

Original Article

# Umbilical-Incision Laparoscopic Surgery with One Assist Port for Right Hemicolectomy: Single Institute Experience

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**Key Words**

Single incision;  
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SILS

**Purpose.** Single-Incision Laparoscopic Surgery (SILS) for right hemicolectomy is a safe and feasible procedure with benign or malignant diseases of the colon. We report a novel umbilical-incision laparoscopic surgery involving one assist port (UILS-One) for right hemicolectomy.

**Methods.** A 3-cm periumbilical longitudinal skin incision was carried down to the fascia layer. Three 5-mm trocars were placed through the incision and another 5-mm trocars was placed in the right lower quadrant. The inclusion criteria were lesions located on the right side of the colon. Patients with obstruction or perforation required emergent operation were excluded. Patient age, gender, surgical indication, intraoperative variables, postoperative condition, and pathology were assessed.

**Result.** A total of 62 patients (29 men and 33 women) underwent umbilical-incision laparoscopic surgery with one assist port (UILS-One) for right hemicolectomy. Patients had a median age of 64.5 years and a median body mass index (BMI) of 23.7 kg/m<sup>2</sup>. The median operative time was 172.5 minutes and the mean intraoperative blood loss was 50 ml. The median length of hospital stay was 6 days, the median length of specimen was 28 cm, and the median number of harvested lymph nodes was 23. There was no conversion to open surgery during any of the procedures and there were no mortality associated with the technique. Post-operative complications were noted in five patients, and included wound infection, ileus, and intra-abdominal abscess.

**Conclusion.** Compared with conventional SILS for right hemicolectomy, UILS-One has better surgical triangulation traction and results in fewer wound problems. The operation can be performed more comfortably and smoothly because of the additional port inserted in the right lower quadrant.

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Single-incision laparoscopic surgery (SILS) is a minimally invasive technique for resecting benign or malignant colonic tissue. Studies have shown that the postoperative and short-term oncological out-

comes of this technique are similar to those of conventional laparoscopic techniques in patients with diseases of the right colon.<sup>1</sup> The downside of performing SILS for right hemicolectomy is limited "direct in-line

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vision” and “loss of triangulation” during surgery. Moreover, because of the crowding of instruments at the access ports, a cross-hand maneuver is frequently required during dissection.<sup>1-3</sup> To improve the surgical field during surgery, we believe an additional port should be employed. Therefore, this study analyzed the safety, feasibility, and potential benefits of UILS with one assist port for right hemicolectomy.

## Materials and Methods

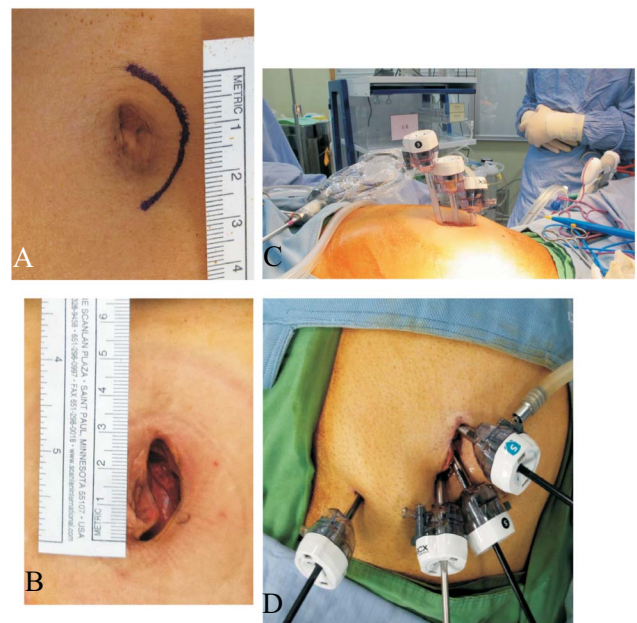
### Patient selections

From March 2010 to June 2011, a total of 62 patients with right-sided colon lesions underwent umbilical-incision laparoscopic surgery with one assist port (UILS-One) for right hemicolectomy. Surgical indications included benign and malignant diseases of the colon. Patients with colonic obstruction or perforation who required emergency operation were excluded. UILS-One for right hemicolectomy was approved by the Institutional Review Board (IRB) of China Medical University Hospital. Before surgery, all patients were informed that the procedure was minimally invasive and would be attempted via a single umbilical incision with one assist port. Patients were also informed of the possibility that additional incisions or trocar ports might be needed to complete the procedure, as well as the chance of conversion to traditional laparoscopic surgery or open right hemicolectomy. Advantages and disadvantages were reviewed to ensure that patients were fully educated about the procedure. Patient age, gender, surgical indication, operative time, estimated blood loss, intraoperative and postoperative morbidity and mortality, postoperative narcotic usage, length of flatus, length of hospital stay, and oncologic features (for malignant disease), including size of the tumor, distal free margin, number of lymph nodes harvest, and pathologic TNM stage were assessed.

