Transanal minimally invasive surgery for total mesorectal excision (TAMIS–TME): results and experience with the first 20 patients undergoing curative-intent rectal cancer surgery at a single institution

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Abstract

Background Transanal TME is a new approach to performing minimally invasive rectal resection. It is particularly well suited for patients with locally advanced distal rectal cancer and obesity, where the abdominal approach is challenging. Transanal TME can be performed with either TAMIS or TEM. Here, we report our initial experience with transanal TME using TAMIS (TAMIS–TME).

Methods Patients were selected to undergo transanal TME using the TAMIS platform (TAMIS–TME) primarily for malignant disease, but also for select cases of benign disease. Transanal TME defines a “bottom-up” approach to *en bloc* rectal cancer resection. Transanal TME requires abdominal access for proximal colonic mobilization and is often done in conjunction with a laparoscopic approach.

Results During a 32-month period, 20 patients underwent TAMIS–TME with curative intent. The primary indication for transanal TME was distal, locally advanced rectal cancer. The median age of rectal cancer patients at the time of surgery was 57 years (range 36–73 years) with 30 % (6) female and 70 % (14) male. The median body mass index (BMI) measured was 24 kg/m² (range 18–41 kg/m²); this included six patients (30 %) with obesity (BMI ≥ 30 kg/m²). Mean operating time was 243 min (range 140–495 min) with blood loss averaging 153 ml. Postoperative length of stay averaged 4.5 days (range 3–24 days). There was no 30-day postoperative mortality. Surgical complications included wound infection (*n* = 2), pelvic abscess (*n* = 4), and prolonged ileus (*n* = 4). The anastomotic leak rate was 6.7 % (1/15). Of the 20 patients who

underwent resection, 90 % (18/20) had negative margins. Pathologic grading of the TME specimen revealed that 85 % (17/20) of transanal TME specimens were found to have “completely” or “near-completely” intact mesorectal envelopes. Data collected during the 6-month median follow-up period revealed that only one patient had developed distant metastasis. There was no locoregional recurrence in any of the patients.

Conclusions Transanal TME is a feasible method for oncologic resection of locally advanced mid- and distal-rectal cancer with curative intent. It has special application for patients with obesity and anatomic constraints such as a narrow male pelvis.

Keywords Total mesorectal excision · Transanal TME · TaTME · TAMIS · TAMIS–TME · Rectal cancer · Natural orifice surgery

Introduction

Flexible and rigid transanal access platforms using transanal minimally invasive surgery (TAMIS) and transanal endoscopic microsurgery (TEM) allow for *en bloc* resection of the rectum, and these methods represent a new approach to performing transanal total mesorectal excision (TME) [1, 2]. It is an attractive option for experienced surgeons, particularly for mobilization of the distal rectum in the setting of difficult pelvic anatomy. This is often referred to as the “down-to-up” or transanal-transabdominal (TATA) approach [3] that can be successfully performed using TAMIS or TEM, and both platforms appear to offer a similar resection quality [4–6]. Furthermore, each platform has been shown to be capable of providing a point of access to accomplish pure natural

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orifice transluminal endoscopic surgery (NOTES) transanal TME [7, 8], other than for completion proctectomy [9].

There are now several published case reports and small series describing transanal TME—primarily with laparoscopic assistance—and early results have been quite encouraging [10–15]. Our group has also previously described the step-by-step technique for TAMIS–TME for both ultralow anastomosis as well as abdominoperineal resection [2]. We now report our initial results for 20 consecutive patients who underwent transanal TME for malignant disease.

Materials and methods

Twenty-three patients were selected to undergo transanal TME using the TAMIS platform (TAMIS–TME) during a 32-month period at a tertiary referral hospital. Three patients were excluded from further study as these resections were completed for benign disease, namely ulcerative colitis. Selection criterion included (a) locally advanced rectal cancer of the middle and distal rectum as well as (b) distal rectal cancer in combination with obesity and anatomic constraints such as a narrow male pelvis. The operations were performed by 4 colorectal surgeons experienced with TAMIS. Each patient gave special consent to undergo TAMIS–TME, and the approach of transanal TME had been approved by our institution review committee. An internal review board approved the retrospective review of prospectively gathered data on transanal TME. For the purpose of this study, Transanal TME is defined as a “bottom-up” approach to *en bloc* rectal cancer resection. Unlike pure NOTES, transanal TME requires a combined abdominal approach for proximal colonic mobilization and for initiation of the medial to lateral approach, as well as construction of a diverting or permanent stoma. Exceptions include completion proctectomy of a short rectal remnant, where an abdominal approach is not required [9].

