—Case Reports—

Successful Treatment of a Colonic Ulcer Penetrating the Urinary Bladder Caused by the Administration of Calcium Polystyrene Sulfonate and Sorbitol

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Abstract

A 77-year-old woman was urgently admitted for the treatment of diabetic ketoacidosis and a duodenal ulcer hemorrhage in March 1999. She had a history of diabetes and angina pectoris. After admission, she received oral calcium polystyrene sulfonate and sorbitol to treat hyperkalemia. Nine days later, severe abdominal pain developed. A colonoscopic examination revealed a sigmoid colonic ulcer and stenosis; the patient was treated conservatively. At a 1-year follow-up examination, the colonic stenosis was found have worsened; pneumaturia developed in January 2001. The patient was found to have a sigmoidovesical fistula and underwent sigmoidectomy and partial resection of the ileum and urinary bladder. The histological findings were a benign colonic ulcer with the infiltration of inflammatory cells, mainly lymphocytes. Rhomboidal, dark violet Kayexalate® crystals were observed on microscope examination in the submucosa in both the first and second colonic biopsy specimens. We concluded that the colonic ulcer and the sigmoidovesical fistula had been caused by the administration of calcium polystyrene sulfonate and sorbitol. Reports of colonic perforation as a result of the administration of calcium polystyrene sulfonate and sorbitol are rare. Here, we report the successful treatment of a colonic ulcer that had penetrated the urinary bladder.
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Key words: calcium polystyrene sulfonate, Kayexalate® crystal, colonic ulcer

Introduction

Sodium polystyrene sulfonate, sold under the trade name Kayexalate®, is a popular treatment for hyperkalemia. Here, we report on a patient with a colonic ulcer and sigmoidovesical fistula that developed 2 years after the administration of calcium polystyrene sulfonate (an analog of sodium polystyrene sulfonate) and sorbitol.

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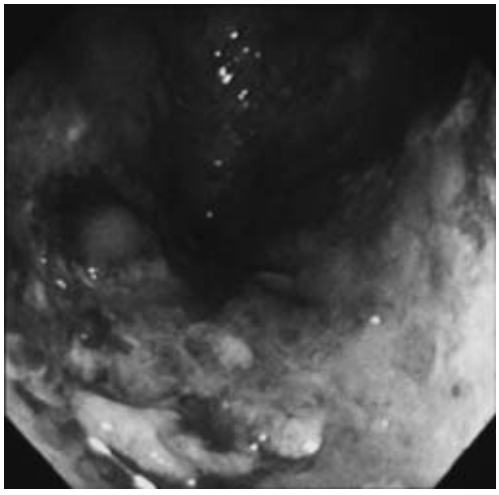

Fig. 1 A dirty-white coated ulceration and elevation with redness was observed during a colonoscopy.

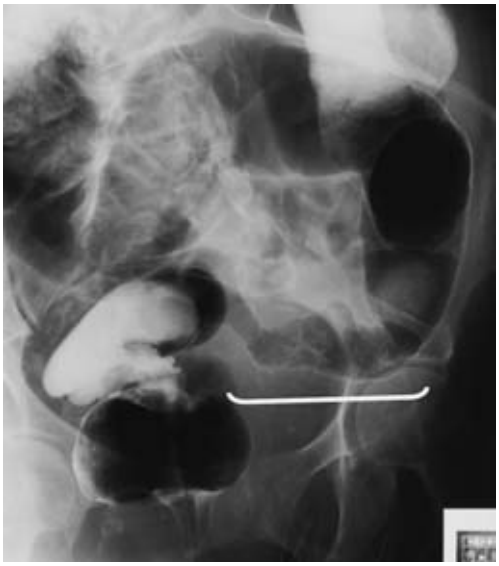

Fig. 2 The sigmoid colon had a tube-like stricture and a hard appearance in a 10-cm long section. **(white line)**

Case Report

A 77-year-old woman was urgently admitted to the Department of Internal Medicine at our hospital for the treatment of diabetic ketoacidosis and a duodenal ulcer hemorrhage in March 1999. The patient had been found to have diabetes at the age of 44 years and had received insulin therapy since the age of 55 years. At the age of 65 years, she had undergone an operation to expand the cervical spinal canal. At the age of 74 years, she received a coronary artery bypass graft to treat ischemic heart disease.

After admission, she received oral calcium polystyrene sulfonate (Kalimate, 15 mg) and sorbitol (D-sorbitol, 15 mg) to treat hyperkalemia (6.1 mEq/L). Nine days later, severe abdominal pain and vomiting developed. Colonoscopic examination revealed a dirty-white moss-like layer adherent to the surface and a red elevation at the erosional site of the sigmoid colon, 20 cm from the anal verge. The part of the colon containing the lesion was severely stenotic, and the colonoscope could not be passed through the site **(Fig. 1)**.

