J Robotic Surg
DOI 10.1007/s11701-014-0488-6

CASE REPORT

Robotic anterior resection in a patient with situs inversus: is it merely a mirror image of everything?

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Received: 23 July 2014 / Accepted: 9 September 2014

Abstract Situs inversus (SI) is a rare condition involving transposition of internal organs. In performing minimally invasive surgeries for these patients, exact mirror image of the usual technique may not be easily achieved, especially for right-handed surgeons. We describe a case of robotic anterior resection in a patient with rectal cancer and SI, illustrating the technique and how robotic system facilitates the procedure. A 59-year-old gentleman presented with altered bowel habit. Colonoscopy showed an obstructing tumour at 10 cm from the anal verge. Computed tomography did not show distant metastasis, but revealed the diagnosis of SI. Intraoperative laparoscopy revealed peritoneal metastasis. Total robotic, single docking, anterior resection was performed to palliate his obstructive symptoms. The operation lasted for 3 h and 24 min. Blood loss was 100 ml. There were no intraoperative or postoperative complications. The patient was discharged on day four. The final pathology was T3N2M1.

Keywords Robotic anterior resection · Situs inversus · Rectal cancer

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Background

Situs inversus (SI) is a rare congenital condition. It involves transposition of all internal organs through the sagittal plane. It is thought to be present in 0.01 % of the population [1]. The condition itself does not increase predisposition to cancer development. However, it is surgically relevant, especially for minimally invasive surgeries, as the surgeon has to accustom to the 'mirrored' anatomy. Although theoretically the operating approach is the same, right-handed surgeons often adopt a slightly modified technique to use the dominant hand to dissect and non-dominant hand for countertraction. In this case report, we describe a robotic anterior resection in a patient with SI and illustrate how the robotic system facilitates the procedure for right-handed surgeons.

Case

A 59-year-old gentleman, a retired cleaner, presented with a two month history of altered bowel habit. His frequency of bowel opening changed from once daily to 10 times per day and he noticed reduction of stool calibre. He experienced tenesmus and had mucus in stool. His symptoms did not improve despite taking laxatives. He had history of knee surgery for ligamentous injury and enjoyed good past health otherwise. There was no family history of colorectal cancer. He is a chronic smoker.

Physical examination was essentially normal. Rectal examination did not reveal any rectal mass. His haemoglobin level was 11.6 g/dL. Carcinoembryonic antigen (CEA) was 7.4 ng/mL. Colonoscopy showed a circumferential obstructing tumour 10 cm from the anal verge. Biopsy of the tumour showed adenocarcinoma. Computed

Journal : Large 11701 | Dispatch : 19-9-2014 | Pages : 5
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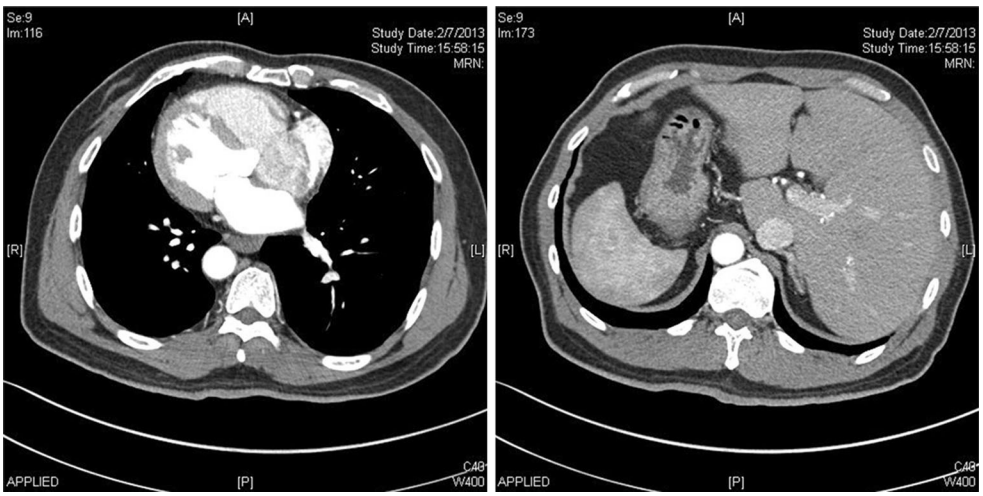

