Editorial

Transanal minimally invasive surgery (TAMIS): validating short and long-term benefits for excision of benign and early stage rectal cancers

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It is with great pleasure that we provide commentary upon the manuscript entitled "Transanal Minimally Invasive Surgery for Rectal Lesions" by Quaresima *et al.* (1). This is a single-center case series of 31 patients undergoing local excision of mid- and upper-rectal tumors using a transanal minimally invasive surgery (TAMIS) platform. By translating their substantial prior expertise with single incision laparoscopic surgery to the use of the TAMIS transanal platform for the treatment of high rectal tumors, the authors demonstrate excellent results from their preliminary experience.

Though proctectomy with total mesorectal excision (TME) is the gold standard for curative resection of rectal cancers at any stage, such radical surgery has been associated with significant morbidity, mortality and impact on the patient's quality of life. Local recurrence rates for this procedure ranges 5–10% based on tumor stage, but because of the high morbidity and mortality, TME has been difficult to justify in the management of benign rectal lesions and early-stage rectal cancers (2,3). Therefore, transanal surgery has been in the arsenal of colorectal surgeons for the local excision of benign and early-stage rectal lesions for quite some time.

Conventional transanal excision (TAE), first described in 1963 by Parks, provides a direct approach via the natural anal orifice allowing avoidance of a stoma and the morbidity associated with abdominal surgery (4). The limitations of exposure within the anorectal lumen, however, pose a significant challenge to achieving a high-quality R0 resection. This is demonstrated by the high rates of margin positivity, tumor fragmentation, and local recurrence after TAE which have been reported as 29%, 35%, and 32% respectively (5). According to NCCN guidelines, successful TAE is thus limited to T1 lesions encompassing <30% of the rectal circumference, ≤3 cm in size, and located within –8 cm from the anal verge (6). Additionally, these lesions should be mobile, non-fixed, well to moderately differentiated, and with clear margins >3 mm and no evidence of lymphovascular or perineural invasion (6).

In response to the challenges inherent with conventional TAE, Professor Buess *et al.* introduced transanal endoscopic microsurgery (TEM) in 1983 for the local excision of sessile polyps in the mid- and upper-rectum (7). Using a rigid TEM platform, better visualization and more precise dissection can be performed. This has provided improved outcomes relative to TAE, with rates of margin positivity, tumor fragmentation, and local recurrence at 10%, 6%, and 5%, respectively (5,8). A similar reusable, rigid transanal endoscopic operations (TEO) system has also been made commercially available, but unfortunately, TEM and TEO were never widely adopted due to the significant upfront cost of the rigid endoscopic platform and the specialized instrumentation and the complex skill set it mandated from surgeons. Reimbursement in the United States was also problematic due to the lack of a category 1 CPT code.

It was not until 2010 when TAMIS was first reported

by Atallah *et al.* as an alternative to TEM that the interest for transanal endoscopic surgery (TES) truly sparked (9). TAMIS is a hybrid between TEM and single-port laparoscopy, employing an alternative disposable platform compatible with standard laparoscopic equipment. The low upfront cost and availability of laparoscopic equipment in most operating rooms enabled surgeons in a variety of settings to apply their proficiency in laparoscopy towards TES. Currently, a number of case series describing TAMIS for the local excision of rectal lesions have demonstrated its safety and feasibility.

Review of all published TAMIS case series with N≥15 highlight that among a total of 460 TAMIS procedures, indications for local excision using TAMIS include rectal adenoma with and without high grade dysplasia, neuroendocrine and carcinoid tumors, as well as incompletely resected benign and malignant polyps (*Table 1*) (10-21). Malignant indications predominantly include carefully selected T1 adenocarcinoma along with a minority of T2 and more advanced rectal tumors in patients deemed to be poor surgical candidates for radical resection and/or chemoradiation. The average size of the lesions and distance from the anal verge are 2.78 and 7.03 cm, respectively. TAMIS procedures were complicated by peritoneal entry in 10/460 cases (2.2%). Among the 10 incidences of peritoneal entry, 6 required laparoscopic assistance to close the rectal defect, and 1 required conversion to open laparotomy. The remaining 3 incidences of peritoneal entry were closed primarily with sutures placed transanally.

