Single-Port Laparoscopic Right Hemicolecotomy: Intermediate Results

Jacob R. Hopping, MD, Ovunc Bardakcioglu, MD

ABSTRACT

Background: Single-port laparoscopic colectomy was first described in 2008 as a new technique for colorectal surgery.1 No available reports have stated the intermediate- or long-term outcome. We report our intermediate results for the first 20 single-port laparoscopic right hemicolecotomies performed by a single laparoscopically trained surgeon at our institution.

Design: Between February 2009 and September 2010, 20 consecutive patients with an indication for right hemicolecotomy who were candidates for laparoscopic surgery underwent a single-port laparoscopic approach. The only exclusion was a previous midline laparotomy. The patients were followed for outcomes after a median of 27 months (range: 15 to 35).

Results: The mean age was 65 years (range: 59 to 88). The mean body mass index was 28 (range: 20 to 35). Seventy-five percent of patients had significant comorbidities, with an American Society of Anesthesiologists class of III or IV. The median estimated blood loss was 25 mL (range: 25 to 250). The mean number of lymph nodes was 13 (range: 0 to 29). There was one conversion to hand-assisted laparoscopic colectomy and one to open colectomy secondary to bleeding. The mean hospital stay was 5 days (range: 3 to 7). Thirty-day postoperative complications included 1 wound infection, 1 patient with alcohol withdrawal, and 1 incidence of colitis caused by *Clostridium difficile* infection.

At a median follow-up of 27 months, there were no local recurrences or distant metastases. One death occurred at 17 months from myocardial infarction. Two patients developed incisional hernias, with one requiring a laparoscopic hernia repair. One patient required a completion proctocolectomy for a pathological diagnosis of hyperplastic polyposis syndrome.

Conclusions: Single-port laparoscopic right hemicolecotomy has been safely performed in patients who are candidates for conventional laparoscopic hemicolecotomy. This small series indicates that intermediate-term results are similar to conventional laparoscopic surgery in efficacy, safety, and oncological outcomes. Larger datasets are necessary to determine cost-effectiveness, differences in postoperative outcomes, and patient satisfaction.

Key Words: Single-port laparoscopic colectomy, Single-incision laparoscopic colectomy, Long-term outcome, Intermediate term.

INTRODUCTION

Many small case series are now available that show single-port laparoscopic (SPL) or single-incision laparoscopic (SIL) colectomy is a safe alternative to conventional laparoscopy. Single-incision techniques have been described since 2008.1 There are many proposed short-term benefits to laparoscopic colectomy, including less postoperative pain, quicker recovery, reduced ileus, lower rate of wound infections/complications, and rapid mobilization.2 Publications of long-term data on conventional laparoscopic colectomy for adenocarcinoma have shown similar oncological outcomes and no higher risks of port-site recurrence.2–4 Similarly, long-term data for conventional laparoscopic colectomy indicate that patient satisfaction, incisional hernia rates, and rates of small bowel obstruction are not statistically different from those in open surgery.5 Now that short-term data for SIL for colon surgery exist showing its efficacy and safety, long-term parameters deserve focus. The primary aim of this study is to look at our intermediate-term morbidity and mortality data, including incisional hernia rate, which is considered to be a particular concern for SIL surgery.
MATERIALS AND METHODS

Patient Selection

Patients were selected from the practice of a single laparoscopic colorectal surgeon at a university institution from February 2009 through September 2010. Patient demographics are listed in Table 1. The only exclusion criterion was a previous midline laparotomy. Patients were selected if they had an indication for laparoscopic right hemicolectomy. Seven patients had a preprocedure pathological diagnosis of adenocarcinoma, 9 patients had adenomatous polyps, and 4 patients had unspecified polyps, one of which was found to have hyperplastic polyposis syndrome on pathological examination. All data were collected retrospectively. All patients were told of the alternative surgical approaches, including open surgery and conventional laparoscopic surgery beforehand, and all agreed to undergo SIL surgery.