A barium enema examination performed 1 month later revealed a 10-cm section of tubular stenosis and consolidation in the sigmoid colon **(Fig. 2)**. We suspected a scirrhous-type colonic cancer or malignant lymphoma. A biopsy specimen, however, showed no signs of malignancy, and surgical treatment was thought to be unnecessary.

After 1 year of conservative treatment, the stenotic colon was found to have decreased to 3 cm in length. We suspected that an inflammatory ulcer scar was the cause of this stenosis, and the lesion was dilated using an endoscopic balloon. A colonic biopsy revealed the growth of monotonous middle-sized lymphocytes, which suggested malignancy. We recommended surgery, but the patient refused and instead received 3 cycles of chemotherapy with cyclophosphamide, doxorubicin hydrochloride, vincristine sulfate, and prednisolone for a suspected malignant lymphoma.

The stenosis did not improve after chemotherapy **(Fig. 3)**. In January 2001, pneumaturia developed. A barium enema examination performed in March showed the flow of barium from the colonic stenotic lesion into the urinary bladder **(Fig. 4)**. She finally underwent surgery for the treatment of a colonic ulcer and a sigmoidovesical fistula. The part of the colon containing the lesion was tightly adherent to the ileum and the urinary bladder.

Sigmoidectomy and partial resection of the ileum and urinary bladder were performed. The lesion in the sigmoid colon was 25 × 15 mm with profound

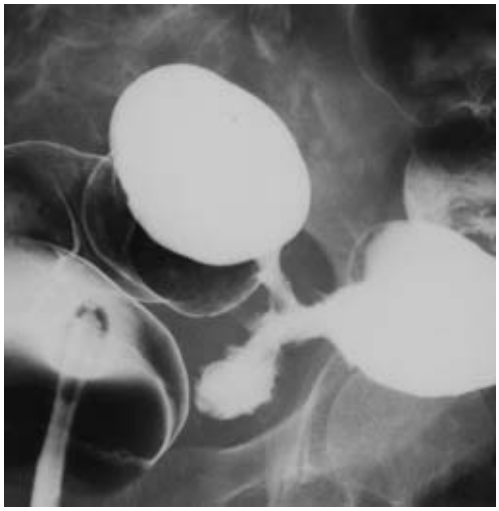

Fig. 3 The stenosis had not improved, and part of the stenotic lesion had assumed a diverticulum shape.

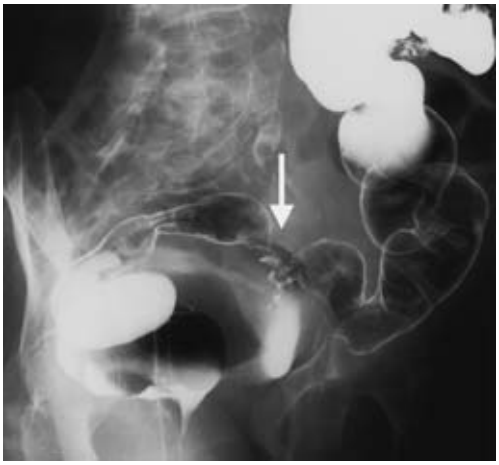

Fig. 4 Contrast material from the colonic stenotic lesion was visible in the urinary bladder. **(white arrow)**

ulceration around the circumference. The mucosa around the ulcer was reddish but did not show signs of malignant change **(Fig. 5)**. The mucosa of the urinary bladder was also reddish but did not show signs of a neoplastic lesion. Pathological examination of the ulcer lesion revealed diffuse and extensive cellular infiltration, mainly plasma cells and lymphocytes. The pathologist, as co-author, diagnosed the lesion as a nonspecific colonic ulcer with rhomboidal, dark violet Kayexalate crystals in the submucosa **(Fig. 6)**. Therefore, we concluded that the colonic lesions had been induced by the administration of calcium polystyrene sulfonate and sorbitol. One year after the operation, barium enema examination revealed a normal colonic appearance.

Discussion

In 1987, Lillemoe et al. first reported that the enema administration of polystyrene sulfonate and sorbitol leads to the development of severe colonic necrosis[1]. The oral administration of this compound has also been reported to lead to the same condition[2,3]. According to several papers[1–10], patients with this complication have ranged in age from 18 to 77 years (average, 51.2 years) and were 13 men and 7 women. The route of administration of polystyrene sulfonate and sorbitol had been oral in 9 patients, by enema in 6 patients, both oral and by enema in 3 patients, and unclear in 2 patients. In the patients who had been treated via enema, the lesions were located throughout the colon in 2 cases, in the right colon in 1 case, in the transverse colon in 2 cases, and in the left colon in 1 case; in the patients who were treated orally, the lesions were located throughout the colon in 3 cases, in the cecum in 3 cases, in the right colon in 2 cases, and in the left colon in 1 case. Eighteen patients underwent abdominal operations (colectomy or colostomy), and 2 patients who had been treated orally received conservative treatment. Seven of the 20 patients died, despite intensive care. Colonic necrosis developed in most patients 1 to 10 days after oral administration but developed in one patient 1 year later. Colonic necrosis developed more slowly after oral treatment than after enema administration. The number of deaths was the same after both routes of administration.

