal tumors, radiation can effectively palliate 87% to 100% of patients and is considered the first-line approach; emergency resection can typically be avoided in this situation.[245,246] Bleeding may also be managed endoscopically, via interventional angiography or with topical therapies, but studies comparing the different approaches are lacking.[247]

Management of tumor-related perforation depends on the clinical presentation but the mortality related to a perforation in this setting may be as high as 65%.[248] Although the main priority in an operation dealing with a perforation is typically to control the septic source, resection with or without anastomosis according to oncologic principles should typically be performed. If the perforation is proximal to the tumor, an extended resection addressing both pathologies may be considered.[243,248]

2. In patients with obstruction due to extraperitoneal rectal cancer, decompression with a proximal diverting stoma should be considered. Grade of recommendation: Strong recommendation based on low-quality evidence, 1C.

Patients with acute or subacute obstructive symptoms such as tenesmus and multiple small-volume liquid stools due to a narrowed lumen should be counseled appropriately and should typically be treated expeditiously to try to prevent worsening symptoms and progression to complete obstruction and even perforation. Treatment decisions should consider disease status, prognosis, the patient's clinical condition, and available expertise.

In patients with potentially curable colon cancer, endoluminal stents have been used as a bridge to surgery, allowing for bowel decompression and, potentially,

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a subsequent single-stage resection with primary anastomosis.[249] Although stenting proximal rectal cancer may similarly be performed as a bridge to further therapy, stenting an obstructing distal rectal cancer is typically not recommended because a stent at this level can cause chronic pain, tenesmus, and worse quality of life and can migrate.[250] In addition, although systematic reviews have not definitively shown an adverse impact of stenting on colorectal cancer local recurrence rates, some series have reported increased risk of local recurrence, possibly related to tissue inflammation and particularly in the setting of stent-related perforation.[251,252]

A proximal diverting ostomy for decompression under these circumstances usually incorporates a loop configuration to allow for distal venting.[253] Decompression via stoma or stenting allows for staging and appropriate multimodality therapy before resection, as indicated. The timing and method of decompression should be individualized and the anticipated response to neoadjuvant therapy should also be considered when deciding whether or not to decompress a patient with a partial obstruction.

Stenting is not typically recommended in patients in whom chemotherapy with an antiangiogenic agent (eg, bevacizumab) is being used because of an increased risk of stenting-related perforation compared with chemotherapy without an antiangiogenic agent (12.5%; 95% CI, 6.4%–22.8% versus 7.0%; 95% CI, 4.8%–10.0%).[254] For palliative decompression of obstructing rectal cancer in patients with terminal life expectancy or whose operative risk is prohibitive, endoluminal stenting may be a preferred option. In the palliative setting, stenting is associated with relatively high technical success rates, low mortality and morbidity rates, and relatively short hospitalization. After initial successful decompression by stenting, some patients may require reintervention such as repeat stenting or subsequent diversion.[255,256]

Multimodality Therapy for Nonmetastatic Rectal Cancer

Neoadjuvant Therapy

1. **Neoadjuvant therapy should typically be recommended for patients with clinical stage II/III rectal cancer. Grade of recommendation: Strong recommendation based on high-quality evidence, 1A.**

The most commonly utilized regimen for neoadjuvant therapy is "long-course" chemoradiotherapy (LCCRT) using conventional doses of 1.8 to 2 Gy per fraction over 5 to 6 weeks for a total dose of 45 to 50.4 Gy with concurrent 5-fluorouracil (5FU)-based chemotherapy. "Short-course" radiotherapy (SCRT) with 5 Gy daily for 5 days without chemotherapy is an alternative regimen less commonly used in the United States. Clinical scenarios where omission of pelvic radiation as a component of neoadjuvant therapy may be considered are discussed in the next section.

The Swedish Rectal Cancer trial randomly assigned 1168 patients to SCRT followed by surgery versus surgery alone, and the SCRT arm was associated with reduced local recurrence (9% versus 26%, $p < 0.001$) and prolonged survival (5-year OS, 38% versus 30%; $p = 0.008$) with a median follow-up of 13 years.[257,258] The Dutch TME trial randomly assigned 1861 patients to SCRT followed by TME surgery versus TME surgery alone, and, even in the setting of standardized TME surgery, local recurrence was significantly reduced with neoadjuvant SCRT.[259] At 10 years, the local recurrence rate was 11% after TME alone versus 5% after SCRT and TME ($p < 0.001$), but there was no benefit in OS (49% after TME versus 48% after SCRT and TME, $p = 0.86$).[260] The benefit of radiotherapy appeared to be the greatest among tumors with nodal involvement located 5 to 10 cm from the anal verge with negative resection margins; neoadjuvant SCRT did not offset the risk for local failure in low rectal tumors with positive resection margins.[260] The addition of SCRT to TME resulted in more long-term toxicity; specifically, higher rates of fecal incontinence (62% versus 38%, $p < 0.001$), pad use (56% versus 33%, $p < 0.001$), and mucus leakage (27% versus 15%, $p = 0.005$) were reported in patients who received radiation.[261] Irradiated men also reported more erectile problems.[261,262] Posttreatment sequelae persisted even after prolonged follow-up (median 14 years) among patients undergoing SCRT and TME without a stoma. A Cochrane database meta-analysis demonstrated that patients undergoing SCRT followed by surgery was associated with reduced local recurrence rates compared with patients who underwent surgery alone but did not significantly increase sphincter-preservation rates or perioperative complication rates.[263]

