CANCER DIAGNOSIS & PROGNOSIS
4: 264-269 (2024) doi: 10.21873/cdp.10318

Laparoscopic Colectomy for Cecal Cancer and Intestinal Malrotation: A Case Report

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Abstract. *Background/Aim: Intestinal malrotation (IM) often remains undetected until adulthood, being discovered during testing or surgery for other comorbidities. Preoperative understanding of this anatomical abnormality is crucial. Case Report: An 80-year-old woman presented with cecal cancer. Three-dimensional computed tomography (CT) revealed that the cecum was located at the midline of the abdominal cavity, the duodenum did not cross the midline, and the ileocolic vein ran to the left. Clinically diagnosed with stage IVc cecal cancer complicated by IM, the patient underwent laparoscopic surgery. The ascending colon and cecum were not fixed to the retroperitoneum. The duodenum lacked the second, third, and fourth portions and the small bowel was distributed on the left and right sides of the abdominal cavity. Adhesions had shortened the mesentery, which were released close to their normal positions. Conclusion: Although laparoscopic surgery is superior to open surgery in terms of securing the field of view in a narrow space, providing a magnifying effect, and minimal invasiveness, it has a limited field of view and is inferior in terms of grasping the overall anatomy, which may be disadvantageous in cases of anatomical abnormalities. Colorectal cancer with IM is rare; however, the rate of preoperative diagnosis seems to be increasing thanks to improvements in diagnostic imaging, such as three-dimensional CT scans. In this study, we also reviewed 49 cases of colorectal cancer associated with IM.*

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Key Words: Intestinal malrotation, anatomical anomaly, laparoscopic colectomy.

Intestinal malrotation (IM) is an abnormality of midgut rotation during embryonic development. In most cases of IM, patients exhibit symptoms of a midgut volvulus or intestinal obstruction in childhood. It is rarely found in adulthood, and most are discovered during testing or surgery for other comorbidities (1). However, a preoperative understanding of such an anatomical abnormality is crucial to ensure surgical safety. Here, we report a rare laparoscopic colectomy for cecal cancer with intestinal malrotation that was diagnosed preoperatively on imaging studies. Using this preoperative information, we safely performed laparoscopic surgery using a suitable approach. The SCARE Checklist has been completed by the authors for this case report (2). The Ethical committee of our institute approved (No.15144-6) this study and written informed consent was obtained from the patient for the publication of this case report and any accompanying images.

Case Report

An 80-year-old woman was admitted to our hospital complaining of abdominal pain and dyspepsia. She had no appreciable medical and surgical history. Colonoscopy revealed a type 3 cancer covering the entire circumference of

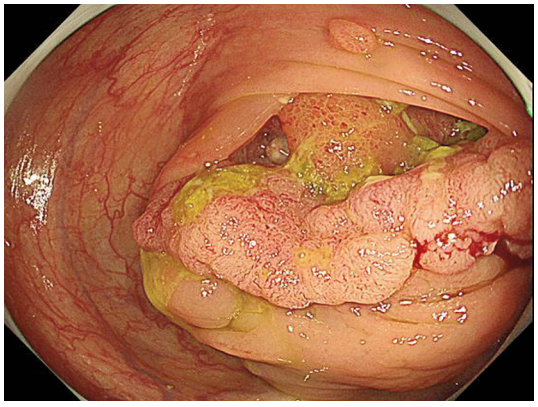

Figure 1. *Colonoscopy showing type 3 cancer covering the entire circumference of the cecum.*

the cecum (Figure 1). Examination of the biopsy specimens revealed well-differentiated tubular adenocarcinoma.

Computed tomography (CT) revealed a tumor measuring approximately 47 mm in diameter in the cecum (Figure 2A). The cecum was located at the midline of the abdominal cavity. One lymph node at the back of the tumor was swollen to a diameter of 10 mm (Figure 2B). There was one liver metastasis, 32 mm in diameter, in the right posterior inferior segment (Figure 2C), and three peritoneal disseminations localized in the lower abdomen. Positron emission tomography–CT showed abnormal accumulation in the lesions (Figure 3A-D). The duodenum did not cross the midline and the ileocolic vein ran to the left (Figure 4). Laboratory tests revealed elevated CEA (13 ng/ml) and CA 19-9 (112.8 U/ml) levels. She was clinically diagnosed with stage IVc cecal cancer T4a N1 M1c (H1P1) complicated by intestinal malrotation (IM). The patient underwent laparoscopic ileocecal and disseminated lesion resections with D3 lymph node dissection. Two disseminated lesions and one liver metastasis (S6) were visualized intraoperatively.

