The surgical treatment of colorectal cancer has multiple facets. Historically, surgery has been and continues to be the best method of effecting cure in this disease. Along with this primary role, surgery is often required for diagnosis and staging of disease, along with the palliation of symptoms. The purpose of this chapter is to outline and illustrate each of these key components of surgical care in the treatment of these cancers of the lower gastrointestinal tract. An understanding of the appropriate application of surgery in this disease is essential for both surgeons and physicians involved in the treatment of colorectal cancer. Only then can surgery be put to its best use, which is to bring about a cure and/or improve the quality and length of life for patients with cancers of the colon and rectum.

SURGERY AS A DIAGNOSTIC TOOL

With the advent of radiologic and endoscopic methods, the need for surgical exploration to obtain diagnostic tissue has decreased considerably. Whereas preoperative tissue diagnosis was not used in the majority of colorectal tumors three decades ago, the vast majority of patients today have histology prior to definitive surgery. Since greater than 98 percent of colon and rectal cancers are adenocarcinomas arising from the mucosa and thus endoluminal, a thorough lower endoscopy can determine the diagnosis prior to any surgical exploration in the vast majority of cases. In the 5 to 10 percent of cases where the colonoscopy is not able to reach the tumor due to technical reasons (tortuous colon, poor preparation, etc.), a double-contrast barium enema can provide a radiologic diagnosis. It should be emphasized that in the case of colon carcinoma, an actual tissue diagnosis is often not necessary prior to surgery. As long as the location and appearance of the tumor, either endoscopic or radiologic, are adequately obtained, the information necessary to proceed with surgery is in hand. In the case of rectal carcinoma, diagnostic tissue and tumor depth and location are usually essential in planning the appropriate definitive treatment.

For the more rare tumors of the colon and rectum, such as carcinoids, lymphomas, and gastrointestinal stromal tumors that are submucosal or extraluminal, standard endoscopic methods may not make the diagnosis. In these situations, endoscopic ultrasonography can often visualize and biopsy these lesions. When this is not successful, ultrasonography or computed tomography (CT)-guided biopsy techniques can often obtain diagnostic tissue. However, with carcinoids, lymphomas, and gastrointestinal stromal tumors, it is common for the true diagnosis to be made at surgical exploration. Figure 8–1 demonstrates a large gastrointestinal stromal tumor of the sigmoid colon. This patient had normal bowel activity and a normal colonoscopy. The CT scan demonstrates the large primary tumor arising from the sigmoid colon.

Surgery may also be necessary to obtain diagnostic tissue in the case of recurrent disease. A rea-
A reasonably common scenario is that of a rising carcinoembryonic antigen (CEA) level and a CT scan showing extraluminal thickened tissue in the area of prior surgery. Endoscopic ultrasonography or radiologic-guided biopsies often return nondiagnostic inflammatory or fibrous tissue. When distant disease is ruled out, these patients warrant re-exploration for diagnosis and possible resection. These patients can still be cured through a combination of surgery, radiation therapy, and chemotherapy, but a firm diagnosis needs to be established.

Surgery as a Curative and Staging Technique

The goal of resection for both colonic and rectal cancers is threefold: first, a complete resection of the involved bowel segment with negative proximal, distal, and radial margins; second, a wide lymphadenectomy to encompass all draining lymph nodes for that segment of bowel; and third, restoration of bowel continuity when possible. The restoration of bowel continuity is an important goal, but the bowel resection and lymphadenectomy should never be compromised to avoid an ostomy. All of these goals should be achieved in conjunction with a thorough exploration and a minimal amount of complications (ie, infection, hemorrhage, and sexual or urinary dysfunction). The actual methods of resection vary according to location and will be discussed separately.

