

Received Date : 09-Nov-2015

Revised Date : 16-Feb-2016

Accepted Date : 02-Mar-2016

Article type : Original Article

A two centre experience of transanal total mesorectal excision

Nicolas C. BUCHS¹ MD, Greg WYNN² MD, Ralph AUSTIN² MD, Marta PENNA¹ MD, John M. FINDLAY^{1,3} MRCS, Alexander L. A. BLOEMENDAAL¹ MD PhD, Neil J. MORTENSEN¹ MD, Chris CUNNINGHAM¹ MD, Oliver M. JONES¹ DM FRCS, Richard J. GUY¹ MD, Roel HOMPES¹ MD.

¹Department of Colorectal Surgery, Churchill Hospital, Oxford University Hospitals, Oxford, UK.

² ICENI Centre, Colchester Hospital University Foundation Trust, Colchester, UK.

³NIHR Oxford Biomedical Research Centre, Churchill Hospital, Oxford, UK.

Correspondence to:

Roel Hompes, MD

Department of Colorectal Surgery

Churchill Hospital, Oxford University Hospitals

Old Road, OX3 7LE, Oxford, UK

roelhompes@gmail.com

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process which may lead to differences between this version and the Version of Record. Please cite this article as an 'Accepted Article', doi: 10.1111/codi.13394

This article is protected by copyright. All rights reserved.

Disclosures: Greg Wynn, Ralph Austin and Roel Hompes are regular faculty members for TAMIS courses sponsored by Applied Medical, Surgique and Medtronic. The other authors have no financial disclosures.

ABSTRACT

Aim: Transanal total mesorectal excision (TaTME) offers a promising alternative to the standard surgical abdominopelvic approach for rectal cancer. The aim of this study was to report a two centre experience of this technique, focusing on the short-term and oncological outcome.

Method: From May 2013 to May 2015, 40 selected patients with histologically proven rectal adenocarcinoma underwent TaTME in two institutions and were prospectively entered on an online international registry.

Results: Forty patients (80% male, mean body mass index (BMI) of 27.4 kg/m²) requiring total mesorectal excision underwent TaTME. Procedures included low anterior resection (n=31), abdominoperineal excision (n=7), and proctocolectomy (n=2). A minimally invasive approach was attempted in all the cases, with three conversions. The mean operation time was 368 minutes and 16 patients (40%) had a synchronous abdominal and transanal approach. There was no mortality and 16 postoperative complications occurred all of which 68.8% were minor. The median length of stay was 7.5 (3-92) days. A complete or near-complete TME specimen was delivered in 39 (97.5%) cases with a mean number of 20 lymph nodes harvested. R0 resection was achieved in 38 (95%) patients. After a median follow-up of 10.7 months, there were no local recurrences and six (15%) patients had developed distant metastases.

Conclusion: TaTME appears to be feasible, safe and reproducible, without compromising the oncological principles of rectal cancer surgery. It is an attractive option for patients for whom laparoscopy is likely to be particularly difficult. These encouraging results should encourage larger studies with assessment of long-term function and the oncological outcome.

KEYS WORDS: Transanal – TME – bottom up – laparoscopy – robotic – outcomes – rectal cancer.

What does this paper add to the literature?

Transanal total mesorectal excision seems to offer a promising alternative to standard dissection for rectal cancer. However, data are still scarce and most reports come from single institutions.

We report one of the largest two-centre studies assessing the initial results of transanal total mesorectal excision for rectal cancer. Whilst the patients were selected, the outcome is encouraging and provides further evidence of the feasibility and safety of the procedure. In addition, we demonstrate that these results are reproducible without compromising the oncological principles of resection.

INTRODUCTION

Transanal total mesorectal excision (TaTME) may have the potential to revolutionize surgery for low rectal tumours [1]. In particular, it may overcome the main technical difficulties of TME performed from the abdomen, especially when dealing with a low tumour in a male or obese patient [2]. While good results have been reported for laparoscopic low anterior resection (LAR) for many years [3], there are still significant technical difficulties, which may in part explain the low rate of adoption of laparoscopic surgery for low rectal cancer [4]. The possibility of an incomplete resection with

This article is protected by copyright. All rights reserved.

positive margins [5] may have discouraged laparoscopic low anterior resection. Consequently, surgical approaches for low rectal cancer continue to be a priority for technical innovation.

TaTME is largely inspired by the transanal transabdominal approach (TATA), transanal minimally invasive surgery (TAMIS), and natural orifice transluminal endoscopic surgery (NOTES). Since the first reports [6, 7], a few studies have demonstrated TaTME to be feasible and safe [8-11]. Improvement in the short-term outcome have been reported when compared with laparoscopic low anterior resection (LAR)[12-14]. This, combined with the potential to perform a more oncologically secure local resection [14], makes TaTME particularly attractive for patients with a tumour that is difficult to perform via a conventional pelvic approach.

