DOI: 10.4274/tjcd.galenos.2025.2025-4-3
Turk J Colorectal Dis 2025;35(2):33-40

INVITED REVIEW

TAMIS: New Horizons in Modern Colorectal Surgery

Nurhilal Kızıltoprak[1], Jack Aaron[2], Camila Diez[3], Sam Atallah[4]

[1]Sultan Abdulhamid Han Training and Research Hospital Hospital, Clinic of General Surgery, İstanbul, Türkiye
[2]Trinity Preparatory School, Florida, United States of America
[3]NOVA Southeastern University, Florida, United States of America
[4]Piedmont Hospital, Clinic of Colon and Rectal Surgery, Georgia, United States of America

ABSTRACT

Transanal minimally invasive surgery (TAMIS) has emerged as a major advancement in the management of rectal neoplasms. Building upon the principles of transanal endoscopic microsurgery (TEM), TAMIS provides a cost-effective and more accessible alternative that integrates standard laparoscopic instruments. To present a comprehensive review of the development, indications, technique, and clinical outcomes associated with TAMIS and to evaluate its current role and future potential in modern colorectal surgery. This narrative review was conducted through a comprehensive analysis of the literature on TAMIS, TEM, and transanal endoscopic surgery, focusing on the evolution of the technique, patient selection, operative strategy, oncological safety, and recent technological advancements such as robotic platforms. TAMIS is effective in the excision of benign rectal neoplasms and carefully selected early-stage rectal cancers, offering high R0 resection rates and low recurrence. It is less invasive than conventional surgery, preserves rectal function, and is associated with reduced morbidity. Although it requires a moderate learning curve, its technical feasibility and low setup cost have contributed to its widespread adoption. Comparative studies support its oncological adequacy, particularly in selected T1 cancers and ypT0 tumors following neoadjuvant therapy. TAMIS represents a transformative innovation in colorectal surgery. As technology and surgical expertise continue to evolve, TAMIS is expected to become integrated into standard oncological practice, expanding its indications and improving functional outcomes. Continued research and long-term follow-up are necessary to further define its role in the treatment of rectal cancer.

Keywords: Transanal minimally invasive surgery, transanal endoscopic microsurgery, rectal cancer, transanal surgery, local excision, minimally invasive surgery, colorectal surgery

Introduction

The first record of transanal excision of rectal tumors was reported by Dr. Jacques Lisfranc in the early 1800s.[1] In this report, a prolapsed and painful large rectal tumor was removed by amputating the tumor, including the anus. Anesthesia was not mentioned, and closure of the defect was not considered, rendering the patient with a perineal colostomy. Hemostasis was achieved with intrarectal packing at the end of the procedure.

In the 1960s, Sir Alan Parks popularized the modern transanal excision method. In this technique, steps such as anesthesia, use of metal ratcheting rectal retractors, epinephrine injection, creation of a submucosal resection plane, and primary closure of the defect with permanent sutures were defined.[2]

In the early 1980s, Professor Gerhard Buess developed a new technique and corresponding instrumentation for the removal of rectal tumors to address the limited field of view and access difficulties of conventional transanal excision. This innovation marked the beginning of transanal endoscopic surgery (TES).[3] The method and devices developed by Buess were named transanal endoscopic microsurgery (TEM) and include a cylindrical, reusable surgical rectoscope measuring 4 × 12 (or 20) cm, which is fixed to the operating table. TEM relies on insufflation of the rectum to expand and expose the surgical

Address for Correspondence: Nurhilal Kızıltoprak MD, Sultan Abdulhamid Han Research and Training Hospital, Clinic of General Surgery, İstanbul, Türkiye
E-mail: drnurhilalkiziltoprak@gmail.com **ORCID ID:** orcid.org/0000-0003-4241-5872
Received: 16.04.2025 **Accepted:** 23.05.2025 **Publication Date:** 27.06.2025

Cite this article as: Kızıltoprak N, Aaron J, Diez C, Atallah S. TAMIS: new horizons in modern colorectal surgery. Turk J Colorectal Dis. 2025;35(2):33-40

field and is similar in principle to single-port laparoscopic access channels (which did not evolve until decades later).

The impetus behind TEM at the time of its inception was to provide higher reach so that benign (only) rectal polyps and lesions could be removed transanally. Interestingly, Buess did not see it as a tool to remove cancers and did not know at the time that data would later reveal that TEM provided a better quality of local excision.

