VIDEO/MULTIMEDIA ARTICLE

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Robotic single-incision right hemicolectomy with extended lymphadenectomy using the da Vinci SP Surgical Platform

Gyoung Tae Noh, Soon Sup Chung, Ryung-Ah Lee, Kwang Ho Kim

Department of Surgery, Ewha Womans University College of Medicine, Seoul, Korea

The da Vinci SP Surgical System (dVSP; Intuitive Surgical, Sunnyvale, CA, USA) was introduced to overcome this limitation of single-incision laparoscopic surgery. This new surgical platform has been demonstrated favorable performance in colorectal surgery and its use has been increasing. And, in accordance with the increment of adoption of dVSP, the indication to apply this platform has been expanding. Herein, we report a technique of right hemicolectomy with extended lymphadenectomy beyond conventional lymph node dissection using dVSP.

Keywords: Robotic surgical procedures, da Vinci SP, Single-incision, Right hemicolectomy, Lymph node excision

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Corresponding author
Kwang Ho Kim
Department of Surgery, Ewha Womans University College of Medicine, 260 Gonghang-daero, Gangseo-gu, Seoul 07804, Korea
Tel: +82-2-6986-4689
Fax: +82-2-2644-7984
E-mail: eastgate@ewha.ac.kr
ORCID:
https://orcid.org/0000-0003-0928-6669

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INTRODUCTION

With the technical evolution of minimally invasive surgery, single-incision laparoscopic surgery (SILS) has been performed to minimize parietal trauma, which might have benefit of less incision-related pain, quicker patient recovery [1–3]. However, adoption of SILS has been slow by its technical challenges arise from the restriction in triangulation and retraction. To overcome this limitation, Intuitive Surgical (Sunnyvale, CA, USA) launched the da Vinci SP surgical system (dVSP) in 2018, which was developed to perform robotic single-incision surgery. Since we reported the first use of dVSP in colorectal surgery, many institutions adopted this system and its use has been increasing [4]. And, in accordance with the increment of adoption of dVSP, the indication to apply this platform has been expanding. Herein, we report a technique of right hemicolectomy (RHC) with extended lymphadenectomy beyond conventional lymph node dissection using dVSP.

PROCEDURES

Patient

A 51-year-old female was diagnosed with cecal cancer on the

screening colonoscopy, which showed a 7-cm sized laterally spreading mass with multiple ulceration in cecum. Biopsy revealed it as a well-differentiated adenocarcinoma. On the following computed tomography, cecal wall thickening without pericolic infiltration was identified, and metastatic lymph node in precaval area was suspicious. On the positron emission tomography, a hypermetabolic mass in the cecum and hypermetabolic lymph nodes in the peritumoral and precaval area were presented. We planned to perform single-incision robotic RHC and paraaortic lymph node dissection with dVSP. The relevant video clip is provided with this article (Supplementary Video 1).

Installation and docking

The patient underwent standard bowel preparation and received prophylactic antibiotics. Surgery was performed under general anesthesia and endotracheal intubation. A vertical transumbilical incision, 40 mm in length, was made and an access port was established using Uniport (Dalim Medical, Seoul, Korea). This access port had four entries to access a multichannel robotic cannula, a linear stapler, and two accessory assistant devices, which was 25 mm, 12 mm, and 5 mm in size, respectively. After achieving pneumoperitoneum with insufflations of carbon dioxide to 12 mmHg, the patient was placed in Trendelenburg position at 15° and tilted left side down. After patients' positioning, laparoscopic exploration was undertaken using laparoscopic instruments through robotic and assistant ports. After completing laparoscopic exploration, the robot was docked with a 0° flexible endoscope, monopolar curved scissors, bipolar grasper, and Cadiere forceps (Intuitive Surgical). All robotic endoscope and instruments were inserted through a 25 mm single robotic cannula.

Surgical procedure

Mobilization of the ascending colon and mesocolon was first performed via an inferior approach. The peritoneal reflection of the small bowel mesentery was incised and the mesocolon was detached from the retroperitoneum. Exposing duodenum, it was lifted and right paraaortic and precaval lymph nodes were harvested, which were corresponded to the suspicious metastatic lymph node on the preoperative study. After sampling the corresponded lymph node, dissection into the surgical plane above the duodenum and Gerota fascia was performed to mobilize the entire ascending colon mesentery from the retroperitoneal structures. Leaving the lateral attachment of ascending colon, the duodenum and pancreatic head were exposed and lesser sac was opened. Then, lateral attachment of ascending colon and hepatocolic ligament were excised, and ascending colon and hepatic flexure were mobilized completely. After mobilizing ascending colon, omentectomy was performed at the level inferior to the gastroepiploic vessels. Securing right gastroepiploic vessels, omentum was excised laterally to the root of right gastroepiploic artery and lymphadenectomy around right gastroepiploic artery was performed. Subsequently, remained hepatocolic and hepatoduodenal ligament were excised and proximal transverse colon was fully mobilized. Lymphadenectomy along the superior mesenteric vessels was performed with individual exposure and ligation of the ileocolic and right branch of middle colic vessels at their origin from the superior mesenteric artery, vein, and middle colic trunk. The gastrocolic trunk was exposed and the colonic branch was ligated while preserving the pancreatic branches. Subsequently, the mesocolon of the transverse colon and the mesentery of the ileum were divided until the desired resection margins were achieved. All these procedures were performed mainly by using three robotic arms and no additional incision for the assistant's port was required. Laparoscopic instruments such as grasper, suction cannula, and stone holding forceps were used by the assistant to introduce/remove gauze pads, suck out smoke, and retrieve sampled lymph nodes, respectively. These laparoscopic instruments were applied through 5-mm and 12-mm sized accessory entries of single access port. Bowel resection and anastomosis were performed extracorporeally. After releasing the robot from docking mobilized bowel was exteriorized through an umbilical incision, and stapled ileocolic end-to-side anastomosis was performed.

