Whole-bowel irrigation as treatment for zinc sulfate overdose

Article *in* Annals of Emergency Medicine · November 1990

DOI: 10.1016/S0196-0644(05)81523-9 · Source: PubMed

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Whole-Bowel Irrigation as Treatment for Zinc Sulfate Overdose

A 16-year-old boy ingested approximately 50 zinc sulfate tablets ($ZnSO_4$; 500-mg tablets). After spontaneous emesis, ipecac-induced emesis, and orogastric lavage, an abdominal radiograph performed four hours after ingestion still demonstrated approximately 50 $ZnSO_4$ tablets within the stomach and three pills within the colon. Whole-bowel irrigation was begun with a polyethylene glycol lavage solution (PEG; Golytely®) that was administered through a nasogastric tube; within one hour, the patient began producing a rectal effluent that contained pills. The patient remained asymptomatic throughout whole-bowel irrigation. Stool guaiac tests were negative. The serum chloride, however, increased from 105 to 127 mEq/L. Follow-up kidney, ureter, and bladder studies demonstrated the clearance of the zinc tablets from the gastrointestinal tract during the next 24 hours. [Burkhart KK, Kulig KW, Rumack B: Whole-bowel irrigation as treatment for zinc sulfate overdose. Ann Emerg Med October 1990;19:1167-1170.]

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Received for publication October 30, 1989. Revision received March 15, 1990. Accepted for publication April 6, 1990.

Dr Burkhart's fellowship was supported in part by Smith, Kline, and French Laboratories.

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INTRODUCTION

Zinc ingestions produce few direct systemic effects, but zinc salts can cause gastrointestinal corrosion. Therefore, attempts to remove zinc from the stomach would appear to be indicated in a large ingestion.

Whole-bowel irrigation (WBI) has become a routine surgical bowel preparation. The successful use of WBI as a gastric decontamination procedure has been reported after toxic ingestion.[1-4] There are few scientific studies of its efficacy.[5-7]

We describe the use of WBI in a 16-year-old boy who ingested approximately 2.5 g zinc sulfate ($ZnSO_4$).

CASE REPORT

In a suicidal gesture, a 16-year-old previously healthy boy ingested 1 oz Nyquil®, 20 acidophilus tablets, and, by history, 10 to 20 $ZnSO_4$ tablets (500-mg tablets). One ounce of Nyquil® contains 25% ethanol, 1,000 mg acetaminophen, 7.5 mg doxylamine succinate, 60 mg pseudoephedrine hydrochloride, and 30 mg dextromethorphan hydrobromide. Acidophilus is a natural culture of lactobacilli with pectin. The patient had four spontaneous emeses but vomited only a few pills.

One hour after ingestion, the patient was transported by ambulance to the emergency department. His vital signs were blood pressure of 140/98 mm Hg; pulse, 88; respirations, 18; and temperature, 37.0 C. On physical examination, no oropharyngeal burns were noted. The remainder of his examination was unremarkable. The patient was given 30 mL syrup of ipecac, which resulted in emesis of two additional pills. Gastric lavage with a 36F tube did not return any pill fragments.

Four hours after ingestion, a kidney, ureter, and bladder study demonstrated approximately 50 radiopaque tablets in the area of the stomach bubble; three tablets appeared to have passed beyond the pylorus (Figure 1). A second lavage with a 36F tube that had its side ports enlarged before insertion did not return any pill fragments.

A nasogastric tube was placed, and polyethylene glycol lavage (PEG; Golytely®) was begun at a rate of 1 L/hr. One hour later, the patient began passing pill fragments in his rectal effluent. The PEG was discontinued after four hours. The patient tolerated WBI without any abdominal discom-

