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Review Article

Can the Single-stapling Technique Following Intersphincteric Resection with Transanal Total Mesorectal Excision Become the New Standard Anastomosis?

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Abstract

For transanal total mesorectal excision (TaTME), the indication for single-stapling technique (SST) has been expanded to include lower anastomosis, even in intersphincteric resection (ISR). We focused on the anastomotic techniques following ISR with TaTME and examined the feasibility and safety of the SST below the anorectal junction (ARJ). Data on postoperative anastomosis-related complications and anorectal function was evaluated in comparison to conventional manual hand-sewn coloanal anastomosis in ISR with TaTME. We examined patients with 3-6 cm tumors from the anal verge who underwent ISR with TaTME between January 2018 and March 2020, and whose anastomotic line was located below the ARJ. Postoperative short-term outcomes and anorectal functions were compared. We also analyzed the effects of various factors on major low anterior resection syndrome (LARS) using multivariate logistic regression analysis. In total, 87 patients-48 in the hand-sewn anastomosis group and 39 in the SST group-were included in this study. SST below the ARJ in ISR with TaTME did not exacerbate surgical outcomes, including anastomosis-related complications. The SST group had a significantly lower LARS score as compared to the hand-sewn anastomosis group, and the proportion of major LARS was significantly lower. Only hand-sewn anastomosis was identified as a statistically significant independent risk factor for major LARS. In TaTME, SST below the ARJ was safe and feasible and had a lower negative impact on postoperative anastomosis-related complications and anorectal function as compared to hand-sewn anastomosis. Thus, SST is a promising anastomotic option for patients with low-lying rectal tumors.

Keywords

intersphincteric resection (ISR), transanal total mesorectal excision (TaTME), single-stapling technique (SST), anorectal function, low anterior resection syndrome (LARS)

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Introduction

Colorectal cancer has been identified as the third most common cancer in the world, with approximately 704,376 patients worldwide diagnosed with rectal cancer annually[1,2]. The surgical gold standard for rectal cancer is total mesorectal excision (TME)[3-5]. Conventionally, abdominoperineal resection (APR), which results in permanent colostomy, has been often used, specifically for low rectal cancer[6]. However, intersphincteric resection (ISR), which combines rectal removal with a partial or complete internal anal sphincter excision and restores continuity by manual hand-sewn coloanal anastomosis[7], has been increasingly recognized as a substitute for APR. ISR was noted to achieve a safe distal and circumferential resection margin, and it considerably reduces the need for permanent colostomy, even in patients with low rectal cancer[8-10].

With recent technological advances in rectal cancer sur-

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gery, there has been a gradual shift from an open approach to a laparoscopic and robotic approach and, more recently, to a transanal approach[11]. Transanal TME (TaTME), which was first described by Sylla et al.[12] in 2010, was developed as a novel technique to overcome the difficulties commonly encountered in other TME approaches during distal pelvic dissection, especially when operating on obese male patients with narrow pelvises and low-lying or huge tumors.

In TaTME, the anastomosis formation is deemed a critical step. In addition to the conventional hand-sewn anastomosis, three other stapling techniques for colorectal anastomosis were introduced by Penna et al.[13] in 2016, including the double purse-string circular-stapled anastomosis and single-stapling technique (SST). Although a hand-sewn anastomosis was introduced as the standard technique for the low anastomosis near the anorectal junction (ARJ) in this initial report[13], the SST could be safely performed in the anal canal below the ARJ with the widespread use of TaTME and the anastomotic technical establishment. In other words, a new option for stapled anastomosis has been included in the ISR procedure.

Although previous reports have shown that a stapled colorectal anastomosis has better anorectal function than a manual hand-sewn coloanal anastomosis in terms of rectal surgery[14,15], these results are likely to be confounded by anastomotic height, and it is yet to be determined which method of anastomosis is superior. Therefore, in this study, we focused on the topic of anastomotic technique following ISR with TaTME and examined the feasibility and safety of the SST below the ARJ, evaluating the data on postoperative anastomosis-related complications and anorectal function as compared to conventional manual hand-sewn coloanal anastomosis in ISR with TaTME.

