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Original Research Article

Transanal total mesorectal excision achieves equivalent oncologic resection compared to laparoscopic approach, but with functional consequences

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ABSTRACT

Background: This study compared transanal total mesorectal excision (taTME) to laparoscopic total mesorectal excision (laTME) for the treatment of low rectal cancer. Adequacy of oncologic resection as well as postoperative outcomes were analyzed.
Methods: We retrospectively reviewed all proctectomy for low rectal cancer by a single surgeon at our institution from January 2014 to September 2019.
Results: There were 20 taTME and 30 laTME patients. TaTME patients had more distal tumors with no difference in pathologic resection margins or frequency of positive distal margin. Operative times were longer for taTME, but there were no differences in short-term outcomes or complications. TaTME patients had a higher rate of postoperative fecal incontinence.
Conclusion: TaTME may be a good option for the most distal tumors, when distal margins may be compromised. TaTME provides equivalent oncologic resection, but there is a higher incidence of postoperative fecal incontinence.

Introduction

Rectal cancer and its surgical management have been evolving in recent decades due to the development of new technology, revolutionary surgical techniques, and improved adjuvant medical therapy. Management of distal rectal cancers balances optimal oncologic resection with reestablishing intestinal continuity, while maintaining acceptable bowel function. Since Heald et al. described the technique of total mesorectal excision (TME) in 1982,[1] oncological outcomes, specifically decreased local recurrence, have improved.

The optimal surgical approach continues to be a debate with multiple studies comparing open versus laparoscopic techniques. Several multi-center randomized controlled trials[2,3] found similar outcomes for disease-free survival and overall survival when comparing open to laparoscopic TME (laTME). However, laTME has its share of challenges in terms of visualization, limited space in a narrow pelvis, risk of conversion, and it is technically challenging. First described by de Lacy and Sylla in 2010,[4] transanal total mesorectal excision (taTME), also referred to as the "bottom up" technique, has been developed to facilitate improvements in visualization, while ensuring better oncologic resections and maintaining bowel continuity.

The purpose of this study is to retrospectively review our initial experience and to compare taTME to laTME in the surgical management of distal rectal cancers. We sought to identify and describe oncologic outcomes, postoperative risk factors for failure as well as report on short- and long-outcomes. Primary outcome measures included adequacy of oncologic resection. Perioperative measures and postoperative complications were secondarily examined.

Methods

A retrospective cohort review was performed on patients with distal rectal cancer (<6 cm from anal verge) who underwent transanal or laparoscopic TME between January 2014 and September 2019. We included only cases performed by a single

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surgeon at our institution (Franciscan Health, Indianapolis, Indiana). This study was approved by our institutional research review committee and was exempt from Institutional Review Board review.

Patients were stratified into taTME or laTME groups based on review of operative reports. Baseline demographics, intraoperative, postoperative and follow up data were collected for both groups. Patients with Stage II or III disease underwent neoadjuvant chemoradiation prior to definitive surgical treatment. Patients who required multivisceral pelvic exenteration or abdominal perineal resections were excluded. Preoperative imaging included thoracic, abdominal and pelvic computer tomography (CT), pelvic magnetic resonance imaging (MRI) and/or endoscopic rectal ultrasound (ERUS). Tumor distance from the anal verge was measured by rigid or flexible sigmoidoscopy. Completeness of TME on pathological specimens was based on the Quirke grading system.[5] Complete TME is defined by smooth, intact mesorectum with no irregularities; near complete specimens contain some mesorectal irregularities; and incomplete specimens harbor large defects with decreased bulk of mesorectum around the specimen.

Postoperative complications were identified as events that prolonged the hospital course, required additional intervention, or resulted in hospital readmission. Complications were identified based on chart review of postoperative readmission and postoperative follow up visits. Short term complications occurring within 30 days of surgery were considered postoperative complications, and adverse events outside of the initial 30 days were included in long term outcomes.

Surgical technique

Both taTME and laTME included an abdominal approach performed with a hybrid laparoscopic and robotic method. The abdominal portion consisted of laparoscopic high ligation of the inferior mesenteric artery and vein, identification of the left ureter, and medialization of the entire left colon including complete splenic mobilization. In the pelvis, circumferential pelvic dissection (total mesorectal excision) was performed with robotic assistance or solely laparoscopic in a few cases. In laTME, the pelvic dissection was carried out to the level of the levator ani. In all but three cases, the specimen was transected with a laparoscopic/robotic linear stapler and a low anastomosis created utilizing a circular stapler from the anus. Three laTME patients were determined intraoperatively to have close distal margins and perineal intersphincteric dissection was performed to provide additional margin. An ultralow handsewn coloanal anastomosis was performed in these three cases.