"Long-course" chemoradiotherapy, the most common neoadjuvant regimen used in the United States, was studied in the German Rectal Cancer trial (CAO/ARO/AIO-94) which randomly assigned patients with clinical stage II/III rectal cancer (n = 823) to either preoperative or postoperative LCCRT.[264] Chemoradiotherapy consisted of 5.4 Gy in 28 fractions with concurrent infusional 5FU. Standard TME was performed and all patients received an additional 4 cycles of adjuvant 5FU-based chemotherapy. The local recurrence rate was lower in the preoperative treatment group (6% versus 13%, $p = 0.006$) and this benefit persisted at long-term (10-year) follow-up (7.1% versus 10%, $p = 0.04$). Meanwhile, there were no significant differences in 10-year OS, DFS, or rate of distant metastasis between the groups.[264] Compared with postoperative therapy, preoperative LCCRT led to significantly less severe (grade 3 or 4), acute (27% versus 40%; $p = 0.001$), and long-term (14% versus 24%; $p = 0.01$) toxicity. The most common acute toxicities related to preoperative therapy were diarrhea and hematologic and dermatologic toxicities, whereas the most common long-term toxicities included chronic diarrhea, bowel obstruction, anastomotic

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stricture, and bladder and sexual dysfunction.[265] Although neoadjuvant LCCRT has not consistently demonstrated a statistically significant difference in the rate of sphincter preservation in meta-analyses, chemoradiotherapy may facilitate sphincter preservation by reducing tumor volume in the deep pelvis.[266]

Two randomized trials that compared neoadjuvant SCRT and LCCRT and reported long-term oncologic outcomes are the Polish trial (316 patients) and the Trans-Tasman Radiation Oncology Group trial (TROG) 01.04 (326 patients).[267] The local recurrence, 5-year distant metastasis, and OS rates did not differ significantly between the arms in either trial. Significantly less acute toxicity was associated with SCRT than with LCCRT (3% versus 18%, $p < 0.001$ in the Polish trial and 1.9% versus 28%, $p < 0.001$ in the TROG trial), although the rates of high-grade late toxicity did not significantly differ in either trial.[267–269] Importantly, LCCRT was consistently more effective in inducing pathologic downstaging and tumor regression than SCRT. Although pooled analysis showed no difference in the rates of sphincter preservation or R0 resection, the rate of pCR was 16% after LCCRT versus only 1% after SCRT ($p < 0.001$).[269,270]

The Stockholm III trial provided data on 385 patients with rectal cancer randomly assigned to SCRT with immediate surgery (SCRT), SCRT with delayed surgery at 4 to 8 weeks (SCRT-delay), or LCCRT with delayed surgery at 4 to 8 weeks (LCCRT-delay), as well as data on an additional 455 patients randomly assigned to SCRT or SCRT-delay.[271] After a median follow-up of 5.2 years, the overall local recurrence rate did not statistically differ among the 3 groups. Although there were no differences in postoperative complication rates among patients in the 3-arm randomization, pooled analysis comparing patients treated by SCRT versus SCRT-delay showed a significantly lower risk of postoperative complications after SCRT-delay (41% versus 53%; OR = 0.61; 95% CI, 0.45–0.83; $p = 0{\cdot}001$) and a higher rate of pCR (11.8% versus 1.7%, $p = 0.001$), suggesting that SCRT-delay may provide the tumor regression more typically attributed to LCCRT.[272,273]

2. The neoadjuvant regimen should typically be tailored to the individual patient after multidisciplinary team discussion. Grade of recommendation: Strong recommendation based on high-quality evidence, 1A.

