Transanal endoscopic microsurgery (TEM) was introduced in 1983 as an alternative to radical proctectomy for the management of rectal adenomas unsuitable for endoscopic or standard transanal resection. Since, its indications have progressively broadened to early rectal cancer. This review article will assess the role of TEM for T1 rectal cancer management, along with its operative and long-term results.

Key words: rectal cancer, transanal endoscopic microsurgery, local excision

INTRODUCTION

As highlighted in both French\(^1\) and American\(^2,3\) guidelines, proctectomy with total mesorectal excision (TME) is the gold standard for rectal cancer surgical management, as it offers optimal oncologic results. However, this radical procedure is impaired by significant drawbacks:

1) TME requires in the majority of the time a temporary diverting stoma, leading to a mandatory additional procedure for intestinal continuity restoration,

2) Although recent advances has broadened the choice of sphincter-saving procedures, TME for low rectal cancer still involves permanent colostomy in 10 to 30 percent of patients\(^4\),

3) TME accounts for a significant risk of postoperative short-term complications, leading to a postope-rative mortality rate ranging from 2 to 5\(^5,6\) and a postoperative morbidity rate ranging from 20 to 30\(^\%\)\(^5\), and

4) TME is associated with high risks of long-term troubles such as bowel dysfunction (30-60\% of the cases) or urogenital disorders (30\% of the cases)\(^7,8\).

On the other hand, transanal local surgery does not involve diverting stoma, has the advantage of sphincter-preservation even for very low rectal tumors, is associated with very good short-term results as reported postoperative mortality rate ranges from 0 to 1\% and postoperative morbidity rate is less than 10\%\(^9\), and accounts for a nearly nil long-term risk of bowel dysfunction or urogenital disorders.\(^9\). It can therefore be regarded as a seductive alternative to radical TME for rectal cancer management. However, as compared to TME, local surgery does not allow lymph node resection and staging. As such, it has been initially proposed only for benign rectal neoplasms\(^10\), but several authors have since reported satisfactory oncologic results for management of early stages of rectal cancer\(^1\) with a low risk of lymph node involvement.

Transanal endoscopic microsurgery (TEM) has been introduced by Gerard Buess in 1983\(^12,13\) as an alternative to the standard transanal technique. It has gained popularity because of the excellent rectal visualization it offers, allowing access to proximal rectal neoplasm and precise excision of specimens. TEM is nowadays considered as the gold standard of transanal techniques\(^14\).

In this review, we will assess the role of TEM for T1 rectal cancer management, along with its operative and long-term results.

PATIENTS SELECTION

Patient selection regarding TEM for rectal cancer management is mainly based on preoperative assessment of technical and oncological safety of transanal excision.

Technical feasibility is assessed by tumor’s distance from the anal verge and size. Although theoretical indications of TEM include tumor located anywhere in the rectum, tumors located very distally (< 1 cm from the anal verge) are technically difficult to handle with TEM, as the rectoscope should be inserted for few millimeters in the rectum to allow a satisfactory airtight insufflation (cf. surgical technique, below). On the same way, tumors located on the upper rectum are associated with a high risk of peritoneal perforation during the full-thickness resection. There is no maximal tumor size assessed as a contra-indi-
cation in the literature\textsuperscript{1}. However, in the majority of the studies, median tumor size was lower than 3 cm. Furthermore, large tumor (> 3 cm) might lead to technical difficulties in complete en-bloc resection and are associated with a higher risk of locoregional failure\textsuperscript{12}.

Oncological safety is mainly related to the fact that TEM does not allow lymph node resection or staging, and should therefore only be proposed to patients with a low lymph node involvement risk. This risk is closely related to the depth of rectal wall invasion (T stage): T1 rectal cancers are associated to lymph node invasion in 10-15\% of the cases, whereas this rate rises to 20-25\% in T2 tumors\textsuperscript{1,16-20}. These results led both French\textsuperscript{1} and American\textsuperscript{1} guidelines to state that only Tis and T1N0 rectal cancer should undergo transanal excision. Preoperative imaging, and most of all rectal echo-endoscopy (EE), is therefore a cornerstone of patient selection for transanal excision of rectal cancer. A meta-analysis published in 2004\textsuperscript{21}, highlighted that the performances of EE was higher than those of pelvic MRI for T staging of early rectal cancers (T1-T2).

