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[Case Report]

## Delayed perforation after endoscopic submucosal dissection for mucosal colon cancer : A conservatively treated case

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### Abstract

A 66-year-old man was diagnosed from colonoscopy as having a 40-mm elevated tumor in the cecum. With a preoperative diagnosis of intramucosal carcinoma, endoscopic submucosal dissection (ESD) was performed. The tumor was resected *en bloc*, yielding a specimen with a 66-mm diameter. No perforation was detected during the operation.

Although neither abdominal pain nor fever was observed immediately after ESD, abdominal pain developed on the following day. Two days after ESD, the abdominal pain ceased. The patient was managed conservatively with fasting and intravenous antibiotic treatment. Four days after ESD, abdominal X-ray revealed marked gas retention. Computed tomography revealed pneumoperitoneum and a pelvic abscess, leading to a diagnosis of delayed perforation after colonic ESD and paralytic intestinal obstruction. A decompression tube was then inserted transnasally into the small intestine. Because a gradual decrease occurred in intestinal gas, the decompression tube was removed. Oral ingestion was resumed 13 days post-ESD.

Delayed perforation after colonic ESD often requires emergency surgery. The present case was managed conservatively, despite paralytic intestinal obstruction. This approach is rarely employed for this condition and is therefore worth reporting.

**Keywords :** colon cancer, complication, endoscopic resection, endoscopic submucosal dissection, perforation

### Introduction

Endoscopic mucosal resection (EMR) is the standard treatment worldwide for colon tumors that invade no deeper than the mucosa<sup>1)</sup>. However, according to the lesions' size and location, not all of them can be removed *en bloc* using EMR. For such lesions, endoscopic submucosal dissection (ESD) might be a better option. Although ESD is gaining popularity in Japan, the colon has a thinner wall compared to the stomach. For that reason, it is associated with poor scope operability, especially in the deep colon<sup>2,3)</sup>. Colonic ESD is technically complicated and is associated with risks of various adverse

events (AEs)<sup>4,5)</sup>.

The most common AEs associated with colonic ESD are hemorrhage and perforation, which can occur not only during an operation but also thereafter. In particular, post-ESD delayed perforation is a rare but severe AE<sup>6)</sup>. Post-ESD delayed perforation can engender severe peritonitis because of extraintestinal leakage of fecal fluid and intestinal bacteria; in fact, it often requires emergency surgery<sup>6)</sup>.

This report presents a case of delayed perforation after colonic ESD for an epithelial tumor in the cecum. This case is being reported because it followed a rare clinical course during which the perfo-

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ration was managed conservatively.

### Case Report

A 66-year-old man tested positive for fecal occult blood at a health screening. He underwent colonoscopy (CS) at a local clinic, which revealed a 40-mm superficial epithelial tumor in the cecum. The lesion had the morphological feature of a "lateral spreading tumor." The tumor was diagnosed endoscopically as an adenoma or a carcinoma in adenoma after detailed CS examination at our hospital. *En bloc* resection was preferred. ESD was selected after obtaining informed consent (Figs. 1a and 1b).

The ESD was performed using a scope (PCF-Q260JI; Olympus Medical System Corp., Tokyo, Japan) and a high-frequency generator (VIO300D; Erbe Elektromedizin, Tübingen, Germany). After sodium hyaluronate solution (MucoUp; Johnson & Johnson K.K., Tokyo, Japan) was injected into the submucosa, the mucosal incision and submucosal

dissection were conducted using a Dual-Knife (Olympus Medical System Corp., Tokyo, Japan). The submucosal dissection could not be completed with the Dual-Knife alone because of moderate fibrosis. Therefore, a SB-Knife Jr (Sumitomo Bakelite Co. Ltd., Tokyo, Japan) was also used as needed. Large blood vessels and hemorrhage encountered during the operation were coagulated with hemostatic forceps (Coagrasper; Olympus Medical System Corp., Tokyo, Japan). After resection, residual vessels in the ulcer bed were also coagulated with hemostatic forceps (Fig. 1c). Neither perforation nor damage to the muscular layer was observed during the operation. Therefore, prophylactic closure with clips was not conducted. The resected specimen was later examined pathologically and characterized as having specimen diameter of 66 × 56 mm, with tumor diameter of 40 × 36 mm, histological type of carcinoma in adenoma, and a cancerous component of a well-differentiated tubular adenocarcinoma. The lesion showed invasion no deeper than the mucosa (Fig. 2).