With taTME, the distal portion of mesorectal dissection was done through the transanal port. A full thickness incision was made at the dentate line, incorporating the internal sphincter muscle. A purse-string suture was placed around the open rectum to prevent stool spillage. A Lone Star retractor (Lone Star Medical Products Inc.) was placed to efface the anus. Transanal insufflation was achieved with the GelPOINT Path Transanal Access Platform (Applied Medical Inc.) and AirSeal® iFS insufflator (Conmed Corp.). Laparoscopic or robotic dissection was continued in the intersphincteric plane in a “bottom up” fashion to complete the mesorectal dissection started in the abdomen. Meticulous dissection was performed with the aid of high definition optics to avoid injury to the urethra or prostate in males or vagina in females, as well as the autonomic nerves laterally. The specimen was extracted transanally followed by a hand sewn end-to-end coloanal anastomosis. If the specimen was bulky and unable to deliver transanally, our preference was to extract through a Pfannenstiel incision. A protective loop ileostomy was performed in all cases. Anastomotic healing was assessed prior to stoma closure with flexible sigmoidoscopy and gastrografin enema.

Statistical analysis

Continuous data were expressed as mean ± standard deviation. Quantitative data were analyzed with student t-test. Categorical data were analyzed by X^2or Fisher exact test. A p value less than 0.05 was considered statistically significant. Data were analyzed using Graphpad Prism 8 (San Diego, CA).

Results

Patient characteristics

A total of 50 patients with distal rectal cancer were included in this study: 20 taTME and 30 laTME patients. Patient demographics and clinical characteristics are shown in Table 1.

Intraoperative and pathological results

Tumor level in the rectum was significantly more distal in the taTME group (Table 2). However, there was no difference in pathologic distal resection margin or frequency of positive distal margin between laTME and taTME. Pathology reports commented on TME specimen quality in 16 taTME and 29 laTME patients. Within this group, complete TME was achieved in 15 (93.3%) taTME and 28 (96.5%) laTME patients. Incomplete TME (1 taTME) and near complete TME (1 laTME) specimens were also reported. Each group had one specimen with threatened CRM (<1 mm). Lymph node harvest was equivalent between groups.

Short and long term post-operative outcomes

Operative time and estimated blood loss (EBL) was greater in the taTME group (Table 2). Short term complications occurred in both groups (Table 3), but there were no differences in frequency of complications. On long term follow-up, taTME patients reported a significantly higher rate of postoperative fecal incontinence but equivalent rates of LAR syndrome (Table 4). Recurrence was reported in 1 taTME and 2 laTME patients. On long term follow up, there was one death in each group.

Table 1
Demographics and patient characteristics.

	taTME	laTME	p value
n	20	30	
Gender	15 (75%)	19 (63.3%)	0.5382
Male	5 (25%)	11 (36.7%)	
Female			
Age	61.4 ± 11.3	57.9 ± 10.9	0.2795
BMI	28.3 ± 5.2	28.7 ± 5.5	0.8179
ASA	2.5 ± 0.5	2.5 ± 0.5	0.9165
Clinical Stage	7 (35%)	6 (20%)	0.0105*
Stage I	9 (45%)	4 (13.3%)	
Stage II	4 (20%)	19 (63.3%)	
Stage III	0	1 (3.3%)	
Stage IV			
Preop T Stage	2 (10%)	1 (3.3%)	0.3611
T1	7 (35%)	6 (20%)	
T2	11 (55%)	22 (73.3%)	
T3	0	1 (3.3%)	
T4			
Neoadjuvant treatment	13 (65%)	24 (80%)	0.3266

Table 2
Operative and pathologic data.