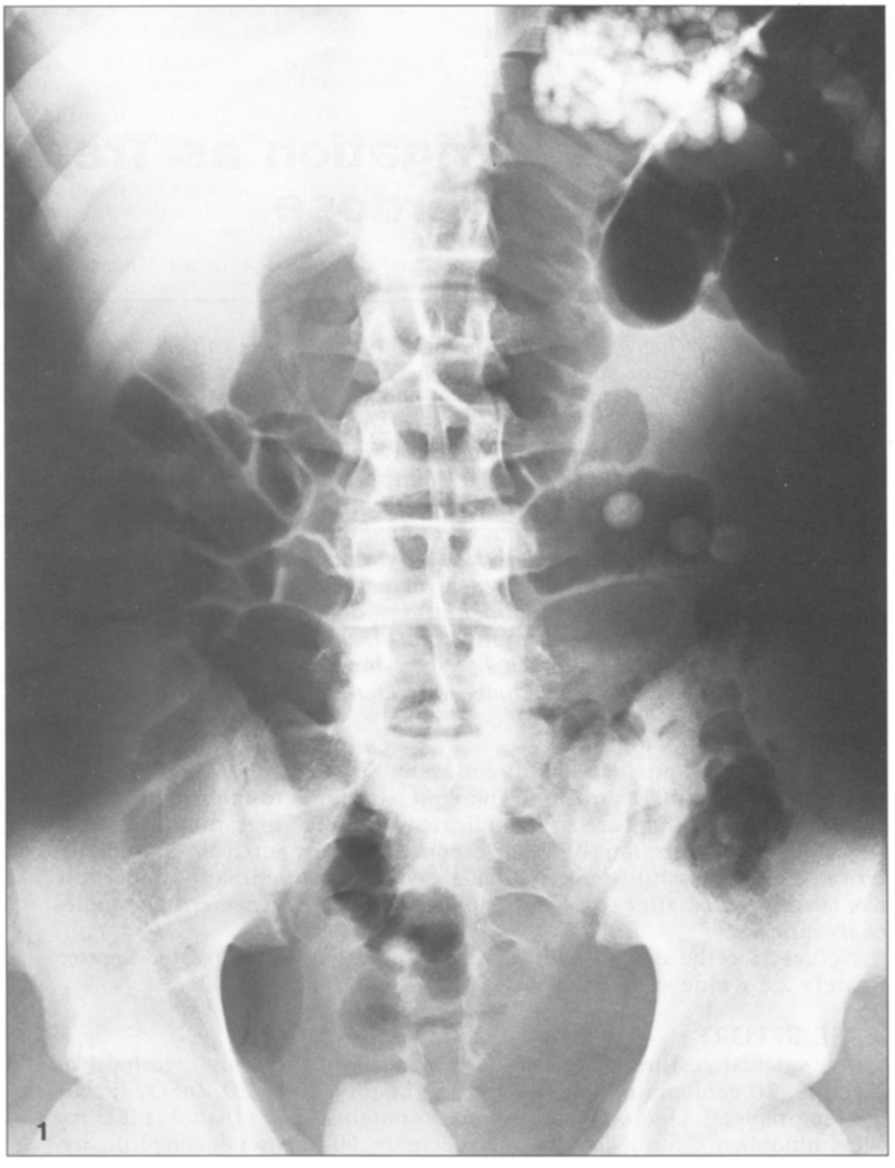

FIGURE 1. *Kidney, ureter, and bladder study four hours after ingestion. Patient had spontaneous emesis, ipecac-induced emesis, and gastric lavage before the radiograph.*

fort and did not develop any abdominal distension. A repeat abdominal radiograph demonstrated a marked decrease in the number of pills within the stomach and extending throughout the colon to the rectum (Figure 2). The treating physician did not restart PEG, and the patient was allowed to eat. His repeat kidney, ureter, and bladder study 12 hours after PEG was started demonstrated that the pills had passed beyond the stomach. The next day, a few pill fragments still remained in the colon. The patient did not develop any abdominal discomfort or distension. His stools throughout his hospital course tested guaiac-negative.

The patient's toxicologic screen was positive for a five-hour acetaminophen level of 15 μg/mL, a six-hour salicylate level of 2 mg/dL, and a serum ethanol level of 20 mg/dL. His electrolytes one hour before PEG were 140 mEq/L sodium, 4.6 mEq/L potassium, 105 mEq/L chloride, and 24 mEq/L bicarbonate. He received 800 mL lactated Ringer's during PEG administration.

His electrolytes at the conclusion of PEG were sodium, 140 mEq/L; potassium, 4.9 mEq/L; chloride, 127 mEq/L; and bicarbonate, 22 m Eq/L. No additional electrolytes were done. Kidney, ureter, and bladder studies obtained during the next 24 hours demonstrated the clearance of the zinc tablets from the colon. After psychiatric evaluation, the patient was discharged the next day.

