

Review

Open Access



# Transanal minimally invasive surgery: how can it help us?

Ratha Krishnan Sriram, William Tzu-Liang Chen

Department of Colorectal Surgery, China Medical University Hsinchu Hospital, Zhubei City, Hsinchu County 30272, Taiwan.

**Correspondence to:** Prof. William Tzu-Liang Chen, Department of Colorectal Surgery, China Medical University Hsinchu Hospital, No 199, Sec 1, Xinglong Road, Zhubei City, Hsinchu County 30272, Taiwan. E-mail: golfoma22@gmail.com

**How to cite this article:** Sriram RK, Chen WTL. Transanal minimally invasive surgery: how can it help us? *Mini-invasive Surg* 2020;4:19. <http://dx.doi.org/10.20517/2574-1225.2019.40>

**Received:** 9 Oct 2019 **First Decision:** 16 Dec 2019 **Revised:** 31 Dec 2019 **Accepted:** 16 Jan 2020 **Published:** 13 Mar 2020

**Science Editor:** Giulio Belli **Copy Editor:** Jing-Wen Zhang **Production Editor:** Tian Zhang

## Abstract

Transanal surgery has evolved significantly in the past few decades. With the technological advancements of endoscopic systems, minimally invasive approaches in transanal surgeries are quickly increasing in popularity. Transanal endoscopic microsurgery was developed initially with subsequent transanal minimally invasive surgery (TAMIS) being introduced as an alternative in 2009. Over the past decade, more and more papers have been published on TAMIS, regarding the management of benign/malignant rectal lesions as well as repair of anastomotic leaks, anastomotic strictures, rectovaginal/rectourethral fistula, *etc.* This review details the progress of transanal surgery and the use of TAMIS in different scenarios.

**Keywords:** Transanal minimally invasive surgery, transanal surgery

## INTRODUCTION

Previously, rectal lesions, both benign and malignancies, were initially managed with local transanal excision (TAE) with the assistance of anal retractors (Park's transanal technique). This approach has its limitations, such as poor visibility, fragmented specimens, and difficulties in accessing proximal two-thirds lesions<sup>[1]</sup>. Subsequently, transanal endoscopic microsurgery (TEM) was introduced to overcome the drawbacks of TAE. TEM has shown to be superior to TAE, resulting in less fragmentation and better quality of excision. TEM also shows lower incidences of local recurrence in well-selected T1 rectal cancer<sup>[2,3]</sup>. However, this technique was not well adopted due to its high cost and steep learning curve.

Transanal minimally invasive surgery (TAMIS) was introduced in 2009 and in the span of a few years gained multiple international experiences. TAMIS is defined as the use of any multichannel port



© The Author(s) 2020. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License (<https://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, sharing, adaptation, distribution and reproduction in any medium or format, for any purpose, even commercially, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.



transanally together with standard laparoscopic camera and a standard CO<sub>2</sub> insufflator. This approach has now been well accepted as it does not incur additional costs and has a lower learning curve. Besides aiding in excision of rectal lesions, this method has been adopted for a variety of other procedures such as transanal total mesorectal excision (TME), repair of rectovaginal/rectourethral fistulas, repair of anastomotic complication after low anterior resection, *etc.* This review details the progress of transanal surgery and the use of TAMIS in different scenarios.

## TAMIS FOR LOCAL EXCISION OF RECTAL LESIONS

Since Park technique was first described in 1968, approaches for local excision of rectal tumors have undergone many changes. TAE evolved to TEM, which was first described by Buess *et al.*<sup>[4]</sup>. However, this approach was not popularized due to the cost and the steep learning curve. With the advancement in natural orifice transluminal endoscopic surgery, TAMIS was introduced in 2009<sup>[5]</sup>. Now, TAMIS is a reasonably good platform for the local excision of multiple rectal neoplasms, such as benign adenomas, lesions with high grade dysplasia, neuroendocrine tumors, and well-selected malignant rectal lesions.