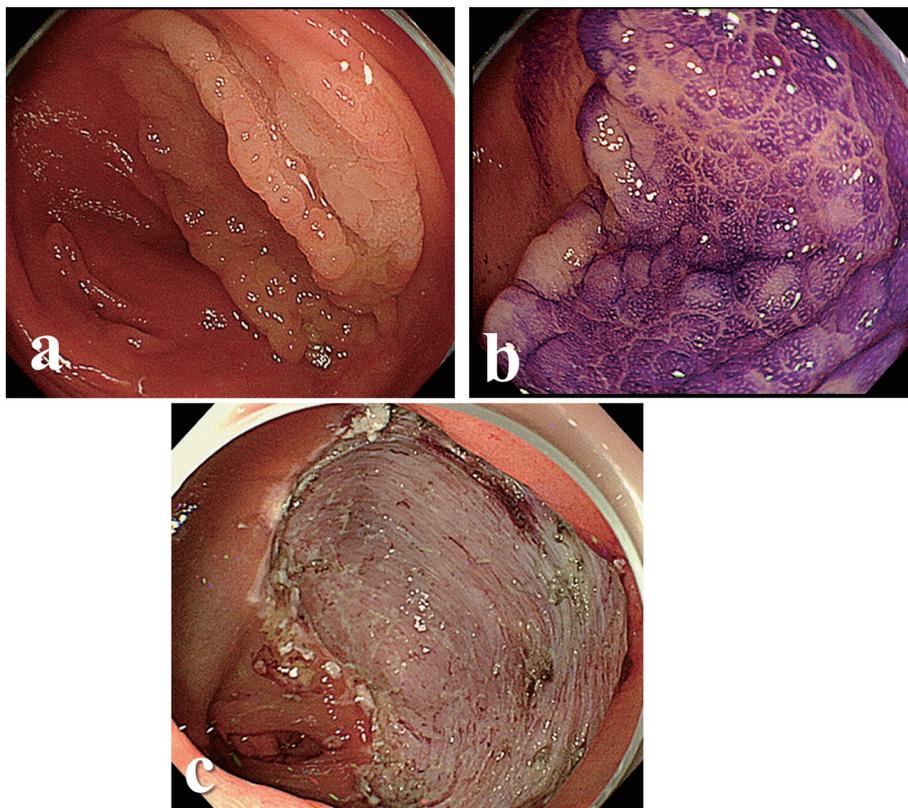


Fig. 1. Endoscopic images of a colon tumor.  
 a A 40-mm superficially elevated tumor was detected in the cecum.  
 b Crystal violet staining. According to the pit pattern classification, the tumor was classified predominantly as Type IIIs.  
 c These images were taken after exposed blood vessels in the ulcer bed were coagulated with hemostatic forceps. No apparent damage to the muscular layer was detected.

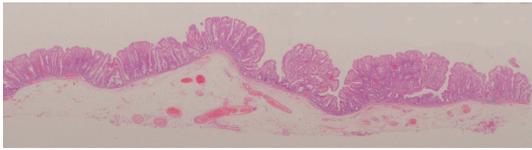


Fig. 2. Loupe image of the resected specimen from endoscopic submucosal dissection (hematoxylin-eosin staining). Submucosal dissection was performed at an appropriate depth. No evidence of damage caused by thermocoagulation was observed.

On the day after ESD, a fever of 38°C and mild abdominal pain developed. Peripheral blood tests showed no evidence of inflammation, with a white blood cell (WBC) count of 6,500/ $\mu$ L and C-reactive protein (CRP) of 0.12 mg/dL. Abdominal X-ray revealed no pneumoperitoneum (Fig. 3). The abdominal pain became aggravated at night on the same day but was relieved by intravenous (IV) injection of an analgesic (15 mg pentazocine, 25 mg hydroxyzine). By nighttime, the fever had ceased. Therefore, no abdominal computed tomography (CT) was taken.

