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ORIGINAL ARTICLE

Transanal endoscopic microsurgery in very large and ultra large rectal neoplasia

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Abstract

Background Transanal endoscopic microsurgery (TEM) has become the treatment of choice for benign rectal lesions and early rectal cancer (T1). The size classification of rectal polyps is controversial. Some articles define giant rectal lesions as those larger than 5 cm, which present a significantly increased risk of complications. The aim of this study was to evaluate the feasibility of TEM in these lesions.

Methods An observational descriptive study with prospective data collection evaluating the feasibility of TEM in large rectal adenomas was performed between June 2004 and September 2018. Patients were assigned to one of the three groups according to size: < 5 cm, very large (5–7.9 cm) and ultra-large (≥ 8 cm). Descriptive and comparative analyses between groups were performed.

Results TEM was indicated in 761 patients. Five hundred and seven patients (66.6%) with adenoma in the preoperative biopsy were included in the study. Three hundred and nine out of 507 (60.9%) tumors < 5 cm, 162/507 (32%) very large tumors (5–7.9 cm) and 36/507 (7.1%) ultra-large tumors (≥ 8 cm) were reviewed. Morbidity increased with tumor size: 17.5% in tumors < 5 cm, 26.5% in those 5–7.9 cm, and 36.1% in those > 8 cm. Peritoneal perforation, fragmentation, free margins and stenosis were also more common in very large and ultra-large tumors ($p < 0.001$). There were no statistical differences between the groups in the definitive pathology ($p = 0.38$).

Conclusions TEM in these large tumors is associated with higher rates of morbidity, peritoneal perforation, free margins and stenosis. Although these tumors do not require total mesorectal excision and are eligible for TEM, the surgery must be carried out by experienced surgeons.

Keywords Transanal endoscopic microsurgery · Minimally invasive surgery · Rectal neoplasia

Introduction

Transanal endoscopic microsurgery (TEM) is a minimally invasive technique for local excision of rectal tumors, and is an example of natural orifice surgery. It is a surgical alternative to total mesorectal excision (TME) in large rectal adenomas, early stage rectal cancer (T1) and other selected benign tumors. Its major advantage is the fact that it reduces morbidity and mortality rates compared to TME, and improves quality of life. Postoperative clinical morbidity rates have been reported to be less than 10%, with no genitourinary or sexual changes, and the mortality rate is also very low (0.3%) [1–6].

TEM was first described by Gerhard Buess in 1984 for the treatment of tumors up to 20 cm from the anal verge. Initially it was only used to resect small benign tumors, but its indications have expanded to include larger and more advanced lesions [7]. Lately, TEM has become the treatment of choice for benign lesions throughout the rectum that are not amenable to flexible endoscopic excision, and also in selected patients with early malignant rectal disease [8].

The classification of the size of the rectal polyps is controversial and varies from study to study. Some articles tend to describe giant rectal lesions as those larger than 5 cm, with a significantly increased risk of complications (5–26%). The local recurrence rate also increases with the excision of lesions greater than 3–5 cm. Therefore, it is crucial to resect

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the whole adenoma by means of a full-thickness excision with free margins [8, 9]. Scala et al. defined rectal tumors as small when below 3 cm in diameter, large between 3 and 5 cm, and giant or huge above 5 cm [10], and reported significantly higher rates of postoperative complications and recurrences in lesions larger than 5 cm. Few studies mention rectal tumors above 8 cm [4, 10, 11].

The aim of this study was to evaluate the feasibility of TEM in rectal neoplasia larger than 5 cm [comparing lesions < 5 cm, very large(5–7.9 cm), and ultra-large lesions (≥ 8 cm)], from the point of view of preoperative evaluation, surgical difficulty, postoperative complications, percentage of adenocarcinoma in the definitive histology, recurrence, and stenosis during follow-up.

