

# Single-Incision Laparoscopic Surgery for Right Hemicolectomy

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**Hypothesis:** Single-incision laparoscopic surgery (SILS) allows surgeons to perform laparoscopic procedures through a single umbilical incision, minimizing surgical trauma.

**Design:** We describe herein our methods of SILS right hemicolectomy using a recent case as an example.

**Setting:** SILS appendectomy and cholecystectomy have been performed by our surgical team for longer than 1 year among more than 80 patients.

**Patient:** SILS right hemicolectomy was performed in a 38-year-old woman with a history of B-cell lymphoma and ileocecal mass.

**Interventions:** The operation was performed using a SILS port and an extracorporeal stapled anastomosis.

**Main Outcome Measures:** Length of stay and postoperative pain and complications.

**Results:** SILS right hemicolectomy took 175 minutes to perform. The patient was discharged on postoperative day 6; a chest infection after surgery had prolonged the length of stay.

**Conclusions:** SILS is an attractive method to further minimize surgical trauma and can be applied in more complex cases, such as colectomy. Large trials are needed to determine the benefits of this new technique.

*Arch Surg. 2011;146(2):183-186*

**M**INIMALLY INVASIVE SURGERY via laparoscopic technology has revolutionized the way we practice surgery. By using such techniques, complex intra-abdominal procedures can be safely and successfully performed, with minimal trauma to the patient.<sup>1</sup> This leads to reduced postoperative pain, wound complications, and length of stay, as well as improved patient cosmesis and satisfaction.<sup>2</sup> Laparoscopic techniques are considered the criterion standard for elective and emergency operations, such as appendectomy and cholecystectomy. More complex procedures, such as laparoscopic colectomy, gastrectomy,<sup>3,4</sup> and esophagectomy,<sup>5</sup> are becoming widely available for planned and acute admissions<sup>1,6</sup> as surgeons are increasingly well trained in these techniques.

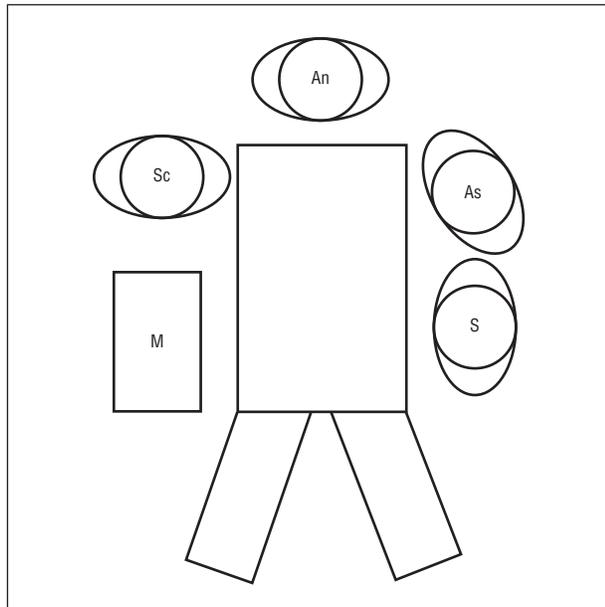
Single-incision laparoscopic surgery (SILS) is an innovation that uses a single access point through the umbilicus. The transumbilical approach has been referred to by several names, including single-port laparoscopy, single-port access surgery, and em-

bryonic natural orifice transluminal endoscopic surgery. In our unit, SILS is the acronym that has been adopted. It requires the insertion of 2 or 3 ports via a single umbilical incision, with or without a specially manufactured SILS port. This technique may further reduce the trauma of surgical access and has the potential benefits of reduced postoperative pain and wound complications. Furthermore, the scar can be almost completely hidden within the umbilicus, leading to virtually scarless surgery. Previous experience using SILS for appendectomy and cholecystectomy has been reported.<sup>7,8</sup> SILS appendectomy and cholecystectomy have been performed by our surgical team for longer than 1 year among more than 80 patients. We report herein our use of the SILS technique in a patient undergoing right hemicolectomy for an ileocecal stricture.