Both the colon and especially the rectum normally carry high bacterial counts (ie, *Bacteroides fragilis* and *Escherichia coli* $10^{10}$ and $10^7$ g of wet feces, respectively) and are thus considered contaminated cases. In order to reduce infectious complications from an expected rate of 70 percent down to less than 10 percent, preoperative decontamination of the bowel is indicated. There are many methods of decontamination but most involve a mechanical washout to evacuate the colon followed by an antibiotic sterilization of residual anaerobic and gram negative bacteria. Patients who undergo a colorectal resection with primary anastomosis in an unprepared situation are more likely to have wound infections, anastomotic breakdown, and leakage. This has traditionally prompted most surgeons to perform a diverting colostomy in this situation. However, surgery on the unprepared right or transverse colon, which has a lower bacterial count and liquid stool, can still be safely performed with either a right colectomy or extended right colectomy and primary ileocolonic anastomosis. When faced with a colorectal cancer that cannot undergo proper decontamination prior to surgery (ie, obstruction, severe hemorrhage, or perforation and infection), the surgeon must weigh these risks and benefits in deciding between a resection with colostomy or an anastomosis. In the case of a colostomy, it is useful for the surgeon to identify the distal bowel stump with a colored nonabsorbable suture at the time of the first surgery to facilitate its identification at a subsequent surgery to restore bowel continuity.

Colonic Resections

Figures 8–2 and 8–3 demonstrate the classic anatomy and vascular supply of the colon. While variations exist, the lymphatic drainage parallels the vascular supply. Thus, by excising the appropriate segment of colon with its accompanying vascular arcades back to their respective origins from either the superior mesenteric or inferior mesenteric artery, a wide lymphadenectomy will be achieved. There is no oncologic benefit to high ligation of the inferior mesenteric artery flush with the aorta. A ligation below the origin of the left colic is equally curative. In terms of the actual tumor and bowel wall resec-
tion, it would be sufficient to resect the involved segment of colon with a 1- to 2-cm margin of normal bowel. This would resect all gross and microscopic disease within the bowel wall. However, this type of resection would not achieve a sufficient lymphadenectomy, and thus wider resections are generally performed. These resections follow the vascular distributions of the colon (Figure 8–4). These hemicolectomies resect the associated lymphatics and minimize the chance of an ischemic anastomosis that can happen with segmental resections in patients with atherosclerotic vessels.

Tumor location and lymphovascular supply determine the appropriate resection. Lesions located in the cecum should be resected to include a segment of terminal ileum and its mesentery. The right colon is resected up to the right of the middle colic vessels. Tumors located in the ascending colon are resected with a standard right hemicolectomy. Lesions at the hepatic flexure may require resection by an extended right hemicolectomy (Figure 8–5). Obviously, the surgeon’s judgment is critical in determining the appropriate operation as there are anatomic variations and other patient issues that must be considered. Tumors in the mid-transverse colon are often resected from the hepatic flexure to the splenic flexure. This includes resection of the contiguous mesentery of the middle colic vessels. When transecting a vessel from the superior or inferior mesenteric artery, there is no curative benefit to a flush transection. A 1-cm cuff of vessel to ligate will give the same lymphadenectomy with less risk of hemorrhage.

The attached segment of omentum should also be resected with the specimen. This is done by transecting the omentum on the colonic side of the gastroepiploic vessels. The omentum also contains lymph nodes, which may be involved with tumor metastases. During right colonic resections, care must be taken to visualize and protect the duodenum, right ureter, and right gonadal vessels. All three of these structures are at risk as the right colon is mobilized out of the retroperitoneum.

Figure 8–6 demonstrates the ligation of the inferior mesenteric artery in order to mobilize the colon during a left hemicolectomy. As stated earlier, ligation of the inferior mesenteric artery does not add to cure rate, but it does remove the inferior mesenteric...
artery as a point of fixation. This in turn allows for better mobilization of the remaining colon and a tension-free anastomosis. For more proximal lesions, the superior rectal artery can often be preserved with no compromise in cure rates. There is no curative or staging benefit to a para-aortic lymphadenectomy.

During the resection of left colon lesions, the splenocolic and renocolic ligaments will often need to be incised to adequately mobilize the colon for resection and or anastomosis. Small tears in the capsule of the spleen are easily created by too vigorous retraction. Prevention is far more successful than treatment. However, when bleeding occurs from splenic capsular tears, it is important to incise the remaining attachments between the colon and spleen. This releases the tension on the capsule. It is then more likely that topical hemostatic agents, cautery, and direct pressure will be successful in achieving hemostasis. Other structures that are easily damaged during mobilization of the left colon from the retroperitoneum include the left ureter, left gonadal vessels, and tail of the pancreas. The tail of the pancreas can be inadvertently injured during mobilization of the splenic flexure of the colon. This can lead to either postoperative pancreatitis or a pancreatic fistula. Visualization of these structures will help prevent their injury.

