Transanal total mesorectal excision for rectal cancer: Surgical outcomes and short-term oncological outcomes in a single-institution consecutive series

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Abstract

Introduction: Rectal cancer surgery is continuously evolving. Transanal total mesorectal excision (TaTME) is a relatively new surgical approach with possible advantages in comparison to current standard surgical techniques. Several studies in recent years have validated this approach regarding safety and effectiveness. We describe our initial experience with TaTME evaluating surgical parameters, post-operative outcomes and short-term oncological outcomes.

Methods: This is a retrospective study reviewing all patients who underwent TaTME in a single institution from May 2015 to April 2018.

Results: The cohort included 25 patients with an average age of 60.4 (range: 40–86), of which 13 (52%) patients were male. The average body mass index was 26.1. The overall 30-day morbidity rate was 40%, with 20% (five cases) being severe complications, defined by Clavien–Dindo Grade of 3b or above. There were three major intraoperative complications. Four cases (16%) required reoperation during the first 30 post-operative days. The median length of stay was 8 days. The surgery duration was on average 296 min (range: 205–510). Negative resection margins were achieved in all patients. At a median follow-up period of 14 months, there were no local recurrences, and 4 cases (16%) had a distant recurrence.

Conclusion: This study describes our initial experience with TaTME, which requires a substantial learning curve to minimise complications and morbidity. Oncological outcomes as expressed by the resection margins, number of lymph nodes harvested and local recurrence rates were all comparable to previously published data.

Keywords: Minimally invasive rectal surgery, rectal cancer, transanal total mesorectal excision

INTRODUCTION

Colorectal cancer is the third most common cause of cancer death in the United States in women and the second leading cause of death in men in spite of medical progress and new surgical techniques.[1–3]

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Surgery still serves as the mainstay of treatment of colorectal cancer.

Rectal cancer can be challenging for the surgeon – an anatomic locale often presenting technical difficulties that must be overcome, particularly in obese patients, and those patients, often male, that may have a narrow pelvis, thus limiting available workspace. This may constrain the surgeon’s ability to safely excise the rectum and its mesentery, while at the same time, maintain crucial surgical oncological principles such as clear distal and radial margins, complete and intact total mesorectal excision (TME) and avoiding injury to surrounding structures. Hence, it is not surprising that many efforts have been made over the past years to facilitate rectal surgery and improve oncologic outcomes. TME was first described in 1982 by Heald[4] and is now considered the gold standard for treating middle and lower third rectal cancers. This technique, which entails autonomic nerve-sparing dissection in the avascular plane around the mesorectum, has improved local control and enhanced survival. A complete TME with no violation of the mesorectal fascia is associated with low (4%–10%) pelvic recurrence rate.[5] In order to overcome the limitations of the open low anterior resection (LAR) of the rectum with TME, laparoscopic or robotic approaches were developed and gained wide acceptance.

Concerns have arisen with the laparoscopic approach for LAR-TME, specifically the ability to obtain clear distal and radial margins, and an intact TME, as compared to open surgery. This includes a perceived risk of technical compromise due to the inflexibility of the instruments used during laparoscopy deep in the pelvis. The ‘ALaCaRT’ randomised trial has failed to establish non-inferiority of laparoscopic resection compared to open resection for adequacy of cancer clearance and that study concluded that currently there is not sufficient evidence for the routine use of laparoscopic surgery for rectal cancer.[6] A recent meta-analysis has reached similar findings and concluded that the risk for a non-complete TME is significantly higher amongst patients undergoing laparoscopic resection compared to open resection.[7]

By contrast, the COlorectal cancer Laparoscopic or Open Resection (COLOR) II trial has demonstrated improved short-term outcomes and similar long-term outcomes after laparoscopic resection of rectal cancer, compared with open resection.[8] The limitation of inflexibility of laparoscopic instruments can be corrected by the robotic approach using articulated instruments. However, another important limitation of both minimally invasive approaches is the length of the distal staple line. In open surgery, a 30-mm stapler is applied safely over the distal resection line following LAR-TME in over 90% of the cases. In minimally invasive surgery (MIS) approaches, stapling across the distal rectum can only be performed in an oblique manner, creating an average staple line of 80–90 mm.

In order to overcome both limitations of MIS LAR-TME, the TA-TME approach was developed by de Lacy et al. in 2013.[9] In this approach, adopted from open transabdominal-transanal approach used by open surgeons for low rectal cancer, the distal resection is performed transanally and the mesorectal dissection is done in a bidirectional manner, both transanal and transabdominal concurrently.

