**Name of Journal:** *World Journal of Gastrointestinal Surgery*

**Manuscript NO:** 84778

**Manuscript Type:** ORIGINAL ARTICLE

***Retrospective Cohort Study***

**Excision of malignant and pre-malignant rectal lesions by transanal endoscopic microsurgery in patients under 50 years of age**

Yaacobi DS *et al*. Excision of rectal lesions by TEM

Dafna Shilo Yaacobi, Yael Berger, Tali Shaltiel, Eliahu Y Bekhor, Muhammad Khalifa, Nidal Issa

**Dafna Shilo Yaacobi,** Department of Plastic Surgery & Burns, Rabin Medical Center, Petah Tikva 4941492, Israel

**Yael Berger, Tali Shaltiel, Eliahu Y Bekhor, Muhammad Khalifa, Nidal Issa,** Department of Surgery, Rabin Medical Center-Hasharon Hospital, Petah Tikva 4941492, Israel

**Author contributions:** Shilo Yaacobi D contributed to methodology, original draft preparation, and manuscript review and editing; Berger Y contributed to investigation and original draft preparation; Shaltiel T contributed to investigation and original draft preparation; Bekhor EY contributed to investigation, statistics, and manuscript review and editing; Khalifa M contributed to original draft preparation and manuscript review and editing; Issa N contributed to project administration, methodology, original draft preparation, and manuscript review and editing.

**Corresponding author: Dafna Shilo Yaacobi, MD, Surgeon,** Department of Plastic Surgery & Burns, Rabin Medical Center, No. 39 Zabutinsky Street, Petah Tikva 4941492, Israel. dafna.yaacobi@icloud.com

**Received:** April 5, 2023

**Revised:** June 24, 2023

**Accepted:** July 29, 2023

**Published online:**September 27, 2023

**Abstract**

BACKGROUND

The most common technique for treating benign and early malignant rectal lesions is transanal endoscopic microsurgery (TEM). Local excision is an acceptable technique for high-risk and elderly patients, but there are hardly any data regarding young patients.

AIM

To describe TEM outcomes in patients under 50 years of age.

METHODS

We collected demographic, clinical, and pathological data from all patients under the age of 50 years who underwent the TEM procedure at Hasharon Rabin Medical Center from January 2005 to December 2018.

RESULTS

During the study period, a total of 26 patients under the age of 50 years underwent TEM procedures. Their mean age was 43.3 years. Eleven (42.0%) were male. The mean operative time was 67 min, and the mean tumor size was 2.39 cm, with a mean anal verge distance of 8.50 cm. No major intraoperative or postoperative complications were recorded. The median length of stay was 2 d. Seven (26.9%) lesions were adenomas with low-grade dysplasia, four (15.4%) were high-grade dysplasia adenomas, two were T1 carcinomas (7.8%), and three were T2 carcinomas (11.5%). No residual disease was found following endoscopic polypectomy in two patients (7.8%), but four (15.4%) had other pathologies. Surgical margins were negative in all cases. Local recurrence was detected in one patient 33 mo following surgery.

CONCLUSION

Among young adult patients, TEM for benign rectal lesions has excellent outcomes. It may also offer a balance between the efficacy of complete oncologic resection and postoperative quality of life in the treatment of rectal cancer. In some cases, it may be considered an alternative to radical surgery.

**Key Words:** Transanal endoscopic microsurgery; Young adults; Rectal lesions; Benign lesions; Malignant lesions; Radical surgery alternative

**©The** **Author(s) 2023.** Published by Baishideng Publishing Group Inc. All rights reserved.

**Citation:** Shilo Yaacobi D, Berger Y, Shaltiel T, Bekhor EY, Khalifa M, Issa N. Excision of malignant and pre-malignant rectal lesions by transanal endoscopic microsurgery in patients under 50 years of age. *World J Gastrointest Surg* 2023; 15(9): 1892-1900

**URL:** https://www.wjgnet.com/1948-9366/full/v15/i9/1892.htm

**DOI:** https://dx.doi.org/10.4240/wjgs.v15.i9.1892

**Core Tip:** Among young adult patients, transanal endoscopic microsurgery for benign rectal lesions has excellent outcomes. It may also offer the balance between efficacy of complete oncologic resection and postoperative quality of life in the treatment of rectal cancer and in some cases may be considered an alternative to radical surgery.

**INTRODUCTION**

The most common gastrointestinal malignancy is colorectal cancer (CRC), with an incidence rate that is increasing among young adults[1,2]. Mortality has also increased in young adults since 2004 (1.3% per year), along with worse outcomes[3,4], but data regarding this population are still controversial[5]. Some studies have demonstrated similar outcomes in young and elderly patients, while others have suggested poorer outcomes in young patients[6,7]. Not much is known regarding the reason why these patients, without any genetic predispositions, develop CRC[8]. Furthermore, young patients tend to present with more advanced stages of disease compared with elderly patients[5,9]. The American National Comprehensive Cancer Network (NCCN) guidelines for CRC screening have recently been revised, and it is now recommended to begin screening at 45 years of age[10]. In Israel, however, routine screening still begins at the age of 50 years[11].

