Abstract

Introduction: A left-sided Inferior vena cava (IVC) is a rare congenital vascular anomaly that is usually incidentally detected by computed tomography. We herein report a case involving a patient with a left-sided IVC who underwent laparoscopic-assisted sigmoidectomy for sigmoid colon cancer.

Case presentation: A 74-year-old man was diagnosed with cStage I (cT2N0M0) colon cancer according to the seventh edition of the Union for International Cancer Control (UICC)/TNM system. Preoperative enhanced CT revealed that the IVC ascending along the left side of the abdominal aorta. While inferior mesenteric vessels, sigmoidal vessels and left ureter seemed to be at normal position. Laparoscopic-assisted sigmoidectomy with lymph node dissection was successfully performed after careful consideration of the patient’s malposition, although there was a limited maneuverability due to the small distance from the operator’s trocars to the root of the inferior mesenteric artery. Although a surgical site infection occurred after surgery, our patient’s recovery and postoperative course were satisfactory.

Conclusion: We emphasize that laparoscopic-assisted sigmoidectomy for treatment of colon cancer in patients with a left-sided IVC should be considered an acceptable treatment option after preoperative confirmation of any abnormal vascularization and meticulously careful performance of the surgical procedure.

Key words: left-sided inferior vena cava, laparoscopic surgery, colorectal cancer

Introduction

A left-sided inferior vena cava (IVC) is a very rare anomaly. Typically, the left IVC joins the left renal vein, which crosses anterior to the aorta in a normal fashion and unites with the right renal vein to form a normal right-sided prerenal IVC. A left-sided IVC is a rare congenital condition with an incidence of about 1 per 200 to 5,000 persons. Although treatment by abdominal surgery has been reported in affected patients, most reported cases involve patients with urological diseases such as left renal cell carcinoma, primary aldosteronism, and donor nephrectomy. Laparoscopic surgery for treatment of gastrointestinal malignant tumors in patients with a left-sided IVC is relatively rare.

The present systematic review included only English-language articles in the PubMed database identified by the keywords “left-sided IVC,” a combination of “left-sided IVC” and “colorectal,” and a combination of “left-sided IVC” and “laparoscopic.” We found only two reported cases of sigmoid colon cancer combined with a left-sided IVC. However, neither of these case reports described the details of the surgical procedure.

No reports to date have described laparoscopic-assisted surgery for colorectal cancer in patients with a left-sided IVC. We herein report a case involving a patient with a left-sided IVC who underwent laparoscopic-assisted sigmoidectomy with D2 lymph node dissection in accordance with the Japanese Society for Cancer of the Colon and Rectum (JSCCR) guidelines 2014 for the treatment of colorectal can-
and preservation of the inferior mesenteric artery. To the best of our knowledge, this is the first such reported case in Japan.

Case Report
A 74-year-old man was referred to the Gastrointestinal Endoscopy Division in our hospital for further evaluation. This patient was previously diagnosed with early sigmoid colon cancer detected during a health checkup and colonoscopy at a different hospital. His medical history included vascular dementia, depressive disorder, atrial fibrillation, and diabetes mellitus. A left-sided IVC had not been diagnosed.

Colonoscopy performed in our hospital revealed an ulcerated lesion with raised margins on the posterior wall of the sigmoid colon. However, enhanced computed tomography (CT) did not reveal an irregularly shaped mass with thick walls (Fig. 1A, B).

We estimated that the mass type was macroscopic type 2, the depth of tumor invasion was to the tunica muscularis propria, and the tumor diameter was 40 mm. An endoscopic biopsy revealed well-differentiated adenocarcinoma. CT showed no regional lymph node metastasis and no distant metastasis. Based on the pretreatment colonoscopy and CT findings, the patient was clinically diagnosed with cT2 (MP) N0M0, clinical Stage I sigmoid colon cancer according to the seventh edition of the Union for International Cancer Control (UICC)/TNM system.

Further, preoperative enhanced CT showed that the patient’s IVC ascended along the left side of the abdominal aorta so far as the level of the second lumbar vertebra, and the left-sided IVC, then crossed over to the right side of the aorta at the level of superior mesenteric artery (Fig. 2A, B). At the level of the fifth lumbar vertebra, the right and
left common iliac veins flowed into the left-sided IVC behind the left iliac artery (Fig. 3A), the left testicular vein entered into the IVC at the level of the third lumbar vertebra. The inferior mesenteric vessels, sigmoidal vessels and left ureter seemed to be at normal position (Fig. 3B).

We decided to perform laparoscopic-assisted sigmoidectomy with D2 lymph node dissection in accordance with the JSCCR Guidelines 2014

A camera port was created above the umbilicus using an open technique. After establishment of pneumoperitoneum using a pressure of up to 8 mmHg of carbon dioxide, laparoscopic sigmoidectomy was performed using another three trocars, including a 5-mm trocar in the right flank and iliac fossa as working ports for the operator and a 5-mm trocar in the left iliac fossa for traction. The surgeon mainly stood on the right side of the patient for mobilization of the left colon and dissection of lymph nodes.

The small bowel was displaced to the right, and the omentum was turned up to the upper quadrant. Laparoscopy showed that the IVC was on the aorta's left side. The lymph node dissection was performed using a medial-to-lateral approach. The peritoneum was cut open from the right edge of the superior rectal artery (SRA) to the root of the inferior mesenteric artery (IMA), following the incision at the level of the promontory. The mesentery of the colon was cut at just caudal site of IMA, and the fascia was mobilized to examine the surface of the abdominal aorta and IVC. Through the mesenteric window opened toward left lateral side, we easily identified the IVC, left ureter and spermatic vessels.