Fig. 1 CT scan showing situs inversus

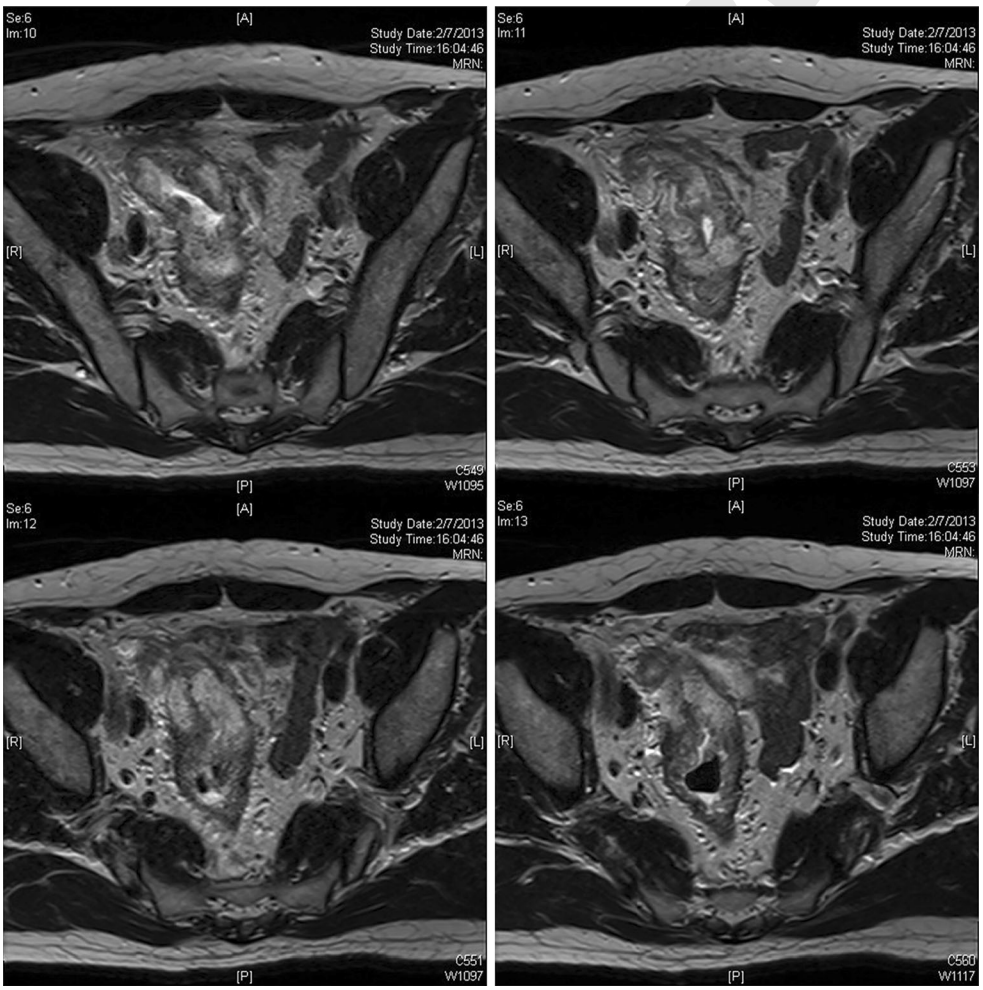

Fig. 2 MRI showing an upper rectal tumour

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tomography (CT) scan showed SI (Fig. 1). There was a 6 × 6cm tumour at the upper rectum. No distant metastasis was detected. Contrast magnetic resonance imaging (MRI) of the pelvis showed a T2/early T3 upper rectal tumour (Fig. 2).

Total robotic anterior resection was performed. During the operation, peritoneal metastasis was noted. In view of the patient's obstructive symptoms, palliative resection proceeded. The operation lasted for 3 h and 24 min. The blood loss was 100 ml. The docking time was 17 min and the console time was 100 min. The tumour measured 7 x 5 cm. The proximal and distal margins were 5 and 5 cm, respectively, from the main tumour. There were, however, peritoneal nodules at the distal resection margin.

The postoperative course was uneventful. Clear fluid was started a few hours after the operation. Feeding was well tolerated and gradually stepped up. Urinary catheter was removed on the first day. The patient was discharged on the fourth day.

The pathology of the specimen showed moderately differentiated adenocarcinoma of the rectum (American Joint Committee on Cancer 7th edition, T3N2M1). The tumour invaded through the muscularis propria to the subserosa. Four out of the 13 lymph nodes showed metastatic adenocarcinoma. Multiple foci of carcinoma were found at the mesentery. Foci of adenocarcinoma were also found at the serosa of the distal resection margin. K-ras mutation was not detected by polymerase chain reaction (PCR) and deoxyribonucleic acid (DNA) sequencing. The patient was referred to the clinical oncologist and scheduled to have eight cycles of oxaliplatin and capecitabine (XELOX).

