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Case Report

Extended Left Colectomy with Coloanal Anastomosis by Indocyanine Green-guided Deloyers Procedure: A Case Report

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Abstract

The Deloyers procedure is performed after extended left colectomy, enabling the reach of the proximal colon to the rectum for anastomosis while preserving sufficient blood supply. We report a case of the Deloyers procedure performed safely under indocyanine green (ICG) fluorescence guidance.

A 50-year-old man with obesity (body mass index, 35.7 kg/m^2) and a history of diabetes underwent an extended left hemicolectomy and ultralow anterior resection of the rectum as radical resection for transverse and sigmoid colon cancers and a lower rectal neuroendocrine tumor. Reconstruction was performed by the Deloyers procedure. A necessary length of the transverse colon with reduced blood flow was additionally resected under ICG fluorescence guidance, and a transanal hand-sewn coloanal anastomosis was performed.

This is the first report in which the Deloyers procedure was performed successfully with the ICG fluorescence method. ICG fluorescence may be useful when combined with the Deloyers procedure.

Keywords

Deloyers procedure, extended left colectomy, indocyanine green

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Introduction

The Deloyers procedure is a well-known method used when the transverse colon cannot reach the rectum after resection of extended left hemicolectomy. In this procedure, the right colon is completely mobilized and rotated to the rectum or anus (Figure 1)[1,2]. To maintain bowel function after surgery, the length of the ascending colon is kept as long as possible. However, insufficient blood flow to the distant anastomosis from the ileocolic artery leads to anastomotic concerns, including leakage or stenosis. The rates of anastomotic leakage and stenosis reported after the Deloyers procedure are 0%-10% and 0%-2%, respectively[2,3], which are not much higher than those after other colorectal surgeries. However, only a few cohort studies have reported the outcome of the Deloyers procedure, and they mentioned mainly colorectal anastomosis. With coloanal anastomosis, anastomotic complications may occur at a higher rate. Therefore, it is vital to evaluate blood flow to the residual colon and anastomosis. Previous studies have shown that intraoperative indocyanine green (ICG) fluorescence imaging is useful in assessing anastomotic perfusion, especially in left-sided colorectal surgery[4,5]. Here we report, for the first time, a case of extended left hemicolectomy with the Deloyers procedure with successful anastomosis under ICG fluorescence guidance.

Case Report

A 50-year-old man was diagnosed with coexisting transverse colon cancer, sigmoid colon cancer, and a neuroendocrine tumor in the lower rectum. The patient had a history

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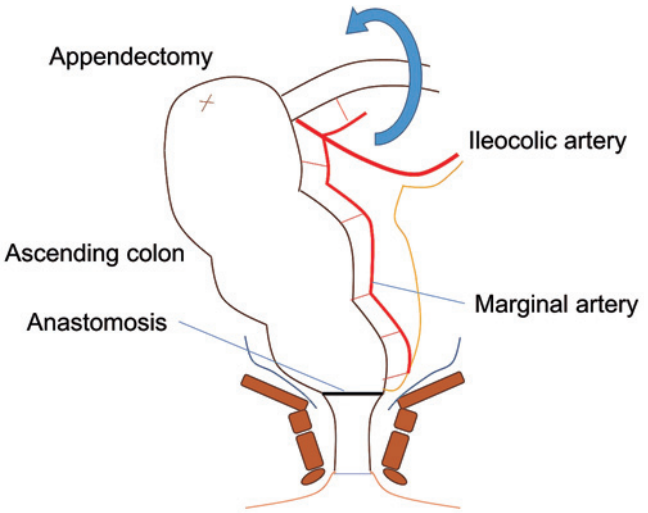

Figure 1. Scheme of the Deloyers procedure. The method was started by a complete mobilization of the right colon and the hepatic flexure. The right colic artery and the middle colic artery were transected proximally, and the right mesocolon was sectioned up to the upper edge of the ileocolic artery. After resection of the additional de-vascularized colon and appendix, the fully mobilized remaining colon was turned in a counterclockwise direction, and the coloanal anastomosis was performed.

Figure 2. A computed tomography colonography after colonoscopy, showing the locations of the three lesions. Two early colon cancers were located at the splenic flexure (→) and sigmoid colon (△). The submucosal tumor was located at the lower rectum (▲).

of diabetes mellitus, with an HbA1c of 7.4% and gout. His height was 173.0 cm, his weight was 107.0 kg, and his body mass index (BMI) was 35.7 kg/m^2, categorized as severe obesity.

Presurgical examinations showed that all three lesions needed surgical resection. Computed tomography scans showed no lymph node metastasis or distant metastasis. The lesion of the transverse colon was located at the splenic flexure (Figure 2). The rectal submucosal tumor was 2.5 cm in diameter, and its distal edge was located at 4 cm from the anal verge (Figure 3). It was diagnosed as a neuroendocrine tumor (G1) by a core needle biopsy.

