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## Laparoscopic resection of sigmoid colon cancer with intestinal malrotation: A case report

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## ABSTRACT

**INTRODUCTION:** Intestinal malrotation is a congenital abnormality which occurs due to a failure of the normal 270° rotation of the midgut. The non-rotation type is usually asymptomatic and discovered incidentally on imaging studies. Intestinal malrotation accompanied by colon cancer is extremely rare. **PRESENTATION OF CASE:** A 53-year-old male presented with postprandial abdominal discomfort. Colonoscopy showed a 14 mm polyp in the sigmoid colon and endoscopic polypectomy was performed. Pathological evaluation revealed an adenocarcinoma invading the submucosa more than 1000 μm with positive vertical and horizontal margins. A contrast enhanced computed tomography scan showed an anatomic variant of the ileocolic and inferior mesenteric arteries originating from a common channel branching from the abdominal aorta. Laparoscopic sigmoid colon resection was performed. The patient did well post operatively.

**DISCUSSION:** The usual trocar placement for laparoscopic left side colectomy was used, and we found no difficulties intraoperatively. To secure safe ligation, the divisions of the common channel branching from the abdominal aorta were exposed as in a usual D3 dissection, and the inferior mesenteric artery was ligated after confirmation of the bifurcation of the ileocolic and inferior mesenteric artery.

**CONCLUSION:** To the best of our knowledge, this is the first report of laparoscopic resection of a sigmoid colon cancer with intestinal malrotation. It was performed without difficulty using the usual trocar placement, with appropriate attention to the variant in vascular anatomy.

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## 1. Introduction

Intestinal malrotation is due to a failure of the normal 270° intestinal rotational and fixation of the intestine. This condition has subtypes, including non-rotation (zero degrees), malrotation (incomplete rotation), reversed rotation and paraduodenal hernias [1]. Intestinal malrotation is generally seen in infants less than one year of age. A retrospective review of a series of 170 symptomatic patients at a single institution found that 48% were adults [2]. Compared with other subtypes, the non-rotation type is usually asymptomatic and most often discovered incidentally on imaging studies performed for other purposes with a reported incidence of 0.2% on barium enema [3]. Intestinal malrotation is associated with congenital diaphragmatic hernia, congenital heart disease and omphalocele [1,4] but synchronous colon cancer is rare. We report

a patient with an intestinal malrotation with sigmoid colon cancer who underwent laparoscopic sigmoid resection.