Surgical technique

Preoperative mechanical bowel preparation was not given. Patient was put under general anaesthesia. Cefuroxime and metronidazole were given as antibiotic prophylaxis. Intermittent pneumatic calf compression was used for deep vein prophylaxis. Urinary catheterization was performed.

The patient was placed in modified lithotomy with a head-down and right-side up position. A 12 mm supraumbilical port was inserted on the left side for camera insertion. Pneumoperitoneum was created by carbon dioxide insufflation.

Four 8 mm robotic ports were used. One was inserted at the right lower quadrant, one-third away from the anterior superior iliac spine (ASIS) at the spino-umbilical line. Another 8 mm port was inserted, mirror image to this, at the left lower quadrant (LLQ). The third one was inserted at the right upper quadrant at the mid-clavicular line, 8 cm from the costal margin. The last one was inserted at the left upper quadrant, 2 cm below the costal margin, slightly medial to the mid-clavicular line. One 5 mm assistant port was used, which was located at the left upper quadrant, just proximal to the camera port and 2 cm lateral to the LLQ port.

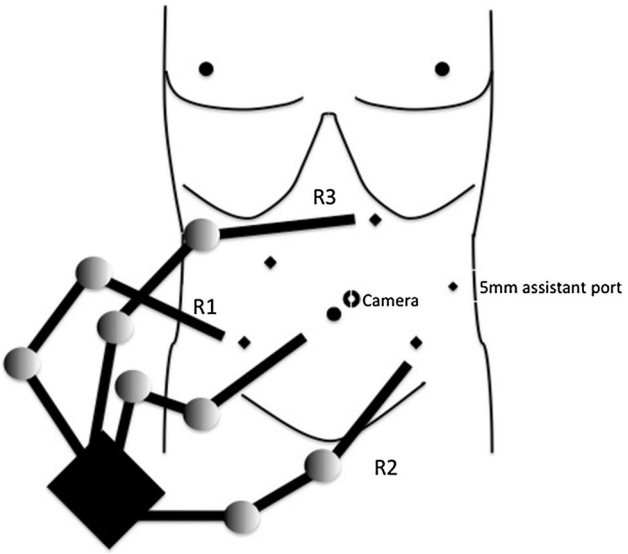

Fig. 3 Setup of the patient cart and port placement for colonic mobilization

The Da Vinci S robotic system (Intuitive Surgical, CA) was docked at the patient's right side, aligning with the right spino-umbilical line. The robotic arms, R1, R2 and R3 were placed at RLQ, LLQ and LUQ, respectively (Fig. 3). Fenestrated bipolar forceps, Cadiere forceps and monopolar curved scissors were mounted on R1, R2 and R3 respectively. A zero degree laparoscope was used.

The medial to lateral approach was adopted. Procedure began with incising the peritoneum at the level of the sacral promontory, using monopolar curved scissors. With the fenestrated bipolar forceps providing cephalic traction to the sigmoid mesentery and the Cadiere forceps providing countertraction, an avascular plane was developed between the mesentery and the retroperitoneum. The dissection plane was further developed towards the caudal and lateral direction. The right ureter was identified and safeguarded. The inferior mesenteric artery was skeletonized and ligated with Hem-o-lok (Teleflex Medical, USA) via the assistant port.

At this juncture, by swapping instruments between R1 and R2, the surgeon was able to, where appropriate, use either right or left hand instruments for incising and dissecting. The lateral peritoneal attachment was incised along the white line of Toldt. The inferior mesenteric vein was skeletonized and ligated with Hem-o-lok. The splenic flexure was not taken down as the sigmoid colon was relatively redundant.

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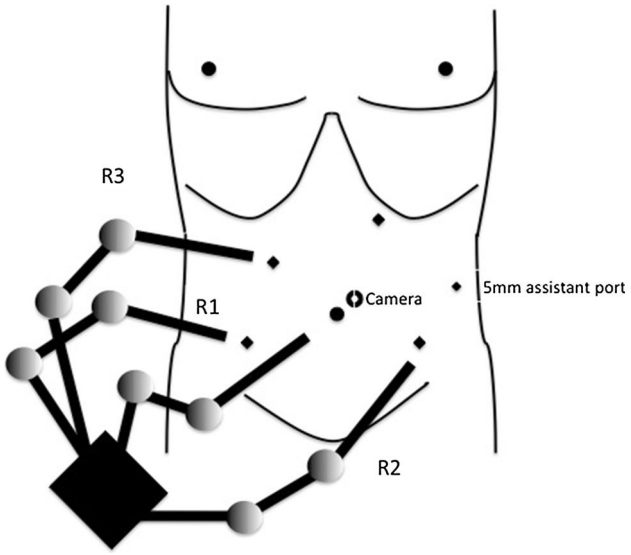