### Surgical technique

Umbilical-incision laparoscopic surgery with one

assist port (UILS-One) for right hemicolectomy was performed in a medial-to-lateral approach followed by extracorporeal stapled functional end-to-end ileocolic anastomosis. Patients were placed in the lithotomy position with right-sided elevation, and prophylactic intravenous antibiotics were administered at the time of anesthetic induction. The surgeon was standing in between the patient’s leg, and the camera assistant was on the left side of the patient. The procedure began with a 3-cm periumbilical incision that was deepened to the level of the fascia (Fig. 1A, 1B). Pneumoperitoneum was induced by the application of a Veress needle and maintained at 15 mmHg with carbon dioxide. A 5-mm trocar was introduced along with a rigid 5-mm 30° angled laparoscope into the middle of the wound to initially explore the abdominal cavity. Subsequently, two additional 5-mm trocars were placed through the same periumbilical access port at the bilateral pole of the same wound (Fig. 1C). The distance between trocars was kept as far as possi-



**Fig. 1.** Surgical wound design and trocars placement. (A. Creation of a peri-umbilical 3 cm wound. B. Deepened the wound to the level of fascia. C. Three trocars placement: distance between trocars was kept as far as possible, and the adjacent three trocars were kept at different heights to reduce crowding. D. One another assist trocar was placed at right lower quadrant.)

ble, and the adjacent three trocars were kept at different heights to reduce crowding. Another 5-mm trocar was placed into the right lower quadrant of abdomen (Fig. 1D).

Traditional laparoscopic instruments were used for all UILS-One procedures for right hemicolectomy (Fig. 2). To perform the procedure with a medial-to-lateral approach, the ileocolic pedicle was exposed with retraction of the ileocolic junction by a rigid grasper. Then, a pair of 5-mm laparoscopic monopolar scissors was used for mesocolic dissection and isolation of the ileocolic vessels. A bipolar vessel sealing device was used for vascular control. The entire ascending colon and terminal ileum were freed after complete mobilization of the right colon from the retroperitoneum, parietal peritoneal reflection, omentum, and right-angle ligament by alternatively using



**Fig. 2.** Laparoscopic instruments and team position. A. Traditional laparoscopic instruments were used for surgery. B. Surgeon and camera assistant work freely without bumping into each other.

laparoscopic monopolar scissors and the bipolar vessel sealing device. During operation, all trocars in the camera and the operator ports were alternated to achieve the best angle of vision and appropriate triangulation of the target area.

After mobilizing the entire right side of the colon, a small abdominal incision was made to extract the specimen. The three trocars in the periumbilical wound were removed and the fascia layer was opened. The wound retractor was set up through the small umbilical incision, maximizing exposure to allow easy specimen removal. After extracorporeal ileocolic anastomosis, the colon was placed carefully into the abdominal cavity, and a surgical glove attached to three (or two) trocars was fixed to the outer ring of the wound retractor. This procedure enables reestablishment of the pneumoperitoneum (Fig. 3), and allowed us to examine the resected area and anastomotic site. When needed, the Morison's pouch was drained through the right lower quadrant after removal of the 5-mm trocar. Finally, the wound was closed in layers (Fig. 4). The only cosmetic defect noted at three-month follow-up in all patients was a small periumbilical scar over the abdominal wall (Fig. 5).

In this study, conversions were defined as any unplanned laparotomy at any time during the surgery or any procedure done through an unplanned incision. Insertion of an additional trocar or any procedure done through a hand port was also considered a conversion. The indication and timing of conversion all depended on the surgeon's judgment and experience.



**Fig. 3.** A surgical glove attached with three trocars was fixed for reestablishment of the pneumoperitoneum.



**Fig. 4.** Post-operative wound and drainage site. A. Closed drainage was performed in the right lower quadrant (the 5-mm assist trocar site) B. The peri-umbilical wound was closed.