Regarding conversions from TAMIS to TAE, laparoscopic, or open surgery, one TAMIS case was converted to conventional TAE due to fibrosis secondary to prior radiation therapy for prostate cancer. A total of 5 cases were converted to laparoscopic low anterior resection (LAR) for reasons that included peritoneal entry, location of tumor above the recto-sigmoid junction, large size of the rectal defect after excision, large size of the tumor itself to where it could not be fully resected transanally. Two cases were converted to open LAR because of peritoneal entry and palliative debulking of a recurrent rectal cancer. There were 4 patients that required laparoscopic LAR after their TAMIS procedures due to upstage to pT2 on final pathology.

The overall average morbidity rate was 18.8% with the most common complications consisting of bleeding, urinary retention, and urinary tract infection (*Table 2*) (10-21). Among the 5 studies that reported length of stay (LOS), the average LOS was 2.2 days. The average follow-up ranged from 3 to 36 months, with most studies describing their results with a follow-up of less than one year. Overall rates of margin positivity, tumor fragmentation, and local recurrence were 6.4%, 5.6%, and 3.7% respectively.

The results by Quaresima *et al.* corroborate these findings and are slightly better. Indications for TAMIS included benign rectal lesions in 14 patients and T1 rectal cancer in 17 patients. Average tumor size was equivalent to that seen in other TAMIS series, i.e., 2.4 versus 2.8 cm. The average distance from the anal verge was higher, 9.5 *vs.* 7.0 cm, which may explain their higher rate of peritoneal entry (16.1% *vs.* 2.2%). That being said, there were no conversions to laparoscopic or open abdominal surgery, and all cases of peritoneal entry could be closed transanally. Complications occurred in 3 (9.6%) patients and included urinary tract infection, subcutaneous emphysema, and hemorrhoid thrombosis. In this series, R0 resection was achieved with TAMIS in 96.7%, with a 100% rate of *en bloc* resection and a 3.7% local recurrence rate at a mean follow-up of 30 months. The authors must be commended for the low margin positivity rates and low recurrence rates achieved at a relatively longer follow-up interval relative to other published TAMIS series, which suggests careful patient selection and excellent surgical technique, despite the fact that the sample size of this series is relatively small.

The limitations of this manuscript include the fact that the operating time was not described, nor was the final pathology of the resected specimens. This would have been of interest to evaluate whether any of the resected lesions were upstaged based on final pathologic assessment. Finally, functional outcomes, which only 5 out the 12 largest TAMIS series have reported on, are not described in this report. This would have been of particular interest given the current series' relatively long mean follow-up of 30 months. One of the proposed main advantages of TAMIS, relative to TEM and TEO, is the shorter set up and operative time, as well as possibly reduced trauma to the anal sphincters by using softer and more pliable platforms. Unfortunately, there continues to be a lack of data to support the validity of these propositions.

With the growing experience with TES, indications have recently expanded to include transanal endoscopic proctectomy with complete rectal and mesorectal dissection for locally invasive rectal cancer, with TAMIS becoming

Table 1 Patient characteristics and intraoperative data from published clinical series of TAMIS with N>15

Author	N	Indications (B:M)	Mean tumor size (cm)	Mean distance from AV (cm)	Transanal platform	Operative time (min)	Peritoneal entry	Conversion
Lim *et al.*, 2012 (10)	16	5:11	0.84 (0.2–1.5)	6.9	SILS	91	NR	0
Albert *et al.*, 2013 (11)	50	23:27	2.75 (0.7–6.0)	8.2	SIIS, GelPOINT	75	1	1 laparoscopic LAR
Lee *et al.*, 2014 (12)	25	21:4	2.4 (0.5–6.0)	9.2	SILS	52	0	2 laparoscopic LAR
McLemore *et al.*, 2014 (13)	32	16:16	3 (1.0–5.0)	4	SIIS, GelPOINT	123	NR	1 TAE
Maglio *et al.*, 2014 (14)	15	5:10	3.5 (2.5–5.0)	7	GelPOINT	86	NR	NR
Hahnloser *et al.*, 2014 (15)	75	37:38	NR	6.4	SILS	77	3	2 laparoscopic LAR, 1 open LAR
Schiphorst *et al.*, 2014 (16)	37	NR	18.0 (4.5–56.0) (cm^2 median)	7 (median)	SILS, SSL	64	2	1 laparoscopic LAR
Gill *et al.*, 2015 (17)	32	11:21	2.1 (0.3–5.0)	7.5	GelPOINT	131	0	0
Sumrien *et al.*, 2016 (18)	28	17:11	4.4 (0–11.5)	NR	SIIS, GelPOINT	<60	1	2 laparoscopic LAR, 1 open LAR
Haugvik *et al.*, 2016 (19)	51	26:22	3.2 (0.4–6.0) (median)	8.0 (median)	SIIS, GelPOINT	40 (median)	NR	NR
Verseveld *et al.*, 2016 (20)	24	20:4	6 (0.25–51.0) (cm^2 median)	8.0 (median)	SSL	32 (median)	NR	NR
Keller *et al.*, 2016 (21)	75	57:17	3.2 (SD 3.1)	10 (median)	SIIS, GelPOINT	76	3	1 LAR, 2 diagnostic laparoscopy with ileostomy creation
Total	460	242:177	2.8	7.0		32–131	10 (2.2%)	12
Quaresima *et al.*, 2016 (1)	31	14:17	2.4 (1.0–5.0)	9.5	SILS, GelPOINT	NR	5 (16.1%)	2 TAE

