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Short-term Outcomes of Restorative Proctocolectomy Using Hand-assisted Laparoscopic Surgery for Ulcerative Colitis

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We have been performing restorative proctocolectomy (RP) using hand-assisted laparoscopic surgery (HALS) since 1998, treating 46 cases of ulcerative colitis (UC) to date. Twenty-two cases underwent stapled RP, with the remaining performed using hand-sewn RP. We analyzed clinical results for HALS compared to 75 cases treated by open surgery (OS) in the same period. The HALS device was inserted through a midline 6- to 8-cm incision left of the navel. Easy identification of mesenteric blood flow to the pouch is one of the advantages of this port site setting. Only 1 patient (2.2%) was converted from HALS to OS. Mean operative time was significantly longer with HALS (340.0 ± 76.8 min) than with OS (261 ± 69.3 min; $p<0.001$), but the volume of bleeding was significantly less with HALS (125.8 ± 162.8 ml) than with OS (299.2 ± 276.0 ml; $p<0.001$). Postoperative complications were comparable between techniques. No patient required reoperation or died within 30 days of HALS. No significant differences in duration of hospitalization were seen between groups. Using HALS techniques, RP for UC can be safely performed. We view RP using HALS as an extremely important technique that could easily expand the number of patients able to benefit from minimal-access surgery.

Key Words: hand-assisted laparoscopic surgery, ileal pouch anal anastomosis, restorative proctocolectomy, ulcerative colitis, laparoscopic surgery

Introduction

Laparoscopic restorative proctocolectomy (RP) is feasible and safe in patients with acute non-fulminant colitis and may allow faster recovery than open surgery (OS)[1)2)]. On the other hand, RP is one of the most extensive and complex operations in the field of colorectal surgery. Hand-assisted laparoscopic surgery (HALS) reduces the operative time, but patient morbidity and recovery rates are similar to those with multi-port laparoscopic colectomy (MLC)[3)]. The majority of surgeons are reluctant to attempt MLC because of its technical complexity and prolonged operative time[3)~5)], although some surgeons are now routinely performing this challenging procedure[3)5)]. While some small studies have compared MLC with HALS[3)5)6)], the advantages of HALS have not been definitively established.

We have performed RP using HALS for ulcerative colitis (UC) since 1998. During HALS, surgeons are able to retain tactile sensation by inserting their hands through a sealing device. Several reports have referred to the efficacy of RP using HALS for UC[3)5)~10)]. The aim of this study was to investigate short-term outcomes of RP using HALS.

Materials and Methods

A total of 121 patients underwent RP (hand-sewn or stapled) in our institution between January 1998 and November 2013. In terms of technique, 46 patients (38.0%) underwent HALS, and 75 received conventional OS. We retrospectively compared short-term outcomes between these two groups. Our indications for RP using HALS excluded emergency surgery. Basically, we performed a 2-stage operation with ileal pouch-anal anastomosis in both groups (Fig. 1). Stapled anastomosis was selected

