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Original Article

Single-incision Plus One Port Versus Standard Multiport Laparoscopic Surgery for Rectal Cancer

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Abstract **We reported the preliminary results of the comparison of perioperative outcomes between single-incision plus one port laparoscopic rectal resection (SILS+1) and standard multiport laparoscopic rectal resection (MPL) at Hatyai Hospital.**

Materials and Methods: **The data were retrospectively collected for patients undergoing SILS+1 (34 patients), and MPL (30 patients) at Hatyai Hospital from January 2011 to September 2013. The demographic data, operative time, hospital stay, postoperative pain, conversion to open surgery, and postoperative complications were analyzed.**

Results: **With the exception of more males in the SILS+1 group, demographic data were similar in both groups. Most of the procedures were low anterior resection in both groups (28/34 in SILS+1 and 26/30 in MPL). The operative time was longer in the MPL group ($p = 0.01$). There were no significant differences in mean estimated blood loss (282.2 mL vs. 208.0 mL), number of open conversions (1 vs. 3), mean maximum postoperative pain score (6.1 vs. 7.3), mean hospital stay (13.4 days vs. 10.9 days), number of reoperations (1 vs. 2) and complication rate (5.9% vs. 13.3%). Average length of specimen was longer in the SILS+1 group (19.7 cm vs. 16.2 cm, $p = 0.01$), which also had more advanced stage tumors ($p = 0.01$). There were no significant differences in mean tumor size (4.8 cm vs. 4.1 cm), mean distal margin (2.2 cm vs. 2.4 cm) and mean number of harvested lymph nodes (10 vs. 9) between the two groups.**

Conclusion: **Preliminary results of the present study showed that SILS+1 is safe and has similar perioperative outcomes as MPL.**

Keywords: **Single incision laparoscopic surgery, rectal cancer, colorectal surgery**

Introduction

Laparoscopic surgery is at present a standard approach for colorectal cancer[1,2]. Laparoscopic low anterior resection, even for experienced surgeons, is technically demanding and usually requires a multiport approach[3,4]. Surgeons using the single port technique (single incision laparoscopic surgery, SILS) must include additional maneuvers that can provide adequate rectum traction for low rectal dissection[5,6]. At our institute, we prefer adding one more port for

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SILS low anterior resection. In the present study we compare perioperative outcomes of low anterior resection for rectal cancer, between SILS plus one 12 millimeter port (SILS+1) and multiport laparoscopic low rectal resection (MPL).

Materials and Methods

The present study was approved by our institution's Research Ethics Committee. All medical charts of patients who underwent laparoscopic low anterior resection between January 2011 and September 2013 were reviewed. There were 34 patients in SILS+1 group and 30 patients in MPL group. All of these patients were followed for at least three months post-operatively. Demographic data and perioperative outcomes, in terms of operative time, estimated blood loss, conversion rate, maximum post-operative pain score, perioperative complications, pathological outcomes and length of stay were compared between the two groups.

The data was analyzed with SPSS for Windows software version 15.0. Univariate comparison between categorical data was performed using chi-square or Fisher's exact test as appropriate. Comparison of quantitative data was performed using the t test or Man-Whitney U test as appropriate. A two-tailed p-value < 0.05 was considered statistically significant.

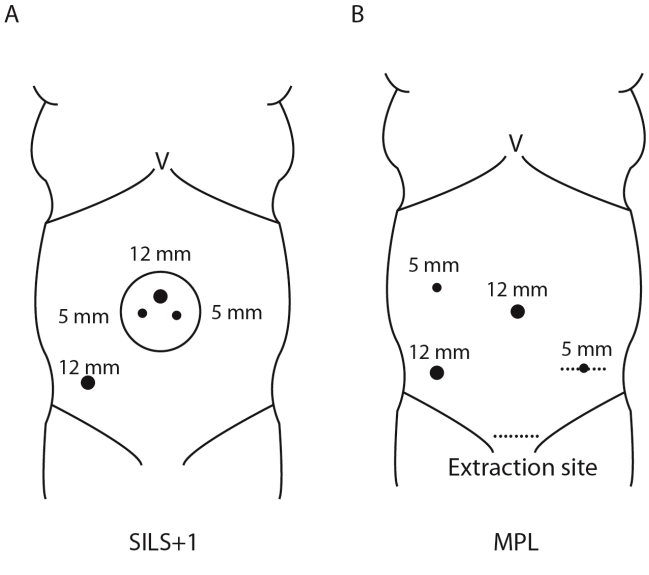

Figure 1 Locations and incisions for ports used in the Single Incision Laparoscopic Surgery Plus One (SILS+1) approach (A) and the MultiPort Laparoscopic surgery (MPL) approach (B).