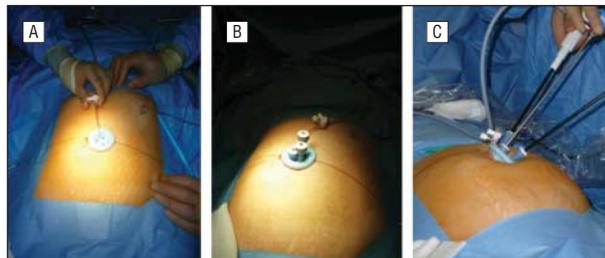
## REPORT OF A CASE

The patient was a 38-year-old woman with a history of large B-cell lymphoma and associated mesenteric lymphadenopathy and

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**Figure 1.** Positioning for colectomy by single-incision laparoscopic surgery. If the hepatic flexure is high, the surgeon may choose to stand between the patient's legs. An indicates anesthetist; As, assistant; M, laparoscopic monitor; S, surgeon; and Sc, scrub nurse.



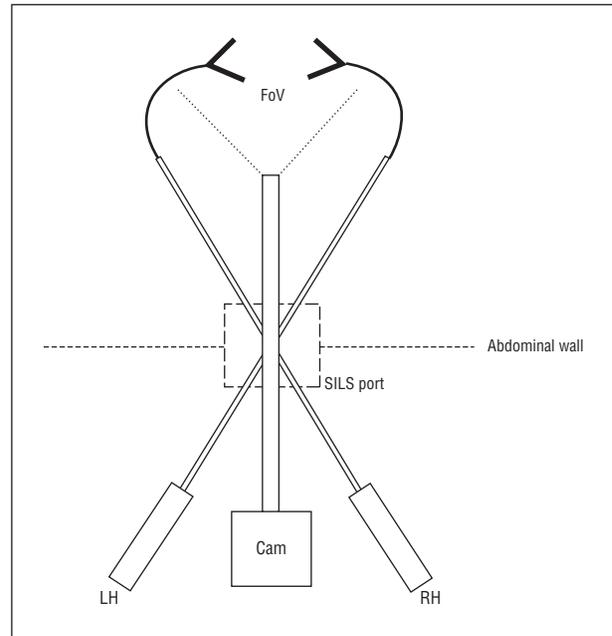
**Figure 2.** A, A single-incision laparoscopic surgery port is inserted through the umbilical incision. B, Three 5-mm trocars can be inserted through the port to accommodate the laparoscopic instruments and camera (C).

ileocecal mass. She had undergone 6 courses of chemoradiotherapy, and her disease was in clinical remission. The patient had been receiving long-term opiate therapy for chronic back pain. Colonoscopy had demonstrated no obvious mass lesion but had been unable to access or obtain a biopsy specimen from the terminal ileum. SILS right hemicolectomy was performed on July 21, 2009, after the patient had been admitted with small-bowel obstruction secondary to ileocecal stricture. Informed consent for SILS with or without conventional laparoscopic or open right hemicolectomy was obtained, and the patient agreed to the use of video recording and photography during the procedure and subsequent publication of the material. Local ethical approval was provided by the internal review board at Imperial College London, National Health Service Trust, London, England.

## METHODS

### PATIENT POSITIONING AND ACCESS

The procedure was performed with the patient under general anesthesia and with endotracheal intubation, a nasogastric tube



**Figure 3.** Positioning of laparoscopic instruments and camera through the single-incision laparoscopic surgery (SILS) port. The surgeon's right hand controls the left-sided instrument and vice versa. The camera is situated between the surgeon's instruments, which may impede movement. Cam indicates laparoscopic camera; FoV, field of vision; LH, surgeon's left hand; and RH, surgeon's right hand.

to deflate the stomach, and urethral catheterization. The patient was placed on a beanbag positioner in modified Lloyd-Davis position with her arms wrapped by her sides. The operating table was tilted in Trendelenburg position with the right side up. The operating surgeon (P.P.) and assistant (S.P.) were on the left-hand side of the patient, with the laparoscopic monitor on the right-hand side of the patient (**Figure 1**). The umbilicus was everted using a Littlewoods forceps and a 2-0 polypropylene (Prolene; Ethicon, New Brunswick, New Jersey) stay suture inserted on either side of the midline. A 3-cm vertical skin incision was made between the stay sutures. Dissection was carried down through the linea alba, and the peritoneum was opened under direct vision. A SILS port (Covidien, Mansfield, Massachusetts) was inserted into the umbilical incision (**Figure 2**). This is a flexible multichannel access port that can accommodate up to 3 instruments, with gas being introduced through a separate channel. Three 5-mm SILS trocars (Covidien) were introduced through the SILS port, and a 5-mm 30° laparoscope was introduced into the abdomen.

