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Selected Topics: Toxicology

AN EMERGENCY DEPARTMENT PRESENTATION OF SEVERE COLITIS AFTER A HOME HYDROGEN PEROXIDE ENEMA

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□ **Abstract—Background: Health information found on open access Internet platforms is often unscrutinized, unreliable, and can lead to considerable morbidity for patients and their presentation to the emergency department. Currently, home treatments for constipation and other gastrointestinal ailments featuring the use of hydrogen peroxide (H_2O_2) enemas are readily available. Case Report: We present a case of a 48-year-old female with a history of fibroids who presented to the emergency department with acute abdominal pain after self-administering a 3% H_2O_2 enema, which she learned about on the Internet as a treatment for constipation. She subsequently developed a severe colitis with evidence of pneumatosis and focal perforation. Why Should an Emergency Physician Be Aware of This?: Although toxicity from oral ingestions of H_2O_2 is well described in the literature, there are few reports of the sequelae related to rectal administration. Due to its significant morbidity and the public health concerns related to this mechanism of toxicity, emergency physicians are at the frontlines for diagnosing and properly managing these patients. This case report reviews the patient's presentation, findings, and management.**

□ **Keywords—emergency medicine; toxicology; public health**

INTRODUCTION

Patients are increasingly using the Internet as a major source of information regarding illnesses and treatment options. The quality of medical information on the Internet varies widely, however. Online queries for homemade remedies to treat constipation offer hydrogen peroxide (H_2O_2) enema among the results. H_2O_2 toxicity via ingestion is well described in the medical literature, with patients typically presenting with pathologies of the upper gastrointestinal (GI) tract and the hepatobiliary system (1). Lower GI toxicity via rectal administration of H_2O_2, however, is not well described (2). Herein, we discuss an unusual case of severe colitis caused by an H_2O_2 enema remedy found on the Internet.

CASE REPORT

A 48-year-old female with a history of fibroids presented to the emergency department (ED) within hours of developing abdominal pain following self-administration of an H_2O_2 enema at her home because she thought she was constipated. On history, she was noted to have no history of colitis, obstipation, or any abdominal pain either in the past or in the time immediately preceding the enema administration. As directed by a video post found on www.youtube.com, she filled a medium-sized, squeezable bottle with a flexible tip with roughly 100 mL of a 1:1 mixture of water and 3% H_2O_2. She squeezed the entire contents into her rectum while lying down. The patient felt an immediate burning sensation in her lower abdomen. She also developed nausea, an episode of

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non-bilious, non-bloody vomiting, and watery diarrhea. She denied headache, chest pain, or shortness of breath. She had never tried this treatment before, and otherwise denied any other toxic habits.

On presentation to the ED, the patient's vital signs were: temperature 97.8°F, blood pressure 159/84 mm Hg, heart rate 81 beats/min, and oxygen saturation 99% on room air. She appeared in moderate distress, lying in a curled position. Her examination was significant for a soft, but diffusely tender abdomen. A left inguinal hernia was palpated. Her stool guaiac examination was positive for occult blood. The remainder of her physical examination was unremarkable. Her pain was managed with morphine intravenously over her ED course.

An abdominal x-ray study with frontal and upright view of the abdomen showed a nonspecific bowel gas pattern, moderate amount of retained stool, and no free intraperitoneal air. Her laboratory studies were significant for an initial white blood cell count of $9.2 \times 10^3/mm^3$ that increased to $15.2 \times 10^3/mm^3$ 3 h later. Her hemoglobin of 8.9 mg/dL was consistent with a past presentation several months earlier. The bicarbonate was 19.0 mEq/L and the anion gap was 14, suggesting a metabolic acidosis. Her other laboratory values were within normal limits.

A computed tomography (CT) scan of the abdomen and pelvis with oral and i.v. contrast showed diffuse colitis from the level of the rectum through the transverse colon with fat stranding, extensive pneumatosis, and focal perforation at the level of the distal descending colon (Figure 1). There was a punctate focus of air concerning for portal venous gas seen in the periphery of the liver (Figure 2).

The patient was given a dose of piperacillan-tazobactam 3.375 mg. The decision was made, in conjunction with the general surgery team, to manage the patient with bowel rest, i.v. fluids, antibiotics, and serial abdominal examinations. Her hospital course was uncomplicated, and her laboratory studies continued to improve. A repeat CT scan of the abdomen and pelvis on hospital day 9 noted improvement of the inflammatory changes involving the rectum, sigmoid, and descending colon. The patient was subsequently seen in the general surgery clinic 2 weeks after discharge and noted to be pain free with the return of normal bowel function.

