

## Case Report

# Acute Intestinal Obstruction Due to Kalimate, a Potassium-Lowering Agent: A Case Report and Literature Review

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*Sodium polystyrene sulfonate (Kayexalate) and calcium polystyrene sulfonate (CPS, Kalimate) are commonly used to reduce serum potassium. There were some published evidences of severe gastrointestinal complications from the administration of these agents such as colonic necrosis with or without perforation and acute obstruction. The authors reported a 52-year-old male patient being critically ill from severe soft tissue infection of the right leg and sepsis. Hyperkalemia had occurred due to renal insufficiency and required several doses of Kalimate to reduce the serum potassium level. Subsequently, the patient developed complete intestinal obstruction and an exploratory laparotomy was performed. The intra-operative findings were distended stomach and the small bowel contained a large amount of intraluminal affected Kalimate that was removed via gastrotomy and enterotomy. These findings suggested that the inspissated Kalimate could lead to significant obstruction of the gastrointestinal tract in some groups of patient.*

**Keywords:** Kalimate, Calcium polystyrene sulfonate, Intestinal obstruction

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The high serum potassium level or hyperkalemia is a condition commonly found in critically ill patients especially in those with renal insufficiency. This electrolyte imbalance needs correction by resin compounds, sodium polystyrene sulfonate (Kayexalate) and calcium polystyrene sulfonate (CPS, Kalimate), which can be administered either orally or rectally. Some minor gastrointestinal disturbances, such as constipation, anorexia, and nausea, were known to be the side effects of these agents. However, there have been some reports regarding serious gastrointestinal complications. Many case reports of colonic necrosis associated with the administration of Kayexalate in sorbitol were published<sup>(1,2)</sup>. The literature of intestinal obstruction from these resin agents was less common. The authors present a case study with suggestive evidence demonstrating Kalimate as the cause of acute intestinal obstruction in the critically ill patient.

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### Case Report

A Thai 52-year-old male patient was hospitalized with the diagnosis of severe soft tissue infection at the right leg. He had a markedly swollen, warm, and painful right foot and leg up to the knee. His vital sign was stable with blood pressure 100/60 mmHg, pulse rate 100 bpm, and body temperature 36.3°C. The blood cell test was Hb 15.3 g%, WBC 8,700 cells/mm<sup>3</sup> (neutrophil 92.8%, lymphocyte 4.1%), platelet 132,000/mm<sup>3</sup>. The serum electrolyte was Na 137 mmol/L, K 3.5 mmol/L, Cl 96 mmol/L, HCO<sub>3</sub> 17.2 mmol/L. The appropriate antibiotics were initially administered. While he was waiting for an operation, he rapidly developed septic shock that needed intubation, fluid resuscitation, and inotropic agents. When he was stabilized, above-knee amputation was performed because of intra-operative findings of severe necrotizing fasciitis and calf muscles necrosis.

After the operation, he was admitted in the intensive care unit and still intubated. He had high central venous pressure (CVP) and still needed high doses of inotropic agents to stabilize his blood pressure. His serum BUN and Cr were rising up to 143 mg/dL and 7.7 mg/dL respectively with no urine excreted. Then he was dialyzed via double-lumen catheter on

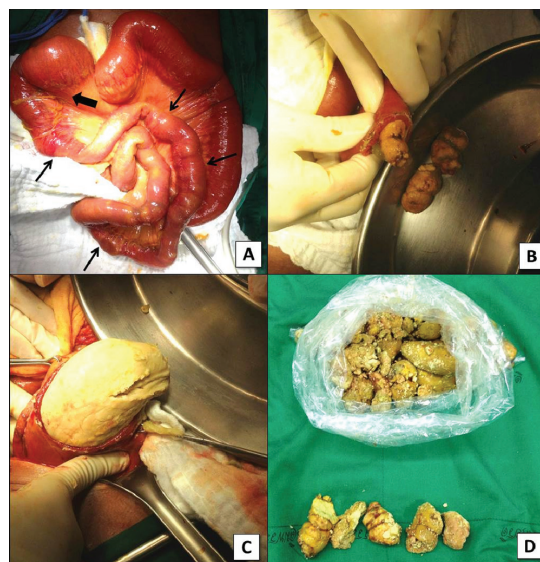
the third postoperative day. He was not fed due to bowel ileus. He also encountered problems of electrolyte imbalance, especially hyperkalemia. In spite of hemodialysis, his serum potassium level was still high in the range of 5.4 to 6.0 mmol/L. Therefore, he received Kalimate 30 g in water 50 ml via nasogastric tube about two to three times/day, overall 12 doses in five days. At this point, his condition seemed to improve with tapering inotropic dose reduced and controllable acidosis. The nasogastric feeding was stepped up from liquid to blenderized diet. Unfortunately, his abdomen was progressively distended after a few feeding. He had not passed stool since he was hospitalized. A plain film of the abdomen was done. It demonstrated the markedly dilated small bowel loop with valvulae conniventes throughout the abdomen. No free air or fluid was detected. The right-sided colon could be identified as having contents but was not dilated. Then a CT scan of the whole abdomen without contrast was performed. As shown in Fig. 1, a small bowel obstruction was proven and the point of disproportion was identified at distal jejunum. Interestingly, a large amount of opaque content was observed in the stomach, distal small bowel, and colon, despite not having contrast administered intravenously, orally, nor rectally.

