

Case Analysis

Single-Site Laparoscopic Right Hemicolectomy: A Preliminary Report of 18 Cases

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Key Words

Single incision;
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Short-term surgical results;
Oncologic results;
Scarless

Background. Since the introduction of laparoscopic colectomy, proof of improved short-term surgical results have been noted in many literatures. Therefore, current focus has shifted to reduce the invasiveness of laparoscopic surgery, resulting in the invention of single site laparoscopic surgery (SSLS). This study is to report our short-term surgical outcomes about SSLS right hemicolectomy.

Methods. Patients were all collected from a single institution from November 2009 to February 2010. The inclusion criteria were only ascending colon adenocarcinoma, diverticulitis and cecal adenocarcinoma. Cases with emergent operations or colon obstructions were excluded. All surgical procedures were completed by the same laparoscopic team. Peri-operative data was collected prospectively, and retrospectively evaluated.

Results. A total of 18 patients of SSLS right hemicolectomy were included in this study. The surgical oncology results revealed that the length of distal cut margin was 14.7 cm, and numbers of harvested lymph nodes was 19.5. Days of flatus passage was 2 days. Postoperative length of hospital stay was 5 days. Three patients were converted to either traditional laparoscopic surgery or open surgery.

Conclusion. Our preliminary experience with SILS right hemicolectomy demonstrated the safety of the procedure and its feasibility in malignant colon cancer, but its' actual benefit is still uncertain. More experiences of SSLS and prospective trials are needed to validate its value and clearly define its role.

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Since the first laparoscopic-assisted right colectomy reported by Schlinkert and his colleagues in 1991, minimally invasive colonic surgery has gained significant momentum.¹ Laparoscopic colectomy is more beneficial compared open colectomy, with faster return of bowel function, decrease wound pain, shorter hospital stay, and lower rates of wound complications.²⁻⁴

Despite its ameliorating effects on patient recovery, conventional laparoscopic surgery still requires 3-6 abdominal incisions for completion of the procedure. Each incision carries potential morbidity risks of bleeding, pain, hernia, or internal organ damage.^{5,6} Therefore, current efforts have shifted towards decreasing parietal trauma and visible scarring during the

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laparoscopic colectomy. To this end, single-port or single-site laparoscopic surgery (SSLS) has been introduced as a new alternative to conventional laparoscopy.

SSLS is also called embryonic nature orifice transumbilical endoscopic surgery, wherein the surgical scar is virtually concealed within the umbilicus, an embryonic nature orifice. Since the first single-incision laparoscopic procedure was described in an appendectomy performed by Pelosi in as early as 1992.⁷ Since then, this technique has been adapted and applied to other surgical field such as gynecology, general surgery, and urology.⁸ In the past two years, early clinic series have demonstrated the feasibility as well as the safe and successful completion of this approach, even for complex procedure such as nephrectomy or sleeve gastrectomy.^{9,10} And as expected, there has been a gradual introduction of single-incision right hemicolectomies and sigmoidectomies.¹¹⁻¹⁴ In these reports, authors all mentioned the potential benefits of cosmesis, other proposed advantages of SSLS include less postoperative pain, faster recovery, and better surgical outcomes.¹⁵ In this study, we reported our pilot study of eighteen cases of single site laparoscopic right hemicolectomy.

Materials and Methods

Patient selection

This series was a retrospective study addressing a single surgeon's experience with single site laparoscopic right hemicolectomy. Single site laparoscopic right hemicolectomy was introduced in November, 2009 after the procedure was a proof by Institutional Review of Board of China Medical University Hospital. By the end of February, 2010 eighteen cases underwent SSLS right colectomies under the indication of benign or malignant tumor of cecum and proximal ascending colon. Obstruction, perforation, history of abdominal surgery, or tumor greater than 5 cm in size was contraindicated for SSLS right colectomy. Prior to surgery, all patients undergoing the SSLS right hemicolectomy were informed that the minimally invasive procedure would be attempted via a

single umbilical incision. Patients were also informed that additional incisions may be necessary for completion of the procedure during operation.