Radical surgery was indicated, and we began with laparoscopic-assisted extended left hemicolectomy. The inferior mesenteric artery and the left branch of the middle colic artery were dissected at the root. The rectum was dissected from the anus at the level of the upper margin of the anal canal by a linear stapler. Anastomosis of the transverse colon and the anal canal was attempted, but was unsuccessful because of a limited reach of the remaining sections. Further laparoscopic reconstruction was difficult owing to the patient's severe obesity, and we converted the operation to laparotomy. The ileocecal portion and right colon were additionally mobilized to perform reconstruction using the Deloyers procedure. The right branch of the middle colic artery and the right colic artery were dissected.

In this situation, the ICG fluorescence method was used to preserve as much of the length of the ascending colon as possible, keeping the anastomosis well-perfused. Twenty-five milligrams of ICG powder was diluted in 10 mL of sterile water, and 5 mL was administered intravenously for fluorescence during surgery (a total of 12.5 mg per patient). The blood perfusion of the proximal colon was evaluated using a near-infrared (NIR) camera (Olympus, Tokyo, Japan), and the demarcation line between the green and non-green areas was identified clearly (Figure 4). The section of the transverse colon with reduced blood flow, measuring 20 cm in length, was additionally resected (Figure 5). The ascending colon was rotated 180° counterclockwise around the ileocolic artery, guided carefully to the anus. The staple line was removed by an abdominal procedure, and a transanal hand-sewn coloanal anastomosis was performed at the upper edge of the anal canal. A covering ileostomy was constructed.

A pathological examination showed that all three lesions had been removed successfully.

Oral intake was resumed on the fifth postoperative day. Once the patient demonstrated the ability to manage the covering ileostomy, he was discharged from the hospital on the 16th postoperative day, with no morbidity. Anorectal manometry 7 months after the operation revealed a maximum resting pressure of 47 mmHg and a maximum squeeze pressure of 240 mmHg, both of which were within normal limits. Anal function was tolerably preserved after the surgery for a very low rectal tumor, the Cleveland Clinic Florida Fecal Incontinence Score[6] was 11, and diarrhea was managed with probiotics after the ileostomy closure.

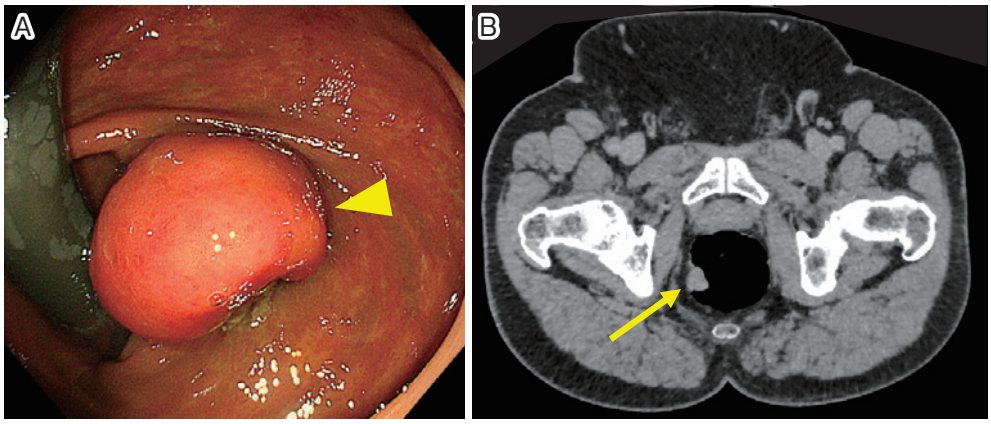

Figure 3. (A) Rectal retroflexion of colonoscopy showing that a 25-mm submucosal tumor was located at 4 cm from the anal verge (▲). It was diagnosed as a neuroendocrine tumor (G1) by a core needle biopsy.
(B) A computed tomography scan showing the 25-mm submucosal tumor located at the right wall of the lower rectum (→).

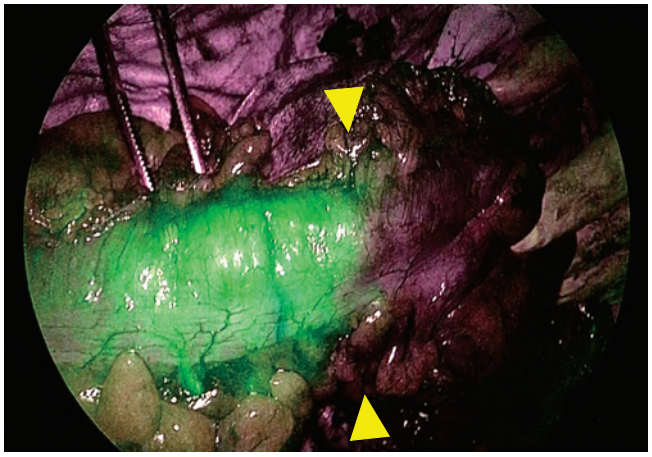

Figure 4. ICG fluorescence imaging of the remaining colon, taken 30 seconds after an intravenous injection of ICG (12.5 mg). Blood flow of the colon was evaluated with a NIR camera fixed 10 cm apart from the bowels in a completely dark operative room. The left side of the line between two arrows (▲) was the proximal colon, and dyed green by ICG, which means that it was well-perfused. The colonic segment distal to this line was not dyed owing to the poor blood flow.

