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Transanal endoscopic video-assisted (TEVA) excision

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Abstract
Background Transanal endoscopic video-assisted (TEVA) excision represents an alternative approach for the surgical treatment of middle and upper rectal lesions not amenable to colonoscopic removal. Utilizing principles of single-incision laparoscopic surgery, this novel minimally invasive approach optimizes access for safe and complete removal of these lesions without the need for a formal rectal resection. We describe our technique and early outcomes with TEVA excision.
Methods Between March 2010 and September 2011, TEVA excision was performed for patients presenting for management of rectal lesions not amenable to colonoscopic or standard transanal removal. Patients were selected if they presented with benign disease or superficial adenocarcinoma, and the proximal extent of the lesion extended beyond 8 cm from the anal verge. Demographic, intraoperative, and postoperative data were assessed. A SILS^{TM} port was placed in the anal canal for access in all cases. Standard laparoscopic instruments were utilized for visualization, full-thickness transanal excision, and primary closure.
Results Twenty patients (50 % male) with a mean age of 64.6 ± 10.9 years, mean body mass index of 28.2 ± 4.9 kg/m^2, and median American Society of Anesthesiologist score of 2 underwent TEVA excision. Fourteen patients (70 %) presented with benign disease and six patients (30 %) presented with malignant disease. The mean size of the lesions was 3.0 ± 1.4 cm, and the mean distance from the anal verge was 10.6 ± 2.4 cm. All excisions were successfully completed with a mean operative time of 79.8 ± 25.1 (range, 45–135) min. The mean length of hospital stay was 1.1 ± 0.7 (range, 0-3) days.
Conclusions TEVA excision is a safe and feasible approach for local excision of rectal lesions not otherwise amenable to standard techniques. Continued investigation and development will be important to establish its role in minimally invasive colorectal surgery.

Keywords Transanal excision · Single-incision · Transanal endoscopic microsurgery · Anorectal · Minimally invasive surgery

Although the majority of rectal polyps can be removed safely by using an array of polypectomy techniques during colonoscopy [1, 2], various factors, such as the size, location, and pathology of the lesion, may necessitate consideration of a surgical approach for definitive treatment [3–5]. Traditional transanal excision (TAE) is an important alternative for local removal of many of these lesions, because it avoids radical abdominal resection and is associated with low morbidity and mortality, expeditious recovery, and improved functional results [7, 8]. However, TAE is limited to lesions confined within 5–8 cm of the anal verge [6], primarily because those lesions of the middle or upper rectum cannot be readily accessed [9].

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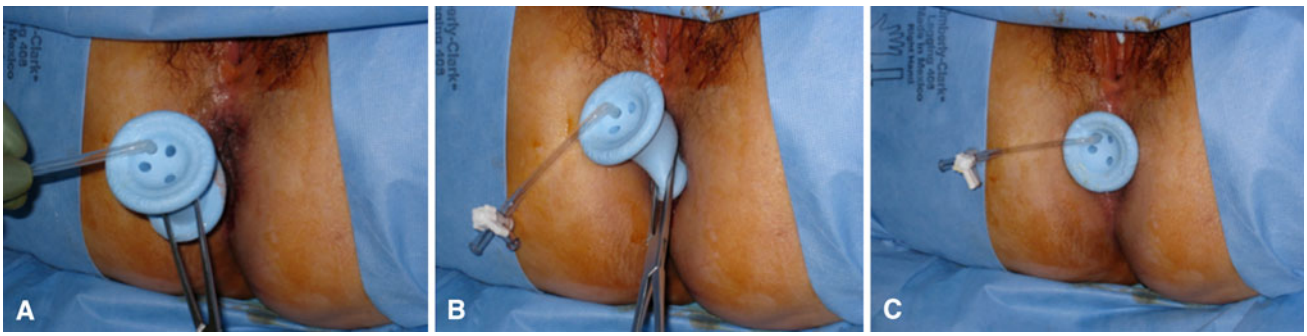

