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Transanal Total Mesorectal Excision With Single-Incision Laparoscopy for Rectal Cancer

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ABSTRACT

Background and Objectives: There has been great enthusiasm for the technique of transanal total mesorectal excision. Coupled with this procedure, we performed single-incision laparoscopic surgery for left colon mobilization. This is a description of our initial experience with the combined approach.

Methods: Patients with distal or mid rectal cancer were included. The operation was performed by 2 teams: one team performed the single-incision mobilization of the left colon via the right lower quadrant ileostomy site, and the other team performed the total mesorectal excision with a transanal platform.

Results: During the study period, 10 patients (5 men) with cancer of the rectum underwent the surgery. The mean age was 62.2 ± 11.1 years, and the mean body mass index was 23.4 ± 3.2 kg/m^2. The tumor's mean distance from the anal verge was 5.1 ± 2.5 cm. The median operating time was 247.5 minutes (range, 188–462 minutes). The mean estimated blood loss was 124 ± 126 mL (range, 10–188 mL). Conversion to multiport laparoscopy was needed in one case (10%). Postoperative pain, as reflected by the pain score, was minimal. The mean number of lymph nodes harvested was 15.6 ± 3.8. All specimens had clear distal and circumferential radial margins. The overall complication rate was 10%.

Conclusion: Our experience showed transanal total mesorectal excision with single-incision laparoscopy to be a feasible option for rectal cancer. Patients reported minimal postoperative pain. Further studies on the long-term outcome are warranted.

Key Words: Rectal cancer, Single-incision laparoscopy, TAMIS, Transanal total mesorectal excision

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INTRODUCTION

Advances in minimally invasive surgery have led to the development of many novel surgical techniques. Single-incision laparoscopic surgery (SILS) and natural orifice transluminal endoscopic surgery (NOTES) are among the techniques that are designed to further reduce surgical trauma and enhance postoperative recovery. Despite continuous research, pure NOTES was confined to simple procedures and only practiced in a few specialized centers.[1,2] Because of the many technical problems yet to be solved with NOTES, SILS, on the other hand, has been applied to multiple surgical procedures, including complex ones. However, the technical feasibility of SILS total mesorectal excision (TME) for rectal cancer remains controversial. Suboptimal visualization, lack of counter traction, and clashing of instruments are some of the major hurdles, especially when the operation involves a bulky tumor in a narrow pelvis.

Recently a NOTES "bottom-up" approach for rectal dissection has been described.[3,4] This is a hybrid technique with multiport laparoscopy and NOTES mobilization of the rectum. The rectal dissection is performed through a transanal platform: this technique has also been named transanal minimally invasive surgery (TAMIS). The mobilization of sigmoid colon and splenic flexure is performed with laparoscopy. Although it may have certain advantages over the conventional transabdominal "top-to-bottom" approach,[5] transanal TME would also address the technical limitations of SILS in rectal surgery. Since 2014, we have adopted this technique for use in selected patients with distal rectal cancer.

This study sought to evaluate the outcomes of our initial experience with transanal TME and SILS for rectal cancer.

METHODS

During the study period, 10 patients with distal or mid rectal cancer underwent transanal TME with SILS. The operations were performed in a single institution, the Queen Mary Hospital. All patients had histologically proven adenocarcinoma. Preoperative staging was performed with a pelvic magnetic resonance imaging (MRI) and computed tomography (CT) scan of the abdomen and

thorax. All cases were discussed in the multidisciplinary treatment meeting to decide on the need of neoadjuvant chemoradiation. Neoadjuvant therapy was offered to those with a threatened circumferential radial margin, defined as ≤1 mm, as shown on the MRI. For patients who underwent preoperative chemoradiation, reassessment imaging studies were arranged to assess treatment response. Surgery would be offered at an interval of at least 8 weeks after the completion of chemoradiation.

All the patients were informed of this surgical technique, and informed consent was obtained before surgery. The patients received bowel preparation with polyethylene glycol electrolyte solution the day before the operation, and intravenous antibiotics were given on induction of anesthesia. The patient-selection criteria were small tumor (<4 cm), located in mid to low rectum. T4 tumors were excluded. Surgeons who performed the abdominal part of the operations are experienced colorectal surgeons with ample experience in single-incision laparoscopy and TAMIS. Two main surgeons (FCC and LWL) were responsible for the transanal surgery. They have a specialty in rectal surgery, each performing ≥20 robotic-assisted TMEs a year, and have prior transanal TME experience on cadavers.