The surgeon’s judgment in determining the extent of the resection is critical. A large premalignant polyp not amenable to endoscopic removal can be removed via a colotomy and polypectomy or via a segmental resection, without lymphadenectomy. Large bulky lesions that invade through the bowel wall into adjacent organs should be resected with a negative margin of the adjacent organ (ie, bladder, small bowel, abdominal wall, etc.). Stage for stage,
these T4 lesions have no increase in complications and an equal cure rate with en bloc surgical resection. The plane of invasion between the colonic tumor and the invaded organ should not be fractured. Disruption of this plane, even with subsequent surgical resection, decreases the cure rate by greater than 50 percent. In the case of invasion into the abdominal wall or retroperitoneum, the area of resection should be marked with metal clips for subsequent radiation therapy to help minimize the risk of a local recurrence. When possible, the area should also be covered by omentum to help exclude as much bowel as possible from the subsequent radiation field.

The No-Touch technique, as popularized by Turnbull and colleagues, involves the early division and ligation of the vascular supply and occlusion of the proximal and distal bowel lumen around the area of the tumor. This is done to limit the shedding of tumor cells into the blood and lymphatic systems and into the bowel lumen during manipulation of the tumor. There certainly is evidence that manipulation of the tumor during the operation leads to increased tumor shedding of detectable tumor cells into the blood supply. Turnbull’s initial series demonstrated improvement in survival in patients resected with this technique. However, subsequent controlled studies have failed to demonstrate any clinical benefit in decreased local recurrence or increased survival. At the present time it cannot be considered standard of care.

There is great variability in the frequency of postoperative bowel movement following a hemicolectomy. Most patients will have a minimal increase in frequency, but some patients will initially have an increase of two to four movements per day. These patients can have their frequency decreased through the addition of fiber to the diet and, when necessary, an antimotility agent. The remaining colon will often adapt over a 4- to 6-month period to return a patient to a more normal-for-them pattern.
RECTAL RESECTIONS

There is a wide array of treatment choices facing the clinician managing rectal cancer. Surgical treatment options can vary from transabdominal operations to local excision. Newer techniques are being applied to reduce the necessity for permanent colostomy, improve functional results, and reduce local recurrence. Radiation therapy with chemotherapy, especially in the preoperative setting, has a much more prominent role in the treatment of rectal cancer than in colon cancer. The roles of adjuvant and neoadjuvant therapy are discussed in subsequent chapters in this text.

Low Anterior and Abdominoperineal Resection

The gold standard for removal of a rectal cancer is via a transabdominal low anterior resection (LAR) or a combined abdominoperineal resection (APR). Both of these operations remove the involved bowel segment and the associated lymphatic tissue. There is no curative benefit of the complete rectal resection and permanent colostomy accomplished by an APR versus the LAR if the surgeon is able to obtain adequate proximal and distal margins in combination with a wide resection of the draining mesorectal lymphatic tissue. Best was the first to demonstrate that mucosal involvement 2 cm or more below the distal edge of the lesion was found in less than 1 percent of cases.9 Others confirmed this finding in several retrospective studies that demonstrated that there was no benefit in local control or metastatic disease for bowel margins greater than 2 cm.10,11 The question was finally laid to rest by the National Surgical Adjuvant Breast and Bowel Project (NSABP) [R-01] trial showing no difference in recurrence between resections with distal margins greater than 3 cm versus those within 2 cm.12 If an adequate distal margin without excising the rectal sphincter mechanism is possible, then a reconstruction via either a colorectal or colorectal anastomosis is indicated (Figure 8–7). However, Figures 8–8A and 8–8B show an example of a specimen of a T3N0M0 rectal tumor that was situated too low to be eligible for a sphincter-saving procedure. Consequently, an APR was performed.

