Sphincter-Sparing Resection for Rectal Cancer

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ABSTRACT

Although there is still a place for abdominoperineal resection in the treatment of rectal cancer, the state of the art is sphincter-preserving resection. Even for the lowest of rectal cancers, using a combination of neoadjuvant chemo/radiation, total mesorectal excision, and intersphincteric proctectomy and colonic J-pouch to anal anastomosis, sphincter preservation can be achieved for most patients. The key concept in pushing sphincter preservation forward has been the realization that the deep, circumferential, or lateral margin is all-important. Unless the rectal tumor involves the external sphincter muscle, there is no oncologic need to remove it, and following resection of the tumor, gastrointestinal tract continuity can be restored.

KEYWORDS: Sphincter-preserving resection, total mesorectal excision, low anterior resection, intersphincteric resection, coloanal anastomosis

Objectives: On completion of this article, the reader should be able to summarize the concepts and the operative techniques for sphincter-preserving resection for patients with rectal cancer.

There are ~40,000 new cases of rectal cancer diagnosed in the United States each year with ~8,000 deaths attributed to this disease.¹ The current treatment of rectal cancer involves a multidisciplinary approach aimed at achieving two primary goals: (1) curing the cancer, or at least reducing the rate of local recurrence; and (2) optimizing the patient's quality of life, which for most cases translates into treating the disease with a sphincter-sparing procedure. This discussion will focus on how best to achieve this secondary goal while optimizing the chances for achieving the primary goal: a good oncologic outcome.

SURGICAL THERAPY

Historically, the gold standard operation for rectal cancer was the abdominoperineal resection (APR), performed using blunt dissection. This operation, championed by Ernest Miles, stood for decades as the

benchmark treatment of rectal cancer. This began to change in the middle part of the 20th century. The operative treatment of rectal cancer has evolved through three phases: (1) simply getting patients through a radical operation (Miles reported a 36% mortality rate in his first 61 patients undergoing an APR²), (2) improving long-term survival once an APR could be performed safely (1920s and 1930s), and (3) a rethinking about how radical surgery had to be, and was APR necessary for all patients with mid and low rectal cancers (in 1948, Claude Dixon reported a 64% 5-year survival in over 400 patients treated with low anterior resection³). There remains a role for APR in the treatment of rectal cancer; however, the permanent colostomy rate for rectal cancer patients treated by experienced rectal cancer surgeons should be well less than 30%.⁴ Recent data from the German rectal cancer trial⁵ shows an APR rate of less than 30%, and our APR rate at Duke University (Durham, NC) is less than 20% (unpublished data).

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Recent data suggest a strong relationship between sphincter-preserving resection and individual rectal cancer surgeon volume.⁶ This third phase of rectal cancer surgery will evolve further as we learn more about the response of tumors to neoadjuvant chemo/radiation therapy. This may lead to a fourth phase: treatment with radiation and chemotherapy followed, in select patients, with either local excision or no surgery at all.

The APR has fallen out of favor as the result of several factors: (1) a better understanding of what is needed in terms of a distal margin and the importance of the radial, or deep, margin; (2) technical advances, (3) a better understanding of reconstruction such that a good functional result is obtained, (4) the importance of the proper use of multimodality chemotherapy and radiation therapy both as an adjunct to achieve and facilitate sphincter preservation and as a means to reduce local failure rates and improve overall survival; and finally, (5) a recognition of the importance of proper surgical technique and the need for a total mesorectal excision for mid and low rectal cancers.

Margins

Despite what was once believed, it is now clear that 5-cm distal margins are not needed to achieve good local control for rectal cancers. A 2-cm margin is quite adequate because distal intramural spread and/or retrograde lymphatic extension are rare; when they do occur prognosis is poor despite the surgery. In addition, the distal resection margin does not predict local recurrence. Williams et al⁷ showed that in a group of 50 resected rectal cancer specimens, in 76% of the cases there was no intramural spread distal to the tumor and in 14% of the specimens there was spread distal to the tumor of <1 cm. In five cases, the spread was >1 cm. All five of these patients had poorly differentiated stage III tumors and had distant metastatic disease within 3 years. Pollett and Nichols⁸ showed that in a series of over 300 rectal cancer specimens, the length of the distal margin did not correlate with risk of local failure. Data from the Large Bowel Cancer Group Project demonstrated the same.⁹