Surgical Technique

Patients were placed in a modified lithotomy position. A 2-team approach was used. The abdominal team made a 3-cm longitudinal incision over the predetermined ileostomy site at the right lower quadrant (RLQ). A single-port access device was then inserted. In this series, either an OctoPort (Dalim Surgnet, Seoul, Korea) or GelPoint Advanced Access Platform (Applied Medical, Rancho Santa Margarita, CA, USA) were used (**Figure 1**). The medial-to-lateral approach was used to mobilize the sigmoid colon. The upper rectum was mobilized down to about 2 cm below the sacral promontory posteriorly. The inferior mesenteric vessels were divided between clips. The splenic flexure of the colon was taken down.

The transanal team had 2 different approaches. For ultralow tumors within 2 cm from the dentate line, initial intersphincteric resection would be performed at the dentate line with the use of a Lone Star retractor (Cooper Surgical, Trumbull, CT, USA). After circumferential dissection for 1–2 cm, the distal rectum was closed with sutures and irrigated. A SILS Port (Covidien, Minneapolis, MN, USA) or GelPoint Path Transanal Access Platform (Applied Medical) was inserted transanally. Carbon dioxide was insufflated at a pressure of 10 mm Hg. A 10-mm laparoscope and conventional straight laparoscopic instruments were used for rectal mobilization, following the avascular plane between the mesorectal fascia propria and the presacral fascia, prostate, and pelvic sidewall (**Figure 2**). Circumferential dissection was performed, and eventually the rectum would be pushed cranially into the peritoneal cavity. This completed the rectal mobilization. The specimen could be delivered transanally or, for large tumors, delivered via the right lower quadrant (RLQ) wound. A hand-sewn coloanal anastomosis (CAA) was then performed. A drain was placed in pelvis and a loop ileostomy was fashioned.

For a tumor located within 2 cm above the dentate line, a different approach was used. The transanal platform was inserted up front. The rectal lumen was closed with a purse-string suture 2 cm below the tumor and irrigated. The rectal wall was circumferentially divided until mesorectal fat was seen. Transanal rectal mobilization and de-

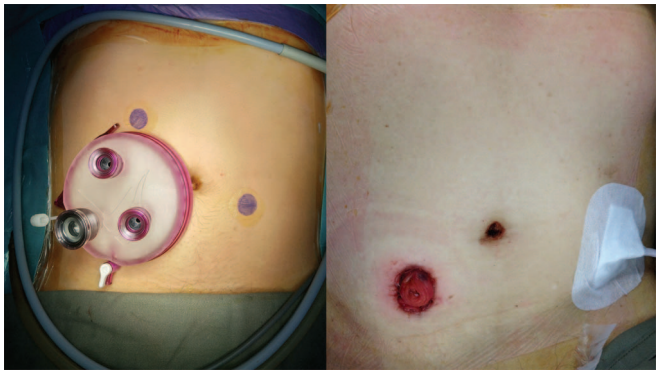

Figure 1. SILS platform at the intended ileostomy site.

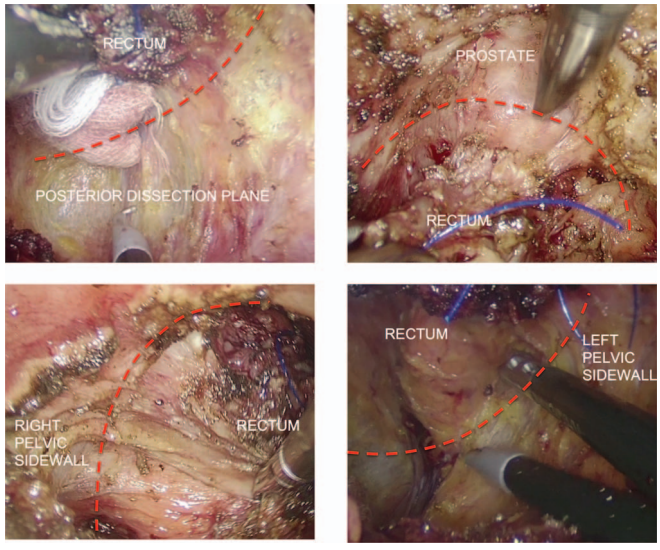

Figure 2. TAMIS rectal dissection.

livery of specimen were same as above. An anvil was tied at the proximal colon with a purse-string suture. The distal rectal stump was closed with another purse-string suture, under direct vision or with the TAMIS technique. An anastomosis was formed with a Chex CS circular stapler (Frankenmann, Shuzhou, China). The drain and ileostomy were fashioned as described earlier.