At present experience is limited to a few centres, and the published results have often been given without information on the oncological outcome. In this study the results of two centres performing TaTME have been combined with the aim of reporting the short-term surgical and the medium-term oncological outcome.

METHOD

From May 2013 to May 2015, 40 selected patients with a histologically proven rectal adenocarcinoma underwent a TaTME in two institutions and were prospectively recorded on an online international registry (www.lorec.nhs.uk). A preliminary report of 17 patients with oncological TaTME was recently published [8]. The present study is an updated series combining the experience of two centres with early cancer specific follow-up. Twenty-six (65%) patients underwent TaTME at the Department of Colorectal Surgery, Oxford University Hospitals (UK) and fourteen (35%) at the ICENI Centre, Colchester Hospital University Foundation Trust (UK). The procedures were performed by colorectal surgeons with experience in open and laparoscopic TME, perineal procedures,

transanal endoscopic microsurgery (TEM), and TAMIS. This observational cohort study was approved by the local Institutional Review Board and informed consent was obtained from all patients.

Patient selection

As previously described [8], eligibility criteria included elective patients with mid and low rectal adenocarcinoma requiring TME. Otherwise, the only selection criterion was the availability of two colorectal consultants for the procedure. Patients with advanced local disease (T4), emergency presentation and major comorbidity precluding a laparoscopic approach were not included and underwent an open procedure. Patients who underwent TaTME for a benign condition were also excluded.

All patients had a standardised approach to preoperative evaluation including digital rectal examination, rigid sigmoidoscopy, total colonoscopy, pelvic magnetic resonance imaging (MRI), computed tomography (CT) of the thorax, abdomen and pelvis and measurement of the carcinoembryonic antigen (CEA) serum concentration. They were all discussed in a multidisciplinary team (MDT) meeting which included colorectal surgeons, radiologists, medical oncologists, radiation oncologists, pathologists and specialist cancer nurses.

Neoadjuvant chemoradiation (50.4 Gy and Capecitabine for 6 weeks) was given in selected patients usually on the basis of a preoperative MRI indicating a threatened or involved (less than 1 mm) circumferential resection margin (CRM). Following neoadjuvant treatment, patients underwent repeat staging with MRI before surgery at 10 to 12 weeks after the completion of radiotherapy.

Surgical technique

All patients received a phosphate enema (Colchester) or mechanical bowel preparation (Oxford) before surgery. Standard perioperative antibiotic prophylaxis was given. Patients were placed in the Lloyd-Davies position. The rectum was irrigated with dilute chlorhexidine or iodine solution immediately before surgery.

The procedure commenced with the abdominal phase, with laparoscopic division of the inferior mesenteric artery and vein (high tie). After full mobilization of the left colon and splenic flexure, mesorectal dissection was initiated from above. The anterior dissection was usually limited to incision of the peritoneal fold, but the posterior dissection continued posteriorly down to Waldeyer's fascia. A gauze swab was placed posteriorly and the perineal phase then commenced. Later in the experience, a synchronous approach was used. The location of the posterior junction between the perineal and abdominal dissection could therefore vary.

For the perineal phase, a Lone Star Retractor System (CooperSurgical Inc, Trumbull, CT, USA) was used. For tumours located within one centimetre of the puborectal sling, a variable intersphincteric dissection with a hand-sewn colo-anal anastomosis was performed. The intersphincteric dissection was extended cranially up to the level of the puborectal sling and the rectum closed with a monofilament 2/0 purse-string suture. For higher tumours, the rectum was occluded below the tumour with an endoluminal purse-string. After a washout with dilute chlorhexidine or iodine solution, the single port platform was inserted. A pneumopelvis was created with carbon dioxide at a pressure of 10-12 mmHg. A glove port was used for the initial few cases at Oxford, but thereafter the GelPOINT Path Transanal Access Platform (Applied Medical) and the Airseal insufflator (SurgiQuest Inc, USA) were routinely used at both centres. After full thickness circumferential division of the rectal wall, the mesorectal plane was identified posteriorly in the 5 or 7 o'clock position allowing initial dissection in the posterior plane before being extended to the anterior and lateral aspects.

An abdominoperineal excision (APE) was performed via a similar approach when a coloanal anastomosis was not considered suitable. A complete description of the technique was recently published[15]. Transection of the proximal colon and mesocolon were completed following exteriorization of the specimen transanally with a wound protector or through another abdominal incision, depending on the bulk of the specimen. Depending on the location of the tumour, the anastomosis was conducted either by a hand-sewn coloanal or double purse-string side/end-to-end stapled technique[16]. A diverting stoma was routinely performed and a suction drain placed deep in the pelvis.

