

Received: 2021.11.18

Accepted: 2022.05.27

Available online: 2022.06.16

Published: 2022.07.23

Laparoscopic Colectomy for a Patient with Situs Inversus Totalis: The Usefulness of Preoperative Assessment

Authors' Contribution:

Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

ABCDEFG **Junichi Sakamoto**E **Heita Ozawa***BCD **Hiroki Nakanishi***BCD **Naoyuki Toyota***FG **Shin Fujita***

Department of Colorectal Surgery, Tochigi Cancer Center, Utsunomiya, Tochigi, Japan

* Heita Ozawa, Hiroki Nakanishi, Naoyuki Toyota, and Shin Fujita contributed equally to this work

Corresponding Author: Junichi Sakamoto, e-mail: jsakamot@tochigi-cc.jp**Financial support:** None declared**Conflict of interest:** None declared

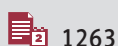
Patient: Female, 63-year-old
Final Diagnosis: Transverse colon cancer
Symptoms: None
Medication: —
Clinical Procedure: —
Specialty: Oncology

Objective: Rare disease

Background: Situs inversus totalis (SIT) is a rare congenital anomaly in which the patient's internal organs are positioned in a mirror image of their normal locations. Laparoscopic surgery for a patient with SIT requires modification of the standard procedure. Several studies have recently reported surgical techniques for laparoscopic colectomy in patients with SIT. Herein, we present the case of a patient with congenital SIT who underwent laparoscopic colectomy for transverse colon cancer with intracorporeal anastomosis and discuss the usefulness of preoperative assessment.

Case Report: A 63-year-old woman with SIT was referred to our department for surgical intervention following endoscopic submucosal dissection of transverse colon cancer. We performed a successful laparoscopic colectomy with intracorporeal anastomosis. Our team had no prior experience performing laparoscopic surgery on a patient with SIT; however, preoperative image training using a horizontally flipped video of a normal laparoscopic colectomy enabled the operation to be performed safely. Preoperative image training is very useful for gaining an understanding of images similar to the actual field of view before surgery. The patient was discharged without complications on the eighth postoperative day.

Conclusions: Careful preoperative assessment that takes into consideration the mirror-image anatomy and the contemplated laparoscopic procedure should allow patients with SIT to fully benefit from minimally invasive surgery.

Keywords: Colectomy • Colonic NeoplasmsFull-text PDF: <https://www.amjcaserep.com/abstract/index/idArt/935538>

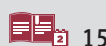
1263



—



5



15



Background

Situs inversus totalis (SIT) is a rare congenital anomaly with an incidence of approximately 1 in 8000-25 000 births, in which the internal organs are positioned in a mirror image of their normal positions [1]. Due to its rare incidence and the mirror-image transposition of organs, laparoscopic surgery for an SIT patient is considered to be more difficult [2] and requires a modification of the standard procedure. Several studies for laparoscopic colectomy in patients with SIT have been published recently [3-8], wherein surgical techniques and preoperative preparation have been reported.

In the present case report, we present a unique case of a laparoscopic colectomy for transverse colon cancer with intracorporeal anastomosis in a patient with SIT, and discuss the usefulness of preoperative image training.

Case Report

A 63-year-old woman with congenital SIT was admitted to our hospital with a diagnosis of transverse colon cancer. Colonoscopy revealed a type-0Is polyp in the transverse colon, and a VI pit pattern was observed by magnifying chromoendoscopy (Figure 1A). Computed tomography (CT) revealed SIT and a mass in the transverse colon close to the hepatic flexure (Figure 1B), but no lymph node metastasis or distant metastases. Since carcinoma with mild submucosal invasion

was suspected and the patient herself was reluctant to undergo an operation, endoscopic submucosal dissection (ESD) was performed. Histological examination of the resected specimen revealed massive submucosal invasion ($\geq 1000 \mu\text{m}$) and lymphovascular infiltration. Following the ESD, the patient was referred to our department for further surgical intervention.