The extent of surgery may be influenced by the age of the patients, with young patients with colon cancer usually undergoing extended surgery[12]. For rectal cancer, the standard surgical technique is total mesorectal excision (TME), either by anterior resection (AR) or abdominoperineal resection (APR). This procedure is usually curative for early-stage rectal cancer but might have a substantial impact on quality of life due to its high morbidity and mortality rates. In fact, there is a 20%-40% rate of adverse events, including urinary and sexual dysfunction, anastomotic leakage, and permanent colostomy[13,14]. Due to morbidity associated with TME, other less invasive transanal approaches have been explored for the management of rectal cancer, including local excision *via* transanal excision (TAE) or transanal endoscopic microsurgery (TEM).

Surgical treatment of rectal tumors in young patients should help patients achieve a good quality of life and, at the same time, be based on efficient oncologic excision[15]. The TEM technique enables high-quality excision of certain rectal lesions[16]. It has proven its superiority over traditional TAE[17] when treating benign rectal lesions, while for early rectal cancer, it has demonstrated better functional outcomes and has excellent long-term survival rates as a form of radical surgery[18].

TEM may be considered the technique of choice for rectal adenoma[19,20] and an acceptable alternative treatment to radical resection in patients with low-risk T1 rectal adenocarcinoma. In elderly and high-risk patients, local excision is considered an acceptable choice for rectal lesions[21,22], but data are limited regarding its application in young adults[23]. The aim of this study was to explore the outcomes in young patients undergoing TEM for rectal lesions. We set the age cut-off to 50 years due to the above-mentioned minimal age for colonoscopy screening and the rare incidence of CRC before this age[5,11].

**MATERIALS AND METHODS**

This retrospective cohort study was approved by the Rabin Medical Center Institutional Review Board, with a waiver of informed consent. We reviewed the data on all patients under the age of 50 years who underwent TEM procedures at our medical center between January 2005 and December 2018. All data (demographic, clinical, and pathological) were collected retrospectively from our medical center electronic system. These data included the tumor location, tumor dimensions, tumor histology, indications for surgery, operative findings, postoperative outcomes, and complications.

All patients underwent a preoperative evaluation protocol for TEM before surgery, consisting of a colonoscopy that included a biopsy and a rigid proctoscopy defining the number of lesions, the tumor size, its location within the rectal wall, and its distance from the anal verge. Patients with malignant tumors underwent an endorectal ultrasound examination preoperatively.

Patients who had benign rectal lesions not amenable to endoscopic excision, T1 rectal cancer without the involvement of lymph nodes per radiology, or indeterminate margins following endoscopic polypectomy were routinely offered TEM. TEM was also offered to selected patients with retrorectal and submucosal lesions.

Preparation of the patients for TEM surgery and colon resection was the same, with mechanical bowel preparation performed a day before the procedure and administration of prophylactic antibiotics at the time of anesthesia induction.

The details of the technique were previously described elsewhere[24]. All rectal wall defects were closed transversally with absorbable sutures. All patients had a urinary catheter during surgery, which was removed on postoperative day 1, at which point the intake of oral liquid and a soft diet were resumed. Pain control included oral dipyrone, paracetamol, and narcotics. Patients were discharged when oral intake was well tolerated, and no complications were detected, which meant that no unexpected events had occurred during the procedure or in the postoperative period.

Patients were evaluated 2 wk following surgery and then at 3-mo intervals for the first two postoperative years, and every 6 mo from then on. Each follow-up visits also included a rigid rectoscopy. In cases of rectal wall invasion per final pathology of the TEM specimen or unfavorablehistologic findings in T1 tumors indicating SM3 or lymphovascular invasion, patients were referred for rectal resection with TME.

A descriptive data analysis was performed for the categorical variables, and the ranges and means were calculated for the continuous variables.

**RESULTS**

During the study period, 186 patients underwent TEM procedures. Of these, 26 patients (14%) were under the age of 50 years and therefore included in the study. The patients’ demographics and tumor characteristics are shown in Table 1. The mean age was 43.3 years (range 21-49 years). Eleven (42%) of the patients were male, and the remainder were female. Most patients (*n* = 17, 65.5%) had an American Society of Anesthesiology score of 1. Indications for TEM were low-grade dysplasia adenomas in seven patients (27%), high-grade dysplasia adenomas in five (19.2%), carcinoma diagnosed in preoperative biopsies in four (15.4%), positive margins following endoscopic polypectomy in four (15.4%), and other pathologies (one tailgut cyst, two suspected carcinoid, and three undetermined pathologies) in six (23%). The mean tumor diameter was 2.39 cm (range 1-4 cm), with a mean anal verge distance of 8.5 cm (range 5-13 cm). Eight (30.8%) of the lesions were located in the posterior rectal wall, three (11.5%) in the anterior wall, and 15 (57.7%) in the lateral walls. Four lesions (15.4%) were diagnosed as carcinomas by preoperative biopsies. The stage of all the tumors was T1 SM1, and all had favorable histological features (*i.e.*, no lymphovascular invasion or perineural invasion).

Table 2 presents the perioperative variables. The mean operative time was 67 min (range 46-108 min). No major intraoperative or postoperative complications were documented. The only recorded minor complication was postoperative urinary retention, which occurred in two patients. The estimated blood loss during surgery was minimal. The median length of stay was 2 d (range 1-4 d). One patient was readmitted during the postoperative period (4 d after discharge) due to rectal bleeding; he was treated conservatively with no need for invasive intervention or blood transfusion. No other readmissions were recorded.