In conclusion, before TEM, all patients should undergo careful clinical examination, including a digital rectal examination, and an EE\textsuperscript{1}.

**SURGICAL TECHNIQUE**

Several apparatus are available for TEM. The original device, as described by Gerard Bess (Richard Wolf GmbH, Knittlingen, Germany), is composed of a rigid rectoscope with optical stereoscope, allowing magnified three-dimensional vision. Several alternative devices are available such as devices from Olympus (Olympus Key-Med, Southend, UK) or Karl Storz (Tuttlingen, Germany). Recent publications have also reported encouraging results using Single Port Laparoscopic Surgery devices for TEM procedures\textsuperscript{22}. On the same way, specific curved surgical graspers are available but standard laparoscopic instruments may also be used, as we do in our routine practice.

Most of the authors proposed to choose patient position according to tumor location in the rectum, so that the lesion is situated at the bottom of the operation field\textsuperscript{13}. We routinely place the patient in lithotomy position as, with growing experience, tumor location does not jeopardize precise dissection and because this position facilitates subsequent laparoscopy in case of peritoneal perforation during the TEM\textsuperscript{23}.

After preoperative bowel preparation (sodium-phosphat enema), and antibiotic prophylaxis for Gram-negative and anaerobic strains given at the time of anesthesia induction, the surgical procedure is started with gentle digital dilatation of the anal sphincter. The rectoscope is then introduced and secured to the operating table. CO2 is insufflated into the rectum to enlarge the intrarectal space and facilitate dissection. This dissection has been originally described using monopolar cautery\textsuperscript{13} but some recent reports suggested that the use of a modern energy device, such as the harmonic scalpel (Ultracision Harmonic, Ethicon Endo-Surgery, Inc, Cincinnati, OH), might reduce the operative time\textsuperscript{24}.

Lesion excision must be performed according to a complete, en bloc, and full-thickness technique, down to the peri-rectal fat, with 10 mm margins\textsuperscript{12}. The specimen should be put in to a corkboard, throughout the normal mucosa margin, for complete pathological examination.

Several authors advocate closing the rectal wall defect after lesion excision\textsuperscript{13}. However, a randomized controlled trial published in 2002, comparing patients with closed defects to patients with unsutured ones, did not highlight any difference in postoperative complication rates\textsuperscript{25}.

In our Department in Beaujon Hospital, after more than 120 TEM performed for both benign and malignant rectal lesions, we selected only patient with T1 tumor on EE. Size of the tumor was not considered as a contraindication and we frequently treat tumor with size greater than 4 or 5 cm, and even sometimes tumor involving more than half of the rectal circumference. Similarly, regarding the location of the lesion, we only contraindicate tumor located higher than 10 cm from the dentate line anteriorly and 15 cm posteriorly. If we have doubt about the location of a "high" rectal tumor, we performed a MRI, which precisely assess if the tumor is not too high (i.e. within the high rectum). Finally, concerning the technic itself, we routinely used harmonic scalpel and we never closed the defect after rectal excision (because of the risk of stenosis after closure of large defect). If duration procedure we make a peritoneal perforation, we close it through abdominal laparoscopy, without any temporary stoma, after checking by transanal instillation of air and liquid that there is no leak whitin the abdomen.

**OPERATIVE RESULTS**

Allaix et al. reported the results of 300 consecutive TEM for rectal neoplasms\textsuperscript{26}. There was no postoperative mortality and the postoperative 30-day morbidity rate was 7.7\%. The most frequent postoperative complication was rectal bleeding, which was always treated with a conservative treatment (blood transfusion, endoscopic hemostasis, or rectal packing). Furthermore, the same authors suggested in another study, focusing on long-term functional outcomes, that TEM had no impact on anorectal function or quality of life\textsuperscript{27}. In this latter study, a tumor size of 4 cm or more was the only factor that significantly impaired the long-term functional outcomes\textsuperscript{27}.