An exploratory laparotomy was performed immediately. The point of changing intestinal diameters was identified at distal jejunum with the chain of hard content densely packed along the ileum down to the ileocecal valve, which was the cause of obstruction. Enterotomy was done to open the ileum longitudinally and a lot of pale yellow stone-like content, which was supposed to be inspissated Kalimate, was removed, as shown in Fig. 2. Gastrotomy was also made at the anterior wall of the body of the stomach. One huge stomach-shaped mass was removed. It was more friable than content in the small bowel. Then an appendectomy was performed and the appendiceal stump was dilated to allow some large impacted content removed out of the right-sided colon. The muddy Kalimate in the dilated part of jejunum was milked up through duodenum to the stomach and sucked out as much as possible by a large-hole suction. Then all three openings were sutured two layers, and one external drain was placed at the right paracolic gutter. The patient was stable during the operation and returned to ICU.

Post-operatively, he had bowel ileus and abdominal distention. Nasogastric tube had drained



**Fig. 1** Axial (A-C) and coronal (D-E) planes of non-contrast CT scan of abdomen demonstrating opaque material filled in the lumen throughout the stomach and dilated small bowel down to terminal ileum.



**Fig. 2** Intra-operative findings: (A) the point of disproportion between proximal and distal small bowel diameters (thick arrow) and multiple sites of impacted intraluminal content (thin arrows) along ileum; (B) enterotomy at distal jejunum with removal of chain of impacted Kalimate; (C) gastrotomy with removal of large inspissated Kalimate from stomach; (D) some amount of intraluminal content removed out of stomach and small bowel.

a large amount of the yellow muddy content out and it was irrigated many times by normal saline. After two days exploration, he had passed inspissated Kalimate in mucus stool two to three times and his abdomen was less distended. On the third post-operative day, NG content was bilous fluid without thick Kalimate-like material, then NG feeding started slowly. Unfortunately, the patient developed severe sepsis from the catheter-induced infection and ventilator-associated pneumonia. The patient died due to those conditions.

### Discussion

Sodium polystyrene sulfonate (Kayexalate) and calcium polystyrene sulfonate (CPS, Kalimate) are commonly used as the serum potassium-lowering agents. One of their known adverse effects is gastrointestinal disturbance such as constipation, nausea, or vomiting. Doctors should be aware of administering these resins in elderly or patients susceptible to constipation. Literature concerning serious GI complications mostly mentioned colonic necrosis related to the administration of Kayexalate in sorbitol. The mechanism was unclear. However, there was evidence demonstrating sorbitol rather than Kayexalate as the contributing factor of the colonic necrosis<sup>(1,2)</sup>. With regards to intestinal obstruction, fewer reports have been published. Specifically, there were 2 case reports found from the literature review demonstrating bowel obstruction associated with the use of Kalimate which is the same agent used in our patient. The first was Minford et al reported a 62-year-old male patient who was hospitalized for treatment of chronic renal and cardiac failure<sup>(3)</sup>. His serum potassium was 7.1 mmol/l and was treated with calcium resonium 15 g, three times a day. Then he was discharged with serum potassium 4.9 mmol/l while containing the same dose of calcium resonium at home. Unfortunately, he was admitted again within 48 hours after being discharge because of absolute constipation, which was presumed to be secondary to calcium resonium therapy. After failed conservative treatment, laparotomy was performed. The intra-operative findings were the impaction of 2-kg inspissated feces including calcium resonium and the perforation of sigmoid colon requiring Hartmann's procedure.