## Results

A total of 62 patients were included in this study (29 men and 33 women; median age, 64.5 years). Patient characteristics are summarized in Table 1. Surgical indication included cecal and ascending colon cancer (n = 46, 74.2%), benign colon sessile polyps (n = 8, 12.9%), diverticulitis (n = 5, 8.1%), appendiceal adenocarcinoma (n = 1, 1.6%), appendiceal carcinoids (n = 1, 1.6%), and cecal gastrointestinal stromal tumor (n = 1, 1.6%). The median operative time was 172.5 minutes (range, 130-240 min) and the mean intraoperative blood loss was 50 ml (range, 20-150 ml). Closed drainage was required in 12 patients (19.4%)



**Fig. 5.** Post-operative wound. A periumbilical wound is noted three months after surgery. The scar over right lower quadrant was a scar after receiving appendectomy.

**Table 1.** Demographic parameters for patients performing umbilical-incision laparoscopic surgery with one assist port (UILS-One) right hemicolectomy

Patient numbers	N = 62
Age (years), Median (range)	64.5 (16-88)
Gender	
Female (%)	33 (53.2%)
Male (%)	29 (46.8%)
BMI, Median (range)	23.7 (17.6-30.2)
ASA score	
1-2	55 (88.7%)
≥ 3	7 (11.3%)
Surgical indications	
Adenocarcinoma	46 (74.2%)
Cecum	14
Ascending colon	17
Hepatic flexure	7
Transverse colon	8
Benign Colon polyp	8 (12.9%)
Cecum	3
Ascending colon	3
Hepatic flexure	2
Diverticulitis	5 (8.1%)
Cecum	1
Ascending colon	4
Appendiceal adenocarcinoma	1 (1.6%)
Appendiceal carcinoid	1 (1.6%)
Gastrointestinal stromal tumor (GIST):	1 (1.6%)
Cecum	

after surgery. During the postoperative period, the median dose of analgesics was 10 mg (range, 5-40 mg), the median time to first flatus passage was 2 days (range, 1-5 days), and the median postoperative hospital stay was 6 days (range, 4-15 days). Five (4.61%) patients developed postoperative complications, including prolonged postoperative ileus (n = 2), intra-abdominal abscess (n = 2), and postoperative wound infection (n = 1) (Table 2). The conditions in all five patients with postoperative complications were successfully managed conservatively and all patients were safely discharged from the hospital. There were no conversions to traditional laparoscopic surgery or open surgery, and there were no surgical mortality during the procedures.

Data on tumor size, length of specimen, number of lymph nodes harvested, and TNM stage are showed in Table 3.

## Discussion

Minimally invasive colon surgeries are widely accepted as an alternative method to open colon surgery. Single-site laparoscopic surgery has been applied to basic procedures such as appendectomies, biopsies, cholecystectomies, and staging.<sup>4</sup> Single-site laparoscopic surgery is feasible when the surgery is restricted to one quadrant; however, single-site laparoscopic co-

lon surgery is a technically challenging procedure even for experienced laparoscopic colorectal surgeons because laparoscopic colon surgery frequently involves more than one quadrant. Studies of traditional laparoscopic resection of colon cancer clearly demonstrate that laparoscopy did not jeopardize the oncologic outcome when compared to open surgery.<sup>5,6</sup> SILS colectomy is a novel procedure, but the trocars and the camera are in a different angle when compared to traditional laparoscopic surgery. SILS colectomy requires a learning period to deal with malignant diseases that needed en-bloc surgery. Our initial experience in 18 patients demonstrated that single-site surgery is a feasible and safe technique for managing diseases of the right colon. We also found that the procedure was effective in patients with malignant cecal and ascending colon cancer and that it provided short-term oncologic results similar to those of conventional laparoscopic surgery.

In our previous study, we concluded that SILS has a limited placed in clinical practice and is still far from ideal.<sup>1</sup> The downsides of SILS right hemicolectomy include the lack of additional ports for placement of the scope. This greatly restricts the maneuverability of nearby instruments, resulting in a narrow operative field, lack of triangulation, the need for cross-hand maneuvers, instrument crowding, and reduced in-line vision caused by the instruments, and the optic devices being parallel to each other.

