



**Table 1.** Analytical parameters.

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

**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).

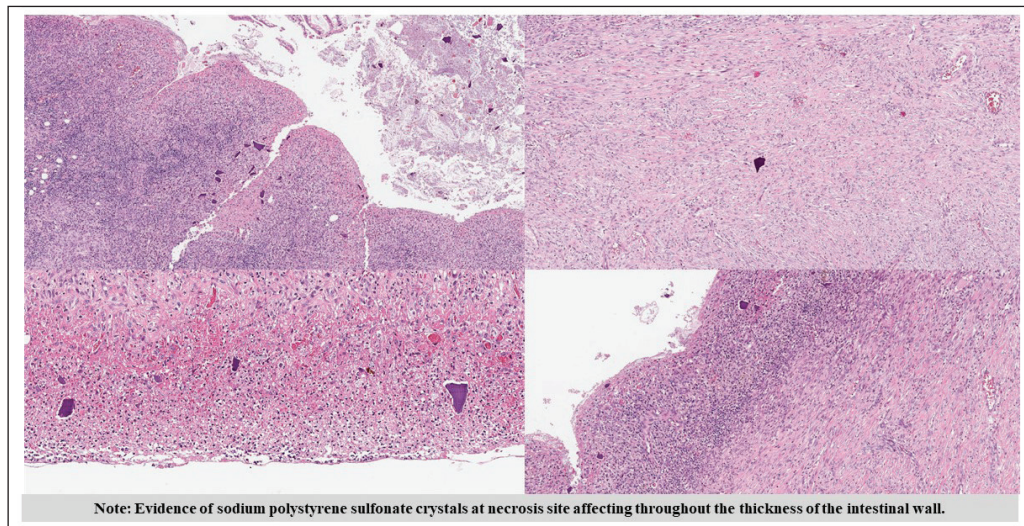
## Discussion

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, immunosuppression, 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, CERs 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

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### 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.

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### Summary of the case

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