The patients were given oral tramadol 50 mg, 3 times per day, until the fifth postoperative day for pain control. Patient demographics, operative data, short-term postoperative outcome and histological results were prospectively collected. Postoperative pain was assessed with the numeric rating scale (NRS-11)[6] and was recorded up to the 5th day.

RESULTS

From August 2014 through July 2015, 10 patients (5 males) underwent transanal TME with SILS for rectal cancer (mean age, 62.2 ± 11.1 years; mean body mass index (BMI), 23.4 ± 3.2 kg/m^2) (**Table 1**). The American Society of Anesthesiologists grading was I, II, and III in 20, 60 and 20% of patients, respectively. The mean tumor distance from the anal verge was 5.1 ± 2.5 cm. Six patients (60%) underwent preoperative chemoradiation.

The median operative time was 247.5 minutes (range, 188–462 minutes). The mean estimated blood loss (EBL) was 124 ± 125.7 mL (range, 10–350 mL) (**Table 2**). None required perioperative blood transfusion. Full mobilization of the splenic flexure was achieved in 80% of the cases. Six cases started with initial intersphincteric resection. Five anastomoses were performed with the hand-sewn technique and 5 with stapling technique. There were no intraoperative complications. One case required conversion to multiport laparoscopy because of dense adhesions encountered at the anterior aspect, rendering

Table 1.
Summary of Patient Demographics

Demographic	N = 10	%	Range
Mean age (years)	62.2 ± 11.1		40–74
Sex			
Male	5	(50)	
Female	5	(50)	
BMI (kg/m^2)	23.4 ± 3.2		18.3–28.4
Previous abdominal surgeries	2	(20)	
Mean tumor distance from anal verge (cm)	5.1 ± 2.5		2–8
Mean size of tumor (cm)	2.4 ± 0.9		1.5–4.0
T (pre-CTRT)			
1	2	(20)	
2	3	(30)	
3	5	(50)	
N (pre-CTRT)			
0	6	(60)	
1	4	(40)	
Presence of EMVI	0	(0)	
Position of Tumor			
Anterior	6	(60)	
Posterior	0	0	
Right Lateral	1	(10)	
Left Lateral	2	(20)	
Circumferential	1	(10)	

CTRT, Chemoradiation; EMVI, Extramural venous invasion.

Table 2.
Summary of Operative and Histological Characteristics

Characteristics	N = 10	%	Range
Operation duration, median (min)	247.5		188–462
Estimated blood loss, mean ± SD (mL)	124 ± 125.7		10–350
Lymph nodes harvested, mean ± SD	15.6 ± 3.8		10–23
Distal margin, mean ± SD (mm)	13.8 ± 8.4		5–30
Circumferential radial margin, clear	10	(100)	
Quality of TME Specimen			
Grade 3: Complete	6	(60)	
Grade 2: Nearly Complete	4	(40)	
Grade 1: Incomplete	0	(0)	

transanal dissection difficult. The median hospital stay was 6 d, with an interquartile range of 5–7 d. The overall complication rate was 10%. One patient (10%) suffered from postoperative urinary retention. The same patient had anastomotic leakage, which was treated conservatively (Clavien-Dindo Grade II[7]). None of the patients required reoperation. The quality of TME specimen was complete in 60% and nearly complete in 40% according to the Quirke classification.[8] The median postoperative pain scores at rest from days 1 to 5 were 1.5, 1, 0, 0, and 0, respectively. The median postoperative pain scores during movement from day 1 to 5 were 5, 3, 2, 2 and 1, respectively (**Figure 3**).

DISCUSSION

Since the first publication of single-incision laparoscopic right hemicolectomy by Remzi et al[9] and Bucher et al,[10] there have been multiple case series showing the feasibility of SILS for colorectal resection.[11–16] In a few studies, SILS appeared to have certain advantages, such as earlier resumption of oral intake, less necessity for postoperative analgesics, and shorter hospital stay.[17,18] In 2012, our center published a randomized controlled trial showing that patients undergoing single-incision laparoscopic colectomy had faster recovery and experienced less postoperative pain.[19]

However, most of these studies were limited to colonic resections. The paucity of publications for SILS rectal resection reflects poor adoption of the procedure. The application of SILS in rectal resections, especially for low rectal tumors, has been limited. Hamzaoglu et al[20] published the first case series of 4 SILS sphincter-saving rectal resections for cancer of the rectum. Thereafter, a few publications showed satisfactory results with this procedure.[17,18,21] A systematic review by Maggiori et al[22] in 2012 showed that only 67% of SILS rectal surgeries were successfully completed and that the conversion rate to multiport laparoscopy and laparotomy was 30 and 3%, respectively. In essence, dissecting within the bony confine of pelvis, using long straight instruments, lacking adequate counter traction and operation under poor visualization were reasons for the high rate of conversion. Factors like large tumor, obesity, bulky mesorectum, postradiotherapy effects, and low-lying tumor have further jeopardized the chance of success for SILS in rectal resection.