The ascending colon and cecum were not fixed to the retroperitoneum. The duodenum lacked the second, third, and fourth portions and the small bowel was located on the left and right sides of the abdominal cavity. The ascending colon showed adhesions with the transverse colon, and the cecum adhered to the sigmoid colon (Figure 5A). The mesentery was shortened by adhesions; therefore, the ileocolic vein could not be identified. All adhesions were released, and the cecum was pulled to the right lower abdomen, close to its normal position (Figure 5B). The ileocolic artery/vein (ICA/V) was separated from the superior mesenteric artery/vein (SMA/V) at its root. The operative time was 177 min, with minimal blood loss.

The patient was readmitted to the hospital because of reduced oral intake, but was able to be discharged 14 days

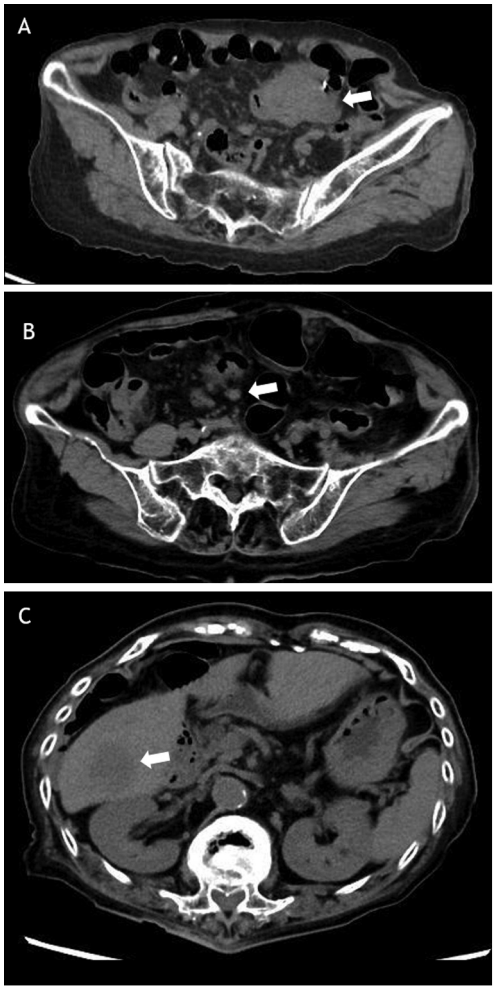

Figure 2. *Abdominal computed tomography scan showing A) a tumor in the cecum, B) one liver metastasis, and C) one swollen lymph node at the back of the cecal tumor.*

after surgery, and was followed up at the outpatient clinic. The pathological diagnosis was pathological T4a(SE) N2aM1 Stage IV.

Discussion

IM is an abnormality of midgut rotation during embryonic development. It is usually diagnosed as a midgut volvulus or intestinal obstruction in childhood and is rarely found in adulthood (1).

Nishijima *et al*. reported the following types: a) non-rotation, b) incomplete rotation, and c) incomplete fixation (3). In general, most cases in adulthood are of the non-rotation type, which is asymptomatic (4); however, this case was of the incomplete rotation type. Because it is mostly asymptomatic, it is most often discovered during testing or