The possible advantages of transanal total mesorectal excision (TaTME) include easier access and visualisation of the pelvis, improved TME quality, improved and controlled distal histological margins, improved radial margins, increased sphincter preservation, enhanced recovery and decreased morbidity.[10-12]

Recent studies have indicated the non-inferiority of this technique in comparison to laparoscopic, open LAR-TME and/or robotic LAR-TME.[10-12]

This study describes a single-institution consecutive series of rectal resections with TaTME. We looked at surgical parameters including intraoperative complications and length of surgery, post-operative outcomes, pathological results and short-term oncological outcomes.

**METHODS**

This is a retrospective analysis of a colorectal surgery prospectively maintained database. Patients who underwent LAR by TATME for rectal cancer or inflammatory bowel disease (IBD) at our institution, a high-volume colorectal centre, between 2015 and 2018 were included in the study. The study was approved by the Independent Ethical Committee (Helsinki Committee, SMC-5884-19). Pre-operative, operative and post-operative clinical data were extracted from the electronic medical records and the computerised colorectal database. Pre-operative data included patient characteristics including age, gender, tumour location (distance from the anal verge), co-morbidities, pre-operative chemoradiation administration, tumour staging (using the Union for International Cancer Control [UICC]-American Joint Committee on Cancer [AJCC] Staging Manual eighth edition), serum albumin, haemoglobin and tumour
markers (carcinoembryonic antigen and CA-19-9) as well as family history of colorectal diseases, body mass index (BMI) and American Society of Anaesthesiologists level.

Operative data included anastomosis height and type, drain placement, procedure duration, intraoperative complications, estimated blood loss (EBL) and proximal diversion creation.

Post-operative data included 30-day morbidity and its classification according to the Clavien–Dindo (CD) grading system,[13,14] early re-admission rate, length of stay (LOS), time to ostomy function and time to initiating enteral feeding.

Pathology results were reported and reviewed including tumour staging according to the UICC-AJCC (eighth edition) tumour, node and metastasis (TNM) system[15] and the status of surgical margins, the presence of mucin, lymphovascular invasion and perineural invasion.

Finally, we evaluated short-term oncological outcomes, particularly rates of pelvic or distant recurrence, time to recurrence and overall disease-free survival.

Surgical technique
All procedures were done by two board-certified (MV and LS) experienced colorectal surgeons. Both underwent a formal TaTME course, and a specific institutional protocol for the procedure was generated before the first procedure. The TaTME technique has been previously described at length. Briefly, we used a two-team approach with two separate working fields: abdominal and perineal. The patient was placed in a high lithotomy position and the procedure commenced with the abdominal team, with the transanal team joining later.

The transabdominal part of the procedure was laparoscopic or open, and included the routine traditional steps of LAR, separating the mesocolon from the left retroperitoneum, dissection and high ligation of the inferior mesenteric artery and vein, mobilisation of the descending colon along the line of Toldt including full splenic flexure mobilisation and upper pelvic dissection along the presacral space, pelvic sidewalls and separating the pelvic peritoneal reflection along the anterior aspect of the rectum. Sympathetic and parasympathetic nerves were identified and preserved. The anterior dissection plane was anterior to the Denonvilliers' fascia.

The transanal dissection started by placing a Lone Star® retractor (CooperSurgical Inc., Trumbull, CT, USA) through which a transanal MIS single-port device (GelPort®, Applied Medical, Santa Margarita, CA, USA) was placed transanally, an AirSeal®, iFS (ConMed Inc., Utica, NY, USA) insufflation system used, CO₂ was insufflated until a pressure of 12 mmHg was reached in the rectum. A scope was inserted visualising the distal edge of the tumour, and a purse-string suture was placed distal to the tumour in order to occlude the lumen, ensure clear distal margins and minimise tumour cell shedding with possible contamination. A circumferential line of dissection was made along the rectal mucosa just distal to the stitch using a monopolar energy device after which a full-thickness circumferential incision of the rectal wall was performed.

The mesorectum was then dissected circumferentially in a retrograde fashion and continued cranially to communicate with the transabdominal dissection and complete the bidirectional TME. The specimen was then extracted through the anus, the colon was separated proximally at the level of the descending colon and a tension-free coloanal anastomosis was constructed using either a hand-sewn technique or with a circular stapler. A diverting loop ileostomy was performed at the discretion of the operating surgeon.

Statistical analysis was performed using the SPSS statistical package (version 23.0; SPSS Inc., Chicago, IL, USA). Descriptive statistics were produced using frequencies (N, %) for categorical variables and means, standard deviations, medians and ranges for continuous variables.

RESULTS

Pre-operative data
The cohort included 25 patients with an average age of 60 years (range: 40–86 years), of which 13 (52%) were male. The average BMI was 26.1 (range: 19–34) [Table 1].

Twenty-one patients were operated on for low and middle rectal cancer, two patients for benign rectal pathology and two patients underwent proctectomy due to IBD.

