n

Intestinal perforation secondary to the use of sodium polystyrene sulfonate, case report

Roberto Adriano-Castro¹, Jorge Sancho-Muriel^{1*}, Hanna_Cholewa¹, Blas Flor-Lorente¹, Francisco Giner Segura^{2,3}

European Journal of Medical Case Reports

Volume 8(4):68–71 DOI: 10.24911/ejmcr.173-1700680736



This is an open access article distributed in accordance with the Creative Commons Attribution (CC BY 4.0) license: https://creativecommons.org/licenses/by/4.0/) which permits any use, Share — copy and redistribute the material in any medium or format, Adapt — remix, transform, and build upon the material for any purpose, as long as the authors and the original source are properly cited. © The Author(s) 2024

ABSTRACT

Background: The use of cation exchange resins such as sodium polystyrene sulfonate (SPS) in the treatment of hyperkalemia has been associated with potential damage to the gastrointestinal tract.

Case Presentation: We present a clinical case of a 63-year-old male patient admitted following a single-lung transplant who presented a complex postoperative period associated with renal failure and hyperkalemia, therefore administering SPS. 17 days afterward, the patient presented a clinical exacerbation with acute abdominal pain, due to a sigmoid perforation. The patient underwent urgent surgery, performing an open sigmoidectomy and terminal colostomy. The anatomo-pathological study of the surgical specimen revealed abundant SPS crystals in the depth of the colonic wall.

Conclusion: Close patient surveillance and high clinical suspicion are essential to prevent potentially fatal complications from the use of SPS. Due to the low incidence of this complication, the evidence in the literature is limited to case reports and retrospective studies.

Keywords: Sodium polystyrene sulfonate, cation exchange resins, intestinal perforation.

Accepted: 16 April 2024

Received: 22 November 2023

Type of Article: CASE REPORT

Specialty: General Surgery

Correspondence to: Jorge Sancho Muriel *Colorectal Unit, University Hospital La Fe, Valencia, Spain. Email: jsanchomuriel@gmail.com Full list of author information is available at the end of the article.

Background

Cation exchange resins (CERs) such as polystyrene calcium sulfonate or sodium polystyrene sulfonate (SPS), have been used for the treatment of electrolyte disturbances, especially hyperkalemia, in patients with significant alteration of the renal function [1].

A potential correlation has been described between the use of these resins and various adverse effects on the gastrointestinal wall. Colon necrosis stands out among them [2,3]. Initially, intestinal damage was associated with the concomitant use of CER and sorbitol, administered to solve constipation problems arising from its use [4]. However, isolated use of CER continued to be associated with adverse effects on the gastrointestinal mucosa.

Colon necrosis as a result of the use of CER, although infrequent, is associated with a high mortality rate which in most series exceeds 20% [3]. Predisposing factors include uremia and solid organ transplantation. These conditions may lead to increased vulnerability to CER-induced injury [5,6].

For diagnosis, a high clinical suspicion is necessary together with the pathological demonstration of SPS crystal aggregates in the intestinal wall necrosis areas [7,8]. This manuscript is written following the CARE reporting checklist.

Case Presentation

We present a case of a 63-year-old male patient with a history of hypertension, type 2 diabetes, ischemic heart disease with double stent implantation, and a pulmonary transplant due to chronic obstructive pulmonary disease in 2019.

The patient was admitted to our center for a single lung transplant, due to chronic rejection of the previously implanted organ. The early postoperative period was marked by various complications, including acute renal failure, a bronchial leak managed conservatively, and an infection by SARS CoV 2. The patient received anticoagulant treatment with low molecular weight heparin at prophylactic doses and therefore presented with a lower gastrointestinal hemorrhage that further aggravated his renal failure. Hydroelectrolyte imbalance started with a predominance of hyperkalemia (Table 1), so treatment with SPS was initiated, with a gradual dosage escalation in the following days.

PARAMETER	POST-TRANSPLANT DAYS (PTD)					
	7	27	37	44	54	65
Creatinine mg/dl	1.19	1.35	1.83	1.43	0.73	0.63
Potassium mEq/l	4.5	4.7	5.7	5.4	4.2	4.8
Procalcitonin ng/ml	0.53	0.06	-	-	0.58	0.17
C-reactive protein mg/l	<1.0	26.9	<1.0	<1.0	128.9	25.2
Leukocytes ×103/µl	5.15	2.56	2.49	5.19	1.41	4.9

Table 1. Analytical parameters.



Figure 1. Contrasted abdomino-pelvic CT scan. Note: Perforation located in the anterior wall of distal sigma.

7 days following the treatment with CER, the patient presented with acute abdominal pain associated with loose stools without blood or mucous and mild elevation of acute-phase reactants in the blood analysis. Urgent abdominal computed tomography (CT) revealed findings related to proctosigmoiditis. Initially, infectious etiology was ruled out by stool cultures and antigens detection. The patient initially responded to conservative treatment with fluids, broad-spectrum antibiotics, and analgesia.