Related Work

Postoperative anastomosis-related complications

Common complications following ISR are often related to anastomosis, including anastomotic leakage, stricture, and bleeding. Early anastomotic leakage, within 30 days after surgery, occurs with an incidence of 3%-20%[16,17] and late leakage with an incidence of 0.3%-4.3%, accounts for approximately one-third of all anastomotic leakages[18-21]. Anastomotic leakage can lead to not only direct clinical consequences, such as intra-abdominal or pelvic abscess, peritonitis, sepsis, prolonged hospitalization, and increased mortality[22], but also pelvic organ dysfunction, anal dysfunction[23], local cancer recurrence, and increased cancer-specific mortality[24].

Postoperative anorectal function following ISR

ISR is an anus-preserving surgery for low rectal cancer; it involves pelvic dissection and mobilization from the pelvic floor, i.e., the external sphincter muscle and levator ani muscle, with partial, subtotal, or total excision of the internal sphincter muscle and the creation of a basic hand-sewn coloanal anastomosis. Therefore, ISR often leads to a certain degree of postoperative anorectal and sphincter function impairment[25,26]. In a multicenter phase II trial of ISR in Japan, 70% of the cases had relatively good function with a Wexner score of less than 10 points, but approximately 10% had severe incontinence, which did not improve in the long-term[27]. In this study, the post-ISR Wexner scores were 11.4, 10.3, 9.7, and 8.5 at postoperative months 3, 6, 12, and 24, respectively[27].

Here, we present the results of a study conducted at our institution comparing postoperative anastomosis-related complications and anorectal function between the SST and hand-sewn anastomosis following ISR with TaTME. Some findings of this study have been previously reported[28].

Methods

Study design

This was a single-center retrospective cohort study using a prospectively collected database. Informed consent was obtained from all participants in the form of an opt-out option, in accordance with the Good Clinical Practice Guidelines of the Ministry of Health and Welfare of Japan. The study protocol was approved by the Ethics Committee of our institution. The study conformed to the provisions of the Declaration of Helsinki in 1964 (as revised in Brazil in 2013).

Patient selection

Patients with a tumor height of 3-6 cm from the anal verge (AV) who underwent ISR with TaTME between January 2018 and March 2020 and whose anastomotic line was located below the ARJ were included in this study. In our department, a questionnaire on the postoperative anorectal function is administered annually to all patients who have undergone rectal surgery with anastomosis, either until 5 years after diverting stoma (DS) closure or for 5 years after the initial surgery (in cases without DS). In this study cohort, all patients underwent diverting ileostomy at the time of initial surgery. Patients who completed the questionnaire during the period of 1 year (±6 months) after DS closure were included in this study.

