# Local Excision of Rectal Cancer

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**KEYWORDS**

• Rectal cancer • Local excision • TEM • TAMIS

**KEY POINTS**

- Several techniques are commonly used for local excision of early-stage rectal cancer, including conventional local excision, transanal endoscopic microsurgery (TEM), and transanal minimally invasive surgery (TAMIS).
- There are strict criteria for selecting patients for local excision of rectal cancer, all of which are calculated to minimize the likelihood of lymph node involvement.
- Local excision avoids the morbidity of radical surgery for rectal cancer, but for advanced tumors it is associated with a higher risk of local and distant tumor recurrence.
- Newer techniques, such as TEM and TAMIS, improve visualization and versatility, and may have superior oncologic outcomes to conventional local excision.
- The use of neoadjuvant and adjuvant therapy in conjunction with local excision is an active area of research and there is no current consensus regarding these multimodality treatments.

## INTRODUCTION

The ideal surgical treatment for rectal cancer would have negligible morbidity, and would be curative while maintaining intestinal continuity and excellent function. In most cases, this is an unrealized standard. In terms of oncologic outcome, total mesorectal excision (TME) provides the best long-term prognosis for rectal cancer, with low rates of local recurrence and excellent long-term survival. Depending on tumor location and morphology, TME can be performed with restoration of intestinal continuity (low anterior resection) or with removal of the anus and creation of a permanent colostomy (abdominoperineal resection). This type of radical surgery removes the tumor and its organ of origin en bloc with associated perirectal lymph nodes.

Although it does provide the best oncologic outcomes, TME is associated with a panoply of complications, including urinary tract infections, nonhealing perineal

Disclosures: The authors have nothing to disclose.
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Surg Clin N Am 97 (2017) 573–585
http://dx.doi.org/10.1016/j.suc.2017.01.007 **surgical.theclinics.com**
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wounds, functional disorders, anastomotic leaks, strictures, and perioperative death.[1–3] Moreover, the 5-year local recurrence rates for radical surgery, even in cases of early-stage rectal cancers, still range from 2% to 8%.[4,5] Therefore, physicians have often used less-invasive techniques when possible that could mitigate the morbidity of rectal resection while providing the patient with acceptable oncologic results, particularly for early-stage rectal cancer.

Local excision (LE) of rectal cancer involves removal of the tumor itself without proctectomy. Interest in LE for early distal rectal cancers began in earnest after Morson and colleagues[6] published their experience at St. Mark's Hospital in London in 1977 demonstrating a low rate of local recurrence after excision with negative margins. This suggested that early rectal cancer could be definitively treated with LE, thereby sparing patients many of the morbidities of radical surgery. As enthusiasm for LE has grown, so has its use in the United States for early-stage rectal cancer.[7]

LE involves full-thickness resection of the tumor and a margin of rectum, down to the perirectal fat, but not necessarily including any draining lymphatics. Several different approaches to local excision have been used, including older transsphincteric and transcoccygeal techniques. Currently, the most widely used technique for LE is transanal excision (TAE). Conventional techniques are somewhat limited due to poor visualization and confinement to the distal rectum. Transanal endoscopic microsurgery (TEM) and transanal minimally invasive surgery (TAMIS) are more recent additions to the surgeon's armamentarium, and allow for improved visualization and access to the more proximal rectum.

## PATIENT SELECTION

### *Premalignant Polyps*

Adenomatous polyps often develop within the rectum, but size and morphology may prevent them from being amenable to complete endoscopic removal. Full-thickness or partial-thickness excision of these lesions can be done successfully via LE, and can avoid the morbidity of major pelvic surgery in a patient without an invasive cancer.

### *Rectal Adenocarcinoma*

In general, LE should be reserved for favorable T1 lesions without irregular or enlarged lymph nodes. Patients under consideration for LE of rectal cancer should undergo routine staging, including computed tomography (CT) imaging of the chest, abdomen, and pelvis and serum carcinoembryonic antigen (CEA) level, as well as digital rectal examination, proctoscopy, and dedicated rectal imaging with MRI or endorectal ultrasound[8] to assess the depth of local invasion. Because lymphatics are not reliably removed with LE, the goal is to select patients with early-stage tumors that have a low risk for lymphatic involvement at the time of operation. A combination of physical examination findings, preoperative imaging, and histopathologic characteristics are taken into account (**Table 1**).

