



Non-occlusive mesenteric ischemia induced by a polyethylene glycol with ascorbate-based colonic bowel preparation

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Abstract

Although conventional bowel preparation for colonoscopy rarely causes serious complications, such complications can be fatal and, therefore, require early recognition and prompt treatment. Herein, we report a case of non-occlusive mesenteric ischemia (NOMI) induced by polyethylene glycol with an ascorbate component (PEG + Asc) that was used as a colonic bowel preparation. An 82-year-old woman with a medical history of hypertension, atrial fibrillation and mild chronic renal failure received a cancer screening colonoscopy. Four hours after the administration of PEG + Asc, she vomited and gradually developed abdominal distention. She went into hypovolemic shock, and a CT scan revealed a distal colon obstruction caused by fecal material. A colonoscopy identified focal necrotic mucosa between the rectum and descending colon, suggesting the occurrence of irreversible intestinal necrosis; consequently, she underwent emergency surgery. The operative and pathological findings showed a discontinuous area of necrosis from the anal margin to the ileum without thrombotic change in the main mesenteric arteries, consistent with a diagnosis of NOMI. NOMI is a rare but fatal disease that can advance to an irreversible stage before a definite diagnosis can be made. Since PEG + Asc is a hypertonic laxative solution, the possibility that dehydration might cause severe secondary complications must be considered.

Keywords Non-occlusive mesenteric ischemia (NOMI) · Colonoscopy · Ascorbate component · Bowel preparation

Introduction

Colonoscopy plays an important role in colorectal cancer screening, and subsequent endoscopic treatment of precancerous lesions can improve the disease outcome. Although bowel preparation is an uncommon cause of iatrogenic disease, serious complications such as obstructive ileus, intestinal necrosis and perforation are possible, all of which are reportedly associated with a high mortality rate [1]. Herein, we report a case of non-occlusive mesenteric ischemia (NOMI) induced by a polyethylene glycol with an ascorbate component (PEG + Asc) that was used as a colonic bowel preparation.

Case report

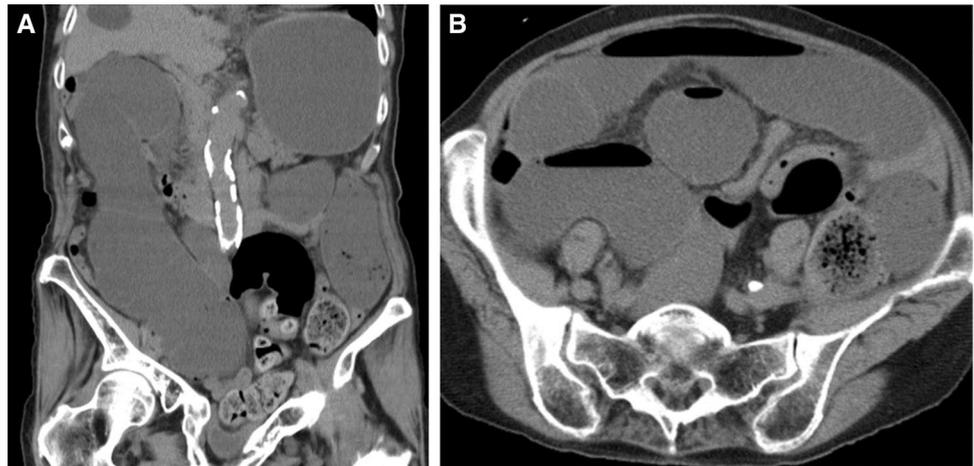
An 82-year-old woman was admitted to our hospital for a cancer screening colonoscopy. She received colonoscopy without any complications at 10 years ago. Her bowel habit was normal. She had a medical history of hypertension, atrial fibrillation and mild chronic renal failure, all of which were adequately controlled pharmacologically. She had taken rivaroxaban for atrial fibrillation, which was continued to avoid the risk of thromboembolism. Subsequent to the administration of a stimulant laxative on the evening before the colonoscopy, she was given PEG + Asc. After the administration of 1 l of PEG + Asc, we stopped further administration because of vomiting and abdominal distention. A CT scan revealed a distal colon obstruction caused by fecal material, but an obvious structural obstruction (e.g., colorectal cancer or volvulus) was not identified (Fig. 1). Therefore, we believed that her condition could be improved by defecation. Despite the administration of an enema, defecation was not induced. Subsequently, she gradually went into shock and experienced decreased consciousness; her blood pressure was 80/52 mmHg and her pulse rate was 113/