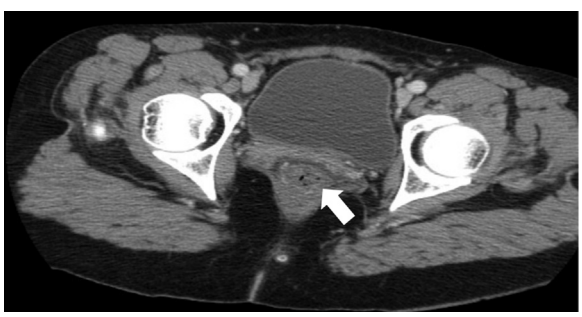

Figure 1. Marked thickening of the rectal wall with presacral edema (white arrow), diffuse thickening of the rectosigmoid with stranding of the sigmoid mesentery. There was a focus of extraluminal air level of the distal descending colon.

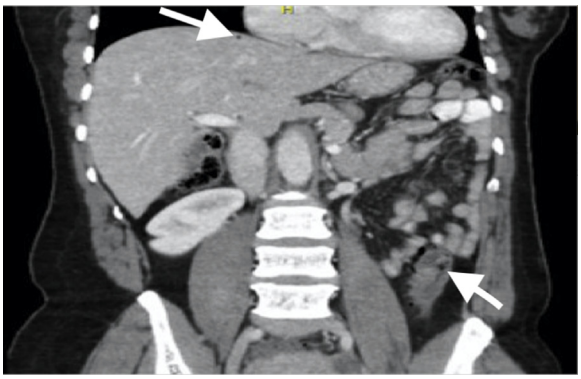

Figure 2. There was moderate pneumatosis of the distal transverse and descending colon with free air. There was also punctate air in the liver near the hepatic dome likely representing portal venous gas associated with the pneumoperitoneum (white arrows).

DISCUSSION

Hydrogen peroxide, in its 3–6% concentration forms, is a ubiquitous disinfecting agent used in both the clinical and nonmedical settings. The 30–35% solutions are common for laboratory use, and commercial grades ranging from 70% to 98% are also available. H_2O_2 damages tissues through the generation of oxygen gas, lipid peroxidation reactions, and direct corrosive damage. Lipid peroxidation reactions can induce cytotoxicity directly by destroying cell membranes. The 3% solution is colorless and odorless, and is used commonly in household cleaning products. As a result, this concentration has led to the majority of cases involving toxicity from the 3% concentration, with the exception of one inadvertent rectal administration of a 35% H_2O_2 enema in a 2-year-old child (3). Orally ingested H_2O_2 is known to cause oxidant stress, caustic burn injuries, tachycardia, lethargy, subepiglottic narrowing, airway compromise, and venous and arterial gas emboli (4,5). In contrast, its effects when introduced directly into the lower GI tract are less well described. Cases of rectal and colonic exposure to H_2O_2 were first reported in the 1950s, but few recent reports have utilized CT to evaluate for the extent of colonic injury.

The decomposition of H_2O_2 liberates oxygen and heat. This can be dangerous, as 1 mL of 30% H_2O_2 can generate 100 mL of oxygen gas. Animal studies on rats

and dogs suggest the primary mechanism of H_2O_2-induced colitis is related to ischemia and gangrene caused by release of gas into the loose connective tissue of the mucosa and submucosa. Arterial and venous gas emboli can occur when the amount of oxygen present exceeds the maximum solubility in blood (5).

Rectal administration of H_2O_2 had been used medically for several decades in managing neonatal meconium obstructions, as a diagnostic modality for detecting rectovaginal fistula, and as a diagnostic adjunct for abdominal plain film imaging, without evidence of adverse events (6). A case series from 1988 reported on 21 patients who developed colitis secondary to endoscopic cleaning solutions that contained 3% H_2O_2, prompting further research into the subject of colonic toxicity of iatrogenic etiology using advanced CT and endoscopic modalities (7–9).

In the general population, rectal and colonic exposure to H_2O_2 have primarily been for the treatment of constipation, with about half of the reported cases being self-administered, while the rest were administered under medical supervision. Although H_2O_2 is generally considered a benign oral ingestion in low concentrations, there appears to be no safe concentration or dilution when administered rectally. As with our patient, and likely due to the easy availability of the common household concentration of 3% H_2O_2, many of the reported cases of colitis involved uses of dilutions of 3% H_2O_2 (2,10,11).

Patients become symptomatic early after exposure, with most patients presenting for medical care within hours. Previously described cases demonstrate patients presenting with symptoms of abdominal pain, bloody diarrhea, fever, tenesmus, leukocytosis, fever, and tachycardia. Descriptions of the colonic injuries vary, due in part to different diagnostic tests. Many of the cases that employed endoscopy describe findings of friable and ulcerated mucosa (12). Only one case described findings consistent with colonic perforation (13). While portal venous gas has been described with oral ingestion of high concentrations of H_2O_2, only one case of rectally administered H_2O_2 found gas emboli in the portal venous system (14,15).