Fig. 1 SILS^{TM} port inserted into the anal canal using a surgical clamp

Traditionally, the majority of patients with middle or upper rectal lesions have required some form of radical abdominal surgery, such as low anterior resection (LAR) or abdominoperineal resection (APR), for early stage malignant disease (Tis and T1) and even large benign lesions [10–12]. These approaches are associated with significant morbidity, including anastomotic leak, pelvic sepsis, stenosis, and sexual or urinary dysfunction [13–17]. Furthermore, permanent colostomy may be necessary in up to 30 % of cases [18], even with the development of minimally invasive approaches and sphincter-preserving procedures.

More recently, the application of a single-incision laparoscopic access device for transanal excision has been assessed [19–26]. Labeled transanal endoscopic video-assisted (TEVA) excision by our group [27], this innovative approach facilitates surgical excision of middle and upper rectal lesions not amenable to standard transanal or colonoscopic removal. Combining the merits and technical skills of single-incision laparoscopic colectomy (SILC) [28–31] with the principles of TAE, TEVA excision optimizes access for safe and complete removal of these lesions without the need for a formal rectal resection. We describe our technique for TEVA excision and present our early outcomes with this novel minimally invasive surgical approach.

Materials and methods

Between March 2010 and September 2011, TEVA excision was performed for patients presenting for management of rectal lesions not amenable to colonoscopic or standard transanal removal. Patients were eligible for TEVA if (1) the proximal extent of the lesion extended beyond 8 cm from the anal verge, and (2) had benign disease, carcinoid, or early-stage adenocarcinomas (ultrasound stage: uTis or uT1N0). All procedures were performed by one of two board-certified colorectal surgeons (TBP and EMH). Demographic information, intraoperative parameters, and postoperative outcomes were assessed.

Surgical technique

Our technique for TEVA excision has been described previously [27]. General endotracheal anesthesia is utilized to secure the airway and to facilitate the use of paralytics, which limits the loss of pneumorectum that tends to occur with changes in intra-abdominal pressure. The patient is always placed in supine position with legs elevated in candy-cane stirrups (independent of the location of the lesion). A SILS^{TM} port (Covidien, Mansfield, MA) is inserted into the anal canal for access. A surgical clamp or sponge stick may be used to assist with port insertion (Fig. 1), and lateral fixation sutures may be placed to secure the port (Fig. 2).

The SILS^{TM} port contains three cannulae for introduction of instrumentation into the lumen and a supplementary cannula that facilitates carbon dioxide (CO_2) gas insufflation (Fig. 3). A maximum pressure of 15–18 mm Hg is used to maintain pneumorectum. Standard laparoscopic instrumentation, which includes an atraumatic bowel grasper, a hook Bovie electrocautery, and a 5-mm 30° camera, is utilized for all cases (Fig. 4). A right-angle light cord adaptor (KARL STORZ Endoscopy, El Segundo, CA) is essential to minimize external clashing between the instruments (Fig. 5).

The lesion is identified and the mucosa is scored by using the hook Bovie cautery in a circumferential fashion 1 cm from its edges to ensure gross-negative margins (Fig. 6). Attention is initially drawn to the proximal extent of the lesion, and a full-thickness excision is performed (Fig. 7). Systematic dissection continues in a tangential plane through the layers of the rectal tissue (confirmed with identification of the mesorectum). Once completely excised, the specimen is extracted transanally and hemostasis is achieved (Fig. 8).