Operative Technique

After induction of general endotracheal anesthesia, the patient was placed in a beanbag and lithotomy position using Allen Stirrups (Allen Medical, Acton, MA). A 4-cm incision was made through the umbilicus, and a single-port access device (Gelpoint, Applied Medical, Ranch Santa Margarita, CA) with one 12-mm and two 5-mm ports was introduced through this incision. A 5-mm flexible tip laparoscope (Olympus, Center Valley, PA), a straight bowel grasper, and a bipolar vessel sealer with a monopolar tip (Ligasure Advance, Covidien, Mansfield, MA) were used as instruments. The following description of the “colonic rollover” approach was reported previously. After a careful examination of the peritoneal cavity, a window in the small bowel mesentery was created 10 cm proximal to the ileocecal valve and the small bowel divided using an endoscopic linear stapler (ETS45, Ethicon Endosurgery, Blue Ash, OH). The mesenteric cut edge of the small bowel was then serially divided with the vessel sealer toward the root of the ileocolic pedicle. This step was alternated with lateral mobilization of the cecum and ascending colon. Constant traction of the mobilized colon into the left upper quadrant allowed adequate tension and visualization of the mesentery and the lateral attachments. The duodenum was identified and dissected off the ileocolic pedicle, which was divided using the bipolar vessel sealer. Further traction of the mobilized colon to the left lower quadrant allowed division of the attachments of the hepatic flexure and dissection of the omentum off the transverse colon entering the lesser sac. The right branch of the middle colic artery was similarly divided from a supramesocolic approach. After complete mobilization and intracorporeal vessel ligation, the colon was exteriorized, and a standard stapled side-to-side functional end-to-end anastomosis was performed. The fascial defect was closed using interrupted #1 Prolene sutures, and the skin was closed with a subcuticular 4–0 Monocryl suture (Ethicon, Somerville, NJ).

RESULTS

In the 18 months of patient selection, 20 right hemicolectomies were performed using the previously described SIL approach. The mean age was 65 years (range: 59 to 88). Eighteen patients were male and two were female. The average body mass index was 28 (range: 20 to 35). The median American Society of Anesthesiologists (ASA) score was III with a range of I to IV. Two cases were converted because of bleeding and difficulty of safe ligation of the ileocolic pedicle; one case was converted to a hand-assisted laparoscopic approach; and one was converted to open. Median blood loss was 25 mL (18 of 20 patients), with two cases reporting a 250-mL blood loss. The median operative time was 156.5 minutes (range: 98 to 272), which is consistent with those previously reported. There were no other intraoperative complications. Thirty-day postoperative complications included 1 case of alcohol withdrawal requiring a longer recovery and hospital length of stay, 1 wound infection, and 1 case of colitis caused by Clostridium difficile infection requiring appropriate antibiotic coverage (Table 2). Average hospital length of stay was 5 days (range: 2 to 7). There were no readmissions within a 30-day period.

Pathological diagnosis was confirmed in all cases. Three patients had pathologically unspecified unresectable pol-
yps preoperatively. Two of these were confirmed as vil-
lous adenoma, and the third was a T3 adenocarcinoma on
final pathology. Of the cases of adenocarcinoma, there
was 1 T1 lesion, 2 T2 lesions, and 5 T3 lesions. Three
patients had positive lymph nodes. The median lymph
node harvest was 13 (range: 0 to 29).

Intermediate follow-up was achieved with a mean of 27
months (range: 15 to 35). There was one death, the result
of a myocardial infarction at 17 months in a patient who
was ASA class IV and also had a significant history of
cardiovascular disease, including coronary artery bypass
graft, congestive heart failure, and atrial flutter. One pa-
tient with a postoperative diagnosis of hyperplastic poly-
posis syndrome and multiple new unresectable polyps in
the remaining colon and rectum on follow-up colonos-
copy required a laparoscopic completion proctocolecto-
tomy. Two patients developed incisional hernias, one of
which required laparoscopic repair.