More recent data suggest that even more-narrow distal margins may be adequate for the very lowest of tumors, especially with resection following neoadjuvant chemo/radiation. Distal margins of 1 cm or less may be sufficient in radical attempts at sphincter preservation for the lowest of tumors.¹⁰

From a surgical and pathologic standpoint it is the deep, lateral, or radial margin that is critically important. This margin, commonly referred to as the *circumferential radial margin*, or CRM, is often measured in millimeters. A positive CRM places the patient at great risk for local failure. This has been shown nicely by Quirke et al,¹¹

who looked carefully at 52 rectal cancer resection specimens, 26 from an APR group and 26 from a low anterior resection group. In 10 specimens from each group there was a positive margin; 75% of these patients developed a local recurrence. In only 1 patient with a negative deep margin was there a local failure. In addition, the lateral margin, as measured microscopically from the deep edge of the tumor was not different in low anterior versus APR specimens. CRM involvement has also been shown to predict distant recurrence and overall survival.¹² A CRM of less than 1 mm, whether as direct tumor extension, lymph node metastasis, or intravascular growth, should be considered as a positive margin. In a report by Adam et al,¹³ local failure with a margin of <1 mm was 74% compared with 10% for a margin >1 mm. Data from the North Central Cancer Treatment Group showed that if the CRM was 0 to 1 mm, the local failure rate was 25% compared with only 3% if the CRM was >1 cm.¹⁴ And, in a study from Birbeck et al,¹⁵ the local failure rate was 58% with a positive margin (28% if <1 mm and 10% if >1 mm). A careful and thorough consideration of what is done anatomically during a proper rectal cancer resection leads one to the conclusion that the deep margin, for all but the lowest rectal tumor, is not maximized by doing an APR. Unless a tumor has invaded the sphincter complex, one can legitimately ask, why should this complex, and the anus be removed? This concept is developed in more detail, below.

Technical Advances

Improvement in surgical instrumentation has dramatically impacted the surgical treatment of rectal cancer. These improvements aid in both conducting a proper resection and in the subsequent reconstruction. One of the key concepts to conduct an operation deep in the pelvis is operating under direct vision in a well-lighted field. To this end, several manufacturers now produce and market specially designed pelvic retractors that have a fiber-optic cord mounted on the retractor so that light can be taken down into the depths of the pelvis. This light makes visualization of the fascial planes, nerves, and other pertinent anatomy, which were once hidden in the depths of the dark pelvis, possible.

Advances in stapling instruments have been very important as aids in reconstruction. Narrow, low-profile staplers allow the surgeon to place a staple line across the rectum at the level of the anorectal ring or below. This, combined with the circular stapler, allows the surgeon to construct a quick and reliable "double-stapled" anastomosis even at the level of the anal canal. These instruments have revolutionized low pelvic surgery. Collectively, this instrumentation has dramatically improved the surgeon's ability to properly resect and then reconstruct at the lowest levels of the pelvis.

Surgical Technique and Total Mesorectal Excision

One of the most significant advances in the treatment of rectal cancer has been the concept of performing rectal cancer resection according to the principle of total mesorectal excision (TME). Although any curative treatment plan for rectal cancer has surgery as its primary modality, many studies of the past have documented the rather disappointing results of extirpative surgery. Local recurrence rates of from 15 to 50% have been observed. Blunt dissection of the rectum was widely taught and utilized. Bill Heald from Basingstoke, England, is credited with changing dramatically how the rectum is removed. In 1982, he first began to write about his technique of TME.¹⁶ He recognized that most local recurrences seen after rectal cancer resection were a result of inadequate resections performed using imprecise, blunt dissection. He recognized that by using meticulous, sharp dissection, under direct vision, staying between the visceral and parietal pelvic fascia down to the level of the levators, or upper aspect of the anal canal, the rectum and its mesentery could be removed as an intact unit. This would lead to three very favorable outcomes: (1) a dramatically reduced lateral margin positivity, leading to astonishingly low local failure rates; (2) the need for performing a very low number of abdominal perineal resections; and (3) a significant reduction in the incidence of bladder and sexual dysfunction after surgery—dissection in the proper planes helped avoid injury to the sympathetic and parasympathetic nerves in the pelvis.¹⁷ The following is just some of the data that helps to support these contentions.