Regarding the final pathological results of the specimens (Table 3), adenocarcinoma was found in six patients, T1 carcinoma in four (15.4%), and T2 carcinoma in two (7.8%). Adenomatous polyps were found in 11 patients (42%), high-grade dysplasia in seven (26.9%), and low-grade dysplasia in four (15.4%); there was no residual disease following endoscopic polypectomy in two patients (7.8%). Other pathological findings included a carcinoid tumor, a neuroendocrine tumor, endometriosis, a tailgut cyst, and a solitary rectal ulcer. Surgical margins were free of tumors in all cases.

In two patients with T2 carcinoma on the final pathology, completion of rectal resection was required; therefore, they both underwent laparoscopic AR 10 wk following TEM. There was no residual tumor or lymph node metastasis in the AR specimens in either case.

In the mean follow-up period of 55 mo (range 20-81 mo, median 80 mo), local recurrence of the rectal tumor was detected in one female patient 33 mo after TEM for T1 carcinoma. The patient underwent radiochemotherapy and laparoscopic abdominoperineal resection. The final pathology was T3, without the involvement of nodes.

There were no reports of postoperative incontinence in any of the patients.

**DISCUSSION**

TEM, like other minimally invasive colorectal surgical techniques, offers an effective treatment option with a low morbidity rate. In high-risk and elderly patients, traditionallocal excision has been found to be more acceptable for rectal lesions[21,22]. Recently, TEM has been considered by several authors[19,20] to be the technique of choice for rectal adenomas and also an acceptable alternative approach for radical resection in patients with T1 rectal carcinoma with favorable features.

Young patients with rectal lesions are being offered more radical resections, which is a reasonable oncological choice due to their longer life expectancy and the advantages of the radical surgery. However, radical resection in the form of AR or APR has considerable postoperative morbidity rates, and it is therefore rational to choose TEM as an alternative when taking into consideration the balance between the advantages and disadvantages of the radical resection approach[25,26].

The overall TEM complication rate for all lesions has been reported to range from 6% to 31%[27]. Possible postoperative complications include urinary retention, suture line dehiscence, and bleeding. In the present study, we reported a urinary retention rate of 7.6% (two cases), compared to 10.8% in the study of Tsai *et al*[28]. Neither length of stay nor overall complications were increased in the present study.

As for postoperative incontinence, which is another morbidity to be considered, Cataldo *et al*[29] found no significant deleterious effects of TEM on fecal continence. Morino *et al*[19] noted a temporary decrease in post-procedure anal resting pressure, which returned to preoperative values at a mean time of 4 mo ostoperatively. Our study cohort reported no incidence of incontinence, which is consistent with the reports in other literature[30,31].

The treatment of rectal tumors in young adult patients undoubtedly presents a challenge for the surgeon when seeking to obtain optimal results in terms of both quality of life and oncological outcome. Some studies suggest that the disease is more aggressive in younger adults with rectal carcinoma[32,33]. Others have found no significant differences in oncologic outcomes when comparing young adult patients with rectal tumors adjusted for tumor stage, suggesting that these patients do not necessarily have a more aggressive disease[34].

Since aggressive management attempts in young patients with colorectal tumors, such as radical resection, have not resulted in improved outcomes, it is suggested that they be handled in the same manner as older patients, considering the increasing incidence of these tumors among this population[35]. Regarding benign lesions, TEM was found to be more effective than transanal local excision in achieving tumor-free margins[17]. In another study, it also resulted in a less fragmented specimen and was therefore associated with lower recurrence rates[27]. TEM represents an alternative to the transabdominal approach, whereby a benign rectal lesion is situated in the upper rectum, which is especially valuable when considering the high morbidity and mortality associated with the latter approach in all age groups[36], with the possibility of a higher impact in young patients. No incontinence was reported in the long-term results among these patients; however, AR syndrome was experienced in 50%-90% of patients undergoing AR[36].

For malignant lesions, TEM is considered effective and safe when treating certain T1 Lesions without adverse pathologic results and with favorable outcomes. It is more strongly associated with lower morbidity and mortality compared to transabdominal radical rectal resection[37,38].

In our cohort, local recurrence of a rectal tumor was detected in one 49-year-old female patient 33 mo after TEM, who had a flat lesion in the lower rectum. The final pathology revealed a T1 carcinoma without vascular or neural invasion, with free margins. She underwent radiochemotherapy treatment followed by a laparoscopic APR. The final pathologic result was T3N0.

In our series, all T1 lesions were SM1. TEM is currently indicated as a curative treatment for malignancies histologically confirmed as pT1 SM1 tumors. Regarding T1 SM2 tumors, the optimal management approach remains unclear, given that they emerge without any unfavorable criteria due to lymph node positivity. In fact, node positivity increases the level of infiltration of the submucosa, with rates of 1%-3% for nodes in T1 SM1 lesions, 8%-10% in T1 SM2, and up to 25% in T1 SM3[39]. Therefore, we suggest that young patients with T1 SM2 lesions be offered radical rectal surgery, with TEM limited to patients participating in prospective trials with neoadjuvant or adjuvant treatment[40].

Two patients in this cohort had a T2 tumor per final pathology and subsequently underwent completion surgery following TEM by radical rectal resection. This approach has been demonstrated to be safe and returned similar oncological outcome to that of primary radical TME surgery. This result was also observed in series where immediate reoperation was performed[41,42]. Laparoscopic rectal surgery following TEM is thus considered safe and has no negative impact on resection completion[43].

