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ORIGINAL ARTICLE

A prospective study of health related quality of life, bowel and sexual function after TaTME and conventional laparoscopic TME for mid and low rectal cancer

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Abstract

Background The aim of our study was to evaluate short -term (3 months) and medium-term (12 months) postoperative effects on health related quality of life (HRQoL), bowel and sexual function after transanal total mesorectal excision (TaTME) in comparison with conventional laparoscopic total mesorectal excision (TME).

Methods A prospective study was conducted on consecutive patients who had conventional laparoscopic TME and TaTME at our institution from November 2014 to December 2018.We evaluated HRQoL and bowel function using validated scales including the European Organization for Research and Treatment of Cancer Quality of Life of colorectal cancer specific module (EORTC-QLQ-CR29), International Index of Erectile Function (IIEF-5), Female Sexual Function Index (FSFI), low anterior resection syndrome (LARS) score and Wexner score. Patients were matched one-to-one through propensity score matching. Outcomes of the questionnaires at 3 and 12 months were compared.

Results Sixty patients were enrolled in the study. There were 30 in the conventional laparoscopic group (13 males; median age 69.3 years [range 35–80 years]) and 30 in the TaTME group (14 males; median age 75.6 years [range 42–83 years]). Three months after ileostmy closure, patients in the TaTME group had significantly more buttock pain ($p = 0.030$), bloating ($p = 0.023$), stool frequency ($p = 0.013$), flatulence ($p < 0.001$) and fecal incontinence ($p = 0.044$), although none of these differences persisted at 12 months. Patients in the TaTME group had a higher median overall LARS score at 3 months ($p = 0.032$) but there was no difference at 12 months. At 12 months after TaTME female patients had better women's sexual interest ($p = 0.039$) and dyspareunia scores ($p < 0.001$), while male patients had better erectile function ($p = 0.038$). Other scales did not reveal a significant difference at either 3 of 12 months between groups.

Conclusions Compared with patients with mid and low rectal cancer treated with conventional laparoscopic TME, those treated with TaTME have worse HRQoL and bowel function for a short period after primary resection, but seem to have better sexual function in the long term.

Keywords Rectal neoplasm · Quality of life · Low anterior resection syndrome · Transanal total mesorectal excision · Dyspareunia · Erectile dysfunction · Defecation · Fecal incontinence · Propensity score

Introduction

Since the principle of total mesorectal excision (TME) was proposed in 1982, it has become the standard surgical treatment for rectal cancer [1]. It is generally accepted that positive circumferential (CRM) and distal margins, indications of suboptimal TME, are prognostic factors for local and distant recurrence. For obese patients and those with a narrow pelvis, the frequent need for multiple stapler applications and the limited visual field often cause anastomotic failure and other complications. Further, the prevalence of functional disorders caused by conventional TME led to a search foran improved approach. Transanal total mesorectal excision (TaTME) was proposed as a novel minimally invasive technique with better visualization in the deep pelvis [2, 3]. The "bottom-up" procedure is adopted to overcome shortcomings of conventional laparoscopic surgery [4].

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Moreover, the implementation of transanal surgery facilitates identification of the pelvic nerves [5, 6]. Recently, the oncological safety of the TaTME has been questioned after Norway imposed a moratorium on TaTME, leading to a wide ranging debate about the safety of this approach. [7].

A series of studies have investigated postoperative dysfunction after laparoscopic low anterior resection (LAR) that affected health related quality of life (HRQoL), particularly bowel function, sexual function and urinary function [8], but little is known about functional outcomes after TaTME [4–6, 9]. It has been established that there is an inherent risk of iatrogenic injury to the urethra during the transanal portion of the TaTME, especially in the male patient [10]. The lower level of anastomosis during TaTME is also deemed a risk factor for the development of low anterior resection syndrome (LARS). Concerns regarding functional outcomes after TaTME have been expressed. So far, there is little data available about patients' quality of life after TaTME vs laparoscopic TME. In this prospective study, we used validated questionnaires to assess postoperative bowel, sexual function and HRQoL alterations after TaTME and conventional laparoscopic TME in patients operated on by a single team of surgeons at 3 and 12 months after diverting ileeostomy closure.