### INSTRUMENTATION AND HAND POSITIONING

Following laparoscopic examination of all 4 quadrants, 2 graspers (Roticulator; Covidien) were inserted into the abdomen to manipulate the bowel. The right-hand instrument entered the abdomen from the right to the left (so that it was viewed on the left side of the screen), with the instrument tip curved to the right. The left-hand instrument controlled the right-sided instrument on-screen, which was curved to the left (**Figure 3**).

### MOBILIZATION OF THE RIGHT COLON

The cecal pole was retracted medially, and dissection from the white line of Toldt was performed from a lateral to medial direction using shears (Roticulator Endo Mini-Shears; Covidien), diathermy, and a diathermy device (LigaSure; Covi-

dien). The right colon and hepatic flexure were mobilized, with clear visualization of the right ureter and gonadal vessels and the duodenum.

### DIVISION OF ILEOCOLIC VESSELS

The ileocolic vessels were dissected using diathermy and blunt dissection. To aid dissection, the ileocolic vessels were placed under slight traction while a retractor (Endo Mini-Retract; Covidien) was used to create a window behind the vessels. At this point, one 5-mm trocar was removed from the SILS port and was replaced with a 12-mm trocar (Covidien). The ileocolic vessels were then divided using a vascular (2.5 mm) stapler (Endo GIA; Covidien). The first firing of the stapler was performed with the cutting blade removed to secure hemostasis, and then another stapler cartridge was used to divide the ileocolic vessels distal to the first staple line.

### BOWEL RESECTION AND ANASTOMOSIS

The terminal ileum and right colon were exteriorized through the umbilical incision. A wound protector was not used in this case, although it is recommended for malignant lesions. Extracorporeal resection and side-to-side ileocolic anastomosis were performed using a stapling device (GIA 80; Covidien), with the staple lines oversewn with 3-0 polyglactin (Vicryl; Ethicon).

The anastomosed bowel was replaced inside the abdomen. The SILS port was reinserted to allow inspection of the peritoneal cavity, careful hemostasis, and irrigation.

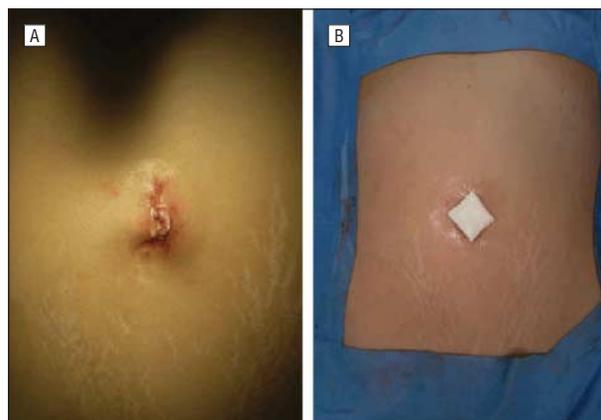
Closure of the umbilical incision was achieved using polydioxanone (PDS; Ethicon) sutures to the abdominal fascia. Twenty milliliters of levobupivacaine hydrochloride, 0.5%, was infiltrated around the umbilical incision as local anesthesia. The umbilical skin was closed with absorbable monofilament sutures (Monocryl; Ethicon) and was covered with an adhesive (Dermabond; Ethicon) (**Figure 4**).

## RESULTS

SILS right hemicolectomy was completed in 175 minutes, with minimal (<100 mL) blood loss. The patient went to a standard ward bed after surgery and was allowed to eat and drink from day 1. Postoperative analgesia was provided by regular intravenous acetaminophen and by a patient-controlled analgesia pump delivering intravenous morphine sulfate. This was replaced by standard oral analgesia in the form of acetaminophen and tramadol hydrochloride on postoperative day 3 until discharge. Postoperative recovery was delayed by a chest infection that required intravenous antibiotic treatment and chest physiotherapy. The patient was discharged on postoperative day 6 and was free of obstructive symptoms at the last follow-up visit. Findings on histologic analysis of the specimen were consistent with lymphoma regression after radiotherapy and showed a strictured terminal ileum with extensive fibrotic change. There was no evidence of inflammatory bowel disease or malignant neoplasm.