Heald reported in 1998 that in 519 patients with rectal cancer less than 15 cm from the anal margin, the rate of local recurrence was only 6%. In those patients who had what he termed *curative* resections, the local failure rate was only 3%. These numbers were achieved in a setting where only 49 patients were treated with neoadjuvant radiation therapy.¹⁸ These numbers contrast dramatically with historical local failure rates for locally advanced, T3, or node-positive tumors, that average greater than 30%. In the multicenter, multi-surgeon Dutch Rectal Cancer Trial that compared TME alone to TME combined with preoperative radiation, the overall local failure rate for TME alone was only 8.2% (10% for tumors < 10 cm from the anal verge and 15% for stage III cancers).¹⁹ Others have reported similar very impressive low local recurrence figures obtained with exacting surgical technique.^{20–23}

Using his technique for conducting TME, Heald has also reported very low APR rates. In his report from 1998 on 519 rectal cancer patients, 465 patients were treated with low anterior resection; only 37 had an APR. Again, others have reported similarly low APR rates.

In terms of preserving the autonomic functions supported by the sympathetic and parasympathetic

pelvic nerves, a TME seems a significant improvement over what was seen historically. In the past, using blunt dissection with little appreciation for the fine points of pelvic anatomy, sexual dysfunction was seen in up to 75% of men and 40% of women. Bladder dysfunction was seen up to 80% of the time. In the TME era, these rates, although influenced by age, location of the tumor and preoperative status, should be in the 10 to 30% range for sexual dysfunction and 5% or less for bladder dysfunction.²⁴

The concept of TME has spread throughout Europe, Asia, and the United States. This technique of rectal dissection has been and can be taught on a broad scale. It is now clear that blunt dissection of the rectum should no longer be taught or practiced. TME has very significantly influenced both the outcomes and surgical options for patients with rectal cancer.

With “What is TME?” and “Why TME?” having been addressed, “How do you do a TME?” follows. I think that the best description of the TME is still Heald’s Presidential address to the Royal Society of Medicine, Surgery Section, in 1987: The “Holy Plane” paper.¹⁷ In his address, Heald describes the three basic principles that one must understand and follow to perform a TME. First, one must recognize that there is mobility between tissues of different embryologic origins. The rectum and its mesentery, encased by the fascia propria of the mesorectum are separate from those structures outside of this fascial envelope. The plane of dissection is just outside the fascia propria (the visceral endopelvic fascia) and just inside the parietal endopelvic fascia. This is the “holy plane.” Second, the dissection must be performed sharply (no ripping or tearing or blunt dissection), under direct vision, with good illumination. The sharp dissection is generally performed with either scissors, or more commonly, with the electrocautery. In my hands, at least, the good lighting issue is managed with the use of fiberoptically lit pelvic retractors. These retractors put the light directly where it is needed and provide excellent visualization even in the depths of the pelvis. To perform precise dissection, one must know the anatomy, but one must also be able to see the anatomy. The field must be well lit. Third, there must be gentle opening of the plane by continuous traction and counter traction, but not so much that the tissue tears or rips. This is just a basic surgical principle.

Heald talks about what is within the holy plane and what is outside the plane. Within the plane, one finds the rectum and its circumferential mesentery, the mesorectum. He describes the rectum and the mesorectum as one distinct lymphovascular entity... and “the tumor is more apt to spread initially along the field of active lymphatic and venous flow.” If one accepts that the vast majority of rectal cancers and their lymphatic metastases are confined to this envelope of tissue, one

Figure 1 In this total mesorectal excision specimen, one can see that the mesorectum ends just above the upper aspect of the surgical anal canal, which is at the anorectal angle. During a double stapled coloanal anastomosis, the anus is divided at the anorectal angle, and the anastomosis will be constructed ~1.5 to 2.0 cm above the dentate line.

can understand how removing it intact might lead to very low rates of local failure.

