Guidelines 2000 for Colon and Rectal Cancer Surgery

Heidi Nelson, Nicholas Petrelli, Arthur Carlin, Jean Couture, James Fleshman, Jose Guillem, Brent Miedema, David Ota, Daniel Sargent

Background: Oncologic resection techniques affect outcome for colon cancer and rectal cancer, but standardized guidelines have not been adopted. The National Cancer Institute sponsored a panel of experts to systematically review current literature and to draft guidelines that provide uniform definitions, principles, and practices. Methods: Methods were similar to those described by the American Society of Clinical Oncology in developing practice guidelines. Experts representing oncology and surgery met to review current literature on oncologic resection techniques for level of evidence (I–V, where I is the best evidence and V is the least compelling) and grade of recommendation (A–D, where A is based on the best evidence and D is based on the weakest evidence). Initial guidelines were drafted, reviewed, and accepted by consensus. Results: For the following seven factors, the level of evidence was II, III, or IV, and the findings were generally consistent (grade B): anatomic definition of colon versus rectum, tumor–node–metastasis staging, radial margins, adjuvant R0 stage, inadvertent rectal perforation, distal and proximal rectal margins, and en bloc resection of adherent tumors. For another seven factors, the level of evidence was II, III, or IV, but findings were inconsistent (grade C): laparoscopic colectomy; colon lymphadenectomy; level of proximal vessel ligation, mesorectal excision, and extended lateral pelvic lymph node dissection (all three for rectal cancer); no-touch technique; and bowel washout. For the other four factors, there was little or no systematic empirical evidence (grade D): abdominal exploration, oophorectomy, extent of colon resection, and total length of rectum resected. Conclusions: The panel reports surgical guidelines and definitions based on the best available evidence. The availability of more standardized information in the future should allow for more grade A recommendations. [J Natl Cancer Inst 2001;93:583–96]

During 2000, in the United States, 130,200 new cases of colon cancer and rectal cancer were reported (1). On the basis of past experience, an estimated 90%–92% of patients with colon cancer and 84% of patients with rectal cancer are treated surgically (2,3). Although surgery may be performed for palliative control of symptoms in advanced cases, in most circumstances, it is performed with curative intent. Surgery, in fact, remains the primary modality of treatment for malignancies of the lower gastrointestinal tract, and standard resection is the only therapy required for early-stage cancer. As the stage of the tumor increases in terms of depth of penetration and lymph node involvement, the chance of cure with surgery alone diminishes; rates of local recurrence and survival are dependent on the tumor–node–metastasis (TNM) stage. Adjuvant therapies have been shown to increase the probability of cure in surgically treated patients who have a high risk of recurrence (4). Parallel to the efforts in adjuvant therapies, there is renewed interest in examining whether surgical techniques have been fully optimized. Could improvements in surgery accomplish further gains in cancer outcome?

It is well established that surgical variation exists and can be measured for rates of both local recurrence and survival. Numerous studies (5–9) have reported local recurrence rates for rectal cancer ranging from as low as 4% to as high as 55% based solely on surgeon differences. Even within U.S. cooperative groups, modest degrees of surgeon variability have been reported (10).

Ample evidence exists to support the premise that surgical techniques clinically significantly affect cancer outcome, yet no standardized and accepted guidelines have ever been proposed. If improvements in surgical outcomes are to be achieved, it is essential that the components of surgery that contribute to local and systemic treatment failure be critically examined. Toward that end, the National Cancer Institute (Bethesda, MD) sponsored a panel of experts to systematically review the literature and to draft guidelines. These guidelines are intended to enhance surgical quality control and to facilitate the homogeneity of groups in clinical trials. Guidelines are needed to help reduce surgical variation and to help standardize documentation to minimize inconsistencies in staging patients with colorectal cancer.

The attitudes toward and methods for practice guidelines were followed as described previously by the American Society of Clinical Oncology (11). It must be recognized that there are limitations in the level of evidence supporting specific surgical practices, since not all variables discussed are well critiqued with the use of a single level of evidence scoring system. Therefore, it is the intent of this article to provide a framework of uniform definitions, principles, and practices of oncologic colon and rectal resection, including documentation. For areas in which evidence is insufficient for the definitive recommendation of guidelines, future research should be considered.

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See "Notes" following “References.”

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METHODS

Methods similar to those used by the American Society of Clinical Oncology in developing practice guidelines (12) were used. These methods are described in detail below.

Panel Composition

The guidelines were developed by a panel of surgeons representing each of the National Cancer Institute-sponsored adult cancer cooperative groups (see “Appendix 1”). In addition, each of the three major surgical societies (Society for Surgery of the Alimentary Tract, American Society of Colon and Rectal Surgeons, and Society of Surgical Oncology) and the National Cancer Institute were represented. Because a secondary goal of this initiative was the development of surgical data collection forms, biostatisticians and data managers from cooperative group operations offices were included.

Process Overview

The guidelines were developed initially during a 2-day meeting and were formalized through a series of subsequent discussions devoted to resolving remaining issues. Before the initial meeting, a list of guidelines to be developed, as well as the data collection forms for surgically related data from each of the cooperative groups, was circulated to the panel members.