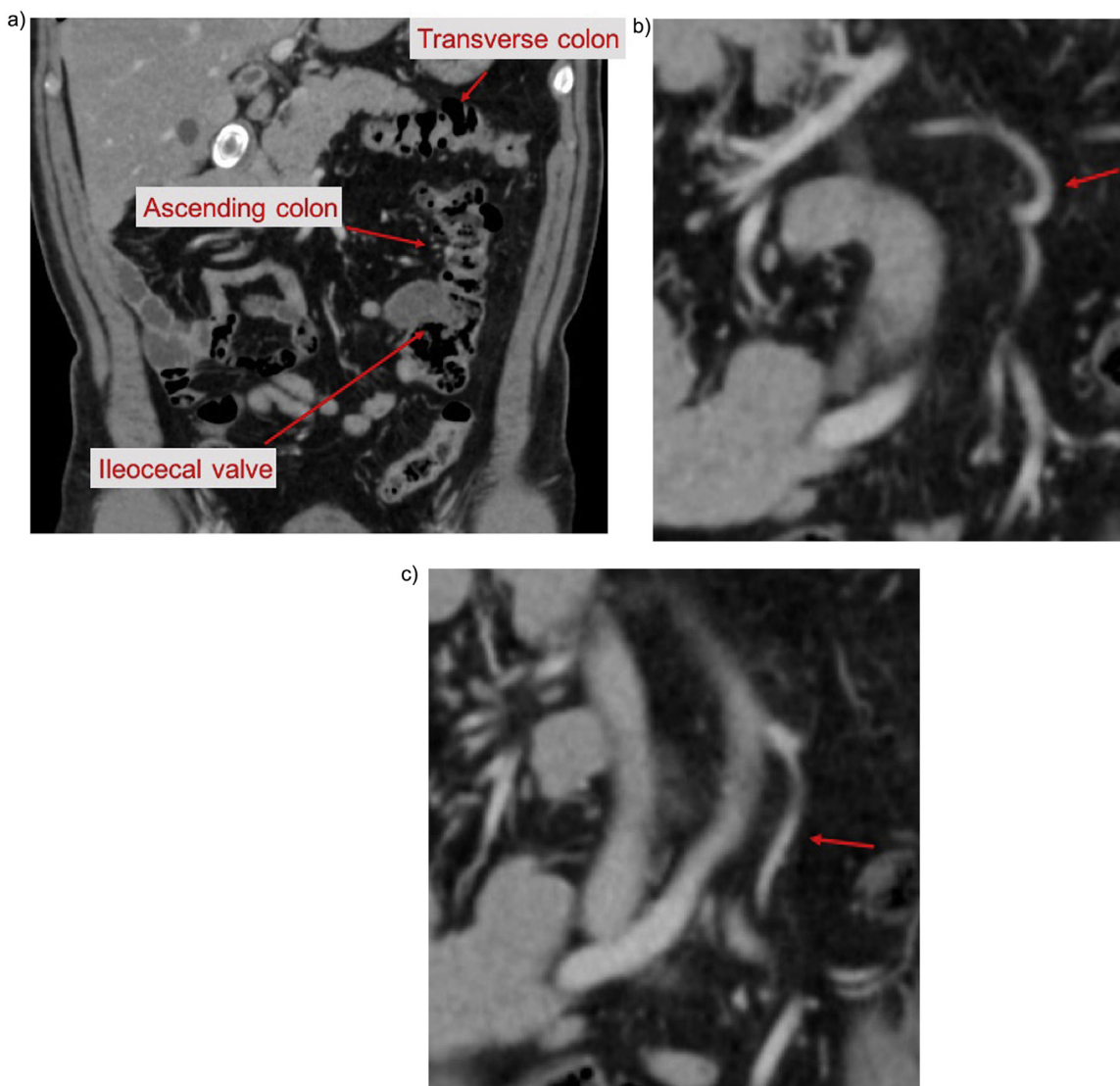
## 2. Case presentation

A 53-year-old man presented with a one year history of postprandial abdominal discomfort. Past medical history was positive for diabetes mellitus treated with linagliptin. His body mass index was 27.4 kg/m<sup>2</sup>. The physical examination was unremarkable. His serum CEA and CA19-9 levels were within normal limits. Total colonoscopy showed a 14 mm sessile polyp in the sigmoid colon and polypectomy was performed. Pathological evaluation showed a well-differentiated adenocarcinoma invading more than 1000 μm in the submucosa with both vertical and horizontal resection margins positive.

Laparoscopic sigmoid resection was planned and a contrast enhanced computed tomography scan was obtained preoperatively which showed the small bowel and colon on the right and left sides of the abdominal cavity, respectively. The ileocolic artery (ICA) and the inferior mesenteric artery (IMA) originated from a common channel which branched directly from the abdominal aorta (Figs. 1 and 2). Laparoscopic sigmoid resection with a D2 dissection

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**Fig. 1.** A contrast enhanced computed tomography scan showed the small bowel and colon in the right and left sides of the abdominal cavity, respectively (a). The ileocolic artery (arrow) (b) and the inferior mesenteric artery (arrow) (c) originate from a common channel branching directly from the abdominal aorta.

was performed using typical trocar placement (Fig. 3). Non-rotation of the intestine was confirmed at surgery. The ascending colon was free from the retroperitoneum but the descending colon was attached to the retroperitoneum and the sigmoid colon and rectum seemed anatomically normal. The IMA was divided after exposure of the common arterial channel and its branches, the ICA and the IMA. There were no technical difficulties due to intestinal malrotation. The patient did well postoperatively and was discharged on seventh postoperative day.

### 3. Discussion

Intestinal malrotation is a congenital abnormality, resulting from a less than normal  $270^\circ$  rotation of the midgut. Despite it being well-known, there is no clear definition or classification. A number of classification schemes have been suggested including a four subgroup classification (non-rotation, malrotation, reversed rotation and paraduodenal hernias) [1], three category classification (true malrotation, non-rotation and atypical malrotation) [4] and an eight subgroup classification [5] although no consensus has developed for the ideal classification. In many cases, symptomatic malrotation seen in infants is the true malrotation type with Ladd's

ligament, and asymptomatic rotation in adults is the non-rotation type. Some congenital disorders, such as diaphragmatic hernia, heart disease or omphalocele, are associated [4] but synchronous colorectal cancer is extremely rare.