Outside the holy plane, one finds those structures that should be avoided, the sympathetic and parasympathetic pelvic nerves and the major vessels (of primary concern are the veins) of the pelvis. He notes that there are two bloodless planes of dissection in the pelvis: one just inside the inferior hypogastric nerves, the proper plane, and one just outside the inferior hypogastric nerves, the wrong plane.

With regard to the ultra low anastomosis that results after a TME, Heald points out that the rectum and mesorectum are attached to the pelvic floor by a clean tube of anorectal muscle. The mesorectum has a very definite end, just a centimeter or two above the anorectal angle. Beyond this point, there is no mesentery, just a muscular tube of bowel (Fig. 1). In this area beneath the mesorectum, during the standard TME, one divides the bowel distally and constructs the “ultra-low stapled anastomosis.” A stapled anastomosis in this location will put the circular staple line ~1.5 to 2 cm above the dentate line. If one follows this muscular tube of anorectum distally, one eventually comes out on the anoderm in the intersphincteric groove at the anal verge. This anatomic understanding is critically important in conceptualizing and conducting an intersphincteric low anterior resection, which will be discussed below. Enough dissection in this area will also convince the surgeon that fibers of the puborectalis muscle and external sphincter interdigitate with this muscular tube of anorectum. This relationship of the anorectal muscular tube and the pelvic floor is more pronounced in some than in others, but it is there.

DEFINITIONS AND ANATOMIC LANDMARKS

The upper rectum is anatomically defined as the location where the tenia coli coalesce into a single longitudinal

muscle layer. For the surgeon, landmarks in the abdomen that mark this location, such as the peritoneal reflection or the point at which the colon reaches the sacral promontory, are quite inaccurate. These landmarks may be variable depending on age, sex, and obstetric history. In general, the rectum measures ~12 to 15 cm in length and contains three valves. The middle rectal valve is a particularly valuable landmark. In an average-sized patient, it will be located 9 to 10.5 cm from the anal verge. The location of the middle rectal valve, in the average-sized adult, is at the anterior peritoneal reflection: the anterior cul-de-sac. Lesions at or beneath the middle rectal valve are considered to lie in the extraperitoneal portion of the rectum. The upper rectal valve is located ~3 cm above the middle valve. The rectum, from a surgical standpoint, ends at the anorectal ring, not the dentate line. Thus, an anastomosis at, or beneath, the anorectal ring is considered a coloanal anastomosis. Histologically, the rectum contains columnar epithelial cells that extend distally to the anorectal ring. There is then a transitional zone of epithelium that extends to the dentate line where the cell type changes to squamous.

Rectal cancers, historically, have a stage-dependent tendency to recur locally. The primary goal when using external beam radiation, with or without sensitizing chemotherapy, is to minimize this local failure rate in the pelvis. Colon cancers, and tumors of the upper rectum, do not have this tendency for local failure and therefore, except in specific situations, are not treated with radiation. Tumors at or below the level of the middle rectal valve are considered to be extraperitoneal, and depending on their stage, may be treated with, in addition to surgery, radiation and chemotherapy to help in reducing local recurrence rates and maximizing the odds of achieving a sphincter-sparing operation. Generally, tumors above the upper rectal valve, that is upper-rectal cancers or rectosigmoid cancers, generally do not warrant the use of radiation as part of the treatment scheme as they should have a very low propensity for local recurrence.

THE CHANGING CONCEPTS IN SPHINCTER-PRESERVING RECTAL CANCER RESECTION

As stated above, from an historical standpoint, the critical issue in rectal cancer surgery has been the distal margin. The classic question has been, “At what level in the rectum does a patient go from being a candidate for sphincter preservation to abdominal perineal resection?” I still hear this question on a regular basis: “How low can you go?” If one accepts the old 5-cm rule, then most patients with a low rectal tumor will be treated with an APR. If one accepts the 2-cm rule as an adequate distal margin, then more patients will be treated with an LAR,

Figure 2 Even with a narrow distal margin, local failure is avoided with a good total mesorectal excision specimen.

but still, most patients with tumors close to the anorectal ring would not be treated with sphincter-preserving resection.