The patient was 157 cm tall and weighed 75 kg (with a body mass index of 30.4 kg/m^2). The patient had undergone an appendectomy at the age of 43 years. Based on the eighth edition of the Union for International Cancer Control-Tumor Node Metastases (UICC-TNM) classification [9], the preoperative clinical diagnosis was early transverse colon cancer, T1N0M0, stage I. We scheduled a partial laparoscopic colectomy with dissection of the D2 lymph nodes and intracorporeal anastomosis.

Three-dimensional CT angiography was used to observe the anatomy and variation in the mesenteric vessels, and this clearly displayed the anatomy of the vascular arch (Figure 1C). The main feeder of the primary tumor was the middle colic artery (MCA).

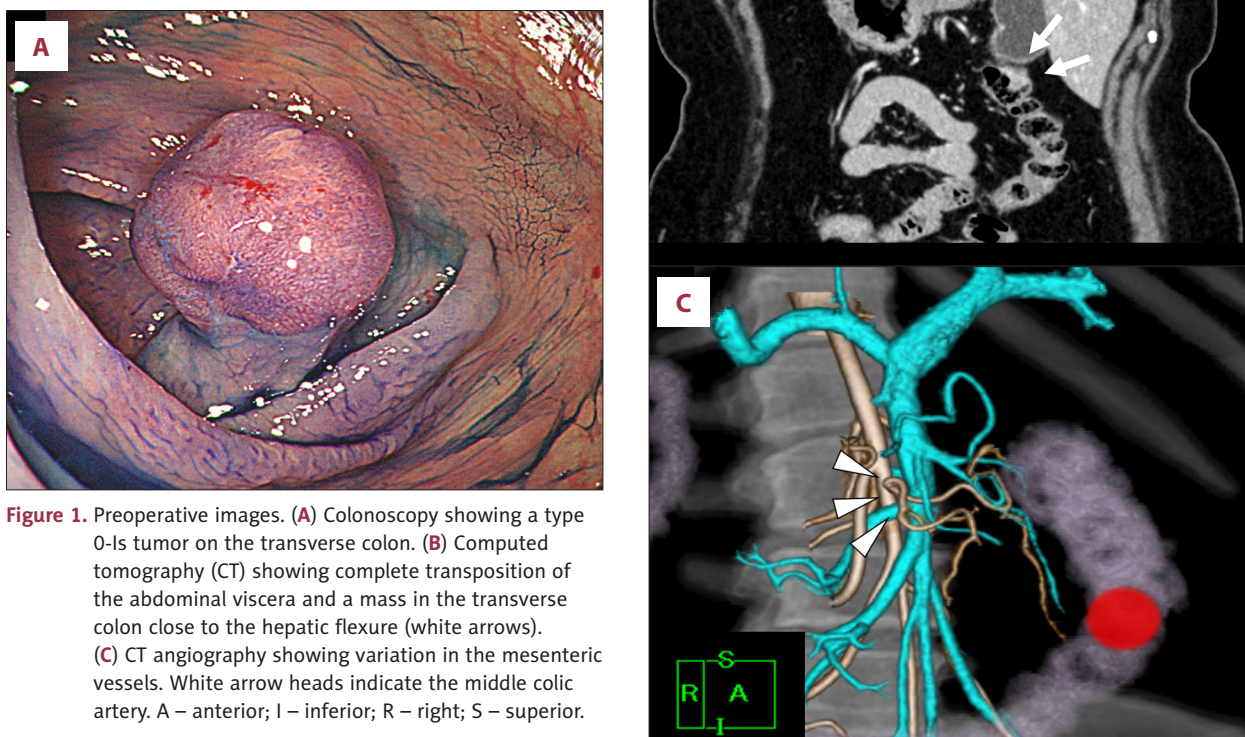


Figure 1. Preoperative images. (A) Colonoscopy showing a type 0-Is tumor on the transverse colon. (B) Computed tomography (CT) showing complete transposition of the abdominal viscera and a mass in the transverse colon close to the hepatic flexure (white arrows). (C) CT angiography showing variation in the mesenteric vessels. White arrow heads indicate the middle colic artery. A – anterior; I – inferior; R – right; S – superior.