The proximal extent of lymphatic resection has likewise been contested but never answered in a prospective study. However, several nonrandomized studies would support a dissection to include the nodal tissue up to the bifurcation of the left colic from the inferior mesenteric artery. Division of the artery just distal to this bifurcation preserves the left colic blood supply and has not shown any survival disadvantage relative to a more extensive proximal lymphadenectomy of para-aortic nodes with ligation of the inferior mesenteric artery at its origin. In a retrospective study from St. Mark’s Hospital of 784 patients with ligation distal to the left colic versus 586 patients with resection of the inferior mesenteric artery and accompanying nodal tissue, there were no differences in 5-year survival for any Dukes A, B, or C patients.13 Similarly, in a series by Hojo and colleagues, there was only 1 survivor among 15 patients who had extensive proximal lymphadenectomies when there were pathologically positive nodes along the inferior mesenteric artery.14 These studies support the practice of resecting proximal nodal tissue up to and including the origin of the superior rectal
artery and preserving the inferior mesenteric and left colic artery.

The concept of a sharp total mesorectal excision (TME) has increased the surgical awareness of the importance of obtaining a wide radial margin by encompassing the mesorectum as a defined packet. In 1982, Heald and colleagues published his initial description of the surgical techniques involved in TME\(^{15}\) (Figure 8–9). He also emphasized the importance of identifying and preserving the sympathetic and parasympathetic nerves to retain postoperative bowel, bladder, and sexual function, the autonomic nerve preservation (TME-ANP) (Figure 8–10). The dissection is continued down to the levator ani muscles to achieve full mobilization of the rectum and mesorectum (Figures 8–11, A and B). Incomplete circumferential mobilization of the rectum limits dis-

**Figure 8–8.** A, Specimen after an APR and B, opened to show a T3N0M0 rectal cancer just above the anal sphincter. It is situated too low to be eligible for a sphincter-saving LAR.

**Figure 8–9.** Schematic of the critical pelvic structures encountered during a sharp total mesorectal excision. The autonomic nerves and rectal vessels are divided sharply and individually to preserve the autonomic innervation necessary for bladder and sexual function. From Enker WE. Total mesorectal excision with sphincter and autonomic-nerve preservation in the treatment of rectal cancer. In: Condon RE, ed. Current techniques in general surgery. New York: Lawrence DellaCorte, 1996.
tal resection margins (Figure 8–11D), whereas full mobilization will allow more distal resections (Figure 8–11C). Traditionally, much of the pelvic dissection below the peritoneal reflection for rectal cancer was performed in a blunt fashion. This method of dissection was rapid and identified lateral tissue containing vascular, lymphatic, and nervous tissue that was then divided between clamps. The traditional technique will also allow for adequate distal mobilization but is more likely to injure autonomic nerve roots and disrupt the mesorectal lymphatic packet.

Table 8–1 demonstrates the results of Heald’s personal, prospectively collected, consecutive, non-randomized series of patients \(^{16}\) compared to the results of the North Central Cancer Treatment Group (NCCTG). \(^{17}\) While the two series cover similar time periods, there are differences in patient tumor profiles that limit the value of a direct comparison. His excellent results with local recurrence rates of less than 5 percent and overall recurrence at 10 years of 22 percent in curatively operated patients have provoked intense discussions about the true merit of this more time- and labor-intensive technique. This study covers a 13-year period from 1978 to 1991, with mean follow-up of 7.5 years. Of the 290 patients, 135 high-risk patients who were most likely to recur after curative resection constituted the group for analysis. There were 126 low anterior resections and 9 abdominoperineal resections in this group. High risk was defined according to the definition from the NCCTG. These investigators excluded Dukes A (Astler Coller A + B1) lesions, those more than 12 cm from the anal verge, and those considered not curative by the surgeon. The operation was considered curative when, at the end of the procedure, the surgeon believed that all grossly detectable cancer had been removed. None of these patients received adjuvant therapy, which reflects a long-term opinion of Heald’s that improved survival and local control can be achieved by optimal surgery alone. This is an obvious divergence from the recommendations of the 1990 National Institutes of Health (NIH) consensus conference where the combination of radiation therapy and chemotherapy was recommended as standard of care for stage 2 and 3 disease. \(^{18}\)