The IMA was isolated, and all soft tissues around the IMA were completely removed from near the root of the IMA to the root of the second sigmoidal artery. The first sigmoidal artery was divided at the root of the IMA, and we finally performed D2 lymph node dissection with preservation of the SRA (Fig. 4). The procedure was not complicated except for an appreciation of the congenital vascular anatomy and awkwardness in handling the surgical instruments for lymph node dissection along the
IMA in the presence of the right–left inversion. After mobilization of the left colon including the tumor and rectum using a medial approach, the specimen was extracted through the small incision that continued to the umbilical port and resected extracorporeally. Reconstruction was also performed extracorporeally using an end-to-end triangulating stapling method\(^{10}\). The operation time was 149 minutes and blood loss volume was 15 mL. Pathological examination of the resected specimen revealed a 45–40-mm ulcerated lesion located at the sigmoid colon with invasion limited to the subserosa; the tumor was determined to be a moderately differentiated adenocarcinoma, ly1, v2. No metastasis was detected in any of the retrieved lymph nodes. Therefore, the final stage was pT3(SS)N0M0, pStage II A according to the seventh edition of the UICC/TNM system. Although an organ/space surgical site infection occurred after surgery, the patient recovered satisfactorily with antibiotic administration. His postoperative course involved no major complications or unexpected occurrences, and he was discharged on postoperative day 13. The patient was alive without immediate postoperative complications or postoperative symptoms such as constipation, diarrhea, paralytic ileus and bowel obstruction of small intestine.

Discussion
Congenital anomalies of the IVC are very rare and extremely diverse. The embryogenesis of the IVC is a complex process involving the formation of several anastomoses between three paired embryonic veins. A left-sided IVC results from regression of the right supracardinal vein with persistence of the left supracardinal vein\(^{1}\). Almost all vascular anomalies are incidentally detected by CT or magnetic resonance imaging, and congenital anomalies of the IVC are commonly recognized in asymptomatic patients as well. Two cases of colon cancer combined with a left-sided IVC have been reported in the English-language literature. In Japan, the first case report of a left-sided IVC in a patient with sigmoid colon cancer was published in 2015. In that case, the left-sided IVC was also incidentally detected on an abdominal CT scan\(^{15}\). Therefore, in addition to confirmation of mirror-image positioning, such as the presence of a left-sided IVC, double IVC, or situs inversus totalis, preoperative confirmation of any abnormal vascularization is extremely important. This is because abnormal vascularization is associated with a risk of misidentifying the anatomy and encountering unanticipated injury of important vessels during lymph node dissection. We commonly perform preoperative thin-slice abdominal CT for detailed clinical observation. When major vascular anomalies are detected, we take extra time to confirm the vascular anomalies by three-dimensional reconstruction CT angiography (Fig. 3A, B).

Five reports of laparoscopic surgery for urological disease\(^{5,11-14}\) and one report of laparoscopic surgery for gynecological disease\(^{15}\) have been published in the English-language literature in the past 10 years; two of these six reports mentioned laparoscopic lymphadenectomy. However, no case report of laparoscopic-assisted sigmoidectomy in a patient with a left-sided IVC has been published. The present report is likely the first in the English-language literature to describe laparoscopic-assisted sigmoidectomy with standard lymph node dissection according to the JSCCR Guidelines 2014. Laparoscopic surgery has been widely accepted as a minimally invasive approach for treatment of colorectal cancer worldwide, and laparoscopic surgery accompanied by standard lymph node dissection provides an acceptable prognosis and quality of life\(^{16,17}\).

In our division, laparoscopic-assisted sigmoidectomy and low anterior resection are performed using four or five ports. In the present case, neither the trocar locations nor the position of the operator differed from those in orthotopic patients, and the surgical technique itself did not differ from the usual situation. A medial-to-lateral approach was useful to facilitate the exposure and identification of the IVC, the left spermatic vessels and the left ureter. Mobilization and resection of the colon were performed easily; however, it is possible that safe and radical lymph node dissection along the IMA was performed with much difficulty. This was the only time point at which limited maneuverability of the instruments occurred because the distance from the operator’s trocars to the root of the IMA was very small. In the present case, these were essential factors for safe and radical lymph node dissection (i.e., the choice of using trocars and the side on which the operator stood); however, no consensus regarding these factors has been reached because laparoscopic surgery for treatment of colorectal cancer in
LAC for sigmoid colon cancer with a left-sided IVC

patients with a left-sided IVC has not been reported until now. If D3 lymph node dissection or para-aortic lymph node dissection is needed to achieve curative resection, our experience indicates that it is better to change the distance from the trocar to the target tissue and the axis of the surgeon’s instruments; e.g., the operator can be situated between the patient’s legs to use trocars placed in the right and left iliac fossa.

Laparoscopic surgery for treatment of colorectal cancer has recently become a standard procedure worldwide. Safe and radical lymph node dissection should be carried out only after preoperative confirmation of any abnormal vascularization and preoperative planning of laparoscopic procedures because abnormal vascularization is associated with a risk of misidentifying the anatomy and encountering unanticipated injury to important vessels during lymph node dissection. Thus, in the present case, laparoscopic-assisted sigmoidectomy was performed safely without any additional bleeding or operative time compared with a normal operation.

In conclusion, two essential clinical factors are demonstrated in the present case. First, we commonly perform preoperative thin-slice abdominal CT for detailed clinical observation, and we take extra time to confirm any vascular anomalies. Second, we ascertained the anatomical features for safe and radical lymph node dissection during laparoscopic surgery. We believe that laparoscopic-assisted sigmoidectomy with standard lymph node dissection is an acceptable treatment option for colorectal cancer in patients with a left-sided IVC.

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Conflict of interest: None.

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