Review of Available Data

To evaluate the available evidence, the panel followed the process for guideline development established by the American College of Chest Physicians (13,14); this process was used previously for developing the American Society of Clinical Oncology guidelines for colorectal cancer surveillance (11). The process involves a systematic consideration of the level and grade of evidence (I–V) available for each issue (Table 1) (13,14). Outcomes of primary interest in determining guidelines were overall survival and local tumor recurrence; consideration was also given to the patient’s quality of life and the cost and feasibility of implementing any guideline.

Information from the published literature as of April 1999 was synthesized for the creation of these guidelines. All relevant literature, both prospective and retrospective, was included in the review. Unpublished data from several sources were included as well, and attention was given to the appropriate weight such evidence should warrant. Before the meeting, panel members comprehensively reviewed the published works on each of the predefined topics.

Initial guidelines were developed by working groups focused on colon and rectal issues. These initial guidelines were circulated and reviewed by the entire panel before a joint meeting of the working groups. At this joint meeting, recommendations were reviewed and revised. Revised guidelines were circulated through several iterations, and all panel members had the opportunity to comment on the final recommendations.

Data Collection Forms

A secondary goal of the conference was to standardize the process of collecting surgically relevant data on National Cancer Institute-sponsored cooperative group clinical trials. The decision was made to classify trials as to whether a surgical question was the primary or the secondary hypothesis, with a different level of data collection for each. Data forms were developed on the basis of integrating the new guidelines into the various current cooperative group data collection systems. Data elements defined as a result of the guidelines are in the process of being incorporated into the National Cancer Institute’s Common Data Elements initiative.

ANATOMIC DEFINITIONS: COLON VERSUS RECTUM

Guidelines: There are many discrepancies in the literature for defining the junction of the colon and rectum. This situation creates uncertainties when assigning patients to colon or rectal protocols. The following definitions are preferred: for colon, greater than 12 cm from anal verge by rigid proctoscopy; for rectum, 12 cm or less from anal verge by rigid proctoscopy.

Level of evidence: IV–V.
Grade of recommendation: B.

Rationale: These definitions are based on the finding that colorectal cancers located above 12 cm from the anal verge have a local recurrence rate more consistent with patterns of recurrence in the colon than in the rectum. In the study by Pilipshen et al. (15), the local recurrence rate was 9.6% for lesions located above 12 cm compared with 30.1% and 30.7% for mid- and low-rectal cancers, respectively. Several retrospective studies (15–21) support this observation.

Anatomic definition of the rectum is highly variable. Both endoscopic and intraoperative criteria are used. For intraoperative definitions, the beginning of the rectum or the end of the colon has been descriptive and imprecise. The end of the _taeniae coli_ or peritoneal reflection has been used to determine that location, but both are highly variable owing to differences in age, sex, and gynecologic and obstetric conditions. Flexible sigmoidoscopy introduces variability in the level of the rectum due to technique. Rigid proctoscopy (suggested in the left decubitus position) is thought to be a highly reproducible method of determining the level of the rectum and is less dependent on the operator or on the technique. The anal verge is the preferred anal landmark, since the edge of the tumor and the verge can be visualized simultaneously during rigid proctoscopy.

STAGING

TNM Staging

Guidelines: The TNM classification of tumors described by the American Joint Committee on Cancer (AJCC) (22) is recommended for tumor staging (standard AJCC language for tumor depth was accepted) (Table 2).

Extent of Resection (R)

Guidelines: In addition to tumor stage, any tumor not removed intraoperatively strongly influences prognosis and therapy. The absence or presence of residual tumor after surgical treatment is described by the letter R. Accepted guidelines from...
Resections should be categorized as follows: R0 (i.e., complete resection) if all gross disease resected by en-bloc resection; R1 (i.e., microscopic residual tumor); and R2 (i.e., macroscopic residual tumor).

Rationale: Numerous studies, including the landmark study by Quirke et al. (23) in 1986, clearly demonstrate the importance of optimal pathologic assessment of lateral, radial, and, most recently, circumferential margins of resection, since margins positive for disease have been clearly associated with an increased rate of local and distal treatment failure. In various studies (23–25), the local recurrence rate after resection of a rectal cancer was 29%, 78%, and 85% for cases with margins positive for disease compared with 3%, 8%, and 10%, respectively, for cases with margins negative for disease.

Furthermore, Hall et al. (26) suggest that, after a total mesorectal excision, both disease-free survival and mortality were clinically significantly related to margin involvement.

Adjuvant R0 Stage

Guidelines: “Adjuvant” therapies requiring “complete resection” should refer to surgical cases that are strictly R0. A case would not be considered R0 (i.e., a “complete resection”) if any of the following are evident from the surgical or pathology reports: non-en-bloc resection, radial margin positive for disease, bowel margin positive for disease, residual lymph node disease, or NX (incomplete staging). “R” definitions are based on the accepted AJCC Prognostic Factors Consensus Conference colorectal Working Group definitions (27).

Surgical Techniques—Colon

This section discusses surgical techniques relevant only to the colon (see also “Surgical Techniques—Colon and Rectum” below).

Ideal Bowel Resection and Margins

Guidelines: The ideal extent of a bowel resection is defined by removing the blood supply and the lymphatics at the level of the origin of the primary feeding arterial vessel. When the primary tumor is equidistant from two feeding vessels, both vessels should be excised at their origin. Resection is substandard when removal of the primary tumor with its named vessel and adjacent lymph nodes is incomplete. Ideally, the inferior mesenteric artery (IMA) should be excised at its origin, but this is not mandated by available supportive evidence.