Conversion was defined as the need to complete a minimally invasive procedure by open surgery. Morbidity included all complications occurring during the hospital stay or within 30 days after discharge and was graded according to the Clavien-Dindo classification[17]. CRM involvement was defined as the presence of tumour cells located at $\leq 1\text{mm}$ from the circumferential margin on histopathological assessment [9].

Follow-up in accordance with local protocols involved performing a clinical examination, tumour markers, endoscopy and radiology. Local recurrence was defined as radiologically and/or biopsy-proven tumour within the pelvis. Distant recurrence was defined as radiological evidence of tumour away from the locoregional area of the primary tumour [9].

Overall survival and the cumulative incidence of local or distant recurrence were calculated using the Kaplan–Meier method. The numbers at risk were plotted using R v3.0.2 (R Foundation for Statistical Computing 2013), the survMiscv0.4.2 (R package version 0.4.2., 2014) and the gg2tool packages.

RESULTS

Patient characteristics

During the study period, 40 patients from two institutions underwent TaTME (Table 1) including 32 (80%) males. The mean age of all patients was 64.4 +/- 10.2 years and the mean body mass index (BMI) was 27.4 +/- 4.9 kg/m². Fifteen (37.5%) patients were overweight (BMI 25-29.9 kg/m²) and twelve (30%) were obese (BMI >30 Kg/m²). The median American Society of Anesthesiologists (ASA) score was 2 (1-4). The median distance between the tumour and the anorectal junction was 3 (0-10) centimetres. In seven (17.5%) patients the CRM appeared involved on the pre-operative imaging. Twelve (30%) patients received preoperative neoadjuvant chemoradiotherapy. Six (15%) patients had previously undergone another procedure: TEM (n=2), colostomy (n=1), subtotal colectomy (n=1), transurethral prostatic resection (n=1), and pelvic radiotherapy for cervical cancer (n=1).

Peri-operative outcomes

Thirty-one (77.5%) patients underwent LAR with TME. Seven (17.5%) had a standard or extralevator APE. The remaining two patients underwent total proctocolectomy for rectal cancer with synchronous colonic tumours (Table 2). A stoma was performed in all patients, which was defunctioning in 77.5%. The initial surgical approach was minimally invasive in all the cases either laparoscopic or robotic. Three (7.5%) patients required conversion to open surgery. In one this was due to bleeding from the pelvic side wall that could not be controlled transanally, one had dense abdominal adhesions and in the remaining patient there was limited access to the rectum owing to a narrow pelvis. In the latter, the initial intention was to perform a completely laparoscopic low anterior resection (LAR), but this was converted to open and subsequently successfully converted to a transanal approach.

The mean operation time was 368.6 +/- 101.7 minutes. A synchronous approach was carried out in 16 (40%) patients. The specimen was extracted transanally in 24 (60%). Two intra-operative complications occurred, both involving pelvic bleeding during the transanal dissection, which required conversion in one case (discussed above). There was no postoperative mortality. Overall, there were 16 postoperative complications. Most (68.8%) were Clavien-Dindo Grade I or II (Table 3) and included postoperative ileus resolving with conservative management (n=4), high stoma output (n=4), pulmonary embolism (n=1), anastomotic sinus treated conservatively (after a coloanal anastomosis; n=1), and perineal wound dehiscence after proctocolectomy (n=1). Of note, there was no case of early urinary dysfunction.

Of the five major complications, one patient developed a pelvic collection without evidence of anastomotic leakage requiring radiologically guided percutaneous drainage (Grade IIIa). Another developed prolapsing ischaemic anal mucosa after coloanal anastomosis, which required local debridement (Grade IIIa). Another patient developed a bilateral calf compartment syndrome (operation time: 360 minutes) requiring fasciotomies (Grade IIb). There were two cases of anastomotic leakage within 30 days. Both were treated by Endo-SPONGE (B. Braun Medical, Meslungen, Germany).

The median length of stay was 7.5 days (range: 3-92). There were six readmissions including three (7.5%) for high stoma output, one (2.5%) for anastomotic leakage, one (2.5%) for a pelvic collection requiring percutaneous drainage, and one (2.5%) for pulmonary embolism. One additional patient presented with delayed pelvic sepsis 90 days after surgery secondary to a contained anastomotic leak identified during the third cycle of adjuvant chemotherapy. This was managed via transanal drainage under general anaesthesia.

