Transanal Minimally Invasive Surgery for Rectal Cancer

27

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Introduction

Surgery is the most critical component of the curative-intent treatment of rectal cancer, a fact that has been recognized for almost 200 years. The surgical treatment of rectal cancer has evolved significantly in that time, from Lisfranc's description of perineal rectal excision [1], to Miles' description of abdominoperineal resection (APR) in 1908 [2], and to Heald's description of total mesorectal excision (TME) in 1982 [3].

In recent years, there has been a growing focus on sphincter-preservation, functional outcomes, and quality of life after treatment for rectal cancer; and rates of APR have seen a measurable decrease [4]. Yet, early malignant and premalignant lesions of the rectum are still commonly treated with radical operations that compromise function and quality of life, in some instances without added oncologic benefit. It is within this context that organ-preserving approaches, such as local excision and watch-and-wait [5], have seen increasing popularity.

Local excision for rectal adenoma and cancer is not a new concept. A.G. Parks and colleagues first described transanal excision (TAE) in the mid-1960s using the now ubiquitous Parks' anal retractor and standard open surgical instruments [6]. While relatively effective for lesions of the low rectum, TAE is significantly more difficult for lesions extending into the mid rectum and above. To overcome the difficulties of TAE for proximal lesions, Gerhard Buess and colleagues described transanal endoscopic microsurgery (TEM) in the early 1980s using a binocular operating proctoscope, gas insufflation, and specialized instruments that facilitate bimanual dissection and suture repair [7]. The technique of TEM has since been modified with the incorporation of modern endoscopic equipment, but still remains an important modality for the local excision of rectal adenomas and early rectal cancers.

Largely driven by the prohibitive cost of standard TEM instrumentation, a more recent modification has involved the use of disposable single-incision laparoscopic ports or dedicated transanal ports along with standard laparoscopic instrumentation. This technique, termed transanal minimally invasive surgery (TAMIS) [8], is the focus of this chapter. Although slightly varied in approach, TAMIS shares with TEM a number of common features including: (1) endoscopic visualization of the rectum, (2) gas/CO_2 insufflation, and (3) the use of laparoscopic and other specialized instrumentation for bimanual surgical dissection and suture repair.

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Indications

Prior to proceeding with TAMIS for rectal cancer, especially if treatment is to be of curative intent, it is critical to perform a thorough history, physical exam, and workup. A detailed discussion with the patient regarding the oncologic risks of local excision compared to radical resection, as well as potential functional benefits should be documented. The surgeon must understand the patient's expectations and wishes, particularly with respect to permanent colostomy.

TAMIS can serve as both a diagnostic or therapeutic procedure and the multiple indications are highlighted below. The technical success, postoperative outcomes, and long-term oncologic results of TAMIS are highly dependent on proper patient selection. Factors that should be taken into account in selecting patients for TAMIS fall into two general categories: (1) disease-specific/oncologic considerations and (2) anatomic considerations. Poor patient selection within these respective categories can often result in the improper inclusion of patients with unrecognized nodal disease, or surgical margin positivity, both of which will contribute to oncologic failure.

Disease-Specific/Oncologic Considerations

The indications for local excision of rectal cancer as curative-intent therapy continue to evolve, particularly with the recent completion of multimodality trials such as the American College of Surgeons Oncology Group (ACOSOG) Z6041 trial [9]. Because local excision of rectal cancer only treats disease that is present in the rectal wall and lumen, the degree to which the procedure is oncologically successful is directly proportional to the likelihood of nodal metastasis.

The most important pathologic predictor of nodal disease is T stage. The risk of nodal metastasis by T stage varies between 5 and 10 % for T1 lesions, 15–25 % for T2 disease, and 35–75 % for T3 disease in the combined literature. Other pathologic factors are also useful in predicting risk of nodal disease and recurrence, and these should be taken into account for patient selection.

Indications

- Adenomatous rectal polyps not amenable to colonoscopic resection, particularly lesions demonstrating high-grade dysplasia or adenocarcinoma in situ.
- Invasive rectal adenocarcinoma with low-risk T1 disease, without any high-risk factors. This is the current position of both the National Comprehensive Cancer Network (NCCN) [10] and the American Society of Colon and Rectal Surgeons (ASCRS) [11], who consider local excision to be an acceptable alternative to radical resection only in this setting. Because they are not reliable risk factors for nodal disease [12], size and circumferential extent alone are not absolute contraindications.
- Nonstandard indications include high-risk T1 or any T2 disease with multimodality therapy in patients who refuse radical resection or in patients enrolled in a clinical trial; T3 lesions in patients who refuse radical resection; rectal adenocarcinomas of any stage for palliative purposes; and Stage II or III rectal adenocarcinomas with complete clinical response to neoadjuvant therapy in highly selected and individualized circumstances.
- Less common indications for TAMIS include carcinoids, endometriomas, angiodysplasia, ulcers, strictures, and other benign pathologies.

