

Single Incision Laparoscopic-Assisted Right Hemicolectomy: Technique and Application (With Video)

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Purpose: Most commonly employed for surgery of the gallbladder and appendix, single-incision laparoscopic surgery (SILS) is rapidly evolving in the field of minimally invasive surgery. The purpose of this report is to describe the feasibility and technique for SILS right hemicolectomy, which has not been widely reported.

Methods: We describe a laparoscopic right hemicolectomy with a modified single-incision technique for the management of a precancerous polyp of the ascending colon.

Results: The procedure was successfully performed in 105 minutes using 3 transumbilical trocars placed through a single port, and readily available nonarticulating laparoscopic instruments. In addition, we review the literature of SILS procedures involving the colon and discuss differences between our approach and those reported elsewhere.

Conclusions: SILS is a feasible modality applicable to minimally invasive surgery of the colon and can offer benefits to the patient.

Key Words: single-incision laparoscopic surgery, SILS, colon surgery, single port access

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Most commonly employed for surgery of the gallbladder and appendix, single-incision or single-port laparoscopic surgery is now being considered in the field of minimally invasive colon surgery. Such approaches are interchangeably referred to as single-incision laparoscopic surgery (SILS), single-port access surgery, scarless single port surgery, and many others. Initial experience with SILS cholecystectomy was reported in 1999 by Bresadola et al.¹ Almost a decade later, the first SILS right hemicolectomy was reported by Bucher et al² in a case involving a polyp of the ascending colon. Since that time, there have been 4 additional reports,^{3–6} 2 of which described SILS right hemicolectomy using either the Uni-XTM Single Site Laparoscopic System (Pnavel Systems, Inc, Brooklyn, NY)³ or the Umbilical GelPort[®] (Applied Medical, Rancho Santa

Margarita, CA) and conventional instrumentation.⁶ Indeed, reports have varied with respect to the access device used. We describe the first modified SILS technique for right hemicolectomy using the SILS™ Port Multiple Instrument Access Port (Covidien, Mansfield, MA), accompanied by a conventional camera and instrumentation. We present a case report and video of a patient requiring a right hemicolectomy with attention to oncologic principles.

MATERIALS AND METHODS

After providing informed consent, the patient was placed in the supine position and prepped and draped in a sterile fashion. A 2.5 cm incision was made through the umbilicus and the fascia was exposed and entered. The length of the fascial incision was kept to 3 cm for the purposes of avoiding inadvertent leakage of pneumoperitoneum throughout the course of the procedure. The SILS™ access port was placed, through which 3 packaged 5 mm trocars were introduced and pneumoperitoneum was established. A standard laparoscopic nonarticulated 5 mm atraumatic grasper and a standard 5 mm 30 degree laparoscopic camera were introduced through 2 of the ports while a Harmonic scalpel (Ethicon Endo-Surgery, Inc, Cincinnati, OH) was introduced as an energy source and dissecting instrument through the third port in a triangular fashion (Fig. 1).

Initial laparoscopic exploration was performed and the patient was then placed in a 20 degree Trendelenburg position. The omentum of the proximal and mid-transverse colon was retracted over the liver in a caudal-to-cranial fashion, exposing the proximal and mid-transverse colon and duodenum. The small bowel was retracted to the left and a medial-to-lateral approach was undertaken. The ileocolic artery was identified and confirmed with lateral retraction of the cecum resulting in a “tenting” effect of the artery (Fig. 2). A retroperitoneal plane was then established and extended laterally and deep to the right colon, superiorly over Gerota’s fascia and medially detaching the retroperitoneal adhesions of the duodenum and exposing the right branch of the middle colic vessels. A window was made at the base of the ileocolic artery and around the right branch of the middle colic artery. At this point, the Harmonic scalpel (Ethicon Endo-Surgery, Inc, Cincinnati, OH) was removed and the 5 mm port was exchanged for a 12 mm port. A laparoscopic linear stapling device was introduced through the 12 mm port and the ileocolic artery was divided at the base of the pedicle, followed by division of the right branch of the middle colic artery. Video 1 (Video 1, Supplemental Digital Content 1,