Although there is some debate, 5 cm of normal bowel on either side of the primary colon tumor appears to be adequate to minimize anastomotic recurrences. The length of ileum resected does not appear to affect local recurrence. Therefore, the shortest length of ileum needed to perform the surgical procedure should be excised to prevent malabsorption syndromes.

Patients with multiple (i.e., two or more) colon cancers or those with hereditary nonpolyposis colorectal cancer should be considered for a total abdominal colectomy with ileorectal anastomosis. Patients with ulcerative colitis should have a procto-

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<th>Table 2. TNM staging definitions*</th>
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<td>Extent of resection (R)‡</td>
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*Standard American Joint Committee on Cancer language was accepted.
†A tumor nodule greater than 3 mm in diameter in perirectal or pericolic adipose tissue without histologic evidence of a residual lymph node in the nodule is classified as residual lymph node metastases; however, a tumor nodule up to 3 mm in diameter is classified in the T category as discontinuous extension (i.e., T3).
‡Cases are not considered R0 (complete resection) if the following are evident: non-en-bloc resection, radial or bowel margin positive for disease, residual lymph node disease, or NX (incomplete staging).
Lymphadenectomy

Guidelines: Lymph node resection carries with it prognostic and therapeutic implications. An appropriate lymph node resection should extend to the level of the origin of the primary feeding vessel. In all cases for cure, the lymph node resection should be radical and the lymph nodes should be removed en bloc.

Lymph nodes at the origin of feeding vessels (apical nodes) should be removed when feasible and tagged for pathologic evaluation. Lymph nodes suspected of being positive for disease outside the field of resection need to be sampled or have a biopsy. If biopsy results of the suspected lymph nodes are positive for disease and the lymph nodes are resected along with the apical nodes, the resection is considered to be complete (R0). If biopsy results of the suspected lymph nodes are positive for disease or are clinically involved and the lymph nodes are not resected along with the apical nodes, the resection is incomplete. If biopsy results of the suspected lymph nodes are negative for disease and the apical nodes positive for disease are resected, the resection is considered to be complete (R0). If biopsy results for lymph nodes left behind are positive for disease, the resection is incomplete (R2). Patients with R1 or R2 resections are not considered to be eligible for adjuvant trials.

For adjuvant trials, a minimum of one lymph node must be examined for entry into a trial. For surgical trials or for entry into a colon adjuvant trial in which the lymph nodes are negative for disease, a minimum of 12 nodes must be examined. The TNM staging system should be used for all colorectal cancer trials.

Level of evidence: III–IV.

Grade of recommendation: C.

Rationale: Only one randomized clinical trial (32) so far has assessed the value of a radical lymphadenectomy for left-sided colon cancer. There was no evidence of a benefit for a wider lymphadenectomy. Several retrospective studies (33–37) have yielded conflicting results on the value of extended lymphadenectomy; however, if any benefit is present, it is in Dukes’ stage C disease. The potential morbidity of an extended lymphadenectomy does not appear to be prohibitive when it is performed by experts but remains to be explored. The panel agreed that an important value of lymphadenectomy is in staging. The apical node may also have prognostic significance in addition to the number of lymph nodes positive for disease in the specimen (38). Therefore, all lymph nodes suspected of being positive for disease beyond the field of resection need a biopsy if feasible. To achieve a high degree of accuracy (>90%), a minimum of 12 lymph nodes negative for disease must be examined to confirm that the disease does not involve the nodes (39).

Laparoscopic Colectomy

Guidelines: Owing to the evolving nature of this technology and technique, the consensus is that laparoscopic colon cancer resection be confined to clinical trials at this time. Recurrence of disease at trocar sites continues to be a concern. This is an unresolved issue.

Surgeon credentialing is an important facet with this new approach and technology. Individual experience should be documented by cases and video presentation.

Level of evidence: IV–V.

Grade of recommendation: D; panel consensus.

Rationale: Laparoscopic colectomy for cancer is currently undergoing rigorous study in the United States (40,41), Europe (42), Scandinavia (40), and Australia (40). There are no results from the randomized, prospective trials about treatment of cancer for cure—either short-term or long-term. Several small randomized, controlled trials (43–46) have produced early data suggesting that laparoscopic colectomy for cancer is safe, offers improved early recovery, and has a low rate of implantation of cancer at the trocar site. There are no randomized, controlled trials evaluating the laparoscopic resection of rectal cancer. There are no long-term data about disease-free survival after laparoscopic colectomy for curable cancer.

Prospective and retrospective reviews of large series of patients who have had laparoscopic resection for colorectal cancer (47–52) suggest that implantation of cancer at trocar sites can be maintained at a low rate, and preliminary survival rates of patients are similar to historical series of open resections for cancer. Even so, anecdotal reports of tumor recurrence at trocar sites (53–56) have raised the awareness of surgeons that this technique has potentially adverse effects on outcomes. Experimental models suggest that implantation of tumors at trocar sites is related to technique and depends on the presence of free cells within the peritoneal cavity and on the rapid distribution of cells throughout the cavity by the pneumoperitoneum and that implantation can be reduced by local treatment of trocar sites to prevent tumor adhesions or contamination of the wound (45,57–64). The effect of laparoscopic conditions is variable and depends on the gas used, the tumor model, and the conditions of the experiment itself (65).