Anastomotic procedure

The type of anastomosis was selected based on the sur-

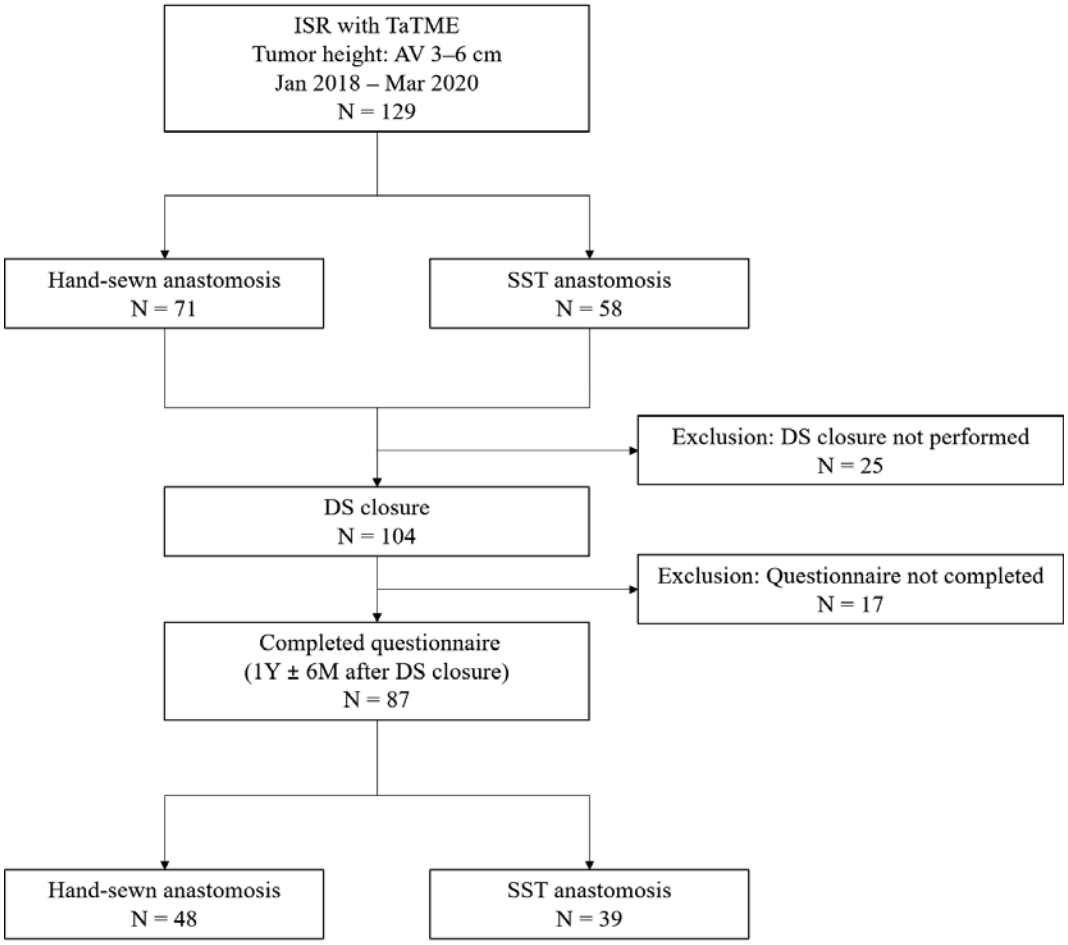


Figure 1. Patient inclusion flowchart.
(ISR, intersphincteric resection; TaTME, transanal total mesorectal excision; AV, anal verge; SST, single-stapling technique; DS, diverting stoma; Y, year; M, month)

geon's discretion. For a stapled anastomosis, either an abdominal or transanal SST was performed, according to the previously reported methods[13], with either a 28 or 25 mm EEA™ Circular Stapler (Medtronic Plc., Dublin, Ireland) or 29 or 25 mm ETHICON™ Circular Stapler (Ethicon Inc., Bridgewater, NJ, USA). After stapling, reinforcement sutures were applied circumferentially with 3-0 PDS II sutures (Ethicon Inc.) at the surgeon's discretion. The same sutures were used for a hand-sewn anastomosis.

Data collection

We collected data from the institutional database. Patient information included age, sex, body mass index, presence or absence of diabetes mellitus, American Society of Anesthesiologists physical status, and neoadjuvant therapy. Tumor information included diagnosis, height from the AV, size, depth of invasion, and pathological stage. Surgical information included anastomotic type, anastomotic height from the AV, operative time, and estimated blood loss. Anastomosis-related complications included anastomotic leakage, pelvic abscess, anastomotic bleeding, and anastomotic stricture. Resection margins included radial margin (RM; positive or negative), distal margin (DM; mm), and circumferential resection margin (CRM; mm).

Any anastomosis-related complications of Grade II or higher on the Clavien-Dindo classification were included in this study. To assess postoperative anorectal function, the answers to the questionnaire following the DS closure were used to calculate the low anterior resection syndrome (LARS) score (42 point scale)[26] and Wexner score (WS; 20 point scale)[29]. A LARS score of 30 points or higher was defined as major LARS, whereas a WS of 16 points or higher was defined as severe incontinence.

Statistical analysis

Numerical data were described as medians (ranges), and these were compared using Mann-Whitney U test. Categorical data were presented as numbers (percentages), and these were compared using Fisher's exact test. The analysis of the effects of various factors on major LARS was carried out

Table 1. Patient and Tumor Characteristics.