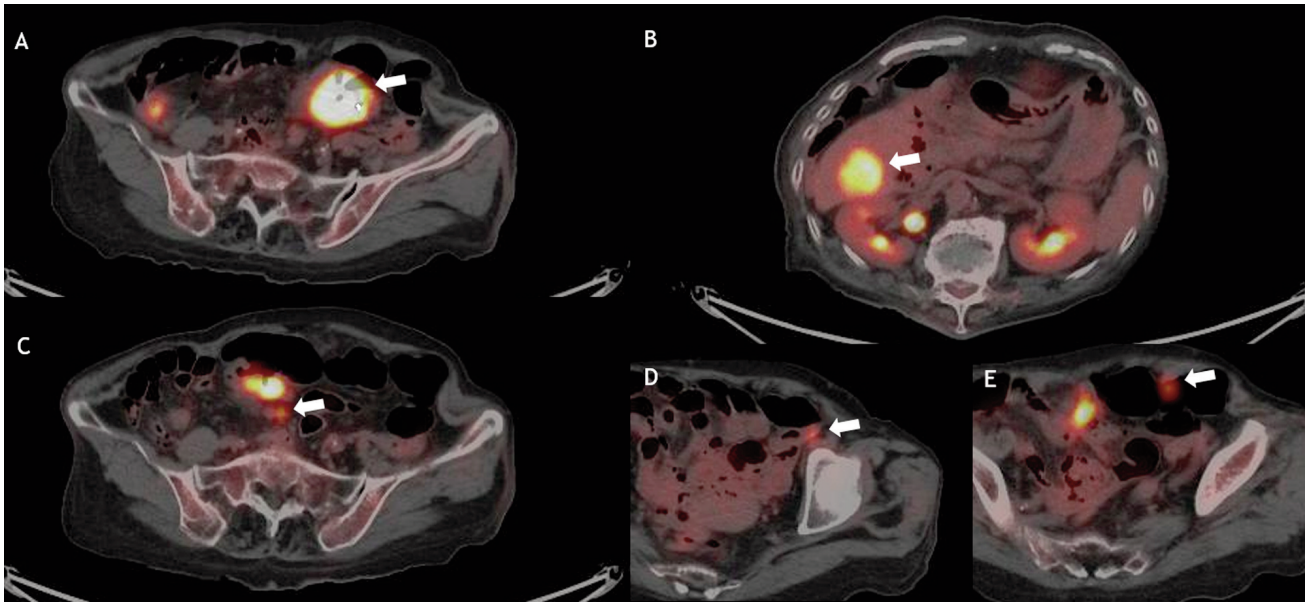

Figure 3. *Preoperative positron emission tomography/computed tomography (PET/CT) images. A) Cecal tumor and one peritoneal dissemination, B) one liver metastasis, C) one swollen lymph node, and D and E) two peritoneal disseminations had abnormal FDG uptake on PET/CT.*

surgery for other comorbidities in adults. Imaging findings indicated that the small intestine was on the right side of the abdominal cavity, with the duodenum not crossing the midline (5). The SMV exists on the left side of the SMA (SMV rotation sign) (6, 7), and in this case, the SMV was laid on the left ventral aspect of the SMA on CT.

Colorectal cancer with IM is rare (8), but many reported cases of malignant tumors are associated with right colon cancer. Repeated chronic inflammation of the oral colon is thought to be due to chronic obstruction caused by IM and vascular ischemia (9). Since 2000, 49 cases of colorectal cancer have been recognized with IM as a complication (Table I). Among these 49 patients, 41 cases of right-sided colon cancer have been reported, and most were of the non-rotation type. In recent years, many patients have been diagnosed with IM preoperatively, and the rate of preoperative diagnosis seems to be increasing in accordance with improvements in diagnostic imaging capabilities, such as three-dimensional CT scans.

Laparoscopic surgery is superior to open surgery in terms of securing the field of view in a narrow space, providing a magnifying effect, and minimal invasiveness. In addition, multiple randomized control trials investigating long-term oncological results have shown noninferior results (10, 11), and this is now a common surgical method in colorectal cancer surgery. However, it has a limited field of view and is inferior in terms of grasping the overall anatomy, which may be disadvantageous in cases of anatomical abnormalities, such as in the present case. To compensate for such issues, it is important to understand the anatomy using preoperative imaging and select an appropriate approach.

In this case, the preoperative three-dimensional CT scan showed IM, and although the ileal blood vessels ran to the left, it was confirmed that they branched from the SMA/V as usual and that there was no branching malformation. Adhesion is observed in many cases, including the present one, possibly because of chronic inflammation. First, by firmly detaching the adhesions and releasing the shortening of the mesocolic ligament, the ileocecal region of the present case was repositioned to the lower right abdomen, resembling the standard anatomical positional relation. As a result, the ileal arteriovenous root was identified accurately and safely, and dissection was performed sufficiently.

Conflicts of Interest

The Authors declare that they have no competing interests in relation to this study.

Authors' Contributions

R.M. and N.M. conceived and performed the operation. Data collection was performed by R.M. and N.M. The first draft of the manuscript was written by R.M. and N.M. T.I., S.N., Y.S., T.H., A.H., T.O., H.T, M.T., Y.K., M.U., Y.D., and H.E. commented on previous versions of the manuscript. All Authors have read and approved the final manuscript.