Materials and methods

Study population and study design

The Institutional Ethics Committee of our institution approved this study and written informed consent was obtained from all participants.

This prospective study was conducted on consecutive patients who had conventional laparoscopic TME and TaTME at our institution between November 2014 and December 2018**.** The following inclusion criteria were adopted: (1) histological diagnosis in all cases was confirmed by experienced gastrointestinal pathologists; (2) tumor stage was assessed by endoscopic ultrasonography (EUS), computerized tomography (CT) scan and magnetic resonance imaging (MRI); (3) tumor distance from the anal verge was less than 10 cm. The exclusion criteria were as follows: (1) anterior resection for an indication other than rectal cancer. (2) distant metastasis after primary surgery. As far as the selection between laparoscopic TME and TaTME, TaTME was the preferred option in 1) patients with a tumor distance from the anal verge of 5 cm or more, 2) tumor size > 4cm, 3) prostatic hypertrophy and 4) BMI ≥ 24 [5-6]. Cadaver-based courses were compulsory for the surgeons in this study to obtain training in TaTME. All procedures were performed laparaoscopically using a two team (abdominal and transanal) approach. When the top dissections were completed, the transanal endoscopic microscopy (TEM) platform (Richard Wolf Medical Instruments Corporation, Vernon Hills, IL, USA) was used. We have performed over 150 cases since the introduction of this technique. Owing to the bias created by the learning curve, the initial 50 cases of TaTME done by surgeons in the department were excluded. Long course chemoradiotherapy was indicated for cT3/4 and/or N+ patients. Surgery was scheduled 8-12 weeks after 5040 cGy in 28 fractions administered over 5 week + 5Fu based chemotherapy 5 days/week.

The majority of these patients had a diverting loop ileostomy**.** To guarantee overall postoperative treatment efficacy, ileostomy reversal was completed after adjuvant treatment. Patients who could not have the reversal procedure or insisted on maintaining permanent stoma were excluded from this study. Patients with distant metastasis were excluded due to the effects of a longer course of treatment and the additional side toxicity effect of drugs on QoL [11].

Questionnaires

Postoperative bowel function was assessed with the LARS score and the Wexner score. Further HRQoL assessment was performed through scales including European Organization for Research and Treatment of Cancer Quality of Life of the colorectal cancer specific module (EORTC-QLQ-CR29), Female Sexual Function Index (FSFI) and the 5- item version of the International Index of Erectile Function (IIEF-5). The LARS score has five questions concerning the bowel movement related disability like controlling flatus and liquid stool [12]. The total LARS score ranges from 0 to 42. Patients who scored 0–20, 21–29 and 30–42 were categorized as no LARS, minor LARS and major LARS, respectively. The Wexner score includes five questions with overall score ranging from 0 to 20. A higher score means greater severity of fecal incontinence [13]. The EORTC QLQ-CR29 consists of 4 main scales and 18 diverse single items, divided into function scales like sexual interest and symptom scales such as urinary frequency [14]. Since the questionnaires were distributed and collected after stoma reversal or after primary surgery without a stoma, items related to stoma care were not listed. The degree of severity was represented by the score: 1 (not at all) to 4 (very much), and from 1 (very poor) to 7 (excellent). Scores calculated initially were transformed to scales of 0–100 according to previously reported procedures [15]. The FSFI is a self-reported questionnaire containing six domains (desire, arousal, lubrication, orgasm, satisfaction, pain) which are calculated as a total score [16]. The IIEF-5 consists of 5 questions reflecting global erectile function and the score ranges from 0 -25. The severity of male patients' erectile dysfunction (ED) is set at the standard of severe (less than 7), moderate (8–11), mild to moderate (12–16), mild (17–21) and no dysfunction (22–25) [17].

All 5 questionnaires were administered at 3 and 12 months. Baseline information for IIEF-5 and FSFI was collected preoperatively.