There is a cost for this apparent decrease in local and distal recurrence. Operative times are increased.
by 2.5 hours, and there are increased blood transfusion requirements. There is an 11 percent clinical and an additional 6.4 percent radiologic leak rate with TME. Heald and many others now routinely use a temporary diverting colostomy. Due to complications, 5 percent of these colostomies were never reversed. A similar series of 350 patients in Norway undergoing TME had an anastomotic leak rate greater than 20 percent, leading to emergency surgery, morbidity, and two deaths.19

While TME is touted as improving autonomic nerve function postoperatively, no good randomized studies exist to document this fact. The standard blunt dissection technique with clamping of the lateral pedicles undoubtedly has resulted in numerous unintended injuries to the pelvic autonomic nerve plexus. It would seem reasonable that a more meticulous dissection with preservation of the defined nerve roots would lead to better function.20

All of the preceding discussion serves to emphasize the point that surgical technique does make a difference in patient outcome. Hermanek and colleagues surveyed rectal cancer outcomes in seven major German cities and found that local recurrence rates varied among individual surgeons from less than 10 percent to more than 50 percent.21,22 Quirke and colleagues demonstrated the importance of radial margin clearance.23 In this prospective series of 52 patients with rectal adenocarcinoma, careful whole-mount sectioning of APR specimens revealed spread to the lateral margins in 14 patients (27%). Twelve of these patients (85%) developed local recurrence whereas only 1 of 38 patients (3%) with negative radial margins developed a local recurrence. Sharp dissection employed in TME to excise the entire mesorectum reproducibly provides a maximal intact lateral resection margin and may explain the beneficial effects on local control.

### Local Excision of Rectal Carcinoma and Sphincter-Sparing Techniques

The best operation in the treatment of rectal cancer is one that achieves a curative resection with the least morbidity and mortality. As the incidence of large bowel cancer increases with each decade of life, many patients diagnosed with cancer of the rectum are older than 70 years of age with coexistent medical problems. An advantage of local excision is that it is usually associated with a mortality rate near zero and similar low morbidity rates.24,25 The avoidance of a permanent stoma is another great advantage to the patient if the cure of cancer is not jeopardized. Approximately 10 to 15 percent of all patients with rectal carcinoma have tumors confined to the rectal wall and might be eligible for local excision after proper patient selection. The approach may be transanal, transcoccygeal, or trans-sphincteric as described in more detail later in this chapter.26–28 However, regardless of the surgical approach, the resection must achieve a negative margin and a full-thickness excision; otherwise, therapy is inadequate and further surgical therapy is indicated.

The most important criterion for local excision is accessibility, which will influence surgical treatment.29 To maximize the chance of a good oncologic procedure, several surgical groups have reported criteria for local excision, mostly in single institution, retrospective studies.25,27 Ideal rectal tumors for this approach are situated below the peritoneal reflection, are less than 4 cm in diameter, take up less than 40 percent of the rectal circumference, have no palpable or radiologically visible perirectal nodes, are mobile on digital examination, and have a well-differentiated histology without lymphatic or vascular invasion.30,31 All of these factors identify tumors that have a low likelihood of nodal metastases. Since local resections generally do not remove draining lymph nodes, these unresected lymph nodes can lead to local and distant recurrence if they in fact contain tumor. This is supported by the finding that local recurrence rates after local resection and the frequency of lymph node.