Pathological and oncologic outcomes

Pathological data are reported in Table 4. The vast majority of patients had an intact or near-intact TME specimen (n=39; 97.5%). In only one case was the TME incomplete. It was one of the first cases, and we believe the specimen might have been torn during the transanal extraction.

Most patients had a pT2 or pT3 tumour (80%). Only 13 (35%) patients had positive lymph nodes. The mean number of nodes retrieved was 20 +/- 9.7. The mean radial and distal margins were 10.8 +/- 9.5 mm and 26.9 +/- 22.2 mm,. R0 resection was achieved in 38 (95%). Of the two patients with an R1 resection, one had a tumour deposit at the surgical margin, while the specimen was ypT0N1c after neoadjuvant chemoradiotherapy (initially mrT3N1). The patient developed lung and liver metastasis at 3 and 7 months after surgery. The other patient was initially staged as mrT2N0, but the final specimen demonstrated stage pT3N0. The patient is currently disease free at 7 months, and is undergoing adjuvant chemoradiotherapy.

No patient was lost to follow up. There were no cases of local recurrence at a median follow-up of 10.7 months. Three (7.5%) patients died, two with disseminated metastases at 12 and 17 months after the initial surgery and one following a traumatic subdural haematoma sustained during a fall two months after surgery with no evidence of recurrence. The overall survival rate was 92.5% (Figure 1). Six (15%) patients developed distant metastases at a median of 6.5 months of whom four are currently alive and receiving chemotherapy (Figure 2).

DISCUSSION

We report one of the largest two-centre studies assessing the initial results of TaTME for rectal cancer. While the patients were selected, the outcome is encouraging and provides further evidence of the feasibility and safety of the procedure. In addition, we demonstrate that these results are reproducible without compromising the oncological principles of resection.

This article is protected by copyright. All rights reserved.

TaTME is especially attractive in patients with unfavourable anatomy including male gender, a narrow pelvis or obesity, or adverse tumour-related features including location in the distal rectum, a bulky tumour or mesorectum or previous radiotherapy. In the present series, most patients were male and overweight, with a low tumour located at a median of 3 cm from the anorectal junction. In such circumstances, a traditional transabdominal laparoscopic or open TME resection can be extremely challenging, especially when performing horizontal rectal dissection [9], with a significant risk of an incomplete TME or positive resection margins [5, 18]. To overcome the main difficulties of inadequate exposure of the surgical field and the plane of dissection [9] multiple stapling, TaTME is an attractive alternative.

Two main parameters need to be considered when assessing such short-term oncological outcome [12]. These include the completeness of TME and the margins of the specimen especially the CRM. Velthuis et al [14] recently reported a significant improvement in the quality of the TME specimen following TaTME with 96% of patients having a complete TME, compared with only 72% having laparoscopic surgery ($p<0.05$). These data are in accordance with our 97.5% rate of complete or near-complete TME. This is important because of the higher rate of local and distant recurrence in patients with an incomplete TME specimen.[19].

Secondly, a longer distal resection margin can be obtained with the transanal approach[13]. Indeed, the distal resection margin can be identified early and more accurately during the transanal dissection[9]. In our experience, even when dealing with low tumours, we found a very good distal margin (26.9 mm). Furthermore, Denost et al [12] showed that the risk of a positive CRM can be reduced with a perineal approach (4% versus 18% for standard laparoscopic TME; $p=0.025$), with perineal dissection being an independent protective factor. As a positive CRM is a strong predictor of distant metastases and survival [20], every effort should be taken to minimise the risk of a positive resection margin. Our results suggest that TaTME, potentially in conjunction with other new

developments such as stereotactic navigation, can help the colorectal surgeon achieve an R0 resection in appropriately selected patients[21, 22].

Anastomotic leakage may be associated with increased local recurrence[23]. Although based on a small series, our leak rate is relatively low with respect to standard LAR[5, 24] and comparable to other reports of TaTME [9, 25] suggesting that TaTME may be safer in this regard. Confirmatory evidence is provided by further studies comparing transanal and laparoscopic TME, reporting non-significant reductions in the anastomotic leakage rate following TaTME[12, 13]. Of the many possible explanations for this effect, TaTME avoids the need for multiple rounds of distal stapling, which is associated with an increased leakage rate[26].

Lacy et al[25] recently reported the outcome of 140 patients undergoing TaTME. Overall, our results with no mortality and acceptable morbidity are comparable with this large series. While we dealt with lower tumours, our overall morbidity rate was 40%, and only five patients developed a major complication (Grade III or higher). Most of the complications (68.8%) were minor and were the main explanation for the relatively long hospital stay. The histopathological and oncological results were not sacrificed, with 97.5% of specimens being either complete or near complete, and a mean number of 20 lymph nodes harvested. Only two patients had an R1 resection. These results are in accordance with the current literature[9, 11, 25] and the short-term oncological outcome is also similar to those previously reported [9, 25].