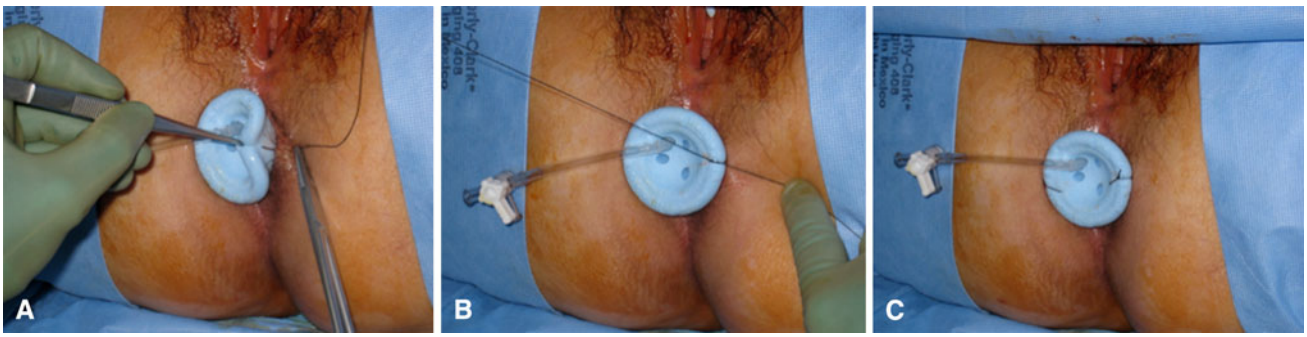

Fig. 2 Placement of fixation sutures

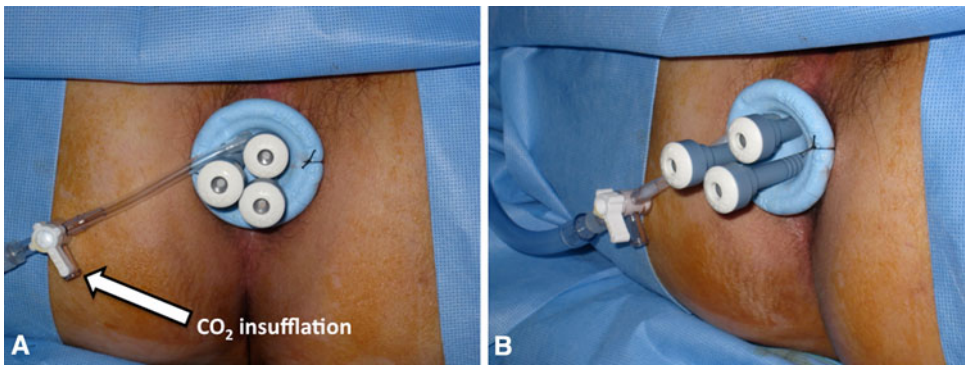

Fig. 3 SILS™ port in anal canal. **A** Three cannulae for introduction of instrumentation and supplementary cannula for CO_2 gas insufflation. **B** Trocars in staggered configuration to reduce clashing

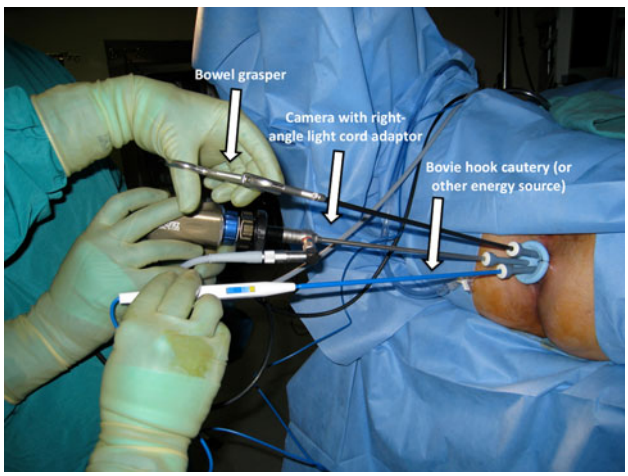

Fig. 4 Standard laparoscopic instrumentation (atraumatic bowel grasper, hook Bovie electrocautery, 5-mm 30° camera) is utilized for all cases

Fig. 5 Right-angle light cord adaptor assists in limiting instrument conflict

The final stages of the procedure involve full-thickness primary closure of the rectal wall defect with interrupted 2.0 Vicryl sutures (Figs. 9, 10). Recently, we have adapted to using a V-Loc™ Absorbable Wound Closure Device (Covidien) for primary closure, which averts the need for intraluminal knot tying.