2 weeks after the beginning of the CER treatment the patient presented a clinical aggravation with abdominal pain exacerbation and laboratory deterioration (Table 1). A new CT scan was performed (Figure 1) showing signs of sigmoid perforation. The patient underwent urgent surgery encountering focal pelvic fecaloid peritonitis secondary to an anterior sigma perforation of the distal sigmoid colon. An open sigmoid resection and end colostomy were performed. The postoperative period was uneventful.

The microscopic study of the surgical specimen showed a widely ulcerated colonic wall with SPS crystals present throughout the thickness of the intestinal wall (Figure 2).

Discussion

SPS is a CER that has been widely used for the treatment of hyperkalemia. It can be administered orally or in the form of rectal enemas. The use of these resins has been associated with potential intestinal damage, especially to the colonic mucosa [9], necrosis and intestinal perforation being the most serious and potentially fatal forms.

The incidence of intestinal necrosis associated with the use of CER is unclear, although it has been established between 0.27% and 1.8% [10]. A higher incidence has been described in males [3], as well as in patients with predisposing factors such as advanced-stage chronic kidney disease with high levels of renin, associated with non-occlusive ischemia mechanism, uremia, immuno-suppression, increasing vulnerability to intestinal lesions induced by CER [5,6,11], such as in the case presented. The average age of presentation differs between the series, the mean being 50-60 years old, with scarce cases reported earlier.

Initially, CREs were administered together with sorbitol preparation, to avoid side effects on the intestinal motility caused by the resins, which include constipation and fecal impaction. The first cases of intestinal morbidity were attributed to the use of sorbitol, as it is a hypertonic solution that could damage the colonic mucosa, a hypothesis only studied in animal models [4]. However, subsequent studies demonstrated the toxicity of CERs on the gastrointestinal wall, regardless of their combined use with sorbitol [8-12].



Figure 2. Microscopic study hematoxylin-cosin staining. Note: Evidence of sodium polystyrene sulfonate crystals at necrosis site affecting throughout the thickness of the intestinal wall.

The onset of complications varies from 1 to 7 days following CERs administration [13], although in some cases up to 20 days have been described [14]. The symptoms and blood work analysis may initially be nonspecific, which hinders an early diagnosis and it is necessary to rule out more frequent pathologies such as ischemic colitis or Clostridium difficile infection.

Histological findings are fundamental for definitive diagnosis. Aggregates of SPS crystals in areas of necrosis of the intestinal wall [7,8] are objectified in the microscopic study, as shown in Figure 2. Other nonspecific findings are the presence of mucosal erosions and micro abscesses in the intestinal wall [15].

We did not find a great variety of quality studies in the literature, most of the evidence found comes from case series, retrospective studies and predominantly case reports [11,16-18].

Conclusion

It is essential to understand the risk of gastrointestinal complications associated with CER usage, especially in patients with comorbidities. We must underline the need for close patient monitoring to allow early symptom recognition as to prevent and treat serious complications.

What is new?

Colon necrosis associated with the use of CER, although infrequent, is associated with a high mortality rate that in most series exceeds 20%. For diagnosis, a high clinical suspicion is necessary together with a pathological demonstration of SPS crystal aggregates in the intestinal wall necrosis areas. Given the rarity of this complication, the authors hope that their experience will serve as a tool for surgeons to better understand this pathology.

List of Abbreviations

CERs Cation exchange resins

CT Computed tomography

SPS Sodium polystyrene sulfonate

Conflicts of interest

The authors declare that they have no conflict of interest regarding the publication of this case report.

Funding

None.

Consent for publication

Written consent was obtained from the patient.

Ethical approval

Ethical approval is not required at our institution to publish an anonymous case report.

Author details

Roberto Adriano-Castro¹, Jorge Sancho-Muriel¹, Hanna_Cholewa¹, Blas Flor-Lorente¹, Francisco Giner Segura^{2,3}

- 1. Colorectal Unit, University Hospital La Fe, Valencia, Spain
- 2. Department of Pathology, University Hospital La Fe, Valencia, Spain
- 3. Department of Surgery, University of Valencia, Valencia, Spain

References

- Gürtler N, Hirt-Minkowski P, Brunner SS, König K, Glatz K, Reichenstein D, et al. Sodium polystyrene sulfonate and cytomegalovirus-associated hemorrhagic duodenitis: more than meets the eye. Am J Case Rep. 2018 Aug;19:912–6. https://doi.org/10.12659/AJCR.910655
- Arvanitakis C, Malek G, Uehling D, Morrissey JF. Colonic complications after renal transplantation. Gastroenterology. 1973 Apr;64(4):533–8. https://doi. org/10.1016/S0016-5085(73)80122-2
- Wu YH, Chou JW, Lai HC, Su GS, Cheng KS, Chen TW. Adverse gastrointestinal effects with Kayexalate or Kalimate: a comprehensive review. Clin Exp Gastroenterol. 2021 Jan;14:1–18. https://doi.org/10.2147/CEG.S278812
- Lillemoe KD, Romolo JL, Hamilton SR, Pennington LR, Burdick JF, Williams GM. Intestinal necrosis due to sodium polystyrene (Kayexalate) in sorbitol enemas: clinical and

experimental support for the hypothesis. Surgery. 1987 Mar;101(3):267–72.