Materials and methods

This was an observational study with prospective data collection at a single center including all patients having TEM between June 2004 and September 2018 at the Coloproctology Unit of Parc Taulí University Hospital. All patients with rectal tumors who were candidates for TEM were assessed and treated by the same team of 5 expert surgeons (XSA, LML, APL, SSP, JB). Patients had a preoperative evaluation in accordance with our previously described protocol [12] and were assigned by a multidisciplinary committee to one of the five preoperative TEM indication groups (I to V). Group I: with curative intent, biopsy suggesting adenomas, after ultrasound (u) and magnetic resonance imaging (MRI), staged u-MRI T0-1 and u-MRI N0. In patients with higher stage by u-MRI than u-MRI T0-1 and u-MRI N0 with biopsy of adenoma, the biopsy was repeated; if the result was once again adenoma, patients were included in group I. Group II: with curative intent, biopsy of low-grade adenocarcinomas, staged u-MRI T0-1 and u-MRI N0. Group III: rectal adenocarcinoma with biopsy of low-grade adenocarcinomas, staged u-MRI T2 and u-MRI N0 who reject radical surgery. Group IV: palliative indication, adenocarcinoma of any stage unsuitable for radical surgery. Group V: atypical indications [13, 14].

Patients in preoperative group I were included in the study. Patients in other preoperative groups (II to V) were excluded.

The day before surgery, all patients had mechanical bowel preparation and received antibiotic and thromboembolism prophylaxis prior to surgery, in accordance with the hospital's protocol. Most procedures were performed under general anesthesia; when this was contraindicated, spinal anesthesia was administered. In the operating room, all patients had rectoscopy to check the definitive size and location of the tumor, and a urinary catheter was inserted [12].

Transanal endoscopic surgery was carried out either by TEM or transanal endoscopic operation (TEO) [15]. All patients underwent a full-thickness excision of the rectal wall using an ultrasound scalpel (Ultracision, Ethicon Endo-Surgery, Cincinnati, OH,USA). Whenever possible, the defect was closed by a long-term absorbable running monofilament suture. In the event of tension in the suture, the proximal defect was partially closed [12]. The TEM technique used for the large lesions is what we call the "rectoscope advancement technique", described in a previous study by our group [16].

In patients with multiple polyps, the largest polyp was selected for the analysis. All patients were evaluated 1 month after discharge by clinical examination. If the patient had no previous polyp history, follow-up by regional endoscopy was performed at 6, 12, and 24 months. A complete colonoscopy was performed in accordance with the consensus protocol [8, 12].

The main variable was tumor size, measured by rectoscopy at the time of the surgery in the operating room. The lesions were classified into three groups (< 5 cm, 5–7.9 cm and ≥ 8 cm), different from the ones described in the literature [10].

The data recorded included age and sex, American Society of Anesthesiologists (ASA) score, lesion characteristics (distance from the anal verge and location of the tumor), ultrasound staging, surgical variables (time, surgical transanal technique, pieces of specimen, type of resection, peritoneal perforation, suture of defect, mortality, adverse effects (AE) according to the Clavien–Dindo classification [17], definitive pathology study and follow-up (recurrence, rescue radical surgery and stenosis). We defined clinical morbidity as a Clavien–Dindo classification score ≥ grade I, and relevant morbidity as a Clavien–Dindo classification score ≥ II CL-D. Rectal stenosis was defined when during follow up, the flexible endoscopy found the rectal lumen to be ≤ 2cm.

Complications after the TEM procedure were prospectively registered if reported within 30 days by any surgeon or nurse attending the patient, or if the patient contacted the surgical department.

If the final pathology report revealed pT2 or pT3, rescue TME was performed within the next few weeks postoperatively.

The study was approved by the local Institutional Ethics Committee (CEIC: 2016/636) and complied with the criteria of the Declaration of Helsinki. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for observational studies were followed.

Statistical analysis

The SPSS statistical package version 23 was used. Data were collected consecutively and prospectively from the patient's file. Quantitative and categorical variables were described in accordance with standard statistical regulations. The univariate analysis of the quantitative variables was carried out using Student's *T* test, providing it was applicable; otherwise, the Mann–Whitney *U* test or Kruskal–Wallis test was used. For categorical variables, Pearson's χ^2 test or Fisher's exact statistical test was used. A p value < 0.05 was considered statistically significant. The diagnostic test was evaluated by calculating the accuracy, sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) and likelihood ratios with 95% confidence intervals.

