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Cation Exchange Resins and colonic perforation. What surgeons need to know



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ABSTRACT

INTRODUCTION: Since 1961 the use of Cation Exchange Resins has been the mainstream treatment for chronic hyperkalemia. For the past 25 years different kind of complications derived from its clinical use have been recognized, being the colonic necrosis the most feared and lethal of all.

PRESENTATION OF CASE: We report a case of a 72-year-old patient with chronic kidney disease, treated with calcium polystyrene sulfonate for hyperkalemia treatment who presented in the emergency department with constipation treated with hypertonic cathartics. With clinical deterioration 48 h later progressed with colonic necrosis requiring urgent laparotomy, sigmoidectomy and open abdomen management with subsequent rectal stump perforation and dead. The histopathology finding: calcium polystyrene sulfonate embedded in the mucosa, consistent with the cause of perforation.

DISCUSSION: Lillemo reported the first case series of five uremic patients with colonic perforation associated with the use of SPS in sorbitol in 1987 and in 2009 the FDA removed from the market the SPS containing 70% of sorbitol.

The pathophysiologic change of CER goes from mucosal edema, ulcers, pseudomembranes, and the most severe case transmural necrosis.

Up to present day, some authors have questioned the use of CER in the setting of lowering serum potassium. Despite its worldwide use in hyperkalemia settings, multiple studies have not demonstrated a significant potassium excretion by CER.

CONCLUSION: Despite the low incidence of colonic complication and lethal colonic necrosis associated with the CER clinical use, the general surgeon needs a high index of suspicion when dealing with patients treated with CER and abdominal pain.

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1. Introduction

Hyperkalemia is a well known complication in patient with chronic kidney disease, its life threatening if unrecognized and untreated, this pathophysiological entity is encounter by internists, intensivists, nephrologists an emergency department physicians [1].

Since 1961 the use of Cation Exchange Resins (CER) has been the mainstream of chronic hyperkalemia treatment [2]. For the past 25 years different kind of complications derived from its clinical use have been recognized, being the intestinal obstruction and colonic necrosis the most feared and lethal of all. In this setting, the general and acute care surgeons joined the specialists listed before in the

emergency management of these patients. We present a review of CER along with the clinical case of a 74-year-old woman with chronic kidney disease treated with calcium polystyrene sulfonate (CPS) (Novofazol Probiomed, S.A de C.V. México) seen at emergency room with uremia and abdominal pain.

2. Case report

A 72-year-old-woman was admitted to the emergency department for uremic syndrome, hemodynamic instability and chronic abdominal pain associated with constipation for 2 weeks. She had a history of nephrectomy and chronic renal failure without replacement therapy of renal function and hypertension. She was treated with telmisartan–hydrochlorothiazide, amlodipine and furosemide.

Three weeks before the current admission she was on treatment for hyperkalemia with calcium polystyrene sulfonate PO 29.92 g daily.

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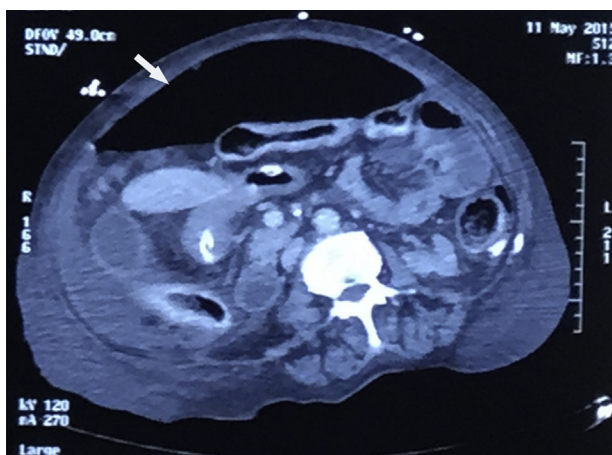


Fig. 1. Abdominal CT scan obtain in the second day of hospital stay in the ICU showing free intraperitoneal air (white arrow) consistent with colonic perforation.

At the emergency department she was treated with polyethylene glycol powder for oral solution 4l at conventional dilution, and rectal enemas with buffered sodium phosphate solution for constipation treatment.

She was admitted to the ICU with metabolic acidosis and uremia exacerbation requiring hemodialysis in the next 48 h.

One day after the admission to the ICU the abdominal distension augmented. Abdominal CT shows free intraperitoneal air consistent with colonic perforation (Fig. 1).