On digital examination, the tumor should be freely mobile, as fixed tumors are predictive of advanced disease.[9,10] Proctoscopic examination should determine tumor size, extent of rectal circumference involvement, and distance from the anal verge. Tumors larger than 4 cm or involving more than 50% of the rectal circumference are often excluded from local excision for technical reasons,[11] although large tumors still can be removed via LE with a selective approach, and circumferential or near-circumferential resections have been described in models.[12] Conventional local excision is limited to distal tumors (usually within 6–8 cm of the anal verge), whereas TEM and TAMIS have allowed for successful resection of more proximal lesions (8–20 cm from the anal verge).

**Table 1**
**Criteria for local excision of rectal cancer**

| Anatomic | Histologic | Staging |
|---|---|---|
| • <50% circumference of bowel<br>• <4 cm in size<br>• Mobile and nonfixed<br>• Within 8 cm of the anal verge for conventional local excision and 20 cm for transanal endoscopic microsurgery or transanal minimally invasive surgery | • T1<br>• sm1 or sm2<br>• Absence of tumor budding<br>• Absence of lymphovascular invasion<br>• Well to moderate differentiation | • No evidence of T2 disease or lymphadenopathy on MRI or endorectal ultrasound |

Histologic features of the endoscopic biopsy also impact the appropriateness for LE. Features including poor differentiation and lymphovascular invasion predict unacceptably high rates of lymph node metastasis and local recurrence, and these lesions should not be considered for LE.[13] Tumor budding or sprouting, in which groups of a few tumor cells are seen invading ahead of the main front of tumor, is another risk factor for lymph node metastasis and should exclude patients from LE.[14–16]

Depth of tumor invasion into the bowel wall (T-stage) not only impacts the feasibility of a complete resection with negative margins, but it is also correlated with the likelihood of lymph node metastasis.[17,18] Preoperative imaging provides an essential but imperfect estimate for depth of invasion. MRI can be used to assess depth of rectal wall invasion, but in select patients, transrectal ultrasound may better discriminate between T1 and T2 lesions.[19,20]

Some evidence suggests that further subclassification of T1 lesions based on depth of invasion of the submucosa allows for even better stratification of risk for lymph node metastasis (LNM). By dividing the submucosal layer into thirds, tumors can be classified by depth of infiltration, as tumors with deeper invasion correlate with increased risk for metastasis (SM1 = superficial 1/3, 3% risk LNM; SM2 = middle 1/3, 8% risk LNM; SM3 = deep 1/3, 23% risk LNM).[14,17,21]

Any patient with clinical evidence of LNM should not be considered for LE. Transrectal ultrasound is used to evaluate mesorectal lymph nodes, but has limited accuracy and relies mostly on size.[18] MRI, although also imperfect, may be the most sensitive and specific preoperative test for lymph node involvement, as it can appreciate irregularities in subcentimeter nodes.[19]

### *Other indications*

Patients with more advanced tumors also may be appropriate for LE if their comorbidities prohibit them from being candidates for major pelvic surgery. LE also may be used for these tumors when curative resection is not the goal, and the focus is instead on palliation. There are also some patients who simply refuse radical surgery for personal reasons. For example, if patients are adamantly against having a permanent colostomy, they demonstrate understanding, and they are willing to accept a higher risk of cancer recurrence to maintain intestinal continuity, it is appropriate to respect their wishes and perform LE despite the potential for an inferior oncologic outcome.

As alluded to previously, LE of rectal lesions also may be considered in patients without a definitive diagnosis of rectal cancer, such as in cases of high-grade dysplasia, large polyps not amenable to endoscopic resection, or submucosal tumors, including carcinoid or gastrointestinal stromal tumors.[22]

Some surgeons also have advocated for LE for those with a complete clinical response to neoadjuvant chemotherapy and radiation. They use LE as a biopsy to confirm or deny a pathologic complete response. Currently, however, there is no role for this approach outside of a clinical trial.[23]

## TECHNIQUE

Conventional LE of rectal tumors can be done via transanal, transcoccygeal, or transsphincteric approach. Among these, the transanal approach is the most common; our technique is described in the following section. Transcoccygeal and transsphincteric excision are reviewed elsewhere.[24] Regardless of the approach, the principles of LE are the same: full-thickness resection of an intact tumor with 1 cm margin of benign tissue circumferentially, and the absence of tissue fragmentation.