Results

Twenty patients (50 % male) with a mean age of 64.6 ± 10.9 (range, 40-86) years, mean body mass index of 28.2 ± 4.9 (range, 20.2–39) kg/m^2, and median American Society of Anesthesiologist score of 2 (range, 1–3) underwent TEVA excision (Table 1). All patients had undergone previous colonoscopy with failed or incomplete

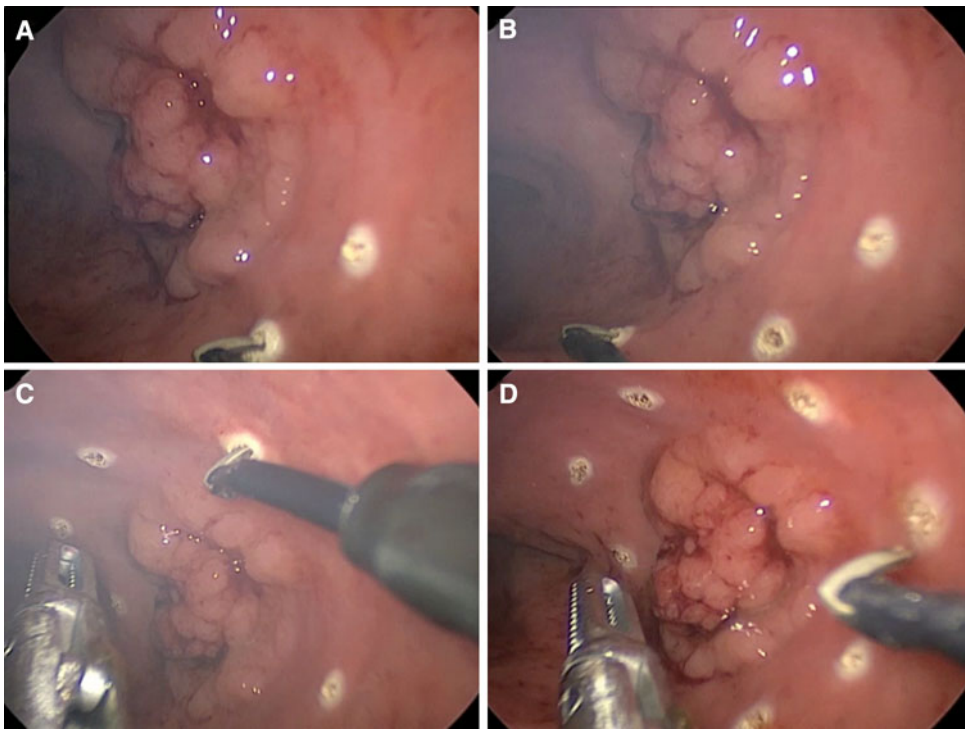

Fig. 6 Lesion is scored circumferentially with 1-cm margins

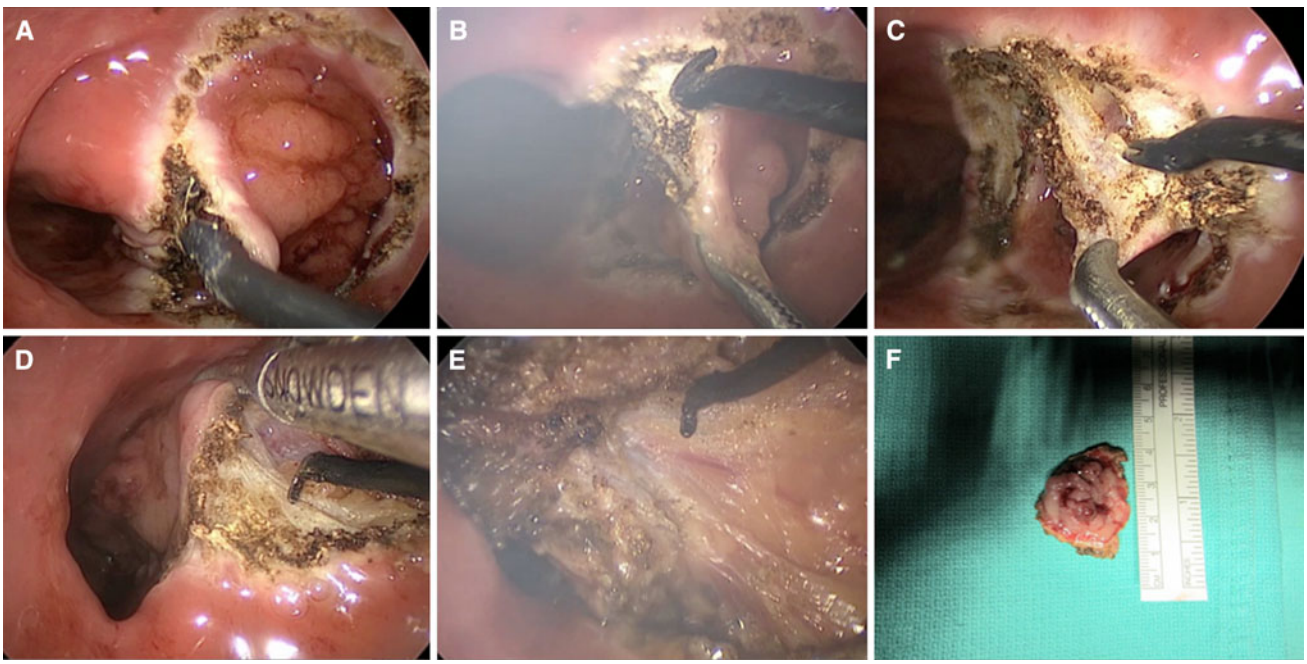

Fig. 7 Full-thickness excision. **A** Margins of excision outlined using score marks. **B–D** Systematic dissection in tangential plane through layers of rectal wall. Smoke accumulation may be eliminated with pulse suctioning. **E** Important to achieve full-thickness excision into perirectal adipose tissue. **F** Specimen extracted