A meta-analysis comparing short and long-term outcomes of TEM for early rectal cancer management, as compared to the standard transanal technique, was published in 2011\textsuperscript{28}. The authors identified 11 studies, including a total of 514 patients managed with TEM and 386 patients managed with the standard transanal technique. There was no difference in terms of postoperative complications rate between the 2 techniques. However, the TEM technique was associated with a lower rate of positive resection margins (Odds-Ratio: 0.32) and consequently a better disease-free survival (Odds-Ratio: 2.16), highlighting the superiority of the TEM over the standard technique.
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ONCOLOGIC RESULTS AND MANAGEMENT STRATEGY

After TEM excision, full pathologic examination of the specimen is mandatory in order to assess predictive factors of local recurrence (LR) and define postoperative strategy.

As discussed before, the risk of lymph node involvement is closely related to the depth of tumoral invasion in the rectal wall. Consequently, T stage is the main LR risk factor after transanal excision for rectal cancer, as LR is observed in 15% of the patients with T1 tumors and in 25% of the patients with T2 tumors. As the Dutch trial showed, LR is observed in less than 5% of the T1-T2 patients after radical TME without neoadjuvant treatment. Comparison of these rates highlight that TEM is not oncologically satisfactory for T2 rectal cancer but also raise questions about oncological safety of this strategy for T1 tumors. As discussed before, this risk of LR is closely related to the risk of lymph node invasion. Nascimento et al. and Kokudo et al. have shown the heterogeneity of the T1 rectal cancer population in terms of lymph node invasion risk. Dividing the rectal sub-mucosa in three layers, this risk raised from 0-3% in T1sm1 tumors (invasion limited to the upper-third sub-mucosa) to 8-15% in T1sm2 tumors and 23-25% in T1sm3 tumors (invasion reaching the lower-third of the sub-mucosa). Consequently, T1sm1 tumors are the only oncologically satisfactory indications of curative transanal excision for rectal cancer. T1sm3 tumors are considered as a clear contra-indication whereas T1sm2 tumors are considered as a non-validated indication that should only be discussed for patients unfit for proctectomy with TME, mainly because of associated comorbidities.

In addition to the "sm stage", several risk factors of LR after TEM have been assessed. These factors include perineural or lymphovascular invasion, poor grade of differentiation, and microscopic resection margins of less than 1 mm. Peng et al. suggested in 2011 that for low-risk patients, whose tumors did not present any of these poor prognosis risk factors, TEM was associated with a 5-year LR rate of 1.2% that compares favorably to the results obtained after radical TME (less than 5%). These low-risk patients represent the ideal indication for TEM.

On the other hand, Peng et al. reported that, in patients presenting at least 1 of the poor prognosis risk factors, 5-year LR rate was 21.2%, highlighting that TEM was not oncologically satisfactory. French guidelines state that these patients should undergo a salvage proctectomy with TME as soon as possible. Comparing patients with radical TME following a transanal excision to patients with radical TME following a TEM, Hahmloser et al. reported similar LR rate and disease free survival in both groups, suggesting that this salvage strategy did not jeopardize oncologic outcomes. However, a recent French study highlighted an increased postoperative morbidity rate after radical TME following a TEM, as compared to TME without prior surgery.

CONCLUSION

Proctectomy with total mesorectal excision remains the gold standard for rectal cancer management. However, in highly selected patients (T1sm1, no perineural or lymphovascular invasion, well differentiated, and cleared microscopic resection margins) TEM appears to be an effective alternative to radical surgery as it is associated with a lower postoperative morbidity, improved functional outcomes, and similar oncologic results. Furthermore, TEM should be preferred to the standard transanal technique as it allows a higher rate of negative resections margins, leading to an improved disease-free survival. Patients with at least one poor prognosis risk factor on the final specimen pathologic examination should undergo an immediate salvage proctectomy with TME.

SUMMARY

Transanal endoscopic microsurgery (TEM) is used in 1983 as an alternative to radical surgery in the management of T1 rectal tumors. The NCCN guidelines state that TEM is associated with a low LR rate and should be preferred to the standard transanal technique as it allows a higher rate of negative resections margins, leading to an improved disease-free survival. Patients with at least one poor prognosis risk factor on the final specimen pathologic examination should undergo an immediate salvage proctectomy with TME.

REFERENCES