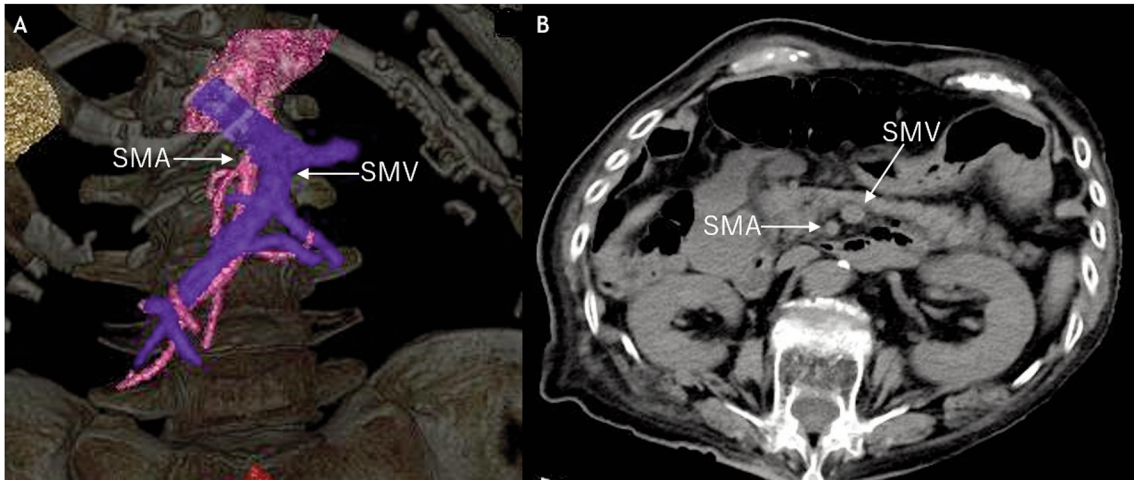

Figure 4. *Computed tomography (CT) scan and reconstructed images. A) Three-dimensional CT angiography and B) abdominal CT scan showing superior mesenteric vein (SMV) located on the left side of superior mesenteric artery (SMA).*

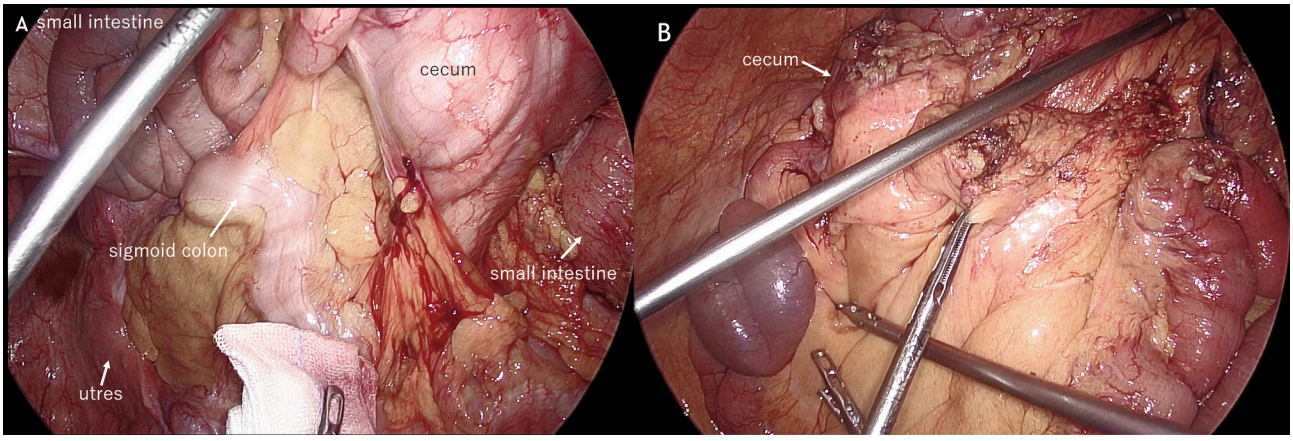

Figure 5. *An intraoperative photograph. A) The ileum was fused to the sigmoid colon and the small intestine was present in the left and right abdominal cavities. B) Image after division of adhesion.*

Funding

No funding was received for this study.

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Table I. *Literature review for cases of colorectal cancer with intestinal malrotation*.