Zorron et al[4] and Sylla et al[3] proposed a novel "bottom-up" approach. The rectal dissection is performed by the NOTES approach, using the TAMIS technique, coupled with hybrid multiport laparoscopy for sigmoid mobilization. This approach has brightened the prospects for the use of SILS TME. Tuech et al[23] published the first case report of the technique combined with SILS laparoscopy. Thereafter, a few case series were published describing similar techniques.[24–28] The results were promising, as they generally demonstrated a low conversion rate and excellent postoperative outcome.

The techniques described in these series varied as to the extent of rectal dissection performed by the transanal or transabdominal approach. In the current study, we attempted mobilization of the rectum up to ~2 to 3 cm below the sacral promontory transanally. The transanal approach provided excellent visualization of the avascular plane between the mesorectal fascia and the surrounding structures. The success of the approach was evident from the relatively low EBL in this series. Instrument clashing,

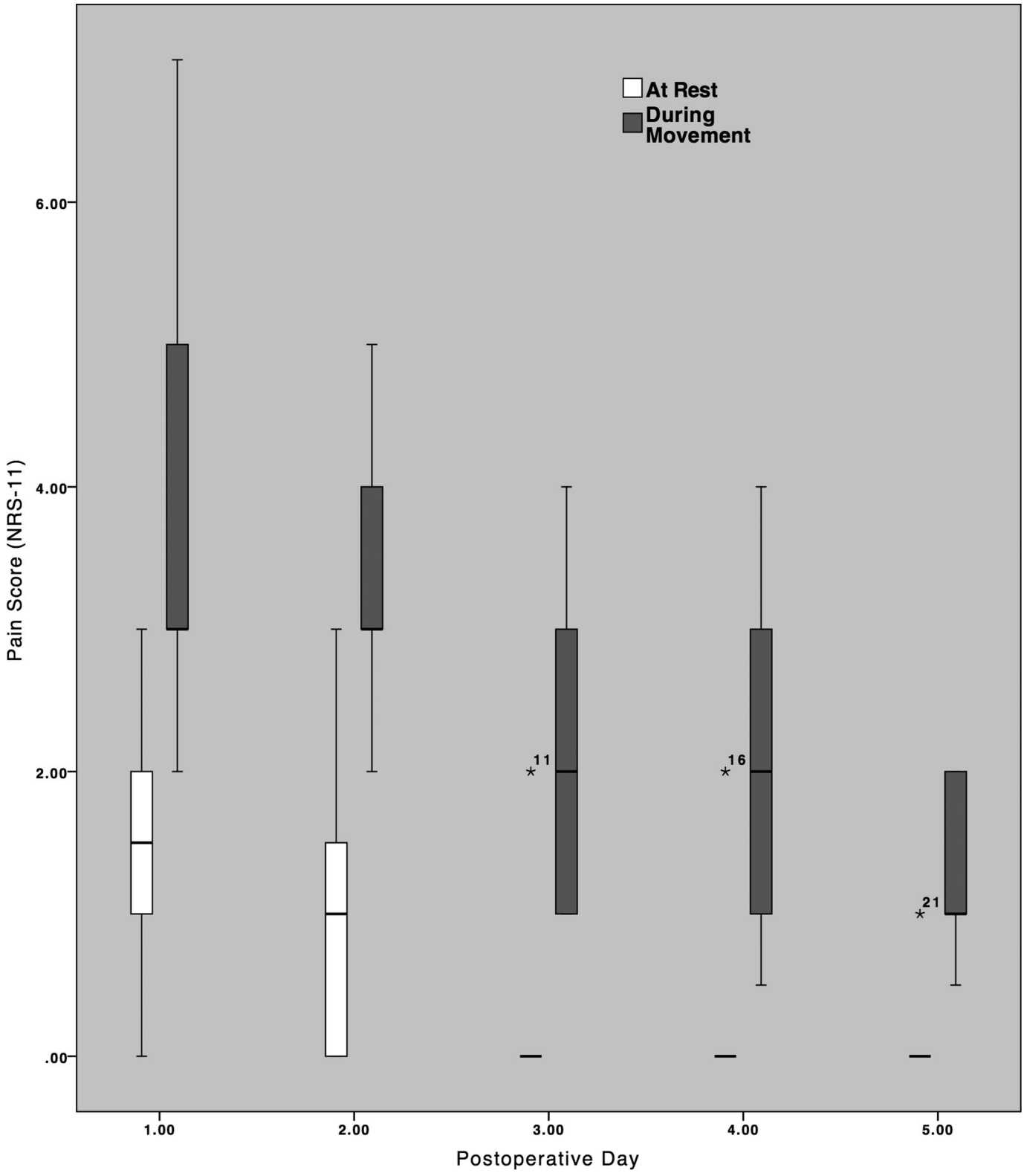

Figure 3. Postoperative pain score.

although still a problem, was less hindering in TAMIS dissection compared with transabdominal SILS.

In the initial reports, intersphincteric resection at the dentate line was invariably performed. Most of the anastomoses were CAA, fashioned by the hand-sewn technique. In SILS TME, clamping across the distal rectum with a laparoscopic stapler, a crucial step of the double-stapling technique, is a daunting task. Fashioning a hand-sewn CAA would obviate such a need. However, we do not agree with the indiscriminate use of the hand-sewn CAA, as this may result in unnecessary morbidity.[29] The question as to whether CAA results in poorer postoperative sphincter function should also be addressed in future studies. We reserved CAA for the very distal tumors, those within 2 cm of the dentate line. The beauty of the transanal approach is that one can precisely tailor the distal transection level, which dictates the distal margin. Given enough distal margin, stapled CAA were performed in half of the cases in this series.

Postoperative pain was evaluated in this study. The pain was mild at rest on the first 2 postoperative days and was minimal thereafter. The pain during movement was moderate on the first 2 postoperative days and mild on day 3. Given that this was only a feasibility study, there was no control group for comparison. Also, except for those who had large tumors that necessitated an extension of RLQ wound for specimen extraction, no fascial closure was needed at the end of the surgeries. Whether this contributed to less postoperative pain should be studied further.

The median hospital stay in this series was 6 days and was 1 day shorter than the median hospital stay for minimally invasive transabdominal TME in this center. Despite minimal postoperative pain, the patient stayed in the hospital for stoma education and mobilization exercises.