Statistical analysis

Propensity score matching (PSM) analysis was applied to minimize the effect of selection biases and potential confounders. Propensity score (PS) was calculated using a multivariable logistic regression model including gender, body mass index (BMI), tumor diameter, distance from anal verge, anastomosis methods and the number of patients who were given adjuvant therapy. Patients in the two given groups were matched one-to-one. After the PS estimation, the cases were matched using 1:1 nearest neighbor matching with a caliper distance set at 0.03 standard deviations of the logit of the PS. Non-matching results were discarded. Characteristics and functional outcome scores were displayed as median (range). Differences of continuous variables were calculated using the Mann–Whitney *U* test. Comparison of categorical variables with regard to different groups was performed with the Chi square test. $P < 0.050$ was considered statistically significant. Statistical analysis was accomplished with the SPSS version 24.0 for Windows (SPSS Inc., Chicago, IL, USA).

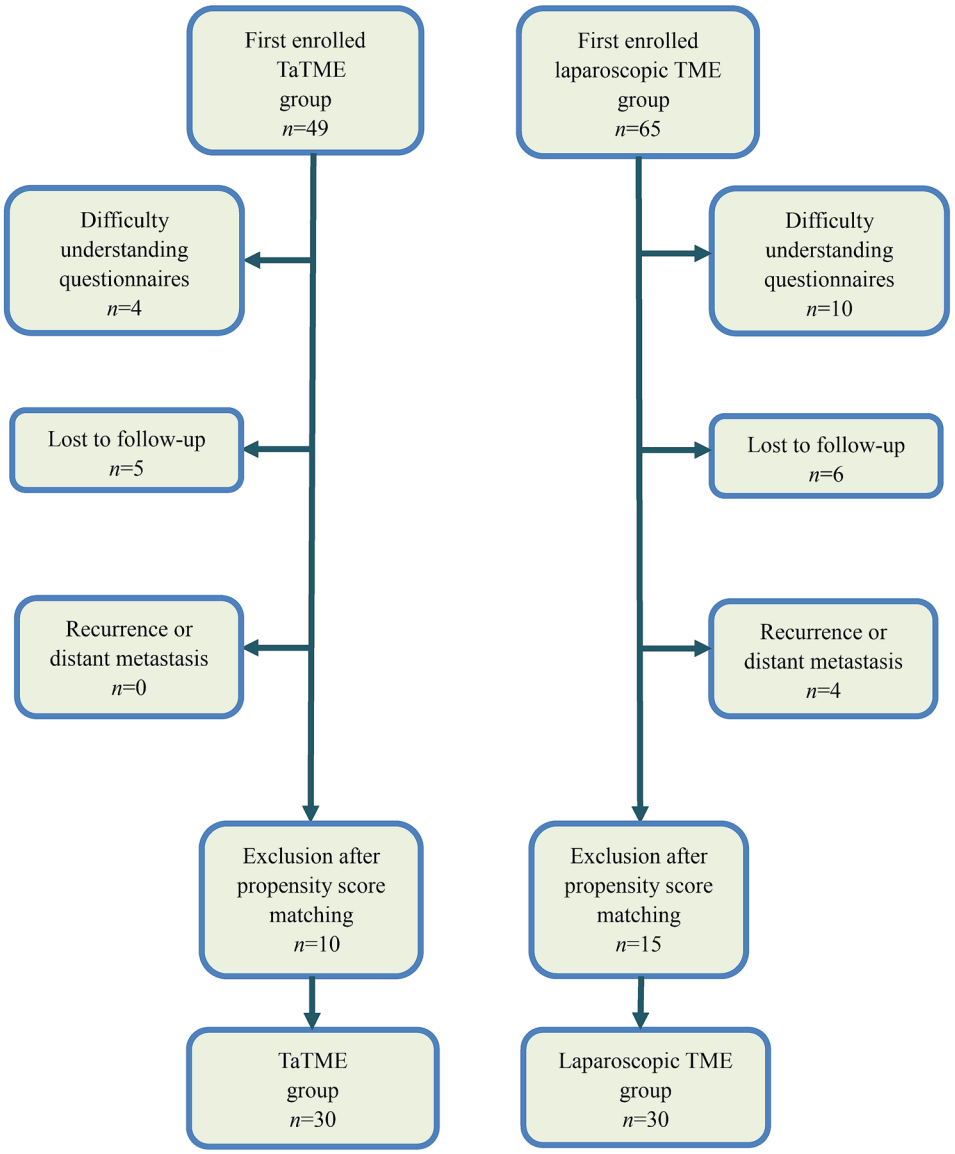

Fig. 1 Inclusion and exclusion flow chart for enrolled patients. *TME* Total mesorectal excision; *TaTME* Transanal total mesorectal excision