**DISCUSSION**

Short-term outcomes for SIL colon resection for benign
and malignant disease have been promising, showing hos-
pital length of stay, time to oral intake, and intravenous pain
medication use that is not significantly different from con-
tventional laparoscopic surgery. The technique has been
used safely in patients who were candidates for conventional
laparoscopy. Most case series report similar to decreased
mean operating times. Currently, long-term data exist
exclusively for conventional laparoscopic colectomies. It
has been shown to be equal in safety, efficacy, and long-
term oncological outcomes. Therefore, we present a
case series reporting intermediate-term outcomes in SIL
collectomy.

One of the leading criticisms of SIL surgery is a potentially
increased rate of hernia formation. On this issue here is
conflict in the literature: some authors believe that be-
cause of the decreased number of incisions, the hernia
rate should decrease as well. Data from long-term fol-
low-up of single-incision cholecystectomies have not
shown an increase in hernias. Some data report rates as
low as 0.1%. One meta-analysis of 1100 SIL cholecystec-
tomies did report a single umbilical hernia that was stran-
gulated and required surgical intervention. It also re-
ported that as a result of a mean follow-up time of only 72
hours to 24 months, the true hernia rate was likely under-
reported. Furthermore, incisional hernia rates of different
SPL procedures may not be comparable. The incision
needed for a SPL cholecystectomy is typically larger than
the 12-mm periumbilical port and gallbladder extraction
site used in conventional laparoscopic cholecystectomy.
The single-port extraction site in our case series is smaller
compared with conventional laparoscopy because of eas-
er extraction of the colon after intracorporeal division of
the small bowel. Because of cosmetic reasons, the incision
was also made through the umbilicus, which is considered
a weak spot prone to hernia formation by many surgeons.
Therefore, technical details may play an important role to
consistently compare incisional hernia rates.

Two of our patients developed incisional hernias, leading
to an incisional hernia rate of 10%. We believe that, given
the small number of patients involved in this study, our
hernia rate may not accurately predict the risk of incisional
hernia in SIL colectomy.

Our median lymph node harvest was 13, similar to that
reported for conventional laparoscopy and open proce-
dures. Many specimens harboring benign adenomas
were not fully examined by the pathologists for lymph
node counts, and secondary examination of the specimen
was not requested by the surgeon because of the benign
nature of the underlying polyp. The number of patients in
this study is too small, and follow-up of up to 35 months
is not adequate to comment on cancer recurrence or
port-site recurrence rates.

**CONCLUSION**

SPL for colorectal surgery has been established to be safe
and effective in the short term compared with conven-
tional laparoscopy. In the hands of an experienced lapa-
roscopic surgeon, SIL or SPL surgery could therefore be an

| Table 2. Perioperative Data and Long-Term Complications |
|---------------------------------------------------------|
| Average length of surgery (min) | 161 |
| Conversion (for bleeding) | 1 to hand assisted |
| 1 to open |
| Median blood loss (mL) | 25 (range: 25–250) |
| Mean intravenous narcotic use (d) | 2.1 (range: 1–5) |
| Median length of stay (d) | 4.5 (range: 2–7) |
| Postoperative complications (30 day) | 1 ETOH withdrawal |
| 1 surgical site infection |
| 1 C difficile colitis |
| Complications at follow up | 4* |

*One death at 17 months from myocardial infarction, 2 incisional
hernias, and 1 completion proctocolectomy for undiagnosed
familial polyposis.
alternative to conventional laparoscopic surgery in patients who are otherwise candidates for a laparoscopic procedure. Given our success with 20 patients, it would appear that the intermediate- to long-term benefits are likewise comparable, with no increase in morbidity or mortality. Larger prospective case series and trials are needed to evaluate differences in long-term postoperative outcomes of SPL in colorectal surgery.