The exact components of the neoadjuvant regimen impact treatment morbidity and the degree of tumor response. In an effort to allow for a more patient-centered approach to neoadjuvant therapy, studies have investigated various neoadjuvant regimens with respect to both their toxicity and their impact on pathologic response. Because the heterogeneity of rectal cancer has been increasingly appreciated, risk stratification based on clinicopathologic factors (eg, T and N staging and histological grade) and MRI-based assessments (eg, CRM involvement) have been proposed as the basis for tailoring the neoadjuvant regimen to the individual patient.[52]

Extended Neoadjuvant Therapy Regimens

Adding chemotherapy concurrently to radiation provides radiosensitization and increases the pCR rate, but can also increase toxicity depending on the regimen. A Cochrane database review compared neoadjuvant radiation alone to neoadjuvant radiation with concurrent 5-FU-based chemotherapy and demonstrated that chemoradiation increased the rate of pCR (OR = 2.12–5.84; $p < 0.001$) and was associated with a lower 5-year local recurrence rate (OR = 0.39–0.72; $p < 0.001$), but there were no differences in the rates of sphincter preservation at 5 years.[273]

The impact of adding oxaliplatin concurrently to neoadjuvant 5-FU-based LCCRT was investigated in several trials that showed significantly increased toxicity.[274] The STAR-01 trial reported grade 3 to 4 toxicity rates of 24% versus 8% ($p < 0.001$) related to adding oxaliplatin.[275] Similarly, in the NSABP R04 trial, grade 3 and higher toxicities were substantially more common in the oxaliplatin-containing arms than in the 5-FU/capecitabine-only arms.[276] In terms of oncologic outcomes related to adding oxaliplatin, a higher pCR rate was only observed in oxaliplatin-containing regimens in the German study (17% versus 13%, $p = 0.03$) and the FOWARC trial (27.5% versus 14%, $p = 0.005$).[277,278] Taken together, the toxicities associated with adding oxaliplatin to 5-FU-based LCCRT outweigh the oncologic benefits. Similarly, adding targeted agents such as vascular endothelial growth factor or epidermal growth factor receptor inhibitors concurrently to LCCRT has been tested in several small, phase II trials without demonstrating significant improvements in pCR rates.[278]

Adding chemotherapy sequentially to 5FU-based LCCRT is another neoadjuvant strategy that was developed with the goal of theoretically addressing micrometastases earlier than the adjuvant setting. Total neoadjuvant therapy (TNT) most commonly refers to induction systemic chemotherapy followed by LCCRT; alternatively, it can involve LCCRT followed by consolidation systemic chemotherapy. The total duration of TNT treatment should not, in general, exceed 6 months.[52]

Induction chemotherapy followed by LCCRT has been evaluated in phase II clinical trials that enrolled patients with poor-risk disease characterized by low-lying, cT4 or cN2 rectal cancer or a threatened CRM as seen on MRI and most commonly utilizes FOLFOX or CAPOX for 8 cycles. Although some trials have reported encouragingly high pCR rates (24% in EXPERT and 29% in CONTRE)[279] others have not (14.3% in Spanish GCR-3).[280,281] "Long-course" chemoradiotherapy followed by consolidation FOLFOX chemotherapy was evaluated in a randomized, phase II trial that showed that adding increasing cycles of FOLFOX (0, 2, 4, and 6) significantly improved pCR rates (20%, 23%, 26%, and 37%; $p = 0.04$) and DFS (50%, 81%,

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86%, and 76%; $p = 0.004$).[282] The main advantage of the TNT sequence may be the ability to deliver all planned systemic therapy to a greater proportion of patients, but comparative data regarding long-term toxicity and survival rates are limited.[283]

The sequential administration of systemic chemotherapy and LCCRT has made it possible to consider more selective use of radiotherapy after induction systemic chemotherapy. In a small, phase II pilot trial, 32 patients received neoadjuvant chemotherapy (FOLFOX with bevacizumab), but only those with stable or progressive disease went on to receive LCCRT before undergoing TME.[284] All patients had an R0 resection, and the pCR rate after chemotherapy alone was 25% (95% CI, 11%–43%), and the 4-year DFS was 84% (95% CI, 67%–94%). A randomized, phase III trial to further investigate the selective use of neoadjuvant chemoradiotherapy, the Preoperative Radiation or Selective Preoperative Radiation and Evaluation Before Chemotherapy and TME (PROSPECT), is currently ongoing.[285]