	taTME	laTME	p value
n	20	30	
Distal tumor edge distance from anal verge (cm)	3.0 ± 2.0	4.6 ± 1.2	0.0032*
Operative time (min)	285.8 ± 52.9	255.7 ± 47.9	0.0425*
EBL (ml)	132.9 ± 63.4	96.6 ± 45.8	0.0248*
Conversion to open	1 (5%)	0	0.9999
Length of stay (days)	4.2 ± 2.6	4.7 ± 2.8	0.5196
Pathologic distal margin (cm)	1.1 ± 0.7	1.4 ± 1.1	0.4162
Positive distal margin	1 (5%)	2 (6.6%)	0.9999
Lymph node harvest	17.5 ± 1.6	18.2 ± 6.6	0.7456
Complete TME	15/16 (93.3%)	28/29 (96.5%)	>0.9999
Circumferential resection margin (mm)	9.1 ± 14.3	11.2 ± 6.4	0.5461

Discussion

Oncological margins are the most important prognostic component of any cancer resection. In rectal cancer, completeness of TME, circumferential resection margin (CRM) and distal margin are examined to determine an R0 resection. There were no differences in these measures of resection adequacy between taTME and laTME in our study. There was one patient in each group with less than complete TME on final pathology. This suggests that transanal TME does not compromise adequacy of TME dissection. Although the laTME group had more advanced disease due to significantly more node positive tumors, there was no difference in preoperative T stage stratification between the two groups. Depth of invasion may affect the ability to achieve clear CRM and negative distal margin, but there was not a significant difference between the groups. Despite taTME patients having significantly more distal tumor locations, there was no difference in the positive distal margin rate. During resection, we aimed for a distal margin of 1 cm on gross examination. If distal margin appeared threatened intraoperatively, we would attempt to achieve negative margin by converting to APR or performing perineal intersphincteric dissection with hand-sewn coloanal anastomosis. Three of the laTME patients had intersphincteric dissection to achieve negative distal margin.

In this study, all three of the positive distal margins had gross surgical margins of 1 cm or greater and failure of this negative margin was only discovered on final pathology. This included one taTME patient with both positive distal and circumferential margins. This patient had T2N0 disease on ERUS, but final surgical pathology showed T4aN1 disease. Retrospectively, preoperative MRI may have provided more accurate preoperative staging. This, in turn, may have allowed neoadjuvant chemoradiation to help clear the distal and circumferential margins. Alternatively, MRI findings may have prompted a change in surgical plan to abdominoperineal resection. In a recent publication from the International taTME Registry Collaborative, the incidence of positive CRM was 4%.[6] In comparison, reports on laparoscopic rectal cancer demonstrated a 7–10% positive CRM.[2,3] Risk factors for positive CRM included tumors located within 1 cm from the anorectal junction, anterior position, cT4 tumors, extra-mural venous invasion or positive CRM on MRI. Positive CRM appears to be more dependent on tumor-related factors rather than surgical technique.

Two male patients in our laTME group had positive distal margins on final surgical pathology. Both patients had preoperative measurements of distal tumor edge 2.5 cm from the anal verge. Both patients had grossly clear margins during surgery, but final pathology showed margin involvement. One of these patients had local recurrence at 18 months treated with APR, and the second patient was recurrence free with 8 months of follow up. In retrospect, we can only speculate whether taTME would have resulted in negative margins in these ultralow tumors.

Recently, the Norwegian taTME collaborative group published their experience with 157 patients describing significantly higher local recurrences with taTME in comparison to the national average (7.6% vs 2.4%, respectively).[7] They also found increased anastomotic leak rate. These findings together resulted in abandonment of the taTME technique in Norway. In contrast, Roodbeen et al. reported local recurrence following taTME of 3–4% and concluded that there was adequate loco-regional control.[8] We hope further insight will be provided by the ongoing Dutch COLOR III randomized control trial.[9] This multi-institutional trial compares taTME to laTME with endpoints of CRM, TME completeness, local recurrence, disease-free and overall survival with a projected long-term follow-up of 5 years.

Our study did not show a statistically significant difference in anastomotic leak rate between taTME and laTME. One taTME patient had an anastomotic dehiscence requiring completion APR and permanent colostomy and three laTME patients had pelvic abscesses requiring IR drainage. We presume these are caused by some degree of anastomotic leakage. One of these three patients with pelvic abscess ultimately required completion APR due to persistent leak. There were no reports of anastomotic strictures in either group. We acknowledge that our leak rate may be lower because we only included clinically significant leaks and all patients had protective loop ileostomy. Furthermore, small leaks at the taTME anastomoses are more likely to be subclinical because they occur extraperitoneal.