### *Transanal Excision*

In selecting the bowel preparation for these procedures, the patient's description of his or her bowel habits can be used to determine if cleansing enemas will be adequate, or if a full mechanical bowel preparation will be necessary. For patients with a history of constipation and straining, a mechanical bowel preparation can reduce the likelihood that a patient will strain immediately after resection. For those with regular bowel habits, an enema the night before surgery and another on the morning of the resection is enough to allow for proper visualization. Preoperative intravenous antibiotics are often given within 1 hour of the procedure, although there is no evidence that this decreases the risk for surgical site infection in anorectal surgery. These procedures usually take less than an hour to perform. They can be done with a combination of intravenous sedation (monitored anesthesia care) and a local anesthetic, or alternatively with the use of general anesthesia, with the approaches being equally effective. A pudendal nerve and perianal block relaxes the anal sphincter and has the additional benefit of improving postoperative pain control.

Lithotomy positioning is usually adequate, even for anterior tumors. However, it is typically easier to operate with the lesion oriented toward the floor, and certain anterior tumors may be accessed more readily in the prone jackknife position. Using a headlamp maximizes visualization.

When the patient is positioned, the rectum is further irrigated with a bulb syringe. Irrigation with betadine is unnecessary and may stain the specimen, obscuring the borders of the lesion. The authors typically use Ferguson plastic anoscopes (CS Surgical, Inc, Slidell, LA) for retraction. These anoscopes are reusable and come in myriad diameters and lengths (**Fig. 1**). Other retractors, such as the Lone Star (Lone Star Medical Products, Inc, Stafford, TX), Sawyer, Hill-Ferguson retractors, or Parks retractors are preferred by others.

The anus is gently dilated until good visualization is obtained. Next, the lesion is marked by scoring the mucosa circumferentially with electrocautery. This preserves the intended 1-cm margin, as the tissue often becomes distorted during the resection. Cautery is then used to incise the full thickness of the rectum along the scored outline around the lesion. The needle-tip cautery is often used with a combination of cut and coagulation settings, as this distorts and shrinks the benign tissue less than the spatulated cautery tip on the coagulation setting alone. The perirectal fat should be visible in the wound once the specimen is removed. For all LE procedures (TAE, TEM, and TAMIS), the specimen should be pinned out and oriented on a cork board immediately after removal while fresh (**Fig. 2**). This prevents retraction of the benign tissue margin once placed in formalin.

**Fig. 1.** Ferguson anoscope set provides varying lengths and diameters for access. The soft bevel allows for the lesion to fall into view for resection. (CS Surgical, Inc, Slidell, LA.)

We thoroughly irrigate the wound bed and typically close the defect transversely with interrupted 3-0 Vicryl sutures, although smaller, distal defects can be left open to heal secondarily. A rigid or flexible proctoscope then can be used to assess for rectal patency after closure of the defect. Patients are typically discharged home from the recovery area.

### *Transanal Endoscopic Microsurgery and Transanal Minimally Invasive Surgery*

Use of TEM and TAMIS instrumentation has become more prevalent in recent years, relying on laparoscopic technology to assist with lesion removal. Although the technique was initially aimed at more proximal tumors, many surgeons use these techniques for distal tumors as well because of the improved visualization and versatility. Selection of TEM versus TAMIS is usually based on surgeon preference and the relative availability of the 2 platforms. In general, the 2 techniques have very similar goals and capabilities, although TAMIS is newer and lacks long-term data.

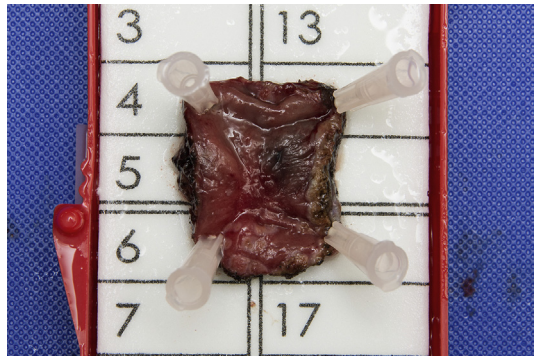


**Fig. 2.** After excision, the full-thickness specimen is pinned to a cork board and oriented to the patient's anatomy and laterality on the pathology slip by using the numbers on the board (ie, 4 = right proximal, 14 = left proximal, 6 = right distal, 16 = left distal). Seen here is an adenocarcinoma arising in a polyp that was incompletely excised by snare polypectomy for which we performed conventional transanal excision.

