Robotic complete mesocolic excision of right-sided colon cancer with bulky lymph node metastases using the da Vinci® Si™ system: A case report

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Abstract. Reports on robotic surgery in the treatment of right-sided colorectal cancer most commonly use the da Vinci® Xi™ system; however, with the increasing popularity of robotic surgery for the treatment of colon cancer, it is likely to be performed using the da Vinci Si™ and X™ systems. The present study reported the case of a 63-year-old woman who underwent complete mesocolic excision (CME) with the da Vinci Si system involving a rotation technique for ascending colon cancer with bulky lymph node metastasis to the anterior pancreas. Robot-assisted right hemicolectomy was planned for this patient with T4aN2bM0, stage IIIc cancer. A lap protector and EZ access (Hakko Co. Ltd.) were fixed in the umbilical incision, and the da Vinci camera port was placed just off-center at the EZ access to allow the camera port to be repositioned by rotating it. The medial approach was used. The bulky metastatic lymph nodes at the head of the pancreas were dissected after ligating the right colic artery and vein. During CME, rotation of the EZ access was used to avoid interference between the robotic arms. The right colon was released from the retroperitoneum and resected. A functional end-to-end anastomosis was created, and right colectomy was successfully completed. The total operation time was 271 min and the console time with the da Vinci Si system was 140 min. The patient was discharged on postoperative day 8 without complications. In conclusion, robotic right colectomy was successfully performed and rotation of the EZ access facilitated robotic surgery using the da Vinci Si system.

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Abbreviations: CME, complete mesocolic excision; SMV, superior mesenteric vein

Key words: robotic surgery, right-sided colon cancer, rotation, da Vinci® Si™ system

Introduction

Colorectal oncosurgery requires narrow-field pelvic manipulation and nerve preservation; therefore, surgical robotic systems have been introduced so that precise surgery can be performed using articulated forceps and three-dimensional images (1). Although a definitive conclusion regarding robotic surgery's utility and long-term results in comparison to those of laparoscopic surgery remains unclear, robotic surgery has advantages in terms of short-term results, detailed anatomical understanding, and completion of total mesorectal excision (TME) (2,3). Robotic surgery is also expected to be effective in colon cancer due to the concept of complete mesocolic excision (CME) (4,5). Moreover, the number of robotic surgeries performed is expected to also increase in Japan as the procedure is covered by public insurance as of April 2022.

The right-sided colon has a more complex and variable vascular supply than the left-sided colon (6). CME of right-sided colorectal cancer can be performed using a minimally invasive robotic approach. We performed robot-assisted TME and lateral lymph node dissection for rectal cancer using the da Vinci® Si™ system (Intuitive Surgical Inc., Sunnyvale, CA, USA). Despite multiple reports on right-sided colorectal cancer surgery using the da Vinci Xi™/X™ systems (Intuitive Surgical, Inc.) (4,5,7), data are lacking on the use of the Si system, which requires more ingenuity regarding port placement and cart insertion angle because it has more arm interference than the Xi system (8). Herein, we describe a case of CME using the Si system in combination with a rotation technique of the port in a patient with cancer of the ascending colon with bulky lymph node metastasis to the anterior pancreas.

Case report

A 63-year-old woman was admitted to Minoh City Hospital (Minoh, Japan) in April 2022 because of anemia (blood

hemoglobin: 7.7 g/dl). Colonoscopy revealed a 2/3 circumscribed type 2 tumor (Fig. 1A) in the ascending colon that was diagnosed as colorectal cancer following biopsy. Contrast-enhanced computed tomography (CT) could not be performed due to pre-existing bronchial asthma. Non-contrast CT revealed multiple lymph node metastases extending to the anterior pancreas and no distant metastases (Fig. 1B). Magnetic resonance imaging (MRI) revealed no obvious involvement of the pancreatic lymph nodes (Fig. 1C). Robot-assisted right hemicolectomy was planned for the patient with TNM stage of T4aT2bM0, stage IIIc (9). All other preoperative tests were unremarkable, and there were no other pre-existing medical conditions.