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Fig. 1 CT scan findings. A fecal ileus occurred in the sigmoid colon. The dilatation of the oral colon to the small bowel and fluid collection were identified. **a** Axial. **b** Coronal



min. A laboratory investigation revealed a mild inflammatory reaction and dehydration-induced acute renal failure (WBC, 11.3 thousand/mm³; Hb, 19.0 g/dL; BUN, 47.9 mg/dL; Cr, 1.56 mg/dL; and CRP, 7.2 mg/L). Along with a hypertonic transfusion, her vital signs were temporarily recovered, therefore, we conducted an endoscopic reduction of the feces, and a colonoscopy identified focal ischemic and/or necrotic mucosa between the rectum and descending colon (Fig. 2). Even after the successful reduction of the feces, her condition continued to worsen, and a blood gas test revealed metabolic acidosis (pH, 7.32; pCO₂, 37.8; pO₂, 123.4; base excess, -4.1; bicarbonate, 21.9). Since these findings strongly suggested the occurrence of irreversible intestinal necrosis, she received emergency surgery after systemic management with vasopressors and mechanical ventilation. The operative findings showed a discontinuous area of necrosis from the anal margin to the ileum, with preserved mucosa on the right side of the colon; therefore, a permanent ileostomy was constructed after the total removal of the colon and necrotic ileum (Fig. 3). Pathological examination revealed total epithelial necrosis and significant bleeding of the submucosal layer without thrombotic changes in the

main mesenteric arteries (Fig. 4). Fortunately, her postoperative course was good, and she was discharged from the hospital 18 days after the emergency surgery.

Discussion

Several severe complications associated with colonic bowel preparation have been reported, such as acute cardiac events, aggravation of gout, ischemic colitis, renal failure, seizure and serum electrolyte abnormalities [2]. To our knowledge, only one case report has published about bowel preparation induced NOMI [3]. Although it was similar to our case, detailed clinical course (e.g. kind of laxatives and serum blood test) was not written in this text. NOMI is caused by intestinal vasospasm due to consistent low perfusion and is reportedly associated with approximately 20–30% of cases of acute mesenteric ischemia [4]. It has a high mortality rate of over 50%, which has changed little over time since it was first described by Ende in patients with heart-failure-associated low outputs [5]. Although an early diagnosis is important to improve patient outcome, the early symptoms of NOMI are

Fig. 2 Endoscopic findings. Focal areas of ischemic and/or necrotic mucosa was identified between the rectum and the descending colon

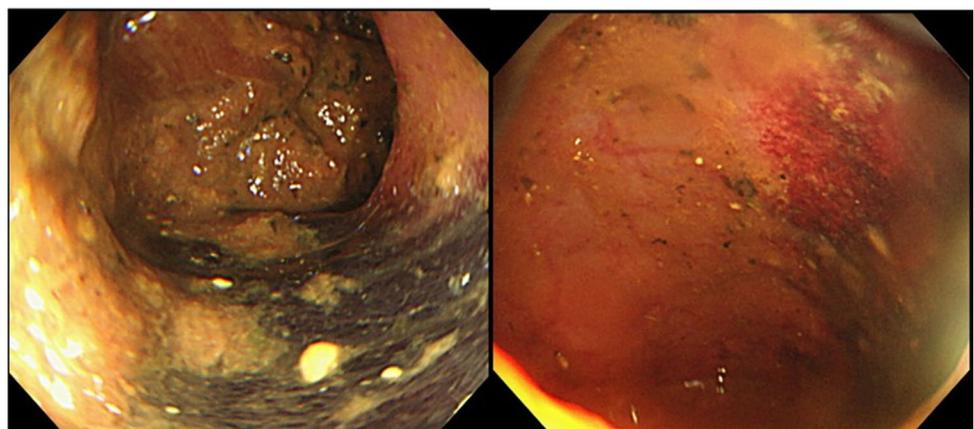


Fig. 3 Intra-operative image and post-operative image. A discontinuous area of necrosis widely spread from the anal margin to the ileum, with preserved mucosa on the right side of the colon, is visible. **a** Intra-operating image. **b** Post-operative image