Compared with conventional transanal excision (Parks' transanal excision), TEM has been associated with better quality resection, a lower local recurrence rate, and better survival, especially in cases of histologically appropriate stage I (T1) rectal cancer.[4-8] In long-term follow-up studies, TEM excision of rectal tumors has been shown to have similar morbidity and mortality rates to conventional transanal excision.[9-13] Despite proven superior excision quality, TEM never became widely adopted. The main reasons for this are the difficulty of the learning process and the high cost of its specialized instruments.[14]

To overcome these limitations, in 2010, Atallah et al.[15] proposed the use of standard laparoscopic instruments and a single-port laparoscopic platform (recently introduced at the time) to perform transanal surgery. This technique was named transanal minimally invasive surgery (TAMIS). Subsequently, others validated the technique by reporting successful results with TAMIS.[16] Following these developments, many researchers have incorporated TAMIS into clinical practice and started to publish their data. Furthermore, TAMIS is likely a more economical alternative to TEM and is definitely more widespread in its use globally.[17-24] TEM and TAMIS show considerable differences in terms of cost, learning process, and technical applicability. The fact that TAMIS does not require costly specialized instrumentation, as in TEM, has enabled it to be performed by most colorectal specialists and minimally ınvasive surgery-trained surgeons. Due to the similarity in clinical outcomes, TEM, transanal endoscopic operation (TEO), and TAMIS are nowadays classified under the name TES, which is a general term covering all surgical methods that perform transanal excision using a minimally invasive approach.

TAMIS is a modification of TEM. Whereas TEM uses a reusable 4 cm diameter rigid surgical proctoscope, TAMIS replaces it with flexible and disposable single-port laparoscopic platforms. Vessel-sealing devices, laparoscopic aspiration, and standard laparoscopic imaging systems are also used. The evolution of TAMIS, including its historical milestones and future projections, is illustrated in Figure 1.

Indications and Contraindications

The indications for TAMIS are similar to those for TEM (and for all TES).[25] This method is especially preferred for the excision of benign rectal neoplasms and curative surgeries. It is also a suitable option for carefully selected T1-stage rectal cancer cases with a low risk of nodal metastasis and histologically favorable features.[26]

TAMIS can be used not only in early-stage cancers but, under special circumstances, also in locally advanced rectal cancers

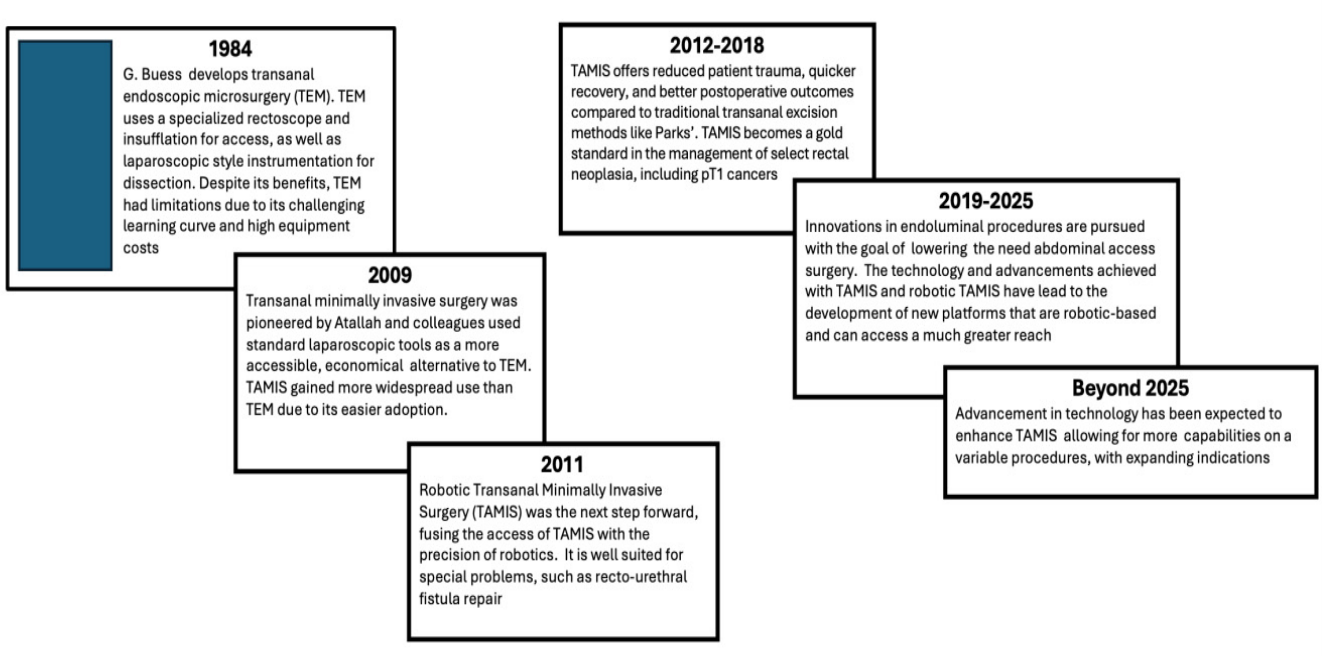

Figure 1. Timeline illustrating the evolution of transanal minimally invasive surgery and related technological advancements from its inception in 1984 to beyond 2025

after neoadjuvant treatment. To confirm the mural complete pathological response (ypT0), the indication for local excision of cT0 lesions after neoadjuvant treatment can be expanded.[27-29] In this context, TAMIS stands out as an effective method for the excision of benign lesions and early-stage rectal cancers, especially in the lower and middle regions of the rectum. Since the risk of occult nodal positivity in ypT0 lesions is reported to be as low as 3%-6%, this method is considered a valid option in appropriate cases.[30-32]