Anatomic Considerations

The selection of patients with rectal lesions that are too distal, too proximal, or too large can lead to both poor oncologic result (e.g., margin positivity and recurrence) and unnecessary morbidity. From the technical standpoint, TAMIS is ideally suited for lesions confined to the mid-upper rectum, involving less than 1/3 of the rectal circumference.

Lesions in the distal rectum are more appropriately treated with transanal excision (TAE). Excision of lesions proximal to 15 cm greatly increases the risk of peritoneal entry and radical resection should be considered in these cases. The likelihood of peritoneal entry is highly dependent on the circumferential location of the lesion, with anterior excisions presenting the greatest risk. Although there is significant individual anatomic variation based on body habitus, Najarian and colleagues have provided useful estimates of the distance of the peritoneal reflection from the anal verge using intraoperative rigid proctoscopy [13].

Anatomic Indications

- Posterior lesions that are 5–15 cm from the anal verge.
- Anterior, anterolateral, and lateral lesions that are 5–10 cm from the anal verge.
- More proximal lesions (both anteriorly and posteriorly) may be approached with planned peritoneal entry. Defects that communicate with the peritoneum can be repaired either transanally, laparoscopically, or a combination of both. With posterior rectosigmoid lesions proximal to 15 cm, it is possible (though difficult) to avoid peritoneal entry by confining the transanal dissection to the space within the visceral peritoneal boundaries of the rectosigmoid mesentery [14].

Diagnosis and Workup

Patients with rectal lesions generally present with clinically evident or occult lower gastrointestinal bleeding or a rectal lesion discovered on screening colonoscopy. Before reaching the surgeon, these patients often have been evaluated by a primary physician and gastroenterologist, and a pathologic diagnosis has already been established. Regardless, a thorough history and physical examination should be performed by the surgeon with specific attention to detailed oncologic history, presence of rectal pain and/or tenesmus, presence of obstructive symptoms, assessment of anorectal function, and assessment of urinary and erectile function/dysfunction. The surgeon should perform rigid proctoscopy documenting proximal and distal extent of the lesion, circumferential position of the lesion within the rectal wall (anterior, posterior, or lateral), and an approximation of the total diameter and circumferential extent of the lesion.

Additional Diagnostic Studies

- Complete colonoscopy.
- Transrectal ultrasound (TRUS) or high-resolution rectal magnetic resonance imaging to stage all rectal neoplasms (≤15 cm from anal verge on rigid proctoscopy). Although there is some debate as to which modality is superior, we prefer TRUS given its ability to better discriminate between T1 and T2 disease, along with comparable sensitivity and specificity with respect to nodal involvement [11].
- Complete staging computed tomography (CT) scan of the chest, abdomen, and pelvis to rule out metastatic disease.
- Positron emission topography (PET)/CT can be used selectively for patients with suspected metastatic disease or in patients in whom intravenous contrast is contraindicated.
- Anal physiologic studies with manometry should be considered in patients with physical evidence of anorectal dysfunction to document preoperative sphincter function.

Preoperative Considerations

The operative field in TAMIS is the lumen of the rectum. Therefore, thorough mechanical bowel preparation is essential for visualization and exposure. We ask our patients to eat a normal lunch the day before surgery with clear liquids thereafter and nothing by mouth after midnight. Our preferred mechanical bowel preparation consists of one bottle of magnesium citrate orally during the afternoon before surgery, with a Fleet's enema the night before and the morning of the procedure.

Equipment

- Disposable transanal access port. Single-incision laparoscopic surgery (SILS) ports from multiple manufacturers have been used to obtain transanal access. More recently, dedicated disposable transanal access ports have become commercially available. We have used a number of these ports and currently prefer the GelPoint Path system (Applied Medical). All of these ports have their limitations. The most notable issue is that in obese patients placed in prone-jackknife position, the ports are sometimes too short to traverse the entire length of the external sphincter/levators. Although we have devised improvised methods of circumventing this particular shortcoming, traditional TEM may be a better option in these circumstances.
- Standard laparoscopic equipment including laparoscopic tower, insufflator, monitors, camera, and a 10-mm 30° laparoscope.
- Laparoscopic/articulating instruments including graspers, dissectors/energy devices, and needle driver. Our preferred grasper at present is the standard Maryland dissector held in the nondominant hand. We have used both straight and articulating hooks with cautery for dissection, as well as ultrasonic shears. We currently use both an articulating SILS hook (Covidien) as well as a harmonic scalpel (Ethicon) for dissection. We prefer standard laparoscopic needle drivers for suture repair of the excision defect.