For rectal T2 adenocarcinomas, the standard of treatment is TME *via* the transabdominal approach with or without neoadjuvant or adjuvant therapy[44], due to the high recurrence rate with occult lymph node metastases[45]. If an unexpected T2 tumor is excised by TEM, it may be managed safely by salvage radical surgery, with good oncological outcomes.

The rate of local recurrence following TEM ranges from 0%-33% for T1 rectal cancers[46]. Stipa *et al*[47] found that 96% (26/27) of patients with local recurrence following TEM underwent subsequent salvage surgery, nine of whom required repeated TEM, and seventeen of whom underwent radical surgery. In the latter group, the 5-year survival rate was 69%, which is similar to previously reported data[48]. TEM for rectal cancer followed by radical surgery offers an overall good long-term survival rate, which is similar to the rate obtained by initial radical surgery[47]. The risk of recurrence is mitigated by the high repeatability of the procedure, as well as by the satisfactory outcomes seen with salvage radical resection.

In this study, a single case of local recurrence was recorded 33 mo following TEM in a patient with a low rectal T1 lesion who had undergone a subsequent laparoscopic APR with a permanent colostomy. Such patients are more likely to require an APR rather than a low AR, according to some reports, due to secondary scar formation and technical difficulties[49,50]. These technical difficulties, as well as unnecessary APR, can be avoided when choosing the transanal TME technique[51]. While TEM may offer a better quality of life with long-term oncologic safety, it might require a longer period of postoperative follow-up. However, the exact frequency and required length of the follow-up period have yet to be defined, and it is suggested that these patients be treated as “high risk” until further data become available from larger randomized controlled trials.

The limitations of this study include its small sample size, retrospective nature, and various pathologies. There was also variability in perioperative care, as it evolved over the years due to long accrual periods. Furthermore, diagnostic modalities were not uniform for all patients, which may have impacted the choice of surgical approach and the various pathologies.

Local excision by TEM has indeed been interpreted as a successful and valid alternative to the traditional surgical treatment for adenomas and low risk (T1) rectal tumors[25], but it is still considered a compromise, especially in cases of advanced and high-risk rectal lesions, for which TME is considered the standard of care[24]. At the same time, rectal radical resection carries considerable postoperative morbidity, and it is therefore justifiable to offer TEM instead[26].

This surgical approach is likely not suitable for patients with a polypogenic rectum that has several lesions, but they will benefit from an up-front radical resection of the rectum rather than repeated TEMs due to the increased burden and cost of undergoing several surgical procedures.

**CONCLUSION**

TEM of benign rectal lesions in young adult patients is safe and leads to excellent outcomes. For early rectal cancer in this group of patients, TEM may offer a balance between postoperative quality of life and the effectiveness of the oncologic resection; therefore, it may be considered in selected cases as an alternative to radical surgery in young adult patients.

**ARTICLE HIGHLIGHTS**

***Research background***

Surgical treatment of rectal tumors in young patients should help patients achieve a good quality of life and, at the same time, be based on efficient oncologic excision. The transanal endoscopic microsurgery (TEM) technique enables high-quality excision of certain rectal lesions.

***Research motivation***

To explore the outcomes in young patients undergoing TEM for rectal lesions.

***Research objectives***

We set the age cut-off to 50 years due to the above mentioned minimal age for colonoscopy screening and the rare incidence of colorectal cancer before this age.

***Research methods***

This is a retrospective cohort study on all patients under the age of 50 years who underwent TEM procedures at our medical center between January 2005 and December 2018. Patients were evaluated 2 wk following surgery and then at 3-mo intervals for the first two postoperative years, and every 6 mo from then on. Each follow-up visits also included a rigid rectoscopy. A descriptive data analysis was performed for the categorical variables, and the ranges and means were calculated for the continuous variables.

***Research results***

During the study period, 186 patients underwent TEM procedures. Of these, 26 patients (14%) were under the age of 50 years and therefore included in the study. The mean age was 43.3 years (range 21-49 years). Eleven (42%) of the patients were male. Indications for TEM were low-grade dysplasia adenomas in seven patients (27%), high-grade dysplasia adenomas in five (19.2%), carcinoma diagnosed in preoperative biopsies in four (15.4%), positive margins following endoscopic polypectomy in four (15.4%), and other pathologies (one tailgut cyst, two suspected carcinoid, and three undetermined pathologies) in six (23%). No major intraoperative or postoperative complications were documented. There was no residual tumor or lymph node metastasis in the AR specimens in either case. In the mean follow-up period of 55 mo (range 20-81 mo, median 80 mo), local recurrence of the rectal tumor was detected in one female patient 33 mo after TEM for T1 carcinoma. The patient underwent radiochemotherapy and laparoscopic APR. The final pathology was T3, without the involvement of nodes. There were no reports of postoperative incontinence in any of the patients.

***Research conclusions***

TEM of benign rectal lesions in young adult patients is safe and leads to excellent outcomes. For early rectal cancer in this group of patients, TEM may offer a balance between postoperative quality of life and the effectiveness of the oncologic resection; therefore, it may be considered in selected cases as an alternative to radical surgery in young adult patients.

***Research perspectives***

The limitations of this study include its small sample size, retrospective nature, and various pathologies. There was also variability in perioperative care, as it evolved over the years due to long accrual periods. Furthermore, diagnostic modalities were not uniform for all patients, which may have impacted the choice of surgical approach and the various pathologies.