In the SILS+1 group, the SILS™ port (Covidien, Inc.) was inserted through a 2.5-centimeter transumbilical incision and a 12 millimeter port was placed at right lower quadrant (Figure 1A). For the MPL group, the setup is as shown in Figure 1B. All the procedures were performed using the 30 degree laparoscope. The medial-to-lateral approach was used, starting with vascular ligation. High ligation of inferior mesenteric vessels was done in low rectal anastomosis cases, while low ligation was done for cases where the anastomosis was situated above the peritoneal reflection. The colon was dissected from its attachment and the left ureter was always identified. The rectum was mobilized in the total mesorectal excision (TME) fashion, deep down to anorectal ring. Rectal transection was performed using laparoscopic linear cutter stapler (Endo GIA™, Covidien, Inc.) through the right lower quadrant port.

In the SILS+1 group, the specimen was removed via the umbilical wound. In the MPL group, the extraction site was at the suprapubic area via a Pfannenstiel incision, or via an extension of the left 5 mm port wound. The anastomosis was performed using a circular DST Series™ EEA™ Stapler (Covidien, Inc.). A protective ostomy was created when the risk of leakage was estimated to be high. A vacuum drain was placed behind the anastomosis in low anterior resection cases and a Penrose drain was placed just above the perineal wound in abdominoperineal resection cases.

Results

Demographic data (Table 1) showed higher male to female ratio in the SILS+1 group ($p = 0.03$). There were no significant differences between the two groups regarding age (mean age, 60.3 years in SILS+1 group, vs. 62.7 years in MPL group) and body mass index (mean, 21.3 kg/m^2 in SILS+1 group, vs. 20.4 kg/m^2 in MPL group). More patients in MPL group received concurrent chemoradiation, but this difference did not reach statistical significance ($p = 0.09$).

Most of the procedures in both groups were low anterior resection (28 in SILS+1 group and 26 in MPL group). The mean operative time was significantly shorter in SILS+1 group (232.4 minutes) than in MPL group (284.5 minutes) with $p = 0.01$. There were no significant differences between the groups in terms of blood loss, maximum postoperative day one pain score,

Table 1 Comparison of demographic data between groups.

	SILS+1 group (n= 34)	MPL group (n= 30)	*p*-value
Age (yr): mean(SD)	60.3 (10.6)	62.7 (16.3)	0.49
Gender[a]			
Male	28	17	
Female	16	13	0.03
BMI (kg/m2): mean(SD)	21.3 (2.1)	20.4 (2.3)	0.10
Preoperative CRT[b]	1	5	0.09

[a]Chi-square test, [b]Fisher's exact test; SD: standard deviation; BMI: body mass index; CRT: chemoradiation

Table 2 Comparison of perioperative outcomes between groups.

	SILS+1 group (n=34)	MPL group (n=30)	*p*-value
Type of operation[b]			
Low anterior resection	25	23	0.92
Low anterior resection+ostomy	3	3	
Abdominoperineal resection	6	4	
Operative time (min): mean (SD)	232.4 (81)	284.5 (76)	0.01
Estimated blood loss (mL): mean (SD)	282.2 (221)	208.0 (219)	0.18
Open conversion[b] (%)	1 (3)	3 (10)	0.33
Additional laparoscopic port	3	NA	NA
Maximum pain score (1-10 scale): mean (SD)	6.1 (2.4)	7.3 (2.2)	0.06
Hospital stay(days): mean (SD)	13.4 (8)	10.9 (13)	0.34
Reoperation	1	2	0.48

[b]Fisher's exact test

Table 3 Comparison of pathological outcomes between groups.

	SILS+1 Group (n=34)	MPL Group (n=30)	p-value
Length of specimen (cm): mean (SD)	19.7 (5.7)	16.2 (4.7)	0.01
Tumor size (cm): mean (SD)	4.8 (1.5)	4.1 (1.9)	0.11
Distal margin (cm): mean (SD)	2.2 (1.5)	2.4 (1.5)	0.76
Number of harvested LNs: median (range)[a]	10.0 (2 to 18)	9.0 (2 to 24)	0.53
TNM stage[b] : number			
Stage I	0	6	
Stage II	12	14	
Stage III	18	8	
Stage IV	4	2	0.01

[a]Mann-Whitney U test; [b]Fisher's exact test; LNs: lymph nodes

and length of hospital stay.

According to Table 2, one case in the SILS+1 group had conversion to open surgery because of advanced stage of cancer, and three cases in the MPL groups were converted to open surgery due to advanced cancers in two cases, and ureteric injury in one case. This difference was not statistically significant (p = 0.33). Three cases in the SILS+1 group needed one more 5 mm port to facilitate dissection. Reoperations because of postoperative complications were required in one case in the SILS+1 group and two cases in the MPL group.