The learning curve for laparoscopic colectomy has been estimated to be 35–50 procedures (66). As young surgeons in training gain experience in other advanced procedures, this quantity may decrease. The current randomized, controlled trials require credentialing of surgeons by submission of at least 20 surgical reports of laparoscopic colectomy that meet established technical requirements, including tissue handling, intracorporeal vessel control with proximal vessel ligation, central...
Surgical Techniques—Rectum

This section discusses surgical techniques relevant only to the rectum (see also “Surgical Techniques—Colon and Rectum” below). The goal of surgery is complete removal of the primary tumor, its named vessel(s), associated lymph nodes, and the appropriate amount of mesorectum.

Length of Bowel

Guidelines: The length of bowel resection was reviewed, and there were no supporting data to indicate that length of bowel had an effect on local control and 5-year survival.

Level of evidence: IV.

Grade of recommendation: D.

Rationale: The length of bowel resected during a resection of the rectum for a rectal cancer is influenced by the available blood supply after appropriate vascular ligation and mesenteric resection. After proximal margins of 5 cm and distal margins of 2 cm are obtained, there is no advantage to resecting additional length of colon or rectum (see below) (67). The main emphasis in determining the appropriate length of bowel resection should be to obtain clear surgical margins and yield an R0 resection (no residual tumor) (68).

Distal and Proximal Bowel Margins

Guidelines: The ideal distal margin length is 2 cm or greater from the transected mucosal edge to the distal edge of the primary tumor (Table 3). This length is measured in the fresh, anatomically restored ex vivo condition or in the formalinized, fixed specimen with the use of a correction factor of 12% reduction for anatomically restored, fixed specimens compared with 50% reduction for nonrestored, fixed specimens. The distal edge is the transected full-thickness edge and does not include the tissue doughnut from the endoluminal stapler. For tumors of the distal rectum (<5 cm from the anal verge), the minimally acceptable length of the distal margin is 1 cm in the fresh, anatomically restored ex vivo condition or in the equivalent formalinized, fixed specimen. A 1-cm margin is not advised in cases of large, bulky tumors or in cases with adverse histologic features, such as poorly differentiated tumors or tumors with lymphovascular or neural invasion. With regard to histologic assessment of distal margins, all patients must have microhistopathologic evaluation of the distal margin by a review of sections of either permanently fixed tissue or frozen tissue. If the distal margin is 1–2 cm, an intraoperative evaluation of frozen tissue section of the distal margin nearest to the tumor is recommended.

Level of evidence: III–IV.

Grade of recommendation: B.

Rationale: Proximal and distal bowel margins are influenced primarily by the level of vascular ligation and excision of distal mesorectum in proximal rectal cancers and mid-rectal cancers. A minimum 5-cm bowel margin has been recommended on the basis of the work by Grinnell (67), in which intramural extension was estimated to occur in 12% of cases. The 5-cm rule has been questioned, especially in the distal rectal cancer in which a 5-cm margin would necessitate excision of the anal sphincters. Several studies (69–72) have shown that distal intramural spread is rare and is found beyond 1 cm in only 4%–10% of rectal cancers. Subsequently, survival and local recurrence have been shown to be acceptable with a 2-cm or greater distal bowel margin (73–76). If distal spread does occur beyond 1.5 cm, it is usually from a poorly differentiated cancer and the prognosis is poor, regardless of the length of the distal margin (71). Therefore, it is currently accepted that 1) distal intramural spread beyond 1 cm occurs rarely, 2) distal spread beyond 1 cm is associated with tumors of advanced stage or histologically aggressive disease, and 3) the associated poor prognosis is not improved by a longer distal margin (77). A 1-cm distal margin may be adequate (73, 74). With preoperative radiation therapy and chemotherapY, a simple, clear margin may be adequate, but this has not been accepted as a general guideline (78).

Level of Proximal Lymphovascular Ligation for Rectal Cancer

Guidelines: Available evidence suggests that an appropriate proximal lymphatic resection for rectal cancer is provided by the removal of the blood supply and lymphatics up to the level of the origin of the primary feeding vessel. For rectal cancer, this is at the origin of the superior rectal artery, which is immediately distal to the takeoff of the left colic artery. There is a lack of evidence about the benefit of ligating the IMA at its origin. This is a valid statement for patients who do not have clinically suggestive lymph node disease. In the context of lymph nodes clinically suggestive of disease, we recommend the removal of all lymph node disease suspicious for metastasis as is technically possible. Suspicious periaortic nodes should have a biopsy for staging.

Level of evidence: II–III.

Grade of recommendation: C.

Rationale: The recommended level of proximal vascular ligation for rectal cancer is at the origin of the primary feeding vessel (superior rectal artery). This recommendation is based on the same data used to recommend primary feeding vessel ligation for colon cancer. The data from a French multicenter, randomized trial (comparing left colectomy and ligation of the IMA with segmental colectomy and ligation of the primary feeding vessel) show no statistically significant difference in long-term (12 years) survival (32). A large series from Columbia-Presbyterian Hospital (New York, NY) showed improved survival only for patients with stage II rectal cancer who had high IMA ligation. Stage III disease was not affected by high ligation at the IMA (79). A more accurate staging and prognosis may be obtained by high ligation, but survival does not seem to be affected (80). Stage migration may affect overall outcome because of improved staging and lead time bias (81). All lymph

Table 3. Distal and proximal bowel margins for resection of rectal tumors

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<td>Ideal</td>
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<td>Minimally acceptable†</td>
<td>≥1</td>
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*Current data indicate that margin standards are equally applicable to patients receiving preoperative radiation therapy.