## INDICATION

The indications for TAMIS do not differ from those of TAE or TEM for both benign and malignant lesions that have been assessed preoperatively with endoscopy and complimented by endoanal/endorectal ultrasonography and/or magnetic resonance imaging<sup>[6-8]</sup>. For benign lesions, it could be large adenoma, high grade dysplasia, or incompletely excised lesion through colonoscopy. For malignant lesions, early rectal cancers that are confined to the submucosal layer (T1 lesions) are best suited for TAMIS.

T1 adenocarcinoma of the rectum can be categorized into low-risk lesions and high-risk lesions based on the risk of recurrence/metastasis. This can be further categorized into low-risk T1 adenocarcinomas of the rectum, which are described as small lesions less than 4 cm in diameter; Haggitts 1-3 lesions; Kikuchi sm1 lesions; and well-differentiated cancer with no lymphatic, vascular, or perineural invasion<sup>[6]</sup>. High-risk lesions are Haggitts 4; Kikuchi sm2/sm3, poorly differentiated tumors; signet cell lesions; presence of tumor budding; lymphovascular involvement; absence of lymphoid infiltration; and young patients (< 45 years old). This is due to T1 lesions having risk of LN metastasis of up to 10%-15%. However, with sub analysis, sm1 lesions only carry 1%-3% risk of lymph node (LN) metastasis while the risk increases to 8% for sm2 lesions and 23% for sm3 lesions. Similarly, Haggitts 1-3 lesions have less than 1% risk of lymph node metastasis, while, for Haggitts 4 lesions, the risk is about 12%-15%. Hence, high-risk lesions should ideally be treated as T2 lesions<sup>[7,8]</sup> and they should be discussed in multi-disciplinary team meetings for a holistic approach of management.

It is sometimes difficult to distinguish T1 or T2 lesions preoperatively, and, for these, TAMIS could be a platform for the resection of these lesions and guide the further management based on the final pathology report. Hence, it is wise to counsel these patients on the possibility of formal radical resection if the pathology report is unfavorable, high-risk T1 or T2 lesions. TAMIS resection could also be an option for palliation for T3 tumors when patients are unfit to undergo a radical resection.

## SAFETY AND FEASIBILITY

Multiple studies have been published on the safety and feasibility of TAMIS<sup>[5,9-17]</sup>, with Albert and Atallah publishing one of the biggest series. They reported an overall loco-regional recurrence rate of 4.3%, with positive margins of 6% in their 20-month follow up study<sup>[16]</sup>, whereas Keller and Haas reported 6.6% of their patients with positive margin and only one patient had local recurrence at median follow up of 39.5 months<sup>[13]</sup>.

Penetration into the peritoneal cavity is unavoidable during local excision of malignant lesions that are located at the anterior wall of the upper rectum (above the peritoneal resection). Chen *et al.*<sup>[18]</sup> reported

about 16% of peritoneal entry for lesions at the upper rectum. During local excision of malignant lesions, it is necessary to excise the lesion in full thickness as there is a possibility of an invasive component<sup>[19]</sup>. Not surprisingly, partial excision will lead to significant positive margins, which translates to loco regional recurrence<sup>[20]</sup>. Dufresme *et al.*<sup>[21]</sup> described the usage of a laparoscopic stapler for excision of high rectal sessile polyps as an approach to prevent peritoneal breach. However, the evidence supporting this approach is only backed by a short series of five cases.

### LEARNING CURVE FOR TAMIS

Assessing the surgical technique competency in TAMIS, Maya *et al.*<sup>[22]</sup> reported that four cases are adequate. Chen *et al.*<sup>[18]</sup>, however, mentioned that at least 10 cases are necessary to obtain proficient skills. Clermonts *et al.*<sup>[23]</sup> stated that a standardized institutional protocol with proficient proctorship could lead to a shorter learning curve with only 6-10 cases, but ideally 18-31 cases, being required.