Two days post-ESD, a fever of 38°C developed again, despite reduced abdominal pain. A peripheral blood test revealed a normal WBC of 4,300/ $\mu$ L and increased CRP of 26 mg/dL. The abdomen appeared flatulent, but no abdominal pain was noted. Based on these findings, post-ESD electrocoagulation syndrome (PEECS), a condition characterized



Fig. 3. Abdominal X-ray taken on the day after endoscopic submucosal dissection. Neither pneumoperitoneum nor evidence of intestinal obstruction was observed.

by post-ESD localized inflammation leading to intestinal paralysis, was suspected. Antibiotic treatment (cefmetazole sodium at 2 g/day) was continued under fasting conditions. Because symptoms of this patient were not severe, abdominal CT was not taken.

Four days post-ESD, an abdominal X-ray revealed pneumoperitoneum over the liver surface and evidence of intestinal obstruction attributable to intestinal paralysis (Fig. 4a). When CT was first taken after ESD, CT also revealed pneumoperitoneum and evidence of intestinal obstruction from intestinal paralysis, as well as a pelvic abscess (Figs. 4b and 4c). At this time, the diagnosis of delayed perforation was first made. After consulting with a surgeon, given no sign of peritoneal irritation or fever and a stable general condition, we chose conservative management with transnasal placement of a 16-Fr decompression tube to relieve the paralytic intestinal obstruction under fasting conditions and continued antibiotic treatment. Bowel movement was observed 6 days post-ESD. Seven days after ESD, contrast-enhanced CT of the colon after infusion of gastrografin through the decompression tube revealed a 10-mm fistula in the cecum (Fig. 5). The pelvic abscess remained localized. The CRP level improved to 6.8 mg/dL. Therefore, conservative treatment was continued. After bowel movement was confirmed, the decompression tube was removed 13 days post-ESD. Oral ingestion was resumed. After a reduced size of pelvic abscess was confirmed on CT 21 days post-ESD, the patient was discharged from hospital 26 days post-ESD. Later, CS taken 63 days post-ESD revealed scarring of the ESD site (Fig. 6).

## Discussion

In the case described in this report, delayed perforation after colonic ESD occurred. The diagnosis of perforation was late. However, the condition of this patient was conservatively managed. For this reason, this case report is regarded as valuable.

The rate of delayed perforation after colonic ESD is reported as 0.3%–0.7%<sup>7–9</sup>. In addition, delayed perforation can follow a severe postoperative course and often requires emergency surgery<sup>6</sup>. In the present case, the diagnosis of perforation was reached after several days. Abdominal pain developed during the daytime on the day after ESD, but it resolved two days post-ESD. These findings led us to speculate perforation was not the cause of the