**REFERENCES**

1 **Sinicrope FA**. Increasing Incidence of Early-Onset Colorectal Cancer. *N Engl J Med* 2022; **386**: 1547-1558 [PMID: 35443109 DOI: 10.1056/NEJMra2200869]

2 **Chang SH**, Patel N, Du M, Liang PS. Trends in Early-onset vs Late-onset Colorectal Cancer Incidence by Race/Ethnicity in the United States Cancer Statistics Database. *Clin Gastroenterol Hepatol* 2022; **20**: e1365-e1377 [PMID: 34325062 DOI: 10.1016/j.cgh.2021.07.035]

3 **Amri R**, Bordeianou LG, Berger DL. The conundrum of the young colon cancer patient. *Surgery* 2015; **158**: 1696-1703 [PMID: 26298030 DOI: 10.1016/j.surg.2015.07.018]

4 **American Cancer Society**. Colorectal cancer facts & figures 2020-2022. 2020. [cited 3 July 2023]. Available from: https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/colorectal-cancer-facts-and-figures/colorectal-cancer-facts-and-figures-2020-2022.pdf

5 **O'Connell JB**, Maggard MA, Livingston EH, Yo CK. Colorectal cancer in the young. *Am J Surg* 2004; **187**: 343-348 [PMID: 15006562 DOI: 10.1016/j.amjsurg.2003.12.020]

6 **Lynch PM**. How helpful is age at colorectal cancer onset in finding hereditary nonpolyposis colorectal cancer? *Clin Gastroenterol Hepatol* 2011; **9**: 458-460 [PMID: 21440092 DOI: 10.1016/j.cgh.2011.03.016]

7 **Endreseth BH**, Romundstad P, Myrvold HE, Hestvik UE, Bjerkeset T, Wibe A; Norwegian Rectal Cancer Group. Rectal cancer in the young patient. *Dis Colon Rectum* 2006; **49**: 993-1001 [PMID: 16741599 DOI: 10.1007/s10350-006-0558-6]

8 **McMillan DC**, McArdle CS. The impact of young age on cancer-specific and non-cancer-related survival after surgery for colorectal cancer: 10-year follow-up. *Br J Cancer* 2009; **101**: 557-560 [PMID: 19672260 DOI: 10.1038/sj.bjc.6605222]

9 **O'Connell JB**, Maggard MA, Liu JH, Etzioni DA, Ko CY. Are survival rates different for young and older patients with rectal cancer? *Dis Colon Rectum* 2004; **47**: 2064-2069 [PMID: 15657655 DOI: 10.1007/s10350-004-0738-1]

10 **Abbadessa B**, Early DS, Friedman M. Continue NCCN Guidelines Panel Disclosures NCCN Guidelines Version 2. [cited 3 July 2023]. Available from: https://www.nccn.org/guidelines/guidelines-panels-and-disclosure/disclosure-panels#:~:text=The%20NCCN%20Disclosure%20Policies%20and%20Potential%20Conflicts%20of,Guidelines%20Panel%20and%20NCCN%20staff%20is%20noted%20below.

11 **Ministry of Health Guidelines**. Prevention and early detection of malignant diseases. [cited 3 July 2023]. Available from: https://hq.moh.gov.my/ohd/images/pdf/publication/4.12.2020\_Oral%20Cancer%20Guidelines\_edaran.pdf

12 **Klos CL**, Montenegro G, Jamal N, Wise PE, Fleshman JW, Safar B, Dharmarajan S. Segmental versus extended resection for sporadic colorectal cancer in young patients. *J Surg Oncol* 2014; **110**: 328-332 [PMID: 24888987 DOI: 10.1002/jso.23649]

13 **Andersson J**, Abis G, Gellerstedt M, Angenete E, Angerås U, Cuesta MA, Jess P, Rosenberg J, Bonjer HJ, Haglind E. Patient-reported genitourinary dysfunction after laparoscopic and open rectal cancer surgery in a randomized trial (COLOR II). *Br J Surg* 2016; **103**: 1746 [PMID: 27801929 DOI: 10.1002/bjs.10279]

14 **Musters GD**, Buskens CJ, Bemelman WA, Tanis PJ. Perineal wound healing after abdominoperineal resection for rectal cancer: a systematic review and meta-analysis. *Dis Colon Rectum* 2014; **57**: 1129-1139 [PMID: 25101610 DOI: 10.1097/DCR.0000000000000182]

15 **Stitzenberg KB**, Sanoff HK, Penn DC, Meyers MO, Tepper JE. Practice patterns and long-term survival for early-stage rectal cancer. *J Clin Oncol* 2013; **31**: 4276-4282 [PMID: 24166526 DOI: 10.1200/JCO.2013.49.1860]

16 **Buess G**. Review: transanal endoscopic microsurgery (TEM). *J R Coll Surg Edinb* 1993; **38**: 239-245 [PMID: 7693935]

17 **Heintz A**, Mörschel M, Junginger T. Comparison of results after transanal endoscopic microsurgery and radical resection for T1 carcinoma of the rectum. *Surg Endosc* 1998; **12**: 1145-1148 [PMID: 9716769 DOI: 10.1007/s004649900802]