Surgical Technique

Positioning and Preparation

The patient is placed under general anesthesia with endotracheal intubation. A Foley catheter is routinely inserted. A minimal sterile preparation of the perineum is performed and the patient is draped in standard fashion. Abdominal preparation may be performed if peritoneal entry is expected. Careful patient positioning is critical to ensure technical success of TAMIS. Although some groups perform TAMIS exclusively in lithotomy, we prefer to adjust patient positioning in order to keep the lesion down at the 6 o'clock position as much as possible. For posterior lesions, the patient is placed in a high-lithotomy position with the surgeon standing in the center and the assistant standing on either side of the surgeon (Fig. 27.1a). For anterior lesions, the patient is placed in the prone-jackknife position on a split-leg table, with the surgeon positioned between the legs (Fig. 27.1b). In case of inadequate flexion/jackknife, the ischial tuberosities will hinder the proper insertion of currently available transanal ports beyond the levators, which will result in poor visualization and exposure.

For lateral lesions, the patient is positioned either in prone-jackknife or lithotomy and turned in either direction such that the lesion is as close to the 6 o'clock position as possible. If the lesion cannot be placed directly at the midline, it is preferentially oriented toward the surgeon's dominant hand to facilitate suture repair. The patient must be firmly secured to the table, which we accomplish with towels and circumferential tape at the level of the chest.

Port Placement and Exposure

The anal sphincter is manually dilated with 2–3 fingers. We no longer perform intersphincteric injections of any kind. The transanal access channel/port is heavily lubricated and inserted into the anal canal with the lip of the port placed proximal to the sphincters and levator. If the lip of the port does not completely traverse the levators, visualization will invariably be obstructed by internal hemorrhoidal tissue. Insertion of the port can be facilitated by internally folding and grasping the port with a ring clamp. After initial insertion, gentle pressure can be applied with the introducer supplied by the manufacturer to push the lip of the port past the levators. There is no need to suture the port to the skin, given that it is fairly stable if placed in the appropriate position (Fig. 27.2).