Results

During the study period, TEM/TEO was indicated in 761 patients. Among these patients, 507 (66.6%) had an adenoma in the preoperative biopsy (group I) and were included in the study. Figure 1 shows the patients distributed according to tumor size: 309/507 (60.9%) patients had small to large tumors (< 5 cm), 162/507 (32%) had very large tumors (5–7.9 cm) and 36/507 (7.1%) had ultra-large tumors (> = 8 cm).

Table 1 shows the demographic data and characteristics of the lesion according to size groups. The median age of patients was 70 years, with patients in the very large group being slightly older ($p = 0.02$). The median distance from anal verge and the distance to upper lesion margin presented statistically significant differences between groups ($p = 0.015$ and $p < 0.001$, respectively).

Table 2 shows the endorectal ultrasound tumor (T) stage of the lesion according to size groups, with slight differences between groups ($p = 0.03$). The ultra-large group presented the highest rate of "non-evaluable" tumors.

Table 3 shows endorectal ultrasound (ERUS) sensitivity, specificity, PPV, NPV, and likelihood ratios by groups, excluding non-evaluable lesions. Larger lesions were not associated with poorer values for accuracy or the other variables.

Table 4 shows the surgical characteristics. Surgical time increased with tumor size, being significantly longer in larger groups ($p < 0.001$). En bloc surgical resection was achieved in 91.9% (466/507); there were statistically significant differences between groups ($p < 0.001$): it was achieved in 63.9% (23/36) of patients with ultra-large tumors. Peritoneal perforation occurred in 7.1% (36/507) of cases, with statistically significant differences between groups ($p < 0.001$). Complete closure of the defect was achieved in 86.6% (439/507) of cases, again with statistically significant differences between groups ($p < 0.001$). All these patients