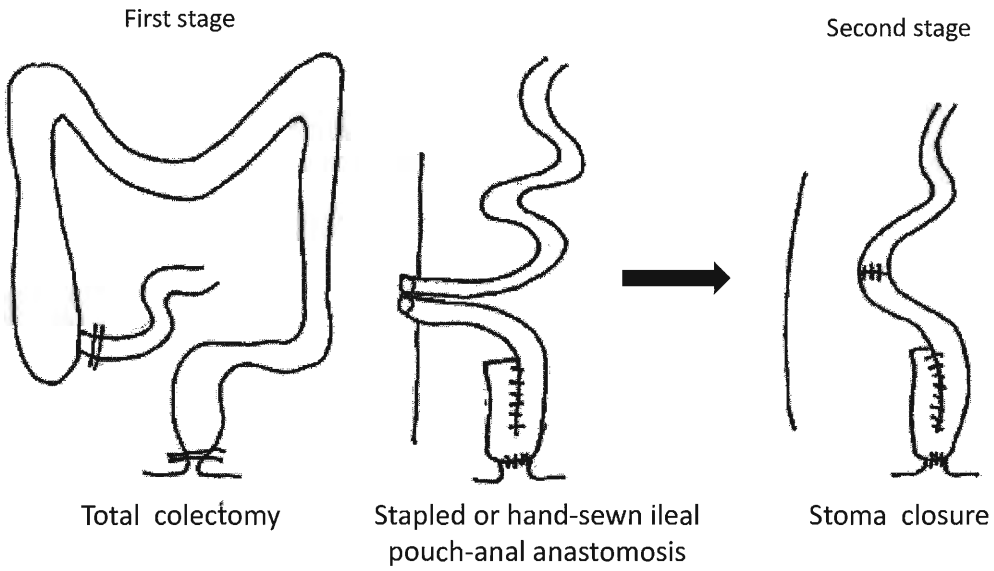

Fig. 1 Surgical technique for two-stage proctocolectomy using HALS
We perform total colectomy and stapled or hand-sewn ileal pouch-anal anastomosis with a covering ileostomy in the first stage.
After several months, we take down the stoma.

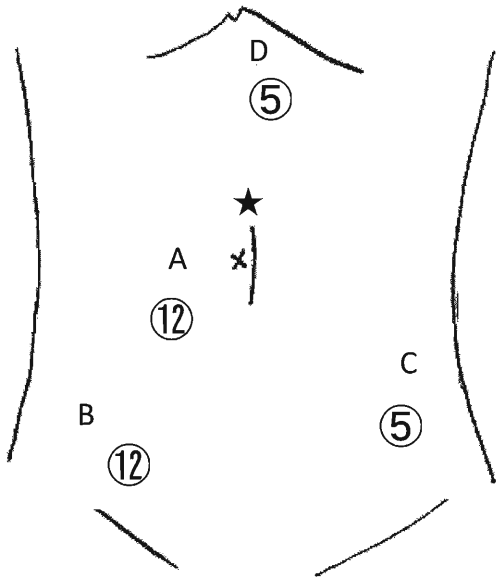

Fig. 2 Port placement for restorative proctocolectomy using HALS
The patient was placed in the modified lithotomy position with use of the Levitator (O.R. Direct, Acton, MA). The head was fixed to the operating table with headgear.
★ 6 cm incision: hand-access device.
A-C: standard trocars.
D: additional trocar.
A: diverting stoma site.
C: drainage tube site.

for 22 of the 46 patients who underwent HALS, while the remaining underwent hand-sewn anastomosis. In the OS group, 49 of the 75 patients underwent stapled anastomosis and the remaining received hand-sewn anastomosis. All data are presented as median and range. The chi-square test was used to compare categorical variables between groups, while the Wilcoxon test was used for continuous variables. Values of p less than 0.05 were taken to indicate statistical significance.

Operative procedure

We start RP using HALS with the patient in a lithotomy position under general anesthesia. The port locations and hand incision are crucial for successful surgery (Fig. 2). The site of the first trocar is used for the covering ileostomy site. The incision for the surgeon's hand is located to the left of the navel and averages 6 cm in length. We use the GelPort system (Applied Medical Resources Corporation, Rancho Santa Margarita, CA) for the HALS device.

Before starting HALS, we perform partial omentectomy and mobilization of the right colon through the mini-laparotomy, confirming that we can reach from the end of the ileum to the anus for ileal pouch-anal anastomosis. When we cannot mobilize the entire right colon, we use HALS with an additional trocar.