Surgical technique

Transanal TME using the TAMIS platform is defined as TAMIS–TME. The technique for TAMIS–TME has been described by our group previously and is published elsewhere [2]. Briefly, TAMIS–TME is a combined technique of a transanal and abdominal approaches for TME. The abdominal portion of the operation is first completed (laparoscopic, robotic-assisted, hand-assisted, or with an open approach), including mobilization of the splenic flexure, high ligation of the inferior mesenteric artery, and division of the descending colon. The fecal stream is diverted with a loop ileostomy, unless a permanent stoma

is being fashioned. These steps of the operation are always completed via an abdominal approach at our center. Selection of the abdominal approach (e.g., laparoscopic or open) is dependent on case complexity, tumor stage, and the extent of resection required. At our center, surgeon preference determines whether robotic or laparoscopic abdominal approaches are used, and there are no specific selection criterion which define whether or not one approach should be used over the other.

Once the abdominal portion has been completed, transanal TME can be performed. It is also feasible to begin the operation with the transanal TME prior to entering the abdomen. Pure NOTES is not performed.

To perform transanal TME using TAMIS, the patient is placed in the dorsal lithotomy position. A GelPOINT® Path Transanal Access Platform (Applied Medical, Inc. Rancho Santa Margarita, CA, USA) or a SILS™ Port (Mansfield, MA, USA) may be used for TAMIS access. For low-lying tumors, an intersphincteric dissection is started prior to admission of a TAMIS port, and this is done under direct vision using an anorectal retractor and electrocautery. The rectal lumen is purse-stringed closed with prolene suture. This allows for complete division of the rectum distal to the lesion, with a known [negative] distal margin. The port is then introduced, and transanal TME is performed. Typically, the operation is completed with a hand-sewn coloanal anastomosis. However, for higher lesions, the TAMIS port is introduced first, and the purse-string suture can be performed more proximally. With the TAMIS port in place and pneumorectum established, the rectal wall is then divided just distal to the purse-string using cautery. This allows for a higher anastomosis, which can be performed using a circular stapler to construct an end-to-end anastomosis or, alternately, a low-rectal-to-colonic J-pouch anastomosis.

Results

During a 32-month period (November, 2010–August, 2013), 23 patients underwent TAMIS–TME. The majority of cases were completed in the latter 24 months (Fig. 1). The primary indication for transanal TME was distal, locally advanced rectal cancer in the majority of cases (20/23). Three TAMIS–TME cases were performed for inflammatory bowel disease and were excluded from the study group.

The median age of patients at the time of surgery was 57 years (range 36–73 years) with 30 % (6) female and 70 % (14) male (Table 1). The median body mass index (BMI) was 24 kg/m² (range 18–41 kg/m²); this included 6 patients (30 %) with obesity, defined as BMI ≥30 kg/m². Mean operating time was 243 min (range 140–495 min)

a: first half of the year; b: second half of the year

Fig. 1 Number of transanal TME cases performed at our center by year. **a** First half of the year; **b** second half of the year

Table 1 Patient characteristics for patients who underwent TAMIS–TME with curative intent for rectal cancer ($n = 20$)

Characteristic	Value
n	20
Age ^a	57 (36–73)
Gender	
Male	14 (70 %)
Female	6 (30 %)
BMI (kg/m^2) ^a	24 (18–41)
ASA	
I–II	14 (70 %)
III–IV	6 (30 %)

n total number of cases, *BMI* body mass index (kg/m^2), *ASA* American Society of Anesthesiologists risk score

^a Values reported as median (range)

with blood loss averaging 153 ml (range 30–500 ml). Postoperative length of stay averaged 4.5 days (range 3–24 days) [Table 2].

Seventy-five percent (15/20) of patients were candidates for reanastomosis after transanal TME. All but one patient had a defunctionalizing loop ileostomy constructed. The majority of the anastomoses were straight, hand-sewn coloanal ($n = 11$); one was performed using an end-to-end anastomotic (EEA) stapling device. In the remaining cases ($n = 3$), an EEA device was used to construct a colonic-J-pouch-to-low-rectal anastomosis (Table 2).