Because more proximal tumors are approached with TEM and TAMIS, a full mechanical and antibiotic bowel preparation is usually used to minimize intraoperative contamination should peritoneal violation occur. This also lessens the bacterial load of stool passing by the excision site in the first few postoperative days. It is imperative that a complete mechanical preparation is achieved, as the propensity of liquid stool to obscure the view or seep out into the wound bed is a legitimate concern.

***Transanal endoscopic microsurgery***

TEM was first introduced in Germany in 1984 by Dr Gerhard Buess, and it has slowly gained momentum globally over the past 30 years as more outcomes data became available.[25] It uses a rigid, beveled proctoscope that is 4 cm in diameter and 12 to 20 cm in length, a laparoscopic camera, and modified laparoscopic instruments. Specialized equipment is necessary for TEM, including disposable tubing, a dedicated machine for pneumorectum, and equipment to position the patient and secure the proctoscope to the bed.[25] The cost of that equipment, along with TEM's steep learning curve, has prevented the technique from being widespread.

The procedure works best when the patients are positioned with the lesion in a dependent orientation, and the bevel of the proctoscope holds up the opposite bowel wall (**Fig. 3**). In this way, visualization is optimized. We have found that even in morbidly obese patients, the rigid proctoscope provides excellent retraction for safe excision.[26]

***Transanal minimally invasive surgery***

TAMIS was introduced in 2009 as an alternative to TEM, offering similar visibility and versatility without the need for certain expensive and specialized pieces of equipment.[25] TAMIS also allows for dissection in multiple quadrants, and so has fewer limitations on patient positioning. It uses a flexible and disposable single-port laparoscopic entry device through which trocars are inserted or are pre-embedded. Pneumorectum is achieved with a regular laparoscopic $CO_2$ insufflator, and conventional laparoscopic cameras and graspers are inserted. Because bellowing and fogging of the lens is more common with TAMIS than with TEM, use of insufflators designed to constantly recirculate and warm the gases can be helpful.

Techniques for dissection are similar for TEM and TAMIS; 1-cm margins are scored circumferentially with hook electrocautery. The full-thickness resection can then be performed using electrocautery, with great care taken to

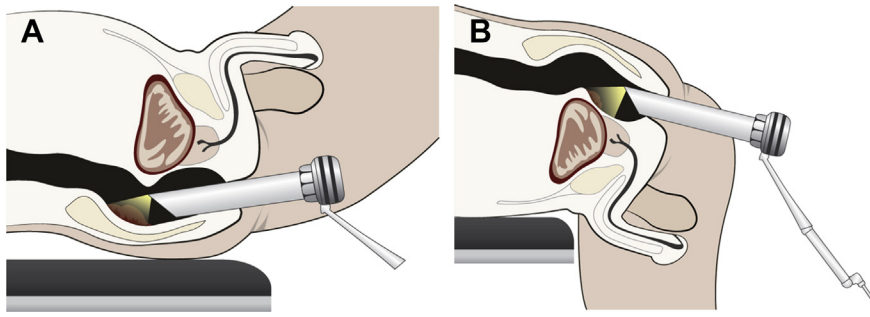


**Fig. 3.** Illustration of the beveled end of the TEM proctoscope, which holds up the opposite wall of the rectum. The lesion is placed in the dependent position; thus, the patient is placed (*A*) supine for a posterior tumor, or (*B*) prone for an anterior tumor.

avoid coning in on the specimen. For TAMIS, ultrasonic shears can counteract the previously described smoke and fog. Some advocate for dissecting the proximal margin first, whereas others work in the more traditional distal-to-proximal manner. Although both techniques are effective, the surgeon must remain focused and remove the tissue in a way that minimizes errors in orientation. After the specimen has been extracted and properly oriented for pathology, a suction irrigation device is used to wash the wound bed and ensure hemostasis.

Defects in the rectal wall can be very large after TEM and TAMIS, and it is best to achieve a watertight closure. Suturing is typically done using laparoscopic sutures and needle drivers, closing the defect in the rectal wall transversely. Both running and interrupted techniques can be used, typically using an absorbable suture. If the peritoneal cavity was entered during dissection, either intentionally or unintentionally depending on the intended depth of resection, this typically can be repaired primarily with sutures without any significant consequences.

