Review Article

Transanal treatment of rectal cancer by rigid platform

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Abstract: Transanal endoscopic surgery is a well-established minimally invasive option for the surgical management of selected rectal cancer patients. Transanal endoscopic surgery represents the gold standard for the transanal excision (TAE) of rectal tumors, since it allows to perform a "en bloc" full thickness local excision and is associated with lower recurrence rates than conventional TAE with retractors. Patients undergoing transanal endoscopic surgery for selected early rectal cancer experience less complications and report better functional outcomes than patients treated with abdominal rectal resection and total mesorectal excision (TME); long-term survival rates are similar. To date, two different rigid platforms are available to perform a transanal endoscopic surgery procedure: the transanal endoscopic microsurgery (TEM) platform that was conceived by Buess and the more recent transanal endoscopic operation (TEO) platform.

Keywords: Rigid platform; transanal endoscopic microsurgery (TEM); transanal endoscopic operation (TEO); full-thickness excision; rectal cancer

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Introduction

Conventional transanal excision (TAE) with retractors has been widely considered a valid oncological option for the treatment of early rectal cancers until the 1990s, when the widespread diffusion of the total mesorectal excision (TME) (1) and the implementation of new endoscopic rigid platforms, such as transanal endoscopic microsurgery (TEM) and transanal endoscopic operation (TEO) have raised substantial questions about the radicality of TAE.

Designed by Buess in the early 1980s, TEM has progressively replaced TAE for the local excision of selected early rectal cancers, showing significantly better early short-term outcomes and better fecal and urogenital outcomes than abdominal rectal resection with TME (2); in addition, it became clear that the quality of the excision performed with TEM was significantly better than with TAE, with subsequent lower rates of local relapse and longer survival (3).

More recently, the rigid TEO platform has been conceived, reporting similar outcomes when compared to the original rigid TEM platform (4).

This paper aims at reviewing the outcomes of local excision with rigid platforms (TEM/TEO) for rectal cancer.

The platforms

There are two rigid platforms available on the market to perform transanal endoscopic surgery for cancers of the rectum: the TEM and the TEO platforms. Both let the surgeon excise tumors that are sited in the lower, mid and upper rectum, providing a significantly better visualization of the operative field than conventional TAE. Current indications to perform a transanal endoscopic procedure by using a rigid platform with a radical intent are similar to those using a soft platform: large rectal adenomas not suitable for endoscopic resection and rectal cancers staged as cT1N0 preoperatively. Preoperative work-up does not differ between patient candidate to TEM/TEO or

anterior resection: endoscopic ultrasound is obtained to evaluate the depth of rectal wall invasion, while a pelvic magnetic resonance imaging (MRI) is performed to rule out the presence of suspected enlarged lymph nodes in the mesorectum.

The TEM (Richard Wolf, Knittlingen, Germany) equipment was originally conceived by Gerhard Buess in the early 80s and comprises:

- An operating rigid rectoscope that is 4 cm in diameter and is available in three different lengths with correspondent obturators that allow insertion of the rectoscope through the anus.
- A working adapter and a working insert to connect the rectoscope to working instruments, camera and insufflator.
- A Martin arm to fix the rectoscope to the operating table.
- A light source and a stereoscopic angled telescope which allows dissection under microsurgical conditions with 3D visualization.
- The surgical tools include suction and irrigation tubes, curved and straight monopolar grasping forceps, suture clips forceps, electrocautery, needle holder.

The TEO Instrumentation (Karl Storz GmbH, Tuttlingen, Germany) is an alternative to the TEM platform that has gained wide acceptance worldwide. TEO instrumentation includes a proctoscope (7 or 15 cm in length, 4 cm in diameter), three operative channels (12, 5 and 5 mm in diameter) for dedicated or conventional laparoscopic tools, and a channel (5 mm in diameter) for a 30° 2D camera. The tip of the TEO rectoscope has a particular shape that let the surgeon manipulate rectal tissues and suture the rectal wall circumferentially. The images of the surgical field are displayed on a screen by using a standard laparoscopic unit.

Surgical technical points

Positioning of the patient on the operative table

All patients that are candidate to TEM or TEO start a low-fiber content diet the week before surgery, and receive a rectal enema 12 and 2 hours preoperatively.

The patient is lies on the operative table either in the prone or supine position, thus keeping the rectal tumor at the 6 o'clock position. Patients with rectal cancer arising from the lateral wall also lay in the supine position; they are placed prone only when the tumor is sited on the anterolateral rectal wall or close to the peritoneal reflection. In case of opening of the peritoneum, having the patient prone prevent the small bowel from entering the rectum and the air leak into the peritoneal cavity, thus facilitating the closure by suture of the peritoneal defect.