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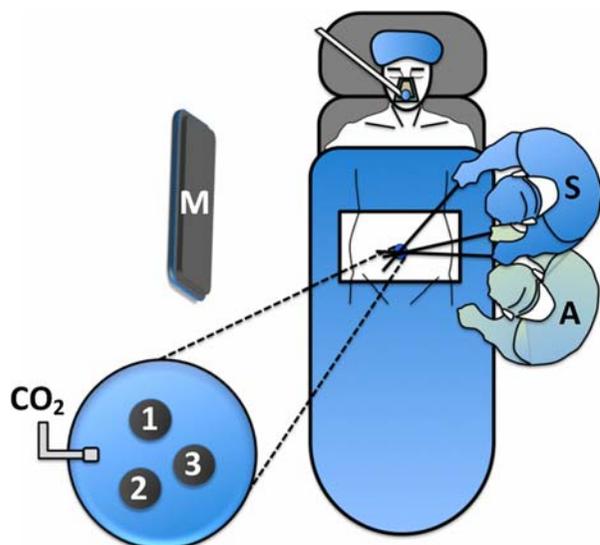


FIGURE 1. Aerial view diagram of surgeon (S), assistant (A), and trocar placement during single-incision laparoscopic right hemicolectomy procedure. (1) 5 mm trocar for retracting instrument. (2) 5 mm trocar for camera. (3) 5 mm trocar for energy device (Harmonic[®]), which is subsequently replaced with 12 mm trocar for arterial ligation. CO₂=gas for pneumoperitoneum. M=monitor.

<http://links.lww.com/SLE/A13>; which demonstrates division of the ileocolic artery and the right branch of the middle colic artery) contains footage of the port insertion, initial laparoscopic exploration, and high ligation of the ileocolic artery.

The table was then tilted 30 degrees with right side elevated and the hepatic flexure was taken down, exposing the duodenum and Gerota's fascia. Dissection continued over the white line of Toldt and any remaining ileocolic adhesions were released thus completely mobilizing the right colon. Video 2 (Video 2, Supplemental Digital Content 2, <http://links.lww.com/SLE/A14>; which contains footage of takedown of the hepatic flexure, white line of Toldt, and ileocolic adhesions) contains footage of takedowns of the hepatic flexure, white line of Toldt, and ileocolic adhesions.

Pneumoperitoneum was released and the SILS[™] device was removed. The fascia was further extended by 1 cm and a small-sized Alexis[®] wound retractor (Applied Medical, Rancho Santa Margarita, CA) was introduced for extracorporealization of the right colon. The proximal and distal

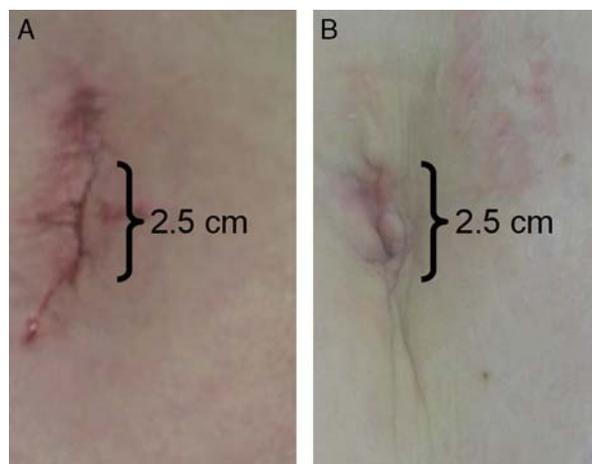


FIGURE 3. Umbilical scar (A) upon completion of surgery and (B) at 2 week postoperative follow-up.

extent of resection was determined based on the mesentery of the divided pedicles. The bowel was resected extracorporeally and a primary anastomosis was fashioned using a double stapling technique. The ileocolic anastomosis was returned to its abdominal domain, the wound retractor was removed, and the SILS[™] device was reinserted. Pneumoperitoneum was reestablished for exploration before closure. The fascial incision and skin edges were primarily closed and a sterile dressing was applied (Fig. 3). Video 3 (Video 3, Supplemental Digital Content 3, <http://links.lww.com/SLE/A15>; which demonstrates extracorporealization and resection of specimen) contains footage of the extracorporealization and resection of specimen, and its return to the abdominal cavity.

RESULTS

A 56-year-old female patient presented after her first colonoscopy which revealed a 2.5 cm sessile polyp of the mid-ascending colon. The lesion could not be removed endoscopically owing to its location over a fold and inability to properly elevate after submucosal injection. The patient was referred for surgical resection.