There were no intraoperative complications, and there was no 30-day postoperative mortality. One patient, however, died suddenly, without prodrome 8 weeks after TAMIS–TME. The cause of death was determined to be acute pulmonary embolism. Postoperative surgical complications included wound infection ($n = 2$), pelvic abscess ($n = 4$), prolonged ileus ($n = 4$), and anastomotic leak ($n = 1$) (Table 2). All were managed conservatively and resolved without sequelae, except the anastomotic leak which necessitated re-operation with takedown of the coloanal anastomosis and construction of a permanent end colostomy. This anastomotic disruption was secondary to

Table 2 Intraoperative and postoperative characteristics of 20 consecutive patients who underwent transanal TME using the TAMIS approach

Characteristic	Value
Approach ^c	
Open + TAMIS–TME	3
Laparoscopic + TAMIS–TME ^c	11
Robotic-assisted + TAMIS–TME ^d	6
Anastomosis	
Coloanal—straight, hand sewn	11
Coloanal—straight with stapled 29-mm EEA device	1
Coloanal with colonic J-pouch (with stapled 29-mm EEA device)	3
None—end ileostomy	2
None—end colostomy	3
Operating time (min) ^a	243 (140–495)
Diversion (loop ileostomy) ^a	14 (93 %)
EBL (ml) ^a	153 (30–500)
LOS (days) ^a	4.5 (3–24)
Morbidity (n)	
Early morbidity	
Wound infection	2
Pelvic abscess	4
Prolonged ileus	4
Pneumonia	1
Acute renal failure	1
Anastomotic leak	1
Late morbidity	
Peri-anastomotic fluid collections	2
Anastomotic strictures ^b	4

EBL estimated blood loss, *EEA* end-to-end anastomotic stapling device, *LOS* postoperative length of stay as measured in days

^a Values reported as median (range)

^b Subclinical stricturing noted on physical exam, patients asymptomatic

^c Denotes which method was used for the abdominal portion of the operation, as well as variations in the approach to transanal TME. In all but the first two transanal TME cases, the GelPOINT[®] Path access platform (Applied Medical, Inc.) was used. The first two cases were performed using a SILS[™] Port (Covidien)

^d This includes one case in which robotic-assisted transanal surgery was performed (RATS–TME)

^e Includes one patient who had TAMIS-assisted APR

ischemia, most likely secondary to disruption of the blood supply to the proximal limb (e.g., descending colon). Therefore, the anastomotic leak rate was determined to be 6.7 % (1 out of the 15 patients who underwent anastomosis). The morbidity profile and variations in operative approaches are detailed in Table 2.

Table 3 Tumor characteristics of patients who underwent TAMIS–TME with curative intent for rectal cancer ($n = 20$)

Characteristic	Value
Distance from anal verge (cm) ^a	5 (1–9)
Tumor size (cm) ^a	3.5 (0.6–9.3)
Tumor location	
Circumferential	3
Anterior	7
Anterolateral	5
Posterior	2
Posterolateral	3
cTNM	
Stage I	2 (10 %)
Stage II	3 (15 %)
Stage III	15 (75 %)
TNM	
Stage 0	5 (25 %)
Stage I	3 (15 %)
Stage II	6 (30 %)
Stage III	5 (25 %)
Stage IV	1 (5 %)
TME grading	
Quirke 3	11 (55 %)
Quirke 2	6 (30 %)
Quirke 1	2 (10 %)
Unknown	1 (5 %)
Lymph node harvest ^a	22.5 (9–51)
Neoadjuvant treatment	17 (85 %)

cTNM clinical preoperative stage, TNM pathologic postoperative stage, TME quality of mesorectal envelope as graded by pathologist

^a Median (range)

Tumor characteristics and quality of oncologic resection for the 20 patients undergoing TAMIS–TME with curative intent is shown in Table 3. The tumor's median distance from the anal verge measured 5 cm (range 1–9 cm) with 12 lesions positioned anterior or anterolateral, 5 posterior or posterolateral, and 3 circumferential. The median tumor diameter was 3.5 cm (range 0.6–9.3 cm). The median number of lymph nodes harvested with transanal TME was 22.5 (range 9–51 nodes). Nodal harvest for patients with an underlying diagnosis of malignancy was ≥ 12 in 75 % (15/20), and of these patients, 80 % (12/15) had neoadjuvant chemoradiation. For patients with ≤ 12 nodes (range 9–11 nodes) harvested, all had received neoadjuvant chemoradiation (Table 4).