Since 1989, with the adoption of advanced transanal techniques in the United States, the local excision rate has approximately doubled for T1 rectal cancers and tripled for T2 lesions.[33] Studies have shown that local excision using advanced transanal platforms (TEM) in early-stage (T1) rectal cancer cases provides high survival rates and low recurrence rates in appropriately selected patients. In fact, these results have been shown to be comparable to radical resection.[34-36] Lezoche et al.[37] described similarly successful outcomes in T2 cancers treated with neoadjuvant chemoradiotherapy in addition to TEM-assisted volumetric or "pyramidal" excision.[38,39] It has also been reported that recurrence-free survival rates are higher in excisions performed with TEM than in standard Parks local excision. The main reason for this difference is thought to be the superior resection quality achieved with TEM/TAMIS-specifically, lower fragmentation rates and higher R0 excision rates.[40]

Polyps that are not amenable to endoscopic excision, carefully selected T1 cancers, low-risk rectal cancers, and patients requiring organ-sparing surgery are among the most preferred indications for TAMIS. However, T2-T3 rectal cancers with deep rectal wall invasion or a high risk of lymph node metastasis, large tumors that cannot be completely removed with TAMIS, and unsuitability for anesthesia due to severe systemic disease are among the conditions where this method cannot be applied with curative intent. Patients with advanced or bulky rectal tumors or evidence of distant metastatic disease are generally not considered suitable candidates for TAMIS due to the extent of the disease. Furthermore, patients with serious comorbidities or in poor general health may not be suitable for TAMIS, as the procedure still carries inherent surgical risks and requires general anesthesia. The feasibility of TAMIS is highly dependent on the expertise and experience of the surgical team. Therefore, careful patient selection is critical to achieving optimal results.

Surgical Technique

The success of TAMIS relies on a single-use access port as well as basic laparoscopic equipment. This system typically includes transanal access platforms that provide a stable working space while preserving the pneumorectum. For example, devices such as the GelPOINT® Path Transanal Access Platform allow effective surgical field control through a reliable seal.[41] Long, thin, and articulating instruments-such as standard laparoscopic insufflators, camera systems, laparoscopic graspers, scissors, and vessel-sealing devices-facilitate precise dissection and surgical maneuvers in the narrow rectal space.

In addition, advanced technologies such as endoscopic ultrasound and intraoperative fluorescence imaging allow better visualization of the surgical field and improved guidance of the surgical approach. In this way, even the excision of more complex lesions can be successfully performed with a minimally invasive approach.

The TAMIS procedure is usually performed in the lithotomy position, although in some cases, the lateral decubitus position may be preferred. Before starting the surgical procedure, the transanal access platform is carefully positioned, and a stable pneumorectum is created by carbon dioxide insufflation to allow better manipulation of the surgical field.

The TAMIS platform allows high-quality local excision using standard laparoscopic instruments. The technique has also been successfully applied in robotic surgery (Atallah et al.[15]).

The TAMIS procedure is performed using a systematic approach involving specific surgical steps. First, under general anesthesia, the patient is typically positioned in the lithotomy position, although the lateral decubitus position may be preferred in selected cases. Once positioned, access to the operative field is achieved by placing disposable transanal ports specific to the surgical procedure (e.g., GelPOINT Path or SILS Port). For enhanced visibility and maneuverability, carbon dioxide is insufflated to create a pneumorectum, thereby expanding the rectal lumen and stabilizing the surgical field. After achieving adequate exposure, lesion demarcation is performed using electrocautery or a marking instrument to

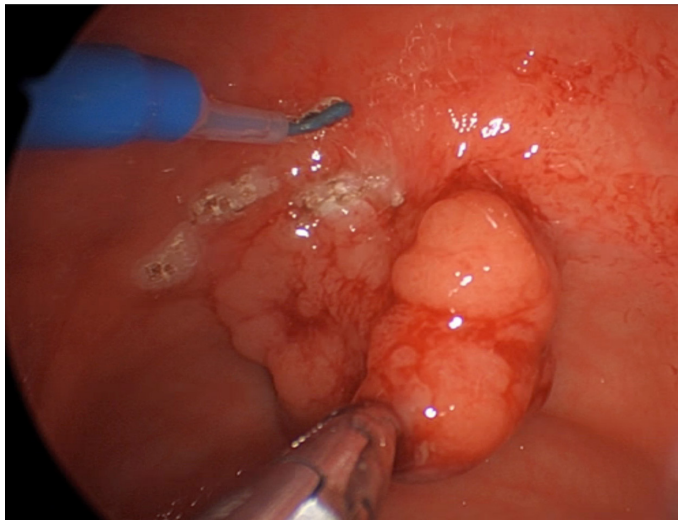

Figure 2. Lesion demarcation: Marking and delineation of the lesion in the transanal minimally invasive surgery procedure

define clear resection margins (Figure 2). During the excision stage, full-thickness or submucosal excision of the lesion is performed using electrocautery or a vessel sealer (Figure 3). Finally, the defect is closed with primary sutures or, in some cases, may be left open (Figure 4).