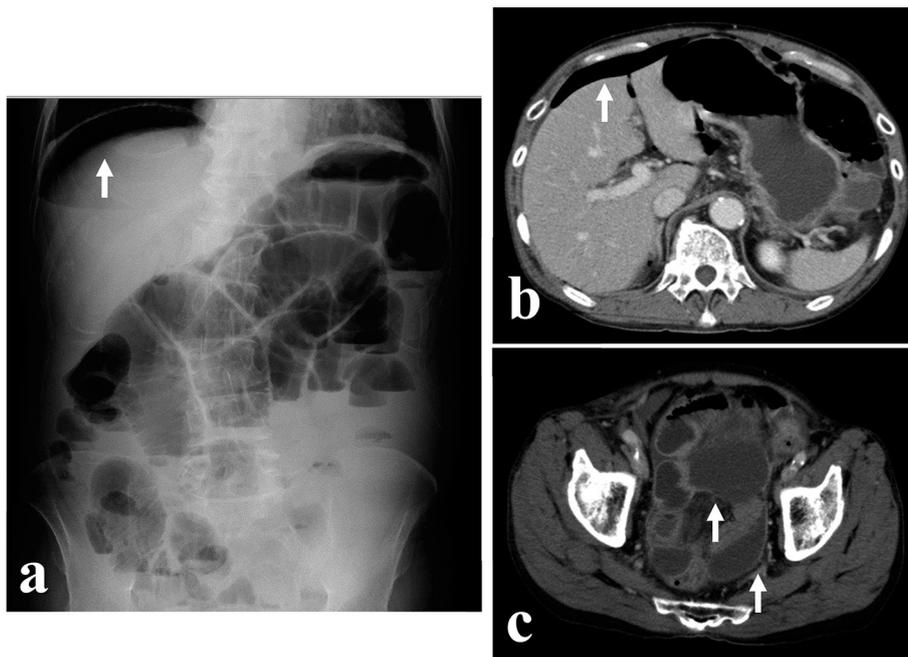


Fig. 4. Imaging findings obtained four days after endoscopic submucosal dissection.

- Abdominal X-ray showing pneumoperitoneum over the liver surface (arrow) and gas retention in the colon attributable to intestinal paralysis.
- Computed tomography (CT) image showing pneumoperitoneum over the liver surface (arrow).
- A CT image showing an abscess in the pelvic cavity (arrow).

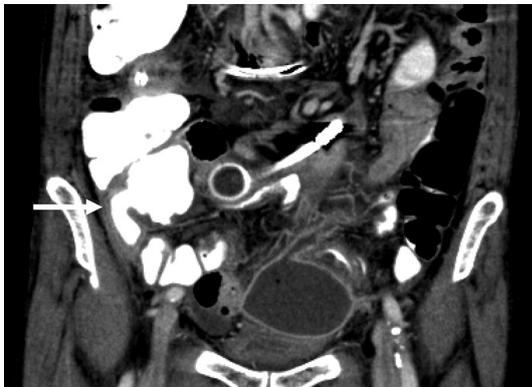


Fig. 5. Computed tomography (CT) image taken seven days after endoscopic submucosal dissection. A contrast-enhanced CT image taken after infusion of gastrografin through a decompression tube showed a 10-mm fistula in the cecum (arrow).



Fig. 6. Endoscopic image taken 63 days after endoscopic submucosal dissection showing scarring of the post-ESD site.

abdominal pain but rather that thermocoagulation had been induced by PEECS, which is defined as fever, regional rebound tenderness, or marked leukocytosis after ESD without perforation. If a patient's condition indicates PEECS, then the patient is treated with intravenous antibiotics<sup>10</sup>. However, in the case described in this report, the event was not PEECS but delayed perforation after colonic ESD. Fortunately, the perforation site was covered by the surrounding mesentery. Therefore, inflammation was localized in the area from the perforation site to

the pelvic cavity.

Delayed perforation after colonic ESD is thought to result from gradual weakening of the muscular layer injured by transmitted heat from excessive thermocoagulation of the submucosa, or from ischemic changes in the muscular layer caused by thermocoagulation<sup>10,11</sup>. We later reviewed a video that had been filmed during ESD. We noted that excessive thermocoagulation might have occurred during the coagulation of blood vessels in the post-dissection ulcer bed. Consequently, coagula-