†For tumors of the distal rectum where sphincter preservation is an issue.
nodes suspicious for metastasis beyond the origin of the feeding vessel should have a biopsy or should be removed, or the level of resection should be extended to include the worrisome lymph nodes. Even so, a “skip” phenomenon (i.e., metastases beyond an uninvolved sentinel lymph node) should be present in only 5% of cases (32).

**Mesorectal Excision**

Guidelines: The mesorectum is defined as the lymphovascular, fatty, and neural tissue that is circumferentially adherent to the rectum, starting at the level of the sacral promontory, where the superior hemorrhoidal vessel divides into right and left branches. The mesorectum tapers and then diminishes just below Waldeyer’s fascia (the investing fascia of the levators) around the levator ani muscles at the level of the distal third of the rectum.

The goal of surgery should be to obtain radial clearance of mesorectal tissue, including the primary tumor and lymphatic, vascular, and perineural tumor deposits. Wide anatomic resection is accepted as the standard technique for rectal cancer procedures. Wide anatomic resection includes presacral dissection under direct visualization, preservation of mesorectal fascia propriety integrity, at least 4-cm clearance of attached mesorectum distal to the tumor, and pathologic confirmation of mesorectum attached to the bowel, distal to the tumor.

In surgical trials, a checklist should verify that dissection under direct visualization has been performed. Surgical and pathologic reports should verify a 4-cm, fresh, distal mesorectal margin.

Level of evidence: III.

Grade of recommendation: C.

Rationale: The clinical significance of the mesorectum and of its surgical clearance is supported by the demonstration of tumor deposits within the mesorectum remote from the primary tumor (82) and by the demonstration of a strong correlation between the extent of the mesorectal tumor spread and cancer outcomes (83).

Mesorectal spread can occur by direct tumor extension or as lymph nodes, perineural invasion, or isolated mesenteric deposits (23). Mesorectal spread appears to be an important indicator of disease severity (83), and surgical clearance of the mesorectum appears to be an important technical variable. Several studies (10,24,25,84,85) have demonstrated greater rates of failure for treating local disease in patients with lateral resection margins that are positive for disease. The fact that lateral clearance rather than lateral spread correlated with the risk of failure for treating local disease in a large study of patients treated in cooperative group studies (10) supports the importance of radial clearance techniques. Further support derives from the fact that most failures for treating pelvic disease are extrarectal rather than anastomotic (86) and that the practice of mesorectal clearance is associated with small rates of local recurrence (87–89). Note that circumferential margin involvement after mesorectal excision of rectal cancer with curative intent indicates advanced disease, not inadequate surgery; accordingly, death from disease typically occurs before local recurrence (26). Data from pathologic assessments of rectal cancer specimens with attention to mesorectal deposits suggest that mesorectal clearance of at least 4 cm distal to the tumor should be sufficient (29,90).

A current controversy considers that proper attention to surgical clearance of mesorectal tumor deposits can reduce rates of pelvic recurrence sufficient to reduce rates of pelvic irradiation. This concept is being tested by the Dutch ColoRectal Cancer Group (91). Patients with nonfixed, resectable cancer are being randomly assigned to receive total mesorectal excision or total mesorectal excision plus preoperative external beam radiation therapy (25 Gy).

Mesorectal excision will remain controversial until scientific evidence from randomized trials demonstrates an advantage.

**Extended Lateral Pelvic Lymph Node Dissection**

Guidelines: Evidence is insufficient to recommend an extended lateral lymphatic dissection for rectal cancer in the context of a patient without lymph nodes that are clinically suspected of having disease. In the context of clinically suspected lateral lymph node disease, the dissection should attempt to remove these nodes, as is technically feasible. A biopsy of suspected lymph nodes that are beyond the surgical field of resection needs to be done for staging purposes (e.g., iliac lymph node). The apical lymph node should be tagged for pathologic examination.

For adjuvant trials, a minimum of one lymph node must be examined for entry into the trial. For surgical trials or for entry into an adjuvant trial for lymph nodes negative for disease, a minimum of four nodes must be examined.

Level of evidence: IV.

Grade of recommendation: C.