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>Local Recurrence (%)</th>
<th>Overall Recurrence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TME</td>
<td>5</td>
<td>22</td>
</tr>
<tr>
<td>Conventional surgery</td>
<td>25</td>
<td>62.7</td>
</tr>
<tr>
<td>+ radiation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conventional surgery + radiation + chemotherapy</td>
<td>13.5</td>
<td>41.5</td>
</tr>
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metastases found at APR are closely matched for similar stage diseases. Therefore, local excision with curative intent is only appropriate when the risk of nodal metastases is as near zero as possible. The methods presently available to determine the depth of tumor invasion of the rectal wall (the T status) and to document regional lymph nodes (N status) are limited. A good digital rectal examination in experienced hands can predict invasion of the rectal wall in up to 80 percent of cases but is less useful for detecting regional tumor-positive lymph nodes. CT scan and MRI are useful for identification of intra-abdominal metastases and can accurately identify locally advanced tumors that have invaded adjacent pelvic structures, but the negative predictive value for regional lymph nodes is only 50 to 70 percent. Endoluminal ultrasonography has been reported to be a more accurate diagnostic instrument for assessment of penetration of the rectal wall by carcinoma. It has a negative predictive value of 70 to 95 percent in experienced centers. The same expert groups report a negative predicted value of 80 to 90 percent for detection of regional lymph nodes by ultrasonography. The caveats are that an expert sonographist is needed for a reliable intraluminal sonographic examination and, even then, not all lymph nodes containing tumor are enlarged in colon and rectal carcinoma. Therefore, despite the best preoperative staging presently available, the status of lymphatic involvement is often still uncertain. This has important implications, as lymph node involvement has the single greatest impact on survival and is present in 40 to 60 percent of all rectal cancer patients treated by surgery alone. When deciding whether to perform a local resection where lymph nodes are generally not removed versus transabdominal resections where lymph nodes are resected, there is always some uncertainty. When a patient is a candidate for a local resection (tumor confined to mucosa, submucosa, or muscularis propria), tumor biopsy information in terms of tumor grade and evidence of lymphatic or vascular invasion can be very important. Patients with poorly differentiated tumors and evidence of lymphatic or vascular invasion on biopsy have a 36 to 53 percent rate of local recurrence after local resections alone versus a 12 to 15 percent rate of local recurrence after transabdominal resection. Because rectal cancer histology can affect the type of operation, most rectal cancers require a tissue diagnosis and thorough staging prior to definitive surgical treatment.

Steele and his co-workers have recently published the only multi-institutional prospective controlled trial of sphincter-sparing treatment for distal rectal carcinoma in the literature, conducted by the CALGB (Cancer and Leukemia Group B). Their inclusion criteria for local excision of a rectal tumor match the criteria mentioned earlier in this chapter, although no effort was made to differentiate between high-grade (including a histology of vascular and lymphatic invasion) and low-grade tumors. After local excision, patients with T1 tumors received no further treatment and were followed for recurrence and survival. Patients with T2 tumors were given adjuvant radiation and chemotherapy. Any patient with a local recurrence was salvaged with a formal APR. Only patients who underwent excision with negative margins were included. After 6 years of follow-up, survival and failure-free survival rates of the eligible patients are 85 and 78 percent, respectively, with no difference between the T1 and T2 (plus adjuvant treatment) groups. Comparing these results to historical control patients who received a formal APR, the authors conclude no significant therapeutic disadvantage in the sphincter-sparing approach thus far, when the strict selection criteria are applied. The efficacy of surgical salvage after local recurrence remains uncertain because too few patients were salvaged and the follow-up was relatively short. The results concerning salvage surgery following local recurrence (mostly a formal APR) are of utmost importance, since disappointing results from retrospective studies have been reported until now.

After local resection, postoperative radiation and chemotherapy are usually given for lesions penetrating the rectal wall. The two prospective series that have looked at this form of therapy indicate a local recurrence rate of 6.5 to 8 percent and a survival rate of 90 percent, which is equal to the expected results of an abdominoperineal resection. Rectal function is reported as good or satisfactory in greater than 80 percent of the patients. Although local excision of rectal carcinoma can be accomplished through a transsacral or trans-
Surgery of Primary Colon and Rectal Cancer

The sphincteric approach, transanal exposure is the technique chosen most frequently. The prone jackknife position is used for lesions in the anterior and lateral locations. For lesions of the posterior rectum, the lithotomy position is preferred. The preoperative bowel preparation is the same as in other large bowel procedures. In the operating room, the rectum is irrigated with an antiseptic solution to minimize contamination during the procedure. Exposure is achieved by an anal speculum and/or retractor. The procedure requires full-thickness excision, with an in vivo margin of 1 cm beyond the edge of the tumor (Figure 8–12, A and B). The positioning of traction sutures helps in removal of the tumor and orients the specimen for the pathologist (Figure 8–13, A and B). To minimize operative bleeding, electrocautery should be used. Primary closure of the resulting defect shortens the time required for healing, but this aspect is not a strict requirement as long as the defect lies caudad to the peritoneal reflection (Figure 8–14, A and B). Proctoscopic examination should be performed at the completion of the procedure to ensure that an adequate lumen has been preserved. Figure 8–15 gives an endoscopic view of the rectal wound 1 year after local excision.