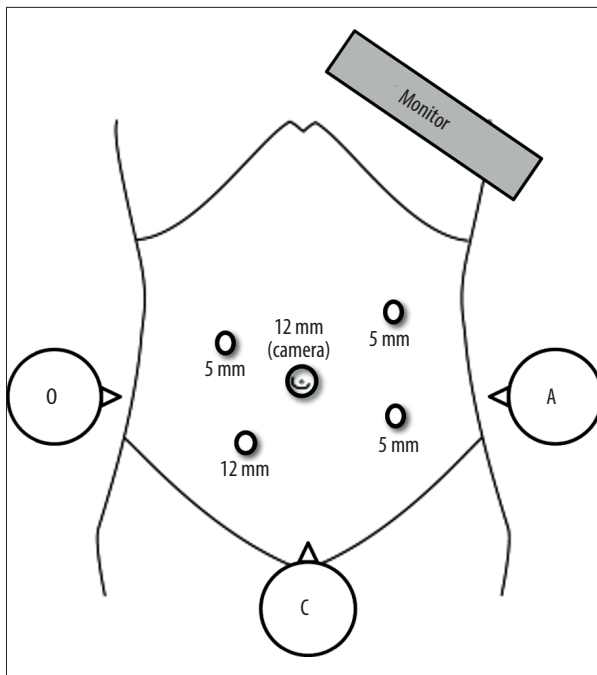


Figure 2. Location of surgeons and trocar placement in the patient with situs inversus totalis. O – operator; A – first assistant; C – camera operator.

To ensure successful laparoscopic surgery, we repeatedly reviewed a horizontally flipped video of a normal laparoscopic colectomy and shared preoperative images of coordinated movement by the operator and first assistant.

After the induction of general anesthesia, the patient was placed in the supine position with her legs spread. The monitor was placed on the left side of the patient. The right-handed surgeon and camera operator were positioned on the right side of the patient, while the first assistant surgeon was on the left side. Pneumoperitoneum was established to a pressure of 10 mmHg using the transumbilical technique, and 5 trocars were placed as shown in **Figure 2**. As expected, laparoscopic exploration showed complete transposition of the abdominal viscera (**Figure 3A**). Preoperative endoscopic tattooing (**Figure 3B**) was used to determine the tumor location.

First, mobilization began at the terminal ileum and proceeded to the hepatic flexure in a medial-to-lateral approach (**Figure 3C**). The pancreatic head was exposed, and the transverse colon was divided. The omentum was separated from the transverse mesocolon. Once the left-sided colon was completely mobilized, the mesentery was incised at the root of the MCA and its branches were confirmed (**Figure 4A**). Both branches of the MCA and veins that run parallel to the arteries were ligated and transected. A D2 lymph node dissection was performed. After resecting the colon on both sides of the lesion using blue-load linear endoscopic staplers (ECHELON FLEX™