## COMMENT

SILS for colectomy has been described in the literature. Bucher et al<sup>9</sup> performed right hemicolectomy in a patient with an ascending colonic polyp and demonstrated good oncologic results using standard laparo-



**Figure 4.** Closure of the umbilical incision.

scopic instruments through a single umbilical port. Remzi et al<sup>10</sup> also performed right hemicolectomy for a cecal polyp using a single-site laparoscopic system (Uni-X; Pnavel Systems, Morganville, New Jersey). More recently, Merchant and Lin<sup>11</sup> described a patient with a right-sided colonic mass that was treated by SILS colectomy using a device for single-incision laparoscopy (GelPort; Applied Medical, Rancho Santa Margarita, California). Sigmoid colectomy using the SILS technique has been described by Bucher et al<sup>12</sup> and by Leroy et al<sup>13</sup> for treatment of benign disease. We are the first group to date to use the SILS port (Covidien) for colectomy, as well as the first to report the use of the SILS technique for colectomy in the United Kingdom.

Critics of the SILS technique point to numerous factors that make it much more demanding than conventional laparoscopic surgery. Because the camera and all instruments are inserted through the same incision, the basic laparoscopic principles of triangulation are lost. Although this can be aided by the use of articulating instruments, the camera position leads to an alteration of depth perception for the surgeon, further compounding the problem. The surgeon must also get accustomed to using his or her hands “in reverse” because the right hand controls the left-sided instrument on-screen and vice versa. Unlike conventional laparoscopic surgery, the assistant is unable to use an additional grasper to aid retraction because only 2 instruments (excluding the laparoscope) are able to pass through the SILS port. Additional retraction may be provided by the use of a series of suspending stitches, as previously described by Bucher et al<sup>9</sup> for right hemicolectomy and by Chow et al<sup>7</sup> for cholecystectomy. During SILS sigmoid colectomy, Leroy et al<sup>13</sup> aided retraction of the descending colon and sigmoid colon by simultaneous colonoscopy and by the use of an extracorporeal magnet to attract and fix the anvil of the circular stapler that was introduced into the lumen of the colon. During SILS procedures, the assistant also may interfere with the surgeon because of the common access point (Figure 3). In the future, this problem may be ameliorated by the use of longer laparoscopes so that the assistant can work with his or her hands away from the surgeon. The use of right-angled light lead connectors or in-line light leads would also reduce interference with the movements of the primary surgeon. The

advent of flexible laparoscopes will facilitate more complex SILS procedures.

All these factors make SILS significantly more demanding than conventional laparoscopic surgery, requiring higher levels of concentration. Clearly, surgeons will need time to be adequately trained in this technique. This effect may become increasingly relevant in longer and more complex procedures, such as colectomy, compared with the use of SILS in uncomplicated settings (eg, for appendicitis). Another limiting factor to the SILS approach may be the size of the specimen to be extracted. Although in this case the right colon was exteriorized, this may not be feasible in patients with large bulky colonic tumors, for example.

The SILS technique has been well described for abdominal operations, such as cholecystectomy<sup>7,14,15</sup> and appendectomy<sup>8,16</sup>; however, its potential benefits to the patient in terms of postoperative recovery, wound complications, and cosmesis have not been proven by high-quality comparative studies. Similarly, although individual reports of the use of SILS for more complex abdominal surgery, such as colectomy, may demonstrate the applicability of this technique, there is much work to do before SILS can be advocated to the wider surgical community. Despite these reservations, SILS remains an attractive future option to surgeons and patients to minimize surgical trauma and to optimize cosmetic outcomes. Evidence from this study demonstrates the applicability of SILS in complex abdominal surgery.

**Accepted for Publication:** January 11, 2010.

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**Author Contributions:** *Study concept and design:* Chow, Purkayastha, Zacharakis, and Paraskeva. *Acquisition of data:* Chow, Purkayastha, Zacharakis, and Paraskeva. *Analysis and interpretation of data:* Chow, Purkayastha, Zacharakis, and Paraskeva. *Drafting of the manuscript:* Chow, Purkayastha, Zacharakis, and Paraskeva. *Critical revision of the manuscript for important intellectual con-*

*tent:* Chow, Purkayastha, Zacharakis, and Paraskeva. *Study supervision:* Chow, Purkayastha, Zacharakis, and Paraskeva.

**Financial Disclosure:** None reported.

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