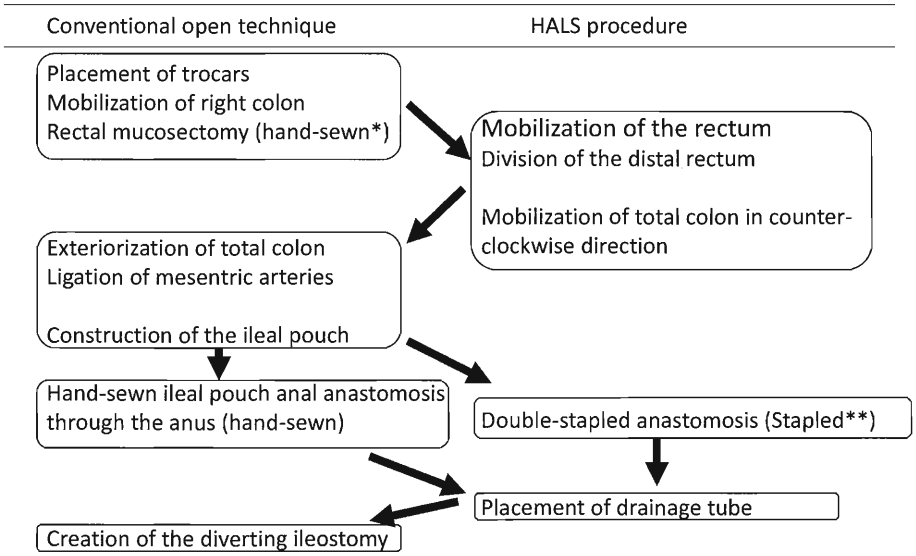

Fig. 3 Surgical technique for restorative proctocolectomy using HALS
*Hand-sewn: hand-sewn ileal pouch anal anastomosis.
**Stapled: stapled ileal pouch anal anastomosis.

Using HALS techniques, we mobilize the rectum and the division of the distal rectum with an endoscopic linear stapler in stapled anastomosis. After cutting the peritoneal reflection, we identify the discolored anterior rectal wall and cut into the muscle cuff in hand-sewn anastomosis. Drawing on the amputation stump of rectal mucosa, we cut the rectal muscle circumferentially.

We mobilize the entire colon in a counter-clockwise direction after rectal division.

After mobilization of the total colon, exenteration is performed through the mini-laparotomy. Ligation of the mesenteric arteries is performed using the conventional technique.

After removal of the specimen, the ileal pouch is created. Following construction, the ileal pouch is pulled down to the anus and double-stapled anastomosis is performed.

Before starting HALS, we perform rectal mucosectomy using a harmonic scalpel in hand-sewn anastomosis. The stump of rectal mucosa is closed for rectal muscle dissection. After construction of the ileal pouch, trans-anal hand-sewn anastomosis is performed (Fig. 3).

Results

We compared clinical results between HALS and OS. No significant differences in age, operative procedure, or body mass index (BMI) were seen between groups (Table 1). As 23 of the 75 patients who underwent OS received this as an emergency operation, indications for surgery differed significantly between groups ($p < 0.01$). HALS was performed by two senior surgeons, and OS was performed by seven senior surgeons. Only 1 patient (2.2%) was converted from HALS to OS; this patient was obese (BMI, 34.0 kg/m^2), and conversion was performed because of a lack of working space due to the volume of abdominal fat. Mean operative time was significantly longer for HALS (340.0 ± 76.8 min) than for OS (261 ± 69.3 min; $p < 0.001$), but the volume of blood loss was less with HALS (125.8 ± 162.8 ml) than with OS (299.2 ± 276.0 ml; $p < 0.001$) (Table 2). The duration of postoperative hospitalization was similar between the two groups.

The rate of postoperative complications was comparable between HALS and OS (Table 3). Bowel obstruction and anastomotic leakage were observed in 11 (23.9%) and 5 (10.9%) of the 46 cases treated using HALS, respectively, with conservative treatment provided in all cases. No patients who underwent HALS required reoperation due to complications or died within 30 days postoperatively. Seven patients with OS (9.3%) required reoperation due to bowel obstruction and anastomotic leakage, and 2