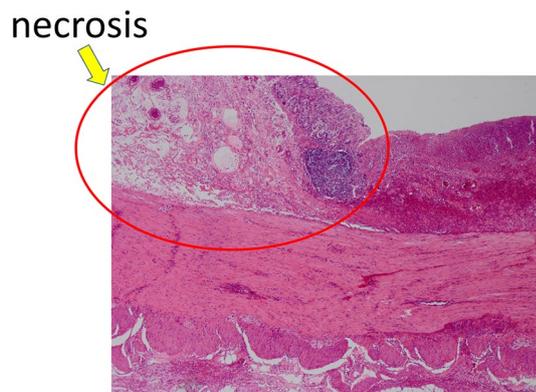
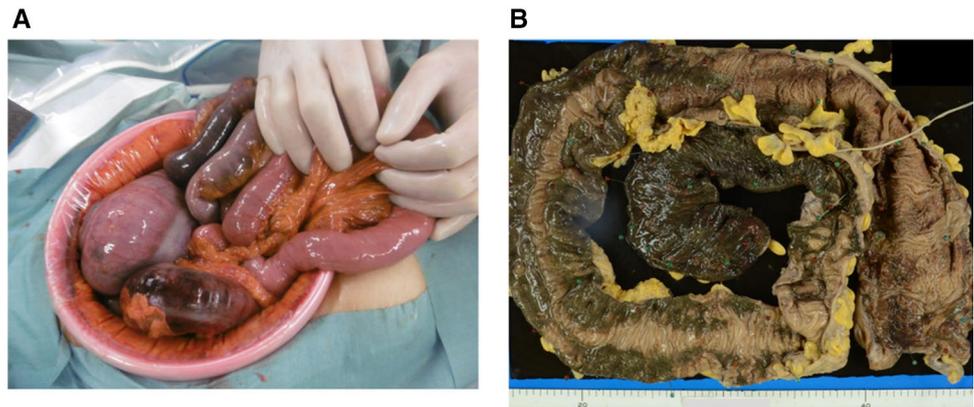


Fig. 4 Pathological examination. Transmural necrosis and significant bleeding of the submucosal layer without thrombotic changes in the main mesenteric arteries

mild and nonspecific; therefore, the disease can advance to an irreversible stage before a definitive diagnosis can be made. A contrast-enhanced CT scan can enable the assessment of mesenteric vessel flow and intestinal wall enhancement, which in turn can help to determine a diagnosis of NOMI and the need for surgical intervention. Angiography is conducted for NOMI in patients without evidence of bowel necrosis, and vasodilators are subsequently administered to correct the mesenteric blood flow [6]. In this case, we were unable to perform contrast-enhanced CT or angiography because the patient had acute kidney injury caused by lavage-solution-induced severe dehydration. Instead, an endoscopic examination was conducted because we believed that a reduction of the fecal matter would attenuate the intestinal wall pressure and improve her condition. Despite the absence of an obvious structural obstruction, her colonic mucosa showed a discontinuous distribution of necrosis, both of which are indicative of a diagnosis of NOMI. Although the necrotic colonic mucosa was limited to within a small segment, her condition worsened even after adequate systemic management. Therefore, we performed surgery to resect the irreversibly necrotized intestine. As a result, discontinuous transmural necrosis was observed

to have spread widely from the anal margin to the ileum, thus requiring a permanent ileostomy. Nevertheless, NOMI can be treated surgically or non-surgically, and this case suggests the difficulty of determining the correct treatment strategy and the golden time for surgical intervention.

A PEG-based gut lavage preparation is an isotonic solution that passes through the bowel without being absorbed or secreted. In contrast, the combination of ascorbic acid and a PEG-based bowel preparation is hypertonic; therefore, it is generally not recommended for patients with severe comorbidities, such as renal failure or congestive heart failure, because of its potential risk for clinically significant alterations in serum electrolyte levels and hemodynamic stability. Although it reportedly reduces the volume patients have to drink and improves patient acceptability [7], careful patient selection is required. In the present case, while the patient was elderly, her comorbidities were adequately controlled. We concluded that the temporary fecal ileus led to the long-term retention of the hypertonic solution in the intestine, which subsequently induced severe dehydration and intestinal vasospasm. Additionally, this case further highlights the importance of adequate hydration both prior and during bowel preparation. Although bowel preparation for a colonoscopy rarely induces fatal complications, we need to keep in mind that dehydration can cause severe secondary complications, such as NOMI, as described in this report. The choice of gut lavage solution should be carefully considered prior to the initiation of bowel preparation especially in higher-risk patients, including elderly patients with comorbidities (e.g., pre-existing renal and/or cardiovascular impairment), which can prevent creating a second case as described in this report.

Compliance with ethical standards

Conflict of interest Rindo Ishii, Ken Ohata and Eiji Sakai, Kentarou and Nakajima and Nobuyuki Matsuhashi declare that they have no conflict of interest.

Human rights All procedures followed have been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Informed consent Informed consent was obtained from all patients for being included in the study.

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