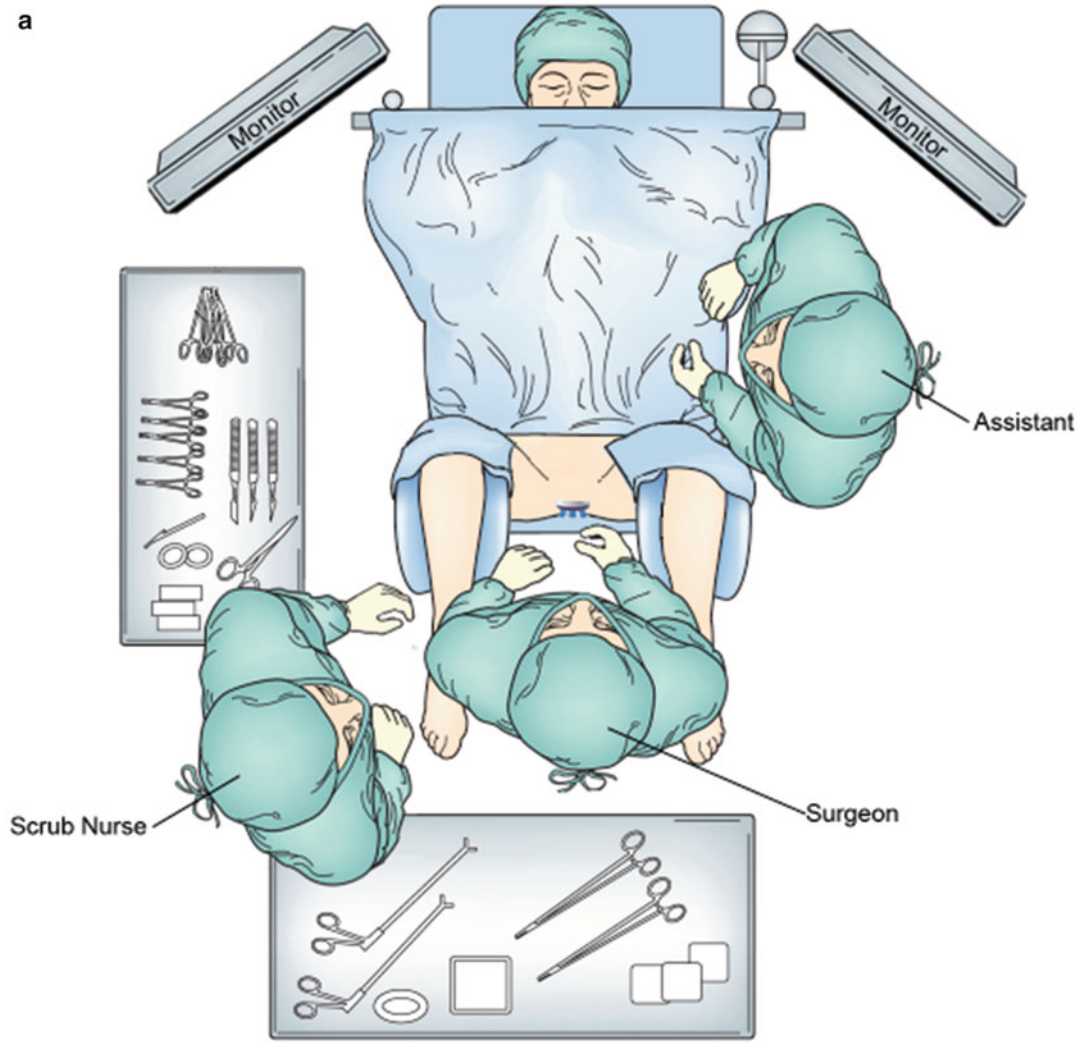

Fig. 27.1 Operative positioning for TAMIS. (**a**) The patient is placed in high lithotomy position for posterior lesions. (**b**) The patient is placed in prone-jackknife position on a split-leg table for anterior lesions

A lightly moistened sponge is inserted into the rectum, to be pushed into the proximal lumen during insufflation. This helps prevent insufflation of the proximal colon and may also limit periodic collapse of the pneumorectum during the case. The instrument sleeves are then placed into the gel cap and the gel cap is then fixed to the transanal port.

Identification of Excision Margins of at Least 1 cm

We routinely mark 1-cm margins using a hook cautery device. As the dissection proceeds, tissue distortion and retraction are encountered and these cautery marks are invaluable in preventing disorientation and assuring adequate margins of excision (Fig. 27.3).

Full-Thickness Incision of the Rectal Wall

A full-thickness incision is made into the perirectal tissue beginning 1 cm distal to the lesion. This is usually accomplished by lifting the rectal wall with a grasper and incising the rectum with a hook cautery device. Distal incision allows