Results

Of the 114 patients who met the inclusion criteria, 49 patients had TaTME and 65 had conventional laparoscopic TME. To diminish probable irrelative bias between two groups, the remaining 85 patients were finally enrolled to be matched one-to-one. The flow chart for the study is shown in Fig. 1. Fourteen patients experienced great difficulties in comprehending the questionnaires provided. After distribution at 3 months, three patients in TaTME group and four patients in the laparoscopic TME group failed to return the results. These seven patients were excluded from our study. At 12 months, two patients in each group were lost to follow-up. Three patients in the laparoscopic TME group had local recurrence and one patient had from distant metastasis and was therefore excluded. The remaining 60 patients were included in the study; 30 patients in the laparoscopic TME group (13 males; median age 69.3 years [range 35–80 years]) and 30 in the TaTME group (14 males; median age 75.6 years [range 42–83 years]). Patient characteristics are shown in Table 1, and surgery related information is summarized in Table 2.

QLQ-CR29

Results of the statistical analysis are shown in Table 3a, b. At 3 months, patients in the TaTME group complained significantly more than those in the TME group about bowel or anal dysfunction, such as buttock pain (15.3 vs. 6.9;

Table 1 Patient and tumor characteristics*

Items	TaTME ($n=30$)	Laparoscopic TME ($n=30$)	P value
Age (years)			0.732
<50	5 (17)	4 (24)	
50–75	14 (47)	12 (40)	
>75	11 (37)	14 (47)	
Sex			0.795[b]
Male	14 (47)	13 (43)	
Female	16 (53)	17 (57)	
BMI kg/m^2,median (range)	27.3 (24.4–32.5)	22.6 (19.3–27.6)	0.147[c]
Distance from anal verge,cm			0.778[b]
<5	11 (37)	13 (43)	
≥5	19 (63)	17 (57)	
Tumor location			0.726[b]
Posterior	5 (17)	4 (24)	
Anterior	17 (57)	20 (66)	
Side	8 (27)	6 (20)	
CRM involvement (preop)			0.739[b]
Positive	5 (17)	6 (20)	
Negative	25 (83)	24 (80)	
Tumor diameter, cm	3.2 (1.2–7.5)	3.6 (1.5–10)	0.539[c]
cT category			0.602[b]
T1/2	20 (66)	16 (53)	
T3/4	10 (33)	14 (47)	
ypT category			0.793[b]
T0/1	12 (40)	13 (43)	
T2/3/4	18 (60)	17 (57)	
ASA class			0.313[b]
I	14 (47)	16 (53)	
II	13 (43)	8 (27)	
III	3 (10)	6 (20)	
Neoadjuvant therapy	17 (57)	15 (50)	0.446[b]
Adjuvant treatment	20 (66)	22 (73.3)	0.123[b]

TME total mesorectal excision; *TaTME* transanal total mesorectal excision; *BMI* body mass index; *CRM* circumferential resection margin; *ASA* American Society of Anesthesiologists