	Hand-sewn (N = 48)	SST (N = 39)
Age (years)	65 [40–82]	64 [35–77]
Sex (Male)	31 (65%)	28 (72%)
BMI (kg/m^2)	24 [15–31]	23 [15–30]
DM	8 (17%)	4 (10%)
ASA–PS		
1	10 (21%)	13 (33%)
2	38 (79%)	24 (62%)
3	0	2 (5%)
Neoadjuvant therapy		
NAC	10 (21%)	5 (13%)
CRT	2 (4%)	3 (8%)
TNT	2 (4%)	1 (3%)
Diagnosis		
Primary adenocarcinoma	44 (92%)	37 (95%)
Recurrent adenocarcinoma	1 (2%)	0
NET	1 (2%)	1 (3%)
GIST	1 (2%)	1 (3%)
Benign tumor	1 (2%)	0
Tumor height from AV (cm)	5 [3–6]	5.5 [3.5–6]
Tumor size (mm)	27 [0–65]	33 [0–86]
Depth of invasion		
T0 (pCR)	1 (2%)	2 (5%)
Tis	1 (2%)	0
T1	17 (35%)	9 (23%)
T2	14 (29%)	12 (31%)
T3	11 (23%)	14 (36%)
pStage (UICC 8th edition)		
0	2 (4%)	2 (5%)
I	26 (54%)	18 (46%)
II	5 (10%)	8 (21%)
III	9 (19%)	8 (21%)
IV	2 (4%)	1 (3%)

Median [range]

SST, single-stapling technique; BMI, body mass index; DM, diabetes mellitus; ASA–PS, American Society of Anesthesiologists physical status; NAC, neoadjuvant chemotherapy; CRT, chemoradiotherapy; TNT, total neoadjuvant therapy; NET, neuroendocrine tumor; GIST, gastrointestinal stromal tumor; AV, anal verge; pCR, pathological complete response; UICC, Union for International Cancer Control

using multivariate logistic regression analysis, and odds ratios (OR) and 95% confidence intervals (CI) were then calculated. All *p*-values were two-sided, and $p < 0.05$ was considered statistically significant. All statistical analyses were performed using EZR[30], which is a graphical user interface for R, version 2.13.0 (The R Foundation for Statistical Computing, Vienna, Austria).

Results

Figure 1 shows the patient inclusion flowchart. In total, 129 patients met the inclusion criteria during the study period; 25 patients with DS closure not performed and 17 patients with incomplete questionnaires were excluded. The response rate for the questionnaire was 84%. Finally, 87 patients (48 in the hand-sewn anastomosis group and 39 in the SST group) were included in this analysis.

The patient and tumor characteristics are shown in Table 1. Primary adenocarcinoma was the most common diagnosis, although recurrent adenocarcinoma and neuroendocrine, gastrointestinal stromal and benign tumors were also found in 1-2 patients each. The pathological diagnosis of the benign tumor was made after surgery. Neoadjuvant therapy was utilized in several patients, with 15, 5, and 4 patients undergoing neoadjuvant chemotherapy, chemoradiotherapy (CRT), and total neoadjuvant therapy, respectively. Three patients were able to achieve a pathological complete response following neoadjuvant therapy.

Surgical outcomes

The surgical outcomes in the hand-sewn and SST anastomosis groups are presented in Table 2. Although the median anastomotic height from the AV in both groups was 3 cm, it was significantly higher in the SST group ($p < 0.001$). Anastomotic leakage was found in seven cases (15%) in the hand-sewn anastomosis group, but not in the SST group ($p = 0.015$). Although the median estimated blood loss was similarly low in both groups, the SST group (41 mL) had significantly ($p = 0.027$) lesser blood loss than the hand-sewn anastomosis group (77 mL). Further, no significant differences were observed in the operative time and other anastomosis-related complications between the two groups.

Regarding resection margins including RM, DM, and CRM, no significant differences were observed between the two groups. RM positivity was seen in one patient in the hand-sewn group, CRM < 1 mm was observed in two patients in each group, and DM positivity was not observed in either group.

Postoperative anorectal function

The LARS scores and WS for each group are shown in Figure 2. The median LARS score was 37 points in the hand-sewn anastomosis group and 32 points in the SST group. Although both groups had high scores, the LARS was significantly more severe in the hand-sewn anastomosis group ($p = 0.018$). In addition, the median WS was slightly higher in the hand-sewn anastomosis group (12 vs. 10 points); however, the difference was deemed insignificant ($p = 0.094$).