The TAMIS platform allows the surgeon to work more comfortably on the non-dependent (downward) wall of the rectum. This enables more cases to be performed in the lithotomy position, whereas TEM typically requires the patient to be positioned so that the lesion is in a downward position. The dissection stage is largely similar to the TEM technique. After completing the TAMIS procedure, the final appearance of the rectal mucosa demonstrates a well-healed and tension-free closure, with no signs of bleeding or residual tumor tissue (Figure 5).

During the procedure, different defect closure techniques may be employed. Among these, which vary between authors, closure can be performed using various laparoscopic suturing devices and barbed (self-locking) sutures, which obviate the need for intraluminal knot tying.

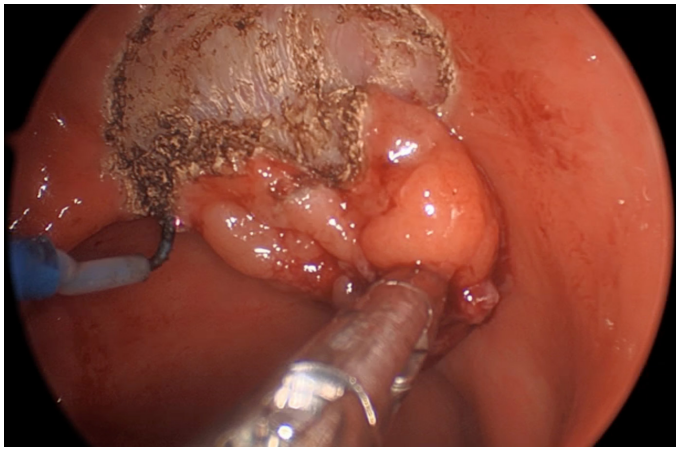

Figure 3. Dissection of the lesion using laparoscopic instruments in the transanal minimally invasive surgery technique

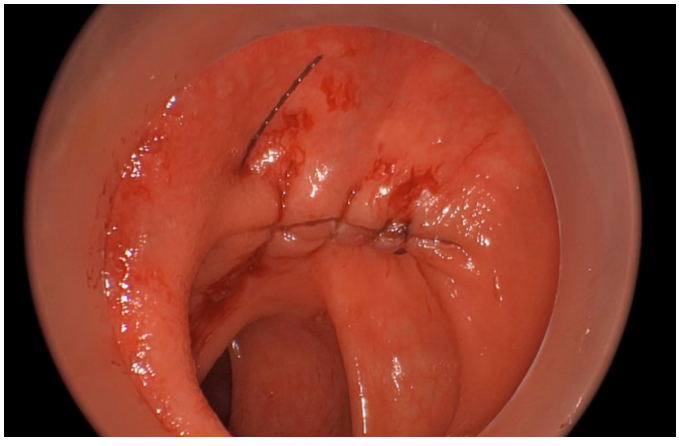

Figure 5. End result: The final surgical outcome after completion of the transanal minimally invasive surgery procedure

Rectal polyps located in the upper region of the sphincter complex may be partially concealed by the transanal device. In such cases, a hybrid TAMIS-transanal endoscopic (TAE) approach is required. In this method, the distal part of the lesion is first dissected under direct vision; then, the TAMIS device is placed, and the proximal part of the lesion is excised, with the closure of the defect completed using the traditional TAE technique. This allows the surgeon to benefit from both the minimally invasive advantages of TAMIS and the additional access provided by TAE. Invasive techniques such as the transcoccygeal (Kraske) and transsphincteric (York-Mason) approaches have been replaced by transanal techniques for local excision of rectal neoplasms and are now of historical interest only.

There are two main TAMIS platforms approved by the U.S. Food and Drug Administration (FDA): the SILS Port and the GelPOINT Path.

The SILS Port (Covidien/Medtronic) was developed for single-port laparoscopic surgery and has been adapted for transanal use. This system is compatible with standard laparoscopic instruments, thanks to its 3-4 trocar ports, and offers flexible use. TAMIS was originally described using this port.

The GelPOINT Path (Applied Medical), another FDA approved platform, is designed specifically for TAMIS procedures. Thanks to its flexible structure and wide gel-based entry points, it better adapts to rectal anatomy. It offers improved maneuverability by facilitating surgical access. In addition, the integrated smoke evacuation system enhances visibility within the surgical field, making the operation process safer and more effective.