Her family history was significant in that both her mother and brother had colon cancer at age 63 and 54 years, respectively. The patient was informed about a SILS right hemicolectomy with oncologic principles including mesenteric lymph node extraction and informed consent was obtained. The total operative time was 105 minutes

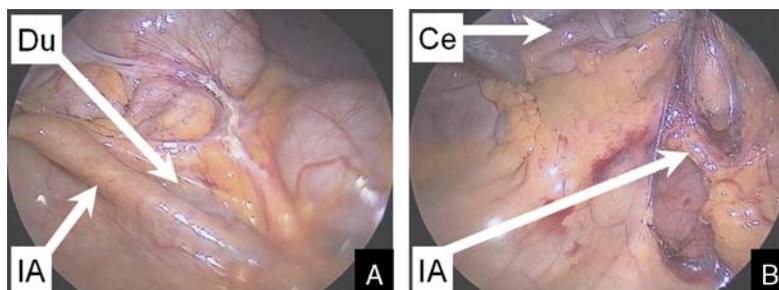


FIGURE 2. A, "Tenting" effect on ileocolic artery (IA) and duodenum (Du) visualized after small bowel retraction. B, Lateral retraction of cecum (Ce) confirms identity of the IA.

TABLE 1. Patient Characteristics for Single Incision Laparoscopic Technique in Colorectal Surgery

References	Gender	Age (y)	BMI (kg/m ²)	Diagnosis
Current report	Female	56	22	Polyp of ascending colon not amenable to endoscopic polypectomy
Bucher et al ²	NR	81	NR	Degenerated ascending colon polyp not amenable to endoscopic approach
Remzi et al ³	Female	67	35	Unresectable cecal polyp
Brunner et al ⁴	Female	56	NR	Diverticulitis of sigmoid colon
	Female	42	NR	Infiltrating endometriosis of rectosigmoid colon
Leroy et al ⁵	Female	40	21	Diverticular abscess
Merchant and Lin ⁶	NR	NR	NR	Colon mass

BMI indicates body mass index; NR, not reported.

with an estimated blood loss of 50 mL and an intraoperative urine output of 250 mL. There were no intraoperative complications.

The total surgical specimen length was 28.5 cm (25 cm colon segment and 3.5 cm terminal ileum segment) and 17 lymph nodes were isolated and examined. The polyp was determined to be a sessile villoglandular adenoma with no evidence of invasive carcinoma in the specimen or the lymph nodes.

Postoperatively, pain control was maintained through patient-controlled analgesia for the first 24 hours and switched to oral narcotic medication thereafter. The patient remained afebrile throughout her postoperative course. A clear liquid diet was resumed on the night of surgery and advanced to a soft low-residue diet on postoperative day 2. Bowel activity (as evidenced by flatus) occurred on postoperative day 3 and the patient was discharged on postoperative day 4 without complications. Thirty day follow-up revealed no postoperative complications and a final measured incision length of 2.5 cm.

DISCUSSION

The application of SILS technique for colon and rectal surgery has only recently emerged in the published literature.²⁻⁶ These studies have reported on the use of single-incision technique in the right colon and sigmoid colon. Table 1 summarizes patient characteristics and diagnoses of

colorectal SILS™ and Table 2 summarizes the corresponding operative characteristics and outcomes for these cases. The hospital length of stay, operative time, and complication rate reported here are comparable to those of previous reports.

We present the first known report of the SILS™ Port Multiple Instrument Access Port (Covidien, Mansfield, MA) device for right hemicolectomy. This device was chosen for its design, availability, and use of a single fascial incision (this avoids the so-called “Swiss cheese” approach in which the closure of adjacent incisions may result in increased tension and possibility for pain and ventral herniation of bowel). Readily available laparoscopic instruments were used. Articulating or specially designed instruments were not required, thus keeping the additional cost limited to the SILS™ device itself (estimated cost: \$450). When considering that the SILS™ device is supplied with all trocars included, it averted the use of disposable trocars that are typically used for our laparoscopic right hemicolectomies (estimated cost: \$250). Thus, the total additional cost of using the SILS™ device for this procedure is estimated to be \$200.