Of note, laparoscopic suturing in this very small field can be technically challenging. To assist in closure, silver beads can be fastened like clips to the ends of the suture to allow knotless closure. Another approach is to use barbed suture, and even specialized suturing devices such as the Endostitch (TM, Covidien, Mansfield, MA, USA).[25] Once closure is completed, it is crucial to ensure that the lumen of the bowel was not compromised. Adequate tension placed on the edges of the wound closure helps mitigate this, as does a combination of linear and transverse closure approaches. At the conclusion of the case, flexible or rigid proctoscopy is used to ensure bowel patency and the absence of luminal narrowing.

## COMPLICATIONS

### *Conventional Local Excision*

Overall, morbidity and complication rates for LE of rectal tumors are much lower than for radical surgery.[7] Common complications include urinary tract infection and bleeding, as well as gastrointestinal complaints, such as diarrhea. Other uncommon complications include wound infections or abscesses, thromboembolic events, and, rarely, rectal strictures or rectovaginal fistulas.[7]

### *Transanal Endoscopic Microsurgery and Transanal Minimally Invasive Surgery*

Like conventional LE, TEM and TAMIS have a low rate of complications. The most common complications are urinary retention, perioperative bleeding, and peritoneal violation.[27] In TEM, both urinary retention and peritoneal violation are associated with anterior and lateral locations of the excised tumor. Entry into the peritoneum has not been shown to have any increased morbidity,[27] and this risk is further reduced if full mechanical and antibiotic bowel preparation is used and patients are observed overnight with 24 hours of intravenous antibiotics.

Increased rates of intraoperative bleeding (more than 50 mL) are associated with larger tumor size. Rectovaginal fistula is reported in fewer than 1.5% of patients in large series.[28–30] Anal dysfunction and fecal incontinence due to anal stretch during the procedure have been hypothetical concerns due to the size of the operating proctoscope, but several studies have demonstrated that fecal incontinence scores do not change significantly after TEM or TAMIS, and long-term fecal incontinence is rare.[31–33]

## OUTCOMES

### *Conventional Local Excision*

The 3 most important outcome measures with regard to LE for rectal cancer are local recurrence, disease-free survival, and overall survival. There are no prospective randomized trials comparing conventional LE with radical surgery, and most studies are small single-institution reviews. There is great variability in reported outcomes for both locally excised T1 and T2 tumors in these studies, reflecting the varied nature of the studies themselves. Local recurrence, for instance, varies from 5% to 28% with LE of T1 lesions and 13% to 37% for T2 lesions.[34] Disease-free survival at 5 years is also a range: 64% to 93% for T1 lesions and 63% to 90% for T2 lesions.[34] These findings compare unfavorably with radical surgery for similar lesions. Nevertheless, despite the increased local recurrence seen with LE of T1 tumors, most studies do not show any statistical difference in 5-year overall survival as compared with radical surgery, although the trend favors radical surgery.[7,35–38] Conventional LE for T2 lesions, however, is clearly inferior to radical surgery.[7,35–38]

### *Transanal Endoscopic Microsurgery and Transanal Minimally Invasive Surgery*

The benefit of endoscopic and minimally invasive resection of rectal tumors is an extended anatomic range, allowing access to more proximal tumors than conventional excision. Moreover, visualization of the tumor is enhanced, leading to a theoretic oncologic advantage with improved margins and less specimen fragmentation when compared with conventional LE. There are no randomized studies that directly compare TEM or TAMIS to conventional LE. A recent meta-analysis concluded that local recurrence rates are lower with TEM than with conventional LE.[39] Several studies directly compare TEM with radical surgery. A single small randomized trial for T1 tumors found no significant difference in local recurrence or overall survival between TEM and radical surgery.[40] This is consistent with other retrospective studies for TEM in T1 tumors.[41,42]

## INDICATIONS TO PROCEED WITH RADICAL SURGERY

Because of the uncertainty that surrounds clinical staging of a rectal tumor, LE may be thought of as a full-thickness biopsy. For patients with clinically staged T1 tumors who want to pursue LE as a definitive resection, the final treatment plan should nevertheless be based on the final pathologic tumor stage. If there are high-risk features (see **Table 1**) after LE or if the tumor is T2 or greater, radical surgery should be recommended in patients physiologically fit for such an operation.