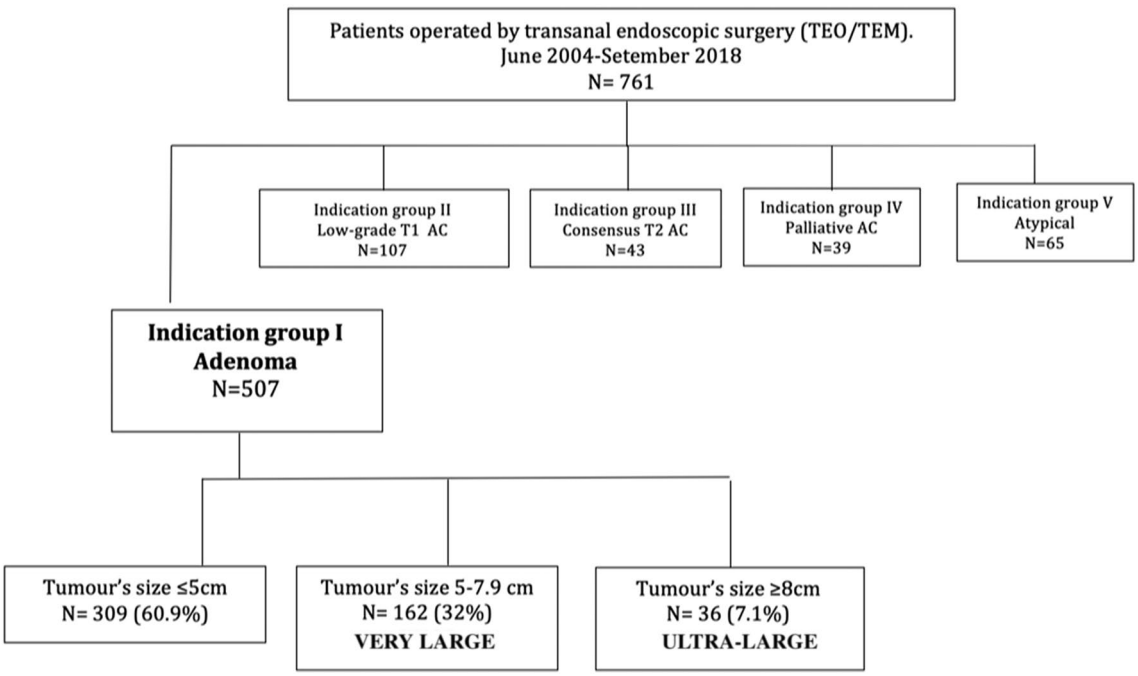

Fig. 1 Patients' flow chart. AC adenocarcinoma. Group I: rectal lesions with biopsy revealing adenoma and staged T0-N0 by endorectal ultrasound (u) and/or pelvic magnetic resonance (mr), divided by tumor size. Group II: adenocarcinomas [either well (G1) or moderately differentiated (G2)], and staged u-mrT0-1, u-mrN0. Group III: indication by consensus, adenocarcinomas [either well (G1) or moderately differentiated (G2)], staged u-mrT2, u-mrN0. Group IV: palliative indications. Group V: atypical indications

Table 1 Demographic data and lesion characteristics according to size group

		Total *n* (%)	< 5 cm *n* (%)	5–7.9 cm *n* (%)	≥ 8 cm *n* (%)	*p*
Age (median IQR) years		70 (17)	68 (16)	72 (18)	76.5 (16)	0.02**
Sex	Male	308 (60.7)	126 (40.8)	102 (63)	23 (63.9)	0.67*
	Female	199 (39.3)	183 (59.2)	60 (37)	13 (36.1)	
ASA	I	20 (3.9)	14 (4.5)	4 (2.5)	2 (5.6)	1*
	II	290 (57.2)	190 (61.5)	85 (52.5)	15 (41.7)	
	III	167 (32.9)	87 (28.2)	64 (39.5)	16 (44.4)	
	IV	30 (5.9)	18 (5.8)	9 (5.6)	3 (8.3)	
Distance from anal verge (median IQR) cm		7 (5)	7 (5)	7 (6)	5 (6)	0.015**
Distance upper lesion margin (median IQR) cm		11 (5)	10 (4)	12 (5)	14 (5.8)	< 0.001**
Quadrant	Anterior	136 (26.8)	89 (28.8)	39 (24.1)	8 (22.2)	0.71
	Posterior	144 (28.4)	87 (28.2)	45 (27.8)	12 (33.3)	
	Right-left lateral	227 (44.8)	133 (58.6)	78 (48.1)	16 (44.4)	
Total		507	309 (60.9)	162 (32)	36 (7.1)	

IQR Interquartile range, *ASA* American Society of Anesthesiologists score

*Pearson Chi Squared

**Kruskal–Wallis test

Table 2 Endorectal ultrasound tumor (T) stage of the lesion according to size group

		Total *n* (%)	< 5 cm *n* (%)	5–7.9 cm *n* (%)	≥ 8 cm *n* (%)	*P**
uT	uT0	115 (22.7)	85 (27.5)	25 (15.4)	5 (13.9)	0.033
	uT1	275 (54.2)	157 (50.8)	96 (59.3)	22 (61.1)	
	uT2	58 (11.4)	40 (12.9)	14 (8.6)	4 (11.1)	
	uT3	9 (1.8)	3 (1)	5 (3.1)	1 (2.8)	
	uT1–2	19 (3.7)	9 (2.9)	10 (6.2)	0 (0)	
	uT2–3	4 (0.8)	0 (0)	3 (1.9)	1 (2.8)	
	Non-evaluable	27 (5.3)	15 (4.9)	9 (5.6)	3 (8.3)	
Total		507	309 (60.9)	162 (32)	36 (7.1)	

U Ultrasound

*Pearson Chi Squared

with perforation underwent transanal repair. None of the patients required checking of the suture by laparoscopy, or a diverted ileostomy.

Table 5 shows postoperative morbidity and mortality. In all, 21.4% (110/507) of patients presented postoperative morbidity, according to the Clavien-Dindo classification; the rates were significantly higher in the larger groups. However, there were very slight differences in clinical morbidity between groups, and none in relevant morbidity. There was only 1 death (0.2%).