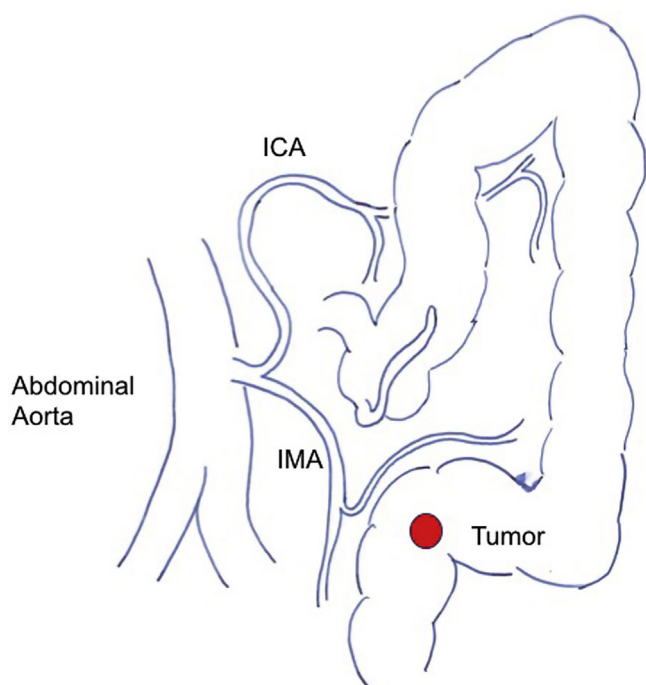
An extensive search was conducted (<http://www.pubmed.com>) for articles related to this topic, using the following search terms: "colon cancer," OR "rectal cancer," AND "intestinal malrotation." Situs inversus totalis was excluded because it is thought to be clearly distinguished from intestinal malrotation. Eleven previously reported patients were identified and are summarized in Table 1 [6–16]. Non-rotation was the most frequent type and confirmed in seven patients. Patients with non-rotation are asymptomatic and the condition is not discovered before a preoperative evaluation or at surgery.

Tumors were found in the right colon in nine patients. Ren and Lu suggest chronic intestinal obstruction caused by anatomical disorders of the colon leads to inflammation and carcinogenesis [15]. Laparoscopic surgery was performed in four patients and one underwent conversion to open laparotomy. Sigmoid colon cancer with intestinal malrotation has not been previously reported. This is the first patient with a sigmoid colon cancer, in the presence of malrotation, treated laparoscopically.

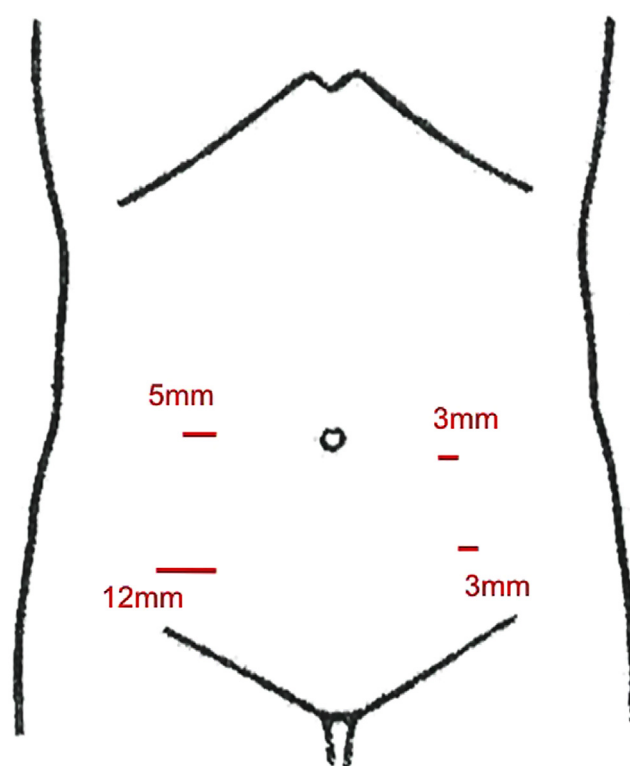
**Table 1**  
Previously reported cases of intestinal rotation with colon cancer.