B, benign; M, malignant; SILS, single incision laparoscopic surgery; SSL, single site laparoscopy; SD, standard deviation; NR, not reported; LAR, low anterior resection; TAE, transanal excision.

the transanal platform of choice. That being said, TAMIS for the local excision of benign and low-grade rectal lesions remains a relatively new technique lacking long-term clinical and oncologic outcomes. The published work by Quaresima *et al.* represents their initial experience with TAMIS. Thanks to their extensive prior experience with single incision laparoscopic surgery and careful patient selection, their demonstrated results are equivalent or slightly better than those reported in the TAMIS literature. This work is an important contribution to validate the short and long-term benefits of TAMIS as a safe platform for local excision of benign and early rectal cancers.

Table 2 Postoperative outcomes of published clinical series on TAMIS with N>15

Author	N	Tumor fragmentation	Positive margins	Pathologically upgraded	Intraoperative complications	Morbidity	Mean LOS (days)	Mean follow-up (months)	Local recurrence	Functional outcomes
Lim *et al.*, 2012 (10)	16	0	0	NR	NR	0	3.6	3	NR	NR
Albert *et al.*, 2013 (11)	50	2 (4.0%)	3 (6.0%)	1 (2%)	3	3 (14.0%)	0.6	20.2	2 (4.0%)	NR
Lee *et al.*, 2014 (12)	25	0	0	5 (20%)	0	1 (4.0%)	3.0 (median)	9.8	0	None
McLemore *et al.*, 2014 (13)	32	0	0	1 (3%)	0	11 (28.0%)	2.5	2–23 (range)	0	Fecal incontinence [3] resolved in 2–4 weeks
Maglio *et al.*, 2014 (14)	15	NR	0	0	0	0 (0.0%)	2.0 (median)	6	0	NR
Hahnloser *et al.*, 2014 (15)	75	6 (8.0%)	3 (4.0%)	0	7	15 (27.0%)	3.4 (median)	12.8 (median)	NR	Normal continence per Vaizey score 1.5
Schiphorst *et al.*, 2014 (16)	37	0	6 (16.2%)	NR	2	4 (14.0%)	1.0 (median)	11 (median)	2 (5.0%)	Improvement in FISI
Gill *et al.*, 2015 (17)	32	0	0	NR	NR	11 (50.0%)	1.1	2.7	2 (6.3%)	NR
Sumrien *et al.*, 2016 (18)	28	0	6 (21.4%)	NR	5	9 (50.0%)	1.5	NR	2 (7.1%)	ICIQ bowel symptoms questionnaire, median score 15
Haugvik *et al.*, 2016 (19)	51	16 (31.0%)	11 (22.0%)	17 (33%)	0	6 (12.0%)	1.0 (median)	7.0 (median)	NR	NR
Verseveld *et al.*, 2016 (20)	24	0	0	NR	0	1 (4.2%)	1.0 (median)	7.0 (median)	NR	5 patients/minor deterioration in FISI score
Keller *et al.*, 2016 (21)	75	1 (1.3%)	5 (6.7%)	5 (6.7%)	2	3 (4.0%)	1.0 (median)	36.5 (median)	5 (6.7%)	NR
Total	460	25 (5.6%)	34 (6.4%)			64 (18.8%)			13 (3.7%)	
Quaresima *et al.*, 2016 (1)	31	0	1 (3.2%)	NR	NR	3 (9.6%)	3	30	1 (3.7%)	NR

FISI, fecal incontinence severity index; ICIQ, International Consultation on Incontinence Modular Questionnaire; LOS, length of stay; NR, not reported.

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Footnote

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