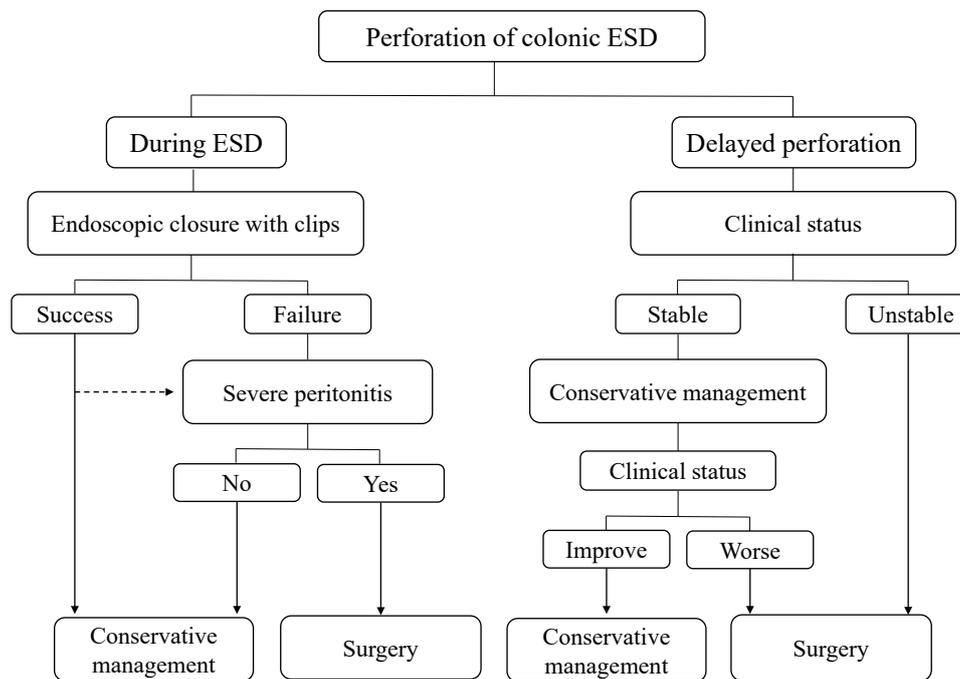


Fig. 7. Proposed algorithm for the diagnosis and management of colonic endoscopic submucosal dissection associated perforation.

tion necrosis of the ulcer bed might have led to delayed perforation. Excessive thermocoagulation after colonic ESD should be avoided for unexpected perforation. The cecum has a thinner intestinal wall and is more likely to retain stool compared to other parts of the colon, which is a feature that increases the risk of severe peritonitis.

Intraoperative perforation during colonic ESD might be treated conservatively by endoscopic closure with clips. However, no established guideline exists for actions to be taken in the event of delayed perforation. The key criteria for determining surgical indication of CS-related perforation include  $\geq 65$  years of age, CS for diagnostic purposes, perforation not amenable closure with clips, and signs of peritoneal irritation<sup>12</sup>. In contrast, emergency surgery is often required in cases of delayed perforation after colonic ESD because of a high risk of peritonitis caused by fecal fluid leakage, weakening of perforation tissue because of necrosis, large perforation size not amenable to endoscopic closure with clips, and a risk of expanded perforation induced by scope re-insertion.

We placed a transnasal decompression tube to relieve the paralytic intestinal obstruction. This step might have contributed to avoidance of surgery. Regarding the decompression tube placement after perforation of colonic ESD, only one report has been published: Xiao *et al.*<sup>13</sup> reported a case of de-

layed perforation after colonic ESD in which the perforation was closed endoscopically, and a decompression tube was placed transanally (not transnasally), followed by conservative management with intestinal decompression. Our report is apparently the first describing a case for which a decompression tube was inserted intranasally for delayed perforation after colonic ESD.

We can suggest the algorithm for both diagnostic and management for colonic ESD-associated perforation in Fig. 7. Although conservative management might be one treatment for patients with stable clinical condition, patients with sepsis should undergo emergency surgery at any time. In addition, the use of the bipolar hemostatic forceps might be effective to decrease the risk of delayed perforations. Furthermore, careful radiological follow-up is important for the early diagnosis of delayed perforation.

In the present case, delayed perforation was conservatively treated successfully. The reasons for the success might include continued fasting, inflammation being localized in the pelvic cavity and not leading to sepsis, and the concomitant use of intestinal decompression through a tube to prevent excessive pressure on the perforation site.

## Conclusions

This report described a case of delayed perfora-

tion after colonic ESD in a patient with cecal carcinoma. In this case, perforation was regarded as occurring on the day after the procedure. However, because inflammation was localized, it was treated conservatively using an intestinal decompression tube. The case is reported because delayed perforation is rarely treated conservatively.

### Acknowledgments

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### Conflict of Interest

The authors have no conflict of interest to declare.

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