Table 1 Patient demographics

	HALS (n=46)	OS (n=75)	Chi square test/ Wilcoxon test
Sex (male/female)	24/22	49/26	ns*
Age at diagnosis (years)	25.6±11.2	32.3±14.2	$p<0.05$
Age at surgery (years)	34.2±13.8	40.4±14.9	$p<0.05$
Body mass index (kg/m^2)	19.9±3.7	20.7±4.2	ns*
Total protein (mean ±SD) (g/dL)	6.3±0.9	5.8±1.0	$p<0.05$
Albumin (mean ±SD) (g/dL)	3.6±0.7	3.2±0.8	ns*
Disease duration from onset to surgery (months)	118±99.7	102.56±103.2	ns*
Indication for surgery			
Medical intractability	33 (71.7%)	36 (48.0%)	$p<0.01$
Dysplasia, carcinoma	12 (26.1%)	17 (22.7%)	
Bleeding	1 (2.2%)	20 (26.7%)	
Perforation		1 (1.3%)	
Toxic megacolon		1 (1.3%)	
Emergency operation	0/46	23/75	$p<0.01$
Staged operation, 1-/2-stage	1/45	3/72	ns*
Mode of anastomosis, stapled/hand-sewn	22/24	49/26	ns*

*ns: not significant

Table 2 Operative results

	HALS (n=46)	OPEN (n=75)	Chi square test/ Wilcoxon test
Procedure (stapled/hand-sewn)	22/24	49/26	ns**
Operative time (min)	340.0±76.8	261±69.3	$p<0.001$
Blood loss (ml)	125.8±162.8	299.2±276.0	$p<0.001$
Conversion	1 (2.2%)*		
Postoperative hospital stay (days)	31.8±21.2	32.1±29.8	ns**

*Case: A 26-year-old man. BMI: 34.0 kg/m^2.
The cause of conversion was the lack of working space due to the volume of abdominal fat.
**ns: not significant.

OS patients died within 30 days.

Discussion

Dramatic improvements in laparoscopic techniques have been made in recent years. The clinical results of RP using HALS were satisfactory compared to OS in our study. The characteristic of our surgical procedure is the port site setting. HALS devices have been placed through a Pfannenstiel incision in previous reports[3)5)6)], whereas the device is inserted through a 6 to 8 cm midline incision left of the navel with our procedure. Mesenteric blood flow to the pouch is easily identified under direct vision. Successful elongation of the mesentery is performed through the mini-laparotomy. This represents one of the important merits of this port site setting. HALS offers surgeons the ability to perform more complex operations in a less-invasive manner[11)]. Current trends in minimally invasive surgery such as the single-port surgery seek to reduce access trauma[12)]. RP is associated with a higher complication rate than other laparoscopic colorectal procedures[7)]. The conversion rate in this series using HALS was lower than reported for MLC[1)8)~10)]. In addition, a trend towards decreased operative time is seen with hand-assisted procedures[5)8)].

The benefits of HALS for the patient are less pain, quicker restoration of bowel function, improved cosmetic outcomes, shorter time under anesthesia and reduced chance of infection. The benefits of HALS for the surgeon are tactile feedback, and the ability to better locate pathology, identify underlying structures, palpate anatomical landmarks, perceive depth and achieve suitable 3-dimensional orientation. The learning curve for

Table 3 Postoperative complications

	HALS (n = 46) Cases (%)	OPEN (n = 75) Cases (%)	Chi square test
Postoperative complications	25 (54.3)	41 (54.6)	ns*
Bowel obstruction	11 (23.9)	10 (13.3)	ns*
Anastomotic leakage (major/minor)	5 (10.9)	8 (10.7)	ns*
	0/5	2/6	
Anastomotic bleeding	3 (6.5)	5 (6.7)	ns*
Enteritis	1 (2.2)	3 (4)	ns*
Sepsis	1 (2.2)	3 (4)	ns*
Deep vein thrombosis	1 (2.2)	9 (12.0)	ns*
Pulmonary embolism	0	1 (1.3)	ns*
Re-operation	0	7 (9.3)	0.03
Death within 30 days	0	2 (2.7)	ns*

*ns: not significant.

HALS is quicker than that for MLC because of these conditions[13].

There is no evidence that RP using HALS offers any significant benefits over RP using MLC. As the large intestine in UC is quite fragile because of severe inflammation, RP using HALS seems particularly appropriate for patients with this pathology. Pietrabissa et al[14] reported the utility of HALS for splenectomy in patients with massive splenomegaly. HALS is feasible for gentle manipulation and traction of these fragile tissues using the surgeon's hand. HALS procedures have been increasingly accepted as a practical and useful alternative to laparoscopic surgery for complex and extensive colorectal operations[4][10].