Recognized by several authors as a step towards a pure NOTES approach [9, 27, 28], TaTME is usually a hybrid procedure. Mobilisation of the splenic flexure and formation of the ileostomy still require a transabdominal phase, but developments in instrumentation and dedicated platforms may change this. From a technical point of view, TaTME is difficult and has a steep learning curve. In the present series the long operation time at the beginning of the experience reduced over the course of the series and the conversion for bleeding which occurred early on, might have been avoided with greater experience.

Dealing with particularly technically difficult cases, Rouanet et al[10] reported two urethral injuries at the beginning of their experience. Although not yet been assessed for TaTME, the learning curve is likely to be shortened by dedicated courses offering hands-on simulation, training and mentoring. The learning curve may be around 20-25 cases, provided that the surgeon is already experienced in laparoscopic LAR and TEM. The creation of an international registry which the patients in the present series, is an important step to promote further the safe introduction of this new technology. Whilst adding significantly to the early evidence base for TaTME, this two-centre study has several limitations. First, as an uncontrolled non-randomized study, there is obvious potential for selection bias, but the TaTME cases included in the present series were anatomically difficult, and despite this the outcome was not sacrificed and the morbidity was acceptable. Secondly, we were unable to evaluate postoperative bowel function.

In conclusion TaTME performed in two centres was not only feasible and safe, but it was reproducible, with no compromise of oncological principles. The technique is an attractive option for patients in whom an entirely laparoscopic or open approach to rectal resection is likely to be difficult. The data demonstrate acceptable results but larger studies are needed reporting the long term function, quality of life and oncological results.

Figure 1. Overall survival Kaplan Meier curve of 40 patients having TaTME for low rectal cancer..

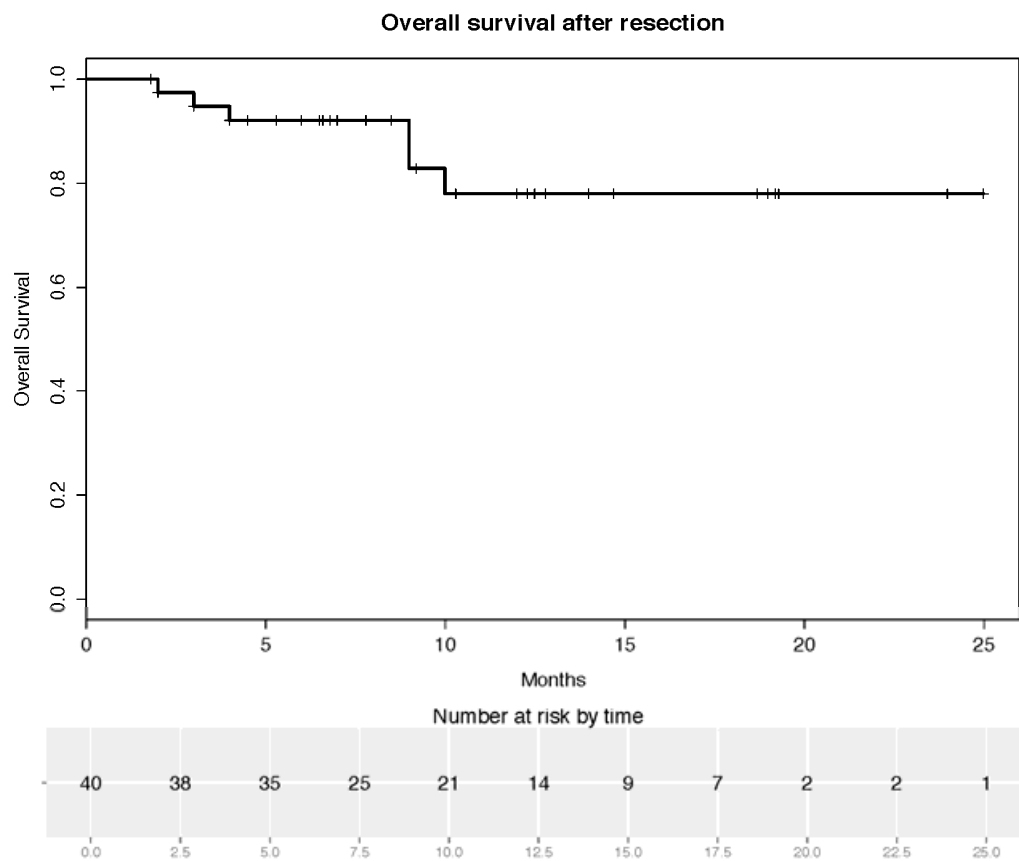


Figure 2. Overall disease survival Kaplan Meier curve of 40 patients having TaTME for low rectal cancer..