polypectomy. All but six patients had a prior surgical history, including one patient who had undergone a previous transanal excision. Fourteen patients (70 %) presented with benign disease (adenoma), and six patients (30 %) presented with malignant disease (carcinoid or adenocarcinoma). The mean size of the lesions was 3.0 ± 1.4 (range, 1.3–5.5) cm, and the mean distance from the anal verge was 10.6 ± 2.4 (range, 6–15) cm.

All TEVA excisions were completed successfully, and there were no intraoperative complications. The mean

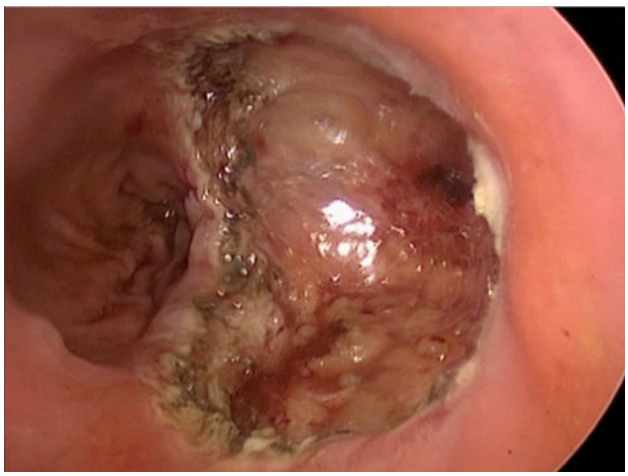

Fig. 8 Rectal wall defect with exposed mesorectum following full-thickness excision