*Values reported as *n* (%) unless otherwise indicated

Table 2 The intraoperative and postoperative features of all patients*

Items	TaTME ($n=30$)	Laparoscopic TME ($n=30$)	P value
Anastomosis method			0.688
Circular-stapled	26 (86.7)	27 (90.0)	
Handsewn	4.0 (13.3)	3 (10.0)	
Anastomotic height, cm, median (range)	3.4 (3–6.5)	3.8 (3.5–7)	0.147
Quality of resected specimen			0.573
Incomplete	0	0	
Near complete	11 (36.7)	8 (26.7)	
Complete	19 (63.3)	22 (73.3)	
Distal margins			1
Positive	0 (0)	0 (0)	
Negative	30 (100)	30 (100)	
Circumferential margins			0.513
Positive	1 (3.3)	2 (6.7)	
Negative	29 (96.7)	28 (93.3)	
Intraoperative complication			0.554
Yes	1 (3.3)	2 (6.7)	
No	29 (96.7)	28 (93.3)	
Postoperative complication			
Pelvic abscess	3 (10)	1 (3.3)	0.301
Ileus	1 (3.3)	0 (0)	0.313
Anastomotic bleeding	2 (6.7)	1 (3.3)	0.554
Anastomotic leak			0.513
No + GradeA	28 (93.3)	28 (93.3)	
GradeB	1 (3.3)	0 (0)	
GradeC	1 (3.3)	2 (6.7)	
Diversion stoma	28 (93.3)	29 (96.7)	0.776
Time until stoma reversal, months (median, (range)	7.8 (3.0–11.0)	8.1 (2.0–12.0)	0.830

TME total mesorectal excision; *TaTME* transanal total mesorectal excision

*Values reported as *n* (%) unless otherwise indicated

$p=0.030$), bloating (22.2 vs. 13.8; $p=0.023$), stool frequency (25.8 vs. 14.7; $p=0.013$), flatulence (34.5 vs. 23.8; $p<0.001$) and fecal incontinence (19.7 vs. 8.4; $p=0.044$). At 12 months, patients in the TME group had significantly more symptoms including decreased sexual interest for women (26.9 vs. 34.3; $p=0.039$) and dyspareunia (5.1 vs. 20.4; $p<0.001$). In males, more patients in the TME group than in the TaTME group suffered from impotence although the difference was not statistically significant.

FSFI and IIEF-5

According to the preoperative data, sexual function in both groups was similar. Female patients who had TaTME did not suffer from severe impairment of sexual function based on the FSFI results at 3 months or 12 months and had results in each domain were similar in the two groups (Fig. 2). The male patients in the TaTME group had significantly better outcomes for erectile function than the males in the TME group ($p=0.038$), especially at 12 months. Though the proportions of moderate and severe ED for patients in the TaTME group was much lower than that in the conventional laparoscopic TME group, there was no significant difference in the overall ED grade either at 3 months or 12 months (Table 4).

LARS score and Wexner score

At 3 months, patients in the TaTME group had more bowel dysfunction than those in the TME group. The

Table 3 **a** Comparison of the results of the European Organization for Research and Treatment of Cancer QLQ-CR29 questionnaire (3 months).*__b__ Comparison of the results of the European Organization for Research and Treatment of Cancer QLQ-CR29 questionnaire (12 months)*

a

Items	TaTME ($n=30$)	Laparoscopic TME ($n=30$)	P value
CR29 scales			
Urinary frequency	18 (12–23)	19 (12–27)	0.683
Blood and mucus in stool	4 (2–8)	3 (1–6)	0.576
Stool frequency	26 (17–33)	15 (8–21)	0.013
Body image	82 (74–88)	87 (80–93)	0.156
CR29 single items			
Urinary incontinence	9 (4–14)	7 (2–12)	0.326
Dysuria	3 (0–6)	3.5 (1–8)	0.455
Abdominal pain	8 (3–12)	8 (3–12)	0.866
Buttock pain	15 (9–22)	7 (3–11)	0.030
Bloating	22 (16–29)	14 (8–19)	0.023
Dry mouth	10 (6–14)	12 (7–17)	0.752
Hair loss	4 (1–7)	4.5 (0–7)	0.134
Taste	7 (3–11)	2 (0–4)	0.036
Anxiety	77 (71–84)	78 (72–83)	0.875
Weight	90 (85–95)	86 (80–92)	0.366
Flatulence	35.5 (27–42)	24 (16–31)	<0.001
Fecal incontinence	25 (17–33)	17 (9–25)	0.044
Sore skin	19 (11–28)	12 (5–17)	0.138
Embarrassment	18 (11–26)	13.5 (5–22)	0.164
Impotence	62 (51–74)	39 (25–53)	0.023
Sexual interest (men)	54 (44–64)	56 (46–67)	0.776
Sexual interest (women)	86 (75–98)	83 (70–97)	0.689
Dyspareunia	7 (0–16)	10 (0–21)	0.864