Moderated Neoadjuvant Therapy Regimens

Selectively omitting pelvic radiation as a component of neoadjuvant therapy has been proposed for patients with relatively favorable prognostic factors including early T3 tumors with minimal invasion into the perirectal fat, tumors in the upper rectum, and tumors with wide CRM clearance on MRI.[286,287] Single institutional studies have reported that T3N0 tumors that are well differentiated, with minimal (< 2 mm) invasion into perirectal fat and without lymphovascular invasion, could be treated without radiation with a 10-year local control rate of 95%.[288] A pair of pooled analyses from 2002 and 2004 of North American randomized, controlled trials where patients with rectal cancer did or did not receive adjuvant chemotherapy and/or radiation highlighted the heterogeneity among patients with stage II and III rectal cancer, and, based on risks for disease relapse and death, T3N0 and T1-2N1 tumors were described as "intermediate risk," given their lower risk for local recurrence compared with moderately high- and high-risk groups.[289,290] However, further studies have highlighted that T3N0 rectal tumors within 5 cm of the anal verge have a higher risk of local recurrence when treated with surgery alone[291] and that there is a substantial (22%) risk for clinical staging to underdetect nodal disease.[292] Although omitting neoadjuvant radiation can be considered in selected T3N0 patients, this approach requires accurate clinical staging and should typically be avoided in the low rectum.

Additional evidence supporting the practice of selectively omitting radiotherapy in treating rectal cancer includes a subgroup analysis of the long-term data from the Dutch TME trial that showed adding preoperative radiation was not associated with significant improvement in the local recurrence risk after TME surgery when tumors were more than 10 cm from the anal verge (5-year local recurrence: 6.2% versus 3.7%, $p = 0.12$) or did not have positive nodes (5-year local recurrence in TNM stage II: 5.3% versus 7.2%, $p = 0.33$).[293] However, the authors cautioned that data from subgroup analyses highlight heterogeneity in the risk of recurrence, but should not be used as a sole criterion to determine radiation use.[293] A recent meta-analysis of 5 studies that compared patients with upper versus lower rectal cancers treated with upfront surgery found that upper rectal cancers were associated with lower rates of local (OR = 0.50; 95% CI, 0.30–0.81; $p = 0.005$) and distant (OR = 0.61; 95% CI, 0.51–0.73; $p < 0.001$) failure.[294] Finally, in the MERCURY trial, baseline MRI stratified patients with rectal cancer according to prognosis where patients with a good prognosis were characterized by MRI-predicted clear CRM (tumor >1 mm from the mesorectal fascia), no extramural venous invasion, and spread <5 mm from the bowel wall. Following a policy of omitting neoadjuvant chemoradiation for patients with a good prognosis, the study reported a 5-year local recurrence risk of 3.3%, 5-year DFS of 84.7% (95% CI, 76.0%–90.4%) and OS of 68.2% (95% CI, 60.3%–77.0%).[295] After long-term follow-up, MRI-predicted CRM clearance was the only independent predictor of local recurrence irrespective of cTNM staging (HR = 3.5; 95% CI, 1.53–8.00; $p < 0.05$) suggesting that a policy of selective radiation based on MRI-predicted CRM was feasible.[54] Recently, the QuickSilver trial conducted in Canada replicated these findings, supporting the feasibility of using MRI criteria to select patients for upfront resection without radiation.[296]

3. Pathologic response to neoadjuvant therapy should be evaluated at the time of radical resection. Grade of recommendation: Strong recommendation based on moderate-quality evidence, 1B.

Assessment of the clinical response to neoadjuvant therapy prior to surgical resection was discussed in Staging. Pathologic response to neoadjuvant therapy should be assessed as a routine part of pathology evaluation at the time of resection, because the degree of tumor response to neoadjuvant therapy is prognostic of long-term outcomes. A pCR after neoadjuvant therapy is associated with excellent long-term oncologic outcomes with local failure rates as low as 0.7% (range, 0%–2.6%) and 5-year OS and DFS rates as high as 90.2% and 87%.[182,183,297] Although there is currently no universally accepted tumor regression grading (TRG) system to document the response to neoadjuvant therapy, available systems include the Mandard 5-tier system (TRG 1–5), the Dowrak and Rödel adapted 5-tier system (TRG 0–4 that incorporates the percentage of tumor fibrosis), a reduced 3-tier system (TRG 1–3 that ranges from complete regression to no regression), and the American Joint Committee on Cancer (AJCC) 4-tier system (TRG 0–3 that ranges from no residual tumor to minimal response).[298] When compared with each other,

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these systems were prognostic for recurrence-free survival, but the AJCC system performed slightly better.[298]

The interval between neoadjuvant LCCRT and surgery influences the degree of pathologic response and the timing of surgery in this setting remains controversial.[299] An interval of ≥8 weeks is associated with a higher pCR rate (RR = 1.25; 95% CI, 1.16–1.35; $p < 0.001$) in comparison with an interval of <8 weeks, but does not significantly influence operative time, complications, local recurrence, DFS, or OS.[300,301] Meta-analyses have shown that downstaging and pCR rates peak about 6 to 7 weeks after completing either SCRT or LCCRT, and that waiting beyond 11 weeks may not result in additional downstaging and may be associated with increased postoperative morbidity.[300–302] The optimal interval associated with emerging neoadjuvant regimens other than LCCRT remains to be established.