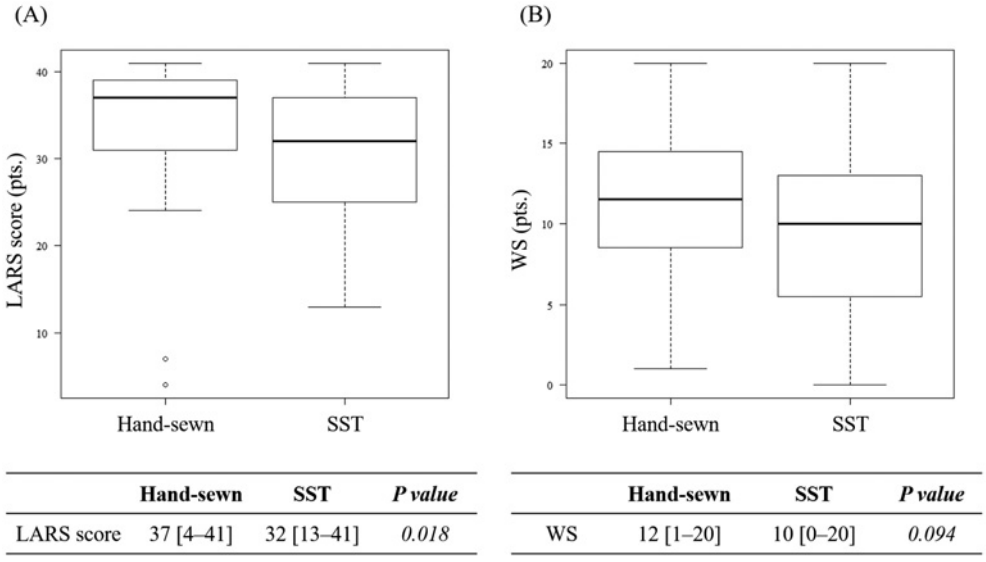
The proportion of patients with postoperative anorectal dysfunction is shown in Figure 3. The proportion of major LARS was significantly higher in the hand-sewn anastomosis group than in the SST group (79% vs. 56%; $p = 0.035$). In addition, the proportion of severe incontinence was

Table 2. Surgical Outcomes in the Hand-sewn and Single-stapling Technique (SST) Anastomosis Groups.

	Hand-sewn (N = 48)	SST (N = 39)	*P-value*
Anastomotic height from AV (cm)	3 [1–4]	3 [2–4]	*<0.001*
Operative time (min)	224 [82–413]	215 [113–352]	*0.113*
Estimated blood loss (mL)	77 [0–1928]	41 [5–315]	*0.027*
Anastomosis-related complication (Grade II ≤)			
Anastomotic leakage	7 (15%)	0	*0.015*
Pelvic abscess	6 (13%)	4 (10%)	*1*
Anastomotic bleeding	0	0	–
Anastomotic stricture	0	0	–
Total	11 (23%)	4 (10%)	*0.158*
Resection margins			
RM (positive)	1 (2%)	0	*1*
DM (mm)	11 [8–15]	12 [9–20]	*0.690*
CRM (mm)	6 [3–10]	6 [3–9]	*0.733*

Median [range]

SST, single-stapling technique; AV, anal verge; RM, radial margin; DM, distal margin; CRM, circumferential resection margin