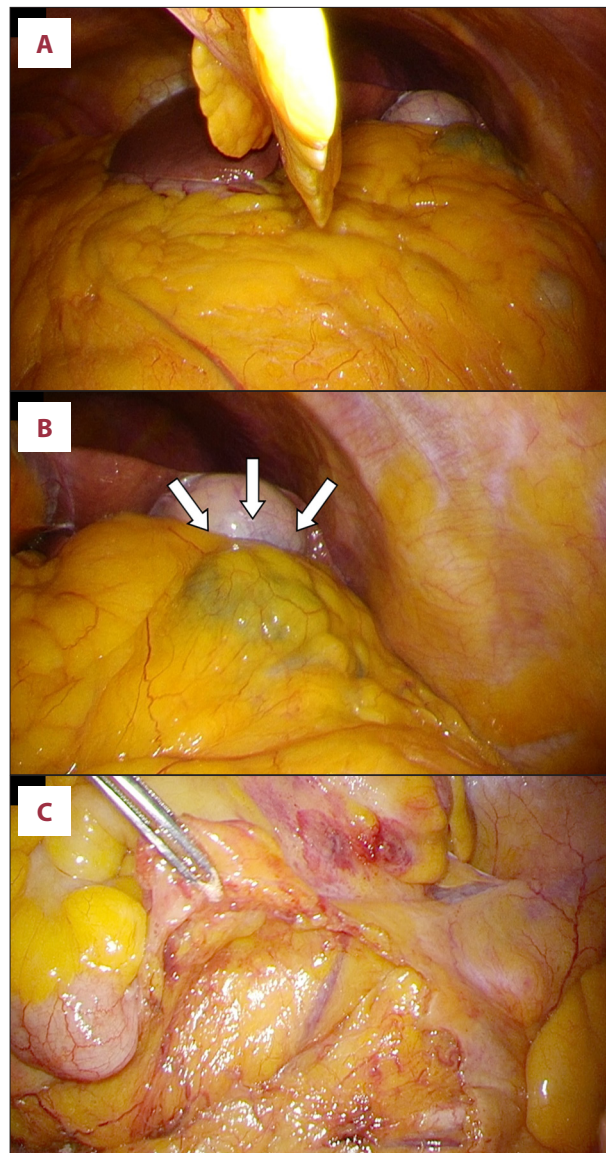


Figure 3. Intraoperative findings 1. (A) Laparoscopic view of the abdomen showing complete transposition of abdominal viscera. (B) Lesion in the proximal transverse colon (endoscopic tattoo mark) (white arrows). (C) Detachment of colonic retroperitoneal attachments at the terminal ileum level.

ENDOPATHR® Stapler; Ethicon, Tokyo, Japan) (**Figure 4B**), the proximal and distal colon were laid in an overlapping fashion. Side-to-side intracorporeal anastomosis was performed using blue-load linear endoscopic staplers (**Figure 4C**), and the common-entry incision was closed by hand-sewn running suture using barbed polydioxanone sutures (PDS) (Spiral PDS PLUS® STRATAFIX®; Ethicon, Tokyo, Japan) (**Figure 4D**). The mesenteric defects were closed using non-absorbable sutures.