### WHICH IS BETTER?

TEM and TAMIS have been compared in multiple papers. Lee *et al.*<sup>[24]</sup> reported that there are no statistical differences in the quality of obtained specimens, peritoneal entry, postoperative complications, five-year disease free survival, and incidence of local recurrence for those who did not undergo salvage surgery. After analyzing 428 patients (247 with TEM and 181 with TAMIS), it was concluded that the cost, availability, and surgeon's preference should determine the choice of the platform.

### TAMIS FOR PROCTECTOMY AND TRANSANAL TME

Standardization of TME as well as the selective use of chemoradiotherapy has brought significant improvement in the management of rectal cancer<sup>[25]</sup>. Local recurrence rates have dropped to < 6% when TME is performed with negative circumferential resection margin and distal resection margin, together with neoadjuvant radiotherapy. The local recurrence was as high as 45% without TME and dropped to 10% with TME alone<sup>[26,27]</sup>.

The first laparoscopic-assisted TME was performed on a 76-year-old woman with rectal cancer in 2009. Since then, multiple articles have been published on TME. The concept of TME came into existence due to the ease in reaching the distal rectum, which would otherwise be technically challenging with the conventional transabdominal TME approach, especially for patients with high body mass index, narrow male pelvis, or bulky low rectal tumors. Indirectly, this leads to a lower conversion rate and better pathological outcomes (distal margin) compared to the transabdominal approach<sup>[28]</sup>. A meta-analysis by Jiang *et al.*<sup>[29]</sup> demonstrated that TME leads to longer circumferential and distal resection margins. This approach also reduces the risk of positive circumferential margin.

However, a Norwegian team reported an unexpectedly high local recurrence after TME (9.5%)<sup>[30]</sup> but data from two of The Netherlands' high-volume hospitals reported otherwise. Their data show local recurrence of only 3.8% over a mean follow up of 54.8 months<sup>[31]</sup>. The currently undergoing GRECCAR 11 and COLOR III randomized control trials will be able to elucidate the long-term oncological outcomes of low and mid rectal cancer with the transanal approach<sup>[32]</sup>.

### TAMIS FOR LATERAL PELVIC NODE DISSECTION AND PELVIC EXENTERATION

Lateral pelvic lymph node (LPLN) metastases in patients with colorectal cancers are usually seen in advanced cases. Some studies have shown neo-adjuvant chemoradiotherapy to be inadequate and a surgical approach remains an option to be considered<sup>[33,34]</sup>. Laparoscopic LPLN dissection is technically challenging, especially in obese patients with narrow pelvis. It is difficult to access those lymph nodes at the inferior margins of the lateral pelvis via laparoscopic approach. Aiba *et al.*<sup>[35]</sup> and Zeng *et al.*<sup>[36]</sup> demonstrated

that transanal LPLN dissection is feasible, safe, and promising in well-selected patients. Hayashi *et al.*<sup>[37]</sup> published that pelvic exenteration is also possible with the TAMIS platform.

### **TAMIS FOR EXCISION PERIRECTAL LESIONS**

Excision of perirectal/pararectal lesion can be difficult even with open techniques due to the narrow space and low accessibility. The lesion frequently needs to be excised together with the rectum. TAMIS can be used to excise pararectal/perirectal lesions without the need for proctectomy or abdominal perineal resection. McCarroll and Moore<sup>[38]</sup> reported their success in excising a retro rectal cyst (tailgut cyst) in a 23-year-old patient. Furthermore, TAMIS has also been used for the excision of rectal GIST<sup>[39,40]</sup>.