For very low rectal tumors, at or near the anorec-
tal junction, an intersphincteric resection with partial excision of the internal anal sphincter might be possible (Figure 8–16). In a small prospective study, 5-year survival rates of 75 percent were reported after this procedure for T2 and T3 tumors plus adjuvant therapy in very low tumors between 2.5 cm and 4.5 cm from the anal verge. Continence was normal in half of the patients and half of the patients suffered from occasional minor leaks.

Kraske was the first to describe a transsacral approach for midrectal cancers in 1885. Others have modified this technique, but the principles are the same. Tumors situated on the anterior side of the midrectum are suitable for this approach. Postoperative fistulae are the most frequent postoperative complications after this procedure and occur in approximately 15 percent of cases. The technique can be ideal for midrectal tumors and should be a part of the surgeon’s armamentarium.

In conclusion, local excision as a sphincter-saving procedure is possible in 10 to 15 percent of patients with rectal cancers. Strict selection minimizes the chance of regional lymph node metastases and is the key to a good outcome.

**PALLIATIVE COLORECTAL SURGERY**

Not all colorectal surgery is performed with curative intent. Patients presenting with truly unresectable primary tumors or patients with metastatic disease constitute this group. In the case of patients with unresectable primary tumors, the goal of surgery is usually to relieve obstruction. For distal tumors of the rectum and sigmoid colon, this will usually involve a diverting colostomy and probably a mucous fistula. Patients with distal obstruction who are unresectable should not have an end colostomy and blind pouch proximal to the obstruction. The colon will continue to secrete mucus and can potentially freely perforate or fistulize into an adjacent organ from internal pressure. Patients with more proximal unresectable colon cancers can usually be bypassed with a side-to-side

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**Figure 8–14.** A, Primary longitudinal closure of the defect with absorbable sutures, without narrowing of the lumen; and B, diagram of the same stage of the operation, although a transverse closure is depicted. From Bailey HR, Huval WV, Max E, et al.27

**Figure 8–15.** Endoscopic view of the healed rectal wound 1 year after local excision of a rectal cancer.
anastomosis between bowel proximal and distal to the obstruction. This will circumvent the obstruction and allow internal decompression of the potentially obstructed segments while keeping the patient free of a colostomy. A side-to-side anastomosis between the cecum and sigmoid colon is usually easily performed and causes only a minimal increase in the number of bowel movements per day.

Patients with unresectable primary tumors and bleeding from the tumor present a more difficult situation. These patients will often have a resolution or decrease in bleeding with colonic diversion or bypass. The continued presence of the fecal stream contributes to the bleeding process. When this fails to control the bleeding, external beam radiation will often be successful.

Patients who present with distant metastases and resectable primary colorectal tumors should generally have their primary tumor resected. Possible exceptions to this include widespread carcinomatosis with expected survival of less than 6 months or multiple medical problems that make the patient a high-risk surgical candidate or that preclude any systemic chemotherapy. Due to difference in tumor biology, almost every surgical series has about a 5 percent, 5-year survival rate for these patients.44

LAPAROSCOPIC TECHNIQUES IN COLORECTAL CANCER SURGERY

Laparoscopy has been used in colorectal surgery for several decades.45 The initial clinical reports of laparoscopic colorectal surgery (LCR) suggested many advantages in comparison to conventional (open) techniques, including reduced postoperative pain, earlier recovery of bowel function, shorter length of hospital stay, and earlier return to normal activities.46 More recent studies have not been as favorable.47 To date, there at least appear to be no significant differences in perioperative complications or mortality between laparoscopic and open colorectal surgery, and short-term outcomes seem equivalent. Despite a trend toward a reduced length of stay, the overall costs of laparoscopic resections have historically been higher. This in part has been related to both a longer operative time and higher equipment costs. Many of the expenses would be expected to decline, as advances in both laparoscopic equipment design and surgical technique reduce the surgeon’s operative time and costs. Some of the specific complications related to laparoscopic technique include port-site herniation, inadvertent organ injury, complications of pneumoperitoneum (respiratory acidosis), and resection of the wrong segment of bowel.48