The cancer recurrence rate was equivalent between our groups: one patient (5%) with taTME and two patients (6.6%) with laTME. However, follow-up time was short (24.9 and 20.4 months). One

Table 3
Postoperative complications.

	taTME	laTME	p value
Pelvic abscess or anastomotic leak	1 (5%)	3 (10%)	0.6411
Readmit for dehydration	3 (15%)	6 (20%)	0.7244
Small bowel obstruction	1 (5%)	1 (3.3%)	>0.9999
Respiratory failure	1 (5%)	0	0.4000
Pulmonary embolus	1 (5%)	0	0.4000

Table 4
Long term outcomes.

	taTME	laTME	p value
Length of follow-up (months)	24.9 ± 12.7	20.4 ± 15.9	0.3085
LAR syndrome (diarrhea, urgency)	3 (15%)	2 (6.6%)	0.3772
Fecal incontinence	6 (30%)	2 (6.6%)	0.0427*
Cancer recurrence	1 (5%)	2 (6.6%)	>0.9999

taTME patient recurred 9 months after proctectomy with solitary hepatic metastasis and underwent successful resection. Two laTME patients had recurrences. One had a positive distal margin following initial resection and developed local recurrence at 18 months that was successfully salvaged with APR. Prior to the local recurrence, this same patient developed a solitary hepatic metastasis at 7 months that was successfully resected. The other laTME patient with recurrence had solitary liver metastasis diagnosed two months after proctectomy. Due to pulmonary complications following the initial surgery, the patient died before the recurrence could be addressed. In retrospect, this patient probably had occult liver metastases at the time of initial surgery despite negative preoperative imaging.

The few studies comparing functional outcomes of taTME and laTME show mixed results. Bjoern et al. demonstrated symptoms of buttock pain, diarrhea, clustering of stools, and urgency were worse in taTME versus laTME, while LAR syndrome score was equivalent.[10] A recent meta-analysis noted that while a large proportion of taTME patients experienced impaired postoperative bowel function, the frequency and nature of complaints were equivalent to the laTME cohort.[11] In the current study, we reported a higher incidence of fecal incontinence in taTME patients. This was not surprising since transanal dissection during taTME may affect continence. In addition, the taTME anastomosis was more distal than the laTME anastomosis although we did not formally measure this. We acknowledge that this is not a fair comparison since taTME required perineal dissection, whereas the majority of laTME did not. It is likely that perineal dissection leads to poor functional outcomes and not the TME technique itself. Functional complaints were self-reported in our patients without utilizing validated questionnaires. We recognize that the lack of validated questionnaires may underestimate the actual rate of functional bowel complaints. The majority of patients with functional complaints were managed conservatively without additional surgical intervention. Two of the taTME patients eventually underwent placement of sacral nerve stimulators with symptomatic improvement. None of these patients requested or required reestablishment of an ostomy.

While this study compares laTME and taTME, we acknowledge the inherent difficulty in comparing a purely abdominal approach with a technique that allows perineal dissection. Prior to the availability of the taTME platform, many of these patients may have attempted laTME with stapled anastomosis if feasible. Ultralow tumors may have required additional perineal dissection and many of these ultralow tumors may have gone directly to APR. However, the purpose of this study was not to show superiority of one technique over the other. We aimed to demonstrate that transanal TME is equally safe and effective for achieving completeness of oncologic resection. The differences we identified in terms of tumor height and functional outcomes suggest to us the rationale why we might choose one technique over the other. In other words, taTME may help achieve negative distal margin in the most distal tumors with the potential consequence of poor anorectal function.

We recognize several limitations in this study, including the retrospective nature and small sample size. The taTME group included all initial procedures by a single surgeon, and learning curve effects were incorporated into our outcomes. Because all procedures were performed by a single surgeon, these results may not be replicable. We previously mentioned lack of universal and standardized measurements of anastomotic leak and functional bowel outcomes, which may have resulted in lower positive findings. Lastly, we recognize the selection bias of favoring taTME for the most distal tumors. This inherently creates different subsets of patients between taTME and laTME. However, one of the goals of our study was to show equivalent technical resection between taTME and laTME irrespective of tumor location.

Conclusion

Transanal total mesorectal excision in distal rectal cancers achieves equivalent oncologic resection quality compared to laparoscopic TME. The predilection for more distal tumors in the taTME group is consistent with selection bias in this group. In other words, taTME may allow for a more generous distal margin and technical feasibility of reestablishing intestinal continuity in these extremely low tumors. However, the consequence of adding perineal dissection may result in a higher incidence of postoperative fecal incontinence.

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