Table 6 shows the definitive pathology and follow up. Adenomas were the definitive pathology in 80.1% (406/507), and 18.7% (95/507) were adenocarcinomas. Adenocarcinoma was more common in very large and ultra-large tumors, but the differences between groups were not statistically significant ($p = 0.38$). pT1 and pT2-3 were also more frequent in very large and ultra-large tumors, but again the differences were not statistically significant ($p = 0.23$). In 10% (51/507) of patients, the resection specimen presented involved margins; this figure rose to 30.6% (11/36) in patients with ultra-large tumors, a statistically significant increase ($p < 0.001$).

During a median follow-up of 57 months (range 3–160 months), recurrence was recorded in 32 patients (6.3%); it was significantly more frequent in patients with ultra-large tumors (11.1%, $p = 0.035$). Twelve patients presented adenoma recurrence and underwent re-TEM. Rescue radical surgery was needed in 3.6% (18/507) of patients, above all in patients with very large tumors (5.6%). Two patients with adenocarcinoma recurrence refused radical surgery.

Table 3 Endorectal ultrasound (ERUS) sensitivity, specificity, PPV, NPV, and likelihood ratios by groups, excluding non-evaluable ERUS

	Total *n* (%)		< 5 cm *n* (%)		5–7.9 cm *n* (%)		≥ 8 cm *n* (%)	
uT	uT0-1	uT2,3,1-2 and 2-3	uT0-1	uT2,3,1-2 and 2-3	uT0-1	uT2,3,1-2 and 2-3	uT0-1	uT2,3,1-2 and 2-3
pT 0 and 1	382	82	238	50	118	26	26	6
pT 2 and 3	8	8	4	2	3	6	1	0
Accuracy (95% CI)	81.25%(78.86–85.80%)		81.63% (76.75–87.01%)		81.05% (74.06–88.03%)		78.79% (63.37–94.21%)	
Sensitivity (95% CI)	82.33% (74.45–81.78%)		82.64% (78.26–87.01%)		81.94% (75.66–88.23%)		81.25% (67.73–94.77%)	
Specificity (95% CI)	50% (25.5–74.5%)		33.33% (−4.39–71.05%)		66.67% (35.87–97.47%)		0% (0–0%)	
PPV (95% CI)	97.95% (96.54–99.36%)		98.35% (96.74–99.95%)		97.52% (94.75–100%)		96.30 (89.17–100%)	
NPV (95% CI)	8.89% (3.01–14.77%)		3.85% (−1.38–9.07%)		18.75% (5.23–32.27%)		0% (0–0%)	
Total	480		294 (61.25%)		153 (31.88%)		33 (6.87%)	

PPV positive predictive value, *NPV* negative predictive value. 95% CI: 95% 95% confidence interval *US* Ultrasound, *IQR* Interquartile range

Table 4 Surgical characteristics according to size group

		Total *n* (%)	< 5 cm *n* (%)	5–7.9 cm *n* (%)	≥ 8 cm *n* (%)	*p*
Surgical time (median IQR) min		70 (50)	60 (40)	90 (55)	117 (50)	< 0.001**
Surgical technique	TEM	240 (47.3)	145 (46.9)	76 (46.9)	19 (52.8)	0.89*
	TEO	266 (52.7)	164 (53.1)	86 (53.1)	17 (47.2)	
Specimen	En bloc	466 (91.9)	302 (97.7)	141 (87)	23 (63.9)	< 0.001*
	Fragmentation	41 (8.1)	7 (2,3)	21 (13)	13 (36.1)	
Type resection	Full-thickness	502 (99)	304 (98.4)	162 (100)	36 (0)	0.19
	Partial	5 (1)	5 (1.6)	0 (0)	0 (0)	
Peritoneal perforation		36 (7.1)	15 (5.5)	10 (6.2)	9 (25)	< 0.001*
Suture of defect	Complete suture	439 (86.6)	276 (89.3)	141 (87)	22 (61.1)	< 0.001*
	Partial suture	65 (12.8)	30 (9.7)	21 (13)	14 (38.9)	
	No suture	3 (0.6)	3 (1)	0 (0)	0 (0)	
Total		507	309 (60.9)	162 (32)	36 (7.1)	

TEM Transanal endoscopic microsurgery, *TEO* Transanal endoscopic operation

Total rectal stenosis was relatively rare and occurred in 3.2% (16/507) of patients, and partial stenosis in 1.6% (8/507), although it was more frequent in ultra-large tumors ($p < 0.001$). There was no stenosis in tumors < 5 cm. Dilatation of the stenosis was required in 1.6% (8/507) of cases–in 4.3% of very large tumors and in 2.8% of ultra-large tumors ($p < 0.001$).