### **TAMIS FOR COMPLICATION OF LOW RECTAL ANASTOMOSIS**

Anastomotic leak after a low anterior resection can be devastating. These patients often require repeat surgery and it is usually laparotomy. However, with high degree of suspicion and early intervention, these complications could be handled with minimally invasive approaches as well. Chen *et al.*<sup>[41]</sup> reported on methods to manage anastomotic leaks post anterior resections using laparoscopic lavage and transanal endoluminal repair on transanal endoscopic operation platform. Patients, in whom the anastomotic leak was detected early (within five days), did not require conversion to laparotomy and were able to be discharged promptly. Olavarria *et al.*<sup>[42]</sup> reported a case managing presacral abscess post anastomotic leak through three sessions of septotomies and debridement through TAMIS before successfully reversing the ileostomy. In a completely occluded anastomosis after a low anterior resection, Bong and Lim<sup>[43]</sup> managed to excise the fibrotic tissue at the stenotic site and regain the continuity of the canal.

### **CONCLUSION**

TAMIS is an evolving surgical approach and should remain an option to be considered in the management of patients. With an increasing number of surgeons becoming familiar with TAMIS procedures, the indication for this approach expands. However, a structured training program including proctoring to ensure safe implementation of the procedure is necessary for beginners to obtain the necessary skills to prevent unnecessary complications, as this is still a relatively new approach.

### **DECLARATIONS**

#### **Authors' contributions**

Contributed in the literature search and write up: Sriram RK

Contributed in literature search, corrections and proof reading: Chen WTL

#### **Availability of data and materials**

Not applicable.

#### **Financial support and sponsorship**

None.

#### **Conflicts of interest**

All authors declared that there are no conflicts of interest.

#### **Ethical approval and consent to participate**

Not applicable.

#### **Consent for publication**

Not applicable.

## Copyright

© The Author(s) 2020.