The safety, feasibility, and oncological effectiveness of TAMIS have been supported by several multicenter studies in recent years.[42-46] Investigations by Lee et al.,[42] Albert et al.,[43]

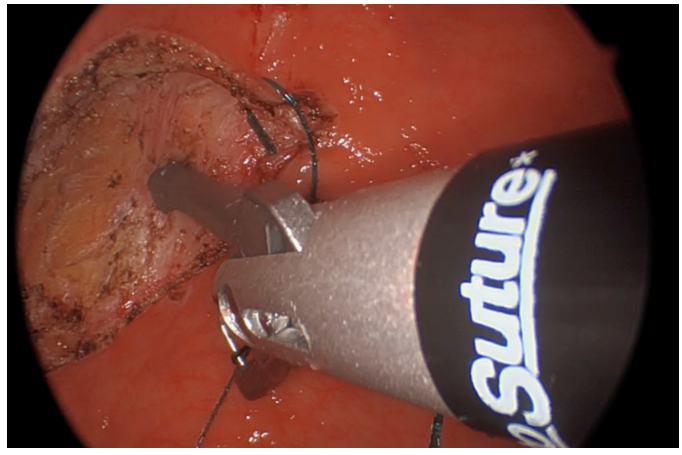

Figure 4. Closure: Primary suturing of the defect after resection

Castaño Llano et al.,[44] Kang et al.,[45] and Duggan et al.[46] have demonstrated that TAMIS is a reliable option for the treatment of benign rectal neoplasms and early-stage rectal cancers, with low complication rates, minimal local recurrence, and high R0 resection rates. These studies have reported positive margin rates ranging from 3.3% to 7% and local recurrence rates between 0% and 6%. These findings further support the role of TAMIS as an oncologically sound alternative to radical resection in appropriately selected patients.

A comparative overview of key TAMIS series is presented in Table 1, summarizing clinical data from five major studies. Patient cohorts ranged from 27 to 200 individuals, with average ages between 55 and 68 years. Average tumor sizes varied across studies (1.6-5.3 cm), and the distance from the anal verge ranged from 6 to 8.1 cm. Operative times differed substantially, reflecting variations in case complexity and surgical experience, with durations ranging from 52 to 115 minutes. Follow-up periods spanned from 14.4 to 53 months. Postoperative complication rates ranged from 6% to 22%, whereas local recurrence rates remained low (0%-6%). Positive margin rates were reported to be between 3.3% and 7%, and overall postoperative morbidity remained below 11% in most studies. These findings highlight the consistency of TAMIS in achieving favorable oncologic and perioperative outcomes, reinforcing its role as a safe and effective modality for both benign and selected malignant rectal neoplasms.

Advantages and Disadvantages of Transanal Minimally Invasive Surgery

Advantages

Minimally invasive technique: Compared with traditional transanal excision, TAMIS results in less postoperative pain, shorter hospital stays, and improved patient comfort.

Organ preservation: Enables rectal-sparing treatment in selected early-stage cancers and benign neoplasms, reducing the need for radical surgery and lowering the risk of low anterior resection syndrome.

Low morbidity: Associated with lower complication rates and better functional outcomes due to its less invasive nature.

Improved visualization and precision: Provides a wide field of view using laparoscopic optics and enables precise dissection with standard laparoscopic or robotic tools.

Lower cost and wider accessibility: Unlike TEM, TAMIS does not require expensive custom instruments, making it more feasible for general use.

Reduced inflammatory response and preserved immune function: The minimally invasive approach supports better postoperative recovery and systemic outcomes.

Robotic adaptation: Robotic-assisted TAMIS increases precision and dexterity, especially in challenging pelvic anatomy.

Feasibility in hybrid approaches: Can be combined with TAE for low-lying or partially concealed lesions.

Table 1. Summary of key clinical studies evaluating transanal minimally invasive surgery for rectal neoplasms

Study	Lee et al.[42]	Albert et al.[43]	Castaño Llano et al.[44]	Kang et al. [45]	Duggan et al.[46]
Year published	2009	2013	2019	2019	2023
Patient size, n	200	50	27	30	168
Gender (men/women)	112/88	37/17	17/10	19/11	101/67
Average age (years)	65	64	68	55	68
Average tumor size (cm)	2.9	2.8	5.3	1.6	4.8
Distance from anal verge (cm)	7.2	8.1	7.0	7.0	6.0
Operation time (min)	69.5	74.9	115	52	N/A
Follow-up (months)	14.4	20	32	53	17
Complication rate (%)	16	6	22	13.33	8.3
Local recurrence (%)	6	4	0	3.8	1.6
Positive margin (%)	7	6	4	3.3	4
Postoperative morbidity (%)	11	8	0	0	11
Cases	Adenoma, adenocarcinoma	Benign and malignant lesions, NETs	Low-/high-grade adenomas, NETs, fibrosis	NET, adenoma, rectal cancer, stenosis	Adenoma, ypT0-T2, carcinoid, maltoma

NET: Neuroendocrine tumor, N/A: Not available, R0: Complete (margin-negative) resection

Cost-effectiveness and accessibility: Compared with TEM, TAMIS eliminates the need for specialized and costly equipment, instead relying on standard laparoscopic tools. This makes it more affordable and scalable, particularly in lower-resource settings.