18 **Demartines N**, von Flüe MO, Harder FH. Transanal endoscopic microsurgical excision of rectal tumors: indications and results. *World J Surg* 2001; **25**: 870-875 [PMID: 11572026 DOI: 10.1007/s00268-001-0043-2]

19 **Morino M**, Arezzo A, Allaix ME. Transanal endoscopic microsurgery. *Tech Coloproctol* 2013; **17** Suppl 1: S55-S61 [PMID: 23314951 DOI: 10.1007/s10151-012-0936-0]

20 **Heidary B**, Phang TP, Raval MJ, Brown CJ. Transanal endoscopic microsurgery: a review. *Can J Surg* 2014; **57**: 127-138 [PMID: 24666451 DOI: 10.1503/cjs.022412]

21 **Smart CJ**, Korsgen S, Hill J, Speake D, Levy B, Steward M, Geh JI, Robinson J, Sebag-Montefiore D, Bach SP. Multicentre study of short-course radiotherapy and transanal endoscopic microsurgery for early rectal cancer. *Br J Surg* 2016; **103**: 1069-1075 [PMID: 27146472 DOI: 10.1002/bjs.10171]

22 **Serra-Aracil X**, Serra-Pla S, Mora-Lopez L, Pallisera-Lloveras A, Labro-Ciurans M, Navarro-Soto S. Transanal endoscopic micro-surgery in elderly and very elderly patients: a safe option? Observational study with prospective data collection. *Surg Endosc* 2019; **33**: 184-191 [PMID: 29934869 DOI: 10.1007/s00464-018-6292-z]

23 **Cao B**, Min L, Zhu S, Shi H, Zhang S. Long-term oncological outcomes of local excision versus radical resection for early colorectal cancer in young patients without preoperative chemoradiotherapy: a population-based propensity matching study. *Cancer Med* 2018; **7**: 2415-2422 [PMID: 29726125 DOI: 10.1002/cam4.1508]

24 **Issa N**, Fenig Y, Yasin M, Schmilovitz-Weiss H, Khoury W, Powsner E. Laparoscopy following peritoneal entry during transanal endoscopic microsurgery may increase the safety and maximize the benefits of the transanal excision. *Tech Coloproctol* 2016; **20**: 221-226 [PMID: 26908311 DOI: 10.1007/s10151-016-1436-4]

25 **Lee W**, Lee D, Choi S, Chun H. Transanal endoscopic microsurgery and radical surgery for T1 and T2 rectal cancer. *Surg Endosc* 2003; **17**: 1283-1287 [PMID: 12739119 DOI: 10.1007/s00464-002-8814-x]

26 **Middleton PF**, Sutherland LM, Maddern GJ. Transanal endoscopic microsurgery: a systematic review. *Dis Colon Rectum* 2005; **48**: 270-284 [PMID: 15711865 DOI: 10.1007/s10350-004-0804-8]

27 **Moore JS**, Cataldo PA, Osler T, Hyman NH. Transanal endoscopic microsurgery is more effective than traditional transanal excision for resection of rectal masses. *Dis Colon Rectum* 2008; **51**: 1026-30; discussion 1030-1 [PMID: 18481147 DOI: 10.1007/s10350-008-9337-x]

28 **Tsai BM**, Finne CO, Nordenstam JF, Christoforidis D, Madoff RD, Mellgren A. Transanal endoscopic microsurgery resection of rectal tumors: outcomes and recommendations. *Dis Colon Rectum* 2010; **53**: 16-23 [PMID: 20010345 DOI: 10.1007/DCR.0b013e3181bbd6ee]

29 **Cataldo PA**, O'Brien S, Osler T. Transanal endoscopic microsurgery: a prospective evaluation of functional results. *Dis Colon Rectum* 2005; **48**: 1366-1371 [PMID: 15933798 DOI: 10.1007/s10350-005-0031-y]

30 **Issa N**, Fenig Y, Khatib M, Yasin M, Powsner E, Khoury W. Transanal Endoscopic Microsurgery Combined with Laparoscopic Colectomy for Synchronous Colorectal Tumors: A Word of Caution. *J Laparoendosc Adv Surg Tech A* 2017; **27**: 605-610 [PMID: 27992283 DOI: 10.1089/lap.2016.0420]

31 **Guerrieri M**, Baldarelli M, de Sanctis A, Campagnacci R, Rimini M, Lezoche E. Treatment of rectal adenomas by transanal endoscopic microsurgery: 15 years' experience. *Surg Endosc* 2010; **24**: 445-449 [PMID: 19565297 DOI: 10.1007/s00464-009-0585-1]

32 **Meyer JE**, Cohen SJ, Ruth KJ, Sigurdson ER, Hall MJ. Young Age Increases Risk of Lymph Node Positivity in Early-Stage Rectal Cancer. *J Natl Cancer Inst* 2016; **108** [PMID: 26719881 DOI: 10.1093/jnci/djv284]

33 **You YN**, Xing Y, Feig BW, Chang GJ, Cormier JN. Young-onset colorectal cancer: is it time to pay attention? *Arch Intern Med* 2012; **172**: 287-289 [PMID: 22157065 DOI: 10.1001/archinternmed.2011.602]

34 **Dinaux AM**, Leijssen LGJ, Bordeianou LG, Kunitake H, Berger DL. Rectal Cancer in Patients Under 50 Years of Age. *J Gastrointest Surg* 2017; **21**: 1898-1905 [PMID: 28842810 DOI: 10.1007/s11605-017-3525-8]