Another aspect is the learning curve. There are major differences in surgical technique between LCR and other more common laparoscopic procedures like laparoscopic cholecystectomy. These differences include working in multiple anatomic regions, the need to divide multiple mesenteric vessels, removal of a fairly large specimen, and the performance of a safe anastomosis. The number of supervised laparoscopic colorectal resections needed to comfortably learn the procedure is not well documented but is estimated to be more than 40 completed cases, partly depending on the laparoscopic experience of the surgeon.49,50 This implies that a second qualified surgeon and a high-volume setting are needed to overcome this problem. Furthermore, if conversion from LCR to an open procedure is needed, one gets the worst of both methods: higher cost and operative time combined with a larger incision and an increased incidence of postoperative complications.51

There are three potential uses of laparoscopy in colorectal cancer. The first is an occasional need for

Figure 8–16. Intersphincteric resection of a very low rectal cancer at the anorectal junction, with partial excision of the internal anal sphincter. From Rullier E, Zerbib F, Laurent C, et al.28
diagnostic or staging information prior to definitive treatment. Given the success of endoscopic and radiologic studies, this is an extremely rare event. Nevertheless, laparoscopy allows inspection of the entire abdominal cavity and permits biopsy of serosal lesions. Furthermore, intraoperative laparoscopic ultrasonography is especially useful for diagnosing occult, small intraparenchymal liver metastasis from colorectal cancer.

The second possible role is in palliative colorectal surgery. In cases where advanced colorectal carcinoma is diagnosed preoperatively, laparoscopic surgery permits a variety of palliative measures, such as resection of the primary tumor, intestinal bypass, and stomal diversion without the need for a large incision. Alternative procedures, including laparoscopically assisted feeding jejunostomies and catheter placement for intraperitoneal chemotherapy, can be performed in the same setting. As compared to open surgery, LCR is generally believed to have a more rapid return of bowel function, decreases length of hospitalization, and results in less postoperative pain, although there are also studies that refute these claims. Given the specific disadvantages of LCR as outlined earlier, the surgeon has to decide whether the potential benefits outweigh these problems.

The role LCR in curative cancer surgery is still to be defined and is presently being evaluated. Although similar 5-year survival rates after LCR and open procedures have been reported in a comparative prospective trial, there is still considerable debate whether there will be a compromise in cure rate. This question is currently being investigated in multiple randomized prospective studies, conducted in several countries. There is some experimental evidence that laparoscopic procedures decrease tumor growth as compared with open procedures. On the other hand, a unique complication related to laparoscopic cancer surgery seems to be an altered pattern of tumor spread. This has led to port-site metastases and is not well understood. Not only are such recurrences present at the site of tumor extraction, but they have also been documented at port sites not involved in specimen removal. Similar findings have been described for other intra-abdominal malignancies, including pancreatic, ovarian, and gallbladder cancer. It is not clear whether these types of recurrences are an inevitable consequence of minimally invasive techniques or perhaps related to a learning experience. Current ongoing studies indicate that the incidence of trocar site recurrence seems to be decreasing, suggesting that the learning curve may have influenced this adverse outcome.

As stated earlier, there are specific techniques and equipment for the laparoscopic procedure. Dissection is primarily performed using a laparoscopic harmonic scalpel (Figure 8–17), and vascular struc-
tures are preferably divided by a laparoscopic vascular stapler (Figure 8–18). The bowel is transsected with the help of a laparoscopic roticulating gastrointestinal stapler (Figure 8–19). After the bowel is dissected out and transsected distally (Figure 8–20), the specimen is taken out of the abdominal cavity through a 4- to 5-cm incision (Figure 8–21). Although the anastomosis can be performed intracorporally, the easier and therefore safer extracorporal technique is chosen by many surgeons, including the authors, in case of a right-sided or transverse colectomy. However, when the anastomosis is to be performed between the distal left colon and rectum, a stapled anastomosis can be carried out intracorporally using a circular stapling device.

Laparoscopy will certainly have an important role in colorectal surgery, but until such time as more prospective trials become conclusive, only patients enrolled in one of these studies should be offered a laparoscopic resection for cancer with curative intent.

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