Year	Author (Ref)	Age	Sex	Site	Type	Preoperative diagnosis of IM	Operation
2001	Sato *et al*. (12)	60	M	Appendix	Non-rotation	Yes	Open
2003	Sasaki *et al*. (13)	71	F	Ascending	Non-rotation	No	Open
2004	Fujita *et al*. [rev in (1)]	55	F	Sigmoid	Non-rotation	Yes	Open
2004	Uchida *et al*. (14)	57	M	Transverse	Non-rotation	Yes	Open
2005	Oku *et al*. [rev in (15)]	56	M	Ascending	Non-rotation	Yes	Open
2007	Sakaizawa *et al*. [rev in (16)]	84	M	Transverse	Non-rotation	Yes	Open
2007	Yamamoto *et al*. (17)	63	F	Rectum	Non-rotation	Yes	Laparo
2008	Seki *et al*. [rev in (16)]	88	F	Transverse	Non-rotation	No	Open
2009	Nakasone *et al*. (18)	71	F	Sigmoid	Non-rotation	Yes	Open
2009	Itatani *et al*. (19)	61	M	Transverse	Non-rotation	Yes	Open
2009	Brillantino *et al*. (20)	34	M	Cecum	Non-rotation	No	Open
2009	Ren *et al*.(9)	45	M	Ascending	Non-rotation	No	Open
2009	Kobayashi *et al*. [rev in (21)]	60	M	Ascending	Incomplete rotation	Yes	Open
2009	Takahashi *et al*. [rev in (15)]	84	M	Ascending	Non-rotation	Yes	Laparo
2010	Ito *et al*. [rev in (21)]	67	F	Transverse	Non-rotation	Yes	Open
2010	Michalopoulos *et al*.(22)	76	M	Ascending	Incomplete rotation	No	Open
2010	Fukuhara *et al*. [rev in (21)]	76	F	Cecum	Non-rotation	No	Open
2011	Kokubo *et al*.(23)	73	M	Cecum	Incomplete rotation	Yes	Open
2012	Taiyo *et al*. [rev in (1)]	53	F	Sigmoid	Non-rotation	Yes	Open
2012	Sekizawa *et al*. (24)	56	F	Rectum	Incomplete rotation	Yes	Open
2012	Tokai *et al*.(25)	79	M	Transverse	Non-rotation	Yes	Laparo
2012	Morimoto *et al*.(26)	57	M	Cecum	Incomplete rotation	No	Laparo
2013	Maeda *et al*. [rev in (16)]	48	M	Transverse	Non-rotation	Yes	Open
2013	Hirano *et al*. [rev in (16)]	82	F	Transverse	Incomplete rotation	Yes	Laparo
2013	Nakatani *et al*.(16)	78	M	Cecum	Non-rotation	No	Laparo
2013	Sakaguchi *et al*.(21)	78	M	Cecum	Non-rotation	No	Laparo
2013	Donaire *et al*.(27)	52	M	Ascending	Non-rotation	No	Laparo→ open
2013	Hirano *et al*.(28)	68	F	Ascending	Non-rotation	Yes	Laparo
2014	Enomoto *et al*. (15)	48	M	Transverse	Non-rotation	Yes	Laparo
2014	Kuroda *et al*. [rev in (16)]	64	F	Transverse	Non-rotation	Yes	Laparo
2014	Takahashi *et al*. [rev in (16)]	53	F	Ascending	Incomplete rotation	Yes	Laparo
2014	Fujii *et al*. [rev in (16)]	73	F	Cecum	Non-rotation	Yes	Open
2014	Norris *et al*. (29)	64	F	Cecum	Non-rotation	Yes	Open
2015	Kuwahara *et al*. [rev in (16)]	54	F	Transverse	Non-rotation	Yes	Laparo
2015	Morioka *et al*. [rev in (16)]	65	M	Cecum	Non-rotation	Yes	Laparo
2015	Ray *et al*. (1)	60	F	Cecum	Non-rotation	No	Open
2015	Kubota *et al*. [rev in (16)]	82	M	Ascending	Incomplete rotation	Yes	Open
2016	Shima *et al*.(30)	77	M	Sigmoid	Incomplete rotation	Yes	Laparo
2016	Nakayama *et al*. (31)	63	M	Desending	Non-rotation	Yes	Open
2016	Oshiro *et al*. [rev in (16)]	75	M	Ascending, Decending	Incomplete rotation	Yes	Open
2016	Motoki *et al*. [rev in (16)]	66	M	Ascending	Non-rotation	Yes	Laparo
2017	Nishida *et al*. (32)	53	M	Sigmoid	Non-rotation	Yes	Laparo
2017	Kiya *et al*. [rev in (33)]	50	F	Cecum	Incomplete rotation	Yes	Laparo
2017	Nakatani *et al*.(16)	78	M	Cecum	Non-rotation	No	Laparo
2017	Nakatani *et al*.(16)	81	M	Cecum	Non-rotation	No	Laparo
2017	Takahashi *et al*. [rev in (16)]	78	M	Ascending	Incomplete rotation	No	Laparo
2017	Kimura *et al*. [rev in (16)]	54	F	Ascending	Incomplete fixation	Yes	Open
2021	Hayashi *et al*.(33)	78	M	Appendix	Non-rotation	Yes	Laparo
2021	Balachandran *et al*. (34)	72	F	Ascending	Incomplete rotation	Yes	Laparo
2024	Our case	80	F	Cecum	Incomplete rotation	Yes	Laparo

IM, Intestinal malrotation; Open, open surgery; Lap, laparoscopic surgery.

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Received January 15, 2024
Revised February 15, 2024
Accepted February 23, 2024