Adjuvant Therapy

1. **Adjuvant chemotherapy should typically be recommended for patients with clinical or pathologic stage II or III rectal cancer if systemic chemotherapy has not been given preoperatively and it should typically begin within 8 weeks of radical resection. Grade of recommendation: Strong recommendation based on moderate-quality evidence, 1B.**

For patients with pathologic stage II or III rectal cancer who have not been treated with upfront systemic chemotherapy, FOLFOX is an approved adjuvant therapy.[52] This recommendation is based on extrapolation of data from adjuvant colon cancer therapy because there is a paucity of data specifically for rectal cancer. In the MOSAIC and NSABP C-07 trials, the addition of oxaliplatin to 5-FU/leucovorin adjuvant therapy (FOLFOX regimen) significantly improved OS and DFS for stage II/III colon cancer compared with 5-FU alone.[303,304] Options for adjuvant therapy for colon cancer other than observation include 5-FU-based regimens with or without oxaliplatin for pathologic low-risk stage II (pT3N0), high-risk stage II (pT3N0 with poor differentiation, lymphovascular or perineural invasion, inadequate margin, fewer than 12 nodes harvested, obstruction or perforation, pT4N0), and stage III disease. In the absence of rectal cancer-specific data, a similar approach may be undertaken for patients who have rectal cancer with pathologic stage II or III disease who have not received neoadjuvant therapy.[52]

For patients with clinical stage II or III rectal cancer who were treated with neoadjuvant chemoradiation therapy, adjuvant chemotherapy is typically recommended regardless of the final pathologic (yp) stage.[305] However, the benefit of additional chemotherapy following preoperative chemoradiation is not uniform for all patients with rectal cancer, and the subgroups of patients who would likely benefit the most from this additional therapy have not been definitively identified, leading to variations in clinical practice.[269,305] The ADORE trial randomly assigned patients with rectal cancer (n = 321) treated with neoadjuvant LCCRT and surgery to adjuvant FOLFOX versus 5-FU therapy and the FOLFOX arm had higher 3-year DFS (71.6% versus 62.9%; HR = 0.66; 95% CI, 0.43–0.99; $p = 0.04$).[306] In meta-analyses including randomized and nonrandomized data, oxaliplatin-containing adjuvant chemotherapy was associated with statistically significant improvement in DFS (HR = 0.7–0.85) compared with 5-FU-based regimens, but the OS benefit from oxaliplatin was inconsistent and appeared to be most significant among patients whose tumors were downstaged after neoadjuvant therapy.[307–309] The National Comprehensive Cancer Network recommends oxaliplatin-containing 5-FU regimens as the preferred regimens and consideration of possibly omitting oxaliplatin in patients whose initial clinical stage was cT3N0.[52]

Adjuvant chemotherapy is typically recommended even for the subgroup of patients with a ypCR.[310–312] A meta-analysis examining 2948 patients with rectal cancer with a ypCR (adjuvant group = 1324 patients; no-adjuvant group = 1624 patients) showed a significant improvement in OS after adjuvant therapy compared with observation (HR = 0.65; 95% CI, 0.46–0.90, $p = 0.01$). In particular, these data support that patients with clinical node-positive disease (stage III) who went on to have a ypCR might benefit more from adjuvant chemotherapy.[311]

Several studies have demonstrated that the time interval between resection and initiating adjuvant chemotherapy impacts the survival benefit of the therapy. A meta-analysis of 6 studies across 12,584 patients showed that every 4-week increase in the time to adjuvant therapy was associated with a decrease in both OS (HR = 1.14; 95% CI, 1.10–1.17) and DFS (HR = 1.14; 95% CI, 1.10–1.18).[313] The most significant risk factors for delaying adjuvant therapy include prolonged postoperative stay (OR = 2.37; 95% CI, 2.10–2.68) and readmission (OR = 3.23; 95% CI, 1.66–6.26), and other relevant risk factors include age >75 years (OR = 1.44; 95% CI, 1.32–1.58), single marital status (OR = 1.32; 95% CI, 1.20–1.44), low socioeconomic status (OR = 1.67; 95% CI, 1.32–2.12), comorbidities (OR = 1.47; 95% CI, 1.14–1.90), and low-grade tumor (OR = 1.06; 95% CI, 1.02–1.11), whereas a minimally invasive approach facilitated earlier adjuvant initiation (OR = 0.70; 95% CI, 0.51–0.97).[313–320]