The more recent cases reported in the last decade have been managed nonoperatively with uneventful recoveries. The vast majority of patients were managed with bowel rest, fluid resuscitation, and broad-spectrum antibiotics, non-steroidal anti-inflammatory drugs, or corticosteroids. Patients typically recovered in fewer than 7 days (12). There have been no deaths directly linked to H_2O_2 enemas, however, there was one death related to a hemolytic reaction from a plasma transfusion (16).

Our report adds to the small body of literature on H_2O_2-induced colonic injuries. Consistent with other reports, even low concentrations of H_2O_2 can cause significant injury. Our patient had relatively severe injuries, including colitis extending to the mid-transverse colon, pneumatosis, and evidence of bowel perforation. She showed signs of sepsis but was able to be managed nonoperatively with antibiotics, serial abdominal checks, and bowel rest. Surgical interventions might have included surgical excision of compromised bowel with a diverting colostomy.

WHY SHOULD AN EMERGENCY PHYSICIAN BE AWARE OF THIS?

As emergency physicians, it is critical to know and understand that our patients, especially those who are most vulnerable, with lower levels of health literacy, can be susceptible to disreputable and possibly dangerous "therapies" that are advertised on the Internet. Rectally administered hydrogen peroxide has been significantly limited in the medical community but, due to a series of openly advertised home remedies, has continued to result in incidences of toxicity. In these cases, the emergency physician's ability to properly identify the scope of the pathology and to initiate an appropriate therapeutic course can have a major impact on patient outcomes.

REFERENCES

1. Papafragkou S, Gasparyan A, Batista R, Scott P. Treatment of portal venous gas embolism with hyperbaric oxygen after accidental ingestion of hydrogen peroxide: a case report and review of the literature. J Emerg Med 2012;43:e21–3.
2. Gan SI, Price LM. Waiting-list induced proctitis: the hydrogen peroxide enema. Can J Gastroenterol 2003;17:727–9.
3. Lee JS, Yoo JK. Chemical colitis caused by hydrogen peroxide enema in a child: case report and literature review. Environ Health Toxicol 2016;32:e2017002. Retraction in: Environ Health Toxicol 2018;33:e2018005.
4. Watt BE, Proudfoot AT, Vale JA. H2O2 poisoning. Toxicol Rev 2004;23:51–7.
5. Shaw A, Cooperman A, Fusco J. Gas embolism produced by hydrogen peroxide. N Engl J Med 1967;277:238–41.
6. Cheong DM, Nogueras JJ, Wexner SD, Jagelman DG. Anal endosonography for recurrent anal fistulas: image enhancement with hydrogen peroxide. Dis Colon Rectum 1993;36:1158–60.
7. Schwartz E, Dabezies MA, Krevsky B. Hydrogen peroxide injury to the colon. Dig Dis Sci 1995;40:1290–1. Review.
8. Jonas G, Mahoney A, Murray J, Gertler S. Chemical colitis due to endoscope cleaning solutions: a mimic of pseudomembranous colitis. Gastroenterology 1988;95:1403–8.
9. West AB, Kuan SF, Bennick M, Lagarde S. Glutaraldehyde colitis following endoscopy: clinical and pathological features and investigation of an outbreak. Gastroenterology 1995;108:1250–5.
10. Meyer CT, Brand M, DeLuca VA, Spiro HM. Hydrogen peroxide colitis: a report of three patients. J Clin Gastroenterol 1981;3:31–5.
11. Love BL, Siddiqui S, McCallum BJ, Helman RM. Severe chemical colitis due to hydrogen peroxide enema. J Clin Gastroenterol 2012;46:87.
12. Pawar D, Calara A, Jacob R, Beck N, Peiris AN. Hydrogen peroxide induced colitis: a case report and literature review. Case Rep Gastrointest Med 2017;2017:6432063.

13. Almalouf P, Shehab TM, Daniel AM, Robinson EA, Barnett JL. Therapeutic hydrogen peroxide enema causing severe acute colitis. Int J Colorectal Dis 2008;23:1139–40.
14. Youssef EW, Chukwueke VS, Elsamaloty L, Moawad S, Elsamaloty H. Accidental concentrated hydrogen peroxide ingestion associated with portal venous gas. Radiol Case 2018; 12:12–6.
15. Volonte F, Gervaz P, Poletti PA, Morel P. Portal vein gas embolism following oxygen peroxide enema. Colorectal Dis 2010;12(10 Online):e335–6.
16. Sheehan JF, Brynjolfsson G. Ulcerative colitis following hydrogen peroxide enema: case report and experimental production with transient emphysema of colonic wall and gas embolism. Lab Invest 1960;9:150–68.