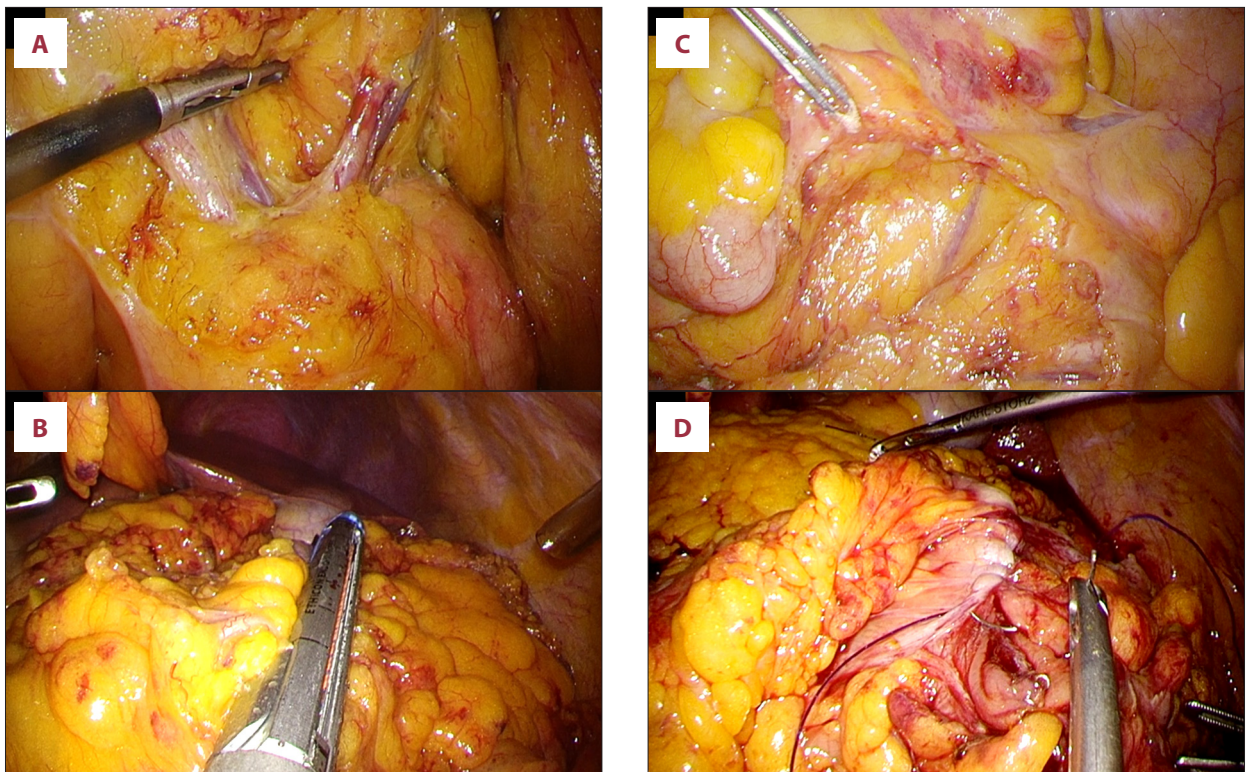


Figure 4. Intraoperative findings 2. (A) Exposure of each blood vessel during operation. (B) Intracorporeal transection of the distal transverse colon. (C) Side-to-side anastomosis in an overlap fashion. (D) Closure of the common-entry incision.

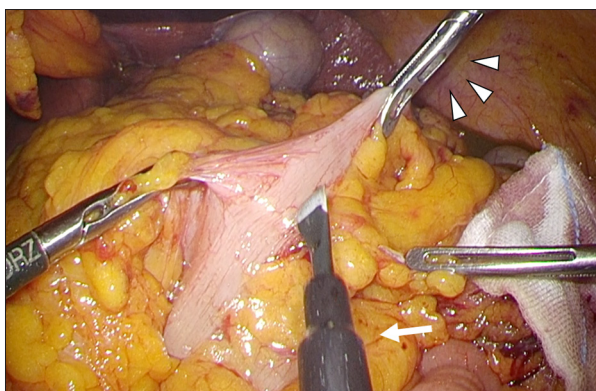


Figure 5. Operative appearance was similar to preoperative image training. White arrow shows the surgeon's right hand, and white arrow heads show the first assistant's right hand.

The intraoperative findings were similar to those observed in the preoperative images, and this enabled the surgery to be performed with greater confidence (Figure 5).

The specimen was extracted through a skin incision, approximately 3.5 cm, extending to the umbilical port site. The operation time was 257 min with minimal blood loss.

The patient commenced with a solid diet on the third postoperative day, and was discharged on the eighth postoperative day without any complications.

Discussion

Herein, we present the case of a patient with transverse colon cancer and SIT who underwent partial laparoscopic colectomy with intracorporeal anastomosis. Besides understanding the blood vessel variation using 3-dimensional CT angiography, image training using a horizontally flipped video of a standard laparoscopic colectomy was very effective as a means of preoperative assessment.

Although SIT is often associated with various congenital anomalies, including congenital heart defects, renal dysplasia, and biliary atresia [1], there is no definite relationship between SIT and malignant tumors [10].

Several studies have recently reported the ingenuity of laparoscopic colectomy in patients with SIT to overcome technical difficulties due to the mirror-image anatomy. In addition to changing the operator position [3] and trocar placement [6], many reports suggest 3-dimensional CT angiography [3,5,7,8]. SIT is often associated with abnormal angiogenesis of blood

vessels [11]. Therefore, it is essential to understand the patient's anatomy and the applicable laparoscopic procedures. In our case, we used flipped movie editing for preoperative assessment.

Flipped movie editing is a standard feature of many video editing software packages, and it is a simple and useful tool; this allowed those involved in the procedure to view images that were similar to the actual field of view before surgery.

It should be noted that the forceps and devices are moved in opposite directions to that in the horizontally flipped video during the actual surgery. The patient's cancer was close to the hepatic flexure, which meant that mobilization from the cecum to the transverse colon was required. During the actual surgery, the confusion created by mirror-imaging was able to be avoided by positioning the operator and assistant similarly to the medial-to-lateral approach used for normal left-sided colon cancer. Because of the magnified laparoscopic view, vascular ligation and lymph node dissection were performed without confusion. Horizontally flipped video is very useful for understanding images associated with such surgical developments.