Discussion

Among the major advantages of TEM are its ability to reduce morbidity and mortality rates in relation to radical surgery or TME and to improve quality of life. In our previous study, postoperative morbidity was reported to be 23.6% [6], a rate similar to the one described here (21.4%). The mortality rate is also very low. Corroborating our previous findings in a randomized trial, there were no differences between patients with regard to the use of TEM or TEO [18].

ERUS is considered the technique of choice for selecting patients for TEM. In this study, it was performed by surgeons at the coloproctology unit. In a previous article by our team assessing the accuracy of the ERUS in relation to the pathology results after TEM (pT) found similar ERUS sensitivity, specificity, PPV, NPV, and likelihood ratios in the different groups classified according to size [19]. However, ERUS was less accurate with larger lesions ($p = 0.004$; OR 0.219, 95% CI 0.137-0.349) and in our previous study, we concluded that ERUS accuracy is dependent on lesion size as well as other variables. In spite of these previous results,

Table 5 Postoperative morbidity and mortality

		Total *n* (%)	< 5 cm *n* (%)	5–7.9 cm *n* (%)	≥ 8 cm *n* (%)	*p*
Overall morbidity		110 (21.4)	54 (17.5)	43 (26.5)	13 (36.1)	0.007*
Clinical morbidity ≥ I CL-D		38 (7.5)	18 (5.8)	14 (8.6)	6 (16.7)	0.052* 0.023^
Relevant morbidity ≥ II CL-D		21 (4.1)	11 (3.6)	7 (4.3)	3 (8.3)	0.39
Clavien–Dindo classification grade	0	396 (78.1)	254 (82.2)	119 (73.5)	23 (63.9)	< 0.001*
	I	74 (14.6)	38 (12.3)	29 (17.9)	7 (19.4)	
	II	17 (3.4)	7 (2.3)	7 (4.3)	3 (8.3)	
	IIIa	6 (1.2)	6 (1.9)	0 (0)	0 (0)	
	IIIb	9 (1.8)	3 (1)	6 (3.7)	0 (0)	
	IVa	3 (0.6)	1 (0-3)	1 (0.6)	1 (2.8)	
	IVb	1 (0.2)	0 (0)	0 (0)	1 (2.8)	
Mortality	CL-D V	1 (0.2)	0 (0)	0 (0)	1 (2.8)	0.6
Total		507	309 (60.9)	162 (32)	36 (7.1)	

CL-D Clavien–Dindo classification

*Pearson Chi Squared. ^Linear association test

Table 6 Definitive pathology and follow up

		Total *n* (%)	< 5 cm *n* (%)	5–7.9 cm *n* (%)	≥ 8 cm *n* (%)	*p*
Definitive pathology	Adenoma	406 (80.1)	252 (81.6%)	128 (79.6)	26 (72.2)	0.37*
	Adenocarcinoma	95 (18.7)	52 (16.8)	33 (20.4)	10 (27.8)	
	No pathology	6 (1.2)	5 (1.6)	0 (0.6)	0 (0)	
pT	pT0	411 (81.1)	256 (82.4)	129 (79.6)	26 (72.2)	0.23
	pT1	78 (15.4)	45 (14.6)	24 (14.8)	9 (25)	
	pT2-3	18 (3.6)	8 (2.6)	9 (5.6)	1 (2.8)	
Resection margins	Free margins	456 (90)	293 (94.8)	138 (85.2)	25 (69.4)	< 0.001*
	Involved margins	51 (10)	16 (5.2)	24 (14.8)	11 (30.6)	
Follow-up (median, range)months: 57, 3–160						
Recurrence		32 (6.3)	14 (4.5)	14 (8.6)	4 (11.1)	0.035^
Rescue to radical surgery		18 (3.6)	8 (2.6)	9 (5.6)	1 (2.8)	0.25*
Stenosis	Total	16 (3.2)	0 (0)	11 (6.8)	5 (13.9)	< 0.001*
	Simple	8 (1.6)	0 (0)	4 (2.5)	4 (11.1)	< 0.001*
	Needs dilatation	8 (1.6)	0 (0)	7 (4.3)	1(2.8)	< 0.001*
Total		507	309 (60.9)	162 (32)	36 (7.1)	