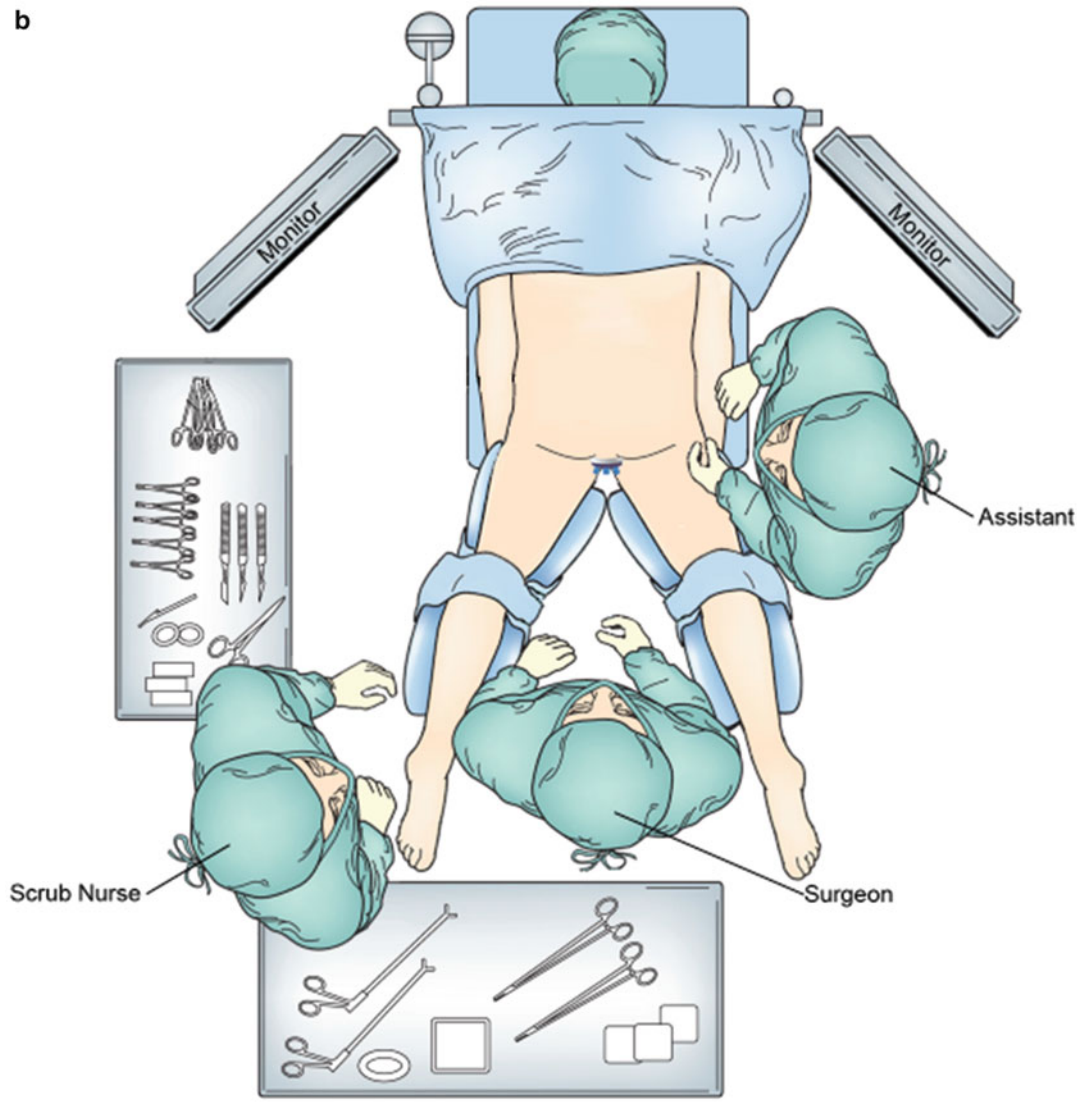

Fig. 27.1 (continued)

complete visualization of the tissue planes during the course of the dissection (Fig. 27.4).

Posteriorly, the perirectal tissue is usually easily recognized by the presence of perirectal fat. While there is often some fat anteriorly as well, the correct plane generally consists of loose, relatively avascular areolar tissue between the rectal wall and the urogenital structures. This initial step should be performed with extreme caution for anterior and lateral excisions to avoid injury to major vascular and urogenital structures.

We do not perform partial-thickness excisions given that this alternative is not oncologically appropriate in the setting of a suspected cancer, and because (in our experience) benign adenomas are almost always appropriately treated with endoscopic mucosal resection by our gastroenterology colleagues.

Circumferential Dissection

The perirectal tissue is dissected first by bluntly spreading the tissue in the appropriate plane and by taking the perirectal tissue sharply with cautery. The overlying rectal wall is then taken