The patient went to exploratory laparotomy where a perforation at the sigmoid colon was found (Fig. 2). A Hartmann procedure was

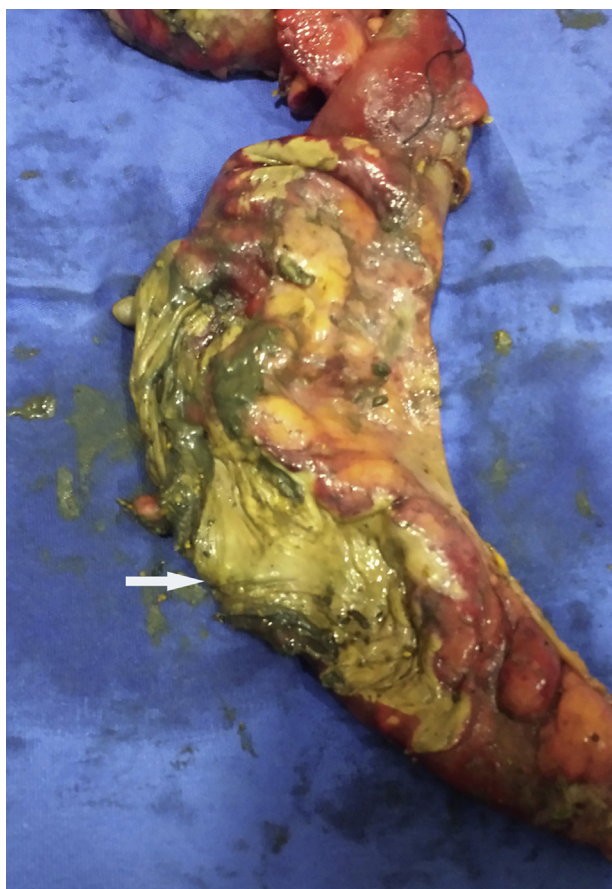


Fig. 2. Sigmoid colon. Transmurial necrosis (white arrow).

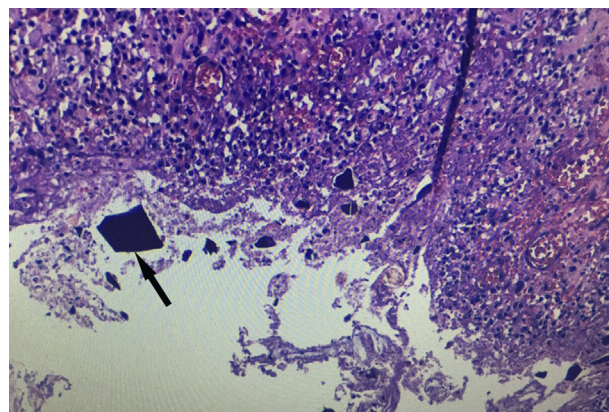


Fig. 3. Sigmoidectomy specimen stained with Haematoxylin-Eosin. Small basophilic angulated crystals (black arrow) embedded in mucosa consisted with calcium polystyrene sulfonate related colonic perforation.

performed and open abdomen protocol was initiated with Open Abdomen Negative Pressure Therapy with ABThera (KCI) in the need for a “second look” surgery. Forty-eight hours later, the rectal stump was found necrotic and a rectal resection on the superior third of rectum was performed.

Microscopically examination revealed areas of transmural necrosis in sigmoid colon and rectal stump of heterogeneous distribution and acute peritonitis with small basophilic angulated crystals embedded in the mucosa (Fig. 3). There was no evidence of recent vascular thrombosis. The final diagnosis was colonic necrosis due to CPS associated with hypertonic cathartic use.

3. Discussion

The CER was first synthesized in 1935 and in late 1950s became available in the open market. Its hypokalemic properties were recognized until 1961, when its clinical use was first described. In 1975 it gained the US federal approval for hyperkalemia treatment [2]. The first CER used was the sodium polystyrene sulfonate (SPS). The complications derived from the sodium overload in patients with chronic kidney disease (CKD) led to the use of alternative salts containing Aluminum and Calcium instead.

Until today, there exists only two therapeutic approaches approved by FDA to eliminate potassium from the body besides hemodialysis: Diuretics and CER [3]. In an era where chronic hemodialysis was not available, different therapies were sought to deal with such a complex problem. The use of laxatives and cathartics in order to achieve potassium excretion is an historical example. Phenolphthalein and sorbitol were the main compounds used with such purpose. The combination of CER and sorbitol had its origins based on these grounds [4]. In alleviating constipation secondary to CER use, its combination with sorbitol gain popularity in 1997 [5].

In 1987 Lillemoe et al. first reported that sorbitol enema leads to intestinal complications, being the most severe the colonic necrosis. Their data suggested that the addition of sorbitol is an important factor for mucosal toxicity. In patients with concomitant use of kayexalate and sorbitol, only 0.27–1.8% developed intestinal injuries in the following 1–7 days [6]. In 2009 the FDA removed from the market the SPS containing 70% of sorbitol and a introduce black-box warning in 33% SPS in sorbitol solution pointing that is associated with colonic necrosis and serious gastrointestinal adverse reactions [7].

CER is currently administered orally or as an enema, acting in the large intestine by extracting and collecting potassium in the stools, so it can be eliminated, although the exact mechanism for

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