Rationale: It has long been recognized that the lymphatic drainage of the rectum is highly variable and that dominant patterns are dependent on the location of the tumor in the rectum (92). In addition to longitudinal lymphatic spread along the colon, tumors in the upper rectum spread mostly to the superior pedicle and tumors in the lower rectum spread superiorly and laterally (29,92). Involved lymph nodes can be detected along the aorta and superior rectal vessels, as well as along iliac, hypogastric, sacral, and inguinal nodal sites and laterally along the middle hemorrhoidal and lateral ligaments (29,92,93). The number and location (i.e., lateral or apical) of lymph nodes positive for disease influence outcomes, especially 5-year survival, and have served as the basis for recommendations for extended or lateral node dissection (38,93,94). What is not yet established is whether the involvement of apical or lateral lymph nodes is relevant only as an indicator of disease severity and prognosis or whether it indicates a need for more radical lymphadenectomy. To date, no controlled trials have demonstrated a benefit for extended lymphadenectomy. Such trials have been difficult to conduct for many reasons, including limitations of intraoperative staging; e.g., the inclusion of patients with stage I or II disease and lymph nodes negative for disease would be expected to dilute the power of the study. Recent reports from the cooperative group rectal adjuvant studies (10) demonstrate a statistically significant effect of the percentage of lymph nodes positive for disease. In fact, in a multivariate analysis testing the effect of lymph nodes on local recurrence rates, the percentage of lymph nodes positive for disease was statistically significant when the number of nodes positive for disease was not (10). This observation suggests that surgical clearance may be an important variable affecting rates of local disease treatment failure much like mesorectal clearance influences local failure rates. Future research efforts should consider reinvestigating the role of extended but selective lymphadenectomy, perhaps using modern techniques of sentinel lymph node mapping.
Importantly, tumor adherence to adjacent organs can represent a form of spread that involves the uterus, adnexa, posterior vaginal wall, and bladder (96). The incidence of histologically proved, malignant adhesions is 49%. Hence, extended resection of structures adherent to the carcinoma should be considered. The critical issue is that one cannot determine reliably before resection whether tumor involvement of contiguous organs is the result of an inflammatory process or of malignant invasion. Therefore, extended resection whether tumor involvement of contiguous organs is the result of an inflammatory process or of malignant invasion.

Guidelines: En bloc resection is considered to be the minimum extent of resection to achieve a complete resection for lesions that are T4 clinically and pathologically. Tumors are considered to be R0 if adjacent structures involved by direct extension of the primary tumor are removed en bloc and if, in the judgment of the surgeon and when confirmed on histologic examination (i.e., the margins of resection are not involved), the resection is considered to be curative. Lesions that are clinically treated as T4 lesions by en bloc resection but that contain only inflammatory adhesions are not considered to be T4 lesions.

Level of evidence: III.
Grade of recommendation: B.

Rationale: An en bloc excision of the colorectal cancer and adjacent organs must be performed so as not to compromise curability. Colorectal cancer adherence to adjacent intra-abdominal organs or structures is encountered in 15% of patients with colorectal cancer (95). Rectal carcinoma most often involves the uterus, adnexa, posterior vaginal wall, and bladder (96). Hence, aggressive surgical procedures are needed because of the direct extension of tumor into these adjacent structures. Importantly, tumor adherence to adjacent organs can represent malignant invasion or simply inflammatory adhesions (96–100). The critical issue is that one cannot determine reliably before resection whether tumor involvement of contiguous organs is the result of an inflammatory process or of malignant invasion. Hence, extended resection of structures adherent to the carcinoma is the most appropriate surgical management. The reported incidence of histologically proved, malignant adhesions is 49%–84% (101–107). In a collective review of 248 patients who underwent total pelvic exenteration for rectosigmoid cancer, Lopez and Monafo (108) reported a 40% incidence of malignant adhesions. In these patients, resection that was less than en bloc not only compromised the survival but also increased the recurrence rate. In a group of 43 patients with adjacent organ involvement reported by Hunter et al. (109), the 5-year survival rate was 61% and the local recurrence rate was 36% for individuals who underwent an en bloc resection compared with 23% 5-year survival and 77% local recurrence rates for those who had their adhesions surgically separated. Other reports in the literature (95,96,106,110–112) have shown improved survival in similar-stage colorectal tumors when en bloc resection is performed. Even for patients with regional lymph node metastases (the most important prognostic factor after potentially curative resection for colorectal carcinoma and adjacent organ involvement), an en bloc resection is warranted because approximately 25% of these patients will survive 5 years (108).

The urinary bladder is the organ most frequently involved by locally advanced colorectal carcinoma (113). Extended resection may include a partial or a total cystectomy as part of the en bloc resection. For such procedures, morbidity rates are increased compared with the standard surgical resections for colorectal carcinoma because of the complications associated with the urinary diversion or bladder repair (114). Results reported by Talamonti et al. (113) confirm that resection of an advanced carcinoma of the colon and rectum with en bloc removal of all or part of the urinary bladder can prolong survival when resection margins are negative for tumor.

In conclusion, en bloc removal of adjacent organs locally invaded by cancers of the colon or rectum can achieve survival rates similar to those of patients with tumors that do not invade an adjacent organ. To achieve this result, resection margins negative for tumor are required.

No-Touch Technique

Guidelines: The value of the no-touch technique in colon surgery is debated; the one randomized study of this topic indicates no advantage to support the routine use of the no-touch technique.

Level of evidence: II.
Grade of recommendation: C.

Rationale: Concern about dislodgment of tumor emboli during resection of colorectal carcinomas was the stimulus for the introduction of the no-touch technique. In a retrospective analysis, Turnbull et al. (119) demonstrated a difference in 5-year survival; however, there were serious problems with the design of this study, especially involving more extended resections...
in the no-touch group. In the only prospective, randomized trial evaluating 236 patients, Wiggers et al. (120) demonstrated no statistically significant difference in 5-year survival with the use of the no-touch technique. The absolute 5-year survival rates were 56.3% and 59.8% in the conventional arm and no-touch surgical groups, respectively. In the conventional group, more patients had liver metastases and the time to metastasis was shorter, but differences in survival were not statistically significant.