Intraoperatively, the patient was placed in the lithotomy position with the head low at 5˚ right superior at 5˚ under general anesthesia. A longitudinal incision of 4 cm was made at the umbilicus, and the abdomen was opened. A lap protector (Hakko Co. Ltd., Nagano, Japan) was inserted into the abdomen. The EZ access (Hakko) was adjusted, and the da Vinci camera port was placed on it. The camera port was placed off-center to facilitate its rotation to reduce interference with the da Vinci arm (Fig. 2A). Pneumoperitoneum was achieved using 10 mmHg. The camera was inserted to identify the hepatic curvature, and a straight line was drawn to connect the camera port with the hepatic curvature. To ensure safety, parallel lines were drawn at least 2 cm away from the rib arch, and two lines (effectively passing through the camera) were drawn cephalad from the line; an 8 mm port was placed on each of these two lines. In our patient, the distance between the parallel lines was 7 cm; this distance generally depends on the effective abdominal wall length. One of the parallel lines was drawn on the foot side, and an 8 mm port was placed on it. A 12 mm assistant port was placed away from these lines (Fig. 2B and C).

The robotic cart was then placed on the patient's right side. Central vascular dissection was performed using this arrangement. During passive colonization of the hepatic curvature, a rotation technique was used to rotate the EZ access counterclockwise and move the camera port outward to the left, thereby avoiding interference between the first robot arm (R1) and the third robot arm (R3) (Fig. 2D). Monopolar curved scissors were placed in the first robot arm (R1), fenestrated bipolar forceps were placed in the second robot arm (R2), and ProGrasp™ forceps were placed in the third robot arm (R3). First, using a medial approach, the superior mesenteric vein (SMV) was exposed (Fig. 3A). The ileocolic vein and artery were transected at the root and dissection was continued upward toward the right colic vessels. The bulky metastatic lymph node at the pancreatic head was grasped and dissected from the pancreas. The anterior superior pancreaticoduodenal vein from the SMV was preserved, and the right colic vein was ligated (Fig. 3B). The right colic artery, a branch of the superior mesenteric artery, was ligated (Fig. 3C), and D3 lymphadenectomy was performed (Fig. 3D). The mesentery of the colon was transferred medially from the ureter to the ovarian artery. The rotation was calculated again to avoid interference between R1 and R3. Adhesions of the transverse colon and omentum were dissected, and the dissected colon was transferred from the hepatic curvature toward the ascending colon.

