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CASE REPORT

Ileum and colon perforation following peritoneal dialysis-related peritonitis and high-dose calcium polystyrene sulfonate

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A rare but severe complication, intestinal necrosis, has been reported after sodium polystyrene sulfonate (SPS; Kayexalate) and sorbitol intake. Some case reports described bowel perforation following calcium polystyrene sulfonate (CPS; Kalimate) administration. We report a case of ileum and colon perforation following peritoneal dialysis-related peritonitis and high-dose Kalimate in a 59-year-old female patient. The patient had a history of hypertension, diabetes mellitus, and end-stage renal disease (ESRD). During hospitalization for peritoneal dialysis-related peritonitis, she developed hyperkalemia, and Kalimate was administered orally. However, severe abdominal distension and pain occurred just one day after Kalimate intake. An urgent surgery disclosed several perforations in the ileum and sigmoid colon. Pathology of the resected gut showed transmural necrosis and perforation with basophilic angulated crystals. The patient finally expired during hospitalization due to refractory septic shock.

Conflicts of interest: The authors have no conflicts of interest relevant to this article.

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Introduction

Hyperkalemia, a common electrolyte disorder in hospitalized patients, may be treated with cation-exchange resins. Though rare, a few previous reports disclosed bowel perforation after the combined use of sodium polystyrene sulfonate and sorbital. Sorbital has been shown to have additional toxic effects on bowel mucosa. Here we present a patient with ileum and colon perforation after using calcium polystyrene sulfonate alone for only one day.

Case report

A 59-year-old woman was admitted to our hospital because of abdominal pain and cloudy peritoneal dialysate for 1 day. Her medical history included hypertension, type 2 diabetes mellitus, myocardial infarction, peripheral artery occlusive disease, and end-stage renal disease (ESRD) under continuous ambulatory peritoneal dialysis (CAPD) since January 2011. Several days before admission, she had suffered from a low-grade fever, followed by diffuse abdominal pain, diarrhea, and cloudy peritoneal dialysate. At our emergency department, her Glasgow Coma Scale was E2V2M5, body temperature was 35.9°C, pulse rate was 85 beats per minute, and blood pressure was 120/62 mmHg. On examination, her abdomen was soft with diffuse tenderness and hypoactive bowel sounds. The peritoneal fluid analysis revealed a total nuclear cell count of 2100 cells/μL with 96% polymorphonuclear leukocytes, and a Gram stain (Sancordon Inc., Taipei, Taiwan) showed no bacteria. Her serum albumin level was only 2.1 g/dL. Empirical intraperitoneal antibiotic treatment with cefazolin (Xindong, Taoyuan, Taiwan) and ceftazidime (China Chemical & Pharmaceutical Co., Ltd., Hsinchu, Taiwan) was administered under the impression of peritoneal dialysis-related peritonitis.

During the initial 10 days of her hospitalization, intermittent fever and abdominal pain were noted, and the antibiotics were replaced with intravenous imipenem (Merck Sharp & Dohme Inc., White house, USA) and daptomycin (Hospira, Illinois, USA) on day 10. A further abdominal computed tomography scan was performed to exclude secondary peritonitis. Although there was no evidence of intraabdominal infection or bowel perforation, nonmechanical ileus was noted and treatment was thus given. On day 11, intraperitoneal fluconazole (Pfizer PGM, Paris, France) was added due to the presence of yeasts found on the Gram-stained smear of the dialysate. On day 12, the Tenckhoff catheter was removed due to probable fungal peritonitis. On day 15, routine dialysate cultures yielded vancomycin-resistant *Enterococcus faecium* and *Candida tropicalis*.

On day 19, hyperkalemia (6.0 mmol/L) was noted. Calcium polystyrene sulfonate (CPS; Kalimate; 15 g; Kowa, Tokyo, Japan) was administered orally four times daily. However, severe abdominal pain and hypotension developed on day 21. Ascites was tapped, and it looked like fecal material. A second computed tomography scan of the abdomen revealed pneumoperitoneum. Urgent surgery disclosed several perforated lesions in the ileum and sigmoid colon as well as a massive amount of yellowish fecal material inside the peritoneum. Eventually, partial ileum resection, sigmoid colon repair, and ileostomy were performed. Pathology of the resected gut reported transmural necrosis and perforation with basophilic angulated crystals extending from the ulcerated luminal surface into the transmural region of ileum (Fig. 1). Numerous pseudohyphae and spore-like bodies compatible with *candida* infection were also observed in the necrotic debris (Fig. 2). The postoperative course was complicated by an anastomotic leak, and the patient expired on day 39 due to refractory septic shock.