Effective training strategies: Simulation-based learning, cadaveric workshops, and mentorship models have been shown to substantially reduce the learning curve, ensuring safer and faster adoption of TAMIS among colorectal and minimally invasive surgeons.

Disadvantages

Learning curve: Although TAMIS is less technically complex than TEM, it still requires experience in laparoscopic techniques and familiarity with transanal platforms. The initial phase of skill acquisition may be challenging without dedicated training.

Equipment requirements: Requires dedicated transanal platforms (e.g., SILS, GelPOINT) and reliable insufflation and imaging systems.

Closure difficulties: Intrarectal suturing, particularly for large or awkwardly located defects, can be technically challenging.

Patient selection limitations: Not suitable for bulky tumors, advanced-stage cancers, or patients with severe comorbidities or contraindications to general anesthesia.

Limited access for some tumor locations: Lesions obscured by rectal folds or located too proximally may require conversion or hybrid techniques.

Comparison with Other Techniques

Compared with TEM and TEO, TAMIS offers a shorter setup time, broader accessibility due to lower costs, and greater instrument flexibility by utilizing conventional laparoscopic tools. Although all three techniques achieve comparable oncologic outcomes in well-selected patients, TAMIS stands out due to its ease of adoption and availability. By contrast, endoscopic submucosal dissection (ESD), although minimally invasive, is limited by technical complexity, longer procedure times, and difficulty in achieving full-thickness excision-particularly in lesions with submucosal fibrosis or deeper invasion. TAMIS presents a more controlled and reproducible option in such cases, especially when oncologic safety and full-thickness resection are critical.

Conclusion

TAMIS has achieved a high global adoption rate. Several studies have demonstrated that TAMIS is safe and effective in early-stage rectal cancers and large benign polyps. Careful patient selection, meticulous surgical planning, and continuous refinement of techniques and instrumentation are paramount to optimizing TAMIS outcomes and ensuring its safe and effective application.

In the future, TAMIS is expected to become applicable to a broader group of patients. As surgeons gain more experience with this emerging technique, its role beyond local excision will likely expand. The role of TAMIS in the treatment of colorectal diseases continues to evolve, with ongoing studies investigating its potential applications and long-term efficacy. With the growing body of available evidence, the clinical utility of TAMIS is expected to become even more widely adopted. Consequently, the integration of TAMIS into standard treatment algorithms is likely to accelerate. Advances in surgical technologies and the integration of robotic platforms may further enhance and optimize the TAMIS procedure. These developments could ultimately improve patient outcomes and expand the scope and reach of its clinical application.

In summary, TAMIS offers distinct advantages over traditional transanal excision (Parks) while also providing a more accessible and versatile alternative to other endoscopic techniques such as TEM, TEO, and ESD. These comparative insights reinforce TAMIS's emerging role as a key tool in minimally invasive rectal surgery.

Ethics

Informed Consent: Written informed consent was obtained from the patients for the use of clinical images and anonymized data in this publication.

Footnotes

Authorship Contributions

Surgical and Medical Practices: J.A., C.D., S.A., Concept: N.K., C.D., S.A., Design: N.K., J.A., S.A., Data Collection or Processing: N.K., Analysis or Interpretation: N.K., S.A., Literature Search: N.K., Writing: N.K., S.A.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

REFERENCES

1. Corman ML. Jacques Lisfranc 1790-1847. Dis Colon Rectum. 1983;26:694-695.
2. Parks AG. Transanal technique in the excision of rectal tumors. Proc R Soc Med. 1963;56:896-898.
3. Burghardt J, Buess G. Transanal endoscopic microsurgery (TEM): a new technique and development during a time period of 20 years. Surg Technol Int. 2005;14:131-137.
4. McCloud JM, Waymont N, Pahwa N, Varghese P, Richards C, Jameson JS, Scott AN. Factors predicting early recurrence after transanal endoscopic microsurgery excision for rectal adenoma. Colorectal Dis. 2006;8:581-585.
5. Whitehouse PA, Tilney HS, Armitage JN, Simson JN. Transanal endoscopic microsurgery: risk factors for local recurrence of benign rectal adenomas. Colorectal Dis. 2006;8:7.