No conclusive data demonstrate that, during surgical manipulation of colorectal tumors, the detachment and circulation of tumor cells increase in the peripheral circulation. In fact, in a study by Garcia-Olmo et al. (121), only one in 18 patients had carcinoembryonic antigen products in the blood of a peripheral vein detected postoperatively by reverse transcription–polymerase chain reaction; this patient was also one of two in whom the products were identified preoperatively. In addition, only one patient was found to have carcinoembryonic antigen products in the blood of a peripheral vein detected postoperatively by reverse transcription–polymerase chain reaction; this patient was also one of two in whom the products were identified preoperatively. In addition, only one patient was found to have carcinoembryonic antigen products in the main drainage vein of the colorectal cancer during the resection. Hayashi et al. (122) used mutant-allele-specific amplification to demonstrate that the no-touch technique may prevent cancer cells from being shed into the portal circulation. However, this was in a small series of only 18 patients with colorectal cancer, and the clinical significance of these experimental findings remains unclear.

Bowel Washout

Guidelines: Studies have shown that viable tumor cells exist in the lumen of the colon and rectum. Rectal washout may have value; however, no information exists to suggest any benefit in the management of colon cancer.

Level of evidence: III.

Grade of recommendation: C.

Rationale: No data conclusively demonstrate reduction of local recurrence or anastomotic implantation with colon or rectal washout. However, exfoliated malignant cells have been found in the effluent of resection margins, in rectal stumps, and on circular stapling devices (123–125). Furthermore, the viability, ability to proliferate, and metastatic potential of exfoliated malignant colorectal cells have been illustrated (124,125). Different chemical washout solutions, including normal saline, have been shown to eliminate exfoliated malignant cells in the doughnut of rectal tissue from a circular stapler (126). Despite the evidence for potential anastomotic implantation, no conclusive evidence supports bowel washout, and no data support its use in colon cancer. However, with no risk and minimal cost, it may have some utility in the management of rectal cancer, where the proximity of the anastomotic site and the cancer is close; furthermore, it may reduce the microbial concentration.

Oophorectomy

Guidelines: Direct extension of the tumor to the ovary or a grossly abnormal ovary should result in en bloc or complete resection of the ovary. Data do not exist to support routine prophylactic oophorectomy. However, oophorectomy may be offered as an option to standard-risk patients who receive preoperative radiation therapy or who are postmenopausal.

Level of evidence: IV.

Grade of recommendation: D; panel consensus.

Rationale: There is general agreement among surgeons that grossly abnormal ovaries should be removed. In addition, metachronous ovarian lesions should be resected, because removal of all gross disease can provide a clinically significant survival advantage (127). En bloc resection is the ideal surgical method to manage locally advanced adherent colorectal cancers. For further details, see the previous section, “En Bloc Resection of Adherent Tumors.”

Ovarian metastases from colorectal carcinoma occur in up to 6% of patients and are associated with a poor prognosis and usually with widespread disease (128). Thus, several investigators have advocated prophylactic oophorectomy to address this issue and to prevent the risk of primary ovarian carcinoma. Although no randomized studies have addressed prophylactic oophorectomy, two studies have retrospectively compared survival in patients with and without prophylactic oophorectomy. Cutait et al. (129) compared 201 women who had prophylactic oophorectomy with 134 women who did not. No statistically significant difference in survival occurred, and the survival curves of the patients with oophorectomy were slightly worse. Ballantyne et al. (130) retrospectively analyzed the impact of oophorectomy on survival and on recurrence-free survival in women with colon cancer. No statistically significant difference occurred in patients undergoing bilateral oophorectomy compared with those not undergoing oophorectomy, although a 5% improvement in survival favored the oophorectomy group. Thus, no data demonstrate a survival advantage with prophylactic oophorectomy. Because of the low risk and potential advantage, this procedure still is considered to be an option in postmenopausal patients, although dysfunctional uterine bleeding can occur as a complication.

Abdominal Exploration

Guidelines: Review of surgical reports has indicated an increasing reliance on preoperative staging techniques, such as ultrasonography and computerized axial tomography (CT). The standard should remain a thorough intraoperative exploration for metastatic and locally advanced primary and lymph node disease. The patient is entitled to an intraoperative exploration that is as thorough as the anatomy and prior surgical procedures permit without increasing the risk to the patient. A thorough examination includes inspection and palpation of the liver, peritoneal surface, omentum, retroperitoneum, and ovaries, if present. The primary tumor should be assessed for local adherence. Palpation of the periaortic, celiac, and portahepatic lymph nodes, when accessible, is important for documentation. Details of the exploration should be part of the surgical note, and the presence of metastatic disease should be documented, preferably histologically.

Alternatives to direct inspection of the liver include intraoperative ultrasonography, bimanual examination of the liver, and preoperative CT. Eligibility requirements for clinical trials are established by each clinical trials group. A reasonable requirement for entry is that all patients at the time of the surgical procedure have a documented abdominal exploration based on the above criteria. CT alone is not a substitute for a thorough abdominal exploration to satisfy eligibility criteria for clinical trial entry.
Surgical Documentation

Ideal Surgical Report

The ideal surgical report for colorectal cancer should provide all of the diagnostic, staging, prognostic, and technical aspects of the procedure that may influence outcome.