Surgical technique

SSLS right hemicolectomy was performed using a medial-to-lateral approach and extracorporeal stapled, side to side ileocolic anastomosis. The procedure begins with a 3 centimeters para-umbilical incision, and deepened to the level of fascia (Fig. 1A). Pneumoperitoneum was induced by use of a Veress needle and maintained at 12 mmHg with carbon dioxide. The entire procedure was done through 5 mm trocar, and the first trocar was initially introduced at the middle of wound to explore the abdominal cavity using a standard 30° angled laparoscope. Subsequently, another two 5 mm trocars were placed through the same periumbilical access at the bilateral pole of the same wound. Distance between trocars were kept as far as possible and the adjacent three trocars should be kept at different heights to reduce crowding (Fig. 1B).

Conventional instruments were used for SSLS right colectomy. In order to perform the procedure with a medial-to-lateral approach, the ileocolic pedicle was exposed with retraction of the ileocolic junction by rigid grasper. Then, 5 mm laparoscopic monopolar scissors were used for mesocolic dissection and isolating the ileocolic, right colic, and middle colic vessels. The 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 laparoscopic monopolar scissor and bipolar vessel sealing device. After complete mobilization of the right-side colon, a periumbilical wound was made to extract the specimen. A wound retractor was inserted through the small umbilical incision to avoid wound contamination from specimen (Fig. 2). After extracorporeal ileocolic anastomosis, the surgical glove attached with three trocars was then fixed to the outer ring of the wound retractor (Fig. 3). This procedure allowed re-establishing pneumoperitoneum, so the resected area and

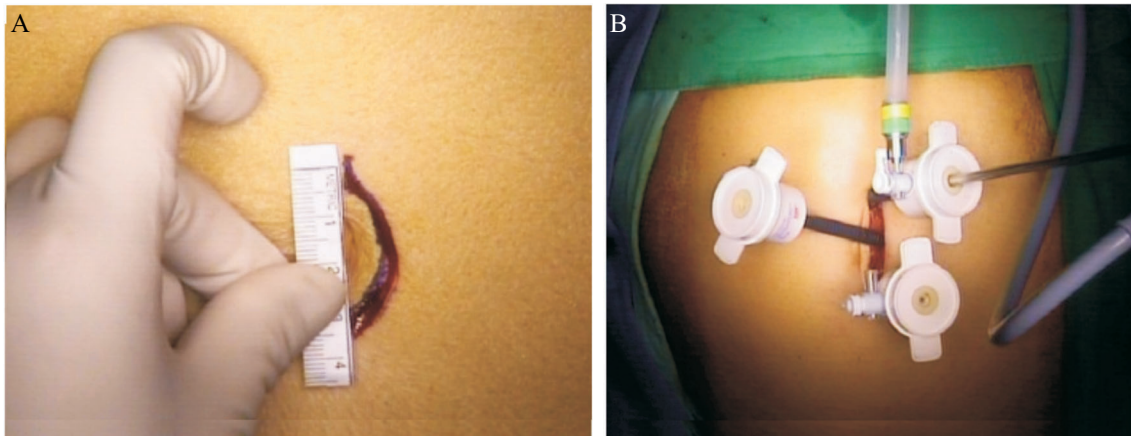


Fig. 1. (A) Schematic of port placement for single-incision laparoscopic surgery (SILS) for right hemicolectomy; (B) The adjacent three trocars stand on different height.

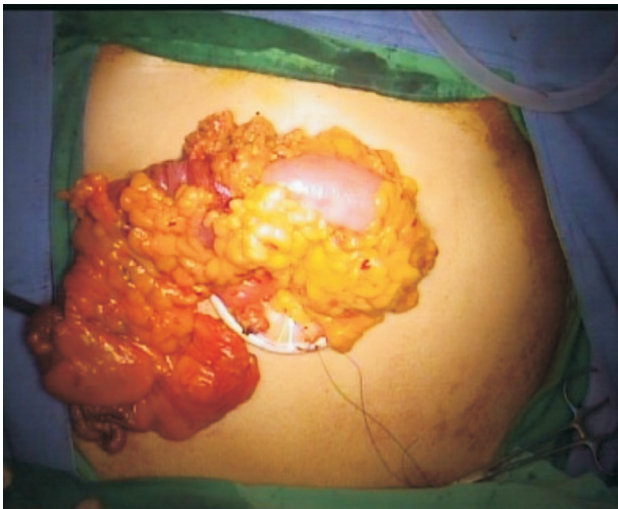


Fig. 2. Specimen extraction from umbilical incision.

anastomosis can be checked. At the end of the surgery, the wound was closed by layers, and the length of wound was measured.