No.	Author	Year	Age	Sex	Tumor Location	Type of malrotation	Procedure Open/Laparoscopic
1	Nakayama [6]	2016	63	Male	Descending colon	Nonrotation	Open
2	Norris [7]	2014	64	Female	Cecum	Malrotation	Open
3	Ray [8]	2014	60	Female	Cecum	Nonrotation	Open
4	Hirano [9]	2013	82	Female	Transverse colon	Reversed rotation	SILC
5	Hirano [10]	2013	68	Female	Ascending colon	Nonrotation	Laparoscopic
6	Donaire [11]	2013	52	Male	Right colon	Nonrotation	Laparoscopic → Open
7	Morimoto [12]	2012	57	Male	Cecum	Reversed rotation	Laparoscopic
8	Michalopoulos [13]	2010	76	Male	Ascending colon	Reversed rotation	Open
9	Brillantino [14]	2009	34	Male	Cecum	Nonrotation	Open
10	Ren [15]	2009	45	Male	Ascending colon	Nonrotation	Open
11	Gilbert [16]	1990	55	Male	Splenic flexure	Nonrotation	Open

SILC, single incision laparoscopic colectomy.



**Fig. 2.** The schema of the colon and arterial supply. ICA, ileocolic artery; IMA, inferior mesenteric artery.

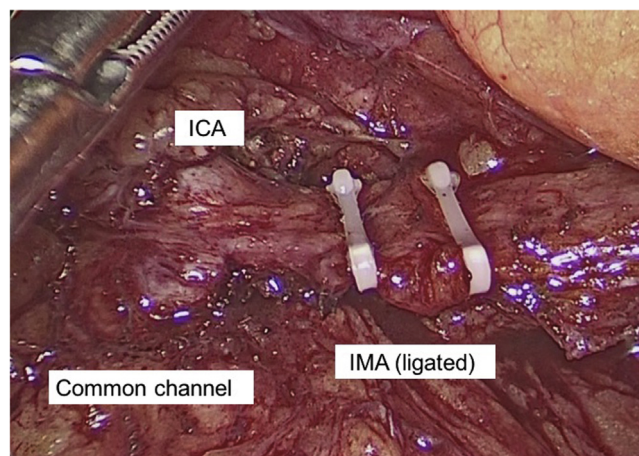


**Fig. 3.** Trocar placement.

**3.1. Operative technique**

The usual trocar placement for laparoscopic left side colectomy was used (Fig. 3), because the large intestine including the descending colon to the rectum appeared anatomically normal based on preoperative imaging. Intraoperatively, we found no difficulties due to trocar placement. If one is performing a right colectomy, as reported in a patient who underwent conversion to open surgery [11], intraoperative position and port insertion may need more individualization.

Variations in arterial anatomy with intestinal malrotation have been rarely reported. Uchida et al. described a patient with intestinal non-rotation with a middle mesenteric artery [17]. In the present patient, an arterial abnormality, with a common channel giving rise to the ICA and IMA, was preoperatively suspected by imaging. According to recent Japanese guidelines [18], T1(SM) lesions do not require a D3 dissection and a D2 dissection is adequate. To secure safe ligation, the divisions of the common channel branching from the abdominal aorta were exposed as in a usual D3 dissection, and the IMA was ligated after confirmation of the bifurcation of the ICA and IMA (Fig. 4). If an arterial abnormality exists,



**Fig. 4.** The divisions of the common channel branching from the abdominal aorta were exposed as in a usual D3 dissection. ICA, ileocolic artery; IMA, inferior mesenteric artery.

intraoperative peri-tumoral subserosal injection of patent blue violet dye [14] or preoperative endoscopic submucosal injection with India ink [17] may be useful to identify the lymphatic drainage.

#### 4. Conclusion

We report a patient with a sigmoid colon cancer who also had intestinal malrotation. Laparoscopic sigmoid resection was readily performed using the usual trocar positions. Attention was paid to a variation in vascular anatomy.

**This case report is compliant with SCARE guidelines [19].**

#### Conflict of interests

The authors declare they have no conflicting interests.

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This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

#### Ethical approval

This case report was approved by the committee of our institution.

#### Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editor of the journal on request.

#### Author's contributions

KN gathered patient's date, designed the case report and drafted manuscript. TK have made substantial contribution to the conception and design of the case study. AL wrote and supervised the report. TS conceived of the study and participated in its design and coordination. All author read and approved the final manuscript.

#### Registration of research studies

This is not a research study.

#### Guarantor

Kazuhiro Nishida.

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