Lillemoe et al.[1] also have demonstrated that polystyrene sulfonate and sorbitol can cause intestinal necrosis in uremic rats. Their data suggest that the addition of sorbitol to polystyrene sulfonate is an important factor in colonic mucosa toxicity. The precise mechanism of sorbitol-induced colonic necrosis remains uncertain. A hyperosmotic load may induce intestinal necrosis, with highly concentrated sorbitol directly damaging the mucosa.

Polystyrene sulfonate and sorbitol may also cause damage to the upper gastrointestinal tract[3,11].

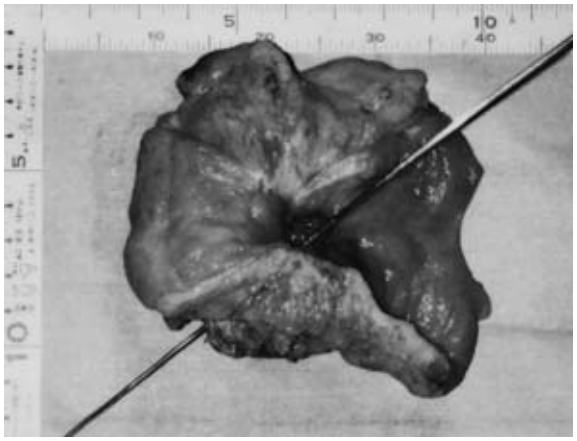

Fig. 5 The lesion was 25 × 15 mm with profound ulceration around the circumference. The mucosa around the ulcer was reddish.

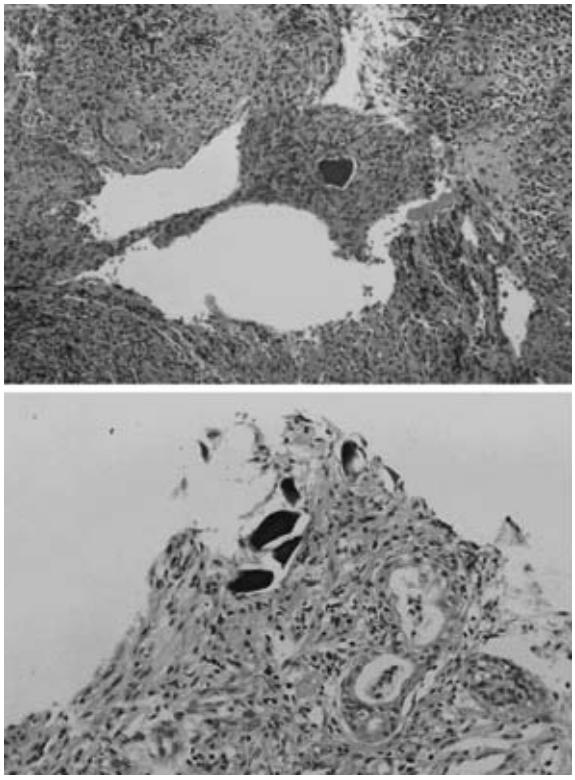

Fig. 6 Rhomboidal, dark violet Kayexalate® crystals were visible in the submucosa.

Patients with necrosis of the upper gastrointestinal tract, however, were treated conservatively and had a good outcome. The upper gastrointestinal tract is considered less susceptible to ischemia. Extensive necrosis with transmural infarction and Kayexalate crystals (appearing lightly basophilic when stained with hematoxylin and eosin) adherent to the mucosa were noted in pathologic specimens[1]. Gastrointestinal necrosis occurs in approximately 1% of patients treated with polystyrene sulfonate and sorbitol[3]. A diagnosis can be easily made when Kayexalate crystals are identified. In the present case, however, we did not initially recognize these crystals and instead suspected a malignant lymphoma, diffuse invasive colonic cancer, or pseudomembranous enterocolitis.

Treatment usually consists of colonic resection or stoma creation or both. In previous reports, the patients underwent surgery during the acute phase, immediately after the administration of polystyrene sulfonate and sorbitol. No other reports have described a successful surgical treatment 2 years after the oral administration of polystyrene sulfonate. The appearance of unusual complications such as colonic necrosis after the oral or rectal administration of polystyrene sulfonate and sorbitol should enable prompt recognition and surgical cure. Polystyrene sulfonate and sorbitol should be used with extreme caution in critically ill patients with hyperkalemia. Alternative methods, such as hemodialysis or glucose / insulin / bicarbonate injections, should be used to control hyperkalemia.

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