Data collection and statistical analysis

Demographic information was collected including age, gender, body-mass index (BMI), history of previous abdominal operation, American Society of Anesthesiologists (ASA) physical status score, and surgical indications. Short-term surgical results were recorded with regard to operative time, estimated blood loss, conversion rate, analgesic requirement (meperidine equivalents), days of flatus passage, and postoperative hospital stay. Oncologic surgical results



Fig. 3. The surgical glove attached with trocars were then fixed to the outer ring of the wound retractor.

such as tumor size, length of distal free margin, number of lymph nodes harvest, and the margin free of malignancy were recorded to assess the feasibility of the new surgical technique for malignant colon disease. Perioperative complications were defined as those occurring within the first month of the right hemicolectomy procedure. In this study, conversions were defined as any unplanned laparotomy at any time during the surgery or any procedure done through an unplanned incision. An additional trocar insertion or any procedure done through a hand port would be considered as a conversion as well. The indication and timing of conversion were all dependent on the surgeon's judgment and experience.

Postoperatively, patients were offered a liquid diet

soon after surgery, but no dietary restrictions thereafter. Intravenous narcotics were given as needed postoperatively for pain control. Discharge criteria included tolerance of general meals without nausea or vomiting, absence of abdominal distention, and passage of flatus.

Results

A total of 18 patients were included in this study, consisting of 10 males and 8 females and the mean age were 69.4 years old. Demographics are summarized in Table 1. In this study, 16 SSLS right hemicolectomies were performed for adenocarcinoma (88.9%), and two patient received SSLS right hemicolectomy due to right sided colon diverticulitis (11.1%). The tumor size, distal margin and number of lymph node harvested were showed in Table 2. There was no operative mortality. Operative time required was 175 minutes (range, 145-280 minutes), the median estimated blood loss was 75 (range, 20-700) ml (Table 3). There was one conversion to open surgery due to ileocolic artery bleeding, and this patient developed postoperative wound infection. Two cases converted

to traditional laparoscopic right hemicolectomy due to viscera obesity and thus unclear anatomy; the postoperative course for these two patients was uneventful. In regards to postoperative recovery, the median narcotics administration was 50 mg (0-300 mg), the median time to first flatus passage was 2 days,¹⁻⁷ and median postoperative hospital stay was 5 days.³⁻¹⁵ Three postoperative complications (16.6%) occurred (Table 4), one patient experienced a prolonged postoperative ileus, one developed postoperative arrhythmia, and one patient developed a postoperative wound infection. All three patients were successfully managed conservatively and safely discharged from the hospital.

Discussion

Since the introduction of laparoscopy in the early 1990s, the minimally invasive technique has ushered in a new era of surgical treatment for diseases. A mere number of incisions are made for the port sites, yet each wound contributes to postoperative pain and potential risks of hemorrhage, hernia, or intraperitoneal

Table 1. Demographic parameters for patients performing laparoscopic surgery (SILS)

Patient numbers	18
Mean age (years)	69.4
Gender	
Male (%)	10 (55.6%)
Female (%)	8 (44.4%)
BMI: Mean (range)	23.3 (18.3-28.6)
ASA score	
1-2	8
≥ 3	10
Surgical indications	
Diverticulitis	2
Ascending colon adenocarcinoma	6
Cecal adenocarcinoma	10

Table 2. Oncology surgical result of single-incision laparoscopic surgery (SILS)

Patient numbers (Solid tumor)	16
Tumor size (cm): Median (range)	2 (0.5-6)
Distal free margin (cm): Median (range)	16 (5-21)
Lymph node harvest (number): Median (range)	19.5 (3-42)

Table 3. The short-term surgical outcomes after single-incision laparoscopic surgery (SILS)