Of the patients who underwent resection for cancer, 90 % (18/20) had negative margins. Any margin ≤ 2 mm was considered a positive margin. Based on this criteria, there were 2 TAMIS–TME cases with positive margins: one patient had a 1-mm distal margin in a rectal tumor that

encroached on the anal canal, and another patient had a 1-mm circumferential resection margin (CRM) (Table 4).

Macroscopic pathologic grading of the TME specimen, including cross-sectional analysis, was done for all but one (19/20) patient who underwent TAMIS–TME with curative intent for rectal cancer. In the single case (1/20) in which the TME was not formally graded, it was noted by the pathologist that the mesorectal envelope “appeared to be intact.” However, macroscopic, cross-sectional examination was not performed, and therefore, the specimen was not properly evaluated. For this reason, the TME quality for this resection could not be determined. The analysis showed that 89.5 % (17/19) of transanal TME surgical specimens were graded as “completely intact” (Quirke 3) or “near-completely” (Quirke 2) intact mesorectal envelopes by a gastrointestinal (GI) pathologist. Only 2 out of 19 specimens (10.5 %) of graded specimens revealed an incomplete mesorectal envelope, due to defects ≥ 5 mm in the mesorectal envelope. In these 2 cases, the resection margins—distal and circumferential—were negative. Surgical specimen quality is detailed in Table 4.

Follow-up data revealed that there was 1 patient who developed distant metastasis. This occurred 9 months after surgery in case #4 (Table 4). Pathology for this patient who underwent TAMIS–TME revealed well-differentiated adenocarcinoma, staged ypT3N0. In this case, 0/17 lymph nodes were harvested and the mesorectal envelope was completely intact (Quirke 3). This patient did not have postoperative chemotherapy due to severe toxicity during neoadjuvant therapy. He successfully underwent curative-intent liver resection and remains under close surveillance. There were no other cases of recurrence detected during the study's 6-month median follow-up period (range 1–24 months).

Ileostomy closure was performed within the first 3 months after TAMIS–TME in 64 % (9/14) of patients who underwent diversion of the fecal stream. The remaining (5/14) were closed within 1 year. The principle reason for delay in ileostomy closure was the recommendation to start adjuvant chemotherapy without delay, and in selected cases, ileostomy reversal was postponed until adjuvant chemotherapy was completed and restaging workup revealed no evidence of disease recurrence. A telephone survey was conducted to assess fecal continence 8 weeks after ileostomy closure. Most patients stated they had mild fecal incontinence defined as less than one accident per day. One patient (case#4, Table 4) reported life-style-limiting incontinence, Cleveland Clinic Florida (Wexner) Fecal Incontinence Score 16, and this has not improved 12 months post-resection [16].

During the follow-up period, anoscopy, rigid proctosigmoidoscopy, and digital rectal examination were performed every 3 months. Physical examination revealed that

Table 4 Diagnosis and pathologic characteristics of 20 consecutive patients who underwent transanal TME (TAMIS–TME) for malignant disease