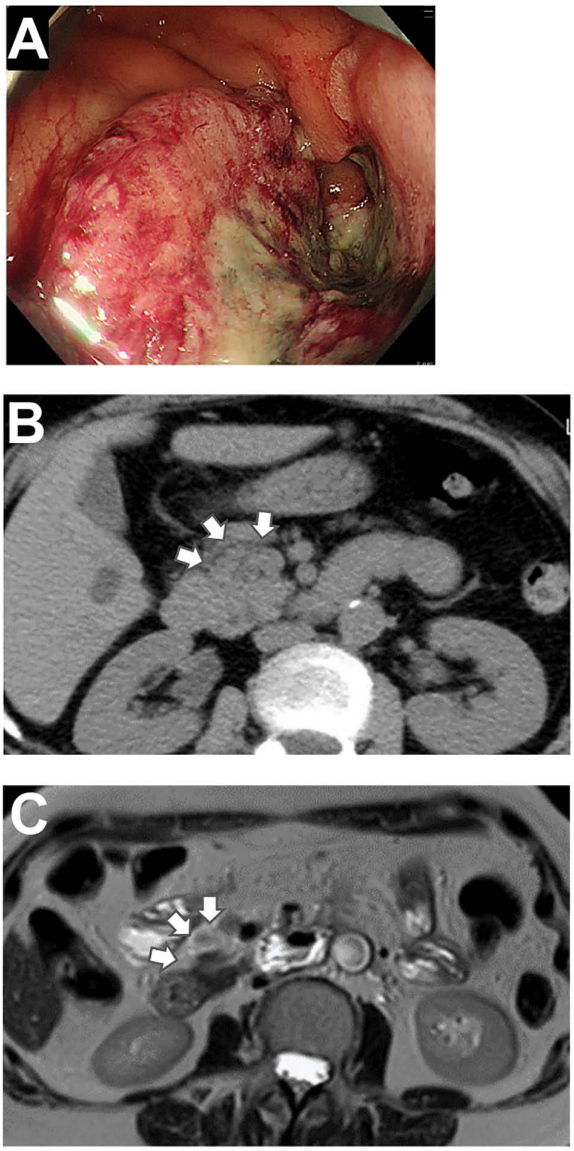

Figure 1. Representative images of the ascending colon cancer and metastatic lymph nodes. (A) Representative image of colonoscopy. (B) Computed tomography shows multiple lymph node metastases to the pancreas (white arrows). (C) Magnetic resonance imaging shows no apparent involvement of the pancreatic lymph nodes (white arrows).

Finally, the right colon was excised by incising the serosa of the ileum from the root of the mesentery of the small intestine. The EZ access was removed, the transferred colon was raised externally, and the transverse colon and terminal ileum were transected using an electrocautery scalpel. The transverse colon and ileum were then anastomosed using a linear stapler for functional end-to-end anastomosis. The anastomosis was returned to the abdomen, an anti-adhesion film was placed under the umbilical incision, and all the ports were closed.

The total operation time was 271 min, and the console time was 140 min. The operation was completed without intraoperative complications, and the volume of blood loss was 48 ml. The patient resumed eating on the third postoperative day and was discharged on the eighth postoperative day. No postoperative complications were observed. The pathological diagnosis included T4a and N2b, and the final diagnosis was stage IIIc.