## REFERENCES

1. Martin-Perex B, Andrade-Ribeiro GD, Hunter L, Atallah S. A systemic review of transanal minimally invasive surgery (TAMIS) from 2010 to 2013. *Tech Coloproctol* 2014;18:775-88.
2. Moore JS, Cataldo PA, Osler T, Hyman NH. Transanal endoscopic microsurgery is more effective than traditional transanal excision for resection of rectal masses. *Dis Colon Rectum* 2008;51:1026-30.
3. Endreseth BH, Myrvold HE, Romundstad P, Hestvik UE, Bjerkeset T, et al; Norwegian Rectal Cancer Group. Transanal excision vs. major surgery for T1 rectal cancer. *Dis Colon Rectum* 2005;48:1380-8.
4. Buess G, Hutterer F, Theiss J, Bobel M, Isselhard W, et al. A system for a transanal endoscopic rectum operation. *Chirurg* 1984;55:677-80.
5. Atallah S, Albert M, Larach S. Transanal minimally invasive surgery: a giant leap forward. *Surg Endosc* 2010;24:2200-05.
6. Heidary B, Phang TP, Raval MJ, Brown CJ. Transanal endoscopic microsurgery: a review. *Can J Surg* 2014;57:127-38.
7. Kikuchi R, Takano M, Takagi K, Fujimoto N, Nozaki R, et al. Management of early invasive colorectal cancer. Risk of recurrence and clinical guidelines. *Dis Colon Rectum* 1995;38:1286-95.
8. Choi PW, Yu CS, Jang SJ, Jung SH, Kim HC, et al. Risk factors for lymph node metastasis in submucosal invasive colorectal cancer. *World J Surg* 2008;32:2089-94.
9. Lee L, Kelly J, Nassif GJ, Keller D, Debeche-Adams TC, et al. Establishing the learning curve of transanal minimally invasive surgery for local excision of rectal neoplasms. *Surg Endosc* 2018;32:1368-76.
10. Clermonts S, van Loon YT, Wasowicz DK, Langenhoop BS, Zimmermann DDE. Comparative quality of life in patients following transanal minimally invasive surgery and healthy control subjects. *J Gastrointest Surg* 2018;22:1089-97.
11. Lee L, Burke JP, deBeche-Adams T, Nassif G, Martin-Perez B, et al. Transanal minimally invasive surgery for local excision of benign and malignant rectal neoplasia: outcomes from 200 consecutive cases with midterm follow up. *Ann Surg* 2017;267:910-6.
12. Garcia-Florez LJ, Otero-Diez JL, Encinas-Muniz AI, SanchezDominguez L. Indications and outcomes from 32 consecutive patients for the treatment of rectal lesions by transanal minimally invasive surgery. *Surg Innov* 2017;24:336-42.
13. Keller DS, Tahliramani RN, Flores-Gonzalez JR, Mahmood A, Haas EM. Transanal minimally invasive surgery: review of indications and outcomes from 75 consecutive patients. *J Am Coll Surg* 2016;222:814-22.
14. Maglio R, Muzi GM, Massimo MM, Masoni L. Transanal minimally invasive surgery (TAMIS): new treatment for early rectal cancer and large rectal polyps-experience of an Italian center. *Am Surg* 2015;81:273-7.
15. Karakayali FY, Tezcaner T, Moray G. Anorectal function and outcomes after transanal minimally invasive surgery for rectal tumors. *J Minim Access Surg* 2015;11:257-62.
16. Albert MR, Atallah SB, deBeche-Adams TC, Izfar S, Larach SW. Transanal minimally invasive surgery (TAMIS) for local excision of benign neoplasms and early-stage rectal cancer: efficacy and outcomes in the first 50 patients. *Dis Colon Rectum* 2013;56:301-7.
17. Lim SB, Seo SI, Lee JL, Kwak JY, Jang TY, et al. Feasibility of transanal minimally invasive surgery for mid-rectal lesions. *Surg Endosc* 2012;26:3127-32.
18. Chen N, Peng YF, Yao YF, Jin Gu. Transanal minimally invasive surgery for rectal neoplasia: experience from single tertiary institution in China. *World J Gastrointest Oncol* 2018;10:137-44.
19. Ramirez JM, Aguilera V, Gracia JA, Ortego J, Escudero P, et al. Local full-thickness excision as first line treatment for sessile rectal adenomas: long-term results. *Ann Surg* 2009;249:225-8.
20. Bach SP, Hill J, Monson JR, Simson JN, Lane L, et al; Association of Coloproctology of Great Britain and Ireland Transanal Endoscopic Microsurgery (TEM) Collaboration. A predictive model for local recurrence after transanal endoscopic microsurgery for rectal cancer. *Br J Surg* 2009;96:280-90.
21. Dufresme AM, Withers R, Ramkumar J, Mackenzie S, Melich G, et al. Trans-anal minimally invasive surgery: a new technique to avoid peritoneal entry. *Int J Surg Case Rep* 2018;52:11-5.
22. Maya A, Vorenberg A, Oviedo M, da Silva G, Wexner SD, et al. Learning curve for transanal endoscopic microsurgery: a single center experience. *Surg Endosc* 2014;28:1407-12.
23. Clermonts SHEM, van Loon YT, Stijns J, Pottel H, Wasowicz DK, et al. The effect of proctoring on the learning curve of transanal minimally invasive surgery for local excision of rectal neoplasms. *Tech Coloproctol* 2018;22:965-75.
24. Lee L, Edwards K, Hunter IA, Hartley JE, Atallah SB, et al. Quality of local excision for rectal neoplasms using transanal endoscopic microsurgery versus transanal minimally invasive surgery: a multi-institutional matched analysis. *Dis Colon Rectum* 2017;60:928-93.
25. Coco C, Valentini V, Manno A, Rizzo G, Gambacorta MA, et al. Functional results after radiochemotherapy and total mesorectal excision for rectal cancer. *Int J Colorectal Dis* 2007;22:903-10.
26. Peeters KCMJ, Marijnen CAM, Nagtegaal ID, Kranenbarg EK, Putter H, et al. The TME trial after a median follow-up of 6 years: increased local control but no survival benefit in irradiated patients with resectable rectal carcinoma. *Ann Surg* 2007;246:693-701.
27. Rickles AS, Dietz DW, Chang GJ, Wexner SD, Berho ME, et al. High rate of positive circumferential resection margins following rectal cancer surgery: a call to action. *Ann Surg* 2015;262:891-8.
28. Kneist W, Aigner F. Total mesorectal excision via transanal minimally invasive surgery. An alternative technique. *Coloproctology* 2015;37:253-61.
29. Jiang HP, Li YS, Wang B, Wang C, Liu F, et al. Pathological outcomes of transanal versus laparoscopic total mesorectal excision for rectal cancer: a systematic review with meta-analysis. *Surg Endosc* 2018;32:2632-42.
30. Larsen SG, Pfeffer F, Kørner H. Norwegian moratorium on transanal total mesorectal excision. *Br J Surg* 2019;106:1120-1.
31. Hol JC, van Oostendorp SE, Tuynman JB, Sietses C. Long-term oncological results after transanal total mesorectal excision for rectal