pT pathology tumor stage

*Pearson Chi Squared. **Kruskal–Wallis test. ^Linear association test

in the present study we did not find lower levels either for accuracy or for the other variables in very-large lesions. At our center, rectal tumors are not necessarily indications for MRI; we use MRI only in patients with preoperative adenocarcinoma biopsy with doubtful diagnosis and risk of peritoneal cavity perforation [19].

Transanal minimally invasive surgery (TAMIS [20]) with a single port system is compatible with the equipment used in laparoscopic surgery and achieves high-quality local excision. TAMIS has emerged as an alternative to TEM, obtaining similar results [20, 21]. However, Molina et al. [22] reported an association between the use of TAMIS and rigid platforms, and regard TAMIS as suboptimal in high and/or near-circumferential lesions. These authors advocate conversion to TEM/TEO for correct closure of the transanal defect.

Tumor size > 6 cm has also been reported to be a risk factor for complications (OR 3.2 (95%)) [6], but assessing only clinical (Clavien-Dindo ≥ I) and relevant morbidity (Clavien-Dindo ≥ II), we can see that there are no statistically significant differences between groups.

The excision of large lesions and the creation of large rectal wall defects raise the risk of peritoneal perforation, which may subsequently be complicated with rectal stenosis. We recommend suture of the defect, as far as possible without tension, in order to avoid these events. In our previous study of perforation in the peritoneal cavity during TEM, we described a quantitative predictive model in which one of the main risk factors for perforation was size ≥ 6 cm. Following on from these results, in the present study we also found peritoneal perforation to be more common in very large and ultra-large tumors. However, all these perforations were repaired transanally [23]. As we describe in this study, perforation in the peritoneal cavity does not increase the risk of recurrence or peritoneal dissemination.

In our previous study of the importance of en bloc and full-thickness resection, 19.8% of the tumors resected were infiltrating adenocarcinomas in the definitive pathology report, and 62.1% were pT1 [8]. In the present study, adenocarcinoma pT1 and pT2-3 were more common in very large and ultra-large tumors but the differences between groups were not significant.

The only randomized study, by de Graaf et al., found a local recurrence rate of 24% for TEM and 0% with TME [24]. A meta-analysis of treatment for T1 colorectal cancer reported recurrence rates of 3.8–18% for TEM and 0–6% for TME, but no significant differences in overall or disease-free survival at 5 years [25].

The recurrence rate of rectal adenomas after TEM is low at 4%, and most of these recurrences can be treated again with TEM [8]. The local recurrence rate also increases with the excision of lesions above 3-5 cm [8]. The present study provides similar results, with more frequent recurrence in patients with ultra-large tumors.

Free margins have been associated with the risk of recurrence. In our previous study tumor size was identified as a risk factor, along with positive margins [8]. In this study we found the same correlation, with an overall recurrence rate of 6.3% and rates of 8.6% and 11.1% in very large and ultra-large tumors, respectively ($p = 0.035$).

Very few studies in the literature have described rectal stenosis after local excision in rectal tumors. This event is associated with fecal urgency and incontinence and has a negative impact on patients' quality of life [17, 26]. The overall rate of stenosis in this series was low, at 3.2%; we did not find stenosis in tumors < 5 cm, but it appeared in 6.8% of very large tumors and in 13.9% of ultra-large tumors. Some of these patients will need dilatation of the stenosis.

Conclusions

The surgical treatment of these rectal tumors is challenging and requires considerable experience. Ultra-large tumors are associated with increases in overall postoperative complications, positive margins, recurrence and stenosis. These tumors do not require total mesorectal excision and are candidates for TEM; nevertheless, the surgery must be carried out at a high-volume center by surgeons who have considerable experience with the technique.

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Compliance with ethical standards

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Informed consent Not applicable.

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