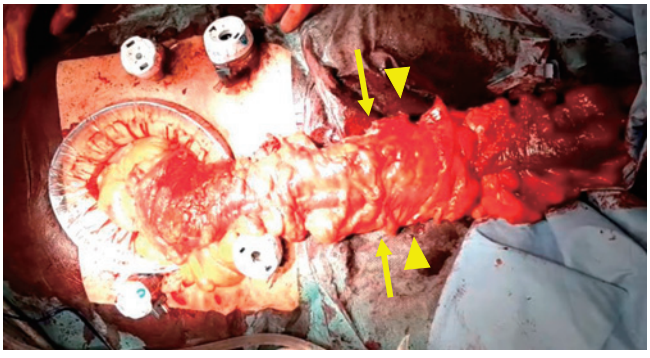

Figure 5. The right colon was extracorporeally rotated counterclockwise to the anus. The left side of the picture shows the cranial view and the right side shows the caudal view. The right side of the line between two arrows (▲) was the distal colon, which was additionally resected owing to the poor blood flow after evaluation using ICG imaging. The remaining colon reached the line 2 fingerbreadth below the pubis (→), which meant that it had enough length for tension-free coloanal anastomosis.

Discussion

The Deloyers procedure was originally reported by Lucien Deloyers in 1964. Although tension-free colorectal or coloanal anastomosis can be achieved by dividing the middle colic artery, it should be noted that blood flow to the proximal colon is perfused only from the ileocolonic artery[1,2,7]. Sufficient blood flow to the anastomosis is necessary to prevent anastomotic complications. Simultaneously, much of the length of the ascending colon should be preserved to maintain bowel function after the operation. Therefore, it is essential to evaluate the blood flow of the remaining colon for the anastomosis, especially in this case as the patient's BMI was higher than 35 kg/m^2 and he suffered from diabetes, both of which are risk factors for anastomotic leakage[8,9].

In recent years, several studies have reported that the ICG fluorescence method is useful in evaluating the blood flow of the bowels[10-13]. Intravenously administered ICG can be observed where blood supply to the bowel is preserved; hence, it is possible to visually inspect blood flow to the bowel rapidly. Previous reports indicated that the rate of anastomotic leakage (AL) on low anterior resection was decreased markedly by using the ICG fluorescence method. Kudszus et al. showed that the ICG fluorescence method

could reduce the AL rate by 4% compared with a control group (7.5% vs. 3.5%) in colorectal surgery[4]. In low anterior resection, Jafari et al. reported that the ICG fluorescence method resulted in a change of the initially planned dissection line by 19% and that the AL rate was decreased by 12% compared with a control group (18% vs. 6%)[11].

Although there have been many reports of ICG to evaluate the blood flow of anastomoses, there is no report of ICG imaging applied to the Deloyers procedure. In the Deloyers procedure, the remaining colon should be kept as long as possible to preserve colonic function; hence, it is necessary to evaluate bowel blood flow precisely. Therefore, we believe that ICG imaging is especially beneficial and worth reporting. As this is a single case, it is necessary to conduct a broader study in the future to determine the full efficacy of this treatment method.

We previously reported a case of laparoscopic Deloyers procedure, showing that it is less invasive than laparotomy and results in a good functional outcome[7]. Other studies show supporting evidence regarding the benefits of the Deloyers procedure over laparoscopic surgery[3,14]. However, in this case, we decided that conversion to laparotomy was a safer surgical choice because of the obesity of the patient, a contracted pelvis, and the short distance from the anus to the distal dissection line.

In conclusion, we experienced a case of extended left colectomy with ICG fluorescence imaging to confirm the blood flow to the remaining colon in the Deloyers procedure. ICG fluorescence imaging may be useful in determining the dissection line of the proximal colon in the Deloyers procedure.

Conflicts of Interest

no conflicts of interest.

Authors' Contributions

KO, SE, KS, and SI carried out the diagnosis of the tumor and carried out the surgery of this patient. KO, SE, KS, KK, and SI participated in the patient's care. KO, SE, KS, HN, KK, KM, YI, HI, YY, HA, HS, and SI participated in writing and revising the manuscript critically. All authors read and approved the final manuscript.

Approval by Institutional Review Board (IRB)

This study was approved by the Ethics Committees of the University of Tokyo (No. 3252-(9)).

Informed Consent

Written informed consent to participate and to publish was obtained from the patient.

Disclaimer

Soichiro Ishihara is the Editor-in-Chief of Journal of the Anus, Rectum and Colon and on the journal's Editorial Board. He was not involved in the editorial evaluation or decision to accept this article for publication at all.

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