- carcinoma. *Tech Coloproctol* 2019;23:903-11.
32. Aubert M, Mege D, Panis Y. Total mesorectal excision for low and middle rectal cancer: laparoscopic versus transanal approach-a meta-analysis. *Surg Endosc* 2019;33:1-12.
  33. Kusters M, Uehara K, Velde CJHV, Moriya Y. Is there any reason to still consider lateral lymph node dissection in rectal cancer? Rationale and technique. *Clin Colon Rectal Surg* 2017;30:346-56.
  34. Akiyoshi T, Ueno M, Matsueda K, Konishi T, Fujimoto Y, et al. Selective lateral pelvic lymph node dissection in patients with advanced low rectal cancer treated with preoperative chemoradiotherapy based on pretreatment imaging. *Ann Surg Oncol* 2014;21:189-96.
  35. Aiba T, Uehara K, Mukai T, Hattori N, Nakayama G, et al. Transanal extended rectal surgery with lateral pelvic lymph node dissection. *Tech Coloproctol* 2018;22:893-4.
  36. Zeng ZW, Zhang XW, Chen JJ, Huang L, Luo SL, et al. Transanal lateral lymph node dissection surgery for 5 cases of mid-low rectal cancer. *Zhonghua Wei Chang Wai Ke Za Zhi* 2019;22:781-5. (in Chinese)
  37. Hayashi K, Kotake M, Kakiuchi D, Yamada S, Hada M, et al. Laparoscopic total pelvic exenteration using transanal minimal invasive surgery technique with en bloc bilateral lymph node dissection for advanced rectal cancer. *Surg Case Rep* 2016;2:74.
  38. McCarroll RH, Moore LJ. Transanal minimally invasive surgery for resection of retrorectal cyst. *J Surg Case Rep* 2018;2018:rjy021.
  39. Aghayeva A, Bayraktar O, Atasoy D, Ozben V, Baca B. Excision of a rectal gastrointestinal stromal tumor using the transanal minimal invasive surgery technique. *Dis Colon Rectum* 2015;58:1108.
  40. Pintor-Tortolero J, Garcia JC, Cantero R. Transanal minimally invasive surgery approach for rectal GIST. *Tech Coloproctol* 2016;20:321-22.
  41. Chen WT, Bansal S, Ke TW, Chang SC, Huang YC, et al. Combined repeat laparoscopy and transanal endolumenal repair (hybrid approach) in the early management of postoperative colorectal anastomotic leaks: technique and outcomes. *Surg Endosc* 2018;32:4472-80.
  42. Olavarria OA, Kress RL, Shah SK, Agarwal AK. Novel technique for anastomotic salvage using transanal minimally invasive surgery: a case report. *World J Gastrointest Surg* 2019;11:271-8.
  43. Bong JW, Lim SB. Transanal minimally invasive surgery as a treatment option for a completely occluded anastomosis after low anterior resection: A new approach to severe anastomotic stenosis. *Asian J Endosc Surg* 2018;12:175-7.