b

Items	TaTME ($n=30$)	Laparoscopic TME ($n=30$)	P value
CR29 scales			
Urinary frequency	23 (16–37)	24 (22–28)	0.650
Blood and mucus in stool	1 (0–5)	3 (2–6)	0.102
Stool frequency	19 (13–26)	19.5 (17–24)	0.860
Body image	81 (79–86)	83.5 (81–92)	0.730
CR29 single items			
Urinary incontinence	15 (9–22)	15.5 (13–20)	0.910
Dysuria	4.5 (1–9)	4 (3–7)	0.903
Abdominal pain	7.5 (1–16)	13 (10–18)	0.053
Buttock pain	9.5 (4–17)	11 (9–14)	0.472
Feeling of bloating	18 (10–26)	24.5 (21–27)	0.061
Dry mouth	19 (12–29)	26 (23–29)	0.087
Hair loss	12.5 (6–19)	10 (8–13)	0.581
Taste	9.1 (3–17)	9 (7–14)	0.821
Anxiety	70 (62–79)	66 (63–70)	0.297
Weight	72 (64–81)	71 (68–76)	0.836
Flatulence	24 (17–35)	23 (16–29)	0.940
Fecal incontinence	8 (2–15)	19 (17–23)	0.860
Sore skin	14 (9–24)	14 (12–18)	0.992
Embarrassment	9 (3–18)	11 (8.-16)	0.695

Table 3 (continued)

b

Items	TaTME ($n=30$)	Laparoscopic TME ($n=30$)	P value
Impotence	49 (45–65)	53 (42–63)	0.154
Sexual interest (men)	34 (12–47)	36 (22–47)	0.426
Sexual interest (women)	25 (15–37)	34.5 (20–49)	0.039
Dyspareunia	5 (1–14)	20 (4–33)	< 0.001

TME total mesorectal excision; *TaTME* transanal total mesorectal excision

*Values reported as median (range)

p value calculated by Mann–Whitney U test

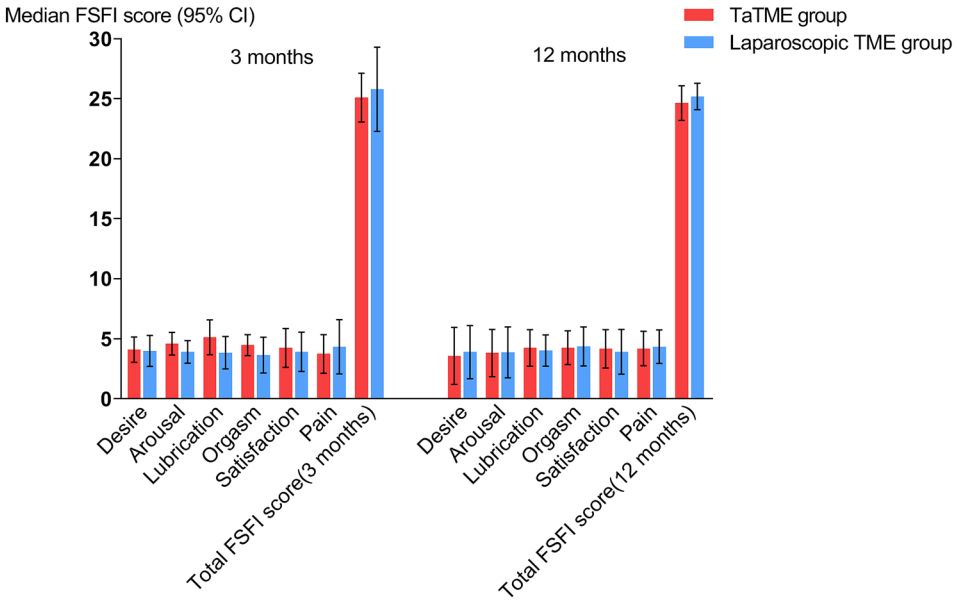

Fig. 2 FSFI score comparison, conventional laparoscopic TME vs. TaTME. *FSFI* Female Sexual Function Index; *TME* Total mesorectal excision; *TaTME* Transanal total mesorectal excision

median overall LARS score in the TaTME group reached 35.3, compared with 30.4 in the conventional laparoscopic TME group, and the difference between the two groups was significant ($p=0.032$). Twenty (66.7%) patients in the TaTME group and 16 (53.3%) in the TME group suffered from major LARS at 3 months, but the difference was not significant ($p=0.439$). The difference at 12 months in the median LARS score ($p=0.671$) and the percentage of mild/moderate/severe LARS ($p=0.833$) was not significant. The Wexner scores for both groups are shown in Table.5. There was no statistically significant difference between groups either at 3 months or 12 months.