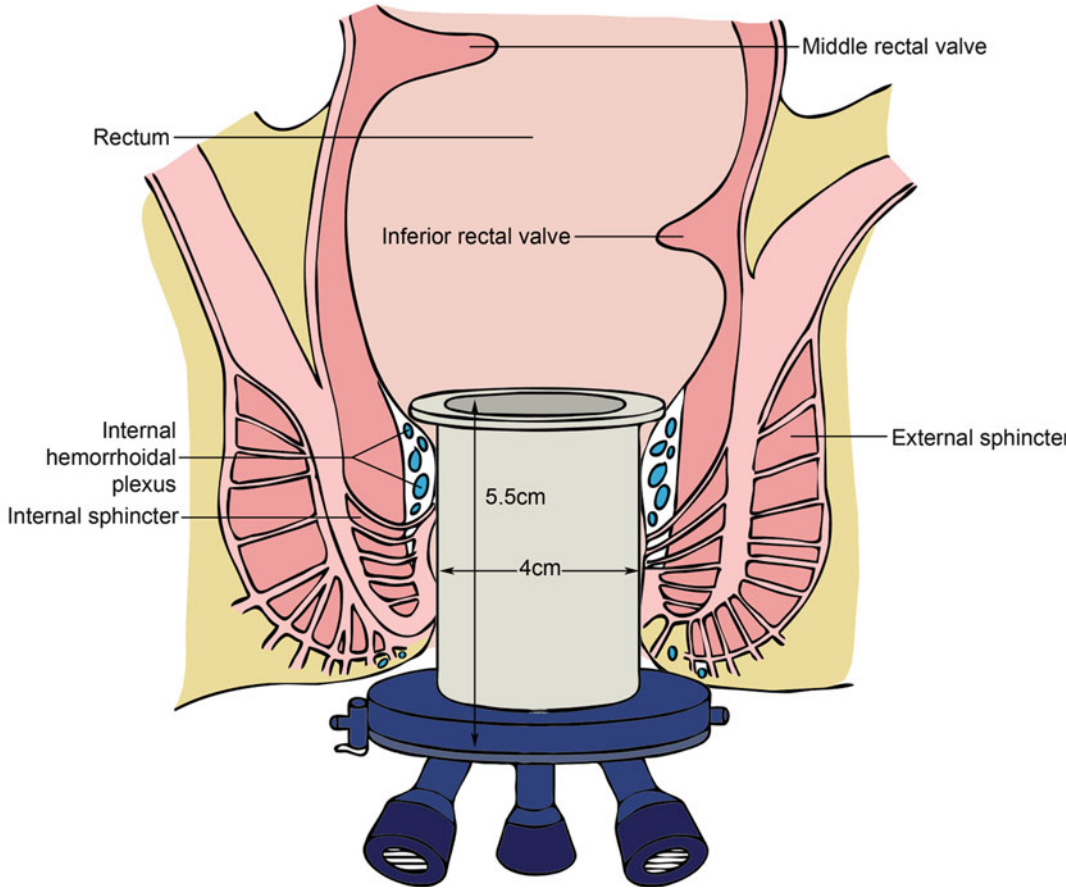

Fig. 27.2 Diagram illustrating proper seating of the transanal port in the anal canal. The body of the port is approximately 4 cm wide and is properly inserted at 5.5 cm

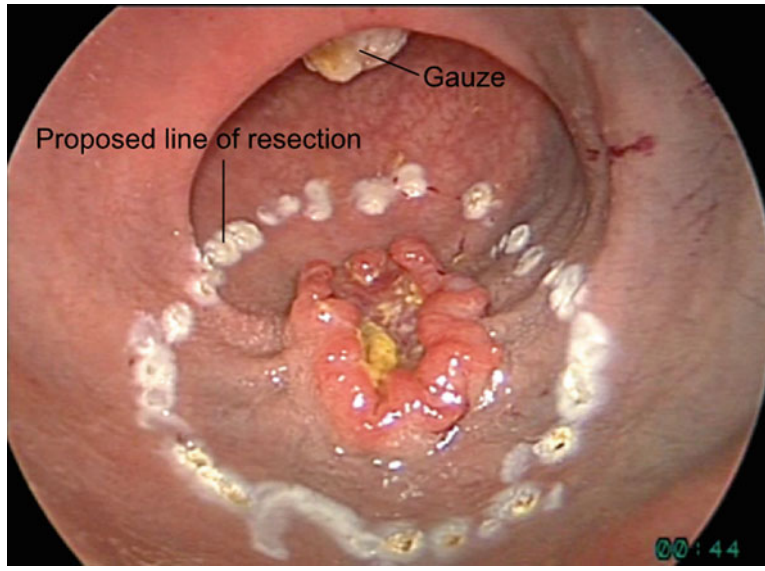

Fig. 27.3 Marking 1-cm margin of excision of rectal lesion marked with hook cautery

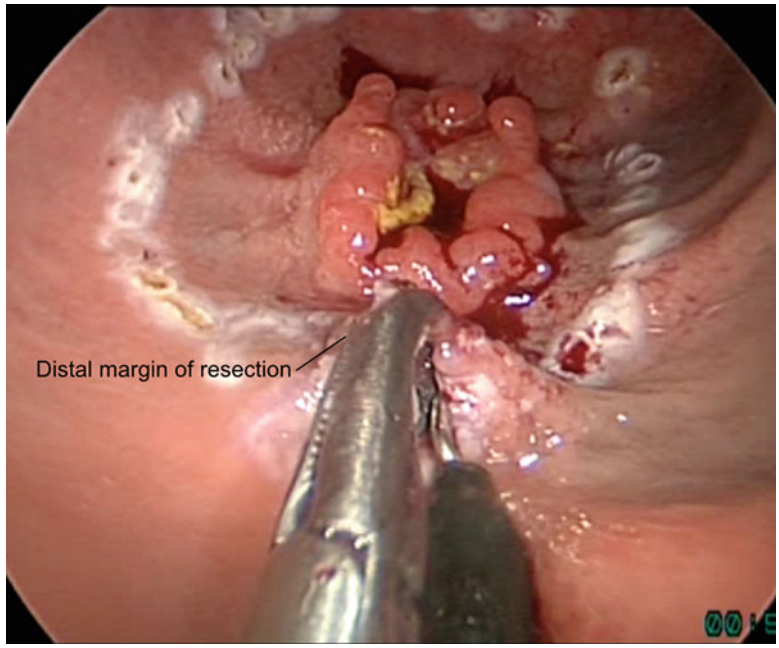

Fig. 27.4 Excision of rectal lesion begins with full-thickness incision of the rectal wall at the distal margin