Regarding pathological outcomes (Table 3), all margins were free of cancer in both groups. The mean length of specimen in the SILS+1 group was longer than that in the MPL group (19.7 cm vs. 16.2 cm, $p = 0.01$). More patients had advanced TNM staging in the SILS+1 group than those in the MPL group ($p = 0.01$). Tumor size, distal margin and number of harvested lymph nodes were not statistically different between the two groups.

There were two anastomotic leakages in the SILS+1 group. One patient had protective ileostomy, and conservative treatment was successfully carried out. The other required a diverting colostomy. In the MPL group, there was one case with urinary retention, one with ureteric injury, one with anastomotic leakage, and one with colostomy gangrene. The latter two cases required reoperation. No umbilical wound complications were detected in the SILS+1 group. No statistical difference was found in overall morbidity between the two groups ($p = 0.31$). There was no mortality in both groups.

Discussion

The number of colorectal cancers in Thailand has been increasing in the last decade[7] and recent data have shown that more than half of colorectal cancers are found in rectum[8]. Laparoscopic rectal resection is now widely used for rectal cancer. Laparoscopic rectal resection with total mesorectal excision has comparable oncologic outcomes to traditional, open exploratory laparotomy[9-11]. However, the laparoscopic approach requires several incisions for port placement and specimen extraction, which may potentially result in complications for each incision[12,13]. To decrease potential wound complications, the concept of single-incision laparoscopic surgery has been introduced for colorectal operations[14].

From our own experience with laparoscopic surgery and single-incision laparoscopic surgery (SILS), we found that during rectal dissection further special instruments were usually needed[15,16]. We therefore decided to add one more 12 mm port at right lower quadrant for rectal resection. This port facilitates better traction for rectal dissection and provides more space for staple application, as well as being a good location for placing a tube drain at the end of the procedure. The mean operative time for laparoscopic rectal resection, including anterior resection and APR, was reported to be between 180 and 280 minutes[17-19]. Our data showed that the operative time was shorter (mean, 232.4 minutes) in the SILS+1 group than in the MPL group (284.5 minutes) even though there were more men and more advanced stage rectal carcinoma in the SILS+1 group. This could be because all cases of SILS+1 were operated on by one of the authors (AK) but patients in the MPL group were operated on by four other laparoscopic surgeons.

The average blood loss for laparoscopic rectal resection ranged from 136 mL to 322 mL in some series[17,20], but could be as low as 40 mL to 145 mL for the single incision approach[21,22], and 64 mL to 109.2 mL for the single-incision plus one port approach[19,22]. Our average blood loss was 228.2 mL in the SILS+1 group, which was slightly higher than the average blood loss in the MPL group, but was not significantly so. This could be partially explained by the fact that there were more advanced cancers in the SILS+1 group.

The open conversion rate for laparoscopic rectal resection ranged from 0 to 34% in the literature[9,17]. The two main reasons for conversion were bulky tumors in a narrow pelvis, and intraoperative complications requiring open correction. The conversion rates in the present study were not significantly different between the two groups. In some difficult cases in the SILS+1 group, we were able to add more ports to facilitate dissection instead of converting to open surgery.

The number of harvested lymph nodes in the present series was less than that in some other studies[20,24,25]. But no significant difference was found between both groups in terms of lymph nodes harvested. The number of lymph nodes retrieved may reflect both the quality of the TME specimen and pathological examination. Improvements in surgical technique and standardization of pathological examination should go hand in hand.

Although SILS is expected to reduce postoperative pain in laparoscopic surgery, some studies could not demonstrate this benefit[26,27]. Similarly, in the present study, we failed to show a benefit of SILS+1 above MPL in terms of pain. The hospital stay in the present study was longer than that in other reports[19,23], possibly because patients underwent preoperative evaluation and surgery during the same admission.

Anastomotic leakage is a major complication of low anterior resection. The leakage rate for laparoscopic anterior resection has been consistently less than 10%[9,24]. Our leakage rates (5.9% and 3.3%) were acceptable for both groups. Some authors have recommended diverting colostomy for anastomoses within 5 cm from the anal verge, or when the anastomosis has questionable blood supply[17,28]. Some reports mentioned a higher rate of umbilical incisional hernia in single-incision laparoscopic surgery[29,30]. Our short-term follow-up did not demonstrate incisional hernia or any complications of the umbilical wound.

Conclusions

Preliminary results of this study showed that SILS+1 is safe and not appreciably different from MPL in terms of perioperative outcomes. However, further studies are needed to definitively demonstrate the advantages of this procedure over standard multiport laparoscopic rectal resection.

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