DISCUSSION

Serious zinc ingestions have occasionally been reported in the toxicologic literature. Zinc chloride and zinc phosphide are highly corrosive salts and may produce severe hemorrhagic gastroenteritis.[8,9] While much less corrosive, $ZnSO_4$ may also produce hemorrhagic gastroenteritis.[10] IV $ZnSO_4$ has resulted in one delayed fatality.[11] Elemental zinc has also been associated with food poisoning.[12] After a massive ingestion of 12 g of metallic zinc, one patient's only symptom was delayed lethargy.[13]

WBI has proven to be a safe surgical bowel preparation procedure in children and adults.[14-17] The concept was introduced in 1973 by Hewitt et al, who used a hydroelectric solution that contained saline, potassium chloride, and sodium bicarbonate.[18] In 1976, Okonek et al reported the use of "gut lavage" to treat a patient with diquat ingestion.[1] The lavage solutions currently in clinical use contain polyethylene glycol and sodium sulfate as the chief osmotic agents. The concentrations of sodium sulfate and other electrolytes in the lavage solution were modified by human experimentation until the solution produced no net movement of water or electrolytes across the gut wall.[14]

Tenenbein recommends that WBI be considered when a patient ingests a large amount of a toxin or presents late after an ingestion, or the toxin is not absorbed to charcoal or is a delayed-release pharmaceutical.[2] Contraindications to the use of WBI include ileus, obstruction, perforation, and significant gastrointestinal hemorrhage.

Few studies have tested the effectiveness of WBI as a decontamination procedure for the treatment of acute poisoning. Tenenbein et al found that WBI decreased the blood concentration and area under the curve after ampicillin ingestion.[5] Rosenberg et al compared WBI with charcoal and with charcoal followed by WBI and

FIGURE 2. *Repeat kidney, ureter, and bladder study four hours after whole bowel irrigation and approximately six hours after the photograph in Figure 1.*

found that charcoal alone was the most efficacious intervention after an aspirin ingestion.[6] Brown et al found WBI as effective as sorbitol when given 45 minutes after a caffeine ingestion.[7] The majority of the remainder of the toxicologic experiences with WBI are case reports. The previous substances for which authors report using WBI include iron, sustained-release theophylline, tricyclic antidepressants, paraquat, and disc batteries.[1-4]

Gastrotomy has primarily been reported as a gastric decontamination procedure after iron overdoses. Iron sulfate and fumarate have been removed eight to 16 hours after ingestion in children and one adult.[19-22] Multiple emeses and large-volume lavages had failed to remove significant amounts of the iron tablets in these cases. At surgery, individual iron tablets were found to adhere to the hemorrhagic gastric mucosa. A large mass containing 25 g meprobamate was removed 40 hours after ingestion by gastrotomy.[23] Mercuric oxide released into the stomach when a disc battery disintegrated was removed by irrigation after gastrotomy.[24] Cocaine packets have been removed by gastrotomy after intestinal obstruction developed.[25,26]

WBI was an effective decontamination procedure in our patient. Gastrotomy was a consideration because of the potential gastrointestinal corrosiveness and risk of perforation from this quantity of $ZnSO_4$ tablets lodged in the stomach. WBI mobilized the tablets, and gastrotomy was no longer considered.

The only adverse effect of PEG administration in this patient was the development of hyperchloremia, whereas the other electrolytes remained normal and unchanged. We can only speculate on the possible etiologies of the hyperchloremia. Sulfate is the major anion in the PEG solution because it is poorly absorbed. The sulfate anion may have remained in the gut, whereas zinc chloride was absorbed. It is doubtful that the dissolution of $ZnSO_4$ in the gastrointestinal tract in our patient altered the electrolyte balance of the PEG solution, which contains 22.74 g sodium sulfate per liter.

SUMMARY

WBI was an effective adjunct in the treatment of zinc overdose in a 16-year-old boy after emesis and lavage failed. Radiopaque toxins allow the effectiveness of this procedure to be judged. The potential for electrolyte derangements when WBI is used after the ingestion of a salt such as $ZnSO_4$ requires additional study.

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