The recommended duration of adjuvant treatment for patients with rectal cancer remains controversial. In patients with rectal cancer who were already treated with preoperative LCCRT, an 8-cycle (4 month) course of adjuvant FOLFOX is generally accepted.[52] A pooled analysis from the IDEA collaboration questioned the feasibility of risk stratifying the duration of adjuvant FOLFOX in patients with colon cancer.[321] Motivated by the potential for reducing treatment toxicity without decreasing DFS,

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3 months of adjuvant FOLFOX is being considered for patients with low-risk stage III colon cancer, whereas 6 months remains standard for patients with higher-risk tumors.[322] However, the impact, if any, of these data on the duration of adjuvant chemotherapy for patients with rectal cancer is unclear.[323]

2. Adjuvant radiotherapy should typically be considered in selected patients with high-risk, pathologic stage II or III rectal cancer, in particular, if neoadjuvant therapy has not been given. Grade of recommendation: Strong recommendation based on moderate-quality evidence, 1B.

In patients whose disease was understaged clinically and/or who did not receive neoadjuvant therapy for other reasons, postoperative LCCRT may be selectively considered in patients with high-risk pathologic stage II or III rectal cancer, characterized by close (≤1 mm) CRM, T4 disease, intraoperative tumor perforation, or N1c/N2 disease.[52] However, postoperative LCCRT likely cannot fully compensate for the increased oncologic risks associated with a positive CRM.[324,325] In the MRC CR07/NCIC-CTG C016 randomized trial, 676 patients underwent TME followed by postoperative LCCRT only when the CRM was positive.[326] When compared to 674 patients treated with neoadjuvant chemoradiation and TME, patients treated with postoperative LCCRT had a higher 3-year local recurrence rate (10.6% versus 4.4%, $p = 0.01$) and worse 3-year DFS (71.5% versus 77.5%, $p = 0.04$). In the setting of TME with R0 margins, data showing an additional benefit of postoperative LCCRT is lacking. The use of LCCRT in the adjuvant setting is associated with several disadvantages including increased overall toxicity; higher risk of injuring bowel in the radiation field; potentially decreased efficacy due to a more radioresistant, hypoxic postsurgical bed; and perineal wound complications.[324]

Multimodality Therapy for Rectal Cancer With Synchronous Metastatic Disease

1. Multidisciplinary assessment of patients with rectal cancer with synchronous metastases should establish the treatment intent as potentially curative or palliative. Grade of recommendation: Strong recommendation based upon moderate-quality evidence, 1B.

Synchronous metastases have been defined as those detected before, at, or within 3 to 6 months after the diagnosis of a primary rectal cancer.[67] Clinical staging, as discussed previously, should define the extent of both local and distant disease and serves as the basis for treatment planning.

Systemic chemotherapy is the mainstay treatment for patients with rectal cancer with metastatic disease, and multidrug regimens typically include targeted agents potentially tailored to the cancer's somatic mutation profile. With significant advances in available systemic treatments, the median OS of patients with stage IV colorectal cancer improved to 24 to 36 months over the past decades.[327] A subset of patients with stage IV rectal cancer may be considered for multimodality therapy with potentially curative intent. These are typically highly selected patients with limited metastatic disease or whose cancer demonstrated a favorable response to systemic chemotherapy and was confined to organs such as the liver, lung, and peritoneum where the role for metastasectomy has been established.[52] Arbitrating whether a patient may be a candidate for a potentially curative-intent approach and determining the optimal first-line treatment require a personalized assessment by a multidisciplinary team.[328–330] Key considerations include overall disease biology, patients' symptoms and physiology, technical feasibility for resecting the disease burden, organ functional reserve, and the balance between therapy aimed at metastatic disease versus primary disease. A multidisciplinary team approach has been associated with improved survival outcomes for patients with stage IV colorectal cancer.[328–330]

2. In patients with symptomatic rectal cancer and unresectable metastatic disease, palliative intervention should typically be considered. Grade of recommendation: Strong recommendation based on low-quality evidence, 1C.

Patients who have rectal cancer with an unresectable metastatic burden should ideally be assessed early and serially to determine if palliative intervention is needed. The decision to delay or interrupt systemic therapy to surgically palliate symptoms should typically be jointly made by the patient, the medical oncologist, and the surgeon.[331] Factors to consider when choosing a palliative intervention may include the overall prognosis and metastatic burden, the morbidity rate, as well as the efficacy of the intervention, and the magnitude of the intervention in relation to the anticipated expediency of starting or resuming oncologic therapy (return to intended oncologic treatment).[332] Bleeding, perforation, and obstruction related to rectal cancer were reviewed earlier in this guideline.