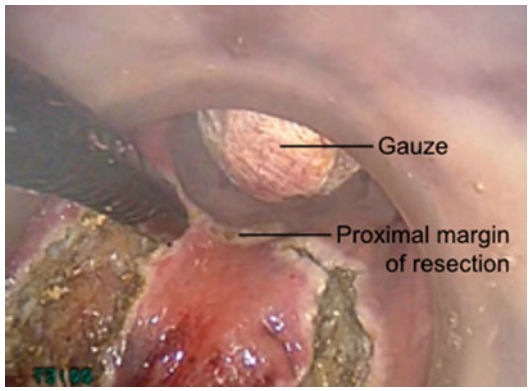

Fig. 27.5 Intraoperative photo demonstrates circumferential dissection of the lesion with 1-cm margin. A Ray-tec sponge has been inserted in the proximal rectum to limit insufflations of the colon and preserve the pneumorectum

progressively with cautery or ultrasonic shears. Dissection in this manner is especially important as the peritoneal reflection is approached and minimizes the risk of injury to perirectal structures (Fig. 27.5). The dissection is carried circumferentially in this manner on both sides. The proximal extent of the dissection is approached in the deep plane first, with the overlying rectal wall and mucosa taken with energy immediately thereafter.

Once free, the specimen is securely grasped to maintain orientation, and removed after unclamping the gelcap of the transanal port. The specimen is then placed on a Telfa dressing and oriented for pathologic examination. The surgeon routinely accompanies the specimen to the pathology room to assure orientation. Gross examination is routinely performed. Frozen section analysis is performed selectively if margin involvement is suspected.

Suture Repair

The pneumorectum often causes the excision defect to appear impressively large in size. This effect can be reduced by decreasing insufflation pressure in order to facilitate repair, though we generally find this unnecessary. We repair the defect using a multifilament absorbable suture with a LapraTy (Ethicon) on one end to avoid

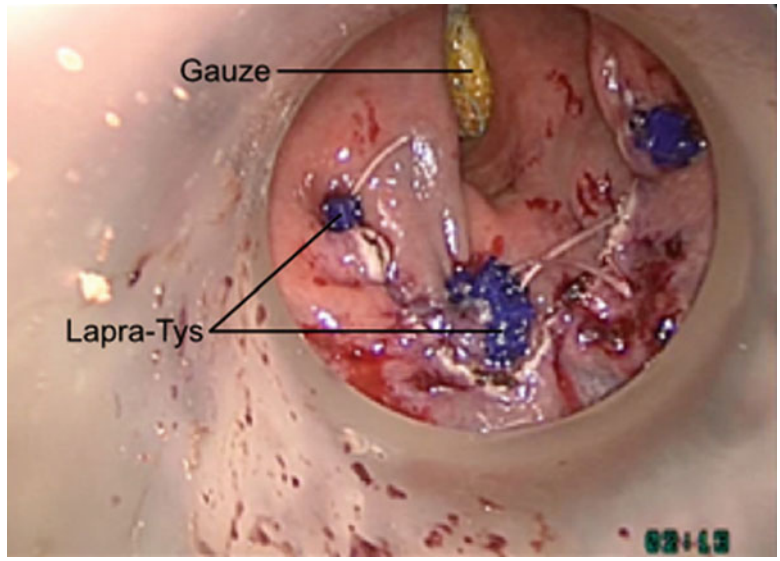

Fig. 27.6 Intraoperative photo demonstrates suture repair of the resulting rectal defect with running multifilament suture. LapraTys (Ethicon) have been placed to secure the sutures in place of knot-tying

tying in a confined space (Fig. 27.6). Locking monofilament absorbable suture is now commercially available and is also a good option.

The repair proceeds in a running fashion with large full-thickness bites from the side of the surgeon's dominant hand towards the nondominant side. Depending on the size of the defect, 2 or 3 separate running sutures may be use to traverse the entire defect. This limits the amount of redundant suture that is in the lumen at any given time. Once the last bite is taken, a LapraTy (Ethicon) is placed and the suture divided to complete the repair. The gauze and transanal port are then gently removed.

Postoperative Care

The patient is admitted overnight for observation and diet is advanced as tolerated. Analgesics are usually unnecessary. In the absence of significant pain, fever, bleeding, or urinary retention the patient is discharged home on postoperative day #1. If fevers are noted, pelvic and abdominal sepsis should be ruled out. In the presence of a benign abdominal exam, empiric antibiotics may be used and the patient may be observed until resolution.

If fevers persist, imaging studies such as abdominal plain-films and/or CT scan of the abdomen and pelvis with rectal contrast should be considered. Free abdominal air should immediately raise concern for unrecognized peritoneal entry and should prompt laparoscopy and/or laparotomy in the setting of persistent abdominal pain and/or fevers.