<i>n</i>	<i>G</i>	<i>BMI</i>	Diagnosis ^a	<i>CRT</i>	<i>cTNM</i>	<i>TNM</i>	<i>DV</i>	<i>Dia.</i>	<i>TME</i>	<i>LN</i>	<i>MAR</i>
1	M	37	Rectal adenocarcinoma ^b	Yes	T3N1	ypT0N0	7	4.5	Complete	0/29	Neg
2	F	31	Squamous cell adenocarcinoma	Yes	T4NX	ypT0N0	8	7.6	Complete	0/21	Neg
3	F	18	Low-grade (moderately differentiated) adenocarcinoma	Yes	T3N0	ypT2N0	2	4	Complete	0/42	Neg
4	M	35	Low-grade (well differentiated) adenocarcinoma	Yes	T3N1	ypT3N0	5	1.5	Complete	0/17	Neg
5	F	18	Low-grade (moderately differentiated) adenocarcinoma	Yes	T4N0	ypT4N0	5	3.5	Complete	0/9	Neg
6	M	27	Low-grade (moderately differentiated) adenocarcinoma	Yes	T4N2	ypT3N1b	4	1.1	Complete	2/11	Neg
7	M	20	Invasive adenocarcinoma	Yes	T3N2	ypT0N0	1	3	Complete	0/23	Neg
8	M	24	Low-grade (moderately differentiated) adenocarcinoma	No	T4N2	T4N0	6	9	Unknown ^c	0/14	Neg
9	M	22	Low-grade (moderately differentiated) adenocarcinoma	No	T2N0	T3N0	5	2.5	Complete	0/19	Neg
10	M	22	Rectal adenocarcinoma	Yes	T2N2	ypT0N0	4	3.5	Complete	0/22	Neg
11	M	21	Invasive mucinous adenocarcinoma	Yes	T3N2	ypT3N2b	1.2	3.5	Nearly complete	10/15	Pos ^d
12	M	32	Mucinous adenocarcinoma	Yes	T3N1	ypT3N1b	4	3	Nearly complete	3/9	Neg
13	F	36	Low-grade (moderately differentiated) adenocarcinoma	Yes	T4N1	ypT2N0	1	3.4	Nearly complete	0/35	Neg
14	M	23	Low-grade (moderately differentiated) adenocarcinoma	Yes	T3N2	ypT3N2b	2	9.3	Nearly complete	9/11	Pos ^e
15	M	24	Low-grade (moderately differentiated) adenocarcinoma	Yes	T3N2	ypT3N2aM1a	3.5	4	Complete	3/32	Neg
16	M	41	Low-grade (moderately differentiated) adenocarcinoma	Yes	T3N1	ypT3N0	9	4.5	Nearly complete	0/24	Neg
17	M	21	Low-grade (moderately differentiated) adenocarcinoma	Yes	T3N1	ypT3N0	7	5	Incomplete	0/19	Neg
18	F	19	Rectal adenocarcinoma on tubulovillous polyp	No	T2N0	T0N2a	5	1.8	Incomplete	5/51	Neg
19	F	25	Invasive adenocarcinoma ^b	Yes	T3N1	ypT0N0	4	4	Nearly complete	0/35	Neg
20	M	27	Low-grade (moderately differentiated) adenocarcinoma	Yes	T3N1	ypT2N0	7	0.6	Complete	0/11	Neg

n patient case number, *G* gender, *BMI* body mass index (kg/m²), *CRT* neoadjuvant chemoradiation, *cTNM* preoperative stage, *TNM* postoperative stage, *DV* distal most extent of tumor from anal verge (cm), *Dia.* diameter of tumor (cm), *TME* quality of mesorectal envelope as graded by pathologist, *LN* number of lymph nodes harvested, denoting fraction positive (+/total), *MAR* surgical margins, including distal and circumferential, *N/A* not applicable

^a Denotes final, post-resection pathology unless otherwise stated

^b Pathology based on initial endoscopic biopsy, in these cases, final pathology revealed complete sterilization

^c Unknown TME: The surgical specimen did not undergo proper pathologic assessment and the status of the TME could not be determined

^d 1-mm distal margin

^e 1-mm circumferential resection margin

4 patients had mild anastomotic strictures that were amenable to manual dilation. These were subclinical anastomotic strictures; operative intervention was not required. All 4 patients were asymptomatic.

The subset evaluation of 6 patients with obesity, defined as BMI ≥ 30 kg/m² (Table 5), revealed that all specimens were resected with negative distal and radial margins, intact TME, and a median lymph node harvest of 22.5. In this subset of patients, all transanal TME procedures were performed for the diagnosis of locally advanced mid- or distal-rectal cancer, and each patient treated had undergone neoadjuvant chemoradiation.