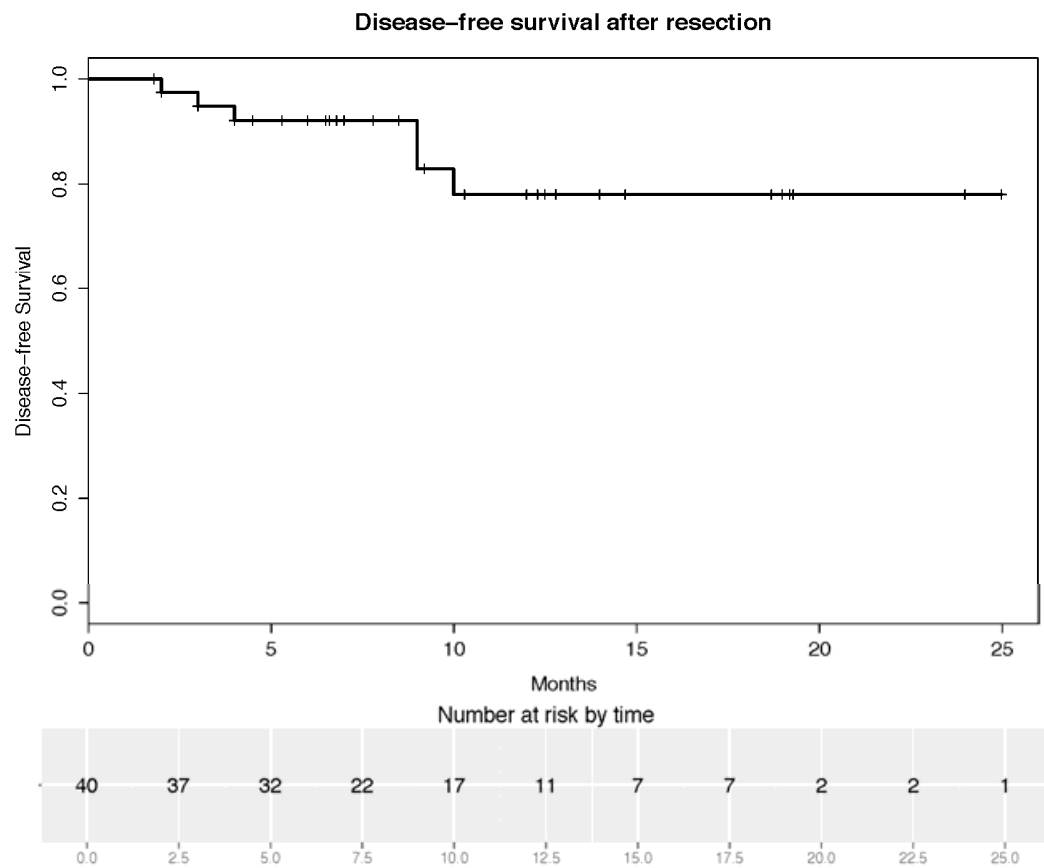


Table 1. Demographics of 40 patients undergoing TaTME for rectal cancer.

Patients' characteristics	
Gender	
Male	32 (80%)
Female	8 (20%)
Age in years, mean +/- SD (range)	64.4 +/- 10.2 (36-87)
ASA score, mean +/- SD (range)	1.8 +/- 0.7 (1-4)
BMI in kg/m ² , mean +/- SD (range)	27.4 +/- 4.9 (17.4-42.7)
Preoperative height of the tumour from the ARJ in cm, median (range)	3 (0-10)
Preoperative CRM involvement	7 (17.5%)
Preoperative MRI staging	
≥ T3	23 (57.5%)
N+	16 (40%)
≥ T3 or N+	30 (75%)
Neoadjuvant treatment	12 (30%)
Previous pelvic procedure	6 (15%)

SD: standard deviation. ASA: American Society of Anesthesiologists. ARJ: anorectal junction. CRM: circumferential resection margins. MRI: magnetic resonance imaging.

Table 2. Perioperative data in 40 patients undergoing TaTME for rectal cancer.