Our indications for RP using HALS for UC are limited to elective operations. Cases with complications such as massive bleeding, peritonitis, toxic megacolon and venous thromboembolism are contraindicated for this operation.

Only 1 patient who underwent HALS required conversion to OS. The total conversion rate to OS was reported as 4.2% in a recent meta-analysis[15]. This low conversion rate to OS represents a key benefit of HALS compared to MLC.

In the present series, the incidence of postoperative complications with HALS was similar to that with OS. The incidence of anastomotic leakage was 10%, consistent with previous studies[5][16]. A recent meta-analysis found no difference in anastomotic leakage rates between laparoscopic and open surgery[15]. Watanabe et al[17] reported that the duration of hospitalization after subtotal colectomy without ileal pouch anal anastomosis was significantly shorter with HALS than with OS, although we found no significant difference between our groups. One reason for this was the relatively high frequency of bowel obstruction encountered in HALS. The main cause of this was peristomal edema of the ileum and bowel rotation with a lack of fixation to the abdominal wall[18][19]. Peristomal edema and bowel rotation can occur in both HALS and OS, so preventing bowel obstruction represents a key step to reducing the postoperative complication rate.

Direct comparison of results between HALS and OS was difficult because the surgical indications differed between our groups.

We consider that the indications of RP using HALS are feasible based on the present results. Flexible selection of surgical procedures according to the general condition of the patient, local inflammation of the bowel, and skill of the surgical team is desirable.

Conclusions

HALS allows safe performance of RP for UC. We view RP using HALS as an extremely important technique that could easily expand the number of patients able to benefit from minimal-access surgery in the treatment of UC. HALS appears to have potential as an extremely effective procedure.

The authors have no conflicts of interest to declare.

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潰瘍性大腸炎に対する用手補助腹腔鏡下大腸全摘術の短期成績

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我々は，潰瘍性大腸炎（UC）に対する用手補助腹腔鏡下大腸全摘術（HALS）を1998年より開始してこれまで46例に施行してきた．22例が機械吻合による再建，残りの24例が経肛門的な手縫い吻合による再建であった．これら症例の短期成績を同時期に再建を伴う開腹手術（OS）を行った75例と後ろ向きに比較検討した．HALSでは載石位として臍左に6 cmの皮切をおきハンドアシスト部として右下腹部のストーマ造設予定部，さらに尾側に12 mm，左下腹部に5 mmトロッカーを配置して手術を施行している．必要に応じて心窩部に5 mmトロッカーを追加した．臍左創をハンドアシスト部とすることで，回腸嚢への腸管膜血流分布が容易に確認できることが本術式の利点である．発症時および手術時年齢がHALS症例で若年であった．HALS症例は待機手術症例のみで施行しており，大量出血，穿孔，中毒性巨大結腸症などの緊急手術症例は適応外としているため，手術理由は差が認められた．分割手術の頻度および回腸嚢肛門吻合手技には差を認めなかった．

HALS症例の手術時間は340.0±76.8分で，OS症例の261±69.3分に比較して長時間を要していた（$p<0.001$）．出血量はHALS症例125.8±162.8 mlで，OS症例299.2±276.0 mlに比較して少量であった（$p<0.001$）．HALS症例のうち1例（2.2%）でOSへの移行症例を認めた．術後合併症の頻度は両群に差がなく，術後入院期間も差を認めなかった．HALS症例では，再手術を要した症例や術後30日以内の死亡例は認めなかった．OS症例では再手術例を7例（9.3%）に要しており術後30日以内の死亡を2例（2.7%）に認めた．

本研究は後ろ向きな検討であり，手術適応も違うため一概に比較することはできないが，OS症例と比較した短期手術成績から考慮して待機手術例を適応とした現在の適応は妥当であると考えられる．

UCに対するHALSは安全で確実に施行可能であった．低侵襲の手術を患者さんに提供する方法としてHALSは非常に重要であり，一つのオプションとして考えられる．