**Table 2.** The short-term surgical outcomes after umbilical-incision laparoscopic surgery with one assist port (UILS-One) right hemicolectomy

Laparoscopic right hemicolectomy (n = 62) (UILS-One)	
Operative time (minutes), median (range)	172.5 (130-240)
Estimated blood loss (ml), median (range)	50 (20-150)
Analgesic equivalents (mg), median (range)	10 (5-40)
Passage of flatus (days), median (range)	2 (1-5)
Postoperative hospital stay (days), median (range)	6 (4-15)
Postoperative complications (%)	5 (8.1%)
Ileus	2 (3.2%)
Intra-abdominal abscess	2 (3.2%)
Wound infection	1 (1.7%)
Conversion rate (%)	0

**Table 3.** Oncology surgical result of umbilical-incision laparoscopic surgery with one assist port (UILS-One) right hemicolectomy

Laparoscopic right hemicolectomy (UILS-One) for adenocarcinoma (n = 46)	
Patient numbers (Adenocarcinoma)	46
Tumor size (cm), median (range)	3 (1-4)
Length of specimen (cm), median (range)	28 (13-40)
Distal free margin (cm), median (range)	14.5 (8-23)
Lymph node harvest (number), median (range)	23 (12-50)
Cancer Stage	
Stage 0 (TisN0M0)	4 (8.7%)
Stage I	13 (28.3%)
Stage II	14 (30.4%)
Stage III	11 (23.9%)
Stage IV	4 (8.7%)

By adding a 5-mm trocar into the right lower quadrant of the abdomen, the “UILS-One” right hemicolectomy procedure overcomes the obstacles mentioned above. This modified procedure frees up both hands of the surgeon, and provides unrestricted exploration of the abdominal cavity. In addition, the surgeon and the camera assistant can work in a comfortable position without bumping into each other. Operating with good posture can possibly prevent fatigue during surgery as well. Furthermore, the UILS-One right hemicolectomy procedure provides surgeons with a good visual field with which to manipulate instruments, perform dissection, and triangulate instruments for suturing.

In this study, there were no intraoperative complications and none of the patients required conversion to traditional laparoscopic or hand-assisted or open surgery. The operative time and the rate of postoperative morbidity associated with UILS-One did not increase when compared to those associated with conventional SILS right hemicolectomy.<sup>1</sup> Furthermore, the addition of an extra trocar allows the surgeon to perform this procedure in a comfortable fashion without needing extensive training.

Although there are different types of single site surgery devices available in the surgical market,<sup>7,8</sup> we believe that the majority of the commercially made devices are rigid, and greatly limit the surgeon’s operative field. Besides, use of commercially available devices increases the cost associated with surgery. Our method provides better trocar flexibility and allows for greater camera angles during surgery. In addition, special instruments such as articulated instruments and flexible or angled optic devices are not required to perform this surgery.

## Conclusion

UILS-One provides for better surgical triangulation traction and can overcome ergonomic difficulties associated with conventional SILS for right hemicolectomy. The short-term outcome is very good; however, the long-term oncological outcome needs to be studied.

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原 著

## 肚臍切口腹腔鏡右側大腸切術併行一個額外的輔助性腹腔鏡套管：單一機構經驗

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**目的** 單切口腹腔鏡右側大腸切除術不管在良性或惡性的疾病皆是一個安全且可行的手術。但是單切口腹腔鏡手術仍是有些限制需要外科醫師去克服。我們在這裡提出一個肚臍切口腹腔鏡右側大腸切除併行一個額外的輔助性腹腔鏡套管。

**方法** 一個肚臍旁約三公分的縱向皮膚切口打開至筋膜層上方。將三個五毫米的腹腔鏡套管置入此皮膚切口中，另外在右下腹置入另一個五毫米的腹腔鏡套管中。只要是病灶位於右側大腸皆符合此研究但有腸阻塞及腸穿孔需要緊急手術的病例則予以排除。病人的年齡、性別、手術適應症、術中因子及術後的病理報告皆列入評估。

**結果** 共有 62 個病例接受肚臍切口腹腔鏡右側大腸切術併行一個額外的輔助性腹腔鏡套管的手術，其中有 29 個男性及 33 個女性。其平均年齡為 64.5 歲，其 BMI 值之中位數為 23.71。手術時間之中位術為 172.5 分鐘，術中的失血量之中位數為 50 c.c.。住院天數之中位數為 6 天。手術樣本長度之中位數為 28 公分。取得淋巴結的中位數為 22.5。並無在術中轉為傳統剖腹手術之病例且為術後死亡之病例。術後的併發症有五例，包含傷口感染、腸阻塞、腹內膿瘍。

**結論** 和傳統的單切口腹腔鏡右側大腸切除術做比較，肚臍切口腹腔鏡右側大腸切除併行一個額外的輔助性腹腔鏡套管（又稱 SILS-One）有較好的視野，且傷口的復原、疼痛及美觀並無差異。在右下腹多置入一個額外的輔助性腹腔鏡套管後，手術可在更順暢的情形下進行。

**關鍵詞** 單一切口、腹腔鏡、助性腹腔鏡套管、右側大腸切除術、SILS-One。