Variables	N = 18
Length of skin incisions (cm): Median (range)	4 (3-6)
Operative time (minutes): Median (range)	175 (145-280)
Estimated blood loss (ml): Median (range)	75 (20-700)
Conversion rate (%)	3 (16.7%)
Convert to traditional laparoscopy	2
Convert to open method	1
Meperidine equivalents (mg): Median (range)	50 (0-300)
Passage of flatus (days): Median (range)	2 (1-7)
Postoperative hospital stay (day): Median (range)	5 (3-15)

Table 4. Surgical complications analysis after single-incision laparoscopic surgery (SILS) laparoscopy

Variables	N = 18
Perioperative complication (%)	3 (16.6%)
Anastomotic leakage	0
Intraabdominal abscess	0
Ileus	1
Arrhythmia	1
Wound infection	1

organ injury. Reducing the invasiveness of laparoscopic surgery would theoretically lower the rates of complications. Ideally, single site laparoscopy surgery offers the wanted reductions in abdominal incisions and scarring while maintaining low rates of morbidity. This report demonstrated the feasibility and short term outcomes for SSLS right hemicolectomy. In this study, our perioperative outcome is similar to previous studies.^{16,17} However, limitation for SSLS is that patients must be selected carefully as not every individual may be a candidate for SSLS. Also in this study, visceral obesity was the primary cause of conversion for SSLS colectomy. Identification of correct surgical plane during traditional laparoscopy is difficult in patient with visceral obesity, and certainly is much more difficult in SSLS colectomy. Therefore abdominal CT scans are suggested to accurately predict visceral fat for future effort in properly selecting patient for SSLS colectomy and reduce the number of conversions.¹⁵ The inherent technicality of SSLS right hemicolectomy also proves to be an obstacle for expanding the usage of the procedure. Standard laparoscopic surgery may be performed through multiple ports, allowing variation of scope placement and angling when met with bowel obstructions. In single-port surgery, no additional ports exist for placement of the scope and maneuvering is really restricted by nearby instruments. Therefore, even an experienced surgeon might have hard time to overcome the difficulties of triangulation, pneumoperitoneum leaks, and instrument crowding. Instrument crowding is another issue in SSLS colectomy, although recent innovations of articulating instruments and devices may possibly reduced instrument crowding, but surgeon adaptation to counter-intuitive maneuvering still remains as an important factor affecting the SILS learning curve. The learning curve of the technique may be improved by existing familiarity to general laparoscopy. Despite these improvements, the overall safety for minor cosmetic improvements still remains the biggest concern; currently no available data have shown the significant improvement of cosmesis after SSLS.

The benefits reaped by SSLS colectomy do not outweigh the procedural difficulties faced by the surgeon. SSLS greatly reduces the operative field, and

more importantly, sustaining cumbersome positioning during the operation may lead to long-term physical discomfort for the surgeon. The three converted patients, while outcomes were discussed, were not separately analyzed because of our small sample size. Increasing case volume and prospective comparison between SSLS and conventional laparoscopic colectomy may validate its true value and clearly define its ability to improve surgical outcomes. Furthermore, this sample size also makes it difficult to ascertain the clinical significance of our findings. However, this initial report is a glimpse into the future of SSLS right colectomy and may lead to larger randomized studies in the future.

Conclusion

Our initial experience with SSLS demonstrated its feasibility for right hemicolectomy. We also found that SSLS was efficacious in patients with malignant right sided colon cancer and with clinically acceptable perioperative outcomes and short term measures. The drawbacks of SSLS include its highly situational application, a careful patient selection, and dependence on experienced hand to its unique scope setup. To prove the superiority of SSLS right colectomy, a prospective, randomized, controlled trial should be conducted.

References

1. Schlinkert RT. Laparoscopic-assisted right hemicolectomy. *Dis Colon Rectum* 1991;34:1030-1.
2. Liang JT, Lai HS, Lee PH. Laparoscopic medial-to-lateral approach for the curative resection of right-sided colon cancer. *Ann Surg Oncol* 2007;14:1878-9.
3. Chen WT, Chen HC, Chui CM, et al. Laparoscopic resection of colorectal cancer. *Formosan J Surg* 2000;33:215-22.
4. Kim J, Edwards E, Bowne W, Castro A, Moon V, Gadangi P, Ferzli G. Medial-to-lateral laparoscopic colon resection: a view beyond the learning curve. *Surg Endosc* 2007;21:1503-7.
5. Lowry PS, Moon TD, D'Alessandro A, Nakada SY. Symptomatic port-site hernia associated with a non-bladed trocar after laparoscopic live-donor nephrectomy. *J Endourol* 2003;17:493-4.