Peri- and postoperative outcomes

The procedure was completed without significant problem using a single-incision approach. The requirement of an additional laparoscopic port was not present. Operative time, docking time, and console time were 280 minutes, 15 minutes, and 210 minutes, respectively. The estimated blood loss was 50.0 mL. On the pathologic report, 5.0-cm sized fungating mass infiltrating till lamina propria of the cecum (pathologic stage [p] Tis) was identified. Distance from tumor to the proximal and distal resection margins was 12.5 cm and 17 cm, respectively. Forty-four lymph nodes were harvested and no metastatic lymph node was identified (pN0). The patient passed gas on postoperative day 2, resumed a soft diet on postoperative day 3, and was discharged to home on postoperative day 6 without any complication.

DISCUSSION

Since the first report of SILS for colonic disease in 2008 by Bucher et al. [5], it has emerged as a feasible minimally invasive modality that could minimize parietal trauma and enhance patient recovery [1–3]. However, the adoption of SILS for colorectal surgery is still limited by its technical challenges of collisions of

laparoscopic instruments through a single port, which causes restriction in triangulation and retraction.

The dVSP is expected to be able to overcome these challenges, which was designed for single-incision surgery with three double-jointed instruments and articulating endoscope inserted through single port. These multiarticulating instruments and endoscope could minimize the collision in a single-incision colorectal surgery. For its use in colorectal surgery, several reports showed its performance and validity during colectomy and total mesorectal excision [4,6–8]. In the present report, we present our experience of RHC with extended lymphadenectomy using dVSP. We could demonstrate the utility of dVSP beyond conventional lymph node dissection in colon cancer surgery and the possible expansion of the use of this surgical platform.

During the presented operation, dVSP demonstrated favorable performance. There was minimal collision among instruments and endoscope compared to SILS while maintaining the advantages of robotic surgery such as better three-dimensional view, dexterity, and ergonomics. Furthermore, multiquadrant surgery was enabled by a 360° rotation of boom around the robotic port including its instruments. This might be a great advantage especially for colectomy that required a wide working field because previous multiport robotic models had limited working field according to the location of the port.

Certainly, the limited range of instrumental motion was a major weakness of this system, which restricted bowel and mesentery traction in a conventional manner. However, leaving the colonic lateral attachments, making adequate surgical triangulation by the elevation of colon and mesentery using one robotic instrument was possible. Lifting colon or mesentery through one robotic instrument, both lateral and medial attachment naturally made counter-traction and surgical plane dissection could be performed by other two robotic instruments in a surgical triangle. In this technique, we could overcome the limited range of motion in dVSP.

The peri- and postoperative results were also favorable. The operation time was acceptable considering our limited experience of RHC and extended extent of surgery than conventional RHC. Estimated blood loss during surgery and duration of postoperative hospital stay, time to first flatus, and soft diet was comparable to previous reports of laparoscopic or robotic colorectal surgery [1,9,10]. Regarding pathologic outcomes, the number of retrieved lymph nodes and status of resection margin were acceptable. The cosmetic result was satisfactory with a transumbilical incision, which was essential to extract the surgical specimen for colorectal surgery and visible scarring was minimal.

In summary, the dVSP is feasible and safe to perform single-incision robotic RHC even in extended lymph node dissection. It can minimize parietal trauma while maintaining surgical principle. This report might be a clue to widen the indication of dVSP colorectal surgery. Accumulation of data should be needed to confirm the validity of this surgical platform to expand its use.

NOTES

Ethical statements

We followed the principles of Declaration of Helsinki for health and the study was reviewed and approved by the Institutional Review Board of our institution, which waived the need for informed consent, given the retrospective nature of the study (No. 2021-04-049).

Authors' contribution

Conceptualization: GTN, KHK
Writing-original draft: GTN
Writing-review and editing: All authors
All authors read and approved the final manuscript.

Conflict of interest

All authors have no conflicts of interest to disclose.

ORCID

Gyoung Tae Noh, https://orcid.org/0000-0001-9849-8211
Soon Sup Chung, https://orcid.org/0000-0003-0921-8228
Ryung-Ah Lee, https://orcid.org/0000-0003-1146-3839
Kwang Ho Kim, https://orcid.org/0000-0003-0928-6669

Supplementary materials

Supplementary Video 1 can be found via https://doi.org/10.7602/jmis.2021.24.2.109.

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