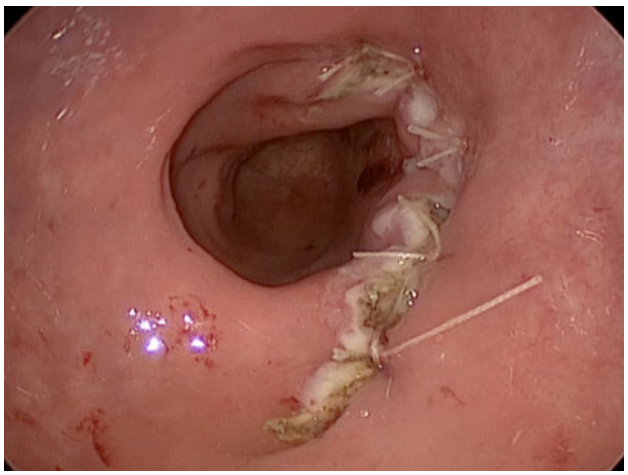

Fig. 10 Final closure of the bowel wall defect

operative time and length of hospital stay were 79.8 ± 25.1 (range, 45–135) min and 1.1 ± 0.7 (range, 0–3) days, respectively. A single postoperative complication occurred, which consisted of a patient who presented with vaginal drainage that spontaneously resolved. Repeat interval TEVA excision was required for two patients (10 %): one with inadequate surgical margins (within 1 mm) in a malignant lesion and another with recurrent villous adenoma 7 months after the index procedure. One patient underwent a formal oncologic LAR after TEVA excision revealed a T2 lesion on final pathology (preoperative stage: T1N0).

Discussion

Transanal endoscopic video-assisted excision is a safe and feasible approach for the treatment of benign polyps and early-stage rectal carcinoma. Merging the technical skill set of SILC with the principles of TAE optimizes access and visualization for safe and complete removal of these lesions when beyond the limits of TAE. Furthermore, the approach averts the need for a formal oncologic resection and the possible negative outcomes associated with a low colorectal anastomosis or definitive colostomy. Although early in our experience, the modality also has proven to be a viable option for excision of middle and upper rectal lesions.