A More Modern Concept Focuses on the Deep Margin More than the Distal Margin

The critical issue, then, for tumors in the lower rectum, even those within the anal canal itself, is whether the tumor has invaded the external sphincter muscle (Fig. 2). If the muscles of the pelvic floor/external sphincter are not involved with the tumor, why remove them? So the issue has changed from distal margin to deep margin. Surgical techniques are available that can preserve the anus and sphincters, even for very low tumors. The surgeon counts on meticulous technique and the use of neoadjuvant chemo/radiation therapy to assure a negative deep margin. This then should ensure a low rate of local recurrence.

Basic Technical Concepts for Sphincter-Preserving Resections

Despite the level of the tumor in the rectum, any sphincter-preserving rectal cancer resection will start with a complete mobilization of the left colon to gain length for an anastomosis in the depths of the pelvis. There should be absolutely no tension on the anastomosis, whether it is constructed in the midrectum after resection of an upper rectal cancer, or at the dentate line after an intersphincteric low anterior resection for a tumor at the upper aspect of the anal canal. For distal tumors, when reconstruction is performed with either a colonic J-pouch or a transverse coloplasty pouch, complete mobilization is of particular importance. These are the steps to achieve the necessary length.

First the left colon is mobilized along its lateral peritoneal and retroperitoneal attachments over to the midline (the aorta). The omentum is taken off the distal transverse colon and the splenic flexure is taken down along the inferior edge of the pancreas, at the base of the

transverse mesocolon, over to the middle colic vessels. The peritoneum to the right of the inferior mesenteric artery (IMA) is incised and the IMA is taken at its origin off of the aorta. The left colic artery is taken at its origin off of the IMA and the inferior mesenteric vein (IMV) is taken at the inferior edge of the pancreas. Taking the IMV is the final step in "straightening-out" the left colon so it will easily reach to the pelvis. The marginal vessel at the sigmoid-descending colon is then isolated and clamped distally. It is divided proximally, good pulsatile flow is confirmed, and it is ligated. The bowel is divided at this point with a linear cutting stapler. At this point, the left colon has been freed from its mesenteric attachments at the midline, which assures complete mobility, and its blood supply is the middle colic artery carried through the marginal vessel high in the mesentery. This type of complete mobilization is generally not needed when performing an abdominal perineal resection. The extensive mesenteric mobilization is performed not necessarily for oncologic reasons, but for length reasons.

Standard Low Anterior Resection for Upper Rectal Cancer

For tumors in the upper rectum, surgery involves anterior (dissection and/or anastomosis does not go beneath the anterior peritoneal reflection) or low anterior resection (anastomosis beneath the anterior peritoneal reflection). These operations result in a colorectal anastomosis. This is typically a straight double-stapled anastomosis with the distal bowel divided with a TA- or PI-type linear stapler, and the anastomosis constructed with a circular stapler. These operations should be performed according to the principles of total mesorectal excision. Mobilization should take place in defined anatomic planes, under direct vision using sharp dissection. The mesorectum is divided at a point ~5 cm below the distal edge of the tumor. It is at this point that the bowel is also divided.

Two concepts are important with this operation. The first is that the mesorectum and the bowel are divided at the same point. This is a critical concept. Many local, so-called mesorectal recurrences, occur because the surgeon "cones-in" on the rectum by coming through the mesorectum starting at a point too close to the tumor. The surgeon is happy that a 5-cm distal margin is obtained at the level of the bowel wall, but the real issue is the margin on the mesentery. Tumor outside the bowel wall, in the mesorectum, deep to the tumor, can get left behind if the surgeon does not take the mesorectal dissection just behind the fascia propria of the mesorectum, down to the point of the distal resection margin. The mesorectum is divided perpendicular to the distal rectal margin (Figs. 3 and 4).

The second important concept is the distal rectal washout performed just before the bowel is divided

Figure 3 This illustrates how local recurrence can occur. In this total mesorectal excision specimen, if one were to come *through* the mesorectum, even with an adequate distal margin, tumor in the mesorectum is left behind and local failure is the result.

distally. There is good evidence that tumor cells are shed into the lumen of the bowel. This should be quite obvious to anyone who has ever proctoscoped a patient with rectal cancer and has noticed how often, and easily, bits of tumor are separated from the tumor. The concept of the distal rectal washout is that these cells must not get caught up in the distal staple line placed on the rectum when doing a double-stapled type of anastomosis. Once the mesorectum is divided distally, a right-angle bowel clamp is placed just distal to the tumor and a cytotoxic solution (I use Betadine; Purdue Pharma, Stamford, CT) is flooded into the distal rectum through a rectal tube or a bulb-type syringe. Once the distal bowel has been washed-out, the distal staple line is placed. Again, the goal is to minimize the chance of getting tumor cells included in the distal staple lines.