Discussion

Over the past few decades, progress has been made in treating rectal cancer, especially mid and low rectal cancer and surgery has progressed from conventional laparotomy to minimally invasive sphincter-saving techniques. More than 70% of rectal cancer patients have therefore avoided a permanent stoma and the psychological trauma caused by abdominoperineal resection (APR) [2–4, 18]. In spite of that sphincter-saving procedures have been shown to have negative effects on patients' HRQoL. Pucciani [19] reported that the reduction of rectal capacity and colonic dysmotility might contribute to the appearance of bowel dysfunction. Wallner et al. [20] found that autonomic nerve injury was the main cause of postoperative defecation or sexual dysfunction through autopsy and analysis of the 5-year follow-up results of 27 patients after TME. LARS has been extensively investigated [14, 21]. A growing number of multicenter studies has shown that patients with major LARS might continue to have those symptoms throughout their lives.

TaTME surgery has been increasingly used since its introduction 2010, but there has been concern about its negative impact on QoL.

Major LARS is associated with a severe decline in QoL. Kneist et al. [2] reported 10% major LARS in TaTME group of a study enrolling 10 patients, while Pontallier et al. [26]

Table 4 Comparison of the results of the International Index of Erectile Function (IIEF-5) score for male patients*

Items	TaTME ($n=14$)	Laparoscopic TME ($n=13$)	*P* value
Preoperative IIEF-5 score, median (range)	23 (17–26)	23.5 (18–27)	0.856[a]
IIEF-5 score (3 months), median (range)	17 (12–23)	16 (11–23)	0.118[a]
Grade of ED (3 months)			0.827[b]
No	4 (28.6)	4 (30.8)	
Mild	5 (35.7)	5 (38.5)	
Mild to moderate	3 (21.4)	2 (15.4)	
Moderate	1 (7.14)	2 (15.4)	
Severe	1 (7.14)	0 (0.0)	
IIEF-5 score (12 months), median (range)	23 (13–27)	20 (16–21)	0.038[b]
Grade of ED (12 months)			0.900[b]
No	4 (28.6)	3 (23.08)	
Mild	5 (35.7)	5 (38.5)	
Mild to moderate	4 (28.6)	3 (23.1)	
Moderate	1 (7.1)	2 (15.4)	
Severe	0 (0.0)	0 (0.0)	

TME total mesorectal excision; *TaTME* transanal total mesorectal excision; *ED* erectile dysfunction

*Values reported as *n* (%) unless otherwise indicated

[a]*p* value calculated by Mann–Whitney *U* test

[b]*p* value calculated by χ^2test

Table 5 Comparison the results of the LARS score and Wexner score*

Items	TaTME ($n=30$)	Laparoscopic TME ($n=30$)	*P* value
LARS score (3 months)	35 (20–40)	28 (23–37)	0.032[a]
Grade of LARS (3 months)			0.439[b]
No	1 (3.3)	1 (3.3)	
Minor	9.0 (30.0)	11 (36.7)	
Major	20 (66.7)	16 (53.3)	
LARS score (12 months), median (range)	27 (16–30)	27.5 (15–33)	0.671[a]
Grade of LARS (12 months)			0.833[b]
No	8 (26.7)	10 (33.3)	
Minor	7 (23.3)	7 (23.3)	
Major	15 (50.0)	13 (43.3)	
Wexner score			
At 3 months, median (range)	9 (2–13)	8 (4–21)	0.578[a]
At 12 months, median (range)	6.5 (3–19)	7 (4–22)	0.498[a]