6. Marcovici I. Significant abdominal wall hematoma from an umbilical port insertion. *JLS* 2001;5:293-5.
7. Pelosi MA, Pelosi MA 3rd. Laparoscopic appendectomy using a single umbilical puncture (minilaparoscopy). *J Reprod Med* 1992;37:588-94.
8. Canes D, Desai MM, Aron M, Haber GP, Goel RK, Stein RJ, Kaouk JH, Gill IS. Transumbilical single-port surgery: evolution and current status. *Eur Urol* 2008;54:1020-9.
9. Raman JD, Bagrodia A, Cadeddu JA. Single-incision, umbilical laparoscopic versus conventional laparoscopic nephrectomy: a comparison of perioperative outcomes and short-term measures of convalescence. *Eur Urol* 2009;55:1198-204.
10. Reavis KM, Hinojosa MW, Smith BR, Nguyen NT. Single laparoscopic incision transabdominal surgery sleeve gastrectomy. *Obes Surg* 2008;18:1492-4.
11. Remzi FH, Kirat HT, Kaouk JH, Geisler DP. Single-port laparoscopy in colorectal surgery. *Colorectal Dis* 2008;10:823-6.
12. Bucher P, Pugin F, Morel P. Single port access laparoscopic right hemicolectomy. *Int J Colorectal Dis* 2008;23:1013-6.
13. Merchant AM, Lin E. Single-incision laparoscopic right hemicolectomy for a colon mass. *Dis Colon Rectum* 2009;52:1021-4.
14. Bucher P, Pugin F, Morel P. Tranumbilical single incision laparoscopic sigmoidectomy for benign disease. *Colorectal Dis*, DOI:10.1111/j.1463-1318.2009.01825.x, Mar 6, 2009.
15. Kaouk JH, Haber GP, Goel RH, Desai MM, Aron M, Rackley RR. Single-port laparoscopic surgery in urology: initial experience. *Urology* 2008;71:3-6.
16. Katsuno G, Fukunaga M, Nagakari K, Yoshikawa S, Ouchi M, Hirasaki Y. Single-incision laparoscopic colectomy for colon cancer: early experience with 31 cases. *Dis Colon Rectum* 2011; 54:705-10.
17. Ross H, Steele S, Whiteford M, Lee, S, Albert M, Mutch M, Rivadeneira D, Marcello P. Early multi-institution experience with single-incision laparoscopic colectomy. *Dis Colon Rectum* 2011;54:187-92.

病例分析

單一切口腹腔鏡右側結腸切除 – 初步 18 個病例分析

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背景 許多文獻已經證實腹腔鏡結腸切除手術可以改善手術短期預後。目前更著重於侵入性更小的腹腔鏡外科發展，即單切口腹腔鏡手術 (SSLS)。本報告是就單切口腹腔鏡右側結腸切除手術的短期手術預後評估。

方法 本研究乃於單一醫學中心從 2009 年十一月至 2010 年二月止之治療經驗。研究對象僅限於升結腸腺瘤、憩室炎與盲腸腺癌，凡需進行急診手術或有阻塞之病人則被排除。所有的手術均由同一手術團隊完成，手術期間數據經事前收集及事後評估。

結果 本研究共評估了 18 位單切口腹腔鏡右側結腸切除手術之病人，外科相關腫瘤成效為：平均遠端斷端距離腫瘤 14.7 公分，平均淋巴廓清 19.5 顆，平均術後 2 天排氣，術後住院日 5 天。有三位患者於術中改為使用傳統腹腔鏡手術。

結論 我們初步的報告為使用單切口腹腔鏡右側結腸切除手術治療惡性大腸癌為安全又可行的方法，但是其真正的優點還不明確，需要更多前瞻性研究去評估其真正的價值。

關鍵詞 單一切口手術、腹腔鏡、右側半結腸切除、手術短期預後、惡性腫瘤相關成效。