Low Anterior Resection for Mid and Low Rectal Cancer

For tumors in the midrectum, the left colon is mobilized as described above and the distal dissection is performed according to the principles of total mesorectal excision. For midrectal tumors, the bowel is divided distally, just

Figure 4 In this total mesorectal excision specimen, local failure is avoided with a very adequate distal margin, but more importantly, an adequate margin *deep* to the tumor.

past the lower edge of the mesorectum, at the upper aspect of the anal canal. At this point the bowel is simply a muscular tube. Also at this point, the rectal diameter tapers down significantly as it transitions into the anal canal and it can be taken distally, for a double-stapled anastomosis, with a 30-mm stapler. There is no need for a larger stapler, as the bowel can almost always fit into this type of stapler. In fact, if it does not, then one is probably not at the proper level in the rectum. This is very consistent. Distal rectal washout is conducted as described above, and the anastomosis is performed with a circular stapler. At this level, reconstruction is usually performed using a colonic J-pouch. The anastomosis after a TME with stapled colonic J-pouch to anal anastomosis will be ~1.5–2.0 cm above the dentate line, in very close proximity to the anorectal ring. This anastomosis is nearly always diverted temporarily with a loop ileostomy. For patients who have been treated with neoadjuvant chemo/radiation, this operation will be followed by a 4-month course of adjuvant chemotherapy. The loop ileostomy is generally closed when this course is completed.

For some tumors in the low rectum, the resection and the reconstruction can be managed as described above for midrectal tumors. For the very low lesions, there are two techniques that allow for sphincter preservation. The first option is simply a reconstructive option, a hand-sewn coloanal anastomosis, and the second is a resection and reconstruction technique known as an *intersphincteric proctectomy* with coloanal anastomosis.

Hand-Sewn Low Anterior Resection with Colonic Pouch to Anal Anastomosis

In my mind, the hand-sewn coloanal anastomosis is simply a technique for reconstruction used when there is just not enough room in the pelvis to place the TA 30 stapler at the upper aspect of the anal canal (generally in a deep and very narrow male pelvis) or in the situation where an adequate margin can be obtained from the abdominal approach, but not enough margin for placing a distal staple line. The TME is conducted in the standard fashion down to the anal canal. However, instead of placing a staple gun distally, the bowel is simply divided, from above, within the anal canal, usually ~0.5 to 1.0 cm above the dentate line, with the electrocautery. The specimen is passed off the table, and the patient is placed in a more exaggerated lithotomy position to expose the anus and perineum. The surgeon then works from between the legs and the anus is then effaced with several heavy sutures to better expose the anal canal. Eight, 3-0 absorbable sutures are then placed at the cut edge of the distal bowel and these are tacked to the drapes. An assistant then passes the proximal bowel (usually fashioned into a colonic J-pouch) into the pelvis.

Different colored sutures placed at the apical colotomy on the pouch, used to mark right, left, anterior and posterior, are then grasped with a clamp passed through the anus by the perineal operator. The pouch is pulled down into the anal canal. Starting with the anterior, posterior, left and right anal sutures, the hand-sewn colonic J-pouch to anal anastomosis is started. The remaining four preplaced sutures are then placed using a small lighted Hill-Ferguson retractor for exposure up in the anal canal. Additional sutures, usually 8 to 10 more, are placed, as needed. Unless the patient has a very long anal canal, I do not generally perform a mucosectomy of the anal canal. I would rather preserve the tissues of the anal canal and sew the colonic J-pouch to anal anastomosis up in the anal canal, if possible.