References:

1. Bucher P, Pugin F, Morel P. Single port access laparoscopic right hemicolectomy. *Int J Colorectal Dis.* 2008;23:1013–1016.
2. Mehta PP, Griffin J, Ganta S, Rangraj M, Steichen F. Laparoscopic-assisted colon resections: Long-term results and survival. *JSLS.* 2005;9:184–188.
3. Fleshman J, Sargent DJ, Green E, et al. Laparoscopic colectomy for cancer is not inferior to open surgery based on 5-year data from the COST Study Group Trial. *Ann Surg.* 2007;246:655–664.
4. Kojima M, Konisha F, Okada M, Nagai H. Laparoscopic colectomy versus open colectomy for colorectal carcinoma: A retrospective analysis of patients followed up for at least 4 years. *Surg Today.* 2004;34:1020–1024.
5. Thaler K, Dinnewitzer A, Mascha E, et al. Long-term outcome and health related quality of life after laparoscopic and open colectomy for benign disease. *Surg Endosc.* 2003;17:1404–1408.
6. Bardakcioglu O, Ahmed S. Single incision laparoscopic total abdominal colectomy with ileorectal anastomosis for synchronous colon cancer. *Tech Coloproctol.* 2010;14:257–261.
7. Adair J, Gromski MA, Lim RB, Nagle DN. Single-incision laparoscopic right colectomy: Experience with 17 consecutive cases and comparison with multiport laparoscopic right colectomy. *Dis Colon Rectum.* 2010;53:1549–1554.
8. Chambers WM, Bicsak M, Lamparello M, Dixon AR. Single-incision laparoscopic surgery (SILS) in common colorectal surgery: A technique offering potential and not just cosmesis. *Colorectal Dis.* 2011;13:393–398.
9. Chen WT, Chang S, Chiang H, et al. Single-incision laparoscopic versus conventional laparoscopic right hemicolectomy: A comparison of short-term surgical results. *Surg Endosc.* 2011;25:1887–1892.
10. Waters JA, Guzman MJ, Fajardo AD, et al. Single-port laparoscopic right hemicolectomy: A safe alternative to conventional laparoscopy. *Dis Colon Rectum.* 2010;53:1467–1472.
11. Waters J, Rapp BM, Guzman MJ, et al. Single-port laparoscopic right hemicolectomy: The first 100 resections. *Dis Colon Rectum.* 2012;55:134–139.
12. Champagne BJ, Lee EC, Leblanc F, Stein SL, Delaney CP. Single-incision vs straight laparoscopic segmental colectomy: A case-controlled study. *Dis Colon Rectum.* 2011;54:183–186.
13. Ross H, Steele S, Whiteford M, et al. Early multi-institution experience with single-incision laparoscopic colectomy. *Dis Colon Rectum.* 2011;54:187–192.
14. Rijcken E, Mennigen R, Argyris I, Senninger N, Bruewer M. Single-incision laparoscopic surgery for ileocolic resection in Crohn's disease. *Dis Colon Rectum.* 2012;55:140–146.
15. Gaujoux S, Bretagnol F, Ferron M, Panis Y. Single-incision laparoscopic colonic surgery. *Colorectal Dis.* 2011;13:1066–1071.
16. Phillips MS, Marks JM, Roberts K, et al. Intermediate results of a prospective randomized controlled trial of traditional four-port laparoscopic cholecystectomy versus single incision laparoscopic cholecystectomy. *Surg Endosc.* 2012;26:1296–1303.
17. Wong JSW, Cheung YS, Chong CCN, Lee KF, Wong J, Lai PBS. Single-incision laparoscopic cholecystectomy: From four wounds to one. *Hong Kong Med J.* 2011;17:465–468.
18. Fransen S, Stassen L, Bouvy N. Single incision laparoscopic cholecystectomy: A review on the complications. *J Min Access Surg.* 2012;8:1–5.