	Hand-sewn	SST	*P value*
LARS score	37 [4–41]	32 [13–41]	*0.018*

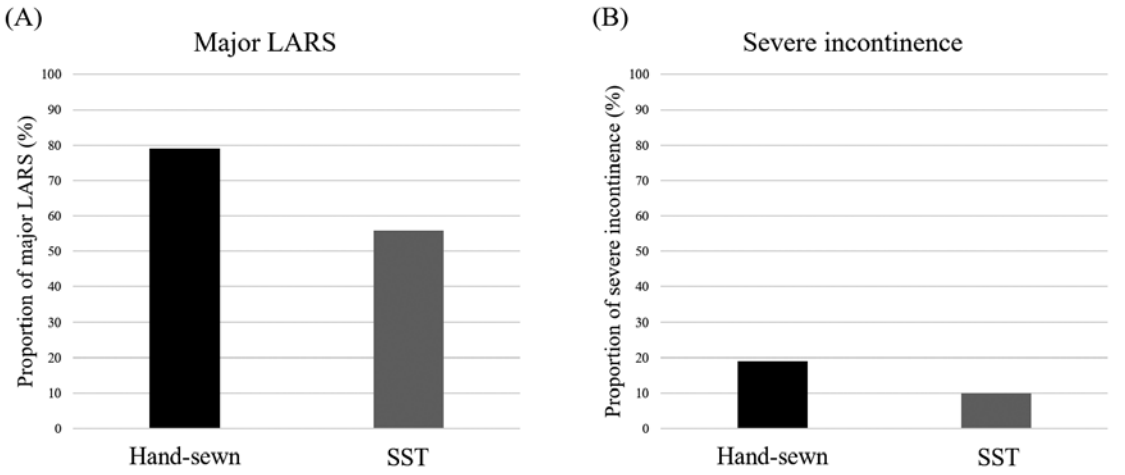
	Hand-sewn	SST	*P value*
WS	12 [1–20]	10 [0–20]	*0.094*

Figure 2. Results of postoperative anorectal function at 1 year (±6 months) after diverting stoma closure in the hand-sewn and single-stapling technique anastomosis groups. (A) Low anterior resection syndrome score, (B) Wexner incontinence score.
(LARS, low anterior resection syndrome; WS, Wexner incontinence score; pts: points; SST, single-stapling technique)

slightly higher in the hand-sewn anastomosis group than in the other group (19% vs. 10%); however, the difference was not significant ($p = 0.368$).

Risk factors for major LARS

Univariate and multivariate logistic regression analyses were performed to identify the risk factors for major LARS (Table 3). In the univariate analysis, only hand-sewn anastomosis was determined to be a significant risk factor for major LARS (OR [95% CI]: 2.90 [1.04-8.46]; $p = 0.035$). In addition, in the multivariate logistic regression analysis performed to eliminate the confounding factors associated with known risk factors for postoperative anorectal dysfunction, including anastomotic height, anastomotic leakage, and preoperative CRT, hand-sewn anastomosis alone has remained a significant independent risk factor for major LARS (OR [95% CI]: 2.99 [1.05-8.46]; $p = 0.041$).



	Hand-sewn	SST	*P value*
Major LARS	38 (79%)	22 (56%)	*0.035*

	Hand-sewn	SST	*P value*
Severe incontinence	9 (19%)	4 (10%)	*0.368*

Figure 3. Proportion of postoperative anorectal dysfunction at 1 year (± 6 months) after diverting stoma closure in the hand-sewn and single-stapling technique anastomosis groups. (A) Major low anterior resection syndrome (low anterior resection syndrome score ≥ 30 points), (B) Severe incontinence (Wexner incontinence score ≥ 16 points).
(LARS, low anterior resection syndrome; SST, single-stapling technique)

Discussion

In this review, we discuss the recent advancements in anastomotic techniques for ISR, along with the results of our institutional study. Our study demonstrated that using the SST below the ARJ in ISR with TaTME had no negative effect on the surgical outcomes, including complications related to anastomosis. These results indicate that the SST is safe and feasible for ISR with TaTME. In addition, major LARS occurred significantly less frequently in the SST group than in the hand-sewn anastomosis group; moreover, hand-sewn anastomosis was considered a significant independent risk factor for major LARS. Therefore, the SST may be a promising anastomotic option, even in cases in which the anastomotic line is below the ARJ.

In a previous systematic review, ISR was defined as a type of surgery that transabdominally and transanally divided the internal anal sphincter from the external sphincter by dissecting the intersphincteric plane and then performing coloanal anastomosis using a hand-sewing technique, without the use of a mechanical anastomosis[31]. Similarly, in TaTME, a hand-sewn anastomosis was introduced as the standard technique for coloanal anastomosis[13]. However, with the technical establishment of the distal purse-string suture for TaTME, the scope of the application of the SST has been expanded to include lower anastomosis[32].