In another report, Garcia-Pardo et al described a 74-year-old male patient with underlying dilated cardiomyopathy and chronic renal failure<sup>(4)</sup>. The reason for his admission was syncope. He had hyperkalemia, serum potassium 6.5 mmol/l, was treated by oral CPS

15 g thrice daily. Because of oral intolerance, 50 g of CPS was administered rectally instead. The treatment continued for 8 days. Despite receiving lactulose as a laxative agent, he had diffused abdominal distention and pain, and could not pass stool or gas via rectum 2 days after CPS had been stopped. The operative decompression, including cecostomy and removal of inspissated resin, was performed with good post-operative results.

Although our patient was not an elderly patient, he had many predisposing factors of decreased intestinal motility and constipation such as uremia, septic shock, restriction of oral fluid and inability of ambulation. The administration of a large amount of CPS in order to reduce serum potassium level in patient with decreased intestinal function could lead to significant bowel obstruction. Unlike the patients of both previous reports which had colonic obstruction, this patient had mass-like inspissated CPS from the stomach down to the sigmoid colon and developed a clinical small bowel obstruction by the impaction at distal jejunum. The treatment including enterotomy with removal of inspissated material and intra-operative decompression resulted in improved bowel function. In some cases with critical conditions, the diverting ileostomy or colostomy and intra-operative milking content to the distal part with postoperative enema might be a good option to minimize operative time.

### Conclusion

Both Kayexalate and Kalimate are commonly used to reduce serum potassium level. Because hyperkalemia is a condition frequently found in clinical practice especially in critically ill patients, serious gastrointestinal complications of the potassium-reducing drugs might result in mortality. The administration of these resin agents in the elderly with constipation or decreased bowel function from any cause, such as immobilization or ileus, should be done cautiously. The intestinal perforation or obstruction should be a concern to the physicians in case the clinical condition deteriorates after resonium therapy in high-risk patients.

### What is already known on this topic?

Nowadays, the clinicians prefer to use Kalimate as the treatment for hyperkalemia more than Kayexalate in sorbitol. The colonic necrosis with or without perforation associated with the administration of Kayexalate in sorbitol was already frequently

reported in the literature. However, there were much fewer reports of serious GI complications from Kalimate. The authors could find only two to three case reports from the literature review that mentioned intestinal obstruction related to Kalimate use, unlike the complications of Kayexalate.

#### What this study add?

Because this is a case report, it has no impact on the change in the clinical practice. However, it can provide one more incidence of the critical complication of Kalimate into the small pool of previously-published evidence concerning this condition. This case can enhance the importance of awareness that serious complication can occur especially in high-risk patients. Moreover, it might be the opportunity to initiate more systematic and statistical study about this issue in the future.

#### Potential conflicts of interest

None.

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ภาวะลำไส้อุดตันจากการให้ kalimate เพื่อลดระดับโพแทสเซียมในเลือด: รายงานผู้ป่วยและ ทบทวนวรรณกรรม  
ทางการแพทย์

อัสนี ทองอยู่, เอกภักดี ศรีอัมภพร, พลินท์ ลิมปวิทยาพร, ฉัตรชัย มิ่งมาลัยรักษ์

เนื่องจากยา sodium polystyrene sulfonate (Kayexalate) และ calcium polystyrene sulfonate (CPS, Kalimate) ถูกใช้อย่างแพร่หลายในการลดระดับโพแทสเซียมในเลือด แต่ก็พบว่ามียารายงานผู้ป่วยที่เกี่ยวข้องกับการเกิดภาวะแทรกซ้อนต่อระบบทางเดินอาหารที่รุนแรงจากการให้ยาเหล่านี้ เช่น ผนังลำไส้ใหญ่บวมอาจเกิดรูทะลุ หรือ ทำให้เกิดการอุดตันในลำไส้ได้ ผู้นิพนธ์ได้รายงานผู้ป่วยชายอายุ 52 ปี ซึ่งมีการติดเชื้อรุนแรงที่เนื้อเยื่อผิวหนังที่ขา และมีการติดเชื้อในกระแสเลือด ผู้ป่วยมีภาวะไตวายและระดับโพแทสเซียมในเลือดสูงขึ้น จึงได้รับการรักษาด้วยยา kalimate ต่อมาผู้ป่วยมีภาวะลำไส้อุดตัน จำเป็นต้องได้รับการผ่าตัดและพบว่ามียา kalimate ซึ่งจับตัวกันเป็นก้อนแข็งปริมาณมากอุดตันในกระเพาะอาหารและลำไส้เล็ก เป็นสาเหตุของภาวะลำไส้อุดตันในผู้ป่วยรายนี้ และต้องเปิดกระเพาะอาหารและลำไส้เพื่อเอาก้อนเหล่านี้่ออก