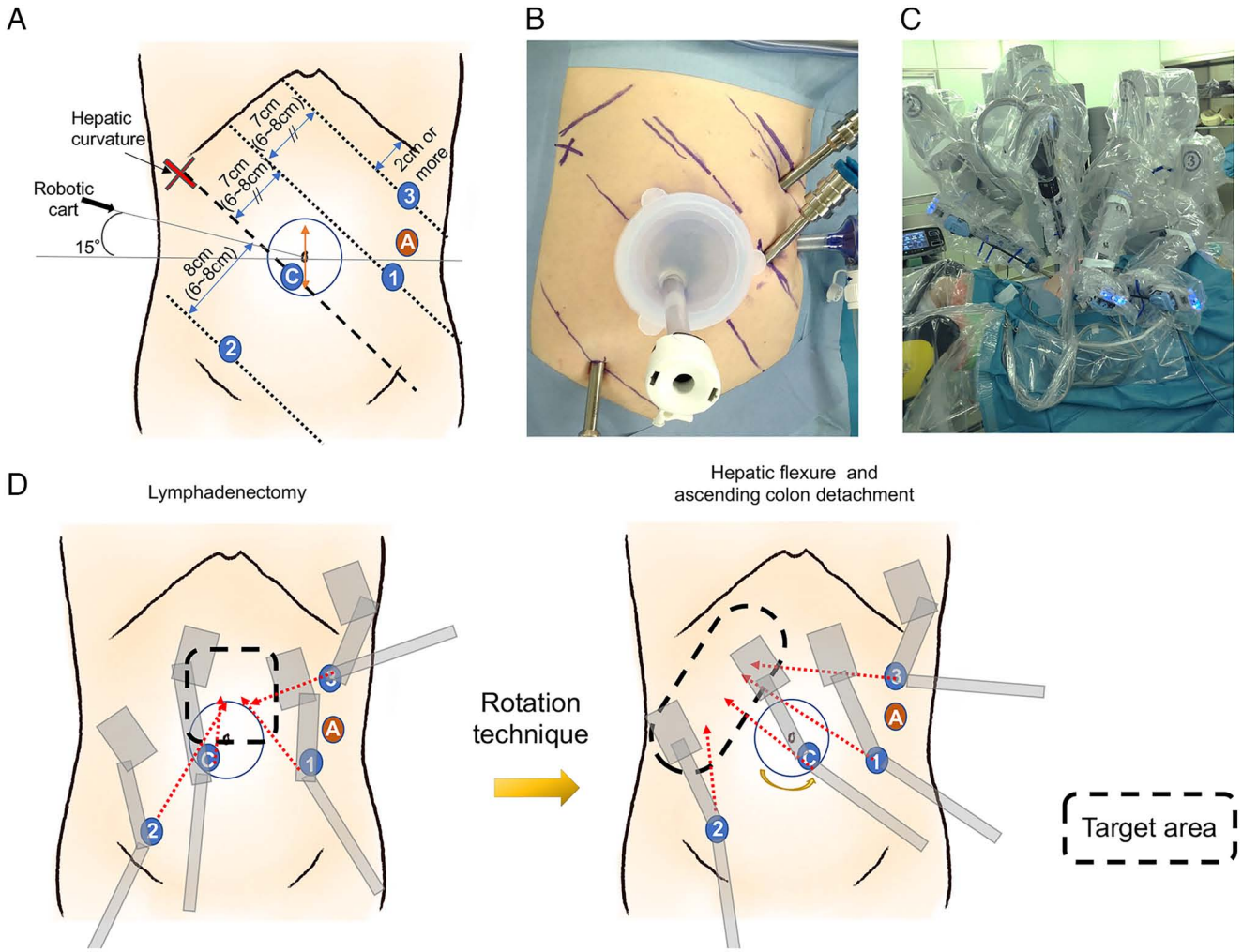

Figure 2. Port layout for the da Vinci® Si™ system. (A) Robot cart and port layout diagram. An 8 mm port is placed on a parallel line between the camera and the hepatic curvature. The parallel lines should be drawn at least 2 cm away from the rib arch. The distance between these lines depends on the effective length of the abdominal wall; however, this generally ranges from 6 to 8 cm (longer distances are preferable). In the present case, the ports were placed on 7 and 8 cm lines. (B) Photo of operative ports. (C) Access port setup. (D) Rotation technique of the EZ access. C, camera port; 1, first robot arm port; 2, second robot arm port; 3, third robot arm port; A, assistant port.

Adjuvant chemotherapy (XELOX) (10) was initiated 1 month after the surgery, and the patient is currently under outpatient observation.

Discussion

The key points that complicate surgeries of right-sided colon cancer are the variations in vascular supply and the inclusion of the surgical trunk (6), which itself has a complex vascular orientation, in the area of lymph node dissection. We have always been conscious of this densely vascular region and, therefore, place a small laparotomy port above the umbilicus, even during laparoscopic surgery (11). Its advantages include easy access to the vessels through the umbilical incision in emergencies, such as bleeding, and extension of the incision for easy conversion to open surgery. Although the number of laparotomies performed has declined due to the widespread use of laparoscopic and robotic surgeries (3,12), it is important to anticipate possible conversions to open surgery (13).

Compared with surgery for rectal cancer, surgery for right-sided colorectal cancer requires a wider range of surgical manipulation, which may be difficult during robotic surgery. EZ access is versatile and allows the port to be placed in any position; therefore, we have found it to be a useful device in single-incision laparoscopic surgery and reduced-port surgery (11,14). In robotic surgery, the camera port can be easily added by intentionally placing it off-center, and the camera axis can be shifted by rotating the EZ access using a rotation technique, thus changing the axis of the other arms and avoiding potential interference. Notably, this technique is very easy. If EZ access is being used, the only requirement to change from the conventional method to this rotation method is to 'unplug the camera port once from EZ access and plug it back in at the edge'. This method can be tried without the requirement for additional supplies and labor. It has been reported that the da Vinci Si system requires port placement in an arc around the left side of the lower abdomen to maintain the proper range of motion of the robotic instruments and to avoid collisions between instruments (13,15,16). Therefore, it is difficult to