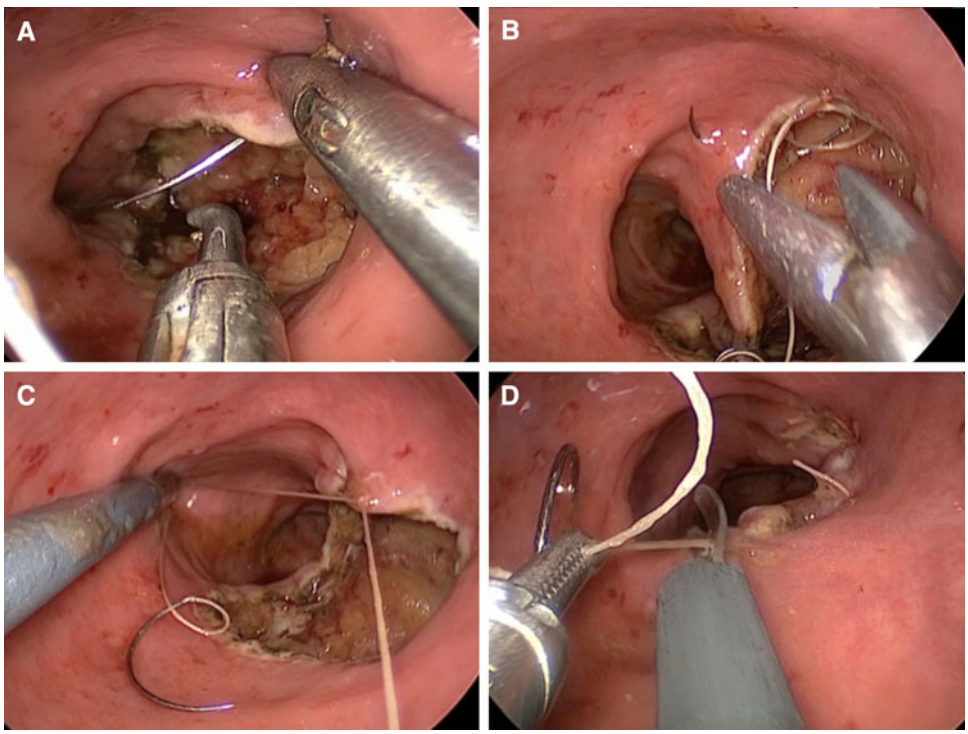

Fig. 9 Full-thickness primary closure with interrupted 2.0 Vicryl sutures

Table 1 Demographic and perioperative data

Parameter	Age (year)	BMI (kg/m^2)	ASA	Lesion size (cm)	Distance from anal verge (cm)	OT (min)	LOS (days)
Mean ± SD	64.6 ± 10.9	28.2 ± 4.9	2.4 ± 0.6	3.0 ± 1.4	10.6 ± 2.4	79.8 ± 25.1	1.1 ± 0.7
Median	64.5	27.4	2	2.9	10	70	1
Range	40–86	20.2–39.0	1–3	1.3–5.5	6–15	45–135	0–3

ASA American Society of Anesthesiologists score, *BMI* body mass index, *SD* standard deviation, *LOS* length of stay

Several case reports [20, 21, 25] and small case series [19, 22–24, 26] have been published describing similar experience utilizing the SILS^{TM} port or other single-incision devices for transanal access and local excision. The first series reported by Atallah et al. [24] demonstrated excellent overall results for six patients. There were no conversions, morbidities or mortalities. Currently, the largest series published by van den Boezem et al. [26] includes 12 patients from the Netherlands. Ten cases were successfully completed using the SILS^{TM} port. However, an open transanal approach was necessary for the remaining two cases, because there was insufficient distance between the port and target polyp in each case. Our operative time, length of stay, and complication rate is comparable to the current literature.

Since initially describing our technique [27], we have incorporated several modifications to enhance the procedure. For instance, the trocars are placed and positioned in a staggered fashion (Fig. 3B) to reduce potential instrument clashing. We also have utilized an extra-long camera as a method for limiting external collisions between the surgeon and assistant. A right-angle light cord adaptor (Fig. 5) is routinely used as well to limit external conflict. Even though intraluminal knot tying can be readily achieved by most experienced surgeon, the narrow confines of the rectal lumen can still be challenging. We have recently begun to use a V-Loc^{TM} Absorbable Wound Closure Device for primary closure. This affords approximation with a running suture technique, obviating the need for intraluminal knot tying and reducing overall operative times.

Another alternative approach to avoid radical resection, transanal endoscopic microsurgery (TEM), was first introduced in the mid 1980s and has become a viable option for the management of lesions not suitable for TAE [32–34]. Studies have demonstrated TEM to be safe, feasible, and efficacious for the management of low-risk lesions, specifically large benign adenomas and early-stage carcinomas (T1 or T2 tumors) [35–37]. The technique provides enhanced visualization and precise excision, resulting in low morbidity and mortality rates for lesions located up to 25 cm from the anal verge [38, 39]. Nonetheless, TEM is not without its own inherent limitations. The high cost of instrumentation and extended learning curve for TEM has restricted its availability and curbed wider adaptation [40–43].

The cost of TEM is significant when taking into account the proctoscope and insufflation system [44], the optical and operative instrumentation, and the maintenance of the plugs and caps that help seal the closed system. Furthermore, the cost of training must be factored into the overall cost of the procedure. Compared with TEM, TEVA excision utilizes readily available surgical instrumentation, requires minimal set-up, and translates well to experienced laparoscopic surgeons. Furthermore, in the absence of a commercially available single-incision port, use of a "glove port," such as previously used for SILC [45–47], may be considered for TEVA excision [48].

Transanal endoscopic video-assisted excision is a safe and feasible approach for local excision of benign and superficial malignant rectal lesions. The approach facilitates exposure and access to pathologies of the middle and upper rectum and averts the need for formal rectal resection. Continued investigation and development of this novel and innovative modality will be important to establish its role in minimally invasive colorectal surgery.

Disclosures Drs. Ragupathi, Vande Maele, Nieto, Pickron, and Haas have no conflicts of interest or financial ties to disclose.

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