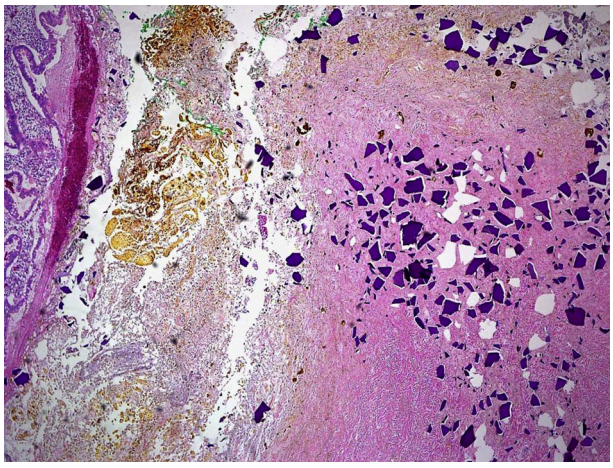

Figure 1 Microphotograph of Kalimate crystals. Basophilic angulated crystals are seen extended from the ulcerated luminal surface into the transmural region of the ileum (hematoxylin and eosin stain ×100).

Discussion

Ion-exchange resins were first synthesized in 1935 and used as a treatment for medical patients in 1961. Kalimate is an ion-exchange resin frequently prescribed to treat hyperkalemia. To the best of our knowledge, only four cases of

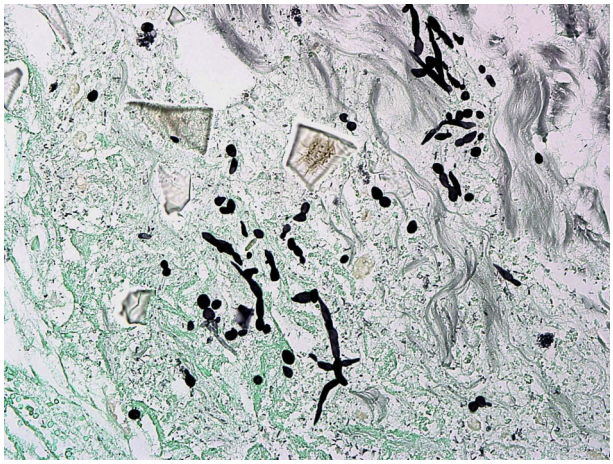

Figure 2 Numerous pseudohyphae and spore-like bodies, morphologically compatible with *Candida* species, are observed in the necrotic debris (Grocott-Gomori's methenamine silver stain ×100).

Kalimate-induced intestinal ulcers have been published.[1–4] Our case is the first to document bowel necrosis with transmural incarceration of Kalimate crystals in the ileum, combined with candida infection.

In the literature, sorbitol is thought to be the main contributor to intestinal necrosis associated with the use of an ion-exchange resin. According to Lillemoe et al,[5] the addition of sorbitol to polystyrene sulfonate is an important factor in colonic mucosa toxicity in uremic rats. Sorbitol may cause osmotic injury by altering the hemodynamic of the bowel wall.[6] It also exerts a direct toxic effect on colonic mucosa by stimulating prostaglandin release.[7] Sodium polystyrene sulfonate (SPS; Kayexalate, Sanofi-Synthelabo, Surrey, England, UK) was reported to cause upper gastrointestinal mucosa erosions or ulcers in 82% of the patients in a case series.[8] The precise mechanism of mucosal damage in patients receiving resin in sorbitol remains uncertain.

All of the previous cases presented with abdominal pain and had different anatomical involvement of the small and large intestines after the use of Kalimate: one of the cases had developed jejunal perforations; one had diffuse sigmoid colon and rectum mucosal necrosis; one had colon ulcer and sigmoidovesical fistula; and one had proximal ascending colon lesion. Our patient's lesions were located in the ileum and sigmoid colon, and the former site has not been reported previously. This shows that the entire small and large intestines may be involved.

The incidence of resin-induced intestinal injury has been estimated to be 0.27–1.8%.[9] The risk factors of resin-induced intestinal necrosis include postoperation, obstructive bowel disease, critical illness, hypovolemia, hypotension, coagulation disorder, immunosuppression, and ESRD. ESRD may predispose patients to intestinal necrosis through intradialytic hypotension, elevated prostaglandin production, hyperreninemia, and localized colonic mesenteric vasospasm. Owing to severe abdominal pain soon after the use of Kalimate in our patient, we assumed that Kalimate was the cause of bowel perforation. The observation of angulated crystals of Kalimate with a characteristic crystalline mosaic pattern is crucial to diagnose Kalimate-associated mucosal necrosis.[8]

It is well known that mechanical intestinal obstruction is a contraindication to Kalimate administration. Based on what happened to our patient, we further suggest not giving Kalimate to patients with on-going or just-treated nonmechanical obstructive ileus. In general, resin-related intestinal necrosis develops more slowly after oral administration than after enema administration. Our patient had rapid bowel perforation probably due to the presence of concomitant fungal peritonitis. There are no presumed limits for Kalimate intake. The Kalimate doses causing bowel perforation range from 60 g per day to 105 g per day in the literature. We suggest that large doses of Kalimate should be used with caution, especially in renal failure and critically ill patients.

Conclusion

Physicians should be aware of the rare complication of bowel necrosis following the administration of ion-exchange resins. Large doses of SPS or CPS should be used with caution, especially in patients with renal failure and critical illness.

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