Intersphincteric Proctectomy with Colonic Pouch to Anal Anastomosis

For the lowest of rectal cancers, the final technique for sphincter-preserving resection is an intersphincteric proctectomy with colonic-pouch to anal anastomosis. This operation is chosen for patients with tumors that are located in proximity, either just above or just below, to the anorectal ring, but have not invaded the external sphincter muscle or pelvic floor. These operations leave very little margin for error in terms of the deep and distal margins. Most tumors treated with this technique are managed with neoadjuvant chemo/radiation to maximize these narrow margins and to decrease the volume of intraluminal tumor so as to avoid intraoperative tumor seeding. The validity of this operation is based on the concept, as stated above, that it is the deep margin on a tumor that is most critical. If the deep margin does not involve the skeletal muscle, then there is no reason to remove it. The intersphincteric resection is based anatomically on the concept (put forth by Heald in his writings on the TME¹⁷) that if one follows the muscular tube of anorectum distally, one eventually comes out on the anoderm in the intersphincteric groove at the anal verge (Fig. 5). This operation removes the upper aspect of the internal sphincter muscle (sometimes more), and as such, there will be functional changes. Patients chosen for this type of operation must be motivated, have a well-functioning sphincter mechanism and have normal premorbid continence.

I typically conduct this operation in two phases. The first part of the operation is conducted with the patient in the prone-jackknife position. This is the most critical part of the operation and this position provides the best exposure to the anal canal and the most comfortable position for the surgeon. The anus is effaced with either a Lone Star retractor (Lone Star Medical Products, Stafford, TX) or heavy sutures. The anal canal is visualized using a lighted Hill-Ferguson or Sawyer retractor, and the anal canal mucosa is incised at the

Figure 5 In this total mesorectal excision specimen from an intersphincteric proctectomy, one can see the bare muscular tube of anus protruding out from the distal aspect of the mesorectum.

dentate line. The incision is circumferential and it extends through the mucosa, the submucosa, and directly through the internal sphincter muscle into the intersphincteric groove onto the external sphincter muscle. The dissection should start away from the tumor so that the proper plane can be identified as an initial step and the area involved by the cancer can be approached last. The surgeon will know he is in the correct plane when he sees the anal canal tissue start to retract upwards as all of its attachments at the anus are disconnected. The most difficult part of the dissection is anterior. The plane here is frequently not perfectly clear. There are fibers of the internal sphincter and the external sphincter that interdigitate. In a man, it is important not to proceed too deep, as it is possible to get deep to the lower edge of the prostate. This obviously puts the urethra at great risk. Again, it is best, if possible, to get the posterior part and the lateral parts of the dissection well started before coming anterior. Finding the proper plane laterally and then coming at the prostate from the side helps. The dissection proceeds proximally staying

just on the external sphincter muscle. The critical issue with this part of the dissection is whether the external sphincter muscle is free of tumor. If the surgeon has judged incorrectly, and this plane on the external sphincter muscle is not clean, attempt at sphincter preservation should be aborted. The involved muscle will need to be resected. If not, dissection proceeds to a point well above the tumor. Often this plane can be followed well up into the pelvis to a point just beneath the seminal vesicles in the man or the cervix in the woman. When this proximal point is reached, the distal aspect of the "tube" of rectum is oversewn with a running suture, the pelvis is irrigated, the anal effacement sutures are removed, and the patient is turned and placed into the modified lithotomy position for the second phase of the operation.

The abdominal part of the operation is conducted and then the pelvic dissection proceeds in the usual fashion until it meets with the plane that has been developed from below. Once the specimen has been removed and the colonic pouch has been fashioned, the patient is placed in an exaggerated lithotomy position, the anus is effaced again and a hand-sewn colonic pouch to anal anastomosis is conducted as described above. This anastomosis is constructed at the dentate line and there is no real need to work up in the anal canal. The anastomotic sutures are placed deep to include anoderm and internal sphincter muscle. The effacement sutures are removed, the anastomosis retracts into the anal canal, and the anastomosis is diverted with a loop ileostomy.