35 **Ganapathi S**, Kumar D, Katsoulas N, Melville D, Hodgson S, Finlayson C, Hagger R. Colorectal cancer in the young: trends, characteristics and outcome. *Int J Colorectal Dis* 2011; **26**: 927-934 [PMID: 21424713 DOI: 10.1007/s00384-011-1174-z]

36 **Khoury W**, Igov I, Issa N, Gimelfarb Y, Duek SD. Transanal endoscopic microsurgery for upper rectal tumors. *Surg Endosc* 2014; **28**: 2066-2071 [PMID: 24519026 DOI: 10.1007/s00464-014-3428-7]

37 **De Graaf EJ**, Doornebosch PG, Tollenaar RA, Meershoek-Klein Kranenbarg E, de Boer AC, Bekkering FC, van de Velde CJ. Transanal endoscopic microsurgery versus total mesorectal excision of T1 rectal adenocarcinomas with curative intention. *Eur J Surg Oncol* 2009; **35**: 1280-1285 [PMID: 19487099 DOI: 10.1016/j.ejso.2009.05.001]

38 **Clancy C**, Burke JP, Albert MR, O'Connell PR, Winter DC. Transanal endoscopic microsurgery versus standard transanal excision for the removal of rectal neoplasms: a systematic review and meta-analysis. *Dis Colon Rectum* 2015; **58**: 254-261 [PMID: 25585086 DOI: 10.1097/DCR.0000000000000309]

39 **Carrara A**, Mangiola D, Pertile R, Ricci A, Motter M, Ghezzi G, Zappalà O, Ciaghi G, Tirone G. Analysis of risk factors for lymph nodal involvement in early stages of rectal cancer: when can local excision be considered an appropriate treatment? Systematic review and meta-analysis of the literature. *Int J Surg Oncol* 2012; **2012**: 438450 [PMID: 22778940 DOI: 10.1155/2012/438450]

40 **Lartigau C**, Lebreton G, Alves A. Local resection for small rectal cancer. *J Visc Surg* 2013; **150**: 325-331 [PMID: 24016715 DOI: 10.1016/j.jviscsurg.2013.08.004]

41 **Borschitz T**, Heintz A, Junginger T. The influence of histopathologic criteria on the long-term prognosis of locally excised pT1 rectal carcinomas: results of local excision (transanal endoscopic microsurgery) and immediate reoperation. *Dis Colon Rectum* 2006; **49**: 1492-506; discussion 1500-5 [PMID: 16897336 DOI: 10.1007/s10350-006-0587-1]

42 **Wu ZY**, Zhao G, Chen Z, Du JL, Wan J, Lin F, Peng L. Oncological outcomes of transanal local excision for high risk T(1) rectal cancers. *World J Gastrointest Oncol* 2012; **4**: 84-88 [PMID: 22532882 DOI: 10.4251/wjgo.v4.i4.84]

43 **Issa N**, Fenig Y, Gingold-Belfer R, Khatib M, Khoury W, Wolfson L, Schmilovitz-Weiss H. Laparoscopic Total Mesorectal Excision Following Transanal Endoscopic Microsurgery for Rectal Cancer. *J Laparoendosc Adv Surg Tech A* 2018; **28**: 977-982 [PMID: 29668359 DOI: 10.1089/lap.2017.0399]

44 **Benson AB**, Venook AP, Al-Hawary MM, Arain MA, Chen YJ, Ciombor KK, Cohen S, Cooper HS, Deming D, Garrido-Laguna I, Grem JL, Gunn A, Hoffe S, Hubbard J, Hunt S, Kirilcuk N, Krishnamurthi S, Messersmith WA, Meyerhardt J, Miller ED, Mulcahy MF, Nurkin S, Overman MJ, Parikh A, Patel H, Pedersen K, Saltz L, Schneider C, Shibata D, Skibber JM, Sofocleous CT, Stoffel EM, Stotsky-Himelfarb E, Willett CG, Johnson-Chilla A, Gurski LA. NCCN Guidelines Insights: Rectal Cancer, Version 6.2020. *J Natl Compr Canc Netw* 2020; **18**: 806-815 [PMID: 32634771 DOI: 10.6004/jnccn.2020.0032]

45 **Landmann RG**, Wong WD, Hoepfl J, Shia J, Guillem JG, Temple LK, Paty PB, Weiser MR. Limitations of early rectal cancer nodal staging may explain failure after local excision. *Dis Colon Rectum* 2007; **50**: 1520-1525 [PMID: 17674104 DOI: 10.1007/s10350-007-9019-0]

46 **Doornebosch PG**, Ferenschild FT, de Wilt JH, Dawson I, Tetteroo GW, de Graaf EJ. Treatment of recurrence after transanal endoscopic microsurgery (TEM) for T1 rectal cancer. *Dis Colon Rectum* 2010; **53**: 1234-1239 [PMID: 20706065 DOI: 10.1007/DCR.0b013e3181e73f33]

47 **Stipa F**, Giaccaglia V, Burza A. Management and outcome of local recurrence following transanal endoscopic microsurgery for rectal cancer. *Dis Colon Rectum* 2012; **55**: 262-269 [PMID: 22469792 DOI: 10.1097/DCR.0b013e318241ef22]