Type of procedure	
LAR	31
Standard APE	4
ELAPE	3
Panproctocolectomy	2
Stoma	100%
Defunctioning ileostomy	31 (77.5%)
End ileostomy or colostomy	9 (22.5%)
Approach	
Laparoscopy / robotic	39 / 1 (97.5%)
Conversion	3 (7.5%)
Operative time in minutes, mean +/- SD (range)	
	368.6 +/- 101.7 (180-690)
Simultaneous approach	16 (40%)
Specimen extraction site	
Transanal	24 (60%)
Pfannenstiel	8 (20%)
Stoma site	3 (7.5%)
Midline	3 (7.5%)

Umbilical port	2 (5%)
Intraoperative complications	2 (5%)
Postoperative complications	16 (40%)
Reoperation	3 (7.5%)
Length of stay in days, median (range)	7.5 (3-92)
Readmission	6 (15%)

LAR: low anterior resection. APE: abdominoperineal excision. ELAPE: extralevator abdominoperineal excision. SD: standard deviation.

Table 3. Postoperative complications among 40 patients undergoing TaTME for rectal cancer.

Grade according to Clavien-Dindo classification	
I	4
II	7
IIIa	2
IIIb	2
IVa	0
IVb	1
V	0

Table 4. Histopathological data of the resected specimen of 40 patients undergoing TaTME for rectal cancer.

Quality of TME	
Intact	37 (92.5%)
Minor defect	2 (5%)
Major defect	1 (2.5%)
T staging	
T0	6 (15%)
T1	2 (5%)
T2	19 (47.5%)
T3	13 (32.5%)
T4	0
N staging	
N0	26 (65%)
N1	10 (25%)
N2	4 (10%)
Number of lymph nodes, mean +/- SD	20 +/- 9.7
Tumour size in mm, mean +/- SD	28.2 +/- 16.3
Distal margins in mm, mean +/- SD	26.9 +/- 22.2
Positive	0
CRM in mm, mean +/- SD	10.8 +/- 9.5
Positive	2 (5%)

TME: total mesorectal excision. SD: standard deviation. CRM: circumferential resection margins.

REFERENCES

1. Heald RJ. **A new solution to some old problems: transanal TME.** *Tech Coloproctol* 2013, **17**(3):257-258.
2. Hompes R, Arnold S, Warusavitarne J. **Towards the safe introduction of transanal total mesorectal excision: the role of a clinical registry.** *Colorectal Dis* 2014, **16**(7):498-501.
3. Delgado S, Momblan D, Salvador L, Bravo R, Castells A, Ibarzabal A, Pique JM, Lacy AM. **Laparoscopic-assisted approach in rectal cancer patients: lessons learned from >200 patients.** *Surg Endosc* 2004, **18**(10):1457-1462.
4. Schwab KE, Dowson HM, Van Dellen J, Marks CG, Rockall TA. **The uptake of laparoscopic colorectal surgery in Great Britain and Ireland: a questionnaire survey of consultant members of the ACPGBI.** *Colorectal Dis* 2009, **11**(3):318-322.
5. van der Pas MH, Haglind E, Cuesta MA, Furst A, Lacy AM, Hop WC, Bonjer HJ, Group COcLoORIS. **Laparoscopic versus open surgery for rectal cancer (COLOR II): short-term outcomes of a randomised, phase 3 trial.** *Lancet Oncol* 2013, **14**(3):210-218.
6. Whiteford MH, Denk PM, Swanstrom LL. **Feasibility of radical sigmoid colectomy performed as natural orifice transluminal endoscopic surgery (NOTES) using transanal endoscopic microsurgery.** *Surg Endosc* 2007, **21**(10):1870-1874.
7. Sylla P, Rattner DW, Delgado S, Lacy AM. **NOTES transanal rectal cancer resection using transanal endoscopic microsurgery and laparoscopic assistance.** *Surg Endosc* 2010, **24**(5):1205-1210.
8. Buchs NC, Nicholson GA, Yeung T, Mortensen NJ, Cunningham C, Jones OM, Guy RJ, Hompes R. **Transanal rectal resection: an initial experience of 20 cases.** *Colorectal Dis* 2016; **18**(1):45-50.