With large transanal excisions, CT scan may demonstrate fluid within the excision defect, which in the absence of clinical findings is likely to be inconsequential. However, in the setting of persistent fevers refractory to antibiotics, consideration should be given to either transanal or percutaneous drainage. Diverting ileostomy should be considered if pelvic sepsis persists or is severe.

Complications

The primary benefits of both TEM and TAMIS are the avoidance of most of the complications encountered from low anterior and abdominoperineal resections, including surgical site infections, anastomotic leak, and other morbidity related to abdominal surgery. In addition, the

relatively frequent and severe functional complications of radical resection, such as erectile dysfunction, urinary retention, low anterior resection syndrome, and fecal soilage, are almost completely obviated by TEM/TAMIS.

Because TAMIS is a relatively new modification of TEM, the combined worldwide experience is relatively small. However, given the similarity between the two procedures, morbidity data for TAMIS can in most instances be extrapolated from TEM data. Complications from both TEM/TAMIS tend to be relatively infrequent, minor, and self-limited. Overall morbidity rate in most series is <15 % for TEM [15], and is likely the same or lower for TAMIS [16]. The risk of perioperative mortality is extremely low (<<1 % in major series). The risk of major morbidity requiring admission and/or significant intervention is also low at <5 % in most series [15, 16]. Specific complications include:

- Rectal bleeding. This complication is relatively rare and, in the majority of cases, self-limited. It can occur intraoperatively, early in the postoperative course, or several days after discharge. The need for operative reintervention is exceedingly rare.
- Suture dehiscence. This may occur in as many as 15 % of patients and is likely more common with large excisions [17]. In most instances, suture dehiscence is likely to be subclinical, though dehiscence of the extraperitoneal rectum may present with fever. While transanal repair can be performed, most cases can be managed nonoperatively with systemic antibiotics. Conversely, intraperitoneal dehiscence after planned or unplanned peritoneal entry will result in intraabdominal contamination and peritonitis mandating urgent exploration. Signs of refractory and progressive sepsis should prompt consideration of abdominal exploration with fecal diversion and possibly radical resection.
- Functional complications. Transient urinary retention is among the more commonly encountered complications of TEM. A brief period of anal leakage has also been reported in rare cases, but is almost always temporary. Significant functional complications have not been reported with TAMIS and we have not encountered significant functional issues in our experience. Both complications may be related to traction injury from the transanal access device, which is potentially mitigated by the somewhat smaller disposable TAMIS platforms.
- Peritoneal entry. We do not consider planned peritoneal entry a complication. Unintended peritoneal entry, however, is more common with anterior, lateral, and upper rectal lesions. Dissection into the peritoneal cavity should be recognized intraoperatively, and may result in abdominal insufflation and collapse of the pneumorectum. With intraoperative recognition and adequate visualization, transanal repair may be sufficient. If transanal repair is not possible, primary repair via laparoscopy or laparotomy can also be accomplished. If repair is impossible or inadequate, resection and/or diversion should be considered.
- Relatively rare complications include intraoperative injury to genitourinary structures; rectovaginal, rectourethral, and rectovesical fistulae; rectal stricture; and complications related to positioning.

Surveillance

There are no standardized protocols for oncologic surveillance after TAMIS. We have been very aggressive with surveillance, particularly in our early experience. Given the concern for local recurrence, our protocol has been to perform flexible sigmoidoscopy every 3 months for the first 6 months, then every 6 months for 2 years, followed by routine endoscopy and cancer screening for a total of 5 years. In patients with invasive cancer, we perform CT scans of the chest, abdomen, and pelvis every 6–12 months for the first 3 years and yearly thereafter for a total of 5 years. Less aggressive surveillance protocols, however, are likely adequate.

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Key Operative Steps

1. Dilate the anal sphincter with 2–3 fingers.
2. Insert the transanal access channel/port into the anal canal.
3. Insert a sponge/gauze into the proximal rectum.
4. Mark 1-cm margin with hook cautery.
5. Make a full-thickness incision into the perirectal tissue at the distal margin.
6. Dissect the perirectal tissue with blunt and sharp maneuvers.
7. Divide the rectal wall with cautery or ultrasonic shears.
8. Complete dissection circumferentially until resection is complete.
9. Secure the specimen to maintain orientation for pathologic examination.
10. Repair the defect with a single layer of full-thickness multifilament suture(s). May close defect with a single running suture or 2–3 serial running sutures. LapraTys (Ethicon) may be used to secure sutures to obviate knot-tying.