3. In patients with asymptomatic rectal cancer and unresectable metastatic disease, chemotherapy is typically considered first-line therapy because the upfront resection of rectal cancer is usually not recommended under these circumstances. Grade of recommendation: Strong recommendation based on moderate-quality evidence, 1B.

In the setting of colorectal cancer with unresectable metastatic disease, the role of resecting the primary tumor has been considered to potentially prevent future tumor-related complications and to possibly confer a survival benefit.[52,67] Unfortunately, much of the literature on this topic groups patients under the heading of colorectal cancer and does not specifically address patients with rectal cancer. Retrospective studies that have suggested a survival benefit in this setting typically did not distinguish whether

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or not the resected primary tumor was symptomatic and were likely subject to selection bias, with resection being performed in patients with better performance status and prognosis.[333] A retrospective analysis of pooled data from 4 metastatic colorectal cancer trials identified 478 patients who had undergone primary tumor resection and 332 patients who did not. The median OS was 19.2 months (95% CI, 18.2–20.4) versus 13.3 months (95% CI, 12.0–14.8) favoring the resection group ($p < 0.001$).[334] Another meta-analysis showed that resection of the primary tumor was associated with a survival advantage of 6.4 months (95% CI, 5.03–7.86; $p < 0.001$) compared with chemotherapy. In this study, the resection group included more patients with limited metastases (eg, liver-only disease with less than 3 lesions) and nonrectal primary tumors, highlighting an underlying selection bias.[325]

Available data specifically focusing on patients who had stage IV disease with asymptomatic primary tumors do not support routine upfront resection. A Cochrane review of asymptomatic patients compared 722 patients who underwent primary colorectal cancer resection to 364 patients who did not and found no survival advantage (median survival ranged from 14 to 23 months versus 8 to 22 months).[335] In addition, the complication rates after either resection or chemotherapy as first-line treatment did not significantly differ.[335]

In general, among patients with metastatic colorectal cancer treated with systemic therapy, the risk of an asymptomatic primary tumor becoming symptomatic and requiring emergency intervention is low. Among 233 patients with colorectal cancer with metastatic disease, complications related to the primary tumor occurred in 11% and operative intervention (ie, diversion, bypass, or resection) was required in only 7%.[336] Having a rectal primary tumor did not confer higher risks for either operative or overall intervention than a colon primary tumor.[336] These findings corroborate data from the NSAPB C-10 trial that followed 90 patients with metastatic colon cancer and found that the morbidity rate related to the primary tumor was 16.3% and that operative intervention was required in only 11.1% of the patients.[337] A recent Surveillance, Epidemiology, and End Rsults Program (SEER)-Medicare database analysis reported a similar rate of 12% for otherwise unplanned operative intervention in the setting of stage IV colorectal cancer with an intact primary tumor.[338]

Although international, prospective trials investigating the role of primary tumor resection in the setting of unresectable metastatic disease are ongoing, routine upfront resection of an asymptomatic rectal primary tumor is not typically recommended, especially given the consequent delay in systemic chemotherapy in the context of the low potential for future complications from an intact primary tumor as well as the uncertain survival advantage related to proctectomy, and the established risk for perioperative morbidity under these circumstances.[52,68,325]

4. In patients with rectal cancer and synchronous resectable (or potentially resectable) metastatic disease, individualized treatment should typically coordinate curative-intent therapies addressing all sites of disease. Grade of recommendation: Strong recommendation based upon moderate-quality evidence, 1B.

Patients with synchronous resectable or potentially resectable metastatic disease may be considered for curative-intent therapy after multidisciplinary assessment. An individualized plan is needed to determine and optimally sequence the multimodality components of treatment. The management of patients with synchronous liver metastases, the most commonly encountered clinical scenario, will be reviewed, but the management of synchronous pulmonary and peritoneal metastases are beyond the scope of this guideline.[68,339–343]

Although preoperative systemic chemotherapy has been advocated as a means of assessing disease biology and minimizing the risk of relapse, its benefit in improving OS remains unclear.[342] For patients with initially resectable synchronous liver metastases, the EORTC 40983 trial showed that receiving perioperative systemic chemotherapy (ie, 12 total cycles of FOLFOX divided pre- and postoperatively) compared with no perioperative chemotherapy was associated with superior progression-free survival with 3-year progression-free survival of 39% (95% CI, 31.7–46.3) versus 29.9% (95% CI, 23.2%–36.9%; $p = 0.03$); although, there was no statistically significant difference in OS.[344] For selected patients with initially unresectable synchronous metastases, systemic chemotherapy offers the opportunity to convert to potential resectability. Under these circumstances, the efficacy of chemotherapy may be as high as 30% to 40% and may be increased further with the addition of anti- vascular endothelial growth factor/epidermal growth factor receptor agents.[345] Given the toxicities of chemotherapeutic agents and the variable clinical course of these patients, patients should typically be reassessed every 2 to 3 months, and preoperative therapy should typically be limited to 6 to 8 cycles among resectable patients.[346–348]

