Stenotic ischemic colitis treated with laparoscopy-assisted surgery

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Abstract
Ischemic colitis is the most common type of intestinal ischemia, and it is more prevalent in the elderly. Boley et al. first reported 5 cases of IC, and defined reversible microvascular occlusion of the colon without apparent blockage of main artery. Marston et al. classified IC into 3 types: transient, strictures, and gangrene. Currently, colonic ischemia is categorized, according to its severity and clinical presentation, as follows: reversible colonopathy, transient colitis, chronic colitis, stricture, gangrene, and fulminant universal colitis. In most cases of IC, conservative therapy is effective, which includes the following vital components: intravenous fluid administration, hemodynamic stabilization, discontinuation or avoidance of vasoconstrictive agents, bowel rest, and empiric antibiotics. Stamatakos et al. reported that approximately one-third of patients with colonic ischemia subsequently develop chronic segmental colitis and strictures. In the acute phase, exploratory laparotomy may be needed in patients with peritoneal irritation signs.
massive bleeding, and fulminant IC. In these cases, right hemicolectomy and primary anastomosis is performed in right-sided IC, whereas left-sided IC is managed with a proximal stoma and mucous fistula. However, patients with a chronic stricture have enough time to prepare for surgery, and thus, they may benefit from less invasive surgery and avoidance of stoma, leading to improved quality of life.

Here, we report the case of a patient with IC, in whom we performed laparoscopy-assisted left colectomy and primary anastomosis for the long strictured segment of the colon, and we have also provided a mini-review of the literature.

CASE REPORT
A 73-year-old male patient suffering from diabetes mellitus for 10 years presented with sudden lower abdominal pain and was subsequently referred to our hospital. When he was brought to our hospital, he had begun to have a gross hematochezia. The abdomen was flat and soft with mild tenderness in the lower abdomen, but no peritoneal irritation signs. There were no findings suggestive of inflammatory bowel disease such as aphthae in the mouth and anal fistula. Blood test results suggested that he had anemia (hemoglobin level, 13.2 g/dL) and mild inflammation (white blood cell count and C-reactive protein level: 13,000/μL and 1.2 mg/dL, respectively). The serum levels of carcinoembryonic antigen and carbohydrate antigen 19-9 were within the normal range (1.8 ng/mL and 18 U/mL, respectively). On analysis of the fecal culture, amoeba and enterohemorrhagic Escherichia coli were not observed. Lower gastrointestinal endoscopy revealed mucosal omission in the entire circumference of the colonic wall with slight hemorrhagic erosions suggestive of inflammatory bowel disease such as aphthae in the mouth and anal fistula. Histopathologically, significant fibrosis and inflammatory cell infiltration were observed in the submucosa (Figure 4B). These findings were consistent with those of IC.

The patient was discharged on postoperative day 9, without any postoperative complications. He is alive at more than 12 mo and is being followed-up closely.

DISCUSSION
The etiology of IC is multifactorial, and its diagnosis is based on a combination of clinical suspicion, endoscopic and histological findings. Even though treatment depends on the severity of the disease, conservative therapy is effective in most cases of IC. However, there are patients who need surgical treatment. Approximately 20% of patients with acute IC require surgery. In general, surgery is indicated in patients with chronic stenotic colitis, gangrene colitis, and fulminant universal colitis. A recent study also reported that clinical patterns of IC included reversible colopathy (26.1%), transient colitis (43.7%), gangrenous colitis (9.9%), fulminant pancolitis (2.5%), and chronic segmental colitis (17.9%). In the disease group requiring surgery, especially in the chronic stenotic colitis group, endoscopic treatment and minimally invasive surgery have been attempted.

Laparoscopic surgery is a typical method of minimally invasive surgery; however, coherent investigations of laparoscopic surgery for IC have not yet been reported. Furthermore, ischemic lesions are rare in the small intestine because of rich collateral circulation. Hence, we reviewed and summarized 6 cases (including ours) of laparoscopic surgery for ischemic enterocolitis (Table 1).