RESULTS WITH LOW ANTERIOR RESECTION AND INTERSPHINCTERIC PROCTECTOMY

The issue of APR versus low anterior resection will never be resolved by a prospective, randomized trial, but there is abundant data indicating that local recurrence rates and survival figures are not adversely affected by aggressive attempts at sphincter preservation. Multiple reports have detailed good results with low anterior resection. Other reports have detailed experiences with intersphincteric proctectomy with reconstruction.²⁵⁻³⁵ Local recurrence figures have been acceptably low, typically less than 10 to 12%. In a series of 92 patients reported by Rullier et al³² using the intersphincteric resection technique for tumors from 1.5 to 4.5 cm from the anal verge, the rate of complete microscopic resection (R0) was 89%, with 98% negative distal margin and 89% negative circumferential margin. In 58 patients with a follow-up of greater than 24 months, the rate of local recurrence was 2% and the 5-year overall and disease-free survival were 81% and 70%, respectively. Seventy-two of these patients had T3 disease and 81 patients were treated with preoperative chemo/radiotherapy. In another series of 121 patients undergoing intersphincteric resection

and coloanal anastomosis, the median distance of the inferior margin of the tumor to the anal margin was 3 (1 to 5 cm). One-hundred seventeen of these patients had rectal cancer and 113 patients underwent curative resection. With a median follow-up time of 93 (range = 24 to 185) months, the local recurrence rate was 5.3% (6 patients) and 5 of these recurrences developed in the first 2 years.³⁴ The largest series of intersphincteric resections comes from Japan. Saito et al³⁵ reported on 228 patients undergoing this operation at seven Japanese institutions. Curative operations were accomplished in 86% of patients and complete microscopic curative surgery was achieved in 225 of the 228 patients. During the median observation time of 41 months, the rate of local recurrence was 5.8% at 3 years and 5-year overall and disease-free survival rates were 91.9% and 83.2%, respectively. Although not standard procedure in Japan, 57 patients with T3 tumors were treated with neoadjuvant chemo/radiation. One-hundred three patients had T3 tumors and 78 patients had T2 disease.

Functional disturbances after almost any rectal cancer surgery are common, but a good quality of life can be achieved, even after intersphincteric proctectomy with coloanal anastomosis.³⁶⁻⁴³ Comparing 37 patients with a conventional coloanal anastomosis to 40 patients with an intersphincteric resection and coloanal anastomosis, Bretagnol et al³⁹ found that there was no differences in stool frequency, fragmentation, urgency, dyschesia, and alimentary restriction between the two groups. However, the intersphincteric resection patients had worse continence and needed more antidiarrheal drugs. Quality of life after intersphincteric resection was altered based on the subscale of embarrassment in the Fecal Incontinence Quality of Life score, but not as measured by the SF-36. Reconstruction with a colonic J-pouch or a transverse colectomy pouch (discussed elsewhere in this issue) can help minimize functional disturbances. In a report from Willis et al,³⁷ looking specifically at the issue of the colic pouch versus the straight coloanal anastomosis after intersphincteric resection, the pouch patients had significantly better results in terms of stool frequency and urgency. On physiologic testing, they fared better in terms of maximum tolerated volume, threshold volume, and compliance. Interestingly, continence was not different between groups. In addition, medical treatment with antidiarrheal agents, low residue diets, antispasmodic agents, enemas, and biofeedback can all help in this regard. Obviously, the intersphincteric operation removes at least the upper aspect of the internal sphincter and this will lower the resting tone of the anus.⁴⁴ The patient chosen for this type of operation must have a normal external sphincter and must understand that achieving normal continence may be a challenge. My experience has been that in properly chosen and motivated patients,

conversion to a permanent colostomy is rarely requested. The patient is always given at least a year or more to adapt to the new anatomy before this type of conversion is even considered.

CONCLUSIONS

Although there is still a place for the APR in treatment of rectal cancer, most patients can now be treated with a sphincter-preserving resection. These operations can be conducted for even the lowest of tumors. The concept of the distal margin as the key issue guiding the operative approach is changing. It is the deep or radial margin that is critical. The key issue for the surgeon is "Can I get a negative deep margin and still reconstruct to achieve sphincter preservation?" Most patients with mid and low rectal cancers can be safely treated with a sphincter-preserving low anterior resection conducted according to the principles of TME. The colonic pouch to anal anastomosis can be either stapled or hand-sewn. For the lowest of tumors, in patients with normal continence mechanisms and motivation to avoid a stoma, the intersphincteric resection with an anastomosis at the dentate line should be considered.

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