Other indications for radical surgery include inadequate circumferential margins or piecemeal extraction of the specimen.[43] Outcomes for patients who undergo delayed radical resection of an early-stage rectal cancer within 30 days of initial LE are similar to those who undergo immediate radical resection.[44] Some patients may refuse radical surgery despite high-risk features or more advanced tumor penetration (T2 or T3); under those circumstances, it is crucial to convey the inferior oncologic outcomes for LE as compared with radical surgery, but ultimately respect the patients' wishes.

### *Posttreatment Surveillance*

Standard posttreatment surveillance of rectal adenocarcinoma includes clinical abdominal and digital rectal examination; CT imaging of the chest, abdomen, and pelvis; serial serum CEA levels; and endoscopic evaluation.[8] For patients who have undergone LE alone, the optimal surveillance protocol has not been determined,[45]

but a more aggressive surveillance regimen may be appropriate to allow early identification of recurrence. Some studies have suggested routine use of transrectal ultrasound and pelvic MRI.[46,47] The authors' favored approach adheres to protocols designed for nonoperative management of rectal cancer in patients with a complete response to chemoradiation therapy,[48] using annual endoscopic surveillance of the wound bed by flexible sigmoidoscopy for the first 5 years and assessing the lymph node basin by alternating endoscopic ultrasounds and pelvic MRI (rectal cancer staging protocols) spaced at 3-month intervals during the year after resection. The imaging interval is lengthened to 6 months and then annually with continued negative findings.

## ADDITIONAL THERAPY

### *Neoadjuvant Therapy*

Neoadjuvant chemoradiation therapy combined with radical surgery has become the standard of care for locally advanced rectal cancer because of evidence for decreased local recurrence.[49,50] This has kindled interested in applying this approach to LE, especially in T2 or T3 rectal cancers, with the hope of decreasing local recurrence and avoiding radical surgery.

Several small studies[51–54] have suggested improved local tumor control with neoadjuvant chemoradiotherapy plus LE. A multicenter phase II clinical trial using LE (TEM or conventional LE) after neoadjuvant therapy for T2N0 rectal cancer recently reported 4% local recurrence and 3-year disease-free survival of 88%, although it did not meet its predetermined statistical threshold for efficacy.[55] This result is nevertheless promising, although such efforts remain within the realm of clinical study and outside the scope of standard practice.

### *Adjuvant Therapy*

The role for adjuvant chemoradiation after LE is not well defined. In contrast to the increase over recent years in rates of LE for early-stage rectal cancer, there has been a decrease in the number of patients who undergo adjuvant therapy after LE.[56] There is retrospective evidence suggesting that LE plus adjuvant radiation therapy may be equivalent to radical surgery alone for overall survival in T1 and T2 tumors.[56] It is not clear that LE plus adjuvant radiation maintains the benefits of LE alone in terms of quality of life versus radical surgery. At least 1 randomized trial comparing radical surgery to LE plus chemoradiation therapy for T1-2 rectal cancers is planned.[57]

### *Salvage*

The prognosis for local recurrence after TAE of T1 adenocarcinoma is poor compared with those initially resected with radical surgery. Five-year disease-free survival ranges from 53% to 79% despite salvage therapy.[34,58,59] A recent single-institution retrospective review found that most patients (87%) with recurrence after LE for T1 rectal cancer were able to undergo a salvage operation, although 5-year overall survival was only 69%.[59] In addition to the dramatic decrease in overall survival, sphincter-sparing approaches that were possible at first presentation may not be possible with salvage surgery. This underscores the importance of patient selection; it is especially critical to discuss these findings with patients who fall outside the strict criteria for LE but are averse to radical surgery.

## SUMMARY

LE for rectal cancer is enticing because of the decreased morbidity and mortality as compared with radical surgery, but it is best used in highly selected patients who

have early-stage cancers with favorable histology. It is also appropriate for those who otherwise would be unfit or unwilling to undergo a more aggressive surgical approach. Oncologic outcomes of LE are inferior to radical surgery, but newer literature suggests that TEM and TAMIS may partially bridge the outcomes gap due to improved visibility and lower margin positivity. Any locally excised tumor, regardless of approach, merits meticulous follow-up and surveillance for local and distant recurrence.

**ACKNOWLEDGMENTS**

The authors gratefully acknowledge the efforts of Alexandria J. Kent, BA, for editorial and administrative assistance in preparation and submission of this article. The authors also thank the ASCRS CREST project for use of the figures in this article.

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