Both TEM and TEO procedures can be performed either under general or spinal anesthesia (SA) (5-7). A recent prospective observational including 50 patients treated with TEO platform for rectal tumors showed that TEO® under spinal anaesthesia is safe and feasible. No intraoperative complications occurred, and no procedure required conversion to general anesthesia (GA). Median operative time was 60 (range, 20–165) min. No patients required opioids postoperatively. No significant postoperative changes were observed in hemodynamic parameters (7). The same group published a few months ago the results of a retrospective study aiming at comparing spinal and GA (8). A total of 148 patients were included: 77 had GA and 71 SA. None patients receiving SA required GA. Length of hospital stay was shorter in the SA group (3 *vs.* 4 days, P=0.0201). Patients mobilization occurred earlier in the SA group, as well as resumption of oral intake (18 *vs.* 24 hours and 24 *vs.* 48 hours, respectively, P<0.0001). Operating room occupancy time was longer in the GA group (120 *vs.* 100 minutes, P=0.0008). There were no differences in postoperative complications, postoperative nausea, vomiting and pain between the two groups. Percentage of patients requiring postoperative rescue therapy with tramadol was similar between groups, but SA patients received a lower opioid dosage (176.6±67.8 *vs.* 238.3±79.5 mg, P=0.0011). Based on these findings, SA should be considered the treatment of choice, when not contraindicated, in patients undergoing TEM or TEO, since it leads to reduced perioperative opioid consumption and a faster postoperative recovery.

Step 1: dissection

After the rectoscope has been inserted into the rectum and the rectal cancer identified, the rectoscope is fixed to the operating table. Endorectal carbon dioxide (CO_2) pressure is kept stable at 8 mmHg.

- The tumor is marked circumferentially by using monopolar electrocautery, thus ensuring at least 5-mm clear circumferential margins.
- The dissection is started from the lower margin of the rectal cancer, and then is continued proximally

around and under the tumor until a circumferential dissection is achieved and the tumor en bloc excised. Tumor excision can be safely performed by using monopolar electrocautery. Ultrasonic shears or an electrothermal bipolar vessel sealing system might be useful in difficult cases to complete the dissection. Due to the limited accuracy of the preoperative staging tools, a full-thickness excision down to the perirectal fatty tissue should be routinely performed. Female and male patients who had previous prostatectomy who undergo a TEM/TEO procedure for an anteriorly located rectal tumor are at higher risk of developing a rectovaginal or rectovesical fistula.

- The specimen is then removed through the anus.
- Although TEM was initially developed for the excision of large adenomas or early cancers arising from the mid and lower rectum, the distance of rectal cancer from the anal verge does not represent a contraindication to a transanal endoscopic procedure. There are several data supporting the use of a rigid platform also for the treatment of selected intraperitoneal rectal cancers, with no increased short-term morbidity or mortality and no adverse oncologic outcomes even in case of inadvertent peritoneal opening (9-15). In our experience, the prone position of the patient on the operating table and the particular shape of the tip of the TEO proctoscope help suture the rectal wall on a 360° surface, thus minimizing the risk of conversion to open surgery or the need for a stoma.

Step 2: wall defect suturing

The optimal management of the rectal wall defect is controversial, with some studies suggesting the closure, others favouring leaving the defect open and others showing no differences. Menahem *et al.* (16) recently performed a meta-analysis of the literature including 4 studies. A total of 489 patients were considered: 317 had the defect closed and 182 had the defect left open). There were no differences in terms of overall morbidity (11% *vs.* 15.4%), postoperative local infection (3.1% *vs.* 4.9%), postoperative bleeding (5.6% *vs.* 7.7%) and reintervention (1.9% *vs.* 1.1%). Major limitations in the 4 studies included were different perioperative management protocols, different surgeon experience, different types of tools used for the tumor dissection and the distance of the rectal lesion from the anal verge.

Similar outcomes were observed by Lee *et al.* (17) in a multi-institutional matched analysis published in 2018, suggesting that the decision to close the rectal wall defect should represent a tailored approach. The authors analysed the data of adult patients undergoing local excision from 2004 to 2016 in three institutions in the United States, performing a propensity score matching in one-to-one fashion. The defect closure was performed at the surgeon's discretion. A total of 220 patients were included: 110 in both groups. There were no significant differences in terms of overall 30-day postoperative morbidity between patients with open or closed rectal wall defect after full-thickness or partial excision (15% *vs.* 12%, P=0.432 and 7% *vs.* 5%, P=0.552). The only complication that occurred more frequently in the group of patients with the rectal defect left open was bleeding: 9% *vs.* 3%, P=0.045). However, the closure of the defect was not independently associated with any postoperative complications.

We think that the opportunity to close the rectal wall defect is one of the points of strength of TEM/TEO platform compared to classical TAE and might lower the morbidity rates in those patients who further undergo abdominal rectal resection with TME after local excision. A prospective study has demonstrated that the rate of grade 3 complications according to the Clavien Dindo classification was significantly reduced when the rectal wall defect was sutured by TEM (18).