Documentation should include the following:

1) Preoperative treatments, including chemotherapy, radiation therapy, and immunotherapy.
2) The site, size, and adherence of the primary tumor(s); obstruction or perforation if present.
3) Staging for metastatic disease (liver, peritoneum, omentum, or ovaries) and nonmesenteric lymph nodes (celiac, portohepatic, periaortic, or iliac); the extent and means (manual, bimanual, or sonographic) of liver exploration; the presence or absence of ascites and whether fluid was sent for cytologic examination; the description of any compromise of the procedure that may influence outcome.

Ideal Surgical Report

Table 4. Summary of surgical guidelines

<table>
<thead>
<tr>
<th>Location of cancer</th>
<th>Surgical guideline and grade of recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colon</td>
<td>Lymphadenectomy should extend to the level of the origin of the primary feeding vessel; suspected positive lymph nodes outside the standard resection should be removed when feasible (grade C). Bowel margins ≥5 cm proximally and distally should be used (grade D). Laparoscopic colectomy for cancer should be confined to clinical trials (grade D).</td>
</tr>
<tr>
<td>Rectum</td>
<td>The ideal bowel margin is ≥2 cm distally and ≥5 cm proximally, measured fresh with the use of full thickness; the minimally acceptable distal margin for sphincter preservation is 1 cm (grade B). Lymphovascular resection of the rectum should include a wide anatomic resection of the mesorectum, including the mesorectal fascia propria and ≥4 cm of clearance distal to the tumor and proximal ligation of the primary feeding vessel (grade C). Extended lateral lymphatic dissection cannot be supported on current evidence (grade C). Length of bowel cannot be supported as an important surgical variable (grade D).</td>
</tr>
<tr>
<td>Colon and rectum</td>
<td>En bloc resection should be performed for tumors adherent to local structures (grade B). Inadvertent bowel perforation increases the risk of recurrence and should be avoided (grade B). Thorough abdominal exploration for metastatic and locally advanced primary and lymph node disease should be performed (grade D). The no-touch technique is debated with little evidence to support it (grade C). Bowel washout may have theoretical benefits in rectal cancer, but such benefits have not been proven (grade C). Ovaries grossly involved with tumor should be removed; prophylactic oophorectomy cannot be supported (grade D).</td>
</tr>
</tbody>
</table>

Explanation of Surgical Checklist

The surgical checklist (see “Appendix 2”) can be used to evaluate patients for clinical trial eligibility and to aid in obtaining complete information for the surgical note. This list is a compromise between obtaining the majority of important data and developing an exhaustive list for every eventuality. This list complements but does not replace the surgical note, in which the variations and nuances in the individual patient are best documented.

The surgical report can be supplemented with a drawing of the colon with its mesentery and arterial supply. This drawing can give important quality control by providing additional information or clarifying written information in the report.

The exact surgical procedure should be detailed. An extended right colectomy extends distal to the middle colic artery. A low anterior resection refers to mobilization of the rectum from its pelvic attachments and anastomosis below the pelvic peritoneum. In a high anterior resection, all of the dissection and the anastomosis are done above the peritoneal reflection. If a low anterior resection of the rectum and sigmoid colon is done, indicate both “sigmoidectomy” and “low anterior resection” or “sphincter-preserving rectal resection.” Any other procedure performed, such as oophorectomy, hysterectomy, or partial cystectomy, should be indicated.

An en bloc resection means that the tumor and attached mesentery, tissue, or organs are removed as a whole. Thus, if a tumor is shaved off the bladder and then the attached portion of the bladder is removed later, the resection is no longer en bloc. If a rectal tumor is transected and then additional rectal tissue is excised to obtain a margin negative for disease, the resection is no longer en bloc. If the specimen is removed and then additional lymph nodes positive for disease are removed, the resection is not en bloc.

The feeding vessels, such as ileocolic, middle colic, left colic, sigmoid, superior rectal, inferior mesenteric, or middle rectal...
arteries, should be identified. A clinical evaluation of residual tumor should be documented.

The distal mesorectal margin should be measured in the fresh specimen, preferably with the specimen pinned. The mesorectal distal margin is measured horizontally from the distal edge of the tumor.

Any areas suspected of having metastatic disease should have a biopsy unless the risk is not justified. If there is a suspicion of liver and extrahepatic metastatic disease, both sites should have a biopsy because the results may influence liver-directed therapy.

**Future Directions**

Using an established methodology, the panel of experts reviewed current literature and drafted guidelines as the first step in promoting consistency in oncologic surgical practices. The limiting factor in developing evidence-based recommendations was the paucity of evidence of levels I and II. The vision of the panel is that future efforts be focused on the collection of data in a standardized manner in large groups of patients. Only coordinated efforts of this sort will generate the data necessary to support grade A recommendations.

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**APPENDIX 1**

The following are members of the Expert Panel and their institutions and group associations:

<table>
<thead>
<tr>
<th>Name and degree</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>David Ota, M.D.</td>
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<tr>
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</tr>
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<td>Sam Wells, Jr., M.D.</td>
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</tr>
</tbody>
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## REFERENCES


NOTES

1Considered to be “category I” as prognostic factors by the College of American Pathologists Consensus Statement 1999 (68); “Definitively proven to be of prognostic import based on evidence from multiple statistically robust published trials and generally used in patient management.”

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