- Nassereddine H, Pelletier AL, Chemouny JM, Rebibo L, Vrtovsnik F, Msika S, et al. Risk of perforated colonic diverticulitis in patients with chronic kidney disease requiring sodium polystyrene sulfonate: not to be forgotten. Am J Gastroenterol. 2019;114(6):1003–5. https://doi. org/10.14309/ajg.0000000000276
- Wu YH, Chen TW, Chou JW. Kalimate-induced upper gastrointestinal bleeding in a 77-year-old woman. Clin Gastroenterol Hepatol. 2019;S1542(19):30516.
- Su GS, Chen TW, Chou JW. A rare cause of abdominal pain with bloody stool. Turk J Gastroenterol. 2020 Jan;31(1):73–4. https://doi.org/10.5152/tjg.2020.18821
- Ayoub I, Oh MS, Gupta R, McFarlane M, Babinska A, Salifu MO. Colon necrosis due to sodium polystyrene sulfonate with and without sorbitol: an experimental study in rats. PLoS One. 2015 Sep;10(9):e0137636. https://doi. org/10.1371/journal.pone.0137636
- Joo M, Bae WK, Kim NH, Han SR. Colonic mucosal necrosis following administration of calcium polystryrene sulfonate (Kalimate) in a uremic patient. J Korean Med Sci. 2009 Dec;24(6):1207–11. https://doi.org/10.3346/ jkms.2009.24.6.1207
- Gerstman BB, Kirkman R, Platt R. Intestinal necrosis associated with postoperative orally administered sodium polystyrene sulfonate in sorbitol. Am J Kidney Dis. 1992 Aug;20(2):159–61. https://doi.org/10.1016/ S0272-6386(12)80544-0
- Watson M, Abbott KC, Yuan CM. Damned if you do, damned if you don't: potassium binding resins in hyperkalemia. Clin J Am Soc Nephrol. 2010 Oct;5(10):1723–6. https://doi.org/10.2215/CJN.03700410
- 12. Harel Z, Harel S, Shah PS, Wald R, Perl J, Bell CM. Gastrointestinal adverse events with sodium polystyrene

sulfonate (Kayexalate) use: a systematic review. Am J Med. 2013 Mar;126(3):264.e9–24. https://doi.org/10.1016/j. amjmed.2012.08.016

- Kelsey PB, Chen S, Lauwers GY. Case records of the Massachusetts General Hospital. Weekly clinicopathological exercises. Case 37-2003. A 79-year-old man with coronary artery disease, peripheral vascular disease, endstage renal disease, and abdominal pain and distention. N Engl J Med. 2003 Nov;349(22):2147–55. https://doi. org/10.1056/NEJMcpc030031
- Chou YH, Wang HY, Hsieh MS. Colonic necrosis in a young patient receiving oral kayexalate in sorbitol: case report and literature review. Kaohsiung J Med Sci. 2011 Apr;27(4):155–8. https://doi.org/10.1016/j. kjms.2010.12.010
- Murakami K. Intestinal necrosis related to administration of cation exchange resin without sorbitol: a retrospective analysis of 61 patients with end-stage renal diseases. Pathol Int. 2020;70(5):270–9. https://doi.org/10.1111/ pin.12906
- Almulhim AS, Hall E, Al Rehaili BM, Almulhim AS. Sodium polystyrene sulfonate induced intestinal necrosis; a case report. Saudi Pharm J. 2018 Sep;26(6):771–4. https://doi. org/10.1016/j.jsps.2018.04.008
- Edhi AI, Cappell MS, Sharma N, Amin M, Patel A. One oral dose of sodium polystyrene sulfonate associated with ischemic colitis and crystal deposition in colonic mucosa. ACG Case Rep J. 2018 Oct;5(1):e74. https://doi. org/10.14309/crj.2018.74
- Dantas E, Coelho M, Sequeira C, Santos I, Martins C, Cardoso C, et al. Lower gastrointestinal bleeding associated with sodium polystyrene sulfonate use. ACG Case Rep J. 2021 May;8(5):e00585. https://doi.org/10.14309/ crj.000000000000585

1	Patient (gender, age)	Male, 63 years old.		
2	Final diagnosis	Sigmoid colon perforation secondary to sodium polystyrene sulfonate		
3	Symptoms	Acute abdominal pain associated with loose stools without blood or mucous.		
4	Medications	Sodium polystyrene sulfonate, broad-spectrum antibiotics, analgesics.		
5	Clinical procedure	cedure Open sigmoidectomy and terminal colostomy.		
6	Specialty	General surgery.		

Summary of the case