TME total mesorectal excision; *TaTME* transanal total mesorectal excision; *LARS* Low anterior resection syndrome

*Values reported as *n* (%) unless otherwise indicated

[a]*p* value calculated by Mann–Whitney *U* test

[b]*p* value calculated by χ^2test

reported that over 80% of patients developed major LARS if they had coloanal anastomosis. In our study, patients in the TaTME group showed rates of no LARS, minor LARS and major LARS at 3 months were 3.3%, 30% and 66.7%, respectively, with similar rates at 12 months. The rate of major LARS in laparoscopic TME and TaTME group in our study was similar to that in prior studies (approximately 40%-50%). Rouanet et al. [27] and Tuech et al. [28] reported Wexner scores after TaTME ranging from 5 to 11 points. Elmore et al. [29], in a study on 6 patients who had TaTME, found that only one patient suffered from severe fecal incontinence and the median Wexner score for the remaining five

patients was three points. Hanke et al. [30] included 66 sample cases in a case series study and followed up the evacuatory function of patients after TaTME for up to 18 months. The results demonstrated that the median Wexner score was lower than 10 points in the follow-up period of up to 18 months and fell to 0 points after 24 months. Synthesizing these results, it seems that the evacuatory function of patients after TaTME is impaired to a certain extent, especially within the short term, whereas severe damage is rare in the long term [17, 31, 32].

According to the EORTC QLQ-CR29 results of our study, significant differences were revealed between the two groups in terms of buttock pain, fecal incontinence, stool frequency, flatulence and bloating, which can be summarized as the problems reflecting bowel or anal dysfunction. Other primary functional domains like body image or sexual interest (men or women) were not affected by the type of surgical management, while in the long term (12 months), patients in the TaTME group had a higher score in some sexual function items including sexual interest and intercourse. Evaluation of the results of the two specific sexual function scales showed that patients who had TaTME were not affected by the choice of surgical technique. Female patients from both groups had similar sexual function outcomes, while male patients from the TaTME group were found to have better erectile function than those in the TME group, especially in the long term. These results were consistent with some previous reports. A study by Pontallier et al. [26] demonstrated better erectile function with a higher rate of sexual activity if patients had TaTME, though the results did not reach statistical significance because of the relatively small number of enrolled patients. Keller et al. [33] enrolled 23 patients and found that TaTME had a slight impact on sexual function, and even improved sexual function after surgery. Kneist et al. [2] prospectively enrolled 10 patients who treated with TaTME, and followed up their postoperative sexual function for 9 months. Postoperative IIEF scores were lower compared with preoperative evaluation, but there was no statistically significant difference. In short-term follow-up (3 months) the IIEF scores were the highest, but the results were not definitive due to the limited follow-up time. Based on some other investigation, the incidence of sexual dysfunction after TaTME is higher in men than in women [34]. The latent cause may be the fact that the male pelvis is narrower than the female pelvis, making it relatively difficult to preserve the autonomic nerves in men [35].

Our study has some limitations, such as its small sample size and short follow-up. A longer follow-up period would permit us to draw a much more reliable conclusion. Some specific examinations like anorectal manometry could have been used as well as a more in depth evaluation of voiding function. The cross-sectional comparison of short- and long-term HRQoL simultaneously increases the validity of this study. More prospective and multicenter studies comparing HRQoL after conventional laparoscopic TME and TaTME are needed.

Conclusions

Compared with patients with mid and low rectal cancer treated with conventional laparoscopic TME, those treated with TaTME have worse HRQoL and bowel function for a short period after primary resection, but could show better sexual function in the long term.

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Availability of data and material Due to the sensitive nature of the results (including sexual function related problems) collected through this study, survey respondents were assured raw data would remain confidential and would not be shared.

Compliance with ethical standards

Conflicts of interest The authors declare there is no conflict of interest regarding the publication of this paper.

Ethics approval The Institutional Ethical Committee of the primary author's institution approved this study of collecting relative data and written informed consent was obtained from all participants.

Consent for publication Primary author's institution approved the publication of this study.

Code availability Statistical analysis was accomplished under the assistance of SPSS version 24.0 for Windows (SPSS Inc., Chicago, IL, USA).

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