The tumour was located at the distal rectum in 10 patients, while in 12 patients, it was located in the middle rectum. Two cases with ulcerative colitis were included in the cohort.

Eighteen of the 21 patients with rectal cancer were treated with neoadjuvant chemoradiation before the surgery.

Operative characteristics
The abdominal part of the procedure was done with total laparoscopy in 22 cases (88%), while two additional
cases were converted to an open approach and only one case was conducted as open approach from the start [Table 2].

In 23 (92%) cases, a proximal diverting loop ileostomy was created. Stapled anastomosis was done in 20 cases (80%) versus 5 cases (20%) of hand-sewn anastomosis. The mean surgery duration was 296 min (range: 205–510). The mean EBL was 192 cc. A drain was placed in the pelvis in 92% of the cases. There were three instances of intraoperative complications including a single case of urethral injury and two cases of rectal wall perforation.

Both urethral injury and rectal wall perforation occurred in an obese male patient with a locally advanced anterior distal rectal tumour. Pre-operative magnetic resonance imaging demonstrated a circumferential resection margin (CRM) of <1 mm. The patient underwent neoadjuvant chemoradiation therapy and decided to postpone his surgery for 5 months after completion of his radiation treatment. Technical difficulties, specifically in developing the anterior plane due to fibrosis between the prostate and anterior plane, resulted in urethral injury and rectal wall perforation. Once the urethral injury was suspected, blue dye (indigo carmine) was injected with a leak demonstrated in the prostatic urethra. This injury was treated conservatively by long-term Foley catheter drainage until complete resolution.

The second instance of an intraoperative complication included two small rectal wall perforations during dissection resulting in local contamination due to faecal spillage. This entailed substantial irrigation and drainage that subsequently required conversion to an open approach. Postoperatively, an anastomotic leak was observed and verified by computed tomography scan with contrast enema. The patient required prolonged hospital stay and additional operative procedures. A third case was characterised with difficult mesorectal excision during the abdominal laparoscopic approach for mandated conversion to an open approach. Initially, anastomosis was found to be ischemic in the first procedure. The anastomosis was taken down, and a new anastomosis was performed. However, the second anastomosis leaked and the patient also had a prolonged hospitalisation due to the anastomotic leak and eventually had to have a permanent end colostomy.

### Post-operative outcomes

There was no post-operative mortality in 30 days. The overall 30-day morbidity was 40%. This included five cases of severe complications (CD Grade 3b or higher) due to anastomotic leaks. Four of those patients were re-operated as a result of these leaks.

The mean length of hospital stay was 8 days (range: 4–15 days). However, there were six cases of re-admissions within the first 30 days after surgery which resulted in overall prolonged hospital stay.

Enteral feeding was commenced on post-operative day 2.8 on average (range: 1–8) days.

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**Table 1: Patient demographic and pre-operative characteristics**

| Parameter                               | TaTME (n=25) |
|-----------------------------------------|--------------|
| Gender                                  |              |
| Female                                  | 12           |
| Male                                    | 13           |
| Age                                     |              |
| Average                                | 60.4         |
| Median                                  | 61           |
| SD                                      | ±11.128      |
| Range                                   | 40-86        |
| BMI                                     | 26.1, range 19-34 |
| ASA score                               |              |
| 1                                       | 0            |
| 2                                       | 11           |
| 3                                       | 13           |
| 4                                       | 1            |
| Co-morbidities (%)                      |              |
| Hypertension                            | 24           |
| Diabetes                                | 20           |
| Steroid use                             | 4            |
| Neoadjuvant chemoradiation (%)          | 72           |
| Tumour distance from anal verge (mean) cm | 7.27, range 3-17 cm |
| Pre-operative albumin (mean) g/dl       | 4.12, range 3-4.6 |
| Family history of GI cancer (%)         | 16           |
| Elevated tumour markers (%)             | 28           |
| High CEA (≥5 ng/mL)                     | 16           |
| High CA 19-9 (U/mL)                     | 8            |
| Previous abdominal surgery (%)          | 20           |
| Laparoscopic                            | 12           |
| Open                                    | 8            |

**Table 2: Operative characteristics**

| Parameter                               | n (%)        |
|-----------------------------------------|--------------|
| Surgical technique                      |              |
| Laparoscopic                            | 22 (88)      |
| Open                                    | 1 (4)        |
| Laparoscopic to open                     | 2            |
| Intraoperative complications             | 3 (12)       |
| Surgery duration (min) - mean, range    | 296 (205-510) |
| EBL - mean (cc)                         | 192          |
| Proximal ostomy                         | 92           |
| Anastomosis type                        |              |
| Stapled                                 | 20 (80)      |
| Hand sewn                               | 5 (20)       |
| Drain                                   | 23 (92)      |
| Ostomy created                          | 23 (92)      |

EBL: Estimated blood loss
Pathology reports demonstrated 100% clear proximal, distal and radial margins and a mean of 18 lymph nodes harvested (range: 5–45). According to the UICC-AJCC (eighth edition) TNM staging system, there were 2 cases of N2, 8 cases of N1, 11 cases of N0, 10 cases of T3, 7 cases of T2 and 2 cases of T1 [Table 3].