6. Christoforidis D, Cho HM, Dixon MR, Mellgren AF, Madoff RD, Finne CO. Transanal endoscopic microsurgery versus conventional transanal excision for patients with early rectal cancer. Ann Surg. 2009;249:776-782.
7. Neary P, Makin GB, White TJ, White E, Hartley J, MacDonald A, Lee PW, Monson JR. Transanal endoscopic microsurgery: a viable operative alternative in selected patients with rectal lesions. Ann Surg Oncol. 2003;10:1106-1111.
8. Moore J, 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;51:1026-1031.
9. Winde G, Nottberg H, Keller R, Schmid KW, Bunte H. Surgical cure for early rectal carcinomas (T1): transanal endoscopic microsurgery vs. anterior resection. Dis Colon Rectum. 1996;39:969-976.
10. Middleton PF, Sutherland LM, Maddern GJ. Transanal endoscopic microsurgery: a systematic review. Dis Colon Rectum. 2005;48:270-284.
11. Doornebosch PG, Tollenaar RA, Gosselink MP, Stassen LP, Dijkhuis CM, Schouten WR, van de Velde CJ, de Graaf EJ. Quality of life after transanal endoscopic microsurgery and total mesorectal excision in early rectal cancer. Colorectal Dis. 2007;9:553-558.
12. Lin GL, Meng WC, Lau PY, Qiu HZ, Yip AW. Local resection for early rectal tumours: Comparative study of transanal endoscopic microsurgery (TEM) versus posterior trans-sphincteric approach (Mason's operation). Asian J Surg. 2006;29:227-232.
13. Guerrieri M, Baldarelli M, de Sanctis A, Campagnacci R, Rimini M, Lezoche E. Treatment of rectal adenomas by transanal endoscopic microsurgery: 15 years' experience. Surg Endosc. [Epub ahead of print].
14. Papagrigoriadis S. Transanal endoscopic microsurgery (TEMS) for the management of large or sessile rectal adenomas: a review of the technique and indications. Int Semin Surg Oncol. 2006;3:13.
15. Atallah S, Albert M, Larach S. Transanal minimally invasive surgery: a giant leap forward. Surg Endosc. 2010;24:2200-2205.
16. Khoo RE. Transanal excision of a rectal adenoma using single-access laparoscopic port. Dis Colon Rectum. 2010;53:1078–1079.
17. Lim SB, Seo SI, Lee JL, Kwak JY, Jang TY, Kim CW, Yoon YS, Yu CS, Kim JC. Feasibility of transanal minimally invasive surgery for mid-rectal lesions. Surg Endosc. 2012;26:3127-3132.
18. Barendse RM, Doornebosch PG, Bemelman WA, Fockens P, Dekker E, de Graaf EJ. Transanal employment of single access ports is feasible for rectal surgery. Ann Surg. 2012;256:1030-1033.
19. Matz J, Matz A. Use of a SILS port in transanal endoscopic microsurgery in the setting of a community hospital. J Laparoendosc Adv Surg Tech A. 2012;22:93-96.
20. Lorenz C, Nimmesgern T, Back M, Langwieler TE. Transanal single port microsurgery (TSPM) as a modified technique of transanal endoscopic microsurgery (TEM). Surg Innov. 2010;17:160-163.
21. Ragupathi M, Haas EM. Transanal endoscopic video-assisted excision: application of single-port access. JSLS. 2011;15:53-58.
22. Khoo RE. Transanal excision of a rectal adenoma using single-access laparoscopic port. Dis Colon Rectum. 2010;53:1078-1079.
23. Smith RA, Anaya DA, Albo D, Artinyan A. A stepwise approach to transanal endoscopic microsurgery for rectal cancer using a single-incision laparoscopic port. Ann Surg Oncol. 2012;19:2859.
24. Watts ES, Peacock O, Gupta A, Speake WJ, Lund JN. Anyone for TAMIS? Tech Coloproctol. doi:10.1007/s10151-012-0806-9.
25. Qi Y, Stoddard D, Monson JR. Indications and techniques of transanal endoscopic microsurgery (TEMS). J Gastrointest Surg. 2011;15:1306-1308.
26. Nascimbeni R, Burgart LJ, Nivatvongs S, Larson DR. Risk of lymph node metastasis in T1 carcinoma of the colon and rectum. Dis Colon Rectum. 2002;45:200-206.
27. Garcia-Aguilar J, Shi Q, Thomas CR Jr, Chan E, Cataldo P, Marcet J, Medich D, Pigazzi A, Oommen S, Posner MC. A phase II trial of neoadjuvant chemoradiation and local excision for T2N0 rectal cancer: preliminary results of the ACOSOG Z6041 trial. Ann Surg Oncol. 2012;19:384-391.
28. Kundel Y, Brenner R, Purim O, Peled N, Idelevich E, Fenig E, Sulkes A, Brenner B. Is local excision after complete pathological response to neoadjuvant chemoradiation for rectal cancer an acceptable treatment option? Dis Colon Rectum. 2010;53:1624-1631.