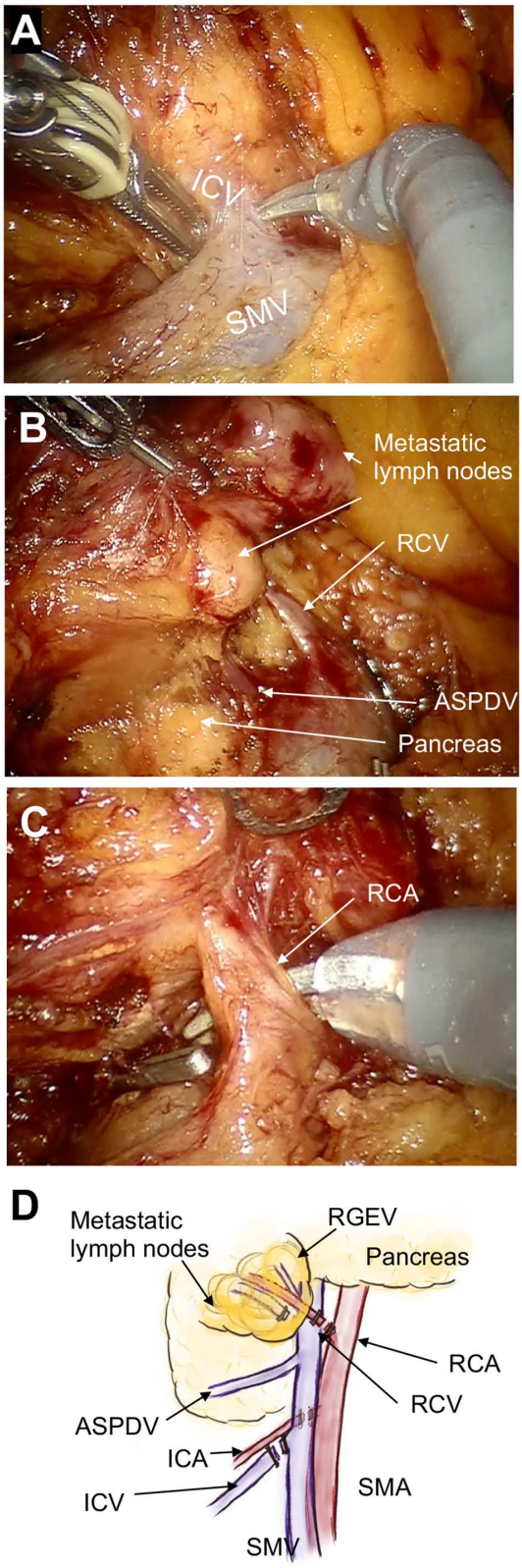

Figure 3. Intraoperative view of the medial approach and lymphadenectomy. (A) Exposure of the SMV and the ICV. (B) Exposure of the ASPDV and the RCV. (C) Ligation of the RCA. (D) Overview of the D3 lymphadenectomy. SMV, superior mesenteric vein; ICV, ileocolic vein; ASPDV, anterior superior pancreaticoduodenal vein; RCV, right colic vein; RCA, right colic artery.

place the port on the surgical trunk, which is an important dissection site during right colon resection (6). However, by using EZ access with a rotation technique and avoiding instrument collision, it is possible to place the port on the surgical trunk. Additionally, we have also performed left colectomy using this method. There is less arm interference in left colectomy than that in right colectomy and, therefore, the benefits of this method may be more in right colectomy (data not shown). However, this method may be useful in patients in whom the required distance between the ports cannot be achieved. In colon cancer surgery, the rotation of the EZ access allows ligation of the vessels and transfer of the bowel without changing the patient's position. We have similarly used the EZ access in midline incisions to place the camera port in rectal cancer surgery. However, the present report has a limitation. Studies or reports on this procedure being performed using the conventional method are lacking; thus, the method described in this report cannot be compared with the conventional method.

Herein, we reported a case of right-sided colon cancer with bulky lymph node metastasis to the anterior pancreas. The report highlights the advantages of robotic surgery using the Si system in conjunction with a rotation technique of the EZ access port. We believe that this technique may also be effective with newer robotic surgery systems.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

SF, KD, TT and SM performed the surgery. KY, MH and KN acquired the patient data. TH and YO contributed to the conception of the study and supervised this study. SF drafted the manuscript. SF and KD edited the manuscript and confirm the authenticity of all the raw data. All authors read and approved the final manuscript.

Ethics approval and consent to participate

The present study was performed in accordance with the Declaration of Helsinki. It was approved by the Minoh City Hospital Ethics Committee (approval no. R0311B64).

Patient consent for publication

Written informed consent for publication was obtained from the participant.

Competing interests

The authors declare that they have no competing interests.

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