Given the nascent use of SILS technique in colon and rectal surgery, advantages and limitations have not been definitively established. The most apparent advantage of SILS is cosmesis, with the location of a single small incision hidden in the natural concavity of the umbilicus. However, other advantages may be realized, including reduced postoperative pain, incidence of incisional hernia, and incidence of surgical site infections.

TABLE 2. Operative Characteristics and Outcomes for Single-Incision Laparoscopic Technique in Colorectal Surgery

References	Procedure	SILS Device	IL (cm)	LN No.	Specimen Length (cm)	Pathology	OT (min)	LOS (d)	EBL (mL)
Current report	RH	Three transumbilical 5 mm trocars (Covidien)	2.5	17	28.5	2.5 cm villoglandular adenoma	105	4	50
Bucher et al ²	RH	12 mm umbilical port (EXT)	3	33	38	5 cm adenoma with high grade dysplasia	158	NR	NR
Remzi et al ³	RH	Umbilical port (PUX)	3.5	NR	NR	NR	115	4	≤ 100
Brunner et al ⁴	SR	Three transumbilical 5 mm trocars (AMC, WS)	2	NA	22	NR	110	7	“Minimal”
				NR	18	NR	180	6	
Leroy et al ⁵	SR	Umbilical port (ASC Triport)	2	NA	40	NR	90	4	NR
Merchant and Lin ⁶	RH	Umbilical GelPort	2.5	18-25	NR	“Negative margins”	120-180	3	NR

AMC indicates Apple Medical Corporation; ASC, Advanced Surgical Concepts; EBL, estimated blood loss; EXT, Endopath Xcel Trocar; IL, incision length; LN, lymph nodes; LOS, hospital length of stay; NA, not applicable; NR, not reported; OT, operative time; PUX, Pnavel Uni-X Single Site Laparoscopic System; RH, right hemicolectomy; SILS, single-incision laparoscopic surgery; SR, sigmoid resection; WS, Woodford Spike.

Limitations are related to technical considerations of the procedure, including decreased range of motion and restricted triangulation and retraction. In part, these result from collisions of instruments, coupled with sub-ideal ergonomic positioning of the surgeon and assistant. Furthermore, the colinearity of the camera with the surgical instruments can limit the visual field and depth perception. Previously, it was thought that special articulating instruments were requisite for the utilization of SILS. However, it is our experience that they are not required to perform the procedure successfully and may add to increased use of resources.

Our modified SILS right hemicolectomy procedure raises important technical considerations regarding positioning of the assistant with respect to the surgeon. First, compared with conventional approaches for laparoscopic right hemicolectomy, in our technique the surgeon is located to the right of the assistant (Fig. 1). By having the surgeon stand at this level while the assistant is positioned caudally, improved ergonomics can be achieved. Second, although the fascial incision length must be kept to within 3 cm to prevent leakage of pneumoperitoneum, we extend the fascial length as necessary to avoid excessive tension during extracorporealization of the bowel.

Single incision laparoscopic-assisted surgery is a feasible technique for colorectal procedures of the right

colon. However, given the limited number of reports on its utilization, advantages and limitations are yet to be conclusively determined. Thus, larger studies comparing outcomes of colorectal single-incision procedures and conventional laparoscopic colorectal surgery are needed to determine actual differences in intraoperative parameters and postoperative outcomes.

REFERENCES

1. Bresadola F, Pasqualuci A, Donini A, et al. Elective transumbilical compared with standard laparoscopic cholecystectomy. *Eur J Surg*. 1999;165:29–34.
2. Bucher P, Pugin F, Morel P. Single port access laparoscopic right hemicolectomy. *Int J Colorectal Dis*. 2008;23:1013–1016.
3. Remzi FH, Kirat HT, Kaouk JH, et al. Single-port laparoscopy in colorectal surgery. *Colorectal Dis*. 2008;10:823–826.
4. Brunner W, Schirnhofner J, Waldstein-Wartenberg N, et al. Single incision laparoscopic sigmoid colon resections without visible scar: a novel technique. *Colorectal Dis*. 2010;12:66–70.
5. Leroy J, Cahill RA, Asakuma M, et al. Single-access laparoscopic sigmoidectomy as definitive surgical management of prior diverticulitis in a human patient. *Arch Surg*. 2009;144:173–179.
6. Merchant AM, Lin E. Single-incision laparoscopic right hemicolectomy for a colon mass. *Dis Colon Rectum*. 2009;52:1021–1024.