29. Kim CJ, Yeatman TJ, Coppola D, Trotti A, Williams B, Barthel JS, Dinwoodie W, Karl RC, Marcet J. Local excision of T2 and T3 rectal cancers after downstaging chemoradiation. Ann Surg. 2001;234:352-359.
30. Bedrosian I, Rodriguez-Bigas MA, Feig B, Hunt KK, Ellis L, Curley SA, Vauthey JN, Delclos M, Crane C, Janjan N, Skibber JM. Predicting the node-negative mesorectum after preoperative chemoradiation for locally advanced rectal carcinoma. J Gastrointest Surg. 2004;8:56-62.
31. Bujko K, Nowacki MP, Nasierowska-Guttmejer A, et al; Polish Colorectal Study Group. Prediction of mesorectal nodal metastases after chemoradiation for rectal cancer: results of a randomised trial: implication for subsequent local excision. Radiother Oncol. 2005;76:234-240.
32. Yeo SG, Kim DY, Kim TH, Chang HJ, Oh JH, Park W, Choi DH, Nam H, Kim JS, Cho MJ, Kim JH, Park JH, Kang MK, Koom WS, Kim JS, Nam TK, Chie EK, Kim JS, Lee KJ. Pathologic complete response of primary tumor following preoperative chemoradiotherapy for locally advanced rectal cancer: long-term outcomes and prognostic significance of pathologic nodal status (KROG 09-01). Ann Surg. 2010;252:998-1004.
33. You YN, Baxter NN, Stewart A, Nelson H. Is the increasing rate of local excision for stage I rectal cancer in the United States justified?: a nationwide cohort study from the National Cancer Database. Ann Surg. 2007;245:726-733.
34. Winde G, Nottberg H, Keller R, Schmid KW, Bünte H. Surgical cure for early rectal carcinomas (T1): transanal endoscopic microsurgery vs. anterior resection. Dis Colon Rectum. 1996;39:969-976.
35. Heintz A, Mörschel M, Junginger T. Comparison of results after transanal endoscopic microsurgery and radical resection for T1 carcinoma of the rectum. Surg Endosc. 1998;12:1145-1148.
36. Moore JS, Cataldo PA, Osler T, et al. Transanal endoscopic microsurgery is more effective than traditional transanal excision for resection of rectal masses. Dis Colon Rectum. 2008;51:1026-1031.
37. Lezoche G, Baldarelli M, Guerrieri M, et al. A prospective randomized study with a 5-year minimum follow-up evaluation of transanal endoscopic microsurgery versus laparoscopic total mesorectal excision after neoadjuvant therapy. Surg Endosc. 2008;22:352-358.
38. Lezoche E, Guerrieri M, Paganini AM, D'Ambrosio G, Baldarelli M, Lezoche G, Feliciotti F, De Sanctis A. Transanal endoscopic versus total mesorectal laparoscopic resections of T2-N0 low rectal cancers after neoadjuvant treatment: a prospective randomized trial with a 3-years minimum follow-up period. Surg Endosc. 2005;19:751-756.
39. Lezoche E, Guerrieri M, Paganini AM, Baldarelli M, De Sanctis A, Lezoche G. Long-term results in patients with T2-3 N0 distal rectal cancer undergoing radiotherapy before transanal endoscopic microsurgery. Br J Surg. 2005;92:1546-1552.
40. 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;51:1026-1030.
41. Cheong JY, Shin SH, Kim J, Kim SH. Novel technique in atraumatic retraction for minimally invasive low anterior resection. ANZ J Surg. 2021;91:2827.
42. Lee BC, Oh S, Lim SB, Yu CS, Kim JC. Transanal minimally invasive surgery for treating patients with regressed rectal cancer after preoperative chemoradiotherapy. Ann Coloproctol. 2017;33:52-56.
43. 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;56:301-307.

44. Castaño Llano R, Puerta JD, Palacios LJ, Uribe D. Transanal minimally invasive surgery (TAMIS): technique and results of initial experience. Rev Colomb Gastroenterol. 2019;34:124-132.

45. Kang MK, Shin R, Sohn B, Heo S. Feasibility and advantages of transanal minimally invasive surgery (TAMIS) for various lesions in the rectum. J Minim Invasive Surg. 2020;23:36-42.

46. Duggan WP, Heagney N, Gray S, Hannan E, Burke JP. Transanal minimally invasive surgery (TAMIS) for local excision of benign and malignant rectal neoplasia: a 7-year experience. Langenbecks Arch Surg. 2024;409:32.

47. Krzystek-Korpacka M, Zawadzki M, Szufnarowski K, Bednarz-Misa I, Górska S, Witkiewicz W, Gamian A. The perioperative dynamics of IL-7 following robot-assisted and open colorectal surgery. Sci Rep. 2018;8.

48. Marinello F, Pellino G, Espín E. Low anterior resection syndrome: An unavoidable price to pay to preserve the rectum? Front Oncol. 2022;12.