The 2-team approach was adopted in this series. The pros and cons of the 2-team, transanal-first and transabdominal-first approach was discussed in the Second International Transanal Total Mesorectal Excision Conference.[30] The two-team approach has the benefit of shorter operating time, early ligation of vascular pedicle and early clamping of the colon to prevent pneumocolon. The disadvantage is that 2 experienced teams are needed and the operating theatre is often crowded with surgeons and equipment. As for the transabdominal-first approach, there is no concern that pneumocolon will lead to loss of cavity space. For the transanal-first approach, the distal margin is delineated up front and whether to sacrifice the sphincter, performing an abdominoperineal resection, can be decided early. For transanal TME with SILS laparoscopy, the 2-team approach has an additional advantage that, should difficulty arise in the transanal dissection, the abdominal surgeon can convert to multiport laparoscopy early, in case transabdominal rectal mobilization is needed.

The one conversion in this series was caused by lack of progress in transanal dissection. Because of prior irradiation and scarring, there was difficulty in identifying the anterior dissection plane. This hindrance was addressed by the use of additional ports and further dissection via the abdominal approach. We admit that the technique of transanal dissection was relatively new and that there would invariably be a learning curve. Prior cadaveric dissections had been performed by the authors and aided in this process. The extent of rectal dissection by transabdominal approach should decrease with experience.

The cases in this study were carefully selected. In the future, patients with previous abdominal surgeries and those with higher BMI would be included. In fact, the consensus statement from the Second International Transanal Total Mesorectal Excision Conference endorsed visceral obesity as one of the indications of transanal TME.[30] However, both previous abdominal surgeries and high BMI increase the difficulty of SILS[31,32] and may result in a higher conversion rate to multiport laparoscopy.

Limitations of this study are the relatively small number of cases and the lack of a control arm. The selection of cases may result in bias, and similar outcomes may well be achieved by laparoscopic TME. A well-designed prospective study, with randomization and long-duration follow-up, would be beneficial in evaluating the safety and potential advantages of transanal TME with SILS.

CONCLUSION

This study showed that transanal TME with SILS is a feasible procedure for patients with rectal cancer. Further studies to evaluate the postoperative outcomes as well as the oncologic outcomes are warranted.

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