Discussion

TAMIS has proven to be of benefit for local excision of rectal neoplasia [4], and its versatility offers multiple applications beyond local excision [15], permitting an interface with ordinary laparoscopic, endoscopic [17, 18], or even robotic devices [19–24]. However, perhaps its most important application beyond local excision is transanal TME (TAMIS–TME). Transanal TME is a promising new approach to facilitate distal rectal mobilization, and thus represents an important area of innovation in rectal cancer surgery [1, 25]. Other pseudonyms have also been used to

Table 5 Patient characteristics and operative outcomes for transanal TME (TAMIS–TME) in a subset of patients with BMI ≥ 30 kg/m²

Case#	Age	G	BMI	OT	EBL	LOS	Diagnosis	CRT	cTNM	TNM	DV	SIZE	TME	LN	MAR
1	59	M	37	245	300	9	Low-grade adenoCA	Yes	T3N1	ypT0N0	7	4.5	Complete	0/29	Neg
2	44	F	31	450	200	5	Squamous cell carcinoma ^a	Yes	T4NX	ypT0N0	8	7.6	Complete	0/21	Neg
4	49	M	35	210	100	3	Low-grade adenoCA	Yes	T3N1	ypT3N0	5	1.5	Complete	0/17	Neg
12	44	M	32	160	50	4	Mucinous adenoCA	Yes	T3N1	ypT3N1b	4	3.0	Nearly complete	3/9	Neg
13	51	F	36	380	200	4	Low-grade adenoCA	Yes	T4N1b	ypT2N0	1	3.4	Nearly complete	0/35	Neg
16	69	M	41	255	250	8	Low-grade adenoCA	Yes	T3N1	ypT3N0	9	4.5	Nearly complete	0/24	Neg
<i>m</i>	50		35.5	250	200	4.5					6	4.5		22.5	

G gender, *BMI* body mass index (kg/m²), *OT* operating time, *EBL* estimated blood loss (ml), *LOS* length of stay (days), *CRT* neoadjuvant chemoradiation, *cTNM* preoperative, clinical stage, *TNM* postoperative, pathologic stage, *DV* distal most extent of tumor from anal verge, *TME* pathologist's grading of mesorectal envelop, *LN* lymph node harvest, including fraction positive for metastasis (+LN/total LN), *MAR* surgical margins, including distal and circumferential, *m* median, *AdenoCA* Adenocarcinoma

^a Vaginal squamous cell primary invading anterior rectal wall

describe transanal TME, most notably “transanal NOTES” and transanal endoscopic surgery (TES). However, these terms are somewhat confusing as transanal TME is not (as yet) a true NOTES procedure and it is not “endoscopic” either as the operation is performed outside of the rectal lumen.

Transanal TME is currently in its infancy, and in 2013, there are only $n = 72$ (human and cadaveric) cases which have been published in reports and small series worldwide [26]. The overall results have been quite encouraging, though—as in the case of any new technique—this new method should be approached with caution. Appropriate experience, training, and surgeon skill are required.

Here, we report our short-term results in a retrospective review of the first 20 patients who underwent transanal TME using the flexible TAMIS platform over a 32-month period. Oncologic data reveal that transanal TME using the TAMIS approach results in high-quality resections, and in this study, 89.5 % of specimens of rectal resections revealed completely or near-completely intact mesorectal envelopes. It is permissible to group these categories (complete and near-complete) together because data reveal that there is no significant difference between clinical outcome in these 2 subsets of TME-graded specimens, assuming radial and distal margins are negative [27].

Most early series and case reports on transanal TME report excellent results with regard to resection quality with negative margins and intact mesorectal envelopes [25, 26]. In our series, proper evaluation of the mesorectal envelope by an independent and experienced GI pathologist was mandatory in assessing TME quality, using the same standards set by the Dutch TME and CLASSIC trials [28,

29]. This included cross-sectional analysis of the fresh, macroscopic specimen in addition to assessing the gross specimen for the smoothness of the mesorectal envelope using methods standardized by GI pathologists [30]. Strict criteria for evaluating the mesorectal envelope were adhered to in this study, and margins were considered positive if they were ≤ 2 mm. This is based on established data that reveal that circumferential margins ≤ 2 mm exhibit clinical behavior similar to grossly positive margins [31]. Hence, in this study, one patient with 1-mm CRM was classified as having a positive margin. In this case, the lesion was a bulky 9.3-cm distal rectal tumor that exhibited a poor response to neoadjuvant treatment. The second patient had a 1-mm distal margin in a tumor 1 cm proximal to the dentate line. This patient is in a program of intense surveillance with proctoscopy, examination, and carcino-embryonic antigen (CEA) testing every 2 months. At 10-month follow-up, he remains disease free.