Although a previous study comparing stapled and manual coloanal anastomosis in laparoscopic ISR demonstrated that a stapled coloanal anastomosis was technically feasible and was less likely to result in anastomotic leakage and stricture formation than a hand-sewn anastomosis[33], this is the first study, to our knowledge, to demonstrate the safety and feasibility of a stapled anastomosis below the ARJ in TaTME. As per the results of the international TaTME registry, a manual hand-sewn anastomosis in addition to male sex, obesity, smoking, DM, tumors >25 mm, excessive intraoperative blood loss, and prolonged perineal operative time was identified as an independent risk factor of anastomotic failure in TaTME[34]. This was consistent with the results of this study, which showed that there was significantly more anastomotic leakage in the hand-sewn anastomosis group than in the SST group.

In this study, the postoperative anorectal function was noted to be significantly better in the SST group than in the hand-sewn anastomosis group. In general, the lower the anastomotic height, the worse the postoperative anorectal function[14,15,35]; therefore, it is difficult to make a fair comparison of the postoperative anorectal function between hand-sewn and stapled anastomoses because the anastomotic height tends to be higher in cases with a stapled anastomosis. In addition, anastomotic leakage and preoperative CRT have a strong negative impact on postoperative anorectal function[36-38]. In this study, the anastomotic height from the AV and the proportion of anastomotic leakage were significantly higher in the hand-sewn anastomosis group; therefore, these factors could account for the significant differ-

Table 3. Univariate and Multivariate Logistic Regression Analysis to Identify Risk Factors for Major Low Anterior Resection Syndrome (LARS).

		N	Major LARS (%)	Univariate Analysis		Multivariate Analysis	
				OR [95% CI]	*P-value*	OR [95% CI]	*P-value*
Age (years)	65>	41	31 (76%)	1.80 [0.654–5.20]	*0.250*		
	65≤	46	29 (63%)				
Sex	Male	59	42 (71%)	1.37 [0.464–3.93]	*0.621*		
	Female	28	18 (64%)				
BMI (kg/m^2)	23>	42	30 (71%)	1.25 [0.457–3.46]	*0.651*		
	23≤	45	30 (67%)				
DM	Yes	12	9 (75%)	1.41 [0.313–8.80]	*0.747*		
	No	75	51 (68%)				
ASA–PS	1	23	17 (74%)	1.38 [0.435–4.91]	*0.609*		
	2≤	64	43 (67%)				
CRT	Yes	8	7 (88%)	3.40 [0.401–161]	*0.426*	3.78 [0.416–34.3]	*0.238*
	No	79	53 (67%)				
Tumor height from AV (cm)	5>	31	22 (71%)	1.16 [0.407–3.45]	*0.813*		
	5≤	56	38 (68%)				
Tumor size (mm)	30>	44	32 (73%)	1.42 [0.521–3.95]	*0.493*		
	30≤	43	28 (65%)				
Depth of invasion	T0–2	56	38 (68%)	1.22 [0.392–4.08]	*0.798*		
	T3, T4	25	18 (72%)				
pStage (UICC 8th edition)	0–II	61	43 (70%)	1.28 [0.369–4.18]	*0.781*		
	III, IV	20	13 (65%)				
Anastomotic height from AV (cm)	3>	20	15 (75%)	1.46 [0.431–5.81]	*0.591*	1.05 [0.302–3.66]	*0.937*
	3≤	67	45 (67%)				
Operative time (min.)	200>	35	26 (74%)	1.52 [0.542–4.51]	*0.480*		
	200≤	52	34 (65%)				
Estimated blood loss (mL)	100>	64	43 (67%)	1.38 [0.435–4.91]	*0.609*		
	100≤	23	17 (74%)				
Anastomotic leakage	Yes	7	6 (86%)	2.86 [0.321–138]	*0.428*	1.16 [0.370–3.64]	*0.799*
	No	80	54 (68%)				
Pelvic abscess	Yes	10	6 (60%)	1.56 [0.294–7.30]	*0.493*		
	No	77	54 (70%)				
Anastomotic type	Hand-sewn	48	38 (79%)	2.90 [1.04–8.46]	*0.035*	2.99 [1.05–8.55]	*0.041*
	SST	39	22 (56%)				