There exist no strict criteria for the surgical treatment of chronic IC. Brandt et al. reported that a patient with severe IC would typically recover in 1-6 mo. Even if the stenosis exists, effect of bougie by the own fecal or gas which transit digestive tract might relieve the stenosis. However, in the case that clinical symptoms interfere with activities of daily living, surgical treatment should
be considered. The median duration until surgery was found to be 65.5 d (range: 28-100 d) (Table 1); in general, prolonged clinical symptoms over 2 mo should be considered as an indication of surgical treatment. Conversely, transendoscopic dilation or stenting has the potential to be an alternative to surgery, and several such studies have been reported. When deciding between surgical treatment and endoscopic therapy, length of stenosis is one of the important factors. Solt et al have reported that the median stenotic length was 1.5 cm (range: 1-5 cm) in 57 cases of balloon dilation for benign disease. Keränen et al summarized the previous report and reported that the median stenotic length was 4.5 cm in patients who were treated with self-expanding metallic stents (SEMSs). The longest stenosis successfully treated by SEMS was 8 cm. Thus, it is believed that endoscopic treatment is technically possible for straight colonic strictures; however, cases of longer stenosis or flexure location are considered difficult. In laparoscopically treated IC patients, the length of the stenosis was 15 cm in 2 patients. One patient showed a 5-cm long stenosis, but the location was right-sided (Table 1). Surgical treatment is considered to be more useful when the site of stenosis is the right-sided colon or hepatic and splenic flexure, when the stenosis is over 10-cm long.

Thus far, no study has focused on surgical treatment in chronic stenosis. Surgical intervention for IC has been applied to relatively severe cases, and a high mortality rate of 10%-48% has been reported. Scharff et al reported that the mortality rate of surgery was 17.6% (3/17) even after conservative treatment. In addition, the primary anastomosis rate was 33%-72.5% and in many cases of surgery, the stoma had been forced. The following rates of complications in endoscopic treatment have been reported: 0% (0/57), 18.7% (10/21), 15.0% (8/21), and 28% (7/25), and thus, endoscopic treatment is considered acceptable and useful as a bridging treatment before surgery. Furthermore, colostomy can be avoided with endoscopic stenting, but endoscopic stenting is temporary and should only be a bridge to surgery. Among the reported cases of laparoscopic surgery, the mean operative time was 222 min, the mean postoperative hospital stay was 12.3 d, and there were no cases of surgical complications or colostomy. Even though a comparison is not appropriate because of the

Figure 1  Endoscopic findings. A: Initial endoscopic findings, with entire mucosal deficiency and oozing at 20 cm from the anal verge; B: Strictures colon wall after conservative treatment.

Figure 2  Computed tomography and 3D reconstituted imaging. A: Computed tomography shows the stricture descending colon wall (arrow); B: Strictures colon for a length of 15 cm (arrows).

Figure 3  Radiographic contrast study of the lower gastrointestinal tract.
Table 1  Reported cases of laparoscopic surgery for ischemic enterocolitis

| Case No. | Age (yr) | Gender | Site of stenosis | Length of stenosis (cm) | Duration until operation (d) | Procedure | Stoma | Operation time (min) | Amount of bleeding (mL) | Complications | Postoperative hospital stay (d) |
|----------|----------|--------|------------------|------------------------|----------------------------|-----------|-------|---------------------|------------------------|--------------|-------------------------------|
| 1        | 68       | Female | Splenic flexure  | 15                     | 63                        | Left colectomy | -     | 260                 | 100                    | -            | 15                            |
| 2        | 76       | Female | Ascending        | 5                      | 30                        | Right colectomy | -     | 210                 | 81                     | -            | 9                             |
| 3        | 60       | Male   | Jejunum          | 6                      | 100                       | Partial resection | -     | 180                 | ND                     | -            | 14                            |
| 4        | 51       | Male   | Jejunum          | 3                      | 28                        | Partial resection | -     | ND                  | ND                     | -            | 13                            |
| 5        | 66       | Male   | Jejunum          | 4                      | 68                        | Partial resection | -     | ND                  | ND                     | -            | 14                            |
| Our case | 73       | Male   | Descending       | 15                     | 80                        | Left colectomy  | -     | 240                 | 110                    | -            | 9                             |

ND: Not detected.

Figure 4  Laparoscopy-assisted left colectomy. A: Macroscopic appearance of the resected specimen; B: Histopathological findings of the stricutured colon (HE, staining × 40).

Differences in patient backgrounds, in conventional open surgery, the mean operative time ranged from 135 to 165 min [18,21], and the postoperative hospital stay was 12-13 d [18,22]. Laparoscopic surgery tends to be associated with a long operating time; however, it is considered a safe and feasible option in cases where the clinical symptoms persist even after conservative therapy and in cases of stenosis exceeding 10 cm in length. In the near future, even in the acute phase, it is expected that colostomy can be avoided by a combination therapy of decompression by endoscopic treatment and laparoscopic surgery, thus producing a favorable effect on the quality of life.

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