Because of the SIT, the dominant forceps were oriented differently from normal forceps. Several reports have described a potential disadvantage for right-handed operators during laparoscopic cholecystectomy [12-14]. However, 2-handed operation itself is a common and essential technique in most laparoscopic surgeries. Furthermore, Karabay et al have reported

that experience in advanced laparoscopic surgery may be considered as an important factor to decrease technical problems associated with SIT [15], and that the limited mobility of forceps could be overcome through coordinated movements of the operators and the assistant. Therefore, we believe that the most important factor in operating on patients with SIT is careful preoperative assessment rather than hand dominance.

Conclusions

With careful preoperative assessment that takes into account the mirror-image anatomy and the planned laparoscopic procedure, patients with SIT should be able to fully benefit from minimally invasive surgery. A horizontally flipped video of a normal laparoscopic colectomy was useful in the present case, and indeed can be deemed essential for achieving a successful operation in patients with SIT.

Acknowledgments

This study was supported by the Tochigi Cancer Center, founded by the Tochigi Prefecture.

Declaration of Figures' Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

References:

1. Spoon JM. Situs inversus totalis. *Neonatal Netw.* 2001;20:59-63
2. Fujiwara Y, Fukunaga Y, Higashino M, et al. Laparoscopic hemicolectomy in a patient with situs inversus totalis. *World J Gastroenterol.* 2007;13:5035-37
3. Yaegashi M, Kimura T, Sakamoto T, et al. Laparoscopic sigmoidectomy for a patient with situs inversus totalis: Effect of changing operator position. *Int Surg.* 2015;100:638-42
4. Hirano Y, Hattori M, Douden K, Hashizume Y. Single-incision laparoscopic surgery for colon cancer in patient with situs inversus totalis: Report of a case. *Indian J Surg.* 2015;77:26-28
5. Sasaki K, Nozawa H, Kawai K, et al. Laparoscopic hemicolectomy for a patient with situs inversus totalis: A case report. *Int J Surg Case Rep.* 2017;41:93-96
6. Takeda T, Haraguchi N, Yamaguchi A, et al. Laparoscopic sigmoidectomy in a case of sigmoid colon cancer with situs inversus totalis. *Asian J Endosc Surg.* 2019;12:111-13
7. Kojima Y, Sakamoto K, Tomiki Y, et al. Laparoscopic right colectomy for a patient with situs inversus totalis. *J Surg Case Rep.* 2019;2019(3):rjz080
8. Kudo T, Matsuda T, Urakawa N, et al. Laparoscopic sigmoidectomy with splenic flexure mobilization for colon cancer in situs inversus totalis: Preoperative assessment and preparation. *Asian J Endosc Surg.* 2022;15:168-71
9. James DB, Mark KG, Christian W. TNM classification of malignant tumours. 8th ed. Geneva: Union for International Cancer Control; 2017
10. Pan K, Zhong D, Miao X, et al. Situs inversus totalis with carcinoma of gastric cardia: A case report. *World J Surg Oncol.* 2012;10:263
11. Zho H, Yang K, Hu JK. Gastrectomy for gastric carcinoma with situs inversus totalis: Case report and literature review. *Hippokratia.* 2015;19:360-62
12. Oms LM, Badia JM. Laparoscopic cholecystectomy in situs inversus totalis: The importance of being left-handed. *Surg Endosc.* 2003;17:1859-61
13. Mohammed AA, Arif SH. Laparoscopic cholecystectomy for left-sided gall bladder in situs inversus totalis patient, a technically demanding procedure. *Ann Med Surg (Lond).* 2019;47:1-4
14. Du T, Hawasli A, Summe K, Meguid AA, et al. Laparoscopic cholecystectomy in a patient with situs inversus totalis: Port placement and dissection techniques. *Am J Case Rep.* 2020;21:e924896
15. Karabay O, Gurbuz B, Zenger S, et al. Laparoscopic colon resection in patients with situs inversus totalis: Is it the same operation as in patients without situs inversus totalis? *J Minim Access Surg.* 2019;15:68-70