- Accepted Article
9. Tuech JJ, Karoui M, Lelong B, De Chaisemartin C, Bridoux V, Manceau G, Delpero JR, Hanoun L, Michot F. **A step toward NOTES total mesorectal excision for rectal cancer: endoscopic transanal proctectomy.** *Ann Surg* 2015, **261**(2):228-233.
 10. Rouanet P, Mourregot A, Azar CC, Carrere S, Gutowski M, Quenet F, Saint-Aubert B, Colombo PE. **Transanal endoscopic proctectomy: an innovative procedure for difficult resection of rectal tumors in men with narrow pelvis.** *Dis Colon Rectum* 2013, **56**(4):408-415.
 11. Veltcamp Helbach M, Deijen CL, Velthuis S, Bonjer HJ, Tuynman JB, Sietes C. **Transanal total mesorectal excision for rectal carcinoma: short-term outcomes and experience after 80 cases.** *Surg Endosc* 2016;30(2):464-470.
 12. Denost Q, Adam JP, Rullier A, Buscail E, Laurent C, Rullier E. **Perineal transanal approach: a new standard for laparoscopic sphincter-saving resection in low rectal cancer, a randomized trial.** *Ann Surg* 2014, **260**(6):993-999.
 13. Fernandez-Hevia M, Delgado S, Castells A, Tasende M, Momblan D, Diaz del Gobbo G, DeLacy B, Balust J, Lacy AM. **Transanal total mesorectal excision in rectal cancer: short-term outcomes in comparison with laparoscopic surgery.** *Ann Surg* 2015, **261**(2):221-227.
 14. Velthuis S, Nieuwenhuis DH, Ruijter TE, Cuesta MA, Bonjer HJ, Sietes C. **Transanal versus traditional laparoscopic total mesorectal excision for rectal carcinoma.** *Surg Endosc* 2014, **28**(12):3494-3499.
 15. Buchs NC, Kraus R, Mortensen NJ, Cunningham C, George B, Jones O, Guy R, Ashraf S, Lindsey I, Hompes R. **Endoscopically assisted extralevator abdominoperineal excision.** *Colorectal Dis* 2015;17(12):O277-280.

16. Bracey E, Knol J, Buchs N, Jones O, Cunningham C, Guy R, Cunningham N, Hompes R. **Technique for a stapled anastomosis following transanal total mesorectal excision (taTME) for rectal cancer.** *Colorectal Dis* 2015; 17(10):O208-212.
17. Dindo D, Demartines N, Clavien PA. **Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey.** *Ann Surg* 2004, **240**(2):205-213.
18. Bondeven P, Hagemann-Madsen RH, Laurberg S, Pedersen BG. **Extent and completeness of mesorectal excision evaluated by postoperative magnetic resonance imaging.** *Br J Surg* 2013, **100**(10):1357-1367.
19. Nagtegaal ID, van de Velde CJ, van der Worp E, Kapiteijn E, Quirke P, van Krieken JH, Cooperative Clinical Investigators of the Dutch Colorectal Cancer G. **Macroscopic evaluation of rectal cancer resection specimen: clinical significance of the pathologist in quality control.** *J Clin Oncol* 2002, **20**(7):1729-1734.
20. Nagtegaal ID, Quirke P. **What is the role for the circumferential margin in the modern treatment of rectal cancer?** *J Clin Oncol* 2008, **26**(2):303-312.
21. Buchs NC, Hompes R. **Stereotactic navigation and augmented reality for transanal total mesorectal excision?** *Colorectal Dis* 2015;17(9):825-827.
22. Atallah S, Nassif G, Larach S. **Stereotactic navigation for TAMIS-TME: opening the gateway to frameless, image-guided abdominal and pelvic surgery.** *Surg Endosc* 2015, **29**(1):207-211.
23. Mirnezami A, Mirnezami R, Chandrakumaran K, Sasapu K, Sagar P, Finan P. **Increased local recurrence and reduced survival from colorectal cancer following anastomotic leak: systematic review and meta-analysis.** *Ann Surg* 2011, **253**(5):890-899.

24. Buchs NC, Gervaz P, Secic M, Bucher P, Mugnier-Konrad B, Morel P. **Incidence, consequences, and risk factors for anastomotic dehiscence after colorectal surgery: a prospective monocentric study.** *Int J Colorectal Dis* 2008, **23**(3):265-270.
25. Lacy AM, Tasende MM, Delgado S, Fernandez-Hevia M, Jimenez M, De Lacy B, Castells A, Bravo R, Wexner SD, Heald RJ. **Transanal Total Mesorectal Excision for Rectal Cancer: Outcomes after 140 Patients.** *J Am Coll Surg* 2015, **221**(2):415-423.
26. Ito M, Sugito M, Kobayashi A, Nishizawa Y, Tsunoda Y, Saito N. **Relationship between multiple numbers of stapler firings during rectal division and anastomotic leakage after laparoscopic rectal resection.** *Int J Colorectal Dis* 2008, **23**(7):703-707.
27. Chouillard E, Chahine E, Khoury G, Vinson-Bonnet B, Gumbs A, Azoulay D, Abdalla E. **NOTES total mesorectal excision (TME) for patients with rectal neoplasia: a preliminary experience.** *Surg Endosc* 2014, **28**(11):3150-3157.
28. Leroy J, Barry BD, Melani A, Mutter D, Marescaux J. **No-scar transanal total mesorectal excision: the last step to pure NOTES for colorectal surgery.** *JAMA Surg* 2013, **148**(3):226-230; discussion 231.