

# Crystals in Perforated Bowel: Culprits or Innocent Bystanders

International Journal of Surgical Pathology  
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DOI: 10.1177/1066896917735172  
journals.sagepub.com/home/ijsp  
**SAGE**

**Aileen Grace P. Arriola, MD<sup>1</sup>, Niels D. Martin, MD, FACS, FCCM<sup>2</sup>, and Rashmi Tondon, MD<sup>2</sup>**

A 52-year-old male is admitted for sepsis and abdominal pain directly from a rehabilitation facility, where he was recovering from a hip fracture. He has multiple medical problems that include ischemic cardiomyopathy status post orthotopic heart transplant 6 years prior, is being treated for end-stage renal disease, and has significant peripheral arterial disease (status post 2 femoral bypass procedures). Imaging revealed free intraabdominal air, and hence, he was brought to the operating room for an exploratory laparotomy where a sigmoid perforation and firm stool were noted. The perforation was presumed to be due to a stercoral ulcer. A partial colectomy with creation of an end colostomy was performed. Grossly, the colectomy specimen contained a transmural defect (black ink; Figure 1) surrounded by fibrinopurulent exudate. On opening, the colonic mucosa also appeared dusky with potential ulceration (Figure 2). Histopathologic examination of the ulcer bed (box, Figure 3) reveals crystalline foreign material (Figure 4). No vascular pathology such as thrombosis or vasculitis was identified.

Sections of the ulcer show 2-toned crystalline material with a broad internal fish scale-like appearance, compatible with sevelamer crystals. It is important to differentiate them from kayexalate crystals, which have a narrowed “fish scale” pattern with perpendicular intersecting lines. Certain medications such as nonsteroidal anti-inflammatory drugs, iron pills, and bisphosphonates are known to directly cause mucosal injury, and this list continues to grow. Sevelamer (Renvela or Renagel) is an ion exchange resin that binds to phosphate in the intestine, thereby lowering serum phosphate levels in patients with end-stage renal disease. Pathologic effects of sevelamer in the gastrointestinal tract was first reported by Swanson et al.<sup>1</sup> In this small series, 14 of 15 biopsies from 7 patients on sevelamer showed various mucosal findings that include ischemic injury, ulceration, and acute inflammation. Due to the small sample, it was not established whether sevelamer played any causal role in the injury pattern. There have since been few reports of various gastrointestinal symptoms associated with sevelamer usage, such as colonic structuring,<sup>2</sup> hematochezia,<sup>3</sup> and ulceration.<sup>4</sup> Discontinuation of sevelamer resulted in no further recurrences of symptoms in these patients.<sup>3,4</sup>



**Figure 1.** Partial colectomy specimen with perforation (marked with black ink).

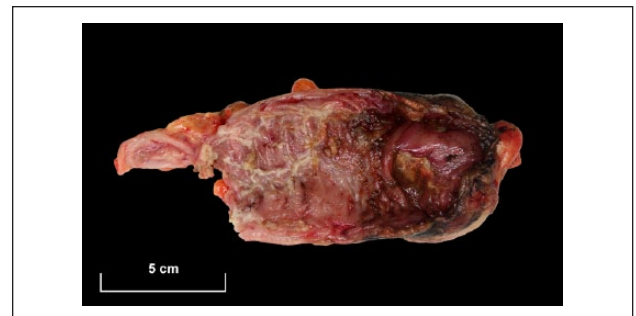


**Figure 2.** Colonic mucosa with green exudate and ulceration at the site of perforation.

Our reported patient returned to the operating room 5 days after his colectomy due to colostomy dehiscence. The splenic flexure was resected, which revealed mucosal erosion with associated sevelamer crystals on pathologic exam. The patient continued to do poorly with multiple

<sup>1</sup>University of Texas MD Anderson Cancer Center, Houston, TX, USA

<sup>2</sup>Hospital of the University of Pennsylvania, Philadelphia, PA, USA

## Corresponding Author:

Rashmi Tondon, Department of Pathology and Laboratory Medicine, Hospital of the University of Pennsylvania, 3400 Spruce St, Philadelphia, PA 19104, USA.

Email: rashmi.tondon@uphs.upenn.edu

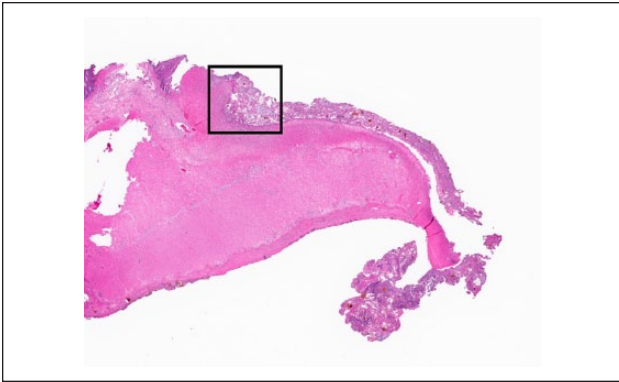


**Figure 3.** Low power view of ulcer bed showing denuded mucosal surface.

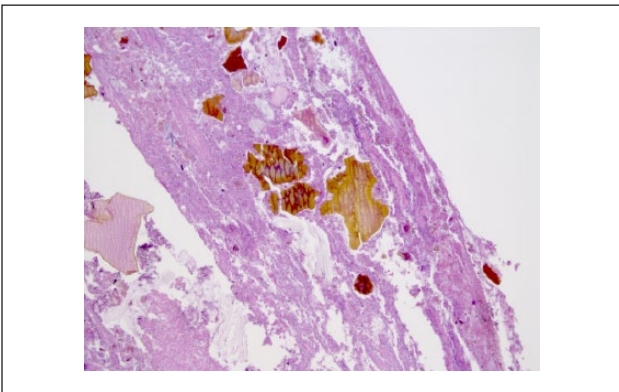


**Figure 4.** High power view of ulcer bed showing characteristic two-toned fish scale appearance of Sevelamer crystals.

intraabdominal abscesses and strokes in a catatonic state. He passed away 2 months after his initial surgery. Whether the sevelamer crystals contributed to the mucosal injury or are simply an innocent bystander in the setting of a presumed stercoral ulcer in this patient with multiple medical comorbidities is unclear. Although similar findings in the second colectomy specimen with crystals in the area of mucosal injury raise the possibility that sevelamer might be an active player. It is important for clinicians to be aware of the increasing reports on the association of sevelamer with mucosal injury, though direct evidence of causation is still lacking. Discontinuation of sevelamer should be considered in patients with predisposing conditions for mucosal injury such as severe chronic constipation and acute diverticulitis.

## References

1. Swanson BJ, Limketkai BN, Liu TC, et al. Sevelamer crystals in the gastrointestinal tract (GIT): a new entity associated with mucosal injury. *Am J Surg Pathol.* 2013;37:1686-1693.
2. Kim J, Olson K, Butani L. Sevelamer crystals in the mucosa of the gastrointestinal tract in a teenager with end-stage renal disease. *Pediatr Nephrol.* 2016;31:339-341.
3. Desai M, Reiprich A, Khov N, Yang Z, Mathew A, Levenick J. Crystal-associated colitis with ulceration leading to hematochezia and abdominal pain. *Case Rep Gastroenterol.* 2016;10:332-337.
4. Chintamaneni P, Das R, Kuan SF, Kermanshahi TR, Hashash JG. Hematochezia associated with sevelamer-induced mucosal injury. *ACG Case Rep J.* 2014;1: 145-147.