- The wall defect is first irrigated with iodopovidone solution to reduce septic complications and the risk of tumor cell implantation.
- The rectal wall defect is then closed by using a running suture that are secured by dedicated silver clips.

Post-operative complications

Postoperative complications occur in 2% to 15% of patients. Rectal bleeding and dehiscence of the rectal wall suture are the most common complications after a TEM/TEO procedure. Rectal bleeding tends to self-limit in the vast majority of patients. In case of persistent and copious bleeding blood transfusions and endoscopic clipping represent the optimal treatment modality. The breakdown of the rectal wall suture is more commonly experienced by patients treated with neoadjuvant (chemo) radiation therapy for preoperatively staged as T2N0 rectal cancer. Patients with suture dehiscence experience severe rectal pain, tenesmus and fever. An endoscopy or cross-

sectional imaging is usually performed to assess the entity of the dehiscence and the dimension of the perirectal fluid collection for possible drainage. The treatment is most often conservative, including intravenous antibiotic therapy and 10% iodine solution enemas, with a healing rate of about 90% (19). Further treatment tools such as the endoscopic vacuum system (Endosponge®, B Braun Medical BV, Melsungen AG, Tuttlingen, Germany) are rarely use. The need for a stoma creation to control sepsis is very uncommon.

TEM or TEO?

There is only one randomized controlled trial comparing TEM and TEO for rectal neoplasms. Serra-Aracil *et al.* (4) enrolled patients with a rectal adenoma or cancer preoperatively staged T1–2 N0, 2 to 6 cm in diameter, located in the mid and lower rectum (2–15 cm). A total of 34 patients were randomized: 17 patients in the TEM group and 17 in the TEO group. Time necessary to assemble the instrumentation, time necessary for excision and rectal wall suturing and total operative time were not significantly different. No conversion from one platform to the other or to abdominal surgery was necessary. Similar postoperative morbidity rates were observed: 21% after TEM and 18% after TEO (P=0.83). There was no mortality and median hospital stay was 3 days in both groups. Mean costs associated with TEO were significantly lower than those associated with TEM (€2,031±€440 *vs.* €2,603±€507, P=0.003).

Local excision for selected rectal cancers: the evidence

The current evidence from several studies comparing TEM and TAE for T1 N0 rectal cancers shows significantly higher and unacceptable local recurrence rates after TAE than TEM, secondary to higher rates of specimen fragmentation and positive resection margins (3,20,21). The evidence that TAE jeopardizes long-term oncologic outcomes in patients with early rectal cancer has led to a shift towards the use of rigid platforms during the last 15 years (22,23). Several studies have demonstrated that the transanal endoscopic surgery with rigid platforms does not compromise the survival in "low risk" T1 carcinoma according to Hermanek criteria (24-27), keeping in mind that submucosal tumor invasion is one of the strongest independent risk factors for long-term failure in T1 N0 patients (28,29).

The risk of lymph node metastases increases with rectal cancer stage, ranging from 0-3% in case of T1 sm1, 15% in T1 sm2–3 to 25% in T2 cancers (30,31). As a consequence, the risk of local and distant relapse is significantly higher in "high risk" T1 and T2 rectal cancer patients after local excision than after radical rectal resection with TME.

When final pathology of the TEM/TEO specimen reveal the presence of a high risk pT1 or a more invasive rectal cancer, a further rectal resection with TME achieves excellent oncologic outcomes (27,32), even though it is more technically difficult and the risk of a definitive stoma is higher (33).

A multimodal organ-preserving approach including neoadjuvant chemoradiation therapy followed by local excision by TEM has been proposed in selected patients with T1–2 N0 rectal cancer, thus aiming at reducing the risk of complications that burden radical abdominal rectal surgery, without jeopardizing the oncologic outcomes (26,34-37). Even though the preliminary oncologic results of this strategy seem promising, significant rectal wound-related morbidity (19,38,39) and poor functional outcomes (40,41) have been reported in patients undergoing neoadjuvant treatment followed by TEM. The high complication rates, ranging between 25% and 70%, are mainly related to the fact that the suture of the rectal wall involves irradiated tissue.

Conclusions

Transanal endoscopic surgery with rigid platforms is the modality of choice for local excision of selected rectal cancers; conventional TAE with retractors is indicated only in highly selected distal rectal tumors if the insertion of the platform is not feasible for technical reasons. The role of neoadjuvant treatment in association with TEM/TEO in highly selected patients with clinically staged T2 N0 rectal cancer is still under evaluation and should be proposed only within study protocols, until the results of large prospective randomized controlled trials will be published (42-44).

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Footnote

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