Fig. 4 Patient cart setup and port placement for pelvic dissection

For pelvic dissection, the R3 was repositioned to RUQ. Fenestrated bipolar forceps, Cadiere forceps and monopolar scissors were mounted on R1, R2 and R3 respectively (Fig. 4). After mobilizing the intraperitoneal portion of the rectum, R2 was undocked and the rectum was transected with a laparoscopic stapler, EchelonFlex™ Endopath® 60 mm stapler (Ethicon, USA) via the LLQ port. A 7 cm supraumbilical incision was made and specimen was retrieved with Alexis® wound retraction system (Applied Medical, USA). Proximal transection of the colon was performed by diathermy. Purse-string suture was tied over an anvil. The pneumoperitoneum was resumed. Intracorporeal colorectal anastomosis was performed with a circular stapler, DST Series™ EEA™ 28 mm (Autosuture, Covidien, USA). Colonoscopy was performed to confirm no air-leak from the anastomosis and satisfactory perfusion to colonic mucosa. Diversion stoma was not performed.

Discussion

Owing to its rarity, there were only a few case reports on minimally invasive surgery for patients with SI. Huh et al. described laparoscopic total mesorectal excision and Leong et al. described robotic-assisted total mesorectal excision in patients with SI [2, 3]. In robotic assisted rectal resection, not only does the surgeon has to adapt to the different anatomy, but also the port position and the setup of the robotic patient cart have to be modified.

In this case report, we described the second total robotic anterior resection after Leong. The port positions were similar. Docking of the patient cart was on the patient's right side. The R3 was swung to the other side so that the overall setup appeared to be a mirror image of the conventional anterior resection setup. Although quite logical, this is not entirely true. As described by Leong, the surgeon utilized the right hand instrument, a scissor, to dissect, and the other two, one controlled by the left hand and the other controlled by the right hand, for retraction. This is understandable, as right-handed surgeons are accustomed to dissecting with the right hand-controlled instrument. Oms et al. suggested that left-handed surgeons have a potential advantage in laparoscopic surgery for patients with SI [4]. On using the right hand instrument to dissect, a right-handed surgeon needs to adopt a technique slightly different from the one used in patients with normal anatomy. This is largely overcome by the flexibility provided by the robotic system.

In our case, the surgeon initially used a right hand instrument to dissect. During the dissection of the inferior mesenteric vessels and division of the lateral peritoneal attachment, by interchanging instruments between R2 and R3, the surgeon used both left hand and right hand instruments. Dissecting with a left hand instrument is sometimes more ergonomic and represents an exact mirror image of the technique used in patients with normal anatomy. The robotic system filters tremor, stabilizes movement and provides three-dimensional view of the surgical field. This allows an easier transition to left hand dissection for right-handed surgeons.

Unavoidably, the surgeon had to use the left hand to control the laparoscopic stapler for transection of the rectum. The newer version robotic system has the benefit of integrating the stapler into the robot. Perhaps even in future, by adjusting the software of the system, a mirror image can be relayed to the surgeon console, and coupled with swapping of the left and right master control, the robotic system can virtually simulate operating with 'normal anatomy' in patients with SI.

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all patients for being included in the study.

Written informed consent was obtained from the patient AQ2 for publication of this Case Report/any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Conflict of interest Authors Chi Chung declares that he has no conflict of interest. Wei Lun Law declares that he has no conflict of interest.

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References

1. Nursal TZ, Baykal A, Iret D, Aran O (2001) Laparoscopic cholecystectomy in a patient with situs inversus totalis. J Laparoendosc Adv Surg Tech A 11:239–241
2. Huh JW, Kim HR, Cho SH, Kim CY, Kim HJ, Joo JK, Kim YJ (2010) Laparoscopic total mesorectal excision in a rectal cancer patient with situs inversus totalis. J Korean Med Sci 25:790–793
3. Leong QM, Son D, Cho J, Amar AJ, Kim S (2012) Robot-assisted low anterior resection for situs inversus totalis: a novel technical approach for an uncommon condition. Surg Laparosc Endosc Percutan Tech 22:87–90
4. Oms LM, Badia JM (2003) Laparoscopic cholecystectomy in situs inversus totalis: the importance of being left-handed. Surg Endosc 17:1859–1861

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