Median [range]

LARS, low anterior resection syndrome; OR, odds ratio; CI, confidence interval; BMI, body mass index; DM, diabetes mellitus; ASA–PS, American Society of Anesthesiologists physical status; CRT, chemoradiotherapy; AV, anal verge; UICC, Union for International Cancer Control; SST, single-stapling technique

ence in the postoperative anorectal function between the two groups. However, even after eliminating these confounding factors via multivariate analysis, a hand-sewn anastomosis was identified as an independent risk factor for major LARS. These results suggest that a stapled anastomosis is useful in maintaining better anorectal function following ISR with TaTME.

Several theories have been considered as to why a stapled anastomosis had better postoperative anorectal function than a hand-sewn anastomosis. In a previous meta-analysis, the anorectal physiologic measurements demonstrated a significant reduction in the resting and squeeze pressure by 13.4 and 14.4 mmHg, respectively, in the hand-sewn anastomosis group as compared to the stapled anastomosis group[39]. Normal values for the resting and squeeze pressures within the anal canal have been reported to be 55.4 ± 15.3 mmHg and 170.3 ± 81.7 mmHg, respectively[40]. Although an 8.4% relative reduction of the squeeze pressure might be a clinically minor change, a 24% relative reduction in the resting pressure might explain the worse postoperative anorectal function in the hand-sewn anastomosis group. According to other theories, it is possible that loss of the rectoanal inhibitory reflex (RAIR) contributes to this difference[41]. One small population study demonstrated that 80% and 33% of

patients could discriminate feces and flatus in the stapled and hand-sewn anastomosis groups, respectively, and these differences were deemed significant. In addition, this notable finding was confirmed via manometric evaluation of the RAIR, that is, 90% and 42% had positive RAIR in the stapled and hand-sewn anastomosis groups, respectively[42]. Further physiological studies are required to elucidate these differences.

This study has several limitations. First, because this was a single-center retrospective analysis with an insufficient sample size and the type of anastomosis was selected based on surgeon discretion, bias was deemed inevitable. In the future, it is thus necessary to validate the results using a prospective randomized controlled trial. Second, the LARS score in the SST group was high, albeit significantly lower than that in the hand-sewn anastomosis group, and it was difficult to determine whether this difference was clinically significant. Third, we limited the time period for the analysis of the postoperative anorectal function to 1 year (± 6 months) after DS closure due to the collection rate of the postoperative anorectal function questionnaire. In addition, follow-up and evaluation for late complications, such as delayed anastomotic fistula and mucosal prolapse, were insufficient. Therefore, long-term analysis should be conducted to obtain further results.

Conclusion

In ISR with TaTME, the SST below the ARJ was safe and feasible and had less negative impact on the postoperative anorectal function as compared to hand-sewn anastomosis. Therefore, we believe that the SST is a promising anastomotic option for patients with low-lying rectal tumors. The Super SST trial[43], which is a multicenter randomized controlled trial comparing stapled and hand-sewn anastomoses in ISR with TaTME, is currently in the recruitment status, and the results are awaited with interest.

Conflicts of Interest

There are no conflicts of interest.

Author Contributions

Conception and design: Daichi Kitaguchi

Acquisition, analysis, and interpretation of data: Daichi Kitaguchi, Hiro Hasegawa, Koji Ando, Koji Ikeda, Yuichiro Tsukada, Yuji Nishizawa, and Masaaki Ito

Drafting of the manuscript: Daichi Kitaguchi

Critical revisions of the manuscript for important intellectual content: Masaaki Ito

Approval of the version to be published: Hiro Hasegawa, Koji Ando, Koji Ikeda, Yuichiro Tsukada, Yuji Nishizawa, and Masaaki Ito

Approval by Institutioal Review Board(IRB)

The study protocol was approved by the Ethics Committee of the National Cancer Center Hospital East (Chiba, Japan) (registration number: 2018-100).

Disclaimer

Masaaki Ito is one of the Associate Editors of Journal of the Anus, Rectum and Colon and on the journal's Editorial Board. He was not involved in the editorial evaluation or decision to accept this article for publication at all.

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