Completing curative-intent resection of all disease with minimal morbidity and resuming systemic oncologic therapy are key priorities when individualizing treatment.[349] The 3 available treatment options include "classic" (primary rectal cancer is treated before the metastatic sites), "combined" or "synchronous" (all disease sites are addressed together), and "reversed" (metastatic disease is resected before the primary tumor).[350,351]

The "combined" approach is suitable for patients with an appropriate risk profile whose overall disease burden is amenable to a relatively safe, 1-stage operation. The efficiency of this synchronous approach in terms of postoperative recovery, convenience, and economics needs to be weighed against the potential for increased perioperative

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morbidity.[350–352] Typical scenarios that favor a combined approach may include nonmajor hepatic resections, upper rectal tumors, or nonrestorative proctectomy.[350,353]

The "classic" and "reversed" approaches allow for staged treatment of the metastatic disease and the rectum and are generally favored when the management of either or both disease sites is relatively complex. The "reversed" approach, typically considered in patients whose primary rectal cancer is asymptomatic, has been utilized when hepatic metastatic disease requires a major hepatectomy or a 2-stage hepatectomy or when the primary disease requires ultralow, extended, or multivisceral resection.[350,353] The proposed rationale for this approach is to utilize an early window to intervene on a relatively significant burden of metastatic disease while avoiding the competing time otherwise spent on pelvis-directed neoadjuvant therapy and the risks of complications related to pelvic surgery.[350,354] The "classic" approach, less commonly utilized today, is generally considered when the primary rectal cancer is symptomatic and requires upfront treatment, but the extent or complexity of metastatic disease precludes a safe combined approach.[67,350]

The use of pelvic radiation in the setting of rectal cancer with synchronous hepatic metastases should be individualized. Because pelvic radiation can interfere with treating systemic disease, radiation use in the metastatic setting requires judicious consideration.[354,355] In these cases, omitting radiation for patients whose tumor is located in the upper rectum or demonstrates wide CRM clearance on imaging, as discussed earlier, or using short-course radiotherapy should typically be considered.[286,356]

DOCUMENTATION

1. **The operative report should typically contain information regarding the diagnostic workup, intraoperative findings, and technical details of the procedure. Grade of recommendation: Strong recommendation based on low-quality evidence, 1C.**

The operative report should typically include preoperative details like histological diagnosis, clinical stage, distance of the tumor to the anal verge, confirmation that an ostomy site was marked preoperatively, and preoperative treatment. Relevant intraoperative factors should typically document incision type, an exploration for extrarectal disease, tumor location, adjacent organ involvement, extent of bowel resection, completeness of mesenteric excision, anastomotic technique, height, and leak test, if applicable, details of en bloc resection of involved organs, and an intraoperative assessment of the completeness of resection.[10] Intraoperative adverse events like tumor perforation should be documented because of its association with local recurrence and reduced 5-year survival.[120,121]

A number of tools are available to aide in the management of patients with rectal cancer. For example, the ASCRS developed The Rectal Cancer Surgery Checklist composed of 25 elements relevant to the pre-, intra-, and postoperative care of patients with rectal cancer. This tool was intended to serve as a comprehensive guide to enhance safety and quality of care for patients with rectal cancer undergoing surgery.[357] In addition, the American College of Surgeons Commission on Cancer National Accreditation Program for Rectal Cancer program requires the use of a synoptic surgical report and developed a list of 20 required elements for the report.[4] Utilization of a synoptic report standardizes reporting, enhances documentation compliance by including required elements, and facilitates timely communication with the multidisciplinary team to potentially improve surgical outcomes and care.[358,359]

2. **Accurate, detailed, and consistent rectal cancer pathology reporting is integral to determining prognosis, facilitating treatment planning, and improving quality assessment. Grade of recommendation: Strong recommendation based on low-quality evidence, 1C.**

Pathologists play a key role for patients with rectal cancer by confirming the histological diagnosis, determining tumor stage, grading the quality of the mesorectal excision, and assessing margin status and response to preoperative therapy. The College of American Pathologists rectal cancer guidelines are contained in the Protocol for the Examination of Specimens from Patients with Primary Carcinoma of the Colon and Rectum.[360] Documenting the required elements of pathologic assessment and using a synoptic format improve the completeness of reporting regardless of pathologists' subspecialty interest.[360,361] In addition, photographs of the surgical specimen, including anterior, posterior, and lateral views, can display the integrity of the mesorectum which correlates with oncologic outcomes.

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