It is reasonable to assume that even expert pelvic surgeons will have some fraction of TME specimens which are not completely intact. The transanal approach may help minimize this and, in turn, could improve clinical outcomes as an incomplete TME has been shown to be an independent factor leading to diminished locoregional control, regardless as to whether or not negative margins (including CRM) are achieved [27]. Furthermore, the likelihood of locoregional recurrence with an intact mesorectal envelope, even with node-positive disease, is significantly lower than would otherwise be predicted, and this has been shown to be as low as 7.5 % [32]. Thus, achieving resection with an intact mesorectal envelope is paramount, especially for low-lying rectal cancers where the risk of local recurrence is higher

[30]. One plausible explanation for this may be that tumor deposits in the mesorectum can be discontinuous in nearly 60 % of specimens, and tumor spread often occurs in the outer one-third of the envelope [33]. In this series, the average lymph node harvest, including patients treated with neoadjuvant external beam radiotherapy, was 22.5 lymph nodes, and 75 % of specimens had ≥ 12 lymph nodes. All patients with malignancy who had <12 lymph nodes harvested had received neoadjuvant chemoradiation (long-course, 54 cGy external beam radiotherapy). This fits with known data which predicts a lower-than-expected lymph node harvest post-treatment [34, 35].

Perhaps the greatest advantage of transanal TME applies to the most difficult of all rectal cancer patients: namely, those with locally advanced distal tumors and anatomic constraints imposed by obesity and a narrow pelvis. The reason for this is that transanal access offers an in-line vantage point to the distal rectum, and with the aid of a gas-tight seal and pneumo-dissection, the “holy plane” for TME dissection is greatly simplified. This fundamental advantage has been highlighted by our group [2, 25] and Rouanet et al. [12] who have described excellent outcomes in 8 male patients with a BMI ≥ 30 kg/m². It is in this context that the transanal approach to TME allows for improved access to the distal rectum with significantly improved visualization and dissection, making it possible to perform a precise dissection, particularly of the distal portion of the mesorectal envelope. In our series, 6 obese patients (BMI ≥ 30 kg/m²) underwent transanal TME using the TAMIS platform. Data from this subset of patients revealed completely/near-completely intact mesorectal envelopes with negative margins in all cases, thereby supporting the use of transanal TME in the obese population.

Typically, morbidity and oncologic outcomes are predicted to be less favorable for tumors of the distal one-third of the rectum [36]. For this subset of operations, the 30-day morbidity is typically 30 % or higher [37]. Morbidity was significant in our small series, but there was no intraoperative morbidity, and the incidence of complication requiring re-intervention (i.e., anastomotic leak) was 6.7 %—1/15 patients who underwent TAMIS–TME with anastomosis. This result compares favorably to the anastomotic leak rate recorded in other series [38, 39].

Short-term oncologic outcomes with TAMIS–TME revealed that 1 out of 19 patients had evidence of recurrence (metastatic liver disease). This occurred despite pathology which demonstrated negative margins and a completely intact mesorectal envelope with final pathology revealing node-negative (0/17) disease. However, this patient was not eligible to receive adjuvant chemotherapy due to grade III toxicity encountered during neoadjuvant therapy. In this case, he represented with a solitary liver metastasis which was resected for cure, and he remains disease free at 5-month follow-up.

Transanal TME requires prerequisite training in advanced colorectal surgery, minimally invasive approaches, and dedicated experience using advanced transanal platforms, such as TEM, transanal endoscopic operation (TEO), or TAMIS. These platforms, coupled with minimally invasive approaches described here, can result in excellent oncologic outcomes. However, there is a potential risk to have worse outcomes, if the operating surgeon is not adequately trained. To date, formal training for transanal TME has not been established, and this will be necessary before the technique can be recommended for more general use.

Our study is limited by its retrospective nature, small number of patients, and short-term follow-up.

Conclusions

Transanal TME is an important application of the versatile TAMIS platform. TAMIS–TME is a feasible method for oncologic resection of locally advanced mid- and distal rectal cancer with curative intent. It has special applications for patients with obesity and anatomic constraints such as a narrow male pelvis. The same methods used in transanal TME for rectal cancer can also be effectively applied for benign disease, such as ulcerative colitis. Pathologist-led grading of the TME specimen is necessary for proper evaluation of the resection quality and should be performed routinely. Though initial results are promising, long-term data are required to determine the full utility of transanal TME. Finally, the appropriate training paradigm for transanal TME has yet to be established and this is strongly encouraged prior to widespread adoption of this technique.

Conflict of interest None.

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