48 **Madbouly KM**, Remzi FH, Erkek BA, Senagore AJ, Baeslach CM, Khandwala F, Fazio VW, Lavery IC. Recurrence after transanal excision of T1 rectal cancer: should we be concerned? *Dis Colon Rectum* 2005; **48**: 711-9; discussion 719-21 [PMID: 15768186 DOI: 10.1007/s10350-004-0666-0]

49 **van Gijn W**, Brehm V, de Graaf E, Neijenhuis PA, Stassen LP, Leijtens JW, Van De Velde CJ, Doornebosch PG. Unexpected rectal cancer after TEM: outcome of completion surgery compared with primary TME. *Eur J Surg Oncol* 2013; **39**: 1225-1229 [PMID: 23972571 DOI: 10.1016/j.ejso.2013.08.003]

50 **Morino M**, Allaix ME, Arolfo S, Arezzo A. Previous transanal endoscopic microsurgery for rectal cancer represents a risk factor for an increased abdominoperineal resection rate. *Surg Endosc* 2013; **27**: 3315-3321 [PMID: 23479257 DOI: 10.1007/s00464-013-2911-x]

51 **Roodbeen SX**, Penna M, Mackenzie H, Kusters M, Slater A, Jones OM, Lindsey I, Guy RJ, Cunningham C, Hompes R. Transanal total mesorectal excision (TaTME) versus laparoscopic TME for MRI-defined low rectal cancer: a propensity score-matched analysis of oncological outcomes. *Surg Endosc* 2019; **33**: 2459-2467 [PMID: 30350103 DOI: 10.1007/s00464-018-6530-4]

**Footnotes**

**Institutional review board statement:** This retrospective cohort study was approved by the Rabin Medical Center Institutional Review Board (Approval No. RMC-0160-18).

**Informed consent statement:** This retrospective cohort study was approved by the Rabin Medical Center Institutional Review Board, with a waiver of informed consent.

**Conflict-of-interest statement:** The authors have no conflicts of interest or financial ties to disclose.

**Data sharing statement:** The data that support the findings of this study are available from the corresponding author, DSY, upon reasonable request.

**Open-Access:** This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: https://creativecommons.org/Licenses/by-nc/4.0/

**Provenance and peer review:** Unsolicited article; Externally peer reviewed.

**Peer-review model:** Single blind

**Peer-review started:** April 5, 2023

**First decision:** June 14, 2023

**Article in press:** July 29, 2023

**Specialty type:** Surgery

**Country/Territory of origin:** Israel

**Peer-review report’s scientific quality classification**

Grade A (Excellent): 0

Grade B (Very good): B

Grade C (Good): C, C

Grade D (Fair): 0

Grade E (Poor): 0

**P-Reviewer:** Liu Z, China; Mishra TS, India; Xiao Y, China **S-Editor:** Chen YL **L-Editor:** Wang TQ **P-Editor:** Guo X

**Table 1 Patient demographics and clinical variables**

|  |  |
| --- | --- |
| **Variable** | ***n* = 26** |
| Age in yr (range) | 43.3 (21-49) |
| Male/female | 45245 |
| BMI (kg/cm2) | 26.8 (20-42) |
| ASA score (%) | |
| I | 17 (65.5) |
| II | 6 (23.0.) |
| III | 3 (11.5) |
| Indication for surgery (%) | |
| Adenoma LGD | 7 (27.0) |
| Adenoma HGD | 5 (19.2) |
| Carcinoma | 4 (15.4) |
| Indeterminate margins after polypectomy | 4 (15.4) |
| Other | 6 (23.0) |
| Tumor diameter, cm (range) | 2.39 (1-4) |
| Distance from anal verge, cm (range) | 8.5 (5-13) |
| Rectal wall location (%) | |
| Posterior | 8 (30.8) |
| Anterior | 3 (11.5) |
| Right lateral | 10 (38.5) |
| Left lateral | 5 (19.2) |

ASA: American Society of Anesthesiology; LGD: Low-grade dysplasia; HGD: High-grade dysplasia.

**Table 2 Operative variables**

|  |  |
| --- | --- |
| **Variable** | ***n* = 24** |
| Operation time, min (range) | 67 (46-108) |
| Hospital stay, d (range) | 2 (1-4) |
| Perioperative complications (%) | |
| Peritoneal entry | 0 |
| Bleeding | 0 |
| Urinary retention | 2 (8.5) |

**Table 3 Final pathological results of the specimens**

|  |  |
| --- | --- |
| **Pathology (%)** | ***n* = 24** |
| Adenoma LGD | 4 (15.4) |
| Adenoma HGD | 7 (26.9) |
| Carcinoma T1 | 4(15.4) |
| Carcinoma T2 | 2 (7.8) |
| Carcinoid | 3 (11.5) |
| NED | 1 (3.8) |
| SRU | 1(3.8) |
| Endometriosis | 1(3.8) |
| Tailgut cyst | 1 (3.8) |
| No residual tumor | 2 (7.8) |

LGD: Low-grade dysplasia; HGD: High-grade dysplasia; NED: Neuroendocrine tumor; SRU: Solitary rectal ulcer.



Published by **Baishideng Publishing Group Inc**

7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA

**Telephone:** +1-925-3991568

**E-mail:** bpgoffice@wjgnet.com

**Help Desk:** https://www.f6publishing.com/helpdesk

https://www.wjgnet.com



**© 2023 Baishideng Publishing Group Inc. All rights reserved.**