At a median follow-up time of 14 months (range: 1–29 months), there were no cases of local recurrence documented. Four patients had distant recurrences in the follow-up period, with a median disease-free survival of 13 months.

**DISCUSSION**

Rectal cancer surgery is steadily moving away from open surgery into MIS. The narrow and deep working space in the pelvis can limit the surgeon's success in achieving complete mesorectal excision with clear distal and radial resection margins using laparoscopic or robotic approach.

TaTME was developed to overcome the technical difficulties related with minimally invasive rectal cancer surgery, using the natural opening of the anal canal which may allow better exposure and better rectal dissection and potentially better low colorectal anastomosis. The ability to dissect the mesorectum in a bidirectional mode overcomes the limitation of the laparoscopic instruments in the lower pelvis while the ability to perform an end-to-end, stapled or hand-sewn anastomosis with a single suture staple line may offer a safe and fast MIS approach to rectal cancer.

In this study, we describe our initial experience with TaTME evaluating surgical parameters, post-operative outcomes and mid-term oncological outcomes.

Our results suggest that TaTME is a feasible technique with acceptable oncological outcome as demonstrated by a 100% negative margin rate with a mean number of 18 lymph nodes harvested, similar to other previous publications.[8,11,12] During the median follow-up time of 14 months, our patients had 4 cases of distant metastasis with no cases of local recurrence.

On the other hand, we encountered a relatively high post-operative complication rate (40%) with 20% severe complications (anastomotic leaks) which also led to urgent reoperations in 16% of cases. This may be a result of the complexity of the procedure and a part of the learning curve. It is also may be related to poor patient selection.

However, our complications rate was similar to other reported studies such as the COLOR II study[8] in which intraoperative complications of both open and laparoscopic surgeries were 14% and 12%, respectively, and the post-operative complication rate was 40% and 37% in laparoscopic and open surgeries, respectively. That study reported a 10%–13% leak rate and a 15%–16% re-intervention rate using more conventional surgical technique such as open LAR and laparoscopic TME. An international TaTME registry which reviewed 720 patients reported an overall morbidity of 32.5%.[16] Similar results were observed by Perdawood et al.[12] reporting no differences in terms of post-operative morbidity according to the CD classification when comparing between laparoscopic, open and transanal TME.

The pioneers of TaTME did show encouraging results in a series of 140 patients,[11] with acceptable morbidity and with a median follow-up time of 15.1 months. In this cohort, the distant recurrence rate was 6.1% with one case (0.8%) of pelvic recurrence.

In a systematic review from 2016 examining 794 patients who underwent TaTME,[17] the overall complication
The high complication rate observed in the current series is a product of a natural learning curve of a new and complex surgical approach as well as form poor patient selection. Koedam et al. reported a learning curve of at least 20–25 cases of TaTME before an evident improvement in post-operative outcomes, assuming that the surgery is being performed by a colorectal surgeon experienced with laparoscopic LAR and open LAR. Before initiating TaTME within our institution, surgeons completed a certified TaTME course, an institutional comprehensive TaTME protocol was generated, dedicated operating room nurses were specifically trained for the procedure by the surgeons and a whole operating room day was reserved for each TaTME case. However, in the early phase of implementation of such complex surgical technique, we should have selected easier cases.

The vast majority of the major complications in this current cohort occurred amongst the first half of our cohort. Careful patient selection is essential for achieving optimal results and minimising morbidity.

Our study has limitations. First, it is based on a relatively small cohort, which also was the first case of TaTME in our institution and the first cases done by our surgeons, thus incorporating the steep learning curve associated with complex surgical procedures. Second, the data were gathered retrospectively based on a prospectively maintained database with data completion from the electronic medical records, so inaccuracies may exist. In addition, our cohort was not homogeneous: four patients were operated for a non-cancerous, benign disease and 2 for IBD.

Post-operative quality of life, bowel function and genitourinary function were not included in this report. Hence, we cannot comment on this important aspect of surgical outcomes.

To date, there are very little available data on quality of life post-TaTME.\[1\]

**CONCLUSION**

TaTME is a feasible surgical technique with acceptable oncological outcomes that might be a valid alternative to the open, robotic or laparoscopic approaches for treating rectal cancer, albeit requiring training and experience to perfect. Patient selection for such complex procedure is essential for success.

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**Conflicts of interest**

There are no conflicts of interest.

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